NATIONAL MARINE FISHERIES SERVICE REPORT ON GROUNDFISH MANAGEMENT

National Marine Fisheries Service (NMFS) Northwest Region will briefly report on recent regulatory developments relevant to groundfish fisheries and issues of interest to the Council.

NMFS Northwest Fisheries Science Center will also briefly report on groundfish-related science and research activities.

Council Task:

Discussion.

Reference Materials:

1. Agenda Item F.1.a, Attachment 1: List of Groundfish *Federal Register* Notices Published Since the November 2005 Council Meeting.
2. Agenda Item F.1.a, Attachment 2: A Summary Report of the 2005 Whiting Fishery.

Agenda Order:

a. Regulatory Activities	Frank Lockhart
b. Science Center Activities	Elizabeth Clarke
c. Reports and Comments of Advisory Bodies	
d. Public Comment	
e. Council Discussion	

PFMC
02/15/06

FEDERAL REGISTER NOTICES

Groundfish and Halibut Notices
October 25, 2005 through February 13, 2005

Documents available at NMFS Sustainable Fisheries Groundfish Web Site
http://www.nwr.noaa.gov/1sustfsh/gdfsh01.htm

70 FR 61595. Pacific Coast Groundfish Fishery; Notice of Intent to Prepare an Environmental Impact Statement or Environmental Assessment for Fishing Conducted under the Pacific Coast Groundfish Fishery Management Plan. Action: Notice of intent to prepare an environmental impact statement or environmental assessment; announcement of public scoping period; request for written comments - 10/25/05

70 FR 65861. Pacific Coast Groundfish Fishery; Spiny Dogfish; Open Access; Routine Management Measure; Closure Authority. Action: Emergency rule and extension of expiration date - 11/1/05

70 FR 70054. Pacific Fishery Management Council; Notice of Intent. Action: Notice of intent to prepare an environmental impact statement; request for comments; preliminary notice of public scoping meetings. NMFS and PFMC announce their intent to prepare an EIS to analyze proposals to allocate groundfish among various sectors of the non-tribal groundfish fishery - 11/21/05

70 FR 71449. Magnuson-Stevens Act Provisions; Fishing Capacity Reduction Program; Pacific Coast Groundfish Fishery; California, Oregon, and Washington, Fisheries for Coastal Dungeness Crab and Pink Shrimp; Industry Fee Collection System for Fishing Capacity Reduction Loan - 11/29/05

70 FR 72385. Pacific Coast Groundfish Fishery; Specifications and Management Measures; Inseason Adjustments. NMFS announces changes to Management Measures in the Commercial and Recreational Pacific Coast Groundfish Fisheries - 12/5/05

70 FR 72777. Pacific Coast Groundfish Fishery; Notice of Availability of Amendment 19 to the Pacific Coast Groundfish Fishery. Action: Notice of availability of an amendment to a fishery management plan; request for comments - 12/7/05

70 FR 75115. Pacific Coast Groundfish Fishery; Specifications and Management Measures. Action: Proposed rule; request for comments. NMFS proposes a rule to implement revisions to the 2006 Commercial and Recreational Groundfish Fishery Management Measures - 12/19/05

70 FR 76447. Pacific Fishery Management Council; Extension of Public Scoping Period for Intersector Groundfish Allocations. Action: Extension of public scoping period for an environmental impact statement (EIS); request for comments – 12/27/05

71 FR 27. Pacific Coast Groundfish Fishery; California, Washington, and Oregon Fisheries for Coastal Dungeness Crab and Pink Shrimp; Industry Fee Collection System for Fishing Capacity Reduction Loan. Action: Final rule - 1/3/06

71 FR 1998. Magnuson-Stevens Act Provisions; Fisheries off West Coast States in the Western Pacific; Pacific Coast Groundfish Fishery. NMFS proposes a rule to implement Amendment 19 to the Pacific Coast Groundfish Fishery Management Plan - 1/12/06

71 FR 4876. Pacific Halibut Fisheries; Catch Sharing Plan. Action: Proposed Rule. NMFS proposes to approve and implement changes to the Pacific Halibut Catch Sharing Plan for International Pacific Halibut Commission's regulatory Area 2A off Washington, Oregon, and California - 1/30/06

71 FR 4886. Pacific Coast Fishery; Correction. Action Proposed rule; correction. On January 12, 2006, a proposed rule to implement Amendment 19 to the Pacific Coast Groundfish Fishery Management Plan was published. The proposed rule was published with an incorrect RIN and also a number of errors in the Prohibition section and the different lists of coordinates - 1/30/06

71 FR 5836. Environmental Protection Agency. Environmental Impact Statements and Regulations; Availability of EPA Comments. EIS No. 20050506, ERP No. F-NOA-L91026-00, Pacific Coast Groundfish Fishery Management Plan, to Conserve and Enhance Essential Fish Habitat Designation and Minimization of Advise Impacts, Coast Exclusive Economic Zone, WA, OR, and CA - 2/3/05

71 FR 7535. Pacific Coast Groundfish Fishery; Application for an Exempted Fishing Permit. Action: announcement of the intent to issue the EFP; request for comments. NMFS announces the receipt of applications, and the intent to issue EFP's for vessels participating in an observation program to monitor the incidental take of salmon and groundfish in the shore-based component of the Pacific Whiting Fishery - 2/13/06

2005 PACIFIC WHITING FISHERY
FOR NON-TRIBAL MOTHERSHIPS AND CATCHER/PROCESSORS

(Based on NorPac Observer Data)

TABLE 1. SUMMARY - CUMULATIVE NON-TRIBAL CATCH OF ALL SPECIES

Groundfish	Retention (mt)	Discard (mt)	Total (mt)
Pacific whiting	126,685.63	775.17	127,460.80
Rockfish	120.07	115.66	235.73
Flatfish	3.67	1.22	4.89
All other groundfish	39.53	71.64	111.18
TOTAL	126,848.91	963.69	127,812.60
Prohibited Species		Number of fish	
Halibut		140	
Salmon		4,114	

TABLE 2. NON-TRIBAL ROCKFISH CATCH AND RATIO BY AREA (in metric tons)

ROCKFISH	VANCOUVER - 670			COLUMBIA - 710			EUREKA - 720			TOTAL WOC		
	Ret	Dis	Tot	Ret	Dis	Tot	Ret	Dis	Tot	Ret	Dis	Tot
Bocaccio	0.20	0.03	0.23	0.02	0.02	0.05	0.00	0.00	0.00	0.22	0.05	0.28
Other rockfish	24.51	1.66	26.17	26.23	6.59	32.82	0.21	0.02	0.23	50.95	8.27	59.22
POP	0.30	0.05	0.35	1.09	0.17	1.26	0.02	0.00	0.03	1.41	0.22	1.64
Thornyhead	0.00	0.00	0.00	6.56	0.47	7.04	0.05	0.00	0.05	6.61	0.47	7.09
Canary	0.25	0.13	0.38	0.34	0.31	0.65	0.00	0.01	0.01	0.59	0.45	1.04
Yellowtail	18.79	43.03	61.82	5.84	5.12	10.96	0.09	0.09	0.18	24.72	48.24	72.96
Widow	4.19	18.51	22.70	19.02	32.87	51.89	1.69	2.37	4.06	24.91	53.74	78.65
Chilipepper	0.00	0.00	0.00	0.69	0.44	1.13	0.01	0.01	0.02	0.70	0.45	1.15
Shortbelly	0.00	0.00	0.00	2.68	0.01	2.69	0.00	0.00	0.00	2.68	0.01	2.69
Darkblotched	0.09	0.00	0.10	6.50	2.15	8.65	0.69	1.59	2.27	7.28	3.74	11.02
TOTAL ROCKFISH	48.33	63.42	111.75	68.98	48.15	117.13	2.76	4.09	6.85	120.07	115.66	235.73
TOTAL WHITING	15,472	114	15,587	105,733	634	106,367	5,480	27	5,508	126,686	775	127,461
Rockfish /Whiting (mt/mt)	0.0072			0.0011			0.0012			0.0018		

Slight discrepancies occur due to rounding.

January 25, 2006

TABLE 3. NON-TRIBAL SALMON CATCH AND RATIO BY AREA

	VANCOUVER - 670	COLUMBIA - 710	EUREKA - 720*	TOTAL
Chinook (no.)	123	3,315	522	3,960
Other salmon (no.)	91	63	0	154
TOTAL salmon (no.)	214	3,378	522	4,114
Whiting (mt)	15,587	106,367	5,508	127,461
No. chinook/mt whiting	0.0079	0.0312	0.0948	0.0311

* Monterey area north of 39° rate was 0.03 salmon per mt whiting.

TABLE 4. CATCH BY NON-TRIBAL MOTHERSHIPS AND CATCHER/PROCESSORS

SPECIES	MOTHERSHIP					CATCHER/PROCESSOR					TOTAL WOC
	RETAIN (mt)	(%)	DISCARD (mt)	(%)	TOTAL (mt)	RETAIN (mt)	(%)	DISCARD (mt)	(%)	TOTAL (mt)	
Whiting	48,436	100	135	0	48,571	78,249	99	640	1	78,890	127,461
Rockfish	62.47	69	28.47	31	90.94	57.60	40	87.19	60	144.79	235.73
Flatfish	0.89	49	0.91	51	1.81	2.78	90	0.31	10	3.09	4.89
All other groundfish	16.44	41	23.60	59	40.04	23.09	32	48.04	68	71.13	111.18
TOTAL	48,516	100	188	0	48,704	78,333	99	776	1	79,109	127,813
SALMON				%	No.				%	No.	
Chinook				96	2206				97	1754	3960
Other				4	94				3	60	154
Total					2300					1814	4114
No.chinook/mt whiting					0.0456					0.0224	0.0311

Slight discrepancies occur due to rounding.

Table 5. CATCH OF ROCKFISH BY NON-TRIBAL MOTHERSHIPS AND CATCHER/PROCESSORS

ROCKFISH SPECIES	MOTHERSHIP	CATCHER/PROCESSOR	TOTAL
Bocaccio	0.16	0.11	0.28
POP	0.86	0.78	1.64
Thornyheads	0.74	6.34	7.09
Canary rockfish	0.70	0.34	1.04
Yellowtail rockfish	25.52	47.44	72.96
Widow rockfish	35.50	43.14	78.65
Chilipepper rockfish	0.89	0.26	1.15
Shortbelly rockfish	2.68	0.01	2.69
Darkblotched rockfish	5.08	5.95	11.02
Other rockfish	18.81	40.42	59.22
TOTAL ROCKFISH	90.94	144.79	235.73
Mt whiting	48,571.23	78,889.57	127,460.80
Mt rockfish/mt whiting	0.0019	0.0018	0.0018

January 25, 2006

Table 6. 1998-2005 PACIFIC WHITING NON-TRIBAL AT-SEAS PROCESSING VESSELS

GROUNDFISH	WEIGHT (mt)							
	1998	1999	2000	2001	2002	2003	2004	2005
Pacific whiting	120,452	115,259	114,655	94,451	62,935	67,236	97,277	127,461
Pacific cod	0.00	0.04	0.19	0.00	0.00	0.25	0.02	0.01
Lingcod	0.11	0.06	0.41	0.66	0.27	0.49	1.18	2.42
Sablefish	27.83	2.10	47.13	21.50	21.02	16.95	28.71	15.13
Arrowtooth	1.04	3.21	8.61	3.76	2.17	2.86	1.12	1.26
Dover sole	0.01	0.00	0.27	1.53	0.65	0.85	0.14	0.38
English sole	0.00	0.02	0.22	0.10	0.11	0.02	0.02	0.06
Petrale sole	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Rex sole	0.36	0.02	5.54	18.32	11.51	6.71	1.89	3.18
Rock sole	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Starry flounder	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
All other flatfish spp	0.01	0.01	1.32	7.05	0.15	0.18	0.02	0.01
Bocaccio	1.21	0.32	2.65	0.29	0.19	0.06	0.16	0.28
Canary	2.72	1.22	1.42	1.61	2.41	0.26	4.60	1.04
Chilipepper	0.01	0.54	4.83	3.57	4.90	1.26	1.97	1.15
Darkblotched				12.07	3.13	4.31	7.38	11.02
POP	21.28	14.15	9.61	19.74	3.62	5.16	1.05	1.64
Shortbelly	0.02	0.00	0.86	27.33	0.60	0.51	0.02	2.69
Thornyhead	2.51	0.02	19.07	15.21	11.91	15.65	5.64	7.09
Widow rockfish	292.76	148.95	220.62	168.91	135.60	12.25	19.80	78.65
Yellowtail	376.98	684.13	555.56	124.99	14.28	2.32	18.49	72.96
Yelloweye					0.00	0.00	0.00	0.00
Other rockfish spp	62.36	33.15	120.34	66.15	20.54	24.74	25.83	59.22
Other groundfish	218.07	254.05	92.46	89.18	38.82	14.33	349.89	94.81
TOTAL GROUNDFISH	121,689	116,401	115,746	95,033	63,207	67,345	97,738	127,813
CPS SPECIES								
Pacific mackerel	458.78	1.47	15.52	47.29	0.04	0.00	0.00	0.03
Jack mackerel	229.14	53.84	52.98	107.43	6.85	12.38	58.07	4.44
Pacific sardine	1.94	0.18	0.06	0.23	0.01	0.00	0.00	0.04
PROHIBITED SPECIES	Number							
	1998	1999	2000	2001	2002	2003	2004	2005
Chinook Salmon	1,477	4,391	6,260	2,568	1,679	2,648	805	3,960
Other Salmon	27	802	115	770	173	224	56	154
TOTAL SALMON	1,504	5,193	6,375	3,338	1,852	2,872	861	4,114
Percent chinook salmon	98.2	84.6	98.2	76.9	90.7	92.2	93.5	96.3
Chinook/mt whiting	0.0123	0.0381	0.0546	0.0272	0.0267	0.0394	0.0083	0.0311
Pacific Halibut	7	47	211	74	59	199	72	140

1/ Defined as sharks, skates, kelp greenling, cabezon, ratfish, morids, and grenadiers.
2/ Non-groundfish species that are incidental to the whiting fishery, but which are not prohibited.
Slight discrepancies occur due to rounding.

January 25, 2006

2004 PACIFIC WHITING FISHERY SUMMARY, ALL SECTORS

SPECIES	TRIBAL						NON-TRIBAL MOTHER-SHIPS		CATCHER/ PROCESSORS		SHORE-BASED PROCESSORS			TOTAL WOC	
	MOTHERSHIP		SHORE BASED		ALL TRIBAL						EFP only		non-EFP		
	mt	Rate	mt	Rate	mt	Rate	mt	Rate	mt	Rate	mt	Rate	mt	mt	Rate
Whiting Allocation					35,000		55,696		78,903		97,469			267,069	
WHITING	23,419		10,938		34,357		48,571		78,890		97,378		3	259,199	
Yellowtail Rockfish	39.19	0.0017	16.09	0.0015	55.28	0.0016	25.52	0.0005	47.44	0.0006	170.43	0.0018		298.97	0.0012
Widow Rockfish	1.39	0.0001	0.52	0.0000	1.91	0.0001	35.50	0.0007	43.14	0.0005	77.15	0.0008		157.70	0.0006
Canary Rockfish	0.41	0.0000	0.20	0.0000	0.61	0.0000	0.70	0.0000	0.34	0.0000	2.22	0.0000		3.87	0.0000
Darkblotched Rockfish	0.02	0.0000	0.00	0.0000	0.02	0.0000	5.08	0.0001	5.95	0.0001	5.34	0.0001		16.39	0.0001
POP	0.06	0.0000	0.00	0.0000	0.06	0.0000	0.86	0.0000	0.78	0.0000	0.52	0.0000		2.22	0.0000
Lingcod	0.99	0.0000	0.02	0.0000	1.01	0.0000	2.02	0.0000	0.39	0.0000	5.87	0.0001		9.29	0.0000
Yelloweye	0.00		0.00		0.00		0.00		0.00		0.01	0.0000		0.01	
All other groundfish	286.48		3.17		289.65		63.32		120.96		148.21			622.14	
TOTAL GROUNDFISH	23,748		10,958		34,706		48,704		79,109		97,481		3	260,307	
Percent over/under Whiting Allocation					- 1.8%		- 12.8%		0.0%		-0.1%			- 2.9%	
	Number	Rate	Number	Rate	Number	Rate	Number	Rate	Number	Rate	Number	Rate		Number	Rate
Chinook	3,862	0.1649	76	0.0069	3,938	0.1146	2206	0.0454	1754	0.0222	4,018	0.0413		11,916	0.0460
Non-Chinook (including salmon unident.)	737		40		777		94		60		92				

Data sources: All data is total catch (retained plus discarded catch). The at-sea Catcher/processor and mothership data is from the NorPac data base. Shore-based data is from Oregon Department of Fish and Wildlife 2004 shore-based sampling summary, and the tribal shore-based catch was provided by the Makah fisheries office
a/ Does not include Pacific cod, flatfish, skates or sharks other than spiny dogfish

Connecting Experiential Knowledge and Scientific Knowledge to Improve Stock Assessments

A Brief Progress Report from a Port Liaison Project Sponsored Project
February 2006

Background and Rationale

Over the years discussions have occurred about how to increase the understanding of the commercial fishing community about stock assessments and the stock assessment process, and how to get more engagement and integration of fishermen's knowledge into the assessment process. An "ad hoc" group of West Coast fisheries scientists, managers, fishing community members, and educators got together and decided to encourage movement on this front. Staff at NOAA Fisheries Northwest Fisheries Science Center and Oregon Sea Grant put articles on the Heads Up! web site (Spring 2005). Others began promoting existing workshops (NOAA Fisheries "data workshops", "Stock Assessment for Fishers" workshops, etc.). And the Port Liaison Project[1] provided support for a project that focuses on this issue.

The Port Liaison Project (PLP) supported project has two goals:

1. to connect interested fishermen with stock assessment authors early in the process (b/4 STAR panels) to improve stock assessments (especially important for "first time" assessments), and
2. support the mentorship of 2-4 fishermen to participate in 2005 STAR panels.

Unfortunately, because of the timing of the project, we began with Goal #2 first, and are now moving toward focusing on Goal #1. Ideally, it will be the other way around; fishermen and stock assessment authors would regularly learn from each other to improve the creation of these stock assessments, and a few, committed fishermen would participate in the STAR panel process.

What We Did

Getting Started

Following standard PLP procedures, port liaisons identified potential industry cooperators to participate in the 2005 STAR panel process. However, the major challenge in executing this project was finding fishermen able and willing to commit to participate. Likely reasons for this were:

1) STAR panel meetings are five days long. This requires a lot of time for fishermen to spend away from their businesses.
2) The timing of the STAR panels is mid-fishing/good weather season.
3) Most fishermen feel ill-prepared to sit in a room full of scientist and listen to them talk.

[1] The Port Liaison Project is an innovative project funded by grant from NOAA Fisheries Northwest Fisheries Science Center, via the Cooperative Institute for Marine Resources Studies, and is administrated by Oregon Sea Grant. The project began in the spring of 2003, with funding for up to 3 years. The goal of the Port Liaison Project is to move towards truly collaborative research by supporting cooperative ocean or fisheries research.

What Occurred
Accompanied by a fishing community mentor, 3 different fishermen agreed to participate in the 2005 STAR panel process. Each were from a different state (WA, OR, and CA). Two of these were trawl vessel owner/operators and one was a charter boat owner/operator. Each of these fishermen attended a different STAR panel meeting.

At the time of the STAR panel meetings each of these fishermen found it difficult to sit through the week-long meeting and follow all of the discussion. At times they would also become frustrated when the discussion would focus on some piece of information that they felt was not reflective of what they see in the ocean.

Several months following the STAR panel meetings, each of these fishermen were interviewed (asked open-ended questions) about their experience with the STAR panel process. Enough time had elapsed so the discomfort and frustration of the meetings had passed and they could give more thoughtful evaluation of their experience. The goal of the interviews was to learn what they thought could/should be done to make fishing community participation more meaningful or to improve the system.

<u>What We Learned</u>
There was a great amount of commonality in each of their replies. Although they did say things in their own way, they all had comments that fell into the following five thematic categories:

1) **Education is needed.**
   Some form of stock assessment orientation or written primer that they could study prior to the meetings would have made the process more meaningful and better prepared them to provide helpful insights into the sock assessment process.

2) **Get fishermen and stock assessment authors together *before* modeling.**
   They would like to have been able to have "pre-assessment discussions" with the assessment author about the fishery. Each was left with the impression that stock assessment authors knew little about the fishery and in some cases what the fish even looked like. Through such discussions they felt they could assist the process the most. The lack of this type of input was the source of much of their frustration.

3) **It is important to get materials *before* the STAR panel meetings.**
   They would like to have received some of the draft assessment papers in advance of the meeting. The goal of the STAR panel arrangement was to have draft assessments available to reviewers two weeks prior to the meeting; the drafts were not widely available to others within that time frame. However, when drafts were available they were available only in an electronic format (which is difficult for people without high speed printers). Granted, all three of these fishermen operated their own boat, so the amount of time available to them to

spend reading draft assessments was limited, but they still commented that this would have been optimal.

4) **The STAR panel process is overloaded.**
   Each fisherman commented that it was apparent that the panels had little time to work through all of the assessments and that critical species were receiving the same amount of attention that less constraining species were receiving. In their view, those species which are critical to the management process should be reviewed much more carefully and thoroughly than those that have little management implications.

5) **Fishermen want to play a role in collecting missing data.**
   Part of the STAR Terms of Reference requires a discussion about data and research needs. Each fisherman commented that when missing or poor data was identified as a problem with an assessment, they would like to have had a discussion about how to help collect data that would improve the quality of the assessment. Fishermen are very interested in participating in collaborative research and data collection projects and they feel they have some insight into how missing information could be obtained.

<u>Next Steps / Recommendations</u>

The PLP supported project will spend this spring focusing on goal #1, to connect interested fishermen with stock assessment authors earlier in the process (b/4 STAR panels) to improve stock assessments. Targeting three stocks and the authors for each, the PLP will engage in an effort to link knowledgeable, willing fishermen to meet with these authors to have pre-STAR panel dialogues about the stocks. The approach will be to discuss questions lingering from the most recent assessment experience (possibly from the research and data needs list), in an effort to find some answers to these questions or get something started that would eliminate problems / gaps in the future.

Although the PLP supported project is still "in progress," the lessons learned could point to a few recommendations that should be considered:

- A basic primer on stock assessment needs to be made available to and used by interested members of the fishing community.
- Two lists could be created and used (one of stock assessment authors interested and willing to work with fishermen, and the other of fishermen interested and willing to work with stock assessment authors).
- Pre-assessment meetings or workshops would be helpful for both fishermen and stock assessment authors.
- Fishermen could help the most where there are anomalies in data or where data is missing.

For more information about this PLP supported project or others, visit the PLP web site at http://www.heads-up.net/plp or contact Flaxen Conway at 541-737-1418.

Agenda Item F.2
Situation Summary
March 2006

STOCK ASSESSMENT PLANNING FOR THE 2009-2010 FISHING SEASON

The Council approved Amendment 17 to the Pacific Coast Groundfish Fishery Management Plan as a means of providing for a biennial management cycle, more opportunity for public input, regulatory efficiencies, and various improvements in the management process. In this process there is a year in which assessments are done to inform decisions for the following biennial management cycle, followed by a year for deciding the new groundfish harvest specifications and management measures. This agenda item concerns planning for new groundfish stock assessments that are anticipated to be done next year, which will be used to decide the harvest specifications and management measures for 2009 and 2010 groundfish fisheries.

Last year 23 groundfish stock assessments were conducted, peer-reviewed, and ultimately adopted for deciding 2007 and 2008 harvest specifications and management measures. This was an ambitious undertaking, which stressed the Council and National Marine Fisheries Service (NMFS) groundfish assessment process on many levels. The Council therefore sponsored a workshop to critically review the recent groundfish stock assessment process and invited the participants to explore improvements to this process. The summary minutes of the January 13, 2006 Groundfish Stock Assessment Review Workshop with recommended assessment process improvements are provided in Agenda Item F.2.b, Attachment 1.

Dr. Elizabeth Clarke, Division Director at the NMFS Northwest Fisheries Science Center, will report on proposed stock assessments for the next biennial fishery management cycle and recommended criteria for prioritizing these assessments (Agenda Item F.2.c, Attachment 1).

The Scientific and Statistical Committee (SSC) developed a draft Terms of Reference for the Groundfish Stock Assessment and Review Process for 2007-2008 (Agenda Item F.2.d, Attachment 1), which specifies how the next assessment process should occur and defines the roles and responsibilities of various entities contributing to this process. Dr. Martin Dorn, the SSC's Groundfish Subcommittee chair, will report on this draft Terms of Reference.

The Council is to consider the input from NMFS, the advisory bodies, and the public; as well as the recommendations of the stock assessment review workshop participants before providing a preliminary decision on stock assessment priorities by species, type of assessment (full or update), and assessment review schedule. Additionally, the Council should provide guidance on the draft Terms of Reference for the Groundfish Stock Assessment and Review Process for 2007-2008. There will be a public review opportunity between the March and April Council meetings, with the Council scheduled to take final action on the 2007 and 2008 assessment process at the April meeting.

Council Action:

1. **Adopt for Public Review the Preliminary Terms of Reference for the Groundfish Stock Assessment and Review Process For 2007-2008.**
2. **Adopt for Public Review the List of Stocks To Be Assessed in 2007.**
3. **Adopt for Public Review the 2007 Stock Assessment Review Schedule.**

Reference Materials:

1. Agenda Item F.2.b, Attachment 1: Draft Summary Minutes of the January 13, 2006 Groundfish Stock Assessment Review Workshop.
2. Agenda Item F.2.c, NWFSC Report: Preliminary Stock Assessment Priorities for 2007.
3. Agenda Item F.2.d, Attachment 1: Draft Terms of Reference for the Groundfish Stock Assessment and Review Process for 2007-2008.

Agenda Order:

a.	Agenda Item Overview	John DeVore
b.	Report from the Stock Assessment Process Review Workshop	Don McIsaac
c.	Stock Assessment Options	Elizabeth Clarke
d.	Preliminary Stock Assessment Terms of Reference	Martin Dorn
e.	Reports and Comments of Advisory Bodies	
f.	Public Comment	
g.	**Council Action:** Adopt for Public Review the Preliminary Terms of Reference, List of Stocks to be Assessed, and Stock Assessment Review Schedule	

PFMC
02/16/06

DRAFT SUMMARY MINUTES

Groundfish Stock Assessment Review Workshop

Pacific Fishery Management Council
Sheraton Portland Airport Hotel
Columbian A Room
8235 NE Airport Way
Portland, OR 97220
503-281-2500

January 13, 2006

FRIDAY, JANUARY 13, 2006 – 8 A.M.

Attendees:

Dr. Elizabeth Clarke, National Marine Fisheries Service Northwest Fisheries Science Center
Dr. Martin Dorn, National Marine Fisheries Service Alaska Fisheries Science Center, Scientific and Statistical Committee
Dr. Steve Ralston, National Marine Fisheries Service Southwest Fisheries Science Center, Scientific and Statistical Committee
Dr. Alec MacCall, National Marine Fisheries Service Southwest Fisheries Science Center
Dr. Jim Hastie, National Marine Fisheries Service Northwest Fisheries Science Center
Dr. David Sampson. Oregon State University, Scientific and Statistical Committee
Dr. Richard Methot, National Marine Fisheries Service
Mr. Jason Cope, University of Washington
Dr. Mark Maunder, International Tropical Tuna Commission, Quantitative Resource Assessment LLC
Mr. Ian Stewart, National Marine Fisheries Service Northwest Fisheries Science Center
Dr. Owen Hamel, National Marine Fisheries Service Northwest Fisheries Science Center, Scientific and Statistical Committee
Dr. Robert Mohn, Department of Fisheries and Oceans, Center of Independent Experts
Mr. Tom Jagielo, Washington Department of Fish and Wildlife, Scientific and Statistical Committee
Mr. Guy Fleischer, National Marine Fisheries Service Northwest Fisheries Science Center
Ms. Meisha Key, California Department of Fish and Game
Ms. Michele Culver, Washington Department of Fish and Wildlife, Groundfish Management Team
Mr. Brian Culver, Washington Department of Fish and Wildlife, Groundfish Management Team
Mr. Mark Saelens, Oregon Department of Fish and Wildlife, Groundfish Management Team
Dr. Steve Berkeley, University of California Santa Cruz, Scientific and Statistical Committee
Dr. Michael Schirripa, National Marine Fisheries Service Northwest Fisheries Science Center
Mr. Tom Ghio, Groundfish Advisory SubPanel
Dr. John Field, National Marine Fisheries Service Southwest Fisheries Science Center, Groundfish Management Team
Mr. Curt Melcher, Oregon Department of Fish and Wildlife
Mr. Rishi Sharma, Columbia River Intertribal Fish Commission
Mr. Henry Yuen, United States Fish and Wildlife Service

Mr. Steve Joner, Makah Tribe
Mr. Hap Leon, Makah Tribe
Mr. Rob Jones, Northwest Indian Fish Commission, Groundfish Management Team
Mr. Kelly Barnett, Independent Fish Filleter, Bay City, Oregon
Ms. Stacey Miller, National Marine Fisheries Service Northwest Fisheries Science Center
Mr. Pete Leipzig, Fishermen's Marketing Association
Mr. Brad Pettinger, Oregon Trawl Commission
Mr. Dan Waldeck, Pacific Whiting Conservation Cooperative
Mr. Steve Theberge, Oregon Sea Grant
Dr. Donald McIsaac, Pacific Fishery Management Council
Mr. Mike Burner, Pacific Fishery Management Council
Mr. John DeVore, Pacific Fishery Management Council

A. *Administrative Matters*

1. Roll Call, Introductions, Announcements, etc.

Dr. McIsaac called the meeting to order at 8:20 a.m. A round of introductions was done.

2. Opening Remarks and Agenda Overview

Mr. DeVore reviewed the agenda. He explained these minutes would help inform the Council process to plan the next suite of stock assessments and the review of those new stock assessments. The Council will consider recommendations from the workshop participants at the March Council meeting. Final adoption of the next round of assessments; new Terms of Reference for stock assessments and assessment reviews; new Terms of Reference for Rebuilding Analyses; and all the other elements of the Council assessment process will occur at the April Council meeting.

B. *Perspectives on 2005 Stock Assessment Process*

1. Groundfish Management Team (GMT) Perspective

Mr. Saelens provided the GMT perspective. The general thought was 23 assessments were too many done in too brief a period. About 10-15 assessments per cycle seemed more reasonable. The GMT also believed there were too many assessments reviewed per Stock Assessment Review (STAR) panel. In many instances, a base model was not decided until late in the week. It might help to have the most contentious and/or complicated assessments scheduled early in the process. Every effort was made to get the information out to the public as early as possible. The GMT recommends a debriefing by the Stock Assessment Team (STAT) after a STAR panel recommends an assessment. The GMT wants more specific advice from STAR panels and the Scientific and Statistical Committee (SSC) on how the science should be applied to management decision-making. There was also concern that not all assessments had the requisite management estimates and other details mandated by the Terms of Reference. This includes lack of timely delivery of STAR panel reports when an assessment is first considered. Most of the executive summaries in assessments were clear and concise, but improvements can be made, particularly with respect to what models and estimates should be used to formulate management advice. The GMT recommends a management trigger to decide which assessments should be done next. The importance to management or risks to stocks of overexploitation are example triggers for making this decision. The GMT agrees early decision-making on the next cycle or more of assessments should be done for contributors to prepare data used in assessments. The GMT recommends the next process be set up to get adequate interactions between STAT teams and Council advisors. Dr. Dorn asked if it would help if STAR Panel chairs attended a GMT meeting. Mr. Saelens said that would help, but it was hard with filled agendas to carve out that time. Perhaps some triage to get such interactions for more complicated or contentious assessments is the answer. Need to do a better job planning sampling priorities for use in assessments. This was a time-honored process that has slipped in recent years. The GMT recommends a greater amount of biological sampling needs to occur in the at-sea observer program. The GMT wants a greater role in the STAR panel process. The GMT could help set a probable range of optimum yields (OYs) earlier in the assessment process (i.e., during the STAR panel). The GMT is concerned with the range of methods used to account for total mortality in assessments. A more consistent approach is requested. Ms. Culver expressed the opinion that the number of assessments done last year (23) was not necessarily too many, if the process was changed to accommodate that many (i.e., fewer assessments reviewed per STAR panel). The GMT wants to set up future processes to allow new stocks to be assessed. All overfished species are assessed each cycle and other important stocks are frequently assessed as well, which limits the number of new assessments. The plan needs to incorporate the quality of assessment data as well as risks to the stock when deciding which stocks get assessed. Mr. Culver said better planning on the data going into assessments would benefit the process. He cited the problems with the petrale sole assessment where the STAT Team was not aware of critical data gaps until the STAR panel. Contributing agencies need to tune in to the pre-assessment data workshop. Dr. Clarke commented that the observer program is collecting some ageing data. They are trying to balance the amount of time dedicated to at-sea catch and biological sampling. Dr. Mohn said he was surprised at the lack of risk plots in the Council's assessment process. Mr. Saelens said he thought that should be the fundamental structure of an assessment decision-table. (Currently, decision tables are used to address assessment modeling uncertainty) Perhaps both treatments are needed: one decision table to depict assessment uncertainty and one table depicting risk of alternative mortality schedules using the most plausible base model in the assessment.

2. Groundfish Advisory SubPanel (GAP) Perspective

Mr. Ghio provided the GAP perspective. Originally, STAR panels were set up to solicit industry input and instill industry confidence in the assessment process. Now, the GAP representative to a STAR panel has a much diluted role. There is also a critical need to have a STAT team member or the STAR panel chair interact with the GAP to answer questions on assessments. The GAP needs a better understanding of the assessment details to make informed recommendations on OYs. In general, he agreed with the comments and recommendations of the GMT as expressed by Mr. Saelens. Mr. Ghio thought one of the priorities in the assessment decision-making process is to assess the more constraining and/or valuable species more frequently. STAR panels spent the majority of time on modeling approaches rather than the quality of input data or the assessment result.

3. SSC Perspective

Dr. Dorn provided the SSC perspective and requested other SSC members in attendance to chime in. The SSC were the architects in this process and did warn the quantity of assessments would compromise the quality. This did occur to some degree; however, the overall quality of assessments given the magnitude of the task is laudable. Now we should think about how to make the process more efficient by doing fewer things better. Shifting more stock assessments into an update mode is one way to achieve this goal. Especially now that the Stock Synthesis 2 (SS2) model is tried and true, there should be more stability in the next cycle. Thoughtful planning on which new assessments should be done will help keep future problems to a minimum. Dr. Ralston agreed one of the major changes to the process last year was to have SSC members chair STAR panels. This provided continuity despite the extra workload. This was a good idea and should be continued. Dr. Dorn thought one problem was the STAR chair became too wedded to the STAR panel recommendations. There should be more sensitivity to outside views of SSC members and other advisors by the STAR chairs after a STAR panel has finished their business. Mr. Jagielo emphasized the problem with the process last year was everyone was working in a new modeling environment (SS2). However, he gave kudos to Dr. Methot for helping everyone understand the complexities of SS2. Dr. Berkeley recommended some greater thought in what kinds of data should be incorporated in an assessment. More consideration of the age structure of the spawning stock and genetic structures should be incorporated more thoroughly in assessments. Ecosystem-based principles needed to be considered as well. More complex spatial management issues need to be considered more thoroughly. Perhaps trophic relationships should be more thoroughly considered as well. One possible improvement might be to do multi-species assessments instead of single species assessments. The scientific community is currently grappling with these issues. Dr. Mohn thought some of the Council's data issues compromise current single-stock assessments. There should be more thought on the biological data sampling and some of the shortcomings of current data (i.e., lack of ageing structures, etc.). Dr. MacCall thought these issues should be addressed during the assessment "off-year". Dr. Field said North Pacific scientists are starting to incorporate food web/trophic relationships in assessment and cited recent pollock assessments. Dr. Berkeley said spatial considerations are critical to avoid localized depletion and other problems. Dr. Dorn said there is a current mandate to evaluate ecological, spatial issues. There is a problem with the lack of informative data that are useful. Dr. Clarke said the Council also needs to plan on how they use ecosystem-based information in their management decisions. Dr. Ralston said there is currently tension between doing updates and incorporating ecosystem considerations in assessment. Such new assessments require more thought and review and will compromise the number of assessments that can be done in a cycle. Dr. Hamel said it will take time to decide how such new information will be incorporated in assessment and used in management decision-making.

4. Northwest Fisheries Science Center (NWFSC) Perspective

Dr. Clarke provided the NMFS perspective and had a Powerpoint presentation to emphasize her points. She also handed out a summary of reviewers' comments to the 2005 STAR process. She reviewed the previous process from the data workshop through the variety of STAR panels. Each STAR panel was chaired by an SSC member and the number of panel members was N (number of assessments) plus 1. There was a single CIE reviewer (Dr. Mohn) who attended each STAR panel except for the hake STAR panel. SS2 was used in most cases. The NWFSC requested summary items for the executive summary of each assessment (new mandate). The NWFSC requested assessment authors list all their intended input data after the Data Workshop. This was done to prepare data contributors, but was only partially successful. Another new item was the “sweep-up” or “mop-up” STAR panel, which was useful (3 assessments were referred to this panel).

Some shortcomings to the process: Several assessments were incomplete coming into the STAR panel or were distributed later than two weeks prior to the STAR panel. There was not enough participation in the Data Workshop. This was a new workshop and more people are expected to tune in to the next workshop. There was not enough utilization of assessment authors’ list of data needs. There were too many assessments done last year and too many assessments reviewed at each panel. There were no species-specific data workshops prior to STAR panels. There were no species-specific presentations to the Council family after the STAR panel.

We need to collectively decide the goal of the assessment process. We should be explicit that the goal is not to assess every groundfish species managed under the FMP. This is neither attainable nor critical to the process. She underscored the value of Stacey Miller’s coordination efforts. She solicited comments from the groups on how to make the logistics more efficient. Dr. Ralston requested more dialogue between the NWFSC and the Southwest Fisheries Science Center (SWFSC). Dr. Clarke said the SSC was the group the NWFSC coordinated with. Dr. Ralston said the SWFSC is doing more planning regarding sampling and assessments. Dr. Clarke agreed more coordination with the SWFSC was a good idea. Dr. Methot said one of the overarching objectives implied in the law and policy is to assess all species. Perhaps a multi-species approach should be more carefully considered. What do we need to say to defer a species’ assessment? What is the probability we are avoiding overfishing in the current and future management regime if an assessment is not done? These are important questions that need to be answered in the process. Dr. MacCall said there seemed to be many entities involved that appeared to be in charge (NWFSC, SSC, Council, and Council staff). Dr. Clarke said the Council is in charge of this process according to FACA rules. The Council delegates science advice and direction to the SSC and logistic support to the NWFSC. Her perspective is that many entities chipped in to help move the process along. Dr. MacCall requested more formal direction from the Council. Dr. Methot said, while ownership of the process is with the Council, there is the issue of corporate ownership of the assessment itself. NMFS relies on the Council review process to decide whether an assessment is the best available science despite the fact that the agency does an independent review of the quality of the assessment and the review. Dr. Clarke said the NWFSC works with the Council to ensure the Council science review process satisfies OMB rules and policies. For any assessment coming from the NWFSC, she signs a letter validating that it complies with the OMB circular. Dr. Dorn said the modeling environment of SS2 is now locked into the Council process. Perhaps different types of assessments and assessment models should be considered. A lot of data is left unexamined. Dr. Methot said there is nothing in the Terms of Reference mandating SS2. Dr. Dorn stated implicit in the current process is the need to fit the data to an assessment model. Returning to Dr. Methot’s recommendation to address all FMP species is to use what you do know in a NEPA document or a multi-species assessment to decide management risk. For instance, identify species with de minimus exploitation. Dr. Schirripa thought that to do this, more flexible rules/guidelines are needed for determining if a stock is overfished or experiencing overfishing. Dr. Methot said there are a variety of processes used nationwide to decide management risk. It is better to gain your flexibility in methods for determining stock status and risk rather than changing the rules.

5. Council Perspective

Dr. McIsaac polled Council members on their perspectives. He talked with Frank Warrens, Don Hansen, Dave Ortmann, and Bob Alverson; and also received emails from Patty Burke, Rod Moore, and Marija Vojkovich. General comments: 23 assessments were too many (with current resources), there were too many full assessments, the roles of GAP and GMT representatives on STAR panels needs to be formalized, 4 assessments per STAR panel were too many and 3 may be pushing it, there was not enough debriefing on individual assessments (many Council members were not comfortable with the advice, or lack of advice, given), more specific management advice is needed (e.g., how should the kelp greenling assessment be used for management?), consistent and useful decision tables are needed, timely delivery of stock assessments and STAR reports was lacking in some instances, more resources/funding for this process is needed, guidelines are needed to prioritize assessments, and many Council member gave their compliments for achieving such an ambitious goal of doing 23 assessments.

Mr. Saelens complimented staff for their roles in the process. He encouraged assessment authors to date-stamp all their documents to maintain version control.

C. Improving the Stock Assessment Process

1. Pre-Assessment Planning
   a. What Worked and What Didn't in 2004-2005
   b. Recommended Improvements for 2006-2007

Dr. Clarke said one consistent recommendation from reviewers was better reviews depended on scheduling fewer assessment reviews per STAR panel. Addressing this requires either fewer assessments be done, more reviewers dedicated to the process, or fewer reviewers per panel. Most reviewers thought 2 assessments per panel was ideal for a 1-week panel with the potential of adding a third assessment if they are not too complicated. Some reviewers and assessment authors stated their workload was too high. Dr. Sampson said incorporating the new SS2 model during 2005 added to the workload because of the steep learning curve. Dr. Clarke said another factor is the delivery of assessment input data. For instance, trawl survey data from the previous summer and fall are delivered in February. Some NWFSC recommendations: try to schedule only 2 assessments per panel, plan for a maximum of 8-10 full assessments, not all assessments need to be done each cycle, clear criteria should be developed for determining priorities for full assessments, updates should be reviewed by the SSC only. Dr. Dorn thought a separate meeting of the SSC Groundfish Subcommittee to review all updated assessments might be advisable. The review itself should be expedited and could be done early in the process. Another idea is to review 2 full assessments plus 1 updated assessment per STAR panel. Dr. Mohn thought that process improvement would work; however, there was a problem with some "updated" assessments coming in that were not really updates (i.e., yelloweye). Dr. Mohn recommended reviewing "benchmark" data-poor assessments early in the process. Much can be learned reviewing such assessments that can be applied in later assessment reviews. Mr. Ghio said a disciplined approach in the assessment review is needed to ensure assessments comply with the Terms of Reference. Mr. Burner said scheduling an SSC review of updated assessments was and could continue to be problematic given SSC members' heavy workload. Mr. Saelens thought updated assessments could be done and reviewed in the off-year. Dr. McIsaac said if the intent is to use these assessments in the next management cycle, then it is hard to defend that decision-making uses the best available science if a reviewed assessment is sitting on the shelf. The potential benefits of multi-year management are eroded in this case and the management regime is vulnerable to legal challenge. Ms. Culver asked if there was a requirement to do a full assessment of overfished stocks every cycle. The mandate is to review rebuilding plans at least once every other year and a full assessment, or even an updated assessment, is not necessary. A data review may be sufficient to decide whether catches are staying within OYs; however, it may be advisable to at least do an updated assessment every cycle for a stock under rebuilding. Dr. McIsaac encouraged brainstorming on a policy for this and let the Council decide a policy later after receiving recommendations. Dr. MacCall recommended putting into the Terms of Reference a requirement for STAR panels to specify whether an assessment is sufficiently developed to do an update in the next cycle.

Dr. Clarke discussed recommended criteria for determining assessment priorities and whether they should be full assessments for the next cycle. Criteria include assessments not currently done using SS2, new stock assessments, etc. for deciding whether an assessment should be a full one. Dr. Hastie said NMFS Headquarters has also determined if an assessment hasn't been done within five years, it is considered out of date.

Dr. Ralston recommended pre-assessment planning within NMFS between the NWFSC and the SWFSC before a recommendation is brought forward into the Council process. Data needs and resource capacity needs to be internally deliberated to decide what can be done. Dr. Clarke thought the first step is to develop criteria for deciding the list of stocks that should be assessed.

Dr. Clarke recommended a pre-STAR data workshop to prepare for assessments. Dr. Dorn thought it would be more useful if there were multiple single-species workshops to bring the right people into the process and deliberate assessment data needs in more detail. Mr. Culver recommended a sampling meeting earlier in the process to prioritize preparation of assessment data. Dr. Methot thought workshops that are subject oriented, such as a trawl survey workshop, would be most efficient. Such workshops would be useful for a host of stock assessments.

A discussion of how to balance the assessment workload with a mix of full and updated assessments ensued. There is a dynamic tension between allowing creativity and innovation in an assessment and engineering a stable process by planning for updated assessments that do not need such a comprehensive review as a full assessment. With the limited resources available, this will remain a conflict.

Dr. Sampson asked if we need a modeling workshop for the next cycle. There were other ideas for workshops beyond those already recommended for this year. Issues, such as how to address model uncertainty, require a lot of careful planning and preparation. Workshops are expensive and need to be carefully planned and prioritized. Some workshops are generic (i.e., the data workshop) and others are specific to one issue (i.e., the contemplated juvenile survey workshop).

2. Stock Assessment Reviews
    a. What Worked and What Didn't in 2004-2005
    b. Recommended Improvements for 2006-2007

Dr. Mohn provided his perspectives on the 2005 STAR process. He thought the process would benefit from more pre-review vetting of data issues. Assessments need more documentation of input data and better descriptions of methodologies. In some cases, which were rare but serious, pre-review assessment drafts were incomplete. In his opinion, there was inadequate contemplation of data (and this was more common). More interaction with fishermen would benefit the sensibility and quality of input data. There was too little context of why assessments were done the way they were. The previous STAR reports with lists of recommended improvements were helpful, but needs to be emphasized. There was too little synthesis of data in pre-review assessments. Requests for re-runs/alternate model runs varied from panel to panel and were not always clearly articulated to STAT Teams – this could be improved. The STAR review schedule was too ambitious- review fewer assessments to improve quality of assessment reviews. Updates should stay as updates- inject more discipline in the review process. The roles of STAT Teams vs. STAR members created a natural tension that was hard for STAR chairs to fix. The SSC, having such a strong role in the STAR process, was mostly positive despite their lack of independence in the process. The choice of a chair for the STAR panel is perhaps more critical than reviewers because there are a number (3-4) of reviewers to help one another, but the chair has no back-up. Communication in the process could be improved. Not all STAT teams attended all the Council, SSC and other meetings that were integral in the process. Treatment of uncertainty varied greatly from panel to panel. Determining model plausibility was done in a somewhat ad hoc fashion. More thought could be given to this. One recommendation might be to do a real-time meta summary of important parameters, such as M (natural mortality rate), h (stock-recruitment steepness), and q (catchability), as well as the recruitment time series by species. This could help identify outliers and potentially aid in model selection. Synthesizing estimated vs. assumed parameters and listing/plotting these parameters would be informative. Another recommendation is to plot the difference in model results pre- and post-STAR. There are competing philosophies on whether the STAT Team prepares the draft assessment to a minimal level anticipating that the STAR panel will change it or defends a more complete draft assessment at a STAR panel. Dr. Clarke said that during 2005 UW and NMFS staff did a lot of vetting of assessments prior to STAR panel review and that helped improve the quality of pre-STAR draft assessments.

Logistic improvements: provide a LAN router/printer at each STAR panel, more attendance of STAT members at more STAR panels, off-season benchmark assessments and reviews could help set the stage for the next round of assessments and reviews (benchmark assessments can be characterized as a prototype and can be done by committee), and a second STAR reviewer who goes to all STAR panels to provide more continuity. There should be more attention paid to the use of priors in assessments. A workshop on the use of CPUE data may be particularly useful in this next assessment process. Dr. Clarke remarked that more and better input from the GAP and GMT on this subject would be useful. Dr. Mohn said the non-linearity of CPUE trends from various surveys is a problem to resolve. Dr. Maunder thought it could be helpful to appoint a data expert on a particular dataset used as an index (i.e., Dr. MacCall's expertise in using recreational CPUE). Dr. MacCall said the process evolved from more ad hoc assessments, which led to the process of dismissing data wholesale, as is the current practice. He disagreed with the process of limiting input data. Others disagreed and championed thoughtful analysis of data before deciding whether they were useful for an assessment. Dr. Mohn said the important distinction is whether the data are used to inform the assessment versus their use in tuning the assessment. Data used to tune an assessment need to be carefully discriminated. Dr. Dorn said part of this discrimination is the quality of the analysis used to create the index. Dr. McIsaac asked about the comment that some assessments were incomplete coming into the STAR panels last year. He wanted to know how frequently that occurred and Dr. Mohn said it was rare. Dr. Clarke said about 25% of the assessments were delivered late (not within two weeks prior to the STAR panel).

Dr. Sampson gave the SSC's perspective on the review process, although he said he was not able to poll SSC members and these comments should be considered his own. He thought lessons learned at the first STAR panel for flatfish were useful in subsequent panels. He recommended capturing and disseminating these lessons. There needs to be better follow-up on recommendations for improving assessments from previous STAR panels. One problem that arose last year is that data issues would crop up during a STAR panel that led to snap decisions. There was inconsistent treatment of common issues, such as treatment of residuals, effective sample sizes, outliers, spatial structure, etc. He recommended that assessment scientists should not serve on more than one of the STATs being reviewed during a STAR panel. Dr. Clarke said, while they know the lead authors for an assessment ahead of time, they were not informed of all STAT team members prior to setting up the STAR panel. More interaction with industry members early in the process prior to a STAR panel would be helpful. Dr. Sampson thought the process loses some of its independence by having SSC members serving on STAT teams, STAR panels, and on the SSC during the final review phase. Dr. Ralston said part of the issue is deciding if a STAR panel needs to be an independent review body or a peer review body. Dr. Sampson said, while it may be appropriate to have SSC members chair STAR panels, there is a cost to the independence of the SSC members in their respective roles. Dr. Ralston pointed out that, in one circumstance, the SSC rejected an assessment (and sent it to the mop-up STAR panel) after the first STAR panel recommended it. This indicates the SSC maintained some level of independence. Dr. McIsaac asked how often SSC members voted within the SSC on their own assessment and was told those members recused themselves from the vote. Dr. Dorn thought this should be formalized in the Terms of Reference and that these members should not write the SSC report on their own assessments. Dr. MacCall said we should not make SSC members totally independent of the review process since the process would lose that expertise. Mr. Ghio asked if the SSC review step should be a two-meeting process and was told there was not enough time in the process to do this (at least there was not enough time in last year's process). Ms. Culver thought the final review step could be a joint SSC-GMT deliberation.

Dr. Clarke provided the NMFS perspective and recommended improvements regarding the review process. She recommended distributing STAR panels coastwide as was done last year. There should be N plus one reviewers at a STAR panel with a maximum of three reviewers. There should be at least one reviewer independent of NMFS and the process at each STAR panel (CIE reviewers are not available for all panels). Dr. Ralston pointed out that some NMFS personnel may be independent of the process and should be considered in the STAR process as an independent reviewer. Dr. Sampson thought it was problematic to limit the panel to three reviewers as a maximum. SSC members should continue to serve as STAR chairs, but should rotate through the stock reviews. There should be strict adherence to Terms of Reference and update criteria. Should there be a rapporteur assigned for all STAR panels in a cycle? Rapporteurs should produce real-time assessment summary tables, which should be produced at each panel to track changes in the assessment as the review progresses. The rapporteur would also track requests by the STAR panel and the responses made by the STAT. The rapporteuring duties should not fall to the chair or the CIE reviewer. These notes and a summary of changes to the assessment could be posted to a web site so other STAT teams and STAR panel members can better understand how each panel addressed review issues. Dr. Mohn did not think it was too onerous to be a rapporteur at a STAR panel and at the same time effectively critique the assessment. Dr. Hastie thought STAR panel members can share rapporteuring duties as is current practice.

Assessments need to be complete coming into a STAR panel. These draft assessments need to be internally reviewed prior to delivery to a STAR panel (if not just to make them more readable). Decision tables should be incorporated in pre-STAR drafts and should be standardized. Executive summaries should be complete and included in the pre-STAR draft. There needs to be a standard minimum set of diagnostics produced for each model run. Each assessment needs an explicit section responding to recommendations for improvement from previous STAR panels. Dr. Sampson pointed out this used to be in the Terms of Reference but was dropped recently. A review of available information from Canadian and Alaska assessments should be included in each assessment. Finally, maps showing the geographic scope of the assessment need to be included.

Mr. Ghio provided some of the GAP and industry perspective in the assessment review process. There is general distrust by industry of the process. To rectify this, industry needs to have direct input in the process prior to the STAR panel. Dr. Clarke said the intent of listing data to be used in each assessment early in the process was to solicit industry feedback, but the approach was not effective. Ms. Key said she reached out to industry to prepare for the gopher rockfish assessment and thought that helped the quality of her assessment. Individual authors approached this type of feedback differently. Dr. Clarke thought this might be difficult to formalize in the Terms of Reference. Dr. MacCall recommended that GMT and GAP members should be formally recognized and incorporated in the STAR process. Dr. Sampson thought this would work under an N + 3 process, but not an N + 1 process. Dr. Sampson thought coordination with the port liaison project (or other source of funding for fishermen) would benefit assessments by providing ideas for data inputs that might not be obvious to an assessment author. Dr. Hastie said older versions of the pre-assessment workshop were more hands-on with lots of industry input. This would be a good way to reintegrate industry early in the assessment planning process.

3. Scientific and Statistical Committee Reviews
    a. What Worked and What Didn't in 2004-2005
    b. Recommended Improvements for 2006-2007

Dr. Dorn provided a review of last year's SSC review process. All assessments were reviewed in two SSC meetings with each STAR chair leading the discussion on the assessments reviewed at their panel. The chief concerns were having too many assessments in the cycle and too many assessments reviewed at each panel, which compromised the quality of the review. This also compromised the SSC review step. For example, new assessment elements, such as the environmental index in the sablefish assessment and the canary assessment, did not receive adequate attention by the SSC at their meetings. The SSC needs to be more sensitive to STAR chairs defending the STAR reviews they chaired. Dr. Sampson thought it might be better if an SSC member who did not chair a particular STAR panel lead the discussion in the SSC meeting. Dr. Clarke wanted a better definition of the SSC's role in the review process. Drs. Sampson and Dorn thought the SSC's role should be review of the assessment, not reviewing the STAR panel report. Dr. McIsaac said the SSC's role is to recommend the best available science to the Council and needs to critically review all aspects of an assessment. Mr. Burner said the SSC's approach at their review last year was limited by the time they could allot to the review. He was not sure an SSC member could find the time to review and report on an assessment if that SSC member had not been present at the assessment's STAR review. Drs. Sampson and Ralston thought the extra cost of an SSC's member time is real, but independence of the SSC could be maintained if the SSC member reporting to the SSC on an assessment was not the person who had chaired the STAR for that assessment. Dr. Methot wondered if there was any opportunity to address SSC concerns during an SSC meeting and Dr. Hamel said the mechanism for further modeling to resolve issues is to send the assessment to a mop-up panel. Otherwise, the SSC decision is either approve or reject the assessment. Mr. Ghio reiterated the need to have the GAP and GMT review a post-STAR assessment as well. Dr. Ralston thought a good mechanism would be to have the independent SSC reviewer solicit GAP and GMT feedback during their review. Dr. Dorn said, in the past, there were formal presentations of assessment results to the Council family. Such a debriefing was beneficial. Dr. Field thought subcommittees from the GMT and GAP could attend these debriefings to manage workload. Mr. Ghio said the main issue with the GAP is erosion of confidence in the assessment process due to lack of interaction with STAT teams and a loss of institutional knowledge within the GAP itself. Staggering the final Council review step across more meetings would help, as would reducing the number of assessments done. Mr. DeVore explained one GMT recommendation was to improve SSC advice on how assessment results should be used. Some of the SSC statements were somewhat vague in that regard. Dr. Hastie said another aspect of GMT deliberations on recommending OYs based on a new assessment are that there is reticence to recommend alternative model results or recommending an OY alternative for analysis that is above the acceptable biological catch (ABC) from the base model in the assessment. Dr. Field said there was discomfort in the GMT recommending specifications from alternative models since there was thought these models did not represent the best available science. Dr. Ralston offered an approach where one decision table is prepared to address model uncertainty and another decision table is prepared to address statistical uncertainty within the base model. Dr. Methot thought the approach taken in the most recent canary assessment, blending the uncertainty of equally plausible models, to be fertile ground for an approach. Alternative models that are not considered as plausible could also be blended with a weighted approach based on probability distributions. If this approach was conceptually accepted, the modeling details could be worked out.

Dr. MacCall thought some consideration to trade assessment authorship with outside entities might help. That is, west coast assessment scientists could do some east coast assessments and vice versa.

D. Terms of Reference

1. Review the "Terms of Reference for Groundfish Stock Assessment and Review Process for 2005-2006" and Provide Recommended Edits
2. Review the "Terms of Reference for Groundfish Rebuilding Analyses" and Provide Recommended Edits

The workshop participants discussed the process for modifying the Terms of Reference. This will be done at the March and April Council meetings and will be informed by advice from participants at this workshop and other advisors to the Council. The Council will adopt a final Terms of Reference in April.

Dr. Hastie asked if the Terms of Reference would be cycle-specific or more generic to the process. Dr. Ralston said these documents have evolved over time and would likely continue to change. Dr. Clarke asked how comments need to be provided- redline/strikeout or general comments? Dr. Ralston said the former vehicle is more specific and clear. Dr. Mohn thought the existing Terms of Reference for stock assessments was quite useful and the rebuilding Terms of Reference less so.

Dr. Ralston reviewed the elements of the current stock assessment Terms of Reference. The roles and responsibilities of various entities are explained followed by stock assessment priorities, terms for STAR panels and their meetings, suggested template for STAR reports, and terms for STAT teams. The appendices go into further detail on what needs to be included in assessments and STAR reports.

Dr. McIsaac asked what the penalty should be if Terms of Reference are violated? Some items should be truly mandated, such as timely delivery of STAR reports (according to some participants), where failure to provide these elements causes the assessment to be rejected. Other omissions are less egregious and should not result in such a harsh penalty. Dr. Ralston thought each violation should be judged specifically to each case- it's hard to draw lines in the sand. Dr. Methot said there were numerous instances of late delivery of critical assessment data. This compromised the timely delivery of assessments and the following STAR and Council process. He recommended a firewall on considering such late data. Ms. Key said another issue was the evolution of the SS2 model during the process. Many stated that many of the SS2 changes were made at the request of assessment scientists to Dr. Methot to fix certain aspects of the model. Dr. Clarke said the mop-up panel should be used to fix assessment problems identified during the review process, not to incorporate data arriving late in the process. Dr. McIsaac said it will be hard to list all possible offenses and requisite penalties in a Terms of Reference, but a process where rules are established regarding how and who decides if an omission is critical enough to reject an assessment could be considered for the Terms of Reference. Dr. Clarke said many of the fixes are on the front end with better data and modeling workshops and more time for assessment authors to do their work. While this won't solve all the problems encountered with late data delivery, it will help. Dr. MacCall said a schedule of deliverables would be helpful.

Dr. Ralston then reviewed the rebuilding analyses Terms of Reference. He agreed with Dr. Mohn's assessment that this Terms of Reference was not as useful. This Terms of Reference needs to incorporate an evaluation of existing rebuilding plans and revision rules if rebuilding progress is lagging or ahead of schedule. An ad hoc process was used in 2005 to have additional rebuilding runs done to evaluate rebuilding progress. Given uncertain outcomes in current litigation, Magnuson-Stevens Act (MSA) reauthorization, and potential changes to National Standard 1 (NS1) guidelines, it may not be useful to modify this Terms of Reference by April.

Dr. Clarke encouraged folks to send a list of candidate species for the next cycle to her. She would compile this list for the March briefing book. Dr. Hastie encouraged folks to look beyond the upcoming cycle when recommending which assessments are done next. Dr. Ralston encouraged folks to identify which assessments should be full assessments and which assessments should be updates. Dr. Hastie recommended folks provide the rationale for their recommendations and judge whether the draft NWFSC list has any fatal flaws. Dr. Clarke asked for a prioritized list (i.e., the top eight stocks for assessment). Dr. Dorn asked whether multi-species data summaries should be done.

Summary of Workshop Participants' Recommendations

Improving the Stock Assessment Process

<u>Pre-Assessment Planning</u>

- Fewer assessments (than the 23 done in 2005) should be done per cycle- consider a maximum of 10-15 full and updated assessments. Limit the number of full assessments to a maximum of 8-10.
- More pre-review vetting of data issues. Consider scheduling either subject-oriented (i.e., trawl surveys, CPUE indices) or species-specific workshops in the "off-year" prior to doing assessments.
- More interaction with fishermen in planning an assessment would benefit the sensibility and quality of input data.
- Develop guidelines for prioritizing full stock assessments in a cycle. Such guidelines include: the stock's importance to management, relative risk of overexploitation, whether the stock has recently been assessed (NMFS Headquarters considers an assessment older than five years to be out of date), whether the most recent assessment uses the most up-to-date model (i.e., SS2), the quality of available data for that species, etc.
- Develop a schedule of deliverables with deadlines when planning an assessment.
- Identify which assessments should be full and which should be updates when recommending an assessment for the next cycle. Also provide the rationale for these recommendations.
- Look beyond the next cycle when recommending assessment priorities (a three-cycle horizon?).

<u>Stock Assessment Reviews</u>

- Attempt to schedule only 2 full assessment reviews per STAR panel.
- Schedule earlier reviews of more contentious or complicated assessments.
- Schedule earlier review of "benchmark" data-poor assessments to serve as a guide on how to resolve common problems when reviewing such assessments.
- Continue to distribute STAR panels coastwide.
- Emphasize recommended improvements from previous STAR panel reports in the review.
- More discipline needed in reviews to ensure assessments comply with the Terms of Reference (i.e., updates need to comply by not entertaining new models).
- Continue to have one reviewer attend all STAR panels to provide continuity. Consider a second "continuous" reviewer.
- Provide a LAN and a printer at each STAR panel meeting.
- Rapporteurs should produce real-time assessment summary tables to track changes in the assessment as the review progresses, STAR requests, and STAT responses to those requests. A summary table of important parameters, such as the recruitment time series by species, should be provided. Such summaries should be made available on a web site to disseminate information to other stock assessment teams, STAR panel reviewers, and other advisors to the process.
- Pay more attention to the use of priors in assessments.
- Continue to have SSC members chair STAR panels, but rotate the chair assignments through the stock assessment reviews.
- Formalize the roles of GMT and GAP representatives at STAR panels.
- Updated assessments should only be reviewed by the SSC.

SSC Reviews

- Stagger the SSC reviews (and Council adoption step) across more meetings.
- Improve the management advice in SSC statements recommending assessments. The GMT, GAP, and Council require more specific advice on how assessment results should be applied to management decision-making.
- Schedule Council debriefings with stock assessment lead authors and STAR chairs.
- Consider a joint SSC-GMT-GAP review rather than an SSC review in isolation.
- SSC members who chaired a STAR panel need to recuse themselves when voting to recommend or reject an assessment. Consider assigning an SSC member other than the one who chaired the STAR panel to lead the discussion on an assessment.

Terms of Reference

- Include a requirement for STAR panels to specify whether an assessment is sufficiently developed to do an update in the next cycle.
- Mandate two types of decision tables in assessments- one to address model uncertainty and to portray relative risk of adopting results of alternative models for management decision-making; and one to address statistical uncertainty within the base model.
- Mandate complete executive summaries and decision tables in pre-STAR draft assessments.
- Require an explicit section in each assessment responding to recommendations for improvement from previous STAR panels.
- Require a review of available information from Canadian and Alaskan assessments in each assessment (for stocks with a northerly trans-boundary distribution).
- Require inclusion of maps depicting the scope of the assessment in each assessment.
- Consider adopting a process where rules are established regarding how and who decides if an omission is critical enough to reject an assessment.
- Consider multi-species assessments and/or data reviews in the process.
- Mandate that SSC members who chaired a STAR panel need to recuse themselves when voting to recommend or reject an assessment.
- Adopt a final stock assessment Terms of Reference in April 2006, but defer adoption of the rebuilding analysis Terms of Reference until after MSA re-authorization, resolution of NS1 guidelines, and/or court rulings on rebuilding plans.

PFMC
02/03/06

F:\!master\stk\Groundfish\Review\STAR05\Review Workshop\StockAssessmentRevWorkshop_Jan1306_Minutes.doc

PRELIMINARY STOCK ASSESSMENT PRIORITIES FOR 2007

At the Council's request, the Northwest Fisheries Science Center (NWFSC) has prepared a draft schedule for conducting full and updated assessments, to help initiate Council discussion of future assessment priorities. A common theme at January's Council-sponsored review of the last stock assessment cycle was that that fewer assessments, particularly full assessments, should be conducted in future cycles. If fewer assessments are to be conducted during each cycle, selection of species to be assessed in 2007 should include consideration of the implications for future assessment cycles. Table 1 summarizes the 2005 assessment activity and presents a possible schedule for full and updated assessments from 2007 to 2011. Based on discussion at the review workshop, we propose that full assessments be reviewed through the normal STAR panel process, with a goal that no more than 2 species will be reviewed by any panel. Attainment of this goal will, in turn, require that no more than 8-10 full be conducted each cycle. For updated assessments, where model structure is unchanged, we propose a more expedited review by the SSC only.

Several factors were considered in developing the schedule presented in Table 1. Most assessments of shelf species have utilized the NMFS Triennial shelf survey as an index of abundance. This survey was last conducted in 2004, by the NWFSC. It will not be continued in the future, due to the availability of annual shelf data since 2003 from the NWFSC shelf-slope trawl survey and the insufficiency of resources to conduct two bottom trawl surveys. No assessments currently include the shelf data from the NWFSC survey. Further, under the current Terms of Reference, new data series cannot be introduced as part of an updated assessment. The Table 1 schedule provides for full assessments of all these species by 2009, with higher 2007 priority for species that are under rebuilding plans. If the Terms of Reference can be modified or a protocol for incorporating shelf data from the NWFSC shelf-slope survey agreed upon at a workshop this year, it may be possible to conduct as updates some assessments that are designated as full in the table.

Another consideration for setting priorities is that previous assessments for a few species are now outdated. This group includes chilipepper (south of $40^{o}10'$), arrowtooth flounder, and the portion of the black rockfish stock off Washington. NOAA Fisheries guidance is that assessments older than 5 years are not considered current, and each of these species was last assessed prior to 2000. In addition to these species, the 5-year guideline is an important consideration for scheduling future assessments for all species. Finally, higher short-term priority for full assessments was given to species whose most recent assessment was conducted with modeling software other than Stock Synthesis 2 (SS2). Although use of SS2 is not required, it provides tools for enhanced exploration and description of parameter uncertainty, relative to many earlier platforms such as Stock Synthesis 1. Perhaps just as importantly, establishing a common platform for west coast assessments will improve the transparency, comparability, and portability of the models. Table 1 also includes first-time assessments for longnose skate and dogfish in 2007.

Based on discussions with the Southwest Fisheries Science Center and Washington Department of Fish and Wildlife, preliminary designations of lead responsibility for 2007 assessments are also indicated in Table 1.

Table 1.--Possible schedule for west coast groundfish assessments in 2007 and beyond

Species	2005 Assessment		Assessment cycle							3-cycle total
			2007			2009		2011		
	Full / Update	Model	Full	Update	Lead	Full	Update	Full	Update	
Number of assessments			9	6		9	9	9	9	
P. hake (Whiting)	2006 Full	SS2	Subject to international treaty process							
Bocaccio rockfish	Update	SS1	X		SWC		X		X	3
Canary rockfish	Full	SS2	X		NWC		X	X		3
Chilipepper rockfish	* 1998	SS1	X		SWC				X	2
Cowcod	Full	SS2		X	SWC		X	X		3
Widow rockfish	Full	ADMB		X	SWC	X			X	3
Yelloweye rockfish	Full (2006)	SS2		X	NWC		X		X	3
Yellowtail rockfish	Update	SS1				X				1
Lingcod	Full	SS2				X				1
Arrowtooth	* 1993	other	X		NWC				X	2
English sole	Full	SS2				X				1
Petrale sole	Full	SS2	X		NWC ?			X		2
Starry flounder	Full	SS2					X	X		2
Pacific ocean perch	Update	ADMB		X	NWC	X			X	3
Darkblotched rockfish	Full	SS2	X		NWC		X		X	3
Blackgill rockfish	Full	SS2		X	NWC			X		2
Shortspine thornyhead	Full	SS2					X	X		2
Longspine thornyhead	Full	SS2					X	X		2
Sablefish	Full	SS2		X	NWC	X			X	3
Dover sole	Full	SS2				X				1
Black rockfish	* 2003/1999	SS1	X		NWC				X	2
Cabezon	Full	SS2				X				1
Cal. Scorpionfish	Full	SS2						X		1
Gopher rockfish	Full	SS2					X	X		2
Kelp greenling	Full	SS2				X				1
Longnose skate	Unassessed		X		NWC					1
Dogfish	Unassessed		X		WDFW					1
Blue rockfish			?			?		?		0
Vermilion			?			?		?		
Sanddabs			?			?		?		
Splitnose			?			?		?		

Highlighted cells indicate species with assessments that 1) are outdated, 2) have not been updated to SS2, and/or 3) require inclusion of NWFSC shelf-slope survey data from shelf depths for there to be new abundance indices beyond 2004.

Agenda Item F.2.c.
Supplemental NWFSC Report
March 2006

2007 Stock Assessment Cycle

M. Elizabeth Clarke
Northwest Fisheries Science Center

March 07, 2006

NOAA Fisheries

Proposals for 2007 Assessment Cycle

- 8-10 ‘Full’ assessments
- Need to consider the implications for future assessment cycles
- ‘Full’ assessments reviewed by STAR panels
- 2 assessments (no more than 3) reviewed per STAR Panel
- Independent Reviewers but in most cases no CIE
- ‘Updated’ assessments be reviewed only by SSC in an expedited process

NOAA Fisheries

Priority for 2007 Stock Assessments

- Assess stocks where assessments:
  1) are outdated
  2) have not been updated to SS2
  3) require inclusion of NWFSC shelf-slope survey data from shelf depths for a new abundance indices beyond 2004

- Add previously unassessed stocks

Possible Schedule for 2007 WC Groundfish Assessments

	2005 Assessment		2007 Assessment Cycle		
Species	Full / Update	Model	**Full**	**Update**	**Lead**
Number of assessments			***9***	***6***	
P. hake (Whiting)	2006 Full	SS2	Subject to International Treaty Process		
Bocaccio rockfish	Update	**SS1**	**X**		**SWC**
Canary rockfish	Full	SS2	**X**		**NWC**
Chilipepper rockfish	*** 1998**	**SS1**	**X**		**SWC**
Cowcod	Full	SS2		**X**	**SWC**
Widow rockfish	Full	**ADMB**		**X**	**SWC**
Yelloweye rockfish	Full (2006)	SS2		**X**	**NWC**
Arrowtooth	*** 1993**	**Other**	**X**		**NWC**
Petrale sole	Full	SS2	**X**		**NWC?**
Pacific ocean perch	Update	**ADMB**		**X**	**NWC**
Darkblotched rockfish	Full	SS2	**X**		**NWC**
Blackgill rockfish	Full	SS2		**X**	**NWC**
Sablefish	Full	SS2		**X**	**NWC**
Black rockfish	*** 2003/1999**	**SS1**	**X**		**NWC**
Longnose skate	**Unassessed**		**X**		**NWC**
Dogfish	**Unassessed**		**X**		**WDFW**

Possible Schedule for WC Groundfish Assessments in 2007 and Beyond

NOAA Fisheries

Species	2007		2009		2011		
	Full (9)	Update (6)	Full (9)	Update (9)	Full (9)	Update (9)	3-cycle total
Bocaccio rockfish	X			X		X	3
Canary rockfish	X			X	X		3
Chilipepper rockfish	X					X	2
Cowcod		X		X	X		3
Widow rockfish		X	X			X	3
Yelloweye rockfish		X		X		X	3
Yellowtail rockfish			X				1
Lingcod			X				1
Arrowtooth	X					X	2
English sole			X				1
Petrale sole	X				X		2
Starry flounder				X	X		2
Pacific ocean perch		X	X			X	3
Darkblotched rockfish	X			X		X	3
Blackgill rockfish		X			X		2
Shortspine thornyhead				X	X		2
Longspine thornyhead				X	X		2
Sablefish		X	X			X	3
Dover sole			X				1
Black rockfish	X					X	2
Cabezon			X				1
Cal. Scorpionfish					X		1
Gopher rockfish				X	X		2
Kelp greenling			X				1
Longnose skate	X						1
Dogfish	X						1

Possible STAR Panel Schedule

	Species	Location	Dates
Panel #1	2 Benchmark Species?	Seattle, Washington	Late Spring 2007
Panel #2	2	Newport, Oregon	Spring / Summer 2007
Panel #3	2	California	Summer 2007
Panel #4	2	California	Summer 2007
Panel #5	2	Seattle, Washington	Early August 2007
Sweep up	?	Portland, Oregon	Fall 2007

Off-Year Workshops

NOAA Fisheries

3 Off-Year Workshops

- Integrating NWFSC Shelf-Slope Survey into 2007 Assessments (mid-summer)
- Protocols for Conducting Juvenile Surveys and Integrating Results into Assessments (September?)
- Data / Modeling Workshop (October)

NOAA Fisheries

Agenda Item F.2.d
Attachment 1
March 2006

GROUNDFISH STOCK ASSESSMENT AND REVIEW PROCESS FOR 200~~5~~7-200~~6~~8

Introduction

The purpose of this document is to help the Council family and others understand the groundfish stock assessment review process (STAR). Parties involved are the National Marine Fisheries Service (NMFS); state agencies; the Council and its advisors, including the Scientific and Statistical Committee (SSC), Groundfish Management Team (GMT), Groundfish Advisory Subpanel (GAP), Council staff; and interested persons. The STAR process is a key element in an overall process designed to make timely use of new fishery and survey data, to analyze and understand these data as completely as possible, to provide opportunity for public comment, and to assure that the results are as accurate and error-free as possible. The STAR process is designed to assist in balancing these somewhat conflicting goals of timeliness, completeness and openness.

STAR Goals and Objectives

The goals and objectives for the groundfish assessment and review process[1] are:

a) Ensure that groundfish stock assessments provide the kinds and quality of information required by all members of the Council family.

b) Satisfy the Magnuson-Stevens Sustainable Fisheries Act (SFA) and other legal requirements.

c) Provide a well-defined, Council oriented process that helps make groundfish stock assessments the "best available" scientific information and facilitates use of the information by the Council. In this context, "well-defined" means with a detailed calendar, explicit responsibilities for all participants, and specified outcomes and reports.

d) Emphasize external, independent review of groundfish stock assessment work.

e) Increase understanding and acceptance of groundfish stock assessment and review work by all members of the Council family.

f) Identify research needed to improve assessments, reviews, and fishery management in the future.

g) Use assessment and review resources effectively and efficiently.

Shared Responsibilities

All parties have a stake in assuring adequate technical review of stock assessments. NMFS must determine that the best scientific advice has been used when it approves fishery management recommendations made by the Council. The Council uses advice from the SSC to determine whether the information on which it will base its recommendation is the “best available” scientific advice. Fishery managers and scientists providing technical documents to the Council for use in management need to assure that the work is technically correct. Program reviews, in-depth external reviews, and peer-reviewed scientific publications are used by federal and state agencies to provide quality assurance for the basic scientific methods used to produce stock assessments. However, the time-frame for this sort of review is not suited to the routine examination of assessments that are, generally, the primary basis for a harvest recommendation.

The review of current stock assessments requires a routine, dedicated effort that simultaneously meets the needs of NMFS, the Council, and others. Leadership, in the context of the stock assessment review process for groundfish, means consulting with all interested parties to plan, prepare terms of reference, and develop a calendar of events and

[1] In this document, the term "stock assessment" includes activities, analyses, and management recommendations, beginning with data collection and continuing through to the development of management recommendations by the Groundfish Management Team and information presented to the Council as a basis for management decisions.

a list of deliverables. Coordination means organizing and carrying out review meetings, distributing documents in a timely fashion, and making sure that assessments and reviews are completed according to plan. Leadership and coordination involve costs, both monetary and time, which have not been calculated, but are likely substantial.

The Council and NMFS share primary responsibility to create and foster a successful STAR process. The Council will sponsor the process and involve its standing advisory committees, especially the Scientific and Statistical Committee. NMFS will provide a coordinator to oversee and facilitate the process. Together they will consult with all interested parties to plan, prepare terms of reference, and develop a calendar of events and a list of deliverables. NMFS and the Council will share fiscal and logistical responsibilities.

The STAR process is sponsored by the Council because the Federal Advisory Committee Act (FACA) limits the ability of NMFS to establish advisory committees. FACA specifies a procedure for convening advisory committees that provide consensus recommendations to the federal government. The intent of FACA was to limit the number of advisory committees, ensure that advisory committees fairly represent affected parties, and ensure that advisory committee meetings, discussions, and reports are carried out and prepared in full public view. Under FACA, advisory committees must be chartered by the Department of Commerce through a rather cumbersome process. However, the SFA exempts the Council from FACA *per se*, but requires public notice and open meetings similar to those under FACA.

NMFS Responsibilities

NMFS will work with the Council, other agencies, groups, or interested persons that carry out assessment work to organize Stock Assessment Teams (STAT Teams) and STAR Panels, and make sure that work is carried out in a timely fashion according to the calendar and terms of reference. NMFS will provide a ~~senior scientist to~~ Stock Assessment ~~c~~Coordinator to organize~~e~~ these tasks with assistance from Council staff. To initiate the assessment cycle, NMFS will convene ~~data and modeling~~ workshops ~~so that STAT teams~~ to provide opportunities for assessment scientists and interested parties (e.g., the GMT) to ~~can~~ discuss important topics relating to upcoming stock assessments. ~~, external reviews, data sources, and modeling approaches.~~ To promote consistency, representatives from each STAT team are expected to attend ~~both the data and modeling~~these workshops.

The SSC will appoint STAR Panel chairpersons. The NMFS Stock Assessment Coordinator will identify and select other STAR panelists following criteria for reviewer qualifications, nomination, and selection that are developed in consultation with the SSC. ~~The SSC will appoint STAR Panel chairpersons, although the NMFS Stock Assessment cCoordinator will identify and select other STAR panelists following criteria for reviewer qualifications, nomination, and selection.~~ The public is welcome to nominate qualified reviewers. Following any modifications to the stock assessments resulting from STAR panel reviews and prior to SSC review~~distribution of the stock assessment documents and STAR panel reports to GMT~~, the ~~c~~Stock Assessment Coordinator will review the Executive Summary ~~stock assessments and panel reports~~ for consistency with the T~~t~~erms of ~~r~~Reference~~, especially completeness of the stock assessment Executive Summary~~. Inconsistencies will be identified and the authors requested to make appropriate revisions in time for the ~~GMT~~ SSC meeting at which an assessment is reviewed~~ABC and OY recommendations are developed~~.

Individuals (employed by NMFS, state agencies, or other entities) ~~that~~ who conduct groundfish stock assessments or associated technical work ~~in connection with groundfish stock assessments~~ are responsible for ensuring that their work is technically sound and complete. ~~The Council's review process is the principal means for review of complete stock assessments, although additional in-depth technical review of methods and data is desirable.~~ Stock assessments ~~conducted by NMFS, State agencies, or other entities~~ must be completed and reviewed in full accordance with the Terms of Reference (Appendices B and C) at the times specified in the calendar (Appendix A).

STAT Team Responsibilities

The STAT, consisting of one or more stock assessment scientists from NMFS, state agencies or academia, is responsible for conducting a complete and technically sound stock assessment that conforms to accepted standards of quality. The STAT will conduct its work and activities in accordance with the Terms of Reference for Groundfish STAT Teams. The final product of the STAT will be a stock assessment document that follows the outline specified in Appendix B: Outline for Groundfish Stock Assessment Documents.

GMT Responsibilities

The GMT is responsible for identifying and evaluating potential management actions based on the best available scientific information. In particular, the GMT makes ABC and OY recommendations to the Council based on estimated stock status, uncertainty about stock status, and socioeconomic and ecological factors. The GMT will use stock assessments, STAR Panel reports, and other information in making their recommendations. The GMT's preliminary ABC recommendation will be developed at a meeting that includes representatives from the SSC, STAT Teams, STAR Panels, and GAP. A representative(s) of the GMT will serve as a liaison to each STAR Panel, but will not serve as a member of the Panel. The GMT will not seek revision or additional review of the stock assessments after they have been reviewed by the STAR Panel. The GMT chair will communicate any unresolved issues to the SSC for consideration. Successful separation of scientific (i.e., STAT Team and STAR Panels) from management (i.e., GMT) work depends on stock assessment documents and STAR reviews being completed by the time the GMT meets to discuss preliminary ABC and OY levels. However, the GMT can request additional model projections, based on reviewed model scenarios, in order to develop a full evaluation of potential management actions.

GAP Responsibilities

The chair of the GAP will appoint a representative to track each stock assessment and attend the STAR Panel meeting. The GAP representative will participate in review discussions as an advisor to the STAR Panel, in the same capacity as the GMT advisor. It is especially important that the GAP representative be included in a discussion and review of all the data sources being used in the assessment, prior to development of the stock assessment model. It is the responsibility of the GAP representative to insure that industry concerns about the adequacy of data being used by the STAT team are expressed at an early stage in the process.

The GAP representative, along with STAT and SSC representatives, will attend the GMT meeting at which ABC recommendations are made. The GAP representative will also attend subsequent GMT, Council, and other necessary meetings where the assessment is discussed.

The GAP representative will provide appropriate data and advice to the STAR Panel and GMT and will report to the GAP on STAR Panel and GMT meeting proceedings.

SSC Responsibilities

The Scientific and Statistical Committee (SSC) will participate in the stock assessment review process and will provide the ~~GMT and~~ Council and its advisory bodies with technical advice related to the stock assessments and the review process. The SSC will assign one of its members to act as chairman of each STAR Panel. The STAR Panel chair will review the stock assessments and panel reports for consistency with the Terms of Reference. ~~This member is not only expected to attend the assigned STAR Panel meeting, but also the GMT meeting at which ABC recommendations are made (should the need arise), and Council meetings when groundfish stock assessment agenda items are discussed (see calendar in Appendix A). Specifically, if requested t~~The SSC representative will present the STAR Panel report to the GMT if it requires assistance in interpreting the results of a stock assessment. In addition, the SSC representative on a STAR panel will present the Panel's report at SSC and Council meetings. However, to insure independence in the SSC's review of stock assessments and STAR Panel proceedings, members of the SSC, who are unaffiliated with the STAR Panel, whether as a member of a STAT team or as a panelist, will be assigned the roles of discussion lead and rapporteur.

The SSC representative will ~~also~~ communicate SSC comments or questions to the GMT and other Council advisory bodies. It is the SSC's responsibility to review and endorse any additional analytical work requested by the GMT after the stock assessments have been reviewed by the STAR Panels. In addition, the SSC will review and advise the GMT and Council on projected ABCs and OYs and, in addition, ~~.~~

~~The SSC, during their normally scheduled meetings,~~ will serve as arbitrator to resolve disagreements between the

STAT Team, STAR Panel, or GMT. ~~The STAT Team and the STAR Panel may disagree on technical issues regarding an assessment. In this case, a complete stock assessment must include a point-by-point response by the STAT Team to each of the STAR Panel recommendations.~~

Council Staff Responsibilities

Council Staff will prepare meeting notices and distribute stock assessment documents, stock summaries, meeting minutes, and other appropriate documents. Council Staff will help NMFS and the state agencies in coordinating stock assessment meetings and events. Staff will also publish or maintain file copies of reports from each STAR Panel (containing items specified in the STAR Panel's term of reference), the outline for groundfish stock assessment documents, comments from external reviewers, SSC, GMT, and GAP, letters from the public, and any other relevant information. At a minimum, the stock assessments (STAT Team reports, STAR Panel reports, and stock summaries) should be published and distributed in the Council's annual SAFE document.

Stock Assessment Priorities

Stock assessments for West Coast groundfish are conducted periodically to assess abundance, trends, and appropriate harvest levels for these species. Assessments use statistical population models to analyze and integrate a variety of survey, fishery and biological data. Due to the large number of groundfish species that have never been assessed, it is the goal of the Council to increase substantially the number of assessed stocks. A constraint on reaching that objective, however, is that a multi-year management regime has recently been adopted, which limits assessment activities to odd years only (e.g., 2005). ~~Nonetheless, for the upcoming assessment cycle an ambitious list of 23 stocks will be evaluated, including at least five species that have never been assessed.~~

In establishing stock assessment priorities a~~n~~ number of factors are considered, including:

1. Assessments should take advantage of new information, especially indices of abundance from fishery-independent surveys.

2. Overfished stocks that are under rebuilding plans should be evaluated to ensure that progress towards achieving stock recovery is adequate. Guidelines for assessing adequacy of progress in rebuilding of overfished stocks are currently being developed through a Council-based process, which when complete, will result in a revision to the SSC's Terms of Reference for Groundfish Rebuilding Analyses.[2]

3. In general no more than ~~2~~ 3 full assessments (preferably 2) will be reviewed by a STAR Panel. ~~, although i~~In exceptional circumstances this number may be exceeded, if ~~in consultation~~ the SSC and NMFS ~~s~~Stock ~~a~~Assessment ~~c~~Coordinator conclude that it is advisable and/or necessary to do so.

4. The SSC encourages attempts to study previously un-assessed stocks, but recognizes that often such efforts will not produce a comprehensive understanding of population dynamics. Even so, updates or reports that fall short of a full assessment are still desirable; in order to summarize whatever information exists that may be useful to the Council in making management decisions.

5. Any stock assessment that is considered for use in management should be submitted through normal Council channels and reviewed at STAR Panel meetings.

6. The proposed stocks for assessment should be discussed by the Council at least a year in advance to allow sufficient time for assembly of relevant assessment data and for arrangement of STAR panels.

Terms of Reference for STAR Panels and Their Meetings

The principal responsibilit~~y~~ies of the STAR Panel ~~is~~ are to ~~carry out these terms of reference according to the calendar for groundfish assessments~~ review stock assessment documents, data inputs, analytical models, and to provide complete STAR Panel reports for all reviewed species. Most groundfish stocks are assessed infrequently and each assessment and review should result in useful advice to the Council. The STAR Panel's work includes:

1. reviewing draft stock assessment documents and any other pertinent information (e.g.; previous assessments and STAR Panel reports, if available);
2. working with STAT Teams to ensure assessments are reviewed as needed;
3. documenting meeting discussions; and
4. reviewing ~~summaries of~~ revised stock assessment documents before they are forwarded to the SSC~~status (prepared by STAT Teams) for inclusion in the SAFE document~~.

STAR Panels ~~normally~~ include a chairman, at least one "external" member (i.e., outside of the Council family and

[2] SSC Terms of Reference for Groundfish Rebuilding Analyses (Final Draft). Exhibit F.7, Supplemental SSC Terms of Reference, April 2001. Available from the PFMC, 7700 NE Ambassador Place, Suite 200, Portland, OR, 97220-1384, (503) 820-2280.

not involved in management or assessment of West Coast groundfish), and one SSC member. The total number of STAR members (including the chair and external reviewer) should be at least "n+1" where n is the number of stock assessments. In addition to Panel members, STAR meetings will include GMT and GAP advisory representatives with responsibilities ~~laid out~~ described in their terms of reference. *(Formalize the role of the GMT and GAP here?)* STAR Panels normally meet for one week.

~~The number of assessments reviewed by a STAR Panel should not exceed two except in unusual circumstances (see item 3 above).~~

The STAR Panel is responsible for determining if a stock assessment document is sufficiently complete according to Appendix B: Outline for Groundfish Stock Assessments. It is the Panel's responsibility to identify assessments that cannot be reviewed or completed for any reason. The Panel's decision that an assessment is complete should be made by consensus. If a Panel cannot reach agreement, then the nature of the disagreement must be described in the Panel's report. Moreover, if a full stock assessment is deemed to have become routine and/or has stabilized its approach to data analysis and modeling, the STAR panel should ~~certify~~make a recommendation that the assessment is eligible to be considered as an update (see below) during the next stock assessment cycle.

For some species the data will be insufficient to calculate reliable estimates of F_{msy} (or its proxy), B_{msy} (or its proxy), ending biomass or unfished biomass, etc. Results of these data-poor assessments typically will not meet the requirements of a full assessment and, in those instances, each STAR Panel should consider what inferences can be drawn from the analysis presented by the STAT Team. The panel should review the reliability and appropriateness of any methods used to draw conclusions about stock status and exploitation potential and either recommend or reject the analysis on the basis of its ability to introduce useful information into the management process.

The STAR Panel's terms of reference solely concern technical aspects of the stock assessment. It is therefore important that the panel should strive for a risk neutral perspective in its reports and deliberations. Assessment results based on model scenarios that have a flawed technical basis, or are implausible on other grounds, should be identified by the panel and excluded from the set upon which management ~~advise~~advice is to be developed. It is recognized that some of these implausible results may need to be reported in the STAT Team document in order to better define the scope of the accepted model results. The STAR panel should comment on the degree to which the accepted model scenarios describe and quantify the major sources of uncertainty, and the degree to which the probabilities associated with these scenarios are technically sound. The STAR panel may also provide qualitative comments on the probability of various model results, especially if the panel does not believe that the probability distributions calculated by the STAT capture all major sources of uncertainty.

Recommendations and requests to the STAT Team for additional or revised analyses must be clear, explicit and in writing. A written summary of discussion on significant technical points and lists of all STAR Panel recommendations and requests to the STAT Team are required in the STAR Panel's report. This should be completed (at least in draft form) prior to the end of the meeting. It is the chair and Panel's responsibility to carry out any follow-up review work that is required.

The primary goal of the STAR Panel is to complete a detailed evaluation of the results of a stock assessment, which puts the Panel in a good position to advance the best available scientific information to the Council. Under ideal circumstances, the STAT Team and STAR Panel should strive to reach a mutual consensus on a single base model, but it is essential that uncertainty in the analysis be captured and transmitted to managers. A useful way of accomplishing this objective is to bracket the base model along what is deemed to be the dominant dimension of uncertainty (e.g., spawner-recruit steepness, natural mortality rate, survey catchability, year-class strength, etc.). Once a base model has been bracketed on either side by alternative model scenarios, which capture the overall degree of uncertainty in the assessment, a 2-way decision table analysis (states-of-nature versus management action) is the preferred way to present the repercussions of uncertainty to management. Bracketing of assessment results could be accomplished in a variety of ways, including ambiguity in the data, statistical precision, or model specification uncertainty, but as a matter of practice the STAR Panel should strive to identify a single preferred model when possible, so that averaging of extremes doesn't become the *de facto* choice of management.

To the extent possible additional analyses required in the stock assessment should be completed during the STAR Panel meeting. It is the obligation of the STAR Panel chairperson, in consultation with other Panel members, to prioritize requests for additional STAT Team analysis. If follow-up work by the STAT Team is required after the review meeting, then it is the Panel's responsibility to track STAT Team progress. In particular, the chair is responsible for communicating with all Panel members (by phone, e-mail, or any convenient means) to determine if the revised stock assessment and documents are complete and ready to be used by managers in the Council family. If stock assessments and reviews are not complete at the end of the STAR Panel meeting, then the work must be completed prior to the GMT meeting where the assessments and preliminary ABC levels are discussed.

The STAR Panel, STAT Team, and all interested parties are legitimate meeting participants that must be accommodated in discussions. It is the STAR Panel chair's responsibility to manage discussions and public comment so that work can be completed.

STAT Teams and STAR Panels are likely to disagree on certain technical issues. If the STAR Panel and STAT Team disagree, the STAR Panel must document the areas of disagreement in its report. The STAR Panel may also request additional analysis based on an alternative approach. However, the STAR Panel's primary duty is to conduct a peer review of the assessment that is presented. In the course of this review, the Panel may ask for a reasonable number of sensitivity runs, additional details of existing assessments, or similar items from the STAT team. However, the STAR Panel is not authorized to conduct an alternative assessment representing its own views that are distinct from those of the STAT Team, nor can it impose an alternative assessment on the Team. Rather, if the Panel finds that an assessment is inadequate, it should document and report that opinion and, in addition, suggest remedial measures that could be taken by the STAT team to rectify whatever perceived shortcomings may exist. Where fundamental differences of opinion remain between the STAR Panel and STAT Team, which cannot be resolved by mutual discussion, the SSC will review the dispute and will issue its own recommendation.

The SSC representative on the STAR Panel is expected to attend GMT and Council meetings where stock assessments and harvest projections are discussed to explain the reviews and provide other technical information and advice. The chair is responsible for providing Council staff with a camera ready and suitable electronic version of the Panel's report for inclusion in the annual SAFE report.

Suggested Template for STAR Panel Report

1. Minutes of the STAR Panel meeting containing
   A. Name and affiliation of STAR Panel members; and
   B. List of analyses requested by the STAR Panel, the rationale for each request, and brief summary of the STAT response to the request.
2. Comments on the technical merits and/or deficiencies in the assessment and recommendations for remedies.
3. Explanation of areas of disagreement regarding STAR Panel recommendations:
   A. A~~a~~mong STAR Panel members (majority and minority reports), and
   B. B~~b~~etween the STAR Panel and STAT Team
4. Unresolved problems and major uncertainties, e.g.; any special issues that complicate scientific assessment, questions about the best model scenario.
5. Prioritized recommendations for future research and data collection

Terms of Reference for Groundfish STAT Teams

The STAT Team will carry out its work according to these terms of reference and the calendar for groundfish stock assessments.

~~Each STAT Team will appoint a representative who will attend any data and modeling~~ All relevant stock assessment workshops should be attended by all STAT team members. The STAT Team is obliged to keep the STAR Panel GAP representative informed of the specific data being used in the stock assessment and to be prepared to respond to concerns about the data that might be raised. STAT Teams are encouraged to also organize independent meetings with industry and interested parties to discuss issues, questions, and data.

Each STAT Team will appoint a representative to coordinate work with the STAR Panel. ~~and~~ Barring exceptional circumstances, all STAT team members should attend the STAR Panel meeting.

Each STAT Team conducting a full assessment will appoint a representative who will be available to attend the ~~GMT meeting and~~ Council meeting where the SSC is scheduled to review the assessment. ~~preliminary acceptable biological catch (ABC) and optimum yield (OY) levels are discussed.~~ In addition, a representative of the STAT Team should be available to attend the GMT and Council meetings where ~~final~~ preliminary ABC and OY levels are discussed~~, if requested or necessary~~. ~~At these meetings, the STAT Team member shall be available to answer questions about the STAT Team report.~~

The STAT Team is responsible for preparing three versions of the stock assessment document: 1) a "draft" for discussion at the stock assessment review meeting; 2) a revised "complete draft" for distribution to the ~~GMT, SSC, GAP, and~~ Council and advisory bodies for discussions about preliminary ABC and OY levels; 3) a "final" version to be published in the SAFE report. Other than changes authorized ~~changes~~by the SSC, only editorial and other minor ~~changes~~ alterations should be made between the "complete draft" and "final" versions. The STAT Team will provide ~~distribute~~ "draft" assessment documents to the Stock Assessment Coordinator, who will distribute them to the STAR Panel, Council, and GMT and GAP representatives at least two weeks prior to the STAR Panel meeting.

The STAT Team is responsible for bringing computerized data and working assessment models to the review meeting in a form that can be analyzed on site. STAT Teams should take the initiative in building and selecting candidate models and should have several complete models ready to present to the STAR Panel and be prepared to discuss the merits of each. The STAT should not expect the STAR Panel to develop a new Base model during a STAR Panel meeting.

In most cases, the ~~The~~ STAT Team ~~is responsible for producing a~~ should produce a complete draft of the assessment ~~by~~ within three weeks of the end of the STAR Panel meeting, including any internal agency review. In ~~the~~ any event, ~~that a~~ the STAT Team must finalize the assessment document ~~complete draft is not completed, the Team is responsible for completing the work to the satisfaction of the STAR Panel as soon as possible, but within at least one week~~ before the ~~GMT~~ briefing book deadline for the Council meeting at which ~~meets to discuss the results of~~ the assessment is scheduled for review.

The STAT Team and the STAR Panel may disagree on technical issues regarding an assessment, but a complete stock assessment must include a point-by-point response by the STAT Team to each of the STAR Panel's recommendations. Estimates and projections representing all sides of the disagreement need to be presented to, reviewed by, and commented upon ~~on~~ by the SSC.

For stocks ~~which~~ that are projected to fall below overfished thresholds, the STAT Team must complete a rebuilding analysis according to the SSC's Terms of Reference for Groundfish Rebuilding Analyses ~~(see footnote 2)~~. It is recommended that this analysis be conducted using the rebuilding software developed by Dr. Andre Punt (aepunt@u.washington.edu). ~~However, authors are also encouraged to present alternative approaches (where appropriate), along with clear justification for why the alternative may be an improvement over the approach described in the SSC's Terms of Reference.~~ The STAT Team is also responsible for preparing a document that summarizes the results of the rebuilding analysis.

Electronic versions of final assessment documents, rebuilding analyses, parameter files, data files, and key output files will be sent by the STAT Teams to the Stock Assessment Coordinator for inclusion in a stock assessment archive. Any tabular data that are inserted into the final documents in and object format should also be submitted in alternative forms (e.g., spreadsheets), which allow selection of individual data elements.

Terms of Reference for Stock Assessment Updates

The STAR process is designed to provide a comprehensive, independent review of a stock assessment. In other situations a less comprehensive review of assessment results is desirable, particularly in situations where a "model" has already been critically examined and the objective is to simply update the model by incorporating the most recent data. In this context a model refers not only to the population dynamics model *per se*, but to the particular data sources that are used as inputs to the model, the statistical framework for fitting the data, and the analytical treatment of model outputs used in providing management advice, including reference points, the allowable biological catch (ABC) and optimum yield (OY). These terms of reference establish a procedure for a limited but still rigorous review for stock assessment models that fall into this latter category. However, it is recognized that what in theory may seem to be a simple update, may in practice result in a situation that is impossible to resolve in an abbreviated process. In these cases, it may not be possible to update the assessment – rather the assessment may need to be revised in the next full assessment review cycle.

Qualification

The Scientific and Statistical Committee (SSC) will determine whether a stock assessment qualifies as an update under these terms of reference. Certification by a STAR Panel that a full assessment is eligible to become an update will be a principal criterion in this determination. To qualify, a stock assessment must carry forward its fundamental structure from a model that was previously reviewed and endorsed by a full STAR panel. In practice this means similarity in: (a) the particular sources of data used, (b) the analytical methods used to summarize data prior to input to the model, (c) the software used in programming the assessment, (d) the assumptions and structure of the population dynamics model underlying the stock assessment, (e) the statistical framework for fitting the model to the data and determining goodness of fit, (f) the procedure for weighting of the various data components, and (g) the analytical treatment of model outputs in determining management reference points, including F_{msy}, B_{msy}, and B_0. A stock assessment update is appropriate in situations where no significant change in these 7 factors has occurred, other than extending time series of data elements within particular data components used by the model, e.g., adding information from a recently completed survey and an update of landings. In practice there will always be valid reasons for altering a model, as defined in this broad context, although, in the interests of stability, such changes should be resisted as much as possible. Instead, significant alterations should be addressed in the next subsequent full assessment and review. In principle, an update is reserved for stock assessments that maintain fidelity to an accepted modeling framework, but the SSC does not wish to prescribe in advance what particular changes may or may not be implemented. Such a determination will need to be made on a case by case basis.

Composition of the Review Panel

The groundfish subcommittee of the SSC will conduct the review of a stock assessment update. A lead reviewer for each updated assessment will be designated by the chairman of the groundfish subcommittee from among its membership, and it will be the lead reviewer's responsibility to ensure the review is completed properly and that a written report of the proceedings is produced. Other members of the subcommittee will participate in the review to the extent possible, i.e., input from all members will not be required to finalize a report. In addition, the groundfish management team (GMT) and the groundfish advisory panel (GAP) will designate one person each to participate in the review.

Review Format

All stock assessment updates will be reviewed during a single meeting of the SSC Groundfish Subcommittee scheduled early in the assessment cycle. This meeting may precede or follow a normally scheduled SSC meeting. The review process will be as follows. The STAT team preparing the update will distribute the updated stock assessment to the review panelists at least two prior to the review meeting. In addition, Council staff will provide panelists with a copy of the last stock assessment reviewed under the full STAR process, as well as the previous STAR panel report. Notice of the meeting will be published in the *Federal Register* (generally, 23 days in advance of the meeting) and a Meeting Notice will be distributed (generally, 14 days in advance). Review of stock assessment updates is not expected to require analytical requests or model runs during the meeting, although large or unexpected changes in model results may necessitate some model exploration. The review will focus on two crucial questions: (1) has the assessment complied with the terms of reference for stock assessment updates and (2) are new input data and model results sufficiently consistent with previous data and results that the updated assessment can form the basis of Council decision-making.

STAT Team Deliverables

Since there will be limited opportunities for revision during the review meeting, it is the STAT team's responsibility to provide the Panel with a completed update at least two weeks prior to the meeting. To streamline the process, the team can reference whatever material it chooses, which was presented in the previous stock assessment (e.g., a description of methods, data sources, stock structure, etc.). However, it is essential that any new information being incorporated into the assessment be presented in enough detail, so that the review panel can determine whether the update satisfactorily meets the Council's requirement to use the best available scientific information. Of particular importance will be a retrospective analysis showing the performance of the model with and without the updated data streams. Likewise, a decision table that highlights the consequences of mis-management under alternative states of nature would be useful to the Council in adopting annual specifications. Similarly, if any minor changes to the "model" structure are adopted, above and beyond updating specific data streams, a sensitivity analysis to those changes will be required.

In addition to documenting changes in the performance of the model, the STAT team will be required to present key assessment outputs in tabular form. Specifically, the STAT team's final update document should include the following:

- Title page and list of preparers
- Executive Summary (see Appendix C)
- Introduction
- Documentation of updated data sources
- Short description of overall model structure
- Base-run results (largely tabular and graphical)
- Uncertainty analysis, including retrospective analysis, decision table, etc.
- 10 year harvest projections under the default harvest policy

Review Panel Report

The stock assessment review panel will issue a report that will include the following items:

- Name and affiliation of panelists
- Comments on the technical merits and/or deficiencies of the update
- Explanation of areas of disagreement among panelists and between the panel and STAT team
- Recommendation regarding the adequacy of the updated assessment for use in management

Appendix A: 200~~5~~7-200~~6~~8 Stock Assessment Review Calendar

TO BE DETERMINED

Include drop dead dates for inclusion of all significant data elements

Include a post-STAR debriefing where STAT teams present their findings to GMT, GAP, and the Council – how is this meeting organized?

When do STAT Teams provide GAP representatives with stock assessment data?

~~July 26-30, 2004 Data Workshop (AFSC, Seattle)~~

~~Oct. 25-29, 2004 Modeling Workshop (NWFSC, Seattle)~~

~~Nov. 1-5, 2004 PFMC adoption of Stock Assessment Terms of Reference (Portland)~~

~~Feb. 1-3, 2005 STAR Panel #1: Pacific whiting~~

~~April 18-22, 2005 STAR Panel #2: English sole, petrale sole, starry flounder~~

~~May 9-13, 2005 STAR Panel #3: California scorpionfish, gopher rockfish, vermilion rockfish, cowcod~~

~~May 16-20, 2005 STAR Panel #4: Pacific ocean perch, darkblotched rockfish, cabezon~~

~~June 20-24, 2005 STAR Panel #5: sablefish, Dover sole, longspine thornyhead, shortspine thornyhead~~

~~Aug. 1-5, 2005 STAR Panel #6: widow rockfish, bocaccio, blackgill rockfish, kelp greenling~~

~~Aug. 15-19, 2005 STAR Panel #7: lingcod, canary rockfish, yelloweye rockfish, yellowtail rockfish~~

~~Sept.-Oct., 2005 Mop-up STAR Panel (if needed)~~

~~Sept., 2005 GMT meeting~~

~~Sept. 18-23, 2005 PFMC preliminary adoption of ABCs and OYs (Portland)~~

~~Nov. 1-4, 2005 PFMC continued adoption of ABCs and OYs (San Diego)~~

~~April 3-7, 2006 PFMC preliminary adoption of management measures for 2007-2008 (California)~~

~~June 12-16, 2006 PFMC final adoption of management measures for 2007-2008 (????)~~

Appendix B: Outline for Groundfish Stock Assessment Documents

This is an outline of items that should be included in stock assessment reports for groundfish managed by the Pacific Fishery Management Council. The outline is a working document meant to provide assessment authors with flexible guidelines about how to organize and communicate their work. All items listed in the outline may not be appropriate or available for each assessment. In the interest of clarity and uniformity of presentation, stock assessment authors and reviewers are encouraged (but not required) to use the same organization and section names as in the outline. It is important that time trends of catch, abundance, harvest rates, recruitment and other key quantities be presented in tabular form to facilitate full understanding and ~~followup~~follow-up work.

A. Title page and list of preparers – the names and affiliations of the stock assessment team (STAT) either alphabetically or as first and secondary authors

B. Executive Summary (see attached template and example in Appendices C and D). This also serves as the STAT summary included in the SAFE.

C. Introduction
   1. Scientific name, distribution, the basis for the choice of stock structure, including regional differences in life history or other biological characteristics that should form the basis of management units.
   2. Important features of life history that affect management (e.g., migration, sexual dimorphism, bathymetric demography)
   3. Important features of current fishery and relevant history of fishery
   4. Management history (e.g., changes in mesh sizes, trip limits, optimum yields)
   5. Management performance – a table or tables comparing acceptable biological catches, optimum yields, landings, and catch (i.e., landings plus discard) for each area and year

~~B.~~ D. Assessment
~~14.~~ 1. Data
      a. Landings by year and fishery, historical catch estimates, discards (generally specified as a percentage of total catch in weight and in units of mt), catch-at-age, weight-at-age, abundance indices (typically survey and CPUE data), data used to estimate biological parameters (e.g.; growth rates, maturity schedules, and natural mortality) with coefficients of variation (CVs) or variances if available. Include complete tables and figures and date of extraction.
      b. Sample size information for length and age composition data by area, year, gear, market category, etc., including both the number of trips and fish sampled.
~~15.~~ 2. History of modeling approaches used for this stock – changes between current and previous assessment models
      a. Response to STAR Panel recommendations from the most recent previous assessment.
~~16.~~ 3. Model description
~~a.~~ a. Complete description of any new modeling approaches.
~~b.~~ b. Definitions of fleets and areas.
      c. Assessment program with last revision date (i.e., date executable program file was compiled).
      d. List and description of all likelihood components in the model.
      e. Constraints on parameters, selectivity assumptions, natural mortality, assumed level of age reader agreement or assumed ageing error (if applicable), and other assumed parameters.
      f. Description of stock-recruitment constraints or components.
      g. Description of how the first year that is included in the model was selected and how the population state at the time is defined (e.g., B_0, stable age structure, etc.).
      h. Critical assumptions and consequences of assumption failures.
~~17.~~ 4. Model selection and evaluation
~~a.~~ a. Evidence of search for balance between model realism and parsimony.
      b. Use nested models where possible (e.g.; asymptotic vs. domed selectivities, constant vs. time-varying selectivities).
~~c.~~ c. ~~Do parameter estimates make sense, are they credible?~~Summary of alternate model configurations that were tried but rejected.
      d. Likelihood profile for the base-run configuration over one or more key parameters (e.g., M, h, Q) to show consistency among input data sources.

e. Residual analysis (e.g.; residual plots, time series plots of observed and predicted values, or other approach).
~~e.~~ f. Convergence status and convergence criteria for the base-run model.
~~f.~~ g. Randomization run results or other evidence of search for global best estimates.
h. Evaluation of model parameters. Do they make sense? Are they credible?
i. Are model results consistent with assessments of the same species in Canada and Alaska? Are parameter estimates (e.g., survey catchability) consistent with estimates for related stocks?

5. Point-by-point response to the STAR Panel recommendations.

~~18.~~ 6. Base-run(s) results

a. Table listing all explicit parameters in the stock assessment model used for base runs, their purpose (e.g.; recruitment parameter, selectivity parameter) and whether or not the parameter was actually estimated in the stock assessment model.

~~b.~~ b. Population numbers at age × sex (where M is sex-specific) × year.
c. Time-series of total and spawning biomass, depletion relative to B_0, recruitment and fishing mortality or exploitation rate estimates (table and figures).
~~d.~~ d. Selectivity estimates (if not included elsewhere).
~~e.~~ e. Stock-recruitment relationship.

7. Uncertainty and sensitivity analyses. The best approach for describing uncertainty and the range of probable biomass estimates in groundfish assessments may depend on the situation. Important factors to consider include:

a. Parameter uncertainty (variance estimation conditioned on a given model, estimation framework, data set choice, and weighting scheme), including likelihood profiles of important assessment parameters (e.g., natural mortality). This also includes expressing uncertainty in derived outputs of the model and estimating CVs by an appropriate methods (e.g., bootstrap, asymptotic methods, Bayesian approaches, or MCMC).
b. Sensitivity to data set choice and weighting schemes (e.g., emphasis or λ factors), which may also include a consideration of recent patterns in recruitment.
~~c.~~ c. Sensitivity to assumptions about model structure, i.e., model specification uncertainty.
d. Retrospective analysis, where the model is fitted to a series of shortened input data sets, with the most recent years of input data being dropped.
~~e.~~ e. Historical analysis (plot of actual estimates from current and previous assessments).
~~f.Decision table analysis.~~
~~g.~~ f. Subjective appraisal of the magnitude and sources of uncertainty.
g. If a range of model runs is used to characterize uncertainty it is important to provide some qualitative or quantitative information about relative probability of each.
h. If possible, ranges depicting uncertainty should include at least three runs: (a) one judged most probable; (b) at least one that depicts the range of uncertainty in the direction of lower current biomass levels; and (c) one that depicts the range of uncertainty in the direction of higher current biomass levels. The entire range of uncertainty should be carried through stock projections and decision table analyses.
i. Risk plots (Mohn suggestion)

~~C.~~ E. Rebuilding parameters –

1. Determine B_o as the product of spawningers per recruit (SPR) in unfished state multiplied by the average recruitment expected while the stock is unfished. This typically is estimated as the average recruitment during early years of fishery. ~~According to the 1999 SAFE report (PFMC 1999, p. 24)[3], t~~The values for spawners are preferably measured as total population egg production, but female spawning biomass is a common proxy.

[3]Pacific Fishery Management Council. 1999. Status of the Pacific Coast Groundfish Fishery Through 1998 and Recommended Biological Catches for 2000: Stock Assessment and Fishery Evaluation. (Document prepared for the Council and its advisory entities.) Pacific Fishery Management Council, 2130 SW Fifth Avenue, Suite, 224, Portland, Oregon 97201.

~~15.~~ 2. $B_{msy} = 0.4\ B_o$;
~~16.~~ 3. Mean generation time; and
4. Forward projection using a Monte Carlo re-sampling of recruitments expected to occur as the stock rebuilds, where future recruitments typically are taken from the recent time series of estimated recruitments or recruits per spawner. Alternatively, if a credible stock-recruitment relationship can be estimated, it could be used to project population growth. Either approach can be conducted using the Punt rebuilding software (see above).

~~D.~~ F. Reference Points (biomass and exploitation rate)

~~E.~~G. Harvest projections and decision tables

1. Harvest projections and decision tables (i.e., a matrix of states of nature versus management action) should cover the plausible range of uncertainty about current biomass and the full range of candidate fishing mortality targets used for the stock or requested by the GMT. These should at least include calculation of the ABC based on F_{msy} (or its proxy) and the OY that is implied under the Council's 40:10 harvest policy. Ideally, the alternatives described in the decision table will be drawn from a probability distribution which describes the pattern of uncertainty regarding the status of the stock and the consequences of alternative future management actions. Where alternatives are not formally associated with a probability distribution, the document needs to present sufficient information to guide assignment of approximate probabilities to each alternative.
2. Information presented should include biomass and yield projections of ABC and OY for ten years into the future, beginning with the first year for which management action could be based upon the assessment.

H. Research needs (prioritized).

I. Acknowledgments-include STAR Panel members and affiliations as well as names and affiliations of persons who contributed data, advice or information but were not part of the assessment team.

J. Literature cited.

K. An appendix with the c~~C~~omplete parameter and data in the native code of the stock assessment program.

Appendix C: Template for Executive Summary Prepared by STAT Teams

Stock: species/area, including an evaluation of any potential biological basis for regional management

Catches: trends and current levels-include table for last ten years and graph with long term data

Data and assessment: date of last assessment, type of assessment model, data available, new information, and information lacking

Unresolved problems and major uncertainties: any special issues that complicate scientific assessment, questions about the best model scenario, etc.

Reference points: management targets and definition of overfishing

Stock biomass: trends and current levels relative to virgin or historic levels, description of uncertainty-include table for last 10 years and graph with long term estimates

Recruitment: trends and current levels relative to virgin or historic levels-include table for last 10 years and graph with long term estimates

Exploitation status: exploitation rates (i.e., total catch divided by exploitable biomass) – include a table with the last 10 years of data and a graph showing the trend in fishing mortality relative to the target (y-axis) plotted against the trend in biomass relative to the target (x-axis).

Management performance: catches in comparison to ABC and OY values for the most recent 10 years (when available), overfishing levels, actual catch and discard.

Forecasts: ten-year forecasts of catch, summary biomass, spawning biomass, and depletion

Decision table: projected yields (ABC and OY), spawning biomass, and stock depletion levels for each year

Research and data needs: identify information gaps that seriously impede the stock assessment

Rebuilding Projections: principal results from rebuilding analysis if the stock is overfished

Summary Table: as detailed in the attached spreadsheet

Appendix D: Example a Complete Stock Assessment Executive Summary

Will update with the Executive Summary from the latest round of assessments (Stacey Miller to provide)

~~**Executive Summary**~~

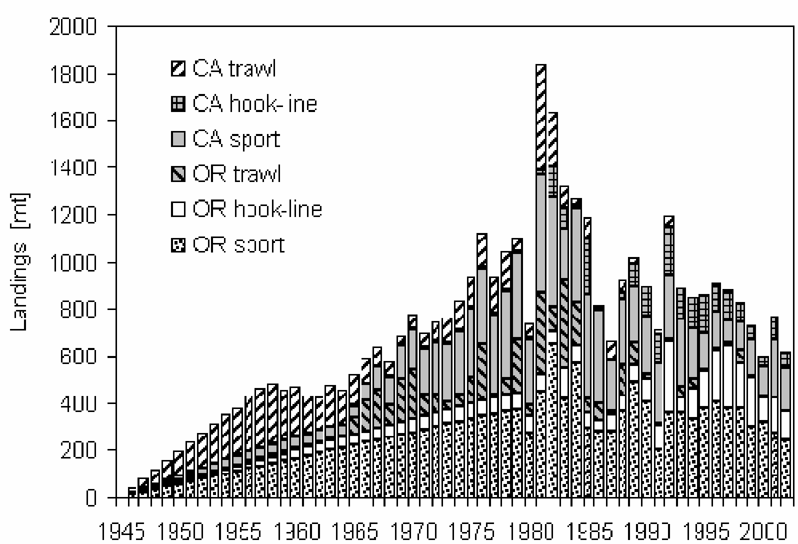
~~Stock: This assessment pertains to the black rockfish (*Sebastes melanops*) population resident in waters located off northern California and Oregon, including the region between Cape Falcon and the Columbia River. Genetic information is presented that indicates black rockfish within that area represent a single homogeneous unit. A separate analysis of black rockfish off the coast of Washington and Oregon north of Cape Falcon was conducted by Wallace *et al*. (1999).~~

~~Catches: Catches of black rockfish from Oregon and California were classified into 6 distinct fisheries, i.e., the recreational, commercial hook-and-line, and trawl sectors from each State. Since 1978, when consistent catch reporting systems began, landings have ranged from 602 1,836 mt. From 1978-2002 recreational catches have been reasonably consistent and have predominated. Concurrently, hook-and-line landings have increased as trawl landings have decreased. For this assessment, catches from 1945-77 were estimated from fragmented data and were ramped up by linear interpolation to known values in 1978. Discard rates of black rockfish are thought to be negligible, so the catch was assumed equal to the landings.~~

~~Recent black rockfish catch statistics [mt] by fishery~~

	~~Oregon~~			~~California~~			
~~Year~~	~~Sport~~	~~Hook~~	~~Trawl~~	~~Sport~~	~~Hook~~	~~Trawl~~	~~Total~~
~~1993~~	~~360.8~~	~~65.7~~	~~43.7~~	~~284.0~~	~~129.1~~	~~2.2~~	~~885.5~~
~~1994~~	~~330.0~~	~~131.2~~	~~43.4~~	~~210.0~~	~~130.9~~	~~1.1~~	~~846.6~~
~~1995~~	~~377.4~~	~~158.5~~	~~4.3~~	~~158.0~~	~~156.9~~	~~2.7~~	~~857.8~~
~~1996~~	~~401.3~~	~~225.6~~	~~7.7~~	~~154.0~~	~~103.4~~	~~10.5~~	~~902.5~~
~~1997~~	~~375.9~~	~~267.6~~	~~17.1~~	~~91.0~~	~~112.8~~	~~14.1~~	~~878.5~~
~~1998~~	~~375.2~~	~~191.6~~	~~58.6~~	~~117.0~~	~~78.6~~	~~6.3~~	~~827.3~~
~~1999~~	~~301.6~~	~~207.7~~	~~2.3~~	~~162.0~~	~~49.0~~	~~3.9~~	~~726.5~~
~~2000~~	~~320.7~~	~~105.6~~	~~0.6~~	~~129.0~~	~~43.7~~	~~2.3~~	~~601.9~~
~~2001~~	~~275.4~~	~~146.2~~	~~0.2~~	~~248.0~~	~~96.6~~	~~2.1~~	~~768.5~~
~~2002~~	~~241.6~~	~~125.2~~	~~1.2~~	~~179.7~~	~~67.0~~	~~2.0~~	~~616.7~~

~~Data and Assessment: A variety of data sources was used in this assessment including: (1) recreational landings, age, and size composition data from the Oregon Department of Fish and Wildlife (ODF&W), (2)~~



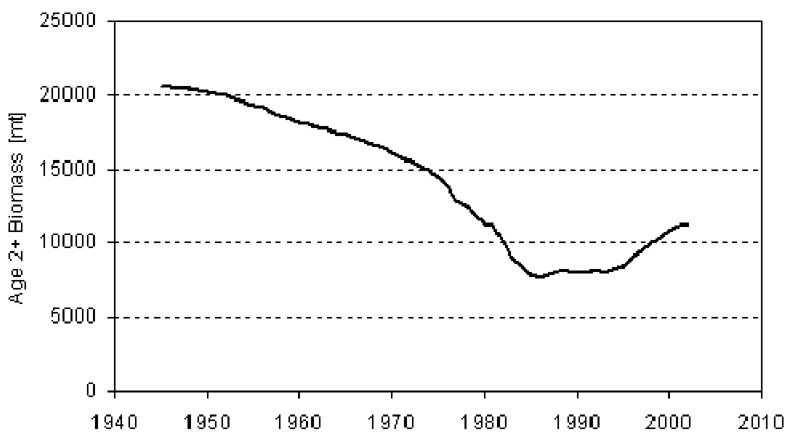
~~recreational landings (all California and Oregon shore-based modes) from the RECFIN data base, (3) Oregon commercial landings (trawl and hook-and-line) from the PACFIN data base, (4) size compositions for the commercial fisheries in Oregon from ODF&W, (5) California commercial landings and length compositions from~~

~~the CALCOM database, (6) a recreational catch-per-unit-effort (CPUE) statistic developed from information provided by ODF&W, (7) recreational CPUE statistics for each State derived from the RECFIN data base, and (8) a recreational CPUE statistic developed from the CDF&G central California CPFV data base. These multiple data sources were combined in a maximum likelihood statistical setting using the length-based version of the Stock Synthesis Model (Methot 1990, 2000).~~

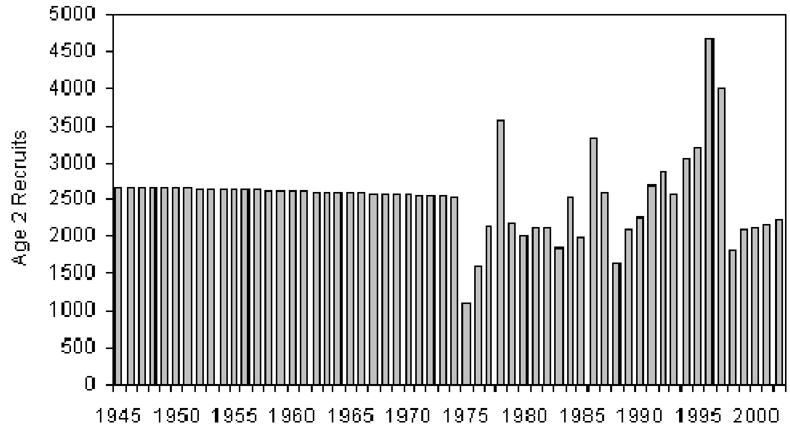
~~Unresolved Problems and Major Uncertainties: The major sources of uncertainty in this stock assessment include: (1) the amount of historical landings that occurred prior to the 1978, (2) the assumed natural mortality rate, and (3) the steepness of the spawner-recruit curve.~~

~~Reference Points: Based on the Pacific Fishery Management Council's current default harvest rate policy for *Sebastes*, the target harvest rate for black rockfish is $F_{50\%}$. Given the life history of the species, and the prevailing mix of fisheries in 2002 (predominately recreational with some commercial hook-and-line catches), this corresponds to an exploitation rate of about 7.7%. Moreover, the Council's current target biomass level for exploited groundfish stocks is $B_{40\%}$, i.e., the spawning output of the stock is reduced to 40% of that expected in the absence of fishing. For black rockfish that corresponds to spawning output of 1.258×10^9 larvae.~~

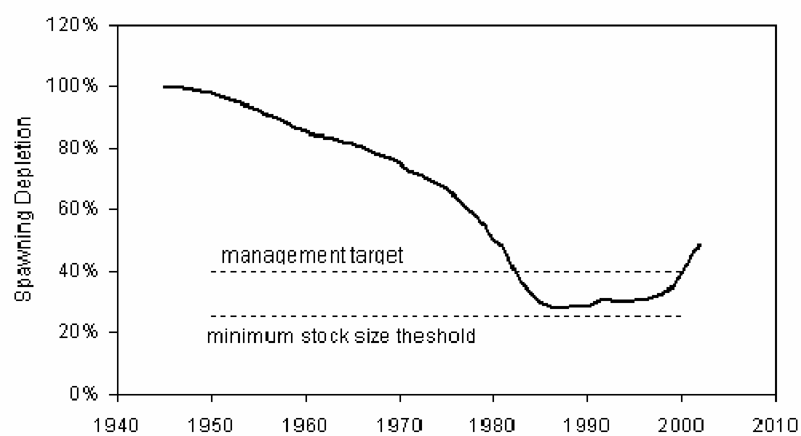
~~Stock Biomass: The biomass of age 2+ black rockfish underwent a significant decline from a high of 20,510 mt in 1945 to a low of 7,702 mt in 1986, representing a 62% decline. Since that time, however, the stock has increased and is currently estimated to be 11,232 mt. Most of the population's growth occurred after 1995, due to several large recruitment events, including especially the 1994 and 1995 year-classes.~~

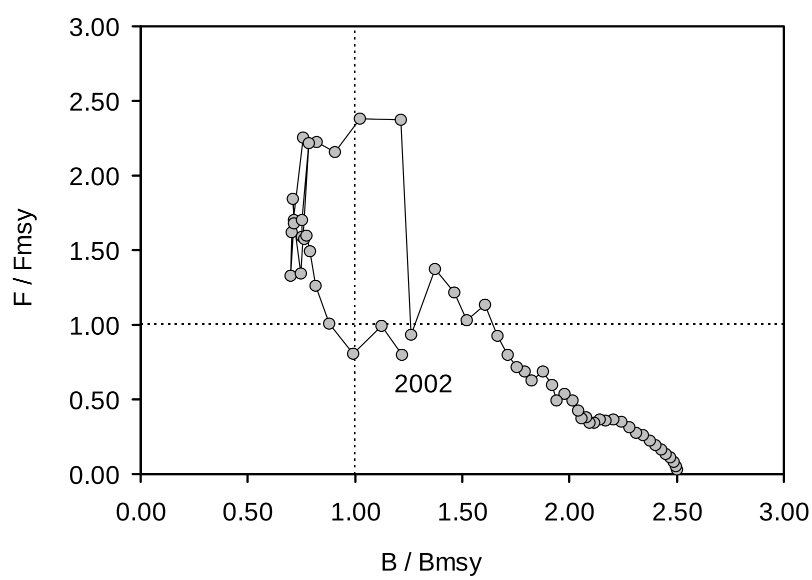


~~Recruitment: In the assessment recruitment was treated as a blend of deterministic values (i.e., 1945-1974 & 1999-2002) and stochastic values (i.e., 1975-1998). The Beverton-Holt steepness parameter (***h***) was fixed at a value of 0.65, based upon on a profile of goodness-of-fit and results from a prior meta-analysis of rockfish productivity. During the 1975-1998 period there was a significant increasing trend in recruitment, even as spawning output declined. That trend culminated with the recruitment of the 1994 and 1995 year-classes, which were about twice as large as expected, based on the predicted value from the spawner-recruit curve.~~



~~Exploitation Status: The northern California-Oregon stock of black rockfish is healthy, with 2002 spawning output estimated to be 49% of the unexploited spawning level. This places the stock well above the management target level of $B_{40\%}$. Likewise, age 2+ biomass in 2002 is estimated to be 11,232 mt, which is 55% of that expected in the absence of fishing. In addition, since 1998 the fishing mortality rate has declined to the point where it is now less than the F_{msy} proxy in 2002 (i.e., $F_{50\%}$).~~





~~Management Performance: Black rockfish in the southern area (Eureka & Monterey INPFC areas) have historically been managed as part of the "Other Rockfish" category, with no explicit ABC or OY designated. For 2001 the ABC of all species within that group was 2,702 mt. In contrast, in the northern area (Vancouver & Columbia INPFC areas) black rockfish is managed within the "Remaining Rockfish" category, with a designated 2001 ABC of 1,115 mt.~~

~~Forecasts: A forecast of stock abundance and yield was developed under the base model. In this projection there was no 40:10 reduction in OY from the calculated ABC because the stock is estimated to be above the management target ($B_{40\%}$) and annual yields were calculated using an $F_{50\%}$ exploitation rate (see above). Results are shown in the following table:~~

Year	Age 2+ Biomass	Spawning Output	Recruits	ABC Exploitation Rate	Yield [mt] ABC	= OY
2003	11,342	1.63E+09	2,307	7.60%	802	802
2004	11,217	1.66E+09	2,353	7.45%	775	775
2005	11,082	1.65E+09	2,386	7.34%	753	753
2006	10,938	1.62E+09	2,394	7.29%	736	736
2007	10,802	1.57E+09	2,392	7.28%	725	725
2008	10,700	1.53E+09	2,381	7.29%	719	719
2009	10,621	1.50E+09	2,366	7.30%	715	715
2010	10558	1.48E+09	2,354	7.32%	713	713
2011	10505	1.47E+09	2,343	7.34%	711	711
2012	10459	1.46E+09	2,335	7.35%	708	708

~~Decision Table: The amount of historical catch prior to 1978 was considered a major source of uncertainty in this assessment. Although some catch estimates were available prior to that time, which were not inconsequential, no continuous time series of catches from the sport and trawl fisheries in Oregon and California could be identified. Therefore, the catch record was assumed to begin in 1945, with no historical catches prior to that year. Catches were then made to ramp up to 1978, using whatever external data were available and linear interpolations to fill missing values. To bracket uncertainty in these catches and their effect on the management system: (1) high and low catch scenarios were created, (2) the base assessment model was refitted to each series, and (3) 10-year yield projections run. Results show that if historical catches were lower than in the base model the calculated OY (= ABC) is reduced. Conversely, if historical catches were higher than modeled the OY would be higher. For purposes of comparison, total catches for 2000, 2001, and 2002 were 602, 768, and 617 mt, respectively.~~

	Low Catch Scenario		Base Model		High Catch Scenario	
Year	OY [mt]	Depletion	OY [mt]	Depletion	OY [mt]	Depletion
2003	757	54.2%	802	51.9%	886	48.1%
2004	729	54.9%	775	52.7%	861	49.0%
2005	706	54.5%	753	52.5%	842	48.9%
2006	688	53.3%	736	51.4%	828	48.2%
2007	676	51.7%	725	50.0%	820	47.1%
2008	668	50.3%	719	48.8%	817	46.2%
2009	663	49.2%	715	47.9%	816	45.6%
2010	660	48.3%	713	47.2%	816	45.1%
2011	657	47.7%	711	46.7%	816	44.9%
2012	654	47.2%	708	46.3%	816	44.7%

~~Research and Data Needs: The black rockfish review panel identified certain gaps in the available information that hindered the stock assessment. These were: (1) a fishery-independent survey should be developed to monitor~~

~~changes in black rockfish population abundance, (2) the California CPFV data set should be more thoroughly investigated to ascertain whether or not serial depletion of fishing sites has artificially kept catch rates high [see Appendix 1], (3) a standard approach to historical catch reconstructions should be developed, (4) the possibility of time-varying growth should be investigated, and (5) the calculation of the RECFIN catch-per-unit-effort statistic should be more thoroughly analyzed and verified.~~

Appendix E: History of STAR process

In 1995 and earlier years, stock assessments were examined at a very early stage during *ad hoc* stock assessment review meetings (one per year). SSC and GMT members often participated in these meetings and provided additional review of completed stock assessments during regular Council meetings. There were no terms of reference or meeting reports from the *ad hoc* meetings. NMFS provided leadership and coordination by setting up meetings. Each agency or Council paid their own travel costs. Council staff distributed meeting announcements and some background documents. The Council paid for publication of assessments as appendices to the annual Stock Assessment and Fishery Evaluation (SAFE) document.

A key event occurred in July 1995 when NMFS convened an independent, external review of West Coast groundfish assessments.[1] The report concluded that: 1) uncertainties associated with assessment advice were understated; 2) technical review of groundfish assessments should be more structured and involve more outside peers; and 3) the distinction between scientific advice and management decisions was blurred. Work to develop a process to review groundfish stock assessments was aimed at resolving these problems.

For 1996, the groundfish stock assessment review process was expanded to include: 1) terms of reference for the review meeting; 2) an outline for the contents of stock assessments; 3) external anonymous reviews of previous assessments; and 4) a review meeting report.[2] Plans were developed during March and April Council meetings and NMFS convened a week long review meeting in Newport, Oregon where preliminary groundfish stock assessments were discussed. The expanded process itself was reviewed by the Council family at an evaluation meeting at the end of the year. Leadership and planning responsibilities were shared by the SSC Groundfish Subcommittee, NMFS, GMT, GAP, and persons who participated in planning discussions during the March and April Council meetings. There was no formal coordination except for the review meeting terms of reference, organization of the review meeting by NMFS, and as provided by Council staff for publication of documents. Costs were shared as in previous years.

The review process for 1997 was further expanded based on a planning meeting in December 1996.[3] It was agreed that agencies (including NMFS and state agencies) conducting stock assessments were responsible for making sure assessments were technically sound and adequately reviewed. A Council-oriented review process was developed that included agencies, the GMT, GAP, and other interested members of the Council family. The process was jointly funded by the Council and NMFS, with NMFS hosting the Stock Assessment Review (STAR) Panel meetings and paying the travel expenses of the external reviewers, and the Council paying for travel expenses of the GAP representative and non-federal GMT and SSC members.

The process for 1997 included: 1) goals and objectives; 2) three STAR Panels, including external membership; 3) terms of reference for STAR Panels; 4) terms of reference for Stock Assessment (STAT) Teams; 5) a refined outline for stock assessments; 6) external anonymous reviews; 7) a clearer distinction between science and management; and 8) a calendar of events with clear deliverables, dates and well defined responsibilities. For the first time, STAR Panels and STAT Teams were asked to provide "decision table" analyses of the effects of uncertain management actions and to provide information required by the GMT in choosing harvest strategies. In addition, STAR Panels were asked to prepare "Stock Summaries" that described the essential elements of stock assessment results in a concise, simple format.

At the end of 1997, participants met to discuss events and make recommendations for 1998.[4] Participants concluded

---

[1] Anon. 1995. West coast groundfish assessments review, August 4, 1995. Pacific Fishery Management Council. Portland, OR.

[2] Brodziak, J., R. Conser, L. Jacobson, T. Jagielo, and G. Sylvia. 1996. Groundfish stock assessment review meeting - June 3-7, 1996 in Newport, Oregon. *In*: Status of the Pacific coast groundfish fishery through 1996 and recommended acceptable biological catches for 1997. Pacific Fisheries Management Council. Portland, OR.

[3] Meeting Report, Proposals and Plans for Groundfish Stock Assessment and Reviews During 1997 (May 8, 1997). Pacific Fishery Management Council, 2130 SW Fifth Avenue, Suite 224, Portland, OR 97201.

[4] Jacobson, L.D. (ed.). 1997. Comments, issues and suggestions arising from the groundfish stock assessment

that objectives were, to varying degrees, achieved during 1997. A notable shortfall was in “increasing acceptance and understanding by all members of the Council family.” The most significant issues seemed to be the nature of the STAR Panels’ responsibilities, communicating uncertainty to decision makers, workload, and inexperience in conducting the review process.

In retrospect, there was no formal coordination and leadership except for the terms of reference and the calendar. As in previous years, Council staff coordinated distribution of meeting announcements and distribution of documents. Costs increased substantially due to travel for external experts, increased number of review meetings (three instead of one), and distribution of larger and additional reports. NMFS paid travel and other costs for external members of STAR Panels. Other costs were distributed as in 1996. It was not possible for the Council to copy and distribute all of the stock assessments because of limited funds.

In 1998, the stock assessment process was similar to that in 1997, including the 8 elements listed above. In November, a joint session of the SSC, GMT, and GAP was held to review events in 1998 and make recommendations for 1999. Several topics were discussed, including policy issues related to the 1998 terms of reference and operational issues related to how the terms of reference were implemented in 1998. This meeting produced a list of recommended changes for 1999, including:

- increasing the SSC's involvement in the process;
- clarify/modify the participant roles;
- limit the number of assessments, especially the difficulty caused by the late addition of assessments (e.g., sablefish and shortspine thornyhead in 1998);
- increase the involvement of external participants;
- timeliness in completing and submitting assessments; and
- duration of STAR Panel meetings, and the time required to adequately reviewing assessments.

Accordingly, the terms of reference were amended to include a cut-off date of November by which anyone proposing to present an assessment for review in the following year must notify the stock assessment coordinator. This change will ensure there is adequate time for formation and planning of STAR Panel meetings. The terms of reference were also changed to clarify the SSC’s role in the process as "editor" and "arbiter;" the SSC will hear reports from all STAR Panels at its September meeting and will be involved in any unresolved issues between the STAT Teams, STAR Panels, or the GMT. Other issues were raised that had no quick solutions, such as how to incorporate socioeconomic information into the process, and how to present the decision tables to GMT and Council members.

Other than the changes noted above, the 1999 STAR process was similar to 1997 and 1998. As in previous years, a joint meeting of the SSC, GAP, and GMT was convened to review and evaluate the stock assessment process and to recommend modifications for 2000. There were relatively few concerns about the process in 1999, and they centered mainly ~~around~~on the difficulty of recruiting sufficient (external and internal) reviewers. Participants did not recommend departing from the current terms of reference regarding STAR panel composition, although they seemed to regard it more as a goal than a strict requirement. A notable continuing concern was the timeliness of STAT team reports prior to the STAR panel meetings.

Requirements for stock rebuilding analyses and monitoring of rebuilding progress and their relationship to the STAR process were also discussed. The group agreed that the terms of reference should be modified to require additional values (e.g., B_{msy}) be tabulated and included in STAT Team report related to an overfished species. There was general agreement that the STAR process should be used to review assessments of overfished species, which are still likely to be on a 3-year cycle. However, the STAR process is not the appropriate process for the "monitoring" reports (required every 2 years), when they are out of phase with the assessment cycle.

---

and review process during 1997. Report to the Pacific Fishery Management Council (Revised Supplemental Attachment B.9.b, November 1997).

Additionally, it was agreed that certain additional values should be consistently tabulated in the STAT team report in order to build a long-term computerized database of key parameters. The group noted that this would not impose additional work for the STAT team, but would simply require these values to be reported consistently.

The 2000 STAR process was reviewed during a joint meeting of the GAP, GMT, and SSC at the November 2000 meeting. There were relatively few recommendations for improvement to the terms of reference for 2001, although concerns about the long-term future for the STAR process were raised. It was agreed that the future of the STAR process would be evaluated during 2001, but the STAR process in 2001 would proceed similarly to past years. For the 2001 STAR process, participants at the review meeting recommended that greater efforts be made to produce and distribute documents in a timely manner and to assure their completeness and consistency with the terms of reference. In addition, the SSC agreed that its groundfish subcommittee would meet in concert with the GMT during the August 2001 meeting to identify issues, if any, with the assessments or STAR panel reviews that may require additional consideration by the SSC.

At the March 2001 PFMC meeting, the SSC provided recommendations for integrating rebuilding analyses and reviews into the STAR process for 2001.

~~**Appendix F: Terms of Reference for Expedited Stock Assessment Updates**~~

~~While the ordinary STAR process is designed to provide a general framework for obtaining a comprehensive, independent review of a stock assessment, in other situations a less rigorous review of assessment results is desirable. This is especially true in situations where a “model” has already been critically examined and the objective is to simply update the model by incorporating the most recent data. In this context a model refers not only to the population dynamics model *per se*, but to the particular data sources that are used as inputs to the model, the statistical framework for fitting the data, and the analytical treatment of model outputs used in providing management advice, including reference points, the allowable biological catch (ABC) and optimum yield (OY). When this type of situation occurs, it is an inefficient use of scarce personnel resources to assemble a full STAR Panel for a whole week to evaluate an accepted modeling framework. These terms of reference establish a procedure that can accommodate an abbreviated form of review for stock assessment models that fall into this latter category. However, it is recognized that what in theory may seem to be a simple update, may in practice result in a situation that is impossible to resolve in an abbreviated process. In these cases, it may not be possible to update the assessment – rather the assessment may need to be revised in the next full assessment review cycle.~~

~~Qualification~~

~~The Scientific and Statistical Committee (SSC) will determine when a stock assessment qualifies for an expedited update under these terms of reference. To qualify, a stock assessment must carry forward its fundamental structure from a model that was previously reviewed and endorsed by a full STAR panel. In practice this means similarity in: (a) the particular sources of data used, (b) the analytical methods used to summarize data prior to input to the model, (c) the software used in programming the assessment, (d) the assumptions and structure of the population dynamics model underlying the stock assessment, (e) the statistical framework for fitting the model to the data and determining goodness of fit, (f) the procedure for weighting of the various data components, and (g) the analytical treatment of model outputs in determining management reference points, including F_{msy}, B_{msy}, and B_0. It is the SSC's intention to employ an expedited stock assessment update in situations where no significant change in these 7 factors has occurred, other than extending time series of data elements within particular data components used by the model, e.g., adding information from a recently completed survey with an update of landings. In practice there will always be valid reasons for altering a model, as defined in this broad context, although, in the interests of stability, such changes should be resisted when possible. Instead, significant alterations should be addressed in the next subsequent full assessment and review. In principle, an expedited update is reserved for stock assessments that maintain fidelity to an accepted modeling framework, but the SSC does not wish to prescribe in advance what particular changes may or may not be implemented. Such a determination will need to be made on a case by case basis.~~

~~Composition of the Review Panel~~

~~Unless an updated assessment is reviewed during a regular STAR Panel, the groundfish subcommittee of the SSC will conduct the review of an expedited stock assessment update. A review panel chairman will be designated by the chairman of the groundfish subcommittee from among its membership and it will be the panel chairman's responsibility to ensure the review is completed properly and that a written report of the proceedings is produced. Other members of the subcommittee will participate in the review to the extent possible, i.e., input from all members will not be required to finalize a report. In addition, the groundfish management team (GMT) and the groundfish advisory panel (GAP) will designate one person each to participate in the review, although the GMT and GAP panelists will serve in an advisory capacity only.~~

~~Review Format~~

~~Typically, a physical meeting will not be required to complete an expedited review of an updated stock assessment, but usually one would be the most efficient way to conduct the review. Rather, if a meeting is not held, materials can be distributed electronically. STAT and panel representatives will~~

~~largely be expected to interact by email and telephone. A conference call will be held to facilitate public participation in the review.~~

~~The review process will be as follows. Initially, the STAT team that is preparing the stock assessment update will distribute to the review panelists a document that summarizes the team's findings. In addition, Council staff will provide panelists with a copy of the last stock assessment reviewed under the full STAR process, as well as the previous STAR panel report. Each panelist will carefully review the materials provided. A conference call will be arranged by the panel chairman, which will provide an opportunity to discuss and clarify issues arising during the review, as well as provide for public participation. Notice of the conference call and a list of public listening stations will be published in the *Federal Register* (generally, 23 days in advance of the conference call) and a Meeting Notice will be distributed (generally, 14 days in advance). A dialogue will ensue among the panelists and the STAT team over a period of time that generally should not exceed one week. Interested members of the public may request access to the discussions (typically email), which would be the facilitated of Council staff. Upon completion of the interactive phase of the review, the panel chairman may, if necessary, convene a second conference call to reach a consensus among panel members and will draft a report of the panel's findings regarding the updated assessment. The whole process should be scheduled to occur within a two week period and the STAT team and panelists should be prepared to complete their work within that time frame. It will be the chairman's responsibility to insure that the review is completed in a timely manner.~~

~~STAT Team Deliverables~~

~~It is the STAT team's responsibility to provide a description of the updated stock assessment to the panel at the beginning of the review. To streamline the process, the team can reference whatever material it chooses, which was presented in the previous stock assessment (e.g., a description of methods, data sources, stock structure, etc.). However, it is essential that any new information being incorporated into the assessment be presented in enough detail, so that the review panel can determine whether the update satisfactorily meets the Council's requirement to use the best available scientific information. Of particular importance will be a retrospective analysis showing the performance of the model with and without the updated data streams. Likewise, a decision table that highlights the consequences of mis-management under alternative states of nature would be useful to the Council in adopting annual specifications. Similarly, if any minor changes to the "model" structure are adopted, above and beyond updating specific data streams, a sensitivity analysis to those changes may be required.~~

~~In addition to documenting changes in the performance of the model, the STAT team will be required to present key assessment outputs in tabular form. Specifically, the STAT team's final update document should include the following:~~

- ~~Title page and list of preparers~~
- ~~Executive Summary (see Appendix C)~~
- ~~Introduction~~
- ~~Documentation of updated data sources~~
- ~~Short description of overall model structure~~
- ~~Base-run results (largely tabular and graphical)~~
- ~~Uncertainty analysis, including retrospective analysis, decision table, etc.~~
- ~~10 year harvest projections under the default harvest policy~~

~~Review Panel Report~~

~~The expedited stock assessment review panel will issue a report that will include the following items:~~

- ~~Name and affiliation of panelists~~
- ~~Comments on the technical merits and/or deficiencies of the update~~
- ~~Explanation of areas of disagreement among panelists and between the panel and STAT team~~
- ~~Recommendation regarding the adequacy of the updated assessment for use in management~~

GROUNDFISH ADVISORY SUBPANEL COMMENTS ON STOCK ASSESSMENT PLANNING FOR THE 2009-2010 FISHING SEASON

The Groundfish Advisory Subpanel (GAP) heard presentations from Dr. Elizabeth Clarke and Dr. Jim Hastie regarding the Groundfish Stock Assessment Review Workshop, the proposed amendments to the Terms of Reference, and the proposed stock assessment schedule for 2007 and beyond, and has the following comments.

In regards to the Terms of Reference, the GAP accepts and approves the proposed changes to amend and improve the Terms of Reference for the Groundfish Stock Assessment and Review Process for 2007-2008.

In regards to the stock assessment schedule, the GAP supports the proposed list of full and updated assessments with the exception of sablefish, which we believe should be assessed fully in 2007. The GAP believes that a higher priority should be placed on a full sablefish assessment than on the chilipepper assessment. While the GAP believes that the information that can be gleaned from a full assessment on chilipepper rockfish is important for the long-term, it is not necessary for short-term fishery management objectives. Additionally, blue, blackgill, vermillion and splitnose rockfish, as well as sanddabs, should be removed from the current list.

Lastly, the GAP advises the National Marine Fisheries Service to give some consideration to the number of assessments per Stock Assessment Review (STAR) Panel beyond just the number of species. For example, the petrale assessment is actually two geographic assessments (not a single assessment) and both assessments will have to be reviewed during the STAR Panel process.

PFMC
03/06/06

GROUNDFISH MANAGEMENT TEAM REPORT ON STOCK ASSESSMENT PLANNING FOR THE 2009-2010 FISHING SEASON

The Groundfish Management Team (GMT) reviewed the summary minutes from the January 13 Groundfish Stock Assessment Review Workshop (Agenda Item F.2.b Attachment 1). Relative to the summary minutes, the GMT supports all of the recommendations contained in the two-page list of recommendations for improving the stock assessment process. The GMT intends to thoroughly review the draft Terms of Reference and make recommendations in time for final action at the April Council meeting. However, the GMT recommends that these be incorporated into the Terms of Reference prior to public review.

The GMT also discussed stock assessment priorities, based on the NWFSC Report (Agenda Item F.2.c, NWFSC Report), and has several comments and suggestions at this point in time.

With respect to sablefish, the GMT recognizes that the declining trends in OY have been perceived by some to be inconsistent with the increasing trends observed in the survey data. The GMT recommends a full assessment in 2007 to provide more opportunity to investigate and better understand these results. The GMT also recommends that yelloweye rockfish be considered for a full assessment in 2007, to address concerns raised at both the STAR Panel and SSC review in recent weeks. With respect to blackgill rockfish, the GMT suggests that an update in the next cycle is preliminary, as there may only be one year of new survey data to inform the assessment in 2007. Additionally, several key research priorities identified in the STAR Panel report, such as conducting a contemporary age and growth study, should be pursued prior to revisiting the blackgill rockfish assessment. With respect to chilipepper rockfish, the GMT recognizes that this stock is a low priority with respect to management needs, but may be informative with respect to ecosystem trends and how certain types of data are used in models. The GMT supports the recommendations for other stocks and species listed in the NWFSC report for 2007. The GMT also recommends that blue rockfish be considered a potential candidate for a full assessment, to be done by CDFG (in collaboration with the SWFSC).

Although it is premature to make extensive comments regarding the assessment cycle beyond 2007, the GMT has discussed issues related to longer term planning for stock assessments, and has several comments. Most importantly, the GMT recommends that a more strategic planning for the assessment cycles that will follow 2007 be conducted before 2008, in order to more appropriately initiate data collection, port sampling, ageing and other biological studies. This should include reviews (perhaps in a workshop format) that would evaluate economic and biological criteria, as well as the availability of data, for unassessed stocks that may be candidates in the longer term. In addition to those listed in the NWFSC report, candidates for longer-term assessments include copper rockfish, brown rockfish, shortraker rockfish, and rougheye rockfish. Some stocks in which full assessments were proposed in 2009, such as lingcod and yellowtail, could be postponed or converted to updates to allow for new assessments to continue to be performed.

Finally, the GMT would like the Council community to more explicitly consider the extent to which the five-year criteria for evaluating stock status must be adhered to for all stocks and species. Given that this infers that stock status be assessed every four years (two cycles) under the current management regime, it is worth investigating the extent to which there may be some latitude for presumably healthy stocks to be assessed or updated every six years (three cycles) or longer, to address the assessment workload

<u>GMT Recommendations:</u>

1. Incorporate workshop recommendations into the Terms of Reference prior to public review.

2. Approve the NWFSC list of candidate species for 2007, with the following changes. Sablefish as a full assessment in 2007, remove blackgill rockfish, consider blue rockfish as a candidate (to be determined in April pending CDFG agreement) for a full assessment.

3. Provide the direction for constructing criteria, such as economic, biological, and data availability, that could be used to more formally consider future assessment cycles more strategically at the April Council meeting.

PFMC
03/07/06

SCIENTIFIC AND STATISTICAL COMMITTEE REPORT ON STOCK ASSESSMENT PLANNING FOR THE 2009-2010 FISHING SEASON

The Scientific and Statistical Committee (SSC) reviewed the first draft of the revised Terms of Reference for the Groundfish Stock Assessment Review process. This document was revised by members of the SSC Groundfish Subcommittee following recommendations developed at the January 2006 Groundfish Stock Assessment Review Workshop. Additional modifications to the Terms of Reference will be made by the SSC. Two new sections were added to the Terms of Reference: 1. STAT Team Responsibilities and 2. Stock Assessment Updates. The STAT Team's responsibility is to produce a stock assessment document that follows a standardized format, an outline of which is provided in appendices B and C.

The draft Terms of Reference document specifies the conditions that must be met for an assessment to qualify for a stock assessment update. Assessments that qualify for updates will be reviewed during a meeting of the SSC Groundfish Subcommittee, scheduled early in the assessment cycle. The Groundfish Subcommittee will determine if the putative update stock assessment followed the Terms of Reference for updates and if there is consistency with previous assessments. If either of these criteria is not met, or if the subcommittee determines that the stock assessment update is inadequate for Council decision making, then a full assessment will be requested and reviewed by the wrap-up STAR Panel. With the return to fewer stocks per STAR Panel, the SSC recommends that the number of STAR Panelists be based on the N+2 rule, the standard for choosing the number of STAR Panel reviewers prior to 2005 (where N= the number of stock assessments). The STAR Panel should include at least one reviewer from outside the Council process.

This current draft will be revised prior to the April Council meeting.

2. Recommended List of Stocks to be Assessed and Schedule

The SSC heard a presentation by Dr. Elizabeth Clark on the proposed list and schedule of stocks to be assessed in 2007, 2009, and 2011. The proposed list was developed following the Groundfish Stock Assessment Review Workshop, which recommended that no more than 8-10 full stock assessments should be conducted in each cycle, and that no more than 2 species should be reviewed by each STAR panel. In setting priorities, overfished species are always assigned a high priority. Higher priority was also given to stock assessments that are more than 5 years old, and stocks whose most recent assessment was conducted with modeling software other than SS2. Given these constraints, only two previously unassessed species can be accommodated in the proposed schedule, longnose skate and spiny dogfish (in 2007).

Dr. Clark also reported that the NWFSC would convene workshops to address the shelf-slope survey, data and modeling, and the juvenile rockfish survey. These workshops would be held in addition to B_0/B_{msy} and Recfin catch estimation procedure workshops.

Although the SSC recognizes that with the current constraints on the number and frequency of stock assessments, very few new species assessments will be possible in the foreseeable future. Nevertheless, since stock assessments drive the management process, it is important that new assessments be conducted on the most critical species. The SSC notes that the current way of prioritizing a list of species for assessments is very informal and is not based on well defined, objective criteria. The SSC recommends that a more formal process be developed for prioritizing species for assessment that would include an evaluation of economic and ecological importance, potential use as ecosystem or habitat indicator species and perceived exploitation status. The SSC is prepared to take the lead and work in conjunction with other Council advisory bodies to develop a set of guidelines for prioritizing species to be assessed in future assessment cycles.

PFMC
03/07/06

YELLOWEYE STOCK ASSESSMENT

In September 2005, the Council adopted a new assessment of yelloweye rockfish (*Sebastes* ruberrimus) for use in 2007-2008 management decision-making. However, in November, the Council decided to explore a re-assessment of yelloweye rockfish before the March 2006 Council meeting. Various technical issues compelled the Council to consider re-doing the yelloweye assessment. The Stock Assessment Review (STAR) Panel reviewing the original assessment was not afforded the time to consider new data sources or new approaches. The Council judged this shortcoming too important to defer until the next assessment cycle and requested the Washington Department of Fish and Wildlife (WDFW) to explore re-doing this assessment.

The WDFW agreed and presented a new yelloweye rockfish assessment to a STAR Panel on February 13-15. The new yelloweye rockfish assessment, STAR Panel report, and rebuilding analysis are presented at this meeting as Agenda Item(s) F.3.a., Supplemental Attachment(s) 1, 2, and 3, respectively. The Council should consider the new yelloweye rockfish assessment, rebuilding analysis, and STAR Panel report, as well as the advice of the Scientific and Statistical Committee, other advisory bodies, and the public before adopting the new stock assessment and rebuilding analysis for use in 2007-2008 groundfish management.

The motion that put a new stock assessment consideration forward stated an intent to cap an optimum yield resulting from any higher abundance conclusion to no more than 27 mt.

Council Action:

Adopt the new yelloweye stock assessment and rebuilding analysis for use in the 2007-2008 fishing season.

Reference Materials:

1. Agenda Item F.3.a, Supplemental Attachment 1: Status of Yelloweye Rockfish (*Sebastes ruberrimus*) Off the U.S. West Coast in 2006.
2. Agenda Item F.3.a, Supplemental Attachment 2: STAR Panel Report on the Status of Yelloweye Rockfish (*Sebastes ruberrimus*) Off the U.S. West Coast in 2006.
3. Agenda Item F.3.a, Supplemental Attachment 3: Rebuilding Analysis for Yelloweye Rockfish in 2006.

Agenda Order:

a. Agenda Item Overview — John DeVore
b. Scientific and Statistical Committee (SCC) Report — Kevin Hill
c. Reports and Comments of Advisory Bodies
d. Public Comment
e. **Council Action:** Approve Yelloweye Assessment and Rebuilding Analysis for use in the 2007-2008 Fishing Season

PFMC
02/14/06

Agenda Item F.3.a
Supplemental Attachment 1
March 2006

Status of yelloweye rockfish (*Sebastes ruberrimus*)

off the U.S. West Coast

in 2006

By

Farron R. Wallace[1], Tien-Shui Tsou [2], Thomas Jagielo[1], and Yuk Wing Cheng [2]

[1]Washington Department of Fish and Wildlife
48 Devonshire Road.
Montesano, Washington 98563

[2]Washington Department of Fish and Wildlife
600 Capitol Way North.
Olympia, Washington 98501-1091

February 2006

Executive Summary

Stock

This assessment reports the status of the yelloweye rockfish (*Sebastes ruberrimus*) resource off the west coast of the United States, from the Mexican border to Canadian border. This stock is treated as a single coastwide population as in the previous two assessments (Wallace *et al*. 2005, Methot *et al*. 2002) and as separate sub-populations in area models for Washington, Oregon and California.

Catches

NMFS and State personnel expended a significant amount of effort to provide the best possible historical accounting of landings prior to 1983. These estimates are considered to be a significant improvement over previous catch time series for California, Oregon and Washington. This resulted in decreasing the overall coastwide recreational catch estimates by 667 mt and increasing the commercial landings by 1,674 mt (compared to the 2005 assessment).

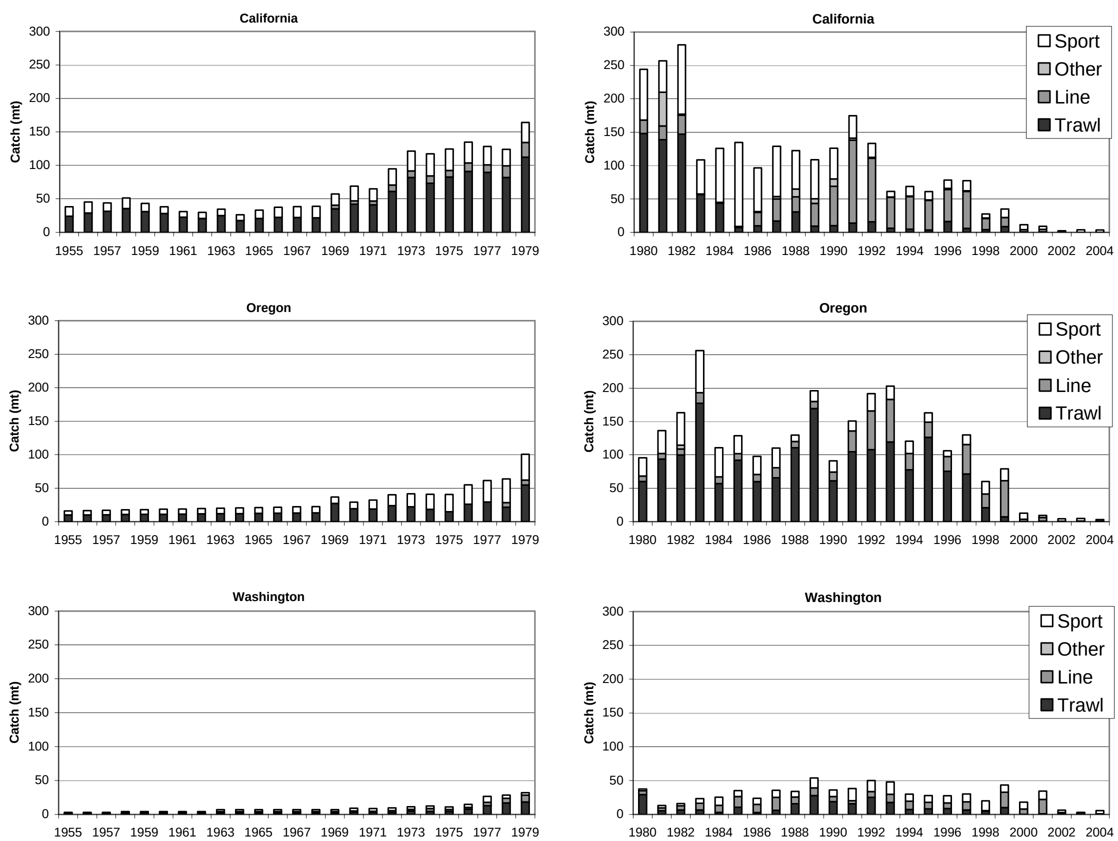


Figure a. Reconstructed historical landings (mt) by area and year.

Table a. Twenty-five year catch history by State, fishery and year (shaded values indicated where there are no data and catches are based on interpolation).

Coastal Washington, Oregon and California Yelloweye Rockfish Landings

Source	PacFIN and MRFSS				Tagart, PacFIN, and ODFW				Tagart, PacFIN and WDFW								
	California [1/]				Oregon [2/]				Washington [3/]				Totals				
Year	Trawl	Line	Other	Sport	Trawl	Line	Other	Sport	Trawl	Line	Other	Sport	Trawl	Line	Other	Sport	Total
1980	147.9	20.2		75.9	60.2	8.0		27.5	29.2	5.8	0	2.4	237.3	34.0	0.0	105.8	377.1
1981	138.7	20.4	50.7	46.9	93.7	8.5		34.2	5.3	4.4	0	3.4	237.7	33.4	50.7	84.5	406.3
1982	146.9	28.3	1.8	103.8	99.9	9.0	5.6	48.7	6.5	6.1	0	3.4	253.3	43.5	7.4	155.8	460.0
1983	56.5	0.3	0.8	51.0	177.3	15.9	0.0	62.9	6.5	10.1	0	6.7	240.3	26.3	0.8	120.6	388.0
1984	43.5	0.5	0.9	80.8	57.1	10.0	0.0	43.6	3.0	10.4	0	12.2	103.6	20.9	0.9	136.6	262.0
1985	7.3	0.9	0.6	125.8	91.9	10.0	0.0	26.8	10.5	15.9	0	8.8	109.7	26.8	0.6	161.4	298.4
1986	9.8	20.0	1.2	65.5	59.8	10.8	0.0	27.2	2.7	12.0	0	9.0	72.3	42.8	1.2	101.7	218.0
1987	16.9	33.1	3.7	75.2	65.7	15	0.0	29.4	6.0	19.1	0	10.5	88.6	67.2	3.7	115.1	274.6
1988	30.6	22.5	11.8	57.5	110.7	9.4	0.0	9.6	15.8	9.8	0	8.3	157.1	41.7	11.8	75.4	286.0
1989	9.4	34.0	6.7	58.7	169.4	10.6	0.0	16.0	27.9	11.3	0	14.6	206.7	55.9	6.7	89.3	358.6
1990	10.1	58.8	10.9	46.12	61.1	13.2	0.0	16.6	18.8	7.5	0	9.9	90.0	79.5	10.9	72.6	253.1
1991	13.9	124.0	3.2	33.57	104.6	31.3	0.0	14.9	15.8	4.6	0	18.0	134.3	159.9	3.2	66.5	363.8
1992	15.8	95.1	1.3	21.02	107.8	58	0.0	25.9	25.1	8.7	0	16.2	148.7	161.8	1.3	63.2	374.9
1993	6.2	46.1	0.6	8.5	119.3	63.9	0.0	19.7	17.6	12.2	0	18.0	143.1	122.2	0.6	46.2	312.1
1994	4.7	48.7	1.0	14	77.6	24.6	0.0	18.3	7.2	12.4	0	10.3	89.5	85.7	1.0	43.0	219.2
1995	3.6	44.2	0.7	12.6	126.3	22.8	0.0	13.8	8.1	9.9	0	9.9	138.0	76.9	0.7	36.3	251.9
1996	16.2	48.0	1.6	12.5	75.5	22.2	0.0	8.4	8.6	8.3	0	10.8	100.3	78.5	1.6	31.7	212.1
1997	6.0	55.3	0.9	15.1	71.4	44.1	0.0	14.4	6.5	12.2	0	11.4	83.9	111.6	0.9	40.9	237.3
1998	4.0	16.7	0.9	5.8	20.8	20.6	0.0	18.9	4.8	0.7	0	14.4	29.6	38.0	0.9	39.1	107.6
1999	8.7	13.4	0.1	12.6	7.1	54.2	0.0	17.8	9.9	23.0	0	10.6	25.7	90.6	0.1	41.0	157.4
2000	0.7	3.3	0.0	7.5	0.3	3.3	0.0	9.2	0.2	7.7	0	10.1	1.2	14.3	0.0	26.8	42.4
2001	0.6	3.9	0.0	4.6	0.7	5.5	0.0	3.1	0.8	21.2	0	12.5	2.1	30.6	0.0	20.3	53.0
2002	0.2	0.0	0.0	2.1	0.4	0.3	0.0	3.6	0.4	2.2	0	3.7	1.0	2.5	0.0	9.4	12.9
2003	0.0	0.0	0.0	3.7	0.8	0.2	0.0	3.8	0.2	0.3	0	2.6	1.0	0.5	0.0	10.1	11.6
2004	0.0	0.0	0.0	3.5	0.2	0.5	0.0	2.4	0.1	0.8	0	4.5	0.3	1.3	0.0	10.4	12.0
2005	1.6	0.0	0.0	3.7	0.2	4.1	0.2	4.3	0.1	4.2	0.1	5.1	1.9	8.3	0.3	13.1	23.6
	Mean Annual Catch				Mean Annual Catch				Mean Annual Catch				Mean Annual Catch				
1980's	60.7	18.0	8.7	74.1	98.6	10.7	0.7	32.6	11.3	10.5	0.0	7.9	170.7	39.2	8.4	114.6	263.7
1990's	8.9	55.0	2.1	18.2	77.2	35.5	0.0	16.9	12.2	9.9	0.0	13.0	98.3	100.4	2.1	48.1	109.8
2000-2004	0.5	1.2	0.0	4.2	0.4	2.3	0.0	4.4	0.3	6.1	0.0	6.4	1.3	9.6	0.1	15.0	26.4

By 2004, all three States instituted regulations for no retention of yelloweye in the recreational fishery. Discard is estimated from a variety of sources and is included in the catch table above. Discard in 2002 and 2003, is considered to be a minimal portion of the catch and prior to 2002 discard is assumed to be 0.

Data and assessment

The first and second full assessments for yelloweye rockfish were conducted in 2001 (Wallace 2001) and 2002 (Methot *et al*. 2002), respectively. Both assessments were length-based models and used an earlier version of the Stock Synthesis program (Methot 1989). Wallace (2001) conducted separate area assessments for the Northern California and Oregon areas. Methot *et al*. (2002) incorporated Washington catch, recreational abundance indices, and age data, and treated the stock as one single assemblage of the W-O-C coast. The 2005 assessment (Wallace *et al*. 2005) provided an update of the 2002 assessment incorporating a revised catch time series and employed the Stock Synthesis 2 (**SS2**) modeling framework to estimate model parameters and management quantities. Abundance indices were not revisited and little new composition data were available. All of the assessments concluded that ending spawning biomass was less than 25% of unfished.

This current (2006) assessment reevaluated all of the available coast-wide catch and effort information, and reformulates all of the indices of abundance. The IPHC survey index of abundance, a revised historical catch time series from 1955-1980 and new age, length and size composition data were also incorporated. The SS2 modeling framework is again used to estimate model parameters for a coastwide model and for separate area models for W-O-C. Additionally, natural mortality was estimated within the coastwide model to be 0.036 and assumed to be 0.036 in all area specific models. This compares to estimates of 0.2 and ~0.035 (in development) used in the SE Alaska, U.S. and British Columbia, Canadian yelloweye assessments, respectively. Natural mortality was assumed to be 0.045 in the previous two assessments.

Stock Biomass and Recruitment for each area model

In agreement with previous assessment(s) yelloweye rockfish biomass is considered to be at historic low levels with spawning biomass less than 25% of unfished in all models.

Table b. Recent trend in spawning biomass and depletion level for each area model.

Year	Exploitable Biomass	Spawning Biomass	SPB ~95% CI	Estimated Depletion	Depletion ~95% CI
		Coastwide			
1995	1934	669	593-744	0.201	
1996	1772	614	536-693	0.185	
1997	1639	574	492-656	0.173	
1998	1475	522	437-608	0.157	
1999	1432	517	427-607	0.156	
2000	1337	488	393-583	0.147	
2001	1350	502	402-601	0.151	
2002	1353	509	405-613	0.153	
2003	1391	531	423-640	0.160	
2004	1430	553	440-665	0.166	
2005	1466	573	457-690	0.173	0.139-0.206
2006	1491	588	467-708	0.177	0.142-0.211
		California			
1995	523	189	136-213	0.110	
1996	483	175	114-192	0.102	
1997	424	153	91-170	0.089	
1998	365	131	86-168	0.076	
1999	354	127	78-162	0.074	
2000	334	120	79-165	0.070	
2001	337	122	80-169	0.071	
2002	343	125	85-175	0.073	
2003	354	130	88-182	0.076	
2004	365	135	92-188	0.079	
2005	375	140	96-194	0.082	0.055-0.108
2006	383	145	192-388	0.085	0.057-0.112
		Oregon			
1995	888	286	243-329	0.227	
1996	781	254	210-297	0.202	
1997	723	241	195-287	0.192	
1998	635	217	169-265	0.172	
1999	610	215	164-266	0.171	
2000	563	203	149-257	0.162	
2001	578	215	158-272	0.171	
2002	596	228	168-288	0.181	
2003	617	241	178-304	0.192	
2004	637	253	187-319	0.201	
2005	657	265	197-334	0.211	0.16-0.261
2006	671	274	203-344	0.218	0.165-0.27
		Washington			
1995	374	152	132-173	0.336	
1996	355	144	123-164	0.317	
1997	338	135	115-155	0.298	
1998	316	126	106-146	0.278	
1999	304	121	101-141	0.267	
2000	270	106	85-126	0.233	
2001	262	101	81-122	0.224	
2002	239	90	69-110	0.198	
2003	242	90	70-111	0.199	
2004	249	92	72-113	0.204	
2005	254	94	73-115	0.208	0.172-0.244
2006	255	95	74-116	0.209	0.173-0.246

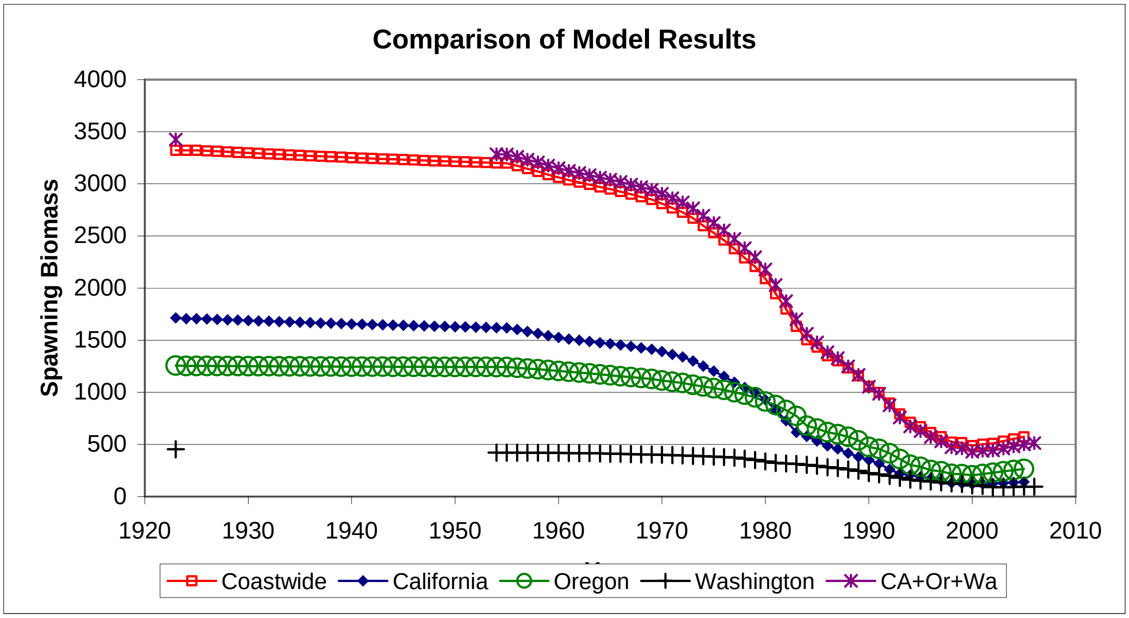


Figure b. Estimated spawning biomass time series from area-specific models, coastwide model and the sum of area-specific models.

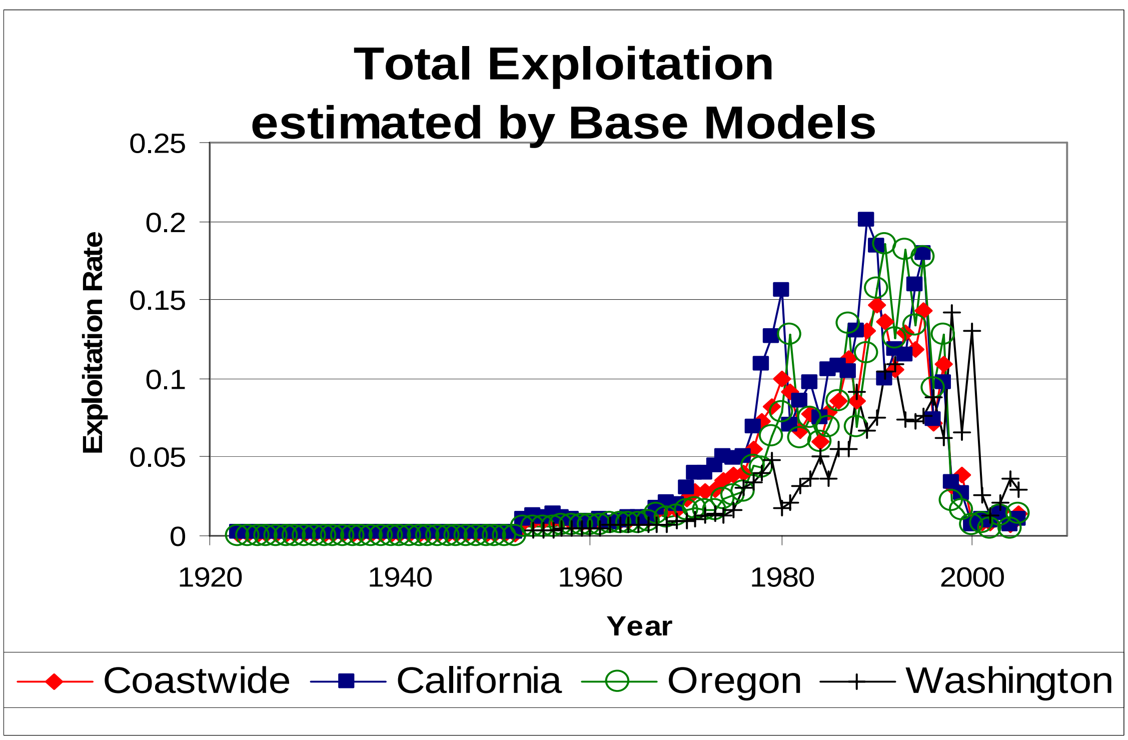


Figure c. Estimated exploitation rate time series from area-specific models and the coastwide model.

Reference points

Reference Point	Coastwide	California	Oregon	Washington
	Area (model) for consideration			
Unfished Spawning Stock Biomass (SSB_0)	3,322	1,715	1,258	453
Unfished Exploitable Biomass (B_0)	7,448	3,877	2,789	1,017
Unfished Recruitment (R_0)	4.85	4.19	3.85	3.00
SSB_{2006}	588	145	274	95
Depletion Level (2006)	17.7%	8.5%	21.8%	21.0%
Depletion -95CI	14.2%	5.7%	16.5%	17.3%
Depletion +95CI	21.1%	11.2%	27.0%	24.6%
Target Spawning Biomass ($B_{0.40}$)	1,329	684	502	181
$F_{MSY\ Proxy\ (SPR=0.50)}$	0.024	0.021	0.021	0.027
Exploitable Biomass	1491	383	671	255
ABC_{2006}	36.2	8.1	14.2	7.0
OY_{2006}	27.0			

Unresolved problems and major uncertainties

As in the previous assessments, the sparseness of the size and age composition data and the lack of a relevant fishery-independent survey has limited the model's ability to properly assess the status of the resource. This is especially apparent in the Washington model where the wholesale lack of data resulted in our inability to obtain a converged model without placing significant restraints and assumptions within the model relative to the area-specific models for California and Oregon. Further, due to catch restrictions since 2002, catch-per-unit-effort (**CPUE**) data no longer reflect the real changes in population abundance, and discard estimates are highly uncertain.

Management Performance

Previous assessments indicated over-exploitation during the last two decades, and regulations have most likely been ineffective in constraining yelloweye catch until the most recent years. Specifically, there have been few regulations developed to effectively control catch or bycatch of yelloweye rockfish until 2002 (Washington prohibited retention in 2002, California and Oregon in 2004). Recent management decisions have significantly restricted yelloweye rockfish catch, which are reflected in the recent low level of yelloweye landings. Nevertheless, discard estimates related to recent management measures are highly uncertain and should be considered unknown. This uncertainty had little impact on the current status because historical discard was likely minimal until enactment of recent regulations.

Research and Data Needs

Additional effort to collect age and maturity data is essential for improved population assessment. Collection of these data can only be accomplished through research studies and/or by onboard observers because this species is now prohibited. In 2006, IPHC and WDFW scientists are conducting a study to increase our knowledge of current stock biomass off Washington coast. Loss of the study due to declining OY will have significant detrimental effects on our ability to adequately assess this stock in the future. We strongly urge Management to make this study the highest priority. Increased effort toward habitat mapping and in-situ observation of behavior will provide information on the essential habitat and distribution for this species.

Alternative survey such as the in-situ 2002 US Vancouver submersible survey in untrawlable habitat is required for future assessment of yelloweye rebuilding status. This study has demonstrated that submersible visual transect surveys can provide a unique alternative method for estimating demersal fish biomass in habitats not accessible to conventional survey tools. For example, because of the low frequency of yelloweye rockfish encountered in the NMFS shelf trawl survey tows, those data were not considered a reliable indicator of abundance and were not used in the 2002 yelloweye stock assessment for PFMC (Methot *et al.* 2002). Results from this study support this conclusion and illustrate the need for large-scale surveys to assess bottomfish densities in habitats that are not accessible to trawl survey gear. Further, stratified random sampling designs should be employed with sample sizes sufficient to ensure acceptable levels of statistical power (Jagielo *et al.* 2003). At present, the in-situ visual transect submersible survey method appears to be a useful tool for this purpose, and the utility of this method will likely improve further with technological advances such as the 3-Beam Quantitative Mensuration System (**QMS**).

At present, the fitted values, exploitation rates, forecast values are heavily dependent on the input of the natural mortality. We believe the change of annual natural mortality of yelloweye is small. Its value is similar to the growth rate estimated from von Bertalanffy growth curve. Its value varies from Alaska to California coastal line. In addition, the growth constant of von Bertalanffy growth curve also varies from Alaska to California coastal line too. The estimated growth constant of Canada yelloweye rockfish should be smaller than the estimated growth constant of California yelloweye rockfish. This implies the natural mortality coefficient of Canada yelloweye rockfish, 0.02~0.035, is smaller than the natural mortality of California yelloweye rockfish, 0.035~0.045. We can estimate the natural mortality of yelloweye rockfish from length frequency data collected from protected area with a known reliable growth curve of yelloweye rockfish. A reliable growth curve should have data from ranged age 0 to age of maturity. But we have limited knowledge and data on yelloweye rockfish with ages 0~5. It is unlikely that we can get it in the near future because the catch rate of age 0-5 yelloweye rockfish is too low. Fitting the growth curve with the unknown variable, age at zero length, induced bias on the estimation of the growth constant. It is unlikely to accept –3.5 cm to –45 cm as the age at zero length. Fitting the growth curve with age zero at length zero can produce bias to the growth constant too. In this report, we demonstrated that the growth constant varied from 0.046 to 0.083 when we fitted the data with the unknown variable, age at zero length or not. This difference was about 80%. To solve this problem, there is urgent need of juvenile yelloweye fish age and fork length data. In addition, we need to collect yelloweye rockfish length frequency data from both protected and unprotected fishing area in W-O-C states.

In order to verify the reliability of length-based structure stock assessment model, alternative model will need to be developed for comparison. Most of the rockfish lives near rocky area. Depletion experiments and models can be considered as an alternative stock assessment model. Data collected from fixed fishing sites along W-O-C states should be considered in the near future. This can provide unbiased CPUE and length frequency data. These data can be used to develop effective and efficient annual abundance indexes for long term monitoring compared the present creel and access point recreational surveys.

Rebuilding Projections

Rebuilding projections are based on results from the SSC default rebuilding analysis simulation software. Specific detail can be obtained from PFMC “Updated Rebuilding Analysis for Yelloweye Rockfish Based on the 2006 Stock Assessment” document.

	Coastwide		California		Oregon		Washington	
FMSY proxy		0.024		0.021		0.021		0.027
FMSY SPR / SPR(F=0)		0.5		0.5		0.5		0.5
Virgin SPR		52.195		52.189		53.349		44.960
Generation time		50		47		49		46
T_{MIN}		2046		2073		2035		2026
T_{MAX}		2096		2120		2084		2072
Virgin Spawning Output		6643		3421		2510		906
Target Spawning Output		2657		1368		1004		362
Current Spawning Output		1146		281		530		188
Spawning Output (ydecl = 2002)		1019		249		456		180
Natural mortality		0.036		0.036		0.036		0.040
Steepness		0.45		0.45		0.45		0.45
SigmaR		0.50		0.50		0.50		0.50
Depletion level in 2005		17.3%		8.2%		21.1%		20.8%
	OY	Depletion	OY	Depletion	OY	Depletion	OY	Depletion
2007	12.6	18.0%	2.7	8.6%	6.4	22.5%	2.6	20.9%
2008	12.9	18.5%	2.8	8.9%	6.6	23.1%	2.7	21.8%
2009	13.2	18.9%	2.9	9.2%	6.7	23.7%	2.8	22.8%
2010	13.5	19.4%	2.9	9.5%	6.8	24.2%	2.9	23.7%
2011	13.8	19.8%	3.0	9.8%	6.9	24.7%	3.0	24.5%
2012	14.1	20.2%	3.1	10.1%	7.0	25.2%	3.0	25.4%
2013	14.3	20.5%	3.1	10.3%	7.1	25.6%	3.1	26.1%
2014	14.5	20.8%	3.2	10.6%	7.1	25.9%	3.2	26.8%
2015	14.7	21.1%	3.3	10.8%	7.2	26.2%	3.2	27.3%
2016	15.0	21.4%	3.3	11.0%	7.3	26.5%	3.3	27.9%

Note: OY projection is base on P_{MAX} = 0.8.

1.0 Introduction

1.1 Life History

Yelloweye rockfish (*Sebastes ruberrimus*) can be characterized as relatively low in abundance, extremely long-lived (aged up to 120 years), late maturing, and slow growing. They primarily inhabit high-relief rocky areas from northern Baja to the Aleutian Islands in depths 15 to 550 meters (Rosenthal *et al.* 1982, Eschemeyer *et al.* 1983, Love *et al.* 2000). Yelloweye are carnivorous feeding primarily on other rockfishes, herring, sand lance, crab and shrimp (Washington *et al.* 1978, Rosenthal *et al.* 1988, Reilly *et al.* 1994, Love 1996).

Growth

Over 1,000 age structures from Oregon and an additional 464 age structures from Washington were recently aged and incorporated into this analysis. The von Bertalanffy growth function (Linf(1-e-k(age-to)) was used to estimate the length of a fish of a known age. Estimated parameter values are compared among estimates derived from age data collected from Washington, Oregon, California and other locales (Table 8). Differences in growth among Washington, Oregon and California fish were not apparent (Figure 4). A single growth function for combined sexes was used for W-O-C areas (Table 8).

Growth parameters are re-estimated within the model to adjust for the effects of size-selectivity and ageing error on the expected value of size-at observed age. Comparison of model results indicates that model estimates are very similar to the previous SS2 model estimates (Table 26).

The growth of yelloweye rockfish was modeled by the von Bertalanffy growth curve (von Bertalanffy, 1938), which has the form:

Model I: $$L_t = L_\infty(1 - e^{-K(t-t_0)}) + \varepsilon \;,$$

where L_t (cm) is the length of captured yelloweye rock at age t (years), L_∞ is the limited growth size (cm), K (per year) is the growth parameter and t_0 is the age with zero length. In Model I, there are three unknown parameters,

We have assumed $\varepsilon \sim N(0, \sigma^2)$. Most of the captured yelloweye rockfish are with age greater than or equal to 5 years, it would possibly induce bias in the estimation of t_0, and subsequently affects the estimation of L_∞ and K because they are highly correlated. We proposed to fit the growth curve with length zero at age zero. The proposed model is

Model II: $$L_t = L_\infty(1 - e^{-Kt}) + \varepsilon \;,$$

where there are two unknown parameters, L_∞ and K to be determined.

We compared both Models I and II with fitting data with age greater than or equal to 5, 10,…, 30 years, and investigate the bias of estimating t_0, K and L_∞ in fitting Models I and II.

From Table 34, $\hat{t}_0$ decrease from –11.16 to 45.10 years with the age of data in fitting Model I. It is unlikely that the initial length of yelloweye rockfish at age zero is 25.5 cm. even with the full data set available. We believe that the yelloweye rockfish at age zero is around 1 to 2 cm. So the estimated $\hat{L}_\infty$ and $\hat{K}$ by fitting the data with Model II are reasonable and should be close to the actual mean values. The estimated $\hat{K}$ of Model II, 0.083 is nearly two times the estimated $\hat{K}$ of Model II, 0.046. This means the yelloweye grows double times faster than we expected. This will affect the time to recover the depleted stock at the moment. In Figure 26, plots of fits by Models I and II with different set of data shows that the more captured yelloweye with age near zero, the less the bias we have in the estimation of the expected von Bertalanffy growth curve.

The estimation of L_∞ and K may vary with other factors, location annual and gender effect. Model III was proposed as

Model III: $$L_t = (L_\infty + r_L z_s + s_L z_a + \sum_j y_{L,j} z_j)(1 - e^{-(K + r_K z_s + s_K z_a + \sum_j y_{K,j} z_j)t}) + \varepsilon,$$

Where j = 1999, 2001, 2002, 2003, 2004 (2005 = control), z_s is a dummy variable (1=female, 0= control), z_a is a dummy variable (1=Columbia, 0=control), z_i are dummy variables(1= year j, 0=elsewhere). r_L, s_L, $y_{L,j}$ s, r_k, s_K, $y_{K,j}$ s are additional unknown parameters to be determined. We used both Akaike information criteria (AIC) (Akaike, 1974) and Bayesian information criteria (BIC) (Schwarz, 1978) to select the optimal sub-model within Model III, the final sub-model is compared with Model II fit by likelihood ratio test.

In Table 35, there is a summary of the number of yelloweye used in modeling the growth of yelloweye rock fish. The smallest group of yelloweye rock fish was captured near Vancouver Island, US in year 2003. The smaller the no. of fish in the group, the higher the chance to induce bias in the estimation. In Table 36, there is a summary of all estimated parameters in the final optimal sub-model from Model III. The estimated residual standard error is 4.013 with 724 degrees of freedom. We used likelihood ratio test (P=0.043) to select the optimal sub-model. The optimal sub-model was Model III. Compared Model II and III, the optimal sub-model was Model III (P=0.00). Female yelloweye rockfish has a small $\hat{L}_\infty = (64.44 - 7.444)$ cm but grows faster ($\hat{r}_K$ =0.022, P <0.05) compared with male yelloweye rockfish. Columbia yelloweye grows slower ($\hat{s}_K$ =-0.0009, P<0.05) compared with Vancouver Island, US yelloweye. The annual effect of year 2003 did significantly ($\hat{y}_{K,2003}$ =-0.086, P <0.05) affect the growth rate of yelloweye compared with the growth rate of year 2005 yelloweye.

1.2 Stock Structure

This assessment treats the yelloweye stock as a single coastwide assemblage and evaluates separate W-O-C models. The affinity for hard bottom of this fish suggests that they may form stable local populations that, when recognized, could be treated as independent stocks. Evaluation of stock boundaries is reliant upon life history traits associated with a population or sub-population. Data for delineation of stock boundaries for W-O-C yelloweye are limited. Thus, the comparison of biological parameters between sub-areas is likely unreliable. Currently, there are three independent studies that give some insight into whether or not local aggregations of fishes can be identified as separate stock units.

Gao and Wallace (2003, unpublished) examined yelloweye rockfish stock structure by evaluating ratios of C^{13}/C^{12} and O^{18}/O^{16} in aragonite powder samples of 200 yelloweye rockfish otoliths from the Washington (**WA**) and Oregon (**OR**) coast. For each otolith, three samples were taken; one from the nucleus (the starting time of otolith growth) and the other two from the first and fifth annual zone (assumed to be year 1 and 5 in life history). The isotopic signature of the nuclei is used to provide information on the natal development and spawning stock separation of the fish, whereas signatures of age-1 and age-5 indicate the behavior of the fish over the sampling period. Isotopic differences were not identified in otolith nuclei samples, suggesting there might be a single spawning stock for yelloweye rockfish along the Washington and Oregon coast. Distinct isotopic differences between samples from otolith nuclei and the fifth annual zones from both sample areas indicate yelloweye rockfish may move to other habitat as they grow from age-1 to age-5. Further, comparison within the fifth annual otolith zones between Washington and Oregon samples show clear differences in $\delta^{13}C$, but not in $\delta^{18}O$ variations, suggesting that the food sources or composition of the two areas are slightly different. In conclusion, the isotopic signatures from otolith nuclei showed there might be a single spawning stock for yelloweye rockfish along the WA and OR coast. From age-1 to age-5, the fish may change their habitat or associated bottom substrates for food.

Yamanaka *et al*. (2001) conducted a genetic analysis of yelloweye rockfish collected from northern Vancouver, B.C. and SE Alaskan waters. Though the authors found little variability among samples and suggested a well-mixed panmictic stock in their study area, specific habitat requirements for yelloweye rockfish support the hypothesis for site fidelity, and little mixing may occur after settlement. It is likely that discrete sub-populations corresponding to high-relief rocky areas form a much larger genetically diverse meta-population. Preliminary results from a DNA analysis of yelloweye collected off Oregon, Washington, Vancouver Island B.C., and the Strait of Georgia B.C. (Personnel communications, Lynne Yamanaka DFO) suggest a distinct genetic separation of Strait of Georgia samples from West Coast samples, indicating the possibility of separate area stocks.

1.3 Fishery

Yelloweye rockfish are highly prized by sport fishers due to their size, beauty, and quality. Commercial fishers value their high market demand and ex-vessel price. Yelloweye rockfish inhabit areas typically inaccessible to trawl gear and catch in the coastal trawl fishery primarily results from incidental harvest associated with other target fisheries operating at the fringes of this habitat. Yelloweye are also caught incidentally in both commercial hook-and-line and sport fisheries targeting other species found in association with the yelloweye habitat preferences. This species has been subjected to a periodic target fishery for both commercial hook-and-line and sport fisheries at least since the 1970’s.

Specific catches of yelloweye are not well documented, but rockfish landings are reported back to 1916 (Table 3) in California (Heimann and Carlisle 1970). The earliest account of detailed yelloweye catch is in the April 1937- March 1938 from the wholesale rockfish markets in Monterey (Phillips 1939). Yelloweye accounted for 0.6 % (4.1 mt) of the total rockfish landed accounting for 4.1 mt of a 669 mt fishery (Table 4). Nitsos and Reed (1965) also reported yelloweye catch in the 1961-1962 animal- food fisheries in California. Rockfish have been a mainstay of the fresh fish markets in California since the early 1900’s and the catch increased significantly to 8 million pounds in 1918. The catch was as high as 13.5 million pounds during the 1943-1947 time period as demand rose during WW I and WW II. There was a significant shift in the California rockfish fishery in 1943. The fishery was first conducted primarily in

Southern California and Central California, with Hook-and-line, trawl lines or long lines with baited hooks. In 1943, the balloon drag net proved successful and the frozen filet industry began in Northern California (Bureau of Marine Fisheries 1949). Immediately following WW II there was a significant increase in the party boat business along with increases recreational catches of rockfish in Central and Northern California (Young 1969). In the 1960 Commercial Passenger Fishing Vessel (**CPFV**) fishery from Crescent City to Aliva, yelloweye rockfish are reported to comprise 0.5% of total rockfish catch with body weight averaging 2.41 kg in weight (Miller and Gotshall 1965).

Significant increases in rockfish landings in Oregon during WW II are also reported in the literature. Landings of rockfish increased from 1.3 million pounds in 1941 to a peak of over 17 million pounds by 1947 in 1945 (Cleaver 1949). The report further states "The principle fish caught by the long-line fishery is the "Red Snapper" *S. ruberrimus*. The report does not state what portion of the rockfish catch was by the long-line fishery. Statistical reports of rockfish landings in Washington indicate that the annual rockfish catch was around 1 million pounds between 1949 and 1951 (Table 5). For Washington, no summary documents were found prior to 1953 (Table 6). Thus, further investigation is needed to verify rockfish catches from the earlier time period.

1.4 Management history

Management of rockfish has had a long history beginning in 1983 when the Pacific Fisheries Management Council (PFMC) first imposed trip limits on landings from the *Sebastes* complex-- a group of about 50 species (Figure 1). Rockfish are now managed independently or part of three species-specific minor rockfish groupings: Nearshore, Shelf and Slope. Yelloweye were managed as part of the *Sebastes* complex until 2000, when the Council abandoned the *Sebastes* complex in favor of a finer scale portioning of rockfish stocks. Yelloweye rockfish are currently managed as part of the Minor Shelf Rockfish group with a separate Optimal Yield (OY). In November 2001, the Council adopted a total catch optimum yield (OY) of 13.5 metric tons (mt) coastwide for yelloweye for all 2002 commercial, recreational, and tribal fisheries combined for California, Oregon, and Washington. This was an interim level that allowed for fisheries to take place and potentially catch yelloweye along with other fish, but did not allow fisheries that target yelloweye. Based on the 2002 assessment and rebuilding plan results (Methot *et.al.* 2002, Methot and Piner 2002), the Council adopted an OY of 26 metric tons and rebuilding measures with consistent harvest levels for the 2003 fisheries.

1.4.1 Commercial Fishery

Prior to 2001 trip limit, regulations on the *Sebastes* complex probably had little or no impact in restricting harvest of yelloweye in the trawl fishery and yelloweye were likely never targeted. Open access and limited entry line gear trip limits for rockfish, which remained at or above 10,000 lbs in all years prior to 1999, did not constrain yelloweye catch because yelloweye landings rarely exceeded 10,000 lbs. Trip and bag limits were significantly reduced following completion of the 2002 yelloweye stock assessment (Figure 1). Commercial retention of yelloweye rockfish was prohibited except for a 300-pound trip limit in the trawl fishery so that yelloweye that are caught dead may be retained.

In addition to restrictive trip limits for yelloweye, managers instituted Rockfish Conservation Areas (**RCAs**) in 2002. These areas are large coastal closure areas intended to protect overfished rockfish species. The boundaries of the RCA's and landings limits outside them have varied by year, gear type, and season. The seaward boundary of the trawl RCA has ranged from 150-250 fm, while the shoreward boundary has ranged from 100 fm to the shore. Trawl gear that is used shoreward of the RCA is required to have small footropes (<8" diameter), which increases the risk of gear loss in rocky areas and diminishes incentive to fish close to these areas. Reductions in landings limits for shelf rockfish species have also reduced incentives to fish in rocky areas shoreward of the RCA.

1.4.2 Sport Fishery

Sport CPUE indices used in this assessment indicate that catch rates for yelloweye rockfish are low. Sport rockfish limits for W-O-C have remained at or above ten-fish until 1999 and it is likely that a ten-fish bag limit had little effect on restricting yelloweye harvest. In response to concerns for declining rockfish stocks, management of sport fisheries started becoming much more restrictive beginning in 2000. WDFW first adopted a two-fish bag limit for yelloweye in 2000, and an either/or two fish limit for yelloweye or canary rockfish in 2001 (Figure 1). In 2002, ODFW began a daily bag limit of one yelloweye rockfish, while California imposed a limit of no more than two yelloweye allowed per day per vessel. In addition to reductions in yelloweye retention, California also closed areas and limited recreational fishing seasons. WDFW first prohibited retention of yelloweye rockfish in coastal recreational fisheries in 2002. Both Oregon and California followed suit prohibiting retention beginning in 2004.

1.5 Management performance

Previous assessments indicated over-exploitation during the last two decades, and regulations have most likely been ineffective in constraining yelloweye catch until most recent years. Specifically, there have been no regulations developed to significantly control catch or bycatch of yelloweye rockfish until 2002. Recent management decisions have significantly restricted yelloweye rockfish catch, which are reflected in the recent low level of yelloweye landings. There are a variety of sources (Westcoast Observer Program, WDFW and Oregon recreational observers and WDFW salmon trool obsevrvoers) to estimate discard related to recent management measures, but are highly uncertain. This uncertainty had little impact on the current status because historical discard was likely minimal until enactment of recent regulations.

2.0 Assessment

2.1 Fishery Dependent Data

2.1.1 Catch and discard

Catch data are treated as known without error and, due to the high market value for yelloweye rockfish, discarding was assumed to have not occurred prior to enactment of strict harvest policies beginning in 2002. Discard estimates in the sport fishery are provided by Marine Recreational Fishery Statistical Survey (**MRFSS**), Oregon Department of Fish and Wildlife (**ODFW**), and Washington Department of Fish and Wildlife (**WDFW**) and are included in the catch estimates since 2002. Commercial catches of yelloweye rockfish are small due to trawl closure areas (Rockfish Conservation Areas) on the shelf since 2001. Discard in commercial fisheries is likely infrequent and there are only a few observations of discard in the commercial fisheries and the overall magnitude cannot be estimated. Discard is likely infrequent and catches are small because of trawl closure areas (Rockfish Conservation Areas) on the shelf since 2001.

Data were compiled and analyzed for three independent areas: California, Oregon and Washington (Table 1). California Department of Fish and Game (**CDFG**) and/or the MRFSS intermittently collected length, weight, effort and catch data on recreational fisheries in northern California ports of landing beginning in 1978. CDFG also collected catch and effort data onboard Commercial Passenger Fishing Vessels (**CPFV**) since 1987. These data provide the most complete and longest time series of information on yelloweye rockfish. Data collection by MRFSS and ODFW in Oregon spans back to the early 1980s, but sampling levels were low and sporadic until most recent years. Washington data (MRFSS and WDFW) is essentially limited to most recent years. Yelloweye commercial catch data prior to 1980 do not exist with the exception of Oregon and Washington trawl catch during the 1970s as estimated by Tagart and Kimura (1982). In 2005, nearly all data sources including MRFSS, PacFIN, ODFW and WDFW provided updated catch estimates based on revised expansion algorithms intended to more accurately define rockfish catch since 1980. The Catches reported on the Council's Groundfish Management Team "Scorecard" from Nov. 2005 was used for the 2005 total catch estimates,

This year, considerable effort by both Federal and State personnel was expended on searching records for catch and species composition information to provide more accurate estimates of catch prior to 1980. This resulted in complete revision of the catch time series for each State for the early time period. For some years and fisheries, there were significant differences in catch estimates compared to those provided during the last stock assessment. In general, catch estimates for recreational fisheries were revised downward and catch estimates for commercial fisheries increased. The total catch for the entire time series increased 1,000 mt (Table 2).

California

A revised California historical commercial catch time series is based on the average California Commercial database (**CALCOM**) proportion of yelloweye rockfish observed in commercial landings of rockfish between 1978 and 1982 after removing widow rockfish. These observations suggest that yelloweye constitute 1.0% of both the hook-and-line and trawl landings of rockfish. This fraction is applied to commercial rockfish landings to estimate yelloweye rockfish catch back to 1969. This fraction was then declined to 0.05% to model decline in technology and rock-tending gear in the earlier years of the trawl fishery.

Trawl landings of yelloweye rockfish declined from well over 100 mt in the late 1970's and early 1980s to 50-75 mt in the 1990s and in recent years to less than 1 mt. The commercial line fishery catch reached a historic high of almost 121 mt in 1991 and declined to less than 20 mt's by the late 1990's. Trawl and hook-and-line catches are grouped with the trawl fishery catch time series prior to 1969. Sport catches of yelloweye rockfish averaged 75 mt during the 1980s and sharply declined to less than 20 mt in the 1990s averaging only 5 mt in 2000 – 2004 (Table 1 and Figure 2).

Rockfish catches have been reported in the California CPFV fishery (Kevin Hill, NMFS personal communication) since the mid 1930's. Miller and Gottshall (1965) reported in 1960 that yelloweye represented 0.5% of the Northern California rockfish catch with an averaged body weight of 2.41 kg in weight. Based on this information, yelloweye catch prior to 1980 is assumed to be equal to 0.5% of all CPFV rockfish catches reported in Northern California waters and 0.025% of Southern California CPFV rockfish catches. The 1980-2004 recreational catches of yelloweye are based on RecFIN catch estimates.

Oregon

Trawl landings of yelloweye rockfish increased in the late 1970's and averaged 80-100 mt in the 1980's. Landings decreased significantly in the mid to late 1990's and fell to less than 1 mt since 2000. A commercial line fishery was developed in the early 1990's and has averaged 37 mt annually until management restrictions in 2000 reduced catches to less than 5 mt. Sport catches of yelloweye rockfish averaged 30 mt during the 1980s, declined to 20 mt in the 1990's and have averaged less than 5 mt between 2000 – 2004 (Table 1 and Figure 2).

Trawl catches are projected using species composition estimates of mixed rockfish categories collected by State port sampling personnel as early as 1963 (in at least some ports). Catch estimates for the most current time period (1984-2004) were obtained from the PacFIN database and for the 1978-1983 time period from Tagart and Kimura (1982). For years between 1969 and 1976, yelloweye are assumed to represent 1.0 % of the total rockfish catch reported in various Fisheries and Statistics of Oregon publications. This fraction was then declined to 0.05% by 1955 to model a presumed decreased in yelloweye catches resulting from absence of technological and rock-tending gear in the earlier years of the trawl fishery.

Commercial gear type was not reported prior to 1980 and few species composition estimates were taken before 1990. The most current hook-and-line catches were obtained from the PacFIN database and 1982-1990 catches are based on species composition estimates (Table 7) taken from various Washington line fisheries.

Washington
Washington trawl landings of yelloweye rockfish have been variable and less than 20 mt annually and have declined to less than 1 mt by 2000. A small target commercial line fishery developed in the late 1990's and catch peaked at 23 mt in 1999. Insignificant catches are reported since strict regulations went into effect in 2001. Sport yelloweye rockfish landings averaged 8 mt in the 1980's, 13 mt during the 1990's and have declined to less than 7 mt in 2000.

Caches from the trawl fishery between 1983 and 2004 are obtained from PacFIN; 1976-1982 from Tagart and Kimura (1982) then assumed to decline to 1 mt by 1955. Commercial line catch estimates from 1970-1999 are estimated from species composition data taken between 1986-1999 and applied to "other rockfish" catch across all years, catch is then assumed to decline to 1 mt by 1955. Recreational catches from various WDF reports back to 1975, catch then assumed to decline to 1 mt.

2.1.2 Life History

Weight-at-length
An allometric length-weight function (weight=0.000021*length$^{2.9659}$) was computed from over 3,000 observations to estimate weight for a fish of known length for combined sexes. This relationship is used in the current assessment and in the previous (Figure 3).

Growth
Over 1,000 age structures from Oregon and an additional 464 age structures from Washington were recently aged and incorporated into this analysis. The von Bertalanffy growth function (Linf(1-e-k(age-to)) was used to estimate the length of a fish of a known age. Estimated parameter values are compared among estimates derived from age data collected from Washington, Oregon, California and other locales (Table 8). Differences in growth among Washington, Oregon and California fish were not apparent (Figure 4). A single growth function for combined sexes was used for W-O-C areas (Table 8).

Growth parameters are re-estimated within the model to adjust for the effects of size-selectivity and ageing error on the expected value of size-at observed age. Comparison of model results indicates that model estimates are very similar to the previous SS2 model estimates (Table 26).

Maturity-at-age
Length and age at 50% maturity for female yelloweye collected from coastal waters off Vancouver Island, B.C., was estimated to be 42.1-42.4 cm and 16.5-17.2 years of age (Yamanaka and Kronlund 1997). Length at 50% maturity for yelloweye collected off Oregon was estimated

to be 41 cm by Barss (1989) and 45 cm by McClure (1982); and for fish collected off California, 40 cm by Reilly *et al.* (1994). Misspecification of length at 50% maturity at a larger size than actual will tend to lower allowable rates of fishing. As in the previous assessment, model runs were made with 50% maturity occurring at 42 cm (Table 10).

Natural mortality

Several procedures to derive estimates of natural mortality were explored (Wallace 2001). Robson and Chapman (1961) method was investigated, but Chi-square testing indicated that at least one of the critical assumptions of the data was not met. Catch curve estimates (Ricker 1975) of total mortality were derived from age data collected from various locales (Table 6). Estimates of mortality from an exploited stock off Neah Bay Washington (0.076) is higher compared to mortality estimates of an unexploited stock (0.025) located at the Bowie Seamount, Queen Charlotte Islands, B.C. (data provided by Yamanaka, DFO). Mortality estimates from Bowie Seamount using five-year age bins were 0.086 males and 0.043 females (Yamanaka 2000) and no age bins were quite different (0.021 males and 0.033 females). Catch curve estimates of natural mortality assume constant recruitment and large variation in recruitment makes it difficult to interpret results derived from catch curve procedures. Differences in yelloweye estimates are related to bin specification of large year class(s) recruited in the late 1960s. An estimated natural mortality rate near 0.045 was used in the 2002 assessment (Methot *et al.* 2002) and represents a compromise between a low value of 0.02 (O'Connell *et al.* 2000) and high estimates of 0.043 for females and 0.086 for males (Yamanaka *et al.* 2001) and is equivalent to that estimated using Hoenig's (1983) method (Tables 11 and 12). A constant natural mortality rate of 0.045 used in the previous assessment was also employed in this assessment.

2.1.3 Age Validation and Ageing Error

Break-and-burn aging techniques for yelloweye rockfish were corroborated using radiometric aging techniques. Andrews *et al.* (2001) verified growth zone age estimates between 30 and 100 years, substantiating that longevity likely exceeds 100 years.

Aging error was assessed using data collected from an exchange of 100 otoliths between the Department of Fisheries and Oceans, Canada (**DFO**) and WDFW. Aging error increased with age and was assumed unbiased, but imprecise and equivalent differences between DFO and WDFW age readings. Comparison of DFO and WDFW age readings indicate that 75% of fish 9-13 years old and 89% of fish older than 70 years of age are mis-aged by at least one year (Wallace 2001). The SS1 model incorporated ageing error by interpolating error estimates between youngest and oldest aged fish. These data were incorporated in both of the last two assessments. To mimic the error structure used in the previous assessment, an age error vector of standard deviations was developed where standard deviation values were interpolated between the youngest and oldest age groups. This age error vector was incorporated in early model runs to explore differences in model fits to data and final results between SS1 and SS2.

A revised aging error vector was incorporated in this assessment. The previous analysis included a single large outlier at the end of the data series that highly influenced the results. The revised ageing error is based on the same dataset, but excludes the outlier and results in an opposite decreasing trend in age error for older aged fish (Figure 5). Age readers (pers. comm.) found older fish easer to age than younger fishes where demarcations between annuli are often difficult to interpret corroborated this result.

2.1.4 Fishery Size and age composition

Northern California data provide the most complete and longest time series of length information for yelloweye rockfish. Data collection in Oregon began in the early 1980s, though sampling levels were low and sporadic until most recent years. Washington data is essentially limited to the last five years (Tables 13-15).

Size frequency distribution data are used to estimate proportion at each size/age for combined sexes and gear for each assessment area. Due to scarcity of data, no weighting is applied in combining samples within State/gear/year strata. As in the last assessment, because of the small sample sizes, some samples are combined across years in order to provide the model with observations that reflect average conditions, although blurring any potential annual signal. The fish within one or a few fishery samples within a year/state/gear cannot represent a good random sample of the entire fishery catch. For example, inspection of the raw data often indicated a cluster of small fish in one year and a cluster of much larger fish in the following year. This occurs because fish within a sample tend to be more similar in size and age than the diversity of size and age that appears when many independent samples are taken. Because the model believes that the fish within a size or age composition observation are from a multinomially distributed random sample, it may attempt to infer recruitment events from what is sampling variability. Since inspection of the data do not reveal any obviously strong recruitment events moving through the population, we felt it was better to blend the small sample size years into multi-year observations. The procedure involved: (1) combining sample data across the range of selected years (see boxed data in Tables 13-15) to create a multi-year observation; (2) assign these proportions at age/size back to each of the source years; (3) assign a multinomial sample size for each of these years so that the sum of these sample sizes equals the sum of the original sample sizes for those years. All blended data time series and proportions are unchanged from the last assessment for years prior to 2000 and have only been revised in most current years.

2.1.5 Fishery CPUE

Abundance indices are assumed to be proportional to population abundance. The catchability coefficient (**Q**) is the factor that relates the units of the index to the abundance of the population. Random variability in the coefficient may occur, but if there is a trend over time or if the coefficient varies with population abundance, then the assessment may be biased. Sport fishery catch rates will be influenced by undocumented search time at sea; and the observed decline in CPUE indices would be underestimated. There is no information to evaluate annual differences in effort for specific individual target species such as yelloweye. It is unlikely that discard or bag limits influenced CPUE historically because yelloweye are a highly valued species and fishers rarely caught their bag limit of yelloweye. To minimize influence of non-bottomfish effort, data were restricted to rockfish or bottomfish-targeted trips. Described below are the statistical models used to explain some of the overall variability in sport CPUE in order to come closer to having indexes that are proportional to the abundance of fish available to the sport fishery.

We explored recreational fishery creel survey data provided by CDFG, ODFW, WDFW, NWFSC, and RecFIN. Data for 2002–2005 were not included in the assessment due to the significant management changes restricting the harvest of yelloweye rockfish since 2001 (Tables 16 and 17, Figure 6). All annual mean CPUE, except for Oregon recreational fishery, was calculated by two methods: 1) total annual catch divided by annual total efforts, and 2) delta lognormal modeling.

Delta lognormal model

Delta lognormal model (Lo *et al.* 1992) has been commonly used in the in modeling of the abundance of marine species from trawling data. It uses generalized linear models GLMs in both stages. The relative abundance of yelloweye in Pacific Northwest among years could be expressed as the product of density and a measure of area:

$$I = DA,$$

where I is the index of relative abundance (tons) for a given year, D is the density (tons per sq. km), A is the total fishing area. If the area of fishing did not change with time, D can be used as the index of relative abundance because A is a constant. Assuming there is i blocks in the fishing with density D_i and area A_i. If A_i s are not known, the annual catch in A_i can be used as substitutes. The density of fish for each year was

$$D_i = P_i C_i$$

where P_i is the probability of abundance and C_i (tons per sq. km) is standard measure of density within the fishing block *i*. In recreational data, we can use the catch per unit effort (CPUE) to replace C on the condition that the speeds of hauling are similar among all the trawling boat and it does not vary among years. CPUE can be catch per angler hr, catch per trip, or catch per angler. The distribution of $C_i > 0$ usually follows a lognormal distribution. The distribution of P_i follows a binomial distribution. The modeling of P_i and C_i through a two stages process with other predictor variables is commonly called delta lognormal model (Lo *et al.* 1992). The advantage of delta lognormal model can help to investigate the probability of abundance in a spatial scale with other predictor variables, which include both geographical information, and environmental variables. In most of catch data, a large proportion of zero catch would be affected the predictability of the model and it can be avoided by delta lognormal model, which only fit the positive catch data. There is possible bias induced by a two stages model process. Lo *et al.* (1992) and Syrjala (2000) attempted to estimate the bias of estimated variance by both simulation and approximation. No much literature has attempted to discuss the bias of the estimates. In fact, neither P_i nor C_i assumes normal distribution (binomial, lognormal) in the 2-stage model process and there is possible correlation between them. The use of delta lognormal method to estimate the variance of final estimate is questionable. This can be overcome by non-parametric bootstrapping.

First stage model

The response variable P_{ij} is a Bernoulli component (presence-absence) of CPUE *j* in year *i*. The choice of logit link function is standard (McCullagh and Nelder 1989, Cheng and Gallinat 2004). The link function is

$$g(P_{ij}) = \log(\frac{P_{ij}}{1 - P_{ij}}) = x_i,$$

where x_i is a factor variable (annual effect).

Second stage model

We model $C_{ij} > 0$ in terms of the covariates $x_{ij.}$ It is a truncated Poisson distribution.

Bootstrapping method and non-parametric coefficient of variation
The nonparametric bootstrap method (Efron 1982, Hall 1992, Jackson and Cheng 2001) was used to estimate the 95% confidence intervals for the mean CPUE in both mean estimates and estimates resulted from delta lognormal model. Due to the intensity computing of GLMs and large data set, K = 200 to 1000 samples have been used. We have rerun the bootstrapping thee times and compared the precision of estimates of 2.5%, 15.87%, 84.13%, 97.5% quantiles. The estimates of the quantiles are correct to the first 3 significant places due to huge dataset. Coefficient of variation of a data X,

$$CV_X = \frac{\sigma_X}{\mu_X} \approx \frac{\hat{\sigma}_X}{\overline{X}},$$

is commonly used to describe variation (one standard deviation) of the data compared with the mean of the data. σ_X and $\hat{\sigma}_X$ are population X standard deviation and estimate population X standard deviation. It is commonly used in marine research and has been widely applied or accepted by fisheries managers and scientists as a measure the quality of data or estimates. Let define $q_{X,0.025}$ be the 2.5% quantile of data X. We define the ad hoc CV for non-normal distribution as

$$CV_X = \frac{q_{X,0.8413} - q_{X,0.1587}}{2\mu_X} \approx \frac{\hat{q}_{X,0.8413} - \hat{q}_{X,0.1587}}{2\overline{X}}.$$

For the sample mean, we use

$$CV_{\overline{X}} = \frac{q_{X,0.8413} - q_{X,0.1587}}{2\sqrt{n}\mu_X} \approx \frac{\hat{q}_{X,0.8413} - \hat{q}_{X,0.1587}}{2\sqrt{n}\overline{X}},$$

where n is the sample mean.

The sample mean of the CPUE in each year was compared with the estimates resulted from delta lognormal model. Delta method (Seber 1982) was used to estimate the overall variance in the sample mean.

Northern California CPFV CPUE
The CDFG Central California Marine Sport Fish Project has been collecting catch and effort data onboard recreational Commercial Passenger Fishing Vessels (CPFV) from 1987 to 1998. Data were collected from trips originating out of northern California ports from Port San Luis to Fort Bragg. Observers collected data on catch, number of fishers and time spent fishing at each location fished for the entire day (personal communication, Deb Wilson-VanDanberg CDFG, 2005). We also explored another version of CPFV data provided by Don Pearson at the SWFSC NOAA. CPUE was calculated as yelloweye catch per angler-hour (Table 16, Figure 6).

Oregon CPUE
Since the late 1970s, samplers with the Oregon Department of Fish and Wildlife (**ODFW**) have conducted dockside interviews and collected recreational catch and effort data from marine sport anglers fishing from boats as they returned to ports along the Oregon coast. Until the mid-1990s the program focused on the ocean sport fishery for Pacific salmon, with sampling effort concentrated during the summer salmon fishing seasons. There was limited sampling to measure the species compositions of the non-salmonid, general categories (rockfish, flatfish, and miscellaneous), but the data collection procedures for bottom-fish were ad hoc, involving weekly data sheets with running tallies of the species seen during some unknown fraction of the interviewed angling trips. More detailed and rigorous sampling for species composition began in 1999. Through 1987 the species composition data were collected on the basis of the *Trip-Type* (bottom-fish versus salmon), but from 1988 through 1998 they were collected by *Boat-Type*

(charter versus private), without regard to the *Trip-Type*. During all years of the sampling program the interviewers collected data on rockfish catch (numbers of fish) and effort (number of boat trips and number of angler trips) on the basis of both *Trip*- and *Boat-Type*.

The Oregon sport boat catch and effort data series for yelloweye rockfish was used in the 2001 stock assessment (as well as the 2002 and August 2005 updates) to develop a catch-per-unit-effort (**CPUE**) abundance index. The data series provided previously by ODFW suffered from two major flaws. First, in the previous data series the species composition estimates (yelloweye rockfish as a percent of the total catch of rockfish) that were used for estimating the catch of yelloweye rockfish were not derived consistently over the entire time series. For the period 1979-87 the species composition estimates were derived only from bottom-fish trips. In later years, when the species composition data were collected by *Boat*- but not *Trip-Type*, the species composition estimates included data from "combination trips", which were directed at catching salmon and possibly bottom-fish as well. The data available for 1979-87 indicate that there can be large differences in rockfish species composition between bottom-fish versus combination trips. Second, the previous catch and effort data series was inconsistent in its measure of fishing effort. The rockfish catch and effort data for 1979-87, and 1999 was based only on bottom-fish trips, but for 1994-98 the series included trips directed at salmon and combination trips.

The revised Oregon sport boat catch and effort data series for yelloweye rockfish, compiled for CPUE analysis in the current assessment, rectified the flaws in the previous data series. First, the species composition data (used to estimate percent yelloweye rockfish by *Year*, *Month*, *Port*) were pooled across bottom-fish and salmons trips (by *Year*, *Month*, *Port*) to maintain consistency across the entire time series. Second, the rockfish catch and effort data (by *Year*, *Month*, *Port*) were taken only from trips designated in the database as bottom-fish trips.

Another change in the process for estimating the revised catch, effort, and CPUE series for yelloweye rockfish was in the treatment of *Year*, *Month*, *Port* cells for which there were no or few species composition data. A GLM with terms for *Year* + *Month* + *Port* was applied to the logits of the available data on the percent yelloweye. Coefficients from the GLM were then used to estimate the percent yelloweye and applied to any *Year*, *Month*, *Port* cells that had less than 100 rockfish sampled for species composition. These GLM coefficients were not used in developing the estimates of total Oregon recreational catch of yelloweye rockfish.

Annual mean CPUE was then estimated by applying a general linear model to the revised catch and effort information. Data were log transformed and normality was assumed. Factors included in the final model were Year, Month, and Port. Back-transformed least square means of the Year factor were calculated as annual mean CPUE (Table 16, Figure 6).

Washington CPUE

April-September estimates of catch and effort (by trip type) for coastal Washington ports are available from the WDFW Ocean Sampling Program since 1984. Directed halibut trips were pooled with bottomfish trips until 1989. However, pre-1990 sample data are not currently available and are not included in this analysis. Yelloweye abundance trends for bottomfish-only and directed halibut trips were explored (Figure 7).

MRFSS CPUE

RecFIN Trip-level summaries of party-boat catch and angler-effort for northern California and Oregon were provided by Wade VanBuskirk, (personal communication). These RecFIN intercept data reflect sampling and interviews conducted at the end of a fishing trip, and do not include information on specific fishing locations. These data include both relevant trips, in which yelloweye rockfish were reasonably likely to be taken, and non-relevant trip such as trips targeting salmon or tuna, two methods were used to obtain a sub-set of the trip data that would be appropriate for calculating yelloweye rockfish CPUE. The first method was by selecting trips targeting bottomfish, lingcod, and rockfish. Delta-lognormal model was applied to this sub-set to calculate CPUE.   The second method was by using the logistic regression method (Stephens and MacCall 2004). This method uses the species composition from each trip catches to determine whether yelloweye rockfish were likely to have been encountered on that trip. Alec McCall at Southwest Fisheries Science Center (**SWFSC**) graciously provided this analysis for the northern California.

For the logistic filtering method, the top 50 species in frequency of occurrence for each region were extracted, and yelloweye rockfish were separated as being the target species. The remaining 49 species served as potential explanatory variables. Three species of salmon were combined into a single category. This resulted in 47 “species” other than yelloweye rockfish being considered in the northern California analysis. Logistic regression of yelloweye rockfish presence/absence on categorical presence/absence of these explanatory species provided predicted probabilities that yelloweye rockfish would be taken on a trip, given the other species that were taken on that trip. Prior to the analysis, some trips were excluded from the data set if they were too short (<0.25hr) or too long (>14hr). Species associations (coefficients from the logistic regression) are shown in Figure 1.

Defining the appropriate subset of the data for use in calculating CPUE requires establishing a threshold probability for inclusion. The threshold probability recommended by Stephens and MacCall (2004) is based on an equal number of false negatives (trips that are excluded from the selected set, but the target is present) and false positives (trips that are included in the selected set, but for which the target is absent). This threshold probability values was 0.4 for the northern California RecFIN data. However it may be possible to gain precision by increasing the number of positive occurrences of the target species in the subset, i.e., by reducing the number of false negatives despite an increase in false positives. Because yelloweye rockfish are relatively rare in the RecFIN data, the threshold was reduced to 0.08, and 59 additional trips below this threshold that caught yelloweye were also included. One year did not appear to be sampled well: Waves 1 to 4 in year 1993 were sampled too thinly to be of use, so trips from year 1993 were deleted from consideration.

The abundance index is calculated from the retained trips by a GLM using a delta-lognormal distribution (R language code provided by Edward Dick, NMFS). A gamma distribution was considered for the positive record, but was rejected based on a large difference in AIC (AIC for gamma model was –2118.55; AIC for lognormal model was –2230.46).

The final northern California GLM included 21 year-effects, 6 wave effects. The year effects serve as the abundance index (Figure 9).   Precision of the estimated year effects was estimated by use of a jackknife procedure.

Northern California CPUE indices calculated from the two methods both showed a declining trend (Figure 9). Oregon yelloweye CPUE trend based on RecFIN data is similar to the trend based on ODFW survey data (Figure 8). RecFIN data collected during 1987 and 1988 were excluded from the assessment models due to species identification problem in these two years (Russ Porter, pers. comm.).

2.2 Fishery Independent data

NMFS Trawl Survey

The National Marine Fisheries Service (**NMFS**) triennial trawl survey has covered a wide range of depths off California, Oregon and Washington since 1977. Yelloweye rockfish inhabit areas typically inaccessible to trawl gear and, as a result, were infrequently caught. Most yelloweye rockfish are caught on and near Hecate Bank off central Oregon and off northern Washington (Figure 16). Estimated biomass by statistical area is summarized in Table 21. Given the low frequency of positive tows, NMFS trawl survey probably does not sample yelloweye habitat consistently and may not be a reliable indicator of abundance. NMFS trawl survey data were not incorporated into this or any of the last assessments.

IPHC longline survey

The International Pacific Halibut Commission (**IPHC**) has conducted longline surveys off Oregon and Washington coast since 1997 (Figures 10-14). These are standardized fixed station surveys with 78, 71, 84, and 85 stations in 1999, 2001, and 2002-2005, respectively. Data collected during 1997 survey were excluded due to the differences in station locations (Figures 10-14). In 1997 and 2001, yelloweye catches were observed for the first 20 hooks of each skate. There were 100 hooks on each skate. Yelloweye catches were expanded from the observed catches. For 2002 – 2005, all hooks were observed for rockfish catches. Fishing gear between the Washington line fishery and the IPHC survey is comparable and both fish the Northern Washington waters off shore of Cape Flattery; and length composition between the fishery and survey is similarly comparable (Figure 18).

2002 US Vancouver Submersible Survey

Only one survey has been conducted (Jagielo 200X) and we therefore do not have inter-annual comparison of biomass estimates. This point estimate was incorporated into an alternate Washington model to allow for useful comparison to other model runs. If additional surveys were conducted on a more routine basis, a time series of yelloweye rockfish density data could be used to develop a more reliable estimate of abundance. Further, because this species cannot be sampled using traditional survey techniques, these data will likely provide the only alternative for development of future demographic models of the yelloweye rockfish population abundance.

To our knowledge, submersible survey data have been used in only two other assessments. In Southeast Alaska, O'Connell *et al.* (2004) have used the submersible visual transect approach to estimate the biomass of yelloweye rockfish for the North Pacific Fishery Management Council (**NPFMC**); and in California, submersible survey information collected by Yoklavich *et al.* (to quantify the biomass of cowcod (*Sebastes levis*) for PFMC management was used in the most recent assessment.

Fifty submersible dive sites ranging in depth from 102 to 225m were randomly sampled throughout the untrawlable habitat sampling stratum between August 18th-28th, 2002 (Fig 18). In total, an estimated 276,258 m^2 was covered across all sites (Table 22). Overall, transect duration averaged 61 min., width averaged 2.52m, length averaged 2183m, and submersible speed averaged 0.60 m/second.

While yelloweye rockfish occurred in 24 of the 50 nominally untrawlable submersible dive sites in 2002, they occurred in only 2 of the 25 of the 2001 NMFS trawl survey tows within the 55-183m U.S. Vancouver INPFC Area strata. With the exception of Dover sole, densities of the seven target species were higher in the untrawlable area compared to the trawlable area.

Approximately 16% of the US Vancouver INPFC statistical area is considered untrawlable, vs. 84% deemed to be trawlable (Zimmermann 2003). When the relative size of these survey sampling strata are accounted for, point estimates of population numbers were higher in the untrawlable area by a factor of 9 (canary rockfish), 5 (yelloweye rockfish), 4 (Pacific halibut), and 3 (lingcod), respectively; and higher in the trawlable area by a factor of 11 (Dover sole), 3 (petrale sole), and 2 (yellowtail rockfish), respectively.

Size distributions of fish sampled in the submersible survey were similar to those of fish sampled in the trawl survey, with the exception of Pacific halibut, which tended to be larger than those in the trawl survey. Mean sizes of fish collected in the submersible survey were 47.9 cm (yelloweye rockfish), 44.1 cm (canary rockfish), 44.2 cm (yellowtail rockfish), 58.6 cm (lingcod), 34.8 cm (petrale sole), 33.0 cm (Dover sole), and 65.8 cm (Pacific halibut). Mean sizes from the trawl survey were 45.3 cm (canary rockfish), 46.4 cm (yellowtail rockfish), 58.2 cm (lingcod), 35.2 cm (petrale sole), 36.0 cm (Dover sole), and 86.2 cm (Pacific halibut), respectively.

Estimates of yellow biomass compared favorably with estimates reported by Methot *et al.* (2002) that estimated a total coastal Washington biomass of 542 mt. This compares to a submersible survey estimate of 292 mt in the untrawlable zone; and a NMFS Trawl survey estimate of 101 mt in the trawlable portion of the U.S. Vancouver INPFC statistical area, which represents only the northern portion of the Washington coast (Tables 23 and 24).

2.3 History of modeling approaches

Yelloweye were first addressed as part of the “remaining rockfish” assessment completed in 1996. This assessment included a number of previously un-assessed rockfish species managed as the “*Sebastes* complex”. Rogers *et al.* (1996) estimated a yelloweye rockfish Allowable Biological Catch (**ABC**) of 39 mt for the Northern area (Columbia and Vancouver) based on biomass estimates from the triennial trawl survey and assumptions about natural mortality (**M**) and catchability (**Q**). No separate yelloweye ABC was estimated for the Southern area (Monterey and Conception), where yelloweye rockfish were incorporated with the “other rockfish” assemblage ABC.

Model description for the 2001 stock assessment

Wallace (2001) used the length-based version of Stock Synthesis (Methot 1990) to model the northern California and Oregon regions separately. Growth was estimated externally to the model. Sport CPUE and sport and commercial size composition data were included in the model. The modeled time period extended from 1970 through 2000 and year-specific recruitments were estimated without constraint by a spawner-recruitment curve. The assessment examined both increasing natural mortality with age and dome-shaped selectivity with size as alternative factors to improve the fit to the data. Alternative model configurations found that increasing natural mortality with age provided a somewhat better fit to the data, but there were no age data included in the 2001 model, and much of an increase in M would be inconsistent with direct examination of age data through the catch curve analysis documented above.

Model description for the 2002 stock assessment

The length-based version of Stock Synthesis was also employed in the 2002 evaluation (Methot *et al.* 2002). There were a number of important differences in model configuration from Wallace (2001) that include: 1) inclusion of Washington catch, CPUE, size and age data, 2) inclusion of age composition data from all three states as available and update of size composition data, 3) inclusion of mean length-at-age data from each data source to aid in the simultaneous estimation of growth parameters and size-selectivity, 4) allowing all fishery sectors to have dome-shaped selectivity 5) including emphasis (0.5) on the spawner-recruitment curve and estimating the curvature (steepness) of this curve, 6) starting in 1955 rather than 1970 to better allow for potential long-term patterns in recruitment, and 7) use of constant natural mortality of 0.045.

Model description for the 2005 stock assessment

The 2005 assessment was a simple update of the 2002 model that included a revised catch time series and additional age and length composition information. The assessment used the Stock Synthesis 2 V1.19 modeling framework written by Dr. Richard Methot at the NOAA Fisheries Northwest Fisheries Science Center (**NWFSC**).

2.4 Model description for the current stock assessment

This assessment employed the Stock Synthesis 2 V1.21 modeling framework written by Dr. Richard Methot at the NWFSC. The SS2 modeling framework is fully described in documentation available from NWFSC (Methot 2005). The 2006 yelloweye stock assessment includes a number of model specifications carried over from the previous assessments, which are described in each of the sub-sections below.

Area Modeling

The 2002 assessment (Methot *et al.* 2002) explored area-specific model configurations by constructing models that included data from subsets of the coast, and compared these results to the baseline coastwide model. The authors (Methot *et al.* 2002) concluded that the estimated differences between the areas (states) were neither sufficiently different nor sufficiently precisely estimated to recommend that management be based on area-specific population models. They suggested that area-specific modeling should remain in consideration as new data become available.

In the current assessment, we revisited separate area models. For a single coastwide model the implicit assumption is that either: (1) similar recruitment and mortality occur off each state, or (2) there is sufficient mixing between areas within the coast so that any differences in recruitment or mortality among area are obscured in the coastwide mixing. Thus, a coastwide model will either capture the common recruitment and mortality trends or it will represent the sum of all the processes operating in each area.

Data elements

Data were compiled and analyzed for three independent areas: California, Oregon and Washington. Each area included a sport CPUE index and combined catch, age and length composition information for separate commercial and sport fisheries. In addition, Washington included a commercial line fishery that began targeting yelloweye rockfish in 2000. CPUE time series are assumed to occur instantaneously at the middle of the year.

As in the last assessment, the model combines male and female data into a single morph. Growth is modeled by using the von Bertalanffy growth equation and is assumed to be equal between female and male. A constant (but estimated) CV is used over time. Maturity is assumed to be a logistic function of length and is estimated externally to SS2. Size data were condensed into 2-cm length bins ranging from 18 cm to 76 cm. Only 0.1% of the observed fish are greater than 76 cm, thus 76 cm was considered to be a reasonable accumulator bin. Age data were condensed into 1-age bins for ages 3 to 29, and into 5-age bins for ages 30-70. All fish above age 70 were accumulated in the 70+ age bin. In addition to providing the model with size and age composition vectors, we calculated the mean length at each age-bin for each gear/state strata (and the number of fish in each age-bin used for the calculation) and assigned this vector to a year that supplied much of the age data. In SS2, the mean size at-age-bin is compared to the expected value for this quantity that takes into account the effects of ageing error and size-selectivity of the fishery. Sample sizes used in this assessment are the number of individual fish sampled for all length and age frequencies with a maximum sample size set at 200.

Natural Mortality and Recruitment

Consistent with the last assessment, natural mortality is assumed to be constant throughout age and time, and set equal to 0.045. The stock-recruitment function was a Beverton-Holt parameterization, with the log of mean unexploited recruitment estimated, along with the steepness (h) of the stock recruit function. The range of years where year-specific recruitment deviations were estimated was determined by examination of the CV of the recruitment and recruitment deviation estimates.

The standard deviation of the recruitment (σ_R) is treated as a fixed input quantity where the initial value was set at the 2002 model (Methot 2002) derived value of 0.4.

Selectivity

Natural mortality is confounded with selectivity in age-structured models. The trade-off between natural mortality and selectivity was explored during the 2002 assessment and since we assume the same constant natural mortality rate (0.045) we did not revisit this issue here.

Selectivity is assumed to be length based for all fleets, and to be logistic in all base model runs (SS2 Type1). Alternative models explored a double logistic shape (SS2 Type 2) for recreational fisheries. Selectivity for the CPUE indices was mirrored from the respective State sport fisheries. Fishery selectivity was assumed to be time-invariant.

Lambdas

Model runs for the 2005 assessment indicated that the model's ability to fit the age and size composition data implied an effective sample size that was approximately 60% of the observed sample size values. Because sample size and emphasis factors are algebraically equivalent, this reduction in each observation's sample size was subsequently implemented by reducing all the size and age composition emphasis factors from 1.0 to 0.6. Emphasis factors (lambdas) for size, age and mean size likelihood components were set similarly for all base model runs. We also set CPUE likelihood components to 1.0 and the baseline model was set to have an emphasis level of 0.5 on deviations from the S/R curve and 0.0001 for the S/R time series as was done in the previous assessment. Lastly, lambda for the initial equilibrium catch was set to 1.0 and parameter prior lambda to 1.0.

Model estimated parameters

Table 26 lists all estimated and assumed model parameters.

Model time period

The modeling time period begins in 1955 is assumed to be in equilibrium and is based on the same assumptions and time period used in the last stock assessment (Methot *et al.* 2002).

2.5 Priors

No informative priors were set for most model parameters and parameter bounds were set to be sufficiently wide to avoid truncating the searching procedure during maximum likelihood estimation. Informative priors were set for both steepness and natural mortality and were based on values derived during the STAR Panel meeting stock assessment. The Washington model differed significantly to other area models in that we had to set informative priors on the indices

(10) and severely limit our estimated recruitment deviations to years 1987-1992 to obtain convergence.

2.6 Model selection and evaluation

The final base model represents a close approximation to the SS2 model with logistic selectivity while re-estimating all parameters estimated in the last assessment with data time series appended since 2005. Steepness was fixed at the SS1 value of 0.45 and SigR =0.5 in all model runs with the exception of the sensitivity analysis.

We evaluated the convergence status of the base model(s) with multiple model runs that explored the ability of the model to recover similar maximum likelihood estimates when initialized from disperse starting values. All model parameters were jittered by 0.5% of the range of the bounds from the maximum likelihood values for a set of 24 convergence runs. Starting values in some runs were outside the range of the model's ability to successfully complete and the run was either terminated early or Hessian matrix was not positive definite. Results for all successful runs show little variability in the objective function and current depletion for all completed runs (Table 27), indicating that the base case model estimates are unlikely to represent local minima.

*2.6 Base-run(s) results selection and evaluatio*n

The base case model population trajectory is similar to that predicted during the last stock (Table 28 and Figure 22). Decline in biomass is significant and uninterrupted beginning in the 1970's reaching lowest levels in 2000 (Table 28). Population numbers at age indicate a substantial loss of the oldest age classes related to overexploitation across the time series (Table 29).

2.7 Uncertainty and sensitivity analyses.

We used a number of alternate models (SS2 version 1.21) to assess the sensitivity of the assessment results to the specific model configuration used in the base case. A profile of likelihood and other model outcomes over a range of fixed values for the initial recruitment level (virgin recruitment) are presented in Table 30. In Table 31 we show likelihood values and other model results over a range of fixed values for steepness. To assess the effect on model fit to emphasis on the SR curve we profiled across increasing lambda values on the SR curve and display the results in Table 32. In Table 33 we assess the effect on model fit to increasing emphasis on length, age and size compositions.

2.8 Alternate model(s)

Double logistic selectivity was evaluated (Table 26 b).

3.0 Rebuilding parameters

Rebuilding projections are based on results from the SSC default rebuilding analysis simulation software. Specific detail can be obtained from PFMC "Updated Rebuilding Analysis for Yelloweye Rockfish Based on the 2006 Stock Assessment" document.

	Coastwide		California		Oregon		Washington	
FMSY proxy		0.024		0.021		0.021		0.027
FMSY SPR / SPR(F=0)		0.5		0.5		0.5		0.5
Virgin SPR		52.195		52.189		53.349		44.960
Generation time		50		47		49		46
T_{MIN}		2046		2073		2035		2026
T_{MAX}		2096		2120		2084		2072
Virgin Spawning Output		6643		3421		2510		906
Target Spawning Output		2657		1368		1004		362
Current Spawning Output		1146		281		530		188
Spawning Output (ydecl = 2002)		1019		249		456		180
Natural mortality		0.036		0.036		0.036		0.040
Steepness		0.45		0.45		0.45		0.45
SigmaR		0.50		0.50		0.50		0.50
Depletion level in 2005		17.3%		8.2%		21.1%		20.8%
	OY	Depletion	OY	Depletion	OY	Depletion	OY	Depletion
2007	12.6	18.0%	2.7	8.6%	6.4	22.5%	2.6	20.9%
2008	12.9	18.5%	2.8	8.9%	6.6	23.1%	2.7	21.8%
2009	13.2	18.9%	2.9	9.2%	6.7	23.7%	2.8	22.8%
2010	13.5	19.4%	2.9	9.5%	6.8	24.2%	2.9	23.7%
2011	13.8	19.8%	3.0	9.8%	6.9	24.7%	3.0	24.5%
2012	14.1	20.2%	3.1	10.1%	7.0	25.2%	3.0	25.4%
2013	14.3	20.5%	3.1	10.3%	7.1	25.6%	3.1	26.1%
2014	14.5	20.8%	3.2	10.6%	7.1	25.9%	3.2	26.8%
2015	14.7	21.1%	3.3	10.8%	7.2	26.2%	3.2	27.3%
2016	15.0	21.4%	3.3	11.0%	7.3	26.5%	3.3	27.9%

Note: OY projection is base on P_{MAX} = 0.8.

4.0 Reference Points (biomass and exploitation rate)

	Area (model) for consideration			
Reference Point	**Coastwide**	**California**	**Oregon**	**Washington**
Unfished Spawning Stock Biomass (SSB_0)	3,322	1,715	1,258	453
Unfished Exploitable Biomass (B_0)	7,448	3,877	2,789	1,017
Unfished Recruitment (R_0)	4.85	4.19	3.85	3.00
SSB_{2006}	588	145	274	95
Depletion Level (2006)	17.7%	8.5%	21.8%	21.0%
Depletion -95CI	14.2%	5.7%	16.5%	17.3%
Depletion +95CI	21.1%	11.2%	27.0%	24.6%
Target Spawning Biomass ($B_{0.40}$)	1,329	684	502	181
$F_{MSY\ Proxy\ (SPR=0.50)}$	0.024	0.021	0.021	0.027
Exploitable Biomass	1491	383	671	255
ABC_{2006}	36.2	8.1	14.2	7.0
OY_{2006}	27.0			

5.0 Harvest projections and decision Table

6.0 Research Needs

Additional effort to collect age and maturity data is essential for improved population assessment. Collection of these data can only be accomplished through research studies and/or by onboard observers because this species is now prohibited. Increased effort toward habitat mapping and in-situ observation of behavior will provide information on the essential habitat and distribution for this species. A study of the role of Marine Protected Areas in harvest management will be beneficial for sedentary species like yelloweye rockfish. Genetic study is required as a first step in delimiting stock boundaries for this species.

Alternative survey such as the in-situ 2002 US Vancouver submersible survey in untrawlable habitat is required for future assessment of yelloweye rebuilding status. This study has demonstrated that submersible visual transect surveys can provide a unique alternative method for estimating demersal fish biomass in habitats not accessible to conventional survey tools. For example, because of the low frequency of yelloweye rockfish encountered in the NMFS shelf trawl survey tows, those data were not considered a reliable indicator of abundance and were not used in the 2002 yelloweye stock assessment for PFMC (Methot *et al.* 2002). Results from this study support this conclusion and illustrate the need for large-scale surveys to assess bottomfish densities in habitats that are not accessible to trawl survey gear. Further, stratified random sampling designs should be employed with sample sizes sufficient to ensure acceptable levels of statistical power (Jagielo *et al.* 2003).   At present, the in-situ visual transect submersible survey method appears to be a useful tool for this purpose, and the utility of this method will likely improve further with technological advances such as the 3-Beam Quantitative Mensuration System (**QMS**).

7.0 Acknowledgments

8.0 Literature cited

Age readers, *personal communication.* p. 13, 3rd paragraph

Andrews, A.H., G. Cailliet, K. Cole, K. Munk, M. Mahoney and V. O'Connell. 2001. Radiometric age validation of the yelloweye rockfish *(Sebastes ruberrimus*) from southeastern Alaska. Manuscript recently submitted to the Indo-Pacific Fish Conference Proceedings.

Barss, W.H. 1989. Maturity and reproductive cycle for 35 species from the family *Scorpaenidae* found off Oregon. Portland, OR: Oregon Department of Fish and Game. Report No. 89-7. 36 p.
Crone, P. 1995. CJFAS.

Bureau of Marine Fisheries, (*staff of*). 1949. The commercial fish catch of California for the year 1947 with an historical review 1916-1947. Calif. Fish and Game *Fish Bulletin*, No. 74.

Cheng, Y.W. and M. Gallinat. 2004. Statistical analysis of the relationship among environmental variables, inter-annual variability and smolt trap efficiency of salmonids in the Tucannon River, *Fisheries Research*, 70, 229-238.

Cleaver, . 1949.

Dick, E. *provided R code language*

Efron, B. 1982. The Jacknife, the Bootstrap and Other Resampling Plans. SIAM (Regional Conference Series in Applied Mathematics, 38). Philadelphia.

Eschmeyer, W.N. and E.S. Herald. 1983. A field guide to Pacific coast fishes North America. HoughtonMifflin CO., Boston, MA. 336 p.

Gao and Wallace. 2003.

Gavaris, S. 1980. Use of a multiplicative model to estimate catch rate and effort from commercial data. Canadian Journal of Fisheries and Aquatic Science. Vol. 37: 2272—2275.

Hall P. 1992. *The Bootstrap and Edgeworth Expansion*, Springer, New York.

Heimann R.F.G. and J.G Carlisle. 1970. The California marine fish catch for 1968 *and* historical review 1916-68. Calif. Fish and Game Fish Bulletin 149.

Heincke, F., 1913. Investigations on the plaice. Plaice Fisheries and Protective Measures. Report 1. Rapp. PV. Reun. Cons. Perm. Int. Explor. Mer. 16. 67p.

Hill, K. *personal communication*.

Hoenig, J.M. 1983. Empirical use of longevity data to estimate mortality rates. Fish. Bull. 82(10):898-903.

Jackson, J. and Y.W. Cheng. 2001. Improving parameter estimation for daily egg production method of stock assessment of pink snapper in Shark Bay, Western Australia. *Journal of Agricultural, Biological and Environmental Statistics* 6: 243-257.

Jagielo, T., 200X. (Re: 2002 sub survey paper.)

Jagielo, T. *et al.* 2003. (same as previous paper above????)

Lo, . 1992.

Love, M.S., L. Thorsteinson, C.W. Mecklenburg, and T.A. Mecklenburg. *In Preparation (January 2000*). A checklist of marine and estuarine fishes of the Northeast Pacific, from Alaska to Baja California. National Biological Service. Located at website http://id www.ucsb.edu/lovelab/home.html

Love, M. 1996. Probably More Than You Want To Know About The Fishes Of The Pacific Coast. Really Big Press, Santa Barbara, California, 381 p.

MacCall A.D., S.Ralston, D. Pearson and E. Williams. 1999. Status of Boccaccio off California in 1999 and Outlook for the next Millennium. *In* Appendix to the Status of the Pacific Coast Groundfish Fishery Through 1999 and Recommended Acceptable Biological Catches for 2000 Stock Assessment and Fishery Evaluation. Pacific Fishery Management Council 2130 SW fifth Ave. Suite 224, Portland, Ore. 97210.

McCullagh, P. and J.A. Nelder. 1989. *Generalized Linear Models*. London: Chapman and Hall.

McClure, R.E. 1982. Neritic reef fishes off central Oregon: Aspects of life histories and the recreational fishery. M.S. Thesis, Oregon State University. 94 p.

Methot, R. 1989.

Methot, R.D. 1990. Synthesis model: an adaptive framework for analysis of diverse stock assessment data. Int. N. Pac. Fish. Comm. Bull. 50:259-277.

Methot, R. and K. Piner. 2002. ???

Methot, R., F. Wallace, and K. Piner. 2002. Status of Yelloweye Rockfish off the U.S. West Coast in 2002. *In* Stock Assessment and Fishery Evaluation. Pacific Fishery Management Council 2130 SW fifth Ave. Suite 224, Portland, Ore. 97210.

Methot, R. 2005.

Miller, D.J. and D. Gotshall. 1965. Ocean sportfish catch and effort from Oregon to Point Arguello, California. Calif. Fish and Game *Fish Bulletin* 130.

Nitsos, R.J. and P.H. Reed. 1965. The animal food fishery in California, 1961-1962. *Calif. Fish and Game*, 51(1):16-27.

O'Connell 2000.

O'Connell 2004. (Re: Plan Team Draft???)

Phillips, J.B. 1939. The rockfish of the Monterey wholesale fish markets. *California Fish and Game*, 25(3).

Porter, R. *personal communication.* p.18, 4th paragraph

Reilly, P.N. D. Wilson-Vandenberg, R.N. Lea, C. Wilson, and M. Sullivan. 1994. Recreational angler's guide to the common nearshore fishes of Northern and Central California. California Department of Fish and Game, Marine Resources Leaflet.

Ricker, W.E. 1975. Computation And interpretation of biological statistics of fish populations. Bull. Fish. Res. Board Can. 191 p.

Robson, D.S. and D.G. Chapman, 1961. Catch curves and mortality rates. Trans. Am. Fish. Soc. 90(2): 181- 189

Rogers, J.B., M. Wilkins, D. Kamikawa, F. Wallace, T. Builder, M. Zimmerman, M. Kander and B. Culver. 1996. Status of the Remaining Rockfish in the Sebastes Complex in 1996 and recommendations for DRAFT #2 post-STAR Page 18 8/23/02 management in 1997. Pacific Fishery Management Council 2130 SW fifth Ave. Suite 224, Portland, OR 97210.

Rosenthal, R.J., L.J. Field, D. Myer. 1981. Survey of nearshore bottomfish in the outside waters of southeastern Ala ska. Alaska Department of Fish and Game. 91 p.

Rosenthal, R.J., L. Haldorson, L.J. Field, V. Moran-O'Connell, and M.G. LaRiviere. 1982. Inshore and shallow offhshore bottomfish resources in the southeastern Gulf of Alaska. Alaska Coastal Research. 166 p.

Rosenthal, R.J., V. Moran-O'Connell, and M.C. Murphy. 1988. Feeding ecology of ten species of rockfishes (*Scorpaenidae*) from the Gulf of Alaska. California Department of Fish and Game 74(1):16-37.

Seber, G.A.F. 1982. The estimation of animal abundance and related parameters. 2nd ed. Charles Griffin & Co. London.

Stephens, . and MacCall, . 2004.

Syrjala, S.E. 2000. Critique on the use of the delta distribution for the analysis of trawl survey data. ICES Journal of Marine Science 57: 831-842.

Tagart J.V., F. Wallace and J. Ianelli. 2000. Status of the yellowtail rockfish resource in 2000. *In* Appendix to the Status of the Pacific Coast Groundfish Fishery Through 2000 and Recommended Acceptable Biological Catches for 2001 Stock Assessment and Fishery Evaluation. Pacific Fishery Management Council 2130 SW fifth Ave. Suite 224, Portland, OR 97210.

Tagart J.V. and D.K. Kimura. 1982. Review of Washington's coastal trawl fisheries. Wash. Dept. Fisheries Tech. Rept. No. 68, 66p.

Van Buskirk, . *personal communication.* p. 17, 4th paragraph

Wallace, F. 2001. Status of the yelloweye rockfish resource in 2001 for northern California and Oregon waters. *In* Appendix to the Status of the Pacific Coast Groundfish Fishery Through 2001 and Recommended Acceptable Biological Catches for 2002 Stock Assessment and Fishery

Evaluation. Pacific Fishery Management Council 2130 SW fifth Ave. Suite 224, Portland, OR 97210.

Wallace *et al.* 2005.

Washington, P.M., R. Gowan, and D.H. Ito. 1978. A biological report on eight species of rockfish *(Sebastes* spp.) from Puget Sound, Washington. NOAA/NMFS, Northwest and Alaska Fisheries Center Processed Report, Reprint F, 50 p.

Wilson-VanDanberg, . 2005. data supplied via *personal communication.* p. 16, 1st paragraph

Yamanaka, K.L. and A.R. Kronlund. 1997. Inshore rockfish stock assessment for the west coast of Canada in 1996 and recommended yields for 1997. Canadian Technical Report of Fisheries and Aquatic Sciences No. 2175, 80 p.

Yamanaka, K.L. 2000. (Re: Bowie mortality)

Yamanaka, L., R. Withler, and K. Miller. 2001. Limited genetic structure in yelloweye rockfish *(Sebastes rubberimu*s) populations of British Columbia. Abstract, 11th Western Groundfish Conference, April 24-28, 2000, Sitka, Alaska, p. 123.

Yamanaka, L. *personal communication*.

Yamanaka, L. *data provided by*. (Re: Bowie)

Yoklavich, M. *et al.* (Re: quantify cowcod biomass)

Young, P.H. 1969. The California partyboat fishery 1947-1967. Calif. Fish and Game *Fish Bulletin* 145.

Zimmerman, . 2003.

9.0 Tables and Figures

Table 1. Summary of estimated yelloweye rockfish catch by State and fishery since 1955. Italicized catch data indicate years where there are no data to estimate catch, but presumed by authors. Grey areas indicate an interpolated catch time series from the earliest to latest years catch estimates. Blank cells indicate catch grouped into the trawl gear column.

Coastal Washington, Oregon and California Yelloweye Rockfish Landings

Source	PacFIN and MRFSS				Tagart, PacFIN, and ODFW				Tagart, PacFIN and WDFW								
	California [1/]				Oregon [2/]				Washington [3/]				Totals				
Year	Trawl	Line	Other	Sport	Trawl	Line	Other	Sport	Trawl	Line	Other	Sport	Trawl	Line	Other	Sport	Total
1955	24.1			14.2	*9.9*			*6.2*	*1*	*1*		1	34.9	1.0	0.0	21.4	57.3
1956	28.8			16.6	*10.1*			*6.5*	*1*	*1*		1	39.9	1.0	0.0	24.0	64.9
1957	31.5			12.4	*10.4*			*6.7*	*1*	*1*		1	42.9	1.0	0.0	20.1	64.0
1958	35.5			15.8	*10.6*			*7.0*	*1*	*1*		2	47.1	1.0	0.0	24.7	72.8
1959	30.9			12.4	*10.9*			*7.2*	*1*	*1*		2	42.7	1.0	0.0	21.6	65.3
1960	28.1			10.0	*11.1*			*7.5*	*1*	*1*		2	40.2	1.0	0.0	19.5	60.7
1961	22.6			8.3	*11.4*			*7.7*	*1*	*1*		2	34.9	1.0	0.0	18.0	53.9
1962	20.8			9.1	*11.6*			*8.0*	*1*	*1*		2	33.4	1.0	0.0	19.1	53.4
1963	25.2			9.4	*11.9*			*8.2*	*2*	*2*		3	39.0	2.0	0.0	20.6	61.6
1964	17.7			8.5	*12.1*			*8.5*	*2*	*2*		3	31.8	2.0	0.0	20.0	53.7
1965	20.7			12.5	*12.4*			*8.7*	*2*	*2*		3	35.1	2.0	0.0	24.2	61.2
1966	22.5			15.0	*12.6*			*9.0*	*2*	*2*		3	37.1	2.0	0.0	26.9	66.0
1967	22.2			16.1	*12.9*			*9.2*	*2*	*2*		3	37.1	2.0	0.0	28.3	67.4
1968	21.7			17.3	*13.1*			*9.5*	*2*	*2*		3	36.8	2.0	0.0	29.8	68.5
1969	35.2	5.3		16.8	27.2			*9.7*	*2*	*2*		3	64.4	7.3	0.0	29.5	101.2
1970	42.0	5.1		21.8	19.2			10.0	3.4	1.7	*0*	4	64.6	6.8	0.0	35.8	107.2
1971	40.9	5.9		18.1	19.0			13.1	3.2	1.4	*0*	4	63.1	7.3	0.0	35.2	105.7
1972	61.1	9.4		24.2	24.0			16.3	3.1	2.4	*0*	4	88.2	11.8	0.0	44.5	144.6
1973	81.8	9.9		29.6	22.2			19.5	5.2	2.2	*0*	4	109.3	12.1	0.0	53.1	174.4
1974	73.3	11.0		33.0	18.2			22.6	4.3	4.2	*0*	4	95.8	15.2	0.0	59.7	170.7
1975	82.6	9.8		32.0	14.8			25.8	4.3	2.8	*0*	4.0	101.7	12.6	0.0	61.7	176.0
1976	91.0	12.6		31.0	25.9			29.0	7.7	2.6	*0*	4.3	124.7	15.3	0.0	64.2	204.2
1977	89.5	11.2		27.5	29.3			32.1	12.9	4.9	0	8.8	131.7	16.1	0.0	68.4	216.2
1978	82.0	17.4		24.5	21.5	7.0		35.3	17	6.9	0	4.5	120.5	31.2	0.0	64.4	216.1
1979	112.3	22.0		29.9	54.7	7.5		38.5	18.4	10.1	0	3.5	185.4	39.6	0.0	71.8	296.8
1980	147.9	20.2		75.9	60.2	8.0		27.5	29.2	5.8	0	2.4	237.3	34.0	0.0	105.8	377.1
1981	138.7	20.4	50.7	46.9	93.7	8.5		34.2	5.3	4.4	0	3.4	237.7	33.4	50.7	84.5	406.3
1982	146.9	28.3	1.8	103.8	99.9	9.0	5.6	48.7	6.5	6.1	0	3.4	253.3	43.5	7.4	155.8	460.0
1983	56.5	0.3	0.8	51.0	177.3	15.9	0.0	62.9	6.5	10.1	0	6.7	240.3	26.3	0.8	120.6	388.0
1984	43.5	0.5	0.9	80.8	57.1	10.0	0.0	43.6	3.0	10.4	0	12.2	103.6	20.9	0.9	136.6	262.0
1985	7.3	0.9	0.6	125.8	91.9	10.0	0.0	26.8	10.5	15.9	0	8.8	109.7	26.8	0.6	161.4	298.4
1986	9.8	20.0	1.2	65.5	59.8	10.8	0.0	27.2	2.7	12.0	0	9.0	72.3	42.8	1.2	101.7	218.0
1987	16.9	33.1	3.7	75.2	65.7	15	0.0	29.4	6.0	19.1	0	10.5	88.6	67.2	3.7	115.1	274.6
1988	30.6	22.5	11.8	57.5	110.7	9.4	0.0	9.6	15.8	9.8	0	8.3	157.1	41.7	11.8	75.4	286.0
1989	9.4	34.0	6.7	58.7	169.4	10.6	0.0	16.0	27.9	11.3	0	14.6	206.7	55.9	6.7	89.3	358.6
1990	10.1	58.8	10.9	46.12	61.1	13.2	0.0	16.6	18.8	7.5	0	9.9	90.0	79.5	10.9	72.6	253.1
1991	13.9	124.0	3.2	33.57	104.6	31.3	0.0	14.9	15.8	4.6	0	18.0	134.3	159.9	3.2	66.5	363.8
1992	15.8	95.1	1.3	21.02	107.8	58	0.0	25.9	25.1	8.7	0	16.2	148.7	161.8	1.3	63.2	374.9
1993	6.2	46.1	0.6	8.5	119.3	63.9	0.0	19.7	17.6	12.2	0	18.0	143.1	122.2	0.6	46.2	312.1
1994	4.7	48.7	1.0	14	77.6	24.6	0.0	18.3	7.2	12.4	0	10.3	89.5	85.7	1.0	43.0	219.2
1995	3.6	44.2	0.7	12.6	126.3	22.8	0.0	13.8	8.1	9.9	0	9.9	138.0	76.9	0.7	36.3	251.9
1996	16.2	48.0	1.6	12.5	75.5	22.2	0.0	8.4	8.6	8.3	0	10.8	100.3	78.5	1.6	31.7	212.1
1997	6.0	55.3	0.9	15.1	71.4	44.1	0.0	14.4	6.5	12.2	0	11.4	83.9	111.6	0.9	40.9	237.3
1998	4.0	16.7	0.9	5.8	20.8	20.6	0.0	18.9	4.8	0.7	0	14.4	29.6	38.0	0.9	39.1	107.6
1999	8.7	13.4	0.1	12.6	7.1	54.2	0.0	17.8	9.9	23.0	0	10.6	25.7	90.6	0.1	41.0	157.4
2000	0.7	3.3	0.0	7.5	0.3	3.3	0.0	9.2	0.2	7.7	0	10.1	1.2	14.3	0.0	26.8	42.4
2001	0.6	3.9	0.0	4.6	0.7	5.5	0.0	3.1	0.8	21.2	0	12.5	2.1	30.6	0.0	20.3	53.0
2002	0.2	0.0	0.0	2.1	0.4	0.3	0.0	3.6	0.4	2.2	0	3.7	1.0	2.5	0.0	9.4	12.9
2003	0.0	0.0	0.0	3.7	0.8	0.2	0.0	3.8	0.2	0.3	0	2.6	1.0	0.5	0.0	10.1	11.6
2004	0.0	0.0	0.0	3.5	0.2	0.5	0.0	2.4	0.1	0.8	0	4.5	0.3	1.3	0.0	10.4	12.0
2005	1.6	0.0	0.0	3.7	0.2	4.1	0.2	4.3	0.1	4.2	0.1	5.1	1.9	8.3	0.3	13.1	23.6
	Mean Annual Catch				Mean Annual Catch				Mean Annual Catch				Mean Annual Catch				
1980's	60.7	18.0	8.7	74.1	98.6	10.7	0.7	32.6	11.3	10.5	0.0	7.9	170.7	39.2	8.4	114.6	263.7
1990's	8.9	55.0	2.1	18.2	77.2	35.5	0.0	16.9	12.2	9.9	0.0	13.0	98.3	100.4	2.1	48.1	109.8
2000-2004	0.5	1.2	0.0	4.2	0.4	2.3	0.0	4.4	0.3	6.1	0.0	6.4	1.3	9.6	0.1	15.0	26.4

Note: GMT "Scorecard" from Nov. 2005 used for all 2005 catch estimates, [1/] 1983-2004 commercial catches from PacFIN, 1969-1982 catch assumed to be 1% of total Rockfish based on CalCom species composition estimates taken 1978-1982 after removing widow rock. Yelloweye are assumed to decline from 1% in 1969 to 0.08% of total rockfish by 1955. Trawl and hook-and-line catches grouped prior to 1969. Recreational catches 1980-2004 from RecFIN and all prior years catch (#'s of fish) assumed to be 0.5% yelloweye weighing 2.41 k (Miller and Gottshall, 1965) for all CPFV rockfish catches (Kevin Hill, NMFS personal communication) in Northern California waters and 0.025% of Southern California rockfish catches.

[2/] 1983-2004 Trawl catches from PacFIN, 1978-1983 from Tagart and Kimura (1982). 1991-2004 hook-and-line from PacFIN and 1982-1990 catches based species composition estimates taken for Washington line gears applied. Trawl and Line gear catch grouped prior to 1977 and yelloweye assumed to 1.0 % of total rockfish catch as reported in variuos Fisheries and Statistics of Oregon publications.

[3/] 1983-2004 Trawl catch from PacFIN, 1976-1982 from Tagart and Kimura (1982) then assumed to decline to 1 mt by 1955. 1970-1999 commercial line catc applies species composition estimates taken 1986-1999 to "other rockfish" catch across all years, catch then assumed to decline to 1 mt by 1955. Recreational catches from various WDF reports back to 1975, catch then assumed to decline to 1 mt.

Table 2. Differences between catch estimates used in the 2006 and 2005 assessments. Bracketed () catch indicate a reduction in catch otherwise an increase in catch. Differences in Initial equilibrium catch on first line.

#_init_equil_catch_for_each_fishery 2006-2005 values

	California		Oregon		Washington			Total		Grand
	(4.0)	7.8	(4.0)	0.8	(1.0)	0.0	0.0	(9.0)	8.6	(0.4)
Year	Rec [1/]	Com [2/]	Rec [3/]	Com [2/]	Rec [4/]	Com [2/]	Line	Rec	Com	Total
1955	(5.8)	23.1	(13.8)	8.9	(4.0)	1.0	0.0	(23.6)	33.0	9.4
1956	(3.4)	27.8	(13.5)	9.1	(4.0)	1.0	0.0	(20.9)	37.9	17.0
1957	(7.6)	30.5	(13.3)	9.4	(4.0)	1.0	0.0	(24.9)	40.9	16.0
1958	(4.2)	34.5	(13.0)	9.6	(3.0)	1.0	0.0	(20.2)	45.1	24.9
1959	(7.6)	29.9	(12.8)	9.9	(3.0)	1.0	0.0	(23.4)	40.8	17.4
1960	(10.0)	27.1	(12.5)	10.1	(3.0)	1.0	0.0	(25.5)	38.2	12.7
1961	(11.7)	21.6	(12.3)	10.4	(3.0)	1.0	0.0	(27.0)	33.0	6.0
1962	(10.9)	19.8	(12.0)	10.6	(3.0)	1.0	0.0	(25.9)	31.4	5.5
1963	(10.6)	24.2	(11.8)	10.9	(2.0)	3.0	0.0	(24.4)	38.1	13.7
1964	(11.5)	16.7	(11.5)	11.1	(2.0)	3.0	0.0	(25.0)	30.8	5.8
1965	(7.5)	19.7	(11.3)	11.4	(2.0)	3.0	0.0	(20.8)	34.1	13.3
1966	(5.0)	21.5	(11.0)	11.6	(2.0)	3.0	0.0	(18.0)	36.1	18.1
1967	(3.9)	21.2	(10.8)	11.9	(2.0)	3.0	0.0	(16.7)	36.1	19.4
1968	(2.7)	20.7	(10.5)	12.1	(2.0)	3.0	0.0	(15.2)	35.8	20.6
1969	(3.2)	39.5	(10.3)	26.2	(2.0)	3.0	0.0	(15.5)	68.7	53.2
1970	(3.3)	45.9	(13.5)	18.7	(1.0)	4.1	0.0	(17.8)	68.7	50.9
1971	(12.1)	41.6	(13.9)	18.5	(1.0)	3.6	0.0	(27.0)	63.7	36.7
1972	(11.1)	61.4	(14.2)	20.5	(1.0)	3.8	0.0	(26.3)	85.7	59.4
1973	(10.7)	78.5	(14.5)	15.7	(1.0)	6.4	0.0	(26.2)	100.6	74.4
1974	(12.4)	67.1	(14.9)	8.7	(1.0)	7.5	0.0	(28.3)	83.3	55.0
1975	(18.5)	71.2	(15.2)	2.3	0.0	4.3	0.0	(33.7)	77.8	44.1
1976	(24.6)	78.5	(15.5)	10.4	0.0	7.0	0.0	(40.1)	95.9	55.8
1977	(33.2)	71.5	(15.9)	10.8	0.0	16.9	0.0	(49.1)	99.2	50.1
1978	(41.2)	66.1	(16.3)	7.0	0.0	22.7	0.0	(57.5)	95.8	38.3
1979	(40.9)	97.0	(16.6)	7.5	1.2	22.5	0.0	(56.3)	127.0	70.7
1980	0.0	126.9	(8.0)	8.0	0.0	4.3	0.0	(8.0)	139.2	131.2
1981	0.0	(158.0)	10.0	8.5	0.0	6.1	0.0	10.0	(143.4)	(133.4)
1982	0.0	(24.8)	9.6	94.5	0.0	7.3	0.0	9.6	77.0	86.6
1983	0.0	0.0	(3.4)	15.9	0.0	8.9	0.0	(3.4)	24.8	21.4
1984	0.0	0.0	9.8	10.0	0.0	8.4	0.0	9.8	18.4	28.2
1985	0.0	0.0	(3.6)	10.0	0.0	9.6	0.0	(3.6)	19.6	16.0
1986	0.0	0.0	9.1	5.1	0.0	5.6	0.0	9.1	10.7	19.8
1987	0.0	0.0	(6.3)	6.3	0.0	11.0	0.0	(6.3)	17.3	11.0
1988	0.0	0.0	1.7	(5.0)	0.0	5.5	0.0	1.7	0.5	2.2
1989	0.0	0.0	1.5	(9.4)	0.0	8.8	0.0	1.5	(0.6)	0.9
1990	0.0	0.0	(2.0)	(12.5)	0.0	5.8	0.0	(2.0)	(6.7)	(8.7)
1991	0.0	0.0	(3.9)	0.0	0.0	2.8	0.0	(3.9)	2.8	(1.1)
1992	0.0	0.0	(0.1)	0.0	0.0	5.4	0.0	(0.1)	5.4	5.3
1993	0.0	0.0	(1.9)	0.0	0.0	3.2	0.0	(1.9)	3.2	1.3
1994	0.0	0.0	1.5	0.0	0.0	9.6	0.0	1.5	9.6	11.1
1995	0.0	0.0	5.6	0.0	0.0	9.8	0.0	5.6	9.8	15.4
1996	0.0	0.0	(7.0)	0.0	0.0	8.3	0.0	(7.0)	8.3	1.3
1997	0.0	0.0	(4.4)	0.0	0.0	0.0	0.0	(4.4)	0.0	(4.4)
1998	0.0	0.0	1.6	0.0	0.0	0.0	0.0	1.6	0.0	1.6
1999	0.0	0.0	8.3	0.0	0.0	0.0	0.0	8.3	0.0	8.3
2000	0.0	0.0	4.4	0.0	0.0	0.0	(0.0)	4.4	(0.0)	4.4
2001	0.0	0.0	0.0	0.0	0.0	0.0	(0.1)	0.0	(0.1)	(0.1)
2002	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2003	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2004	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	(313.6)	1000.7	(308.4)	424.7	(44.8)	248.2	(0.1)	(666.8)	1673.6	1006.8

Table 3. Historical rockfish landings in California waters from 1916 to 1955 (Heimann and Carlisle, 1970) and estimated catch of yelloweye. Catch estimates are not available for blank cells.

Historical Rockfish Landings in California

Year	Commercial Catch (mt) 1/	CPFV Catch Catch (mt) 2/
1916	2,231	
1917	3,526	
1918	3,739	
1919	2,449	
1920	2,555	
1921	2,160	
1922	1,956	
1923	2,312	
1924	2,151	
1925	2,490	
1926	3,421	
1927	2,899	
1928	2,912	
1929	2,738	
1930	3,277	
1931	3,301	
1932	2,557	
1933	2,172	
1934	2,088	
1935	2,191	
1936	2,088	139
1937	1,946	165
1938	1,650	163
1939	1,512	143
1940	1,620	205
1941	1,545	
1942	646	
1943	1,253	
1944	2,913	
1945	6,027	
1946	5,063	
1947	3,855	132
1948	2,952	279
1949	2,704	388
1950	3,681	462
1951	4,987	491
1952	4,866	480
1953	5,547	474
1954	5,734	782
1955	5,752	1182

1/ Commercial rockfish catch reported by Heimann and Carlisle (1970). 2/ Receational landings (#numbers offish) assumed to have an average weight of 1.5 kg.

Table 4. Historical observations of the yelloweye proportion in rockfish landings.

Source	Year of Estimate	Fishery	Proportion of Rockfish that are Yelloweye
Phillips, 1939.	1937-1938	Wholesale Monterey rockfish markets	0.6%
Nitsos and Reed, 1965.	1961-1962	Trawl caught animal food fishery in Calif.	0.1%
Heimann, 1963.	1960	Trawl caught rockfish in Monterey Bay	none reported
Miller and Gotshall, 1965 [1/]	1960	CPFV Cresent city to Avila	0.5%
Nitsos, R.J., 1965.	1962	Ca. Ottertrawl (Monterey Excluded)	0.2%
Don Pearson (NMFS personnel com.)	1978-1982	Ca. Trawl and Line fisheries (spp. Comps.)	1.00%

[1/] Miller and Gotshall reported 1,059 "Turkey Red" fish landed totaling 5,625 lbs (Ave. weight = 5.3 lbs or 2.41 k)

Table 5. Historical rockfish landings in Oregon waters between 1928 and 1953.

Historical rockfish landings in Oregon

	Total Rockfish [1/]	
Year	**Catch (lbs)**	**Catch (mt)**
1928	73,702	33
1929	128,265	58
1930	118,688	54
1931	90,833	41
1932	33,303	15
1933	48,709	22
1934	52,900	24
1935	48,800	22
1936	121,100	55
1937	153,800	70
1938	139,700	63
1939	163,800	74
1940	619,300	281
1941	1,301,400	590
1942	1,898,488	861
1943	6,923,325	3140
1944	11,367,169	5156
1945	17,458,309	7919
1946	10,867,187	4929
1947	6,799,941	3084
1948	4,658,388	2113
1949	4,737,478	2149
1950	4,163,795	1889
1951	3,670,157	1665
1952	3,760,818	1706
1953	1,986,794	901

[1/] 1928-1949 rockfish catch from: Fisheries Statistics ofOregon, F.C. Cleaver - Editor, Oregon Fish Commission, Portland, Oregon,Contribution No. 16, September, 1951. And 1950-1953 data from: Fisheries Statistics of Oregon, Harrison S., Fish Commission of Oregon, Portland, Oregon, Contribution No. 22,February 1956.

Table 6. Historical rockfish landings in Grays' Harbor and Willapa Harbor in1953.

Species	Month	Catch (lbs)	Gear	Area
Gen. Rockfish	Jan-July	250,304	Otter Trawl (GH)	Cape John-Cape Shoal
Black Rockfish	Apr-May	10,720	Otter Trawl (GH)	Cape Shoal
Red Rockfish	May-June	6,310	Otter Trawl (GH)	Cape Shoal
POP	Feb-Aug	160,473	Otter Trawl (GH)	Cape Flattery-Cape Tlmk
Red Snapper	April	17,595	Otter Trawl (GH)	Cape John-Cape Shoal
Gen. Rockfish	Feb-Nov	93,781	Troll (Grays Harbor)	Cape Flattery-Cape Tlmk
Red Snapper	May-Sept	364	Troll (Grays Harbor)	Cape Flattery-Cape Shoal
Gen. Rockfish	June&Oct	101	Troll (Willapa Harbor)	Cape shoal-Cape Tlmk
Red Rockfish	Sept	16	Troll (Willapa Harbor)	Cape shoal-Cape Tlmk
Gen & Red	Total	368,471		
Yelloweye %	1.0%	1.7		
From table belwo		0.4		
Total Yelloweye Catch (mt)		2.1		

Species	Month	Catch (lbs)	Gear	Area
Rockfish liver	March	342	Otter Trawl	Cape Shoal
Black Rockfish liver	May	126	Otter Trawl	Cape Shoal
Red Rockfihs liver	Jan-Oct	9841	Otter Trawl	Cape Flattery-Pt Lookout
POP liver	May-Sept	406	Otter Trawl	Cape Shoal

No data for Troll rockfish livers in GH & Willapa

Misc. data- All gears combined

Species	Month	Catch (lbs)	Gear	Area
Gen. Rockfish	Apr-May	344,056	all gears combined	Grays Harbor
Black Rockfish	Jan-Dec	10,720	all gears combined	Grays Harbor
Red Rockfish	May-June	6,310	all gears combined	Grays Harbor
POP	Feb-Aug	160,473	all gears combined	Grays Harbor
Red Snapper	Apr-Sept	17,959	all gears combined	Grays Harbor
Gen. Rockfish	Jun&Oct	101	all gears combined	Willapa Harbor
Red Rockfish	Sept	16	all gears combined	Willapa Harbor

Species	Month	Catch (lbs)	Gear	Area
Gen. Rockfish livers	March	342	all gears combined	Grays Harbor
Black Rockfish liver	May	126	all gears combined	Grays Harbor
Red Rockfish liver	Jan-Oct	12,898	all gears combined	Grays Harbor
POP liver	May&Sept	406	all gears combined	Grays Harbor

Table 7. Number of species composition estimates taken in Washington ports by Fishery since 1986.

Number of species compositions taken in Washington ports by Gear

YR	Bottomfish Troll	Hand-line-jig	Set Line	SN	Salmon Troll
86		33			6
87		1			
88	2	285	252		34
89	15	311	4	2	22
90	5	314	2	1	81
91		230			11
92		308	1		18
93		308			5
94		631	1		
95		197	350		
96		124	234		3
97			166		
98			146		
99			112		

Table 8. Summary of the estimated yelloweye rockfish von Bertalanffy growth function parameters by area and sex. Sizes are in cm fork length.

von Bertalanffy Growth Parameters

	Males						Females						Combined Sexes					
Area	Linf	K	t 0	t 20	t 40	N	Linf	K	t 0	t 20	t 40	N	Linf	K	t 0	t 20	t 40	N
California	67.3	0.054	-5.0	49.9	61.4	50	66.3	0.048	-7.8	49.0	59.7	79	65.4	0.052	-7.1	49.2	59.6	160
Oregon	67.3	0.054	-5.5	50.5	61.6	424	64.1	0.055	-6.0	48.6	58.9	531	65.4	0.055	-5.5	49.2	60.0	1060
Washington	68.5	0.050	-5.6	49.6	61.6	355	67.3	0.043	-9.3	48.1	59.1	286	67.5	0.047	-7.4	49.1	60.3	759
W-O-C	68.0	0.051	-6.0	50.0	61.5	779	64.9	0.051	-6.6	48.4	59.0	817	65.9	0.053	-5.9	49.2	60.1	1979
[1] Vancouver Is.	69.1	0.052	-3.7	49.2	62.1	684	66.4	0.052	-4.3	47.8	59.9	642	67.2	0.055	-3.5	48.6	60.9	1326
[2] Queen Charlotte Islands	68.3	0.053	-6.2	51.2	62.4	749	65.4	0.051	-6.6	48.7	59.4	997	65.8	0.056	-5.6	49.9	60.5	1746
[3] Bowie Seamount	79.3	0.043	-6.0	53.8	68.6	240	82.4	0.035	-7.8	50.9	66.6	228	81.0	0.038	-7.1	52.3	67.7	468
[4] SE Alaska	64.4	0.051	-5.4	46.9	58.1	1112	65.9	0.037	-11.6	45.6	56.3	1091	64.4	0.046	-7.6	46.2	57.1	2203

Table 9. Comparison of mean length estimates and standard deviations.

Source	L at Age 6	L at Age 60	K	CV @ Age 6	CV @ Age 60
External	30.8	63.9	0.053	0.180	0.098
SS1 Model estimates	26.9	65.7	0.049	0.128	0.095
SS2 (SS1 age error and catch)	23.1	64.1	0.059	0.141	0.134
SS2 Base Model (revised age error and catch)	22.6	64.6	0.063	0.082	0.051

Table 10. Length and age at 50% maturity for yelloweye rockfish by area and source.

		Male		Female	
Source	**Area**	A_{50}	L_{50}	A_{50}	L_{50}
O' Connell et.al. 2000	SE Alaska	23	50	21	45
Rosenthal et.al., 1982	SE Alaska	-	52-60	-	50-52
Kronlund and Yamanaka, 2000	Queen Charolotte Is.	-	-	18.9-20.3	48.5-49.1
Kronlund and Yamanaka, 2000	Vancouver Is.	-	-	16.5-17.2	42.1-42.4
Barss, 1989	Oregon	-	45	-	41
McClure, 1982 [1]	Oregon	12	56	11	45
Reilly et al. 1994 [2]	California		40		40
Watters, 1992 [1]	California	7	40	7	40

[1] Surface age reading of otoliths

[2] Sex unspecified

Table 11. Catch curve estimates of natural mortality.

Ricker Catch Curve Analyses

Area	Year	Age Range	Combined Sexes	Males	Females
Neah Bay, Washington	2000	16-34	0.076	0.060	0.083
		17-34	0.065	0.049	0.074
		18-34	0.048	0.036	0.056
		19-34	0.048	0.049	0.049
Bowie Seamount [1]	1999	19-46	0.025	0.021	0.033
		20-46	0.011	0.008	0.020
		21-46	-0.003	-0.007	0.009
Bowie Seamount-bright [2]	1999	>=20, 5yr Bins	-	0.086	0.043
SE Alaska [3]	1988	36-96,2yr Bins	0.02	-	-

[1] Data provide by Yamanaka, DFO Canada

[2] Yamanaka ,2000

[3] O'Connel et.al., 2000

Table 12. Natural mortality estimates derived from maximum age (Hoenig, 1983).

Empiracle use of longevity data to estimate natural mortality (Hoenig,1983)

			Sexes Combined				Males				Females			
Area	Year	Gear	Mean	Max	Mortality	N	Mean	Max	Mortality	N	Mean	Max	Mortality	N
California	77-85	Sport	25.8	122	0.038	163								
Neah Bay, Washington	98-00	Sport	25.8	87	0.053	296	25.2	79	0.058	152	26.6	87	0.053	144
N. Vancouver Island	97-98	Set Line	23.8	95	0.048	1129	23.8	109	0.042	577	24.9	94	0.049	552
Queen Charelotte	97-98	Set Line	24.3	115	0.040	1407	22.6	95	0.048	716	25.2	89	0.051	684
Bowie Seamount	99	Set Line	28.6	99	0.046	851	26.9	92	0.050	427	30.4	99	0.046	424
SE Alaska														

Note: Natural mortality was estimated using Hoenig's "all groups" a and b parameters.

Table 13. Fishery size and age composition sample size from California Fisheries. X in the size@age column indicates the year to which mean size-at-age observation was assigned for data source and negative values indicate sample data not used due to small sample size.

	Size		Age				
Year	**N**	**N 1/**	**N**	**N 1/**	**Size@Age**	**Catch (mt)**	**N/Catch**
SPORT							
1978	81					66	1.2
1979	119					71	1.7
1980	124		17	23		76	1.9
1981	83		33	23	X	47	2.5
1982	106		18	22		104	1.2
1983	105					51	2.1
1984	169					81	2.1
1985	300					126	2.4
1986	206					65	3.1
1987	98					75	1.3
1988	317					58	5.5
1989	385					59	6.6
1990	89					46	1.9
1991	112					34	3.3
1992	164					21	7.8
1993	236					8	27.9
1994	250					14	17.4
1995	199					13	15.8
1996	239					12	19.2
1997	250					15	16.5
1998	125					6	21.5
1999	88	66				13	7.0
2000	47	67				8	6.2
2001	15	15				5	3.3
2002	13	13				2	6.3
2003	15	15				4	4.1
2004	15	15				3	4.3
COMMERCIAL							
1978	50	15				33	1.5
1979	5	15				37	0.1
1980	11	15	12	6		41	0.6
1981	3	15		6		368	0.0
1982	8	15	8	6		202	0.1
1983	22	15	5	7		58	0.5
1984	18	15	17	20		45	0.8
1985	11	15	39	20		9	5.7
1986	14	15	5	21	X	31	0.6
1987	22	15				54	0.4
1988	14	15				65	0.2
1989	8	15				50	0.2
1990	10	15				80	0.1
1991	224					141	1.6
1992	493					112	4.4
1993	709					53	13.4
1994	748					54	13.8
1995	383					49	7.9
1996	534					66	8.1
1997	299					62	4.8
1998	54					22	2.5
1999	507	268				22	22.8
2000	28	267				4	7.0
2001	**132**					5	29.3

Table 14. Fishery size and age composition sample size from Oregon Fisheries. X in the size@age column indicates the year to which mean size-at-age observation was assigned for data source and negative values indicate sample data not used due to small sample size.

Year	Size N	N [1/]	Age N	N [1/]	Size@Age	Catch (mt)	N/Catch
SPORT							
1978	120		120			52	4.7
1979	106		169			55	5.0
1980	25	29				36	0.7
1981	13	29				24	0.5
1982	61	29				39	1.6
1983	17	29				66	0.3
1984	373					34	11.0
1985	222		244			30	15.3
1986	177		124		X	18	16.6
1987	163		140			36	8.5
1988	38		123			8	20.3
1989	112					14	7.7
1993	163		32			22	9.0
1994	151					17	9.0
1995	110					8	13.5
1996	73					15	4.7
1997	99					19	5.3
1998	147					17	8.5
1999	246					10	25.8
2000	62					5	12.8
2001	368		86			3	144.6
2002	448		73			4	144.3
2003	490					4	128.6
2004						2	0.0
COMMERCIAL							
1992	-13					165.8	-0.1
1995	98					149.1	0.7
1996	161					97.7	1.6
1997	256					115.5	2.2
1998	118					41.4	2.9
1999	166		24			61.3	3.1
2000	141					3.6	39.2
2001	248		38			6.2	46.1

Table 15. Fishery size and age composition sample size from Washington Fisheries. X in the size@age column indicates the year to which mean size-at-age observation was assigned for data source and negative values indicate sample data not used due to small sample size.

Year	Size N	N [1/]	Age N	N [1/]	Size@Age	Catch (mt)	N/Catch
SPORT							
1980	111	29				2.4	45.7
1981	45	29				3.4	13.3
1982	15	29				3.4	4.5
1983	7	29				6.7	1.0
1984	19	29				12.2	1.6
1985	15	29				8.8	1.7
1986	9	29				9.0	1.0
1987	34	28				10.5	3.2
1988	4	28				8.3	0.5
1995	9	11				9.9	0.9
1996	14	12				10.8	1.3
1998	48		25	60		14.4	3.3
1999	96		95	60		10.6	9.0
2000	189		189		X	10.1	18.6
2001	101		96			12.5	8.1
COMMERCIAL							
1996	266					8.6	30.9
1997	118					18.7	6.3
1998	40	34				5.5	7.3
1999	45	34				32.9	1.4
2000	17	34				0.2	85.0
2001						0.8	0.0
2002	48	23	48	23		0.4	120.0
2003	5	23	2	23		0.2	25.0
2004	16	23	14	23		0.1	160.0
LINE							
2000	344				X	7.7	44.4
2001	582		186			21.2	27.4
2002	139		139			2.2	63.2
2003	14		8			0.3	46.7
2004	24		14			0.8	30.0
IPHC (Washington and Oregon)							
2002	141						
2003	314						
2004	174						
2005	155						

Table 16. CPUE indices of abundance used in base run.

	CPFV per angler hour	**CA_MRFSS** per angler hour	**OR_Sport** per angler hour	**OSP_BFO** per angler trip	**IHPC** per set
1979			11.67		
1980		4.48	15.69		
1981		2.78	13.92		
1982		11.27	18.09		
1983		4.64	23.27		
1984		8.46	16.52		
1985		13.57			
1986		6.25	13.03		
1987		11.70	15.14		
1988	26.19	2.96	10.17		
1989	25.52	3.94	6.58		
1990	32.16		12.21	6.90	
1991	31.59		14.69	16.03	
1992	20.88		11.91	15.29	
1993	23.63	7.72	10.81	13.19	
1994	21.67	1.87	8.98	7.15	
1995	16.33	3.06	7.24	5.70	
1996	17.90	2.08	5.63	5.72	
1997	13.31	4.23		8.75	
1998	10.13	3.12	9.53	11.06	
1999		2.14	10.79	6.88	5.71
2000		3.39		6.45	
2001		1.18		4.42	4.82
2002					3.36
2003					4.8
2004					3.37
2005					2.65

Table 17. Number of interviewed trips in MRFSS, CPFV, and OSP data sets.

	Oregon MRFSS		N. California MRFSS		CPFV		OSP	
	Angler_hour	Trip	Angler_hour	Trip	Angler_hour	Trip	Halibut trip	Bottomfish trip
1980	15,765	294	80,417	694				
1981	7,347	174	25,221	217				
1982	12,581	182	24,836	262				
1983	7,718	151	10,780	135				
1984	22,610	393	46,099	378				
1985	11,872	239	146,683	997				
1986	15,480	224	132,868	836				
1987	16,950	189	39,321	363	3,658	148		
1988	25,463	286	84,401	550	10,423	351		
1989	30,389	254	68,479	371	9,796	384		
1990					2,706	120	4,470	20,678
1991					3,165	131	4,372	20,437
1992					7,041	376	3,386	19,797
1993	32,720	1,520	6,479	178	7,407	459	5,046	18,843
1994	42,252	1,446	16,043	500	6,323	458	5,576	25,821
1995	29,653	873	62,141	627	5,755	513	6,760	23,890
1996	36,014	1,463	245,694	2,061	5,978	557	7,760	26,046
1997	80,943	1,475	115,810	2,475	6,684	628	8,368	21,355
1998	47,331	1,343	89,658	1,160	4,243	431	9,500	21,889
1999	58,203	1,586	298,606	1,741			6,728	15,919
2000	31,795	916	106,164	680			6,641	16,719
2001	21,690	567	101,973	732			5,773	14,733

Table 18. Numbers of stations and yelloweye caught during the IPHC surveys. Note that values for the 1999 and 2001 yelloweye catch were expanded from the first 20 hooks of each skate. There are 100 hooks per skate.

Year	Yelloweye catch	no. of stations
1999	336	71
2000		
2001	203	84
2002	141	85
2003	317	85
2004	172	85
2005	156	85

Table 19. Summary of Northern California partyboat (CPFV) trips sampled, number retained for CPUE analysis and number positive for yelloweye rockfish.

		WAVE						Year Total
YEAR	Trips	1	2	3	4	5	6	
1980	Positive	3	2	9	4	6	2	26
	Retained	7	5	14	9	14	7	56
	Total Trips	13	21	37	37	31	46	185
1981	Positive	0	2	4	2	3	1	12
	Retained	2	5	8	8	9	2	34
	Total Trips	10	13	18	30	18	11	100
1982	Positive	1	1	3	2	4	2	13
	Retained	5	4	11	9	10	3	42
	Total Trips	10	15	26	24	18	5	98
1983	Positive	0	1	6	4	3	0	14
	Retained	1	5	19	13	6	3	47
	Total Trips	5	14	32	31	14	9	105
1984	Positive	5	2	7	6	7	3	30
	Retained	9	5	10	13	15	7	59
	Total Trips	22	19	30	30	32	24	157
1985	Positive	6	4	7	10	20	6	53
	Retained	14	14	16	24	31	11	110
	Total Trips	21	31	47	52	48	21	220
1986	Positive		7	12	7	11	3	40
	Retained		18	20	19	24	10	91
	Total Trips	21	25	35	43	35	23	182
1987	Positive	3	0	3	2	1	4	13
	Retained	5	4	6	4	5	8	32
	Total Trips	15	18	16	25	31	19	124
1988	Positive	5	2	1	3	3	2	16
	Retained	7	6	2	7	8	4	34
	Total Trips	12	24	8	30	16	16	106
1989	Positive			5	6	2	5	18
	Retained			6	13	9	7	35
	Total Trips	1		12	20	10	8	51
1993	Positive							
(not used)	Retained							
	Total Trips	1			5	60	56	122
1994	Positive	2	1			1		4
	Retained	9	7			9		25
	Total Trips	33	108	110	227	111	5	594
1995	Positive		0	7	8		0	15
	Retained		2	15	25		2	44
	Total Trips		13	35	89	1	4	142
1996	Positive	7	3	7	6	6	3	32
	Retained	17	18	21	32	25	11	124
	Total Trips	40	87	191	226	105	26	675
1997	Positive	1	1	3	11	5	5	26
	Retained	1	11	13	47	26	34	132
	Total Trips	2	70	105	245	139	94	655
1998	Positive	1	4	1	6	8	8	28
	Retained	2	6	6	30	34	22	100
	Total Trips	10	43	71	164	141	68	497
1999	Positive	8	8	3	4	6	2	31
	Retained	30	29	8	15	21	7	110
	Total Trips	63	79	82	76	52	21	373
2000	Positive	4		2	0	2	4	12
	Retained	8		6	4	12	17	47
	Total Trips	16	16	30	46	32	28	168
2001	Positive	3		0	2	2	0	7
	Retained	10		1	15	13	1	40
	Total Trips	16	12	50	82	50	12	222
2002	Positive	3			0	1		4
	Retained	16			6	6		28
	Total Trips	28	38	57	103	47	8	281
2003	Positive	1			1	1	1	4
	Retained	1			13	11	6	31
	Total Trips	18	37	65	129	78	27	354
Total Positive		53	38	80	84	92	51	398
Total Retained		144	139	182	306	288	162	1221
Total Trips		357	683	1057	1714	1069	531	5411

Table 20. Estimated year effects from delta-GLM of yelloweye rockfish CPUE (catch per hour) on northern California RecFIN trips.

Year	CPUE Index	CV
1980	0.0081	0.19
1981	0.0064	0.30
1982	0.0094	0.36
1983	0.0057	0.34
1984	0.0144	0.25
1985	0.0120	0.20
1986	0.0106	0.20
1987	0.0100	0.30
1988	0.0125	0.30
1989	0.0109	0.28
1994	0.0071	0.51
1995	0.0052	0.27
1996	0.0043	0.22
1997	0.0096	0.24
1998	0.0167	0.28
1999	0.0038	0.25
2000	0.0061	0.38
2001	0.0030	0.42
2002	0.0017	0.58
2003	0.0017	0.52

Table 21. Yelloweye rockfish biomass as estimated from area-swept densities observed in bottom trawl surveys.

	California			Oregon			Washington			Canada		
YEAR	**Biomass**	**CV**	**Tows**	**Biomass**	**CV**	**Tows**	**Biomass**	**CV**	**Tows**	**Biomass**	**CV**	**Tows**
					Depth Zone 55-183m							
1977	**0**		**0**	**68**	**0.78**	**2**	**232**	**0.29**	**14**	**0**		**0**
1980	**59**	**0.72**	**2**	**234**	**0.65**	**11**	**82**	**0.72**	**8**	**7**	**0.44**	**7**
1983	**4**	**1.00**	**1**	**180**	**0.43**	**11**	**510**	**0.58**	**14**	**4**	**0.50**	**4**
1986	**299**	**0.70**	**2**	**136**	**0.47**	**6**	**181**	**0.31**	**29**	**0**		**0**
1989	**83**	**0.54**	**8**	**187**	**0.52**	**11**	**463**	**0.36**	**8**	**17**	**0.62**	**17**
1992	**11**	**0.65**	**4**	**213**	**0.58**	**11**	**108**	**0.30**	**11**	**12**	**0.41**	**12**
1995	**18**	**1.00**	**1**	**44**	**0.96**	**3**	**22**	**0.60**	**3**	**6**	**0.58**	**6**
1998	**4**	**1.00**	**1**	**24**	**0.75**	**3**	**61**	**0.36**	**5**	**10**	**0.49**	**10**
2001	**0**		**1**	**172**	**0.52**	**8**	**111**	**0.49**	**9**	**3**	**0.75**	**3**
					Depth Zone 184-366m							
1977[a]	**0**		**0**	**0**		**0**	**23**	**0.61**	**3**	**0**		**0**
1980	**34**	**1.00**	**1**	**0**		**0**	**6**	**1.00**	**1**	**2**	**0.67**	**2**
1983	**4**	**1.00**	**1**	**126**	**0.58**	**4**	**49**	**0.75**	**5**	**0**		**0**
1986	**0**		**0**	**0**		**0**	**27**	**1.00**	**1**	**0**		**0**
1989	**1**	**1.00**	**1**	**12**	**1.00**	**1**	**2**	**0.79**	**1**	**1**	**1.00**	**1**
1992	**0**		**0**	**0**		**0**	**10**	**0.72**	**1**	**1**	**0.96**	**1**
1995	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**0**
1998	**4**	**1.00**	**1**	**0**		**0**	**1**	**1.00**	**0**	**1**	**1.00**	**1**
2001	**0**		**1**	**0**		**0**	**8**	**0.53**	**3**	**1**		**1**
					Depth zone 367-475							
1977[a]							52	0.60	3			

Table 22. Yelloweye submersible study area statistics.

Area Description	Area (ha)
Vancouver (U.S. only) shallow strata 55-183 meters	351,800
Study Area	55,680
Total Sampled Area	28
Study Area/U.S. Vancouver Area Ratio	15.8%

[1] *Vancouver US includes U.S. territorial coastal waters from 47 30' - U.S. Canadian Border.*

Table 23. Results from the 2002 yelloweye submersible survey in untrawlable habitat found in the US Vancouver INPFC area.

Study results for yelloweye rockfish

	All Fish	Age 3+ Fish [1]
Mean Length (cm)	50.0	51.7
Length Estimates (#'s of Fish)	38	36
Weight (kg) [2]	2.73	2.69
Number of Fish Observed	59	57
Mean Density (#'s per ha)	2.02	1.95
Estimated Numbers of Fish in Stu	112,586	108,746
Biomass in Study Area (mt)	307	292

[1] *Fish greater than 30 cm*

[2] *Weighted biomass*

Table 24. Adjusted NMFS trawl survey area swept estimates in the US Vancouver INPFC area.

	Washington State			U.S. Vancouver 55-183 meter			[2] Adjusted Biomass (mt)	
Year	Total	CV	[1] Tows	Total	CV	[1] Tows	U.S. Vancouver	Total Washington
1977	232	0.29	14	56	0.50	4	47	223.6
1980	82	0.72	8	57	1.00	2	48	73.0
1983	510	0.58	14	140	0.48	7	118	487.9
1986	181	0.31	29	120	0.44	18	101	162.1
1989	463	0.36	8	422	0.38	4	355	396.0
1992	108	0.30	11	82	0.33	8	69	95.2
1995	22	0.60	3	8	0.55	1	7	21.1
1998	61	0.36	5	52	0.39	4	44	53.0
2001	111	0.49	9	64	0.61	7	54	101.2
Mean	197	0.45	11	111	1	6	94	179
Median	111	0.36	9	64	0	4	54	101

[1] *Tows with yelloweye rockfish.*

[2] *WDFW adjustment to NMFS trawl survey biomass reflecting trawlable habitat in US Vancouver Area onl*

Table 25. Comparison of biomass estimates from the current assessment and the 2002 submersible survey in the US Vancouver INPFC area.

Comparison of biomass estimates

Area Model	Biomass (mt) [1/]	Ratio W-O-C
Current Yelloweye Stock Assessment		
W-O-C [2/]	1,593	
California [3/]	484	30.4%
Oregon [3/]	581	36.5%
Washington [3/]	312	19.6%
Survey Biomass Estimates		
Adjusted 2001 NMFS Trawl Survey for	101	
Study Survey	292	
Total Survey Based Biomass	393	

[1/] *Age 3+ Biomass in 2005*

[2/] *2006 Base Model Results*

[3/] *2006 Base Model Results*

[4/] *WDFW adjusted NMFS trawl survey biomass*

Table 26a. Comparison between 2005 and 2006 model configurations, parameter estimates and results.

Parameters Estimated (Bold) in Final Base Model

Area	**Coastwide**	**Coastwide**	**California**	**Oregon**	**Washington**
Assessment Year	2005	2006	2006	2006	2006
Start Year	1955	1955	1955	1955	1955
End Year	2004	2005	2005	2005	2005
Composition	Through 2004	Appended New	Appended New	Appended New	Appended New
Catch (Years Revised)	1980-2004	1955-1980	1955-1980	1955-1980	1955-1980
Number of Parameters	112	58	38	42	18
Estimated Recruitement Years	1955-2004	1968-1999	1968-1999	1968-1999	1984-1999
Objective function value	1171	1481	437	529	589
Selectivity	**Double Logistic**				
	Time varying	**Logistic**	**Logistic**	**Logistic**	**Logistic**
Peak	7 Fisheries	7 Fisheries	2 Fisheries	2 Fisheries	3 Fisheries
Initial	0.001	0.001	0.001	0.001	0.001
Ascending inflection	7 Fisheries	7 Fisheries	2 Fisheries	2 Fisheries	3 Fisheries
Ascending slope	7 Fisheries	7 Fisheries	2 Fisheries	2 Fisheries	3 Fisheries
Final	7 Fisheries	7 Fisheries	2 Fisheries	2 Fisheries	3 Fisheries
Descending inflection	7 Fisheries	na	na	na	na
Descending slope	7 Fisheries	na	na	na	na
Width of top	7 Fisheries	na	na	na	na
Mirror related sport fisheries	4 Surveys	4 Surveys	2 Surveys	2 Surveys	2 Surveys
Estimated		1 Survey	1 Survey	1 Survey	1 Survey
Age Error	Revised Age Error	Same as 2005	Same as 2005	Same as 2005	Same as 2005
Discard	Included in catch	Included in catch	Included in catch	Included in catch	Included in catch
M-G Parameters					
Natural Mortality (Young)	0.045	0.045	0.045	0.045	0.045
Old Offset	0	0	0	0	0
age_for_growth_Lmin	6	6	6	6	6
age_for_growth_Lmax	60	60	60	60	60
Body length @Agemin	**22.6**	**23.6**	**27.4**	**21.2**	Fixed to Oregon
Body length @Agemax	**64.6**	**61.4**	**57.9**	**61.0**	Fixed to Oregon
VonBert	**0.063**	**0.068**	**0.110**	**0.082**	Fixed to Oregon
CV@Age 6	**0.082**	**0.105**	**0.055**	**0.071**	Fixed to Oregon
CV@Age 60	**0.577**	**0.158**	**0.904**	**0.600**	Fixed to Oregon
Biology					
W-length-1	2.9696	2.9696	2.9696	2.9696	2.9696
W-length-2	0.0000	0.0000	0.0000	0.0000	0.0000
Mat-length-1	42.1	42.1	42.1	42.1	42.1
Mat-length-2	-0.415	-0.415	-0.415	-0.415	-0.415
S-R Parameters					
Ln(R0) (Lambda 0.5)	**5.269**	**5.233**	**4.487**	**4.254**	**3.231**
S-R Steepness (assumed, est ir	0.437	0.437	0.437	0.437	0.437
SD Recruitments (assumed, est	0.4	0.4	0.4	0.5	0.5
Enviro Link	0	0	0	0	0
Initial Equil	**0.01**	**0.03**	**0.01**	**0.01**	**0.01**
Final Results					
B_{2005}	2,008	1,593	484	581	312
SPB 0	3,808	3,255	1,686	1,271	457
SPB2001	798	616	170	232	112
Depletion	21.0%	18.9%	10.1%	18.2%	24.5%

Table 26b. Comparison between alternative model configurations, parameter estimates and results.

Parameters Estimated (Bold) in Final Base Model

Area	Coastwide	California	Oregon	Washington	Washington
Model Name	**CST-1b**	**CA-1b**	**OR-1b**	**WA-1b**	**WA-1c**
					Fit to Wa Sub Survey
Assessment Year	2006	2006	2006	2006	2006
Start Year	1955	1955	1955	1955	1955
End Year	2005	2005	2005	2005	2005
Composition	Appended New	Appended New	Appended New	Appended New	Appended New
Catch (Years Revised)	1955-1980	1955-1980	1955-1980	1955-1980	1955-1980
Number of Parameters	64	41	45	21	67
Estimated Recruitement Year	1968-1999	1968-1999	1968-1999	1984-1999	1984-1999
Objective function value	1469	433	527	590	589
Selectivity Type	**Dbl Logistic Rec**	**Dbl Logistic Rec**	**Dbl Logistic Rec**	**Dbl Logistic Rec**	**Logistic**
Age Error	Same as 2005	Same as 2005	Same as 2005	Same as 2005	Same as 2005
Discard	Included in catch	Included in catch	Included in catch	Included in catch	Included in catch
M-G Parameters					
Natural Mortality (Young)	0.045	0.045	0.045	0.045	0.045
Old Offset	0	0	0	0	0
age_for_growth_Lmin	6	6	6	6	6
age_for_growth_Lmax	60	60	60	60	60
Body length @Agemin	**23.6**	**27.4**	**21.2**	Fixed to Oregon	Fixed to Oregon
Body length @Agemax	**61.4**	**57.9**	**61.0**	Fixed to Oregon	Fixed to Oregon
VonBert	**0.068**	**0.110**	**0.082**	Fixed to Oregon	Fixed to Oregon
CV@Age 6	**0.105**	**0.055**	**0.071**	Fixed to Oregon	Fixed to Oregon
CV@Age 60	**0.158**	**0.904**	**0.600**	Fixed to Oregon	Fixed to Oregon
Biology					
W-length-1	2.9696	2.9696	2.9696	2.9696	2.9696
W-length-2	0.0000	0.0000	0.0000	0.0000	0.0000
Mat-length-1	42.1	42.1	42.1	42.1	42.1
Mat-length-2	-0.415	-0.415	-0.415	-0.415	-0.415
S-R Parameters					
Ln(R0) (Lambda 0.5)	**5.242**	**4.482**	**4.256**	**3.230**	**3.231**
S-R Steepness (assumed, est	0.437	0.437	0.437	0.437	0.437
SD Recruitments (assumed, e	0.4	0.4	0.5	0.5	0.5
Enviro Link	0	0	0	0	0
Initial Equil	**0.04**	**0.00**	**0.00**	**0.00**	**0.00**
Final Results					
B_{2006}	1619	475	580	313	314
SPB 0	6566	1677	1273	456	456
SPB2006	1271	176	235	113	113
Depletion	19.4%	10.5%	18.5%	24.8%	24.8%

Table 27. Convergence test for the base models.

Convergence test of base models using SS2 V1.21

Run	Obj. Func. Value	Max. Gradient	Hession	Depletion	Run	Obj. Func. Value	Max. Gradient	Hession	Depletion
	Coast-Wide Model					***Oregon Model***			
1	1480.05	0.000199822	184.398	18.9%	1	528.527	0.00027718	115.135	18.2%
2	2.01939E+12	1.04506E+15	184.398	100.0%	2	528.527	0.000195903	115.135	18.2%
3	1480.05	0.00131074	184.398	18.9%	3	528.527	0.000406173	115.135	18.2%
4	5.72071E+12	2.85438E+15	184.398	100.0%	4	528.527	0.000189687	115.135	18.2%
5	1480.05	6.75684E-05	184.398	18.9%	5	528.527	0.00026801	115.135	18.2%
6	1480.05	0.000218353	184.398	18.9%	6	528.527	0.000287327	115.135	18.2%
7	1480.05	0.000362469	184.398	18.9%	7	528.527	0.00006825	115.135	18.2%
8	2.48702E+12	1.74875E+15	184.398	100.0%	8	528.527	0.000290843	115.135	18.2%
9	1480.05	0.000152958	184.398	18.9%	9	528.527	0.000023134	115.135	18.2%
10	1480.05	0.000316715	184.398	18.9%	10	528.527	3.73447E-05	115.135	18.2%
11	5.64667E+13	3.0276E+16	184.398	100.0%	11	528.527	7.31964E-05	115.135	18.2%
12	4.38991E+17	3.55971E+20	184.398	100.0%	12	528.527	4.68811E-05	115.135	18.2%
13	1480.05	0.000734386	184.398	18.9%	13	528.527	6.58172E-05	115.135	18.2%
14	1480.05	0.000094615	184.398	18.9%	14	528.527	9.56227E-05	115.135	18.2%
15	2.4039E+16	2.11462E+19	184.398	100.0%	15	528.527	7.02865E-05	115.135	18.2%
16	1480.05	0.00172253	184.398	18.9%	16	528.527	0.000741329	115.135	18.2%
17	1480.05	0.00224036	184.398	18.9%	17	528.527	1.43859E-05	115.135	18.2%
18	1480.05	5.33006E-05	184.398	18.9%	18	528.527	0.00008854	115.135	18.2%
19	1480.05	0.000508299	184.398	18.9%	19	528.527	0.000062811	115.135	18.2%
20	2.35306E+13	1.13591E+16	184.398	100.0%	20	528.527	9.45772E-05	115.135	18.2%
21	1480.05	0.000260828	184.398	18.9%	21	528.527	3.37473E-05	115.135	18.2%
22	1480.05	0.000103058	184.398	18.9%	22	528.527	0.000092456	115.135	18.2%
23	1480.05	0.00625271	184.398	18.9%	23	528.527	2.59858E-05	115.135	18.2%
24	8.67482E+13	5.30047E+16	184.398	100.0%	24	528.527	2.59858E-05	115.135	18.2%
25	1480.05	0.00058619	184.398	18.9%	25	528.527	2.63323E-05	115.135	18.2%
	California Model					***Washington Model***			
1	432.881	0.000155719	115.072	10.1%	1	589.384	3.54E-05	68.99	24.5%
2	432.881	2.15347E-05	115.072	10.1%	2	589.384	8.53E-05	68.99	24.5%
3	432.881	4.93922E-05	115.072	10.1%	3	589.384	6.12E-05	68.99	24.5%
4	432.881	9.62336E-05	115.072	10.1%	4	589.384	5.79E-05	68.99	24.5%
5	432.881	5.83771E-05	115.072	10.1%	5	589.384	8.75E-06	68.99	24.5%
6	432.881	1.79366E-05	115.072	10.1%	6	589.384	8.75E-06	68.99	24.5%
7	432.881	7.55239E-05	115.072	10.1%	7	589.384	7.84E-07	68.99	24.5%
8	432.881	3.17318E-05	115.072	10.1%	8	589.384	2.30E-05	68.99	24.5%
9	432.881	9.46131E-05	115.072	10.1%	9	589.384	5.17E-06	68.99	24.5%
10	479.586	8545.02		38.3%	10	589.384	4.95E-04	68.99	24.5%
11	432.881	0.000291002	115.072	10.1%	11	589.384	5.61E-05	68.99	24.5%
12	432.881	8.76344E-05	115.072	10.1%	12	589.384	1.07E-04	68.99	24.5%
13	432.881	1.40817E-05	115.072	10.1%	13	589.384	3.02E-06	68.99	24.5%
14	432.881	0.00006416	115.072	10.1%	14	589.384	2.44E-06	68.99	24.5%
15	432.881	2.16804E-05	115.072	10.1%	15	589.384	8.65E-05	68.99	24.5%
16	432.881	7.42887E-05	115.072	10.1%	16	589.384	3.75E-05	68.99	24.5%
17	432.881	0.000101997	115.072	10.1%	17	589.384	3.87E-05	68.99	24.5%
18	432.881	5.57475E-05	115.072	10.1%	18	589.384	2.17E-05	68.99	24.5%
19	432.881	9.79033E-05	115.072	10.1%	19	589.384	1.18E-05	68.99	24.5%
20	432.881	1.28848E-05	115.072	10.1%	20	589.384	6.23E-05	68.99	24.5%
21	432.881	3.35142E-05	115.072	10.1%	21	589.384	5.16E-05	68.99	24.5%
22	432.881	0.000591106	115.072	10.1%	22	589.384	8.71E-06	68.99	24.5%
23	432.881	0.000011705	115.072	10.1%	23	589.384	1.36E-06	68.99	24.5%
24	432.881	4.11385E-05	115.072	10.1%	24	589.384	2.90E-05	68.99	24.5%
25	432.881	5.73436E-05	115.072	10.1%	25	589.384	1.01E-04	68.99	24.5%

Note: Blank cells indicate non-convergence and depletion=100% results have unreasonable estimates for Fpenalty.

Table 28. Biomass results from base models.

	Coastwide Model				California Model				Oregon Model				Washington Model			
Year	bio-all	bio-smry	Recruit	SpawnBio	bio-all	bio-smry	Recruit	SpawnBio	bio-all	bio-smry	Recruit	SpawnBio	bio-all	bio-smry	Recruit	SpawnBio
1953	7616	7546	187	3255	3873	3839	89	1685	2928	2902	70	1271	1052	1042	25	456
1954	7556	7483	194	3209	3639	3606	89	1572	2899	2872	70	1257	993	984	25	428
1955	7555	7483	186	3209	3639	3606	87	1572	2899	2872	70	1257	993	984	25	428
1956	7508	7437	186	3188	3608	3576	87	1559	2884	2858	70	1250	992	983	25	427
1957	7455	7385	186	3165	3571	3539	86	1542	2869	2842	70	1243	991	982	25	427
1958	7403	7333	185	3141	3536	3504	86	1526	2853	2827	70	1236	990	981	25	426
1959	7343	7273	185	3114	3494	3462	86	1507	2837	2811	70	1228	988	979	25	426
1960	7291	7222	184	3090	3460	3428	85	1491	2821	2795	69	1221	986	977	25	425
1961	7244	7175	184	3069	3432	3400	85	1478	2805	2779	69	1213	984	975	25	424
1962	7205	7135	183	3051	3412	3380	85	1469	2789	2763	69	1205	982	973	25	423
1963	7166	7097	183	3034	3393	3361	85	1460	2772	2746	69	1197	980	971	25	422
1964	7119	7050	183	3013	3369	3337	84	1449	2755	2729	69	1189	975	966	25	420
1965	7081	7012	182	2996	3354	3323	84	1442	2738	2712	69	1181	970	961	25	418
1966	7035	6967	182	2976	3333	3301	84	1433	2721	2695	69	1173	966	956	25	415
1967	6986	6917	181	2954	3307	3275	84	1421	2703	2678	68	1165	961	952	24	413
1968	6925	6867	103	2932	3276	3249	44	1409	2686	2660	68	1157	956	947	24	411
1969	6872	6816	162	2909	3246	3223	55	1397	2664	2643	39	1149	951	942	24	409
1970	6831	6733	497	2872	3202	3179	82	1377	2656	2611	243	1134	947	938	24	407
1971	6755	6637	278	2832	3151	3119	113	1352	2634	2588	82	1123	940	931	24	404
1972	6670	6550	198	2794	3097	3065	65	1329	2608	2559	74	1111	934	925	24	401
1973	6547	6462	207	2738	3011	2982	58	1293	2575	2546	73	1095	927	918	24	398
1974	6410	6320	311	2670	2897	2875	57	1245	2562	2513	238	1080	919	909	24	394
1975	6284	6183	282	2603	2789	2768	56	1199	2525	2479	52	1064	909	900	24	389
1976	6146	6053	152	2535	2681	2656	86	1150	2493	2452	43	1049	901	892	24	386
1977	5983	5915	121	2456	2565	2534	102	1095	2453	2436	38	1028	890	881	24	380
1978	5819	5768	140	2372	2453	2420	77	1043	2408	2393	39	1005	867	858	24	370
1979	5685	5615	294	2289	2343	2313	62	993	2376	2350	132	980	842	834	23	358
1980	5483	5388	316	2175	2206	2169	154	926	2317	2277	141	941	815	806	23	345
1981	5192	5091	196	2031	1980	1946	57	824	2254	2215	48	905	783	774	23	330
1982	4869	4784	177	1881	1749	1713	82	718	2153	2123	53	856	775	766	22	326
1983	4497	4427	182	1714	1497	1471	70	602	2075	2006	432	798	764	756	22	321
1984	4212	4134	263	1583	1416	1393	38	562	1851	1784	51	702	747	738	22	313
1985	4067	3970	324	1508	1328	1309	49	516	1778	1709	83	672	727	719	22	304
1986	3866	3777	126	1422	1234	1217	46	469	1685	1663	42	635	699	691	21	291
1987	3740	3675	80	1371	1184	1163	69	441	1625	1604	40	613	682	674	20	283
1988	3561	3527	67	1297	1098	1079	38	402	1555	1537	59	584	653	646	14	270
1989	3377	3350	70	1220	1016	999	27	369	1476	1460	27	546	625	620	11	258
1990	3131	3105	73	1113	946	934	28	343	1340	1327	21	479	579	574	10	237
1991	2989	2963	66	1052	857	846	26	311	1311	1302	21	457	550	546	11	224
1992	2735	2711	57	949	718	708	29	259	1223	1215	21	413	521	516	15	211
1993	2467	2444	60	843	616	608	16	220	1093	1086	14	356	481	475	24	193
1994	2253	2231	59	762	585	576	25	209	948	942	10	300	447	436	49	175
1995	2120	2100	42	720	553	536	91	194	879	874	12	279	426	415	16	166
1996	1949	1932	39	666	517	500	19	181	763	758	15	245	407	397	16	158
1997	1810	1794	43	626	461	446	16	162	697	691	15	231	388	382	15	150
1998	1640	1624	44	575	404	398	14	142	603	596	26	205	365	360	15	141
1999	1589	1573	46	569	396	390	14	140	572	564	26	201	353	348	14	137
2000	1491	1471	72	540	385	379	19	135	519	509	24	186	321	315	13	122
2001	1499	1475	73	553	397	391	19	139	527	517	25	196	314	309	13	118
2002	1494	1467	73	560	412	405	20	143	537	527	26	205	291	286	12	107
2003	1524	1497	75	580	433	425	21	151	550	540	27	215	296	292	12	107
2004	1553	1524	77	599	451	443	22	159	562	552	28	223	305	300	13	110
2005	1579	1550	79	616	469	460	23	170	575	564	29	231	311	307	13	112

Table 29. Estimates of average fishing mortality from each base model.

Year	Average Fishing Mortaily Rates			
	Coastwide	California	Oregon	Washington
1953				
1954				
1955	0.007	0.010	0.005	0.003
1956	0.008	0.012	0.005	0.003
1957	0.008	0.012	0.005	0.003
1958	0.009	0.014	0.006	0.004
1959	0.008	0.012	0.006	0.004
1960	0.008	0.010	0.006	0.004
1961	0.007	0.008	0.006	0.004
1962	0.007	0.008	0.006	0.004
1963	0.008	0.010	0.007	0.006
1964	0.007	0.007	0.007	0.006
1965	0.008	0.009	0.007	0.006
1966	0.009	0.011	0.007	0.007
1967	0.009	0.011	0.007	0.007
1968	0.009	0.011	0.008	0.007
1969	0.013	0.017	0.013	0.007
1970	0.014	0.020	0.010	0.009
1971	0.014	0.019	0.011	0.008
1972	0.020	0.029	0.014	0.009
1973	0.025	0.038	0.015	0.011
1974	0.025	0.038	0.015	0.012
1975	0.026	0.042	0.015	0.011
1976	0.031	0.048	0.020	0.015
1977	0.034	0.048	0.023	0.027
1978	0.035	0.048	0.025	0.030
1979	0.050	0.068	0.040	0.035
1980	0.067	0.111	0.039	0.042
1981	0.077	0.132	0.058	0.015
1982	0.094	0.168	0.073	0.019
1983	0.085	0.073	0.126	0.028
1984	0.061	0.089	0.059	0.032
1985	0.073	0.103	0.072	0.045
1986	0.056	0.078	0.057	0.031
1987	0.074	0.111	0.067	0.049
1988	0.081	0.113	0.084	0.049
1989	0.109	0.108	0.139	0.082
1990	0.082	0.136	0.069	0.059
1991	0.126	0.217	0.122	0.066
1992	0.145	0.197	0.170	0.093
1993	0.134	0.101	0.205	0.097
1994	0.100	0.119	0.132	0.065
1995	0.123	0.113	0.198	0.063
1996	0.111	0.159	0.142	0.066
1997	0.135	0.178	0.194	0.076
1998	0.065	0.068	0.097	0.052
1999	0.102	0.089	0.137	0.127
2000	0.028	0.030	0.023	0.056
2001	0.036	0.022	0.016	0.116
2002	0.008	0.005	0.007	0.022
2003	0.007	0.008	0.008	0.010
2004	0.007	0.007	0.005	0.017
2005	0.014	0.011	0.014	0.029

Table 30. Profile of likelihood and other model outcomes over a range of fixed values for the initial recruitment level (virgin recruitment) for the Coast-Wide model.

Bold = Estimated — **R_0 Profile**

Model Initial R_0	**145**	**152**	**159**	**166**	**173**	**180**	**187**	**194**	**201**	**208**	**215**	**222**	**229**	**236**	**243**
RUN FILE	SS2-15	SS2-16	SS2-17	SS2-18	SS2-19	SS2-20	SS2-21	SS2-22	SS2-23	SS2-24	SS2-25	SS2-26	SS2-27	SS2-28	SS2-29
S-R Parameters															
Ln(R0)	**4.977**	**5.024**	**5.069**	**5.112**	**5.153**	**5.193**	**5.233**	**5.268**	**5.303**	**5.338**	**5.371**	**5.403**	5.434	**5.464**	**5.493**
S-R Steepness (model est)	**0.437**	**0.437**	**0.437**	**0.437**	**0.437**	**0.437**	**0.437**	**0.437**	**0.437**	**0.437**	**0.437**	**0.437**	0.437	**0.437**	**0.437**
SD Recruitments	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Enviro Link	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Initial Equil	0.0349	0.0349	0.0349	0.0349	0.0349	0.0349	0.0349	0.0349	0.0349	0.0349	0.0349	0.0349	0.0349	0.0349	0.0349
SPB 0					6007	6252	6508	6739	6979	7228	7471	7713	7956	8199	8440
SPB2005					907	1052	1251	1467	1736	2087	2484	2915	3366	3824	4300
Depletion					15.1%	16.8%	19.2%	21.8%	24.9%	28.9%	33.2%	37.8%	42.3%	46.6%	51.0%
LIKELIHOOD	**No Convergence or crash**				**1494.8**	**1483.1**	**1479.7**	**1481.6**	**1486.5**	**1493.2**	**1500.5**	**1507.7**	**1514.5**	**1521.6**	**1526.8**
indices					27	27	28	28	30	32	35	38	41	44	47
discard					0	0	0	0	0	0	0	0	0	0	0
length_comps					967	965	966	969	972	976	979	983	986	990	990
age_comps					406	399	395	394	394	393	392	391	390	390	389
size-at-age					76	76	76	77	78	78	78	78	78	77	78
mean_body_wt					0	0	0	0	0	0	0	0	0	0	0
Equil_catch					0	0	0	0	0	0	0	0	0	0	0
Recruitment					19	16	14	13	14	15	16	18	19	21	24
Parm_priors					0	0	0	0	0	0	0	0	0	0	0
Parm_devs					0	0	0	0	0	0	0	0	0	0	0
penalties					0	0	0	0	0	0	0	0	0	0	0
Forecast_Recruitment					0	0	0	0	0	0	0	0	0	0	0
CaCPFV Index					3.7	4.0	4.6	5.2	6.1	7.3	8.6	10.0	11.2	12.3	13.5
Ca MRFSS Index					19.3	19.1	19.3	19.7	20.4	21.5	22.9	24.4	25.9	27.3	28.8
OrRec Index					3.1	2.9	2.6	2.5	2.4	2.3	2.4	2.5	2.7	2.8	3.1
Wa Rec Index					1.1	1.0	1.0	0.9	0.9	1.0	1.0	1.0	1.1	1.1	1.1
IPHC					0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.1

Table 31. Profile of likelihood and other model outcomes over a range of fixed values for steepness for the Coast-wide Model.

Bold = Estimated — **Profile on Steepness**

Model	**0.05**	**0.1**	**0.15**	**0.2**	**0.25**	**0.3**	**0.35**	**0.4**	**0.45**	**0.5**	**0.55**	**0.6**	**0.65**	**0.7**	**0.75**
RUN FILE	SS2-30	SS2-31	SS2-32	SS2-33	SS2-34	SS2-35	SS2-36	SS2-37	SS2-38	SS2-39	SS2-40	SS2-41	SS2-42	SS2-43	SS2-44
S-R Parameters															
Ln(R0)	**5.273**	**5.242**	**5.234**	**5.230**	**5.230**	**5.228**	**5.229**	**5.231**	**5.234**	**5.229**	**5.242**	5.24585	**5.25039**	**5.25505**	**5.25967**
S-R Steepness (model est)	**0.05**	**0.1**	**0.15**	**0.2**	**0.2**	**0.3**	**0.35**	**0.4**	**0.45**	**0.35**	**0.55**	0.6	**0.65**	**0.7**	**0.75**
SD Recruitments	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Enviro Link	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Initial Equil	**0.0349**	**0.0349**	**0.0349**	**3.49E-02**	**0.0349**	**0.0349**	**0.0349**	**0.0349**	**0.0349**	**0.0349**	**0.0349**	0.0349	**0.0349**	**0.0349**	**0.0349**
SPB 0	6776	6567	6512	6485	6485	6476	6483	6496	6515	6483	6563	6592	6622	6653	6683
SPB2005	532	610	695	787	787	971	1072	1177	1280	1072	1477	1570.14	1658	1741	1819
Depletion	0.08	0.09	0.11	0.12	0.12	0.15	0.17	0.18	0.20	0.17	0.23	0.24	0.25	0.26	0.27
LIKELIHOOD	1543	1502	1488	1481	1481	1477	1478	1479	1480	1478	1483	1484	1486	1487	1488
indices	**35**	**32**	**30**	**29**	**29**	**27**	**27**	**27**	**28**	**27**	**29**	29.5308	**30**	**31**	**31**
discard	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
length_comps	984.0	975.6	971.8	969.7	969.7	967.0	966.5	966.3	966.2	966.5	966.1	966.1	966.0	965.9	965.8
age_comps	374.6	381.9	385.3	388.4	388.4	392.1	393.5	394.7	395.6	393.5	397.1	397.6	398.1	398.5	398.9
size-at-age	75.0	71.6	72.3	72.5	72.5	74.5	75.3	75.9	76.5	75.3	77.4	77.8	78.1	78.4	78.7
mean_body_wt	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Equil_catch	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Recruitment	73.7	40.3	27.7	21.6	21.6	16.4	15.1	14.4	13.9	15.1	13.4	13.3	13.2	13.1	13.1
Parm_priors	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Parm_devs	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
penalties	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Forecast_Recruitment	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CaCPFV Index	4.4	4.0	3.7	3.5	3.5	3.7	4.0	4.3	4.7	4.0	5.5	5.9	6.3	6.6	6.9
Ca MRFSS Index	23.4	22.1	21.0	20.1	20.1	19.3	19.2	19.2	19.4	19.2	19.9	20.2	20.5	20.8	21.1
OrRec Index	5.0	4.6	4.1	3.7	3.7	3.1	2.9	2.7	2.6	2.9	2.4	2.4	2.3	2.3	2.3
Wa Rec Index	2.0	1.7	1.5	1.3	1.3	1.1	1.0	1.0	1.0	1.0	0.9	1.0	1.0	1.0	1.0
IPHC	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.1	0.2	0.2	0.2	0.2	0.2

Table 32. Profile of likelihood and other model outcomes over a range of Lambda values on the SR curve.

Bold = Estimated	**Rec from SR**	**Rec from SR**	**SR Lamda Profile**				
Model	**Emp 0 for comps Force SR**	**for comps Force SR**	**10**	**1**	**0.5**	**0.01**	**0.001**
RUN FILE	SS2-1	SS2-2	SS2-3	SS2-4	SS2-5	SS2-6	SS2-7
S-R Parameters							
Ln(R0)	5.190	5.242	5.296	5.242	5.229	5.229	5.229
S-R Steepness (model est)	0.437	0.437	0.437	0.437	**0.437**	**0.437**	**0.437**
SD Recruitments	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Enviro Link	0	0	0	0	0	0	0
Initial Equil	0.0349	0.0349	0.0349	0.0349	0.0349	0.0349	0.0349
SPB 0	6234	6564	6933	6564	6480	6480	6481
SPB2005	710	1181	1150	1181	1462	1462	1470
Depletion	0.11	0.18	0.17	0.18	0.23	0.23	0.23
LIKELIHOOD	**29**	**1492.19**	**1582**	**1492.19**	**1464**	**1464**	**1463**
indices	26.9	27.4	27.8	27.4	28.8	28.8	28.9
discard	0.0	0.0	0.0	0.0	0.0	0.0	0.0
length_comps	0.0	967.9	1000.6	967.9	964.8	964.8	964.8
age_comps	0.0	397.1	418.0	397.1	393.9	393.9	393.8
size-at-age	0.0	77.3	81.6	77.3	75.5	75.5	75.5
mean_body_wt	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Equil_catch	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Recruitment	1.9	22.4	54.1	22.4	0.4	0.4	0.0
Parm_priors	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Parm_devs	0.0	0.0	0.0	0.0	0.0	0.0	0.0
penalties	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Forecast_Recruitment	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CaCPFV Index	4.3	4.3	4.5	4.3	5.5	5.5	5.5
Ca MRFSS Index	18.6	19.2	19.4	19.2	19.8	19.8	19.9
OrRec Index	2.9	2.7	2.8	2.7	2.4	2.4	2.4
Wa Rec Index	0.967	0.983	0.992	0.983	0.951	0.951	0.951
IPHC	0.098	0.154	0.164	0.154	0.161	0.161	0.161

Table 33. Profile of likelihood and other model outcomes over a range of Lambda values on the size, age and mean-size-at-age compostion.

Bold = Estimated	**Length, Age and Size Profile**						
Model Lamda	**100**	**10**	**1**	**0.5**	**0.1**	**0.01**	**0.001**
RUN FILE	SS2-8	SS2-9	SS2-10	SS2-11	SS2-12	SS2-13	SS2-14
S-R Parameters							
Ln(R0)	**5.324**	**5.271**	**5.234**	**5.234**	**5.265**	**5.304**	5.30518
S-R Steepness (model est)	**0.437**	**0.437**	**0.437**	**0.437**	**0.437**	**0.437**	0.437
SD Recruitments	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Enviro Link	0	0	0	0	0	0	0
Initial Equil	**0.0349**	**0.0349**	**0.0349**	**0.0349**	**0.0349**	**0.0349**	0.0349
SPB 0	7128	6761	6513	6515	6718	6987	6995
SPB2005	3,342	2,236	1,361	1,222	1,117	1,114	1,038
Depletion	0.469	0.331	0.209	0.188	0.166	0.159	0.148
LIKELIHOOD	238526	23922.7	2437.55	1239.95	277.119	55.1195	31.8194
indices	47.5	36.2	28.2	27.5	27.3	27.8	27.7
discard	0.0	0.0	0.0	0.0	0.0	0.0	0.0
length_comps	161329.0	16109.1	1609.8	805.4	162.4	17.0	1.9
age_comps	64659.2	6503.5	657.1	329.9	67.3	7.1	0.7
size-at-age	12438.5	1242.8	126.2	63.9	13.4	1.4	0.1
mean_body_wt	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Equil_catch	1.5	0.0	0.0	0.0	0.0	0.0	0.0
Recruitment	50.3	31.1	16.1	13.3	6.6	1.7	1.3
Parm_priors	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Parm_devs	0.0	0.0	0.0	0.0	0.0	0.0	0.0
penalties	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Forecast_Recruitment	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CaCPFV Index	14.2	9.3	5.0	4.4	4.1	4.5	4.6
Ca MRFSS Index	28.9	23.3	19.5	19.3	19.2	19.3	19.2
OrRec Index	3.0	2.4	2.5	2.6	2.8	2.9	2.8
Wa Rec Index	1.2	1.0	1.0	1.0	1.0	1.0	1.0
IPHC	0.178	0.171	0.158	0.155	0.153	0.166	0.173

Table 34: Summary of the estimated parameters in fitting both Models I and II.

Age (year) [>= age]	No. of yelloweye rockfish used	Estimates					
		Model I				Model II	
		$\hat{L}_\infty$ (cm)	$\hat{K}$ (per year)	$\hat{t}_0$ (year)	$\hat{L}_0$ (cm)	$\hat{L}_\infty$ (cm)	$\hat{K}$ (per year)
5	730	63.38	0.04614	-11.16	25.50	**59.94**	**0.08314**
10	723	64.64	0.03764	-16.86	30.37	60.05	0.08268
15	697	65.46	0.03318	-21.01	32.86	60.37	0.08042
20	559	65.42	0.03341	-20.70	32.66	61.37	0.07290
25	364	67.43	0.02403	-36.08	29.09	62.31	0.06583
30	268	68.62	0.02041	-45.10	41.29	62.92	0.06095

Table 35: Summary of the number of yelloweye used in modeling the growth of yelloweye rock fish.

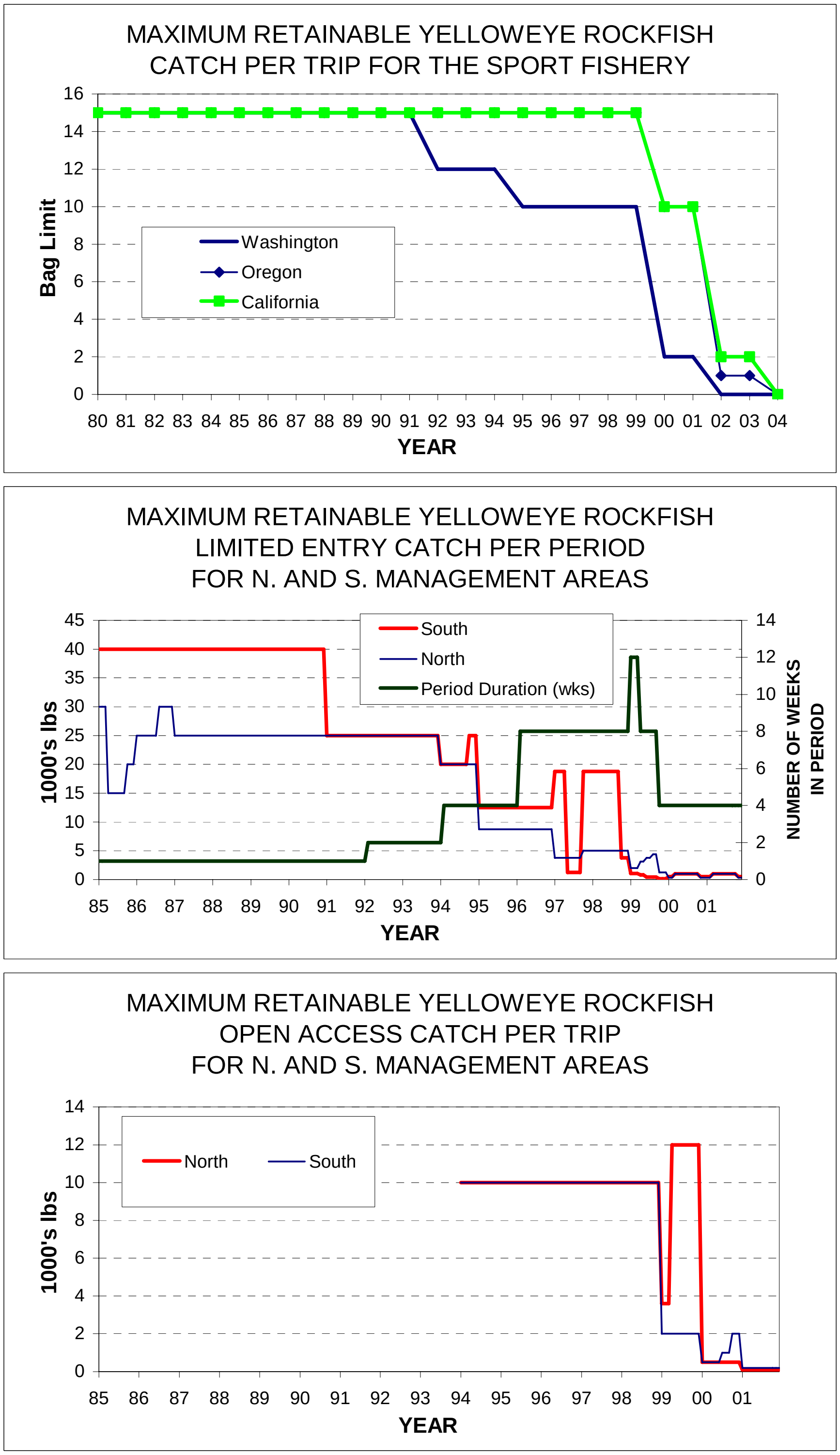
	No. of yelloweye collected	
Year	Columbia	Vancouver Island, US
1999	24	0
2001	19	125
2002	0	135
2003	208	10
2004	154	55

Table 36: Summary of estimated unknown parameters and their standard errors in the final sub-optimal model in Model III.

Parameters	Estimates (Model III)	Estimated standard error
$\hat{L}_\infty$ (cm)	64.44	0.5160
$\hat{K}$ (per year)	0.07779	0.001944
$\hat{r}_L$ (female) (cm)	-7.444	0.6678
$\hat{s}_K$ (Columbia) (per year)	-0.0009158	0.001531
$\hat{r}_K$	0.02224	0.0035
$\hat{y}_{K,2003}$	-0.008632	0.002408

Table 37: Summary of estimated yelloweye rockfish total mortality coefficients from years 1984 to 2002 in Washington, Oregon and California states. Bold value means the estimated coefficient was not significant (P>0.05).

Years	**Estimated total mortality coefficient [M+F] (standard error)**		
	Washington	**Oregon**	**California**
1984		0.17 (0.006)	
1985		0.09 (0.022)	
1986		0.13 (0.030)	
1987		0.14 (0.006)	
1989		0.18 (0.023)	0.08 (0.031)
1990			**0.09 (0.12)**
1991			0.10 (0.023)
1992			0.13 (0.014)
1993		0.09 (0.026)	0.14 (0.008)
1994			0.17 (0.013)
1995			0.15 (0.004)
1996	0.15 (0.031)		0.18 (0.006)
1997	0.20 (0.026)		0.14 (0.012)
1998	0.12 (0.017)		0.15 (0.016)
1999	0.08 (0.019)	0.07 (0.049)	0.15 (0.069)
2000	**0.07 (0.037)**		
2001	**0.02 (0.059)**	0.24 (0.063)	0.17 (0.076)
2002	0.08 (0.031)	0.21 (0.040)	



Note: The PFMC N/S Management border shifted North from Cape Mendencio to 40° 10' in 2000. Between Cape Mendocino and N of 36' N, recreational rockfish fishing is closed 3/1 - 4/30; S of 36' N, recreational rockfish fishing is closed 1/1 - 2/29

Figure 1. Yelloweye management history by fishery and area 1985-2004.

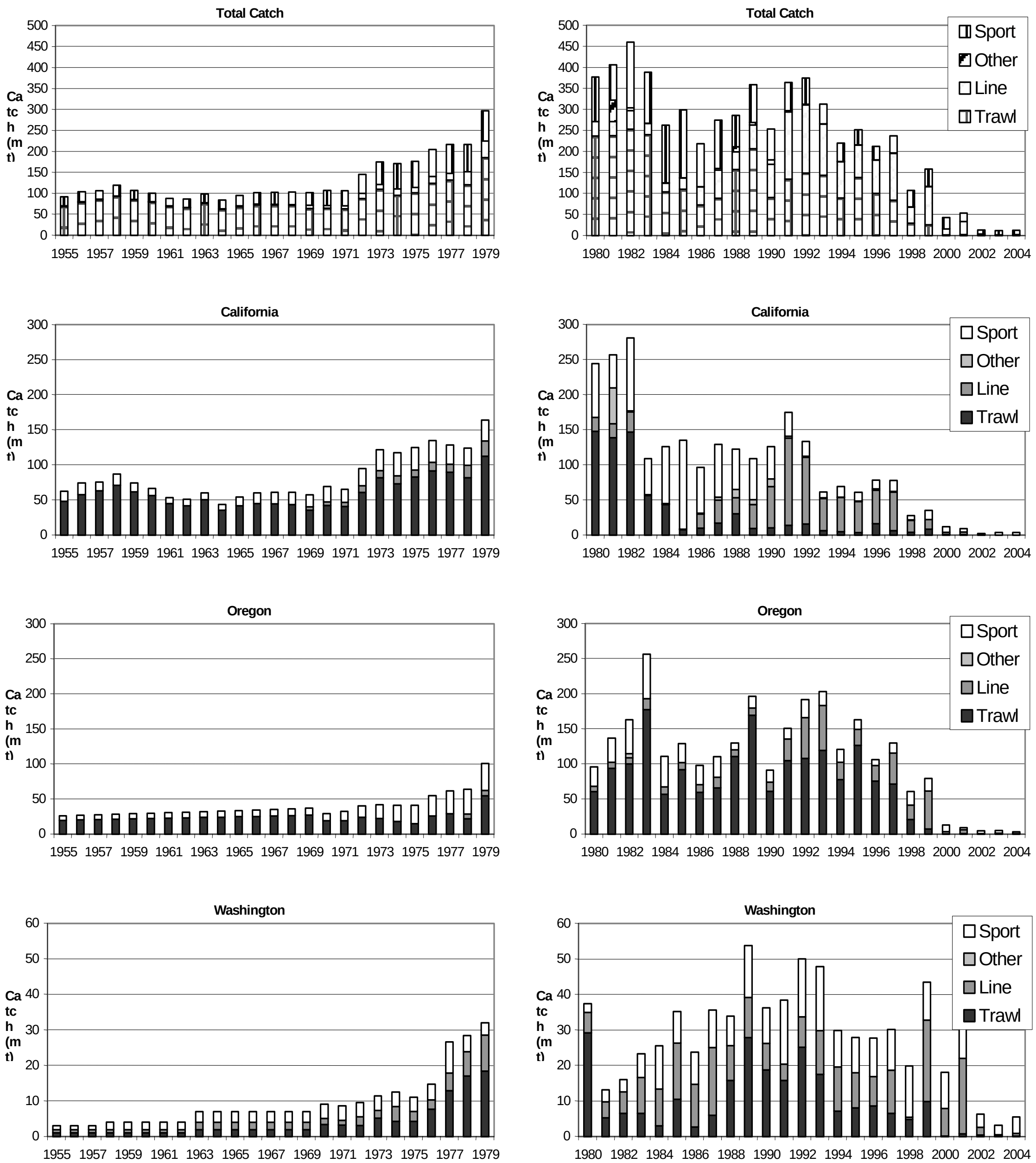


Figure 2. Estimated yelloweye rockfish catch by State and year since 1955.

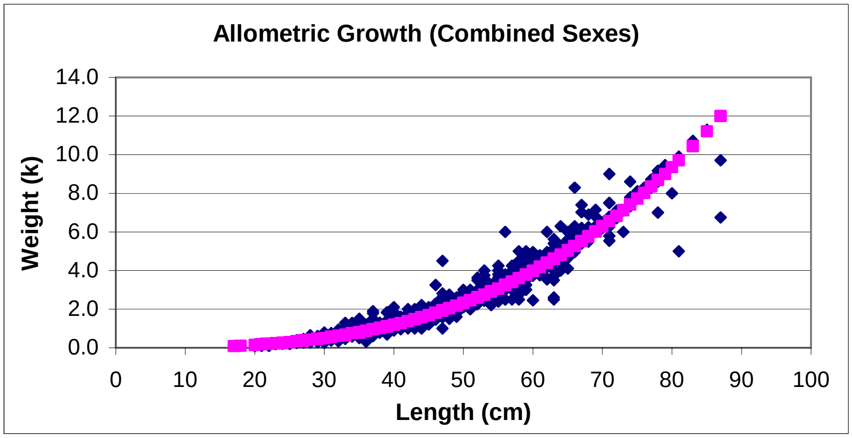


Figure 3. Yelloweye allometric growth for combined sexes (weight= $0.000021*\text{length}^{2.9659}$)

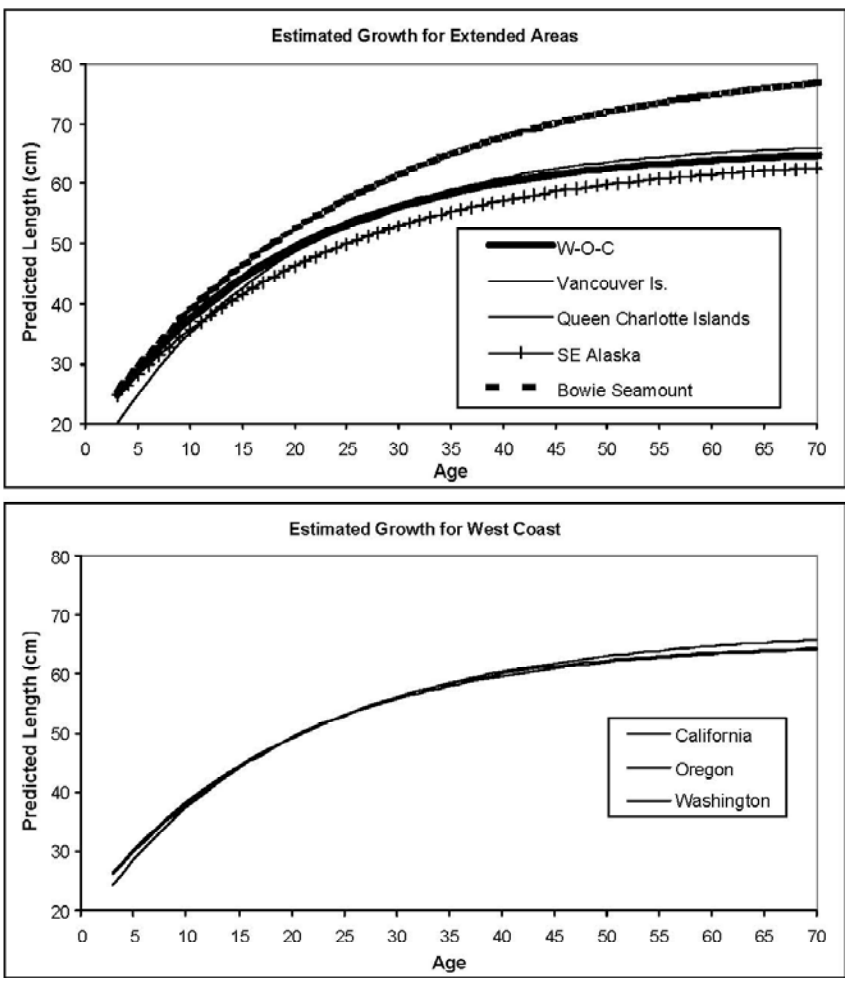


Figure 4. Predicted yelloweye rockfish size-at-age by locale. Need to update for the final model.

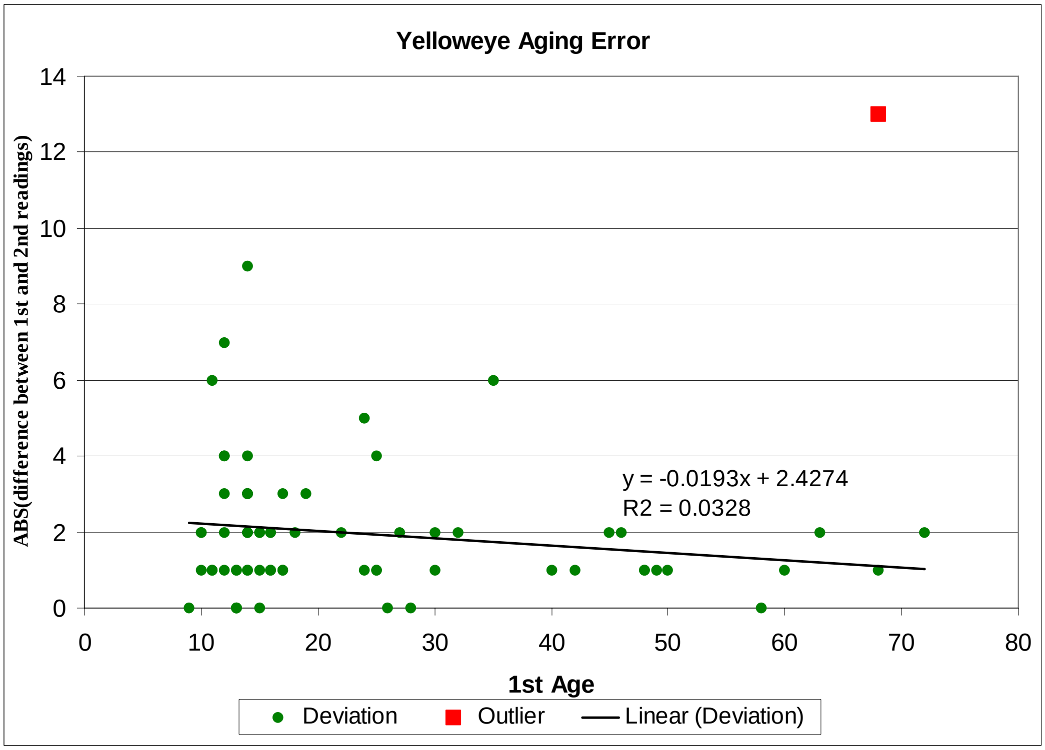


Figure 5. Observed and predicted age error for yelloweye rockfish when omitting the outlier from the dataset.

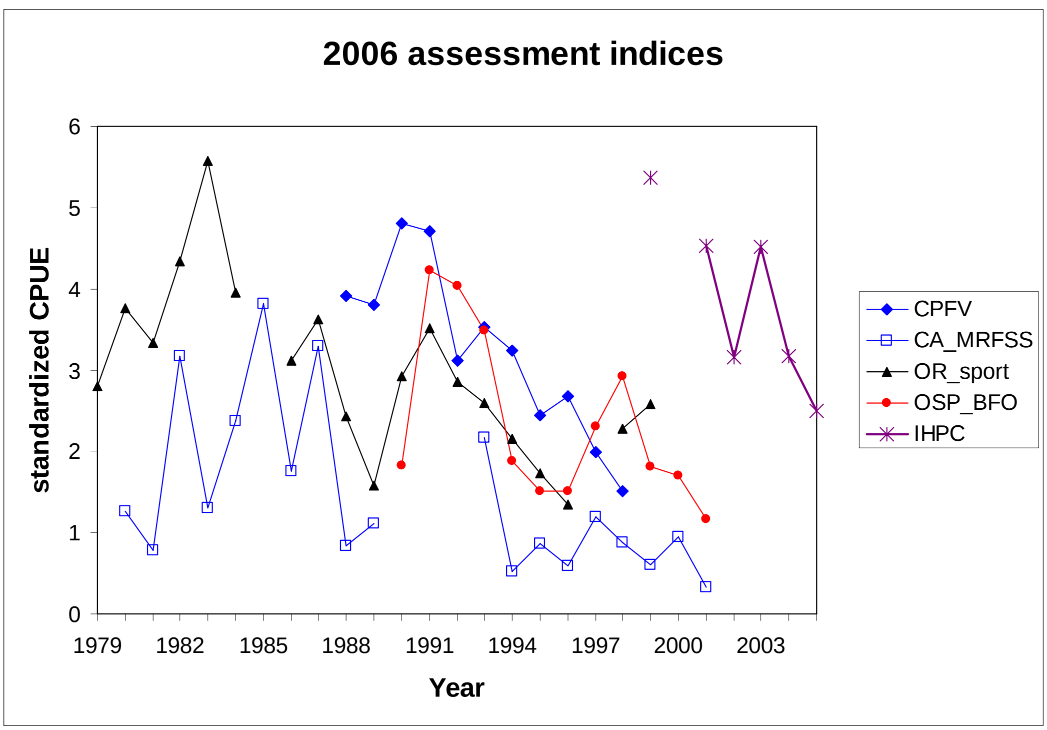


Figure 6. Comparison of standardized CPUE indices used in the base run.

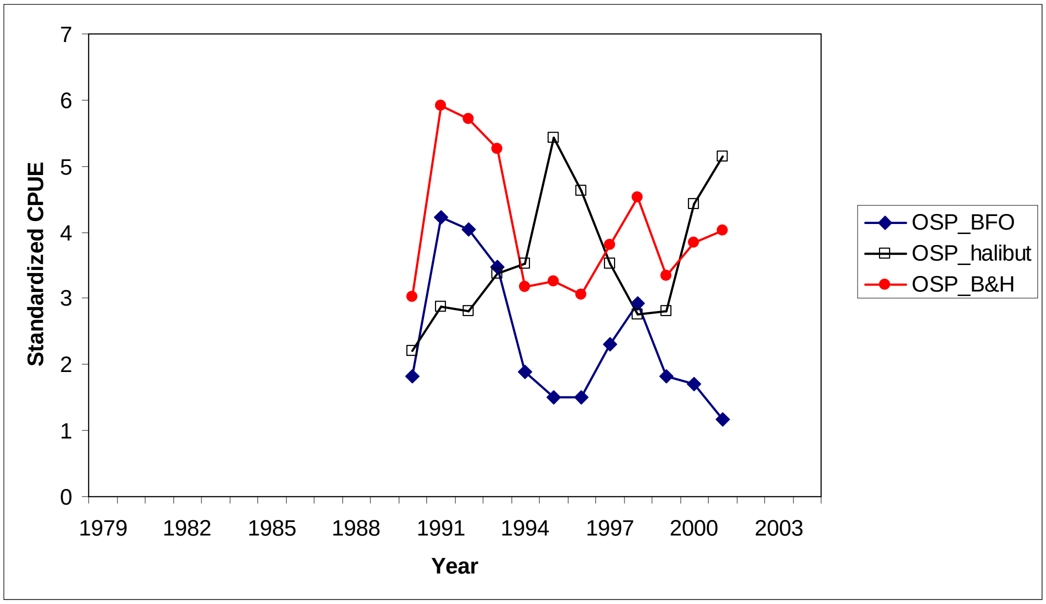


Figure 7. Abundance indices calculated from Washington recreational sampling – bottomfish only trips (OSP_BFO), halibut directed trips (OSP_halibut), and combined (OSP_B&H).

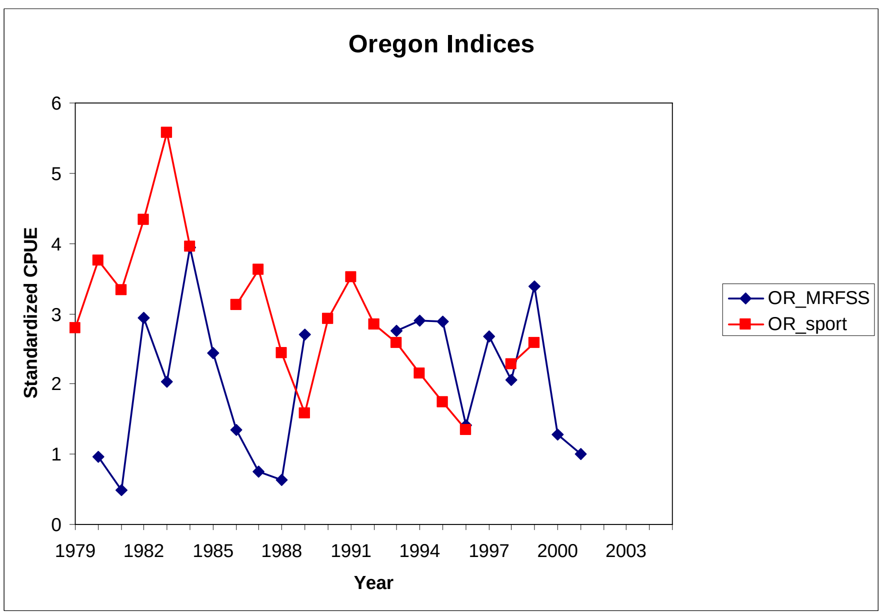


Figure 8. Comparison of Oregon sport CPUE and MRFSS CPUE.

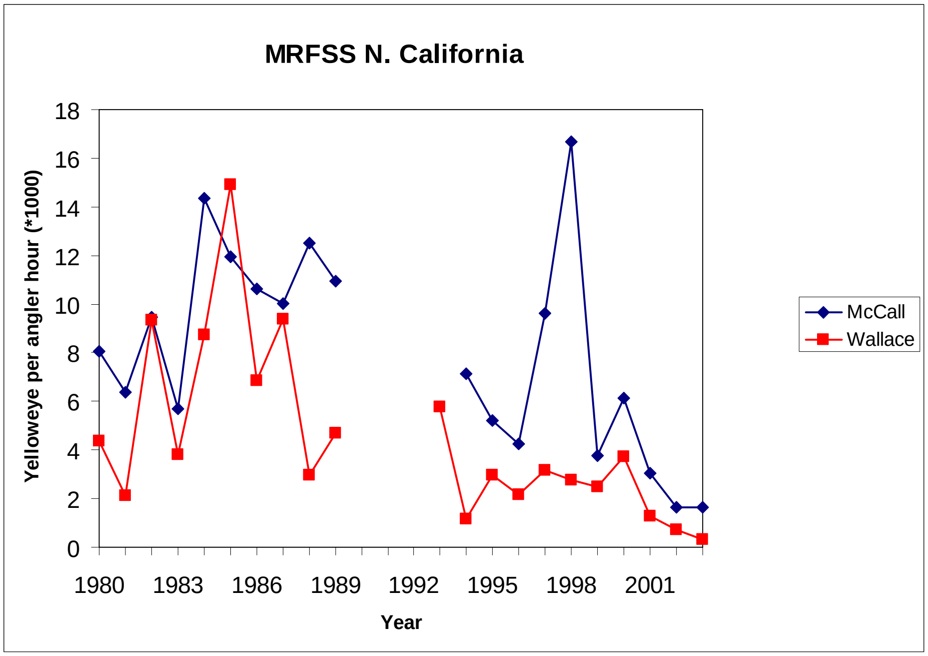


Figure 9. Comparison of Northern California MRFSS CPUE trends generated by using targeted speicies information (Wallace) and by using a binomial filtering mechanism (McCall).

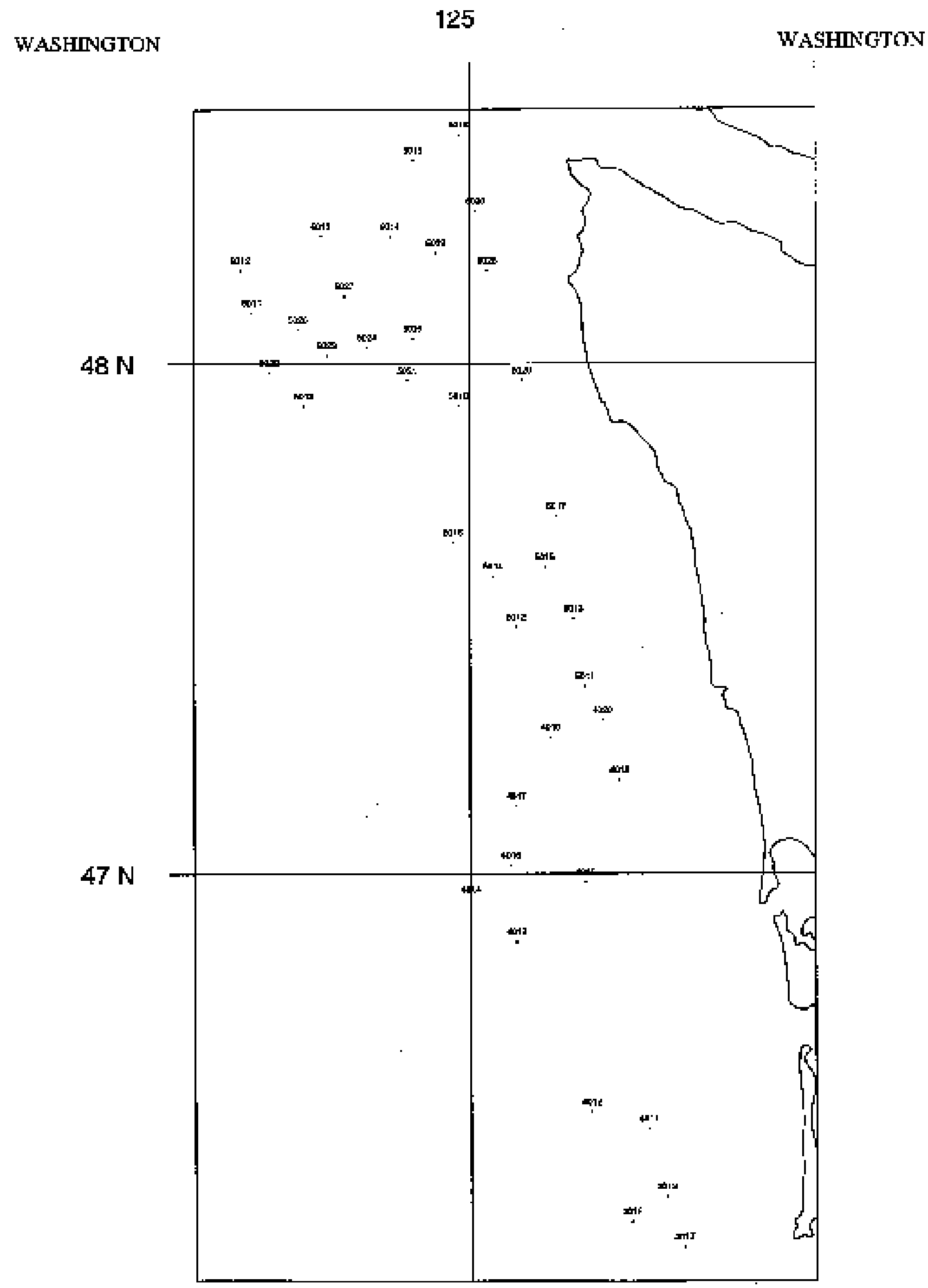


Figure 10. IPHC 1997 stations off Washington coast.

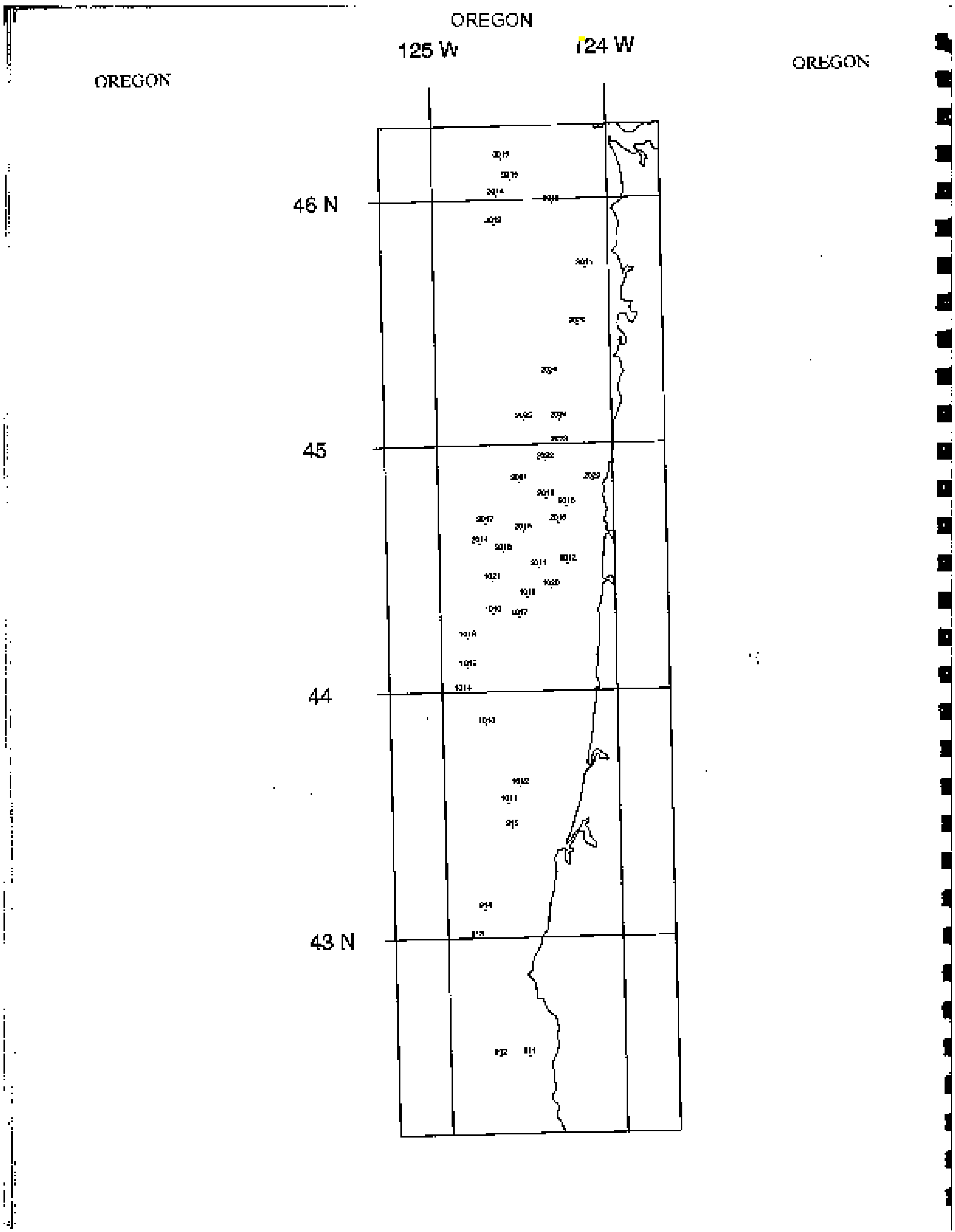


Figure 11. 1997 IPHC survey stations off Oregon coast.

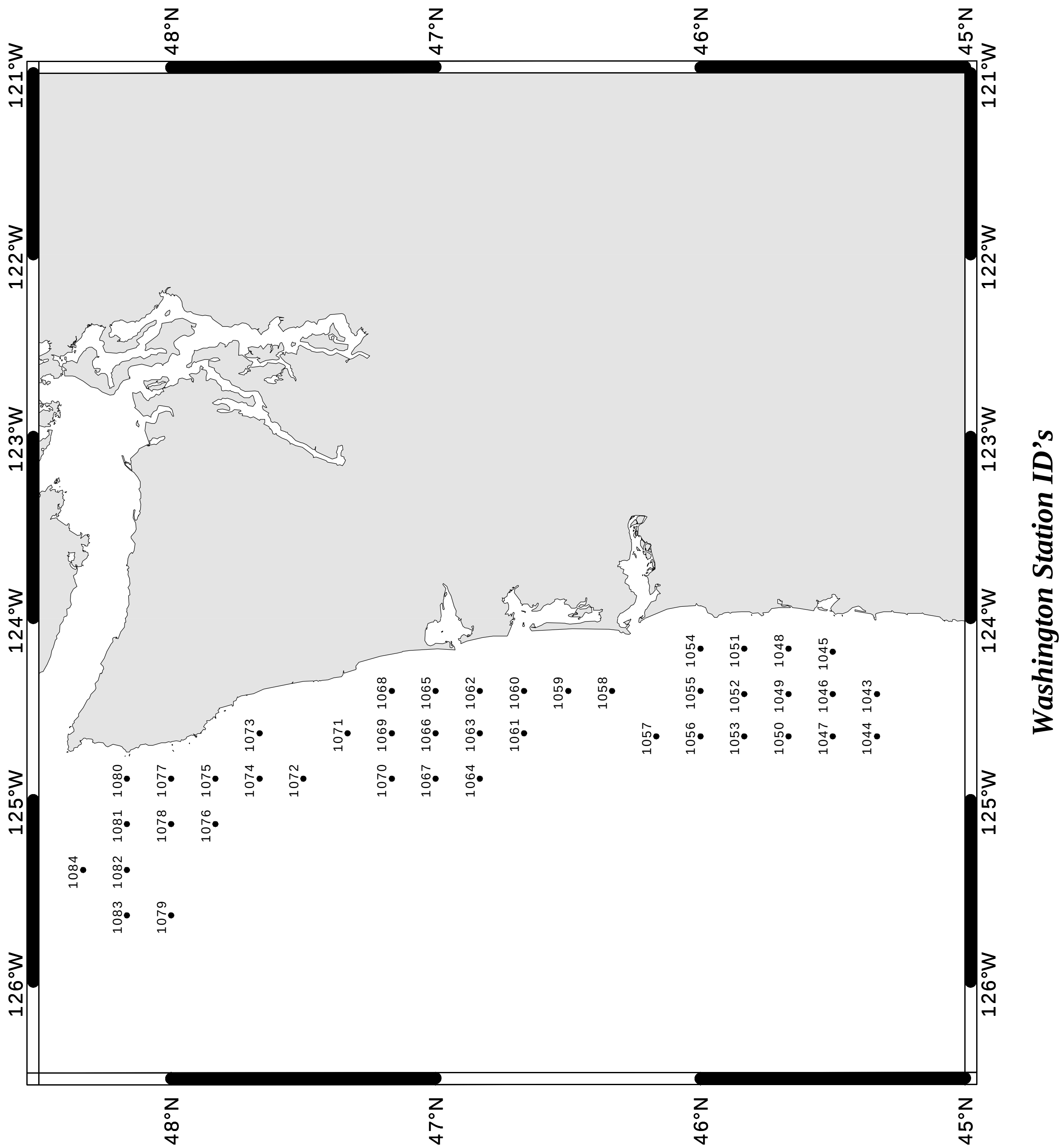


Figure 12. IPHC survey stations off Washington coast during 1999 and 2001.

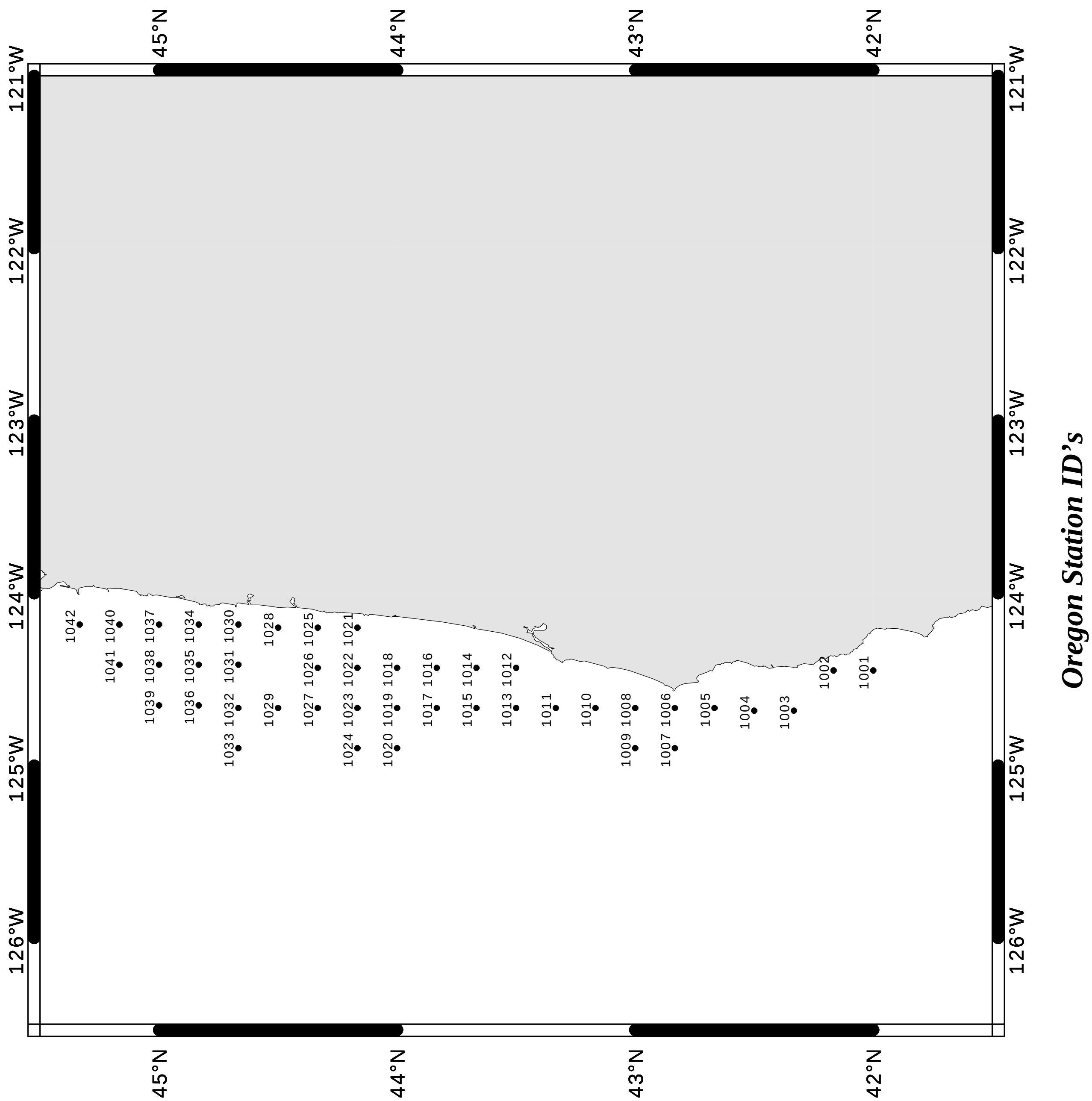


Figure 13. IPHC survey stations off Oregon coast during 1999 and 2001.

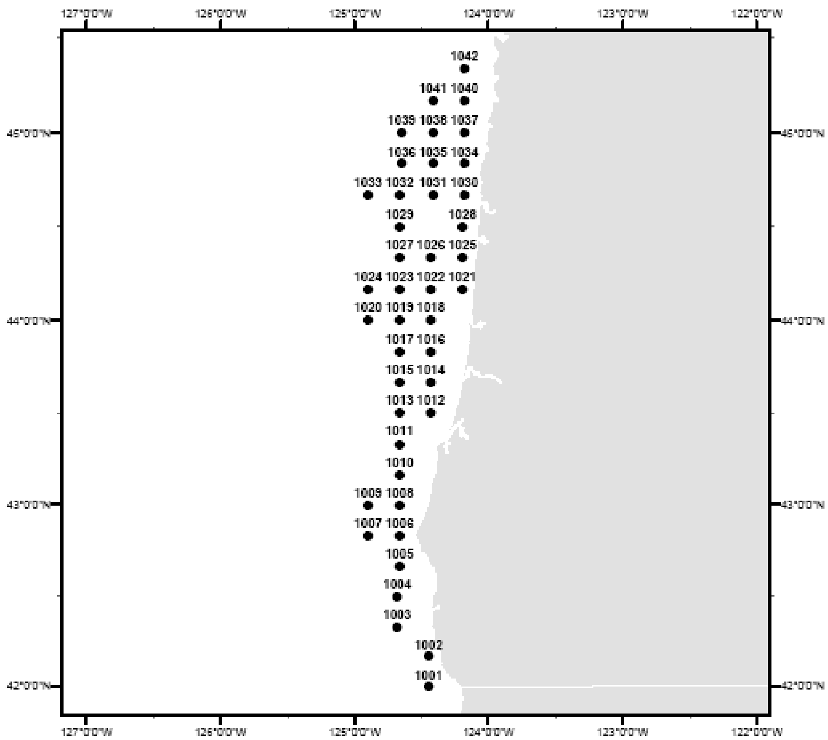


Figure 14. IPHC survey stations off Oregon coast during 2002 - 2005.

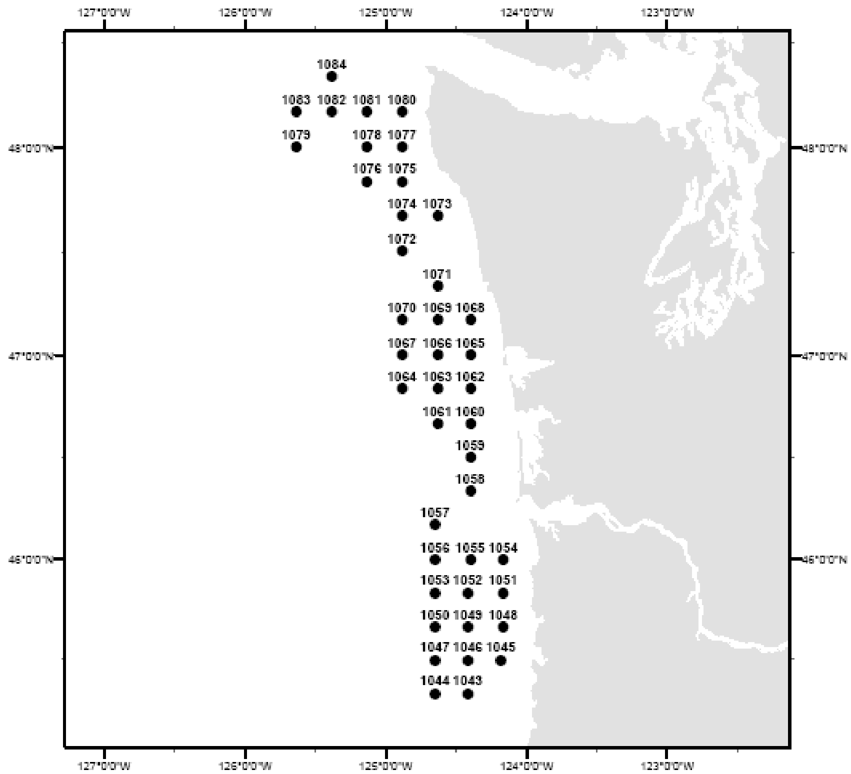


Figure 15. IPHC survey stations off Washington coast during 2002 - 2005.

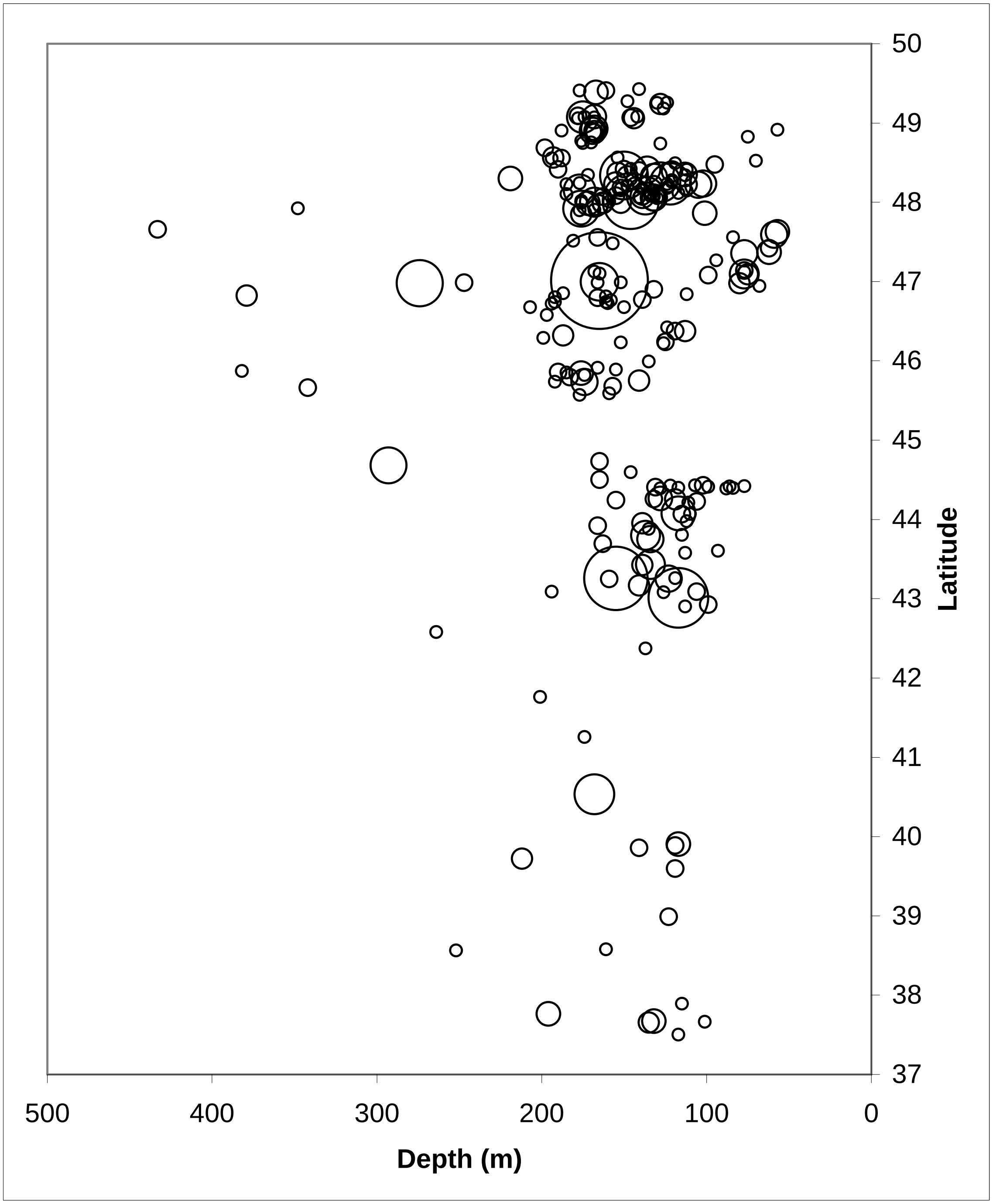


Figure 16. Spatial pattern of yelloweye rockfish occurrence in the NMFS bottom trawl survey; 1977-2001. Size of circle is proportional to yelloweye rockfish density at that location.

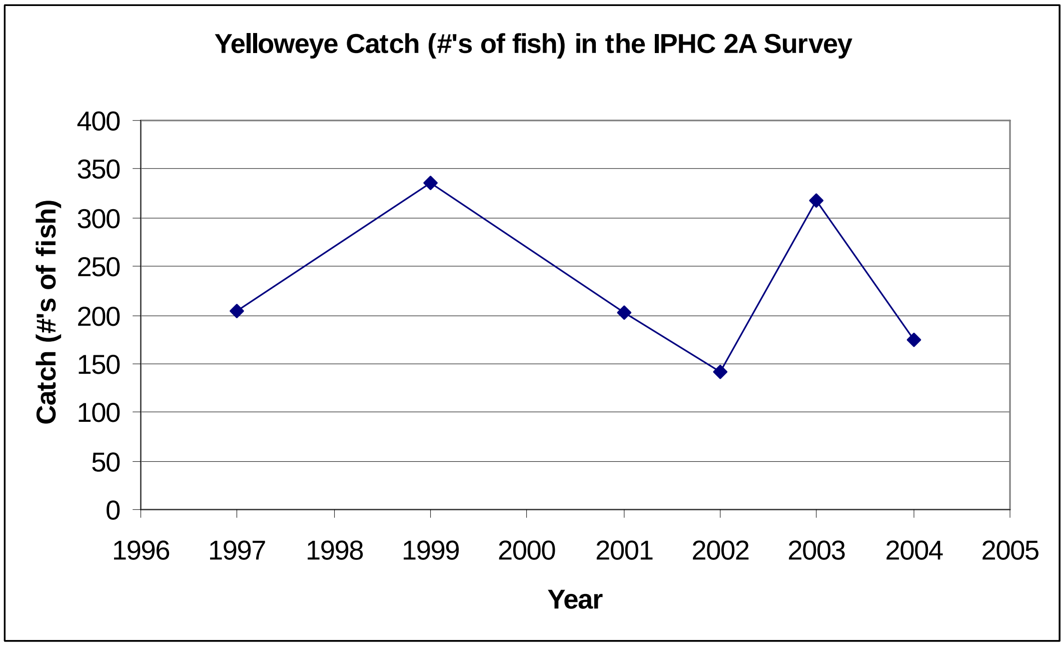


Figure 17. IPHC US water 2A yelloweye catch since 1997. Expanded estimates through 2001.

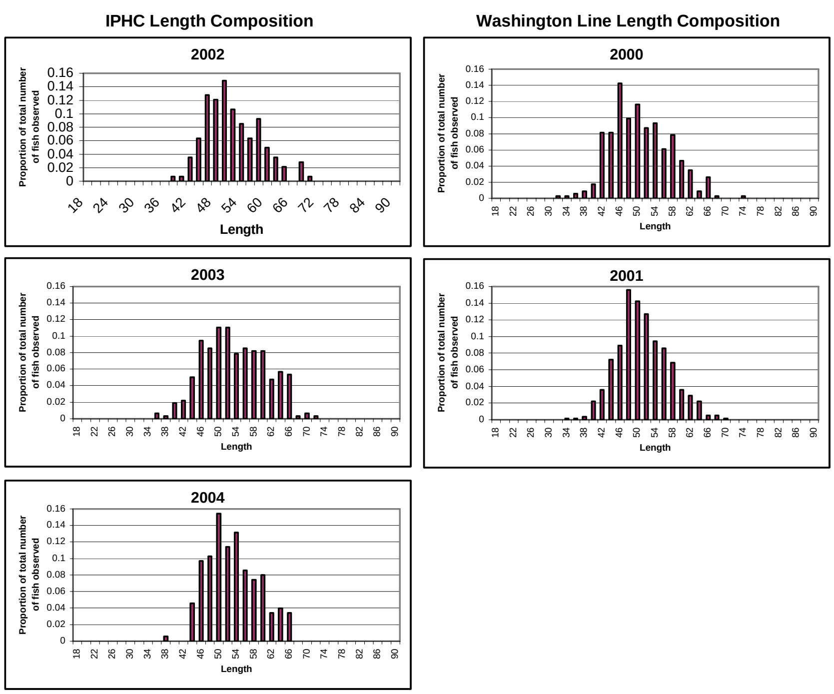


Figure 18. Comparison of length composition between the Washington yelloweye line fishery and the IPHC line survey by year.

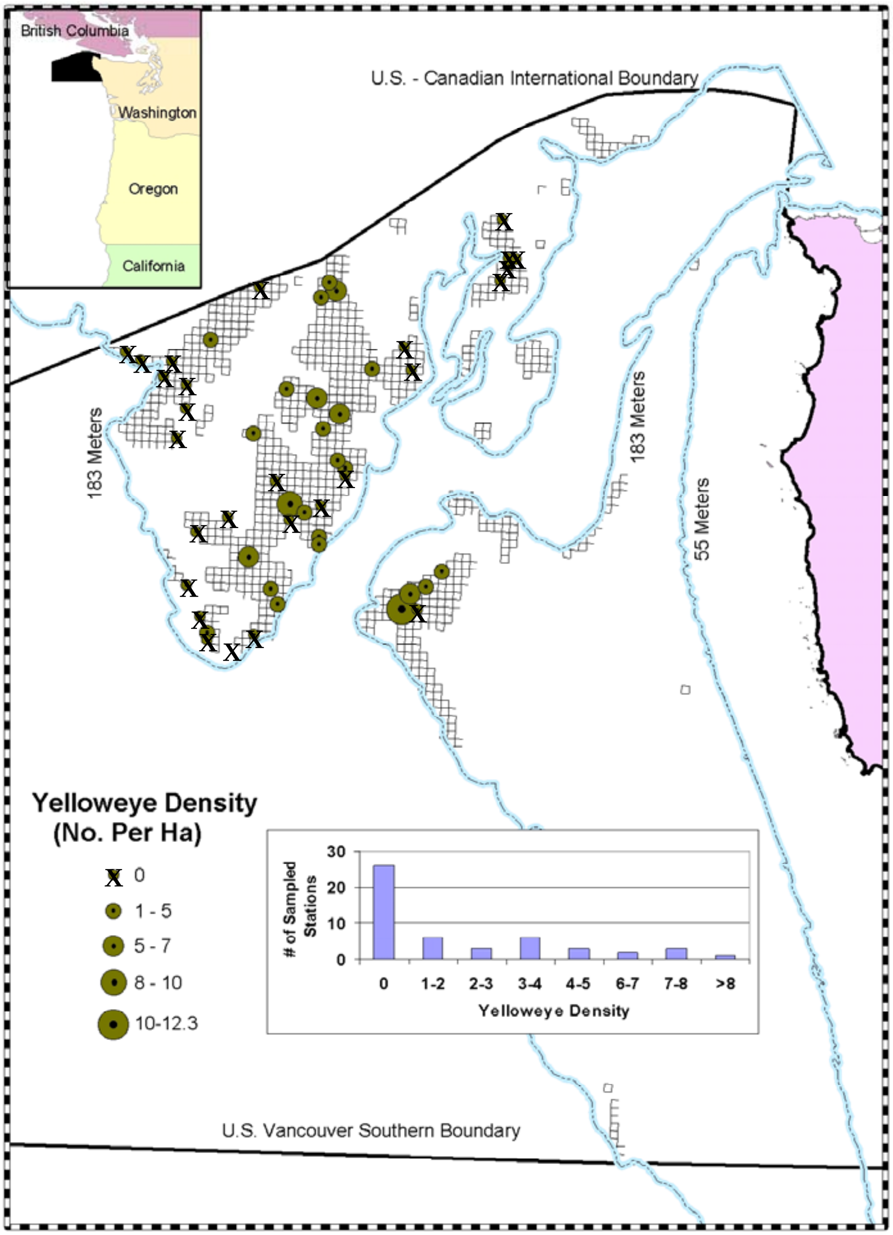


Figure 18. Yelloweye density in the untrawlable habitat surveyed in 2002.

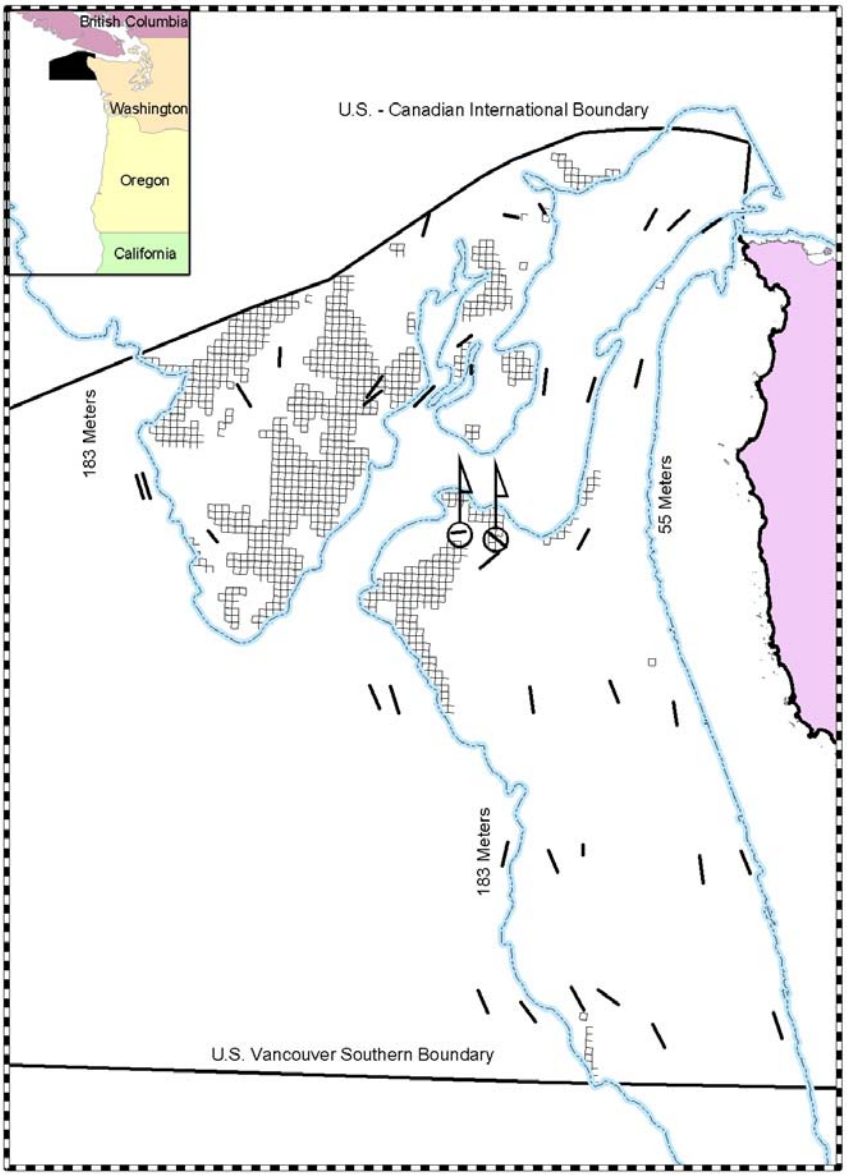


Figure 19. NMFS trawl survey haul location for all successful tows in the U.S. Vancouver Area in 2001. Symbols mark tows with yelloweye rockfish and grey grid represents the untrawlable habitat surveyed in 2002.

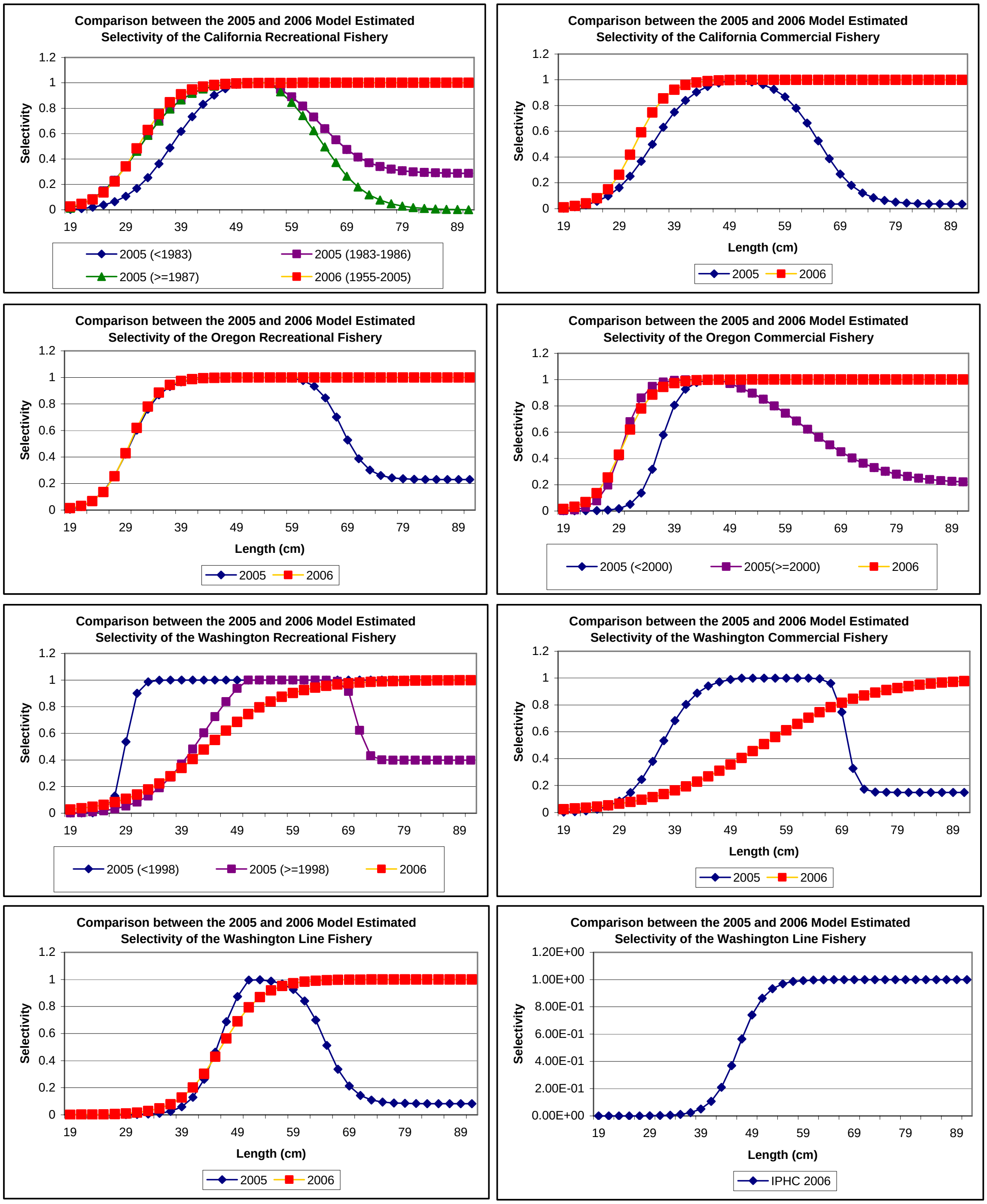
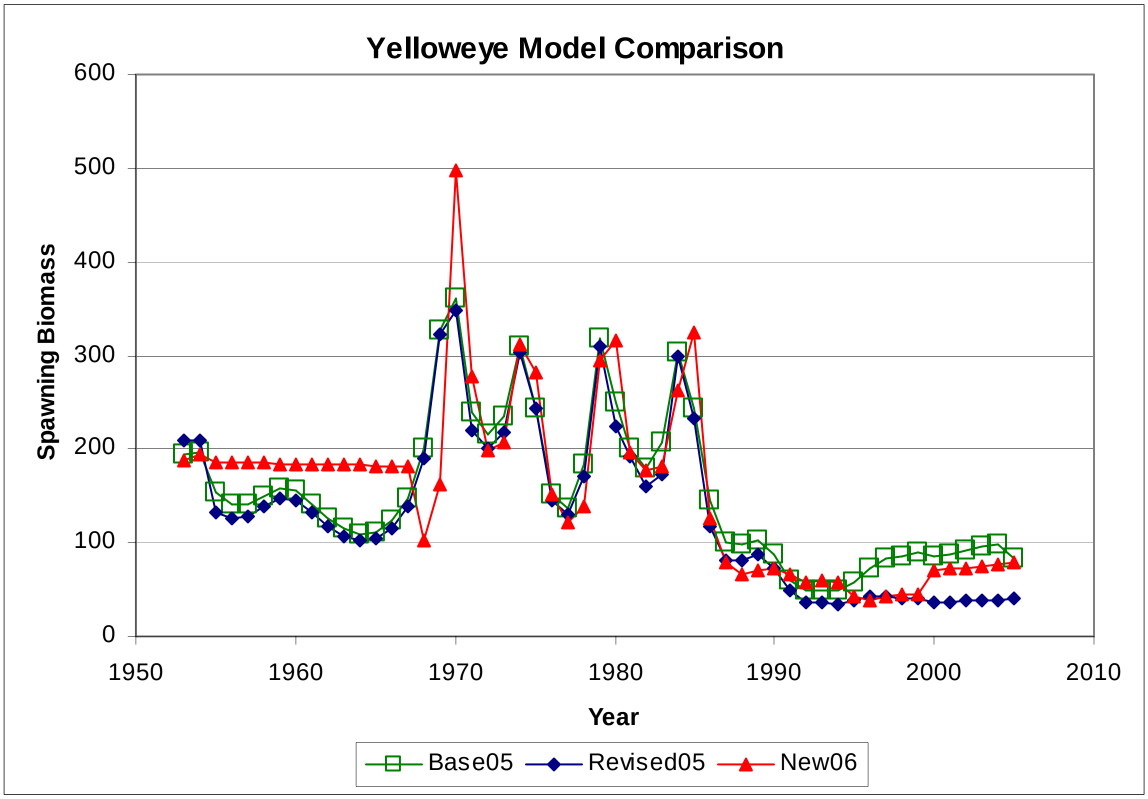


Figure 20. Comparison of estimated selectivity's between 2005 and 2006 models.



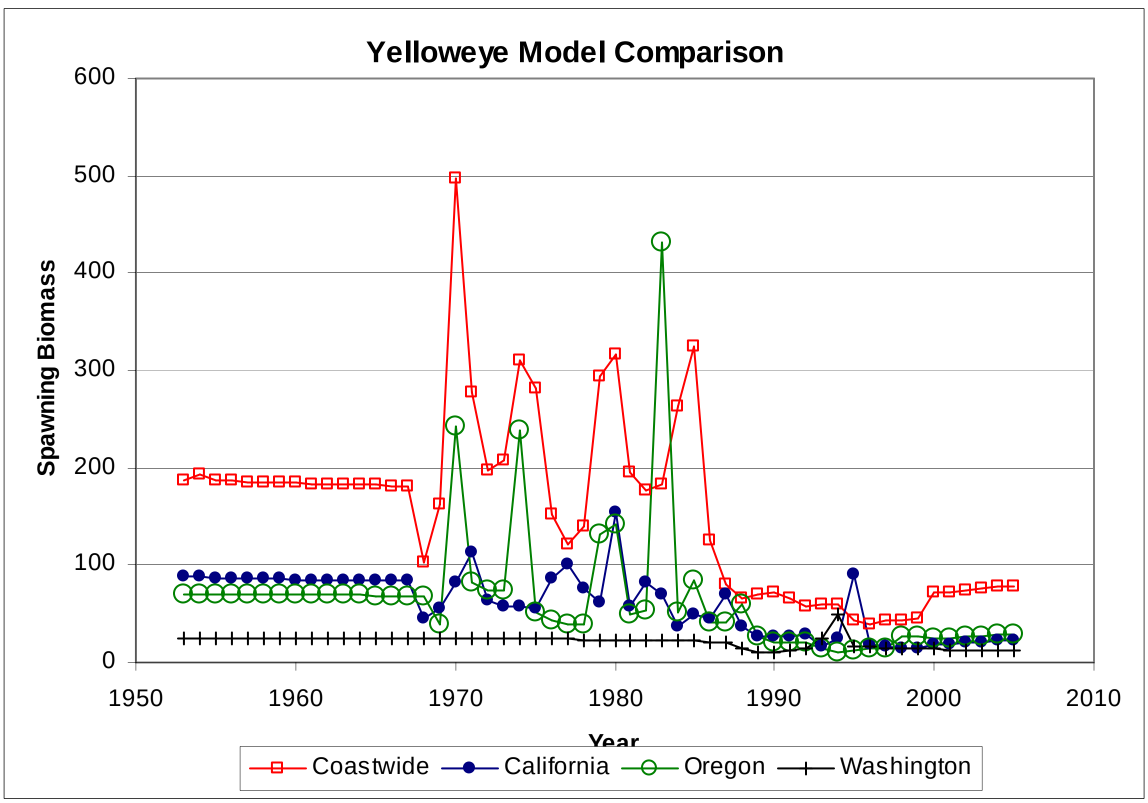


Figure 21. Comparison of the estimated recruitment time series between 2005 and 2006 base models (top panel) and between 2006 area specific models.

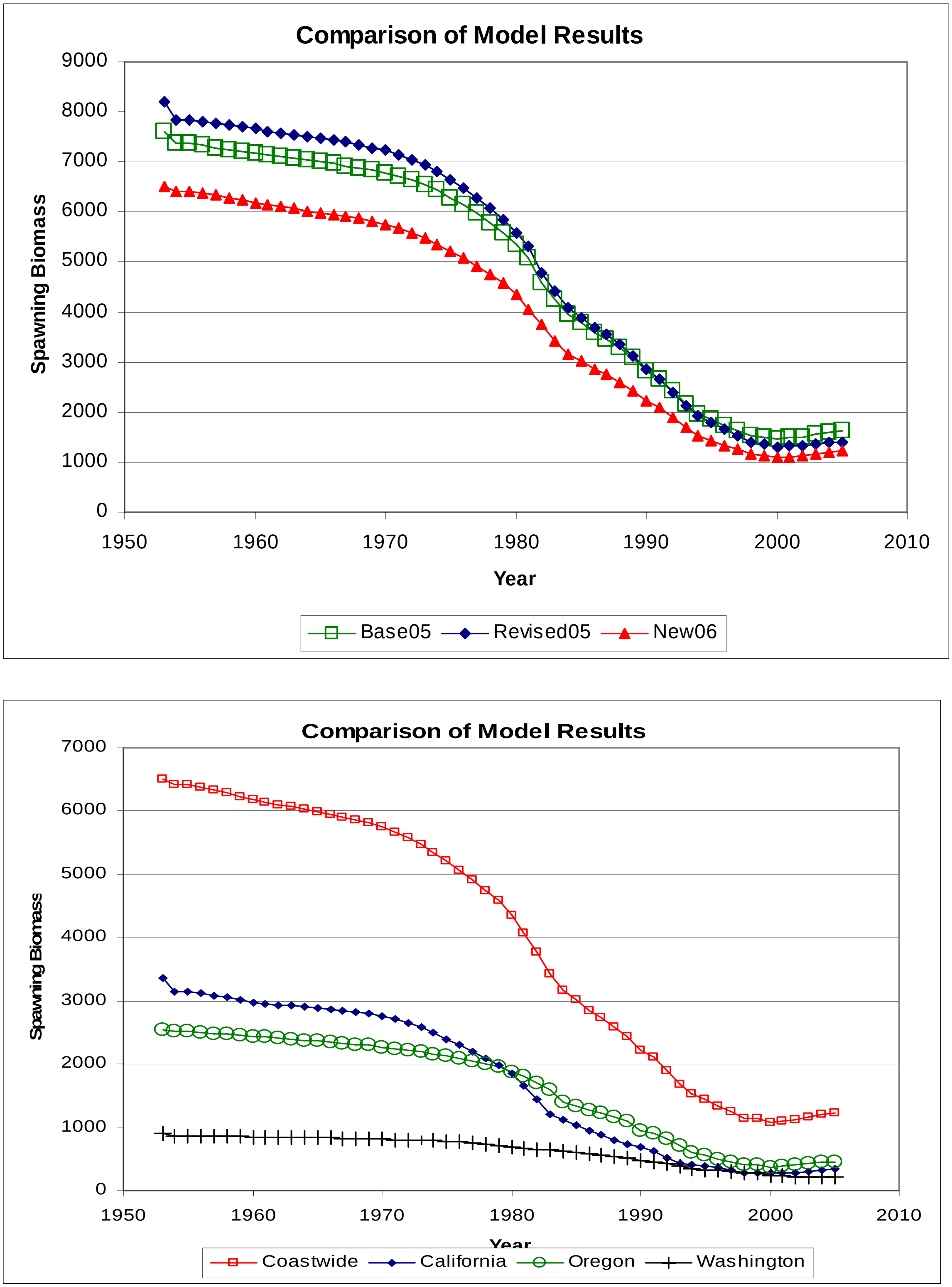


Figure 22. Comparison of the spawning biomass time series between 2005 and 2006 base models (top panel) and between 2006 area specific models.

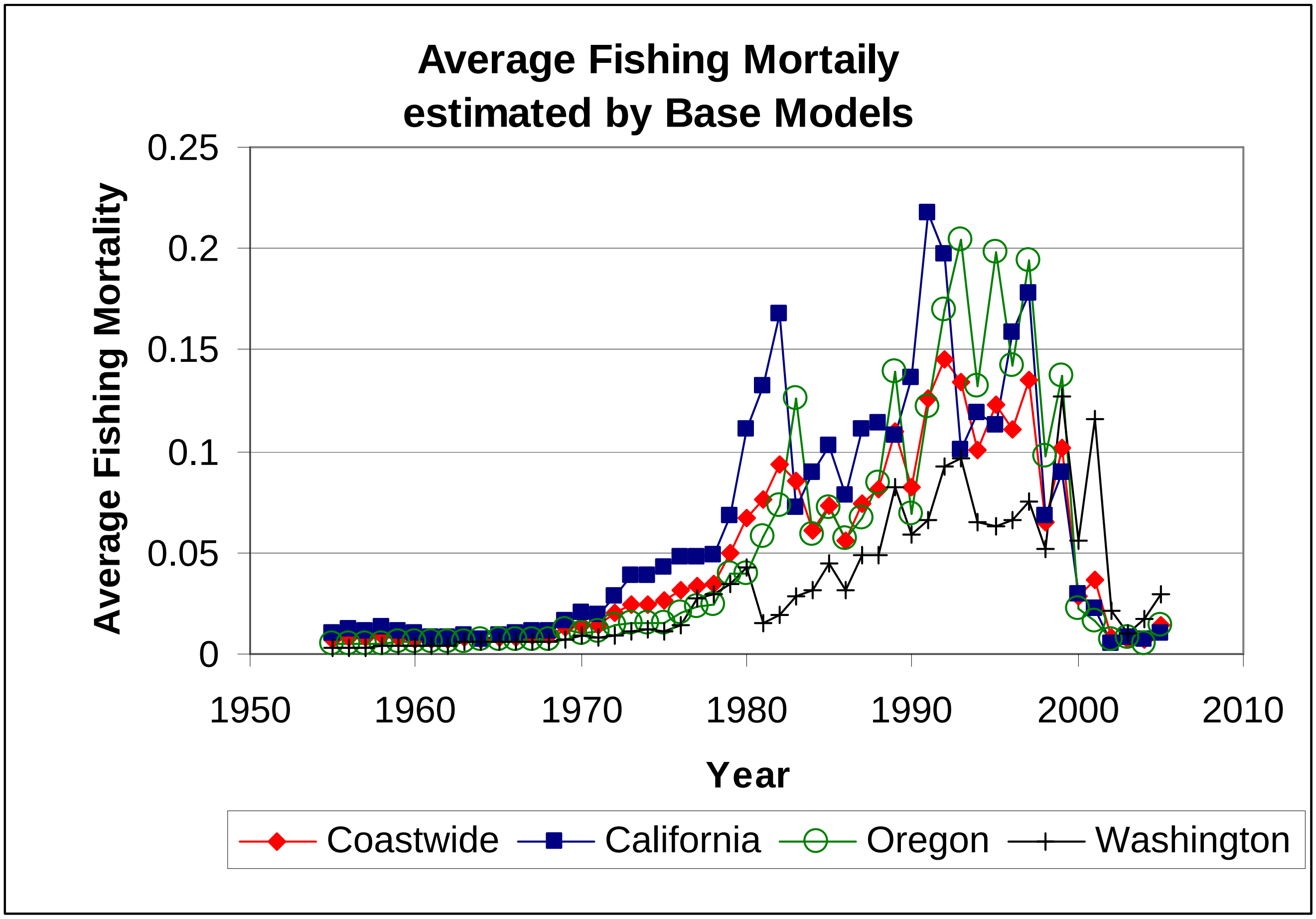


Figure 23. Comparison of average fishing mortality between all 2006 area specific base models.

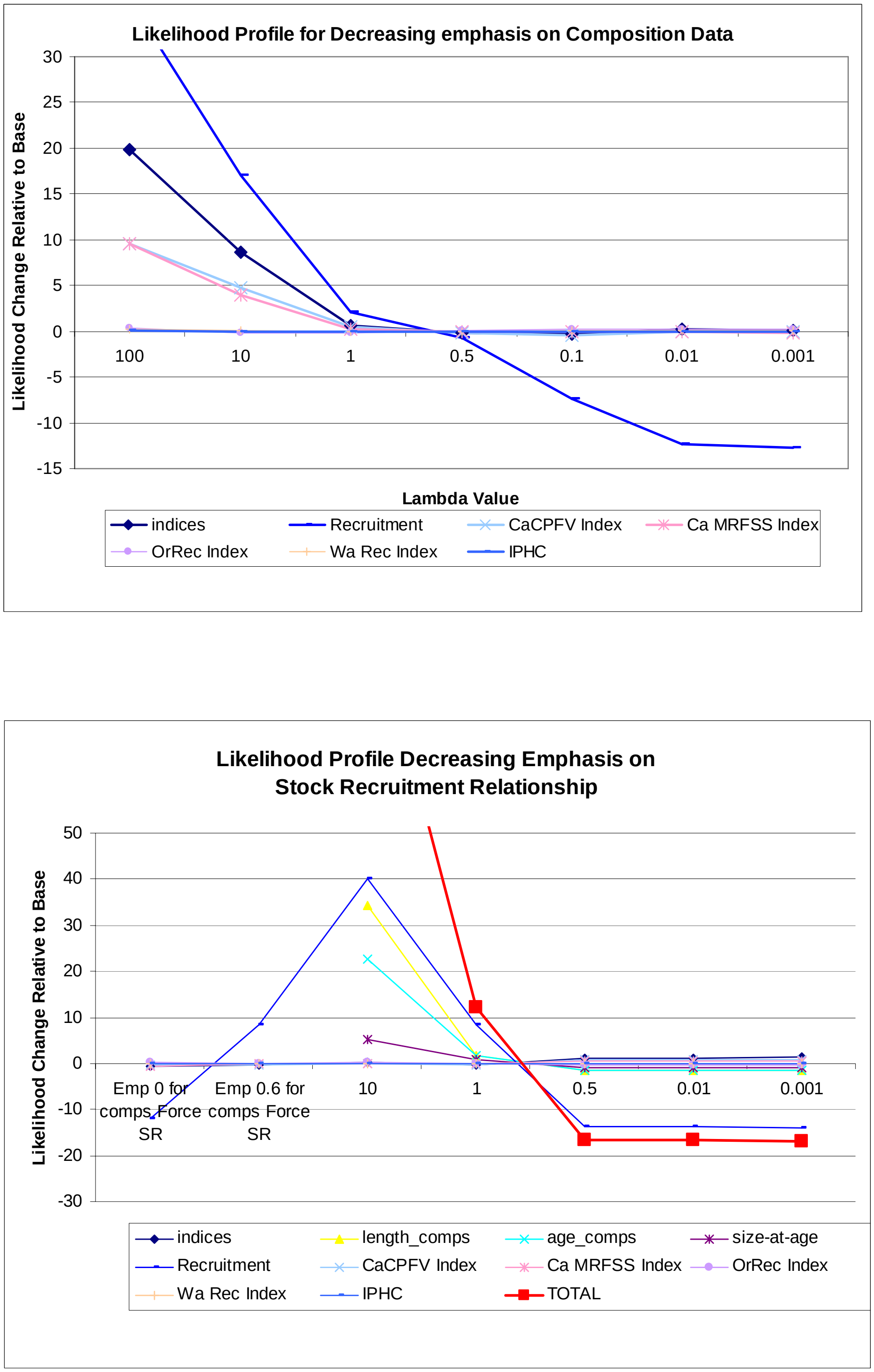
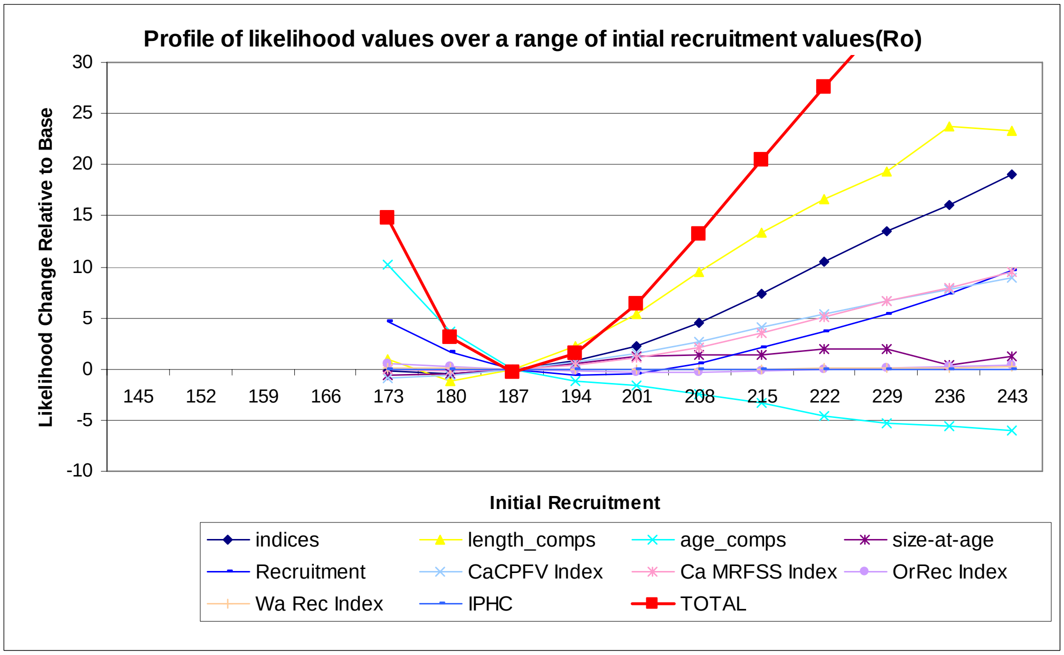


Figure 24. Profile of likelihood over a range of emphasis values (lambda) on length, age and size composition data (top panel) and over a range of emphasis values on the stock recruitment curve.



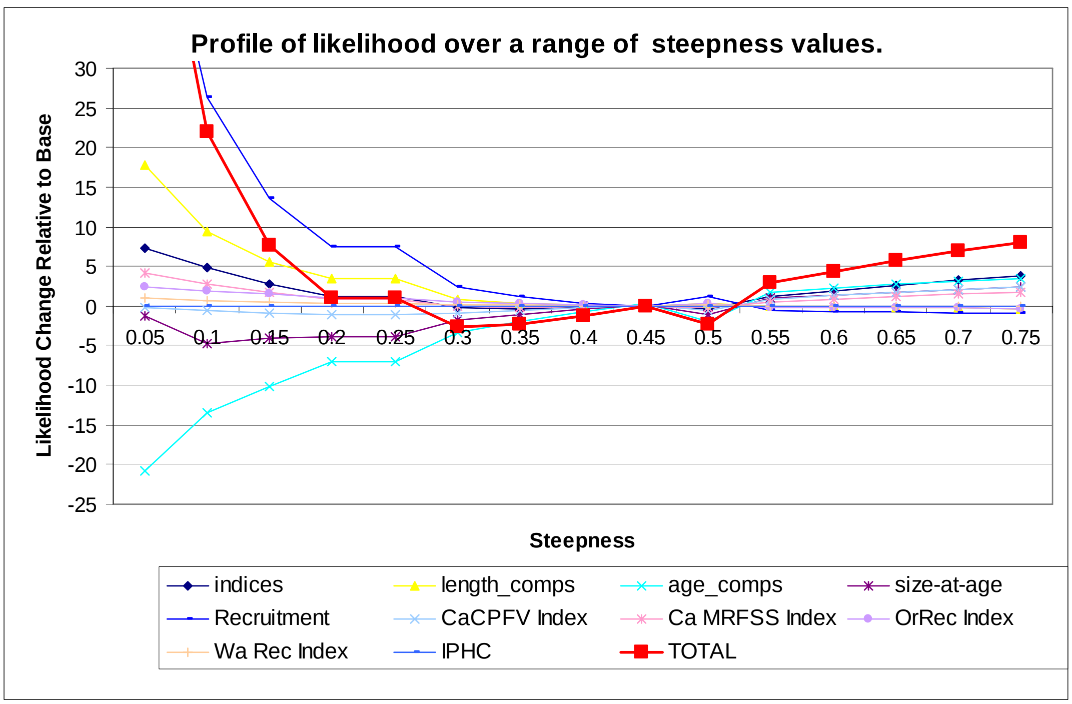


Figure 25. Profile of likelihood over a range of initial recruitment (Ro) values (top Panel) and over a range of steepness values presumed in the stock recruitment curve.

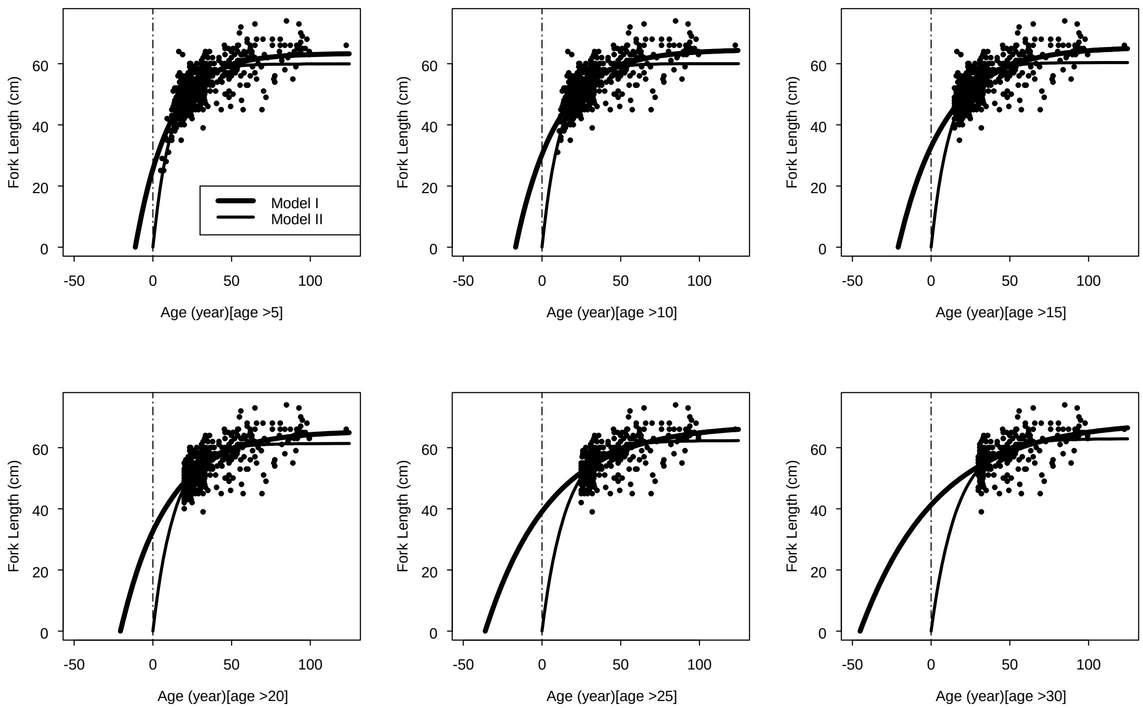


Fig. 26: Plots of expected yelloweye rockfish growth curves fitted by Models I and II with different age groups.

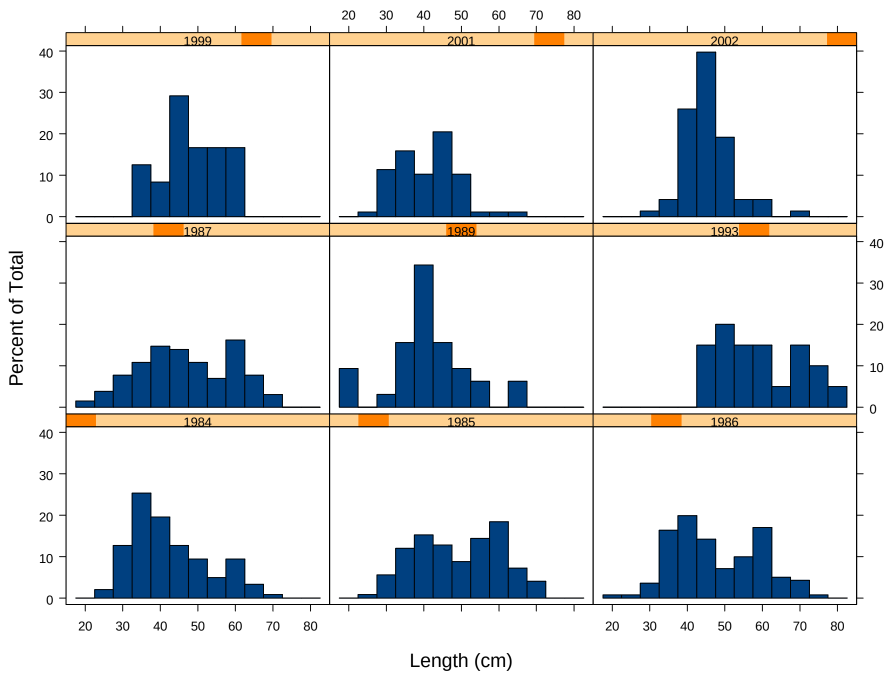


Fig. 27: Plot of the yelloweye rockfish length frequency data collected from years 1984 to 2002 in Oregon State coastal sampling.

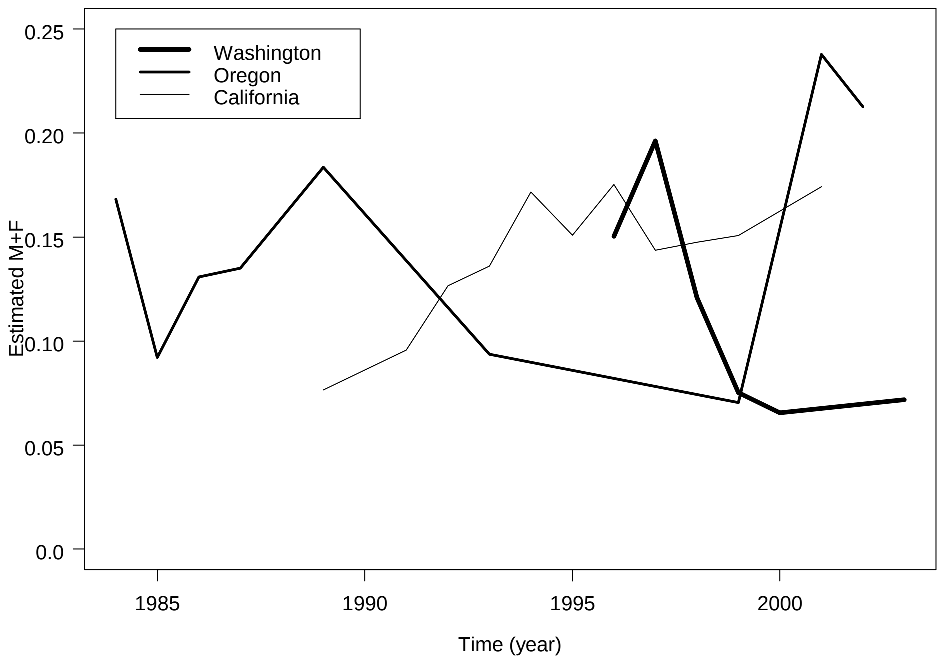


Fig. 28: Plot of the estimated total mortality coefficients from yelloweye rock fish length frequency data collected between years 1984 to 2002 in Washington, Oregon and California states coastal sampling.

STAR Panel Report

YELLOWEYE ROCKFISH

Alaska Fisheries Science Center
Seattle, Washington, USA
13-15 February, 2006

Stock Assessment Review (STAR) Panel Members:

Owen Hamel (Chair), Northwest Fisheries Science Center and SSC representative
Scott Nichols, Southeast Fisheries Science Center
Michael Wilberg, Michigan State University

Brian Culver, WDFW and GMT representative
Wayne Butler, GAP representative

Stock Assessment Team (STAT) Members Present:

Farron Wallace, WDFW
Tien-Shui Tsou, WDFW
Thomas Jagielo, WDFW
Yuk Wing Cheng, WDFW

General Overview

The STAR Panel met the 13-15 of February 2005 at the NMFS Alaska Fisheries Science Center in Seattle Washington to review the 2006 West Coast yelloweye rockfish (*Sebastes ruberrimus*) stock assessment. A Draft assessment document and extensive background material (previous assessments, previous STAR panel reports, etc.) were provided to the Panel in advance of the meeting.

Yelloweye rockfish were assessed in 2001, 2002, and again in 2005 as an "update" of the 2002 assessment, although the 2005 assessment used the new Stock Synthesis 2 (SS2) model rather than SS1. Both the 2002 and 2005 assessments were coastwide assessments. In November, 2005, a new full assessment was requested by the council to allow inclusion of IPHC longline halibut survey data, which is the only currently collected survey data within the primary habitat of yelloweye rockfish. This assessment was also to consider regional assessments by state.

The STAT successfully completed a new Yelloweye assessment. The new assessment incorporated extensive revisions of landings statistics. The STAT opted for logistic rather than double logistic selectivities as in past assessments. The STAR panel endorsed both changes. A new analytical treatment of Oregon recreational CPUE was presented at the STAR meeting, which supported use of a simple annual means model, which the STAR panel endorsed. The STAT presented analyses on both a coast-wide and individual state basis. The STAR panel saw no appreciable conflict between the coastwide and state by state results, suggesting that either structure could be used for management, although the state results are less precise. The Washington single state model is suspect because of sparse data and failure of convergence with the same steepness and M values used in the California and Oregon models. A considerable amount of time during the STAR panel was spent discussing and reviewing the data. This was partly due to multiple issues with the CPUE data sources, but could have been lessened by more diagnostic reporting in the pre-STAR draft assessment.

During the meeting, the STAR panel made additional requests as detailed below. Most were intended either to look at sensitivity, or to 'tighten up' some issues in the modeling decisions. A new base was selected incorporating information learned in that sequence of runs. The most significant features of the base change appeared to be the choice of which years to allow the model to estimate recruitment, and allowing estimation of M internally in the base coastwide model and then fixing that value in all models.

All runs examined support point estimates of depletion well below the 40% management target. Depletion appears to have proceeded from south to north. Despite the sparse data, the Stock Synthesis 2 model had little problem finding plausible population models to fit the existing data and choices of constraints. Only one data element, the short and localized IHPC CPUE series appeared to be poorly fit. The lack of fit to the IHPC CPUE series is likely partially due to assuming average recruitment in the most recent years based on minimal data on younger age classes. The IPHC survey data is also highly variable over the few years of its existence. There were no major conflicts among the different data elements (landing, CPUE indexes, size/age composition data), and no major conflicts among the different CPUE indices. There was some suggestion of recruitment decline, in that the last several recruitments estimated did not contain a strong year class. The STAR panel saw little significance to the small upturn in abundance in the last years. A small change may well have occurred, but the data available allow little confidence that model can detect its direction correctly.

The panel sees no persuasive reason for a full assessment to be carried out in 2007. An update could be undertaken with another year of IPHC data, and with the possibility of reexamining the catch data.

Analyses requested by the STAR Panel

First Requests

1. Alter yelloweye proportion of general rockfish catch from base of 1% to either 0.5% or to 2% for 1969-1976 for all three states and -1982 in California.

Rationale: To evaluate the effect of uncertainty in the catches prior to 1983 in California and 1977 elsewhere.

Result: Only a small change in overall results

2. Oregon Sport CPUE index - change to two indices through 1987 and 1988 and beyond – for both Oregon and Coastwide models.

Rationale: Catchability may have changed due to subtle change in method of identifying target species.

Result: Almost the same q for both, so leave as one index.

3. Run sensitivities to each index of abundance by changing lambdas by a factor of 5 in each direction, independently for Coastwide model and states (if time allows).

Rationale: To evaluate the influence of each index.

Result: No single index has undue influence on the results coastwide.

Second Requests

1. Put in revised Oregon CPUE series

Rationale: recommended, should see if makes difference

Result: Depletion coastwide up from 17.5% to 19.6%, trajectory flattens out earlier

2. Present recent age data to analyze data on recruitment in recent years

Rationale: need to set an end date for estimating recruitments, 1999 too late

Result: Certainly > 10 years before good data on rec., so about 1990+- 3 years

3. Substitute in Oregon MRFSS for Oregon CPUE series

   Rationale: to see effect of this other series, which is considered inferior.

   Result: Slightly less depleted state in 2006

Third Requests

1, 2, 3, 4 and 5 define new possible base cases for coastwide and individual states

1. Set SD offset to 1 instead of 0.

Rationale: This is the correct setting given size-at-age data.

2. Estimate recruitments only through year 1987 for all models

Rationale: Full selectivity at about age 12 results in lack of good estimating data at end of time series.

3. Set sigma r at 0.7 for all models for consistency.

Rationale: currently variable, but iterated to about 0.7 in coastwide model.

4. Set base steepness (h) at 0.45 for all models.

Rationale: Simply to have fewer significant digits (was 0.437).

5. Change Oregon data to annual mean calculations.

Rationale: Recommended by STAT team, similar to complex Poisson model, but simpler.
Result 1-5: all these changes resulted in a slightly more optimistic current state due to higher recent recruitments from the SR curve, except for Oregon model due to error in input of new Oregon data.

6. Do sensitivities to equilibrium catch for all models:
    a. set = 0
    b. add catch series back to 1925 at equilibrium value, before then = 0

Rationale: Concern about initial biomass being higher than Bzero.
Result: a: Small change coastwide, incomplete by state. b: Fixes issue with mismatch

7. Perform sensitivities to steepness (h) of 0.35 and 0.60 for all models.

Rationale: To see effect of uncertainty in steepness.
Result: Expected directions but not overwhelming changes.

8. Sensitivities to M = 0.03, 0.08

Rationale: To see effect of uncertainty in natural mortality.
Result: expected directions but not overwhelming changes, 0.08 considered unrealistic

9. Do runs with new ageing error assumptions:
    a. ageing error cv = constant at 0.1
    b. ageing error sd constant at 2

Rationale: The current model with decreasing sd with increasing age is counterintuitive and different from other assessments.
Result: Quite small effect

10. Set selectivity parameters for slope of ascending limb of Washington fisheries to be similar to Oregon and California

Rationale: The Washington selectivities are estimated to be quite different from similar fisheries off Oregon and California.
Result: Model did not converge

Fourth requests
Changes to base 1-4:

1. Estimate recruits through 1992

Rationale: Looked at SDs of recruitment estimates in original model and dropped off here, also 13 years from last data and ~ 12 years full selectivity.
Sigma r = 0.5
Rationale: 0.7 seems to allow extremely high recruitments.

2. Correct Oregon data

Rationale: Should have correct data as input.

3. Add catch series back to 1925 at equilibrium value, and 0 before 1925

Rationale: Fixed problem (see above).

4. Estimate Natural mortality internally in coastwide model.

Rationale: see if get a reasonable result close to fixed value of 0.045
Result: M = 0.036

Recommendation from STAT team to use this value, and consensus is that it is a better estimate given that it is closer to values used in Canada and Alaska, life history, etc.

5. New Base with M = 0.036,

Do for coastwide and states, alter Washington model as needed to get convergence. Main axes of uncertainty for decision table agreed upon by STAR and STAT for decision table analysis. For Washington use a single alternative based on submersible study.

Base Models: H = 0.45, sigma r = 0.5, M = 0.036 (except for WA: M = 0.04)
Low state: H = 0.30, sigma r = 0.4, M = 0.030 (except for WA: alternative below)
High state: H = 0.60, sigma r = 0.7, M = 0.045 (except for WA)

Other sensitivities requested:

Estimate recruits through 1987 or 1999 instead of 1992

Final Base-Case Models and Quantification of Uncertainty

	Coastwide	California	Oregon	Washington	CA+OR+WA
Unfished Spawning Stock Biomass (SSB_0)	3322	1715	1258	453	3426
Unfished Exploitable Biomass (B_0)	7448	3877	3789	1017	7686
Log Unfished Recruitment ($Log(R_0)$)	4.85	4.19	3.85	3.00	4.93
SSB_{2006}	588	145	274	95	514
Depletion Level (2006) Base Model	17.7%	8.5%	21.8%	21.0%	15.0%
Depletion – 95%CI	14.2%	5.7%	16.5%	17.3%	
Depletion + 95% CI	21.1%	11.2%	27.0%	24.6%	
Depletion Low State	13.5%	8.0%	16.9%		
Depletion High State	22.8%	10.9%	27.6%		

Alternative to Washington Model results based on NPFMC tier 5 calculations with the assumption of reliable estimates of natural mortality and biomass:

2002 submersible survey study area

Area Description	Area (ha)
NMFS Trawl Survey USVan 55-183 m	351,800
Study Area	55,680
Total Sampled Area	28
Study Area/U.S. Vancouver Area Ratic	15.8%

[1/] *Vancouver US includes areas from 47 30' -U.S. Canac*
Wilkins etal., 2002

2002 submersible survey yelloweye study results

Study results for yelloweye rockfish

	All Fish	Age 3+ Fish [1/]
Mean Length (cm)	50.0	51.7
Length Estimates (#'s of Fish)	38	36
Weight (kg) [2/]	2.73	2.69
Number of Fish Observed	59	57
Mean Density (#'s per ha)	2.02	1.95
Estimated Numbers of Fish in Study Ar	112,586	108,746
Biomass in Study Area (mt)	307	292

[1/] *Fish greater than 30 cm*
[2/] *Weighted biomass*

NMFS Trawl Survey estimates for yelloweye rockfish

NMFS trawl survey swept-area biomass estimates

	Washington State			**U.S. Vancouver 55-183 meters**			**[2] Adjusted Biomass (mt)**	
Year	**Total**	**CV**	**[1] Tows**	**Total**	**CV**	**[1] Tows**	**.S. Vancouv**	**tal Washingt**
1977	232	0.29	14	56	0.50	4	47	223.6
1980	82	0.72	8	57	1.00	2	48	73.0
1983	510	0.58	14	140	0.48	7	118	487.9
1986	181	0.31	29	120	0.44	18	101	162.1
1989	463	0.36	8	422	0.38	4	355	396.0
1992	108	0.30	11	82	0.33	8	69	95.2
1995	22	0.60	3	8	0.55	1	7	21.1
1998	61	0.36	5	52	0.39	4	44	53.0
2001	111	0.49	9	64	0.61	7	54	101.2
Mean	197	0.45	11	111		6	94	179
Median	111	0.36	9	64		4	54	101

[1] *Tows with yelloweye rockfish.*

[2] *WDFW adjustment to NMFS trawl survey biomass reflecting trawlable habitat in US Vancouver Area only.*

Assuming no biomass outside Untrawlable zone then:
ABC =292 (age 3+ biomass)*0.75*0.036 (natural mortality)=7 .88 mt
OFL =292 (age 3+ biomass) *0.036 (natural mortality)=10.51 mt

Assuming biomass outside Untrawlable zone = median NMFS survey:
ABC =292 (age 3+ biomass)+54 (median NMFS survey biomass for US Vancouver)*0.75*0.036(natural mortality)=9.34 mt
OFL =292 (age 3+ biomass)+54 (median NMFS survey biomass for US Vancouver) *0.036 (natural mortality)=12.46 mt

Areas of Disagreement Regarding STAR Panel Conclusions

There were no areas of disagreement concerning this assessment.

Unresolved Problems and Major Uncertainties

1) By any standards, the data remain ‘sparse,’ and there seem to be no further avenues to improve that situation in the historical series. Size and age composition data are particularly lacking. A heroic effort to update the landings statistics by seeking out secondary sources was completed, and the accuracy of the assessment was no doubt improved by the effort; but many of the decisions about catches early in the time series had to ‘borrow’ from information remote in time and space. Supporting data from fishery dependent CPUE series that might be used to improve them often did not exist, at least for an entire series. Appropriate fishery independent data was generally not available. Those sets that have begun recently are promising, but do not as yet cover enough of the yelloweye spatial range to rely on them heavily.

2) The underlying landings data are basically derived from total landings of unclassified rockfish times an estimated fraction that are yelloweye. In recent years, actual samples are available in many areas, but the meeting participants believed an extensive pattern of substitution for missing cells is still required. In earlier years, estimates of fraction yelloweye had to be borrowed from remote years and areas. The consequence of these estimation steps is that the catch is known only with considerable uncertainty (possibly to a factor of 2 or 3x?). Unfortunately, the current version of SS2 does not allow for uncertainty measurements of landings. This makes it nearly impossible to evaluate the

true uncertainty of model results. Internal estimates of standard error on depletion estimates were on the order of 2-2.5%. These seem likely to be serious underestimates of uncertainty.

3) No Canadian data were available. Spatial distribution plots and genetics information suggest a continuous population extending well into Canada. Thus, the coastwide assessment presented here is probably not a true stockwide assessment.

4) The methods for calculating recreational CPUE for Washington and Oregon differ in that the Oregon CPUE includes trips targeting halibut (as the target data has not been collected in Oregon) but the Washington CPUE calculations exclude those trips. As most of the yelloweye rockfish taken in the sport fishery in both states since ~1990 have been taken in the halibut fishery, this may have an important impact on the trends seen in these CPUE series.

Although these 4 items put limits on we can learn from this particular assessment, we saw nothing to cause us to doubt the basic results seen here. The central tendency estimates from the SS2 model are the best estimate of central tendency currently available, and these central tendencies would be unlikely to change substantially with the addition of uncertainty in the catch data. The relatively good agreement between the individual state and the US coastwide models suggests that the dynamics of exchange across the Canadian border may not be too significant. There were no indications of unaccounted subsidies or depletions that sometimes appear in assessments not incorporating the complete range of a stock, though information from Canadian waters would still be advantageous. The most important change that could be anticipated in a next round of assessment is improved rigor in evaluation of uncertainty.

Recommendations

1) In the current assessment model, catches are assumed known without error. Because yelloweye rockfish are relatively rare in the fisheries, catches are estimated with considerable error. Ignoring this source of uncertainty will lead to an overestimation of model precision. Future assessments should allow catch to have some error to better propagate this key uncertainty to model estimates. SS2 should be modified to allow error in the catch data. This should not be difficult to code, although it may cause some problems with convergence that may require attention. Allowing for some autocorrelation in F might improve the estimation.

2) Formal estimates of uncertainty in catch should be produced by modeling the species composition sampling process. This will require an extended analytical effort, but it should be doable. The analysis may lead to using model-based estimates for missing cells, rather than substitution, which may change the best estimates of catch somewhat. Estimates of uncertainties in the total unclassified rockfish landings and in the species fraction estimates in the earlier years may still have to be assumed.

3) Obtain data from Canada for a truly stockwide model.

4) Continue efforts on the fishery independent survey programs. The most promising should be expanded stockwide.

5) Consider an assessment model incorporating several rockfish species simultaneously.

6) The panel recommends that aging error be explored again in future assessments. The panel was not completely comfortable with decreasing aging error as age increased as is currently in the base model. The panel discussed that it seemed counterintuitive that fish would become easier to age as they became older, and evidence for this pattern was sparse. However, removing the trend in aging error (to either a constant SD or CV) had small effects on model estimates.

7) Data are sparse in the most recent years of the model since the fisheries have been closed. Because of this, there is considerable uncertainty about current age and size structure of the population as well as uncertainty because most of the CPUE time series end in 2001. This uncertainty will become worse for future assessments if no new data streams are added. The best types of data to add would be surveys that estimate absolute abundance such as the submersible survey conducted in 2001. This survey would need to be expanded to include Oregon and California waters. Another option would be to continue and expand the IPHC survey.

DRAFT FOR DISSEMINATION TO REVIEW – DO NOT CITE

Updated Rebuilding Analysis for Yelloweye Rockfish Based on Stock Assessment in 2006

February 2006

Tien-Shui Tsou[1] and Farron R. Wallace[2]

[1]Washington Department of Fish and Wildlife
600 Capitol Way North.
Olympia, Washington 98501-1091

[2]Washington Department of Fish and Wildlife
48 Devonshire Road.
Montesano, Washington 98563

Introduction

The yelloweye rockfish (*Sebastes ruberrimus*) stock off the United States Pacific coast was declared to be at an "overfished" state in 2002 based on the first two full stock assessments Wallace (2001) and Methot *et al*. (2002). Both assessments were length-based models and used an earlier version of the Stock Synthesis program (Methot 1990). Wallace (2001) conducted two area assessments by using data from California and Oregon. Methot *et al*. (2002) incorporated Washington catch and age data, and treated the stock as one single assemblage off the California, Oregon, and Washington (W-O-C) coast. Results from Methot *et al.* (2002) indicated that the stock was depleted at 24% of B_0 in 2002. A subsequent rebuilding analysis was conducted (Methot and Piner 2002) and the estimated rebuilding parameters were adopted by the Pacific Fishery Management Council in 2004 (PFMC 2004). The parameters in the 2004 rebuilding plan are as follows:

Year stock declared overfished:	2002
Year rebuilding plan adopted:	2004
B_0:	3,875 mt
B_{MSY}:	1,550 mt
$B_{CURRENT}$ (% OF B0):	24% in 2002
T_{MIN}:	2027
T_{MAX}:	2071
P_{MAX}:	80%
T_{TARGET}:	2058
Harvest control rule:	F = 0.0153

Based on the harvest control rule (F = 0.0153), the optimum yields (OY) for 2004, 2005, and 2006 were determined to be 22, 26, and 27 metric tons, respectively. In 2005, Wallace et al. (2005) updated stock assessment by Methot et al (2002) and subsequently Tsou and Wallace (2005) updated the rebuilding analysis by Methot and Piner (2002).

In 2006, The PFMC requested a full stock assessment for the yelloweye rockfish to incorporate new data sources and area-specific modeling in the assessment. The purpose of this document is to update rebuilding analysis based on this most recent stock assessment.

Highlights of 2006 assessment

The 2006 assessment for yelloweye rockfish (Wallace et al., 2006) revised the historical fishery catch data prior to 1983, re-evaluated all abundance indices, incorporated the

IPHC yelloweye catch trend index and appended new age and size composition data. There are several features that influence the rebuilding analysis:

- There were four models constructed – one coastwide and three area-specific models. Though the stock assessment review panel (February 2006) adopted all four models, the assessment authors point out that relative to other area-specific models, the Washington model is much more uncertain. This uncertainty is associated with the lack of data that required additional model assumptions on growth, selectivities and fit to indices.
- The assessment start year was moved back from 1953 to 1923 in the coastwide, California, Oregon models.
- Selectivity functions were changed from double logistic to logistic functions.
- Natural mortality and recruitment steepness were revised. The values of these parameters used in three coastwide models are listed below. In this rebuilding analysis, we use the values in the 2006 assessment.

Assessment year	Natural mortality	Recruitment Steepness	Sigma R
2002	0.045	0.437	0.4
2005	0.045	0.437	0.4
2006	0.036	0.450	0.5

Rebuilding Calculations

We followed the guidelines from the PFMC Statistic and Scientific Committee (SSC) Terms of Reference for Groundfish Rebuilding Analyses dated 20 April 2005 and used the SSC Default Rebuilding Analysis as implemented by Punt (December 2005, version 2.9).

Life History and Selectivity parameters

Life history parameters, age structures, and historical estimates of spawning output and recruitments are taken from Wallace *et al*. (2006). The age-specific selectivity patterns are from Wallace et al (2006), except for the coastwide rebuilding analysis in which we used averaged selectivity functions for seven fisheries, weighted by total catches of each fishery over the last five years.

Future Recruitment

To calculate recruitment during rebuilding period, four methods were considered: 1) random sampling of observed recruitment levels, 2) random sampling of observed recruits per spawner (R/S) levels, 3) using a Beverton-Holt stock-recruitment relationship, and 4) using a Ricker stock-recruitment relationship. We used the Beverton-Holt curve with a steepness of 0.45 and Sigma R = 0.5 because recruitments in 1993 - 2005 were estimated based on this relationship in the stock assessment (Figure 1). Also, this method will reproduce current low recruitment levels while the spawning biomass remains low and will predict smoother mean recruitment towards rebuilding.

Minimum Possible Rebuild Time
Stock-recruitment steepness greatly affects the calculation of the minimum rebuild time (T_{MIN}). In the absence of fishing from 2002, T_{MIN} are estimated to be 2046, 2073, 2035, and 2026 for the coastwide, California, Orgon, and Washington models, respectively (Table 1). The rebuilding trade-off of various OY and PMX is summarized in Figure 2 and Tables 4 – 7.

The SSC Requested Runs
A set of six rebuilding runs was requested in the SSC Terms of Reference for species currently managed under rebuilding plans. We conducted all six runs for the coastwide model but did not do so for the area-specific models. This is because there has not been an area-specific rebuilding plan adopted by the PFMC.

Run #	**Prob (recovery)**	**By**	**Based on**
#1 (default)	Estimated	Current T_{TARGET}	Current SPR
#2 (T_{TARGET} with 50% prob)	0.5	Current T_{TARGET}	Estimated SPR
#3 (#1 based on T_{MAX})	Estimated	Current T_{MAX}	Current SPR
#4 (#2 based on T_{MAX})	P_0	Current T_{MAX}	Estimated SPR
#5 (#3 with re-estimated T_{MAX})	Estimated	T_{MAX} (re-estimated)	Current SPR
#6 (#4 with re-estimated T_{MAX})	P_0	T_{MAX} (re-estimated)	Estimated SPR

To compute current SPR rate for three of the six SSC runs, effort was made to re-construct 2002 rebuilding analysis by using current rebuilding computer application (Punt 2005, version 2.8a). We could not get a solution using the materials and methods documented in the Methot and Piner (2002) without substantially increasing steepness of the spawner-recruitment curve. As documented in Tsou and Wallace (2005), a rough estimate of 0.519 for "current SPR" in runs 1, 3, and 5.

The results from this analysis indicate that the yelloweye rockfish stock is behind in rebuilding schedule and will take longer time to rebuild then as indicated in the 2002 rebuilding analysis (Methot and Piner 2002). New T_{MIN} of 2046 and T_{MAX} of 2096 are 19 and 25 years longer than the T_{MIN} of 2027 and T_{MAX} of 2071 reported in the previous analysis (Table 1). Probabilities of recovery by current T_{TARGET} (2058) and T_{MAX} (2071) based on current SPR are low (Table 2). Probability of recovery by re-estimated T_{MAX} (2080) with current SPR is also low. The current harvest control rule (F = 0.0153) is too high to rebuild the stock by current T_{TARGET} and current T_{MAX}. Based on SSC run 6 settings (Table 3), where T_{MAX} and SPR are re-estimated and P_o = 80%, OY is projected to be 12.6 mt in 2007 and the coastwide stock is estimated to rebuild in year 2096.

Literature Cited

Methot, R.D. 1990. Synthesis model: an adaptive framework for analysis of diverse stock assessment data. Int. N. Pac. Fish. Comm. Bull. 50:259-277.

Methot, R.D. and K.R. Piner 2002. Rebuilding Analysis for Yelloweye Rockfish: Update to Incorporate Results of Coastwide Assessment in 2002. Pacific Fishery Management Council.

Methot, R.D., F.R. Wallace, and K.R. Piner 2003. Status of the Yelloweye rockfish (*Sebastes ruberrimus*) off the U.S. west coast in 2002. Pacific Fishery Management Council.

PFMC. 2004. Appendix H to Amendment 16-3 to the Pacific coast groundfish fishery management plan. Yelloweye rockfish (*Sebastes ruberrimus*) draft rebuilding plan. Adopted April 2004. Pacific Fishery Management Council.

Punt, A.E. 2005. SSC default rebuilding analysis – technical specification and user manual. Version 2.9.

Wallace, F.R., T. Tsou, and T.H. Jagielo. 2005. Status of the Yelloweye rockfish (*Sebastes ruberrimus*) off the U.S. West Coast in 2005. Pacific Fishery Management Council.

Wallace, F.R., T. Tsou, T.H. Jagielo, W.Y. Cheng. 2006. Status of the Yelloweye rockfish (*Sebastes ruberrimus*) off the U.S. West Coast in 2006. Pacific Fishery Management Council.

Table 1. Rebuilding parameters and 10-year OY projects for coastwide and area-specific models.

	Coastwide		California		Oregon		Washington	
FMSY proxy		0.024		0.021		0.021		0.027
FMSY SPR / SPR(F=0)		0.5		0.5		0.5		0.5
Virgin SPR		52.195		52.189		53.349		44.960
Generation time		50		47		49		46
T_{MIN}		2046		2073		2035		2026
T_{MAX}		2096		2120		2084		2072
Virgin Spawning Output		6643		3421		2510		906
Target Spawning Output		2657		1368		1004		362
Current Spawning Output		1146		281		530		188
Spawning Output (ydecl = 2002)		1019		249		456		180
Natural mortality		0.036		0.036		0.036		0.040
Steepness		0.45		0.45		0.45		0.45
SigmaR		0.50		0.50		0.50		0.50
	OY	Depletion	OY	Depletion	OY	Depletion	OY	Depletion
2007	12.6	18.0%	2.7	8.6%	6.4	22.5%	2.6	20.9%
2008	12.9	18.5%	2.8	8.9%	6.6	23.1%	2.7	21.8%
2009	13.2	18.9%	2.9	9.2%	6.7	23.7%	2.8	22.8%
2010	13.5	19.4%	2.9	9.5%	6.8	24.2%	2.9	23.7%
2011	13.8	19.8%	3.0	9.8%	6.9	24.7%	3.0	24.5%
2012	14.1	20.2%	3.1	10.1%	7.0	25.2%	3.0	25.4%
2013	14.3	20.5%	3.1	10.3%	7.1	25.6%	3.1	26.1%
2014	14.5	20.8%	3.2	10.6%	7.1	25.9%	3.2	26.8%
2015	14.7	21.1%	3.3	10.8%	7.2	26.2%	3.2	27.3%
2016	15.0	21.4%	3.3	11.0%	7.3	26.5%	3.3	27.9%

Note: OY projection is base on P_{MAX} = 0.8.

Table 2. Summary of the SSC requested runs.

Run #	Prob (recovery)	By	Based on	SPR	2007 OY
1	**0.000**	2058	Current SPR	0.591	21.3
2	0.5	2058	estimated SPR	**0.860**	**5.5**
3	**0.001**	2071	Current SPR	0.591	21.3
4	0.8	2071	estimated SPR	**0.812**	**7.7**
5	**0.006**	**2096**	Current SPR	0.591	21.3
6	0.8	**2096**	estimated SPR	**0.719**	**12.6**

Table 3. Ten-year OY projects of the SSC requested runs.

	SSC runs 1, 3, 5	SSC run 2	SSC Run 4	SSC Run 6
P_0		0.5	0.8	0.8
Rebuild by T_{TARGET}		2058	--	--
Rebuild by T_{MAX}		--	2071	**0**
SPR	0.519	**0.86**	**0.812**	**0.719**
F		**0.0044**	**0.0061**	**0.0101**
2007	21.3	5.5	7.7	12.6
2008	21.7	5.6	7.9	12.9
2009	22.1	5.8	8.1	13.2
2010	22.4	5.9	8.3	13.5
2011	22.7	6.1	8.5	13.8
2012	23.0	6.2	8.7	14.1
2013	23.3	6.4	8.9	14.3
2014	23.5	6.5	9.0	14.5
2015	23.8	6.6	9.2	14.7
2016	24.0	6.7	9.4	15.0

Table 4. Ten-year OY projection and depletion levels under different P_{MAX} for the coastwide model.

	P= .5		P= .6		P= .7		P= .8		P= .9		Yr=Tmid		F=0	
2007	14.8	18%	14.1	18%	13.4	18%	12.6	18%	11.4	18%	10.2	18%	0.0	18%
2008	15.1	18%	14.5	18%	13.7	19%	12.9	19%	11.7	19%	10.5	19%	0.0	19%
2009	15.4	19%	14.8	19%	14.0	19%	13.2	19%	12.0	19%	10.7	19%	0.0	19%
2010	15.7	19%	15.1	19%	14.3	19%	13.5	19%	12.3	20%	11.0	20%	0.0	20%
2011	16.0	20%	15.4	20%	14.6	20%	13.8	20%	12.6	20%	11.2	20%	0.0	21%
2012	16.3	20%	15.6	20%	14.9	20%	14.1	20%	12.8	20%	11.4	20%	0.0	21%
2013	16.6	21%	15.9	21%	15.1	21%	14.3	21%	13.0	21%	11.7	21%	0.0	22%
2014	16.8	21%	16.1	21%	15.4	21%	14.5	21%	13.2	21%	11.9	21%	0.0	22%
2015	17.0	21%	16.4	21%	15.6	21%	14.7	21%	13.5	22%	12.1	22%	0.0	23%
2016	17.3	21%	16.6	22%	15.8	22%	15.0	22%	13.7	22%	12.2	22%	0.0	23%

Table 5. Ten-year OY projection and depletion levels under different P_{MAX} for the California model.

	P= .5		P= .6		P= .7		P= .8		P= .9		Yr=Tmid		F=0	
2007	3.3	9%	3.1	9%	3.0	9%	2.7	9%	2.5	9%	2.1	9%	0.0	9%
2008	3.4	9%	3.2	9%	3.0	9%	2.8	9%	2.5	9%	2.2	9%	0.0	9%
2009	3.5	9%	3.3	9%	3.1	9%	2.9	9%	2.6	9%	2.2	9%	0.0	9%
2010	3.6	9%	3.4	9%	3.2	10%	2.9	10%	2.7	10%	2.3	10%	0.0	10%
2011	3.6	10%	3.4	10%	3.3	10%	3.0	10%	2.7	10%	2.4	10%	0.0	10%
2012	3.7	10%	3.5	10%	3.3	10%	3.1	10%	2.8	10%	2.4	10%	0.0	10%
2013	3.8	10%	3.6	10%	3.4	10%	3.1	10%	2.9	10%	2.5	10%	0.0	11%
2014	3.9	10%	3.7	10%	3.5	11%	3.2	11%	2.9	11%	2.5	11%	0.0	11%
2015	3.9	11%	3.7	11%	3.5	11%	3.3	11%	3.0	11%	2.6	11%	0.0	11%
2016	4.0	11%	3.8	11%	3.6	11%	3.3	11%	3.0	11%	2.6	11%	0.0	12%

Table 6. Ten-year OY projection and depletion levels under different P_{MAX} for the Oregon model.

	P= .5		P= .6		P= .7		P= .8		P= .9		Yr=Tmid		F=0	
2007	7.5	22%	7.2	22%	6.9	22%	6.4	22%	5.8	22%	5.5	22%	0.0	22%
2008	7.7	23%	7.3	23%	7.0	23%	6.6	23%	6.0	23%	5.6	23%	0.0	23%
2009	7.8	24%	7.5	24%	7.1	24%	6.7	24%	6.1	24%	5.7	24%	0.0	24%
2010	7.9	24%	7.6	24%	7.2	24%	6.8	24%	6.2	24%	5.8	24%	0.0	25%
2011	8.0	25%	7.7	25%	7.3	25%	6.9	25%	6.3	25%	5.9	25%	0.0	26%
2012	8.1	25%	7.8	25%	7.4	25%	7.0	25%	6.4	25%	6.0	25%	0.0	26%
2013	8.2	25%	7.9	25%	7.5	25%	7.1	26%	6.5	26%	6.1	26%	0.0	27%
2014	8.3	26%	7.9	26%	7.6	26%	7.1	26%	6.5	26%	6.1	26%	0.0	28%
2015	8.3	26%	8.0	26%	7.7	26%	7.2	26%	6.6	26%	6.2	27%	0.0	28%
2016	8.4	26%	8.1	26%	7.7	26%	7.3	27%	6.7	27%	6.3	27%	0.0	29%

Table 7. Ten-year OY projection and depletion levels under different P_{MAX} for the Washington model.

	P= .5		P= .6		P= .7		P= .8		P= .9		Yr=Tmid		F=0	
2007	3.0	21%	2.9	21%	2.8	21%	2.6	21%	2.4	21%	2.1	21%	0.0	21%
2008	3.1	22%	3.0	22%	2.9	22%	2.7	22%	2.4	22%	2.2	22%	0.0	22%
2009	3.2	23%	3.1	23%	3.0	23%	2.8	23%	2.5	23%	2.3	23%	0.0	23%
2010	3.3	24%	3.2	24%	3.1	24%	2.9	24%	2.6	24%	2.3	24%	0.0	24%
2011	3.4	24%	3.3	24%	3.1	24%	3.0	25%	2.7	25%	2.4	25%	0.0	26%
2012	3.5	25%	3.3	25%	3.2	25%	3.0	25%	2.8	25%	2.5	26%	0.0	27%
2013	3.6	26%	3.4	26%	3.3	26%	3.1	26%	2.8	26%	2.5	26%	0.0	28%
2014	3.6	26%	3.5	27%	3.4	27%	3.2	27%	2.9	27%	2.6	27%	0.0	29%
2015	3.7	27%	3.5	27%	3.4	27%	3.2	27%	2.9	28%	2.7	28%	0.0	30%
2016	3.8	27%	3.6	28%	3.5	28%	3.3	28%	3.0	28%	2.7	28%	0.0	31%

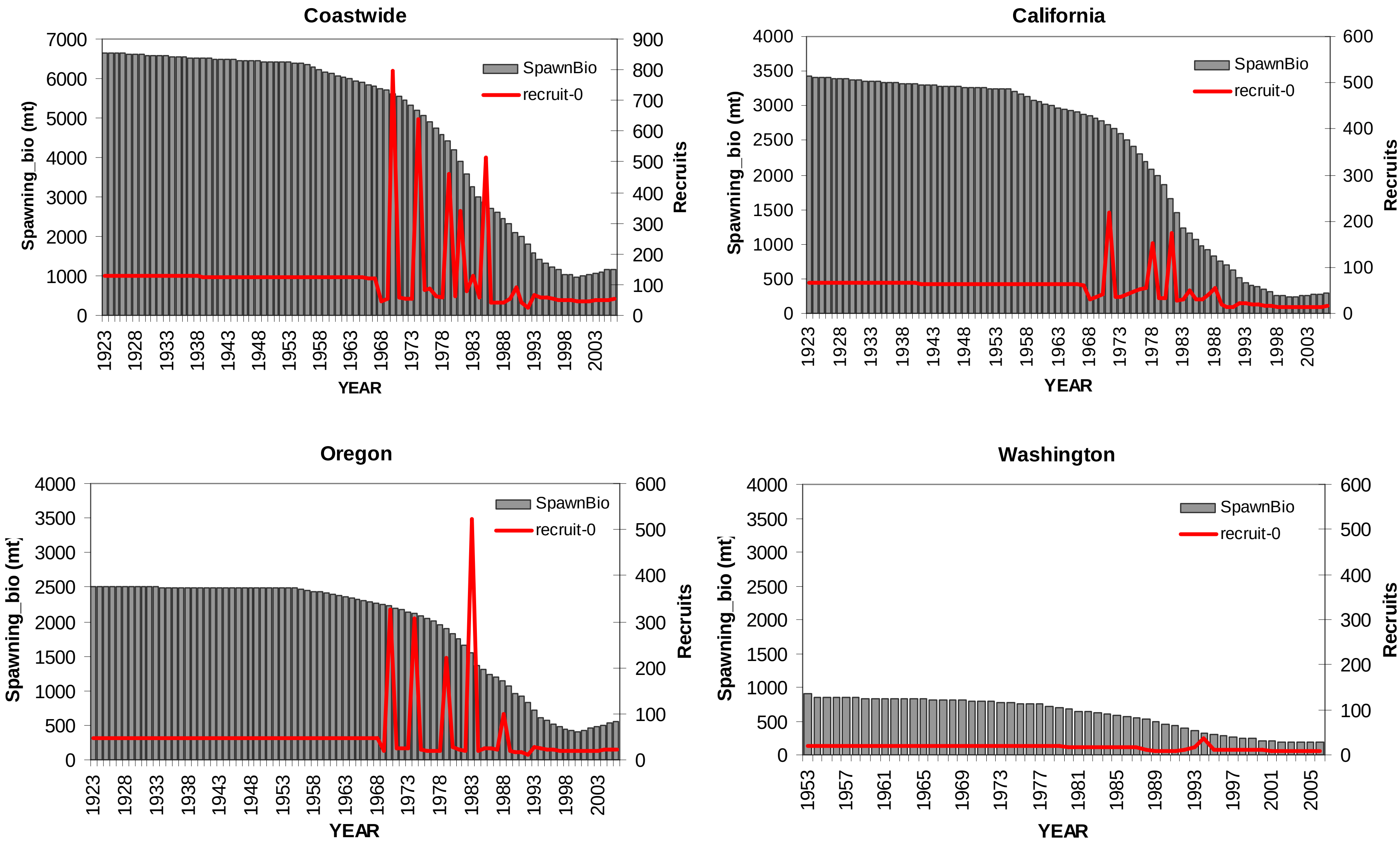


Figure 1. Spawning biomass and age-0 recruits in coastwide and area-specific models.

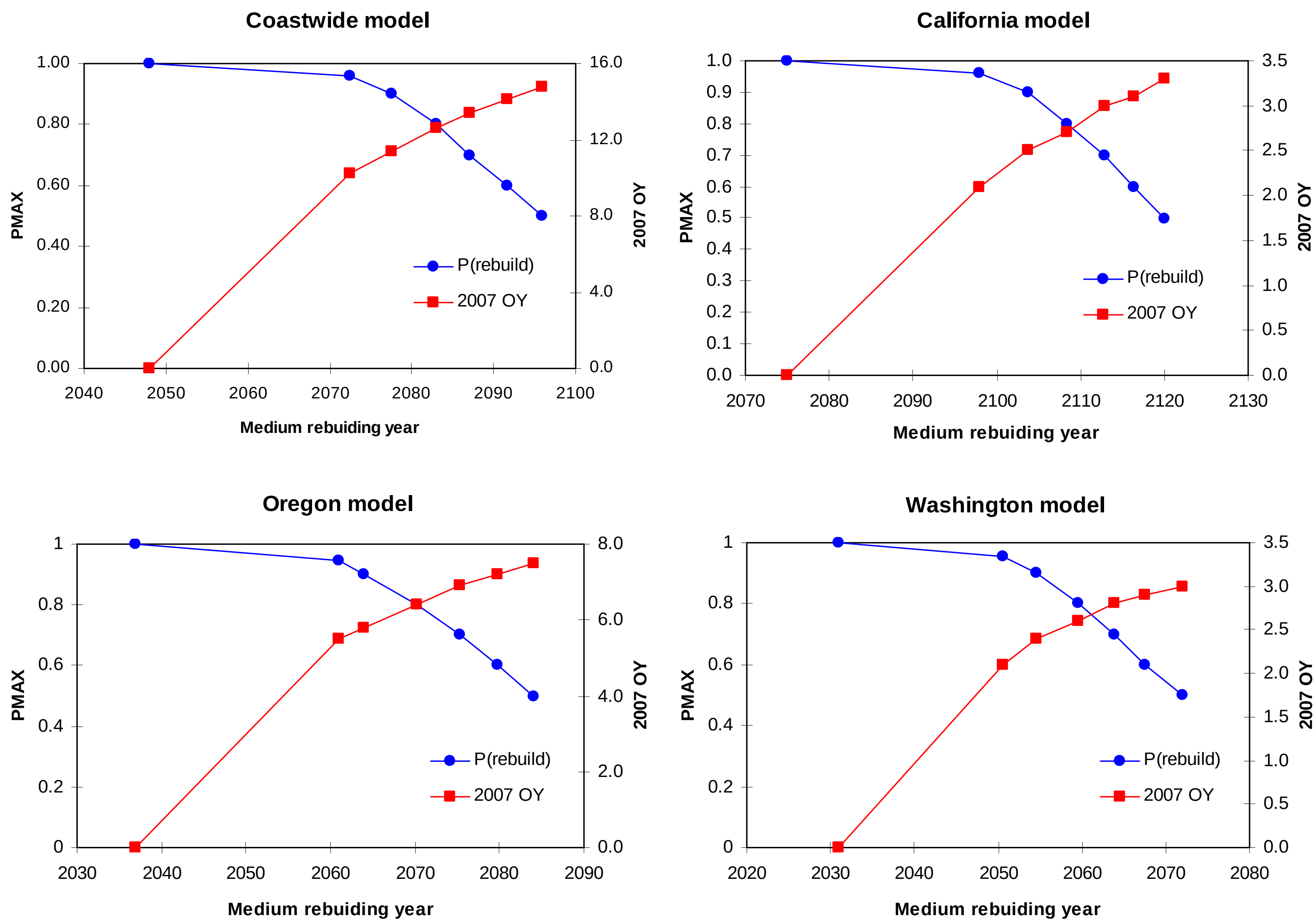


Figure 2. Trade-off between OY in 2007 and medium rebuilding time before T_{MAX}.

Appendix A. Input data for coastwide model

```
#Title
Yelloweye_CST_06
# Number of sexes
1
# Age range to consider (minimum age; maximum age)
0 70
# Number of fleets
3
# First year of projection (Yinit, last year of assessment)
2005
# Year declared overfished (Ydecl, the first year of zero OY)
2002
# Is the maximum age a plus-group (1=Yes;2=No)
1
# Generate future recruitments using historical recruitments (1)  historical recruits/spawner (2)  or a stock-recruitment (3)
3
# Constant fishing mortality (1) or constant Catch (2) projections
1
# Fishing mortality based on SPR (1) or actual rate (2)
1
# Pre-specify the year of recovery (or -1) to ignore (64 or 51: #of years beyond Tstart to Tmax 2071 or Ttarget 2058, from previous rebuilding plan)
-1
# Fecundity-at-age
#0	1	2	3	4	5	6	7	8	9	10	11	12	13
	14	15	16	17	18	19	20	21	22	23	24	25	26
	27	28	29	30	31	32	33	34	35	36	37	38	39
	40	41	42	43	44	45	46	47	48	49	50	51	52
	53	54	55	56	57	58	59	60	61	62	63	64	65
	66	67	68	69	70
0.00001	0.00001	0.00001	0.00001	0.00002	0.00008	0.00037689
	0.00163636	0.00618861	0.0198959	0.0531941	0.118229	0.22283
	0.366512	0.541439	0.736379	0.940456	1.14517	1.34484
	1.5362	1.71769	1.88888	2.04994	2.20134	2.34371	2.47766
	2.60381	2.72269	2.83479	2.94056	3.04039	3.13462
	3.22358	3.30755	3.3868	3.46158	3.53213	3.59867	3.6614
	3.72052	3.77623	3.8287	3.8781	3.9246	3.96835	4.00951	4.04821
	4.08459	4.11879	4.15092	4.18111	4.20945	4.23607
	4.26106	4.28451	4.30651	4.32716	4.34653	4.3647	4.38173
	4.39771	4.41265	4.42667	4.4398	4.45211	4.46365	4.47446
	4.48459	4.49407	4.50296	4.51129
# Age specific information (Females then males) weight  selectivity
# wt and selex fleet 1=CA fleets
0.1309	0.1309	0.1309	0.1336	0.1641	0.2291	0.3132	0.4099	0.5169	0.6324	0.7551	0.8832	1.0156
	1.1507	1.2876	1.4250	1.5622	1.6982	1.8324	1.9641	2.0930	2.2186	2.3405	2.4586	2.5726
	2.6824	2.7879	2.8891	2.9860	3.0786	3.1669	3.2511	3.3312	3.4074	3.4796	3.5482	3.6131
	3.6746	3.7328	3.7878	3.8397	3.8887	3.9349	3.9785	4.0196	4.0583	4.0947	4.1290	4.1613
	4.1916	4.2201	4.2469	4.2721	4.2958	4.3180	4.3388	4.3584	4.3767	4.3940	4.4101	4.4253
	4.4395	4.4528	4.4653	4.4769	4.4879	4.4982	4.5078	4.5168	4.5252	4.5332
0.0252	0.0252	0.0252	0.0265	0.0425	0.0885	0.1705	0.2854	0.4174	0.5462	0.6577	0.7467	0.8141
	0.8635	0.8992	0.9249	0.9433	0.9566	0.9664	0.9735	0.9789	0.9829	0.9860	0.9884	0.9903
	0.9917	0.9929	0.9938	0.9946	0.9952	0.9958	0.9962	0.9966	0.9969	0.9972	0.9974	0.9976
```

```
         0.9977  0.9979  0.9980  0.9981  0.9982  0.9983  0.9984  0.9985  0.9985  0.9986  0.9986  0.9987
         0.9987  0.9988  0.9988  0.9988  0.9989  0.9989  0.9989  0.9989  0.9990  0.9990  0.9990  0.9990
         0.9990  0.9990  0.9990  0.9991  0.9991  0.9991  0.9991  0.9991  0.9991  0.9991
# wt and selex fleet 2=OR fleets
0.1309   0.1309  0.1309  0.1336  0.1641  0.2291  0.3132  0.4099  0.5169  0.6324  0.7551  0.8832  1.0156
         1.1507  1.2876  1.4250  1.5622  1.6982  1.8324  1.9641  2.0930  2.2186  2.3405  2.4586  2.5726
         2.6824  2.7879  2.8891  2.9860  3.0786  3.1669  3.2511  3.3312  3.4074  3.4796  3.5482  3.6131
         3.6746  3.7328  3.7878  3.8397  3.8887  3.9349  3.9785  4.0196  4.0583  4.0947  4.1290  4.1613
         4.1916  4.2201  4.2469  4.2721  4.2958  4.3180  4.3388  4.3584  4.3767  4.3940  4.4101  4.4253
         4.4395  4.4528  4.4653  4.4769  4.4879  4.4982  4.5078  4.5168  4.5252  4.5332
0.0098   0.0098  0.0098  0.0105  0.0210  0.0575  0.1345  0.2536  0.3963  0.5377  0.6600  0.7563  0.8277
         0.8787  0.9143  0.9389  0.9559  0.9678  0.9760  0.9819  0.9861  0.9892  0.9915  0.9932  0.9944
         0.9954  0.9962  0.9968  0.9972  0.9976  0.9979  0.9982  0.9984  0.9986  0.9987  0.9988  0.9989
         0.9990  0.9991  0.9992  0.9992  0.9993  0.9993  0.9993  0.9994  0.9994  0.9994  0.9995  0.9995
         0.9995  0.9995  0.9995  0.9995  0.9996  0.9996  0.9996  0.9996  0.9996  0.9996  0.9996  0.9996
         0.9996  0.9996  0.9996  0.9996  0.9996  0.9997  0.9997  0.9997  0.9997  0.9997
# wt and selex fleet 3=WA fleets
0.1309   0.1309  0.1309  0.1336  0.1641  0.2291  0.3132  0.4099  0.5169  0.6324  0.7551  0.8832  1.0156
         1.1507  1.2876  1.4250  1.5622  1.6982  1.8324  1.9641  2.0930  2.2186  2.3405  2.4586  2.5726
         2.6824  2.7879  2.8891  2.9860  3.0786  3.1669  3.2511  3.3312  3.4074  3.4796  3.5482  3.6131
         3.6746  3.7328  3.7878  3.8397  3.8887  3.9349  3.9785  4.0196  4.0583  4.0947  4.1290  4.1613
         4.1916  4.2201  4.2469  4.2721  4.2958  4.3180  4.3388  4.3584  4.3767  4.3940  4.4101  4.4253
         4.4395  4.4528  4.4653  4.4769  4.4879  4.4982  4.5078  4.5168  4.5252  4.5332
0.0123   0.0123  0.0123  0.0126  0.0160  0.0241  0.0367  0.0543  0.0776  0.1075  0.1443  0.1876  0.2367
         0.2900  0.3454  0.4011  0.4551  0.5062  0.5534  0.5964  0.6351  0.6694  0.6998  0.7266  0.7501
         0.7707  0.7888  0.8047  0.8187  0.8310  0.8418  0.8514  0.8599  0.8675  0.8742  0.8802  0.8856
         0.8905  0.8948  0.8987  0.9023  0.9055  0.9084  0.9110  0.9134  0.9156  0.9176  0.9194  0.9211
         0.9226  0.9240  0.9253  0.9265  0.9276  0.9286  0.9296  0.9304  0.9312  0.9320  0.9327  0.9333
         0.9339  0.9344  0.9350  0.9354  0.9359  0.9363  0.9367  0.9370  0.9374  0.9377
# M and initial age-structure for 2005
# for both male and female
0.036    0.036   0.036   0.036   0.036   0.036   0.036   0.036   0.036   0.036   0.036   0.036   0.036   0.036
         0.036   0.036   0.036   0.036   0.036   0.036   0.036   0.036   0.036   0.036   0.036   0.036   0.036
         0.036   0.036   0.036   0.036   0.036   0.036   0.036   0.036   0.036   0.036   0.036   0.036   0.036
         0.036   0.036   0.036   0.036   0.036   0.036   0.036   0.036   0.036   0.036   0.036   0.036   0.036
         0.036   0.036   0.036   0.036   0.036   0.036   0.036   0.036   0.036   0.036   0.036   0.036   0.036
         0.036   0.036   0.036   0.036   0.036
51.6255          48.5266         45.4700         42.5004         40.5386         38.2789         38.4885
         37.3432         38.4787         38.7310         39.3492         39.1482         39.8207
         14.6943         22.8271         44.0905         24.0429         16.0633         13.5908
         12.3064         129.6330        12.7506         23.1109         12.0458         43.5901
         6.6227  42.8411         4.5909  4.4241  5.2766  4.4016  29.0624         2.1195  1.8523  1.7643
         21.6986         1.3380  0.9875  2.4541  2.2532  2.0796  1.9284  1.7969  1.6805  1.5772  1.4854
         1.4031  1.3289  1.2604  1.1975  1.1387  1.0816  1.0281  0.9778  0.9303  0.8854  0.8432  0.8037
         0.7670  0.7329  0.7012  0.6717  0.6440  0.6180  0.5933  0.5699  0.5476  0.5264  0.5061  0.4867
         12.8309
# Initial age-structure female then male  for Ydeclared=2002 (Tmin)
47.3655          45.1882         42.6739         42.9246         41.6864         43.0243         43.4054
         44.2166         44.1111         44.9822         16.6355         25.8913         50.0887
         27.3513         18.2953         15.4953         14.0437         148.0510        14.5722
         26.4288         13.7825         49.8982         7.5842  49.0784         5.2609  5.0712  6.0499
         5.0477  33.3347         2.4315  2.1252  2.0246  24.9025         1.5357  1.1335  2.8172  2.5868
         2.3877  2.2142  2.0634  1.9297  1.8113  1.7060  1.6115  1.5263  1.4477  1.3754  1.3079  1.2424
         1.1810  1.1232  1.0687  1.0171  0.9687  0.9234  0.8812  0.8420  0.8056  0.7717  0.7399  0.7100
         0.6817  0.6548  0.6292  0.6048  0.5814  0.5591  0.5378  0.5173  0.4977  13.1895
# Year for Tmin Age-structure
```

2002
Number of simulations
1000
recruitment and biomass
Number of historical assessment years
83
Historical data
year recruitment spawner in B0 in R project in R/S project

1923	127.281	6643.41	1	0	0
1924	127.281	6643.41	1	0	0
1925	127.281	6643.41	0	0	0
1926	127.222	6633.39	0	0	0
1927	127.163	6623.41	0	0	0
1928	127.105	6613.48	0	0	0
1929	127.047	6603.62	0	0	0
1930	126.989	6593.84	0	0	0
1931	126.932	6584.14	0	0	0
1932	126.875	6574.56	0	0	0
1933	126.818	6565.1	0	0	0
1934	126.763	6555.76	0	0	0
1935	126.708	6546.58	0	0	0
1936	126.654	6537.55	0	0	0
1937	126.601	6528.68	0	0	0
1938	126.549	6519.98	0	0	0
1939	126.497	6511.44	0	0	0
1940	126.447	6503.07	0	0	0
1941	126.397	6494.87	0	0	0
1942	126.349	6486.82	0	0	0
1943	126.301	6478.94	0	0	0
1944	126.254	6471.21	0	0	0
1945	126.208	6463.62	0	0	0
1946	126.163	6456.19	0	0	0
1947	126.118	6448.9	0	0	0
1948	126.075	6441.75	0	0	0
1949	126.032	6434.73	0	0	0
1950	125.99	6427.85	0	0	0
1951	125.948	6421.1	0	0	0
1952	125.908	6414.47	0	0	0
1953	125.868	6407.97	0	0	0
1954	125.828	6401.59	0	0	0
1955	125.79	6395.33	0	0	0
1956	125.49	6346.98	0	0	0
1957	125.144	6291.85	0	0	0
1958	124.802	6237.97	0	0	0
1959	124.406	6176.33	0	0	0
1960	124.052	6122.01	0	0	0
1961	123.726	6072.38	0	0	0
1962	123.44	6029.5	0	0	0
1963	123.159	5987.64	0	0	0
1964	122.83	5939.12	0	0	0
1965	122.552	5898.51	0	0	0
1966	122.229	5851.86	0	0	0
1967	121.878	5801.66	0	0	0
1968	44.6223	5751.12	0	1	0
1969	54.626	5700.33	0	1	0
1970	794.277	5620.62	0	1	0

1971	57.4323	5536.46	0	1	0
1972	53.1839	5454.66	0	1	0
1973	53.3088	5338.45	0	1	0
1974	637.256	5196.34	0	1	0
1975	83.934	5058.85	0	1	0
1976	87.4141	4917.57	0	1	0
1977	63.5935	4752.41	0	1	0
1978	57.0958	4579.12	0	1	0
1979	458.69	4411.06	0	1	0
1980	60.6498	4180.21	0	1	0
1981	339.435	3892.78	0	1	0
1982	79.3289	3594.84	0	1	0
1983	128.363	3265.23	0	1	0
1984	59.709	3006.81	0	1	0
1985	513.603	2864.65	0	1	0
1986	41.6036	2699.16	0	1	0
1987	39.6196	2604.61	0	1	0
1988	40.9073	2465.36	0	1	0
1989	54.2458	2316.87	0	1	0
1990	89.5403	2110.33	0	1	0
1991	42.3809	1993.85	0	1	0
1992	25.2998	1792.08	0	1	0
1993	64.3818	1582.76	0	0	0
1994	60.0054	1422.81	0	0	0
1995	57.5386	1337.55	0	0	0
1996	54.2349	1228.48	0	0	0
1997	51.7059	1148.68	0	0	0
1998	48.2626	1044.84	0	0	0
1999	47.8721	1033.4	0	0	0
2000	45.8841	976.155	0	0	0
2001	46.8447	1003.61	0	0	0
2002	47.3655	1018.65	0	0	0
2003	48.8742	1062.9	0	0	0
2004	50.3054	1105.8	0	0	0
2005	51.6255	1146.2	0	0	0

```
# Number of years with pre-specified catches
2
# catches for years with pre-specified catches
2005 26
2006 27
# Number of future recruitments to override
0
# Process for overiding (-1 for average otherwise index in data list)
# Which probability to product detailed results for (1=0.5; 2=0.6; 3=0.7; 4=0.8; 5=0.9; 6=Ttarget of
Tmin+0.75(Tmax-Tmin); 7="F=0"; 8="40-10" rule; 9=ABC rule)
4
# Steepness sigma-R Auto-correlation  (Change sigmaR to 0.4 for final runs!!)
0.45      0.5       0
# Target SPR rate (FMSY Proxy)
0.5
# Target SPR information: Use (1=Yes) and power
0         20
# Discount rate (for cumulative catch)
0.1
# Truncate the series when 0.4B0 is reached (1=Yes)
0
```

```
# Set F to FMSY once 0.4B0 is reached (1=Yes)
0
# Percentage of FMSY which defines Ftarget
0.9
# Maximum possible F for projection (-1 to set to FMSY)
-1
# Conduct MacCall transition policy (1=Yes)
0
# Defintion of recovery (1=now only;2=now or before)
1
# Results for rec probs by Tmax (1) or 0.5 prob for various Ttargets (2)
2
# Definition of the "40-10" rule
10	40
# Produce the risk-reward plots (1=Yes)
0
# Calculate coefficients of variation (1=Yes)
0
# Number of replicates to use
20
# Random number seed
-89102
# Conduct projections for multiple starting values (0=No;else yes)
0
# File with multiple parameter vectors
MCMC.PRJ
# Number of parameter vectors
1
# User-specific projection (1=Yes); Output replaced (1->6)
0	6	0	0.5
# Catches and Fs (Year; 1/2/3 (F or C or SPR); value); Final row is -1
2007 3 0.591
-1	-1	-1
# Split of Fs (first year MUST be Yinit)
2005 0.3 0.3 0.4
2006 0.3 0.3 0.4
-1	1	1	1
# Time varying weight-at-age (1=Yes;0=No)
0
# File with time series of weight-at-age data
HakWght.Csv
# Use bisection (0) or linear interpolation (1)
0
# Target Depletion
0.4
```

Appendix B. Input data for California model

```
#Title
Yelloweye_CA_06
# Number of sexes
1
# Age range to consider (minimum age; maximum age)
0 70
# Number of fleets
2
# First year of projection (Yinit, last year of assessment)
2005
# Year declared overfished (Ydecl, the first year of zero OY)
2002
# Is the maximum age a plus-group (1=Yes;2=No)
1
# Generate future recruitments using historical recruitments (1)  historical recruits/spawner (2)  or a stock-
recruitment (3)
3
# Constant fishing mortality (1) or constant Catch (2) projections
1
# Fishing mortality based on SPR (1) or actual rate (2)
1
# Pre-specify the year of recovery (or -1) to ignore
-1
# Fecundity-at-age
#0      1       2       3       4       5       6       7       8       9       10      11      12      13
        14      15      16      17      18      19      20      21      22      23      24      25      26
        27      28      29      30      31      32      33      34      35      36      37      38      39
        40      41      42      43      44      45      46      47      48      49      50      51      52
        53      54      55      56      57      58      59      60      61      62      63      64      65
        66      67      68      69      70
0.00    0.00    0.00    0.00006         0.0003  0.0014  0.0051  0.0176  0.0509  0.1207  0.2374  0.3984
        0.5909  0.7993  1.0102  1.2152  1.4096  1.5914  1.7604  1.9171  2.0624  2.1972  2.3224  2.4388
        2.5471  2.6481  2.7422  2.8300  2.9118  2.9881  3.0593  3.1257  3.1876  3.2453  3.2990  3.3491
        3.3957  3.4391  3.4794  3.5170  3.5520  3.5844  3.6146  3.6427  3.6688  3.6930  3.7155  3.7363
        3.7557  3.7737  3.7904  3.8059  3.8202  3.8335  3.8459  3.8573  3.8680  3.8778  3.8869  3.8954
        3.9032  3.9104  3.9171  3.9232  3.9289  3.9342  3.9391  3.9437  3.9479  3.9518  3.9554
# Age specific information (Females then males) weight  selectivity
# wt and selex fleet 1=CA recreation
0.1309  0.1320  0.1764  0.2644  0.3650  0.4736  0.5877  0.7100  0.8362  0.9658  1.0979  1.2314  1.3653
        1.4986  1.6302  1.7594  1.8855  2.0079  2.1261  2.2400  2.3492  2.4536  2.5531  2.6477  2.7374
        2.8224  2.9027  2.9784  3.0497  3.1168  3.1798  3.2390  3.2944  3.3462  3.3948  3.4401  3.4825
        3.5221  3.5589  3.5933  3.6254  3.6552  3.6830  3.7088  3.7329  3.7552  3.7760  3.7953  3.8132
        3.8299  3.8453  3.8597  3.8730  3.8854  3.8968  3.9075  3.9173  3.9265  3.9350  3.9428  3.9501
        3.9568  3.9629  3.9686  3.9739  3.9788  3.9833  3.9875  3.9914  3.9950  3.9983
0.0000  0.0357  0.0540  0.1143  0.2169  0.3533  0.5001  0.6321  0.7363  0.8125  0.8660  0.9031  0.9286
        0.9464  0.9589  0.9679  0.9744  0.9792  0.9829  0.9856  0.9878  0.9895  0.9908  0.9919  0.9927
        0.9935  0.9941  0.9946  0.9950  0.9954  0.9957  0.9959  0.9962  0.9964  0.9965  0.9967  0.9968
        0.9969  0.9970  0.9971  0.9972  0.9973  0.9974  0.9974  0.9975  0.9975  0.9976  0.9976  0.9977
        0.9977  0.9977  0.9977  0.9978  0.9978  0.9978  0.9978  0.9979  0.9979  0.9979  0.9979  0.9979
        0.9979  0.9979  0.9980  0.9980  0.9980  0.9980  0.9980  0.9980  0.9980  0.9980
# wt and selex fleet 2=CA commercial
```

```
0.1309  0.1323  0.1838  0.2783  0.3843  0.4952  0.6076  0.7265  0.8483  0.9736  1.1021  1.2330  1.3650
        1.4970  1.6278  1.7565  1.8822  2.0045  2.1227  2.2365  2.3457  2.4502  2.5498  2.6445  2.7343
        2.8193  2.8997  2.9755  3.0469  3.1141  3.1771  3.2363  3.2918  3.3437  3.3923  3.4377  3.4801
        3.5197  3.5566  3.5910  3.6231  3.6529  3.6807  3.7066  3.7306  3.7530  3.7738  3.7931  3.8111
        3.8277  3.8432  3.8576  3.8709  3.8833  3.8947  3.9054  3.9153  3.9244  3.9329  3.9408  3.9481
        3.9547  3.9609  3.9666  3.9718  3.9767  3.9813  3.9855  3.9894  3.9930  3.9963
0.0000  0.0087  0.0161  0.0475  0.1220  0.2524  0.4206  0.5865  0.7190  0.8130  0.8755  0.9160  0.9421
        0.9591  0.9704  0.9780  0.9832  0.9869  0.9896  0.9916  0.9930  0.9941  0.9950  0.9957  0.9962
        0.9966  0.9970  0.9973  0.9975  0.9977  0.9979  0.9980  0.9981  0.9982  0.9983  0.9984  0.9985
        0.9986  0.9986  0.9987  0.9987  0.9987  0.9988  0.9988  0.9988  0.9989  0.9989  0.9989  0.9989
        0.9989  0.9989  0.9990  0.9990  0.9990  0.9990  0.9990  0.9990  0.9990  0.9990  0.9990  0.9990
        0.9991  0.9991  0.9991  0.9991  0.9991  0.9991  0.9991  0.9991  0.9991  0.9991
# M and initial age-structure for 2005
# for both male and female
0.036   0.036   0.036   0.036   0.036   0.036   0.036   0.036   0.036   0.036   0.036   0.036   0.036   0.036
        0.036   0.036   0.036   0.036   0.036   0.036   0.036   0.036   0.036   0.036   0.036   0.036   0.036
        0.036   0.036   0.036   0.036   0.036   0.036   0.036   0.036   0.036   0.036   0.036   0.036   0.036
        0.036   0.036   0.036   0.036   0.036   0.036   0.036   0.036   0.036   0.036   0.036   0.036   0.036
        0.036   0.036   0.036   0.036   0.036   0.036   0.036   0.036   0.036   0.036   0.036   0.036   0.036
        0.036   0.036   0.036   0.036   0.036
14.8329         13.8524         12.9318         12.0221         11.3712         10.8050         10.8923
        10.6878         11.6463         12.3016         12.3010         12.1624         11.5713
        10.4492         6.0055  4.9790  5.9539  14.0654         8.5047  5.0151  4.2398  5.8357  2.9907
        2.0763  11.5461         1.9081  1.6592  6.4867  2.0495  1.6458  1.2881  0.9644  0.7431  0.6702
        3.5202  0.5999  0.4803  0.3651  0.6875  0.6381  0.5954  0.5581  0.5260  0.4975  0.4722  0.4496
        0.4292  0.4105  0.3926  0.3758  0.3594  0.3427  0.3267  0.3114  0.2970  0.2834  0.2709  0.2594
        0.2488  0.2389  0.2296  0.2208  0.2124  0.2044  0.1967  0.1894  0.1823  0.1755  0.1690  0.1627
        4.3220
# Initial age-structure female then male  for Ydeclared=2002 (Tmin)
13.4058         12.6932         12.0832         12.2164         12.0314         13.1620         13.9523
        13.9919         13.8641         13.2104         11.9420         6.8685  5.6973  6.8153  16.1045
        9.7395  5.7440  4.8565  6.6851  3.4261  2.3787  13.2285         2.1862  1.9011  7.4324  2.3484
        1.8858  1.4759  1.1051  0.8514  0.7679  4.0338  0.6874  0.5504  0.4184  0.7878  0.7312  0.6823
        0.6395  0.6028  0.5702  0.5411  0.5152  0.4918  0.4704  0.4499  0.4306  0.4118  0.3927  0.3744
        0.3569  0.3403  0.3248  0.3105  0.2973  0.2851  0.2737  0.2631  0.2530  0.2434  0.2342  0.2254
        0.2170  0.2089  0.2011  0.1937  0.1865  0.1796  0.1729  0.1665  4.4338
# Year for Tmin Age-structure
2002
# Number of simulations
1000
#  recruitment and biomass
# Number of historical assessment years
83
# Historical data
# year recruitment spawner in B0 in R project in R/S project
1923    65.704          3429.02         1       0       0
1924    65.4049         3413.41         1       0       0
1925    65.6123         3413.41         0       0       0
1926    65.5696         3406.18         0       0       0
1927    65.5269         3398.97         0       0       0
1928    65.4843         3391.78         0       0       0
1929    65.4417         3384.63         0       0       0
1930    65.3993         3377.52         0       0       0
1931    65.3571         3370.47         0       0       0
1932    65.3152         3363.5          0       0       0
1933    65.2737         3356.61         0       0       0
```

1934	65.2328	3349.83	0	0	0
1935	65.1924	3343.17	0	0	0
1936	65.1528	3336.64	0	0	0
1937	65.1139	3330.25	0	0	0
1938	65.0757	3323.99	0	0	0
1939	65.0383	3317.88	0	0	0
1940	65.0015	3311.89	0	0	0
1941	64.9656	3306.04	0	0	0
1942	64.9302	3300.31	0	0	0
1943	64.8956	3294.71	0	0	0
1944	64.8616	3289.22	0	0	0
1945	64.8283	3283.85	0	0	0
1946	64.7955	3278.58	0	0	0
1947	64.7633	3273.42	0	0	0
1948	64.7317	3268.37	0	0	0
1949	64.7007	3263.41	0	0	0
1950	64.6703	3258.56	0	0	0
1951	64.6403	3253.8	0	0	0
1952	64.6109	3249.13	0	0	0
1953	64.582	3244.55	0	0	0
1954	64.5536	3240.06	0	0	0
1955	64.5257	3235.66	0	0	0
1956	64.3242	3204.1	0	0	0
1957	64.0789	3166.23	0	0	0
1958	63.8396	3129.87	0	0	0
1959	63.5532	3087.11	0	0	0
1960	63.3128	3051.81	0	0	0
1961	63.103	3021.45	0	0	0
1962	62.9388	2997.96	0	0	0
1963	62.7821	2975.77	0	0	0
1964	62.5966	2949.79	0	0	0
1965	62.467	2931.82	0	0	0
1966	62.2935	2907.98	0	0	0
1967	62.0932	2880.78	0	0	0
1968	30.3249	2853.27	0	1	0
1969	36.4519	2825.59	0	1	0
1970	41.3152	2781.87	0	1	0
1971	218.362	2728.16	0	1	0
1972	37.0963	2678.42	0	1	0
1973	36.3038	2602.33	0	1	0
1974	41.1095	2502.85	0	1	0
1975	47.435	2407.19	0	1	0
1976	52.0892	2305.22	0	1	0
1977	55.7812	2194.07	0	1	0
1978	152.371	2089.3	0	1	0
1979	33.7009	1990.26	0	1	0
1980	33.3917	1859.12	0	1	0
1981	172.841	1661.94	0	1	0
1982	26.2746	1456.13	0	1	0
1983	31.6742	1230.91	0	1	0
1984	51.1318	1154.82	0	1	0
1985	30.4267	1065.9	0	1	0
1986	29.4327	972.492	0	1	0
1987	40.9978	913.922	0	1	0
1988	56.2407	833.007	0	1	0
1989	19.9289	760.843	0	1	0

1990	14.0639	702.201	0	1	0
1991	14.4547	631.309	0	1	0
1992	21.7774	520.784	0	1	0
1993	21.3551	439.811	0	0	0
1994	20.3219	412.711	0	0	0
1995	18.9849	378.741	0	0	0
1996	17.801	349.652	0	0	0
1997	15.9558	306.054	0	0	0
1998	13.9752	261.479	0	0	0
1999	13.6365	254.076	0	0	0
2000	12.9935	240.189	0	0	0
2001	13.1585	243.731	0	0	0
2002	13.4058	249.068	0	0	0
2003	13.9023	259.881	0	0	0
2004	14.3602	269.972	0	0	0
2005	14.8329	280.512	0	0	0

```
# Number of years with pre-specified catches
2
# catches for years with pre-specified catches
2005 8
2006 8
# Number of future recruitments to override
0
# Process for overiding (-1 for average otherwise index in data list)
# Which probability to product detailed results for (1=0.5; 2=0.6; 3=0.7; 4=0.8; 5=0.9; 6=Ttarget of Tmin+0.75(Tmax-Tmin); 7="F=0"; 8="40-10" rule; 9=ABC rule)
4
# Steepness sigma-R Auto-correlation  (Change sigmaR to 0.4 for final runs!!)
0.45    0.5    0
# Target SPR rate (FMSY Proxy)
0.5
# Target SPR information: Use (1=Yes) and power
0       20
# Discount rate (for cumulative catch)
0.1
# Truncate the series when 0.4B0 is reached (1=Yes)
0
# Set F to FMSY once 0.4B0 is reached (1=Yes)
0
# Percentage of FMSY which defines Ftarget
0.9
# Maximum possible F for projection (-1 to set to FMSY)
-1
# Conduct MacCall transition policy (1=Yes)
0
# Defintion of recovery (1=now only;2=now or before)
1
# Results for rec probs by Tmax (1) or 0.5 prob for various Ttargets (2)
1
# Definition of the "40-10" rule
10      40
# Produce the risk-reward plots (1=Yes)
0
# Calculate coefficients of variation (1=Yes)
0
# Number of replicates to use
```

20
Random number seed
-89102
Conduct projections for multiple starting values (0=No;else yes)
0
File with multiple parameter vectors
MCMC.PRJ
Number of parameter vectors
1
User-specific projection (1=Yes); Output replaced (1->6)
0 6 0 0.5
Catches and Fs (Year; 1/2/3 (F or C or SPR); value); Final row is -1
2007 3 0.717
-1 -1 -1
Split of Fs (first year MUST be Yinit)
2005 0.8 0.2
2006 0.8 0.2
-1 1 1 1
Time varying weight-at-age (1=Yes;0=No)
0
File with time series of weight-at-age data
HakWght.Csv
Use bisection (0) or linear interpolation (1)
0
Target Depletion
0.4

Appendix C. Input data for Oregon model

```
#Title
Yelloweye_OR_06
# Number of sexes
1
# Age range to consider (minimum age; maximum age)
0 70
# Number of fleets
2
# First year of projection (Yinit, last year of assessment)
2005
# Year declared overfished (Ydecl, the first year of zero OY)
2002
# Is the maximum age a plus-group (1=Yes;2=No)
1
# Generate future recruitments using historical recruitments (1)  historical recruits/spawner (2)  or a stock-recruitment (3)
3
# Constant fishing mortality (1) or constant Catch (2) projections
1
# Fishing mortality based on SPR (1) or actual rate (2)
1
# Pre-specify the year of recovery (or -1) to ignore
-1
# Fecundity-at-age
#0	1	2	3	4	5	6	7	8	9	10	11	12	13
	14	15	16	17	18	19	20	21	22	23	24	25	26
	27	28	29	30	31	32	33	34	35	36	37	38	39
	40	41	42	43	44	45	46	47	48	49	50	51	52
	53	54	55	56	57	58	59	60	61	62	63	64	65
	66	67	68	69	70
0.00000	0.00000	0.00001	0.00001	0.00001	0.00001	0.00006
	0.00038	0.00201	0.00900	0.03218	0.08970	0.19769
	0.35888	0.56178	0.78864	1.02318	1.25403	1.47468
	1.68223	1.87588	2.05599	2.22337	2.37902	2.52390
	2.65887	2.78472	2.90214	3.01173	3.11402	3.20950
	3.29861	3.38175	3.45929	3.53158	3.59895	3.66171
	3.72015	3.77454	3.82514	3.87219	3.91593	3.95658
	3.99433	4.02939	4.06193	4.09213	4.12015	4.14614
	4.17024	4.19257	4.21328	4.23247	4.25024	4.26671
	4.28196	4.29609	4.30916	4.32127	4.33248	4.34286
	4.35241	4.36125	4.36943	4.37700	4.38401	4.39049
	4.39648	4.40202	4.40715	4.41189
# Age specific information (Females then males) weight  selectivity
# wt and selex fleet 1=CA recreation
0.1309 0.1309 0.1309 0.1309 0.1318 0.1854 0.2929 0.4043 0.5156 0.6313 0.7551 0.8882 1.0296
       1.1770 1.3284 1.4815 1.6345 1.7859 1.9346 2.0796 2.2202 2.3558 2.4862 2.6110 2.7301
       2.8434 2.9509 3.0527 3.1488 3.2395 3.3249 3.4051 3.4804 3.5511 3.6172 3.6790 3.7368
       3.7908 3.8411 3.8880 3.9317 3.9724 4.0103 4.0455 4.0783 4.1087 4.1369 4.1632 4.1875
       4.2101 4.2311 4.2505 4.2685 4.2852 4.3007 4.3150 4.3283 4.3406 4.3520 4.3625 4.3723
       4.3812 4.3895 4.3972 4.4043 4.4109 4.4170 4.4227 4.4279 4.4327 4.4371
0.0000 0.0118 0.0118 0.0118 0.0119 0.0231 0.0864 0.2411 0.4570 0.6560 0.7969 0.8832 0.9327
       0.9604 0.9760 0.9850 0.9903 0.9935 0.9955 0.9968 0.9976 0.9982 0.9986 0.9989 0.9991
       0.9993 0.9994 0.9995 0.9996 0.9996 0.9997 0.9997 0.9997 0.9998 0.9998 0.9998 0.9998
       0.9998 0.9998 0.9998 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999
```

```
        0.9999  0.9999  0.9999  0.9999  0.9999  0.9999  0.9999  0.9999  0.9999  0.9999  0.9999  0.9999
        0.9999  0.9999  0.9999  0.9999  0.9999  0.9999  0.9999  0.9999  0.9999  0.9999
# wt and selex fleet 2=CA commercial
0.1309  0.1309  0.1309  0.1309  0.1316  0.1784  0.2884  0.4204  0.5612  0.7012  0.8386  0.9753  1.1134
        1.2539  1.3967  1.5411  1.6860  1.8303  1.9729  2.1128  2.2491  2.3812  2.5085  2.6309  2.7479
        2.8594  2.9655  3.0660  3.1611  3.2509  3.3354  3.4150  3.4897  3.5598  3.6255  3.6870  3.7444
        3.7981  3.8481  3.8948  3.9383  3.9788  4.0165  4.0516  4.0842  4.1145  4.1426  4.1687  4.1930
        4.2155  4.2363  4.2557  4.2736  4.2903  4.3057  4.3200  4.3332  4.3455  4.3568  4.3673  4.3770
        4.3860  4.3943  4.4019  4.4090  4.4156  4.4216  4.4272  4.4324  4.4372  4.4417
0.0000  0.0036  0.0036  0.0036  0.0037  0.0060  0.0184  0.0539  0.1299  0.2511  0.3977  0.5413  0.6628
        0.7563  0.8246  0.8731  0.9071  0.9309  0.9478  0.9598  0.9685  0.9749  0.9797  0.9832  0.9860
        0.9881  0.9898  0.9912  0.9922  0.9931  0.9938  0.9944  0.9949  0.9953  0.9957  0.9960  0.9963
        0.9965  0.9967  0.9969  0.9970  0.9971  0.9972  0.9974  0.9974  0.9975  0.9976  0.9977  0.9977
        0.9978  0.9978  0.9979  0.9979  0.9979  0.9980  0.9980  0.9980  0.9981  0.9981  0.9981  0.9981
        0.9981  0.9982  0.9982  0.9982  0.9982  0.9982  0.9982  0.9982  0.9982  0.9982
# M and initial age-structure for 2005
# for both male and female
0.036   0.036   0.036   0.036   0.036   0.036   0.036   0.036   0.036   0.036   0.036   0.036   0.036   0.036
        0.036   0.036   0.036   0.036   0.036   0.036   0.036   0.036   0.036   0.036   0.036   0.036   0.036
        0.036   0.036   0.036   0.036   0.036   0.036   0.036   0.036   0.036   0.036   0.036   0.036   0.036
        0.036   0.036   0.036   0.036   0.036   0.036   0.036   0.036   0.036   0.036   0.036   0.036   0.036
        0.036   0.036   0.036   0.036   0.036   0.036   0.036   0.036   0.036   0.036   0.036   0.036   0.036
        0.036   0.036   0.036   0.036   0.036
21.9894         20.5636         19.1752         17.7679         16.4652         15.2328         15.2911
        14.8226         15.3906         15.3280         15.9415         15.9114         16.8150
        6.7280  8.4961  8.3043  8.5727  39.7469         7.9843  7.2014  5.9153  3.9757  84.1920
        2.6733  2.3903  2.4198  16.7143         1.2385  1.0151  0.9076  0.8684  10.8216         0.7696
        0.6936  0.6232  7.0388  0.3788  0.8131  0.7517  0.7001  0.6559  0.6175  0.5834  0.5529  0.5250
        0.4993  0.4755  0.4535  0.4329  0.4137  0.3956  0.3779  0.3613  0.3455  0.3305  0.3164  0.3029
        0.2902  0.2782  0.2669  0.2564  0.2465  0.2372  0.2284  0.2200  0.2120  0.2043  0.1969  0.1898
        0.1830  4.9528
# Initial age-structure female then male  for Ydeclared=2002 (Tmin)
19.7969         18.3469         16.9736         17.0394         16.5228         17.1753         17.1459
        17.8930         17.9239         18.9994         7.6187  9.6349  9.4263  9.7368  45.1619
        9.0744  8.1859  6.7248  4.5201  95.7253         3.0396  2.7179  2.7515  19.0059         1.4083
        1.1543  1.0320  0.9875  12.3058         0.8751  0.7888  0.7086  8.0042  0.4307  0.9247  0.8548
        0.7961  0.7459  0.7022  0.6635  0.6287  0.5970  0.5678  0.5408  0.5157  0.4923  0.4704  0.4499
        0.4298  0.4108  0.3929  0.3759  0.3598  0.3445  0.3300  0.3163  0.3035  0.2916  0.2803  0.2698
        0.2597  0.2502  0.2411  0.2323  0.2239  0.2159  0.2081  0.2006  0.1935  0.1865  5.0515
# Year for Tmin Age-structure
2002
# Number of simulations
1000
#  recruitment and biomass
# Number of historical assessment years
83
# Historical data
# year recruitment spawner in B0 in R project in R/S project
1923    47.1445         2515.11         1       0       0
1924    46.9689         2505.74         1       0       0
1925    47.0907         2505.74         0       0       0
1926    47.0854         2504.82         0       0       0
1927    47.0801         2503.89         0       0       0
1928    47.0748         2502.98         0       0       0
1929    47.0695         2502.07         0       0       0
1930    47.0644         2501.17         0       0       0
```

1931	47.0592	2500.28	0	0	0
1932	47.0541	2499.4	0	0	0
1933	47.0492	2498.53	0	0	0
1934	47.0442	2497.69	0	0	0
1935	47.0394	2496.86	0	0	0
1936	47.0348	2496.05	0	0	0
1937	47.0302	2495.26	0	0	0
1938	47.0258	2494.51	0	0	0
1939	47.0216	2493.78	0	0	0
1940	47.0176	2493.09	0	0	0
1941	47.0138	2492.43	0	0	0
1942	47.0101	2491.79	0	0	0
1943	47.0066	2491.19	0	0	0
1944	47.0032	2490.6	0	0	0
1945	46.9999	2490.04	0	0	0
1946	46.9968	2489.5	0	0	0
1947	46.9938	2488.98	0	0	0
1948	46.9908	2488.48	0	0	0
1949	46.988	2487.99	0	0	0
1950	46.9852	2487.51	0	0	0
1951	46.9826	2487.05	0	0	0
1952	46.9799	2486.6	0	0	0
1953	46.9774	2486.16	0	0	0
1954	46.9749	2485.74	0	0	0
1955	46.9725	2485.32	0	0	0
1956	46.8889	2471.03	0	0	0
1957	46.802	2456.28	0	0	0
1958	46.7123	2441.19	0	0	0
1959	46.6194	2425.68	0	0	0
1960	46.5238	2409.88	0	0	0
1961	46.4252	2393.73	0	0	0
1962	46.3242	2377.33	0	0	0
1963	46.2203	2360.62	0	0	0
1964	46.1142	2343.73	0	0	0
1965	46.0055	2326.59	0	0	0
1966	45.8948	2309.31	0	0	0
1967	45.7815	2291.8	0	0	0
1968	45.6663	2274.19	0	1	0
1969	19.4462	2256.38	0	1	0
1970	327.158	2225.66	0	1	0
1971	25.9613	2202.43	0	1	0
1972	25.6524	2176.91	0	1	0
1973	25.05	2144.21	0	1	0
1974	307.775	2110.63	0	1	0
1975	21.4547	2078.32	0	1	0
1976	19.3827	2046.63	0	1	0
1977	18.6466	2002.29	0	1	0
1978	19.4331	1952.81	0	1	0
1979	221.978	1902.86	0	1	0
1980	26.9285	1822.99	0	1	0
1981	22.0788	1753.85	0	1	0
1982	20.3212	1657.00	0	1	0
1983	523.067	1544.93	0	1	0
1984	20.1546	1358.73	0	1	0
1985	24.5851	1302.58	0	1	0
1986	24.8154	1235.07	0	1	0

1987	23.193	1196.04	0	1	0
1988	99.3495	1146.26	0	1	0
1989	18.8451	1077.39	0	1	0
1990	16.4023	950.896	0	1	0
1991	15.3674	913.641	0	1	0
1992	11.3309	829.403	0	1	0
1993	26.7272	718.584	0	0	0
1994	24.0959	608.913	0	0	0
1995	23.1138	571.285	0	0	0
1996	21.337	507.238	0	0	0
1997	20.5976	482.005	0	0	0
1998	19.1026	433.322	0	0	0
1999	18.9889	429.743	0	0	0
2000	18.2427	406.65	0	0	0
2001	19.0194	430.701	0	0	0
2002	19.7969	455.554	0	0	0
2003	20.6078	482.348	0	0	0
2004	21.3174	506.561	0	0	0
2005	21.9894	530.179	0	0	0

```
# Number of years with pre-specified catches
2
# catches for years with pre-specified catches (use W-O-C: 5.1:4:3.7 ratio to split the OY)
2005 8
2006 8
# Number of future recruitments to override
0
# Process for overiding (-1 for average otherwise index in data list)
# Which probability to product detailed results for (1=0.5; 2=0.6; 3=0.7; 4=0.8; 5=0.9; 6=Ttarget of Tmin+0.75(Tmax-Tmin); 7="F=0"; 8="40-10" rule; 9=ABC rule)
4
# Steepness sigma-R Auto-correlation  (Change sigmaR to 0.4 for final runs!!)
0.45	0.5	0
# Target SPR rate (FMSY Proxy)
0.5
# Target SPR information: Use (1=Yes) and power
0	20
# Discount rate (for cumulative catch)
0.1
# Truncate the series when 0.4B0 is reached (1=Yes)
0
# Set F to FMSY once 0.4B0 is reached (1=Yes)
0
# Percentage of FMSY which defines Ftarget
0.9
# Maximum possible F for projection (-1 to set to FMSY)
-1
# Conduct MacCall transition policy (1=Yes)
0
# Defintion of recovery (1=now only;2=now or before)
1
# Results for rec probs by Tmax (1) or 0.5 prob for various Ttargets (2)
1
# Definition of the "40-10" rule
10	40
# Produce the risk-reward plots (1=Yes)
0
```

```
# Calculate coefficients of variation (1=Yes)
0
# Number of replicates to use
20
# Random number seed
-89102
# Conduct projections for multiple starting values (0=No;else yes)
0
# File with multiple parameter vectors
MCMC.PRJ
# Number of parameter vectors
1
# User-specific projection (1=Yes); Output replaced (1->6)
0       6       0       0.5
# Catches and Fs (Year; 1/2/3 (F or C or SPR); value); Final row is -1
2007 3 0.717
-1      -1      -1
# Split of Fs (first year MUST be Yinit)
2005 0.8 0.2
2006 0.8 0.2
-1      1       1       1
# Time varying weight-at-age (1=Yes;0=No)
0
# File with time series of weight-at-age data
HakWght.Csv
# Use bisection (0) or linear interpolation (1)
0
# Target Depletion
0.4
```

Appendix D. Input data for Washington model

```
#Title
Yelloweye_WA_06
# Number of sexes
1
# Age range to consider (minimum age; maximum age)
0 70
# Number of fleets
2
# First year of projection (Yinit, last year of assessment)
2005
# Year declared overfished (Ydecl, the first year of zero OY)
2002
# Is the maximum age a plus-group (1=Yes;2=No)
1
# Generate future recruitments using historical recruitments (1)  historical recruits/spawner (2)  or a stock-
recruitment (3)
3
# Constant fishing mortality (1) or constant Catch (2) projections
1
# Fishing mortality based on SPR (1) or actual rate (2)
1
# Pre-specify the year of recovery (or -1) to ignore
-1
# Fecundity-at-age
#0	1	2	3	4	5	6	7	8	9	10	11	12	13
	14	15	16	17	18	19	20	21	22	23	24	25	26
	27	28	29	30	31	32	33	34	35	36	37	38	39
	40	41	42	43	44	45	46	47	48	49	50	51	52
	53	54	55	56	57	58	59	60	61	62	63	64	65
	66	67	68	69	70
0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00005
	0.00031	0.00172	0.00806	0.03102	0.09285	0.21444
	0.39745	0.62398	0.87036	1.11793	1.35575	1.57896
	1.78627	1.97815	2.15571	2.32025	2.47295	2.61486
	2.74690	2.86983	2.98432	3.09096	3.19027	3.28272
	3.36876	3.44879	3.52319	3.59233	3.65653	3.71612
	3.77140	3.82266	3.87017	3.91417	3.95492	3.99264
	4.02753	4.05980	4.08964	4.11722	4.14270	4.16624
	4.18799	4.20806	4.22659	4.24369	4.25948	4.27404
	4.28747	4.29986	4.31129	4.32182	4.33154	4.34050
	4.34861	4.35609	4.36299	4.36934	4.37519	4.38059
	4.38556	4.39014	4.39435	4.39824
# Age specific information (Females then males) weight  selectivity
# wt and selex fleet 1=WA recreation
0.1309	0.1309	0.1309	0.1309	0.1309	0.1731	0.2821	0.4184	0.5576	0.6893	0.8197	0.9549	1.0973
	1.2461	1.3995	1.5551	1.7109	1.8650	2.0162	2.1633	2.3057	2.4426	2.5738	2.6989	2.8178
	2.9305	3.0371	3.1376	3.2321	3.3209	3.4041	3.4820	3.5549	3.6228	3.6862	3.7453	3.8002
	3.8513	3.8987	3.9428	3.9836	4.0215	4.0566	4.0891	4.1192	4.1470	4.1728	4.1966	4.2186
	4.2389	4.2577	4.2751	4.2911	4.3058	4.3195	4.3321	4.3437	4.3544	4.3643	4.3734	4.3818
	4.3893	4.3963	4.4027	4.4086	4.4141	4.4191	4.4237	4.4280	4.4319	4.4356
0.0000	0.0009	0.0009	0.0009	0.0009	0.0017	0.0098	0.0502	0.1743	0.3836	0.5974	0.7561	0.8555
	0.9135	0.9466	0.9657	0.9771	0.9841	0.9885	0.9914	0.9933	0.9947	0.9957	0.9964	0.9969
	0.9974	0.9977	0.9979	0.9981	0.9983	0.9984	0.9985	0.9986	0.9987	0.9988	0.9988	0.9989
	0.9989	0.9990	0.9990	0.9990	0.9991	0.9991	0.9991	0.9991	0.9991	0.9992	0.9992	0.9992
```

```
        0.9992  0.9992  0.9992  0.9992  0.9992  0.9992  0.9992  0.9992  0.9993  0.9993  0.9993  0.9993
        0.9993  0.9993  0.9993  0.9993  0.9993  0.9993  0.9993  0.9993  0.9993  0.9993
# wt and selex fleet 2=WA commercial (with line gear)
0.1309  0.1309  0.1309  0.1309  0.1309  0.1638  0.2636  0.3933  0.5459  0.7134  0.8864  1.0574  1.2232
        1.3839  1.5405  1.6938  1.8442  1.9915  2.1352  2.2751  2.4105  2.5411  2.6665  2.7864  2.9008
        3.0094  3.1123  3.2096  3.3013  3.3875  3.4685  3.5444  3.6155  3.6818  3.7438  3.8016  3.8554
        3.9054  3.9519  3.9951  4.0352  4.0724  4.1069  4.1388  4.1684  4.1958  4.2211  4.2445  4.2662
        4.2862  4.3047  4.3217  4.3375  4.3521  4.3655  4.3779  4.3893  4.3999  4.4096  4.4186  4.4269
        4.4342  4.4410  4.4473  4.4531  4.4584  4.4633  4.4678  4.4720  4.4758  4.4794
0.0004  0.0004  0.0004  0.0004  0.0004  0.0006  0.0019  0.0056  0.0149  0.0355  0.0750  0.1391  0.2264
        0.3273  0.4295  0.5237  0.6051  0.6728  0.7276  0.7716  0.8066  0.8345  0.8569  0.8749  0.8895
        0.9015  0.9113  0.9195  0.9263  0.9320  0.9369  0.9410  0.9446  0.9476  0.9503  0.9526  0.9546
        0.9564  0.9580  0.9594  0.9606  0.9617  0.9627  0.9636  0.9643  0.9650  0.9657  0.9663  0.9668
        0.9672  0.9677  0.9681  0.9684  0.9687  0.9690  0.9693  0.9695  0.9697  0.9699  0.9701  0.9703
        0.9705  0.9707  0.9708  0.9710  0.9711  0.9712  0.9713  0.9714  0.9715  0.9716
# M and initial age-structure for 2005
# for both male and female
0.04    0.04    0.04    0.04    0.04    0.04    0.04    0.04    0.04    0.04    0.04    0.04    0.04    0.04
        0.04    0.04    0.04    0.04    0.04    0.04    0.04    0.04    0.04    0.04    0.04    0.04    0.04
        0.04    0.04    0.04    0.04    0.04    0.04    0.04    0.04    0.04    0.04    0.04    0.04    0.04
        0.04    0.04    0.04    0.04    0.04    0.04    0.04    0.04    0.04    0.04    0.04    0.04    0.04
        0.04    0.04    0.04    0.04    0.04    0.04    0.04    0.04    0.04    0.04    0.04    0.04    0.04
        0.04    0.04    0.04    0.04    0.04
9.3089  8.8362  8.3557  7.9966  8.3428  8.2372  8.6273  8.4875  8.5030  8.4335  8.3180  22.7786
        10.6208         6.1877  4.4632  3.7844  3.6566  4.1672  5.6961  4.6955  4.1456  3.6217  3.1537
        2.7398  2.3882  2.1216  1.8910  1.6944  1.5278  1.3801  1.2532  1.1465  1.0550  0.9747  0.9023
        0.8361  0.7743  0.7181  0.6679  0.6236  0.5845  0.5498  0.5187  0.4899  0.4637  0.4397  0.4175
        0.3969  0.3775  0.3592  0.3421  0.3333  0.3177  0.3031  0.2893  0.2763  0.2640  0.2524  0.2414
        0.2310  0.2212  0.2119  0.2030  0.1945  0.1864  0.1786  0.1712  0.1641  0.1572  0.1507  3.4918
# Initial age-structure female then male  for Ydeclared=2002 (Tmin)
9.0165  9.4071  9.2880  9.7281  9.5721  9.5986  9.5503  9.4814  26.2087         12.3455         7.2570
        5.2706  4.4921  4.3576  4.9813  6.8255  5.6373  4.9845  4.3596  3.7997  3.3034  2.8811  2.5606
        2.2831  2.0463  1.8456  1.6675  1.5144  1.3856  1.2752  1.1783  1.0909  1.0109  0.9363  0.8683
        0.8076  0.7541  0.7069  0.6649  0.6273  0.5925  0.5608  0.5318  0.5050  0.4800  0.4565  0.4345
        0.4137  0.4032  0.3843  0.3666  0.3499  0.3342  0.3194  0.3053  0.2921  0.2795  0.2676  0.2563
        0.2455  0.2352  0.2254  0.2160  0.2071  0.1985  0.1902  0.1823  0.1748  0.1675  0.1606  3.7211
# Year for Tmin Age-structure
2002
# Number of simulations
1000
#  recruitment and biomass
# Number of historical assessment years
53
# Historical data
# year recruitment spawner in B0 in R project in R/S project
1953    20.1555         906.199         1       0       0
1954    20.1555         842.582         1       0       0
1955    19.701          842.582         0       0       0
1956    19.6942         841.668         0       0       0
1957    19.6873         840.756         0       0       0
1958    19.6804         839.846         0       0       0
1959    19.6667         838.028         0       0       0
1960    19.653          836.217         0       0       0
1961    19.6393         834.418         0       0       0
1962    19.6257         832.634         0       0       0
1963    19.6122         830.87          0       0       0
```

1964	19.5778	826.383	0	0	0
1965	19.5433	821.925	0	0	0
1966	19.5087	817.494	0	0	0
1967	19.4741	813.081	0	0	0
1968	19.4393	808.681	0	0	0
1969	19.4043	804.294	0	0	0
1970	19.3693	799.925	0	0	0
1971	19.3186	793.665	0	0	0
1972	19.2715	787.905	0	0	0
1973	19.2175	781.377	0	0	0
1974	19.1489	773.179	0	0	0
1975	19.0715	764.063	0	0	0
1976	19.0049	756.332	0	0	0
1977	18.9102	745.513	0	0	0
1978	18.7153	723.881	0	0	0
1979	18.4986	700.77	0	0	0
1980	18.242	674.603	0	0	0
1981	17.9234	643.801	0	0	0
1982	17.8338	635.453	0	0	0
1983	17.7171	624.778	0	0	0
1984	17.5265	607.814	0	0	0
1985	17.3089	589.117	0	0	0
1986	16.9786	562.024	0	0	0
1987	17.9171	545.66	0	1	0
1988	11.4743	518.901	0	1	0
1989	8.89669	493.991	0	1	0
1990	8.23966	451.587	0	1	0
1991	8.81922	425.257	0	1	0
1992	11.2441	397.383	0	1	0
1993	17.9672	359.504	0	1	0
1994	36.2702	323.943	0	1	0
1995	12.5664	304.453	0	0	0
1996	12.1511	287.145	0	0	0
1997	11.7294	270.423	0	0	0
1998	11.2369	251.894	0	0	0
1999	10.9699	242.271	0	0	0
2000	10.0625	211.597	0	0	0
2001	9.79097	202.981	0	0	0
2002	9.01646	179.688	0	0	0
2003	9.05178	180.711	0	0	0
2004	9.19683	184.95	0	0	0
2005	9.3089	188.268	0	0	0

Number of years with pre-specified catches
2
catches for years with pre-specified catches
2005 10
2006 11
Number of future recruitments to override
0
Process for overiding (-1 for average otherwise index in data list)
Which probability to product detailed results for (1=0.5; 2=0.6; 3=0.7; 4=0.8; 5=0.9; 6=Ttarget of Tmin+0.75(Tmax-Tmin); 7="F=0"; 8="40-10" rule; 9=ABC rule)
4
Steepness sigma-R Auto-correlation (Change sigmaR to 0.4 for final runs!!)
0.45   0.5   0
Target SPR rate (FMSY Proxy)

```
0.5
# Target SPR information: Use (1=Yes) and power
0	20
# Discount rate (for cumulative catch)
0.1
# Truncate the series when 0.4B0 is reached (1=Yes)
0
# Set F to FMSY once 0.4B0 is reached (1=Yes)
0
# Percentage of FMSY which defines Ftarget
0.9
# Maximum possible F for projection (-1 to set to FMSY)
-1
# Conduct MacCall transition policy (1=Yes)
0
# Defintion of recovery (1=now only;2=now or before)
1
# Results for rec probs by Tmax (1) or 0.5 prob for various Ttargets (2)
1
# Definition of the "40-10" rule
10	40
# Produce the risk-reward plots (1=Yes)
0
# Calculate coefficients of variation (1=Yes)
0
# Number of replicates to use
20
# Random number seed
-89102
# Conduct projections for multiple starting values (0=No;else yes)
0
# File with multiple parameter vectors
MCMC.PRJ
# Number of parameter vectors
1
# User-specific projection (1=Yes); Output replaced (1->6)
0	6	0	0.5
# Catches and Fs (Year; 1/2/3 (F or C or SPR); value); Final row is -1
2007 3 0.717
-1	-1	-1
# Split of Fs (first year MUST be Yinit)
2005 0.5 0.5
2006 0.5 0.5
-1	1	1	1
# Time varying weight-at-age (1=Yes;0=No)
0
# File with time series of weight-at-age data
HakWght.Csv
# Use bisection (0) or linear interpolation (1)
0
# Target Depletion
0.4
```

Agenda Item F.3.a
Supplemental WDFW Request
March 2006

February 28, 2006

Dr. Donald O. McIsaac, Executive Director
Pacific Fishery Management Council
7700 Northeast Ambassador Place
Portland, Oregon 97220-1384

Dear Dr. McIsaac:

First of all, I want to thank the Council and the Northwest Fisheries Science Center for your cooperation in ensuring the process to review and reconsider a new stock assessment and rebuilding plan for yelloweye rockfish went as smooth as possible. I would also like to commend the Stock Assessment (STAT) Team for their efforts. They put in a lot of hours to produce new model runs, and draft a revised assessment and rebuilding analyses within the limited timeframe.

Among the benefits of the additional effort was the STAT Team's work to undertake a comprehensive review of all of the available data and an examination of how the natural mortality rate was estimated. In contrast to the 2002 and 2005 assessments, the new assessment allows the model to re-estimate the natural mortality rate.

We note that one of the key parameters that changed in the 2006 assessment, which may have had a significant effect, is the selectivity function. In the 2002 and 2005 assessments, a double-logistic selectivity was used; in 2006, a logistic selectivity was used. The logistic selectivity would suggest that larger, older fish are as available to the fishery as younger fish, whereas the double-logistic selectivity supports the theory that the larger, older fish are not available to the fishery.

It is my understanding that the Stock Assessment Review (STAR) Panel was made aware of this parameter change, but did not review in detail the affect of this change on the model. Perhaps, given the abbreviated STAR Panel meeting and the process deadlines, which needed to be met, there was not sufficient time to fully explore the effects of the change in selectivity function. However, I believe that this is a significant change and I recommend that the Scientific and Statistical Committee (SSC) explore this issue including the potential need for a sensitivity run using the dome-shaped selectivity function. This run, if confirmed by the SSC, should occur at the Council meeting next week. The STAT Team will be available at the SSC meeting on Monday to address any questions and to respond to this request.

If you have any questions, please feel free to call me at (360) 902-2720.

Sincerely,

Philip Anderson, Special Assistant
Intergovernmental Resource Management

cc: Council Members
Council SSC Members
Council GMT Members
Elizabeth Clarke, NWFSC
Jeff Koenings, WDFW
Tom Jagielo, WDFW
Theresa Tsou, WDFW
Farron Wallace, WDFW

Agenda Item F.3.b
Supplemental SSC Report
March 2006

SCIENTIFIC AND STATISTICAL COMMITTEE REPORT ON YELLOWEYE STOCK ASSESSMENT

Following completion of an updated stock assessment and Stock Assessment Review (STAR) Panel review of yelloweye rockfish in 2005, the Council in November requested that the stock assessment team (STAT) further develop the analysis to include new data sources, and in particular, fishery-independent catch rate data from the International Pacific Halibut Commission (IPHC) survey. The STAT completed a new stock assessment (F.3.a., Supplemental Attachment 1), which was reviewed at a STAR Panel held from 13-15 February (F.3.a., Supplemental Attachment 2). Subsequently, using results from the new assessment the STAT conducted an updated rebuilding analysis, contained in (F.3.a., Supplemental Attachment 3).

The new assessment model treats the West Coast population of yelloweye rockfish in two different ways: as a single coastwide stock (consistent with the 2002 and 2005 assessments) and as separate and distinct sub-populations for the States of California, Oregon and Washington. Other significant changes that were incorporated into the new model included: (1) inclusion of an abundance trend calculated from the IPHC survey, (2) a detailed re-examination and evaluation of all recreational CPUE statistics available from each State, (3) a thorough summary of historical catch data that extended the model back to as early as 1923, (4) a change from dome-shaped selectivity curves to simpler asymptotic ones, and (5) a reduction in natural mortality rate from 0.045 to 0.036 yr^{-1}. Collectively, the new assessment model that includes all of these alterations, indicates that the spawning biomass of the coastwide yelloweye stock is currently 17.7% of the unfished level.

The SSC considered the attempt to build separate State-specific sub-population models for yelloweye rockfish to be an ambitious undertaking, given the sparseness of the available data. While considerable progress was made in that direction, including the development of plausible models for California and Oregon, the SSC was concerned with the Washington sub-population model, which had difficulty converging and required additional constraints. Moreover, there was an apparent discrepancy in the implied coastwide distribution of the species based on modeling results at the sub-population level and long-term distributional data from the triennial shelf trawl survey. As a consequence of these concerns, the SSC favors using the coastwide yelloweye rockfish model for setting the optimum yield (OY) of the stock, which is consistent with current practice. Nonetheless, given the apparent vulnerability of this species to localized depletion the SSC encourages future development of area-specific models and notes that results from the California and Oregon models may be of use to the Council in characterizing regional patterns of depletion. The continued development of *in situ* submersible surveys and focused sampling in yelloweye habitat during the IPHC survey should be of considerable value in improving the Washington sub-population model. However, the SSC wishes to strongly reiterate, as it did following the 2005 assessement, that without the development of new trend indices, especially for the States of California and Oregon, any future attempt to assess the yelloweye rockfish stock will be fruitless.

Concern was also expressed that the change from dome-shaped to asymptotic selectivity curves was not fully evaluated during the STAR Panel and a request was made that the SSC explore this issue (letter from P. Anderson to D. McIsaac dated February 28, 2006). With respect to this matter the SSC notes that models using dome-shaped selectivity were problematic due to frequent lack of convergence, resulting in difficulties in interpreting model results. Furthermore, the information presented in Tables 26a and 26b compare and contrast results from fitting the model to both types of selectivity curves. From the information presented in those tables, albeit from pre-STAR versions of the models, it is apparent that only modest gains in fit are obtained with the increase in parameters required by the dome-shaped (double logistic) model, which generally are statistically insignificant. Based on this consideration the SSC supports the STAT's use of asymptotic selectivity curves in the yelloweye model.

Results presented in the latest rebuilding analysis that are derived from the coastwide model indicate that rebuilding of yelloweye rockfish is lagging behind the current Council adopted schedule, i.e., the probability of rebuilding by the current T_{target} (2058) = 0.005. Given the numerous changes that have been incorporated into the yelloweye model, including a substantial alteration in the natural mortality rate, the SSC considers it appropriate to re-estimate T_{max}, T_{target}, and a suite of harvest rates that would rebuild the stock over a range of probability values. If the Council elects to maintain a probability of rebuilding before the new, re-estimated T_{max} (2096) equal to 0.80, which is the current policy, the calculated OY in 2007 from the coastwide model is 12.6 mt. The SSC notes, however, that this approach to establishing fishery yields during rebuilding has been deemed inappropriate by the 9th Circuit Court of Appeals.

The 2006 re-assessment and review of yelloweye rockfish was completed in a very short time by the STAT and STAR Panel and both are to be commended for completing the task in the available time. Nonetheless, from an evaluation perspective the SSC does not view this kind of rapid response analysis in a favorable light. The accelerated turn-around that was required between completion of the STAR Panel report, conducting rebuilding analyses, finalizing the assessment document, and distribution of all these material to meeting participants led to both inadequate and inaccurate reporting in the assessment document and multiple versions of the rebuilding analysis, which clearly hampered the SSC's review.

PFMC
03/07/06

GROUNDFISH ADVISORY SUBPANEL COMMENTS ON YELLOWEYE STOCK ASSESSMENT

The Groundfish Advisory Subpanel (GAP) heard a presentation on the yelloweye assessment from Farron Wallace of the Washington Department of Fish and Wildlife. The assessment was data poor. The GAP recognizes the difficulty associated with doing a stock assessment when there is very little data to use.

If the optimum yield (OY) is reduced to 12.6 mt the GAP believes there will be dramatic effects on many fisheries.

Limited Entry Trawl: Although the trawl fisheries have very little incidental catch of yelloweye, with this level of reduction the GAP is concerned that the trawl fishery will take further cuts. For example, in Washington they expect reductions of as much as 50% in:

- the summer flatfish,
- arrowtooth and
- beach fisheries.

Tribal: The GAP was uncertain as to what reductions may or may not occur in the Tribal fishery.

Limited Entry Fixed Gear: In Washington, Oregon, and California the limited entry blackcod (sablefish) fishery may experience significant cost increases associated with lower catch rates and higher fuel expenditures if the fishery must be constrained to deeper waters to avoid yelloweye impacts. Such a constraint would also reduce the incidental catch of halibut and associated revenues.

Limited Entry and Open Access: In Washington, the dogfish fishery would have to be curtailed.

Nongroundfish: In Oregon, the directed halibut longline fisheries would likely be closed, for an estimated direct loss to fishermen of at least $6 million dollars in exvessel revenue. This does not include associated economic losses for processors and communities.

Open Access Fishery: The open access fishery is now fishing inside of 30 fathoms and in deeper waters, primarily for blackcod. To achieve the needed reductions the fishery will probably be constrained to within 20 fathoms. Constraint of this and other fisheries to these shallow waters is likely to result in increasing restrictions to protect nearshore stocks. The constraints and effects on the open access backcod fishery would be similar to those discussed for the limited entry blackcod fishery.

Recreational Fisheries: In the scorecard, the recreational fisheries have greater total impact on yelloweye than the other sectors. Both the Washington and Oregon recreational fisheries would likely be pushed inside 20 fathoms. Washington and Oregon estimate that they could lose their entire halibut fishery (estimated to be at least 16,000 fish). With a catch per unit of effort of nearly 1 fish per angler and an estimated impact of $200 per angler day, the resulting direct losses for this fishery alone could be $3.2 million. Oregon representatives expect to see groundfish trips decline by one-third to one-half. Oregon recreational representatives indicated that their fisheries would likely be reduced to a 2 month season and questioned the ability of businesses to remain viable with a fishery of such short duration.

Overall, the GAP is concerned about the ability of many fishing and fishing dependent businesses to survive given these draconian reductions when combined with similar reductions in other fisheries on which these same businesses rely, for example the salmon fishery.

All sectors are concerned about the potential gear conflicts that may occur as the industry is constrained to fishing in smaller and smaller geographic areas.

The GAP is concerned that with an extremely low OY there will not be fish available to perform research to improve understanding of the biology and status of the stock. For example, the halibut survey may be constrained. Additionally, the loss of fishery dependent information will impact stock assessments and impact the Council's ability to develop management tools better tailored to achieve the needed reductions with lesser adverse economic impact. For example, without a fishery it would be difficult to identify hot spots, the closure of which might achieve the needed reductions with lesser impacts on the broader fishing grounds.

The GAP heard a presentation of management options from the Groundfish Management Team (GMT). The option was to use a phase-in approach to reducing the OY for yelloweye from 27 MT status quo to 25 MT in 2007, 23 MT in 2008, 21 Mt in 2009, and 19 Mt in 2010. The GAP also understands that using such a phase in approach only lengthens the mean time to rebuild by approximately by 7 months.

Given

- the paucity of data being used in the current yelloweye assessment,
- the high degree of uncertainty that results from using this data,
- the draconian effects of the reductions on fishers, processors, and the dependent businesses and local governments,
- and the opportunities a phase-in approach would provide to
    - better understand the stock status and
    - develop management tools to achieve reductions with lesser adverse economic effects on the industry and dependent communities
- while having minimal impacts on the mean rebuilding time,

The GAP agrees with the GMT phase-in approach and urges the Council to accept the GMT recommendation.

PFMC
03/07/07

GROUNDFISH MANAGEMENT TEAM REPORT ON YELLOWEYE STOCK ASSESSMENT

The Groundfish Management Team (GMT) reviewed the yelloweye rockfish stock assessment, rebuilding analysis, and Stock Assessment Review (STAR) Panel report. The Stock Assessment (STAT) Team did a thorough job in examining all of the data sources available to produce a credible assessment; however, as pointed out at the STAR Panel meeting, the assessment is considered to be data poor, especially for certain areas (such as Washington) and the model results are highly uncertain. With regard to how the assessment is used for management, the GMT would like to offer the following comments and recommendations for the Council's consideration.

The GMT recognizes that four models were presented—one coastwide and three state-specific models—with varying degrees of uncertainty as noted in the STAR Panel report. The GMT notes that there are not any biological or genetic data to suggest that there are separate stocks by region and there are significant challenges associated with managing yelloweye on a state-specific basis. Using state-specific optimum yields (OYs) would require the use of the state borders as management lines for commercial fisheries, which would add significant complexity to the GMT's current modeling and catch monitoring practices. While the GMT does think that the relative depletion levels by state may inform management decisions, the GMT would appreciate guidance on how to incorporate this information if the Council wishes to pursue a more regional management approach.

The resulting rebuilding OY at a status quo coastwide rebuilding probability (Pmax at 80%) would be 12.6 mt in 2007 and 12.9 mt in 2008; for reference, these OY levels compare to 26 mt in 2005 and 27 mt in 2006. Fishing opportunities across numerous sectors have already been severely curtailed under the current OY. Examples of these restrictions include implementing a rockfish conservation area for the fixed gear fleet (i.e., closed shallower than 100 fms in the north and between 75 and 150 fms in the south); large yelloweye area closures for both Washington and Oregon recreational fisheries; and reduced opportunity for halibut and bottomfish recreational fisheries across all three states. To manage to an OY that is less than half the current level, additional restrictions, which may include closures, to groundfish fisheries as well as non-groundfish fisheries will need to be implemented.

For example, yelloweye rockfish are encountered in commercial fisheries targeting nearshore stocks as well as halibut, sablefish, and spiny dogfish. At a 12.6 mt OY, enlarging the rockfish conservation area (e.g., moving the seaward line to 125 or 150 fms in the north) would likely be necessary. This would have a detrimental effect on those fisheries, as the target stocks are not as available at those deeper depths. Some consideration of limiting the directed groundfish open access fishery or providing differential opportunities for limited entry vs. open access (i.e., a reallocation of sablefish and other targeted species) would also need to be addressed, as well as restrictions for fisheries not directed at groundfish that have an incidental catch of yelloweye (e.g., salmon troll).

Recreational fisheries coastwide prohibit the retention of yelloweye; however, yelloweye are encountered incidentally while anglers are targeting other, healthier stocks, such as nearshore rockfish, halibut and lingcod. Complete closures for these fisheries would also be considered, as well as additional area closures and depth restrictions during the open season.

Given the high level of uncertainty in the yelloweye stock assessment and the measures that would likely be needed to achieve a reduction in the rebuilding OY to something on the order of 12.6 mt (which is the calculated 2007 OY that corresponds to Tmax), the GMT recommends that the Council adopt a phased-in approach whereby the OYs for the next few years could be set at incrementally lower levels. Given the tools we have available for management, the GMT considers a reduction in the yelloweye OY to something on the order of 12.6 mt in 2007 to be impractical to fishing communities and sectors. Although a specific economic analysis of a 12.6 mt OY in 2007 has not been done, a cursory examination of sector impacts on yelloweye leads to the conclusion that multiple fishery sectors would need to be closed entirely or substantially constrained to achieve such a reduction. A phased-in approach would allow fishers and managers to develop tools that have the effect of reducing the take of yelloweye while allowing for some continued operation of fisheries potentially affected by an OY reduction. The GMT envisions the further development of tools to reduce the take of yelloweye (e.g. refined area closures and gear restrictions). In addition, a phased-in approach to an OY reduction would provide time for: 1) additional data to be collected (through additional research, such as the enhanced International Pacific Halibut Commission survey planned for this year, and ongoing barotraumas and site fidelity work being conducted by the Oregon Department of Fish and Wildlife) and used to inform subsequent stock assessments that would be precluded by adopting the 12.6 OY; 2) fishermen, such as fixed gear participants, and processors who will potentially be affected by the yelloweye rebuilding plan to make decisions that could affect their future businesses; and 3) the Council, its advisory bodies, and the states to identify, explore, and develop management tools to manage to the lower OYs that are anticipated over the next few years. During this time, the Council could also move forward on developing a limited entry program for the directed groundfish open access fishery to provide effort control.

The GMT would like to point out that the Pacific Council used a fixed harvest level for bocaccio from 2000 through 2002 whereby the total mortality OY was set at 100 mt for each of those years. Canary rockfish was also managed in a similar fashion, using a constant harvest OY of 93 mt for 1999-2002. To make progress toward rebuilding, the GMT is not recommending a constant harvest OY for yelloweye, but, rather, phasing in the lower rebuilding OY.

The GMT examined a phased-in approach that would incrementally reduce the OY over the next few years, and then use the prescribed rebuilding trajectory beginning in 2011. The GMT requested that the STAT team complete a rebuilding analysis (at Pmax = 80%) using this approach, and the results are described in Table 1.

Table 1.

Year	Base Model		Phase-in Model	
	OY	Depletion	OY	Depletion
2007	12.6	18.00%	25.0	18.00%
2008	12.9	18.50%	23.0	18.30%
2009	13.2	18.90%	21.0	18.70%
2010	13.5	19.40%	19.0	19.10%
2011	13.8	19.80%	13.2	19.40%
2012	14.1	20.20%	13.5	19.80%
2013	14.3	20.50%	13.7	20.20%
2014	14.5	20.80%	14.0	20.60%
2015	14.7	21.10%	14.2	20.90%
2016	15.0	21.40%	14.4	21.20%

The median time to rebuild in the base case was 2083 (for Pmax = 80%), whereas the phase-in approach would extend the median time to rebuild to 2083.6 (about 7 more months); discussions with the STAT team indicate that, given the level of uncertainty of the assessment, there is essentially no difference between these two time periods.

The GMT notes that the OYs presented above would still have a fairly large drop (6 mt) between 2010 and 2011 (from 19 mt to 13.2 mt), so the Council may wish to use a linear phase-in to avoid this. (Note: This linear phase-in would still produce results similar to those in Table 1.)

GMT Recommendations:

1. Adopt for analysis, a phased-in approach for the yelloweye rebuilding plan for setting OYs for 2007-2010.

PFMC
03/07/06

Agenda Item F.4
Situation Summary
March 2006

PACIFIC WHITING MANAGEMENT FOR 2006

The Pacific whiting fishery management process is unlike that for other federally-managed West Coast groundfish for 2006 fisheries, for which catch specifications and management measures were adopted by the Council at the June 2004 Council meeting for the two-year period 2005-2006. The Council deferred a decision on setting harvest specifications and management measures for the 2006 Pacific whiting fisheries pending the development and review of a new stock assessment to occur during February 2006. An updated Pacific whiting assessment was prepared this winter (Agenda Item F.4.a, Attachments 1 and 2) and reviewed by a Stock Assessment Review (STAR) Panel during February 2006 (Agenda Item F.4.a, Attachment 3). The Council should consider the advice of the STAR Panel, the Scientific and Statistical Committee (SSC), and other advisors before adopting the assessment for use in management decision-making. The assessment, once approved, will be used to set 2006 Pacific whiting harvest specifications and management measures.

In 2004 and 2005, this transboundary stock was managed jointly with the Department of Fisheries and Oceans, Canada, in the spirit of a new process described in a treaty that has been signed by both countries and is currently awaiting ratification by the U.S. Senate and passage of implementing legislation by the U.S. Congress. The primary tenets of the treaty include a joint U.S.-Canada annual assessment and management process, a research commitment, and a harvest sharing agreement providing 73.88% of the coastwide optimum yield (OY) for U.S. fisheries and 26.12% for Canadian fisheries.

The Council is tasked with setting an acceptable biological catch (ABC) and OY for Pacific whiting that will be used to manage 2006 fisheries. Considerations for this decision include the stock's current and projected status with respect to the overfishing threshold, the international agreement with Canada, and overfished species' bycatch concerns.

<u>Council Action:</u>

1. **Adopt the 2006 Pacific whiting stock assessment.**
2. **Adopt a 2006 ABC and OY for Pacific whiting.**
3. **Adopt 2006 management measures for Pacific whiting fisheries.**

<u>Reference Materials</u>:

1. Agenda Item F.4.a, Attachment 1: Executive Summary of Stock Assessment of Pacific Hake (Whiting) in U.S. and Canadian Waters in 2006.
2. Agenda Item F.4.a, Attachment 2: ***CD copy of*** Stock Assessment of Pacific Hake (Whiting) in U.S. and Canadian Waters in 2006.
3. Agenda Item F.4.a, Attachment 3: Report of the Joint Canadian and U.S. Pacific Hake/Whiting Stock Assessment Review Panel.

Agenda Order:

a. Agenda Item Overview John DeVore
b. Reports and Comments of Advisory Bodies
c. Public Comment
d. **Council Action:** Adopt 2006 Stock Assessment, 2006 ABC and OY Levels, and Management Measures

PFMC
02/15/06

DRAFT DOCUMENT FOR COUNCIL BRIEFING USE ONLY

Stock Assessment of Pacific Hake (Whiting) in U.S. and Canadian Waters in 2006

Thomas E. Helser[1]
Ian J. Stewart[1]
Guy W. Fleischer[1]
Steve Martell[2]

[1]*Northwest Fisheries Science Center*
National Marine Fisheries Service
National Oceanic and Atmospheric Administration
2725 Montlake Blvd., East
Seattle, WA 98112, USA

[2]*University of British Columbia*
Fisheries Centre
2259 Lower Mall
Vancouver, B.C. Canada
V6T 1Z4

February 16, 2006

Executive Summary

Stock

This assessment reports the status of the coastal Pacific hake (*Merluccius productus*) resource off the west coast of the United States and Canada. The coastal stock of Pacific hake is currently the most abundant groundfish population in the California Current system. Smaller populations of hake occur in the major inlets of the north Pacific Ocean, including the Strait of Georgia, Puget Sound, and the Gulf of California. However, the coastal stock is distinguished from the inshore populations by larger body size, seasonal migratory behavior, and a pattern of low median recruitment punctuated by extremely large year classes. The population is modeled as a single stock, but the United States and Canadian fishing fleets are treated separately in order to capture some of the spatial variability in Pacific hake distribution.

Catches

Fishery landings from 1966 to 2005 have averaged 214 thousand mt, with a low of 90 thousand mt in 1980 and a peak harvest of 362 thousand mt in 1994. Recent landings have been above the long term average, at 335 thousand mt in 2004, and 360 thousand mt in 2005. Catches in both of these years were predominately comprised by the large 1999 year class. The United States has averaged 159 thousand mt, or 74.6% of the total landings over the time series, with Canadian catch averaging 54 thousand mt. The 2004 and 2005 landings had similar distributions, with 62.9 and 72.1%, respectively, harvested by the United States fishery. The current model assumes no discarding mortality of pacific hake.

Table a. Recent commercial fishery landings (1000s mt).

Year	US at-sea	US shore based	US tribal	US total	Canadian foreign and JV	Canadian shore based	Canadian total	Total
1996	113	85	15	213	67	26	93	306
1997	121	87	25	233	43	49	92	325
1998	120	88	25	233	40	48	88	321
1999	115	83	26	225	17	70	87	312
2000	116	86	7	208	16	6	22	231
2001	102	73	7	182	22	32	54	236
2002	63	46	23	132	0	51	51	183
2003	67	55	21	143	0	62	62	206
2004	90	96	24	210	59	65	124	335
2005	150	86	24	260	15	85	100	360

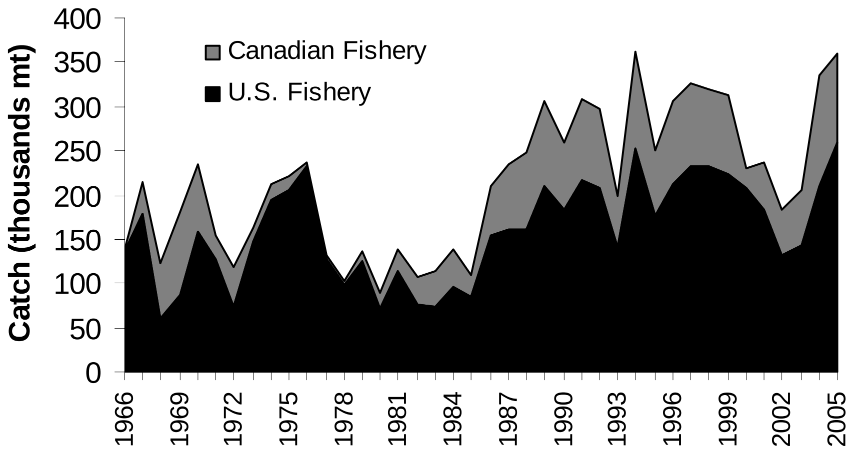


Figure a. Pacific whiting landings (1000s mt) by nation, 1966-2005.

Data and assessment

Age-structured assessment models of various forms have been used to assess Pacific hake since the early 1980's, using total fishery catches, fishery age compositions and abundance indices. In 1989, the hake population was modeled using a statistical catch-at-age model (Stock Synthesis) that utilizes fishery catch-at-age data and survey estimates of population biomass and age-composition data (Dorn and Methot, 1991). The model was then converted to AD Model Builder (ADMB) in 1999 by Dorn (1999), using the same basic population dynamics equations. This allowed the assessment to take advantage of ADMB's post-convergence routines to calculate standard errors (or likelihood profiles) for any quantity of interest. Since 2001, Helser et al. (2001, 2003, 2004) have used the same ADMB modeling platform to assess the hake stock and examine important assessment modifications and assumptions, including the time varying nature of the acoustic survey selectivity and catchability. The acoustic survey catchability coefficient (q) has been, and continues to be, one of the major sources of uncertainty in the model. Due to the lengthened acoustic survey biomass trends the assessment model was able to freely estimate the acoustic survey q. These estimates were substantially below the assumed value of q=1.0 from earlier assessments. The 2003 and 2004 assessment presented uncertainty in the final model result as a range of biomass. The lower end of the biomass range was based upon the conventional assumption that the acoustic survey q was equal to 1.0, while the higher end of the range represented a q=0.6 assumption.

This year's assessment used the Stock Synthesis modeling framework (SS2 Version 1.21, December, 2006) which was written by Dr. Richard Methot (Northwest Fisheries Science Center) in AD Model Builder. Conversion of the previous hake model into SS2 was guided by three principles: 1) the incorporation of less derived data, 2) explicitly model the underlying hake growth dynamics, and 3) achieve parsimony[1] in terms on model complexity. "Incorporating less derived data" entailed fitting observed data in their most elemental form. For instance, no pre-processing to convert length data to age compositional data was performed. Also, incorporating conditional age-at-length data, through age-length keys for each fishery and survey, allowed

[1] Parsimony is defined as a balance between the number of parameters needed to represent a complex state of nature and data quality/quantity to support accurate and precise estimation of those parameters.

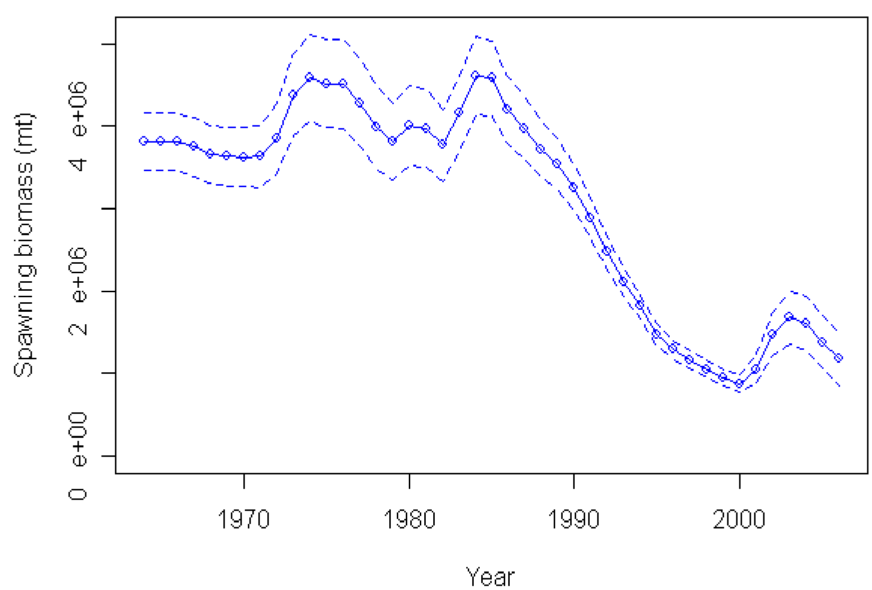
explicit estimation of expected growth, dispersion about that expectation, and its temporal variability, all conditioned on selectivity. As in the previous year's assessment, two models are presented to bracket the range of uncertainty in the acoustic survey catchability coefficient, *q*. The base model with steepness fixed at *h*=0.75 and *q*=1.0 represents the endpoint of the lower range while the alternative model which places a prior on *q* (effective *q*=0.7) represents the upper endpoint of the range. As such, model estimates presented below report a range of values representing these endpoints.

Stock biomass

Pacific hake spawning biomass declined rapidly after 1984 (4.6-5.1million mt) to the lowest point in the time series in 2000 (0.88-1.21 million mt). This long period of decline was followed by a brief increase to 1.68-2.13 million mt in 2003 as the 1999 year class matured. In 2006 (beginning of year), spawning biomass is estimated to be 1.18-1.60 million mt and approximately 30.9%-38.0% of the unfished level. Estimates of uncertainty in level of depletion range from 24.7%-36.9% and 29.7%-45.0% of unfished biomass for the base and alternative models, respectively, based on asymptotic confidence intervals.

Table b. Recent trend in Pacific hake spawning biomass and depletion level from the base and alternative SS2 models.

	Base Model				Alternative Model			
Year	Spawning biomass millions mt	~ 95% Interval	Relative Depletion	~ 95% Interval	Spawning biomass millions mt	~ 95% Interval	Relative Depletion	~ 95% Interval
1997	1.169	1.063 - 1.273	30.6%	-	1.314	1.146 - 1.482	30.66%	-
1998	1.056	0.954 - 1.157	27.7%	-	1.202	1.037 - 1.368	28.05%	-
1999	0.952	0.849 - 1.054	25.0%	-	1.102	0.934 - 1.271	25.72%	-
2000	0.880	0.767 - 0.990	23.1%	-	1.044	0.860 - 1.227	24.35%	-
2001	1.054	0.891 - 1.213	27.6%	-	1.288	1.025 - 1.551	30.04%	-
2002	1.485	1.217 - 1.746	38.9%	-	1.857	1.437 - 2.277	43.32%	-
2003	1.684	1.358 - 2.003	44.2%	-	2.132	1.624 - 2.641	49.74%	-
2004	1.617	1.280 - 1.945	42.4%	-	2.075	1.552 - 2.598	48.40%	-
2005	1.386	1.060 - 1.703	36.3%	30.4% - 42.1%	1.826	1.322 - 2.330	42.59%	35.2% - 50.1%
2006	1.178	0.857 - 1.491	30.9%	24.7% - 36.9%	1.601	1.109 - 2.093	38.00%	29.7% - 45.0%



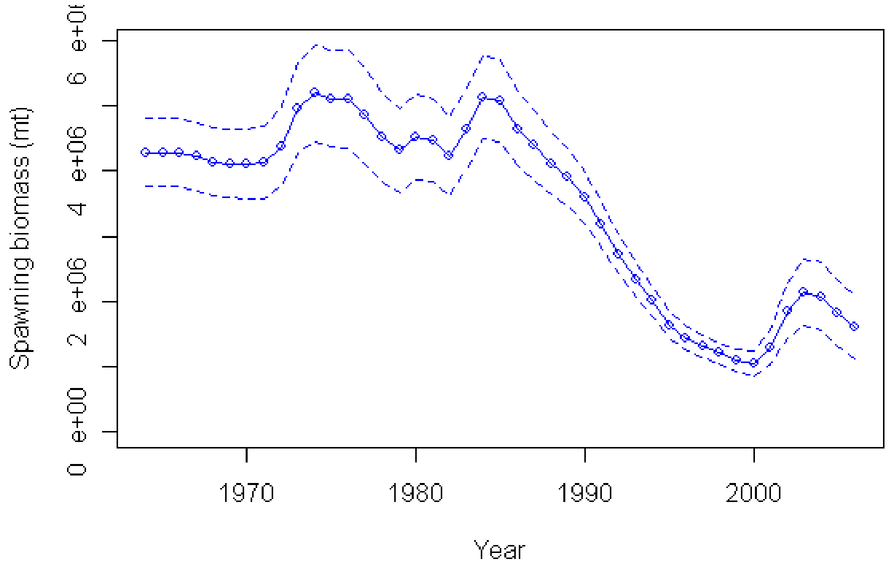


Figure b. Estimated spawning biomass time-series with approximate asymptotic 95% confidence intervals for the base (upper plot) and alternative (lower plot) models.

Recruitment

Estimates of Pacific hake recruitment indicate very large year classes in 1980 and 1984, with secondary recruitment events in 1970, 1973 and 1977, earlier in the time series. The recent 1999 year class was the single most dominate cohort since the late 1980s and has in large part support fishery catches during the last few years. Uncertainty in recruitment can be substantial as shown by asymptotic 95% confidence intervals. Recruitment to age 0 before 1967 is assumed to be equal to the long-term mean recruitment. Age-0 recruitment in 2003 is very uncertain, but predicted to be below the mean, despite some evidence to the contrary in the 2005 acoustic survey.

Table c. Recent estimated trend in Pacific hake recruitment.

	Base Model		Alternative Model	
Year	Recruitment (billions)	~ 95% Interval	Recruitment (billions)	~ 95% Interval
1997	1.933	1.671 - 2.227	2.275	1.893 - 2.735
1998	2.814	2.365 - 3.328	3.435	2.774 - 4.253
1999	13.789	11.337 - 16.692	17.323	13.667 - 21.956
2000	0.990	0.770 - 1.264	1.267	0.953 - 1.684
2001	1.372	1.048 - 1.783	1.787	1.322 - 2.416
2002	0.234	0.147 - 0.371	0.312	0.192 - 0.505
2003	2.338	1.502 - 3.618	3.137	1.978 - 4.976
2004	1.446	0.417 - 5.004	1.663	0.467 - 5.924
2005	0.279	0.069 - 1.131	0.323	0.079 - 1.315
2006	2.192	0.366 - 13.103	2.565	0.428 - 15.370

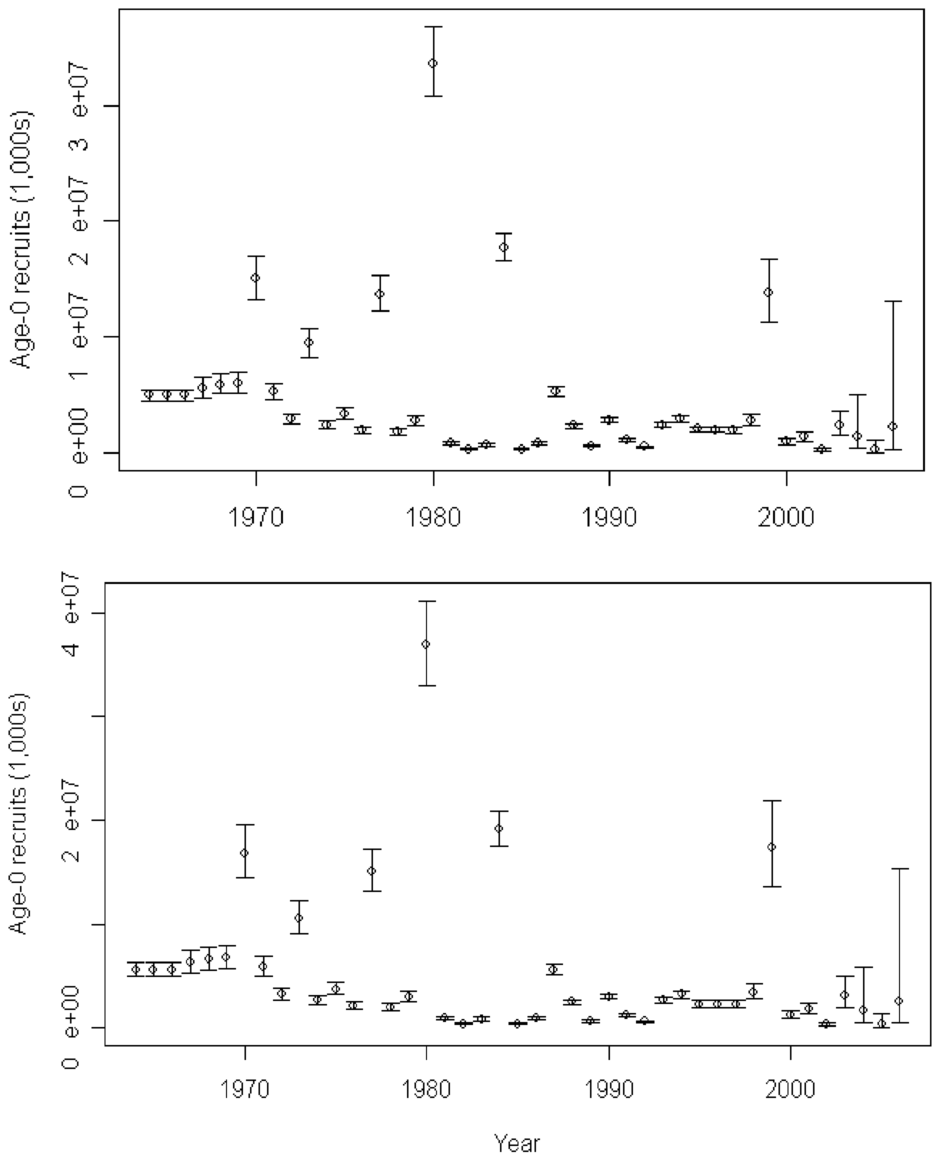


Figure c. Estimated recruitment time-series with approximate asymptotic 95% confidence intervals for the base (upper plot) and alternative (lower plot) models.

Reference points

Two types of reference points are reported in this assessment: those based on the assumed population parameters at the beginning of the modeled time period and those based on the most recent time period in a 'forward projection' mode of calculation. This distinction is important since temporal variability in growth and other parameters can result in different biological reference point calculations across alternative chronological periods. All strictly biological reference points (e.g., unexploited spawning biomass) are calculated based on the unexploited conditions at the start of the model, whereas management quantities (MSY, SB_{msy}, etc.) are based on the current growth and maturity schedules and are marked throughout this document with an asterisk (*).

Unexploited equilibrium Pacific hake spawning biomass (B_{zero}) from the base model was estimated to be 3.81 million mt (~ 95% confidence interval: 3.46 – 4.16 million mt), with a mean expected recruitment of 4.97 billion age-0 hake. Under the alternative model, spawning biomass (B_{zero}) from the base model was estimated to be 4.29 million mt (~ 95% confidence interval: 3.76 – 4.81 million mt), with a mean expected recruitment of 5.59 billion age-0 hake. Associated management reference points for target and critical biomass levels for the base model are 1.52 million mt (B40%) and 0.95 million mt (B25%), respectively. Under the alternative model, B40% and B25% are estimated to be 1.71 and 1.07 million mt, respectively. The MSY-proxy harvest amount (F40%) under the base model was estimated to be 573,945* mt (~ 95% confidence interval: 521,122-619,501), and 645,240* mt (~ 95% confidence interval: 566,830-712,848) under the alternative model. The spawning stock biomass that produces the MSY-proxy catch amount under the base model was estimated to be 1.06 million* mt (confidence interval is 0.96-1.14* million mt), and 1.19 million* mt (confidence interval is 1.04 -1.31* million mt) under the alternative model, given current life history parameters.

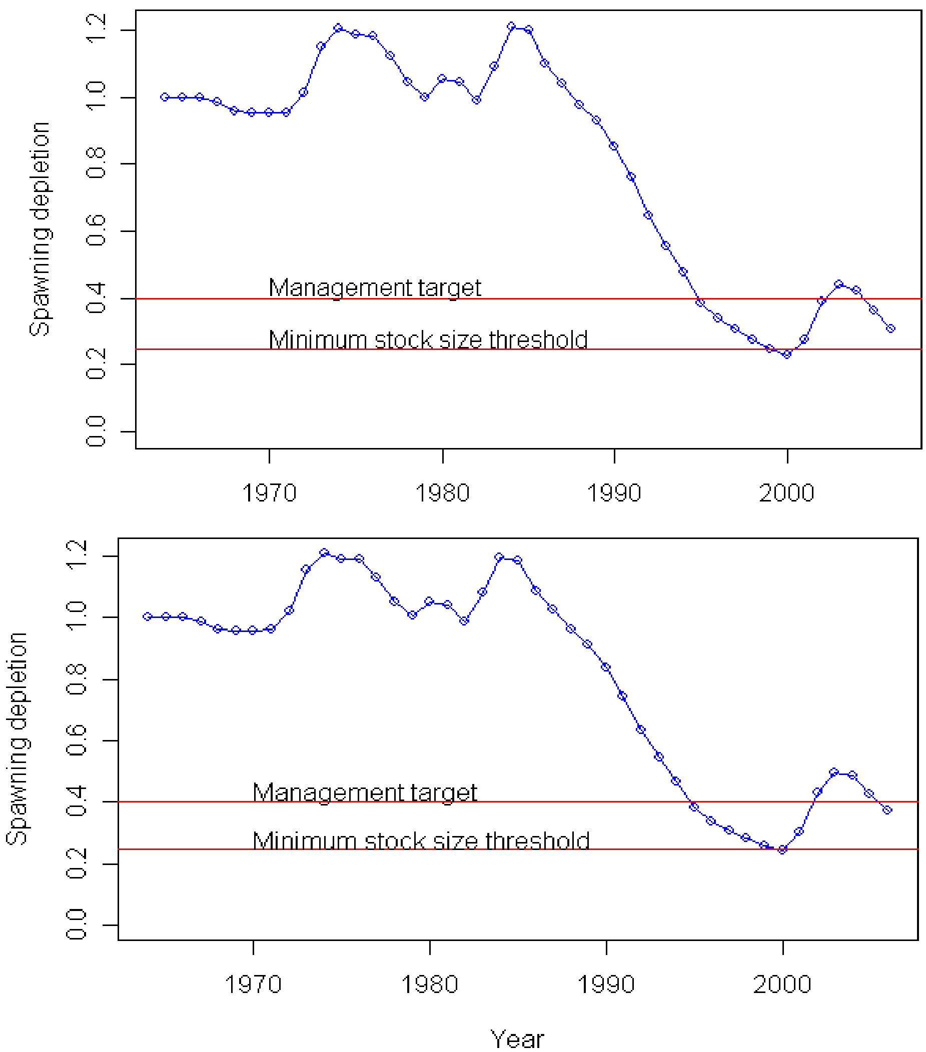


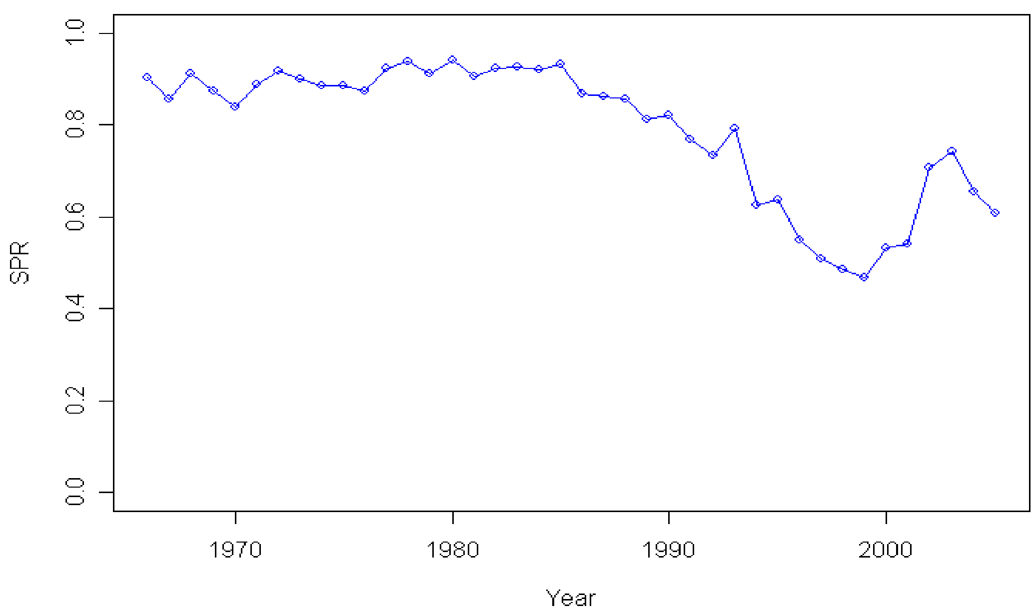
Figure d. Time series of estimated depletion, 1966-2006, for the base (upper plot) and alternative (lower plot) models.

Exploitation status

The estimated spawning potential ratio (SPR) for Pacific hake has been above the proxy target of 40% for the history of this fishery. In terms of its exploitation status, Pacific hake are presently above both the target biomass level (40% unfished biomass) and the target SPR rate (40%). The full exploitation history is portrayed graphically below which plots for each year the calculated SPR and spawning biomass level (B) relative to their corresponding targets, F40% and B40%, respectively.

Table d. Recent trend in spawning potential ratio (SPR).

	Base Model		alternative Model	
Year	Estimated SPR	~ 95% Interval	Estimated SPR	~ 95% Interval
1997	0.513	-	0.539	-
1998	0.491	-	0.521	-
1999	0.473	-	0.509	-
2000	0.540	-	0.584	-
2001	0.550	-	0.601	-
2002	0.716	-	0.762	-
2003	0.749	-	0.793	-
2004	0.664	-	0.721	-
2005	0.619	-	0.686	-



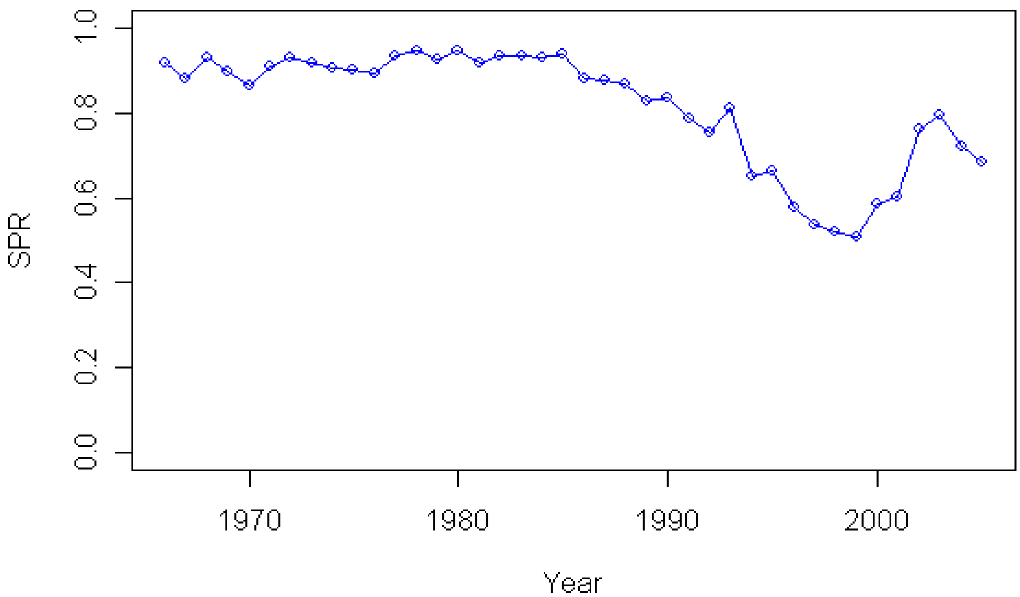
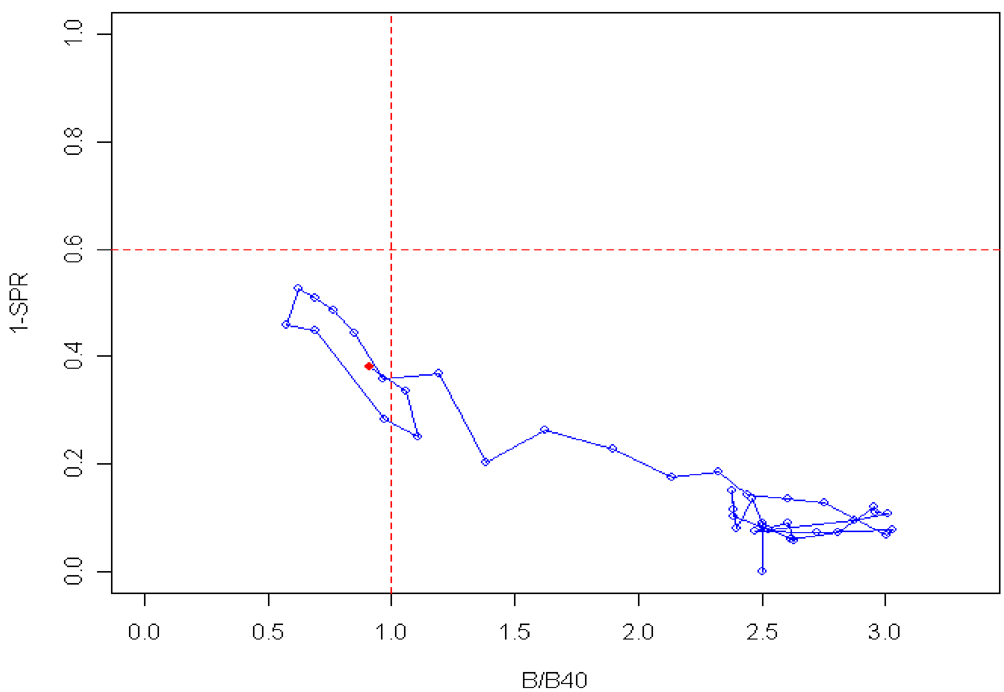


Figure e. Time series of estimated spawning potential ratio from base (upper plot) and alternative (lower plot) models.



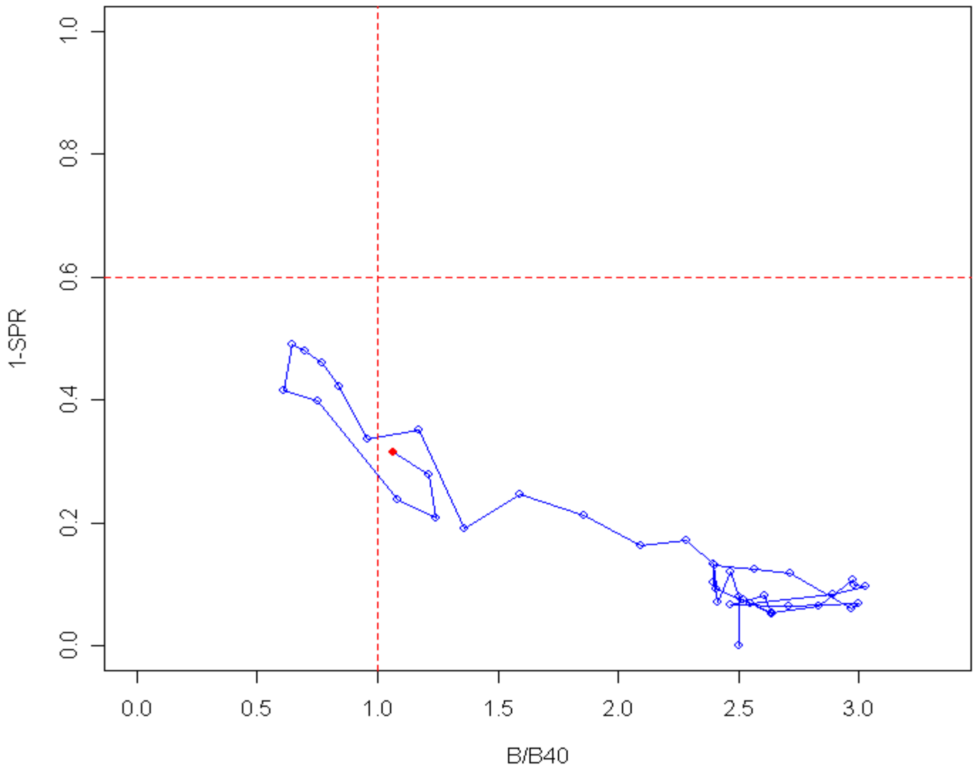


Figure f. Temporal pattern of estimated spawning potential ratio relative to the proxy target of 40% vs estimated spawning biomass relative to the proxy 40% level for base (upper plot) and alternative (lower plot) models.

Management performance

Since implementation of the Magnuson Fisheries Conservation and Management Act in the U.S. and the declaration of a 200 mile fishery conservation zone in Canada in the late 1970's, annual quotas have been the primary management tool used to limit the catch of Pacific hake in both zones by foreign and domestic fisheries. The scientists from both countries have collaborated through the Technical Subcommittee of the Canada-US Groundfish Committee (TSC), and there has been informal agreement on the adoption of an annual fishing policy. During the 1990s, however, disagreement between the U.S. and Canada on the division of the acceptable biological catch (ABC) between the two countries led to quota overruns; 1991-1992 quotas summed to 128% of the ABC and quota overruns have averaged 114% from 1991-1999. Since 2000, total catches have been below coastwide ABCs. A recent treaty between the United States and Canada (2003), which awaits final signature, establishes U.S. and Canadian shares of the coastwide allowable biological catch at 73.88% and 26.12%, respectively.

Table e. Recent trend in Pacific hake management performance.

Year	Total landings (mt)	ABC
1996	306,100	265,000
1997	325,215	290,000
1998	320,619	290,000
1999	311,855	290,000
2000	230,819	290,000
2001	235,962	238,000
2002	182,883	208,000
2003	205,582	235,000
2004	334,721	514,441
2005	360,306	

Unresolved problems and major uncertainties

The acoustic survey catchability, *q*, remains uncertain. This is largely driven by an inconsistency in the acoustic survey biomass time series and age compositions; age composition data suggest a large build up of stock biomass in the mid 1980s while the acoustic survey biomass time series is relatively flat since 1977.

Forecasts

Forecasts were generated assuming the maximum potential catch would be removed under 40:10 control rule for both the base and alternative models. Projections were based on the relative F contribution of 74.88% and 26.12% coast wide national allocation to the U.S. and Canada, respectively. For base case model, the 2006 coastwide ABC is estimated to be 661,681 mt with an OY of 593,750 mt. Under the alternative model, the 2006 coastwide ABC is estimated to be 904,944 mt with an OY of 883,490 mt. Spawning stock biomass is projected to decline with a corresponding relative depletion of 22.7% and 26.4% for the base and alternative models, respectively in 2007.

Table f. Three year projection of potential Pacific hake landings, spawning biomass and depletion for the base and alternative models under the 40:10 rule.

		Spawning biomass millions mt			Depletion percent unfished biomass		
Year	Expected coastwide catch (mt)	Mean	5%	95%	Mean	5%	95%
Base model, h=0.75, q=1.0							
2006	593,750	1.174	0.857	1.491	30.8%	24.7%	36.9%
2007	358,420	0.864	0.636	1.092	22.7%	18.1%	27.2%
2008	213,220	0.679	0.485	0.873	17.8%	13.5%	22.1%
2009	183,620	0.657	0.337	0.976	17.2%	9.2%	25.3%
Alt. model, h=0.75, q prior							
2006	883,490	1.601	1.109	2.093	38.0%	29.7%	45.0%
2007	522,510	1.130	0.795	1.464	26.4%	21.0%	31.7%
2008	302,300	0.851	0.588	1.113	19.8%	15.1%	24.5%
2009	240,700	0.792	0.404	1.179	18.5%	10.0%	26.9%

Decision table

A decision table was constructed to represent the uncertainty on the acoustic survey catchability coefficient, *q*. The base model with a *q*=1.0 represents the lower range while the alternative model which places a prior on *q* (effective *q*=0.7) represents the upper range. Below the decision table shows the consequences of management action given a state of nature. States of nature include the base model (*h*=0.75, *q*=1.0) and the alternative model (*h*=0.75, *q* prior). The management actions include the OY from each state of nature and two constant coastwide catch scenarios.

Table g. Decision table for two states of nature (base and alternative models) and four different harvest strategies given the state of nature.

			State of Nature	
Relative probability			**0.50**	**0.50**
Model			h = 0.75, q = 1.0	h = 0.75, q prior
Management action	Total coast-wide Catch (mt)	Year	Relative depletion (2.5%-97.5% interval)	
OY Model h=0.75, q=1.0	593,746	2006	0.308 (0.247-0.369)	0.380 (0.304-0.457)
	358,416	2007	0.227 (0.181-0.272)	0.310 (0.219-0.401)
	213,223	2008	0.178 (0.135-0.221)	0.263 (0.164-0.363)
	183,620	2009	0.172 (0.092-0.253)	0.254 (0.127-0.380)
OY Model h=0.75, q prior	883,490	2006	0.308 (0.247-0.369)	0.380 (0.304-0.457)
	522,511	2007	0.202 (0.125-0.279)	0.268 (0.215-0.322)
	302,298	2008	0.144 (0.056-0.232)	0.202 (0.155-0.249)
	240,702	2009	0.136 (0.020-0.252)	0.188 (0.104-0.273)
Total coast-wide	200,000	2006	0.308 (0.247-0.369)	0.380 (0.304-0.457)
catch = 200,000 mt	200,000	2007	0.282 (0.209-0.354)	0.351 (0.264-0.438)
	200,000	2008	0.250 (0.167-0.333)	0.315 (0.219-0.411)
	200,000	2009	0.239 (0.125-0.352)	0.299 (0.175-0.423)
Total coast-wide	400,000	2006	0.308 (0.247-0.369)	0.380 (0.304-0.457)
catch = 400,000 mt	400,000	2007	0.258 (0.184-0.332)	0.330 (0.241-0.419)
	400,000	2008	0.207 (0.122-0.292)	0.276 (0.177-0.375)
	400,000	2009	0.178 (0.063-0.294)	0.245 (0.118-0.372)

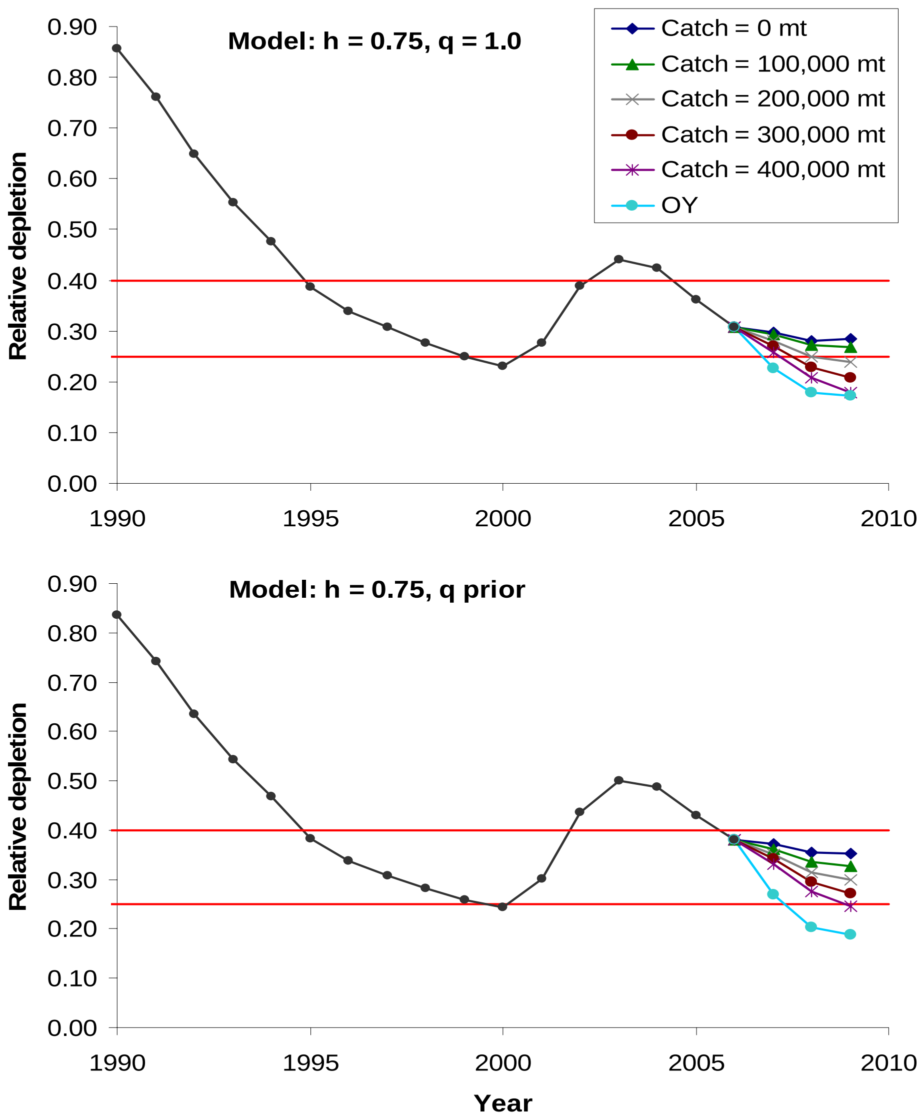


Figure g. Projections through 2009 for the base case (upper plot) and alternative (lower plot) models under various total coast-wide catch scenarios.

Research and data needs

1) The quantity and quality of biological data prior to 1988 from the Canadian fishery should be evaluated for use in developing length and conditional age at length compositions.
2) Evaluate whether modeling the distinct at-sea and shore based fisheries in the U.S. and Canada explain some lack of fit in the compositional data.
3) Compare spatial distributions of hake across all years and between bottom trawl and acoustic surveys to estimate changes in catchability/availability across years. The two primary issues are related to the changing spatial distribution of the survey as well as the environmental factors that may be responsible for changes in the spatial distribution of hake and their influences on survey catchability and selectivity.

4) Initiate analysis of the acoustic survey data to determine variance estimates for application in the assessment model. The analysis would provide a first cut to define the appropriate CV for the weighting of the acoustic data.
5) Develop an informed prior for the acoustic q. This could be done either with empirical experiments (particularly in off-years for the survey) or in a workshop format with technical experts. There is also the potential to explore putting the target strength estimation in the model directly. This prior should be used in the model when estimating the q parameter.
6) Review the acoustic data to assess whether there are spatial trends in the acoustic survey indices that are not being captured by the model. The analysis should include investigation of the migration (expansion/contraction) of the stock in relation to variation in environmental factors. This would account for potential lack of availability of older animals and how it affects the selectivity function.
7) Investigate aspects of the life history characteristics for Pacific hake and their possible effects on the interrelationship of growth rates and maturity at age. This should include additional data collection of maturity states and fecundity, as current information is limited.

Table h. Summary of recent trends in Pacific hake exploitation and stock levels; all values reported at the beginning of the year.

Base Model	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Landings (1000s mt)	306.1	325.2	320.6	311.9	230.8	236.0	182.9	205.6	334.7	360.3	NA
ABC (1000s mt)	265	290	290	290	290	238	208	235	514.441	265	
OY (1000s mt)											
SPR*	0.579	0.539	0.521	0.509	0.584	0.601	0.762	0.793	0.721	0.686	NA
Total biomass (millions mt)	2.601	2.437	2.184	1.958	1.761	1.813	3.657	3.534	3.274	2.640	2.328
Spawning biomass (millions mt)	1.293	1.169	1.056	0.952	0.880	1.054	1.485	1.684	1.617	1.386	1.178
~95% interval	1.180-1.405	1.063-1.273	0.954-1.157	0.849-1.054	0.767-0.990	0.891-1.213	1.217-1.746	1.358-2.003	1.280-1.945	1.060-1.703	0.857-1.491
Recruitment (billions)	1.988	1.933	2.814	13.789	0.990	1.372	0.234	2.338	1.446	0.279	2.192
~95% interval	1.711-2.167	1.617-2.152	2.271-3.199	10.770-15.912	0.722-1.199	0.972-1.681	0.124-0.343	1.238-3.233	4.165-4.988	4.165-4.988	4.165-4.988
Depletion	33.9%	30.6%	27.7%	25.0%	23.1%	27.6%	38.9%	44.2%	42.4%	36.3%	30.9%
~95% interval	NA	NA	NA	NA	NA	NA	NA	NA	NA	30.4%-42.1%	24.7%-36.9%

Alternative Model	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Landings (1000s mt)	306.1	325.2	320.6	311.9	230.8	236.0	182.9	205.6	334.7	360.3	NA
ABC (1000s mt)	265	290	290	290	290	238	208	235	514.441	265	
OY (1000s mt)											
SPR*	0.579	0.539	0.521	0.509	0.584	0.601	0.762	0.793	0.721	0.686	
Total biomass (millions mt)	2.979	2.812	2.556	2.340	2.166	2.295	4.801	4.699	4.427	3.680	3.389
Spawning biomass (millions mt)	1.443	1.314	1.202	1.102	1.044	1.288	1.857	2.132	2.075	1.826	1.601
~95% interval	1.266-1.620	1.146-1.482	1.037-1.368	0.934-1.271	0.860-1.227	1.025-1.551	1.437-2.277	1.624-2.641	1.552-2.598	1.322-2.330	1.109-2.093
Recruitment (billions)	2.275	2.275	3.435	17.323	1.267	1.787	0.312	3.137	1.663	0.323	2.565
~95% interval	1.945-2.661	1.893-2.735	2.774-4.253	13.677-21.956	0.953-1.684	1.322-2.416	0.192-0.505	1.978-4.976	0.467-5.924	0.079-1.315	0.428-15.370
Depletion	33.7%	30.7%	28.0%	25.7%	24.3%	30.0%	43.3%	49.7%	48.4%	42.6%	38.0%
~95% interval	NA	NA	NA	NA	NA	NA	NA	NA	NA	35.2%-50.1%	29.7%-45.1%

Table i. Summary of Pacific hake reference points.

Base Model

Quantity	Estimate	~95% Confidence interval
Unfished spawning stock biomass (SB_0, millions mt)	3.810	3.461 - 4.160
Unfished total biomass (B_0, millions mt)	9.200	NA
Unfished age 3+ biomass (millions mt)	7.832	NA
Unfished recruitment (R_0, billions)	4.974	4.536 – 5.447
Spawning stock biomass at MSY (SB_{msy})*	1.06	0.96 – 1.14
Basis for SB_{msy}	$F_{40\%}$ proxy	NA
SPR_{msy}*	40.0%	33.2%-46.7%
Basis for SPR_{msy}	$F_{40\%}$ proxy	NA
Exploitation rate corresponding to SPR_{msy}*	24.6%	NA
MSY* (mt)	573,945	521,122 – 619,501

Alternative Model

Quantity	Estimate	~95% Confidence interval
Unfished spawning stock biomass (SB_0, millions mt)	4.287	3.764 – 4.810
Unfished total biomass (B_0, millions mt)	10.333	NA
Unfished age 3+ biomass (millions mt)	8.804	NA
Unfished recruitment (R_0, billions)	5.593	4.955 - 6.313
Spawning stock biomass at MSY (SB_{msy})*	1.191	1.041 - 1.310
Basis for SB_{msy}	$F_{40\%}$ proxy	NA
SPR_{msy}*	40.0%	33.2%-46.7%
Basis for SPR_{msy}	$F_{40\%}$ proxy	NA
Exploitation rate corresponding to SPR_{msy}*	24.6%	NA
MSY* (mt)	645,240	566,830 - 712,848

DRAFT DOCUMENT FOR COUNCIL BRIEFING USE ONLY

Stock Assessment of Pacific Hake (Whiting) in U.S. and Canadian Waters in 2006

Thomas E. Helser[1]
Ian J. Stewart[1]
Guy W. Fleischer[1]
Steve Martell[2]

[1]*Northwest Fisheries Science Center*
National Marine Fisheries Service
National Oceanic and Atmospheric Administration
2725 Montlake Blvd., East
Seattle, WA 98112, USA

[2]*University of British Columbia*
Fisheries Centre
2259 Lower Mall
Vancouver, B.C. Canada
V6T 1Z4

February 16, 2006

Executive Summary

Stock

This assessment reports the status of the coastal Pacific hake (*Merluccius productus*) resource off the west coast of the United States and Canada. The coastal stock of Pacific hake is currently the most abundant groundfish population in the California Current system. Smaller populations of hake occur in the major inlets of the north Pacific Ocean, including the Strait of Georgia, Puget Sound, and the Gulf of California. However, the coastal stock is distinguished from the inshore populations by larger body size, seasonal migratory behavior, and a pattern of low median recruitment punctuated by extremely large year classes. The population is modeled as a single stock, but the United States and Canadian fishing fleets are treated separately in order to capture some of the spatial variability in Pacific hake distribution.

Catches

Fishery landings from 1966 to 2005 have averaged 214 thousand mt, with a low of 90 thousand mt in 1980 and a peak harvest of 362 thousand mt in 1994. Recent landings have been above the long term average, at 335 thousand mt in 2004, and 360 thousand mt in 2005. Catches in both of these years were predominately comprised by the large 1999 year class. The United States has averaged 159 thousand mt, or 74.6% of the total landings over the time series, with Canadian catch averaging 54 thousand mt. The 2004 and 2005 landings had similar distributions, with 62.9 and 72.1%, respectively, harvested by the United States fishery. The current model assumes no discarding mortality of pacific hake.

Table a. Recent commercial fishery landings (1000s mt).

Year	US at-sea	US shore based	US tribal	US total	Canadian foreign and JV	Canadian shore based	Canadian total	Total
1996	113	85	15	213	67	26	93	306
1997	121	87	25	233	43	49	92	325
1998	120	88	25	233	40	48	88	321
1999	115	83	26	225	17	70	87	312
2000	116	86	7	208	16	6	22	231
2001	102	73	7	182	22	32	54	236
2002	63	46	23	132	0	51	51	183
2003	67	55	21	143	0	62	62	206
2004	90	96	24	210	59	65	124	335
2005	150	86	24	260	15	85	100	360

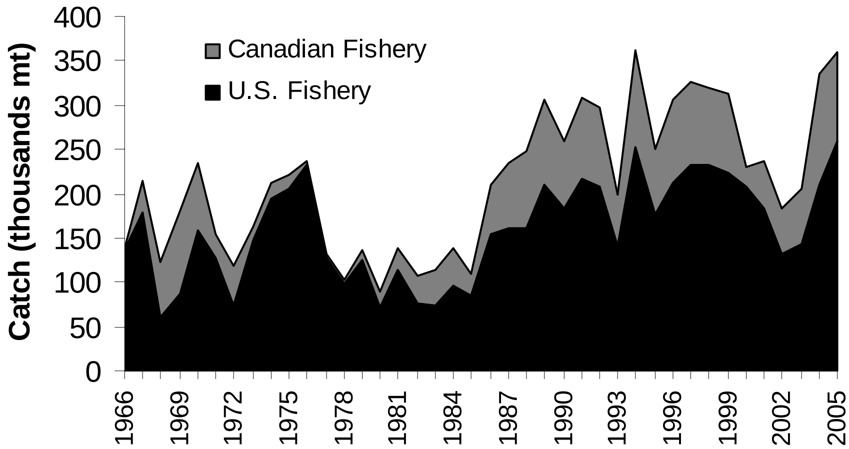


Figure a. Pacific whiting landings (1000s mt) by nation, 1966-2005.

Data and assessment

Age-structured assessment models of various forms have been used to assess Pacific hake since the early 1980's, using total fishery catches, fishery age compositions and abundance indices. In 1989, the hake population was modeled using a statistical catch-at-age model (Stock Synthesis) that utilizes fishery catch-at-age data and survey estimates of population biomass and age-composition data (Dorn and Methot, 1991). The model was then converted to AD Model Builder (ADMB) in 1999 by Dorn (1999), using the same basic population dynamics equations. This allowed the assessment to take advantage of ADMB's post-convergence routines to calculate standard errors (or likelihood profiles) for any quantity of interest. Since 2001, Helser et al. (2001, 2003, 2004) have used the same ADMB modeling platform to assess the hake stock and examine important assessment modifications and assumptions, including the time varying nature of the acoustic survey selectivity and catchability. The acoustic survey catchability coefficient (q) has been, and continues to be, one of the major sources of uncertainty in the model. Due to the lengthened acoustic survey biomass trends the assessment model was able to freely estimate the acoustic survey q. These estimates were substantially below the assumed value of q=1.0 from earlier assessments. The 2003 and 2004 assessment presented uncertainty in the final model result as a range of biomass. The lower end of the biomass range was based upon the conventional assumption that the acoustic survey q was equal to 1.0, while the higher end of the range represented a q=0.6 assumption.

This year's assessment used the Stock Synthesis modeling framework (SS2 Version 1.21, December, 2006) which was written by Dr. Richard Methot (Northwest Fisheries Science Center) in AD Model Builder. Conversion of the previous hake model into SS2 was guided by three principles: 1) the incorporation of less derived data, 2) explicitly model the underlying hake growth dynamics, and 3) achieve parsimony[1] in terms on model complexity. "Incorporating less derived data" entailed fitting observed data in their most elemental form. For instance, no pre-processing to convert length data to age compositional data was performed. Also, incorporating conditional age-at-length data, through age-length keys for each fishery and survey, allowed

[1] Parsimony is defined as a balance between the number of parameters needed to represent a complex state of nature and data quality/quantity to support accurate and precise estimation of those parameters.

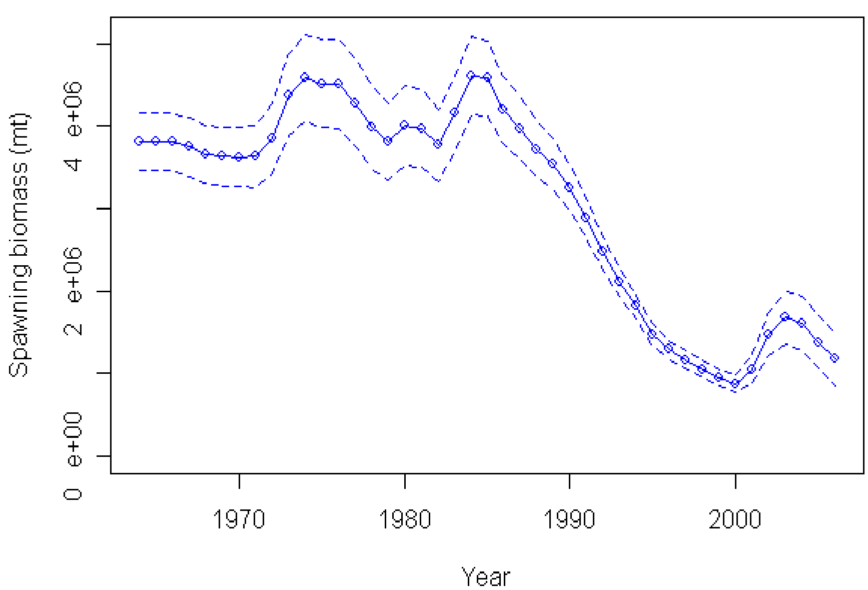
explicit estimation of expected growth, dispersion about that expectation, and its temporal variability, all conditioned on selectivity. As in the previous year's assessment, two models are presented to bracket the range of uncertainty in the acoustic survey catchability coefficient, q. The base model with steepness fixed at h=0.75 and q=1.0 represents the endpoint of the lower range while the alternative model which places a prior on q (effective q=0.7) represents the upper endpoint of the range. As such, model estimates presented below report a range of values representing these endpoints.

Stock biomass

Pacific hake spawning biomass declined rapidly after 1984 (4.6-5.1million mt) to the lowest point in the time series in 2000 (0.88-1.21 million mt). This long period of decline was followed by a brief increase to 1.68-2.13 million mt in 2003 as the 1999 year class matured. In 2006 (beginning of year), spawning biomass is estimated to be 1.18-1.60 million mt and approximately 30.9%-38.0% of the unfished level. Estimates of uncertainty in level of depletion range from 24.7%-36.9% and 29.7%-45.0% of unfished biomass for the base and alternative models, respectively, based on asymptotic confidence intervals.

Table b. Recent trend in Pacific hake spawning biomass and depletion level from the base and alternative SS2 models.

	Base Model				Alternative Model			
Year	Spawning biomass millions mt	~ 95% Interval	Relative Depletion	~ 95% Interval	Spawning biomass millions mt	~ 95% Interval	Relative Depletion	~ 95% Interval
1997	1.169	1.063 - 1.273	30.6%	-	1.314	1.146 - 1.482	30.66%	-
1998	1.056	0.954 - 1.157	27.7%	-	1.202	1.037 - 1.368	28.05%	-
1999	0.952	0.849 - 1.054	25.0%	-	1.102	0.934 - 1.271	25.72%	-
2000	0.880	0.767 - 0.990	23.1%	-	1.044	0.860 - 1.227	24.35%	-
2001	1.054	0.891 - 1.213	27.6%	-	1.288	1.025 - 1.551	30.04%	-
2002	1.485	1.217 - 1.746	38.9%	-	1.857	1.437 - 2.277	43.32%	-
2003	1.684	1.358 - 2.003	44.2%	-	2.132	1.624 - 2.641	49.74%	-
2004	1.617	1.280 - 1.945	42.4%	-	2.075	1.552 - 2.598	48.40%	-
2005	1.386	1.060 - 1.703	36.3%	30.4% - 42.1%	1.826	1.322 - 2.330	42.59%	35.2% - 50.1%
2006	1.178	0.857 - 1.491	30.9%	24.7% - 36.9%	1.601	1.109 - 2.093	38.00%	29.7% - 45.0%



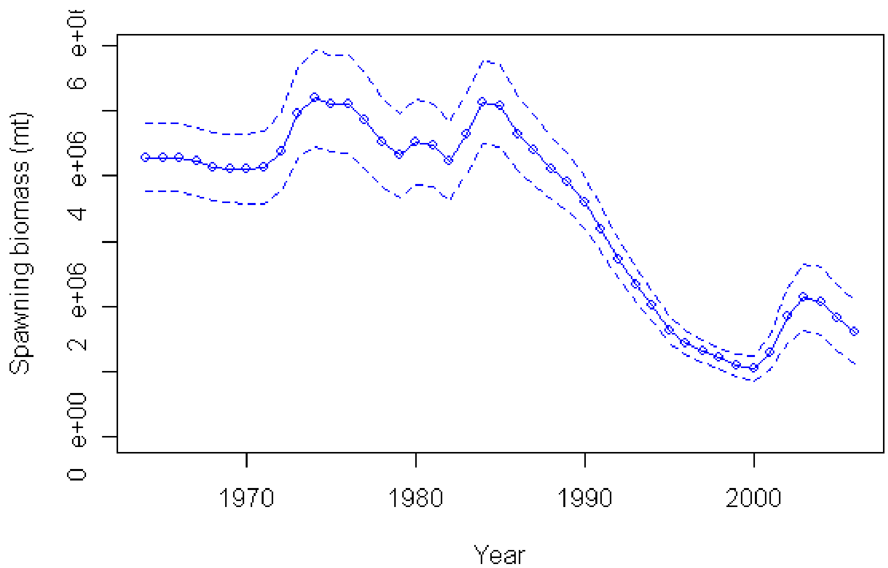


Figure b. Estimated spawning biomass time-series with approximate asymptotic 95% confidence intervals for the base (upper plot) and alternative (lower plot) models.

Recruitment

Estimates of Pacific hake recruitment indicate very large year classes in 1980 and 1984, with secondary recruitment events in 1970, 1973 and 1977, earlier in the time series. The recent 1999 year class was the single most dominate cohort since the late 1980s and has in large part support fishery catches during the last few years. Uncertainty in recruitment can be substantial as shown by asymptotic 95% confidence intervals. Recruitment to age 0 before 1967 is assumed to be equal to the long-term mean recruitment. Age-0 recruitment in 2003 is very uncertain, but predicted to be below the mean, despite some evidence to the contrary in the 2005 acoustic survey.

Table c. Recent estimated trend in Pacific hake recruitment.

	Base Model		Alternative Model	
Year	Recruitment (billions)	~ 95% Interval	Recruitment (billions)	~ 95% Interval
1997	1.933	1.671 - 2.227	2.275	1.893 - 2.735
1998	2.814	2.365 - 3.328	3.435	2.774 - 4.253
1999	13.789	11.337 - 16.692	17.323	13.667 - 21.956
2000	0.990	0.770 - 1.264	1.267	0.953 - 1.684
2001	1.372	1.048 - 1.783	1.787	1.322 - 2.416
2002	0.234	0.147 - 0.371	0.312	0.192 - 0.505
2003	2.338	1.502 - 3.618	3.137	1.978 - 4.976
2004	1.446	0.417 - 5.004	1.663	0.467 - 5.924
2005	0.279	0.069 - 1.131	0.323	0.079 - 1.315
2006	2.192	0.366 - 13.103	2.565	0.428 - 15.370

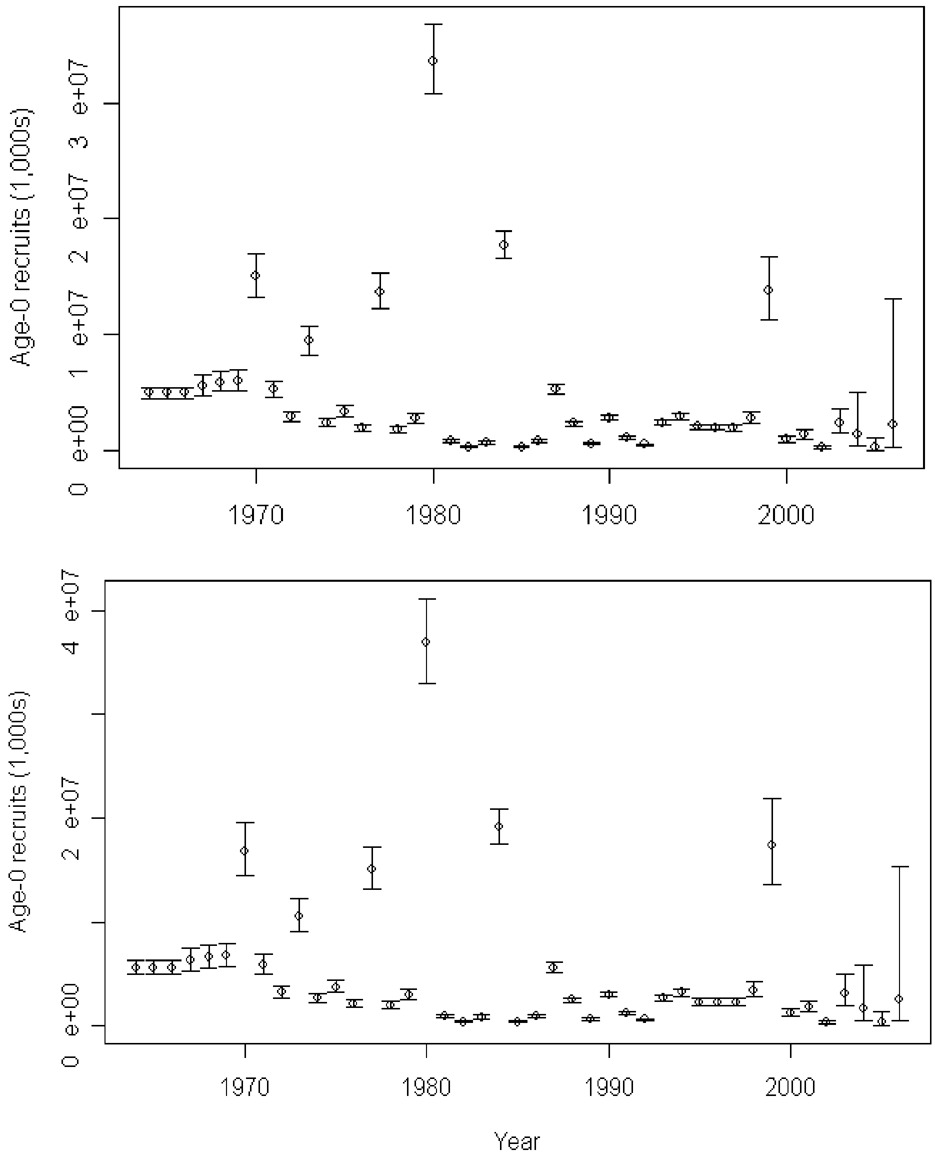


Figure c. Estimated recruitment time-series with approximate asymptotic 95% confidence intervals for the base (upper plot) and alternative (lower plot) models.

Reference points

Two types of reference points are reported in this assessment: those based on the assumed population parameters at the beginning of the modeled time period and those based on the most recent time period in a 'forward projection' mode of calculation. This distinction is important since temporal variability in growth and other parameters can result in different biological reference point calculations across alternative chronological periods. All strictly biological reference points (e.g., unexploited spawning biomass) are calculated based on the unexploited conditions at the start of the model, whereas management quantities (MSY, SB_{msy}, etc.) are based on the current growth and maturity schedules and are marked throughout this document with an asterisk (*).

Unexploited equilibrium Pacific hake spawning biomass (B_{zero}) from the base model was estimated to be 3.81 million mt (~ 95% confidence interval: 3.46 – 4.16 million mt), with a mean expected recruitment of 4.97 billion age-0 hake. Under the alternative model, spawning biomass (B_{zero}) from the base model was estimated to be 4.29 million mt (~ 95% confidence interval: 3.76 – 4.81 million mt), with a mean expected recruitment of 5.59 billion age-0 hake. Associated management reference points for target and critical biomass levels for the base model are 1.52 million mt (B40%) and 0.95 million mt (B25%), respectively. Under the alternative model, B40% and B25% are estimated to be 1.71 and 1.07 million mt, respectively. The MSY-proxy harvest amount (F40%) under the base model was estimated to be 573,945* mt (~ 95% confidence interval: 521,122-619,501), and 645,240* mt (~ 95% confidence interval: 566,830-712,848) under the alternative model. The spawning stock biomass that produces the MSY-proxy catch amount under the base model was estimated to be 1.06 million* mt (confidence interval is 0.96-1.14* million mt), and 1.19 million* mt (confidence interval is 1.04 -1.31* million mt) under the alternative model, given current life history parameters.

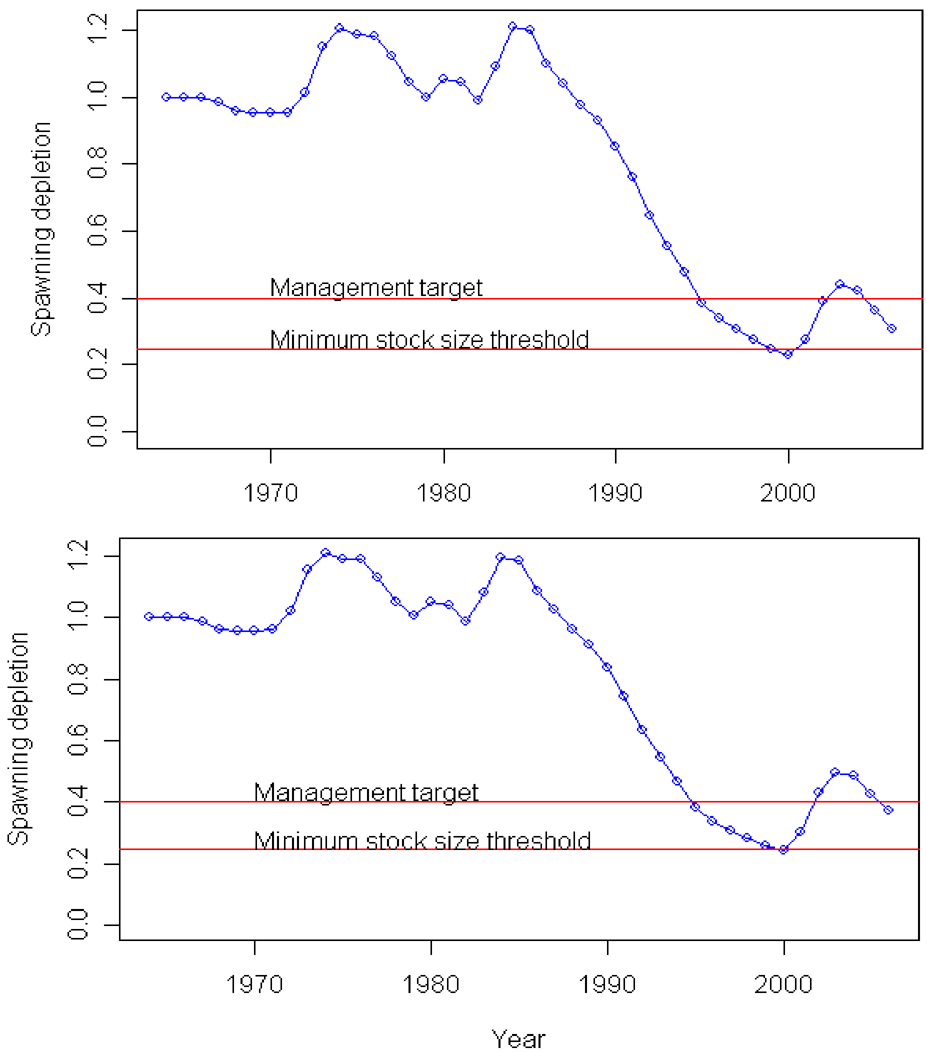


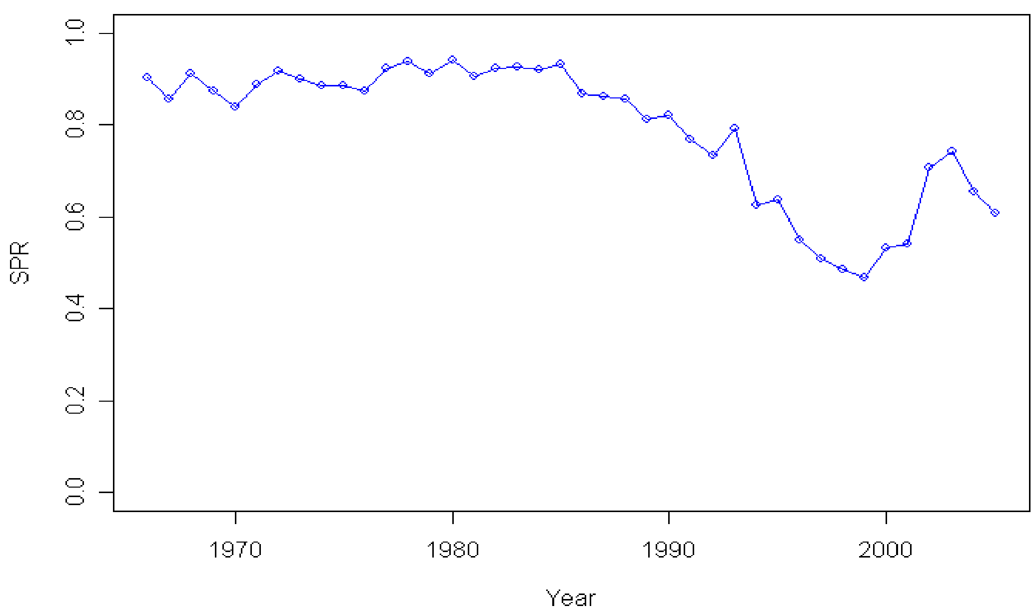
Figure d. Time series of estimated depletion, 1966-2006, for the base (upper plot) and alternative (lower plot) models.

Exploitation status

The estimated spawning potential ratio (SPR) for Pacific hake has been above the proxy target of 40% for the history of this fishery. In terms of its exploitation status, Pacific hake are presently above both the target biomass level (40% unfished biomass) and the target SPR rate (40%). The full exploitation history is portrayed graphically below which plots for each year the calculated SPR and spawning biomass level (B) relative to their corresponding targets, F40% and B40%, respectively.

Table d. Recent trend in spawning potential ratio (SPR).

	Base Model		alternative Model	
Year	Estimated SPR	~ 95% Interval	Estimated SPR	~ 95% Interval
1997	0.513	-	0.539	-
1998	0.491	-	0.521	-
1999	0.473	-	0.509	-
2000	0.540	-	0.584	-
2001	0.550	-	0.601	-
2002	0.716	-	0.762	-
2003	0.749	-	0.793	-
2004	0.664	-	0.721	-
2005	0.619	-	0.686	-



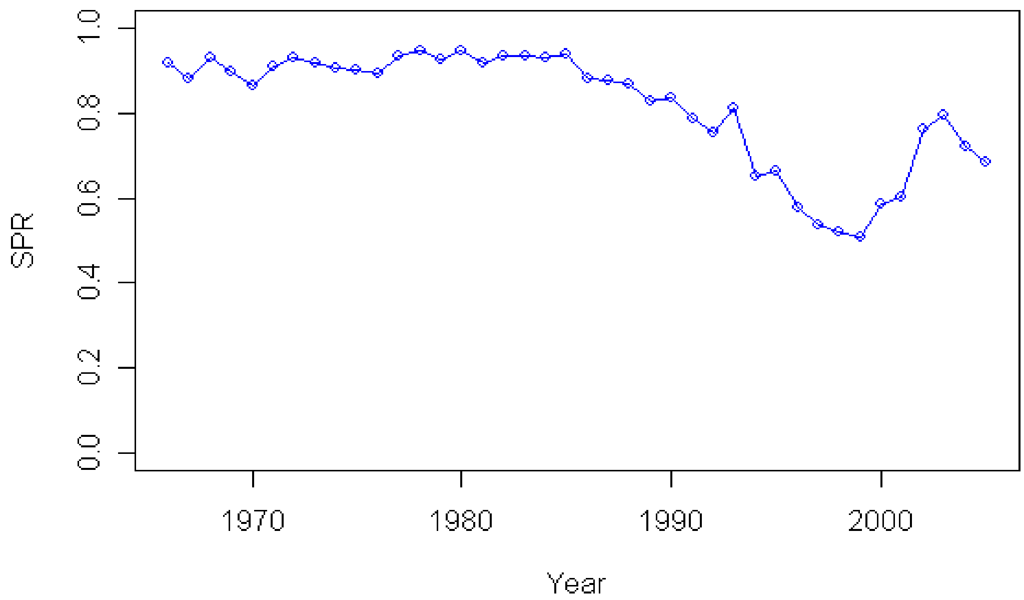
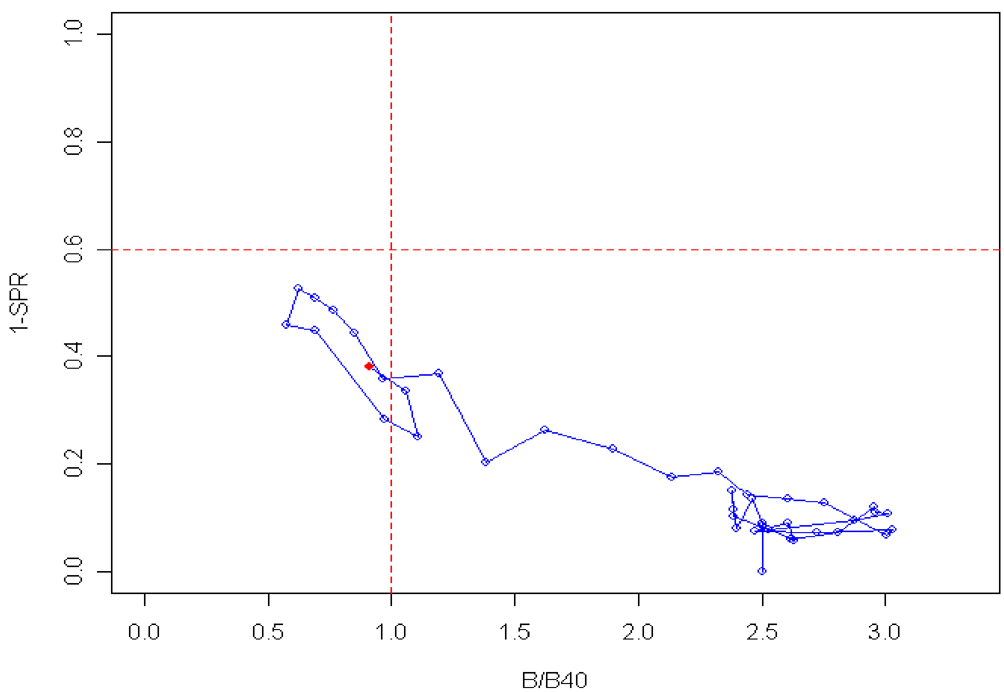


Figure e. Time series of estimated spawning potential ratio from base (upper plot) and alternative (lower plot) models.



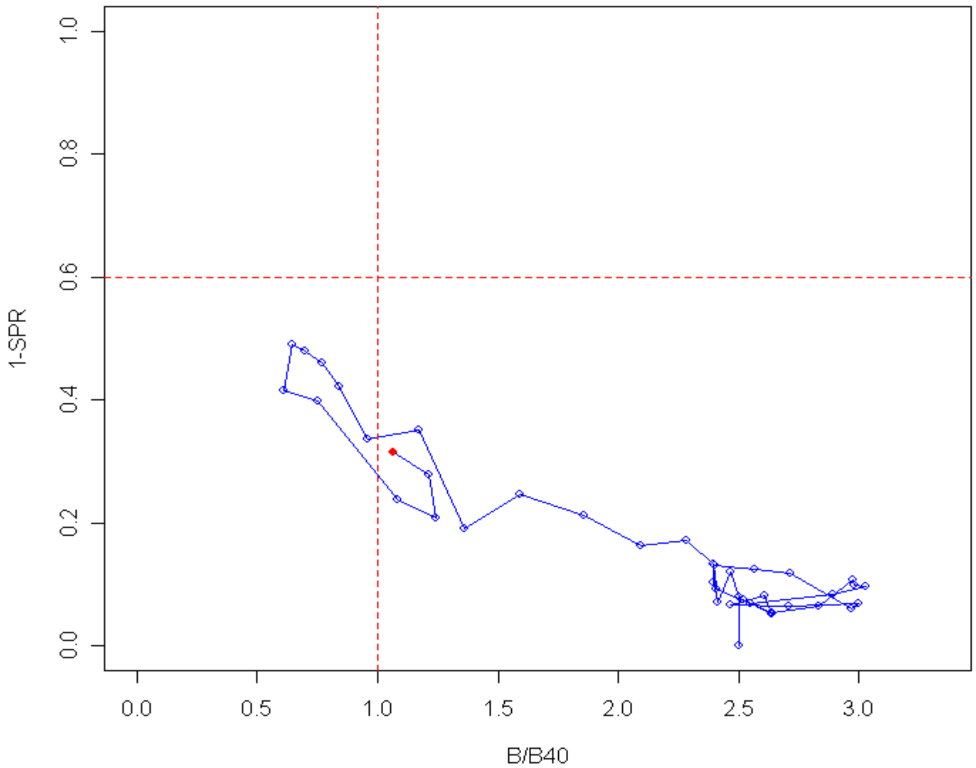


Figure f. Temporal pattern of estimated spawning potential ratio relative to the proxy target of 40% vs estimated spawning biomass relative to the proxy 40% level for base (upper plot) and alternative (lower plot) models.

Management performance

Since implementation of the Magnuson Fisheries Conservation and Management Act in the U.S. and the declaration of a 200 mile fishery conservation zone in Canada in the late 1970's, annual quotas have been the primary management tool used to limit the catch of Pacific hake in both zones by foreign and domestic fisheries. The scientists from both countries have collaborated through the Technical Subcommittee of the Canada-US Groundfish Committee (TSC), and there has been informal agreement on the adoption of an annual fishing policy. During the 1990s, however, disagreement between the U.S. and Canada on the division of the acceptable biological catch (ABC) between the two countries led to quota overruns; 1991-1992 quotas summed to 128% of the ABC and quota overruns have averaged 114% from 1991-1999. Since 2000, total catches have been below coastwide ABCs. A recent treaty between the United States and Canada (2003), which awaits final signature, establishes U.S. and Canadian shares of the coastwide allowable biological catch at 73.88% and 26.12%, respectively.

Table e. Recent trend in Pacific hake management performance.

Year	Total landings (mt)	ABC
1996	306,100	265,000
1997	325,215	290,000
1998	320,619	290,000
1999	311,855	290,000
2000	230,819	290,000
2001	235,962	238,000
2002	182,883	208,000
2003	205,582	235,000
2004	334,721	514,441
2005	360,306	

Unresolved problems and major uncertainties

The acoustic survey catchability, *q*, remains uncertain. This is largely driven by an inconsistency in the acoustic survey biomass time series and age compositions; age composition data suggest a large build up of stock biomass in the mid 1980s while the acoustic survey biomass time series is relatively flat since 1977.

Forecasts

Forecasts were generated assuming the maximum potential catch would be removed under 40:10 control rule for both the base and alternative models. Projections were based on the relative F contribution of 74.88% and 26.12% coast wide national allocation to the U.S. and Canada, respectively. For base case model, the 2006 coastwide ABC is estimated to be 661,681 mt with an OY of 593,750 mt. Under the alternative model, the 2006 coastwide ABC is estimated to be 904,944 mt with an OY of 883,490 mt. Spawning stock biomass is projected to decline with a corresponding relative depletion of 22.7% and 26.4% for the base and alternative models, respectively in 2007.

Table f. Three year projection of potential Pacific hake landings, spawning biomass and depletion for the base and alternative models under the 40:10 rule.

		Spawning biomass millions mt			Depletion percent unfished biomass		
Year	Expected coastwide catch (mt)	Mean	5%	95%	Mean	5%	95%
Base model, h=0.75, q=1.0							
2006	593,750	1.174	0.857	1.491	30.8%	24.7%	36.9%
2007	358,420	0.864	0.636	1.092	22.7%	18.1%	27.2%
2008	213,220	0.679	0.485	0.873	17.8%	13.5%	22.1%
2009	183,620	0.657	0.337	0.976	17.2%	9.2%	25.3%
Alt. model, h=0.75, q prior							
2006	883,490	1.601	1.109	2.093	38.0%	29.7%	45.0%
2007	522,510	1.130	0.795	1.464	26.4%	21.0%	31.7%
2008	302,300	0.851	0.588	1.113	19.8%	15.1%	24.5%
2009	240,700	0.792	0.404	1.179	18.5%	10.0%	26.9%

Decision table

A decision table was constructed to represent the uncertainty on the acoustic survey catchability coefficient, *q*. The base model with a *q*=1.0 represents the lower range while the alternative model which places a prior on *q* (effective *q*=0.7) represents the upper range. Below the decision table shows the consequences of management action given a state of nature. States of nature include the base model (*h*=0.75, *q*=1.0) and the alternative model (*h*=0.75, *q* prior). The management actions include the OY from each state of nature and two constant coastwide catch scenarios.

Table g. Decision table for two states of nature (base and alternative models) and four different harvest strategies given the state of nature.

			State of Nature	
Relative probability			**0.50**	**0.50**
Model			h = 0.75, q = 1.0	h = 0.75, q prior
Management action	Total coast-wide Catch (mt)	Year	Relative depletion (2.5%-97.5% interval)	
OY Model h=0.75, q=1.0	593,746	2006	0.308 (0.247-0.369)	0.380 (0.304-0.457)
	358,416	2007	0.227 (0.181-0.272)	0.310 (0.219-0.401)
	213,223	2008	0.178 (0.135-0.221)	0.263 (0.164-0.363)
	183,620	2009	0.172 (0.092-0.253)	0.254 (0.127-0.380)
OY Model h=0.75, q prior	883,490	2006	0.308 (0.247-0.369)	0.380 (0.304-0.457)
	522,511	2007	0.202 (0.125-0.279)	0.268 (0.215-0.322)
	302,298	2008	0.144 (0.056-0.232)	0.202 (0.155-0.249)
	240,702	2009	0.136 (0.020-0.252)	0.188 (0.104-0.273)
Total coast-wide	200,000	2006	0.308 (0.247-0.369)	0.380 (0.304-0.457)
catch = 200,000 mt	200,000	2007	0.282 (0.209-0.354)	0.351 (0.264-0.438)
	200,000	2008	0.250 (0.167-0.333)	0.315 (0.219-0.411)
	200,000	2009	0.239 (0.125-0.352)	0.299 (0.175-0.423)
Total coast-wide	400,000	2006	0.308 (0.247-0.369)	0.380 (0.304-0.457)
catch = 400,000 mt	400,000	2007	0.258 (0.184-0.332)	0.330 (0.241-0.419)
	400,000	2008	0.207 (0.122-0.292)	0.276 (0.177-0.375)
	400,000	2009	0.178 (0.063-0.294)	0.245 (0.118-0.372)

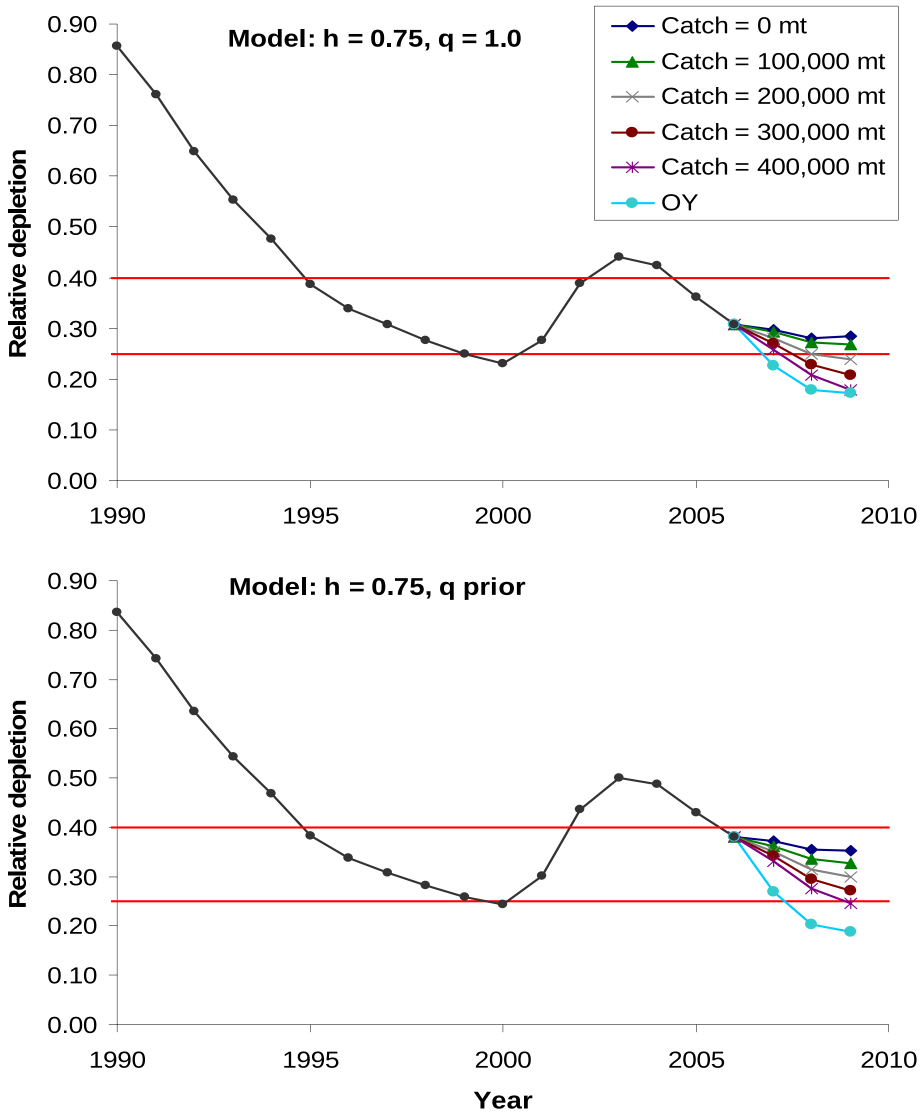


Figure g. Projections through 2009 for the base case (upper plot) and alternative (lower plot) models under various total coast-wide catch scenarios.

Research and data needs

1) The quantity and quality of biological data prior to 1988 from the Canadian fishery should be evaluated for use in developing length and conditional age at length compositions.
2) Evaluate whether modeling the distinct at-sea and shore based fisheries in the U.S. and Canada explain some lack of fit in the compositional data.
3) Compare spatial distributions of hake across all years and between bottom trawl and acoustic surveys to estimate changes in catchability/availability across years. The two primary issues are related to the changing spatial distribution of the survey as well as the environmental factors that may be responsible for changes in the spatial distribution of hake and their influences on survey catchability and selectivity.

4) Initiate analysis of the acoustic survey data to determine variance estimates for application in the assessment model. The analysis would provide a first cut to define the appropriate CV for the weighting of the acoustic data.
5) Develop an informed prior for the acoustic q. This could be done either with empirical experiments (particularly in off-years for the survey) or in a workshop format with technical experts. There is also the potential to explore putting the target strength estimation in the model directly. This prior should be used in the model when estimating the q parameter.
6) Review the acoustic data to assess whether there are spatial trends in the acoustic survey indices that are not being captured by the model. The analysis should include investigation of the migration (expansion/contraction) of the stock in relation to variation in environmental factors. This would account for potential lack of availability of older animals and how it affects the selectivity function.
7) Investigate aspects of the life history characteristics for Pacific hake and their possible effects on the interrelationship of growth rates and maturity at age. This should include additional data collection of maturity states and fecundity, as current information is limited.

Table h. Summary of recent trends in Pacific hake exploitation and stock levels; all values reported at the beginning of the year.

Base Model	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Landings (1000s mt)	306.1	325.2	320.6	311.9	230.8	236.0	182.9	205.6	334.7	360.3	NA
ABC (1000s mt)	265	290	290	290	290	238	208	235	514.441	265	
OY (1000s mt)											
SPR*	0.579	0.539	0.521	0.509	0.584	0.601	0.762	0.793	0.721	0.686	NA
Total biomass (millions mt)	2.601	2.437	2.184	1.958	1.761	1.813	3.657	3.534	3.274	2.640	2.328
Spawning biomass											
(millions mt)	1.293	1.169	1.056	0.952	0.880	1.054	1.485	1.684	1.617	1.386	1.178
~95% interval	1.180-	1.063-	0.954-	0.849-	0.767-	0.891-	1.217-	1.358-	1.280-	1.060-	0.857-
	1.405	1.273	1.157	1.054	0.990	1.213	1.746	2.003	1.945	1.703	1.491
Recruitment (billions)	1.988	1.933	2.814	13.789	0.990	1.372	0.234	2.338	1.446	0.279	2.192
~95% interval	1.711-	1.617-	2.271-	10.770-	0.722-	0.972-	0.124-	1.238-	4.165-	4.165-	4.165-
	2.167	2.152	3.199	15.912	1.199	1.681	0.343	3.233	4.988	4.988	4.988
Depletion	33.9%	30.6%	27.7%	25.0%	23.1%	27.6%	38.9%	44.2%	42.4%	36.3%	30.9%
~95% interval										30.4%-	24.7%-
	NA	NA	NA	NA	NA	NA	NA	NA	NA	42.1%	36.9%

Alternative Model	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Landings (1000s mt)	306.1	325.2	320.6	311.9	230.8	236.0	182.9	205.6	334.7	360.3	NA
ABC (1000s mt)	265	290	290	290	290	238	208	235	514.441	265	
OY (1000s mt)											
SPR*	0.579	0.539	0.521	0.509	0.584	0.601	0.762	0.793	0.721	0.686	
Total biomass (millions mt)	2.979	2.812	2.556	2.340	2.166	2.295	4.801	4.699	4.427	3.680	3.389
Spawning biomass											
(millions mt)	1.443	1.314	1.202	1.102	1.044	1.288	1.857	2.132	2.075	1.826	1.601
~95% interval	1.266-	1.146-	1.037-	0.934-	0.860-	1.025-	1.437-	1.624-	1.552-	1.322-	1.109-
	1.620	1.482	1.368	1.271	1.227	1.551	2.277	2.641	2.598	2.330	2.093
Recruitment (billions)	2.275	2.275	3.435	17.323	1.267	1.787	0.312	3.137	1.663	0.323	2.565
~95% interval	1.945-	1.893-	2.774-	13.677-	0.953-	1.322-	0.192-	1.978-	0.467-	0.079-	0.428-
	2.661	2.735	4.253	21.956	1.684	2.416	0.505	4.976	5.924	1.315	15.370
Depletion	33.7%	30.7%	28.0%	25.7%	24.3%	30.0%	43.3%	49.7%	48.4%	42.6%	38.0%
~95% interval										35.2%-	29.7%-
	NA	NA	NA	NA	NA	NA	NA	NA	NA	50.1%	45.1%

Table i. Summary of Pacific hake reference points.

Base Model

Quantity	Estimate	~95% Confidence interval
Unfished spawning stock biomass (*SB_0*, millions mt)	3.810	3.461 - 4.160
Unfished total biomass (*B_0*, millions mt)	9.200	NA
Unfished age 3+ biomass (millions mt)	7.832	NA
Unfished recruitment (*R_0*, billions)	4.974	4.536 – 5.447
Spawning stock biomass at MSY (*SB_{msy}*)*	1.06	0.96 – 1.14
Basis for *SB_{msy}*	$F_{40\%}$ proxy	NA
*SPR_{msy}**	40.0%	33.2%-46.7%
Basis for *SPR_{msy}*	$F_{40\%}$ proxy	NA
Exploitation rate corresponding to *SPR_{msy}**	24.6%	NA
MSY* (mt)	573,945	521,122 – 619,501

Alternative Model

Quantity	Estimate	~95% Confidence interval
Unfished spawning stock biomass (*SB_0*, millions mt)	4.287	3.764 – 4.810
Unfished total biomass (*B_0*, millions mt)	10.333	NA
Unfished age 3+ biomass (millions mt)	8.804	NA
Unfished recruitment (*R_0*, billions)	5.593	4.955 - 6.313
Spawning stock biomass at MSY (*SB_{msy}*)*	1.191	1.041 - 1.310
Basis for *SB_{msy}*	$F_{40\%}$ proxy	NA
*SPR_{msy}**	40.0%	33.2%-46.7%
Basis for *SPR_{msy}*	$F_{40\%}$ proxy	NA
Exploitation rate corresponding to *SPR_{msy}**	24.6%	NA
MSY* (mt)	645,240	566,830 - 712,848

INTRODUCTION

This assessment was undertaken in the spirit and intent of the "Agreement between the Government of the United States and the Government of Canada on Pacific Hake/Whiting", signed at Seattle, Washington, on November 21, 2003. Under this agreement, pending ratification as part of the reauthorization of the Magnuson-Stevens Act by Congress, Pacific hake (a.k.a. Pacific whiting) stock assessments are to be prepared by the Hake Technical Working Group comprised of U.S. and Canadian scientists and reviewed by a Scientific Review Group (SRG), with memberships as appointed by both parties to the agreement. While these entities have not been formally established, the current assessment was cooperatively prepared and reviewed as outlined in this agreement. As background, separate Canadian and U.S. assessments were submitted to each nation's assessment review process prior to 1997. In the past, this practice has resulted in differing yield options being forwarded to each country's managers for this single, yet shared trans-boundary fish stock. Multiple interpretations of Pacific hake status made it difficult to coordinate overall management policy. To address this problem, the working group agreed in 1997 to present scientific advice in a single collaborative assessment, while that agreement was officially formalized in 2003. To further advance the coordination of scientific advice on Pacific hake, this report was submitted to a joint Canada-U.S. SRG for technical review in fulfillment of the agreement and to satisfy management responsibilities of both the U.S. Pacific Fisheries Management Council (PFMC) and the Canadian Pacific Stock Assessment Review Committee (PSARC). The Review Group meeting was held in Seattle, WA at the Northwest Fisheries Science Center, during Feb 6-10, 2006. While this report forms the basis for scientific advice to managers, final advice on appropriate yield is deferred to Canadian DFO managers by the PSARC Groundfish Sub-committee and the PSARC Steering Committee and to the U.S. Pacific Fisheries Management Council by the Groundfish Management Team.

Stock Structure and Life History

Pacific hake (*Merluccius productus*), also referred to as Pacific whiting, is a codlike species distributed along the west coast of North America generally ranging from 25^0 N. to 51^0 N. latitude. It is among about 11 other species of hakes from the genus, *Merluccidae*, which are distributed worldwide in both hemispheres of the Atlantic and Pacific Oceans and collectively constitute nearly two million mt of catch annually (Alheit and Pitcher 1995). The coastal stock of Pacific hake is currently the most abundant groundfish population in the California Current system. Smaller populations of this species occur in the major inlets of the North Pacific Ocean, including the Strait of Georgia, Puget Sound, and the Gulf of California. Electrophoretic studies indicate that Strait of Georgia and the Puget Sound populations are genetically distinct from the coastal population (Utter 1971). Genetic differences have also been found between the coastal population and hake off the west coast of Baja California (Vrooman and Paloma 1977). The coastal stock is distinguished from the inshore populations by larger body size, seasonal migratory behavior, and a pattern of low median recruitment punctuated by extremely large year classes.

The coastal stock of Pacific hake typically ranges from the waters off southern California to Queen Charlotte Sound. Distributions of eggs, larvae, and infrequent observations of spawning aggregations indicate that Pacific hake spawning occurs off south-central California during January-March. Due to the difficulty of locating major offshore spawning concentrations, details of spawning behavior of hake remains poorly understood (Saunders and McFarlane 1997). In spring, adult Pacific hake migrate onshore and to the north to feed along the continental shelf and slope from northern California to Vancouver Island. In summer, Pacific hake form extensive midwater aggregations in association with the continental shelf break, with highest densities located over bottom depths of 200-300 m (Dorn et al. 1994). Pacific hake feed on euphausiids, pandalid shrimp, and pelagic schooling fish (such as eulachon and Pacific herring) (Livingston and Bailey 1985). Larger Pacific hake become increasingly piscivorous, and Pacific herring are commonly a large component of hake diet off Vancouver Island. Although Pacific hake are cannibalistic, the geographic separation of juveniles and adults usually prevents cannibalism from being an important factor in their population dynamics (Buckley and Livingston 1997).

Older (age 5+), larger, and predominantly female hake exhibit greatest northern migration each season. During El Niño events, a larger proportion of the stock migrates into Canadian waters, apparently due to intensified northward transport during the period of active migration (Dorn 1995). Range extensions to the north also occur during El Niño conditions, as evidenced by reports of hake from southeast Alaska during these warm water years. Throughout the warm period experienced in 1990s, there have been changes in typical patterns of hake distribution: Spawning activity has been recorded north of California, and frequent reports of unusual numbers of juveniles from Oregon to British Columbia suggest that juvenile settlement patterns have also shifted northwards in the late 1990s. Because of this shift, juveniles may be subjected to increased predation from cannibalism and to increased vulnerability to fishing mortality. Subsequently, La Nina conditions apparently caused a southward shift in the center of the stock's distribution and a smaller portion of the population was found in Canadian waters in the 2001 survey.

Fisheries

The fishery for the coastal population of Pacific hake occurs primarily during April-November along the coasts of northern California, Oregon, Washington, and British Columbia. The fishery is conducted almost exclusively with midwater trawls. Most fishing activity occurs over bottom depths of 100-500 m, but offshore extensions of fishing activity have occurred. The history of the coastal hake fishery is characterized by rapid changes brought about by the development of foreign fisheries in 1966, joint-venture fisheries in the early 1980's, and domestic fisheries in 1990's (Fig. 1).

Large-scale harvesting of Pacific hake in the U.S. zone began in 1966 when factory trawlers from the former Soviet Union began targeting Pacific hake. During the mid 1970's, factory trawlers from Poland, Federal Republic of Germany, the former German Democratic Republic and Bulgaria also participated in the fishery. During 1966-1979, the catch in U.S.

waters averaged 137,000 t per year (Table 1). A joint-venture fishery was initiated in 1978 between two U.S. trawlers and Soviet factory trawlers acting as mother ships (the practice where the catch from several boats is brought back to the larger, slower ship for processing and storage until the return to land). By 1982, the joint-venture catch surpassed the foreign catch. In the late 1980's, joint-ventures involved fishing companies from Poland, Japan, former Soviet Union, Republic of Korea and the People's Republic of China. In 1989, the U.S. fleet capacity had grown to a level sufficient to harvest the entire quota, and no foreign fishing was allowed. In contrast, Canada allocates a portion of the Pacific hake catch to joint-venture operations once shore-side capacity is filled.

Historically, the foreign and joint-venture fisheries produced fillets and headed and gutted products. In 1989, Japanese mother ships began producing surimi from Pacific hake, using a newly developed process to inhibit myxozoan-induced proteolysis. In 1990, domestic catcher-processors and mother ships entered the Pacific hake fishery in the U.S. zone. Previously, these vessels had engaged primarily in Alaskan pollock fisheries. The development of surimi production techniques for walleye pollock was expanded to include Pacific hake as a viable alternative. In 1991, the joint-venture fishery for Pacific hake ended because of the increased level of participation by domestic catcher-processors and mother ships, and the growth of shore-based processing capacity. Shore-based processors of Pacific hake had been constrained historically by a limited domestic market for Pacific hake fillets and headed and gutted products. The construction of surimi plants in Newport and Astoria, Oregon led to a rapid expansion of shore-based landings in the U.S. fishery in the early 1990's.

The sectors involved in the Pacific hake fishery in Canada exhibits a similar pattern, although phasing out of the foreign and joint-venture fisheries has lagged a few years relative to the U.S. Since 1968, more Pacific hake have been landed than any other species in the groundfish fishery on Canada's west coast (Table 1). Prior to 1977, the fishing vessels from the former Soviet Union caught the majority of Pacific hake in the Canadian zone, with Poland and Japan accounting for much smaller landings. Since declaration of the 200-mile extended fishing zone in 1977, the Canadian fishery has been divided into shore-based, joint-venture, and foreign fisheries. In 1990, the foreign fishery was phased out, but the demand of Canadian shore-based processors remains below the available yield, thus the joint-venture fishery will continued through 2002. Poland is the only country that participated in the 1998 joint-venture fishery. The majority of the shore-based landings of the coastal hake stock is processed into surimi, fillets, or mince by processing plants at Ucluelet, Port Alberni, and Delta, British Columbia. Small deliveries were made in 1998 to plants in Washington and Oregon. Although significant aggregations of hake are found as far north as Queen Charlotte Sound, in most years the fishery has been concentrated below 49° N latitude off the south coast of Vancouver Island, where there are sufficient quantities of fish in proximity to processing plants.

Management of Pacific hake

Since implementation of the Magnuson-Stevens Fishery Conservation and Management Act in the U.S. and the declaration of a 200-mile fishery conservation zone in Canada in the late

1970's, annual harvest quotas have been the primary management tool used to limit the catch of Pacific hake. Scientists from both countries have historically collaborated through the Technical Subcommittee of the Canada-US Groundfish Committee (TSC), and there have been informal agreements on the adoption of annual fishing policies. During the 1990s, however, disagreements between the U.S. and Canada on the allotment of the acceptable biological catch (ABC) between U.S. and Canadian fisheries lead to quota overruns; 1991-1992 quotas summed to 128% of the ABC, while in 1993-1999 the combined quotas were 107% of the ABC on average. The 2002 and 2003 fishing year were somewhat different from years past in that the ABC of Pacific hake was utilized at an average of 87%. In the signed Pacific hake agreement between the United States and Canada 73.88% and 26.12%, respectively, of the coastwide allowable biological catch is to be allocated between the two countries. Furthermore, the agreement establishes a Joint Technical Committee to exchange data and conduct stock assessments, which will be reviewed by a Scientific Review Group. This document represents the efforts of the aborning joint US-Canada Technical Committee.

United States

Prior to 1989, catches in the U.S. zone were substantially below the harvest guideline, but since 1989 the entire harvest guideline has been caught with the exceptions in 2000, 2001 and 2003, in which 90%, 96% and 96% of the quota were taken, respectively. The total U.S. catch has not significantly exceeded the harvest guideline for the U.S. zone (Table 2), indicating that in-season management procedures have been effective.

In the U.S. zone, participants in the directed fishery are required to use pelagic trawls with a codend mesh that is at least 7.5 cm (3 inches). Regulations also restrict the area and season of fishing to reduce the bycatch of Chinook salmon, and several depleted rockfish stocks. More recently, yields in the U.S. zone have been restricted to level below optimum yields due to widow rockfish bycatch in the Pacific hake fishery. At-sea processing and night fishing (midnight to one hour after official sunrise) are prohibited south of 42° N latitude. Fishing is prohibited in the Klamath and Columbia River Conservation zones, and a trip limit of 10,000 pounds is established for Pacific hake caught inside the 100-fathom contour in the Eureka INPFC area. During 1992-95, the U.S. fishery opened on April 15, however in 1996 the opening date was advanced to May 15. Shore-based fishing is allowed after April 1 south of 42° N. latitude., but is limited to 5% of the shore-based allocation being taken prior to the opening of the main shore-based fishery. The main shore-based fishery opens on June 15. Prior to 1997, at-sea processing was prohibited by regulation when 60 percent of the harvest guideline was reached. The current allocation agreement, effective since 1997, divides the U.S. non-tribal harvest guideline between factory trawlers (34%), vessels delivering to at-sea processors (24%), and vessels delivering to shore-based processing plants (42%).

Shortly after the 1997 allocation agreement was approved by the PFMC, fishing companies with factory trawler permits established the Pacific Whiting Conservation Cooperative (PWCC). The primary role of the PWCC is to allocate the factor trawler quota between its members. Anticipated benefits of the PWCC include more efficient allocation of resources by fishing companies, improvements in processing efficiency and product quality, and a reduction in waste and bycatch rates relative to the former “derby” fishery in which all vessels competed for a fleet-wide quota. The PWCC also initiated recruitment research to support hake stock assessment. As part of this effort, PWCC sponsored a juvenile recruit survey in summer of 1998 and 2001, which since 2002 is presently ongoing in collaboration and support by NMFS.

Canada

The Canadian Department of Fisheries and Oceans (DFO) is responsible for managing the Canadian hake fishery. Prior to 1987, the quota was not reached due to low demand for hake. In subsequent years the quota has been fully subscribed, and total catch has been successfully restricted to ±5% of the quota (Table 2).

Domestic requirements are given priority in allocating yield between domestic and joint-venture fisheries. During the season, progress towards the domestic allocation is monitored and any anticipated surplus is re-allocated to the joint-venture fishery. The Hake Consortium of British Columbia coordinates the day-to-day fleet operations within the joint-venture fishery. Through 1996, the Consortium split the available yield equally among participants or pools of participants. In 1997, an Individual Vessel Quota (IVQ) system was implemented for the British Columbia trawl fleet. IVQs of Pacific hake were allotted to license holders based on a combination of vessel size and landing history. Vessels are permitted to deliver Joint-venture hake quota to domestic shore-side processors. However, vessels are not permitted to deliver domestic allocation to Joint-venture/processor operations at sea. There is no direct allocation to individual shoreside processors. License holders declare the proportion of their hake quota that will be landed in the domestic market, and shoreside processors must secure catch from vessel license holders.

Overview of Recent Fishery and Management

United States

The coastwide acceptable biological catch (ABC) for 2004 was estimated to be 514,441 mt based on the F_{msy} proxy harvest rate of F40% applied to the model in which acoustic survey catchability (q) was assumed to be 1.0 (Helser et al. 2004). This was the largest ABC in recent years and reflected substantial increases in biomass (above 40% unfished biomass) due to the presence of the strong 1999 year-class. The final commercial US optimum yield (OY) was set at 250,000 mt due to constraints imposed by bycatch of canary and widow rockfish in the hake fishery. The Makah tribe was allocated 32,500 mt in 2004. For the 2005 fish season, the coastwide OY was estimated to be 364,197 mt, with 269,069 mt apportioned to the U.S. fishery. The 2005 OY was nearly 100% utilized.

The at-sea sector’s distribution of catch in 2004 ranged slightly stronger northward with roughly 50% of the catch occurring north and south of Newport, Oregon (Fig. 2). The total at sea sector harvested approximately 43% (90,200 mt) of the total U.S. catch of 210,400 mt. In

2005, at sea catches extended from south of Cape Blanco to Cape Flattery, with nearly even distribution north and south of Newport.

The shore-based sector harvested 46% (96,200 mt) of the total U.S. catch of 210,400 mt in 2004. As in previous years, the dominate ports were Newport (38,800 mt) followed by Westport (30,000 mt) and Astoria (16,000 mt). The 2005 shore-based fishery began on June 15 and ended on August 18, and utilized approximately 94% of the commercial optimum yield of 97,469 mt.

Since 1996, the Makah Indian Tribe has conducted a separate fishing in its" usual and accustomed fishing area." During the 2004 and 2005 fishing season, the distribution of Pacific hake provided favorable conditions to support the fishery in the Makah tribal fishing area;, where the Makahs harvested approximately 74% (24,000 mt) of the Tribal allocation and 11% of total US catch in 2004. The 2005 Makah fishery, which began on May 1 and ended on August 15, utilized 28,325 mt, (approximately 81% of the 35,000 mt allocation).

Canada

DFO managers allow a 15% discrepancy between the quota and total catch. The quota may be exceeded by up to 15% in any given year, which is then deducted from the quota for the subsequent year. Conversely, if less than the quota is taken, up to 15% can be carried over into the next year. For instance, the overage in 1998 (Table 2) is due to carry-over from 1997 when 9% of the quota was not taken. During 1999-2001 the PSARC groundfish subcommittee recommended to DFO managers yields based on F40% (40-10) option and Canadian managers adopted allowable catches prescribed at 30% of the coastwide ABC (Table 14; Dorn et al. 1999).

The all-nation catch in Canadian waters was 53,585 mt in 2001, up from only 22,401 mt in 2000 (Table 1). In 2000, the shore-based landings in the Canadian zone hit a record low since 1990 due to a decrease in availability. Catches in 2001 increased substantially over those of 2000 for both the Joint Venture and shore-based sectors over catches in 2000, but were still below recommended TAC. Total Canadian catches in 2002 and 2003 were 50,769 mt and 62,090 mt, respectively, and were harvested exclusively by the shore-side sector; constituting nearly 87% of the total allocation of that country. In 2004, the allowable catch in Canada was 26.14% of the coastwide ABC, approximately 134,000 mt. Catches were nearly split equally between the shore-based and joint venture sectors, totaling 124,000 mt. Canadian Pacific hake catches were fully utilized in the 2005 fishing season with 85,284 mt and 15,178 mt taken by the Domestic and Joint Venture fisheries, respectively.

ASSESSMENT

Modeling Approaches

Age-structured assessment models have been used to assess Pacific hake since the early 1980's. Modeling approaches have evolved as new analytical techniques have been developed.

Initially, a cohort analysis tuned to fishery CPUE was used (Francis et al. 1982). Later, the cohort analysis was tuned to NMFS triennial acoustic survey estimates of absolute abundance at age (Hollowed et al. 1988a). Since 1989, a stock synthesis model that utilizes fishery catch-at-age data and acoustic survey estimates of population biomass and age composition has been the primary assessment method (Dorn and Methot, 1991). Dorn et al. (1999) converted the age-structured stock synthesis Pacific hake model to an age-structured model using AD model builder (Fournier 1996). AD model builder's post-convergence routines permit calculation of standard errors (or likelihood profiles) for any quantity of interest, allowing for a unified approach to the treatment of uncertainty in estimation and forward projection. Since 2001, Helser et al. (2001, 2003, 2004) have used the same ADMB modeling platform to assess the hake stock and examine important modifications and assumptions, including the time varying nature of the acoustic survey selectivity and catchability. The acoustic survey catchability coefficient (*q*) has been, and continues to be, one of the major sources of uncertainty in the model. Due to the lengthened acoustic survey biomass trends the assessment model was able to freely estimate the acoustic survey *q*. These estimates were substantially below the assumed value of *q*=1.0 from earlier assessments. The 2003 and 2004 assessment presented uncertainty in the final model result as a range of biomass. The lower end of the biomass range was based upon the conventional assumption that the acoustic survey *q* was equal to 1.0, while the higher end of the range represented a *q*=0.6 assumption.

This year's assessment used the Stock Synthesis modeling framework (SS2 Version 1.21, December, 2006) which was written by Dr. Richard Methot (Northwest Fisheries Science Center) in AD Model Builder. Conversion of the previous hake model into SS2 was guided by three principles: 1) the incorporation of less derived data, 2) explicitly model the underlying hake growth dynamics, and 3) achieve parsimony[2] in terms on model complexity. "Incorporating less derived data" entailed fitting observed data in their most elemental form. For instance, no pre-processing to convert length data to age compositional data was performed. Also, incorporating conditional age-at-length data, through age-length keys for each fishery and survey, allowed explicit estimation of expected growth, dispersion about that expectation, and its temporal variability, all conditioned on selectivity. Our final goal was to achieve parsimony of model complexity without loss of performance in maximum likelihood estimation. We assess this goal through a combination of diagnostics, convergence criteria and comparative analysis with MCMC integration.

Data Sources

The data used in the stock assessment model included:

- Total catch from the U.S. and Canadian fisheries (1966-2005).

[2] Parsimony is a balance between the number of parameters needed to represent a complex state of nature and data quality/quantity to support accurate and precise estimation of those parameters.

- Length compositions from the U.S. fishery (1975-2005) and Canadian fishery (1988-2005).

- Age compositions from the U.S. fishery (1973-1974) and Canadian fishery (1977-1987). These are the traditional age compositional data generated by applying fishery length compositions to an age-length key. Use of this approached was necessary to fill in gaps for those years in which biological samples could not be re-acquired from standard procedures.

- Conditional age-at-length compositions from the U.S. fishery (1975-2005) and Canadian fishery (1988-2005).

- Biomass indices, length compositions and conditional age-at-length composition data from the Joint US-Canadian acoustic/midwater trawl surveys (1977, 1980, 1983, 1986, 1989, 1992, 1995, 1998, 2001, 2003, and 2005). Note: the 1986 acoustic survey biomass index was omitted due to transducer and calibration problems.

- Indices of young-of-the-year abundance from the Santa Cruz Laboratory larval rockfish surveys (1986-2005). In this, as in the previous 2001 and 2003 assessment, the Santa Cruz Laboratory indices of young-of-the-year abundance were used as an age-2 tuning index for stock reconstruction and for future projections (two years out from the terminal year in the assessment, i.e. 2003 and 2004).

As in the previous hake model, the U.S. and Canadian fisheries were modeled separately. The model also used biological parameters to estimate spawning and population biomass to obtain predictions of fishery and survey biomass from the parameters estimated by the model. These parameters were:

- Proportion mature at length (not estimated in model).

- Population allometric growth relationship, as estimated from the acoustic survey (not estimated in model).

- Initial estimates of growth including CVs of length at age for the youngest and oldest fish (estimated in model).

- Natural mortality (*M*, not estimated in model).

Total catch

Table 1 lists the catch of Pacific hake for 1966-2005 by nation and fishery. Catches in U.S. waters for 1966-1980 are from Bailey et al. (1982). Prior to 1977, the at-sea catch was reported by foreign nationals without independent verification by observers. Bailey et al. (1982) suggest that the catch from 1968 to 1976 may have been under-reported because the apparent catch per vessel-day for the foreign feet increased after observers were placed on foreign vessels in the late 1970's. For 1981-2005, the shore-based landings are from Pacific Fishery Information Network (PacFIN). Foreign and joint-venture catches for 1981-1990, and domestic at-sea catches for 1991-2005 are estimated by the North Pacific Groundfish Observer Program (NPGOP).

At-sea discards are included in the foreign, joint-venture, at-sea domestic catches in the U.S. zone. Discards have not been estimated for the shore-based fishery. The majority of vessels in the U.S. shore-based fishery operate under experimental fishing permits that require them to retain all catch and bycatch for sampling by plant observers. Canadian joint-venture catches are monitored by at-sea observers, which are placed on all processing vessels. Observers use volume/density methods to estimate total catch. Domestic Canadian landings are recorded by dockside monitors using total catch weights provided by processing plants. Catch data from Canadian JV and domestic fisheries were provided by Greg Workman (DFO, Pacific Biological Station, Nanaimo, B.C.).

Fishery-dependent Data

Since the SS2 model uses length compositions and conditional age-at-length compositions, a complete reconstruction of these data inputs was required. Biological information from the U.S. at-sea commercial Pacific hake fishery was extracted from the NORPAC database management system maintained at the Alaska Fisheries Science Center. A query of length, weight and age information yielded biological samples from the Foreign and Joint Venture fisheries from 1975-1990, and from the domestic at sea fishery from 1991-2005. Specifically these data included sex-specific length and age data collected at the haul level by observers, where random samples of fish lengths from a known sampled haul weight and otoliths are then collected on a length-stratified basis. Detailed sampling information including the numbers of hauls sampled, lengths collected, and otoliths aged in the Foreign, JV and domestic at-sea fisheries are presented in Table 2.

Biological samples from the U.S. shore-based fishery were collected by port samplers from ports with substantial landings of Pacific hake: primarily Newport, Astoria, Crescent City, and Westport, from 1991-2005. Port samplers routinely take one sample per offload or trip in the port consisting of 100 randomly selected fish for individual length and weight, and 20 random samples per offload for otolith extraction and subsequent aging. It should be noted that the sampling unit here is the trip rather than the haul as in the case of the at-sea fishery. Since detailed haul-level information is not recorded on trip landings documentation in the shore-based fishery, and hauls sampled in the at-sea fishery can not be aggregated to a comparable trip level, there is no least common denominator for aggregating at-sea and shore-based fishery samples. As a result, samples sizes were simply summed over hauls and trips for U.S. fishery length- and age-compositions, however each fishery was weighted according to the proportion of its catch.

The Canadian domestic shore-based fishery is subject to 10% observer coverage. On observed trips, an otolith sample is taken from the first haul of the trip with associated length information, followed by length samples on subsequent hauls. For unobserved trips, port samplers obtain biological data from the landed catch. Observed domestic haul-level information is then aggregated to the trip level to be consistent with the unobserved trips that are sampled in ports. Sampled weight of the catch from which biological information is collected must be inferred from year-specific length-weight relationships. Canadian domestic fishery biological samples were only available from 1996-2005, and detailed sampling information is presented in Table 3.

For the Canadian at-sea Joint Venture fishery, an observer aboard the factory ship records the codend weight for each codend transferred from companion catcher boats. However, length samples are only collected every second day of fishing operations, and an otolith sample is only collected once a week. Length and age samples are taken randomly from a given codend. Since sample weight from which biological information is taken is not recorded, sample weight must be inferred from a weight-length relationship applied to all lengths taken and summed over haul. Length and age information was only available from the Joint Venture fishery from 1988-2005. As in the case with the U.S. at-sea fishery, the basic sampling unit in the Canadian Joint Venture fishery is assumed to be a haul. Detailed sampling information for the Canadian Joint Venture fishery is also presented in Table 3.

The length and age data were analyzed based on the sampling protocols used to collect them, and expanded to estimate the corresponding statistic from entire landed catch by fishery and each year that sampling occurred. In general, the analytic steps can be summarized as follows:

1) Count lengths (or ages) in each size (or age) bin (1 cm/year) for each haul in the at-sea fishery and for each trip in the shore-based fishery, generating “raw” frequency data.
2) Expand the raw frequencies from the haul or trip level to account for the catch weight sampled in each trip.
3) Expand the summed frequencies by fishery sector to account for the total landings.
4) Calculate sample sizes (number of samples and number of fish within sample) and normalize to proportions that sum to unity within each year.

To complete step (2), it was necessary to derive a multiplicative expansion factor for the observed raw length frequencies of the sample. This expansion factor was calculated for each sample corresponding to the ratio of the total catch weight in a haul or trip divided by the total sampled weight from which biological samples were taken within the haul or trip. In some cases, where there was not an estimated sample weight (more common in the Canadian domestic shore-based trips), a predicted weight of the sample was computed by applying a year-specific length-weight relationship to each length in the sample, then summing these weights. Anomalies that could emerge where very small numbers of fish lengths were collected from very large landings were avoided by constraining expansion factors to not exceed the 95th percentile of all expansion factors calculated for each year and fishery. The expanded lengths (N at each length times the expansion factor for the sample) were then summed within each fishery sector, and then weighted a second time by the relative proportion of catches by fishery within each year and nation. Finally, the year-specific length frequencies were summed over fishery sector and normalized so that the sum of all lengths in a single year and nation was equal to unity.

Tables 4 and 5 provide a detailed sampling summary, by fishery and nation, including the number of unique samples (hauls in the JV fishery and trips in the domestic fishery) by year and other sampling metrics of the relative efficiency of sample effort. Ultimately, the total sample size (# samples) by year is the multinomial sample size included in the stock assessment model. In both the U.S. and Canada, at-sea biological samples are collected at the haul level while shore-based samples are collected at the trip level. Tables 4 and 5 provide comparisons of sampling levels relative to the total sector catches in each country. In recent U.S. fisheries, between 9% and 16% of all shore-based catch has been sampled, compared to 40% to 60% of the at-sea catch. In both cases, fraction sampled has increased over time. Between 2000 and 2005, a sample was taken, on average, once per 575 mt of hake caught in the shore-based fishery, compared to once per 45 mt of catch in the at-sea fishery. Sample sizes for conditional age at length compositions for the U.S. and Canadian fisheries are given in Tables 6 and 7, respectively.

U.S. fishery length compositions representing fish caught in both the at-sea and shore-based fisheries are shown in Figures 3 and 4. It should be noted that there are some differences in the length compositions between the at sea and shore-based domestic fisheries, suggesting that future attempts should be made to model them separately. In general, the composite U.S. fishery length compositions confirm the well known pattern of year class strengths, including the dominant 1980 and 1984 and secondary 1970, 1977 and 1999 year classes moving through the size structure (Figure 4). These relationships suggest that the sizes of hake which are vulnerable to the U.S. fishery have changed over time, possibly due to growth, selectivity or both. This is particularly evident as larger fish before 1990 and a shift to smaller fish between 1995 and 2000. These features will be explored within the population dynamics model.

As with the U.S. fleet sectors, differences in length compositions between the Canadian Joint-venture and domestic fleets among some years warrant exploration of fitting the fisheries separately. This however was not done in this assessment due to time limitations. The composite Canadian fishery length compositions (Figures 5 and 6) indicate that the Canadian fleets exploit larger and presumably older hake. A particularly interesting feature of these length compositions is that the Canadian fleet prosecuted a seemingly fast growing 1994 year class of hake in 1995 (age 1), 1996 (age 2) and subsequent years. It is unclear whether this is due to size- vs. age-based selectivity, however, it is well known that larger (and older) hake migrate further northward annually (Dorn, 1995). As in the U.S. fishery, Canadian length compositions show some temporal pattern in the range of fish exploited by the fishery (Figure 6).

U.S. and Canadian fishery conditional age-at-length compositions constitute the bulk of data in this assessment and provide information on recruitment strength, growth and growth variability. These data are shown graphically for the U.S. fishery from 1975-2005 and from 1988-2005 for the Canadian hake fishery in Figures 7 and 8, respectively. Since age-composition data used in the old hake assessment extended further back in time than the conditional age-at-length data generated here, the older data were also included in the assessment model to augment information on recruitment earlier in the time series and are shown in Figure 9.

Acoustic Survey (Biomass, length and age composition)

Integrated acoustic and trawl surveys, used to assess the distribution, abundance and biology of coastal Pacific hake, *Merluccius productus*, along the west coasts of the United States and Canada. The Pacific Biological Station (PBS) of the Canadian Department of Fisheries and Oceans (DFO) has conducted annual surveys along the Canadian west coast since 1990. From 1977-2001, surveys in U.S. waters were conducted triennially by Alaska Fisheries Science Center (AFSC). The triennial surveys in 1995, 1998, and 2001 were carried out jointly by AFSC and PBS. Following 2001, the responsibility for the US portion of the survey was transferred to the Fishery Resource Analysis and Monitoring (FRAM) Division of NOAA's Northwest Fisheries Science Center (NWFSC). Following the transfer, the survey was scheduled on a bi-annual basis, with joint acoustic surveys conducted by FRAM and PBS in 2003 and 2005.

The 2005 survey was conducted jointly by US and Canadian science teams aboard the NOAA vessel *Miller Freeman* from 20 June to 19 August, spanning the continental slope and shelf areas the length of the West Coast from south of Monterey California (35.7º N) to the Dixon Entrance area (54.8º N). A total of 106 line transects, generally oriented east-west and spaced at 10 or 20 nm intervals, were completed (Figure 10). During the 2005 acoustic survey, aggregations of coastal Pacific hake were detected as far south as 37º N (Monterey Bay) and extending nearly continuously to the furthest northerly area surveyed at Dixon Entrance. Areas of prominent concentrations of hake included the waters off Point Arena (ca. 39º N) and north of Cape Mendocino, California (ca. 41º N), in the area south of Heceta Bank, Oregon (ca. 44º N), the waters spanning the US-Canadian border off Cape Flattery and La Perouse Bank (ca. 48.5E N), and locally within Queen Charlotte Sound (ca. 51º N). Mid-water and bottom trawls, deployed to verify size and species composition and collect biological information (i.e., age composition, sex), found that smaller individuals - age-2 fish - were prevalent in the southern portion of their range, but the coastal Pacific hake stock continued to be dominated by representatives of the 1999 year-class (age 6) throughout most of their range, except for the occurrence of numbers of larger Pacific hake in the north.

As with the fishery data, acoustic survey length and conditional age compositions were used to reconstruct the age structure of the hake population. In general, biological samples taken by midwater trawls were post-stratified based on geographic proximity and similarity in size composition. Each sample was given equal weight without regard to the total catch weight. The composite length frequency was then used for characterizing the hake distribution along each particular transect and were the basis for predicting the expected backscattering cross section for Pacific hake based on the fish size-target strength relationship TS_{db} = 20logL-68 (Traynor

1996.). Estimates of numbers (or biomass) of hake at length (or age) for individual cells were summed for each transect to derive a coast-wide estimate. Details of this procedure can be found in Fleischer et al. (2005).

Acoustic survey sampling information including the number of hauls, numbers of length taken and hake aged are provided in Tables 8 and 9. The 2005 acoustic survey size composition shows a dominate peak at 45 cm indicating the persistence of the 1999 year class in the population (Figure 11). A secondary peak around 33 cm suggests the potential of a 2003 year class. Model structure in the size compositions of the previous acoustic surveys also confirm the dominant 1980 and 1984 year classes present in the mid-1980s to early 1990s. Proportions at size are given in Figure 12 and conditional age-at-length proportions are shown in Figure 13.

Based on the estimates from the acoustic survey, Pacific hake biomass has declined by 32% from 1.8 million mt in 2003 to 1.26 million mt in 2005 (Table 10). In general, acoustic survey estimates of biomass indicate that the hake population has varied with little trend since the first survey in 1977 to the most recent in 2005 survey (Figure 14). Error bars shown around point estimates of biomass are not estimated but rather assumed based on reliability of the survey in a given year and are used as input in SS2 (CV=0.5 1977-1989, CV=0.25 1992-2005). It should be noted that while shown in this plot the 1986 acoustic survey biomass estimate is not used in the assessment due to transducer calibration problems during survey operations that year (The decision to omit this data point was made during the 2003 STAR panel review).

Aging Error

Since aging Pacific hake was transferred to the Northwest Fisheries Science Center in 2001, an effort was made to cross-calibrate age reader agreement. Cross-calibration was performed on a total of 197 otoliths from the 2003 acoustic survey between the Northwest Fisheries Science Center (NWFSC) and Department of Fisheries and Oceans (DFO). Overall agreement between NWFSC/DFO was 50%, and for ages assigned that were aged within one and two years, the agreement was 86% and 96%, respectively. As would be expected, agreement between the three labs was better for younger fish than for older fish. These cross-calibration results were somewhat better than 2001 comparisons between NWFSC/DFO, but poorer than 1998 comparisons between AFSC (Alaska Fishery Science Center) and DFO. It should be noted, however, that agreement between two age readers at NWFSC was closer to 87%, with 98% agreement within one year of age. Agreement for ages 3-4 and ages 5-7 was 82% and 40%, respectively, for NWFSC between reader comparisons, with similar results for NWFSC/DFO comparisons. Also, when ages did not agree between the three labs, the NWFSC tended to assign older ages than DFO. Additional comparisons are needed to further calibrate ageing criteria between agencies. For the present model, aging error has not been included.

Pre-recruit surveys

The Santa Cruz Laboratory (SCL) of NOAA's Southwest Fisheries Science Center has conducted annual surveys since 1983 to estimate the relative abundance of pelagic juvenile rockfish off central California. Although not specifically designed to sample juvenile hake, young-of-the-year hake appear frequently in the midwater trawl catches. In this assessment, as in the previous assessments, this survey is used to produce a tuning index for recruitment to age-2 (Table 11, Figure 15). This index was created using a generalized linear model (GLM) fit to the log-transformed CPUEs (Ralston et al. 1998; Sakuma and Ralston 1996). Specifically, the year effect from the GLM was back-transformed to obtain an index of abundance. Only the Monterey outside stratum was used because of its higher correlation with hake recruitment. Also, Dorn et al. (1999) showed that the juvenile index was significantly correlated to the predicted recruitment two years later in the stock assessment model. The index in 1999 suggested that age-2 recruitment in 2001 may be above average, which has largely been confirmed by other data sources, such as numbers at age in the fishery catches and acoustic surveys. The 2003 juvenile index, representing recruitment in 2005, is among the lowest observed since 1986. As will be discussed below, the Pacific Whiting Conservation Cooperative (PWCC)/NWFSC recruit survey shows a marked contrast to the 2003 survey index. The two most recent index values, in 2004 and 2005, suggest an above average year class in 2006 and very low year class in 2007. The general magnitude of these forecast indexes are consistent with those from the PWCC/NWFSC pre-recruit survey. The Santa Cruz series average CV, estimated from the GLM, was calculated to be approximately 0.50. Relative accuracy of the Santa Cruz and PWCC/NWFSC pre-recruit surveys will be evaluated in future work. It should be noted that comparative analyses with SS2 and the previous hake model lagged the index forward two years and was used to index recruitment to age-2. Subsequent formulation of the base case model in SS2 used the log-abundance to index age-0 recruitment during the year in which the survey occurred.

The PWCC and NWFSC, in cooperation with the SCL, have been conducting an expanded survey of juvenile hake and rockfish relative abundance and distribution to include Oregon and California since 1999. This survey is an expansion of the SCL juvenile survey, which is conducted between Monterrey Bay and Pt. Reyes, California. Prior to 2001, results between the PWCC/NWFSC survey and the SCL survey were not comparable because of trawl gear differences. Since 2001, the gear has been comparable and side-by-side comparisons were made between the contracted vessel *Excalibur* and the NOAA vessel *David Starr Jordan.*

The cooperative PWCC/NWFSC pre-recruit survey uses a modified anchovy midwater trawl with an 86' headrope and ½" codend with a 1/4” liner was used to obtain samples of juvenile hake and rockfish. Trawling was done at night with the head rope at 30 m at a speed of 2.7 kt. Some trawls were made prior to dusk to compare day/night differences in catch. Trawl tows of 15 minutes duration at target depth were conducted along transects located at 30 nm intervals along the coast. Stations were located along each transect from 50m bottom depth seaward to 700 m with hauls taken over bottom depths of 50, 100, 200, 300, and 500 meters at each transect.

The PWCC/NWFSC Pacific hake pre-recruit survey results show an inconsistent trend in some years compared to the Santa Cruz survey over the same time period. The PWCC/ NWFSC survey indicates 2001 and 2002 abundance to be about the same magnitude , but 2003 to be significantly higher. The SCL survey, on the other hand, suggests that the 2003 index to be the least abundant year class of the series, while the index for 2004 (after an extension of the range surveyed by SCL this year) is more consistent between the two surveys. However, until the effects on catch rate of the differences in geographic ranges of each survey can be established and a longer time series collected, it is difficult to interpret the implications for future abundance levels of a particular year class. As the year classes in question age and become selected by the fishery, their relative sizes will be established. The expansion of the hake recruitment index beyond the traditional SCL survey area raises questions about the inter-annual consistency of juvenile hake distribution. The results of the 2003, and particularly 2004 PWCC/ NWFSC survey shows a northward shift in the distribution of juveniles with peak numbers of age-0 found north of the Monterey index area in recent years. However, it is possible that the age-0 hake follow a set transport pattern, but vary temporally. If there is a temporal component there may be some evidence in age-0 daily growth or an environmental signal. With additional data, it may be possible to model and predict the distribution of young-of-the-year hake and improve the deployment of survey efforts.

Biological Parameters

Growth

There is a considerable amount of variability in the length-at-age data collected during the acoustic surveys since 1977. The process governing variation in growth may include effects from size-selective fishing, changes in size selectivity over time, and variation in growth rates over time. In order to explore alternative specifications for hake growth within SS2, we fit alternative growth models to the length-at-age data collected in the acoustic surveys (assuming size-selectivity in the acoustic surveys has been constant over time). The first of these models is a simple time-varying growth model, where the growth coefficient (k) is allowed to vary over time. This assumes that all extant cohorts are subject to time varying changes in the metabolic rates (presumably associated with changes in available food). This is the version of the growth model that is presently implemented in Stock Synthesis 2 (SS2). The second growth model assumes that growth is density-dependent. That is, the density of each cohort determines the overall growth rate and each cohort has its own asymptotic length. The third model is similar to the second model; however, in this case we assume the growth coefficient (k) is cohort specific. Details of this analysis are given in Appendix A.

Temporal variability in hake growth is shown in Figure 16 in terms of the observed lengths at age from the acoustic survey from 1977-2005. Of the 3 alternative growth models, the model with cohort specific l_2 values explains more of the variation in the length-age data versus the time varying k model and cohort k model (Figure 17). In particular, cohort based L2 begins relatively high (> 55 cm) prior to 1980 (Figure 22) and then appears to decline rapidly as the very large 1980 and 1984 year class grow. Expected size at age, based on the cohort based L2, parameter are above the expected size for the other models in the 1977, 1980, and 1983 survey data (Figure 16). Likewise, cohort based k declines rapidly between the mid 1970s and middle 1980s (Figure 17). Is should be noted that these cohort based models do not assume the cumulative affects of size-selective fisheries. To properly represent the cumulative affects of size-selective fisheries in this approach, the cohort based growth model should be integrated into the assessment model itself. This would provide a fruitful area of research for improving SS2. In this case it would not be necessary to use the conditional MLE for the numbers at age; this information could be provided from the stock assessment model itself. Since this feature is not currently implemented in SS2, blocks were created aggregating various years in which it was anticipated the cohort affects on growth would be manifested (See *Model Selection and Evaluation* below).

Size/Age at Maturity

Fraction mature by size was estimated using data from Dorn and Saunders (1997) with a logistic regression. These data consisted of 782 individual ovary collections based on visual maturity determinations by observers. The highest variability in the percentage of each length bin that was mature within an age group occurred at ages 3 and 4, with virtually all age-one fish immature and age 4+ hake mature. Within ages 3 and 4, the proportion of mature hake increased with larger sizes such that only 25% were mature at 31 cm while 100% were mature at 41 cm. Maturity in hake probably varies both as a function of length and age, however, for the purposes of parameterizing SS2 the logistic regression model was fit as a function of length. Maturity proportions by length are shown in Figure 18. Less then 10% of the fish smaller than 32 cm are mature, while 100% maturity is achieved by 45 cm.

Natural mortality

The natural mortality currently used for Pacific hake stock assessment and population modeling is 0.23. This estimate was obtained by tracking the decline in abundance of a year class from one triennial acoustic survey to the next (Dorn et. al 1994). Pacific hake longevity data, natural mortality rates reported for Merluciids in general, and previously published estimates of Pacific hake natural mortality indicate that natural morality rates in the range 0.20-0.30 could be considered plausible for Pacific hake (Dorn 1996).

Model description

This assessment used the Stock Synthesis modeling framework written by Dr. Richard Methot at the NWFSC (SS2 Version 1.21). The Stock Synthesis application provides a general framework for the modeling fish stocks because the complexity of the population dynamics can be made commensurate with the data quantity and quality. In this regard, both complex and simple models were explored. The Pacific hake population is assumed to be a single coastwide stock along the Pacific coast of the United States and Canada. As in the previous model, sexes are combined in the current model in representing the underlying dynamics and in all data sources where this was possible: growth and fishery and survey size/age compositions. The accumulator age for the internal dynamics of the population was set at 15 years, well beyond the expectation of asymptotic growth. The length structure ranged from 20 cm to 70 cm. The years explicitly modeled were 1966-2005 (last year of available data). Initial population conditions were assumed to be in equilibrium prior to the first year of the model. No initial fishing mortality was estimated and the spawning biomass was assumed equal to Bzero in 1966, preceding the advent of the distant water fleets during the mid-to-late 1960s. The level of hake removals prior to 1966 is unknown, but there were no directed commercial fisheries for hake until the arrival of foreign fleets in the mid to late 1960s.

The following narrative of the model structure is accompanied by the detailed parameter specifications and assumptions found in Table 12. The assessment model includes two national fisheries: US and Canadian trawl fisheries. Arguably, the U.S. at-sea and shore-based fisheries, as well as the Canadian JV and domestic fisheries could be modeled separately for reasons mentioned above. However, in this assessment each nation's fleets are combined and implicitly assumed to have the same selectivity patterns. The selectivity curves for the acoustic survey and the U.S. and Canadian fisheries are assumed to be dome-shaped and modeled as a function of age using the double logistic function (option 19 in SS2). Considerable discussion continues to be centered on asymptotic vs. dome-shaped selectivity for the acoustic survey: dome-shaped selectivity implies a greater proportion of older hake in the population than that observed in the survey. While this topic warrants more detailed analysis, preliminary work comparing the numbers at age in both the acoustic and bottom trawl surveys indicate empirical evidence in support of an acoustic survey selectivity that is dome-shaped (Figure 19). As will be discussed in greater detail below, a time-varying selectivity option for the U.S. and Canadian fisheries, in which the parameters are treated as a random walk process, was initially implemented as a means to provide a direct comparison between the previous hake model and SS2. While some of the fundamental underlying assumptions differed between these two modeling platforms, the specification of selectivity, survey catchability, recruitment deviations and growth parameters were tuned in as close as possible in order to confirm results of the basic population dynamic equations. The model specification in SS2 was then simplified in terms of reducing model complexity to achieve parsimony with the data. This reduced model is considered the base model.

For the base case model, as well as the previous model, instantaneous natural mortality (M) is assumed to be age- and time-independent and equal to 0.23 y^{-1}. The stock-recruitment function was a Beverton-Holt parameterization, with the log of mean unexploited recruitment estimated. When freely estimated, the steepness parameter was close to the upper limit of 1.0, thus implying that recruitment is independent of the level of spawning biomass. However, for this assessment steepness was assumed to be h=0.75 based on several meta-analyses of marine fish stocks (Myers et al. 1999, Myers et al. 2002). Year-specific recruitment deviations were estimated from 1967-2003. This structure was based upon inspection of year-specific standard deviations relative to the input value of $sigma_R$.

The constraint and bias correction standard deviation, $sigma_R$, is treated as a fixed quantity in SS2. Typically, the value is derived through an iterative process of adjusting the input value corresponding to the minimal difference between the root means square error (RMSE) of the predicted recruitment deviations and the input value. This ensures that the approximate bias-correction term would be appropriately and internally consistent for predicted recruitments estimated in the model and projected forward in time. Initial models runs began with the value used in the previous hake model, $sigma_R$ = 1.17, but were iterated to 1.13. In addition, input sample sizes were iterated by examining the relationship between effective sample size estimated in the model and the observed input sample sizes.

Maturity of Pacific hake is assumed to have a logistic functional form, increasing sigmoidally to an asymptote as a function of size (Figure 20). Fecundity (spawning output) is assumed to be a function only of mass and equivalent in form to the maturity-at-length relationship. Individual growth is modeled for combined sexes and based on the von Bertalanffy growth function. All von Bertalanffy growth parameters, including the growth coefficient k, length at minimum age, length at maximum age (15 years old), CVs of size at age, as well as time blocks describing changes in some parameters, were estimated within the model. The explicit temporal parameterization is shown in Table 12.

Multinomial sample sizes for the length composition and conditional age at length data used in this assessment are based on the number of hauls or trips sampled for the commercial at sea and shore-based fisheries, respectively, and the number of tows in the research surveys. Sample sizes for conditional age-at-length data were taken from the number of fish aged. Standard deviations from the survey indices were not adjusted, as the RMSE from preliminary model runs were consistent with the mean of the input standard deviations. The base case model employs equal emphasis factors (lambdas=1.0) for each likelihood component, however, sensitivity analyses are performed.

Modeling Results

Comparative Models

As previously mentioned our first goal was to perform a comparative population assessment between the previous hake model and SS2. This exercise required reconstruction of the entire time series of data inputs for SS2 and configuring the model so that assumptions in SS2 were as close as possible to the previous hake model. It is important to point out that the structure of the data inputs for SS2 was quite different from the previous hake model, and used length-frequency compositions and conditional age-at-length compositions from the U.S. and Canadian fisheries, as well as the acoustic survey. Time series of biomass indices remained the same, including the same error assumptions as Model 2b (CVs=0.20 1977-1989, CVs=0.10 1992-2005) in the previous hake model (Helser et al. 2004). However, multinomial sample sizes were input consistent with the year in which samples were taken, unlike the old hake model which used a single sample size over all years of a given data source. Those years for which fishery data could not be acquired from standard U.S. and Canadian sources, (1972-1973 in the U.S. and 1977-1987 in the Canadian fishery), the traditional age-composition data and associated sample sizes were used. In terms of model specification, time-varying fishery selectivity was modeled as a random walk process constrained by standard deviation of 0.2 using the double logistic curve. As in the previous model, maturity was specified as a function of age and natural mortality (M) was assumed to be equal over ages and time invariant at 0.23 y^{-1}. Growth in SS2 was treated as time varying, by assuming a random walk process in the growth parameter k (constrained by standard deviation of 0.1), and with all other growth parameters freely estimated as base parameters. This aspect of time-varying growth was employed to mimic temporal changes in the observed fishery weights at age, which were treated as deterministic inputs in the old hake model.

Despite some differences in acoustic survey biomass and selectivity patterns, SS2 and the previous hake model produced very similar biomass trajectories and management reference points (Figure 21). Age 3+ biomass and female spawning biomass trajectories between assessment models were consistent over time, but in general SS2 estimates of biomass were slightly higher than those from the previous hake model, particularly for the years 1970-1990 (Figure 21). This result appears to be primarily driven by global scaling parameters, such as logRzero and the magnitude of year-class strengths, which were estimated to be higher in the SS2 model. These scale parameters in turn are most likely due to slight differences in acoustic survey biomass trends (Figure 22) and fishery and acoustic survey selectivities (Figure 23). Despite these differences the relative depletion level of the Pacific hake stock over time and in the final year (beginning of 2006) were similar. Current depletion was estimated to be 27% of the unfished level using SS2 compared to 29% using the previous hake model, respectively (Figure 21). Based on this evaluation, we concluded that SS2 was capable of reproducing the most important results from the previous model, when similarly configured. Consequently, further model explorations were performed in SS2.

Model selection and evaluation

An effort was made to explore many levels of model complexity in order to achieve a model that was parsimonious in the number of estimated parameters, but also retained a realistic level of complexity in representing the underlying population dynamics. Many preliminary models were fit to the data and evaluated based on residual patterns, plausibility of estimated model parameters and convergence criteria. However, only a subset of these models was retained for sensitivity analysis (see below), and the base case model reflects the best aspects from each these exploratory analyses.

Based on past and current experience with modeling hake dynamics, a complex modeling structure was used as the starting point for explorations of more parsimonious alternatives. Factors that were important in this decision included: 1) a persistent structure of recruitment deviations, most notably the 1980 and 1984 cohorts, have a large impact on the scale parameter logRzero, 2) hake growth has varied substantially over time either through density-dependent and or environmental factors, and 3) fishery selectivity has varied temporally in response to the presence of one or two dominant year classes in the exploitable population. Based on this knowledge our approach was to reduce the total number of parameters, but maintain the underlying dynamic, temporal structure of the hake population.

The wealth of conditional age-at-length data from the commercial fleets and acoustic survey provided a great deal of flexibility in modeling potential changes in growth curves over time. The comparative analysis used a ‘random walk’ approach to growth, but it was felt that this approach might be over-parameterized since empirical examination of the growth parameters outside the model suggested a pattern of discrete changes between multi-year periods. Preserving some degree of temporal variability was clearly warranted, since specifying growth as time-invariant resulted in a decline of roughly 8,000 likelihood units in the objective function, relative to the random-walk structure. Through an iterative process of gradually increasing the size of adjacent-year blocks and examining residuals, a block structure was developed that sacrificed little in the value of the objective function and seemed consistent with empirical observations. Two blocks were used for the L2 parameter, 1966-1983 and 1984-2005, which allowed the model to account for the larger asymptotic fish size and the generally prevalence of larger observed during the early period. Three blocks were used to partition the growth parameter k: 1966-1980, 1981-1986, and 1987-2005. The middle period was intended to allow the model accommodate the slightly smaller body size of age 4-6 year old fish during those years. The temporal structure of hake growth in terms of the expected size at age is (Figure 24) characterized as an early period from 1966 to the early 1980s where expected maximum size (i.e., L2) is high relative to the subsequent period from the mid 1980s to 2005, and a decline in growth rates (i.e., smaller expected size at age for ages 4-6) during the early-to-mid 1980s. In the most recent block, 1987-2005, growth returns to near baseline rates but the expected maximum size is lower.

As with growth, we employed the same approach and developed a block structure that seemed consistent with the empirical data. In particular, both the U.S. and Canadian fisheries consisted of four discrete temporal blocks. For the U.S. fishery, separate selectivity functions were estimated for the periods: 1966-1983, 19884-1992, 1993-2000, and 2001-2005. Selectivity functions for the Canadian fishery were estimated for the periods: 1966-1994, 1995-2000, 2001-2002, and 2003-2005. The acoustic survey selectivity was estimated freely but was time invariant. The estimated selectivity curves are shown in Figure 25 with parameter estimates and asymptotic standard deviations in Table 13. The shapes of the curves for both the U.S. and Canadian fisheries appear to be quite reasonable, even with the apparent temporal shifts in the curves. The U.S. fishery selectivity curves show substantial temporal variation in both the ascending and descending limbs. As might be expected, U.S. fishery selectivity increased on the younger aged fish (ages 3 and 4) as the dominant 1980 and 1984 year classes become vulnerable to exploitation during the mid 1980s to early 1990s. As these cohorts grew into the older age structure and persisted in the fishable stock U.S. fishery selectivity increased on the older ages as seen as an increase in the descending curve in 1993-2005. Canadian fishery selectivity curves also show variability through time (it should be noted that Canadian fishery selectivity curves on older fish were assumed to be the same through). As is the case with the U.S., changes in ascending-limb selectivity appear to be associated with availability of a specific year class and its exploitation by the Canadian fleets, which can be observed in the exploitation of the 1994 year class during1995-2000.

Model fits to size-composition data are shown as predicted length frequency distributions, Pearson residual plots, and effective vs. observed sample sizes and illustrated separately for the U.S. fishery (Figures 26-28), Canadian fishery (Figures 29-31) and acoustic survey (Figures 32-34). In general, model fits to the U.S. fishery length-frequency distributions show reasonable predictions given the observed data (Figure 26). Predictions seem be consistent with the observed length compositions in terms of hitting the modes of the distribution and range of sizes exploited. Comparison of observed and calculated effective sample sizes for U.S. fishery length frequencies show no clear relationship, but generally indicate that model fits are as good as expected given the input sample sizes and length frequency data (Figure 27). It should be noted that the input samples sizes shown in Figure 31 for the U.S. length and length-at-age compositions have already been iteratively tuned to 0.3 and 0.5, respectively, of their original input sizes. Some lack of fit does appear to be evident in the U.S. fishery length compositions, but this is generally restricted to the largest sizes, especially in the earlier years (Figure 28).

The model fit the Canadian fishery length composition data slightly less well than the U.S. fishery, but this may not be surprising given the fewer years of data (Figure 29). Predicted length distributions were on the mode for most years with the exception of 2000, 2001, and 2002 suggesting a pool of larger hake was exploited during those years than predicted by the model. The model was also not able to accommodate well the catches of smaller hake in 1995-1998. This suggests that hake spawned in Canadian waters in 1994 and were exploited by the Canadian fleet as young fish. This pattern has not been observed in the Canadian fishery during any other period. Despite the lack of fit created by these anomalies, overall the model fit these data as well as expected given the observed data and input sample sizes (Figure 30). Canadian size or age composition data did not require iterative re-scaling of input sample sizes. Pearson residuals of length compositions data also illustrate the apparent lack of fit in the mid-1990s and early 2000s (Figure 31).

Predicted lengths for the acoustic survey were also generally on the modes with the observed size compositions. But in a number of years (1980, 1995, and 2005) the model was unable to effectively reproduce the observed bi-modal structure (Figure 32). Comparison of effective vs. input sample sizes suggest that the model fit these data as well as expected, given the observed data and input sample sizes (Figure 33). Figure 34 illustrates model lack of fit, consistent with the model's inability to reproduce the bi-model structure of the observed size compositions.

Given the assumption of age-based selectivity for the fisheries and the volume of conditional age-at-length data, the model generally fits the age data better than the length-composition data. Plots of effective vs. input sample sizes indicate that the model fit the data as well as expected, given the data and sample sizes (Figure 27, Figure 30, and Figure 33). As with the U.S. fishery length compositions, the U.S. fishery age-composition sample sizes were iterated to 50% of the original input sample sizes. The Canadian and acoustic survey conditional age-at-length compositions were unmodified. Model fits to the conditional age-at-length data are illustrated for 1988 (Figures 35-36) and 2005 (Figure 38-40). Plots of Pearson residuals by fishery for 1988 and 2005 are provided in Figures 37 and 41, respectively. These years were chosen to show the structure of the conditional age-at-length data when several dominant year classes were present. In 1988, the large 1980 (age 8) and 1984 (age 4) cohorts are evident in the size bins between 39 and 50 cm in both the U.S. and Canadian fisheries. The 1977 year class is also present as age 11 fish in size bins greater than 50 cm. Model fits to the conditional age-at-length compositions are generally in agreement with the observed data in both the U.S. (Figure 35) and Canadian fisheries (Figure 36). The discrepancy of model fits to the observed data at length bins greater than 59 cm reflects relatively small sample sizes and cannot be differentiated from noise. Pearson residuals for the U.S. and Canadian conditional age-at-length data for 1988 show no severe patterns of lack of fit (Figure 37). The 1999 year class was the dominant year class in the 2005 U.S. fishery, Canadian fishery and acoustic survey conditional age-at-length compositions, and the model fit approximately this well (Figure 38-40). The acoustic survey age-compositions also show the presence of the 2003 year class as age-2 fish in the 28-38 cm length bins (Figure 40). Again, the model appears to fit the conditional age-at-length data reasonably well (Figure 41). The full suite of standardized Pearson residuals for all fisheries and survey conditional age-at-length data in each year are shown in detail in Figure 42.

The model's fit to the acoustic survey biomass time series seems reasonable given the error structure assumed for the index (Figure 43). For biomass points since 1992, which are assumed to have less error than pre-1992 data, the predicted biomasses are within asymptotic 95% confidence intervals for all years except 2001. Given the assumed error on the Santa Cruz juvenile hake recruitment index, the model fits the observed data quite well (Figure 44). As plotted in log-space the index appears rather flat and the model fits the slight departures from the mean, as in the case of the 1999 year class (in 2001). Despite being the lowest index on record, the 2003 (age 2 in 2005) prediction of recruitment is greater (although below average) than indicated by the observed data owing to the relatively large CV on the recruit index time series and sigma*R*.

Assessment Model Results

During the STAR panel review, Feb. 6-10, discussion focused on the uncertainty in acoustic survey *q* as the dominant axis of uncertainty. This parameter essentially globally scales population biomass higher if *q* is lower and lower if *q* is higher. As in the previous year's assessment, two models are presented to bracket the range of uncertainty in the acoustic survey catchability coefficient, *q*. The base model with steepness fixed at *h*=0.75 and *q*=1.0 represents the endpoint of the lower range while the alternative model which places a prior on *q* (effective *q*=0.7) represents the upper endpoint of the range. As such, model estimates presented below report a range of values representing these endpoints.

The predicted time series of hake recruitments, as well as recruitment uncertainty, recruitment deviations from the S-R curve, and yearly estimates of variability are shown in Figure 45. The model predicted very large year classes in 1980 and 1984, with secondary recruitment events in 1970, 1973 and 1977. The 1999 year class was the single most dominate cohort since the late 1980s. Uncertainty in recruitment can be substantial as shown by asymptotic 95% confidence intervals (Figure 45). Based on the assumption of log-normal error about the mean log recruitment, uncertainty increases with the magnitude of recruitment. Recruitment to age 0 before 1967 is assumed to be equal to mean recruitment, while recruitment from 1967 to 2005 is estimated from the data. Age-0 recruitment in 2003 is predicted to be uncertain and below mean recruitment, despite some evidence to the contrary in the 2005 acoustic survey. Except for the actual magnitude of estimated recruitments, the patterns in recruitment deviations and uncertainty are qualitatively the same under both the base and alternative models.

Summary of Pacific hake population time trends in 3+ biomass, recruitment, spawning biomass, relative depletion, spawning potential ratio (SPR) and fishery performance are shown in Figures 46-48 for the base model and in Figures 49-51 under the alternative model. Summary Pacific hake biomass (age 3+) under unfished conditions (< 1966) was estimated to be 7.8 millions mt (Table 14a). Summary biomass increased briefly during the mid-1970s, as the 1970 and 1973 year classes recruited, then declined briefly until 1980 (Figure 46, Table 14a). Summary biomass increased again to the highest level in the time series in 1983 as the very large 1980 and 1984 classes entered the population (Figure 46, Table 14a). The hake population then experienced a long period of decline as fishing increased and few large recruitment events occurred between 1985 and 2001. Summary biomass increased slightly in 2002 due to recruitment of the 1999 year class, but has subsequently declined as the U.S. and Canadian fisheries prosecute this dominate cohort in the exploitable biomass. Trends in summary biomass and recruitment under the alternative model are nearly identical but larger in magnitude (Figure 49, Table 14b).

Pacific hake spawning biomass trend is similar to that for summary biomass (Figure 47 and 50, Table 14a and 14b). Under both the base and alternative models, spawning biomass declined rapidly after peaking in 1984 (4.6 and 5.1 million mt, respectively) to the lowest point in the time series in 2000 (0.88 and 1.0 million mt), followed subsequently by a brief increase to 1.68 and 2.1 million mt, respectively, in 2003. In 2006, spawning biomass is estimated to be 1.18 million mt, and is at 30.8 % (~95% CI range from 24.7% to 36.9%; Figure 47, Table 14a) of the unfished level (Figure 49; Table 14a) under the base model. Under the alternative model, spawning biomass is 1.6 million mt with an associated relative depletion of 38.0% (~95% CI range from 29.7% to 45.0%, Figure 50, Table 14b). Approximate asymptotic intervals about the MLE for spawning biomass and recruitment for the entire times series are given in Tables 15a and 15b for the base and alternative models, respectively.

Reference points (biomass and exploitation rate)

Because of temporal changes in growth, there are two types of reference points reported in this assessment: those based on the assumed population parameters at the beginning of the modeled time period and those based on the most recent time period in a ‘forward projection’ mode of calculation. All strictly biological reference points (e.g., unexploited spawning biomass) are calculated based on the unexploited conditions at the start of the model, whereas management quantities (MSY, SB_{msy}, etc.) are based on the current growth and maturity schedules and are marked throughout this document with an asterisk (*).

Given the current life history parameters and long term exploitation patterns, the fishing mortality that reduces the spawning potential of the stock to 40% of the unfished level is referred to as F40%, which is the default Pacific Fishery Management Council proxy for F_{MSY} for Pacific hake. Similarly, the proxy for B_{MSY} is spawning biomass corresponding to 40% of the unfished stock size (B40%). Unexploited equilibrium Pacific hake spawning biomass (B_{zero}) from the base model was estimated to be 3.81 million mt (~ 95% confidence interval: 3.46 – 4.16 million mt), with a mean expected recruitment of 4.97 billion age-0 hake. Under the alternative model, spawning biomass (B_{zero}) from the base model was estimated to be 4.29 million mt (~ 95% confidence interval: 3.76 – 4.81 million mt), with a mean expected recruitment of 5.59 billion age-0 hake. Associated management reference points for target and critical biomass levels for the base model are 1.52 million mt (B40%) and 0.95 million mt (B25%), respectively. Under the alternative model, B40% and B25% are estimated to be 1.71 and 1.07 million mt, respectively. The MSY-proxy harvest amount (F40%) under the base model was estimated to be 573,945* mt (~ 95% confidence interval: 521,122-619,501), and 645,240* mt (~ 95% confidence interval: 566,830-712,848) under the alternative model. The spawning stock biomass that produces the MSY-proxy catch amount under the base model was estimated to be 1.06 million* mt (confidence interval is 0.96-1.14* million mt), and 1.19 million* mt (confidence interval is 1.04 - 1.31* million mt) under the alternative model, given current life history parameters.

The full exploitation history under the base and alternative models is portrayed graphically in Figures 48 and 51, respectively, which plot for each year the calculated spawning potential ratio (1-SPR) and spawning biomass level (B) relative to their corresponding targets, F40% and B40%, respectively. As seen from Figures 48and 51estimated spawning potential ratio for Pacific hake has generally been above both the 40% proxy target MSY and B_{MSY} level for several decades. During the last decade both target reference points have gradually declined as stock biomass decreased under moderately high removals. While SPR has been above proxy target of 40% for Pacific hake, the biomass relative to the B40 reference target dropped briefly below the target in recent years.

Harvest projections

Forecasts were generated assuming the maximum potential catch would be removed under the 40:10 harvest control rule. Projections were based on the relative F contribution from the U.S. and Canadian fishery commensurate with the 74.88% and 26.12% coast wide national allocation to the U.S. and Canada, respectively, as specified in the Treaty. Table 16 presents 3-year projections using the base case and alternative models. Spawning biomass is expected to continue to decline in 2007 to 864 thousand mt (~95% CI 0.64 - 1.1 million mt) with a corresponding depletion level of 22.7% (~95% CI 18.1% - 27.2%) of unfished biomass for the base model. Under the alternative model, spawning biomass in 2007 is 1.1 million mt (~95% CI 0.79 - 1.46 million mt) with a corresponding relative depletion of 26.2% (~95% CI 21.0% - 31.7%).

Uncertainty and reliability

A retrospective analysis of the base model was performed to evaluate any pathological behavior or pattern of bias in the model results. This analysis was performed by systematically removing the terminal years' data sequentially for six years and re-running the model. This analysis revealed no systematic bias in model results based on an evaluation of trends in relative depletion or recruitment (Figure 52).

Uncertainty in current stock size and other state variables were explored using a Markov Chain Monte Carlo (MCMC) simulation in AD model builder. Although MCMC has been used mostly in Bayesian applications, it can also be used to obtain likelihood-based confidence regions (Punt and Hilborn 1997). It has the advantage of producing the true marginal likelihood (or marginal distributions) of the parameter, rather than the conditional mode, as with the likelihood profile. We ran the MCMC routine in ADMB drawing 1,000,000 samples in which one in every 1000th sample was saved to reduce autocorrelation in the chain sequence. Results of the MCMC simulation were evaluated for nonconvergence to the target posterior distribution as prescribed in Gelman et al. (2004). The final samples from the MCMC were used to develop the probability distributions of the marginal posterior of management quantities and were compared to MLE asymptotic estimates of uncertainty.

We also preformed a parametric bootstrap of the observed data to assess model reliability to the data and assumptions. Within the SS2 model framework, new data sets were generated directly from expected values of population parameters obtained during maximum likelihood estimation. Observation error about the expected values is included via a parametric bootstrap, based on the appropriate likelihood and the level of error assumed for each data source. All data components in this application were assumed to have observation errors distributed as either lognormal (indices) or multinomial (length- and age-frequencies) distributions. Therefore, the input standard errors and sample sizes are retained in the simulated data sets; the resulting simulated data set has identical dimensions as the original, but new 'observations'. Using this method, 75 simulated data sets were generated from the assessment model and evaluation of simulation results is performed through comparison of the set of simulated parameter value against the MLE and the true value.

Convergence diagnostics of selected parameters from the MCMC simulation provided no evidence for lack of convergence in the base model, in either the primary estimated parameters (Figure 53) or derived quantities such as spawning stock biomass and recruitment (Figure 54). In nearly all cases, parameter autocorrelation was less than +/- 0.15. Furthermore, most of the primary parameters or derived variables have a Geweke statistic of less than +/- 1.96 indicating stationarity of the parameter mean. Finally, parameters passed the Heidelberger-Welch statistic test. If this test is passed, the retained sample is deemed to estimate the posterior mean with acceptable precision, while failure implies that a longer MCMC run is needed to increase the accuracy of the posterior estimates for the given variable. Based on the above diagnostic tests the retained MCMC sample appears acceptable for use in characterizing the uncertainty (distribution) of state variables.

There was very good agreement between distributions from MCMC integration and asymptotic variance estimates from the Hessian estimated using maximum likelihood in SS2 (Figure 55-56). Maximum likelihood estimates of the expected value of unfished spawning biomass (SBzero) and unfished recruitment (Rzero) were in very close agreement with the median of the marginal posterior distribution of those quantities obtained from MCMC (Figure 55). Likewise, the median of unfished biomass and recruitment from SS2 fit to 75 parametric bootstraps of the data were also close to expected values from MLE (Figure 55). Dispersion about the expected value was also in close agreement between MLE, MCMC and parametric bootstrap. Similar results were found for other state variables such as 2006 spawning biomass and depletion (Figure 56). In general, these results confirm convergence of MLE and reliability of the model and data assumptions.

Additional Analyses Requested by the STAR Panel

A number of additional analyses were requested during the course of the STAR panel. These requests were intended to be either 1) exploratory in nature and to assist the panel in better understanding the assessment or 2) to provide a more complete explanation of the assessment results in the final presentation. The exploratory requests are summarized here (as well as in the STAR panel report itself), while the second kind of requests have been integrated into the document and executive summary as appropriate.

STAR panel requests (in italics) are reported in the order they were made during the panel:

1) *Use the biomass at age and the survey selectivity curve to assess what proportion of the spawning biomass is less vulnerable with respect to the acoustic survey. Rationale: there are concerns regarding the inability of the survey to "see" the entire biomass.*

The spawning biomass greater than or equal to age 9 that was selected by the acoustic survey (the product of: spawning biomass at age, selectivity at age and maturity at age) was calculated from the base case model output. This value was then subtracted from the total spawning biomass greater than or equal to age 9 to obtain the absolute level of poorly selected spawning biomass. This quantity and the ratio of poorly selected age 9+ spawning biomass to total spawning biomass are shown in Figure 57. The fraction of poorly selected spawning biomass was 10-15% throughout the early part of the time series, and increased to 30% during the late 1990s. This increase is attributable to the persistence and relative abundance of the 1980 and 1984 year classes at older ages. The ratio of 'poorly selected' to total spawning biomass subsequently dropped to less than 10%, as the population became dominated by younger fish.

2) *Run the model using asymptotic selectivity for the acoustic survey, both with age of full selectivity free and with a prior on the ascending slope of the selectivity curve that would approximate full selectivity at age 5. Rationale is same as above.*

Both of these sensitivity runs produced a substantial degradation of the model fit to the age composition data. The total negative log-likelihood for the sensitivity without a prior was increased by almost 500 units (Table 17), with the prior on the ascending limb further degrading the fit. Assuming asymptotic selectivity reduced the spawning biomass dramatically over the entire time-series (Figure 58), but the relative trend was most noticeably different during only the most recent years and resulted in a current depletion below 10% of unexploited equilibrium conditions. This change in scaling also resulted in much larger estimated exploitation rates throughout the time-series, again most pronounced in the most recent years (Figure 60). The SSB time series with the age of full selectivity moved forward to roughly age 5 produced little change to the above results.

3) *Explore the results when pre-1992 acoustic survey data points (both biomass and age/size comps) are removed from the model. Rationale: The higher CVs used in the early acoustic survey data lead the Panel to question what impact those data are having in the model. Similarly, the observation that full selectivity is not reached until age 9, whereas 9 year old fish rarely comprise a major fraction of the catch at age, lead to questions regarding the true shape of the acoustic survey selectivity curve.*

When the pre-1992 acoustic survey data were removed from the assessment model, the estimated selectivity of acoustic survey tended to shift toward older age classes, and the 2006 spawning biomass is estimated to be close to $SB_{40\%}$; no other major changes were observed.

4) *Down-weight the input sample sizes to the 2001-2002 Canadian age-composition data (as well as conditional length at age) to assess what the impact is to the model. Rationale: This will allow the STAT and STAR to evaluate what the consequences of these patterns may be to the model (particularly the strength of the 1999 year class).*

The input sample sizes were set to 1 for all length-frequency and conditional age-at-length-frequency data during these two years. In addition, the selectivity block for 2001-2002 was merged with that for 2003-2005. Very little change was observed in model predicted size and age distributions during these years, or other estimated quantities. It was concluded that it made little difference if these data were included or excluded from the base case and so they were retained with original weighting for all subsequent analyses in the absence of a clear rationale for removal.

5) *Following up on request #2 to use asymptotic selectivity for acoustic survey, repeat this run, but (1) allow q to be estimated in one of the asymptotic selectivity runs, (2) allow M to be estimated with a uninformative prior, if feasible.*

When estimated freely, acoustic survey catchability (q) fell to unrealistically low values, indicating some sort of informative prior would be necessary in this assessment. When natural mortality (M) was estimated using the model in which acoustic selectivity was forced to be asymptotic the maximum likelihood value was 0.33. Natural mortality in this run was constrained by a very uninformative prior with a mean of 0.23 and a standard deviation of 0.8. The fit to the age and length frequency distributions was degraded by over 300 units of log-likelihood, but was somewhat better than the model with asymptotic acoustic selectivity and M fixed at 0.23 (Table 17). This sensitivity run predicted fewer older fish, and forces fishery selectivity curves into unusual and unrealistic configurations, although the relative trend in spawning biomass is similar to other sensitivities (Figures 58, 59).

6) *With respect to the catchability coefficient (q), run the model with an informative prior on q (mean of 1 and a standard deviation of 0.1), both with the entire acoustic biomass time series as well as without the pre-1992 data. Rationale: Fixing q at 1 underestimates the true uncertainty in the model.*

Because the acoustic survey catchability (*q*) is estimated in log-space the requested prior was converted to have a mean of 0 with a standard deviation of 0.112. This prior resulted in a maximum likelihood estimate of 0.69. This is consistent with the general tendency of this model to estimate a lower q, and reflects an estimate that is very nearly bounded by the small prior density at values appreciably lower than 0.69. The overall improvement in fit was small (8 units of log-likelihood), suggesting that there is little information in the data to inform an estimate of *q* (Table 17). The greatest changes in model output was an upward scaling of total biomass, a slightly greater estimate of the 1999 year class, both of which resulted in the estimated relative depletion level increasing from 0.34 (with q = 1.0) to 0.41 in 2006 (Table 17). The projected 2006 OY from this model was substantially increased to 942,000 mt, nearly double that of the model assuming q = 1.0.

When the pre-1992 acoustic survey data was excluded, catchability was estimated to be 0.76. This result implies that survey catchability may have been lower (or selectivity may have differed) during the pre-1992 survey years. This sensitivity produced an upward revision of the estimated size of the 1999 year class that then translated into a larger current biomass both on an absolute and relative scale (Table 17, Figures 58, 59). Although there was considerable discussion regarding the inclusion of these early data, it was recognized that they provide the only contrast in the survey time-series and would be retained pending a more detailed reanalysis of specific application of a threshold value for the entire survey series.

7) *Run the model with a steepness value (h) of 0.75. Rationale: There is some resistance to the idea that recruitment is entirely independent of SSB. In a meta-analysis of steepness values for thirteen assessed Merluciid stocks, Dorn (1999) had earlier estimated a posterior mode of approximately 0.6, with a wide posterior distribution that was indicative of a great deal of uncertainty. The STAR Panel suggests that a reasonable expectation for steepness might be 0.75, based on theoretical considerations as well as Myers et al. 2002.*

The resulting time-series' of biomass and relative depletion were very similar to the h = 1.0 model, indicating the strong influence of informative age frequency data to estimate recruitments. The projected recruitments (much more heavily influenced by the central tendency of the stock-recruitment relationship and the variability about this relationship) did show a response to the reduction in steepness. Catch projections for 2006 were nearly identical, but projections for future catches declined somewhat more rapidly than the base model reflecting a reduced expectation of recruitment at predicted stock levels. There was little change in the objective function and associated model fit to the data included. There was general agreement that the lower steepness value may represent a more realistic expectation for *h*.

8) *Provide the relative contributions to changes in likelihood in the model runs in request # 2 (asymptotic versus dome-shaped selectivity, and a freely estimated M). Rationale: the Panel was interested in what factors actually contributed to the relative changes in likelihood.*

By forcing asymptotic acoustic survey selectivity, the reduction in total biomass caused both the U.S. and Canadian fishery selectivity curves to become much more asymptotic as well. There was a slight improvement in fit to the Canadian age composition data, but a substantial degradation in the objective function resulting from the poor fit to the U.S. fishery and acoustic survey data (Table 17). These results suggested that a sensitivity where at least one data series had asymptotic selectivity should consider the Canadian fishery; and that this could be explored in future assessments.

9) *Evaluate the relative proportion of older hake in the triennial shelf survey versus the acoustic survey over time. Rationale: There are questions lingering regarding where the older fish (i.e. those not seen in the acoustic survey) might be. If feasible, explore doing this with the Canadian catch-at-age data as well.*

A preliminary comparison was made between the acoustic and historic shelf groundfish survey age composition data from 1977-2001 to evaluate whether there was empirical evidence for dome-shaped selectivity. This analysis provided preliminary evidence in support of dome-shaped acoustic survey selectivity (Figure 19). A more methodical analysis, however, is needed to fully address this issue.

10) *Provide graphs of the time series from beginning of the modeled time period to 2009 that includes catch, spawning biomass, depletion, and exploitation rate (relative to vulnerable biomass). Present the time series to 2005 and the forecasts with a different set of symbols. Do these for the STAT base model with steepness set at 0.75.*

These figures were provided to the STAR panel and are included in their report. They resulted in a discussion of the 40:10 harvest policy creating the projected OY catch levels for 2006 and future years. The concern was raised that this policy would lead to a decline in spawning biomass to the lowest level of the time series by 2009, during which time the largest total coast-wide catch could be removed in 2006.

11) *The STAR Panel requests that the base model be run with steepness fixed at 0.75 and acoustic survey catchability (q) estimated with a mean of 1 and a standard deviation of 0.1 in the equivalent log domain. Rationale: The STAR Panel would like to evaluate the STAT base model with steepness fixed at 0.75, with q estimated.*

The results of the h = 0.75 model, as described above, were similar to the h = 1.0 model for the time-series but resulted in slightly lower OY projections. The model with h = 0.75 and catchability estimated with an informative prior scaled the biomass up considerable, while showing little change to the objective function (Table 17). These two models were considered to be plausible alternatives that bracketed the range of uncertainty in acoustic survey catchability.

12) *The STAR would like to see projections of the base model with a range of catches (0 to 400,000 tons in 100,000 ton increments) to evaluate the relative impact of harvest on the biomass trajectory. Rationale: Given that the strict application of the 40:10 harvest rule in this run will result in stock biomass falling below the 25% depletion level, the STAR Panel would like to explore the relative impact of fishing on future stock biomass.*

With total coast-wide catch set to 0 in 2006 onward, the spawning biomass continues to decline (Figure 61). For total catches in excess of 100,000 mt through 2008, the stock is predicted to drop below the $SB_{25\%}$ overfished threshold. It was agreed that this figure was an informative addition to the decision table which should also include some constant catch scenarios for comparison with OY catches generated via the 40:10 harvest policy.

13) *The STAR Panel would like to see the same graphic as in request #12 with the q estimated scenario (as in request #11). Rationale: Same as request # 12.*

This graphic is combined with the request above and reported in the lower panel of Figure 61. For the alternate model with q estimated using an informative prior the same pattern of decline in spawning biomass is observed through 2009, even in the absence of fishing. However, this model shows much less sensitivity to the constant catch scenarios, with only the 400,000 mt level resulting in a relative depletion less than 25% in 2009.

14) *The STAR Panel would like to see a draft decision table, based on the two scenarios presented as preliminary base and alternative models in request # 11 (the STAT base model with steepness fixed at 0.75 and acoustic survey catchability (q) estimated with an informative prior with mean of 1 and a standard deviation of 0.1 in the equivalent log domain). Rationale: The STAR Panel considers these two models to be the two most important alternative states of nature for the final document. The decision table will include the following management actions: OY from model 1, OY from model 2, and 200,000 and 400,000 mt total coast-wide catch for 2006-2008.*

The STAT Team produced a final decision table based on this request (Table 18).

ACKNOWLEDGMENTS

Stock assessments draw upon many sources. The following individuals contributed information, data, or ideas: Mike Guttormsen, Chris Wilson, and Mark Wilkins (NMFS, Alaska Fisheries Science Center); Steven Ralston (NMFS, Southwest Fisheries Science Center); Patrick McDonald and Jonathan Nottage (Oregon Department of Fish and Wildlife); Vidar Wespestad (Pacific Whiting Conservation Cooperative); John Wallace (NMFS; Northwest Fisheries Science Center); Ken Cooke (DFO, Pacific Biological Station). Their assistance is gratefully acknowledged. Special thanks to Larry Hufnagle, Rebecca Thomas, Steve Deblois, and Patrick Ressler for the timely production of the 2005 acoustic survey biomass data. Dr. Richard Methot (Office of Science and Technology, NWFSC) provided valuable discussion and was very

responsive in modifying SS2 source code to accommodate migration into SS2. The STAT team also extends its thanks to the STAR panel for insightful suggestions and discussion.

LITERATURE CITED

Alheit J. and T.J. Pitcher. 1995. Hake: biology, fisheries, and markets. Chapman and Hall. London. 477 p.

Bailey, K. M., R. C. Francis, and E. R. Stevens. 1982. The life history and fishery of Pacific whiting, *Merluccius productus*. Calif. Coop. Oceanic Fish. Invest. Rep. 23:81-98.

Buckley, T. W. and P. A. Livingston. 1997. Geographic variation in the diet of Pacific hake, with a note on cannibalism. Calif. Coop. Oceanic Fish. Invest. Rep. 38:53-62.

Dorn, M. W. 1991. Spatial and temporal patterns in the catch of Pacific whiting in the U.S. management zone during 1978-88. U.S. Dep. Commer. , NOAA Tech. Memo. NMFS-F/NWC-205, 68 p.

Dorn, M. W. 1992. Detecting environmental covariates of Pacific whiting (*Merluccius productus*) growth using a growth-increment regression model. Fish. Bull. U.S. 90: 260-275.

Dorn, M. W. 1995. The effects of age composition and oceanographic conditions on the annual migration of Pacific whiting *Merluccius productus*. Calif. Coop. Oceanic Fish. Invest. Rep. 36:97-105

Dorn, M. W. 1996. Status of the coastal Pacific whiting resource in 1996. In Pacific Fishery Management Council, Appendix Volume I: Status of the Pacific Coast groundfish fishery through 1996 and recommended acceptable biological catches in 1997, p. A1-A77. (Document prepared for the Council and its advisory entities.) Pacific Fishery Management Council, 2130 SW Fifth Avenue, Suite 224, Portland, OR 97201.

Dorn, M. W., E. P. Nunnallee, C. D. Wilson and M. E. Wilkins. 1994. Status of the coastal Pacific whiting resource in 1993. U.S. Dep. Commer., NOAA Tech. Memo. NMFS F/AFSC-47, 101 p.

Dorn, M. W. and M. W. Saunders. 1997. Status of the coastal Pacific whiting stock in U.S. and Canada in 1997. In Pacific Fishery Management Council, Appendix: Status of the Pacific Coast groundfish fishery through 1997 and recommended acceptable biological catches in 1998: Stock assessment and fishery evaluation. Pacific Fishery Management Council, 2130 SW Fifth Avenue, Suite 224, Portland, OR 97201.

Dorn, M. W., M. W. Saunders, C. D. Wilson, M. A. Guttormsen, K. Cooke, R. Kieser, and M. E. Wilkins. Status of the coastal Pacific hake/whiting stock in U.S. and Canada in 1998. In Pacific Fishery Management Council, Appendix: Status of the Pacific Coast groundfish fishery through 1998 and recommended acceptable biological catches in 1999: Stock assessment and fishery evaluation. Pacific Fishery Management Council, 2130 SW Fifth Avenue, Suite 224, Portland, OR 97201.

Doubleday, W.G. 1976. A least-squares approach to analyzing catch at age data. Res. Bull. Int. Comm. Northw. Atl. Fish. 12:69-81.

Fleischer, G.W., K.D. Cooke, P.H. Ressler, R.E. Thomas, S.K. de Blois, L.C. Hufnagle, A.R. Kronlund, J.A. Holmes, and C.D. Wilson. 2005. The 2003 integrated acoustic and trawl survey of Pacific hake, Merluccius productus, in U.S. and Canadian waters off the Pacific coast. U.S. Dept. Commer., NOAA Tech. Memo. NMFS-NWFSC-65, 45 p.

Fournier, D. and C. P. Archibald. 1982. A general theory for analyzing catch at age data. Can. J. Fish. Aquat. Sci. 39:1195-1207.

Fournier, D. 1996. An introduction to AD model builder for use in nonlinear modeling and statistics. Otter Research Ltd. PO Box 2040, Sidney, B.C. V8L 3S3 Canada.

Francis, R.C., G.L. Swartzman, W.M. Getz, R. Harr, and K. Rose. 1982. A management analysis of the Pacific whiting fishery. U.S. Dep. Commer., NWAFC Processed Report 82-06. 48 p.

Francis, R. C., and A. B. Hollowed. 1985. History and management of the coastal fishery for Pacific whiting, *Merluccius productus*. Mar. Fish. Rev. 47(2):95-98.

Gelman, A., Carlin, J.B., Stern, H.S., and Rubin, D.B. 2004. Bayesian data analysis, 2nd Edition. Chapman and Hall, New York.

Gudmundsson, G. 1994. Time series analysis of catch-at-age observations. Appl. Statist. 43:117-126.

Helser, T.E, M.W. Dorn, M.W. Saunders, and R.D. Methot. 2001. Pacific whiting assessment update for 2000. In Pacific Fishery Management Council, Status of the Pacific Coast groundfish fishery through 2001 and recommended acceptable biological catches in 2002 (Document prepared for the Council and its advisory entities.) Pacific Fishery Management Council, 2130 SW Fifth Avenue, Suite 224, Portland, OR 97201.

Helser, T.E, R.D. Methot, and G. W. Fleischer. 2004. Pacific whiting assessment update for 20003 In Pacific Fishery Management Council, Status of the Pacific Coast groundfish fishery through 2001 and recommended acceptable biological catches in 2002 (Document prepared for the Council and its advisory entities.) Pacific Fishery Management Council, 2130 SW Fifth Avenue, Suite 224, Portland, OR 97201.

Helser, T.E, G. W. Fleischer, Steven Martell, and N. Taylor. 2005. Pacific whiting assessment update for 2004 In Pacific Fishery Management Council, Status of the Pacific Coast groundfish fishery through 2001 and recommended acceptable biological catches in 2004 (Document prepared for the Council and its advisory entities.) Pacific Fishery Management Council, 2130 SW Fifth Avenue, Suite 224, Portland, OR 97201.

Hollowed, A. B., S. A. Adlerstein, R. C. Francis, M. Saunders, N. J. Williamson, and T. A. Dark. 1988a. Status of the Pacific whiting resource in 1987 and recommendations to management in 1988. U.S. Dep. Commer., NOAA Tech. Memo. NMFS F/NWC-138, 54 p.

Hollowed, A.B., R. D. Methot, and M. W. Dorn. 1988b. Status of the Pacific whiting resource in 1988 and recommendation to management in 1989. In Pacific Fishery Management Council, Status of the Pacific Coast groundfish fishery through 1988 and recommended acceptable biological catches in 1989, p. A1-A50. (Document prepared for the Council and its advisory entities.) Pacific Fishery Management Council, 2130 SW Fifth Avenue, Suite 224, Portland, OR 97201.

Livingston, P.A. and K. M. Bailey. 1985. Trophic role of the Pacific whiting, Merluccius productus. Mar. Fish. Rev. 47(2):16-22-34.

McCullagh, P., and J. A. Nelder. 1983. Generalized linear models. Chapman and Hall, London. 261 p.

Methot, R.D. 1989. Synthetic estimates of historical abundance and mortality for northern anchovy. In E.F. Edwards and B.A. Megrey, (eds.), Mathematical Analysis of Fish Stock Dynamics: Reviews. Evaluations, and Current Applications, p. 66-82. Am. Fish. Soc. Symp. Ser. No. 6.

Myers, R.A, K.G. Bowen, and N.J. Barrowman. 1999. Maximum reproductive rate of fish at low population sizes. Can. J. Fish. Aquat. Sci. 56: 2404-2419.

Myers, R.A., N.J. Barrowman, R. Hilborn, and D.G. Kehler. 2002. Inferring Bayesian priors with limited direct data: Application of risk analysis. North American Journal of Fisheries Management 22:351-364.

Press, W.H., S.A. Teukolsky, W.T. Vetterling, and B.P. Flannery. 1992. Numerical recipes in C. Second ed. Cambridge University Press. 994 p.

Punt, A. E. and R. Hilborn. 1997. Fisheries stock assessment and decision analysis: the Bayesian approach. Rev. Fish. Biol. Fish. 7:35-63.

Ralston, S., Pearson, D., and Reynolds, J. 1998. Status of the Chillipepper Rockfish stock in 1998. In Pacific Fishery Management Council, Appendix: Status of the Pacific Coast groundfish fishery through 1998 and recommended acceptable biological catches in 1999: Stock assessment and fishery evaluation. Pacific Fishery Management Council, 2130 SW Fifth Avenue, Suite 224, Portland, OR 97201.

Ricker, W. E. 1975. Computation and interpretation of biological statistic of fish populations. Bull. Fish. Res. Board. 191:382 p.

Sakuma, K. M. and S. Ralston. 1996. Vertical and horizontal distribution of juvenile Pacific whiting (*Merluccius productus*) in relation to hydrography of California. Calif. Coop. Oceanic Fish. Invest. Rep. 38:137:146.

Saunders, M.W. and G.A. McFarlane. 1997. Observation on the spawning distribution and biology of offshore Pacific hake. Calif. Coop. Oceanic Fish. Invest. Rep. 38:147:160.

Schnute J.T. and L.J. Richards. 1995. The influence of error on population estimates from catch-age models. Can. J. Fish. Aquat. Sci. 52:2063-2077.

Shuter, B. J., and J. F. Koonce. 1985. A review of methods for setting catch quotas on fish stocks. Unpubl. manuscr., 78 p. Research Section Fisheries Branch, Ontario Ministry of Natural Resources, P.O. Box 50, Maple, Ontario, L0J 1E0. (Contribution to Assessment of Stock and Prediction of Yield Workshop, Thunder Bay, Ontario, Canada, August 1985.)

Traynor, J. J. 1996. Target-strength measurements of walleye pollock (*Theragra chalcogramma*) and Pacific whiting (*Merluccius productus*). ICES Journal of Marine Science 53:253-258.

Utter, F.M. 1971. Biochemical polymorphisms in Pacific hake (*Merluccius productus*). Cons. Perm. Int. Explor. Mer Rapp. P.-V. Reun. 161:87-89.

Vrooman, A.M. and P.A. Paloma. 1977. Dwarf hake off the coast of Baja California, Mexico. Calif. Coop. Oceanic Fish. Invest. Rep. 19:67-72.

Wespestad V. G. and A. M. Shimada. 1998. Pacific Whiting Conservation Cooperative National Marine Fisheries Service 1998 Pacific whiting cooperative survey report. Pacific Whiting Conservation Cooperative, 1200 Westlake N. Suite 900, Seattle WA 98109.

Wilkins, M. E. 1998. The 1995 Pacific west coast bottom trawl survey of groundfish resources: estimates of distribution, abundance, and length and age composition. NOAA Tech. Memo. NMFS-AFSC-89.

Wilson, C. D. and M. A. Guttormsen. 1997. Echo integration-trawl survey results for Pacific whiting (*Merluccius productus*) along the Pacific coast of the US and Canada during summer, 1995. NOAA Tech. Memo. NMFS-AFSC-74.

Table 1. Annual catches of Pacific hake (1,000 t) in U.S. and Canadian management zones by foreign, joint venture (JV), domestic at-sea, domestic shore-based, and tribal fisheries, 1966-2005.

			U.S.				Canada				U.S. and
			Domestic								Canada
Year	Foreign	JV	At-sea	Shore	Tribal	Total	Foreign	JV	Shore	Total [1]	total
1966	137.000	0.000	0.000	0.000	0.000	137.000	0.700	0.000	0.000	0.700	137.700
1967	168.699	0.000	0.000	8.963	0.000	177.662	36.713	0.000	0.000	36.713	214.375
1968	60.660	0.000	0.000	0.159	0.000	60.819	61.361	0.000	0.000	61.361	122.180
1969	86.187	0.000	0.000	0.093	0.000	86.280	93.851	0.000	0.000	93.851	180.131
1970	159.509	0.000	0.000	0.066	0.000	159.575	75.009	0.000	0.000	75.009	234.584
1971	126.485	0.000	0.000	1.428	0.000	127.913	26.699	0.000	0.000	26.699	154.612
1972	74.093	0.000	0.000	0.040	0.000	74.133	43.413	0.000	0.000	43.413	117.546
1973	147.441	0.000	0.000	0.072	0.000	147.513	15.125	0.000	0.001	15.126	162.639
1974	194.108	0.000	0.000	0.001	0.000	194.109	17.146	0.000	0.004	17.150	211.259
1975	205.654	0.000	0.000	0.002	0.000	205.656	15.704	0.000	0.000	15.704	221.360
1976	231.331	0.000	0.000	0.218	0.000	231.549	5.972	0.000	0.000	5.972	237.521
1977	127.013	0.000	0.000	0.489	0.000	127.502	5.191	0.000	0.000	5.191	132.693
1978	96.827	0.856	0.000	0.689	0.000	98.372	3.453	1.814	0.000	5.267	103.639
1979	114.909	8.834	0.000	0.937	0.000	124.680	7.900	4.233	0.302	12.435	137.115
1980	44.023	27.537	0.000	0.792	0.000	72.352	5.273	12.214	0.097	17.584	89.936
1981	70.365	43.556	0.000	0.839	0.000	114.760	3.919	17.159	3.283	24.361	139.121
1982	7.089	67.464	0.000	1.024	0.000	75.577	12.479	19.676	0.002	32.157	107.734
1983	0.000	72.100	0.000	1.050	0.000	73.150	13.117	27.657	0.000	40.774	113.924
1984	14.722	78.889	0.000	2.721	0.000	96.332	13.203	28.906	0.000	42.109	138.441
1985	49.853	31.692	0.000	3.894	0.000	85.439	10.533	13.237	1.192	24.962	110.401
1986	69.861	81.640	0.000	3.463	0.000	154.964	23.743	30.136	1.774	55.653	210.617
1987	49.656	105.997	0.000	4.795	0.000	160.448	21.453	48.076	4.170	73.699	234.147
1988	18.041	135.781	0.000	6.876	0.000	160.698	38.084	49.243	0.830	88.157	248.855
1989	0.000	203.578	0.000	7.418	0.000	210.996	29.753	62.618	2.563	94.934	305.930
1990	0.000	170.972	4.713	8.115	0.000	183.800	3.814	68.313	4.022	76.149	259.949
1991	0.000	0.000	196.905	20.600	0.000	217.505	5.605	68.133	16.178	89.916	307.421
1992	0.000	0.000	152.449	56.127	0.000	208.576	0.000	68.779	20.048	88.827	297.403
1993	0.000	0.000	99.103	42.119	0.000	141.222	0.000	46.422	12.355	58.777	199.999
1994	0.000	0.000	179.073	73.656	0.000	252.729	0.000	85.162	23.782	108.944	361.673
1995	0.000	0.000	102.624	74.965	0.000	177.589	0.000	26.191	46.193	72.384	249.973
1996	0.000	0.000	112.776	85.127	14.999	212.902	0.000	66.779	26.395	93.174	306.076
1997	0.000	0.000	121.173	87.410	24.840	233.423	0.000	42.565	49.227	91.792	325.215
1998	0.000	0.000	120.452	87.856	24.509	232.817	0.000	39.728	48.074	87.802	320.619
1999	0.000	0.000	115.259	83.419	25.844	224.522	0.000	17.201	70.132	87.333	311.855
2000	0.000	0.000	116.090	85.828	6.500	208.418	0.960	15.059	6.382	22.401	230.819
2001	0.000	0.000	102.129	73.474	6.774	182.377	0.000	21.650	31.935	53.585	235.962
2002	0.000	0.000	63.258	45.708	23.148	132.114	0.000	0.000	50.769	50.769	182.883
2003	0.000	0.000	67.473	55.335	20.684	143.492	0.000	0.000	62.090	62.090	205.582
2004	0.000	0.000	90.258	96.229	23.997	210.484	0.000	58.892	65.345	124.237	334.721
2005	0.000	0.000	150.400	85.914	23.53	259.844	0.000	15.178	85.284	100.462	360.306
Average 1966-2005						159.482				54.441	213.923

[1] Canadian fishery total catch revised 1996-2001.

Table 2. U.S. fishery sampling information by sector showing the number of hauls (or trips), number of lengths and number of ages taken by year. Samples sizes shown are the number of hauls or trips where length samples were taken.

U.S. At-sea fishery length samples				U.S. Shore-based fishery			
Year	No. Hauls	No. Lengths	No. Aged	Year	No. Trips	No. Lengths	No. Aged
1973	-	-	-	1973	-	-	-
1974	-	-	-	1974	-	-	-
1975	13	486	332	1975	-	-	-
1976	249	48,433	4,077	1976	-	-	-
1977	1,071	140,338	7,693	1977	-	-	-
1978	1,135	122,531	5,926	1978	-	-	-
1979	1,539	170,951	3,132	1979	-	-	-
1980	811	101,528	4,442	1980	-	-	-
1981	1,093	135,333	4,273	1981	-	-	-
1982	1,142	169,525	4,601	1982	-	-	-
1983	1,069	163,992	3,219	1983	-	-	-
1984	2,035	237,004	3,300	1984	-	-	-
1985	2,061	259,583	2,450	1985	-	-	-
1986	3,878	467,932	3,136	1986	-	-	-
1987	3,406	428,732	3,185	1987	-	-	-
1988	3,035	412,277	3,214	1988	-	-	-
1989	2,581	354,890	3,041	1989	-	-	-
1990	2,039	260,998	3,112	1990	-	-	-
1991	800	94,685	1,333	1991	17	1,273	934
1992	787	72,294	2,175	1992	49	3,152	1,062
1993	406	31,887	1,196	1993	36	1,919	845
1994	569	41,143	1,775	1994	80	4,939	1,457
1995	413	29,035	690	1995	57	3,388	1,441
1996	510	32,133	1,333	1996	47	3,330	1,123
1997	614	47,863	1,147	1997	67	4,272	1,759
1998	740	47,511	1,158	1998	63	3,979	2,021
1999	2,176	49,192	1,047	1999	92	4,280	1,452
2000	2,118	48,153	1,257	2000	81	2,490	1,314
2001	2,133	48,426	2,111	2001	106	4,290	1,983
2002	1,727	39,485	1,695	2002	94	3,890	1,582
2003	1,814	37,772	1,761	2003	101	3,866	1,561
2004	2,668	57,014	1,875	2004	129	7,170	1,440
2005	2,956	62,944	2,451	2005	108	6,166	1160

Table 3. Canadian fishery sampling information by sector showing the number of hauls (or trips), number of lengths and number of ages taken by year. Samples sizes shown are the number of hauls or trips where length samples were taken.

	Canadian JV fishery samples				Canadian shore-based fishery samples		
Year	No. Hauls	No. Lengths	No. Aged	Year	No. Trips	No. Lengths	No. Aged
1988	231	75,767	1,557	1988	-	-	-
1989	261	56,202	1,353	1989	-	-	-
1990	171	33,312	1,024	1990	-	-	-
1991	632	97,205	1,057	1991	-	-	-
1992	429	60,391	1,786	1992	-	-	-
1993	500	70,522	1,228	1993	-	-	-
1994	875	122,871	2,196	1994	-	-	-
1995	183	20,552	1,747	1995	-	-	-
1996	813	99,228	1,526	1996	463	116	-
1997	414	16,957	1,430	1997	1,011	41,782	50
1998	468	45,117	1,113	1998	897	28,173	454
1999	66	8,663	812	1999	1,332	40,964	1,318
2000	375	45,946	1,536	2000	131	1,001	50
2001	284	26,817	1,424	2001	689	14,320	-
2002	-	-	-	2002	1,033	12,132	1,337
2003	-	-	-	2003	1,183	8,296	1,065
2004	595	60,025	1,102	2004	976	3,900	1,201
2005	58	5,206	292	2005	130	2,416	327

Table 4. U.S. fishery sampling summary by sector showing number of samples, total sampled weight, total fishery weight, and sampling intensity given as the percent of total catch weight sampled and catch weight per sample taken.

	Foreign-JV fishery sampling					U.S. Shore-based fishery sampling				
Year	No. Hauls	Sampled weight (mt)	Total fishery landings (mt)	% total weight Sampled	Weight (mt) per sample	No. Trips	Sampled weight (mt)	Total fishery landings (mt)	% total weight Sampled	Weight (mt) per sample
1975	13	47	205,654	0.0%	15,820	-	-	-	-	-
1976	249	4,165	231,331	1.8%	929	-	-	-	-	-
1977	1,071	4,239	127,013	3.3%	119	-	-	-	-	-
1978	1,135	4,769	97,683	4.9%	86	-	-	-	-	-
1979	1,539	6,797	123,743	5.5%	80	-	-	-	-	-
1980	811	10,074	71,560	14.1%	88	-	-	-	-	-
1981	1,093	9,846	113,921	8.6%	104	-	-	-	-	-
1982	1,142	23,956	74,553	32.1%	65	-	-	-	-	-
1983	1,069	27,110	72,100	37.6%	67	-	-	-	-	-
1984	2,035	13,603	93,611	14.5%	46	-	-	-	-	-
1985	2,061	11,842	81,545	14.5%	40	-	-	-	-	-
1986	3,878	24,602	151,501	16.2%	39	-	-	-	-	-
1987	3,406	22,349	155,653	14.4%	46	-	-	-	-	-
1988	3,035	21,499	153,822	14.0%	51	-	-	-	-	-
1989	2,581	20,560	203,578	10.1%	79	-	-	-	-	-
1990	2,039	16,264	175,685	9.3%	86	-	-	-	-	-
1991	800	15,833	196,905	8.0%	246	17	683	20,600	3.3%	1,212
1992	787	17,781	152,449	11.7%	194	49	1,964	56,127	3.5%	1,145
1993	406	11,306	99,103	11.4%	244	36	1,619	42,119	3.8%	1,170
1994	569	13,959	179,073	7.8%	315	80	4,461	73,656	6.1%	921
1995	413	9,833	102,624	9.6%	248	57	3,224	74,965	4.3%	1,315
1996	510	13,813	112,776	12.2%	221	47	3,036	85,127	3.6%	1,811
1997	614	17,264	121,173	14.2%	197	67	4,670	87,410	5.3%	1,305
1998	740	17,370	120,452	14.4%	163	63	4,231	87,856	4.8%	1,395
1999	2,176	47,541	115,259	41.2%	53	92	6,740	83,419	8.1%	907
2000	2,118	48,482	116,090	41.8%	55	81	7,735	85,828	9.0%	1,060
2001	2,133	43,459	102,129	42.6%	48	106	8,524	73,474	11.6%	693
2002	1,727	37,252	63,258	58.9%	37	94	7,089	45,708	15.5%	486
2003	1,814	38,067	67,473	56.4%	37	101	7,676	55,335	13.9%	548
2004	2,668	53,411	90,258	59.2%	34	129	10,918	96,229	11.3%	746
2005	2,956	66,356	150,400	44.1%	51	108	8,997	85,914	10.5%	796

Table 5. Canadian fishery sampling summary by sector showing number of samples, total sampled weight, total fishery weight, and sampling intensity given as the percent of total catch weight sampled and catch weight per

	Canadian JV fishery sampling					Canadian Shore-based fishery sampling				
Year	No. Hauls	Sampled weight (mt)	Total fishery landings (mt)	% total weight Sampled	Weight (mt) per sample	No. Trips	Sampled weight (mt)	Total fishery landings (mt)	% total weight Sampled	Weight (mt) per sample
1988	231	4,184	49,243	8.5%	213	-	-	-	-	-
1989	261	4,679	62,618	7.5%	240	-	-	-	-	-
1990	171	3,396	68,313	5.0%	399	-	-	-	-	-
1991	632	13,054	68,133	19.2%	108	-	-	-	-	-
1992	429	8,901	68,779	12.9%	160	-	-	-	-	-
1993	500	8,929	46,422	19.2%	93	-	-	-	-	-
1994	875	15,387	85,162	18.1%	97	-	-	-	-	-
1995	183	3,770	26,191	14.4%	143	-	-	-	-	-
1996	813	14,863	66,779	22.3%	82	463	21,297	26,395	80.7%	57
1997	414	8,325	42,565	19.6%	103	1,011	44,802	49,227	91.0%	49
1998	468	9,638	39,728	24.3%	85	897	45,982	48,074	95.6%	54
1999	66	1,970	17,201	11.5%	261	1,332	66,700	70,132	95.1%	53
2000	375	6,557	15,059	43.5%	40	131	5,791	6,382	90.7%	49
2001	284	6,072	21,650	28.0%	76	689	30,852	31,935	96.6%	46
2002	-	-	-	-	-	1,033	49,189	50,769	96.9%	49
2003	-	-	-	-	-	1,183	61,110	62,090	98.4%	52
2004	595	14,620	58,892	24.8%	99	976	58,624	65,345	89.7%	67
2005	58	1,630	15,178	10.7%	262	130	12,244	85,284	14.4%	656

Table 6. U.S. fishery sample sizes for conditional age at length. Sample size shown by year and length bin represent the sum of the total number of hauls (in the at-sea fishery) and trips (in the shore-based fishery) contributing age information to each 1 cm length category.

	Year samples were taken														
Length	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
20			1		1	1	5								
21			1	2		3	9								
22		1		2		2	13								
23	1	1		4		1	23								
24	1	1		4		2	25	2				1			
25	1	3		10	1	1	29	5							
26	2	1		10	2		40	11	1		1			1	
27	2	4		9	2	1	34	9		1					
28	1	5		14	4	1	22	12			1				
29	3	4		7	10	1	21	18	6		2	1		1	2
30	5	4		4	21	1	16	37	10		1	5			3
31	3	6	2	2	27		12	38	11	3	3	8		1	9
32	5	8			30	3	6	52	23	1	3	19		2	15
33	2	9	4		46	4	9	62	23	2	3	22	3	2	15
34	4	10	5		33	9	12	66	35	6	2	49	6	3	8
35	4	7	12		24	19	16	62	39	12	1	41	16	3	10
36	5	13	28	3	17	38	28	55	51	25	1	42	29	3	13
37	5	23	56	7	19	66	49	59	55	41	2	40	60	15	9
38	3	26	71	17	12	74	59	48	62	72	7	39	79	56	17
39	2	45	99	51	11	84	78	50	58	112	16	36	88	101	40
40	6	58	114	88	17	89	94	62	62	121	43	51	97	129	79
41	10	53	146	129	25	83	84	66	69	135	78	85	104	141	120
42	9	55	141	176	36	93	85	86	77	125	107	114	112	141	129
43	9	56	160	171	44	88	88	94	72	112	121	119	121	145	125
44	10	54	160	158	65	100	101	99	69	93	124	110	117	153	127
45	8	47	147	165	72	111	101	100	69	82	115	113	113	152	125
46	9	47	142	148	74	114	107	99	75	83	101	105	106	150	130
47	7	39	132	144	84	96	114	103	74	74	79	100	102	137	133
48	10	42	128	154	83	90	122	111	70	67	63	83	92	123	118
49	8	44	136	143	76	85	122	116	69	66	58	67	83	81	98
50	4	57	123	147	83	90	105	101	71	50	52	77	59	68	74
51	5	62	135	156	89	87	113	112	59	49	25	59	40	45	49
52	6	60	140	184	85	92	107	100	66	43	24	51	31	34	40
53		69	146	178	86	94	116	106	66	28	17	52	18	22	35
54	2	64	147	186	78	105	96	104	61	20	15	44	14	15	27
55	4	58	161	176	70	102	80	86	57	11	11	27	8	14	14
56		67	139	156	66	102	65	85	44	5	3	31	5	8	15
57	1	65	131	115	58	102	56	81	32	5	4	24	5	13	8
58	1	62	94	103	41	88	39	48	32	4	3	11	3	11	8
59	2	57	95	60	47	52	34	53	17	7		11	2	4	7
60	1	56	73	60	22	60	36	37	22	2	1	7	5	6	3
61		48	60	45	26	39	30	28	15		1	8	3	5	6
62		45	52	41	16	27	20	17	9	4		7	6	1	
63		30	46	27	12	25	20	21	12	4		3	1		3
64		36	42	26	8	26	16	21	6	2		6	2	4	1
65		33	23	18	13	19	8	18	6	1		5	3	3	1
66		33	17	14	11	12	10	9	4			6	1	4	2
67		33	15	18	6	11	10	10	4	1		4	2		
68	1	28	18	13	8	9	5	6	5	2	1	3	3	2	4
69	1	25	17	10	4	7	7	6	1	3		4	1	3	
70		71	62	60	16	14	15	14	12	9		25	5	12	4

Table 6. Continued.

	Year samples were taken															
Length	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
20		2				1										
21		2														
22		1														
23		1														
24																
25																
26																
27			1									1				
28	2		2								2					
29	6		5							2	2					
30	5	1	6		1		1			8	3	6				
31	15	2	8	4			6			8	3	7	1		1	
32	22	5	5	1		1	9		2	9	2	15				
33	24	13	3	5	1		17		4	19	1	19				1
34	45	23	4	5		1	23	1	1	29	2	28	1			2
35	51	32	3	17	3		30	1	5	41	2	32	2			4
36	76	33	6	31	9		30	7	13	38	6	50	11	2		
37	84	39	22	42	19	2	23	16	17	41	18	55	19	2	1	2
38	94	37	23	45	42	4	27	32	30	54	16	61	45	6	7	3
39	98	46	58	49	64	2	33	47	36	60	24	56	80	25	23	6
40	104	50	66	44	70	6	38	59	50	53	36	61	113	61	45	25
41	95	55	78	38	66	18	35	77	56	59	43	97	128	133	90	49
42	96	59	84	50	73	31	36	83	73	49	56	100	117	199	133	125
43	93	58	82	57	81	33	50	84	97	77	85	100	100	227	216	242
44	91	54	81	64	99	38	65	70	102	70	86	112	85	203	227	309
45	82	53	81	65	99	37	73	71	90	84	89	121	63	156	225	318
46	88	53	81	63	98	36	74	57	77	63	106	136	53	106	177	267
47	82	47	84	58	95	39	72	53	51	63	120	136	61	67	105	199
48	84	48	84	62	90	38	64	41	43	47	100	153	65	49	79	114
49	73	44	82	46	91	37	59	28	25	31	95	118	74	33	39	72
50	72	36	73	30	63	33	47	27	17	17	75	86	76	33	26	46
51	74	18	59	22	34	25	30	21	7	13	55	59	68	17	8	31
52	58	9	39	9	25	23	29	11	3	9	34	50	55	15	12	9
53	43	6	35	4	15	13	10	11	3	6	17	37	48	5	5	11
54	34	6	26	7	13	10	12	5	2	3	17	34	38	7	3	6
55	20	7	20	6	8	8	7	1	4		9	10	27	4	2	3
56	15	2	15	1	4	6	4	3	1		12	8	17	3	2	4
57	14	3	15	2	5	4	1	1		3	4	11	13		2	3
58	14	2	9		6	6	3	1	1	2	3	1	7		2	1
59	11	3	9	1	2	3	3	1	1		5	2	4	1	1	2
60	14		7		3	1	1	1		1	4	4	4		2	
61	15	3	5	2	1	1	2	1		2	2	1	2			1
62	9	3	5		1	2	2		1	1	4		3		1	
63	9	3	2		1	1	1	1			1		1			
64	8		3		1		1						2			
65	8	2	2		2		1		1		2	1	1	1		
66	8	5	2					1					1			1
67	6	2			1		1								1	
68	6	2	2		1											1
69	7	1		1	1											
70	20	8	6	1	3	1	2	2					1			

Table 7. Canadian fishery sample sizes for conditional age at length. Sample size shown by year and length bin represent the sum of the total number of hauls (in the at-sea fishery) and trips (in the shore-based fishery) contributing age information to each 1 cm length. category.

	Year samples were taken																	
Year	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
20											1							
21												1						
22												1						
23								1				2						
24								2										
25								2										
26								1				2						
27								1										
28								1			1							
29												1					1	
30												1					1	
31									2			3	1	1				
32									2			5				2	1	
33							1	1	3			10				2	1	
34						1			3		1	7	1				2	
35	1						1		4			10	3				1	
36						1	1		8		4	16	4			1	1	
37	1				1		1		9		8	17	5		1		2	
38	1		2		1				12	1	10	19	6				2	2
39	3		3	1	2				7	7	17	26	5				3	
40	4	2	3	1	3	5			8	10	18	27	9			1	11	1
41	4	5	4	1	9	10	6	1	6	17	19	30	13	1		3	20	3
42	4	6	5	3	15	14	10	6	14	21	25	35	14	3		11	26	12
43	5	6	6	6	22	17	20	11	15	22	24	36	14	4	8	14	31	17
44	5	6	4	14	27	17	24	18	22	22	25	35	17	6	3	14	32	19
45	5	6	4	16	29	18	28	21	24	23	25	37	16	11	5	15	32	20
46	5	6	4	16	29	18	29	21	24	23	25	38	18	15	11	15	32	20
47	5	6	4	16	29	18	30	21	24	23	25	38	19	18	15	15	32	20
48	5	6	4	16	29	18	31	21	24	23	23	34	19	20	22	15	31	19
49	5	6	4	16	29	18	30	21	23	22	21	35	19	20	24	15	31	17
50	5	6	5	16	27	17	28	21	23	22	22	31	20	20	25	15	31	12
51	5	6	5	16	28	13	28	21	22	18	17	27	18	20	26	13	27	12
52	5	6	6	13	16	12	27	17	17	18	8	22	16	20	26	13	18	2
53	5	6	4	13	15	4	23	17	11	14	8	14	17	19	26	11	17	5
54	5	4	5	8	12	5	18	14	12	9	6	11	15	18	26	11	13	7
55	4	5	3	4	7	1	21	11	4	5	2	9	9	19	26	9	11	6
56	4	4	4	8	4		12	7	7	2	2	6	10	17	25	7	5	4
57	4	4	4	3	4		9	5	7	3	3	2	6	17	25	6	7	2
58	4	3	3	5	4	5	6	9	6		2	4	6	17	21	8	3	2
59	3	2	4	3	1		8	6	1	1	1	4	8	12	13	5	1	1
60	3	2	3	2	3		6	4	4	1		1	4	9	18	5	5	
61	2	1	2	2			5	4	4			1	4	7	12	3	2	1
62	1	3	4	2	1		3	1	1			1		4	12	1	1	
63	1	3	4		2		2	2			1		2	2	7	1	2	
64	1	2	2	1			3	3		1		1	1	2	2	1		1
65	1	1	2				5	1	2					3	1	1	1	1
66		1	1	1			1	1	1			2	1	1	2		1	
67		2	2					1					1	2	1			
68				1					1	1					1	1	1	
69			1	1				1									1	
70	1	4	1	1	1		2	1					1					

Table 8. Acoustic survey sampling information showing the number of hauls, number of lengths and number of hake aged by year.

Year	No. hauls	No. lengths	No. aged
1977	85	11,695	4,262
1980	49	8,296	2,952
1983	35	8,614	1,327
1986	43	12,702	2,074
1989	22	5,606	1,730
1992	43	15,852	2,184
1995	69	22,896	2,118
1998	84	33,347	2,417
2001	49	16,442	2,536
2003	71	19,357	3,007
2005	49	13.644	1,905

Table 9. Acoustic survey sample sizes for conditional age at length. Sample size shown by year and length bin represent the sum of the total number of hauls contributing age information to each 1 cm length. category.

	Number hauls by length and year										
Length	1977	1980	1983	1986	1989	1992	1995	1998	2001	2003	2005
24						2		1			
25						2		3		1	
26	1					2		2			
27					1	4		4	2		
28	1					2	2	10		1	1
29	1	1		2		5	1	13			1
30	1			3		7	2	16	3	2	4
31	2			6		7	4	20	8	2	6
32	3			8		8	9	23	14	4	7
33	4		2	8	1	8	13	23	17	4	10
34	3	4	4	9	3	8	15	31	20	8	8
35	9	7	3	9	4	7	21	31	20	8	10
36	14	9	5	11	6	6	20	30	20	8	9
37	16	10	7	8	8	6	17	36	17	9	10
38	14	12	8	10	7	5	14	39	13	14	8
39	17	10	9	5	9	8	6	50	10	14	10
40	20	12	13	6	10	7	11	44	17	29	6
41	22	11	11	12	15	10	15	55	14	43	22
42	24	10	11	21	20	24	26	62	18	56	28
43	29	12	9	21	20	28	40	66	22	55	36
44	34	13	13	20	20	36	45	64	17	59	41
45	40	16	12	21	20	38	49	57	29	61	42
46	41	18	13	21	20	39	53	49	29	53	41
47	45	19	12	17	18	37	50	51	30	55	39
48	48	21	13	18	16	34	47	46	30	43	32
49	48	24	12	16	16	30	38	31	28	41	27
50	45	22	12	16	10	22	27	22	27	32	23
51	47	22	11	16	8	18	17	9	25	28	12
52	46	21	10	11	9	14	14	5	26	24	12
53	44	19	9	13	6	6	10	6	24	19	9
54	40	18	8	8	5	3	7	4	25	12	5
55	38	17	6	9	2	4	5	2	18	12	3
56	31	19	5	4	2	5	6	2	13	7	5
57	33	16	7	4		4	3	3	10	6	2
58	27	11	2	3	3	3	5	5	10	5	1
59	19	14	3	3	2	1	2		7	3	1
60	18	7	1	4	2	1	2	1	8	6	
61	16	4	2	3		1	1	2	5	2	
62	11	3	2	2		2	4		3	5	
63	11	2	1		1	3	2		2		
64	10	2		3	1		1		4	2	1
65	8	3	1	1	1		2		3	2	1
66	8	2	1				2		2	2	
67	8	2		1			2		1	2	
68	7	4		1					2		1
69	4	3	1	1	1		1	1	4	2	1
70	7	3		1	2		3		4	6	6

Table 10. Acoustic survey estimates of Pacific whiting biomass and age composition. Surveys in 1995 and 1998 were cooperative surveys between AFSC and DFO. Biomass and age composition for 1977-89 were adjusted as described in Dorn (1996) to account for changes in target strength, depth and geographic coverage. Biomass estimates at 20 log l - 68 in 1992 and 1995 are from Wilson and Guttormson (1997). The biomass in 1995 includes 27,251 t of Pacific whiting found by the DFO survey vessel W.E. Ricker in Queen Charlotte Sound. (This estimate was obtained from 43,200 t, the biomass at -35 dB/kg multiplied by 0.631, a conversion factor from -35 dB/kg to 20 log l - 68 for the U.S. survey north of 50°30' N lat.). In 1992, 1995, and 1998, 20,702 t, 30,032 t, and 8,034 t of age-1 fish respectively is not included in the total survey biomass. In 2001-2005 no age one fish were captured in survey trawls. Estimates of biomass and numbers at age from 1977-1992 include revised based on year-specific deep-water and northern expansion factors (Helser et al. 2004).

	Total biomass at 20 log l - 68 (1,000 t)	Number at age (million)														
Year		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1977	1915.01	0.24	151.94	144.57	902.04	82.60	115.79	1001.86	138.13	102.08	58.53	54.82	28.54	10.61	2.79	3.46
1980	2115.09	0.00	16.18	1971.21	190.90	115.65	94.42	417.83	154.83	333.21	133.62	78.76	13.26	22.81	4.75	3.49
1983	1646.68	0.00	1.10	3254.35	107.83	32.62	428.59	68.59	47.27	33.71	92.68	21.86	25.80	26.90	4.32	0.00
1986	2857.06	0.00	4555.66	119.65	21.04	148.80	2004.57	215.71	171.63	225.45	27.33	28.72	2.08	10.85	3.49	0.00
1989	1237.69	0.00	411.82	141.76	31.19	1276.32	28.43	10.08	18.30	435.18	22.95	1.75	43.08	0.00	0.00	1.76
1992	2169.20	230.71	318.37	42.50	246.38	630.74	77.96	31.61	1541.82	46.68	28.08	14.14	533.23	27.13	0.00	28.42
1995	1385.00	316.41	880.52	117.80	32.62	575.90	26.58	88.78	403.38	5.90	0.00	429.34	0.96	17.42	0.00	130.39
1998	1185.00	98.31	414.33	460.41	386.81	481.76	34.52	135.59	215.61	26.41	39.14	120.27	7.68	4.92	104.47	29.19
2001	737.00	0.00	1471.36	185.56	109.35	117.25	54.26	54.03	29.41	17.11	12.03	5.07	4.48	8.73	0.83	3.10
2003	1840.00	5.19	99.78	84.88	2146.50	366.87	92.55	201.22	133.09	73.54	74.67	24.06	14.18	14.63	10.33	14.12
2005	1265.16	8.65	601.86	61.02	180.86	129.98	1210.5	132.12	45.07	61.09	34.83	28.17	11.9	6.11	0.81	4.35

Table 11 Santa Cruz midwater trawl juvenile groudfish survey estimates of log-transformed Pacific hake abundance (Sakuma and Ralston 1997).

		All Strata		Monterey outside stratum only	
Year class	Year of recruitment	log(numbers)	SE	log(numbers)	SE
1986	1988	1.679	0.192	3.153	0.507
1987	1989	3.129	0.172	6.258	0.490
1988	1990	3.058	0.161	4.917	0.474
1989	1991	0.979	0.170	2.008	0.490
1990	1992	1.323	0.173	3.553	0.490
1991	1993	2.134	0.167	3.769	0.490
1992	1994	0.583	0.166	2.561	0.507
1993	1995	3.095	0.173	7.048	0.490
1994	1996	2.152	0.177	3.470	0.490
1995	1997	0.768	0.173	1.940	0.490
1996	1998	1.968	0.174	4.586	0.507
1997	1999	1.487	0.197	2.767	0.526
1998	2000	0.602	0.177	1.599	0.507
1999	2001	-	-	4.589	0.490
2000	2002	-	-	2.616	0.507
2001	2003	-	-	3.415	0.490
2002	2004	-	-	2.130	0.528
2003	2005	-	-	0.508	0.490
2004	2006	-	-	4.547	0.490
2005	2007	-	-	0.273	0.490

Table 12 Parameter assumptions and model configureation of Stock Synthesis II (Ver. 1.21) for Pacific hake. The alternative model imposes a prior on the Ln acoustic survey q equivalent to mean = 1.0 and standard deviation = 0.10.

Parameter	Number Estimated	Bounds (low,high)	Prior (Mean, SD)
Natural Mortality	-	NA	Fixed at 0.23
Stock and recruitment			
Ln(Rzero)	1	(11,15)	~N(15,99)
Steepness	-	NA	Fixed at 0.75
Sigma R (based on 1967-2003 R devs)	-	NA	Fixed at 1.138
Ln(Recruitment deviations): 1967-2005	39	(-15,15)	~Ln(N(0.Sigma R))
Catchability			
Ln(Acoustic survey)	-	NA	fixed at 1.0 / q prior [1]
Ln(Recruitment survey)	1	(-15,10)	~N(-1,99)
Selectivity (double logistic)			
US Fishery:			
Base Period block: 1966 - 1983			
Ascending inflection (ln trans.)	1	(1,10)	~N(3,99)
Ascending slope	1	(0.001,10)	~N(2.5,99)
Descending inflection (ln trans.)	1	(1,20)	~N(12,99)
Descending slope	1	(0.001,10)	~N(1.0,99)
Temporal blocks for all: 1984-1992, 1993-2000, 2001-2005	12	same as above	same as above
Canadian Fishery:			
Base Period block: 1966 - 1994			
Ascending inflection (ln trans.)	1	(1,20)	~N(3,99)
Ascending slope	1	(0.001,10)	~N(1.0,99)
Descending inflection (ln trans.)	1	(1,40)	~N(13,99)
Descending slope	1	(0.001,10)	~N(1.0,99)
Temporal blocks for ascending infl and slp: 1995-2000, 2001-2002, 2003-2005	6	same as above	same as above
Acoustic Survey:			
Ascending inflection (ln trans.)	1	(1,10)	~N(3,99)
Ascending slope	1	(0.001,10)	~N(1.0,99)
Descending inflection (ln trans.)	1	(1,20)	~N(7,99)
Descending slope	1	(0.001,10)	~N(1.0,99)
Individual growth			
Sex combined:			
Length at age min (age 2)	1	(10,40)	~N(33,99)
base period Lmax 1966-1983	1	(30,70)	~N(53,99)
blocks for Lmax: 1984-2005	1	(30,70)	~N(53,99)
base period von Bertalanffy K, 1966-1980 and 1987-2005	1	(0.1,0.7)	~N(0.3,99)
blocks for von Bertalanffy K, 1981-1986	1	(0.1,0.7)	~N(0.3,99)
CV of length at age min	1	(0.01,0.35)	~N(0.1,99)
CV of length at age max	-	NA	fixed at 0
Total number of parameters: 38 + 39 recruitment devs = 77	77		

[1] Alternative model includes estimation of Acoustic survey q ~ LN(0.0, 0.112)

Table 13. Maximum likelihood model parameter estimates with asymptotic standard deviations from Stock Synthesis II (Ver. 1.21) applied to Pacific hake for the base and alternative models.

Parameter	Base Model, *q* =1.0, *h* =0.75 MLE	Base Model, *q* =1.0, *h* =0.75 Asympt. SD	*h* =0.75, *q* prior MLE	*h* =0.75, *q* prior Asympt. SD
Stock and recruitment				
Ln(Rzero)	15.42	0.05	15.537	0.062
Catchability				
Ln(Acoustic survey)	NE	NE	-0.357	0.090
Ln(Recruitment survey)	-10.970	0.259	-11.113	0.263
Selectivity (double logistic)				
US Fishery:				
Base Period block: 1966 - 1983				
Ascending inflection (ln trans.)	3.357	0.070	3.330	0.073
Ascending slope	1.673	0.077	1.690	0.078
Descending inflection (ln trans.)	11.906	0.111	11.850	0.113
Descending slope	1.058	0.049	1.044	0.048
Block 1984 - 1992				
Ascending inflection (ln trans.)	2.499	0.044	2.477	0.044
Ascending slope	2.532	0.141	2.570	0.146
Descending inflection (ln trans.)	12.530	0.147	12.440	0.149
Descending slope	1.259	0.084	1.226	0.081
Block 1993- 2000				
Ascending inflection (ln trans.)	2.955	0.056	2.945	0.056
Ascending slope	2.343	0.111	2.386	0.111
Descending inflection (ln trans.)	13.979	0.159	13.859	0.165
Descending slope	1.623	0.240	1.486	0.204
Block 2001- 2005				
Ascending inflection (ln trans.)	2.918	0.042	2.923	0.042
Ascending slope	3.051	0.137	3.060	0.137
Descending inflection (ln trans.)	13.222	0.376	13.040	0.489
Descending slope	1.742	0.403	1.547	0.427
Canadian Fishery:				
Base Period block: 1966 - 1994				
Ascending inflection (ln trans.)	5.160	0.127	5.124	0.127
Ascending slope	1.313	0.093	1.323	0.095
Descending inflection (ln trans.)	13.085	0.153	12.990	0.153
Descending slope	1.355	0.107	1.285	0.098
Base Period block: 1995 - 2000				
Ascending inflection (ln trans.)	4.670	0.316	4.528	0.301
Ascending slope	0.633	0.070	0.667	0.074
Base Period block: 2001 - 2002				
Ascending inflection (ln trans.)	3.623	0.102	3.627	0.104
Ascending slope	4.995	0.757	4.994	0.761
Base Period block: 2003 - 2005				
Ascending inflection (ln trans.)	4.715	0.136	4.705	0.137
Ascending slope	1.703	0.182	1.712	0.185
Acoustic Survey:				
Ascending inflection (ln trans.)	11.564	0.189	11.633	0.192
Ascending slope	0.944	0.038	0.936	0.039
Descending inflection (ln trans.)	2.373	0.232	2.445	0.230
Descending slope	0.859	0.043	0.865	0.043
Growth Parameters:				
Length at age min (Lmin, age 2)	33.076	0.087	33.077	0.096
Base period Lmax, 1966-1983	53.017	0.081	53.021	0.128
Block for Lmax: 1984-2005	49.890	0.057	49.893	0.113
Base period K, 1966-1980, 1987-2005	0.332	0.004	0.331	0.007
Blocks for K: 1981-1986	0.212	0.004	0.212	0.007
CV of length at age min	0.072	0.000	0.072	0.001

Table 14a. Time series of estimated 3+ biomass, spawning biomass, recruitment, and utilization for 1966-2006 from the base model using Stock Synthesis 2. U.S. and Canadian exploitation rate is the catch in biomass divided by vulnerable at the start of the year. Population (3+) and spawning biomass is in millions of tons at the start of the year. Recruitment is given in billions of age-0 fish.

	3+ Population	Spawning	Age 0	Depletion	Exploitation Rate		
Year	biomass (mt)	biomass (mt)	Recruits	% Bzero	U.S.	Canada	Sum
1966	7.832	3.814	4.974	100.00%	2.6%	0.0%	2.6%
1967	7.704	3.750	5.582	98.34%	3.4%	0.9%	4.3%
1968	7.521	3.660	5.908	95.98%	1.2%	1.6%	2.8%
1969	7.454	3.636	6.019	95.34%	1.7%	2.5%	4.2%
1970	7.459	3.628	15.027	95.14%	3.1%	2.0%	5.2%
1971	7.500	3.641	5.244	95.46%	2.5%	0.7%	3.2%
1972	7.659	3.856	2.889	101.10%	1.4%	1.2%	2.5%
1973	9.498	4.385	9.428	114.99%	2.4%	0.4%	2.8%
1974	9.609	4.589	2.368	120.32%	2.8%	0.4%	3.3%
1975	9.038	4.518	3.361	118.46%	3.0%	0.3%	3.3%
1976	9.514	4.507	1.931	118.18%	3.4%	0.1%	3.5%
1977	8.749	4.283	13.685	112.30%	2.0%	0.1%	2.1%
1978	8.175	3.990	1.774	104.63%	1.6%	0.1%	1.7%
1979	7.376	3.817	2.757	100.09%	2.2%	0.3%	2.5%
1980	8.722	4.012	33.618	105.19%	1.3%	0.4%	1.7%
1981	7.968	3.979	0.837	104.33%	2.1%	0.6%	2.7%
1982	7.248	3.771	0.357	98.88%	1.4%	0.8%	2.2%
1983	11.692	4.157	0.769	108.99%	1.2%	1.0%	2.1%
1984	11.020	4.615	17.771	121.01%	1.1%	1.0%	2.0%
1985	9.558	4.581	0.328	120.11%	1.1%	0.5%	1.6%
1986	8.215	4.197	0.851	110.04%	2.2%	1.0%	3.2%
1987	9.503	3.975	5.298	104.21%	2.1%	1.4%	3.6%
1988	8.425	3.725	2.326	97.68%	2.3%	1.9%	4.2%
1989	7.282	3.550	0.596	93.08%	3.5%	2.2%	5.6%
1990	6.833	3.259	2.859	85.45%	3.4%	1.8%	5.3%
1991	6.041	2.893	1.158	75.86%	4.7%	2.5%	7.2%
1992	4.981	2.471	0.567	64.78%	5.6%	3.0%	8.6%
1993	4.413	2.110	2.444	55.32%	4.3%	2.5%	6.7%
1994	3.772	1.816	2.910	47.62%	9.3%	5.7%	15.0%
1995	2.962	1.473	2.062	38.62%	8.7%	4.4%	13.1%
1996	2.7	1.293	1.988	33.89%	11.9%	6.7%	18.5%
1997	2.5	1.169	1.933	30.64%	13.9%	7.9%	21.8%
1998	2.2	1.056	2.814	27.70%	15.0%	8.7%	23.7%
1999	2.0	0.952	13.789	24.97%	15.9%	9.4%	25.3%
2000	1.8	0.880	0.990	23.07%	15.6%	2.5%	18.1%
2001	1.9	1.054	1.372	27.64%	12.6%	5.1%	17.8%
2002	3.8	1.485	0.234	38.93%	5.2%	4.1%	9.3%
2003	3.7	1.684	2.338	44.17%	4.4%	4.7%	9.1%
2004	3.4	1.617	1.446	42.40%	7.0%	6.3%	13.3%
2005	2.8	1.386	0.279	36.34%	10.1%	4.9%	15.0%
2006	2.5	1.178	2.192	30.89%	-	-	-
	2005 5% - 95% Asymptotic Interval			30.4% - 42.1%			
	2006 5% - 95% Asymptotic Interval			24.7% - 36.9%			

Table 14b. Time series of estimated 3+ biomass, spawning biomass, recruitment, and utilization for 1966-2006 from the alternative model using Stock Synthesis 2. U.S. and Canadian exploitation rate is the catch in biomass divided by vulnerable biomass at the start of the year. Population (3+) and spawning biomass is in millions of tons at the start of the year. Recruitment is given in billions of age-0 fish.

Year	3+ Population biomass (mt)	Spawning biomass (mt)	Age 0 Recruits	Depletion % Bzero	Exploitation Rate U.S.	Exploitation Rate Canada	Exploitation Rate Sum
1966	8.804	4.287	5.593	100.00%	2.3%	0.0%	2.3%
1967	8.676	4.224	6.281	98.52%	3.0%	0.8%	3.8%
1968	8.493	4.133	6.634	96.42%	1.0%	1.4%	2.5%
1969	8.426	4.110	6.748	95.88%	1.5%	2.2%	3.7%
1970	8.445	4.108	16.828	95.83%	2.8%	1.8%	4.5%
1971	8.507	4.130	5.867	96.33%	2.2%	0.6%	2.8%
1972	8.686	4.372	3.228	101.98%	1.2%	1.0%	2.2%
1973	10.741	4.962	10.523	115.75%	2.1%	0.3%	2.5%
1974	10.864	5.190	2.637	121.06%	2.5%	0.4%	2.9%
1975	10.229	5.113	3.734	119.26%	2.6%	0.3%	2.9%
1976	10.761	5.101	2.140	118.99%	3.0%	0.1%	3.1%
1977	9.908	4.851	15.097	113.16%	1.7%	0.1%	1.8%
1978	9.254	4.518	1.952	105.40%	1.4%	0.1%	1.5%
1979	8.347	4.315	3.019	100.66%	2.0%	0.2%	2.2%
1980	9.808	4.518	36.826	105.38%	1.2%	0.4%	1.5%
1981	8.953	4.469	0.914	104.25%	1.8%	0.5%	2.4%
1982	8.140	4.231	0.388	98.70%	1.2%	0.7%	1.9%
1983	12.984	4.643	0.830	108.31%	1.0%	0.9%	1.9%
1984	12.227	5.134	19.113	119.77%	1.0%	0.9%	1.8%
1985	10.607	5.088	0.351	118.68%	1.0%	0.4%	1.4%
1986	9.118	4.654	0.908	108.56%	2.0%	0.9%	2.9%
1987	10.470	4.399	5.631	102.61%	1.9%	1.3%	3.2%
1988	9.280	4.117	2.470	96.03%	2.1%	1.7%	3.8%
1989	8.026	3.913	0.632	91.29%	3.2%	1.9%	5.1%
1990	7.516	3.589	3.029	83.72%	3.1%	1.7%	4.8%
1991	6.643	3.185	1.231	74.30%	4.3%	2.3%	6.6%
1992	5.492	2.724	0.607	63.55%	5.2%	2.7%	7.9%
1993	4.866	2.330	2.640	54.34%	3.9%	2.3%	6.2%
1994	4.163	2.007	3.190	46.81%	8.6%	5.2%	13.8%
1995	3.294	1.638	2.312	38.22%	7.9%	4.0%	11.9%
1996	3.0	1.443	2.275	33.67%	10.8%	6.0%	16.8%
1997	2.8	1.314	2.275	30.66%	12.6%	7.0%	19.5%
1998	2.6	1.202	3.435	28.05%	13.4%	7.5%	20.9%
1999	2.3	1.102	17.323	25.72%	13.9%	8.0%	21.9%
2000	2.2	1.044	1.267	24.35%	13.2%	2.1%	15.3%
2001	2.3	1.288	1.787	30.04%	10.5%	4.3%	14.7%
2002	4.8	1.857	0.312	43.32%	4.2%	3.3%	7.5%
2003	4.7	2.132	3.137	49.74%	3.5%	3.7%	7.2%
2004	4.4	2.075	1.663	48.40%	5.5%	4.9%	10.3%
2005	3.7	1.826	0.323	42.59%	7.6%	3.7%	11.3%
2006	3.4	1.601	2.565	38.00%	-	-	-
	2005 5% - 95% Asymptotic Interval			35.2% - 50.1%			
	2006 5% - 95% Asymptotic Interval			29.7% - 45.0%			

Table 15a. Estimates of uncertainty as expressed by asymptotic 95% confidence intervals of spawning biomass and recruitment to age-0 from the base model. Deviations from log mean recruitment were estimated between 1967-2003 and values given for 1966 and 2004-2006 represent mean recruitment.

	Spawning biomass (millions, mt)			Recruitment to Age-0 (billions)		
		Asymptotic interval			Asymptotic interval	
Year	MLE	5%	95%	MLE	5%	95%
1966	3.814	3.460	4.161	4.974	4.536	5.447
1967	3.750	3.397	4.098	5.582	4.801	6.492
1968	3.660	3.307	4.008	5.908	5.122	6.818
1969	3.636	3.281	3.985	6.019	5.235	6.920
1970	3.628	3.264	3.987	15.027	13.242	17.060
1971	3.641	3.259	4.018	5.244	4.560	6.028
1972	3.856	3.437	4.270	2.889	2.488	3.353
1973	4.385	3.896	4.872	9.428	8.280	10.727
1974	4.589	4.061	5.114	2.368	2.049	2.738
1975	4.518	3.983	5.051	3.361	2.929	3.856
1976	4.507	3.960	5.051	1.931	1.656	2.251
1977	4.283	3.751	4.812	13.685	12.229	15.319
1978	3.990	3.491	4.487	1.774	1.519	2.073
1979	3.817	3.344	4.289	2.757	2.397	3.171
1980	4.012	3.530	4.491	33.618	30.730	36.784
1981	3.979	3.512	4.445	0.837	0.686	1.020
1982	3.771	3.334	4.207	0.357	0.272	0.467
1983	4.157	3.704	4.608	0.769	0.641	0.922
1984	4.615	4.141	5.088	17.771	16.599	18.991
1985	4.581	4.122	5.039	0.328	0.260	0.413
1986	4.197	3.787	4.606	0.851	0.740	0.978
1987	3.975	3.601	4.347	5.298	4.954	5.673
1988	3.725	3.386	4.064	2.326	2.144	2.525
1989	3.550	3.240	3.858	0.596	0.522	0.679
1990	3.259	2.982	3.535	2.859	2.662	3.067
1991	2.893	2.651	3.134	1.158	1.052	1.274
1992	2.471	2.263	2.677	0.567	0.499	0.644
1993	2.110	1.933	2.286	2.444	2.258	2.640
1994	1.816	1.665	1.966	2.910	2.673	3.163
1995	1.473	1.345	1.601	2.062	1.861	2.281
1996	1.293	1.180	1.405	1.988	1.762	2.238
1997	1.169	1.063	1.273	1.933	1.671	2.227
1998	1.056	0.954	1.157	2.814	2.365	3.328
1999	0.952	0.849	1.054	13.789	11.337	16.692
2000	0.880	0.767	0.990	0.990	0.770	1.264
2001	1.054	0.891	1.213	1.372	1.048	1.783
2002	1.485	1.217	1.746	0.234	0.147	0.371
2003	1.684	1.358	2.003	2.338	1.502	3.618
2004	1.617	1.280	1.945	1.446	0.417	5.004
2005	1.386	1.060	1.703	0.279	0.069	1.131
2006	1.178	0.857	1.491	2.192	0.366	13.103

Table 15b. Estimates of uncertainty as expressed by asymptotic 95% confidence intervals of spawning biomass and recruitment to age-0 from the alternative model. Deviations from log mean recruitment were estimated between 1967-2003 and values given for 1966 and 2004-2006 represent mean recruitment.

	Spawning biomass (millions, mt)			Recruitment to Age-0 (billions)		
		Asymptotic interval			Asymptotic interval	
Year	MLE	5%	95%	MLE	5%	95%
1966	4.287	3.764	4.810	5.593	4.955	6.313
1967	4.224	3.701	4.746	6.281	5.289	7.459
1968	4.133	3.611	4.656	6.634	5.623	7.825
1969	4.110	3.585	4.635	6.748	5.740	7.933
1970	4.108	3.572	4.645	16.828	14.480	19.557
1971	4.130	3.573	4.687	5.867	4.995	6.890
1972	4.372	3.767	4.977	3.228	2.726	3.821
1973	4.962	4.267	5.657	10.523	9.046	12.241
1974	5.190	4.450	5.929	2.637	2.237	3.109
1975	5.113	4.366	5.859	3.734	3.193	4.366
1976	5.101	4.345	5.857	2.140	1.807	2.536
1977	4.851	4.119	5.583	15.097	13.222	17.238
1978	4.518	3.832	5.204	1.952	1.646	2.315
1979	4.315	3.664	4.966	3.019	2.585	3.527
1980	4.518	3.860	5.175	36.826	32.934	41.176
1981	4.469	3.832	5.106	0.914	0.742	1.125
1982	4.231	3.633	4.830	0.388	0.294	0.511
1983	4.643	4.025	5.261	0.830	0.685	1.005
1984	5.134	4.487	5.782	19.113	17.489	20.888
1985	5.088	4.457	5.719	0.351	0.277	0.446
1986	4.654	4.085	5.223	0.908	0.782	1.055
1987	4.399	3.875	4.922	5.631	5.167	6.137
1988	4.117	3.638	4.595	2.470	2.240	2.724
1989	3.913	3.471	4.356	0.632	0.548	0.729
1990	3.589	3.189	3.989	3.029	2.771	3.311
1991	3.185	2.832	3.538	1.231	1.102	1.375
1992	2.724	2.418	3.030	0.607	0.527	0.698
1993	2.330	2.065	2.594	2.640	2.384	2.924
1994	2.007	1.778	2.235	3.190	2.848	3.573
1995	1.638	1.441	1.835	2.312	2.021	2.645
1996	1.443	1.266	1.620	2.275	1.945	2.661
1997	1.314	1.146	1.482	2.275	1.893	2.735
1998	1.202	1.037	1.368	3.435	2.774	4.253
1999	1.102	0.934	1.271	17.323	13.667	21.956
2000	1.044	0.860	1.227	1.267	0.953	1.684
2001	1.288	1.025	1.551	1.787	1.322	2.416
2002	1.857	1.437	2.277	0.312	0.192	0.505
2003	2.132	1.624	2.641	3.137	1.978	4.976
2004	2.075	1.552	2.598	1.663	0.467	5.924
2005	1.826	1.322	2.330	0.323	0.079	1.315
2006	1.601	1.109	2.093	2.565	0.428	15.370

Table 16. Three year projections of Pacific hake assuming the maximum potential catch would be removed under the 40:10 harvest control rule. Projections were based on the relative F contribution from the U.S. and Canadian fishery commensurate with the 74% and 26% coast wide national allocation.

		Spawning biomass millions mt			Depletion percent unfished biomass		
Year	Expected coastwide catch (mt)	Mean	5%	95%	Mean	5%	95%
Base model, h=0.75, q=1.0							
2006	593,750	1.174	0.857	1.491	30.8%	24.7%	36.9%
2007	358,420	0.864	0.636	1.092	22.7%	18.1%	27.2%
2008	213,220	0.679	0.485	0.873	17.8%	13.5%	22.1%
2009	183,620	0.657	0.337	0.976	17.2%	9.2%	25.3%
Alt. model, h=0.75, q prior							
2006	883,490	1.601	1.109	2.093	38.0%	29.7%	45.0%
2007	522,510	1.130	0.795	1.464	26.4%	21.0%	31.7%
2008	302,300	0.851	0.588	1.113	19.8%	15.1%	24.5%
2009	240,700	0.792	0.404	1.179	18.5%	10.0%	26.9%

Table 17. Comparison of likelihood components and derived quantities of interest from alternative models. Likelihood components in italics are not comparable to other values due to the exclusion of some data.

Likelihood components	**Base** **h = 0.75** **q = 1.0**	**Alt.** **h = 0.75** **q prior**	Asymptotic free m	q prior	no < 1992 q prior	h = 1.0	Asymptotic selectivity
Total negative log-likelihood	10,459.8	10,451.5	10,756.3	10,450.1	*9,958.1*	10,458.7	10,941.6
Indices	26.2	21.7	26.5	21.8	*20.9*	26.9	21.2
Length comps	1,798.3	1,800.7	1,852.4	1,799.2	*1,786.4*	1,797.9	1,835.2
Age comps	8,608.6	8,597.3	8,847.6	8,597.4	*8,121.6*	8,607.3	9,056.2
Recruitment devs	23.3	23.3	26.5	23.2	*22.9*	23.3	25.8
Parameter priors	0.0	5.1	0.0	5.3	*3.0*	0.0	0.0
Forecast devs	3.3	3.3	3.3	3.1	*3.3*	3.3	3.1
By fleet							
US. Fishery							
Length comps	1,212.9	1,217.3	1,241.9	1,215.7	1,216.5	1,212.5	1,228.5
Age comps	5,078.9	5,070.7	5,270.9	5,070.9	5,088.8	5,080.5	5,300.6
Canadian fishery							
Length comps	496.0	494.4	517.2	494.7	496.7	496.2	518.7
Age comps	2,175.2	2,176.4	2,119.3	2,177.6	2,150.1	2,174.2	2,103.5
Acoustic survey							
Index	7.3	1.9	9.6	2.0	*-0.4*	7.8	4.6
Length comps	89.4	88.9	93.3	88.8	*73.3*	89.3	88.1
Age comps	1,354.5	1,350.2	1,457.4	1,349.0	*882.6*	1,352.6	1,652.1
Recruitment survey							
Index	18.9	19.9	16.9	19.9	21.3	19.2	16.6
Derived quantities							
Sbzero	3,810,000	4,286,920	3,542,590	4,105,780	4,203,785	3,639,110	1,961,335
2006 depletion	0.308	0.380	0.197	0.407	0.495	0.337	0.097
2006 SB	1,175,000	1,600,895	1,395,620	3,342,960	4,161,910	2,454,090	379,228
2005 SPR	0.618	0.686	0.628	0.694	0.739	0.628	0.294
2006 OY	593,746	883,490	411,747	941,708	1,205,510	648,139	10

Table 18. Decision table showing the consquences of management action given a state of nature. States of nature include the base model (h=0.75, q=1.0) and the alternative model (h=0.75, q prior). The management actions include the OY from each state of nature and two constant coastwide catch scenarios.

			State of Nature	
Relative probability			**0.50**	**0.50**
Model			h = 0.75, q = 1.0	h = 0.75, q prior
Management action	Total coast-wide Catch (mt)	Year	Relative depletion (2.5%-97.5% interval)	
OY Model h=0.75, q=1.0	593,746	2006	0.308 (0.247-0.369)	0.380 (0.304-0.457)
	358,416	2007	0.227 (0.181-0.272)	0.310 (0.219-0.401)
	213,223	2008	0.178 (0.135-0.221)	0.263 (0.164-0.363)
	183,620	2009	0.172 (0.092-0.253)	0.254 (0.127-0.380)
OY Model h=0.75, q prior	883,490	2006	0.308 (0.247-0.369)	0.380 (0.304-0.457)
	522,511	2007	0.202 (0.125-0.279)	0.268 (0.215-0.322)
	302,298	2008	0.144 (0.056-0.232)	0.202 (0.155-0.249)
	240,702	2009	0.136 (0.020-0.252)	0.188 (0.104-0.273)
Total coast-wide	200,000	2006	0.308 (0.247-0.369)	0.380 (0.304-0.457)
catch = 200,000 mt	200,000	2007	0.282 (0.209-0.354)	0.351 (0.264-0.438)
	200,000	2008	0.250 (0.167-0.333)	0.315 (0.219-0.411)
	200,000	2009	0.239 (0.125-0.352)	0.299 (0.175-0.423)
Total coast-wide	400,000	2006	0.308 (0.247-0.369)	0.380 (0.304-0.457)
catch = 400,000 mt	400,000	2007	0.258 (0.184-0.332)	0.330 (0.241-0.419)
	400,000	2008	0.207 (0.122-0.292)	0.276 (0.177-0.375)
	400,000	2009	0.178 (0.063-0.294)	0.245 (0.118-0.372)

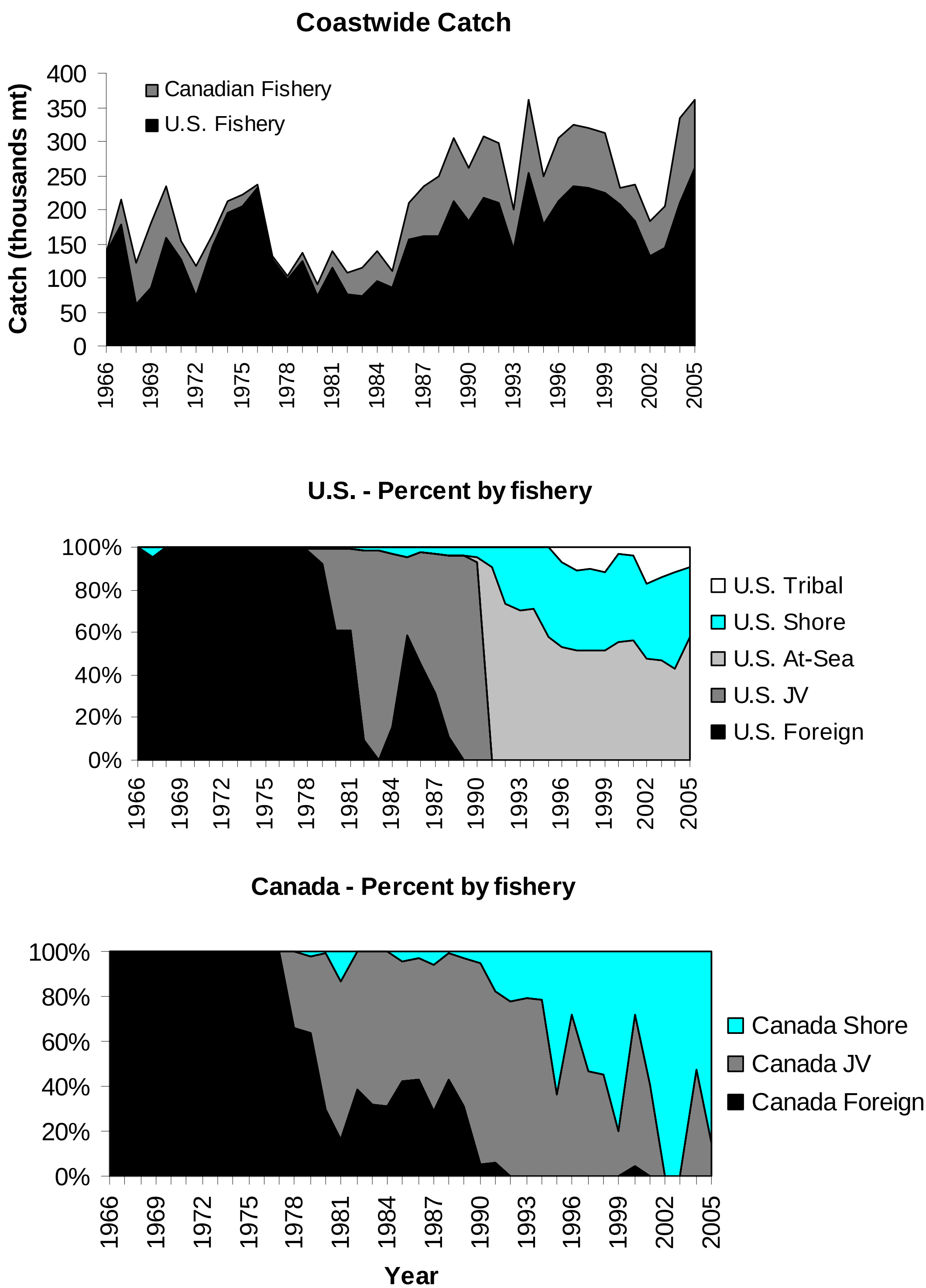


Figure 1. Pacific hake catches by fishery and proportions by fishing sector for U.S. and Canada, 1966-2005.

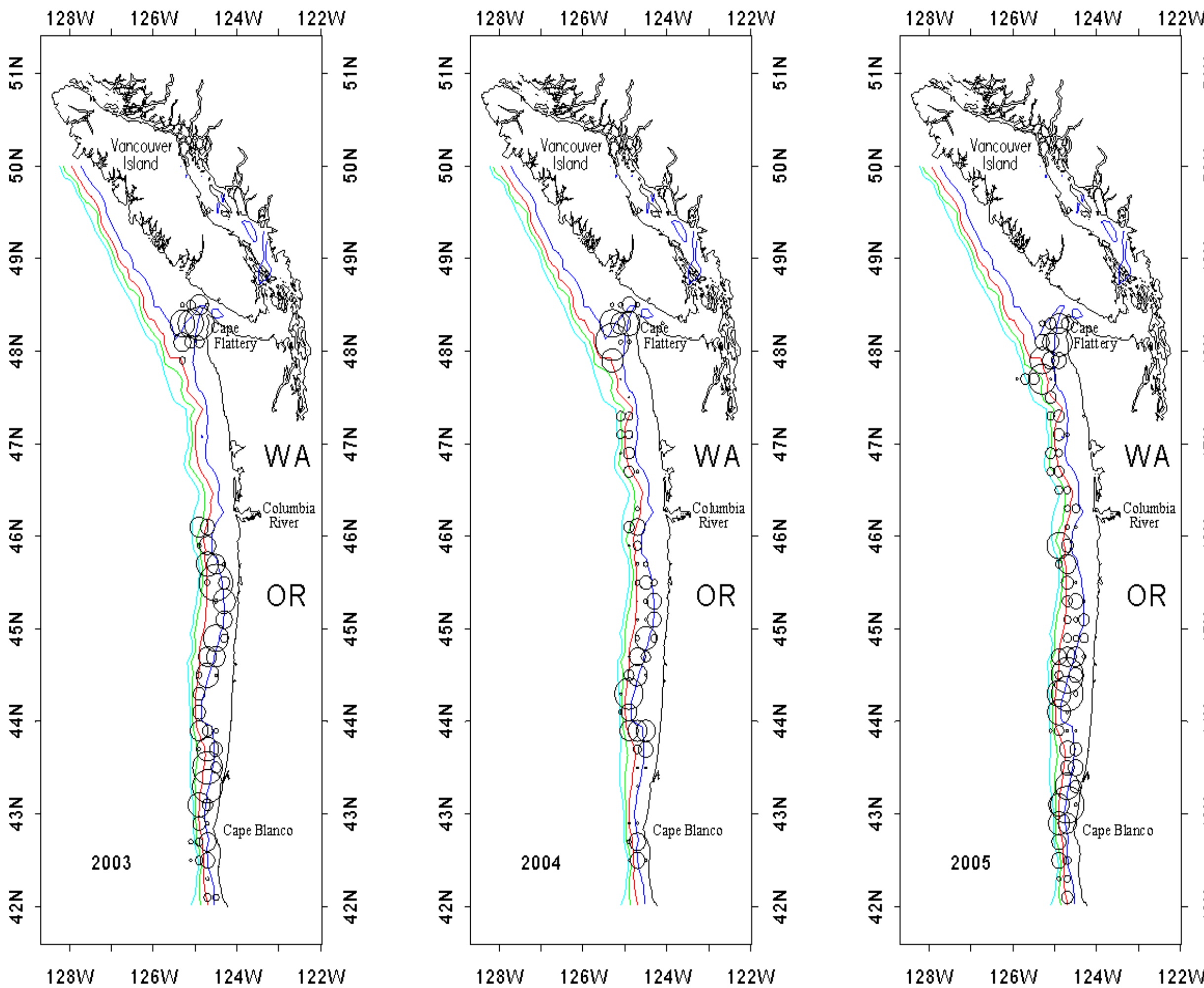


Figure 2. Plot of at-sea Pacific hake catches off the west coast of the U.S. in 2003 (left), 2004 (middle), and 2005 (right). Size of circle represents magnitude of individual hauls.

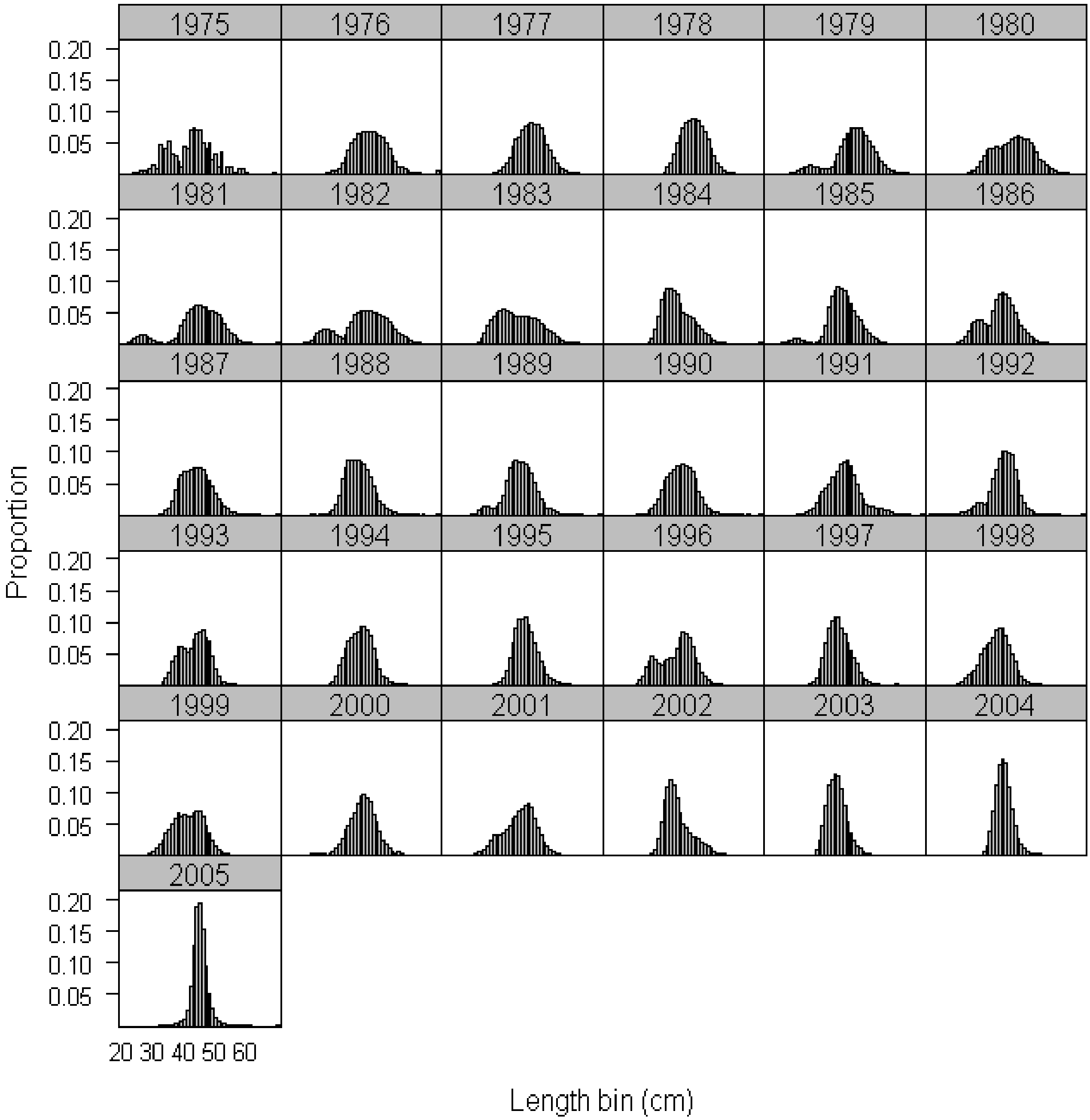


Figure 3. Plot of composite U.S. fishery size compositions of Pacific hake from fisheries operating off the west coast of the U.S., 1975-2005.

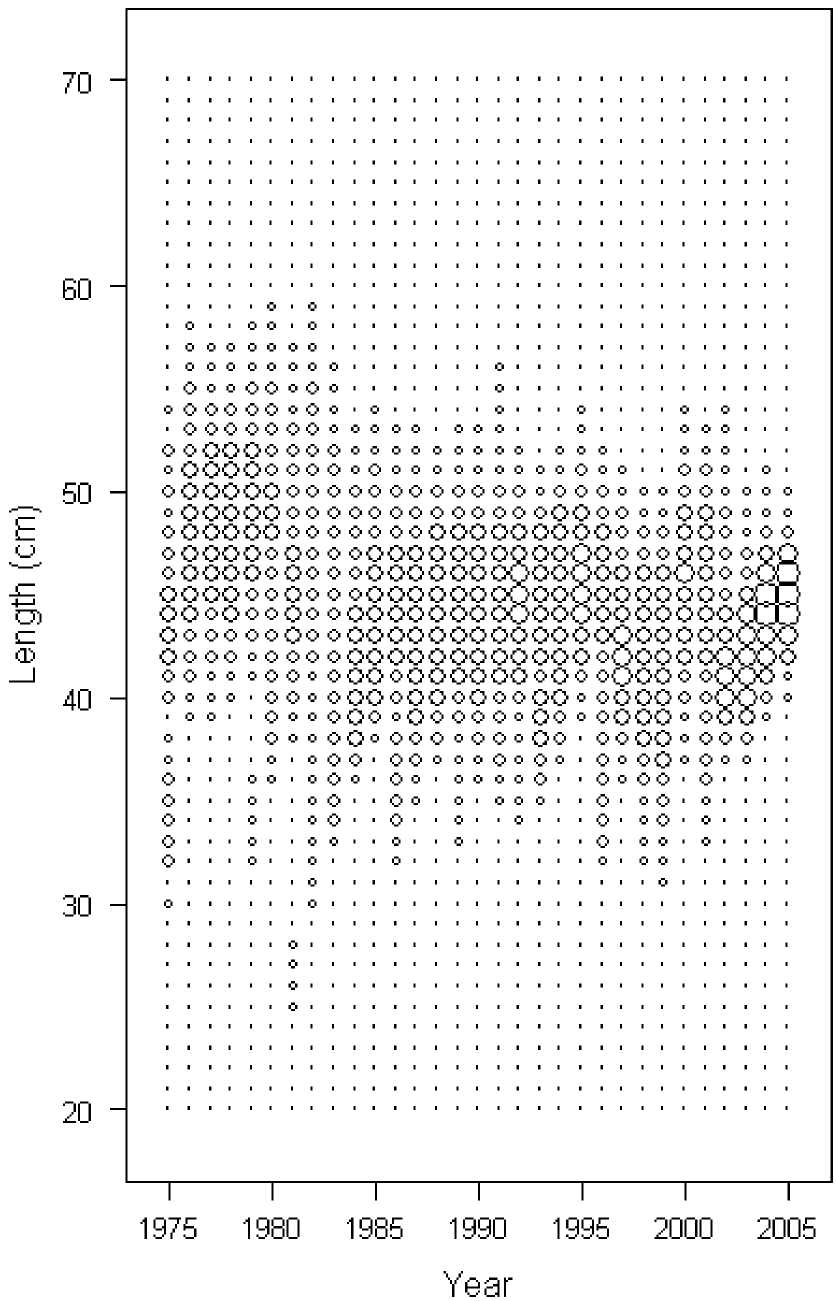


Figure 4. Composite U.S. fishery size compositions of Pacific hake from all fisheries operating off the west coast of the U.S., 1975-2005. Diameter of circles are proportional by year.

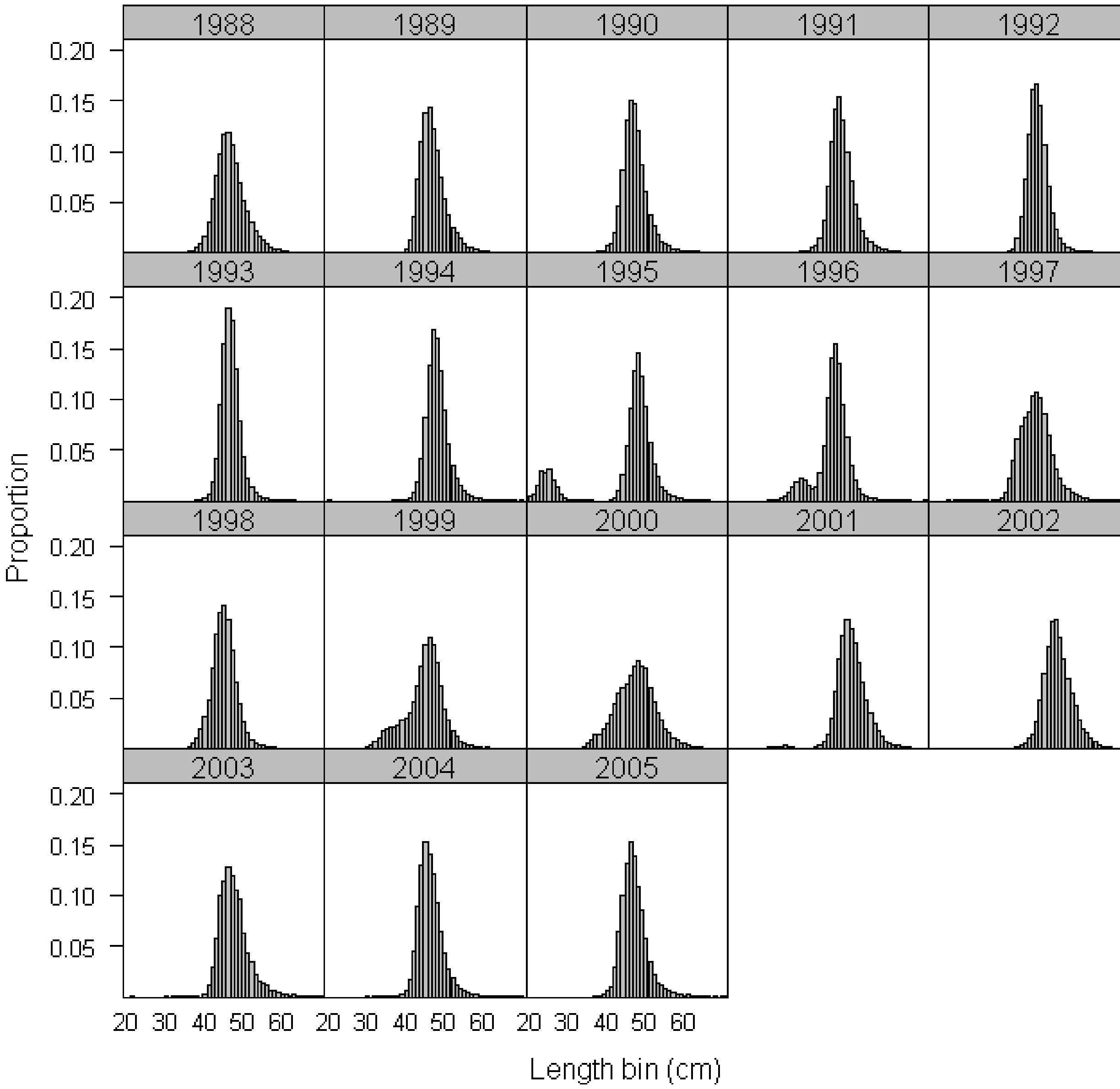


Figure 5. Plot of composite Canadian fishery size compositions of Pacific hake from fisheries operating off the west coast of the U.S., 1975-2005.

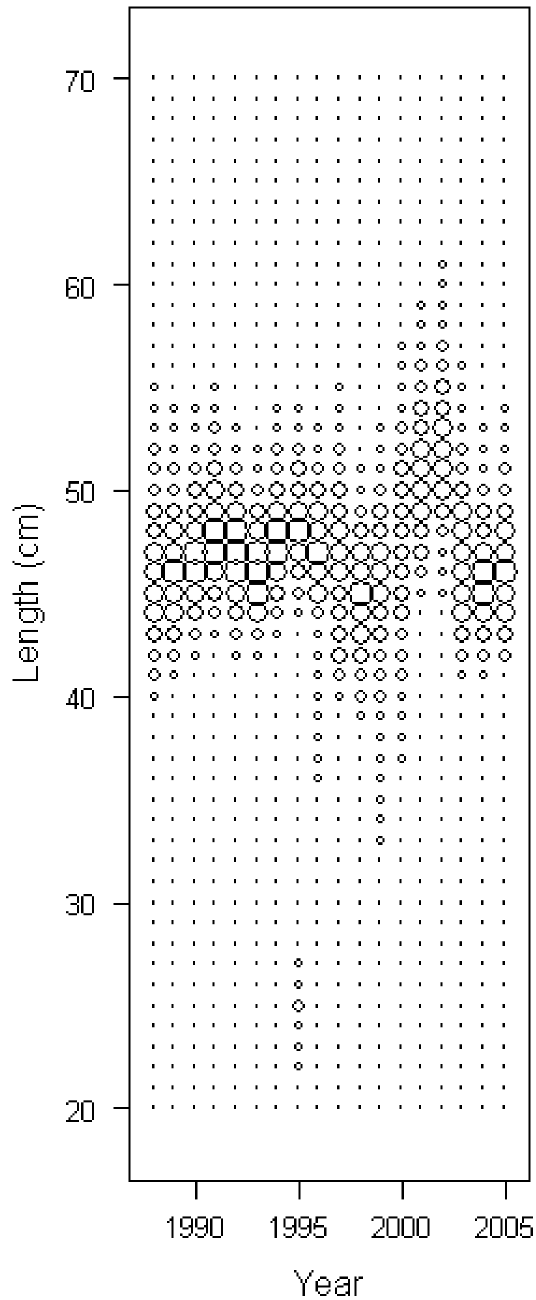


Figure 6. Size compositions of Pacific hake from the acoustic survey. Diameter of circles are proportional by year.

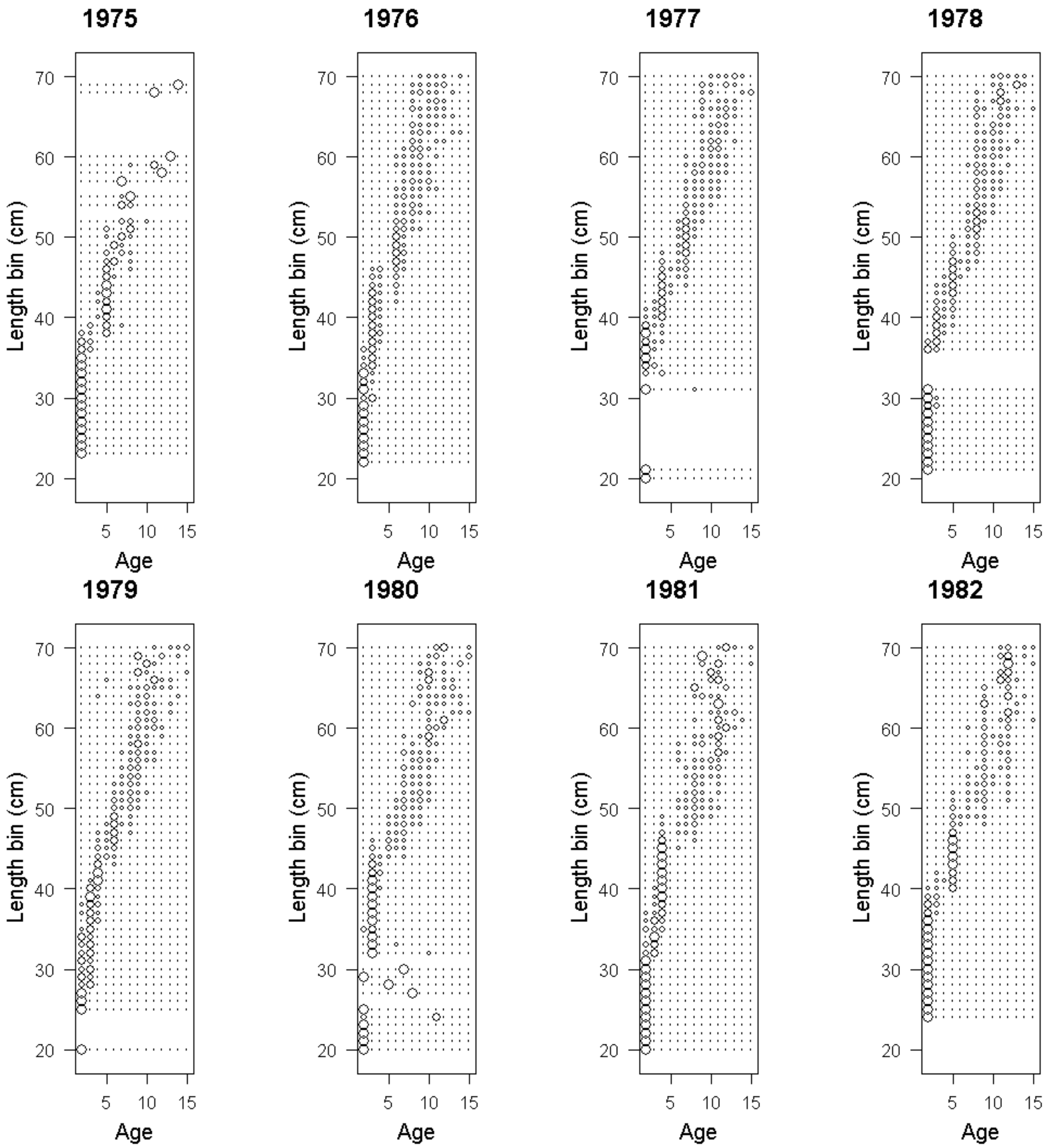


Figure 7. Bubble plots of U.S. fishery conditional age at length composition of Pacific hake by year (as input directly into model). Circle diameter is proportional within length class.

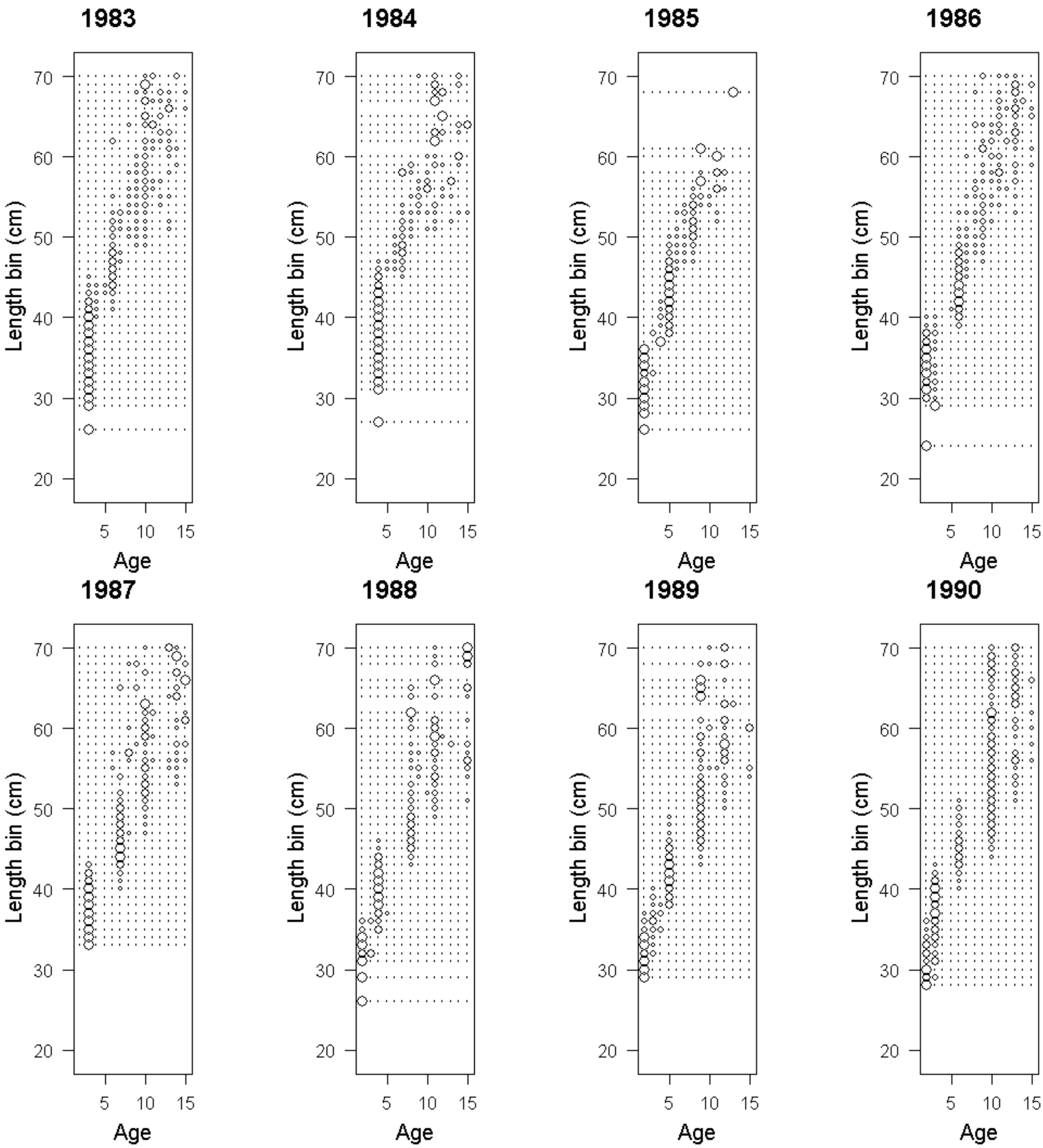


Figure 7 (continued).

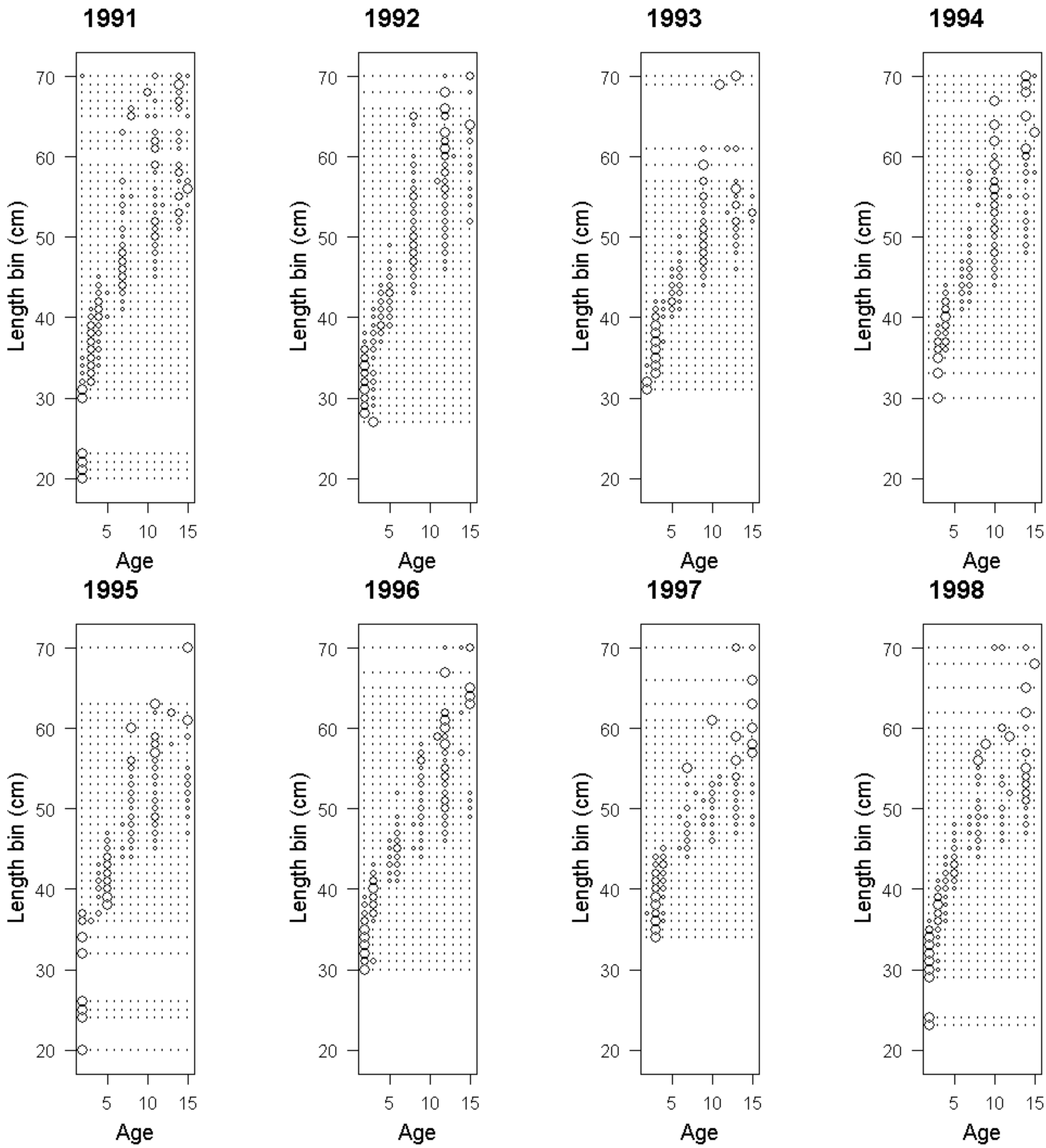


Figure 7 (continued).

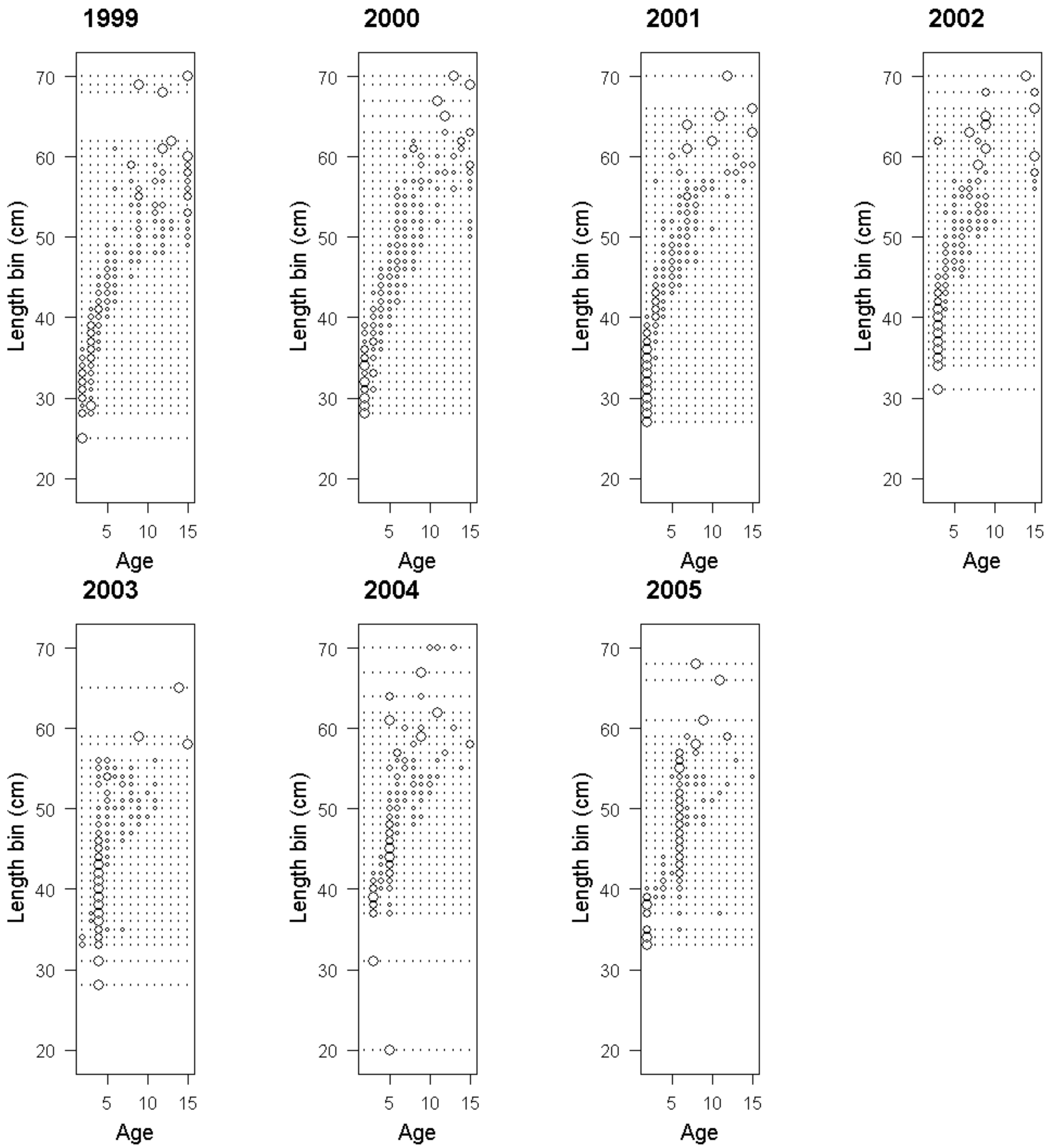


Figure 7 (continued).

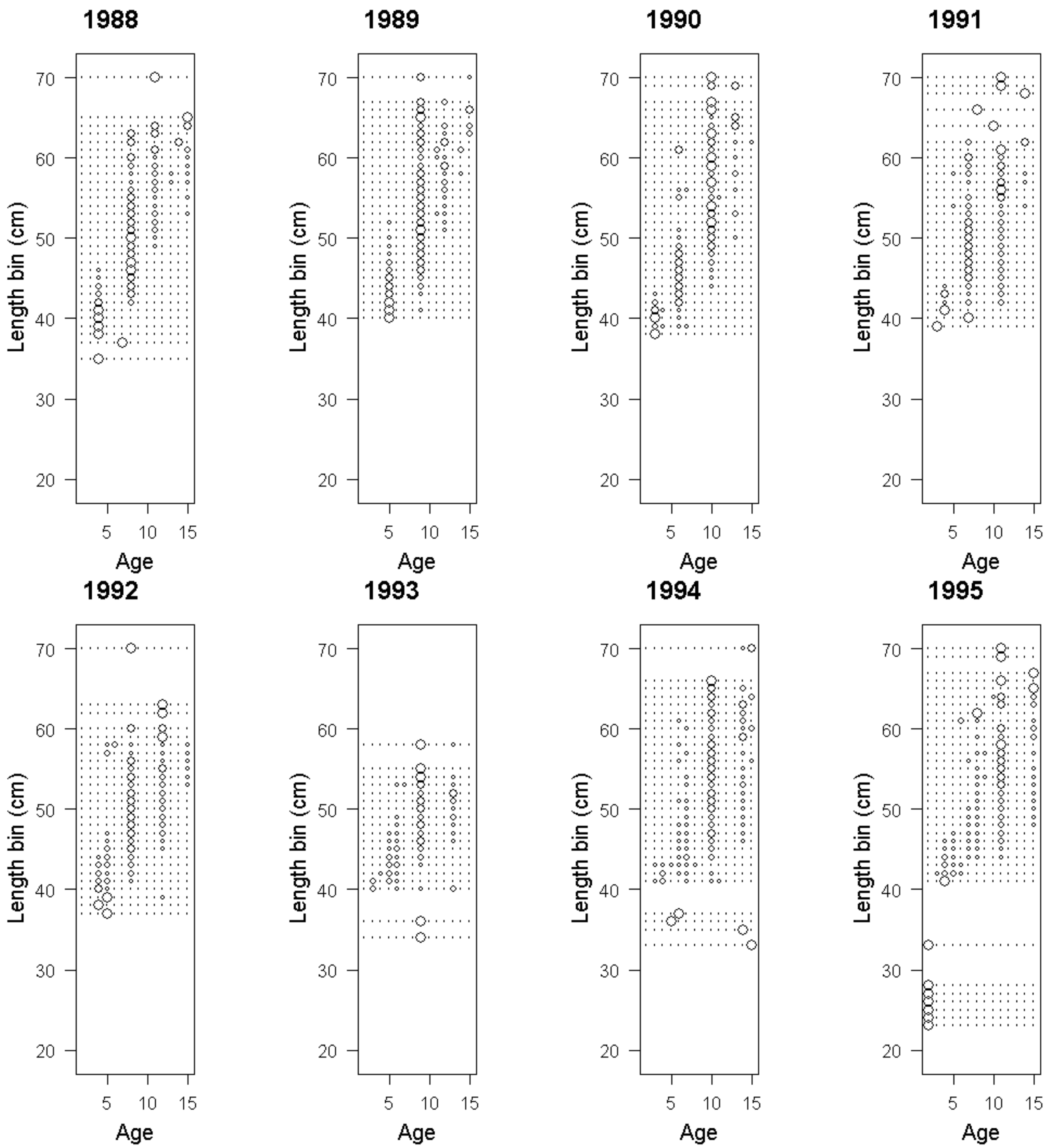


Figure 8. Bubble plots of Canadian fishery conditional age at length composition of Pacific hake by year (as input directly into model). Circle diameter is proportional within length class.

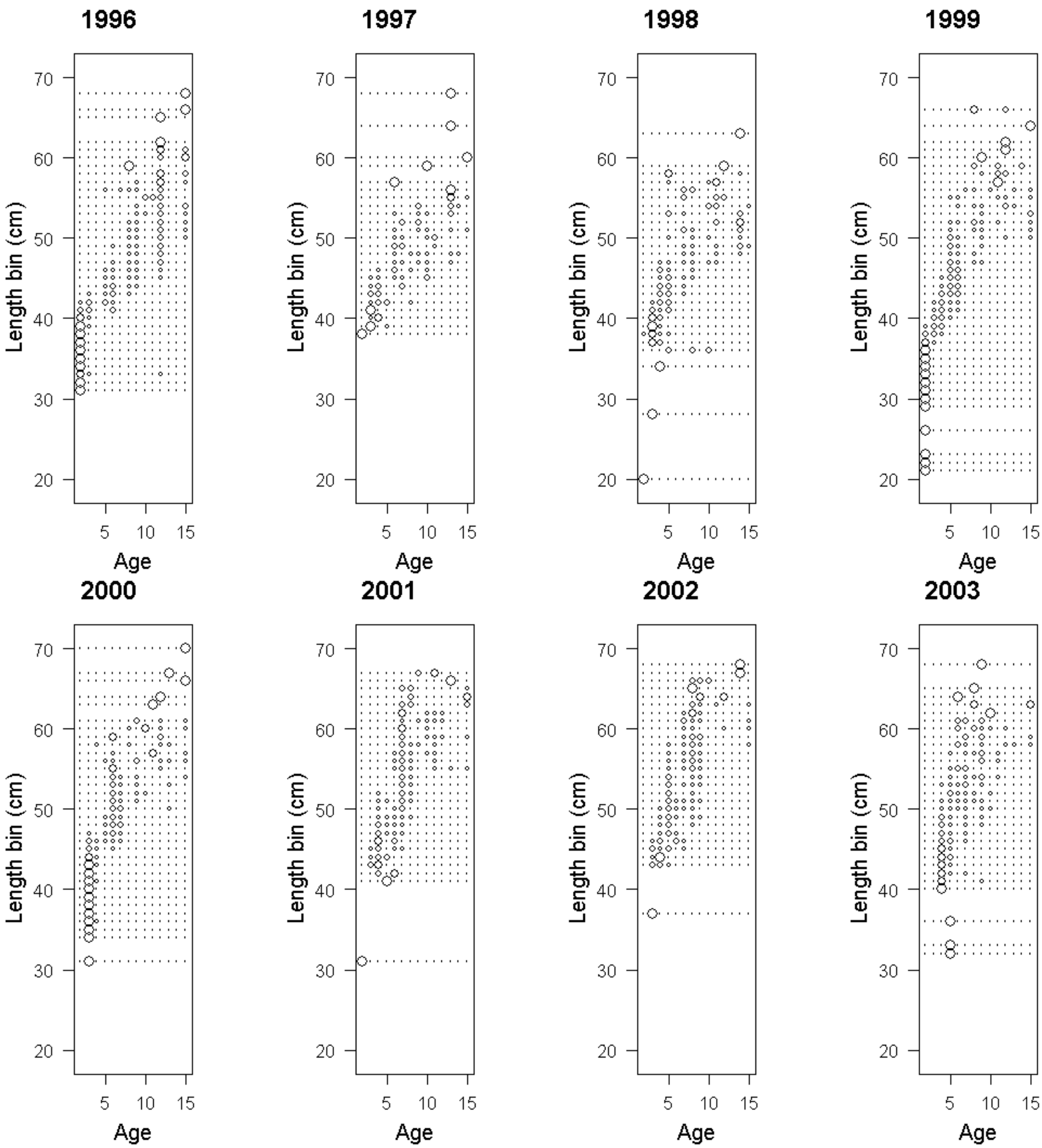


Figure 8 (continued).

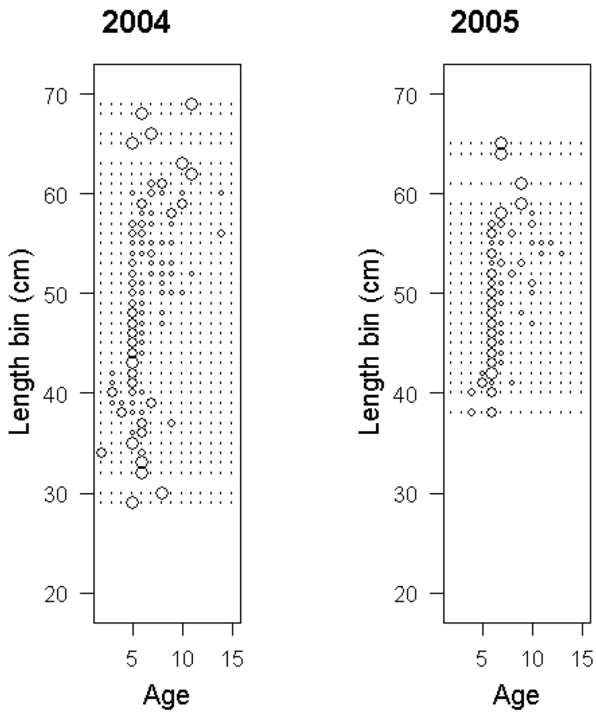


Figure 8 (continued).

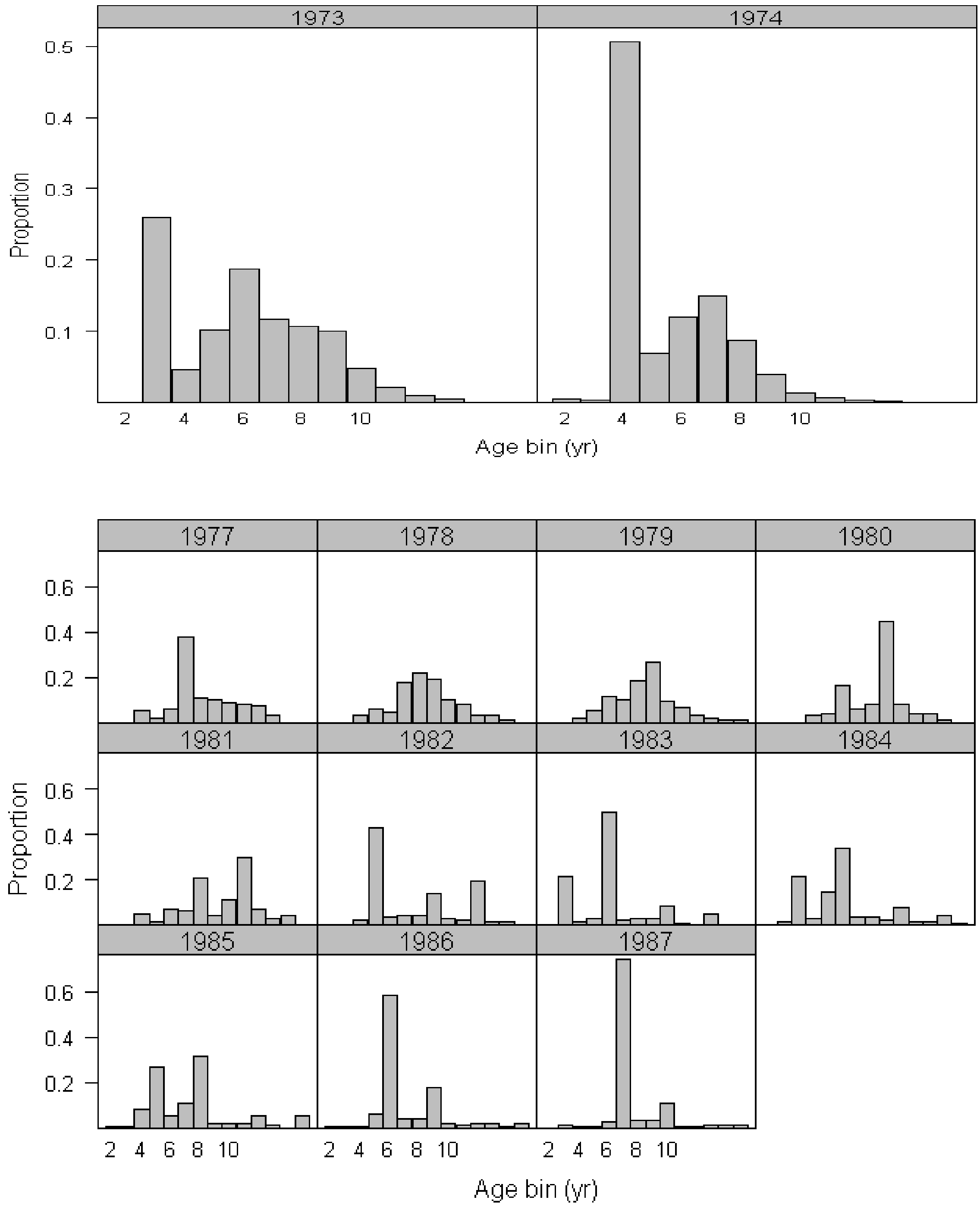


Figure 9. U.S. fishery age composition (top panel) and Canadian fishery age composition (bottom panel) of Pacific hake from previous model used in current assessment model.

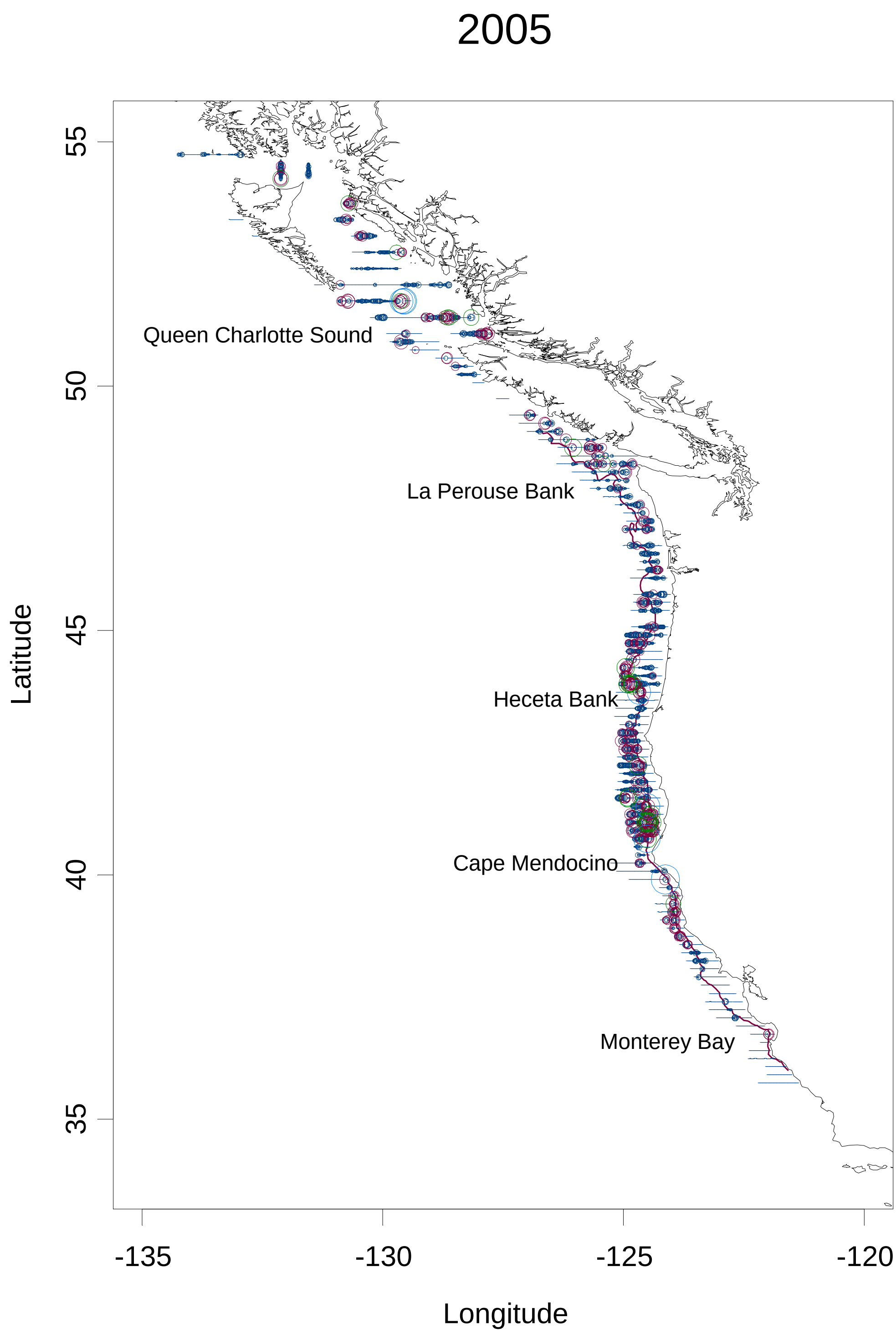


Figure 10. Line transects and occurrence of acoustic area backscattering attributable to Pacific hake in the 2005 joint US-Canada acoustic survey. Diameter of circles is proportional to measured backscatter levels.

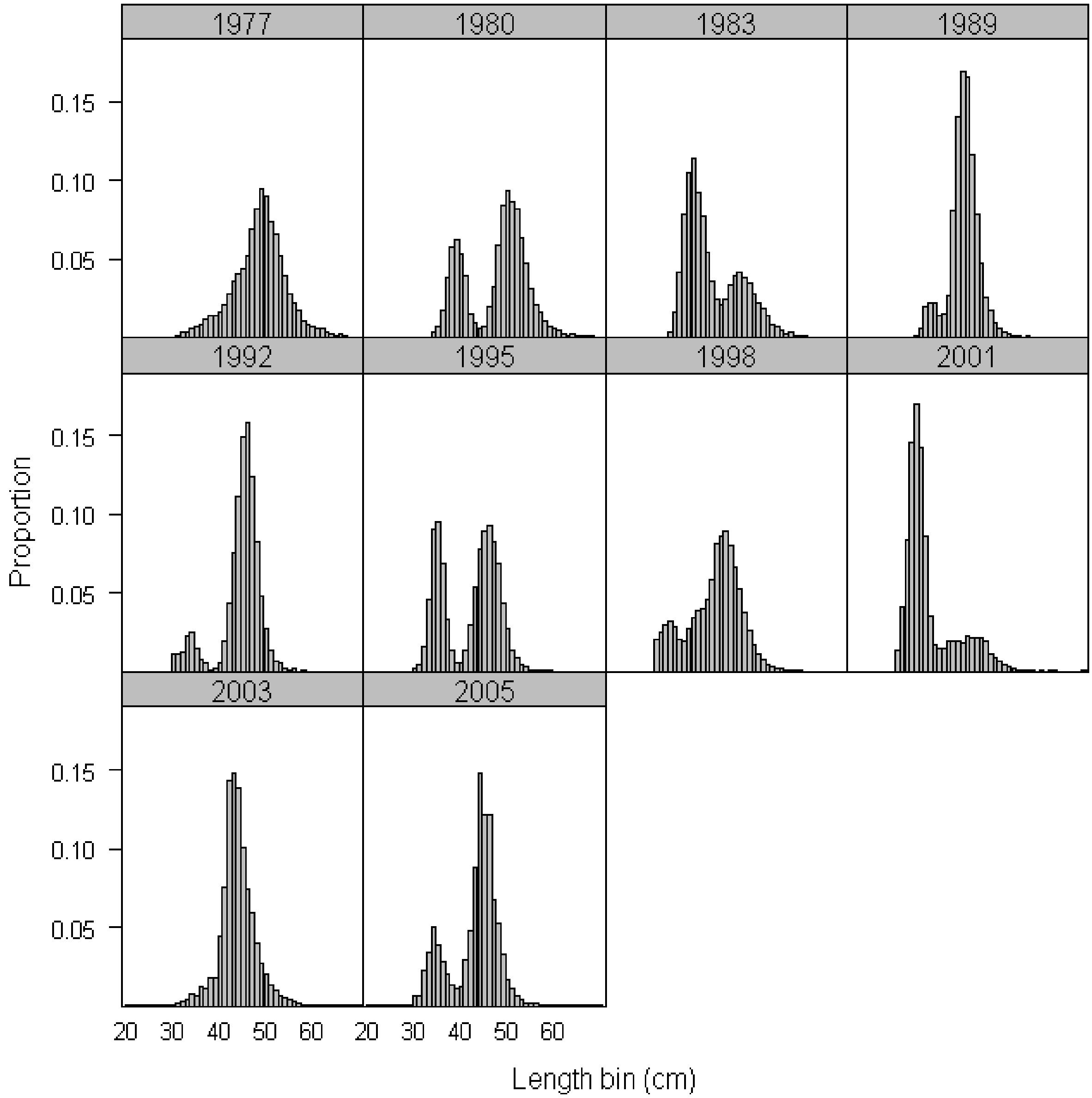


Figure 11. Plot of size compositions of Pacific hake sampled in acoustic surveys, 1977-2005.

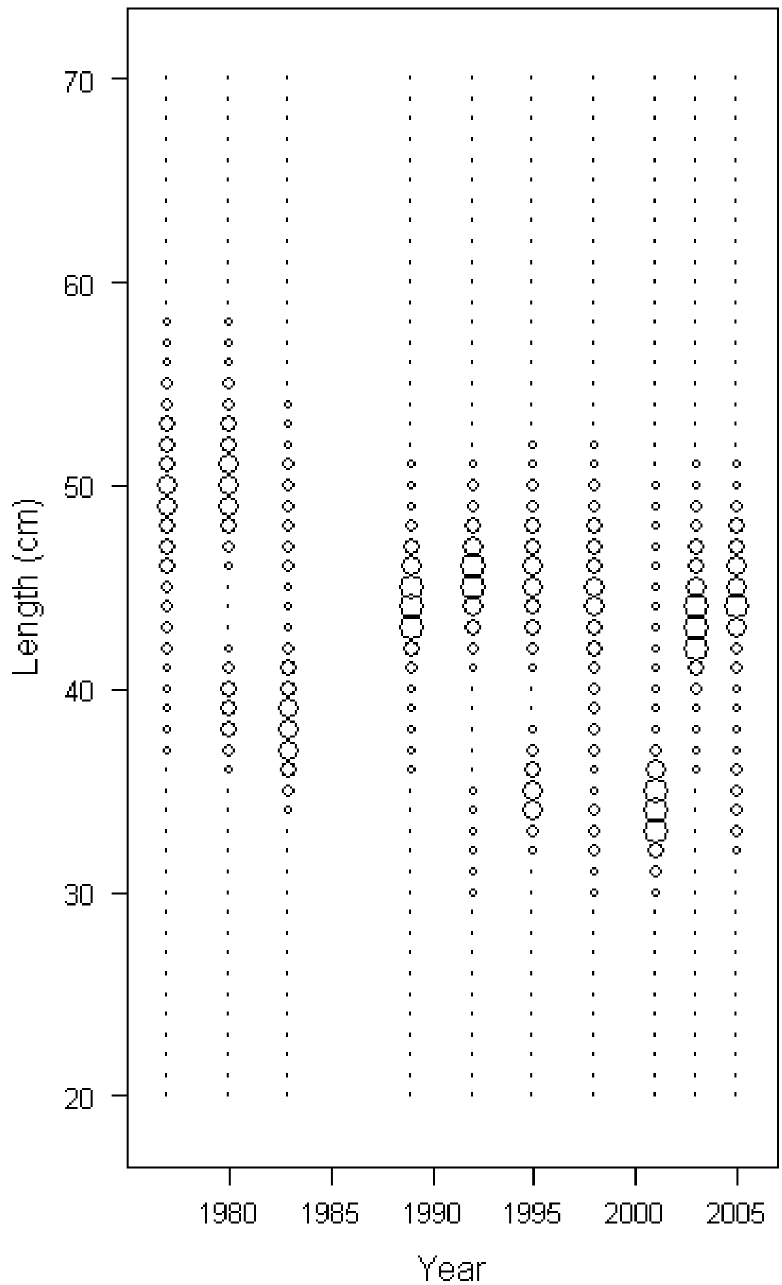


Figure 12. Composite Canadian fishery size compositions of Pacific hake from all fisheries Operating in Canadian waters., 1975-2005. Proportions sum to unit by year.

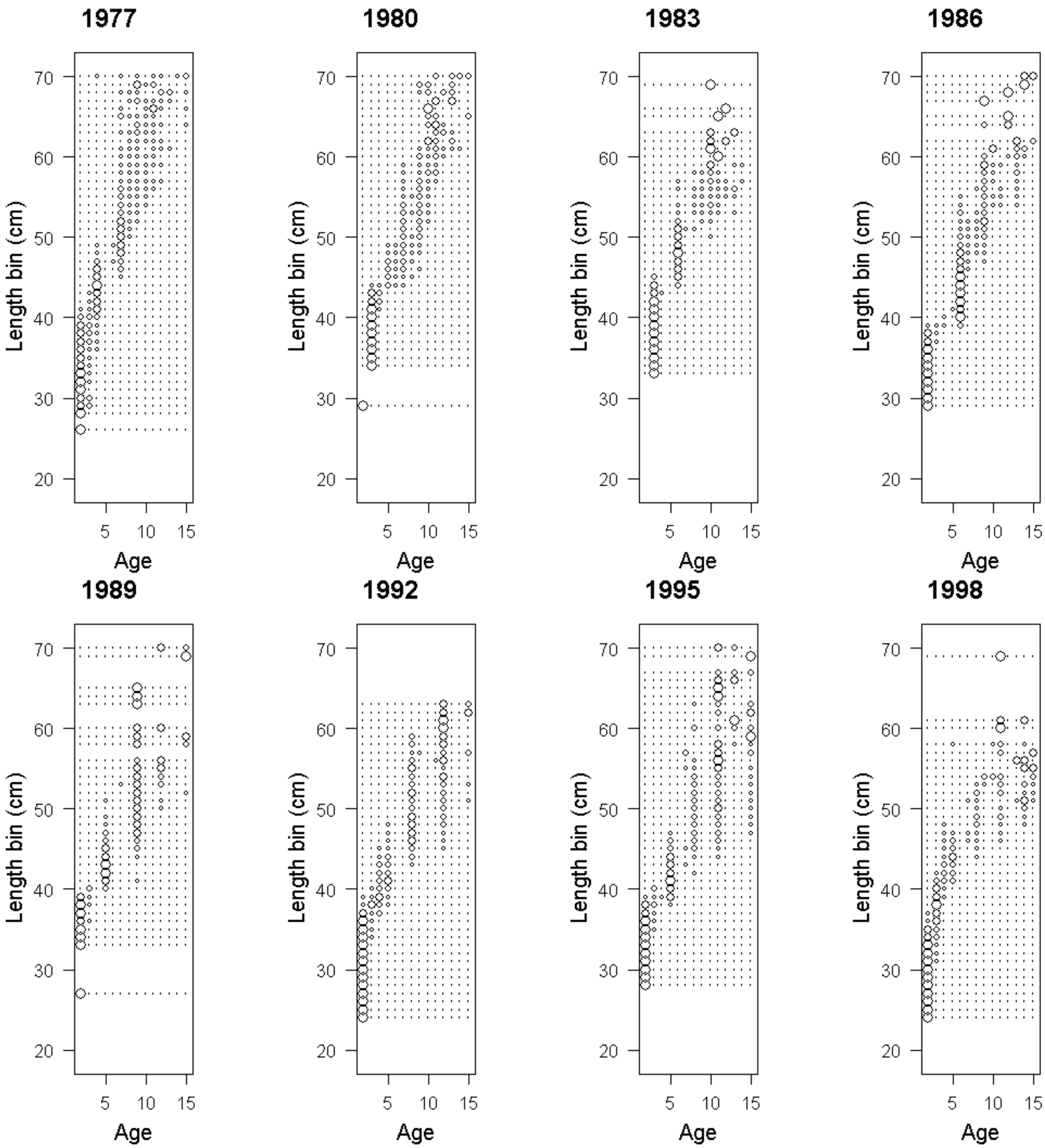


Figure 13. Bubble plots of acoustic survey conditional age at length composition by year (as input directly into model). Circle diameter is proportional within length class.

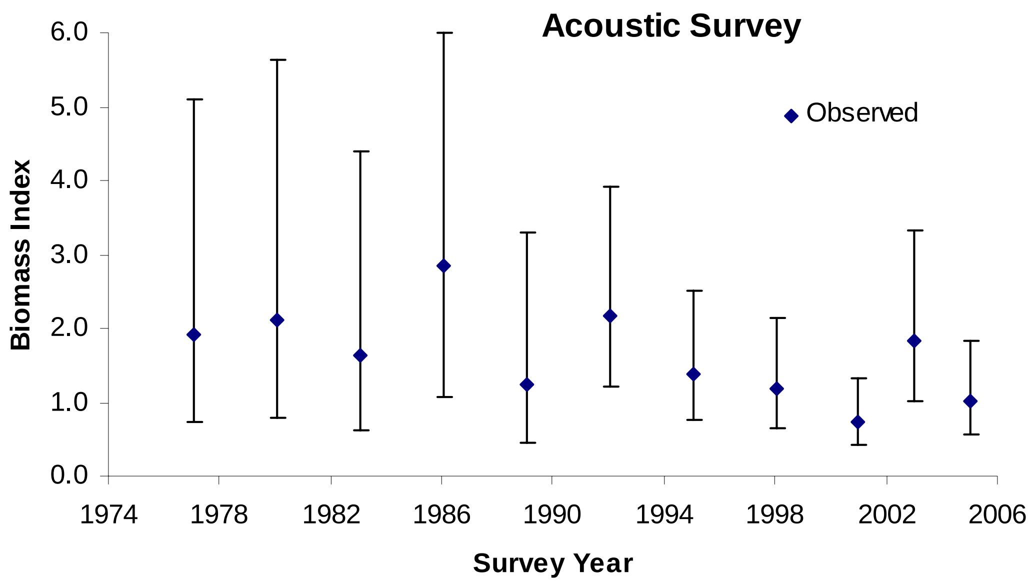


Figure 14. Time series of acoustic survey Pacific hake biomass (millions mt), 1977-2005. Error bars are not estimated but rather assumed based on the reliability of the survey.

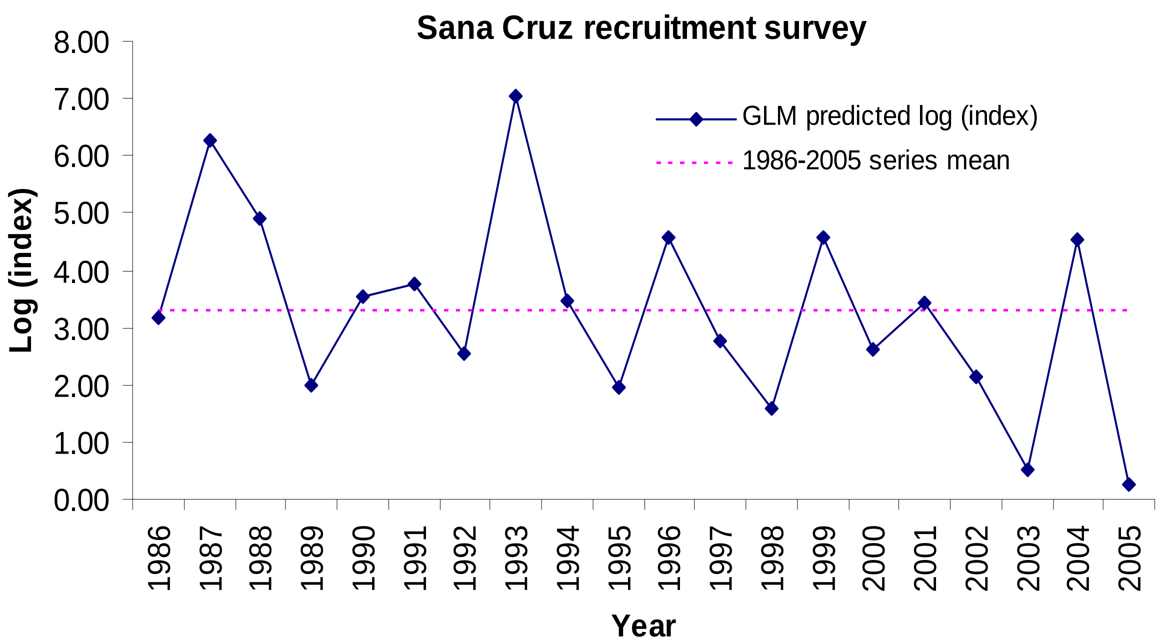


Figure 15. Plot of time series of the Santa Cruz pre-recruit survey for young-of-year Pacific hake.

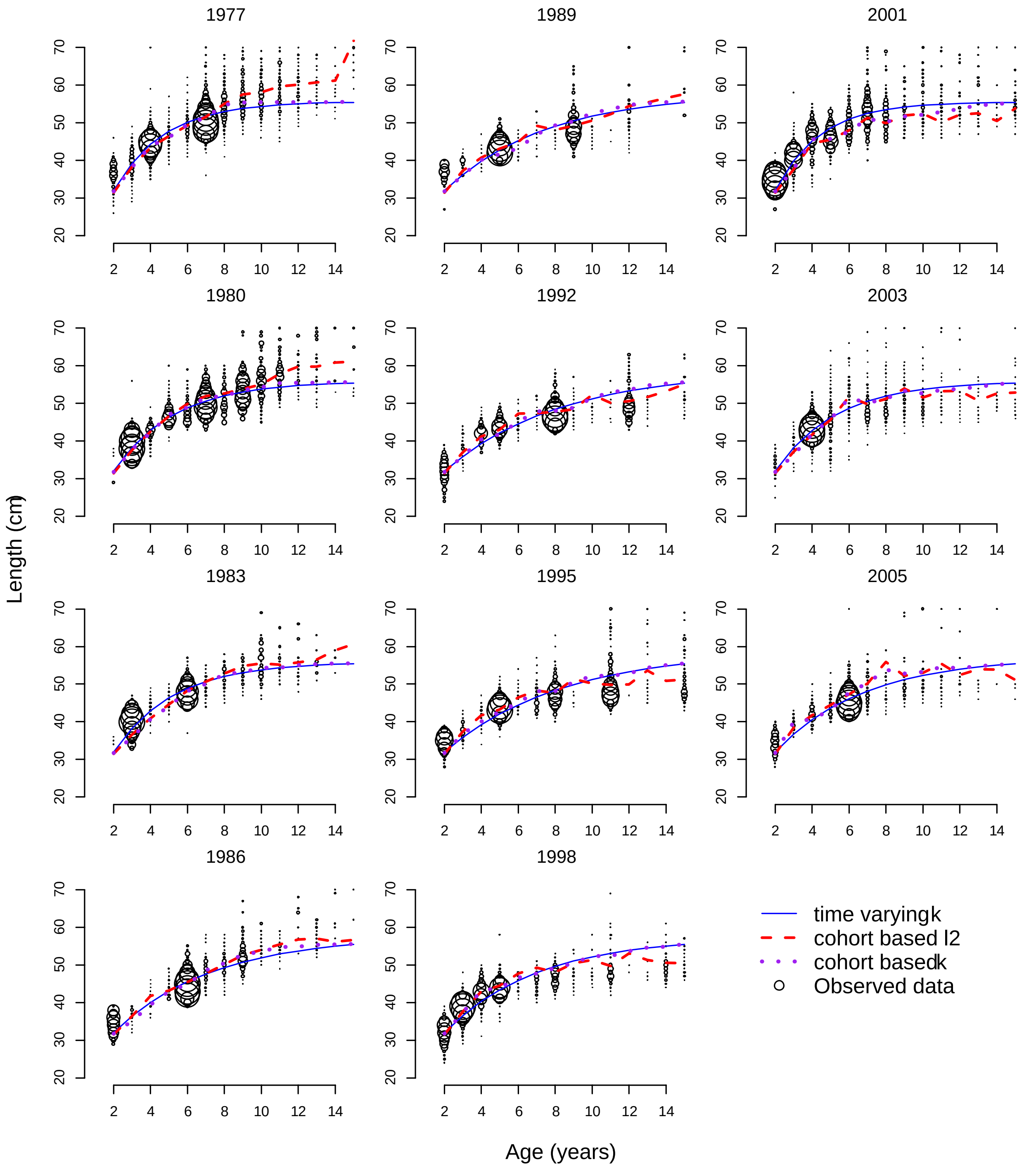


Figure 16. Time varying and cohort based fits of the von Bertalanffy growth model to Pacific hake age data from the acoustic survey, 1977-2005. Growth trajectories show expected size at age based on the different models applied.

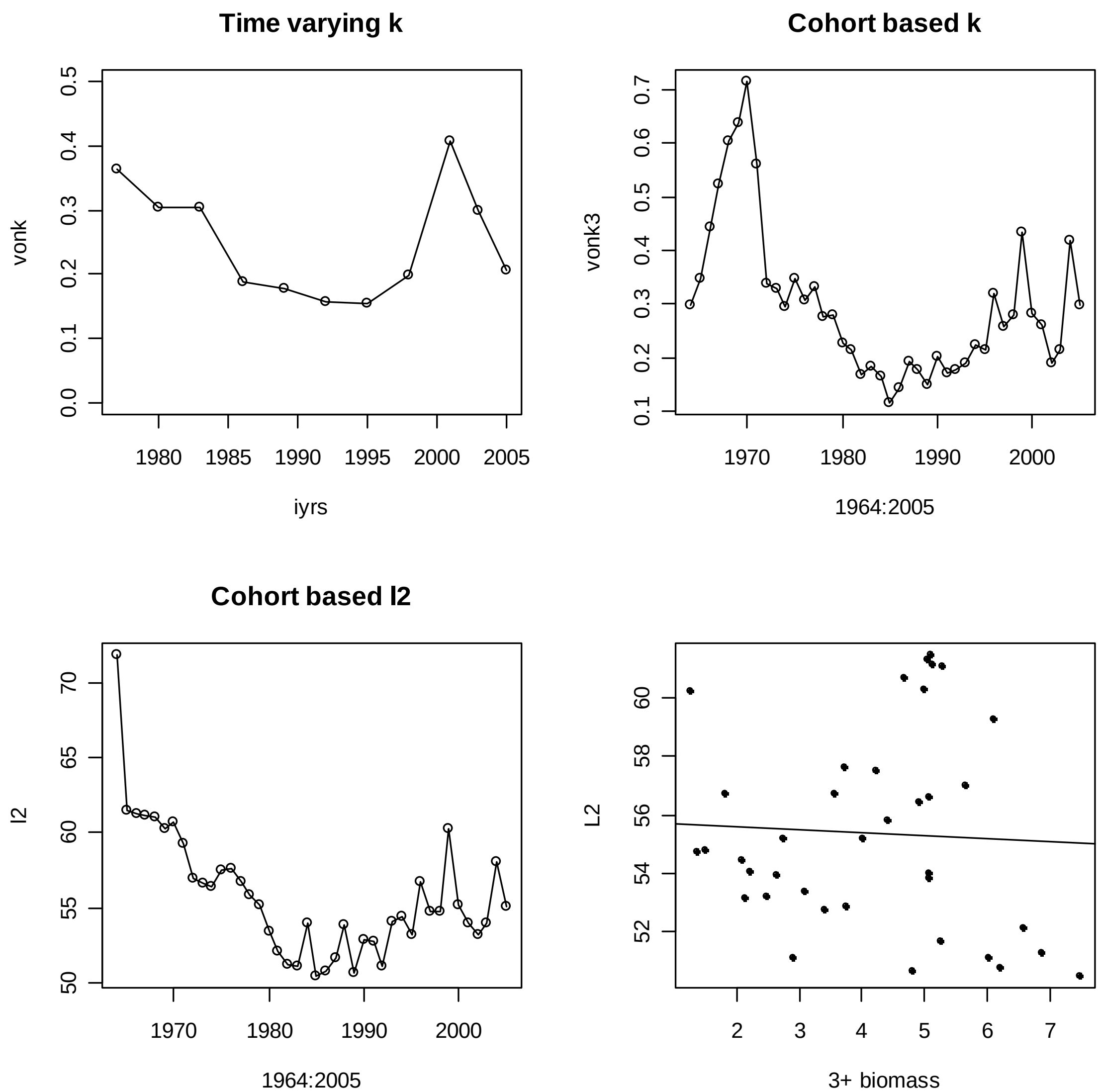


Figure 17. Time varying and cohort based fits of the von Bertalanffy growth model to Pacific hake age data from the acoustic survey, 1977-2005.

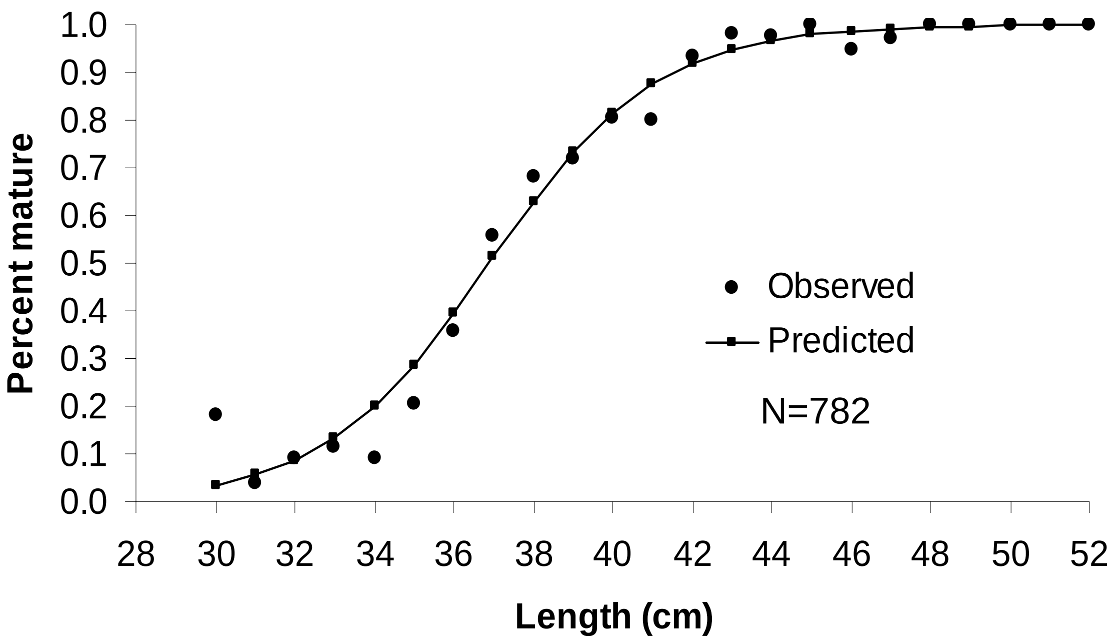


Figure 18. Observed and predicted fraction of Pacific hake mature at length.

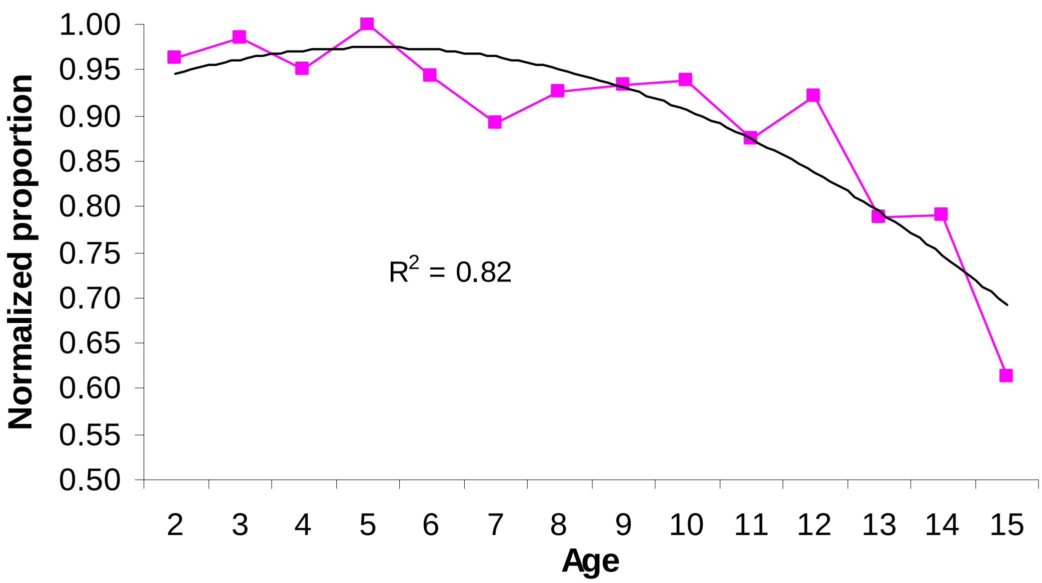


Figure 19. Plot of the normalized (divided by maximum value) average (1977-2001) ratio of acoustic survey numbers at age to the sum of acoustic survey and triennial bottom trawl survey numbers at age. This analysis was used as empirical evidence for exploration of dome-shaped selectivity in the acoustic survey.

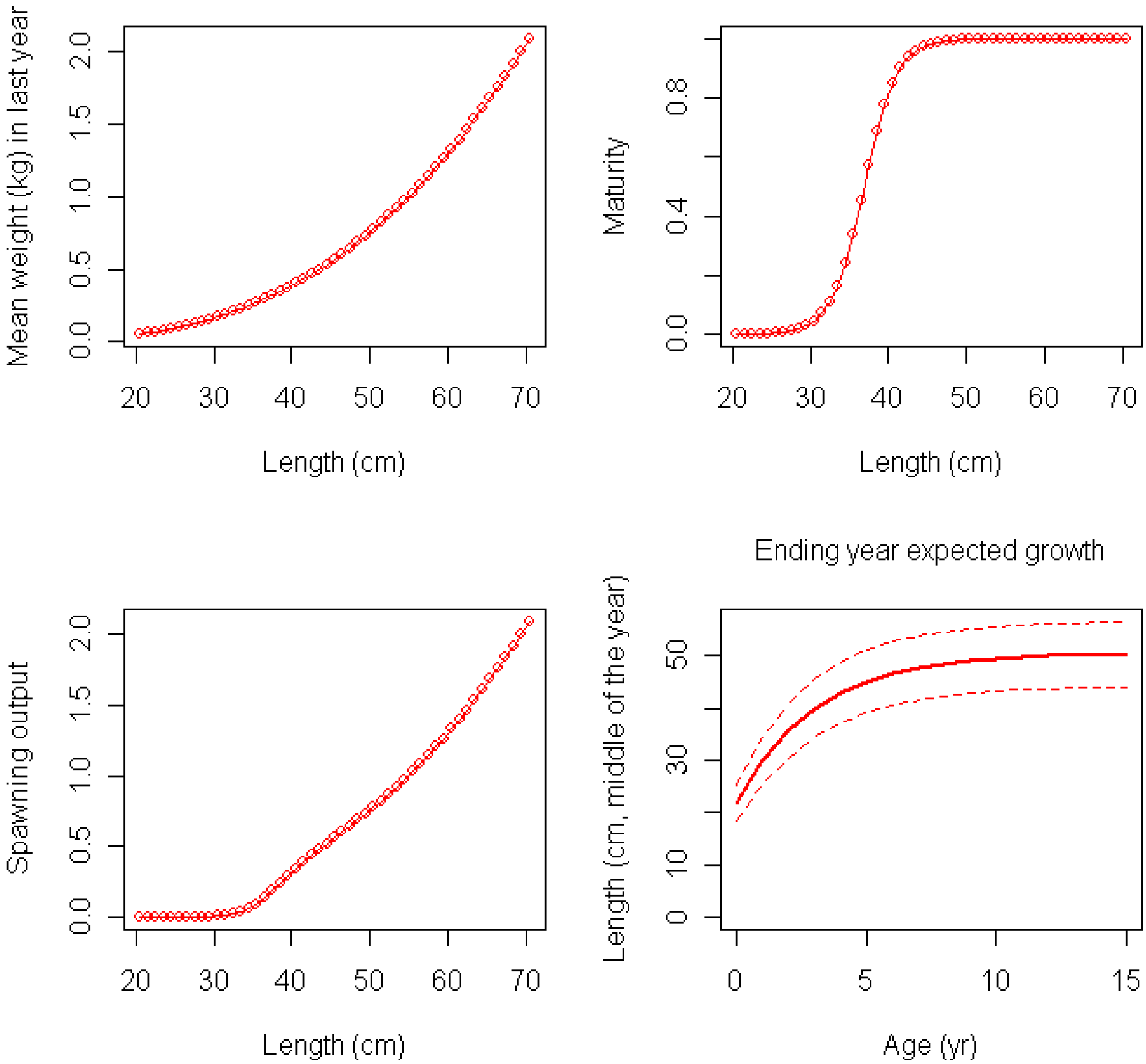


Figure 20. Biological parameters (functional forms) assumed in the hake model.

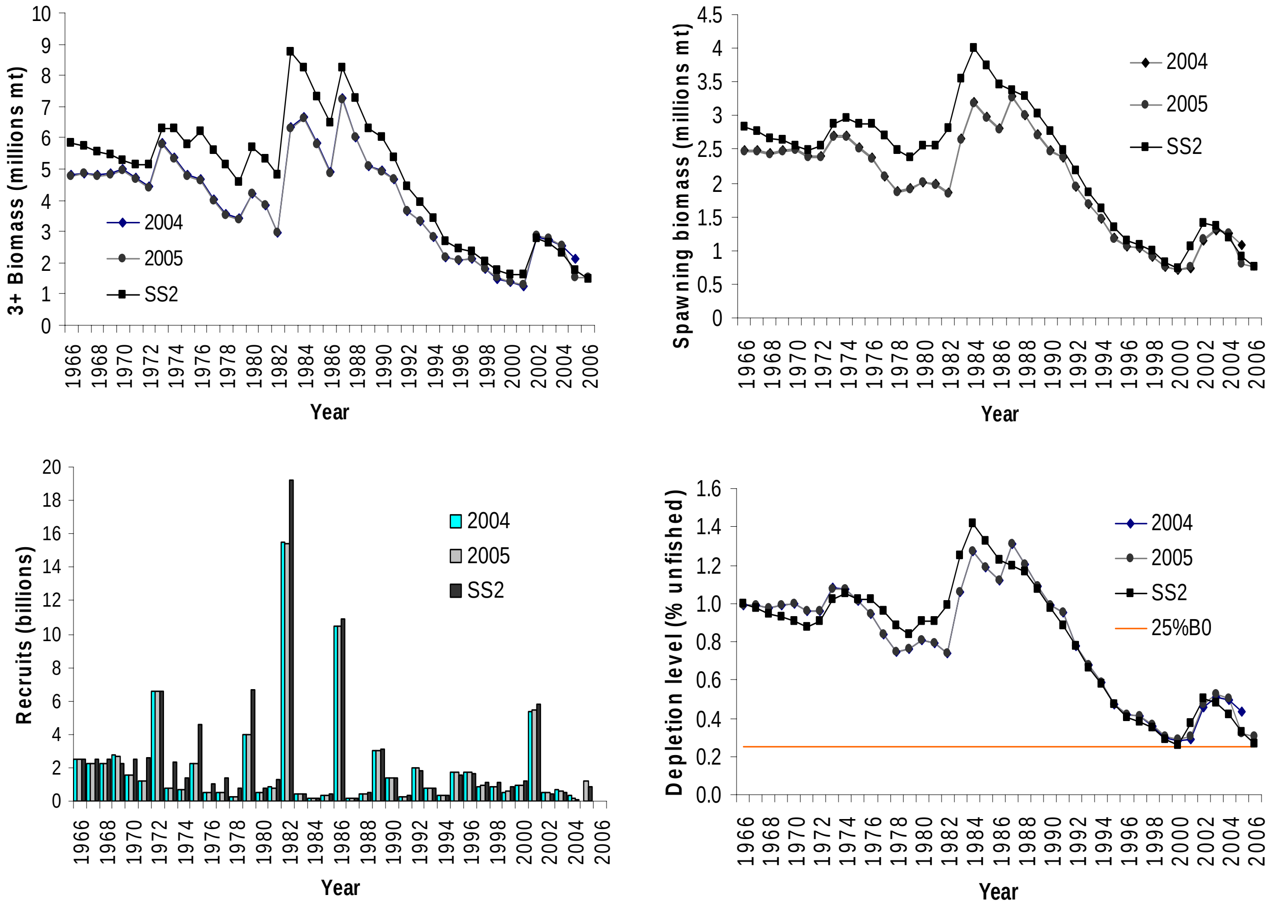


Figure 21. Time series of summary biomass (3 +), spawning biomass, recruitment (age 2) and depletion from comparative assessment model results; old hake model (Helser et. al. 2004) vs. SS2 (Methot 2005).

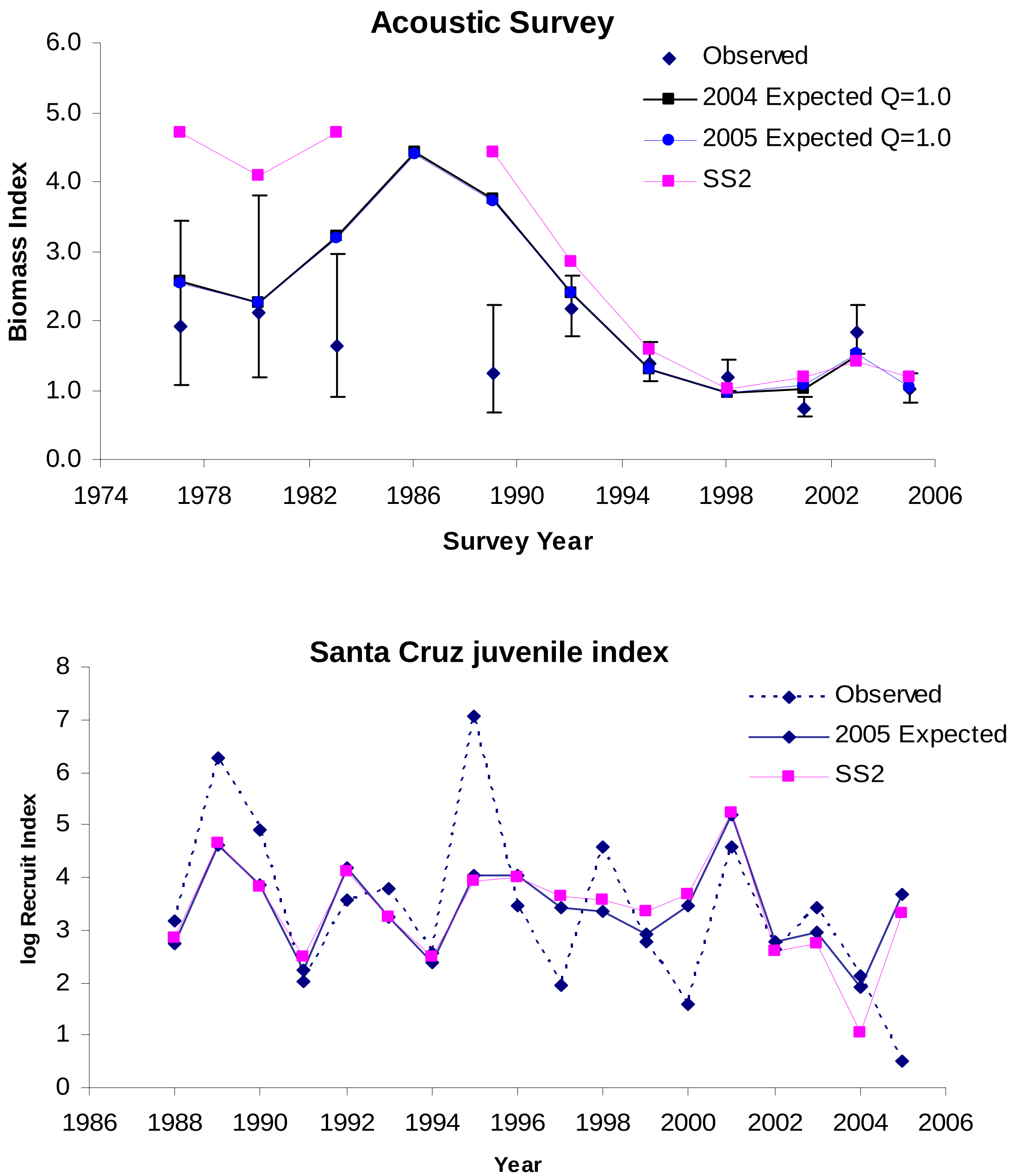


Figure 22. Predicted acoustic and juvenile survey fits from comparative assessment model results; old hake model (Helser et. al. 2004) vs. SS2 (Methot 2005).

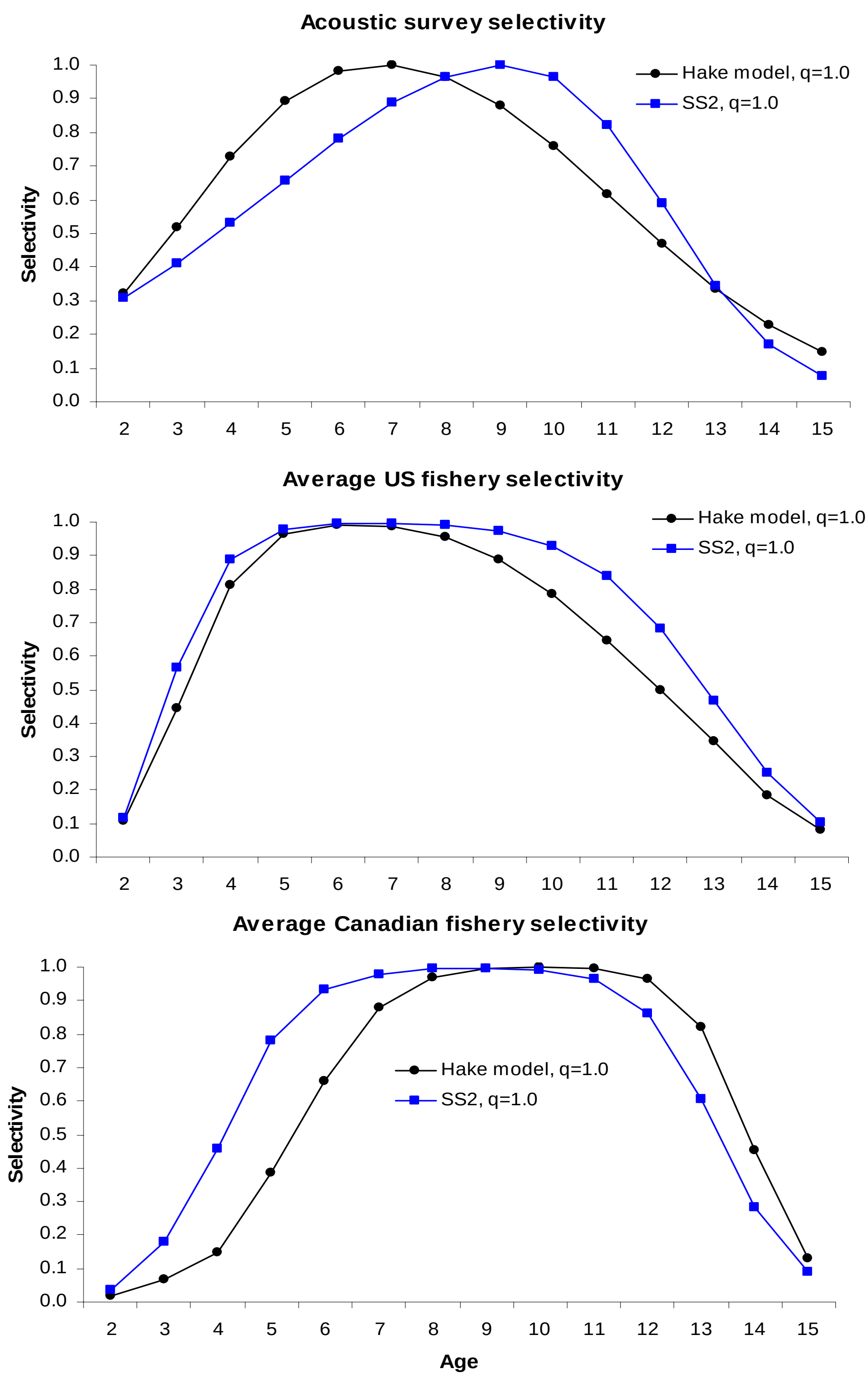


Figure 23. Comparison of estimated selectivity curves from previous assessment model (Helser et. al. 2004) and current model using SS2 (Methot 2005) for acoustic survey (top), U.S. fishery (middle), and Canadian fishery (bottom).

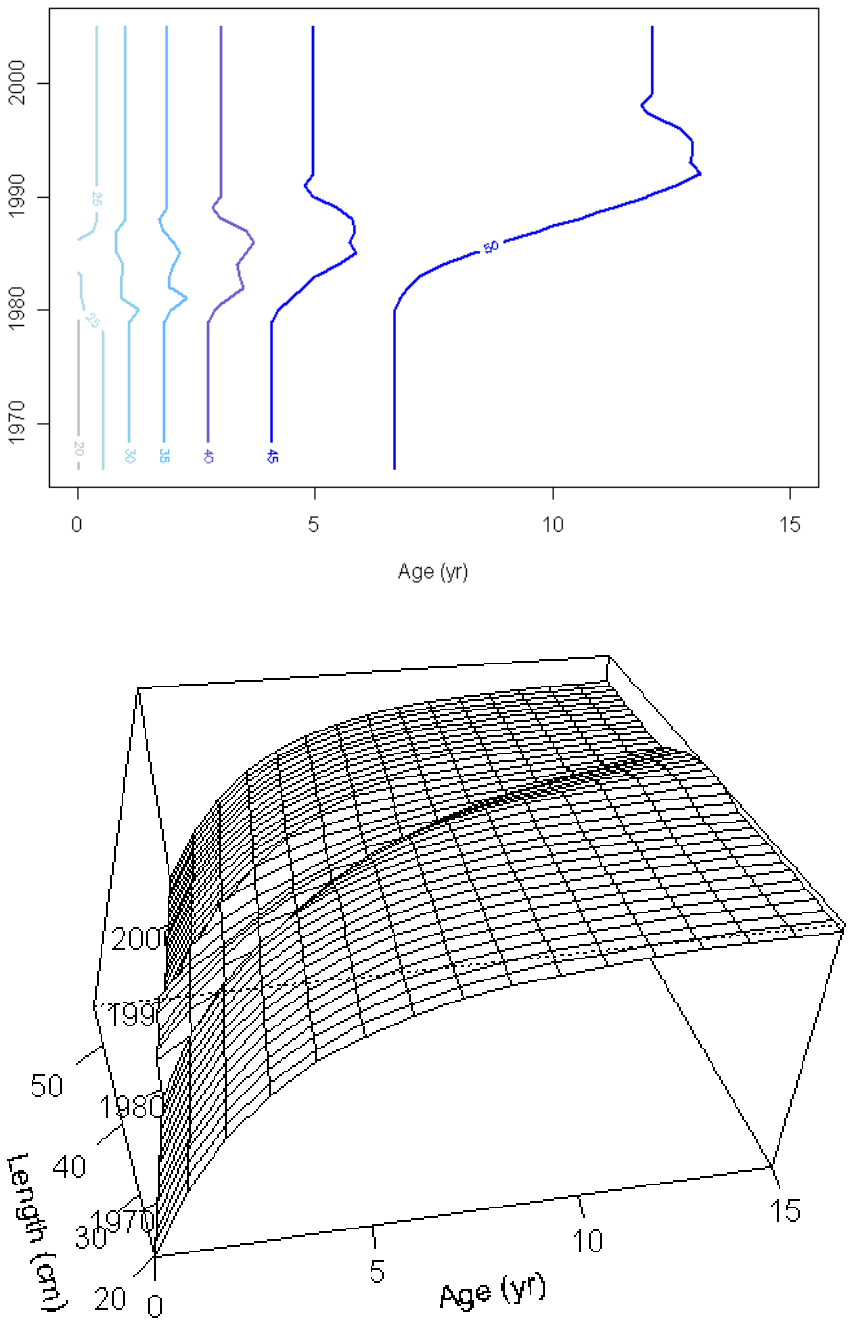


Figure 24. Time varying trajectory of growth in size at age assumed for Pacific Hake. Parameters were initially estimated but then fixed in the model.

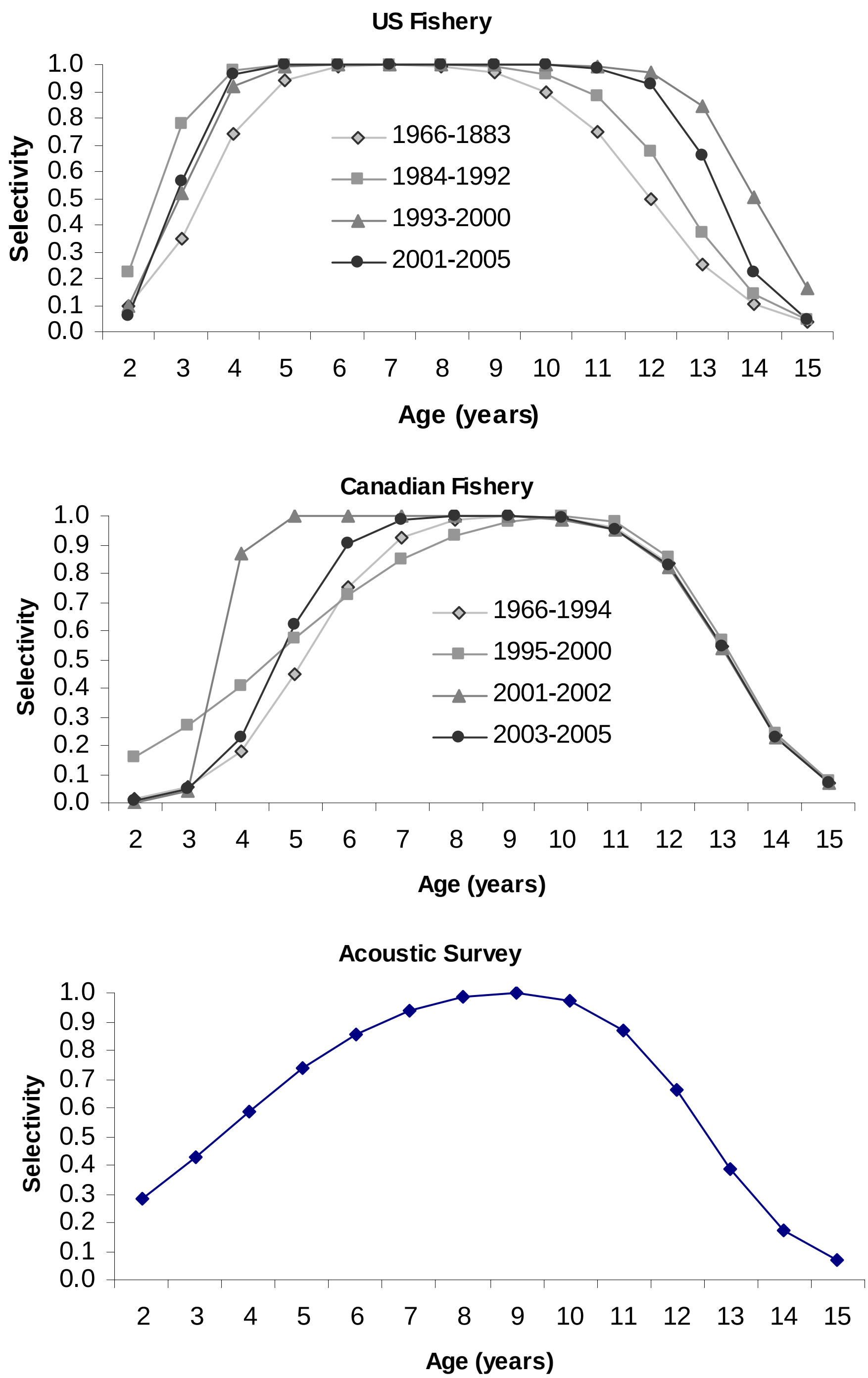


Figure 25. Estimated selectivity curves for different time blocks in the U.S. fishery, the Canadian fishery and acoustic survey. Selectivity in the acoustic survey was Assumed to be time-invariant.

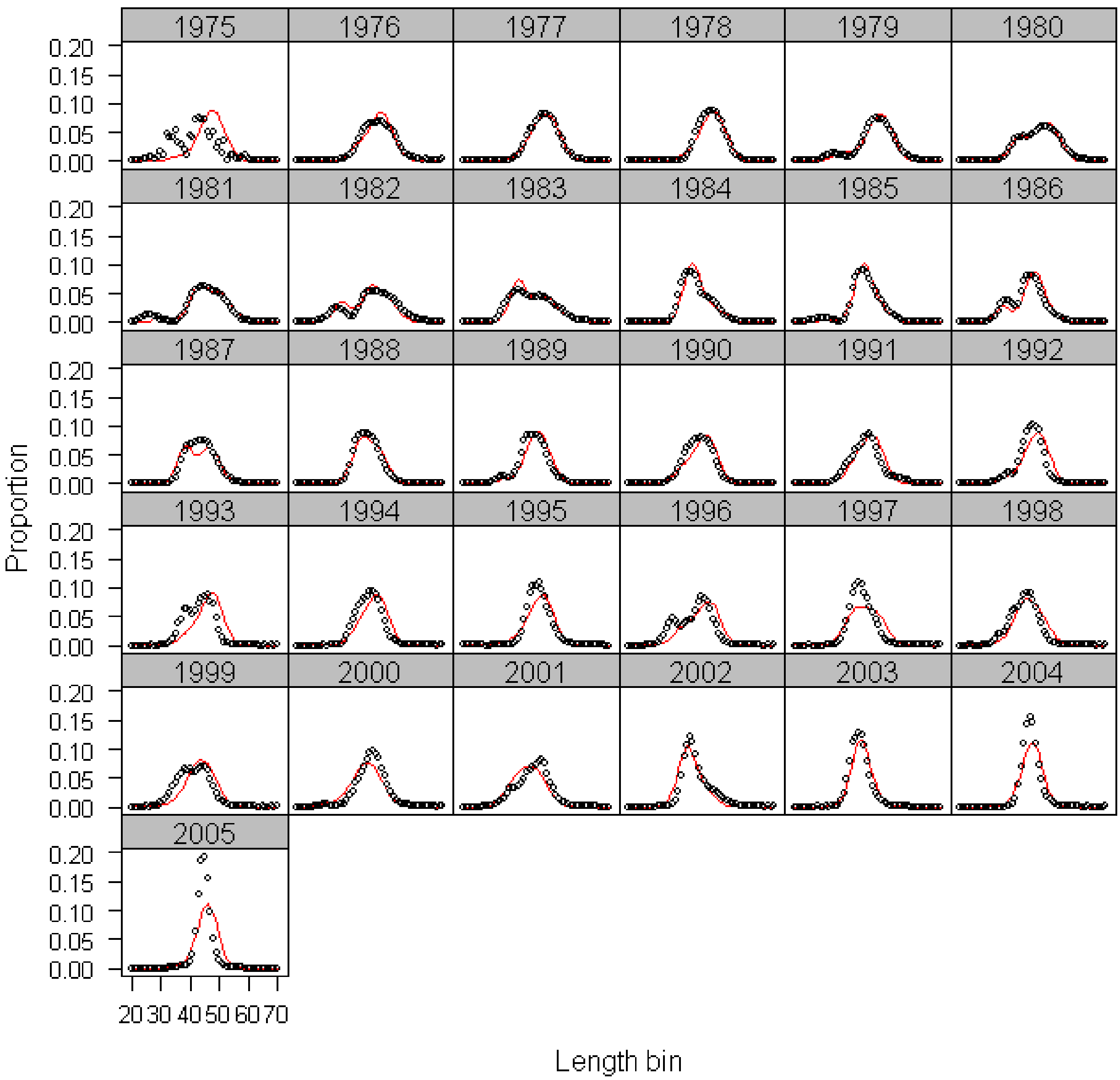
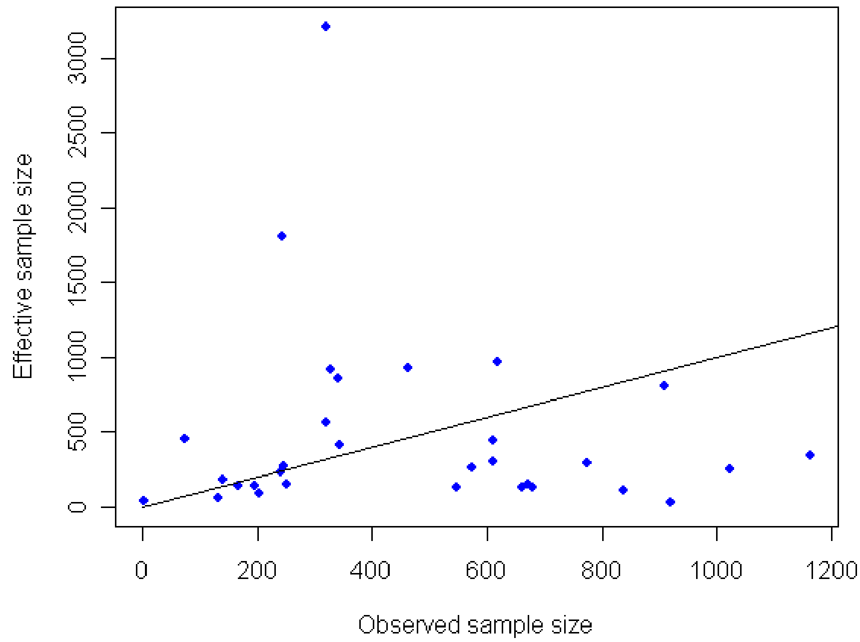


Figure 26. Predicted fits to the observed U.S. fishery length composition data.



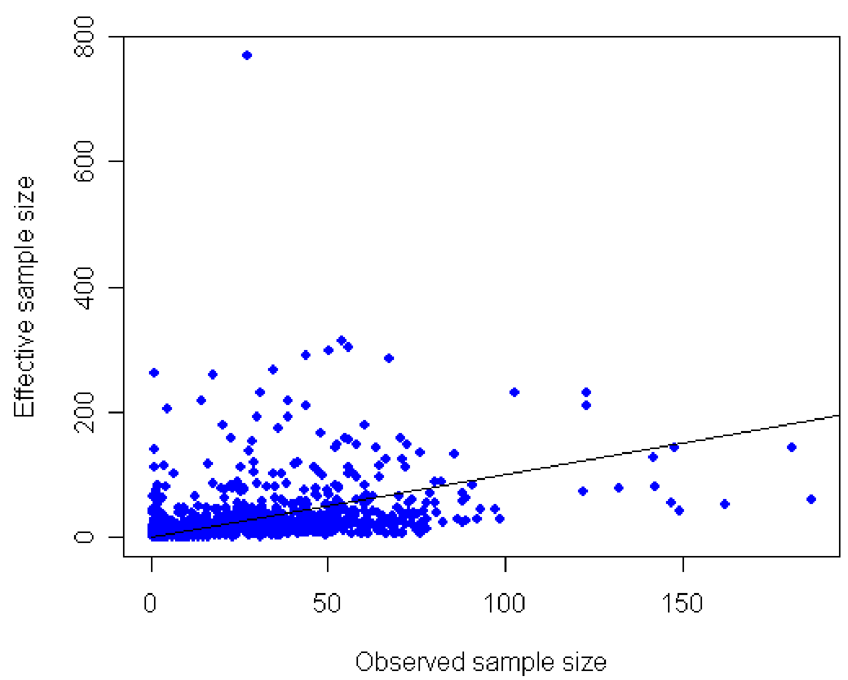


Figure 27. Effective vs. input sample sizes for the U.S. fishery length compositions (top panel) and conditional age at length compositions (bottom panel).

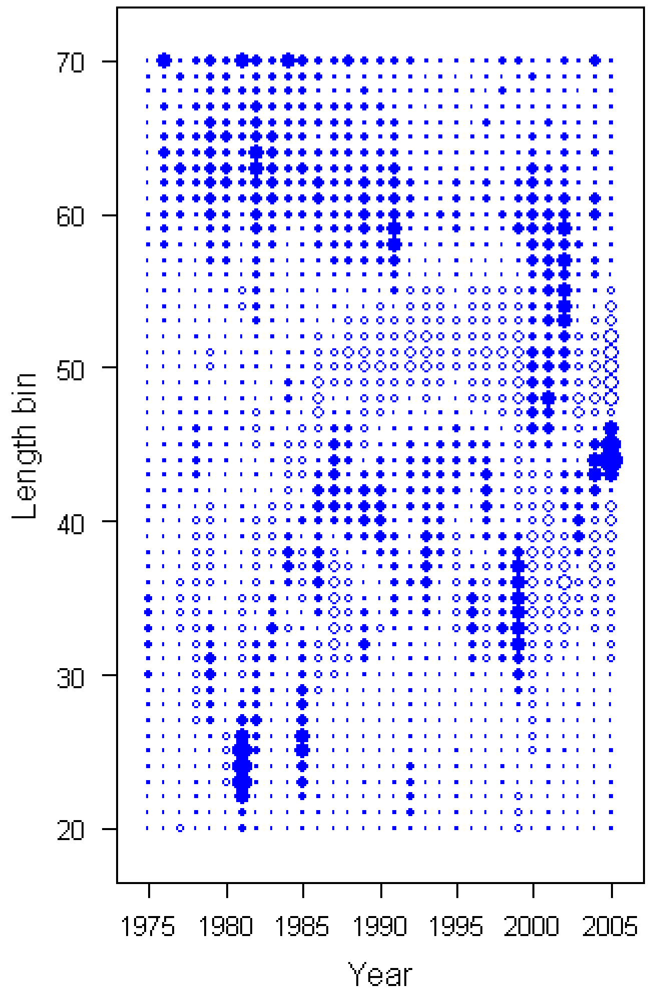


Figure 28. Pearson residuals of model fits to the U.S. fishery length composition data. Filled indicates positive residuals and unfilled indicates negative residuals.

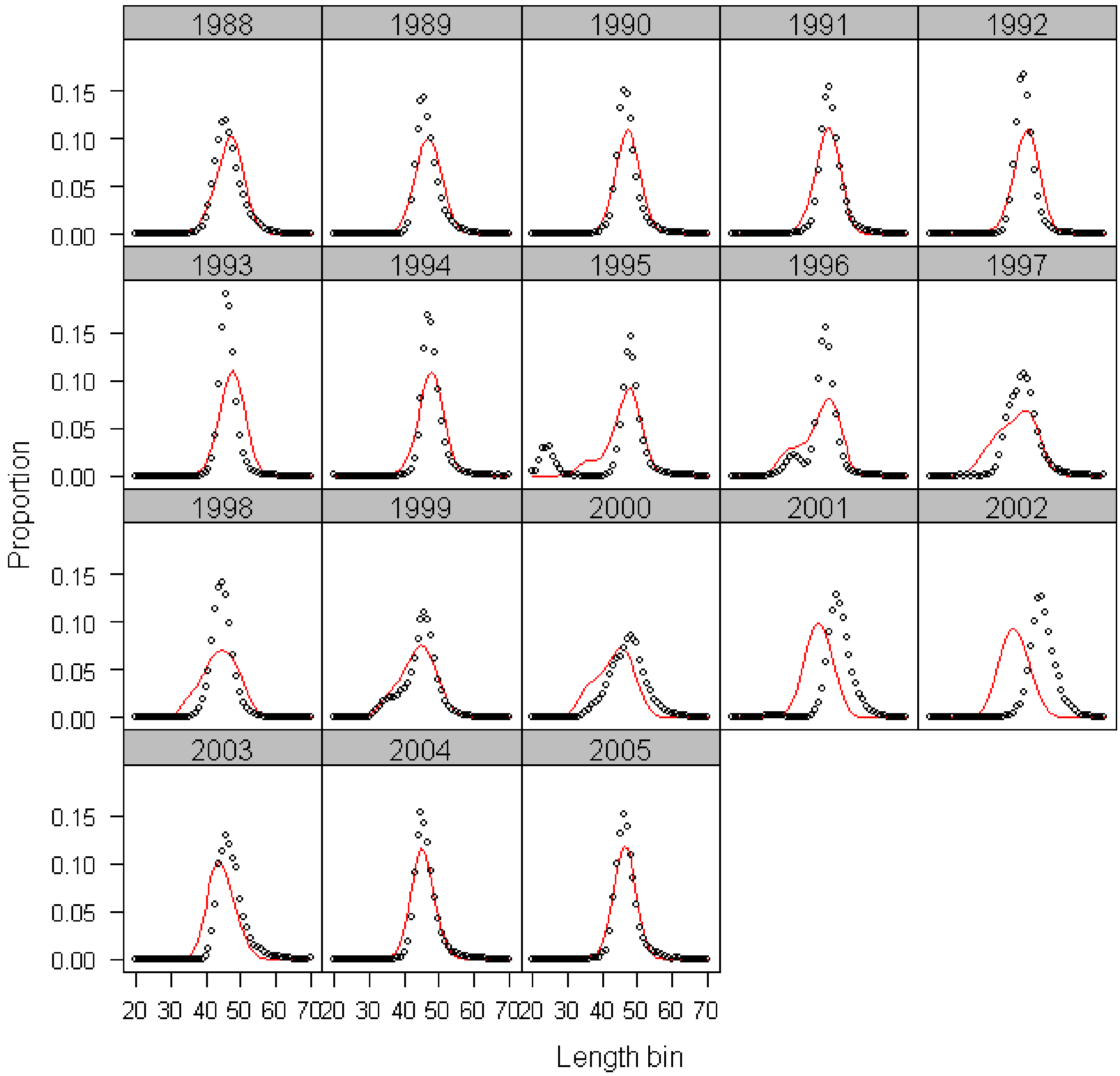


Figure 29. Predicted fits to the observed Canadian fishery length composition data.

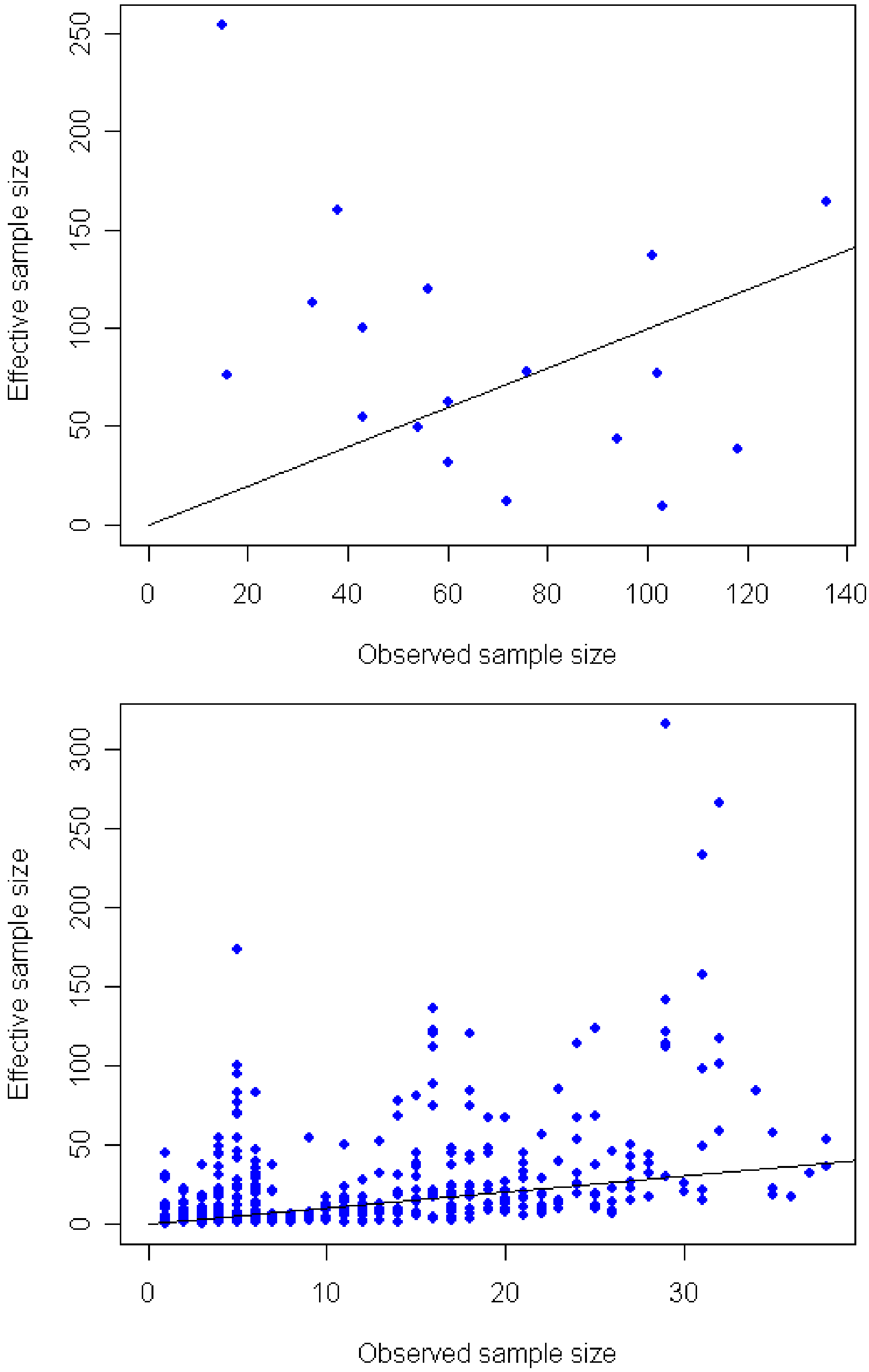


Figure 30. Effective vs. input sample sizes for the Canadian fishery length compositions (top panel) and conditional age at length compositions (bottom panel).

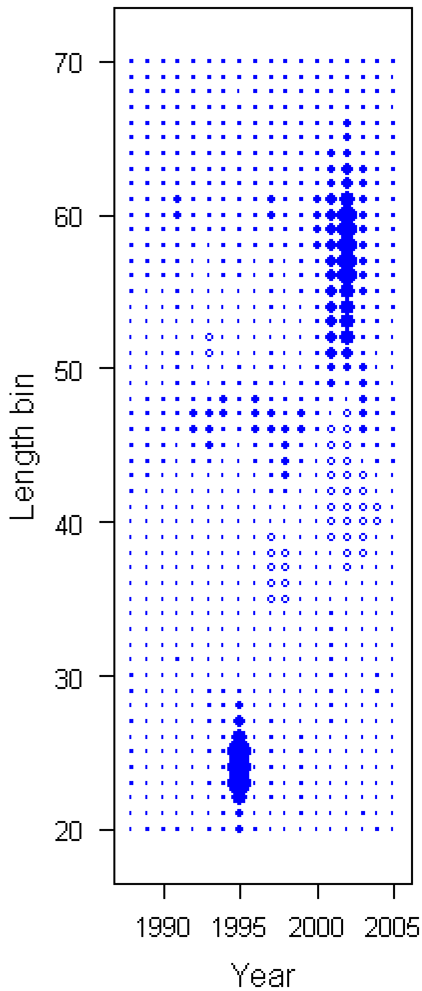


Figure 31. Pearson residuals of model fits to the Canadian length composition data. Filled indicates positive residuals and unfilled indicates negative residuals.

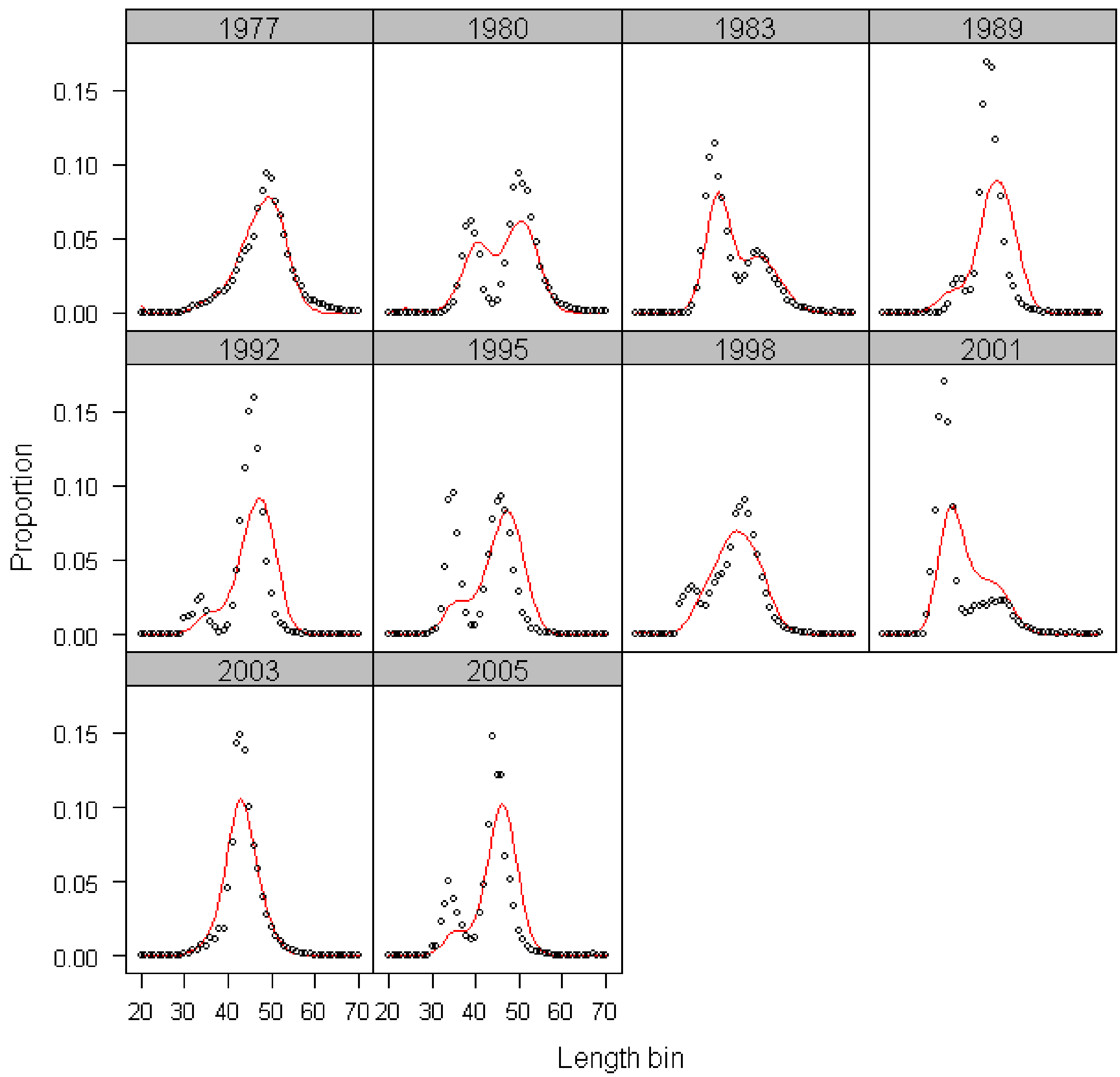


Figure 32. Predicted fits to the observed acoustic survey length composition data.

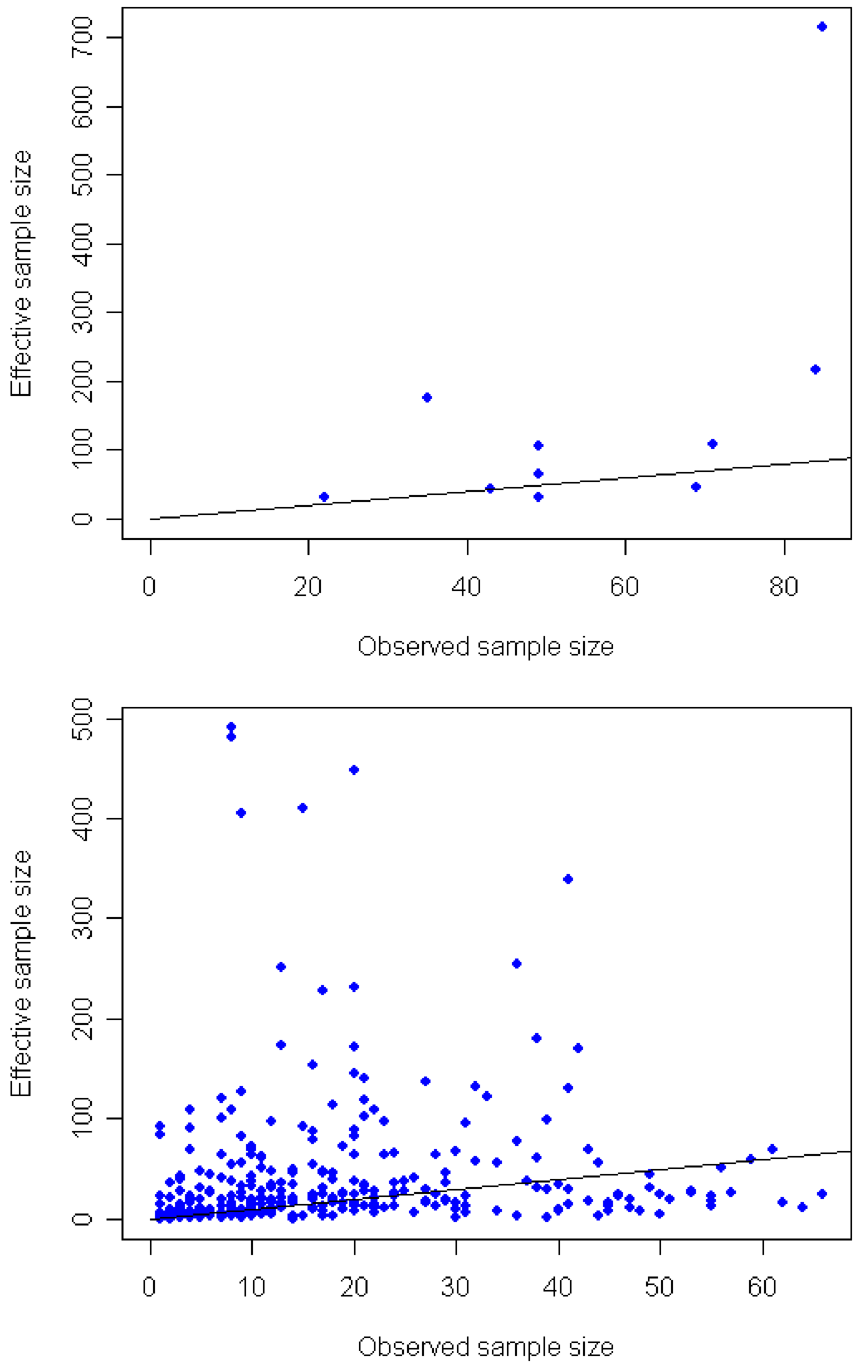


Figure 33. Effective vs. input sample sizes for the acoustic survey length compositions (top panel) and conditional age at length compositions (bottom panel).

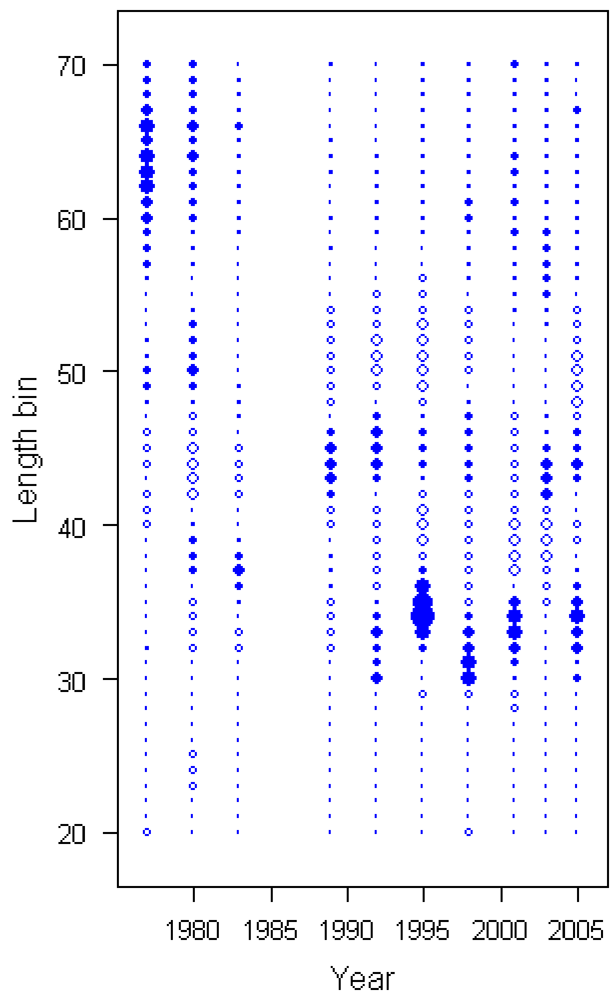


Figure 34. Pearson residuals of model fits to the acoustic survey length composition data. Filled indicates positive residuals and unfilled indicates negative residuals.

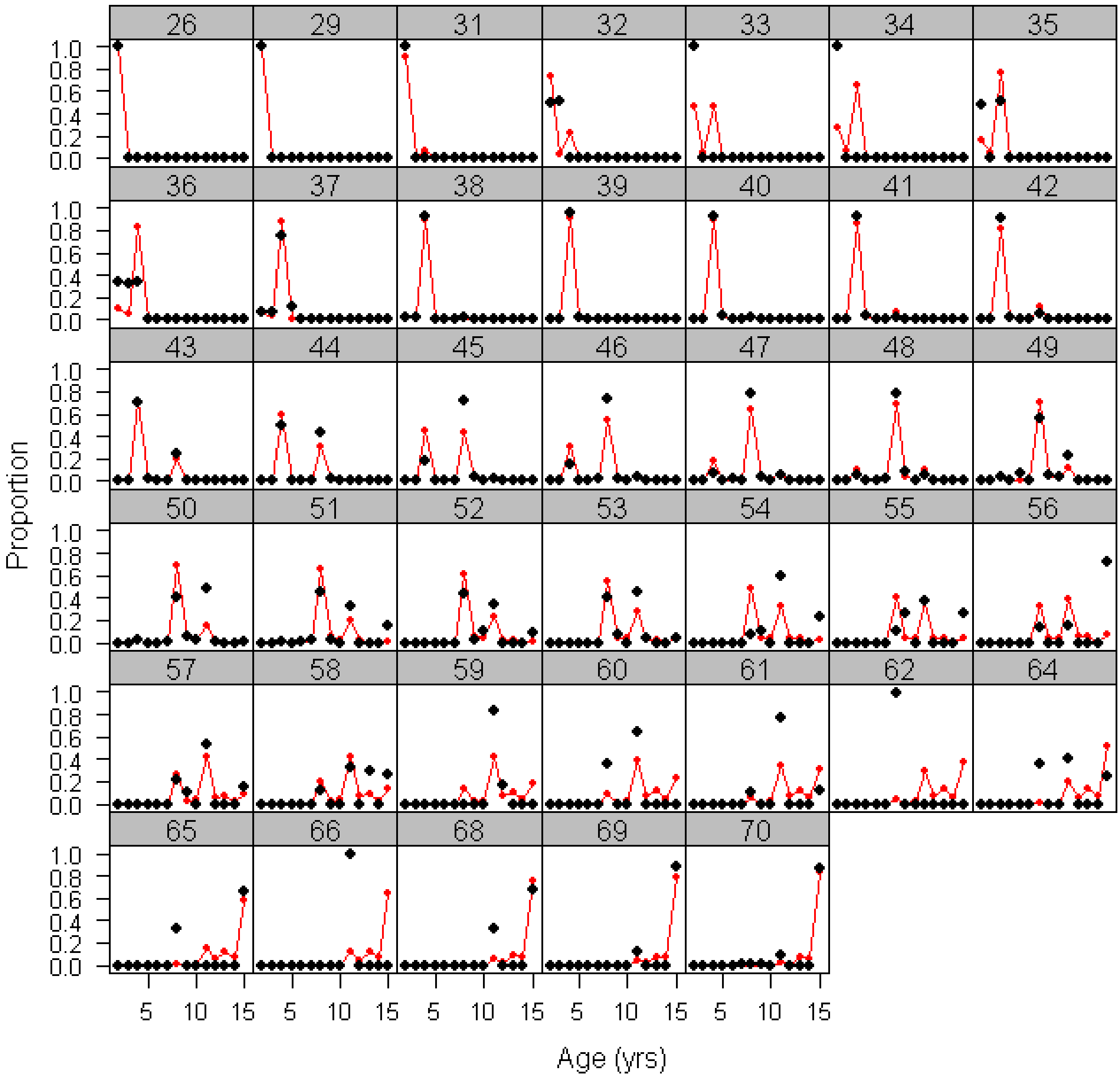


Figure 35. Model fits to the observed 1988 U.S. fishery conditional age at length data .

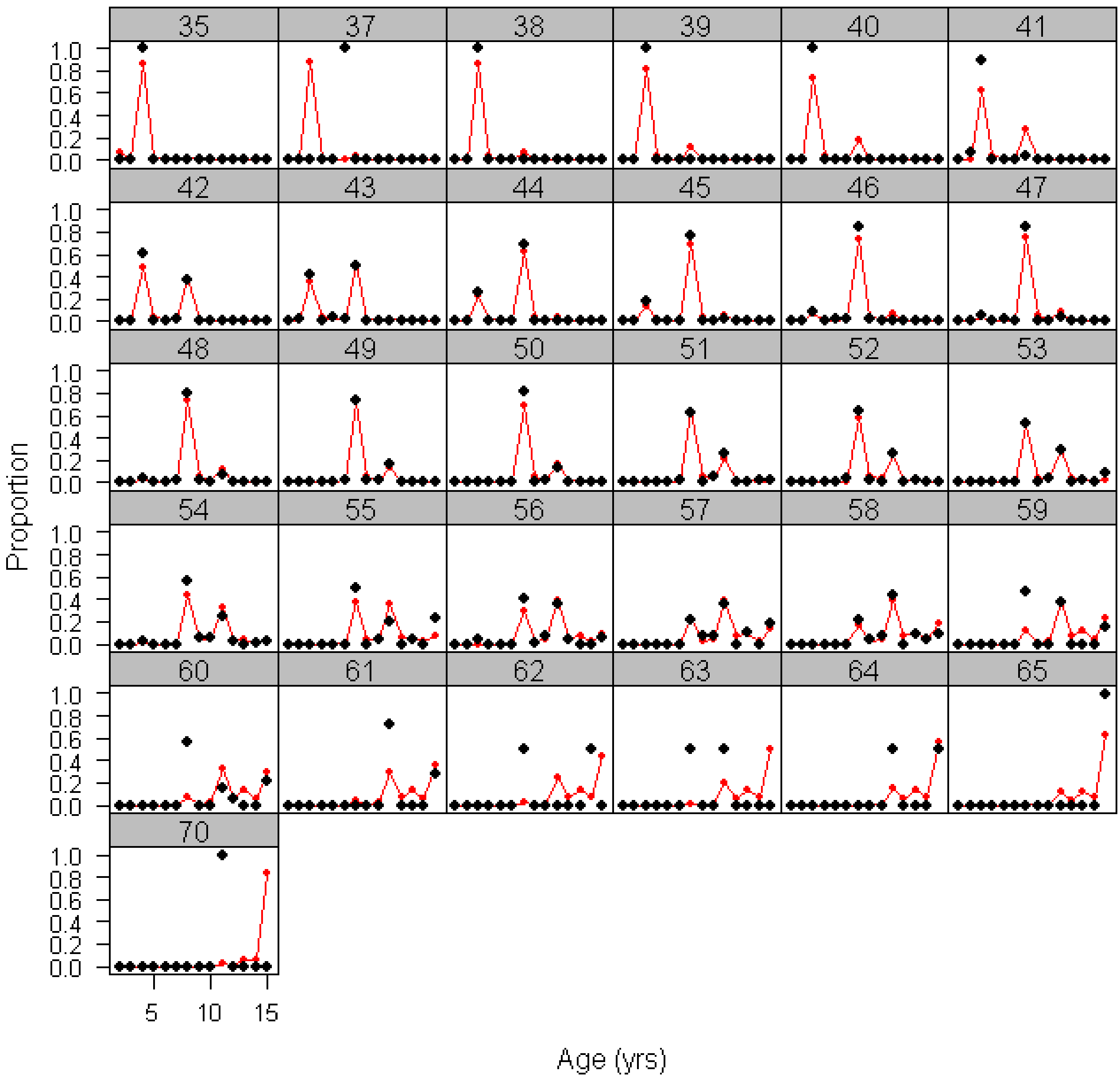


Figure 36. Model fits to the observed 1988 Canadian fishery conditional age at length data .

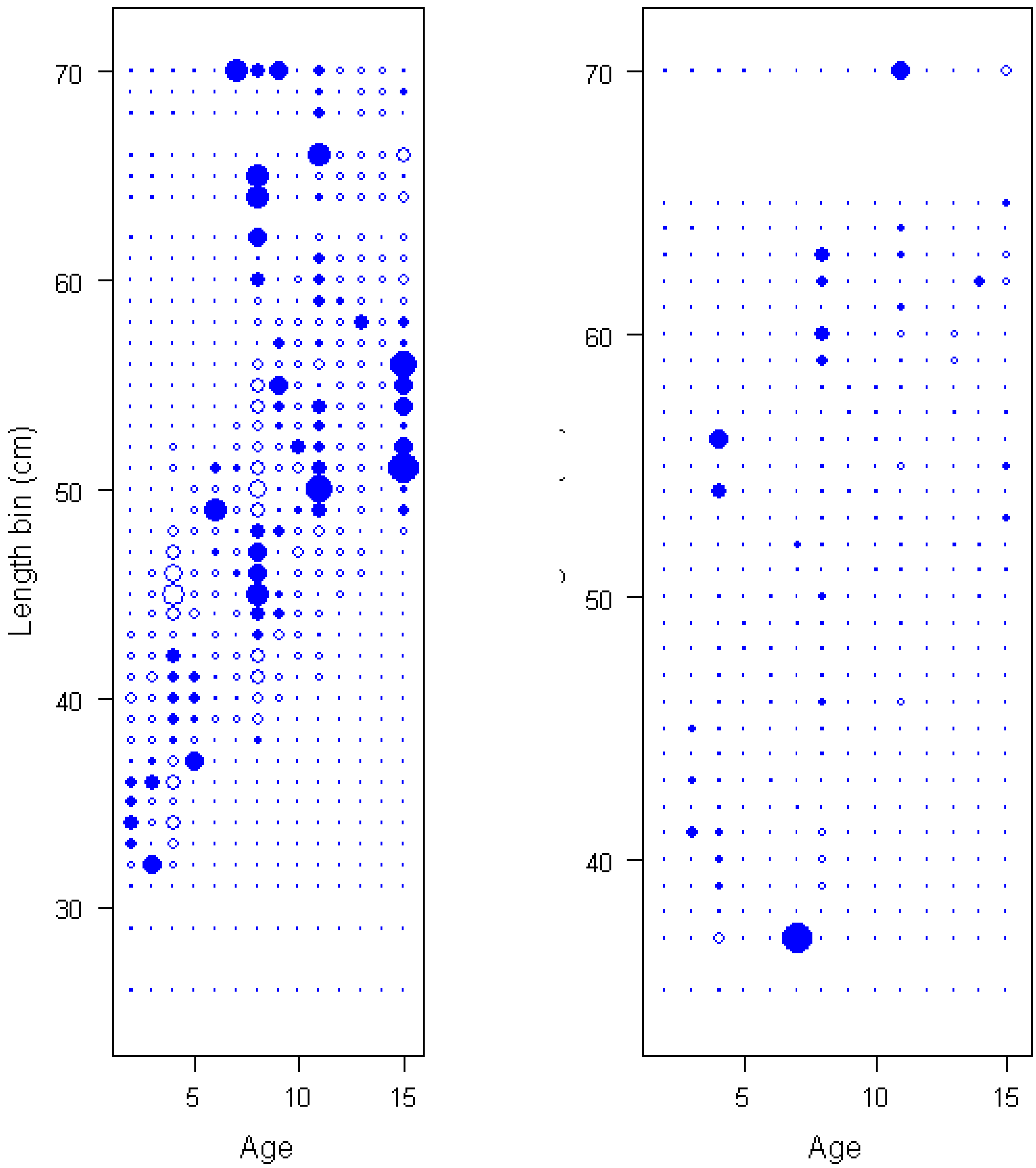


Figure 37. Pearson residuals of model fits to the 1988 U.S. fishery (left) and Canadian (right) conditional age at length data . Filled indicates positive residuals and unfilled indicates negative residuals.

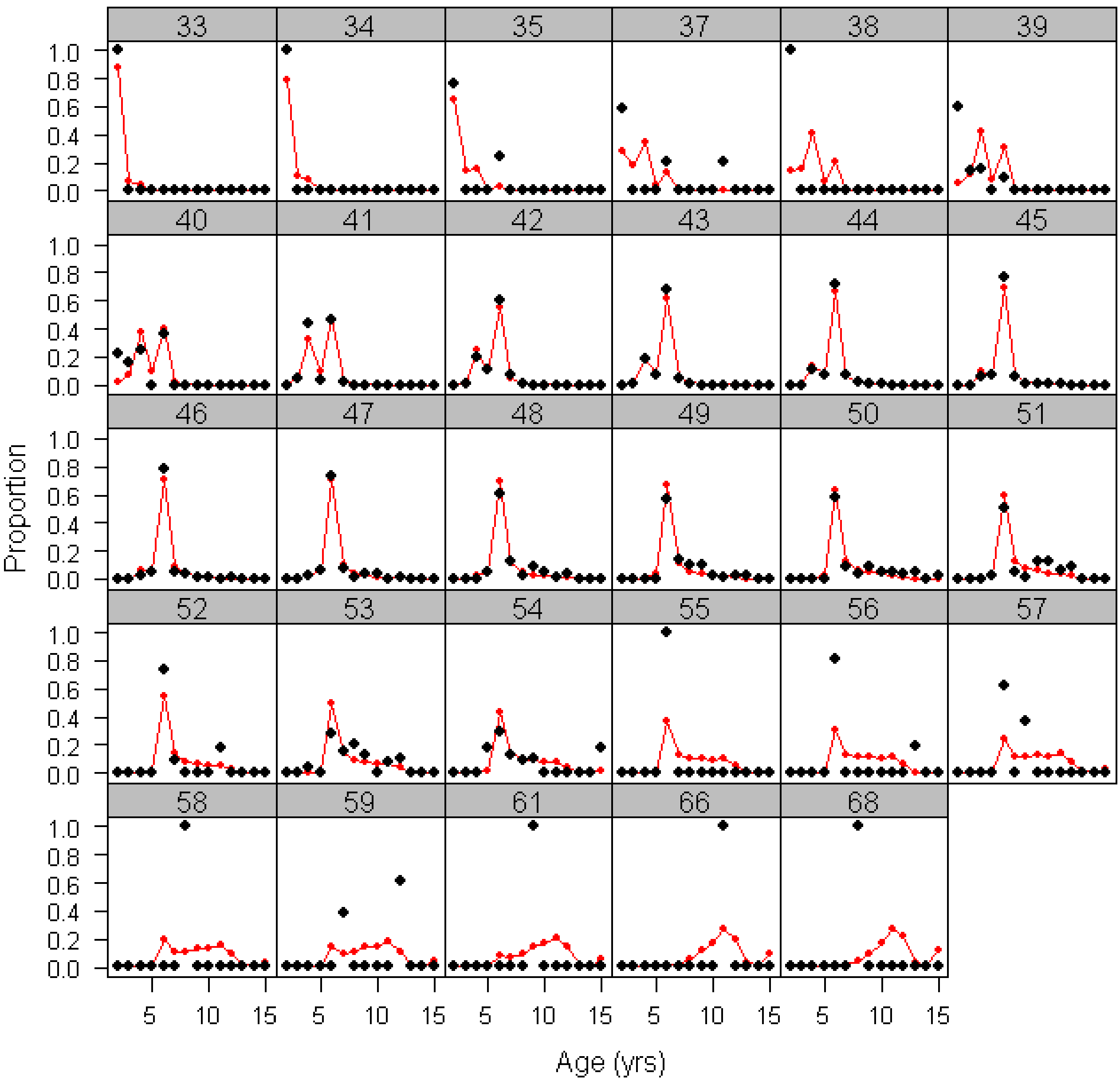


Figure 38. Model fits to the observed 2005 U.S. fishery conditional age at length data .

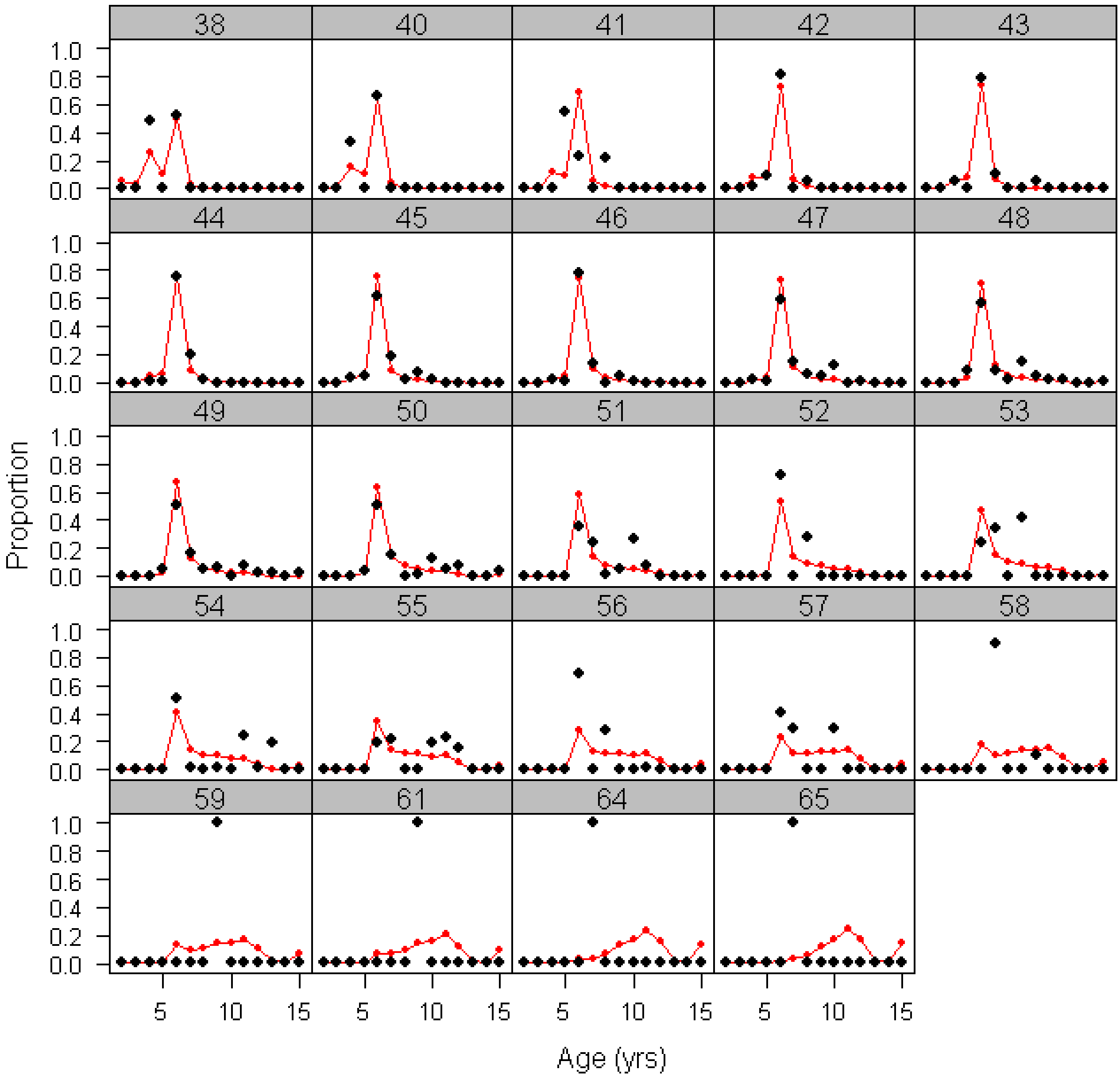


Figure 39. Model fits to the observed 2005 Canadian fishery conditional age at length data .

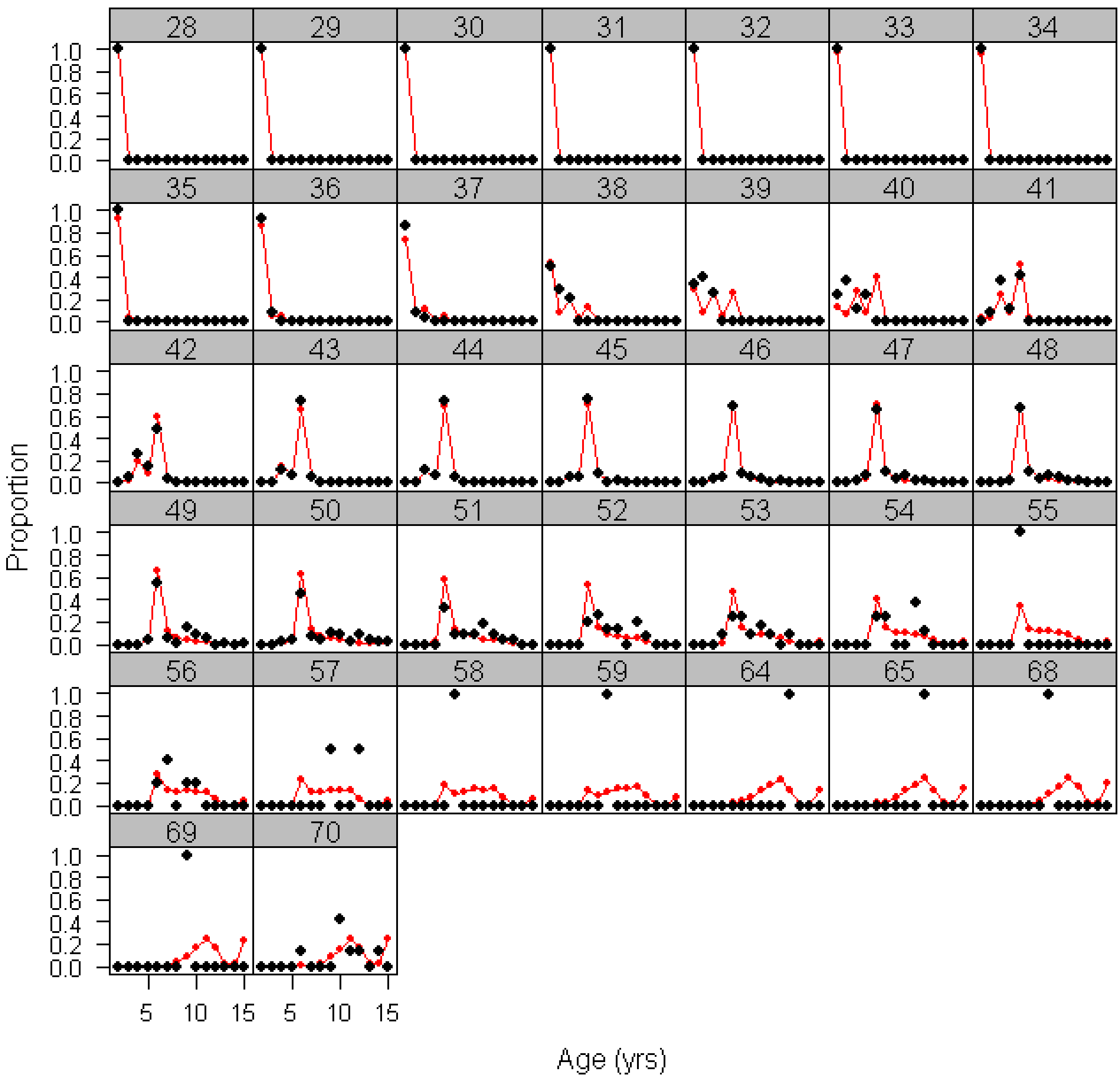


Figure 40. Model fits to the observed 2005 acoustic survey conditional age at length data .

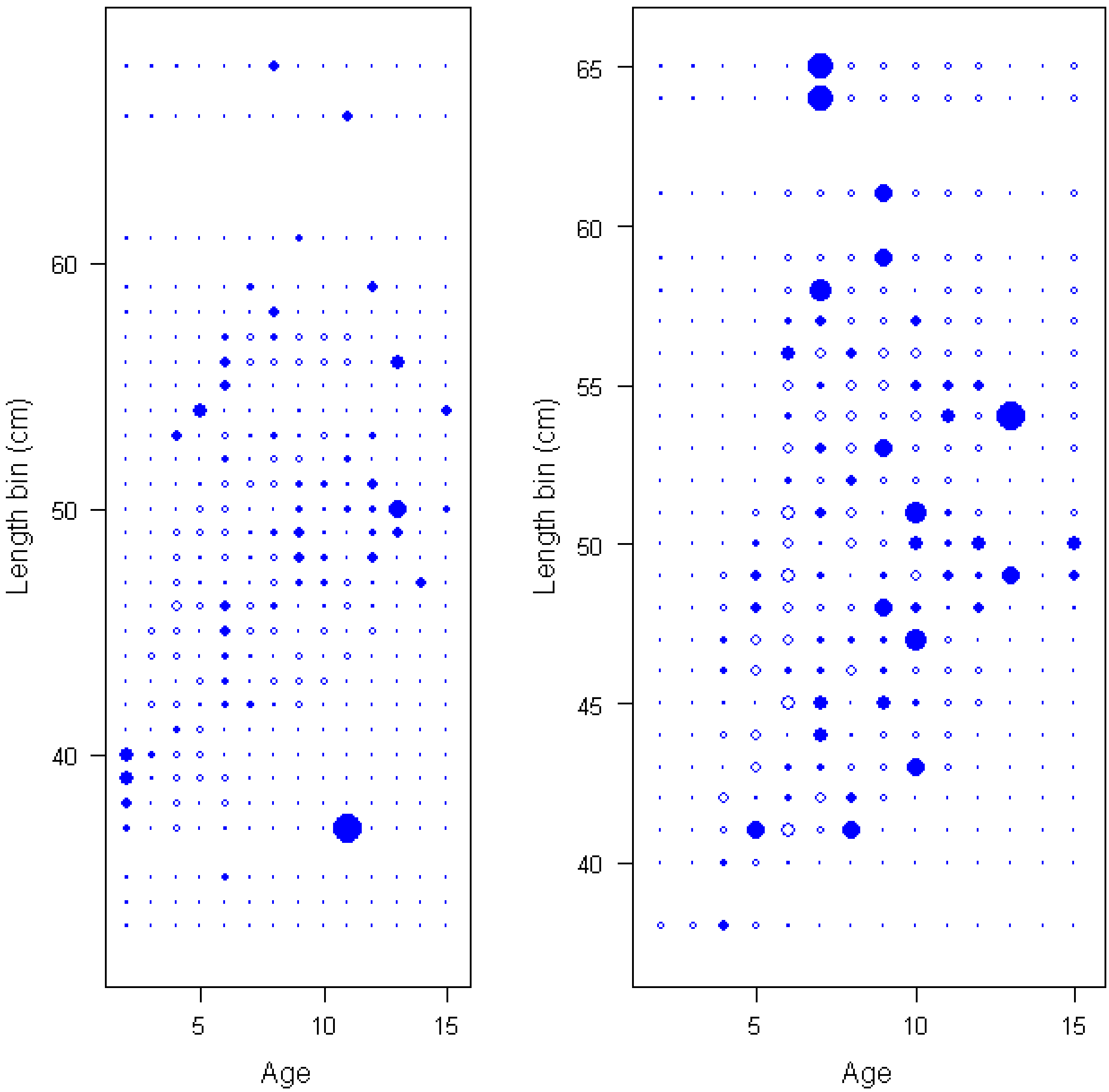


Figure 41. Pearson residuals of model fits to the 2005 U.S. fishery (left) and Canadian (right) conditional age at length data. Filled indicates positive residuals and unfilled indicates negative residuals.

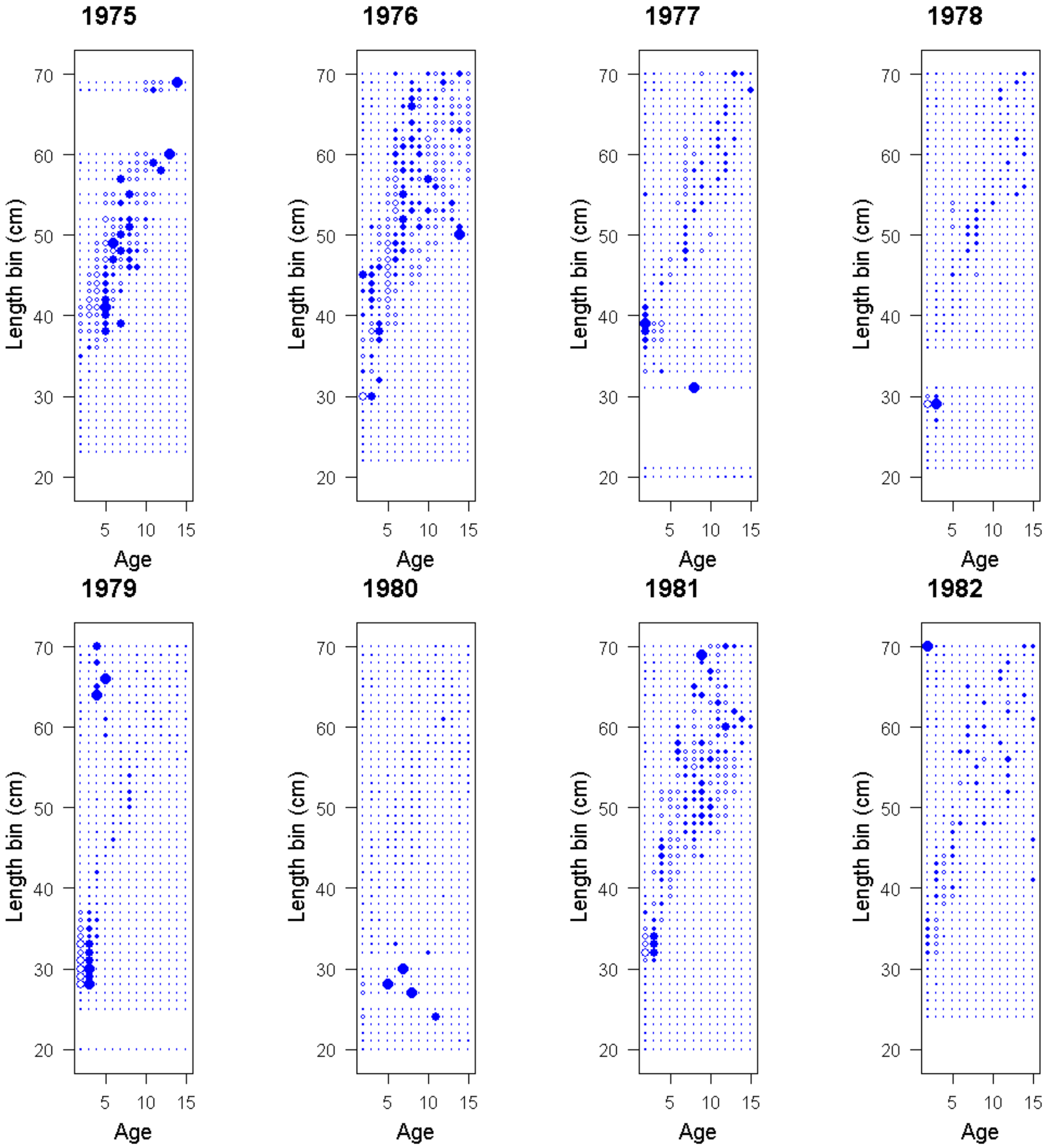


Figure 42. Standardized Pearson age at length residuals for the US fleet. Unfilled circles indicate negative residuals, filled circles indicate positive residuals.

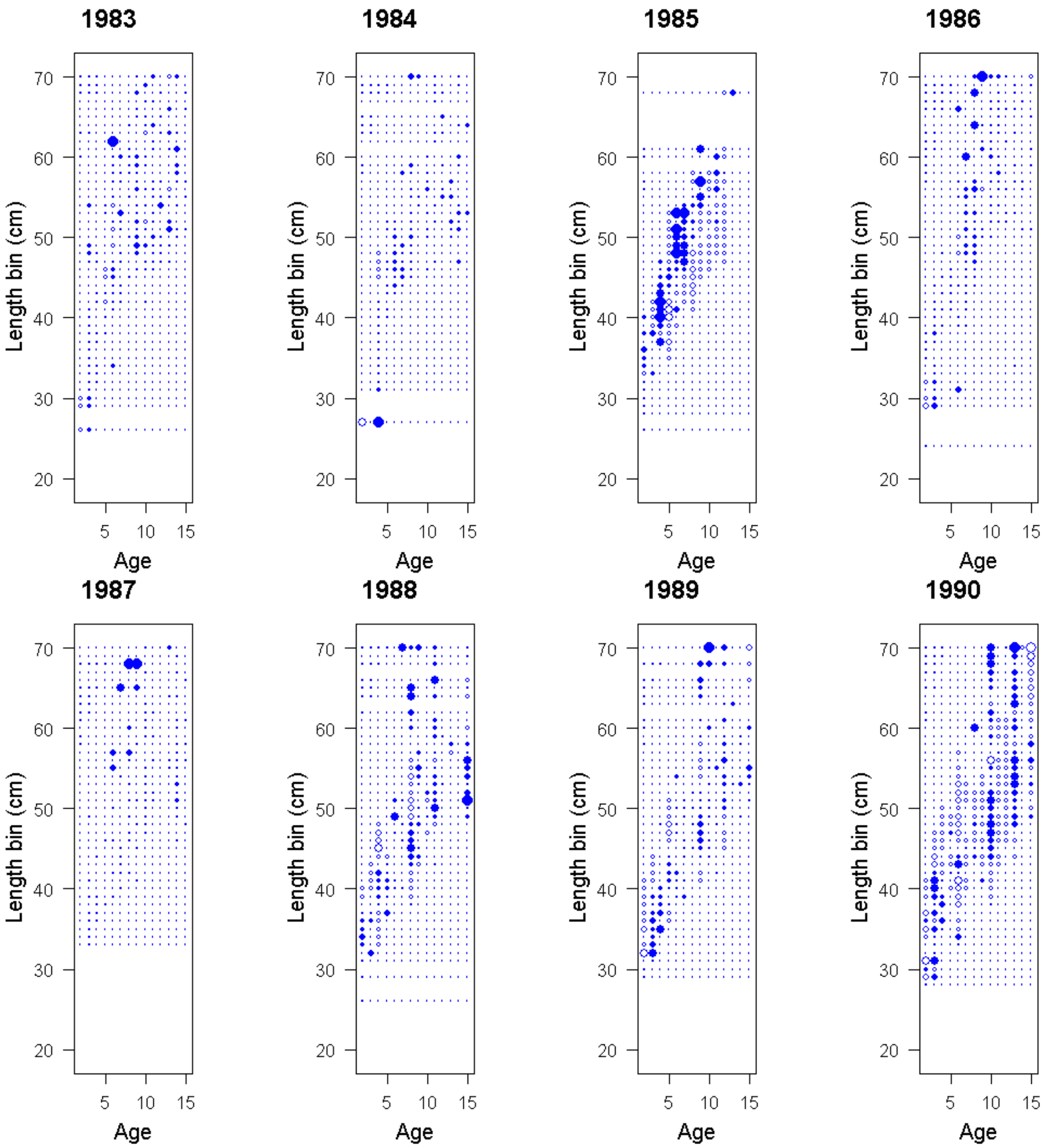


Figure 42 continued. Standardized Pearson age at length residuals for the US fleet. Unfilled circles Indicate negative residuals, filled circles indicate positive residuals.

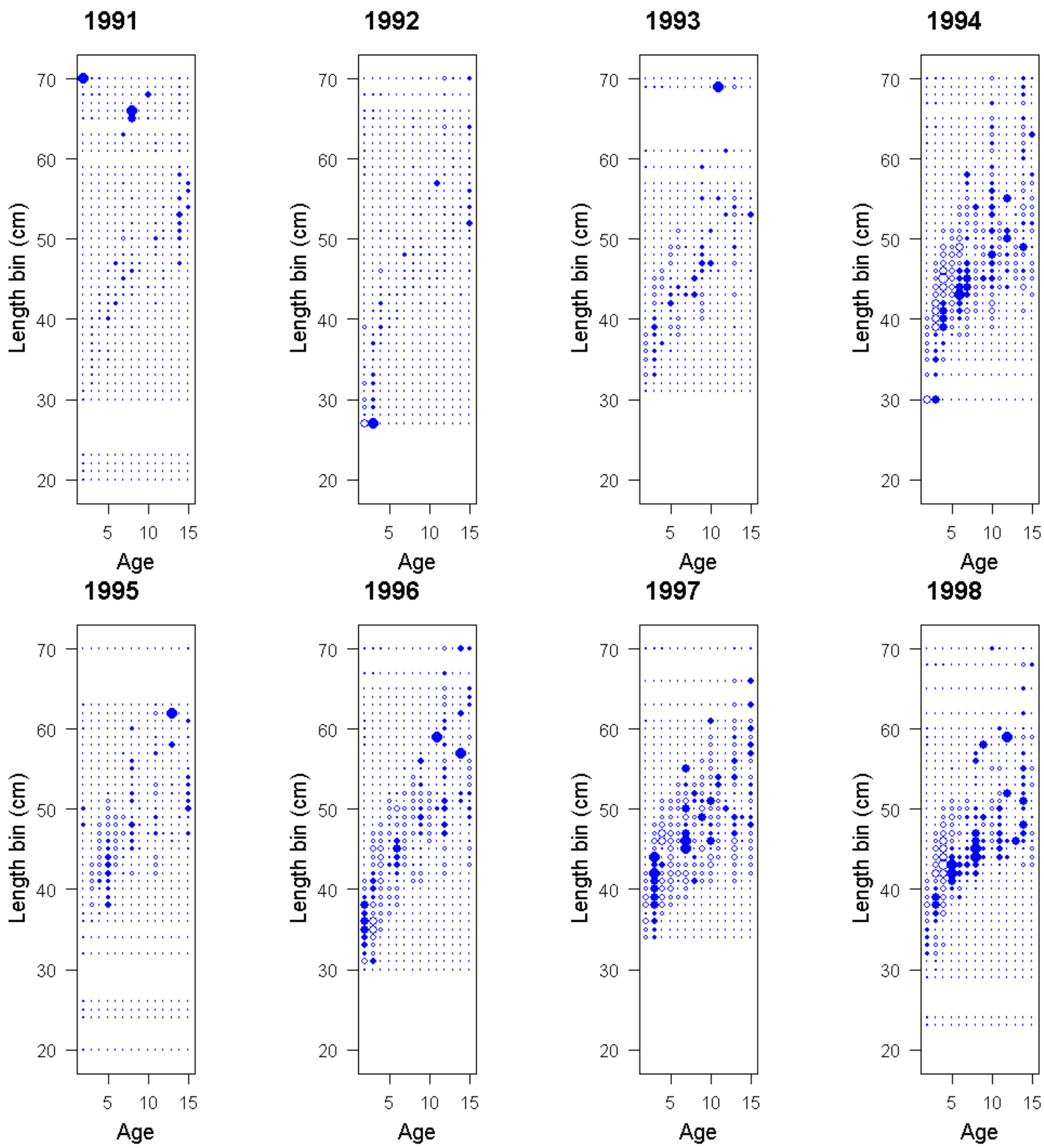


Figure 42 continued. Standardized Pearson age at length residuals for the US fleet. Unfilled circles indicate negative residuals, filled circles indicate positive residuals.

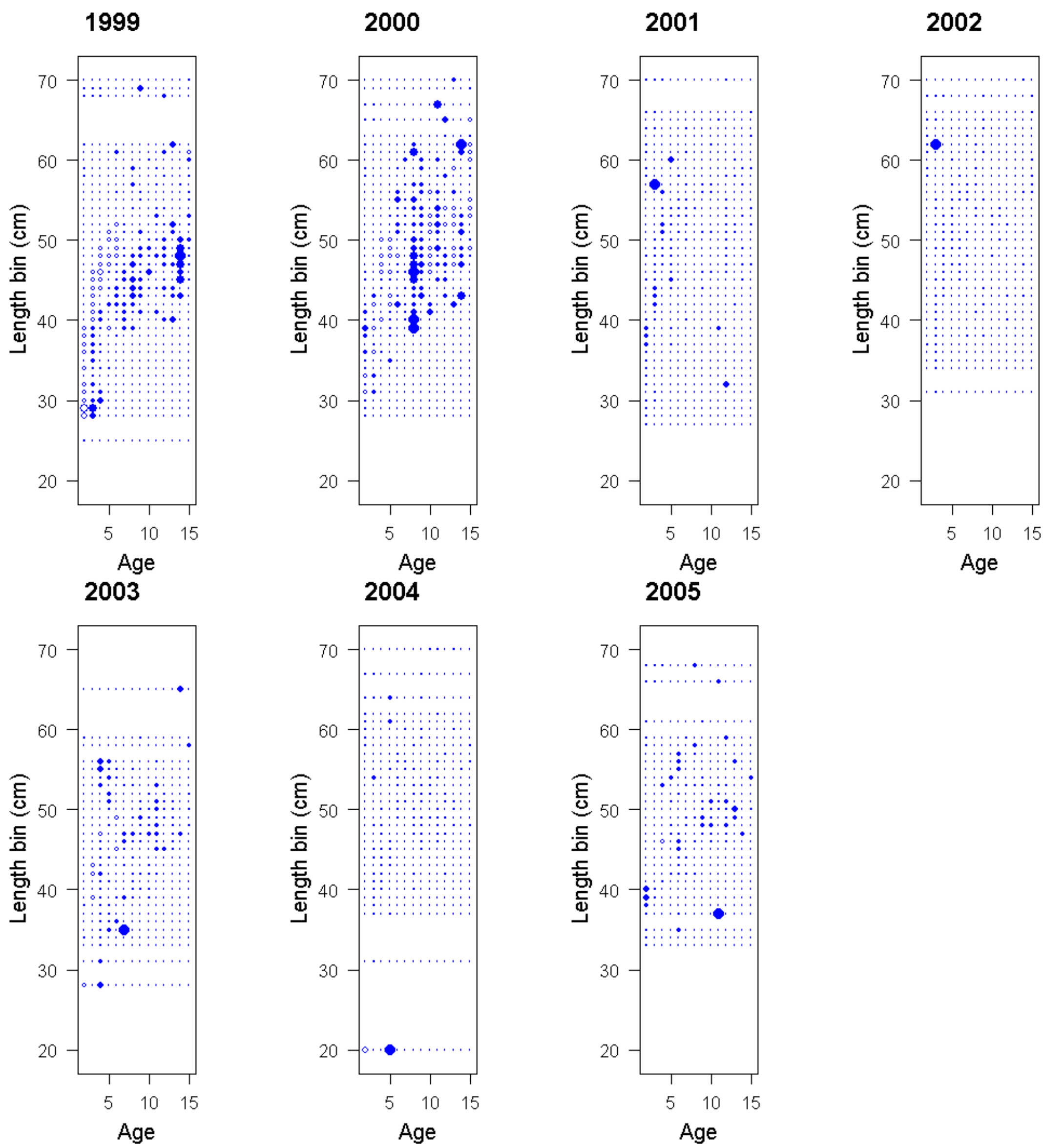


Figure 42 continued. Standardized Pearson age at length residuals for the US fleet. Unfilled circles indicate negative residuals, filled circles indicate positive residuals.

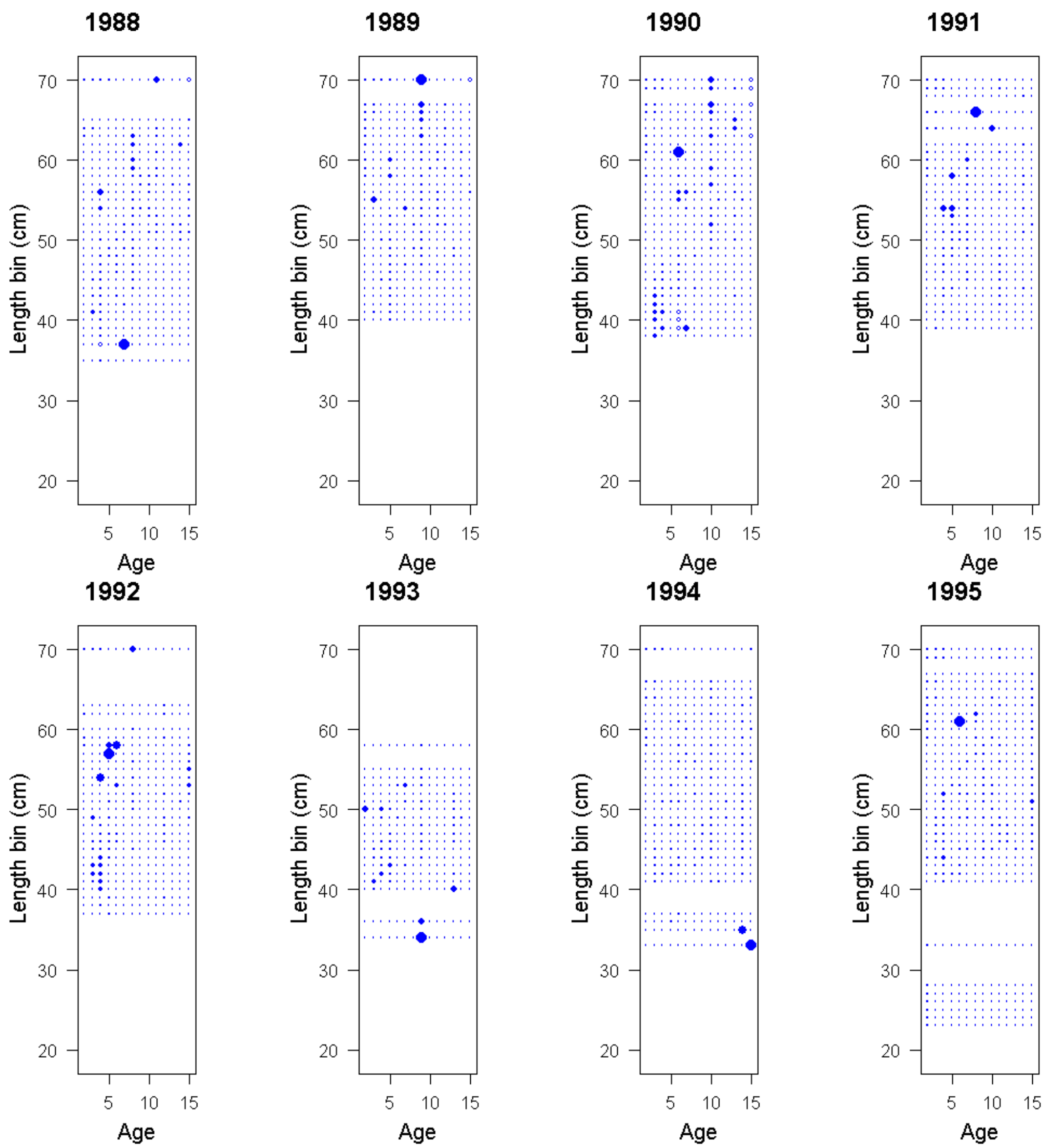


Figure 42 continued. Standardized Pearson age at length residuals for the Canadian fleet. Unfilled circles indicate negative residuals, filled circles indicate positive residuals.

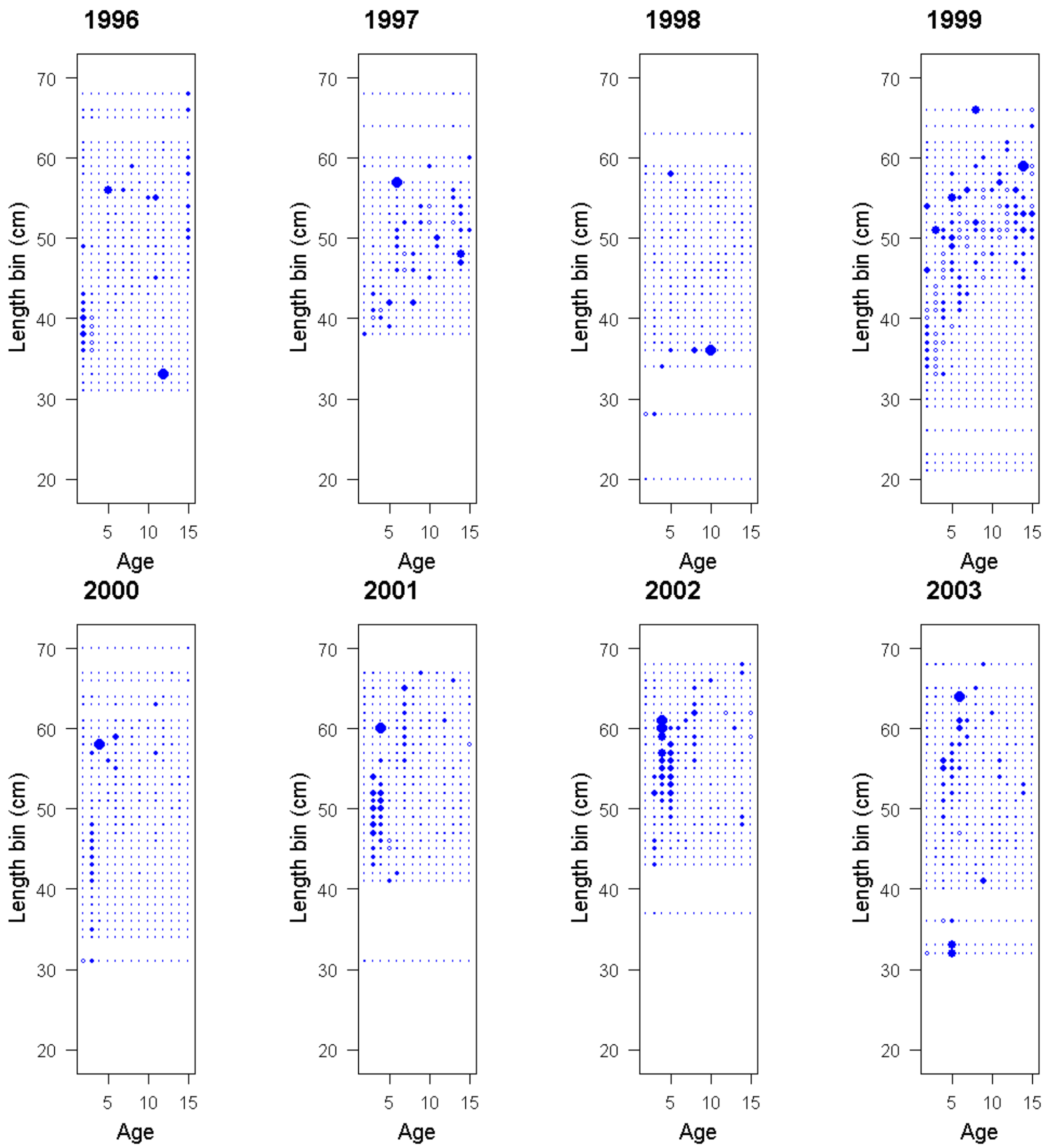


Figure 42 continued. Standardized Pearson age at length residuals for the Canadian fleet. Unfilled circles indicate negative residuals, filled circles indicate positive residuals.

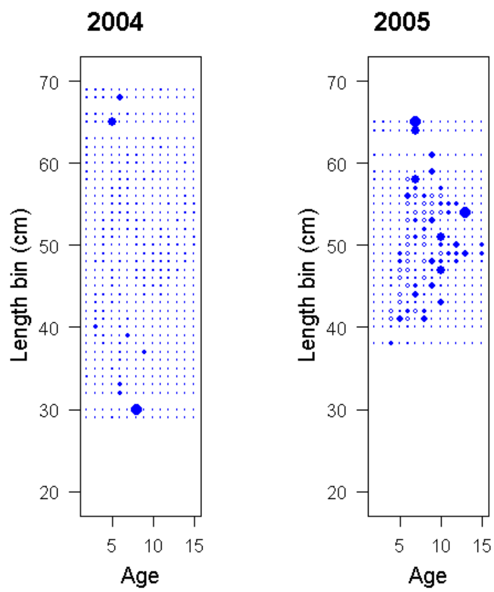


Figure 42 continued. Standardized Pearson age at length residuals for the Canadian fleet. Unfilled circles indicate negative residuals, filled circles indicate positive residuals.

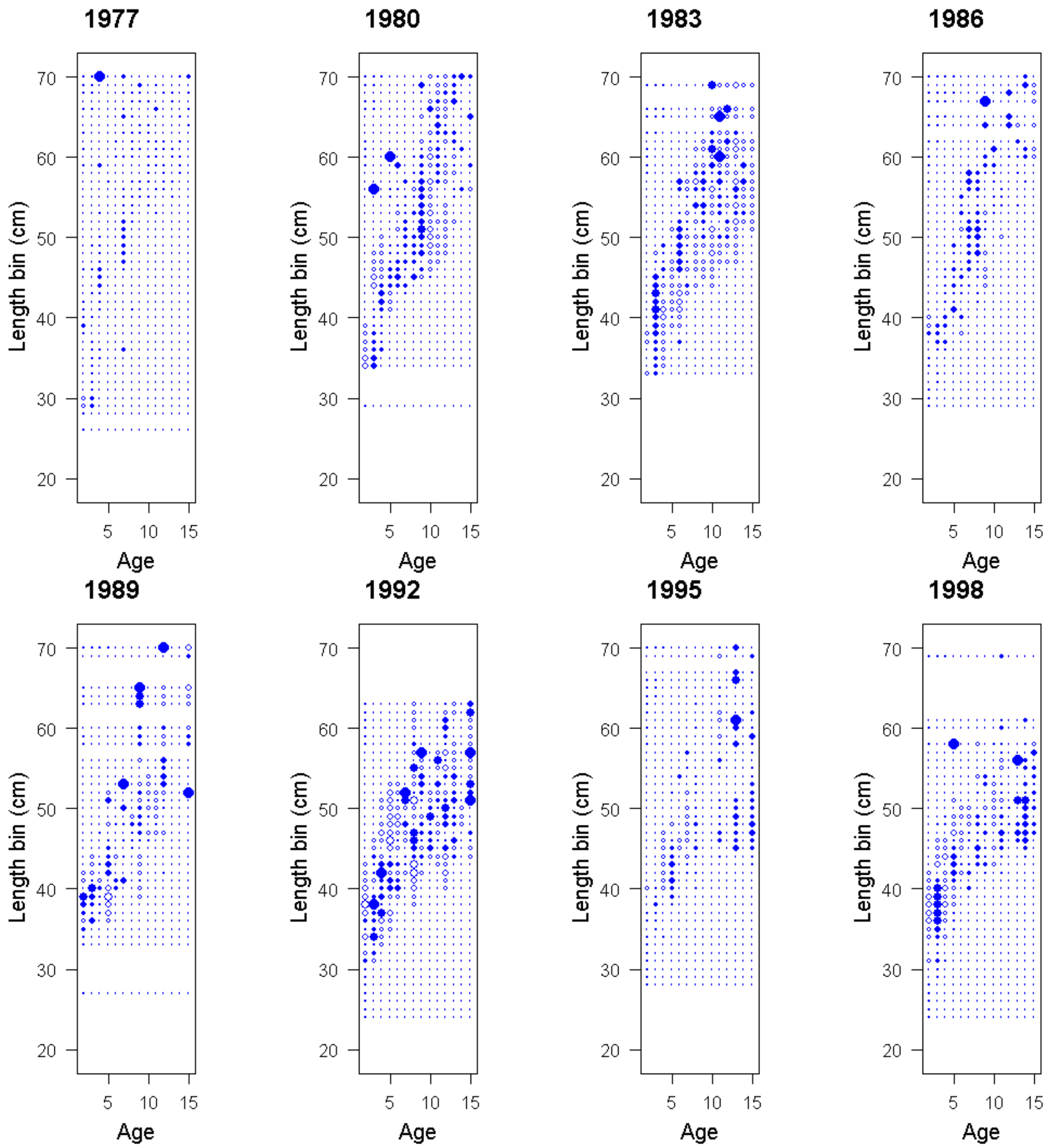


Figure 42 continued. Standardized Pearson age at length residuals for the acoustic survey. Unfilled circles indicate negative residuals, filled circles indicate positive residuals.

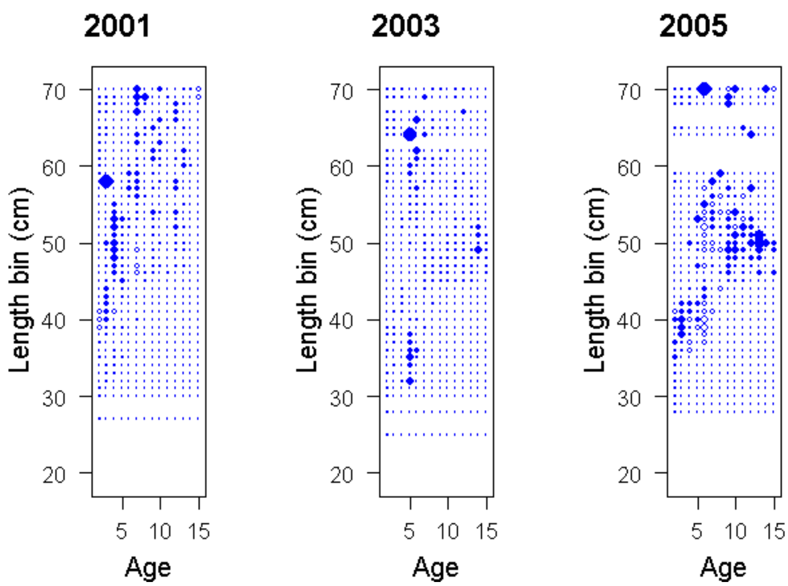
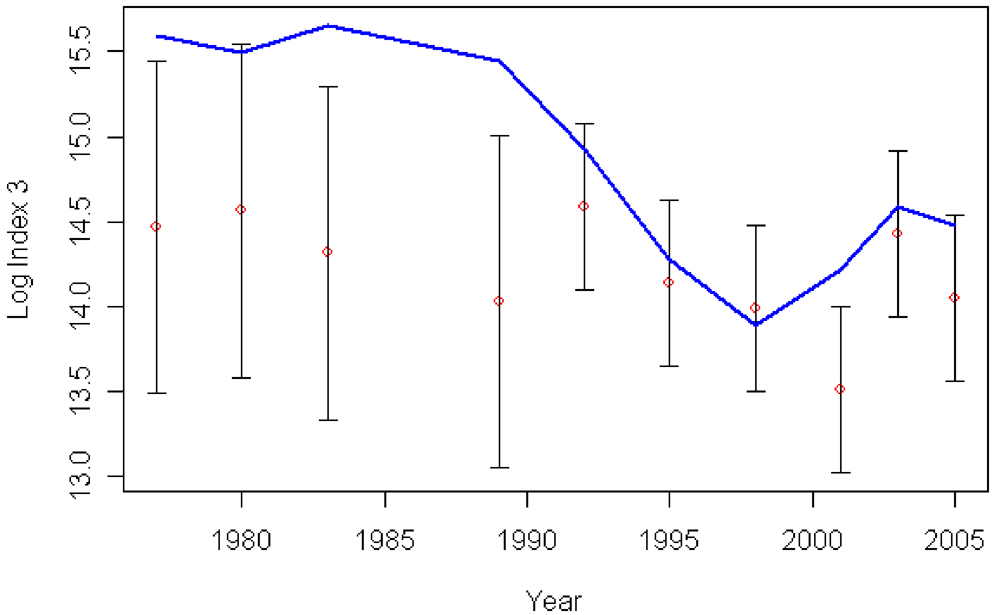


Figure 42 continued. Standardized Pearson age at length residuals for the acoustic survey. Unfilled circles indicate negative residuals, filled circles indicate positive residuals.



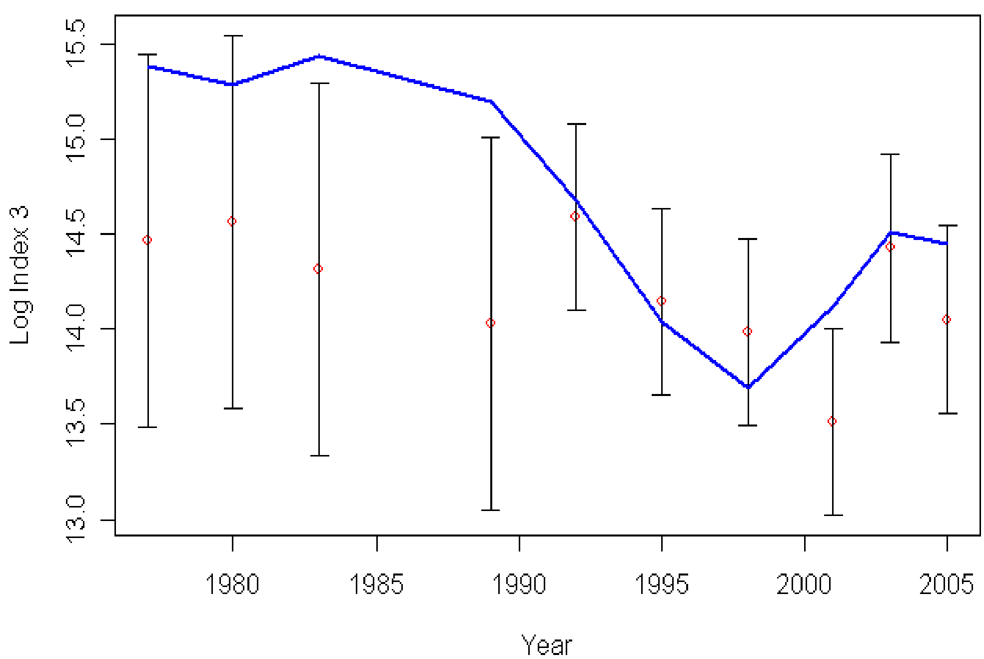


Figure 43. Predicted fit of acoustic survey biomass to the observed time series for the base (top) and alternative (bottom) models. Value are shown on a logarithmic scale.

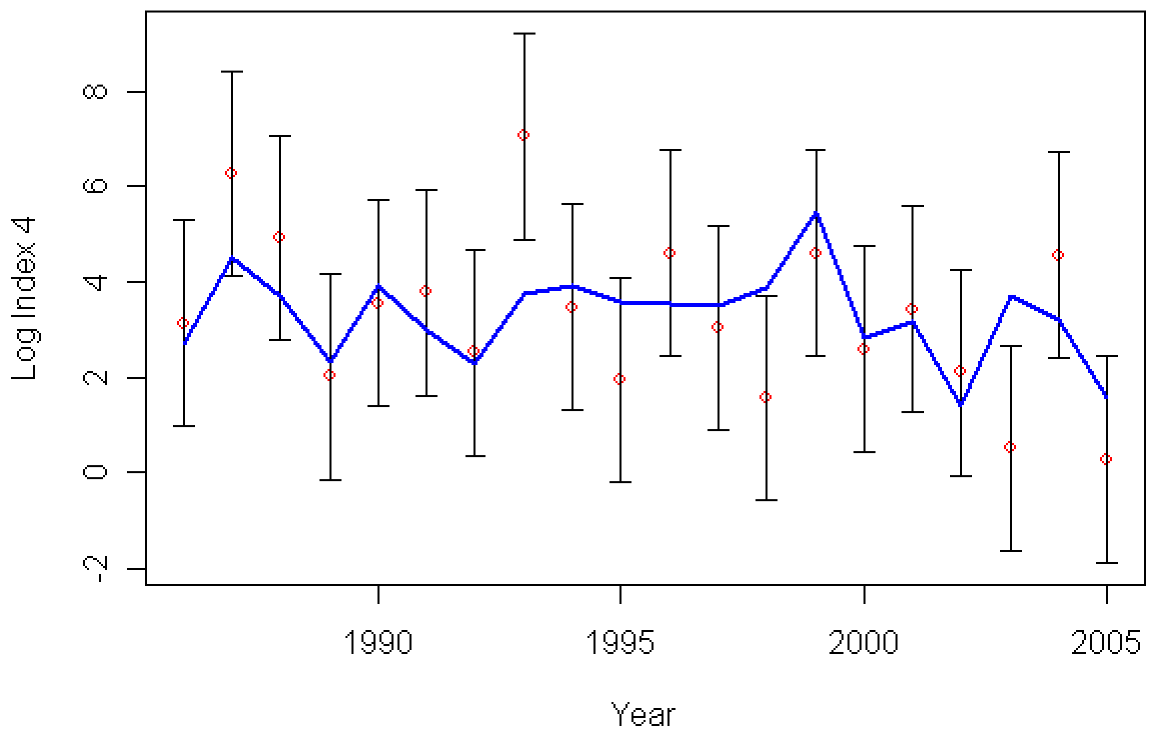


Figure 44. Predicted fit of the Santa Cruz pre-recruit hake survey to the observed time series, 1986. Value are shown on a logarithmic scale.

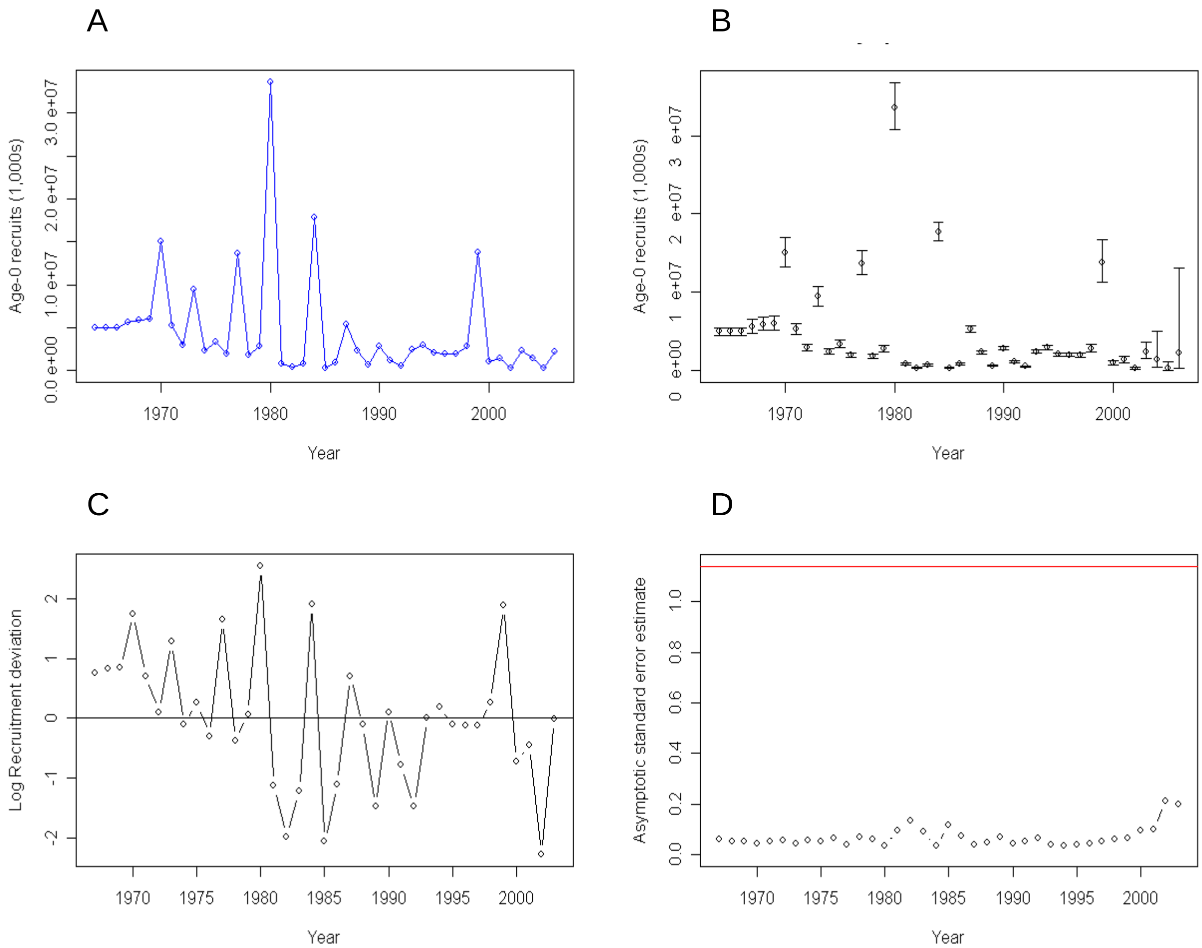


Figure 45. Estimates of Pacific hake recruitment (A), recruitment uncertainty (B), recruitment deviations (C) and asymptotic standard errors (D) from base SS2 model results. Recruitments were estimated from 1967-2003, but otherwise taken as mean recruitment.

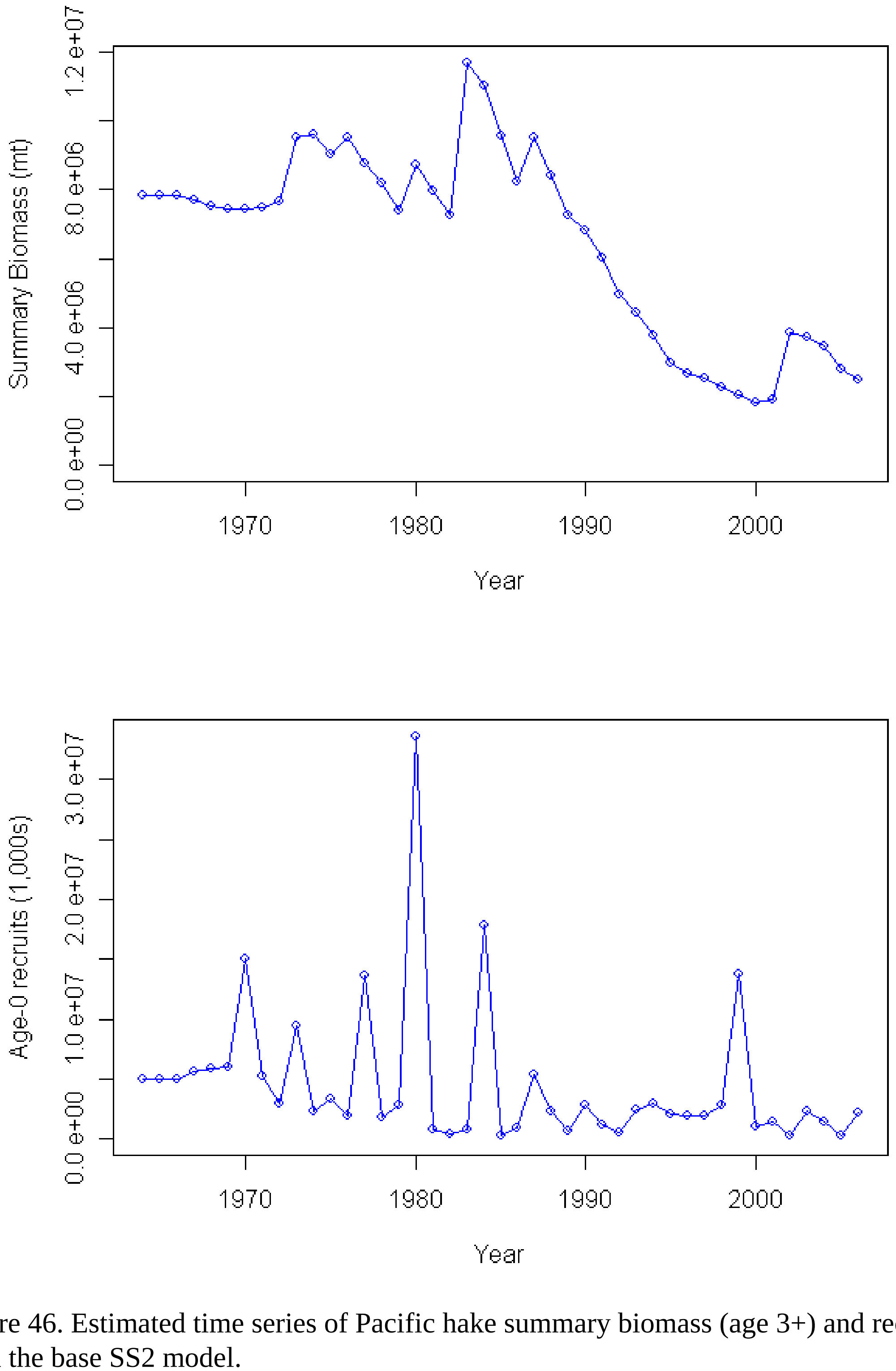


Figure 46. Estimated time series of Pacific hake summary biomass (age 3+) and recruitment from the base SS2 model.

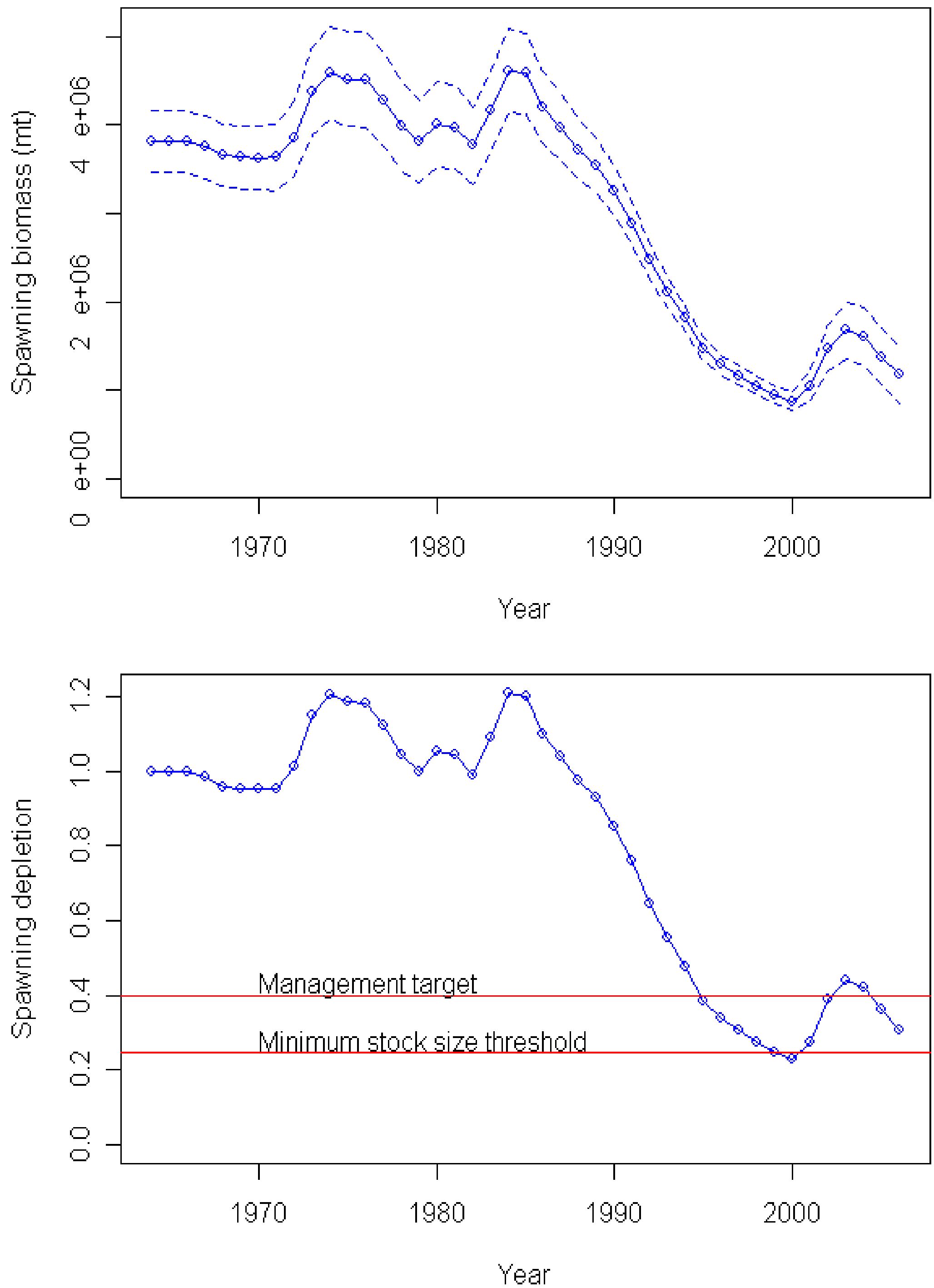


Figure 47. Estimated time series of Pacific hake spawning biomass and spawning depletion (fraction of unfished biomass) from the base SS2 model.

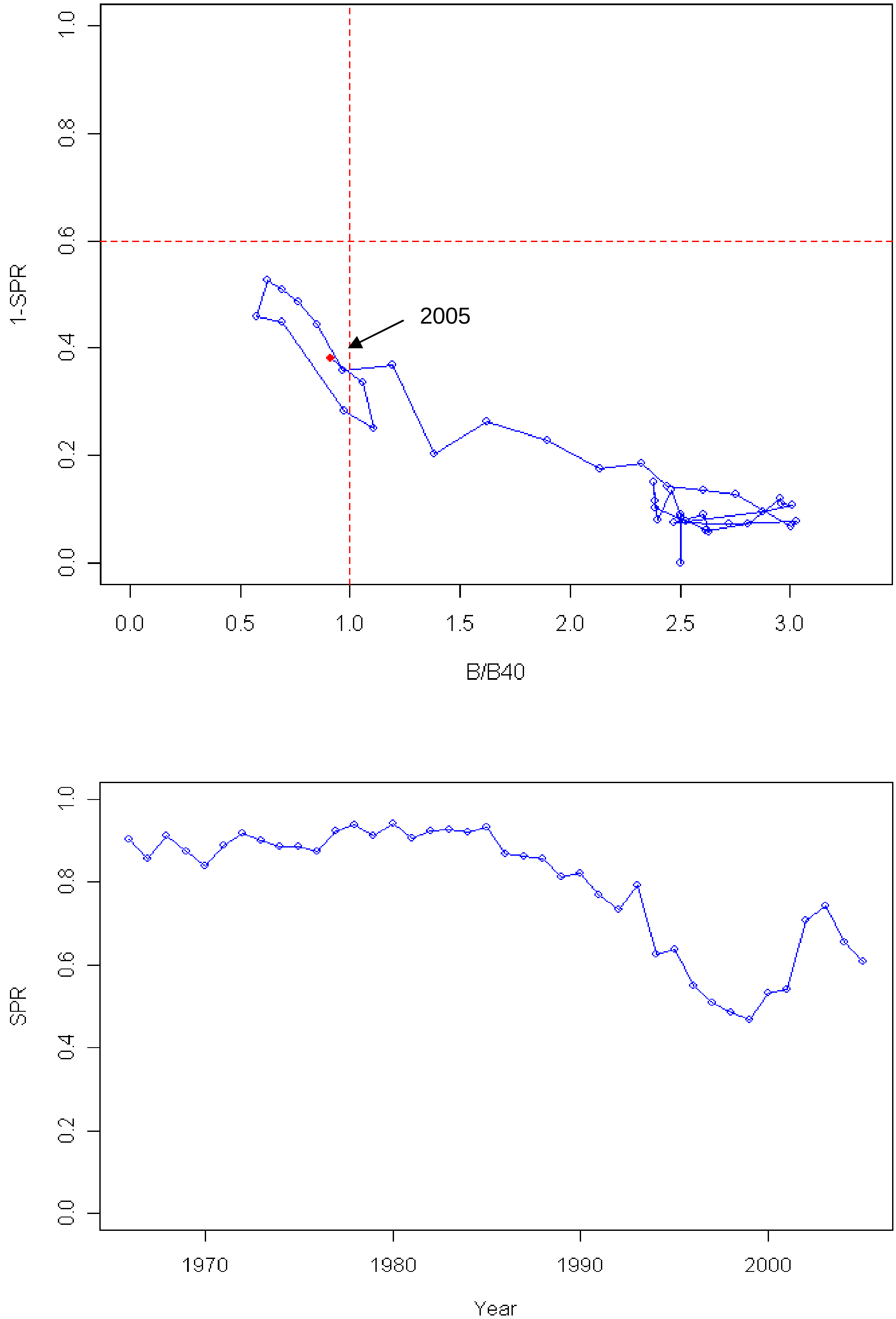
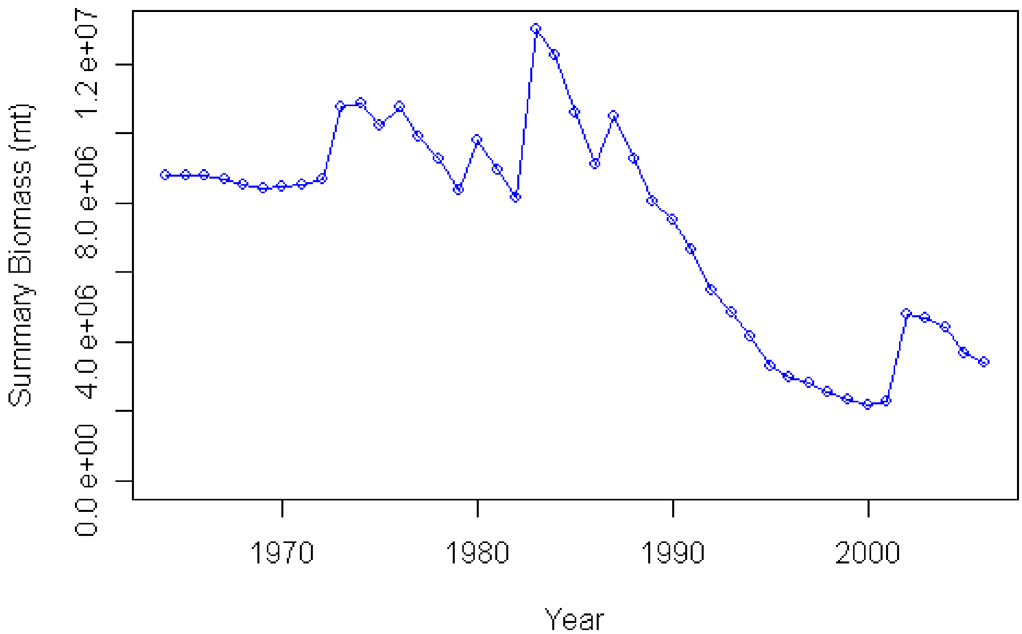


Figure 48. Estimated time series of Pacific hake spawning potential ratio (SPR) and fishery performance relative to reference point targets from the base SS2 model.



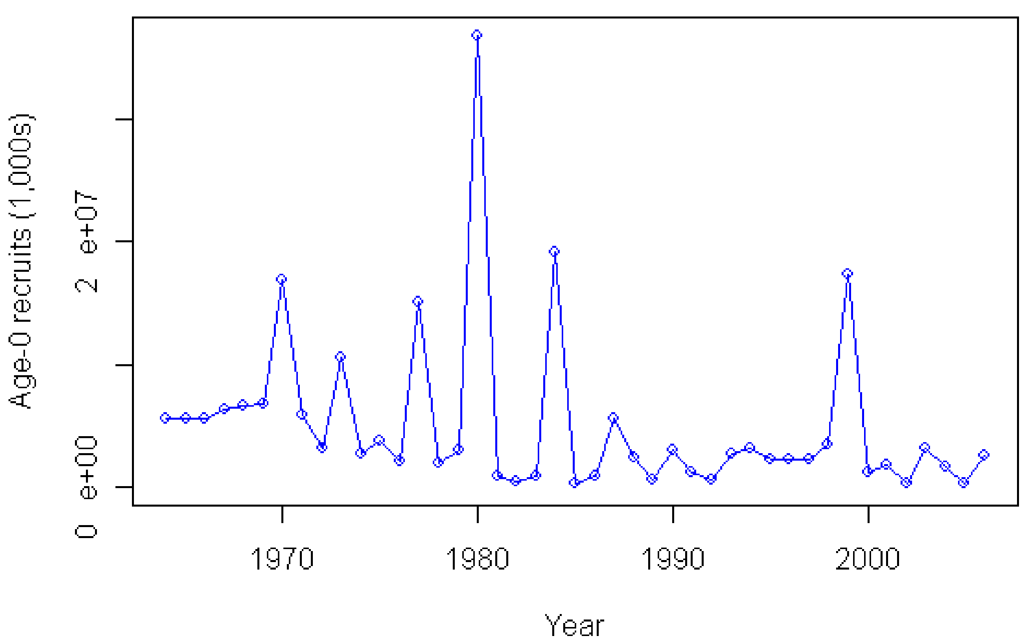


Figure 49. Estimated time series of Pacific hake summary biomass (age 3+) and recruitment from the alternative SS2 model (h=0.75 with q prior).

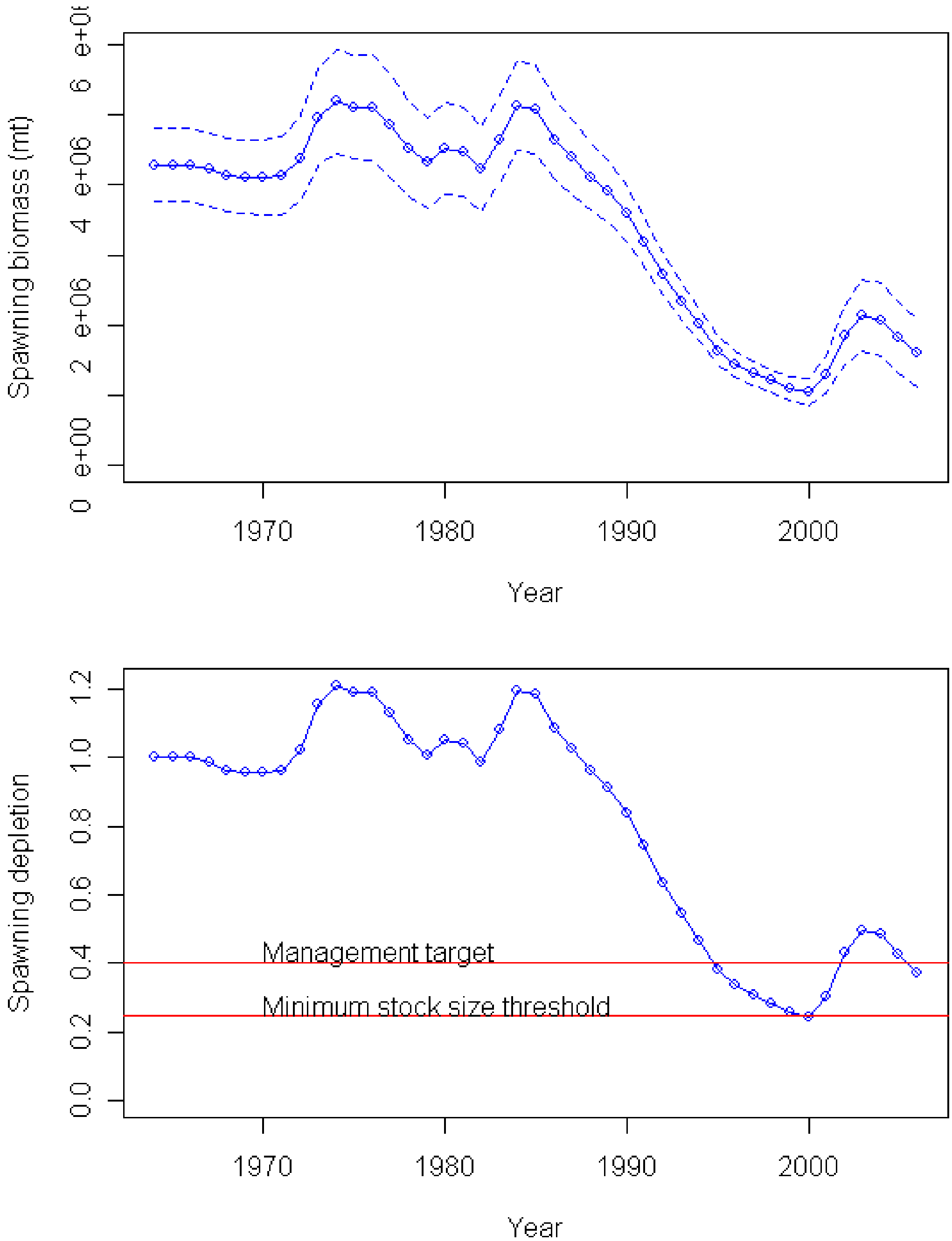


Figure 50. Estimated time series of Pacific hake spawning biomass and spawning depletion (fraction of unfished biomass) from the alternative SS2 model (h=0.75 with q prior).

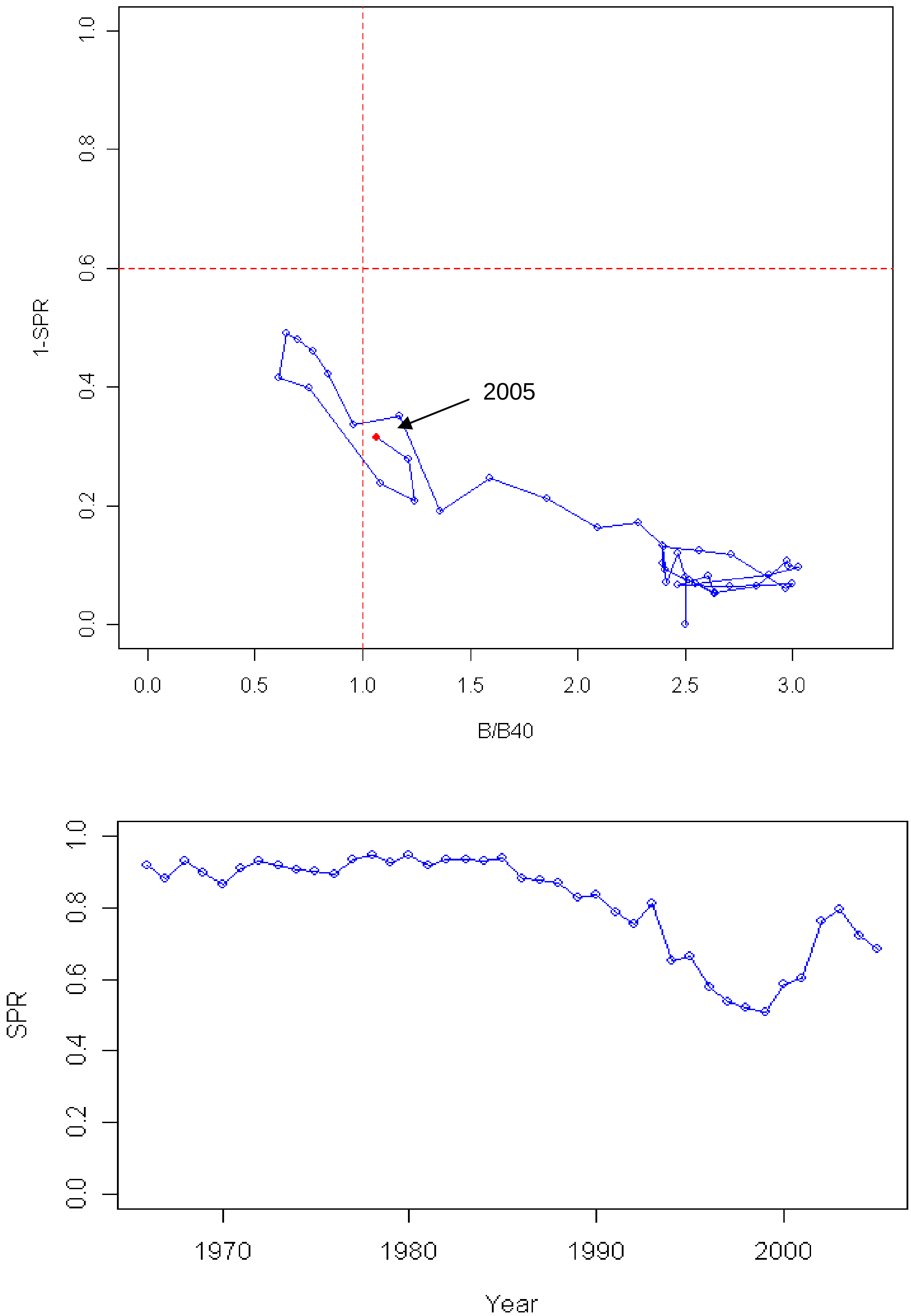


Figure 51. Estimated time series of Pacific hake spawning potential ratio (SPR) and fishery performance relative to reference point targets from the alternative SS2 Model (h=0.75 with q prior).

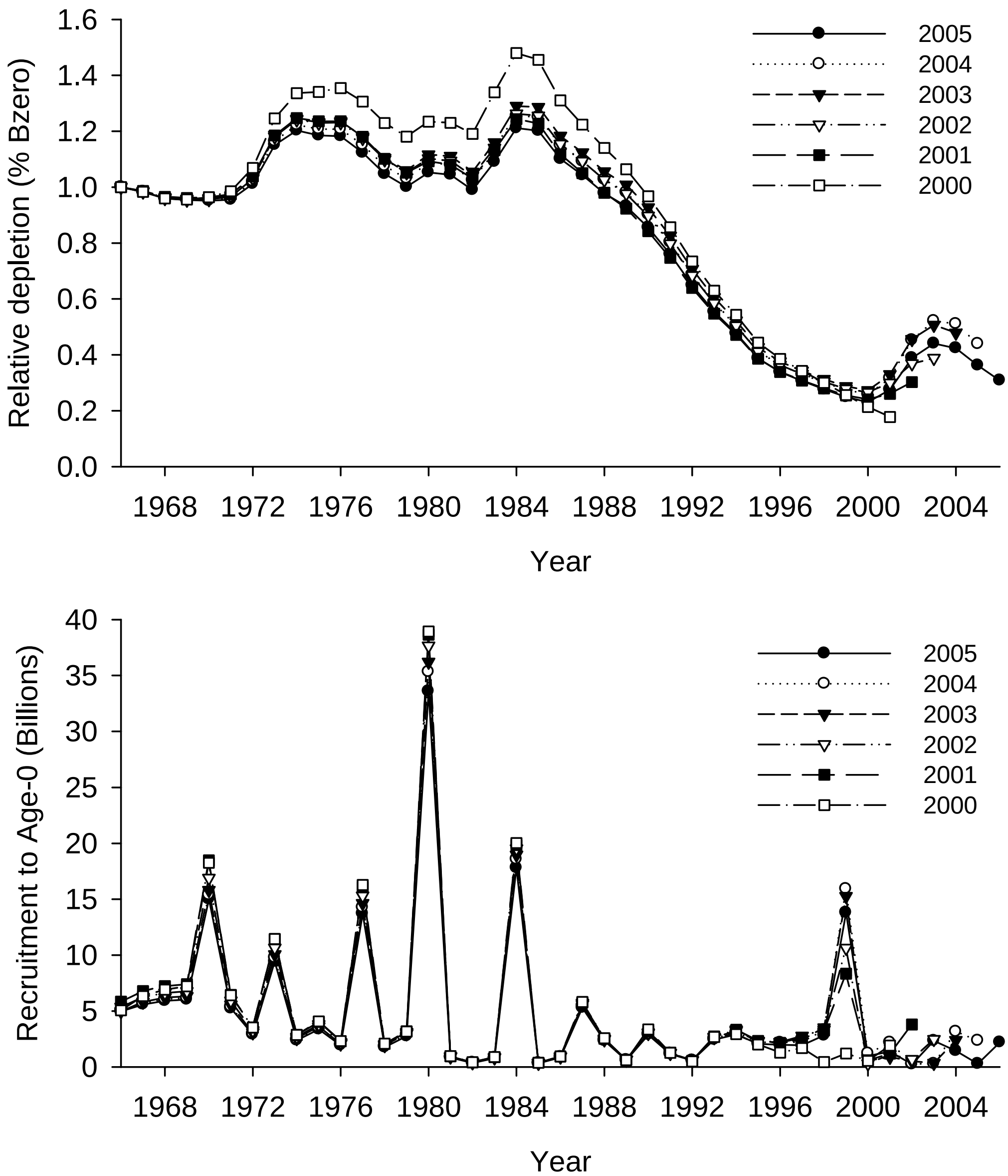


Figure 52. Retrospective analysis showing the pattern of relative depletion (% Bzero) recruitment to Age-0 from sequentially removing the last year of data in the base model.

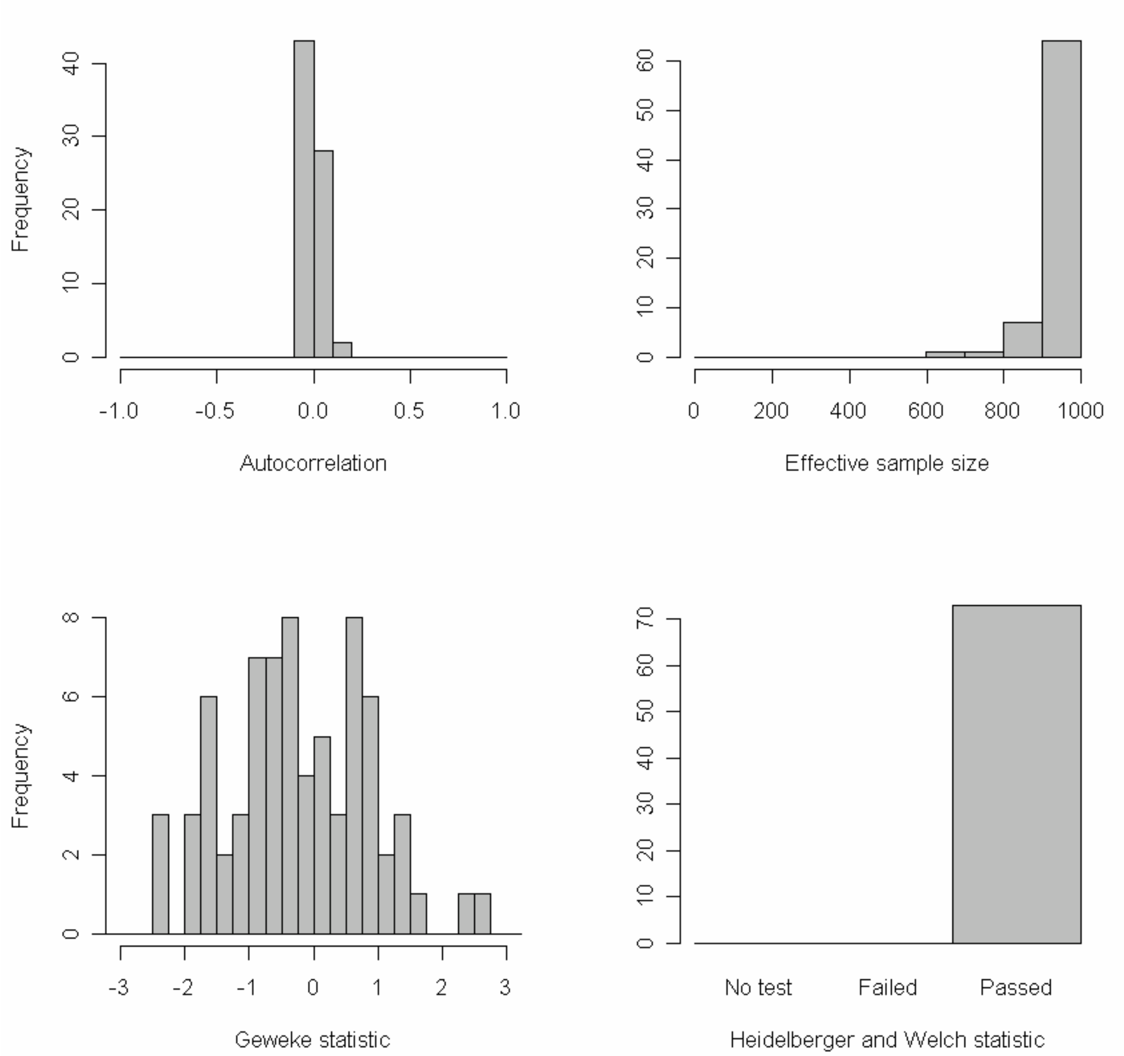


Figure 53. Summary of convergence criteria for all estimated model parameters.

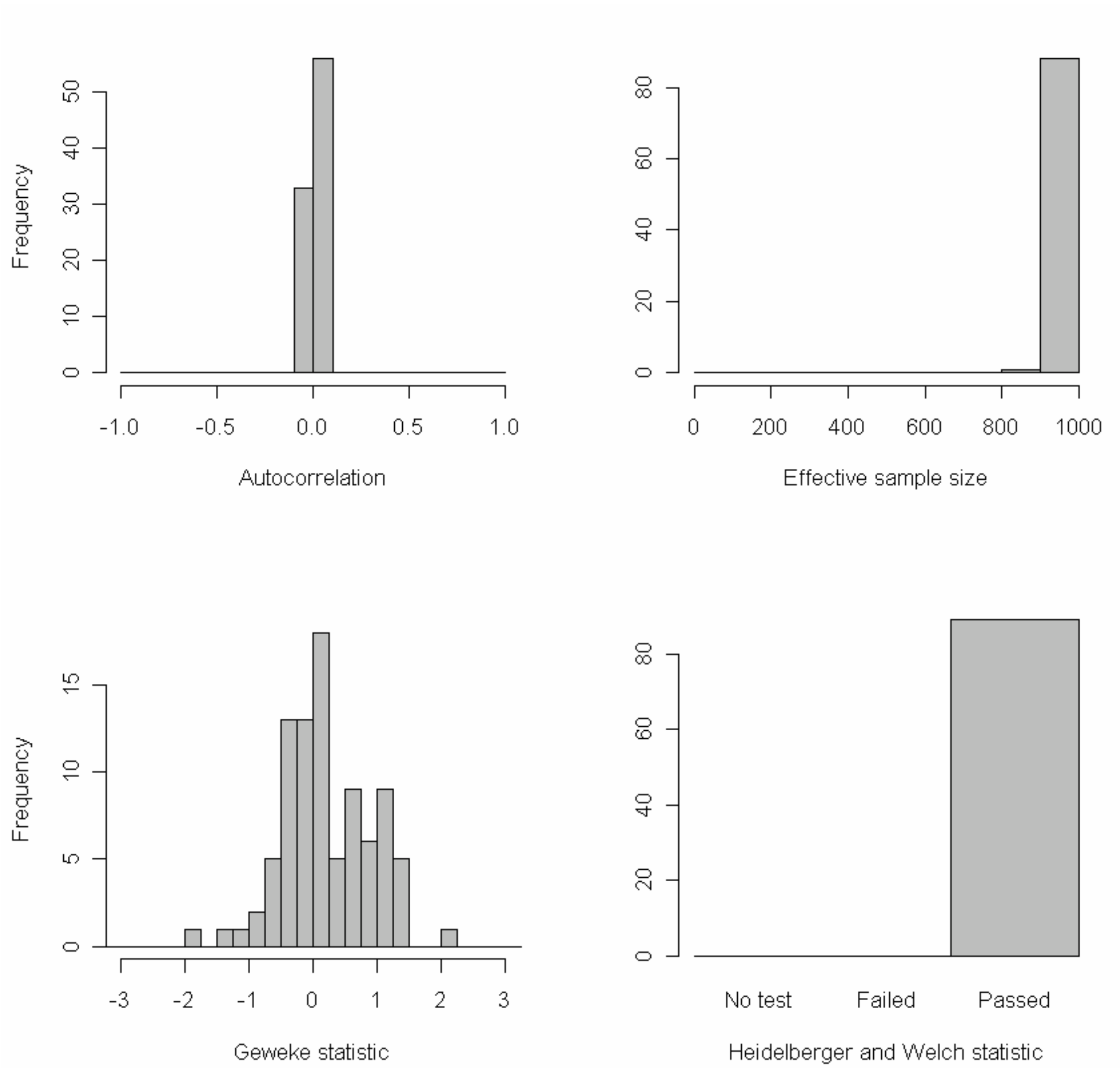


Figure 54. Summary of convergence criteria for the derived variables such as spawning biomass and recruitment time-series'.

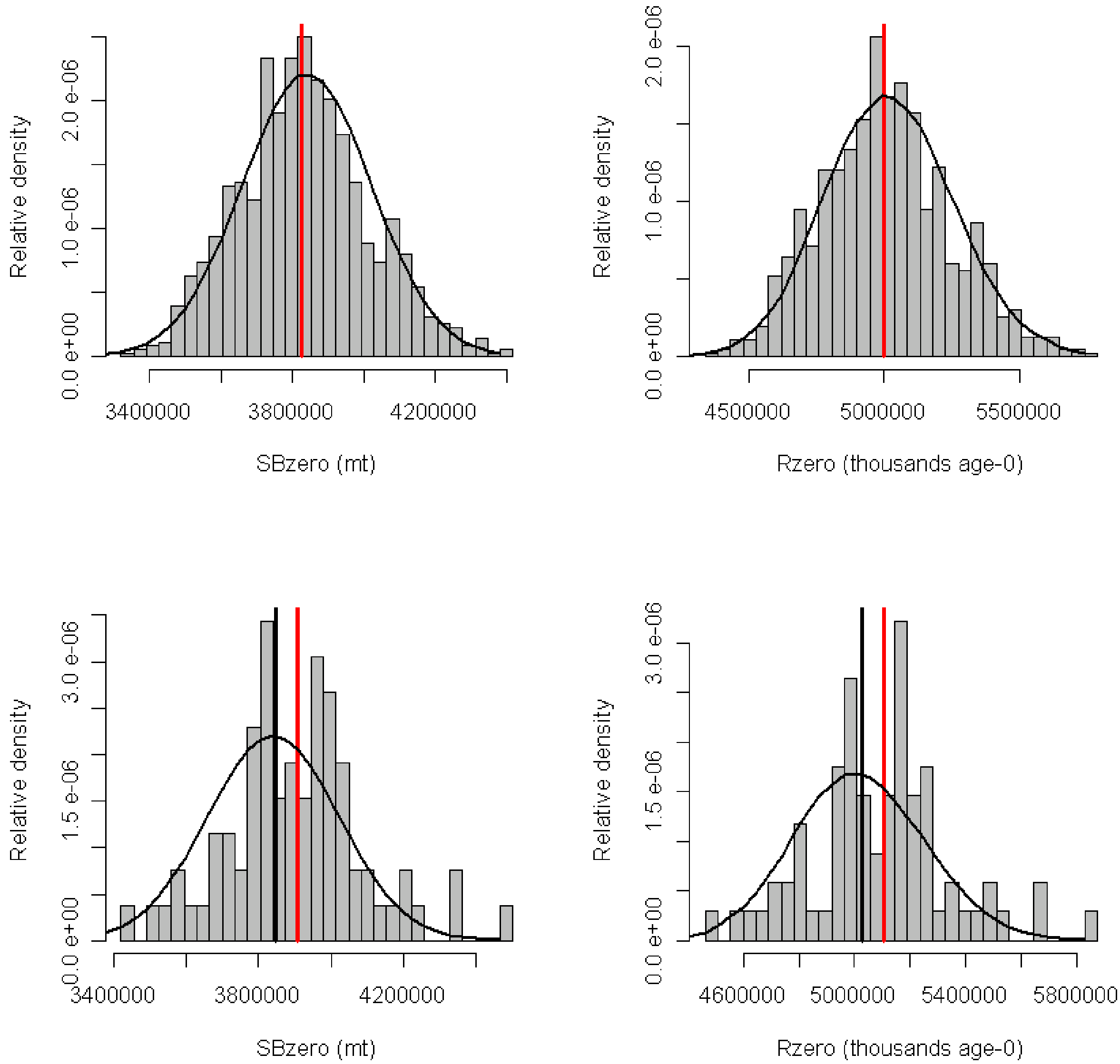


Figure 55. Top) Comparison of the posterior distribution of unfished biomass (Bzero) and recruitment (Rzero) from Markov Chain Monte Carlo (MCMC) integration (bars) to asymptotic variance estimates from maximum likelihood estimates of the Hessian (solid line). Bottom) Comparison of the distribution of unfished biomass (Bzero) and recruitment (Rzero) from model fits to 75 parametric bootstraps of the data (gray line is the “true” value; black line is the median) to asymptotic variance estimates from maximum likelihood estimates of the Hessian (solid line).

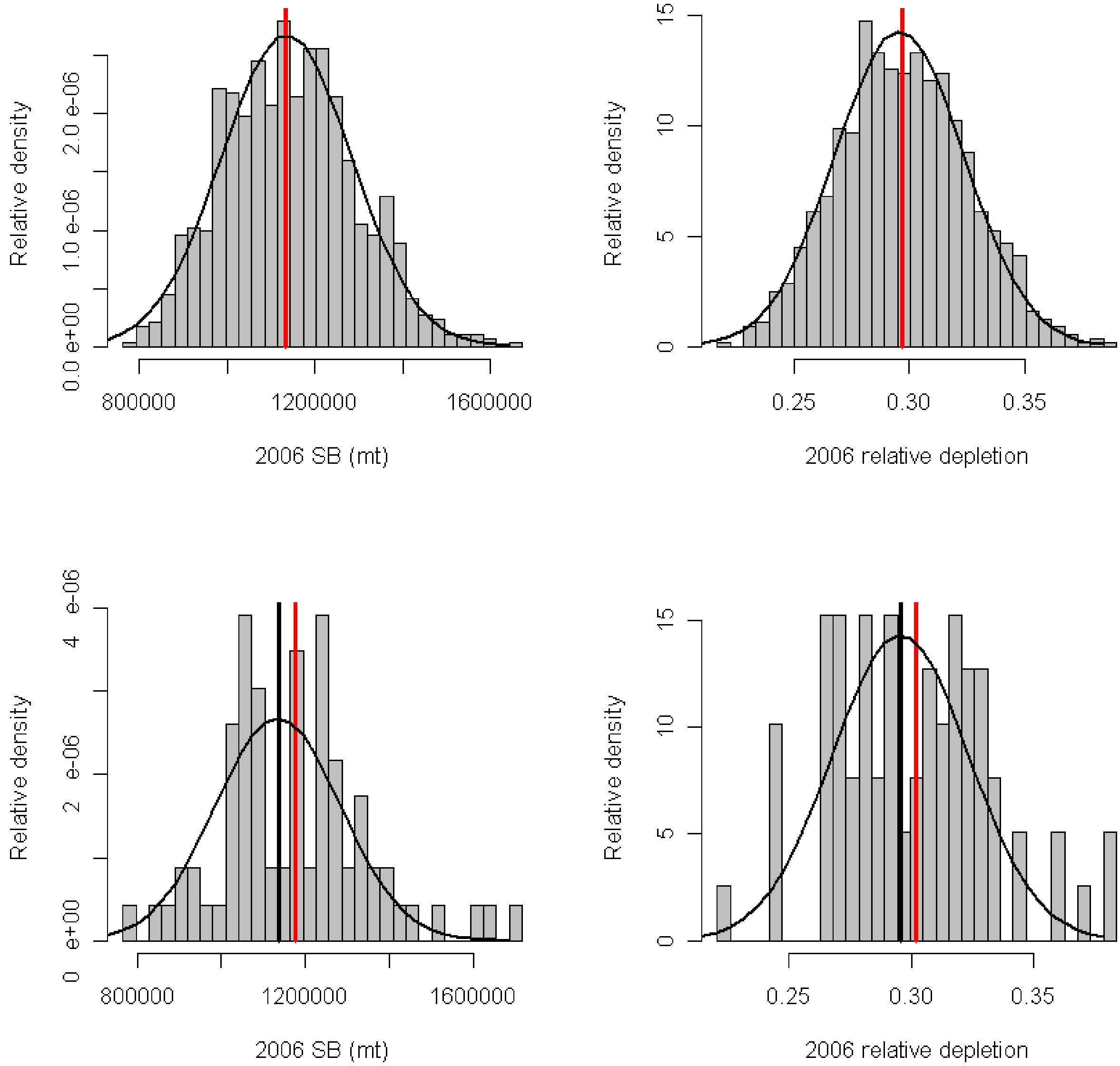


Figure 56. Upper plots show comparison of the posterior distribution of 2006 spawning biomass (2006 SB) and 2006 relative depletion from Markov Chain Monte Carlo (MCMC) integration (bars) to asymptotic variance estimates from maximum likelihood estimates of the Hessian (solid line). Lower plots show comparison of the distribution of 2006 spawning biomass and 2006 relative depletion from model fits to 75 parametric bootstraps of the data (gray line is the "true" value; black line is the median) to asymptotic variance estimates from maximum likelihood estimates of the Hessian (solid line).

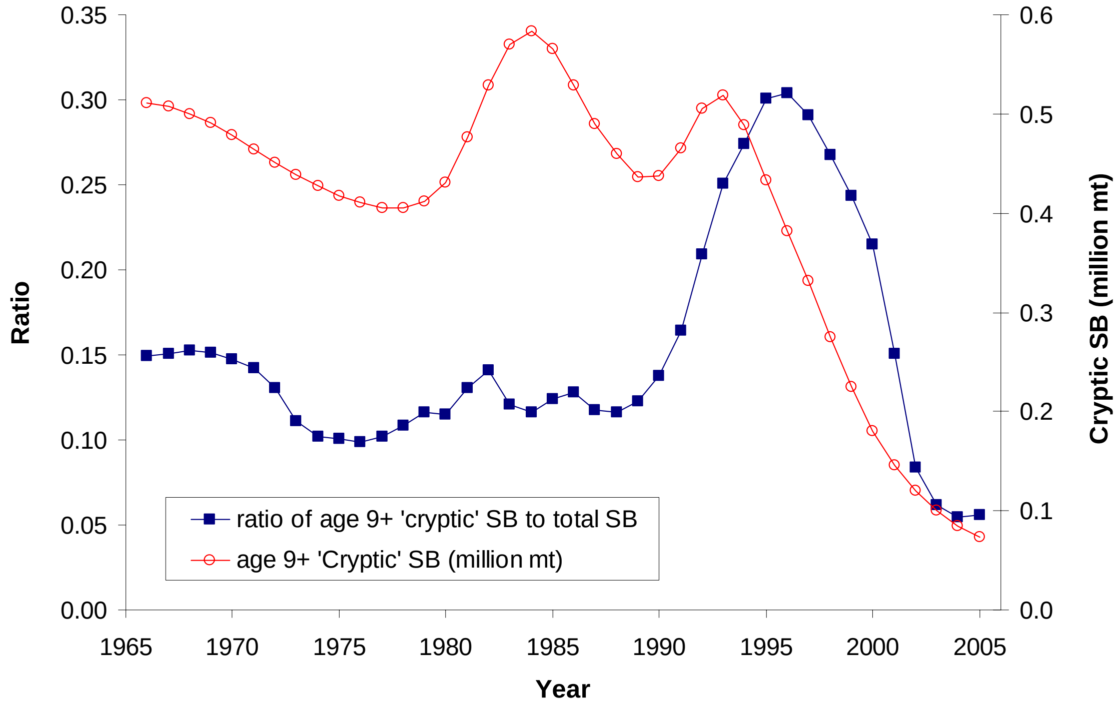


Figure 57. Time series of the ratio of age 9+ poorly selected (‘cryptic’) spawning biomass (relative to the dome-shaped acoustic survey selectivity) to total spawning biomass (solid squares, primary axis), and poorly selected spawning biomass (million mt).

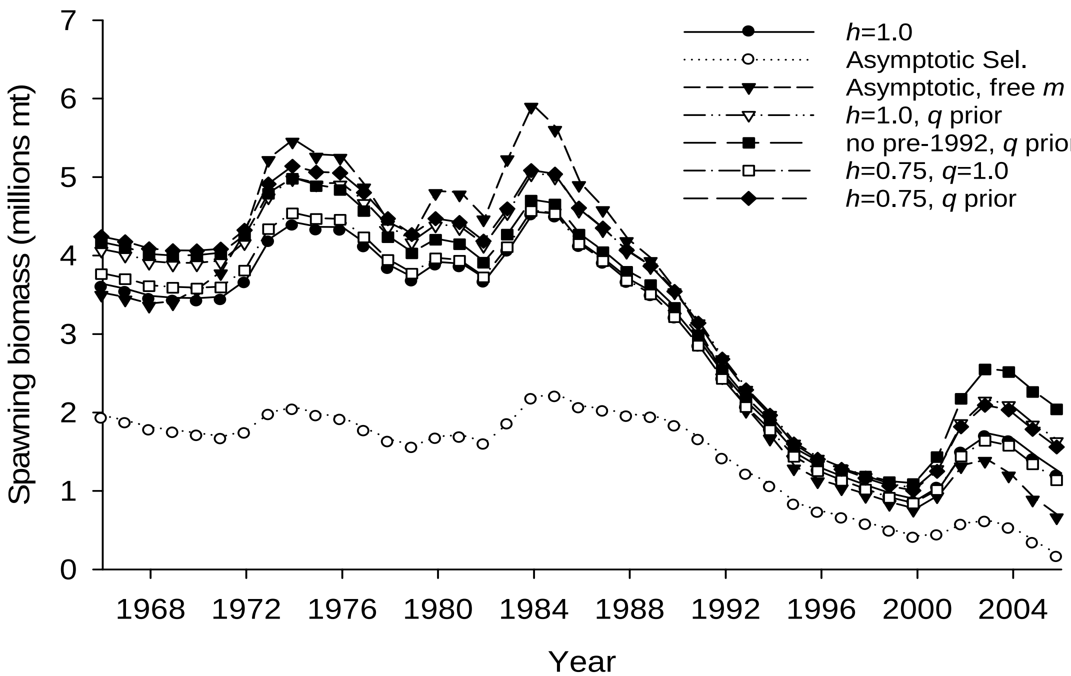


Figure 58. Trends in spawning biomass from base case and alternative models.

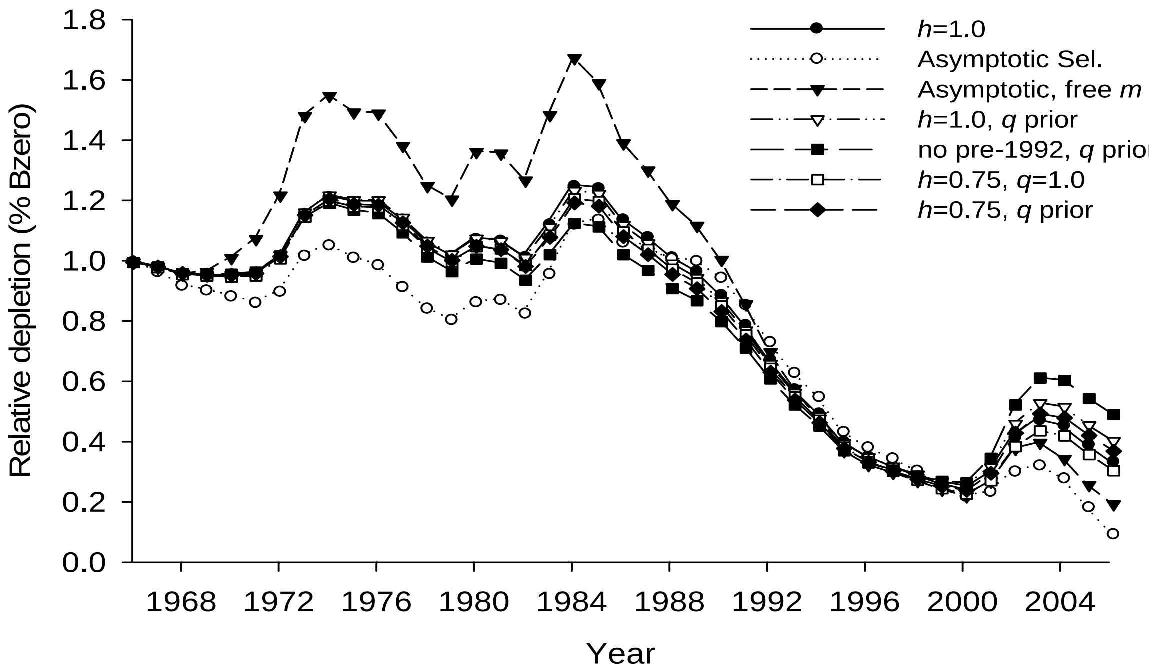


Figure 59. Trends in relative depletion (% Bzero) from base case and alternative models.

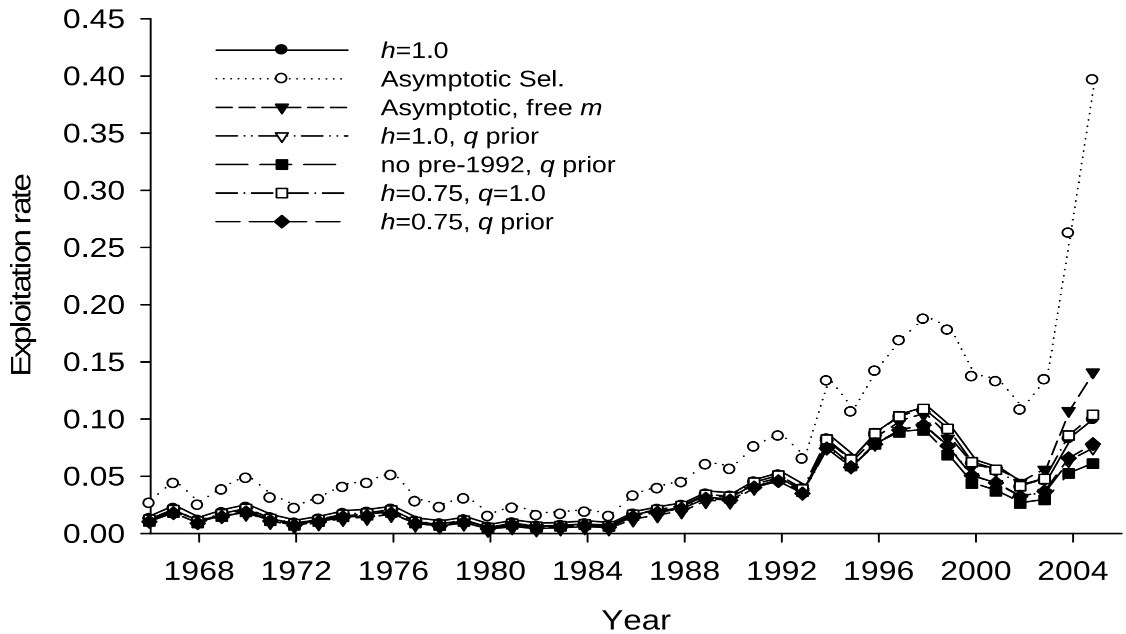


Figure 60. Trends in coastwide exploitation rate (total catch / total biomass) from base case and alternative models.

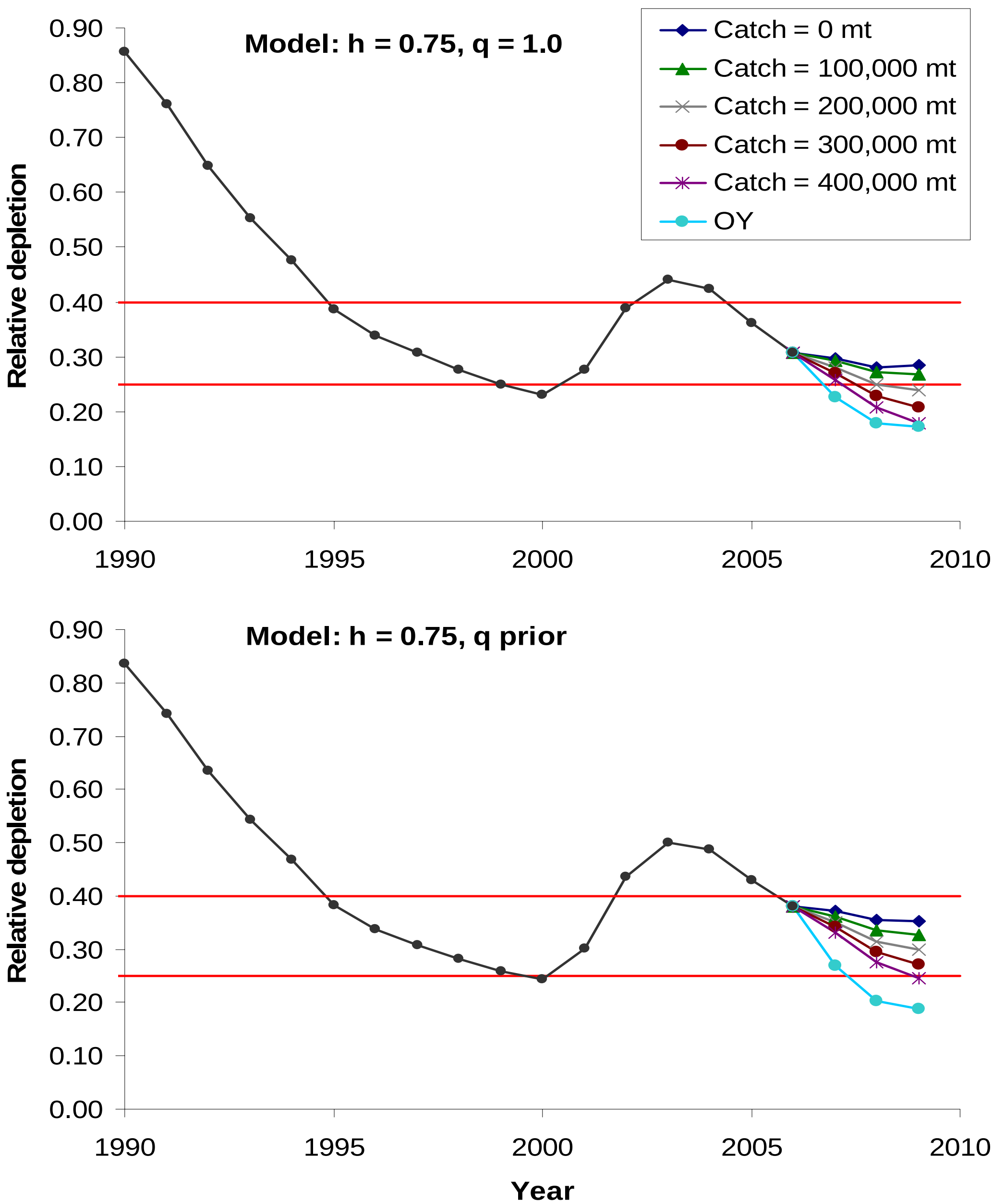


Figure 61. Projections through 2009 for the base (upper plot) and alternative (lower plot) models under various total coast-wide catch scenarios.

Appendix A: Growth Analysis

Pacific Hake Growth

There is a considerable amount of variability in the length-at-age data collected during the acoustic surveys since 1977. There are a number of ways to interpret this variability including: effects from size-selective fishing, changes in size selectivity over time, and variation in growth rates over time. Here we explore alternative explanations in hake growth by fitting alternative growth models to the length-at-age data collected in the acoustic surveys (assuming size-selectivity in the acoustic surveys has been constant over time).

The first of these models is a simple time-varying growth model, where the growth coefficient (k) is allowed to vary over time. This assumes that all extant cohorts are subject to time varying changes in the metabolic rates (presumably associated with changes in available food). This is the version of the growth model that is presently implemented in Stock Synthesis 2 (SS2). The second growth model assumes that growth is density-dependent. That is, the density of each cohort determines the overall growth rate and each cohort has its own asymptotic length. The third model is similar to the second model; however, in this case we assume the growth coefficient (k) is cohort specific.

Growth Model

We assume that hake growth follows the von Bertalanffy growth equation, which is given by:

(1) $$L_a = L_1 + (L_2 - L_1)\left[\frac{1-\rho^{a-2}}{1-\rho^{A-2}}\right]$$

where L_a is the mean length at age a (a is an index for age and A corresponds to age 15), L_1 and L_2 are the mean lengths of age 2 and age 15, respectively, and ρ is the Brody growth coefficient (ρ=exp(-k), where k is the standard von Bertalanffy growth coefficient). Mean variation in length-at-age is assumed not to vary over time and the estimates of standard deviation in length-at-age is assume to be a function of 2 unknown parameters and the growth coefficient (k) only:

(2) $$S_a = \lambda_1 \exp\left[\lambda_2\left(-1+2\frac{1-\rho^{a-2}}{1-\rho^{A-2}}\right)\right]$$

where λ_1 and λ_2 are unknown parameters to be estimated. Using equation 2 to describe variation in length-at-age is more desirable than estimating a fixed coefficient of variation in length-at-age as it is less confounded with the growth parameters (Fournier et al. 1991).

The following growth models assume that fish samples for size-age composition information were drawn from a multinomial distribution that includes the joint probability of sampling a fish of a given age and length. The negative log likelihood kernel for estimating growth parameters is given by:

(3) $$L = -\sum_l \sum_a n_{l,a} \ln(p_{l,a})$$

where $n_{l,a}$ is the observed sample numbers of length l and age a fish and $p_{l,a}$ are the predicted proportions. The predicted proportions sampled is the product of size selectivity (v_l), then numbers at age and the probability of being in length interval l for a given age.

(4) $$p_{l,a} = \frac{v_l N_a P(l \mid a)}{\sum_l \sum_a v_l N_a P(l \mid a)}$$

Variation in length at age was assumed to be normally distributed and we used the normal distribution to compute the probability of sampling a fish of a certain length l for a given age ($P(l|a)$). In the acoustic survey samples, we assume that size selectivity follows a simple logistic function where the length at 50% vulnerability is 35cm and the standard deviation in size selectivity is 2cm. It is possible to estimate the selectivity parameters simultaneously, but for comparative reasons we fixed these parameters at these arbitrary values. We used the conditional maximum likelihood estimate for the numbers-at-age (N_a) in the population (Taylor et al. 2005). To obtain the MLE for N_a we differentiate equation (3) with respect to N_a, set the derivative to 0 and solve for N_a, which is given by:

(5) $$N'_a = \left(\frac{n_a}{n_T}\right)\left(\frac{V_T}{\bar{v}_a}\right),$$

where $\bar{v}_a \sum_l v_l P(l \mid a)$ is the sum vulnerabilities-at-length in each age class weighted by $P(l|a)$, n_a and n_T are the observed sample numbers at age a and total number sampled. Substituting equation (5) into equations (4) and (3), and noting that the n_a/n_T do not change with respect to parameter values, the likelihood kernel for the conditional MLE estimates of N_a is given by:

(6) $$L = -\sum_l \sum_a n_{l,a} \ln\left(\frac{v_l P(l \mid a)}{\bar{v}_a}\right)$$

The parameter vector to estimate for a single length-age matrix consists of the growth parameters for estimating the mean length-at-age (l_1, l_2, k) and the parameters that describe the variation in length at age (λ_1, λ_2).

Time varying k

In the case of adding time varying effects on the growth coefficient k, we estimated vector of growth coefficients k_t (one for each survey year and 15 parameters in total were estimated). In this case, the l_1 and l_2 parameters of the growth model were assumed to be time invariant and inter annual variation in mean length-at-age was assumed to arise through inter annual variability in metabolic rates (k_t).

Cohort effects

In the case of assuming cohort density determines the overall growth rate, we estimated a vector of $l_{2,g}$ parameters or a vector of growth coefficients k_g, where the g subscript denotes a specific cohort. In the acoustic survey data, spanning 1977 to 2005, there are

42 cohorts between the ages of 2 and 15 (a total of 46 parameters were estimated). Not all cohorts are sampled with the same frequency during each survey year. For example, in 1977, the 1963-1965 cohorts (representing the age 13-15 age classes in 1977) are only represented once in the length-age data. Similarly, the age 2 and 3 year classes sampled in 2005 are only represented once in the data. We used a weak informative normal prior on the cohort specific parameters in the form of:

$$P(\theta_g) = \ln(\sigma) + \frac{\sum_g \left(\theta_g - \bar{\theta}\right)^2}{2\sigma^2} \tag{7}$$

where θ_g represents the cohort specific parameter being estimated. In the case of estimating $l_{2,g}$ parameters, the standard deviation for the prior distribution was set to 25cm, and the case of estimating k_g parameters the standard deviation for the prior distribution was set to 0.25. The effect of this prior is minimal for cohorts that are represented more than once in the data.

Results

The motivation for using the cohort based model is apparent in the observed length-age data (Figure 1) whereby some of the cohorts appear to grow at different rates than other cohorts sampled in the same year. For example, the age-5 and age-6 cohorts sampled in 1980 appear to have the same mean length indicating that the age-5 cohort is growing faster than the age-6 cohort. Similarly, the age-4 cohort appears to be growing faster than the age-5 cohort in 2001. Of the 3 alternative growth models, the model with cohort specific l_2 values explains more of the variation in the length-age data versus the time varying k model and cohort k model (Table 1).

Table 1. Parameter estimates and corresponding fits and AICs for the 3 alternative growth models. For the time varying k model the mean estimate of k is presented and for the cohort models the mean estimate of l2 and k are presented.

Growth Model	ln(L)	n	AIC	L1	L2	k	λ_1	λ_2
Time Varying k	32701.2	15	65372.4	31.99	55.42	0.25	3.93	0.34
Cohort l2	32572.5	46	65053.0	31.48	55.80	0.29	3.88	0.24
Cohort k	32738.1	46	65384.2	31.77	55.57	0.30	3.98	0.30

Comments on Growth Analysis

Note that these cohort based models do not assume the cumulative affects of size selective fisheries. To properly represent the cumulative affects of size selective fisheries in this approach, the cohort based growth model should be integrated into the assessment model itself. In this case it would not be necessary to use the conditional MLE for the numbers-at-age; this information could be provided from the stock assessment model it self.

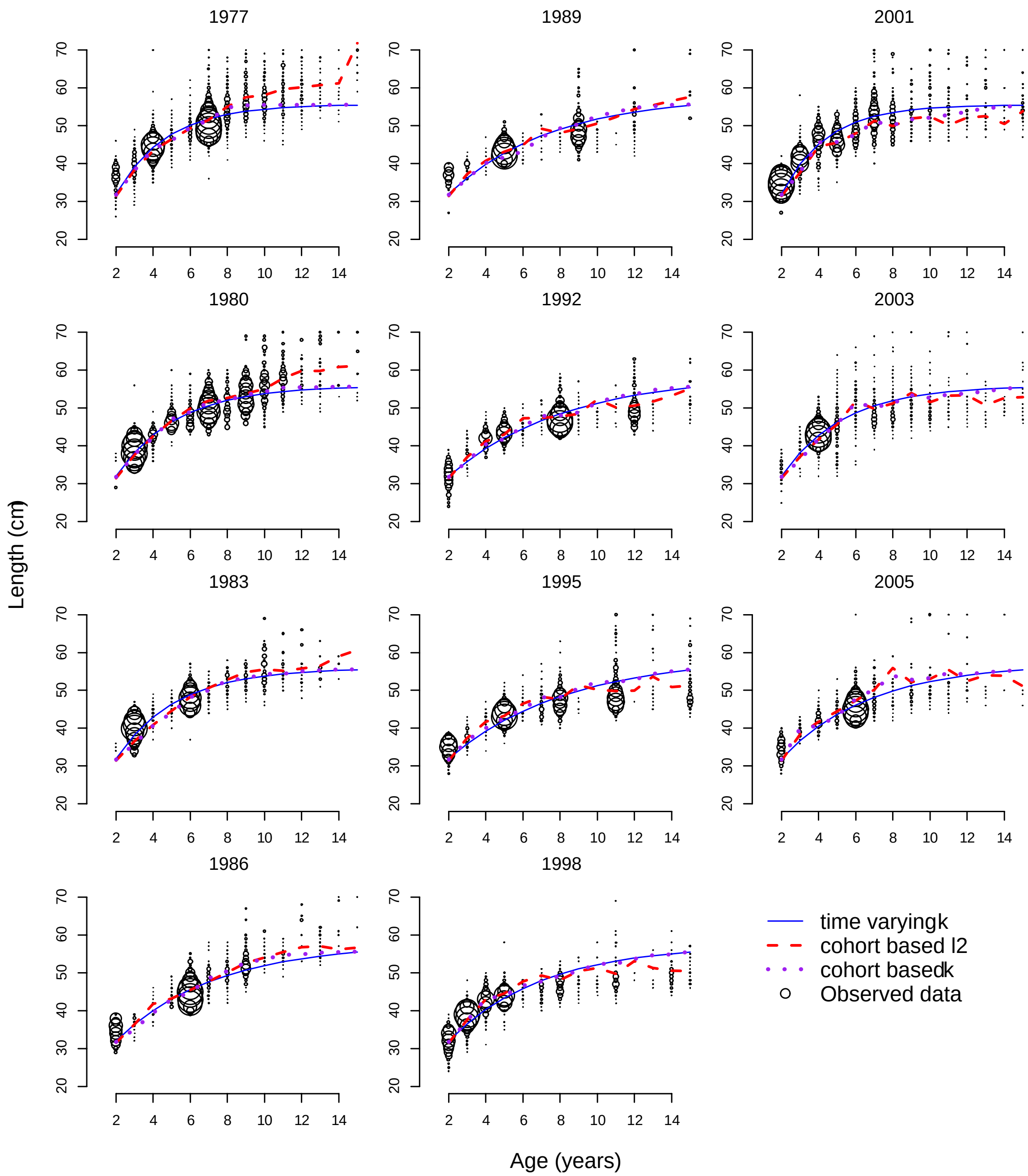


Figure 1. Length-at-age data collected from the acoustic surveys where the diameter of the circle is proportional to the sample size collected. Three separate growth models were fit to the data using a multinomial likelihood criterion. In the first model it was assumed that the growth coefficient (k) varies over time (time varying k), the second model assumes that the asymptotic length of each cohort varies (cohort based l2) and the third model assumes that the growth coefficient for each cohort varies over time (cohort based k).

It is probably not necessary to estimate growth parameters for each cohort in the model, rather to use a functional relationship that relates the effect of cohort density on the mean asymptotic size attained by each cohort. Based on the acoustic survey data alone and an arbitrary selectivity curve for the acoustic survey, there is a weak relationship between the 3+ biomass and the asymptotic length (Figure 2). We also examined the relationship between age-2 recruits and l_2, but found no significant relationship. Integrating the cohort based growth model into the assessment model would allow for additional data sources from the commercial length-age sampling to provide more information about growth parameters for more of the cohorts; however, we suspect that this would create additional confounding with time varying selectivity parameters already in use in the assessment model. Alternatively, an explicit density-dependent growth model could easily be integrated into the assessment frame work, where the l_2 parameter varies

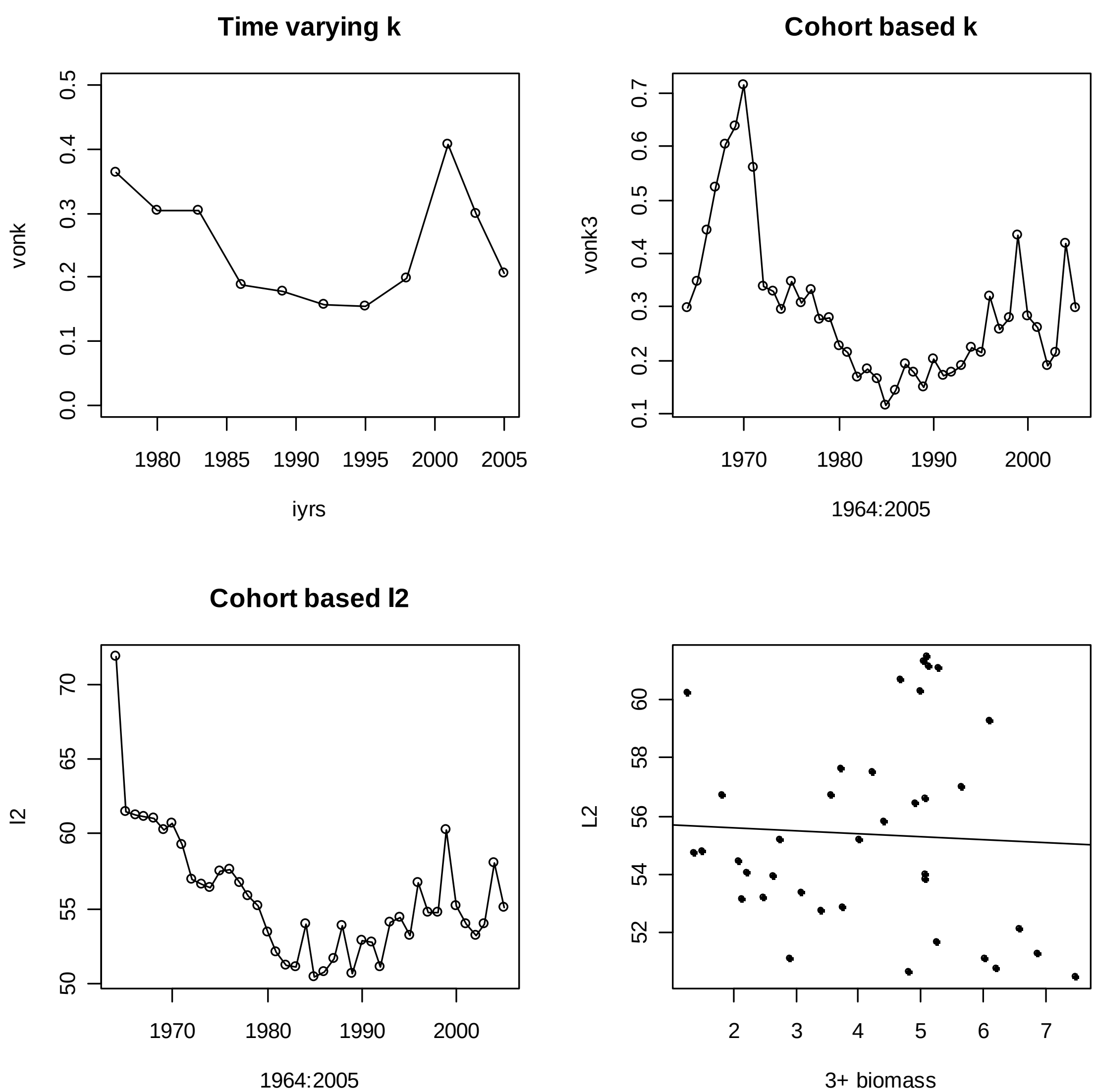


Figure 2. Estimates of time varying k and cohort based k and l2 parameters obtained from fitting the growth models to acoustic survey length-age data. Also, the relationship between estimates of l2 and 3+ biomass from the 2004 assessment is shown in the lower right panel.

according to stock density. Based on historical observations of changes in mean weight at age over time, incorporating the effects of overall stock density into growth may be the most parsimonious explanation of changes in hake growth.

Fournier, D., J. Sibert, and M. Terceiro. 1991. Analysis of Length Frequency Samples with Relative Abundance Data for the Gulf of Maine Northern Shrimp (*Pandalus borealis*) by MULTIFAN Method. Can. J. Fish. Aquat. Sci. **48**:591-598.

Taylor, N. G., C. J. Walters, and S. J. D. Martell. 2005. A new likelihood for simultaneously estimating von Bertalanffy growth parameters, gear selectivity, and natural and fishing mortality. Can. J. Fish. Aquat. Sci **62**:215-223.

APPENDIX B: SS2 Control and Data files

```
#  hake ss2 version 1.ctl
#  datafile:_hake ss2.dat
1  #_N_growthmorphs

#_assign_sex_to    each_morph_(1=female;_2=male)
1

1  #_N_Areas_(populations)

#_each_fleet/survey_operates_in_just_one_area
#_but_different_fleets/surveys_can be assigned_to_share_same_selex
1  1    1    1    #area_for_each_fleet/survey

0  #do_migration_(0/1)

6  #_N_Block_Designs
4
1
1
3
3
2
# Lmin
1982    1987
1988    1999
2000    2002
2003    2005
#K blocks
1980    1986
#1988   1993
#1994   1997
#1998   1999
#2000   2002
#2003   2005
# Lmax blocks
1984    2005
#1994   1997
#1998   2002
#2003   2005
# US Fish sel blocks
1984    1992
1993    2000
2001    2005
# Can sel blocks
1995    2000
2001    2002
2003    2005
# US inf1 blocks
1984    2000
2001    2005

#Natural_mortality_and_growth_parameters_for_each_morph
4  #_Last_age_for_natmort_young
15 #_First_age_for_natmort_old
2  #_age_for_growth_Lmin
12 #_age_for_growth_Lmax
-3 #_MGparm_dev_phase
#LO   HI    INIT  PRIOR  PR_type  SD    PHASE  env-variable     use_dev  dev_minyr dev_maxyrdev_stddev
0.05  0.6   0.23  0.23   0        0.8   -3     0      0     0    0    0.5   0    0
   #M1_natM_young
-3 3  0     0     0      0.8      -3    0      0      0     0    0.5  0     0
   #M1_natM_old_as_exponential_offset(rel_young)
10 40 33    33    0      99       3     0      0      0     0    0.5  0     0
   #M1_Lmin
30 70 50    50    0      99       3     0      0      0     0    0.5  3     2
   #M1_Lmax
0.1   0.7   0.30  0.40   0        99    3      0      0     0    0    0.5   2    2
   #M1_VBK
0.01  0.35  0.10  0.10   0        99    4      0      0     0    0    0.5   0    0
   #M1_CV-young
```

```
-3 3	0.32	0	0	0.8	-4	0	0	0	0	0.5	0	0	#M1_CV-old_as_exponential_offset(rel_young)
#-3	3	0	0	0	0.8	-3	0	0	0	0	0.5	0	0	#M2_natM_young_as_exponential_offset(rel_morph_1)
#-3	3	0	0	0	0.8	-3	0	0	0	0	0.5	0	0	#M2_natM_old_as_exponential_offset(rel_young)
#-3	3	0	0	0	0.8	-3	0	0	0	0	0.5	0	0	#M2_Lmin_as_exponential_offset
#-3	3	0	0	0	0.8	-2	0	0	0	0	0.5	0	0	#M2_Lmax_as_exponential_offset
#-3	3	0	0	0	0.8	-3	0	0	0	0	0.5	0	0	#M2_VBK_as_exponential_offset
#-3	3	0	0.	0	0.8	-3	0	0	0	0	0.5	0	0	#M2_CV-young_as_exponential_offset(rel_CV-young_for_morph_1)
#-3	3	0	0.	0	0.8	-3	0	0	0	0	0.5	0	0	#M2_CV-old_as_exponential_offset(rel_CV-young)

# Add 2+2*gender lines to read the wt-Len and mat-Len parameters
-3 3	7.0E-06	7.0E-06	0	0.8	-3	0	0	0	0	0.5	0	0	#Female wt-len-1
-3 3	2.9624	2.9624	0	0.8	-3	0	0	0	0	0.5	0	0	#Female wt-len-2
-3 3	36.89	36.89	0	0.8	-3	0	0	0	0	0.5	0	0	#Female mat-len-1
-3 3	-0.48	-0.48	0	0.8	-3	0	0	0	0	0.5	0	0	#Female mat-len-2
-3 3	1.	1.	0	0.8	-3	0	0	0	0	0.5	0	0	#Female eggs/gm intercept
-3 3	0.	0.	0	0.8	-3	0	0	0	0	0.5	0	0	#Female eggs/gm slope
#-3	3	0	0	0	0.8	-3	0	0	0	0	0.5	0	0	#Male wt-len-1

# pop*gmorph lines For the proportion of each morph in each area
0  1	1	1	0	0.8	-3	0	0	0	0	0.5	0	0	#frac to morph 6 in area 1

# pop lines For the proportion assigned to each area
0  1	1	1	0	0.8	-3	0	0	0	0	0.5	0	0	#frac to area 1

# Enter maturity at age (multiplied by 0.5 for female mature biomass)
#0 0	0.088	0.3305	0.445	0.4845	0.493	0.498	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5

#_custom-env_read
0  #_	0=read_one_setup_and_apply_to_all_env_fxns; 1=read_a_setup_line_for_each_MGparm_with_Env-var>0

#_custom-block_read
1  #_	0=read_one_setup_and_apply_to_all_MG-blocks;	1=read_a_setup_line_for_each_block x MGparm_with_block>0
# LMIN
#10	40	30	33	0	99	3
#10	40	30	33	0	99	3
#10	40	30	33	0	99	3
#10	40	30	33	0	99	3
# Lmax
30 70	50	50	0	99	3
#30	70	50	50	0	99	3
#30	70	50	50	0	99	3
# K
0.1	0.7	0.30	0.40	0	99	3
#0.1	0.7	0.30	0.40	0	99	3
#0.1	0.7	0.32	0.40	0	99	3
#0.1	0.7	0.35	0.40	0	99	3
#0.1	0.7	0.30	0.40	0	99	3
#0.1	0.7	0.30	0.40	0	99	3

#  LO	HI	INIT	PRIOR	Pr_type	SD	PHASE

#_Spawner-Recruitment_parameters
```

```
1  # SR_fxn:  1=Beverton-Holt
#LO     HI      INIT    PRIOR   Pr_type SD      PHASE
11 31   14.2    15      0       99      2       #Ln(R0)
0.2     1       0.75    1       2       0.2     -4      #steepness
0  2    1.139   1.2     0       0.8     -3      #SD_recruitments
-5 5    0       0       0       1       -3      #Env_link
-5 5    0       0       0       1       -4      #init_eq
0  #env-var_for_link
#  recruitment_residuals
#  start_rec_year   end_rec_year   Lower_limit   Upper_limit   phase
   1967     2003    -15     15      2

#init_F_setupforeachfleet
#LO     HI      INIT    PRIOR   PR_type SD      PHASE
0  1    0.0     0.01    0       99      -1
0  1    0.0     0.01    0       99      -1

#_Qsetup
#_add_parm_row_for_each_positive_entry_below(row_then_column)
#-Float(0/1)  #Do-power(0/1)  #Do-env(0/1)  #Do-dev(0/1)  #env-Var  #Num/Bio(0/1)  for  each  fleet  and
   survey
0  0    0       0       0       1
0  0    0       0       0       1
1  0    0       0       0       1
1  0    0       0       0       0

#LO     HI      INIT    PRIOR   PR_type SD      PHASE
-5 .5   0       0       0       99      -1      # Acoustic survey
-15     10      7       4       0       99      1       # recruit survey

#_SELEX_&_RETENTION_PARAMETERS
#Pattern   Retention(0/1)   Male(0/1)  Special
# Size_selex
0  0    0       0       #_fleet_1
0  0    0       0       #_fleet_2
0  0    0       0       #_acoustic
0  0    0       0       #_recruit

#_Age_selex
#13     0       0       0       #_fleet_1
#13     0       0       0       #_fleet_2
#13     0       0       0       #_acoustic

19 0    0       0       #_fleet_1
19 0    0       0       #_fleet_2
19 0    0       0       #_acoustic
11 0    0       0       #_recruit

#LO     HI      INIT    PRIOR   PR_type SD      PHASE   env-variable   use_dev   dev_minyr dev_maxyrdev_stddev
   Block_Pattern

#2          60   45   10   0   99   -4   0   0   0   0   0.5   0   0   #peak
#0.0000  0.1   0.0   0   0   99   -2   0   0   0   0   0.5   0   0   #init
#-5   5   0.0   0.3   0   99   2   0   1   1975   2004   0.1   0   0   #infl
#0.0000  10   0.3   0.3   0   99   2   0   1   1975   2004   0.1   0   0   #slope1
#-10   100   -4   -4   0   99   -2   0   0   0   0   0.5   0   0   #final
#-5   5   0.0   0.5   0   99   2   0   1   1975   2004   0.1   0   0   #infl2
#0.0001  10   0.3   .3   0   99   2   0   1   1975   2004   0.1   0   0   #slope2
#0.   25   1   0.2   0   99   -2   0   0   0   0   0.5   0   0   #width of top

#2          60   50   8   0   99   -3   0   0   0   0   0.5   0   0   #peak
#0.0000  0.1   0.0   0   0   99   -2   0   0   0   0   0.5   0   0   #init
#-5   5   0.0   1.7   0   99   2   0   1   1988   2004   0.1   0   0   #infl
#0.0001  10   0.3   1.0   0   99   2   0   1   1988   2004   0.1   0   0   #slope1
#-10   10   -2   -2   0   99   2   0   0   0   0   0.5   0   0   #final
#-5   5   0.0   0.1   0   99   2   0   0   0   0   0.5   0   0   #infl2
#0.0001  10   0.3   0.1   0   99   2   0   0   0   0   0.5   0   0   #slope2
#0.   25   2   2   0   99   -4   0   0   0   0   0.5   0   0   #width of top

1  20   3.2  3   0   99   5   0   0   1975   2004   0.005   4   2   #inf_1
```

```
0.00001   10     2.5    2.5    0      99   5   0     0      1975   2004   0.005   4     2     #slp_1
1  40     11.8   12     0      99   5   0     0      1975   2004   0.005   4     2     #inf_2
0.00001   10     1.0    1.0    0      99   5   0     0      1975   2004   0.005   4     2     #slp_2
2  2      1      2      0      99   -2  0     0      0      0      0.5     0     0     #min_age
2  2      0      2      0      99   -2  0     0      0      0      0.5     0     0     #

1  20  4.0  3    0      99   5   0     0      1988   2004   0.05   5     2     #inf_1
0.00001   10     1.5    0.9    0      99   5   0     0      1988   2004   0.05    5     2     #slp_1
1  40     13.8   7      0      99   5   0     0      0      0      0.5     0     0     #inf_2
0.00001   10     1.0    0.5    0      99   5   0     0      0      0      0.5     0     0     #slp_2
2  2      2      2      0      99   -2  0     0      0      0      0.5     0     0     #min_age
2  2      0      2      0      99   -2  0     0      0      0      0.5     0     0     #

1  20  3.3  3    0      99   5   0     0      0      0      0.5    0     0     #inf_1
0.00001   10     0.775  0.9    0      99   5   0     0      0      0      0.5     0     0     #slp_1
1  40     7.84   7      0      99   5   0     0      0      0      0.5     0     0     #inf_2
0.00001   10     0.507  0.5    0      99   5   0     0      0      0      0.5     0     0     #slp_2
2  2      2      2      0      99   -2  0     0      0      0      0.5     0     0     #min_age
2  2      0      2      0      99   -2  0     0      0      0      0.5     0     0     #

0  40     0      0      0      99       -1     0      0      0      0      0.5    0     0     #min_age
0  40     0      0      0      99       -1     0      0      0      0      0.5    0     0     #min_age

#_custom-env_read
0  #_     0=read_one_setup_and_apply_to_all;_1=Custom_so_read_1_each;

#_custom-block_read
1  #_     0=read_one_setup_and_apply_to_all;_1=Custom_so_see_detailed_instructions_for_N_rows_in_Custom_setup

# US inf1 blocks
1  20  3.2  3    0      99   5
1  20  3.2  3    0      99   5
1  20  3.2  3    0      99   5

# US slp1 blocks
0.00001   10     2.5    0.9    0      99   5
0.00001   10     2.5    0.9    0      99   5
0.00001   10     2.5    0.9    0      99   5

# US inf2 blocks
1  40     11.8   7      0      99   5
1  40     11.8   7      0      99   5
1  40     11.8   7      0      99   5

# US slp2 blocks
0.00001   10     1.0    0.5    0      99   5
0.00001   10     1.0    0.5    0      99   5
0.00001   10     1.0    0.5    0      99   5

# Can inf1 blocks
1  20  5.5  3    0      99   5
1  20  5.5  3    0      99   5
1  20  5.5  3    0      99   5

# Can slp1 blocks
0.00001   10     1.5    0.9    0      99   5
0.00001   10     1.5    0.9    0      99   5
0.00001   10     1.5    0.9    0      99   5

#  LO     HI     INIT   PRIOR  PR_type  SD    PHASE
-6 #_phase_for_selex_parm_devs

0 0 0 0
0 0 0 0
0 0 0 0
.3 1 1 1
.5 1 1 1
1 1 1 1

1  #_max_lambda_phases:_read_this_Number_of_values_for_each_componentxtype_below
```

```
1  #_include (1) or not (0) the constant offset For Log(s) in the Log(like) calculation
#_survey_lambdas
0  0        1        1
#_discard_lambdas
0  0        0        0
#_meanbodywt
0
#_lenfreq_lambdas
1  1        1        0
#_age_freq_lambdas
1  1        1        0
#_size@age_lambdas
0  0        0        0
#_initial_equil_catch
1
#_recruitment_lambda
1
#_parm_prior_lambda
1
#_parm_dev_timeseries_lambda
1
# crashpen lambda
100
#max F
0.9

999        #_end-of-file
```

```
1966 #_styr
2005 #_endyr
1 #_nseas
12 #_months/season
1 #_spawn_seas
2 #_Nfleet
2 #_Nsurv
 fishery1%fishery2%survey1%survey2
 0.5 0.5 0.5 0.0001          #_surveytiming_in_season
1 #_Ngenders
15 #_Nages
0 0 #_init_equil_catch_for_each_fishery
#_catch_biomass(mtons):_columns_are_fisheries,_rows_are_year*season
137000      700         #       1966
177662      36713       #       1967
60819       61361       #       1968
86280       93851       #       1969
159575      75009       #       1970
127913      26699       #       1971
74133       43413       #       1972
147513      15126       #       1973
194109      17150       #       1974
205656      15704       #       1975
231549      5972        #       1976
127502      5191        #       1977
98372       5267        #       1978
124680      12435       #       1979
72352       17584       #       1980
114760      24361       #       1981
75577       32157       #       1982
73150       40774       #       1983
96332       42109       #       1984
85439       24962       #       1985
154964      55653       #       1986
160448      73699       #       1987
160698      88106       #       1988
210996      94920       #       1989
183800      75992       #       1990
217505      89753       #       1991
208576      88334       #       1992
141222      58213       #       1993
252729      108800      #       1994
177589      72181       #       1995
212901      93174       #       1996
233423      91792       #       1997
232817      87802       #       1998
224522      87333       #       1999
208418      22402       #       2000
182377      53585       #       2001
132115      50796       #       2002
143492      62090       #       2003
210487      124185      #       2004
249109  100462  #       2005

30 #_N_cpue_and_surveyabundance_observations
#_year seas index obs se(log)
1977  1  3  1915000  0.5
1980  1  3  2115000  0.5
1983  1  3  1647000  0.5
1989  1  3  1238000  0.5
1992  1  3  2169000  0.25
1995  1  3  1385000  0.25
1998  1  3  1185000  0.25
2001  1  3   737000  0.25
2003  1  3  1840000  0.25
#2005  1  3  1073563  0.25
2005  1       3  1265000  0.25
1986  1       4   22.90   1.1
1987  1       4   522.17 1.1
1988  1       4   137.14 1.1
```

```
1989 1      4  7.45   1.1
1990 1      4  34.92  1.1
1991 1      4  43.34  1.1
1992 1      4  12.27  1.1
1993 1      4  1150.56        1.1
1994 1      4  32.14  1.1
1995 1      4  6.96   1.1
1996 1      4  98.89  1.1
1997 1      4  20.78  1.1
1998 1      4  4.74   1.1
1999 1      4  98.40  1.1
2000 1      4  13.25  1.1
2001 1      4  30.42  1.1
2002 1      4  8.08   1.1
2003 1      4  1.66   1.1
2004 1  4  94.31      1.1
2005 1  4  1.31       1.1

2 #_discard_type
0 #_N_discard_obs

0 #_N_meanbodywt_obs

-1     #_comp_tail_compression
0.0001 #_add_to_comp
51 #_N_LengthBins
 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70
59 #_N_Length_obs
#Yr Seas Flt/Svy Gender Part Nsamp datavector(female-male)
1975    1       1       0       0       13      0.0000  0.0000  0.0000  0.1310  0.4138  0.4138  0.6101  0.6101
   0.3291  0.7411  1.5447  0.9566  4.6455  4.0107  4.1898  5.3717  3.0869  2.8926  2.0167  1.0373  4.3164  4.0849
   7.0859  7.4219  7.1653  7.1658  4.9095  4.0224  5.0698  2.3889  3.2625  1.2916  3.4063  0.0000  1.1843  1.0342
   0.3465  0.4138  0.8734  0.9032  0.3465  0.0000  0.0000  0.0000  0.0000  0.0000  0.0000  0.0000  0.1310  0.1742
   0.0000
1976    1       1       0       0       249     0.0000  0.0000  0.0000  0.0000  0.0000  0.0000  0.0016  0.0000
   0.0056  0.0033  0.0383  0.0461  0.0619  0.0983  0.2605  0.2710  0.4635  0.5851  0.9688  1.7104  2.6494  3.7108
   5.1325  5.6852  6.3574  6.5997  6.6614  6.7014  6.7809  6.7467  6.3412  6.0203  5.7434  5.0318  4.0850  2.9869
   2.1415  1.3175  1.1743  0.7971  0.5916  0.4178  0.3714  0.2021  0.3217  0.1198  0.0626  0.1229  0.0766  0.0428
   0.4921
1977    1       1       0       0       1071    0.0000  0.0000  0.0000  0.0000  0.0000  0.0000  0.0000  0.0000
   0.0000  0.0000  0.0000  0.0000  0.0018  0.0134  0.0376  0.0706  0.1661  0.4152  0.6903  1.1624  1.8450  2.7529
   4.3062  5.5899  5.8003  7.0414  7.6587  8.0144  8.2014  8.0120  7.8118  7.2003  6.2315  4.7967  3.7873  2.7235
   1.7045  1.2366  0.8199  0.5163  0.3222  0.2985  0.1799  0.1885  0.1195  0.0886  0.0573  0.0324  0.0296  0.0462
   0.0296
1978    1       1       0       0       1135    0.0000  0.0137  0.0335  0.0204  0.0187  0.0129  0.0269  0.0195
   0.0268  0.0177  0.0119  0.0196  0.0000  0.0052  0.0068  0.0000  0.0232  0.0374  0.1341  0.4019  1.1005  1.8736
   3.2463  4.8921  6.2182  7.2486  8.1810  8.5122  8.8032  8.7842  8.3771  7.6130  6.8721  5.5053  3.9908  2.9505
   1.7999  1.1040  0.6053  0.4234  0.2603  0.2115  0.1333  0.0826  0.1005  0.0837  0.0252  0.0539  0.0204  0.0118
   0.0858
1979    1       1       0       0       1539    0.0037  0.0097  0.0000  0.0000  0.0045  0.0116  0.0377  0.1272
   0.2419  0.3627  0.6064  0.9330  1.0785  1.2116  1.3609  1.1767  1.0738  0.9737  0.8697  0.7638  1.0134  1.2884
   2.1901  3.1243  4.4482  5.5505  6.5905  7.3083  7.4803  7.3508  7.1915  6.8207  6.1776  5.2697  4.4570  3.4610
   2.5085  1.9857  1.3847  1.0024  0.6851  0.4921  0.3971  0.2037  0.1600  0.1547  0.1172  0.0869  0.0479  0.0772
   0.1275
1980    1       1       0       0       811     0.0091  0.0023  0.0015  0.0000  0.0073  0.0000  0.0000  0.0087
   0.0126  0.0458  0.0204  0.0433  0.1149  0.2228  0.5250  0.7315  1.2779  2.1458  3.0350  3.7493  4.1531  4.0760
   4.3104  4.0557  4.3473  4.6273  5.0774  5.6263  5.8858  6.0686  5.8665  5.5856  5.4307  5.0389  4.3970  3.5729
   2.4554  2.0179  1.4813  1.1084  0.7881  0.5016  0.3861  0.4173  0.1653  0.1672  0.1005  0.0862  0.0783  0.0779
   0.0960
1981    1       1       0       0       1093    0.0800  0.1084  0.3599  0.7080  0.9938  1.3236  1.4714  1.4205
   1.1953  0.9210  0.5505  0.3604  0.3151  0.1801  0.1889  0.2756  0.5729  0.9527  1.7359  2.9281  4.0255  5.0184
   5.6197  6.0028  6.2402  6.2228  6.0960  5.8936  5.4876  5.3678  5.1780  4.8316  4.1992  3.4228  2.5465  1.9163
   1.4854  1.0655  0.5759  0.4974  0.3794  0.2661  0.1841  0.1667  0.1191  0.0804  0.0909  0.0528  0.0518  0.0368
   0.2368
1982    1       1       0       0       1142    0.0012  0.0006  0.0006  0.0069  0.0278  0.0623  0.1581  0.3195
   0.4785  0.7517  1.1521  1.7236  2.2861  2.4465  2.4854  2.2689  2.0172  1.5572  1.1535  1.1139  1.6668  2.6606
   3.7590  4.8387  5.2255  5.3355  5.4254  5.3001  5.2641  5.1765  5.0040  4.8301  4.5324  4.1043  3.5769  3.1039
   2.2985  1.8991  1.4468  1.2094  0.8385  0.6099  0.4744  0.3877  0.2877  0.1802  0.1433  0.1309  0.0730  0.0768
   0.1282
```

1983	1	1	0	0	1069	0.0000	0.0000	0.0000	0.0000	0.0000	0.0019	0.0039	0.0049
0.0079	0.0489	0.1747	0.4093	0.9641	1.9860	3.0671	3.7988	4.5641	5.0988	5.4378	5.5811	5.4899	5.2058
4.8753	4.4715	4.3545	4.5081	4.6308	4.5736	4.3279	4.1003	3.7933	3.3540	3.0048	2.5516	2.1759	1.7089
1.3795	0.9958	0.7211	0.5140	0.4447	0.4355	0.3254	0.2806	0.1772	0.1214	0.0937	0.0720	0.0499	0.0400
0.0738													
1984	1	1	0	0	2035	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0105	0.0637	0.2676	0.8974	2.4412	4.6053	7.0343	8.2610	8.8066	8.8926
8.7328	8.0202	6.4816	5.1629	4.8620	4.4832	4.1105	3.7143	3.0779	2.4524	1.9414	1.4921	1.0246	0.7090
0.4861	0.3571	0.2395	0.2084	0.1822	0.1480	0.1098	0.1142	0.0654	0.0783	0.0392	0.0748	0.0613	0.0518
0.2390													
1985	1	1	0	0	2061	0.0087	0.0274	0.0648	0.1319	0.2167	0.3147	0.4723	0.5712
0.7749	0.8416	0.8311	0.7368	0.6614	0.4257	0.2871	0.2003	0.2466	0.5571	1.2729	2.9829	5.8356	7.8579
8.7403	9.0648	8.9656	8.5779	7.5892	6.4114	5.4273	4.5509	3.8589	2.9729	2.3139	1.7167	1.2206	0.8974
0.6230	0.3798	0.2779	0.1994	0.1635	0.1281	0.0756	0.1044	0.0668	0.0528	0.0551	0.0356	0.0388	0.0281
0.1439													
1986	1	1	0	0	3878	0.0000	0.0016	0.0013	0.0000	0.0013	0.0028	0.0096	0.0200
0.0693	0.1515	0.3138	0.5911	1.1404	2.1111	3.2822	3.7332	3.8731	3.7860	3.3537	2.7946	3.0905	5.3259
7.2056	8.0638	8.2040	8.0180	7.5393	6.3690	4.9986	3.8386	3.0525	2.3423	1.8172	1.3727	1.0227	0.6270
0.4857	0.3479	0.2423	0.1877	0.1401	0.1158	0.0973	0.0599	0.0422	0.0187	0.0227	0.0287	0.0125	0.0215
0.0526													
1987	1	1	0	0	3406	0.0007	0.0003	0.0003	0.0034	0.0017	0.0011	0.0010	0.0046
0.0057	0.0063	0.0188	0.0204	0.0694	0.2387	0.6284	1.1515	2.2635	4.1013	5.6298	6.4771	6.8780	6.9840
7.1824	7.5291	7.5888	7.4579	7.1477	6.4886	5.4910	4.4749	3.4480	2.5218	1.8452	1.3414	0.9380	0.5999
0.3987	0.3065	0.1802	0.1242	0.0990	0.0605	0.0629	0.0346	0.0404	0.0319	0.0267	0.0229	0.0186	0.0088
0.0434													
1988	1	1	0	0	3035	0.0007	0.0000	0.0000	0.0000	0.0017	0.0093	0.0120	0.0258
0.0340	0.0449	0.0486	0.0299	0.0550	0.0644	0.1627	0.3887	0.8553	1.5375	3.2362	5.6799	7.6535	8.5678
8.8030	8.8150	8.6617	8.3324	8.0693	7.2917	6.1416	4.5565	3.2785	2.2118	1.6226	1.0448	0.8112	0.4643
0.3538	0.2647	0.2094	0.1601	0.0876	0.0695	0.0400	0.0650	0.0289	0.0369	0.0335	0.0233	0.0179	0.0229
0.0740													
1989	1	1	0	0	2581	0.0005	0.0067	0.0011	0.0040	0.0045	0.0000	0.0043	0.0110
0.0275	0.1121	0.3024	0.6741	1.0166	1.2433	1.2873	1.1719	1.1842	1.3513	1.8609	3.2026	5.4862	7.6096
8.4166	8.5480	8.5158	8.3558	8.1199	7.4837	6.5009	5.1206	3.5657	2.4235	1.8394	1.2021	0.9268	0.6719
0.4551	0.2600	0.2193	0.2046	0.1429	0.0997	0.0843	0.0574	0.0486	0.0286	0.0164	0.0259	0.0302	0.0163
0.0577													
1990	1	1	0	0	2039	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0011
0.0165	0.0335	0.0560	0.1147	0.2150	0.3131	0.6847	1.0370	1.6040	2.5415	3.9025	5.3464	6.1623	6.6671
7.1218	7.7462	7.9435	8.0196	7.9224	7.6186	6.9470	5.6783	3.7969	2.7834	1.6893	1.1798	0.7962	0.5256
0.3690	0.2677	0.2133	0.1416	0.0824	0.0778	0.0709	0.0621	0.0564	0.0224	0.0350	0.0320	0.0178	0.0174
0.0702													
1991	1	1	0	0	817	0.0253	0.0066	0.0046	0.0095	0.0000	0.0000	0.0037	0.0188
0.0188	0.0064	0.0447	0.1253	0.2715	0.4231	0.8148	1.2033	2.0136	2.9728	3.5959	4.2063	4.7795	5.9500
6.1653	6.8269	8.1632	8.4062	8.7522	7.8287	6.3656	4.8131	3.4933	2.4196	1.6501	1.3979	1.2589	1.1846
1.1067	0.9981	0.8329	0.6915	0.3356	0.2210	0.1430	0.1272	0.0789	0.0680	0.0615	0.0107	0.0326	0.0170
0.0554													
1992	1	1	0	0	836	0.0281	0.0667	0.0757	0.0833	0.0847	0.0681	0.0818	0.0962
0.1170	0.1903	0.2537	0.4457	0.6030	0.7764	1.1068	1.3336	1.8384	2.0298	1.6095	1.8875	3.7787	5.8426
7.3393	8.9692	10.0915	10.2542	9.9512	9.4832	7.3533	5.4802	3.2085	1.8284	1.2047	0.7084	0.4253	0.3018
0.2260	0.1613	0.1262	0.0848	0.0840	0.0563	0.0546	0.0267	0.0317	0.0166	0.0102	0.0082	0.0162	0.0065
0.0938													
1993	1	1	0	0	442	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0070
0.0000	0.0000	0.0082	0.1118	0.0949	0.4661	1.0299	1.9220	3.7253	4.5722	6.2424	6.2361	5.8973	5.3501
5.8937	7.2187	8.3169	8.6226	8.8043	7.5067	7.1225	4.6537	2.7273	1.3580	0.5706	0.4606	0.3049	0.2458
0.1720	0.1125	0.0270	0.0518	0.0266	0.0349	0.0235	0.0061	0.0025	0.0025	0.0047	0.0000	0.0576	0.0000
0.0085													
1994	1	1	0	0	649	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
0.0015	0.0141	0.0015	0.0170	0.0052	0.0191	0.0819	0.1821	0.6538	1.5734	3.1216	4.4610	5.8132	6.9431
7.4792	8.1627	8.4792	9.3948	9.4855	8.9230	7.8291	5.9172	4.1409	2.6141	1.4632	1.0154	0.6571	0.4624
0.2675	0.1930	0.1728	0.1298	0.1028	0.0608	0.0196	0.0257	0.0226	0.0176	0.0132	0.0044	0.0019	0.0104
0.0457													
1995	1	1	0	0	470	0.1038	0.0228	0.0198	0.0284	0.0357	0.0357	0.0357	0.0198
0.0000	0.0000	0.0091	0.0078	0.0571	0.0912	0.1238	0.1013	0.2443	0.2585	0.5044	1.1955	2.3724	4.4641
6.6707	9.0914	10.4171	10.4798	10.8746	9.6864	8.4629	6.6830	5.2642	3.6818	2.8972	1.8339	1.2249	0.8681
0.5701	0.5399	0.2679	0.2461	0.1648	0.1209	0.0787	0.0556	0.0218	0.0338	0.0073	0.0208	0.0036	0.0000
0.0018													
1996	1	1	0	0	557	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0151	0.0148
0.0575	0.0624	0.3453	0.9726	1.5831	3.0203	3.8219	4.7231	4.1074	3.4972	3.3323	3.8879	4.0162	4.3223
4.5049	5.8851	7.4956	8.5752	8.2382	7.4850	6.1778	4.4124	3.4555	2.1185	1.4007	0.7752	0.5304	0.3100
0.2074	0.2374	0.1246	0.0495	0.0525	0.0369	0.0385	0.0192	0.0183	0.0234	0.0000	0.0000	0.0104	0.0000
0.0381													

1997	1	1	0	0	681	0.0000	0.0000	0.0000	0.0000	0.0000	0.0054	0.0000	0.0000
0.0000	0.0000	0.0004	0.0129	0.0242	0.0621	0.1670	0.5697	1.1618	2.5034	4.2684	6.5930	9.1337	10.3301
10.9611	10.6951	9.1385	8.2452	6.7816	5.6553	4.4197	3.4122	2.0201	1.2148	0.7188	0.4538	0.3833	0.2249
0.2018	0.0783	0.1077	0.0375	0.0815	0.0931	0.1300	0.0086	0.0097	0.0081	0.0552	0.0051	0.0000	0.0129
0.0138													
1998	1	1	0	0	803	0.0000	0.0019	0.0000	0.0356	0.0312	0.0000	0.0000	0.0018
0.0050	0.0307	0.1578	0.5719	1.1926	1.8658	1.8962	2.1940	3.1873	4.9169	5.9828	6.3878	6.7259	7.5506
8.9308	9.1918	8.9787	7.9720	6.5252	5.1066	3.8389	2.3801	1.5499	0.8679	0.5270	0.3689	0.2026	0.1499
0.1612	0.1050	0.0570	0.0861	0.0879	0.0039	0.0120	0.0034	0.0132	0.0171	0.0161	0.0014	0.0454	0.0000
0.0642													
1999	1	1	0	0	2268	0.0028	0.0000	0.0000	0.0030	0.0088	0.0298	0.0088	0.0562
0.1532	0.3180	0.7684	1.1024	1.6890	2.4598	3.4549	4.0658	5.0615	5.8249	6.6752	6.3233	6.6134	6.1512
6.1289	6.7057	6.9914	7.0649	6.3137	4.8892	3.6905	2.3132	1.5526	1.0083	0.7842	0.4498	0.3077	0.1635
0.1629	0.1472	0.0544	0.1511	0.0529	0.0800	0.0497	0.0106	0.0125	0.0187	0.0165	0.0089	0.0198	0.0152
0.0657													
2000	1	1	0	0	2199	0.0008	0.0000	0.0000	0.0000	0.0000	0.0049	0.0230	0.0779
0.1520	0.3576	0.3585	0.3253	0.2198	0.2314	0.2139	0.3953	0.6127	1.1692	1.9467	2.6461	4.1004	4.7630
5.8897	6.8340	8.3000	9.5471	9.8429	9.2381	8.5885	6.6670	5.2995	3.7409	2.5171	1.7399	1.2479	0.7236
0.4943	0.5228	0.3619	0.2084	0.1557	0.1254	0.0844	0.0832	0.0432	0.0291	0.0261	0.0251	0.0104	0.0289
0.0260													
2001	1	1	0	0	2239	0.0040	0.0047	0.0000	0.0142	0.0049	0.0144	0.0049	0.0450
0.0368	0.1065	0.2524	0.5181	0.7379	1.0920	1.5401	2.4071	3.1572	3.3718	3.3389	3.6980	4.1295	4.9045
5.9444	6.3796	6.9969	7.3855	8.0234	8.2212	7.5621	5.8676	4.3308	3.3034	2.0719	1.5149	0.9362	0.6821
0.4124	0.2491	0.1603	0.1745	0.1023	0.0504	0.0731	0.0517	0.0206	0.0268	0.0330	0.0073	0.0166	0.0030
0.0161													
2002	1	1	0	0	1821	0.0000	0.0000	0.0000	0.0000	0.0000	0.0153	0.0000	0.0005
0.0005	0.0009	0.0349	0.0455	0.0237	0.0205	0.1192	0.3983	0.9800	2.6734	5.4078	8.8163	10.7909	12.1021
11.2284	9.1867	6.7869	5.1606	4.4545	3.5139	3.1230	2.9931	2.6154	2.2683	1.8634	1.5485	1.1389	0.7967
0.4894	0.3872	0.2213	0.1985	0.1627	0.1216	0.0636	0.0584	0.0544	0.0301	0.0271	0.0061	0.0231	0.0117
0.0366													
2003	1	1	0	0	1915	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
0.0300	0.0000	0.0000	0.0387	0.0022	0.0769	0.0808	0.1733	0.9888	2.3873	4.6812	8.0242	11.1703	11.9985
12.9450	12.6406	10.5481	8.0278	5.3379	3.5339	2.3350	1.6809	1.1599	0.7129	0.4354	0.2866	0.2158	0.1281
0.1050	0.0474	0.0597	0.0310	0.0171	0.0142	0.0162	0.0138	0.0066	0.0076	0.0093	0.0099	0.0000	0.0080
0.0143													
2004	1	1	0	0	2797	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
0.0007	0.0016	0.0038	0.0089	0.0000	0.0000	0.0081	0.0131	0.0296	0.1831	0.6135	1.4590	3.7500	7.0232
11.1220	14.3372	15.4579	14.7871	10.8375	7.4020	4.8577	2.7464	1.7989	1.2653	0.6564	0.3878	0.2692	0.2233
0.2484	0.0934	0.0338	0.0283	0.0757	0.0703	0.0158	0.0102	0.0581	0.0045	0.0151	0.0173	0.0045	0.0044
0.0767													
2005	1	1	0	0	3064	0.0039	0.0031	0.0026	0.0020	0.0000	0.0023	0.0000	0.0000
0.0000	0.0030	0.0024	0.0063	0.0239	0.0509	0.0915	0.1204	0.1841	0.4387	0.5751	0.6107	1.1091	2.4939
6.2652	12.8750	18.8037	19.4426	15.5383	9.6723	5.1798	2.7770	1.4521	0.8477	0.4493	0.3130	0.1687	0.1364
0.0896	0.0711	0.0473	0.0281	0.0267	0.0180	0.0129	0.0096	0.0076	0.0067	0.0072	0.0038	0.0045	0.0044
0.0175													
1988	1	2	0	0	38	0.0000	0.0000	0.0000	0.0015	0.0042	0.0013	0.0000	0.0012
0.0000	0.0026	0.0047	0.0016	0.0109	0.0287	0.0347	0.1011	0.1622	0.2725	0.4999	0.8217	1.6591	3.0254
5.2973	7.5743	9.8487	11.8018	11.9507	10.6459	8.8695	6.9198	5.2416	4.0676	3.0620	2.1469	1.6566	1.2806
0.8882	0.6213	0.4338	0.3289	0.2480	0.1422	0.0926	0.0926	0.0635	0.0281	0.0175	0.0131	0.0143	0.0048
0.0143													
1989	1	2	0	0	43	0.0040	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0008
0.0000	0.0000	0.0000	0.0000	0.0000	0.0079	0.0039	0.0013	0.0116	0.0234	0.0729	0.1029	0.3302	1.1841
3.6208	7.3076	11.0626	13.9101	14.3775	12.2475	10.0729	7.4976	5.3460	3.8031	2.5146	1.9580	1.3638	0.8697
0.6090	0.4848	0.2969	0.2583	0.2076	0.1215	0.0985	0.0644	0.0415	0.0313	0.0347	0.0133	0.0026	0.0093
0.0314													
1990	1	2	0	0	33	0.0025	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0146	0.0089	0.0665	0.0878	0.1169	0.2445	0.6916	0.8924
1.9520	4.6396	8.2469	13.1450	15.1195	14.6946	12.1628	8.7682	6.0184	3.8082	2.6119	1.7409	1.1643	0.8935
0.7293	0.4191	0.3702	0.2793	0.2472	0.1841	0.1927	0.1571	0.0847	0.0648	0.0653	0.0228	0.0194	0.0370
0.0351													
1991	1	2	0	0	56	0.0020	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0031	0.0100	0.0000	0.0033	0.0073	0.0033	0.0288	0.0615	0.1335	0.1961	0.2554	0.5079
0.7854	1.3650	3.2862	6.6629	11.0345	14.2636	15.4089	13.1927	9.9821	7.0393	4.8797	3.3430	2.1798	1.4970
1.0171	0.7579	0.5609	0.3871	0.3152	0.2666	0.1598	0.1119	0.0769	0.0668	0.0524	0.0185	0.0272	0.0168
0.0327													
1992	1	2	0	0	60	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0015	0.0000	0.0000	0.0000	0.0017	0.0017	0.0070	0.0113	0.0170	0.1428	0.4641
1.4115	3.5680	7.2311	11.7795	16.0994	16.7776	14.5902	10.6207	6.6180	3.9245	2.3324	1.3938	0.8834	0.5575
0.3640	0.2610	0.2263	0.1462	0.1277	0.1166	0.0871	0.0495	0.0532	0.0353	0.0125	0.0261	0.0057	0.0117
0.0424													

1993	1	2	0	0	60	0.0102	0.0000	0.0000	0.0017	0.0000	0.0014	0.0000	0.0014
0.0103	0.0061	0.0079	0.0053	0.0019	0.0014	0.0039	0.0054	0.0045	0.0070	0.0187	0.0581	0.2378	0.6761
1.7934	4.2474	9.5096	15.5218	19.1337	17.8105	12.9661	7.8210	4.2887	2.2775	1.3447	0.7572	0.4675	0.3220
0.2047	0.1464	0.1057	0.0596	0.0460	0.0213	0.0202	0.0200	0.0028	0.0151	0.0076	0.0100	0.0072	0.0031
0.0103													
1994	1	2	0	0	76	0.0391	0.0037	0.0033	0.0034	0.0025	0.0051	0.0019	0.0009
0.0027	0.0026	0.0015	0.0000	0.0017	0.0023	0.0013	0.0090	0.0121	0.0202	0.0211	0.0403	0.1377	0.3263
0.7286	1.8425	4.1592	8.2000	13.3817	16.8869	16.0807	12.8616	9.0190	5.6153	3.4957	2.2325	1.5106	0.9776
0.6701	0.4595	0.3314	0.2424	0.1778	0.1279	0.0899	0.0687	0.0405	0.0392	0.0236	0.0318	0.0200	0.0084
0.0378													
1995	1	2	0	0	43	0.5433	0.5663	1.5444	2.8853	2.8406	3.0367	2.0194	1.2639
0.6258	0.1966	0.0873	0.0440	0.0292	0.0483	0.0254	0.0278	0.0167	0.0000	0.0000	0.0034	0.0068	0.0722
0.2495	0.9728	2.6665	5.3574	9.1578	12.8613	14.7039	12.3917	9.3775	5.8628	3.5750	2.4331	1.2689	0.9287
0.6043	0.4867	0.3577	0.3214	0.1383	0.1170	0.0715	0.0482	0.0518	0.0412	0.0355	0.0100	0.0000	0.0113
0.0151													
1996	1	2	0	0	54	0.0024	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0069	0.0168	0.0622	0.1235	0.2794	0.4614	0.8566	1.3516	1.9391	2.2300	2.0055	1.5635	1.2560
1.4221	2.7105	5.4517	10.2072	14.0882	15.4694	13.5617	9.5714	6.3589	3.5570	2.0126	1.1256	0.7121	0.4531
0.2665	0.2264	0.1552	0.0981	0.0831	0.0799	0.0618	0.0397	0.0297	0.0245	0.0246	0.0090	0.0115	0.0090
0.0244													
1997	1	2	0	0	102	0.0000	0.0000	0.0045	0.0045	0.0175	0.0095	0.0180	0.0283
0.0240	0.0361	0.0300	0.0346	0.0303	0.0320	0.0191	0.0136	0.0307	0.1000	0.2532	0.9009	2.1714	3.9752
6.0868	7.3180	8.2774	8.8846	10.3676	10.7128	10.2442	8.6087	6.4056	4.5583	3.0897	2.2322	1.5336	1.0943
0.7586	0.6056	0.3728	0.2314	0.2456	0.1737	0.1118	0.0810	0.0760	0.0483	0.0550	0.0183	0.0299	0.0052
0.0394													
1998	1	2	0	0	94	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0291	0.0055	0.0152	0.0201	0.0309	0.0786	0.2148	0.4806	0.9896	1.9114	3.1067	4.6458
7.7507	10.9445	13.0675	13.7215	12.3742	9.4706	6.3908	4.2349	2.5262	1.4915	0.9287	0.5946	0.3971	0.2716
0.2143	0.1214	0.1003	0.0878	0.0475	0.0406	0.0232	0.0258	0.0235	0.0122	0.0057	0.0036	0.0029	0.0049
0.0093													
1999	1	2	0	0	136	0.0000	0.0140	0.0037	0.0090	0.0010	0.0034	0.0066	0.0057
0.0316	0.0521	0.1189	0.3614	0.7028	1.1060	1.7214	1.9452	2.0639	2.0924	2.2368	2.8403	3.0093	3.6328
4.6785	6.2507	8.1427	10.3291	10.9685	10.3095	8.5619	6.2326	3.9248	2.8442	1.7230	1.1824	0.7861	0.5753
0.4115	0.2814	0.1936	0.1657	0.0846	0.1275	0.0871	0.0396	0.0642	0.0204	0.0157	0.0201	0.0028	0.0078
0.0104													
2000	1	2	0	0	16	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0002	0.0115	0.0269	0.0783	0.2229	0.5715	0.8796	1.3716	1.4679	1.9613	2.4665	3.4212
4.4835	5.4263	6.1167	6.3849	7.2244	8.1919	8.6751	8.1729	7.9389	6.0299	4.6940	3.5788	2.7613	1.9144
1.6095	1.1091	0.8607	0.6031	0.4619	0.4388	0.2513	0.2007	0.1381	0.0794	0.0489	0.0472	0.0230	0.0196
0.0364													
2001	1	2	0	0	72	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0095
0.0067	0.0587	0.2057	0.2672	0.2541	0.2360	0.2768	0.1680	0.1071	0.0729	0.0268	0.0359	0.0413	0.0228
0.1328	0.3029	0.7079	1.4757	3.0338	5.7325	8.9079	11.2086	12.8480	11.8996	10.4744	8.4391	6.5580	4.7269
3.5529	2.5374	1.8422	1.1844	0.7793	0.5817	0.3953	0.2782	0.2220	0.1321	0.1047	0.0273	0.0319	0.0287
0.0642													
2002	1	2	0	0	103	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0116	0.0168	0.0046	0.0046	0.0049	0.0295	0.0076	0.0620	0.0081	0.0366
0.1599	0.2942	0.4882	1.1396	1.3920	2.5956	4.8810	7.4663	10.1087	12.5335	12.7077	11.0521	8.9671	6.8943
5.5104	4.3519	2.7694	1.8741	1.5376	1.1212	0.6999	0.4071	0.2684	0.1780	0.1428	0.0868	0.0675	0.0483
0.0700													
2003	1	2	0	0	118	0.0000	0.0078	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0091	0.0000	0.0376	0.0168	0.0530	0.0391	0.0327	0.0427	0.0346	0.0000	0.2505	1.1718
2.9946	5.7363	9.9890	11.3838	12.8838	11.9749	10.6071	9.6759	6.2904	4.3829	3.3957	2.1501	1.5351	1.2581
1.0889	0.6767	0.5597	0.3709	0.3422	0.3288	0.1696	0.2269	0.0750	0.0465	0.0194	0.0403	0.0334	0.0069
0.0614													
2004	1	2	0	0	101	0.0023	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0023	0.0064	0.0000	0.0070	0.0080	0.0116	0.0067	0.0323	0.0295	0.0828	0.1954	0.6188	1.7741
4.5173	8.9999	13.0525	15.3074	14.1836	12.1532	9.2861	6.4924	4.2643	2.8084	1.8428	1.1967	0.7829	0.6262
0.4351	0.3246	0.2555	0.1571	0.1370	0.0928	0.0753	0.0591	0.0316	0.0263	0.0152	0.0227	0.0202	0.0102
0.0464													
2005	1	2	0	0	15	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0725	0.1077	0.1977	0.6648	0.9805
2.9974	6.5045	9.9976	13.1943	15.2801	13.8470	10.8480	8.5224	5.6856	3.3915	2.2879	1.4004	1.1228	0.7615
0.6550	0.4855	0.3073	0.1842	0.0406	0.2334	0.0693	0.0561	0.0344	0.0426	0.0048	0.0000	0.0066	0.0000
0.0161													
1977	1	3	0	0	85	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0762	0.1870	0.4156	0.4018	0.6304	0.6719	0.8313	1.2122	1.3716	1.3716	1.5932	2.1543
2.7847	3.6021	4.1009	4.3918	5.1676	6.9825	8.2433	9.4417	8.9983	7.4397	6.5738	5.2092	3.8930	2.7847
2.2582	1.7872	1.1153	0.8728	0.7551	0.5819	0.5611	0.3671	0.3117	0.1940	0.2078	0.1316	0.0485	0.0554
0.0554													

```
1980 1 3 0 0 49 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
  0.0000 0.0000 0.0241 0.0000 0.0241 0.0723 0.3135 0.6872 1.7483 3.7618 5.6909 6.1249 5.2689 3.8582
  1.5192 0.8922 0.5426 0.7596 1.9050 3.2433 5.8235 8.3193 9.2838 8.5483 8.1022 6.2937 4.7263 3.0625
  2.0979 1.5915 1.0851 0.6872 0.6028 0.4943 0.2773 0.1688 0.2411 0.1206 0.1326 0.1206 0.1085 0.0603
  0.0603
1983 1 3 0 0 35 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
  0.0000 0.0000 0.0232 0.0116 0.0348 0.4295 1.6369 4.1560 7.8941 10.5410 11.4465 9.2408 7.7084 5.4678
  3.6568 2.4611 2.1477 2.4611 3.3666 4.0051 4.2141 3.8542 3.5407 2.8326 2.2638 1.8923 1.4511 0.8591
  0.7198 0.4644 0.2786 0.3367 0.1741 0.1393 0.0929 0.0580 0.0116 0.0116 0.0580 0.0116 0.0116 0.0232
  0.0000
1989 1 3 0 0 22 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
  0.0000 0.0000 0.0534 0.0356 0.0000 0.0356 0.1956 0.5513 1.9029 2.2230 2.1697 1.3694 1.5472 2.6143
  7.9673 13.8182 16.6993 16.3258 11.4885 7.7361 4.6239 2.4898 1.6895 0.9248 0.5513 0.3557 0.2668 0.1601
  0.1067 0.0178 0.1423 0.0000 0.0178 0.0000 0.0000 0.0178 0.0178 0.0356 0.0000 0.0000 0.0000 0.0000
  0.0178
1992 1 3 0 0 43 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
  0.0000 0.0000 0.9966 1.0747 1.1451 2.0523 2.2678 1.3747 0.7046 0.4705 0.1384 0.2064 0.5554 1.7227
  3.9070 6.9265 10.1668 13.5941 14.4537 11.2977 7.4794 4.4176 2.5313 1.2286 0.5984 0.4789 0.2226 0.1257
  0.1510 0.0318 0.0608 0.0354 0.0260 0.0126 0.0029 0.0043 0.0014 0.0000 0.0000 0.0000 0.0000 0.0000
  0.0000
1995 1 3 0 0 69 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
  0.0000 0.0000 0.2414 0.3534 1.4379 4.0874 8.1213 8.5327 6.1473 2.9749 1.2684 0.5451 0.5222 1.2059
  2.6843 4.8278 6.9954 8.0774 8.3294 7.4855 6.1477 3.8777 2.5148 1.2530 0.8335 0.3644 0.2652 0.1357
  0.0966 0.0656 0.0532 0.0414 0.0348 0.0181 0.0073 0.0056 0.0032 0.0024 0.0091 0.0226 0.0176 0.0037
  0.0037
1998 1 3 0 0 84 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
  0.0000 0.0000 1.9111 2.3583 2.7987 2.9771 2.6344 1.9192 1.7780 2.5431 3.2512 3.6925 3.7927 4.3047
  5.4560 7.6075 8.0688 8.4396 7.5478 6.2551 4.9928 3.5322 2.5057 1.6519 1.0415 0.7464 0.4515 0.3132
  0.2538 0.1641 0.1156 0.0562 0.0557 0.0423 0.0236 0.0210 0.0125 0.0035 0.0053 0.0059 0.0084 0.0061
  0.0135
2001 1 3 0 0 49 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
  0.0000 0.0000 1.3525 4.1216 8.3658 14.6019 16.9774 14.2018 8.5876 3.5231 1.6717 1.4485 1.5298 1.9460
  1.9285 1.9610 1.8787 2.2680 2.1509 2.2040 2.1926 1.9429 1.1800 0.8779 0.6301 0.4768 0.3006 0.2136
  0.1543 0.1206 0.0551 0.0789 0.0185 0.0621 0.0381 0.0841 0.0565 0.0314 0.0243 0.0261 0.0014 0.0354
  0.0687
2003 1 3 0 0 71 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
  0.0000 0.0000 0.0944 0.1537 0.3314 0.4047 0.7614 0.6356 1.1926 1.0760 1.7630 1.7640 4.4833 7.5862
  14.3289 14.8713 13.9081 10.0821 7.4014 5.8903 3.9399 2.7178 1.9627 1.3133 0.9244 0.6519 0.4871 0.3781
  0.2422 0.1693 0.1103 0.1016 0.0309 0.0101 0.0184 0.0231 0.0085 0.0160 0.0057 0.0028 0.0028 0.0046
  0.0249
2005 1 3 0 0 49 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
  0.0000 0.0000 0.5764 0.6518 2.2930 3.3930 4.9816 3.7852 2.8587 2.0472 1.2751 1.0973 1.1591 2.8742
  4.7100 8.8084 14.7650 12.1110 12.1030 6.6716 5.1654 3.3105 1.6901 1.0512 0.6182 0.3690 0.1856 0.1908
  0.1801 0.0734 0.0314 0.0457 0.0478 0.0314 0.0335 0.0175 0.0161 0.0124 0.0118 0.0879 0.0000 0.0000
  0.0131

14 #_N_age_bins
 2 3 4 5 6 7 8 9 10 11 12 13 14 15
1 #_N_ageerror_definitions
0.5 1.5 2.5 3.5 4.5 5.5 6.5 7.5 8.5 9.5 10.5 11.5 12.5 13.5
  14.5 15.5
0.000001 0.0001 0.0001 0.0001 0.0001 0.0001 0.0001 0.0001 0.0001 0.0001 0.0001 0.0001 0.0001 0.0001
  0.0001 0.0001
#0.0000001 0.0000001 0.0000001 0.0000001 0.0000001 0.0000001 0.0000001 0.0000001 0.0000001 0.0000001 0.0000001 0.0000001 0.0000001 0.0000001
  0.0000001 0.0000001

2212 #_N_Agecomp_obs
# Yr Seas Flt/Svy Gender Part Ageerr Lbin_lo Lbin_hi Nsamp datavector(female-male)
1973 1 1 0 0 1 1 51 60 0.00000 0.25999 0.04498 0.10099 0.18700
  0.11699 0.10699 0.10001 0.04801 0.02098 0.00903 0.00502 0.00000 0.00000
1974 1 1 0 0 1 1 51 60 0.00439 0.00331 0.50658 0.06924 0.11978
  0.14944 0.08681 0.03846 0.01208 0.00550 0.00331 0.00111 0.00000 0.00000
1975 1 1 0 0 1 4 4 1 100.0000 0.0000 0.0000 0.0000 0.0000
  0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
1975 1 1 0 0 1 5 5 1 100.0000 0.0000 0.0000 0.0000 0.0000
  0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
1975 1 1 0 0 1 6 6 1 100.0000 0.0000 0.0000 0.0000 0.0000
  0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
1975 1 1 0 0 1 7 7 2 100.0000 0.0000 0.0000 0.0000 0.0000
  0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
```

1975	1	1	0	0	1	8	8	2	100.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1975	1	1	0	0	1	9	9	1	100.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1975	1	1	0	0	1	10	10	3	100.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1975	1	1	0	0	1	11	11	5	100.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1975	1	1	0	0	1	12	12	3	100.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1975	1	1	0	0	1	13	13	5	100.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1975	1	1	0	0	1	14	14	2	94.0517	5.9483	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1975	1	1	0	0	1	15	15	4	95.9144	4.0856	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1975	1	1	0	0	1	16	16	4	93.3344	6.6656	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1975	1	1	0	0	1	17	17	5	70.3671	29.6329	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1975	1	1	0	0	1	18	18	5	68.2976	31.7024	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1975	1	1	0	0	1	19	19	3	28.0522	15.6902	0.0000	56.2576	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1975	1	1	0	0	1	20	20	2	0.0000	37.1985	0.0000	50.0000	0.0000
12.8015	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1975	1	1	0	0	1	21	21	6	0.0000	0.0000	23.8065	74.4685	1.7249
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1975	1	1	0	0	1	22	22	10	0.0000	0.0000	0.0000	94.6658	5.3342
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1975	1	1	0	0	1	23	23	9	0.0000	0.0000	19.3168	80.6832	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1975	1	1	0	0	1	24	24	9	0.0000	0.0000	9.2807	85.5284	0.0000
5.1909	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1975	1	1	0	0	1	25	25	10	0.0000	0.0000	7.0029	84.8703	7.0029
0.0000	1.1240	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1975	1	1	0	0	1	26	26	8	0.0000	0.0000	0.0000	77.8311	16.8185
2.6752	2.6752	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1975	1	1	0	0	1	27	27	9	0.0000	0.0000	7.0051	72.2056	0.0000
2.8446	10.9396	7.0051	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1975	1	1	0	0	1	28	28	7	0.0000	0.0000	0.0000	28.1288	53.1793
2.5515	16.1404	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1975	1	1	0	0	1	29	29	10	0.0000	0.0000	0.0000	31.0378	0.0000
41.6159	21.4534	5.8928	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1975	1	1	0	0	1	30	30	8	0.0000	0.0000	0.0000	4.8178	78.2151
13.3559	0.0000	0.0000	3.6112	0.0000	0.0000	0.0000	0.0000	0.0000					
1975	1	1	0	0	1	31	31	4	0.0000	0.0000	0.0000	9.9887	0.0000
70.1459	19.8654	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1975	1	1	0	0	1	32	32	5	0.0000	0.0000	0.0000	28.7065	0.0000
5.3602	58.2321	7.7012	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1975	1	1	0	0	1	33	33	6	0.0000	0.0000	0.0000	0.0000	0.0000
27.6850	46.4223	4.2596	16.0317	5.6014	0.0000	0.0000	0.0000	0.0000					
1975	1	1	0	0	1	35	35	2	0.0000	0.0000	0.0000	0.0000	0.0000
73.5368	26.4632	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1975	1	1	0	0	1	36	36	4	0.0000	0.0000	0.0000	0.0000	0.0000
10.7028	89.2972	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1975	1	1	0	0	1	38	38	1	0.0000	0.0000	0.0000	0.0000	0.0000
100.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1975	1	1	0	0	1	39	39	1	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	100.0000	0.0000	0.0000	0.0000					
1975	1	1	0	0	1	40	40	2	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	21.4858	0.0000	0.0000	78.5142	0.0000	0.0000	0.0000	0.0000					
1975	1	1	0	0	1	41	41	1	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	100.0000	0.0000	0.0000					
1975	1	1	0	0	1	49	49	1	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	100.0000	0.0000	0.0000	0.0000	0.0000					
1975	1	1	0	0	1	50	50	1	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	100.0000	0.0000					
1976	1	1	0	0	1	3	3	1	100.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					

1976	1	1	0	0	1	4	4	1	100.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
1976	1	1	0	0	1	5	5	1	100.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
1976	1	1	0	0	1	6	6	3	100.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
1976	1	1	0	0	1	7	7	1	100.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
1976	1	1	0	0	1	8	8	4	100.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
1976	1	1	0	0	1	9	9	5	100.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
1976	1	1	0	0	1	10	10	4	97.7960	2.2040	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
1976	1	1	0	0	1	11	11	4	43.8099	56.1901	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
1976	1	1	0	0	1	12	12	6	95.5825	4.4175	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
1976	1	1	0	0	1	13	13	8	76.7567	18.4825	4.7609	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
1976	1	1	0	0	1	14	14	9	83.9321	16.0679	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
1976	1	1	0	0	1	15	15	10	46.8326	53.1674	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
1976	1	1	0	0	1	16	16	7	21.1327	78.8673	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
1976	1	1	0	0	1	17	17	13	28.6504	71.3496	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
1976	1	1	0	0	1	18	18	23	7.3862	67.0779	24.4526	1.0833	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
1976	1	1	0	0	1	19	19	26	4.3779	63.4472	31.9532	0.0000	0.2217	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
1976	1	1	0	0	1	20	20	45	6.0606	70.0659	22.3420	1.0983	0.1712	0.2619	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
1976	1	1	0	0	1	21	21	58	5.7384	73.4517	16.4006	2.2534	2.0180	0.1380	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
1976	1	1	0	0	1	22	22	53	0.2413	68.3268	20.0115	4.7414	5.5814	1.0976	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
1976	1	1	0	0	1	23	23	55	0.3227	71.2757	13.9827	1.3467	10.8578	2.2144	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
1976	1	1	0	0	1	24	24	56	0.5693	55.2655	22.0991	4.6384	14.5621	2.1280	0.7376	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
1976	1	1	0	0	1	25	25	54	0.0000	39.2864	16.6332	7.8940	29.4872	6.6992	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
1976	1	1	0	0	1	26	26	47	0.9784	26.3184	12.2003	5.6000	46.3883	8.5146	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
1976	1	1	0	0	1	27	27	47	0.0000	10.9275	29.5591	5.3167	41.7652	11.3236	1.1080	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
1976	1	1	0	0	1	28	28	39	0.0000	2.1858	1.9251	5.1130	73.7158	11.4959	4.1530	1.4115	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
1976	1	1	0	0	1	29	29	42	0.0000	2.0295	3.1365	4.8578	58.6207	25.8779	3.4834	0.8045	0.6164	0.0000	0.2866	0.2866	0.0000	0.0000
1976	1	1	0	0	1	30	30	44	0.0000	0.0000	1.0698	1.1458	63.8017	23.0548	6.9754	3.6944	0.2582	0.0000	0.0000	0.0000	0.0000	0.0000
1976	1	1	0	0	1	31	31	57	0.0000	0.0000	0.0000	3.3948	56.7487	21.7595	2.2945	5.9717	3.1858	1.4822	0.6462	0.0000	4.5167	0.0000
1976	1	1	0	0	1	32	32	62	0.0000	0.3791	0.0000	2.0588	37.3613	27.6379	11.1598	17.0640	1.4028	0.0077	0.8297	0.2036	1.8954	0.0000
1976	1	1	0	0	1	33	33	60	0.0000	0.0000	0.7657	0.9368	26.2805	38.6238	10.8890	5.4954	8.2739	5.5776	0.2439	2.9134	0.0000	0.0000
1976	1	1	0	0	1	34	34	69	0.0000	0.0000	0.0000	3.3871	14.7311	19.6219	29.8552	10.3788	16.4266	0.1283	5.4709	0.0000	0.0000	0.0000
1976	1	1	0	0	1	35	35	64	0.0000	0.0000	0.3421	0.0000	11.0217	21.8405	26.2875	17.6601	7.6358	4.2391	4.1915	6.4957	0.2861	0.0000
1976	1	1	0	0	1	36	36	58	0.0000	0.0000	0.0000	0.2708	13.0015	39.1557	17.7728	14.3922	8.3931	5.1437	1.5169	0.3533	0.0000	0.0000
1976	1	1	0	0	1	37	37	67	0.0000	0.0000	0.0000	0.6980	10.6328	18.9382	17.5666	17.2477	12.6425	20.0793	1.2431	0.4759	0.0000	0.4759
1976	1	1	0	0	1	38	38	65	0.0000	0.0000	0.0000	0.0000	5.3902	15.4987	25.0662	12.3064	32.5292	3.8356	3.0498	2.3239	0.0000	0.0000

1976	1	1	0	0	1	39	39	62	0.0000	0.0000	0.0000	0.0000	7.9191
24.4537	21.6249	24.2027	12.1828	3.7566	0.7874	4.2232	0.8497	0.0000					
1976	1	1	0	0	1	40	40	57	0.0000	0.0000	0.0000	0.0000	14.5499
16.1500	24.2507	17.2322	15.1879	5.6006	2.4368	2.7291	0.0000	1.8627					
1976	1	1	0	0	1	41	41	56	0.0000	0.0000	0.0000	0.3698	14.7860
11.5339	15.1401	33.5873	7.2072	9.6345	7.0728	0.0000	0.6684	0.0000					
1976	1	1	0	0	1	42	42	48	0.0000	0.0000	0.0000	0.0000	1.8084
16.6353	25.7895	26.2363	12.6774	8.0682	5.7936	0.2729	2.7183	0.0000					
1976	1	1	0	0	1	43	43	45	0.0000	0.0000	0.0000	0.0000	5.8540
1.2137	34.6234	20.3965	5.2532	15.8921	11.0806	4.4300	1.2565	0.0000					
1976	1	1	0	0	1	44	44	30	0.0000	0.0000	0.0000	0.0000	4.6786
3.9711	15.3690	25.3344	15.7209	8.2153	7.5612	10.1405	9.0090	0.0000					
1976	1	1	0	0	1	45	45	36	0.0000	0.0000	0.0000	0.0000	0.0000
5.9087	28.1231	20.8982	24.0840	10.9702	8.1064	1.7668	0.1426	0.0000					
1976	1	1	0	0	1	46	46	33	0.0000	0.0000	0.0000	0.0000	0.0000
3.7865	6.7746	16.2949	21.6834	23.2934	16.2259	11.0570	0.8844	0.0000					
1976	1	1	0	0	1	47	47	33	0.0000	0.0000	0.0000	0.0000	0.0000
4.9150	31.3628	9.8847	17.9954	13.4229	18.5724	3.8469	0.0000	0.0000					
1976	1	1	0	0	1	48	48	33	0.0000	0.0000	0.0000	0.0000	0.0000
2.0002	20.7350	8.4514	24.7553	27.2844	11.0622	4.2534	0.8532	0.6049					
1976	1	1	0	0	1	49	49	28	0.0000	0.0000	0.0000	0.0000	0.0000
1.3655	13.8929	27.3256	20.1634	16.1174	1.6081	11.2454	3.2539	5.0279					
1976	1	1	0	0	1	50	50	25	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	12.2001	10.0776	15.2984	18.0650	38.0500	2.9465	3.3623	0.0000					
1976	1	1	0	0	1	51	51	71	0.0000	0.0000	0.0000	0.0000	0.6090
0.1009	3.0129	10.8672	22.9649	17.3907	21.8658	7.5526	13.3343	2.3018					
1977	1	1	0	0	1	1	1	1	100.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1977	1	1	0	0	1	2	2	1	100.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1977	1	1	0	0	1	12	12	2	82.9880	0.0000	0.0000	0.0000	0.0000
0.0000	17.0120	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1977	1	1	0	0	1	14	14	4	45.3659	6.9065	47.7276	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1977	1	1	0	0	1	15	15	5	56.6159	43.3841	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1977	1	1	0	0	1	16	16	12	92.2371	7.7629	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1977	1	1	0	0	1	17	17	28	81.2489	11.9260	6.5982	0.0000	0.0000
0.0000	0.2270	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1977	1	1	0	0	1	18	18	56	77.7231	12.8647	9.4122	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1977	1	1	0	0	1	19	19	71	81.4173	5.6653	12.4739	0.0000	0.0000
0.1492	0.2943	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1977	1	1	0	0	1	20	20	99	73.3349	10.3069	16.1720	0.1117	0.0744
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1977	1	1	0	0	1	21	21	114	16.4360	22.1488	59.3424	1.7339	0.0000
0.1569	0.0000	0.1819	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1977	1	1	0	0	1	22	22	146	9.2255	15.9035	69.4831	2.6438	0.7687
1.9086	0.0668	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1977	1	1	0	0	1	23	23	141	0.6195	14.7629	72.1790	5.7738	3.1643
3.5005	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1977	1	1	0	0	1	24	24	160	0.3242	7.1591	72.5376	9.4246	4.8971
5.0064	0.5703	0.0000	0.0000	0.0806	0.0000	0.0000	0.0000	0.0000					
1977	1	1	0	0	1	25	25	160	0.0000	3.2658	68.7676	12.5367	5.4345
9.1482	0.8472	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1977	1	1	0	0	1	26	26	147	0.0000	4.8424	54.7204	5.9414	11.5271
21.7455	0.8584	0.3648	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1977	1	1	0	0	1	27	27	142	0.0000	0.2494	44.3487	10.9689	11.0646
25.7662	6.1457	0.8211	0.6354	0.0000	0.0000	0.0000	0.0000	0.0000					
1977	1	1	0	0	1	28	28	132	0.0000	0.6012	31.3953	6.1256	10.9794
44.1143	4.7314	0.5953	0.3177	1.1399	0.0000	0.0000	0.0000	0.0000					
1977	1	1	0	0	1	29	29	128	0.0000	0.2299	14.2010	5.4263	15.2649
59.9647	3.9293	0.4268	0.3848	0.1724	0.0000	0.0000	0.0000	0.0000					
1977	1	1	0	0	1	30	30	136	0.0000	0.0000	7.9310	5.9277	21.5934
49.9216	7.7696	3.5785	2.7260	0.5523	0.0000	0.0000	0.0000	0.0000					
1977	1	1	0	0	1	31	31	123	0.0000	0.0000	4.1411	3.9877	15.8156
59.9814	9.5119	4.8576	0.1438	0.8082	0.5893	0.1635	0.0000	0.0000					
1977	1	1	0	0	1	32	32	135	0.0000	0.1234	2.8113	1.4858	13.2941
58.7713	10.1174	6.5536	6.0846	0.3534	0.0721	0.3331	0.0000	0.0000					

1977	1	1	0	0	1	33	33	140	0.0000	0.0000	0.2559	2.7541	10.8073
49.4598	18.4086	10.2561	6.2171	1.5742	0.1149	0.1520	0.0000	0.0000					
1977	1	1	0	0	1	34	34	146	0.0000	0.0000	0.9874	0.4331	7.0031
47.7984	24.5164	9.7240	6.9744	1.8871	0.4628	0.2133	0.0000	0.0000					
1977	1	1	0	0	1	35	35	147	0.0000	0.0000	0.0000	0.1185	2.4314
38.3218	17.8767	22.0905	10.3715	5.5349	3.2546	0.0000	0.0000	0.0000					
1977	1	1	0	0	1	36	36	161	0.1913	0.0000	0.3858	0.2173	4.2066
23.4200	19.2493	20.4471	13.7526	10.0091	4.6525	2.4618	1.0066	0.0000					
1977	1	1	0	0	1	37	37	139	0.0000	0.0000	0.0000	0.0000	3.0252
22.1477	19.4925	22.8892	13.6802	10.8272	6.6941	1.2439	0.0000	0.0000					
1977	1	1	0	0	1	38	38	131	0.0000	0.0000	0.0000	0.0000	1.0490
16.7450	20.9951	19.1942	12.0354	20.6506	8.1388	1.0497	0.0000	0.1421					
1977	1	1	0	0	1	39	39	94	0.0000	0.0000	0.0000	0.0000	1.2696
5.7308	33.7677	19.5312	11.2809	11.8543	11.6093	4.3514	0.2984	0.3065					
1977	1	1	0	0	1	40	40	95	0.0000	0.0000	0.0000	0.0000	0.2665
12.8299	11.4637	29.8325	13.8010	13.1680	14.8108	2.8738	0.6274	0.3266					
1977	1	1	0	0	1	41	41	73	0.0000	0.0000	0.0000	0.5475	0.5475
17.7256	2.3572	14.0544	19.7261	20.1293	19.8637	4.1806	0.8680	0.0000					
1977	1	1	0	0	1	42	42	60	0.0000	0.0000	0.0000	0.0000	0.5468
4.9916	5.9445	15.8735	26.9359	36.4313	2.2429	4.9156	1.0530	1.0649					
1977	1	1	0	0	1	43	43	52	0.0000	0.0000	0.0000	0.0000	0.0000
2.4184	5.1171	14.1831	25.5692	32.0752	7.2869	12.4864	0.8638	0.0000					
1977	1	1	0	0	1	44	44	46	0.0000	0.0000	0.0000	0.0000	0.7250
5.3723	8.2086	24.4120	21.1603	20.3670	12.8727	6.1472	0.0000	0.7348					
1977	1	1	0	0	1	45	45	42	0.0000	0.0000	0.0000	0.0000	0.0000
8.2443	2.2163	7.6727	22.6185	30.3151	19.2876	6.0596	3.5858	0.0000					
1977	1	1	0	0	1	46	46	23	0.0000	0.0000	0.0000	0.0000	0.0000
1.0454	15.0771	12.1072	8.4822	15.6341	36.6320	11.0221	0.0000	0.0000					
1977	1	1	0	0	1	47	47	17	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	1.1405	23.7013	9.6254	10.3692	37.4895	17.6742	0.0000	0.0000					
1977	1	1	0	0	1	48	48	15	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	3.6467	25.3825	7.7141	13.9808	19.2942	21.8805	8.1011	0.0000					
1977	1	1	0	0	1	49	49	18	0.0000	0.0000	0.2475	0.0000	0.0000
0.0000	0.0000	11.5687	20.6759	2.3019	0.0000	7.8811	10.4428	46.8821					
1977	1	1	0	0	1	50	50	17	0.0000	0.0000	0.0000	0.0000	0.0000
1.5902	8.2386	28.4288	15.8384	1.9813	34.2432	9.6795	0.0000	0.0000					
1977	1	1	0	0	1	51	51	62	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.1002	12.1790	10.3335	19.0401	38.5546	12.1864	7.6061					
1978	1	1	0	0	1	2	2	2	100.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1978	1	1	0	0	1	3	3	2	100.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1978	1	1	0	0	1	4	4	4	100.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1978	1	1	0	0	1	5	5	4	100.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1978	1	1	0	0	1	6	6	10	100.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1978	1	1	0	0	1	7	7	10	98.9750	1.0250	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1978	1	1	0	0	1	8	8	9	98.3490	1.6510	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1978	1	1	0	0	1	9	9	14	100.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1978	1	1	0	0	1	10	10	7	58.8246	41.1754	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1978	1	1	0	0	1	11	11	4	86.2655	13.7345	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1978	1	1	0	0	1	12	12	2	97.5982	2.4018	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1978	1	1	0	0	1	17	17	3	70.5236	29.4764	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1978	1	1	0	0	1	18	18	7	46.1926	53.8074	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1978	1	1	0	0	1	19	19	17	0.0000	74.2069	23.0689	1.9590	0.0000
0.0000	0.7652	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1978	1	1	0	0	1	20	20	51	0.0000	60.8946	20.3482	18.5923	0.1649
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1978	1	1	0	0	1	21	21	88	0.0000	51.2769	24.2535	23.6698	0.7998
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					

1978	1	1	0	0	1	22	22	129	0.0000	41.0592	19.3237	34.1030	5.5142
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1978	1	1	0	0	1	23	23	176	0.0000	34.2083	20.1949	41.1195	4.2760
0.2014	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1978	1	1	0	0	1	24	24	171	0.0000	20.0304	22.6900	51.0418	4.5108
0.6021	1.1249	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1978	1	1	0	0	1	25	25	158	0.0000	14.3774	19.2885	56.4600	6.1994
2.3597	0.7128	0.0000	0.0000	0.6022	0.0000	0.0000	0.0000	0.0000					
1978	1	1	0	0	1	26	26	165	0.0000	4.2908	12.5674	66.1397	12.2751
2.8114	1.9156	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1978	1	1	0	0	1	27	27	148	0.0000	1.3330	8.5730	62.2963	8.2001
9.3331	8.8240	0.4230	1.0176	0.0000	0.0000	0.0000	0.0000	0.0000					
1978	1	1	0	0	1	28	28	144	0.0000	0.6368	5.9131	51.7811	10.4093
12.2047	18.3740	0.6809	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1978	1	1	0	0	1	29	29	154	0.0000	0.0000	1.4291	42.1601	8.1269
21.5714	26.3262	0.0320	0.1693	0.1850	0.0000	0.0000	0.0000	0.0000					
1978	1	1	0	0	1	30	30	143	0.0000	0.0000	0.7408	30.0068	6.6298
20.6821	37.8254	3.4003	0.7147	0.0000	0.0000	0.0000	0.0000	0.0000					
1978	1	1	0	0	1	31	31	147	0.0000	0.0000	0.0210	17.7822	5.1822
24.6946	43.1725	6.1325	3.0150	0.0000	0.0000	0.0000	0.0000	0.0000					
1978	1	1	0	0	1	32	32	156	0.0000	0.0000	0.5226	6.7014	4.9582
26.0819	50.1408	8.5370	1.4712	1.0363	0.4169	0.1337	0.0000	0.0000					
1978	1	1	0	0	1	33	33	184	0.0000	0.0000	0.0000	8.4375	3.7199
19.4815	49.2595	13.1139	2.6051	2.7507	0.6320	0.0000	0.0000	0.0000					
1978	1	1	0	0	1	34	34	178	0.0000	0.0000	0.0000	2.1094	1.2381
14.2679	53.1940	12.7013	9.7158	5.5027	1.0466	0.2242	0.0000	0.0000					
1978	1	1	0	0	1	35	35	186	0.0000	0.0000	0.0000	0.6479	1.2373
10.6758	42.2168	19.2058	19.6519	5.0413	1.2176	0.1056	0.0000	0.0000					
1978	1	1	0	0	1	36	36	176	0.0000	0.0000	0.0000	0.0000	0.4133
5.8335	44.4928	15.1620	17.4728	7.7444	4.2682	4.6131	0.0000	0.0000					
1978	1	1	0	0	1	37	37	156	0.0000	0.0000	0.0000	0.0985	0.7436
3.4055	37.8339	21.0622	18.3756	11.9138	2.2365	1.2134	3.1171	0.0000					
1978	1	1	0	0	1	38	38	115	0.0000	0.0000	0.0000	0.2417	0.7999
5.7688	27.2762	22.7972	17.3709	17.1460	7.3108	0.1622	1.1262	0.0000					
1978	1	1	0	0	1	39	39	103	0.0000	0.0000	0.0000	0.0000	0.0000
1.3067	29.2208	25.3050	11.5186	18.2952	5.8494	6.6573	0.2396	1.6075					
1978	1	1	0	0	1	40	40	60	0.0000	0.0000	0.0000	0.0000	0.0000
11.8699	29.6259	21.7768	13.5358	5.1605	16.8897	0.8441	0.2973	0.0000					
1978	1	1	0	0	1	41	41	60	0.0000	0.0000	0.0000	0.0000	0.0000
1.1535	19.9717	16.4503	26.9830	24.9810	2.6530	0.5189	6.7660	0.5225					
1978	1	1	0	0	1	42	42	45	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	31.9748	15.2065	14.0015	18.2134	12.7340	6.0837	1.7861	0.0000					
1978	1	1	0	0	1	43	43	41	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	17.1970	22.0545	17.6622	18.2999	2.4744	18.9506	3.3614	0.0000					
1978	1	1	0	0	1	44	44	27	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	16.2285	21.2574	28.3578	17.7912	3.1864	8.3541	4.8246	0.0000					
1978	1	1	0	0	1	45	45	26	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	21.4406	5.9732	38.6484	18.1391	11.3181	4.4806	0.0000	0.0000					
1978	1	1	0	0	1	46	46	18	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	38.5317	3.0573	6.0480	29.0638	12.0131	1.7471	0.7029	8.8361					
1978	1	1	0	0	1	47	47	14	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	27.5601	21.9506	2.0744	11.6092	12.8396	9.5603	0.0000	14.4059					
1978	1	1	0	0	1	48	48	18	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	12.0434	5.9918	15.8819	52.8239	10.2369	0.0000	3.0222	0.0000					
1978	1	1	0	0	1	49	49	13	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	13.2756	0.0000	0.0000	76.7316	0.9819	1.8313	3.1307	4.0489					
1978	1	1	0	0	1	50	50	10	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	2.4655	11.2512	9.2090	1.0001	56.8408	16.2329	3.0005					
1978	1	1	0	0	1	51	51	60	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	1.0959	3.3073	11.7625	32.7537	12.1348	16.0179	15.9347	6.9931					
1979	1	1	0	0	1	1	1	1	100.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1979	1	1	0	0	1	6	6	1	100.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1979	1	1	0	0	1	7	7	2	100.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1979	1	1	0	0	1	8	8	2	100.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1979	1	1	0	0	1	9	9	4	37.4549	62.5451	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					

1979	1	1	0	0	1	10	10	10	56.4297	43.5703	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1979	1	1	0	0	1	11	11	21	37.7220	62.2780	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1979	1	1	0	0	1	12	12	27	50.9072	48.0541	1.0387	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1979	1	1	0	0	1	13	13	30	48.6310	50.3018	1.0672	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1979	1	1	0	0	1	14	14	46	43.1019	56.3326	0.5654	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1979	1	1	0	0	1	15	15	33	50.6294	41.7595	7.6111	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1979	1	1	0	0	1	16	16	24	22.0489	74.5477	3.4035	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1979	1	1	0	0	1	17	17	17	1.7270	66.9432	31.3299	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1979	1	1	0	0	1	18	18	19	9.8575	77.9602	12.1823	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1979	1	1	0	0	1	19	19	12	22.6630	49.7456	26.0477	1.5437	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1979	1	1	0	0	1	20	20	11	3.6569	85.8906	10.4524	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1979	1	1	0	0	1	21	21	17	4.5028	54.0578	41.0475	0.3919	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1979	1	1	0	0	1	22	22	25	0.0000	15.2136	84.1714	0.0000	0.6149
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1979	1	1	0	0	1	23	23	36	0.0000	6.8053	81.8263	4.8729	6.4955
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1979	1	1	0	0	1	24	24	44	0.0000	3.8878	69.5035	8.4962	18.1126
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1979	1	1	0	0	1	25	25	65	0.0000	5.5350	38.5584	28.4802	24.0820
1.3265	1.8331	0.0000	0.0000	0.1849	0.0000	0.0000	0.0000	0.0000					
1979	1	1	0	0	1	26	26	72	0.0000	0.0000	26.3971	20.3836	47.2403
2.0032	3.9758	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1979	1	1	0	0	1	27	27	74	0.0000	0.0000	14.6988	11.3878	63.7733
3.7284	5.3364	1.0753	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1979	1	1	0	0	1	28	28	84	0.0000	0.0000	19.1513	13.8647	51.5776
2.5131	9.6805	3.2129	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1979	1	1	0	0	1	29	29	83	0.0000	0.0000	4.4667	10.5735	52.4512
10.4265	15.9740	5.9515	0.1566	0.0000	0.0000	0.0000	0.0000	0.0000					
1979	1	1	0	0	1	30	30	76	0.0000	0.0000	4.0555	7.3365	50.8283
7.5392	23.4677	6.4728	0.2999	0.0000	0.0000	0.0000	0.0000	0.0000					
1979	1	1	0	0	1	31	31	83	0.0000	0.0000	1.8055	0.4565	31.9742
20.9162	28.9325	13.4488	2.4662	0.0000	0.0000	0.0000	0.0000	0.0000					
1979	1	1	0	0	1	32	32	89	0.0000	0.0000	1.7266	0.0370	25.2759
17.1383	38.8252	15.4785	1.0318	0.4868	0.0000	0.0000	0.0000	0.0000					
1979	1	1	0	0	1	33	33	85	0.0000	0.0000	0.0000	1.4664	19.2499
12.1375	31.3405	24.2688	9.7544	0.3681	1.4144	0.0000	0.0000	0.0000					
1979	1	1	0	0	1	34	34	86	0.0000	0.0000	0.0000	1.8524	24.5045
14.2241	29.3112	23.1349	5.3064	1.5195	0.1469	0.0000	0.0000	0.0000					
1979	1	1	0	0	1	35	35	78	0.0000	0.0000	0.0000	0.0462	5.5764
10.5366	38.2895	32.8987	3.7230	7.4132	0.1555	1.3609	0.0000	0.0000					
1979	1	1	0	0	1	36	36	70	0.0000	0.0000	0.0000	0.0000	6.4035
11.7156	29.4469	41.2412	6.2188	4.3501	0.0000	0.6240	0.0000	0.0000					
1979	1	1	0	0	1	37	37	66	0.0000	0.0000	0.0000	0.0000	7.4133
8.3199	24.8693	28.7462	13.9441	11.4646	3.0692	0.0394	2.1338	0.0000					
1979	1	1	0	0	1	38	38	58	0.0000	0.0000	0.0000	0.0000	2.6318
11.5198	10.7464	48.4410	12.6860	9.3651	2.1449	0.1687	0.0000	2.2964					
1979	1	1	0	0	1	39	39	41	0.0000	0.0000	0.0000	0.0000	2.9299
6.3921	9.4858	49.0281	21.0317	2.8837	2.0813	6.1674	0.0000	0.0000					
1979	1	1	0	0	1	40	40	47	0.0000	0.0000	0.0000	3.3877	3.7358
2.1002	21.4652	18.3884	10.2626	6.6324	22.4429	4.6302	6.9545	0.0000					
1979	1	1	0	0	1	41	41	22	0.0000	0.0000	0.0000	0.0000	1.2984
0.0000	12.0910	26.7106	17.3922	27.6139	12.3790	2.5149	0.0000	0.0000					
1979	1	1	0	0	1	42	42	26	0.0000	0.0000	0.0000	2.6431	0.0000
0.0000	4.0869	32.1972	14.7386	31.3907	8.8480	0.3074	0.0000	5.7881					
1979	1	1	0	0	1	43	43	16	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	7.7284	17.7831	45.4167	16.5623	0.3584	12.1511	0.0000	0.0000					
1979	1	1	0	0	1	44	44	12	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	16.2501	40.0104	12.0289	19.8775	0.0000	11.8331	0.0000	0.0000					

1979	1	1	0	0	1	45	45	8	0.0000	0.0000	17.0985	0.0000	0.0000
0.0000	0.0000	19.6632	41.1278	0.0000	5.3357	0.0000	16.5493	0.2255					
1979	1	1	0	0	1	46	46	13	0.0000	0.0000	5.3702	0.0000	0.0000
0.0000	9.5997	13.4674	25.6850	18.4811	11.4694	10.4535	5.4737	0.0000					
1979	1	1	0	0	1	47	47	11	0.0000	0.0000	0.0000	13.6427	0.0000
0.0000	0.0000	2.2006	2.4067	59.3447	9.4986	12.9067	0.0000	0.0000					
1979	1	1	0	0	1	48	48	6	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	67.0219	19.3341	0.0000	0.0000	0.0000	0.0000	13.6441					
1979	1	1	0	0	1	49	49	8	0.0000	0.0000	7.9528	0.0000	0.0000
0.0000	0.0000	5.6338	65.6897	14.5545	0.0000	0.0000	4.3762	1.7930					
1979	1	1	0	0	1	50	50	4	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	50.0000	0.0000	0.0000	37.7964	0.0000	12.2037	0.0000					
1979	1	1	0	0	1	51	51	16	0.0000	0.0000	6.4763	0.0000	0.0000
0.0000	0.1076	0.0000	8.1230	20.5851	4.0649	16.5860	15.5592	28.4979					
1980	1	1	0	0	1	1	1	1	100.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1980	1	1	0	0	1	2	2	3	100.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1980	1	1	0	0	1	3	3	2	100.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1980	1	1	0	0	1	4	4	1	100.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1980	1	1	0	0	1	5	5	2	48.6287	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	51.3713	0.0000	0.0000	0.0000	0.0000					
1980	1	1	0	0	1	6	6	1	100.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1980	1	1	0	0	1	8	8	1	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	100.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1980	1	1	0	0	1	9	9	1	0.0000	0.0000	0.0000	100.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1980	1	1	0	0	1	10	10	1	100.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1980	1	1	0	0	1	11	11	1	0.0000	0.0000	0.0000	0.0000	0.0000
100.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1980	1	1	0	0	1	13	13	3	0.0000	90.9031	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	9.0969	0.0000	0.0000	0.0000	0.0000	0.0000					
1980	1	1	0	0	1	14	14	4	0.0000	85.2727	0.0000	3.1730	11.5543
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1980	1	1	0	0	1	15	15	9	5.0945	94.6274	0.2781	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1980	1	1	0	0	1	16	16	19	42.2098	57.5786	0.2116	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1980	1	1	0	0	1	17	17	38	0.2384	91.9161	7.8455	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1980	1	1	0	0	1	18	18	66	0.0000	98.6346	1.3654	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1980	1	1	0	0	1	19	19	74	7.4359	89.6295	2.9346	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1980	1	1	0	0	1	20	20	84	0.0000	94.7616	4.4731	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.7654	0.0000	0.0000	0.0000					
1980	1	1	0	0	1	21	21	89	0.0000	81.5264	13.9646	0.4763	1.1188
2.9139	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1980	1	1	0	0	1	22	22	83	0.0000	88.8257	7.2840	2.1929	0.2252
1.4722	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1980	1	1	0	0	1	23	23	93	0.4081	57.6571	37.5236	3.1275	0.1565
1.1272	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1980	1	1	0	0	1	24	24	88	0.0000	55.4872	16.0974	8.1475	8.8696
7.5864	2.7762	0.0000	1.0356	0.0000	0.0000	0.0000	0.0000	0.0000					
1980	1	1	0	0	1	25	25	100	0.0000	44.4977	12.9589	18.9812	8.0987
9.9118	4.9173	0.3506	0.2839	0.0000	0.0000	0.0000	0.0000	0.0000					
1980	1	1	0	0	1	26	26	111	0.0000	27.9088	5.2943	33.8362	13.7390
12.3223	3.3534	3.1531	0.2043	0.1815	0.0071	0.0000	0.0000	0.0000					
1980	1	1	0	0	1	27	27	114	0.0000	12.5535	8.8142	30.6808	21.2714
17.9931	5.4085	3.2786	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1980	1	1	0	0	1	28	28	96	0.0000	1.8410	4.4095	22.7725	22.2881
36.4027	3.6013	6.2571	2.3669	0.0610	0.0000	0.0000	0.0000	0.0000					
1980	1	1	0	0	1	29	29	90	0.0000	0.0000	3.4369	9.6124	18.4343
39.2499	12.4947	10.5384	4.9934	0.9822	0.0000	0.0000	0.2578	0.0000					
1980	1	1	0	0	1	30	30	85	0.0000	0.4576	1.3147	17.1273	20.3037
24.6464	10.8454	18.1444	5.8858	1.2514	0.0000	0.0000	0.0233	0.0000					

1980	1	1	0	0	1	31	31	90	0.0000	0.0000	0.0000	5.9136	13.3633
39.8685	12.2295	17.2727	8.9396	1.0726	0.2696	0.6777	0.3928	0.0000					
1980	1	1	0	0	1	32	32	87	0.0000	1.3266	0.0000	2.8802	11.0404
28.3622	11.8162	29.0913	11.7644	0.6189	1.8765	0.8707	0.3525	0.0000					
1980	1	1	0	0	1	33	33	92	0.0000	1.2676	1.4202	1.7054	4.8358
21.0876	21.3745	26.6807	12.4655	5.1797	1.4843	2.0392	0.0048	0.4548					
1980	1	1	0	0	1	34	34	94	0.0000	0.8256	0.0000	0.0399	3.7952
47.7201	13.6294	11.5466	15.1674	3.5725	0.9214	1.4817	0.0000	1.3002					
1980	1	1	0	0	1	35	35	105	0.0000	0.0000	0.0000	2.6990	1.7207
21.2313	19.8732	20.3707	22.5670	5.8453	3.1737	1.0615	0.4979	0.9596					
1980	1	1	0	0	1	36	36	102	0.0000	0.0000	0.0000	1.2687	2.3019
27.4757	9.1708	23.8392	21.2979	8.1179	3.1566	2.9142	0.1166	0.3405					
1980	1	1	0	0	1	37	37	102	0.0000	0.0000	0.0000	0.0000	1.2532
7.5417	9.7044	34.6656	21.0506	13.1736	2.8780	3.7439	2.3504	3.6386					
1980	1	1	0	0	1	38	38	102	0.0000	0.0000	0.0000	0.0000	0.7164
35.0095	16.3949	19.7012	16.9026	1.2360	3.2035	4.4931	1.0150	1.3278					
1980	1	1	0	0	1	39	39	88	0.0000	0.0000	0.0000	0.0000	0.0000
5.4797	13.8540	7.9478	39.6788	16.8573	7.3679	4.1428	2.0821	2.5895					
1980	1	1	0	0	1	40	40	52	0.0000	0.0000	0.0000	0.0000	0.0000
9.3405	6.9539	12.3348	56.8865	5.0456	2.8647	1.8415	2.2197	2.5128					
1980	1	1	0	0	1	41	41	60	0.0000	0.0000	0.0000	0.0000	0.1554
0.8296	1.4621	6.7293	34.6049	26.5221	19.9466	8.1721	0.0000	1.5779					
1980	1	1	0	0	1	42	42	39	0.0000	0.0000	0.0000	0.0000	0.0000
0.0121	2.1368	1.8770	22.7806	7.6152	57.2506	8.1670	0.0000	0.1606					
1980	1	1	0	0	1	43	43	27	0.0000	0.0000	0.0000	0.0000	0.0000
1.4970	5.8963	2.8093	27.9958	8.0111	2.7548	18.6132	13.5920	18.8305					
1980	1	1	0	0	1	44	44	25	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	28.9487	6.4452	17.0357	20.9010	12.2106	3.8174	9.6419	0.9994					
1980	1	1	0	0	1	45	45	26	0.0000	0.0000	0.0000	0.0000	0.0000
2.3335	2.6961	18.9152	19.0996	20.5074	12.5063	10.5755	10.1536	3.2130					
1980	1	1	0	0	1	46	46	19	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	40.7660	16.5690	3.0644	14.2193	25.3813	0.0000	0.0000					
1980	1	1	0	0	1	47	47	12	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	2.3972	58.0744	0.0000	15.6373	23.8911	0.0000	0.0000					
1980	1	1	0	0	1	48	48	11	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	16.1640	50.9516	6.8931	22.0555	0.0000	3.9061	0.0297					
1980	1	1	0	0	1	49	49	9	0.0000	0.0000	0.0000	0.0000	0.0000
5.0794	0.0000	18.1303	18.1080	0.0000	12.4880	3.0087	43.1856	0.0000					
1980	1	1	0	0	1	50	50	7	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	1.0735	23.6016	35.1162	0.0000	0.0000	0.0000	40.2087					
1980	1	1	0	0	1	51	51	14	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.4581	0.0000	28.1292	56.5101	0.0000	2.7448	12.1578					
1981	1	1	0	0	1	1	1	5	100.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1981	1	1	0	0	1	2	2	9	100.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1981	1	1	0	0	1	3	3	13	100.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1981	1	1	0	0	1	4	4	23	100.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1981	1	1	0	0	1	5	5	25	100.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1981	1	1	0	0	1	6	6	29	100.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1981	1	1	0	0	1	7	7	40	100.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1981	1	1	0	0	1	8	8	34	100.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1981	1	1	0	0	1	9	9	22	100.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1981	1	1	0	0	1	10	10	21	100.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1981	1	1	0	0	1	11	11	16	100.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1981	1	1	0	0	1	12	12	12	94.1489	5.8511	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1981	1	1	0	0	1	13	13	6	38.2230	61.7770	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1981	1	1	0	0	1	14	14	9	33.8614	66.1386	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					

1981	1	1	0	0	1	15	15	12	1.7329	97.2736	0.9935	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1981	1	1	0	0	1	16	16	16	27.5861	46.9726	25.4413	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1981	1	1	0	0	1	17	17	28	12.8881	55.6901	31.0864	0.3355	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1981	1	1	0	0	1	18	18	49	10.8798	24.9356	64.1845	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1981	1	1	0	0	1	19	19	59	3.4170	15.8602	80.7228	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1981	1	1	0	0	1	20	20	78	0.8869	15.5085	83.6046	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1981	1	1	0	0	1	21	21	94	0.1186	9.8116	89.3495	0.7203	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1981	1	1	0	0	1	22	22	84	0.0000	3.6354	95.9503	0.4143	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1981	1	1	0	0	1	23	23	85	0.0000	1.0779	98.1307	0.6339	0.1575
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1981	1	1	0	0	1	24	24	88	0.0000	0.6993	95.0383	1.9293	2.3330
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1981	1	1	0	0	1	25	25	101	0.0000	0.9004	91.4056	2.9971	1.4665
1.2684	0.1582	1.8036	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1981	1	1	0	0	1	26	26	101	0.0000	0.0000	83.8204	4.6664	9.6795
0.1385	1.6952	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1981	1	1	0	0	1	27	27	107	0.0000	0.0000	61.6047	8.1335	7.9404
3.2465	15.6315	0.2699	2.6072	0.5663	0.0000	0.0000	0.0000	0.0000					
1981	1	1	0	0	1	28	28	114	0.0000	0.0000	39.2556	4.4370	14.5936
11.5599	23.8495	3.1361	2.4981	0.6702	0.0000	0.0000	0.0000	0.0000					
1981	1	1	0	0	1	29	29	122	0.0000	0.0000	22.0472	6.5778	14.8068
13.2376	26.7541	6.0124	6.1018	4.1646	0.0000	0.2978	0.0000	0.0000					
1981	1	1	0	0	1	30	30	122	0.0000	0.0000	10.1189	6.3685	8.0832
12.6932	34.4634	12.6683	10.4075	5.1971	0.0000	0.0000	0.0000	0.0000					
1981	1	1	0	0	1	31	31	105	0.0000	0.0000	6.1426	0.3342	9.6340
15.2238	27.9564	13.6163	16.3522	10.7404	0.0000	0.0000	0.0000	0.0000					
1981	1	1	0	0	1	32	32	113	0.0000	0.0000	0.1919	0.1387	10.4877
14.8255	44.5625	10.1516	13.1920	5.0023	1.3708	0.0769	0.0000	0.0000					
1981	1	1	0	0	1	33	33	107	0.0000	0.0000	0.0000	0.5156	4.4997
11.5439	42.7883	21.0876	7.9721	10.7050	0.8501	0.0377	0.0000	0.0000					
1981	1	1	0	0	1	34	34	116	0.0000	0.0000	0.0000	0.5355	6.2752
7.8308	35.2225	17.6969	6.9920	23.7630	0.4386	0.7099	0.5356	0.0000					
1981	1	1	0	0	1	35	35	96	0.0000	0.0000	0.0000	0.0000	1.0550
11.4248	44.3976	9.8853	13.9048	16.7798	1.6998	0.0000	0.1198	0.7332					
1981	1	1	0	0	1	36	36	80	0.0000	0.0000	0.0000	0.0000	3.1439
13.3813	12.2466	15.5499	17.0550	36.6969	0.7187	0.1860	1.0217	0.0000					
1981	1	1	0	0	1	37	37	65	0.0000	0.0000	0.0000	0.0000	9.1529
1.1279	21.0040	18.0610	31.0203	15.6254	2.2255	0.2188	0.0000	1.5641					
1981	1	1	0	0	1	38	38	56	0.0000	0.0000	0.0000	0.0000	12.1190
0.0000	6.2235	1.8690	7.0319	48.9987	18.3078	4.3469	1.0865	0.0167					
1981	1	1	0	0	1	39	39	39	0.0000	0.0000	0.0000	0.0000	11.6065
0.0000	10.1695	33.9137	4.1554	26.8407	2.9517	6.5072	3.5984	0.2569					
1981	1	1	0	0	1	40	40	34	0.0000	0.0000	0.0000	0.0000	1.0849
0.6052	20.5654	9.7394	9.0427	53.8155	1.7940	2.9225	0.0000	0.4303					
1981	1	1	0	0	1	41	41	36	0.0000	0.0000	0.0000	0.0000	2.5406
0.0000	4.7108	6.0604	2.5295	13.4537	54.2586	8.9983	2.5648	4.8834					
1981	1	1	0	0	1	42	42	30	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	13.4455	5.6128	8.8575	51.5736	6.7607	2.4209	11.1768	0.1522					
1981	1	1	0	0	1	43	43	20	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	1.3812	3.7989	19.0748	21.1406	15.3170	36.3729	0.0000	2.9145					
1981	1	1	0	0	1	44	44	20	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	2.9910	0.1495	0.0000	90.5396	0.7718	2.4062	2.5088	0.6332					
1981	1	1	0	0	1	45	45	16	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	24.6494	37.0664	9.9647	19.0099	7.7834	0.9554	0.0000	0.5707					
1981	1	1	0	0	1	46	46	8	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	64.5473	0.0000	0.6646	2.6846	31.7632	0.0190	0.3213	0.0000					
1981	1	1	0	0	1	47	47	10	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	1.4485	1.3736	41.1394	49.6614	5.7853	0.5919	0.0000	0.0000					
1981	1	1	0	0	1	48	48	10	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	70.2031	22.9640	3.1021	3.7308	0.0000	0.0000					
1981	1	1	0	0	1	49	49	5	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	29.3855	0.0000	59.6623	0.0000	0.0000	0.0000	10.9522					

1981	1	1	0	0	1	50	50	7	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	97.2362	0.0000	0.4102	0.0000	1.2558	1.0977	0.0000					
1981	1	1	0	0	1	51	51	15	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	12.0478	52.5152	20.6271	5.3696	9.4404					
1982	1	1	0	0	1	5	5	2	100.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1982	1	1	0	0	1	6	6	5	100.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1982	1	1	0	0	1	7	7	11	100.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1982	1	1	0	0	1	8	8	9	100.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1982	1	1	0	0	1	9	9	12	97.9904	2.0096	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1982	1	1	0	0	1	10	10	18	100.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1982	1	1	0	0	1	11	11	37	100.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1982	1	1	0	0	1	12	12	38	98.9879	1.0121	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1982	1	1	0	0	1	13	13	52	100.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1982	1	1	0	0	1	14	14	62	100.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1982	1	1	0	0	1	15	15	66	98.5704	0.6063	0.8233	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1982	1	1	0	0	1	16	16	62	98.4006	0.4470	1.1525	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1982	1	1	0	0	1	17	17	55	94.3115	5.6885	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1982	1	1	0	0	1	18	18	59	78.4510	18.0130	0.0000	3.5359	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1982	1	1	0	0	1	19	19	48	62.3397	31.7648	2.0087	3.8868	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1982	1	1	0	0	1	20	20	50	46.9875	37.3804	5.9354	8.0123	1.6844
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1982	1	1	0	0	1	21	21	62	9.9694	23.7130	6.2402	58.7764	1.3010
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1982	1	1	0	0	1	22	22	66	2.2336	20.2780	17.4804	55.6042	3.7715
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.6322					
1982	1	1	0	0	1	23	23	86	0.5766	9.5805	5.5073	78.7020	4.9504
0.0000	0.0000	0.6831	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1982	1	1	0	0	1	24	24	94	0.0000	5.2427	3.3467	85.2920	3.9317
0.5515	0.0000	1.6355	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1982	1	1	0	0	1	25	25	99	0.0000	0.7352	2.1970	92.6498	3.8144
0.6036	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1982	1	1	0	0	1	26	26	100	0.0000	0.6469	3.2197	89.4656	3.8542
0.8166	0.6410	0.6986	0.0000	0.3787	0.0000	0.0000	0.0000	0.2786					
1982	1	1	0	0	1	27	27	99	0.0000	0.0000	0.7499	82.0131	6.9586
2.5486	1.4822	4.5580	0.6270	0.0000	0.3946	0.0000	0.0000	0.6680					
1982	1	1	0	0	1	28	28	103	0.0000	0.0000	0.3788	77.9100	7.9181
3.6832	3.5066	6.6033	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1982	1	1	0	0	1	29	29	111	0.0000	0.0000	0.0000	46.9972	16.5576
8.2504	6.2780	16.8904	2.4074	2.6189	0.0000	0.0000	0.0000	0.0000					
1982	1	1	0	0	1	30	30	116	0.0000	0.0000	1.3613	47.8803	10.2615
9.9402	9.5507	17.5775	0.3960	1.4957	0.9236	0.0000	0.0000	0.6133					
1982	1	1	0	0	1	31	31	101	0.0000	0.0000	0.0000	34.7691	7.4641
13.8050	7.6648	23.3964	5.5656	1.2368	6.0981	0.0000	0.0000	0.0000					
1982	1	1	0	0	1	32	32	112	0.0000	0.0000	0.0000	16.5933	3.5340
15.2245	11.8911	27.6656	7.5737	5.4478	11.6595	0.4107	0.0000	0.0000					
1982	1	1	0	0	1	33	33	100	0.0000	0.0000	0.0000	11.5466	3.8546
10.6115	13.6971	29.2288	6.0096	4.8190	18.4538	1.7790	0.0000	0.0000					
1982	1	1	0	0	1	34	34	106	0.0000	0.0000	0.0000	4.4072	0.5484
13.8186	17.3717	32.8207	10.7374	6.9145	10.5590	0.6058	0.5274	1.6894					
1982	1	1	0	0	1	35	35	104	0.0000	0.0000	0.0000	3.7007	2.0055
11.5943	5.7285	34.3375	10.2167	8.0253	23.8216	0.0000	0.0000	0.5700					
1982	1	1	0	0	1	36	36	86	0.0000	0.0000	0.0000	0.7740	0.6679
5.0666	23.4578	29.0983	5.1988	14.0409	19.5953	1.6955	0.0000	0.4049					
1982	1	1	0	0	1	37	37	85	0.0000	0.0000	0.0000	0.6837	1.3018
5.5782	8.0935	24.7073	3.6967	5.7182	48.3121	0.8577	0.5244	0.5265					

1982	1	1	0	0	1	38	38	81	0.0000	0.0000	0.0000	0.5976	3.5871
13.0628	4.2651	28.0879	4.7963	20.3296	18.5667	5.0823	1.6247	0.0000					
1982	1	1	0	0	1	39	39	48	0.0000	0.0000	0.0000	0.0000	0.0000
4.1946	5.3389	25.7048	8.2842	26.3270	20.5459	5.2781	0.0000	4.3264					
1982	1	1	0	0	1	40	40	53	0.0000	0.0000	0.0000	0.0000	0.0000
8.1501	8.7201	36.1601	12.1317	9.8521	21.8858	0.3130	1.6155	1.1717					
1982	1	1	0	0	1	41	41	37	0.0000	0.0000	0.0000	0.0000	0.0000
9.9974	0.2466	44.1838	7.6383	4.9558	25.8561	0.0000	4.5958	2.5263					
1982	1	1	0	0	1	42	42	28	0.0000	0.0000	0.0000	0.0000	0.0000
1.5550	7.1392	24.9344	0.0000	14.6880	41.7864	0.0000	0.0000	9.8970					
1982	1	1	0	0	1	43	43	17	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	17.0232	1.3540	2.9755	68.8525	9.7948	0.0000	0.0000					
1982	1	1	0	0	1	44	44	21	0.0000	0.0000	0.0000	0.0000	0.0000
1.5939	2.2983	61.0117	3.1181	5.4055	7.5778	15.7641	3.2306	0.0000					
1982	1	1	0	0	1	45	45	21	0.0000	0.0000	0.0000	0.0000	0.0000
1.7819	7.1157	9.2623	0.0000	4.3341	52.9252	4.5995	16.1694	3.8119					
1982	1	1	0	0	1	46	46	18	0.0000	0.0000	0.0000	0.0000	0.0000
6.6512	0.0000	32.6097	0.0000	4.5417	48.9098	7.2876	0.0000	0.0000					
1982	1	1	0	0	1	47	47	9	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	2.2843	7.9569	50.3492	30.1938	9.2158	0.0000	0.0000					
1982	1	1	0	0	1	48	48	10	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	6.2427	0.0000	43.7270	50.0303	0.0000	0.0000	0.0000					
1982	1	1	0	0	1	49	49	6	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	1.6185	0.0000	0.0000	87.4692	0.0000	0.0000	10.9124					
1982	1	1	0	0	1	50	50	6	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	25.8082	50.7283	0.0000	16.3325	7.1310					
1982	1	1	0	0	1	51	51	14	5.6776	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	1.2189	9.8107	39.2829	6.0371	17.4085	20.5644					
1983	1	1	0	0	1	7	7	1	0.0000	100.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1983	1	1	0	0	1	10	10	6	0.0000	100.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1983	1	1	0	0	1	11	11	10	0.0000	100.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1983	1	1	0	0	1	12	12	11	0.0000	100.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1983	1	1	0	0	1	13	13	23	0.0000	97.5478	2.4522	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1983	1	1	0	0	1	14	14	23	0.0000	95.9864	4.0136	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1983	1	1	0	0	1	15	15	35	0.0000	94.8162	4.0641	0.0000	1.1197
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1983	1	1	0	0	1	16	16	39	0.0000	99.2795	0.7205	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1983	1	1	0	0	1	17	17	51	0.0000	95.7910	4.2090	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1983	1	1	0	0	1	18	18	55	0.0000	92.6787	7.3213	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1983	1	1	0	0	1	19	19	62	0.0000	90.7181	8.4097	0.8722	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1983	1	1	0	0	1	20	20	58	0.0000	90.5170	8.1957	1.2873	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1983	1	1	0	0	1	21	21	62	0.0000	84.7834	9.7092	2.8952	2.6122
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1983	1	1	0	0	1	22	22	69	0.0000	76.4043	12.0019	2.2435	9.3503
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1983	1	1	0	0	1	23	23	77	0.0000	60.1477	17.2718	1.2158	19.3830
1.5990	0.0000	0.0000	0.3827	0.0000	0.0000	0.0000	0.0000	0.0000					
1983	1	1	0	0	1	24	24	72	0.0000	41.0145	14.5683	10.5069	32.3868
1.5234	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1983	1	1	0	0	1	25	25	69	0.0000	23.2105	9.9221	10.6123	50.9668
5.1893	0.0000	0.0361	0.0630	0.0000	0.0000	0.0000	0.0000	0.0000					
1983	1	1	0	0	1	26	26	69	0.0000	11.0450	2.3200	4.6987	73.7100
3.2607	4.3030	0.5759	0.0315	0.0550	0.0000	0.0000	0.0000	0.0000					
1983	1	1	0	0	1	27	27	75	0.0000	1.5427	0.7439	3.3269	79.0185
4.7000	2.3639	3.2155	4.1992	0.8893	0.0000	0.0000	0.0000	0.0000					
1983	1	1	0	0	1	28	28	74	0.0000	2.5471	2.7064	4.1431	72.1073
9.7005	2.3012	0.3373	4.1848	0.7059	0.7256	0.5408	0.0000	0.0000					
1983	1	1	0	0	1	29	29	70	0.0000	2.7818	1.5088	3.5878	64.3051
10.5212	3.7663	6.9575	3.7893	1.1962	1.3231	0.2629	0.0000	0.0000					

1983	1	1	0	0	1	30	30	69	0.0000	1.6271	0.0000	1.8599	41.6911
6.8924	5.8083	16.0416	16.3715	3.7918	2.8433	3.0731	0.0000	0.0000					
1983	1	1	0	0	1	31	31	71	0.0000	0.0000	0.0000	1.1830	45.9298
8.1839	11.4912	11.9391	9.8159	7.6836	3.5098	0.0000	0.2638	0.0000					
1983	1	1	0	0	1	32	32	59	0.0000	0.0000	0.0000	0.3797	25.3145
10.8359	11.5253	10.7074	23.0377	0.6550	0.8205	14.8267	0.4741	1.4231					
1983	1	1	0	0	1	33	33	66	0.0000	0.0000	0.0000	0.6805	36.1631
11.5615	7.3976	15.6277	11.3089	5.5881	1.2734	10.3993	0.0000	0.0000					
1983	1	1	0	0	1	34	34	66	0.0000	0.0000	0.0000	0.8689	16.8735
25.4494	13.9941	11.4711	18.7969	7.4435	0.6932	4.4094	0.0000	0.0000					
1983	1	1	0	0	1	35	35	61	0.0000	0.4272	0.0000	0.5981	5.8048
5.7328	10.1190	10.4327	35.1549	3.8242	22.2095	3.6126	2.0840	0.0000					
1983	1	1	0	0	1	36	36	57	0.0000	0.0000	0.0000	0.0000	12.7828
1.8710	15.0597	9.4654	30.2074	8.1324	11.3522	9.0331	0.0000	2.0960					
1983	1	1	0	0	1	37	37	44	0.0000	0.0000	0.0000	0.0000	6.7639
1.3306	11.6097	22.8571	38.6396	12.6023	5.4708	0.7258	0.0000	0.0000					
1983	1	1	0	0	1	38	38	32	0.0000	0.0000	0.0000	0.0000	5.2981
6.5382	4.4551	11.4930	35.6330	15.4808	10.4283	4.0303	4.3750	2.2682					
1983	1	1	0	0	1	39	39	32	0.0000	0.0000	0.0000	0.0000	2.5859
3.5385	13.8379	17.5078	25.5945	7.1871	8.4378	12.9156	8.3949	0.0000					
1983	1	1	0	0	1	40	40	17	0.0000	0.0000	0.0000	0.0000	3.1067
0.0000	8.6783	22.4567	40.0804	6.4602	3.0897	3.1106	13.0174	0.0000					
1983	1	1	0	0	1	41	41	22	0.0000	0.0000	0.0000	0.0000	1.8142
6.4691	8.7743	21.8172	45.5021	4.7278	0.9261	9.8811	0.0000	0.0881					
1983	1	1	0	0	1	42	42	15	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	7.3012	0.0000	19.8526	11.5785	1.5874	34.2770	23.9713	1.4318					
1983	1	1	0	0	1	43	43	9	0.0000	0.0000	0.0000	0.0000	27.8276
0.0000	0.0000	3.9966	25.9397	21.8071	10.0854	10.3435	0.0000	0.0000					
1983	1	1	0	0	1	44	44	12	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	7.6942	8.6178	30.1768	45.6177	7.8935	0.0000					
1983	1	1	0	0	1	45	45	6	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	10.9423	0.0000	32.8370	49.9380	0.0000	6.2828	0.0000	0.0000					
1983	1	1	0	0	1	46	46	6	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	7.2145	61.4945	0.0000	31.2910	0.0000	0.0000	0.0000					
1983	1	1	0	0	1	47	47	4	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	5.6758	0.0000	6.6186	0.0000	78.4857	0.0000	9.2200					
1983	1	1	0	0	1	48	48	4	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	54.9134	23.8862	10.5067	10.6937	0.0000	0.0000					
1983	1	1	0	0	1	49	49	5	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	17.4201	15.2732	0.0000	35.0731	19.2894	0.0000	12.9441					
1983	1	1	0	0	1	50	50	1	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	100.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1983	1	1	0	0	1	51	51	12	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	1.9721	9.9753	31.8084	3.9705	8.5778	36.5148	7.1812					
1984	1	1	0	0	1	8	8	1	0.0000	0.0000	100.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1984	1	1	0	0	1	12	12	3	0.0000	0.0000	100.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1984	1	1	0	0	1	13	13	1	0.0000	0.0000	100.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1984	1	1	0	0	1	14	14	2	0.0000	0.0000	100.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1984	1	1	0	0	1	15	15	6	0.0000	0.0000	100.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1984	1	1	0	0	1	16	16	12	0.0000	0.0000	100.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1984	1	1	0	0	1	17	17	25	0.0000	3.2983	96.7017	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1984	1	1	0	0	1	18	18	41	0.0000	1.9622	98.0378	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1984	1	1	0	0	1	19	19	72	0.0000	1.6140	97.3894	0.8964	0.1001
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1984	1	1	0	0	1	20	20	112	0.0000	2.1496	95.6482	2.2021	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1984	1	1	0	0	1	21	21	121	0.0000	0.9496	94.7333	4.3171	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1984	1	1	0	0	1	22	22	135	0.0000	1.2447	93.6581	4.8753	0.0000
0.2220	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1984	1	1	0	0	1	23	23	125	0.0000	0.0000	94.6344	3.5122	0.8290
1.0244	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					

1984	1	1	0	0	1	24	24	112	0.0000	0.0000	85.8425	8.8225	2.1728
3.1623	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1984	1	1	0	0	1	25	25	93	0.0000	0.0000	76.1002	7.5489	8.0232
8.3276	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1984	1	1	0	0	1	26	26	82	0.0000	0.0000	58.8511	5.9328	8.2557
24.7285	2.2319	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1984	1	1	0	0	1	27	27	83	0.0000	0.0000	28.5562	10.3480	17.0380
39.9494	3.0863	0.0000	1.0221	0.0000	0.0000	0.0000	0.0000	0.0000					
1984	1	1	0	0	1	28	28	74	0.0000	0.0000	13.9624	9.7794	21.4070
46.5562	2.8905	1.1703	0.0000	2.4039	0.0000	0.0000	1.8303	0.0000					
1984	1	1	0	0	1	29	29	67	0.0000	0.0000	4.8885	2.4817	22.9699
57.3095	7.2801	1.3959	1.5691	2.1053	0.0000	0.0000	0.0000	0.0000					
1984	1	1	0	0	1	30	30	66	0.0000	0.0000	3.9832	0.1415	10.2103
71.3292	6.4062	4.5686	1.1362	2.2247	0.0000	0.0000	0.0000	0.0000					
1984	1	1	0	0	1	31	31	50	0.0000	0.0000	2.1882	1.1627	13.7039
45.9393	15.9119	3.8382	6.2286	7.5442	0.0000	3.4830	0.0000	0.0000					
1984	1	1	0	0	1	32	32	49	0.0000	0.0000	0.0000	1.2164	8.3546
41.9724	9.3841	7.3439	9.8482	11.9281	0.8791	1.9444	7.1288	0.0000					
1984	1	1	0	0	1	33	33	43	0.0000	0.0000	0.0000	0.5130	4.2096
40.3123	9.1091	5.9564	4.9541	19.4442	0.0000	9.8918	5.6096	0.0000					
1984	1	1	0	0	1	34	34	28	0.0000	0.0000	0.0000	0.0000	0.0000
22.4547	17.0781	11.6577	12.6528	15.4162	0.0000	0.0000	11.3360	9.4044					
1984	1	1	0	0	1	35	35	20	0.0000	0.0000	0.0000	0.0000	0.0000
17.2943	5.3151	25.9165	3.1594	41.7931	0.0000	0.0000	6.5216	0.0000					
1984	1	1	0	0	1	36	36	11	0.0000	0.0000	0.0000	0.0000	0.0000
5.8098	17.5670	26.2206	1.0763	0.0000	24.9662	24.3602	0.0000	0.0000					
1984	1	1	0	0	1	37	37	5	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	8.6490	9.5849	50.6884	8.5495	22.5282	0.0000	0.0000	0.0000					
1984	1	1	0	0	1	38	38	5	0.0000	0.0000	0.0000	0.0000	0.0000
7.2878	0.0000	9.5434	29.5302	0.0000	0.0000	50.1773	3.4613	0.0000					
1984	1	1	0	0	1	39	39	4	0.0000	0.0000	0.0000	0.0000	0.0000
70.6928	13.1832	0.0000	11.0028	0.0000	5.1212	0.0000	0.0000	0.0000					
1984	1	1	0	0	1	40	40	7	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	25.6315	0.0000	6.7051	35.8468	12.3954	0.0000	19.4211	0.0000					
1984	1	1	0	0	1	41	41	2	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	15.4736	15.4736	0.0000	0.0000	69.0528	0.0000					
1984	1	1	0	0	1	43	43	4	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	96.4659	0.0000	3.5341	0.0000	0.0000					
1984	1	1	0	0	1	44	44	4	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	59.5023	28.9483	0.0000	11.5494	0.0000					
1984	1	1	0	0	1	45	45	2	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	44.8431	55.1569					
1984	1	1	0	0	1	46	46	1	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	100.0000	0.0000	0.0000	0.0000					
1984	1	1	0	0	1	48	48	1	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	100.0000	0.0000	0.0000	0.0000	0.0000					
1984	1	1	0	0	1	49	49	2	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	47.1264	52.8736	0.0000	0.0000	0.0000					
1984	1	1	0	0	1	50	50	3	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	71.7554	0.0000	0.0000	28.2446	0.0000					
1984	1	1	0	0	1	51	51	9	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	7.3897	13.0868	0.0000	29.3454	2.7410	3.4597	36.8766	7.1008					
1985	1	1	0	0	1	7	7	1	100.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1985	1	1	0	0	1	9	9	1	100.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1985	1	1	0	0	1	10	10	2	100.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1985	1	1	0	0	1	11	11	1	100.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1985	1	1	0	0	1	12	12	3	100.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1985	1	1	0	0	1	13	13	3	100.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1985	1	1	0	0	1	14	14	3	64.3301	35.6699	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1985	1	1	0	0	1	15	15	2	100.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1985	1	1	0	0	1	16	16	1	100.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					

1985	1	1	0	0	1	17	17	1	100.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1985	1	1	0	0	1	18	18	2	0.0000	0.0000	100.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1985	1	1	0	0	1	19	19	7	4.9113	33.6362	0.0000	61.4525	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1985	1	1	0	0	1	20	20	16	0.0000	0.0000	21.2589	78.7411	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1985	1	1	0	0	1	21	21	43	0.6274	0.1817	27.1075	69.0188	3.0646
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1985	1	1	0	0	1	22	22	78	0.0000	0.0000	14.4384	76.7545	8.8071
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1985	1	1	0	0	1	23	23	107	0.0000	0.0000	12.9545	83.5932	3.4523
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1985	1	1	0	0	1	24	24	121	0.0000	0.0000	8.5546	88.6021	2.5742
0.2690	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1985	1	1	0	0	1	25	25	124	0.0000	0.0000	3.9961	89.7364	6.2003
0.0672	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1985	1	1	0	0	1	26	26	115	0.0000	0.0000	2.3387	88.6879	6.4600
0.9930	1.5205	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1985	1	1	0	0	1	27	27	101	0.0000	0.0000	1.0296	80.0792	9.9326
4.9880	3.9706	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1985	1	1	0	0	1	28	28	79	0.0000	0.0000	0.9827	61.6474	10.3871
15.2938	11.6891	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1985	1	1	0	0	1	29	29	63	0.0000	0.0000	0.0000	41.5022	24.1526
17.8557	16.1533	0.3363	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1985	1	1	0	0	1	30	30	58	0.0000	0.0000	0.0000	29.5440	16.5183
17.8796	34.1454	1.9127	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1985	1	1	0	0	1	31	31	52	0.0000	0.0000	0.0000	15.1122	13.5739
15.4814	50.7642	4.7016	0.0084	0.0000	0.3583	0.0000	0.0000	0.0000					
1985	1	1	0	0	1	32	32	25	0.0000	0.0000	0.0000	4.4790	24.6862
8.7998	54.3793	0.0000	5.1079	0.0000	2.5479	0.0000	0.0000	0.0000					
1985	1	1	0	0	1	33	33	24	0.0000	0.0000	0.0000	0.0000	0.0000
15.8630	66.9781	1.3128	4.1447	11.7015	0.0000	0.0000	0.0000	0.0000					
1985	1	1	0	0	1	34	34	17	0.0000	0.0000	0.0000	0.0000	16.1168
29.9989	38.7397	0.0000	5.4183	9.7263	0.0000	0.0000	0.0000	0.0000					
1985	1	1	0	0	1	35	35	15	0.0000	0.0000	0.0000	0.0000	0.0000
9.0182	50.5774	20.5277	11.5148	0.0000	8.3619	0.0000	0.0000	0.0000					
1985	1	1	0	0	1	36	36	11	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	39.8294	35.8073	18.3288	4.8177	1.2168	0.0000	0.0000	0.0000					
1985	1	1	0	0	1	37	37	3	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	14.0538	0.0000	0.0000	67.0945	18.8517	0.0000	0.0000	0.0000					
1985	1	1	0	0	1	38	38	4	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	6.6840	93.3160	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1985	1	1	0	0	1	39	39	3	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	10.4694	0.0000	51.1219	38.4087	0.0000	0.0000	0.0000					
1985	1	1	0	0	1	41	41	1	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	100.0000	0.0000	0.0000	0.0000	0.0000					
1985	1	1	0	0	1	42	42	1	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	100.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1985	1	1	0	0	1	49	49	1	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	100.0000	0.0000	0.0000					
1986	1	1	0	0	1	5	5	1	100.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1986	1	1	0	0	1	10	10	1	0.0000	100.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1986	1	1	0	0	1	11	11	5	79.8566	20.1434	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1986	1	1	0	0	1	12	12	8	83.6901	9.8684	0.0000	0.0000	6.4415
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1986	1	1	0	0	1	13	13	19	74.7533	25.2467	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1986	1	1	0	0	1	14	14	22	89.5239	10.4761	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1986	1	1	0	0	1	15	15	49	89.2371	10.3292	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.4337	0.0000	0.0000					
1986	1	1	0	0	1	16	16	41	93.1547	6.8453	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1986	1	1	0	0	1	17	17	42	89.9281	10.0719	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					

1986	1	1	0	0	1	18	18	40	76.5963	20.2151	2.2675	0.0000	0.9210
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1986	1	1	0	0	1	19	19	39	53.4605	36.1108	4.3440	2.3386	3.7462
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1986	1	1	0	0	1	20	20	36	21.6803	20.6794	7.9408	0.0000	48.1011
1.5984	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1986	1	1	0	0	1	21	21	51	9.6723	12.4527	0.0000	4.1529	71.8026
1.9195	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1986	1	1	0	0	1	22	22	85	1.4255	5.6884	4.2855	9.6279	74.6979
4.0753	0.1994	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1986	1	1	0	0	1	23	23	114	0.0000	1.6172	1.3752	6.3261	82.6503
7.4612	0.5700	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1986	1	1	0	0	1	24	24	119	0.0000	0.0000	1.3223	7.5530	83.4591
7.3691	0.2965	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1986	1	1	0	0	1	25	25	110	0.0000	0.7320	0.0000	3.8499	86.8785
6.1391	2.0014	0.3991	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1986	1	1	0	0	1	26	26	113	0.0000	0.0000	0.6440	3.8806	79.3400
9.9877	4.3877	1.7600	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1986	1	1	0	0	1	27	27	105	0.0000	0.0000	0.0000	3.9243	76.9395
9.6030	4.6696	4.8636	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1986	1	1	0	0	1	28	28	100	0.0000	0.0000	0.0000	0.4966	68.6065
11.7330	8.6686	10.4954	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1986	1	1	0	0	1	29	29	83	0.0000	0.0000	0.8714	0.5444	51.1067
17.3212	13.1685	15.3556	0.7044	0.9279	0.0000	0.0000	0.0000	0.0000					
1986	1	1	0	0	1	30	30	67	0.0000	0.0000	0.0000	0.0000	41.5502
14.6979	17.0642	23.4513	1.8469	1.3895	0.0000	0.0000	0.0000	0.0000					
1986	1	1	0	0	1	31	31	77	0.0000	0.0000	0.0000	0.0000	24.5191
12.6599	19.1573	38.1992	3.4464	1.2981	0.0000	0.7199	0.0000	0.0000					
1986	1	1	0	0	1	32	32	59	0.0000	0.0000	0.0000	0.0000	21.6392
15.0053	8.9895	41.7254	3.7693	3.6423	1.4189	2.4577	0.5267	0.8258					
1986	1	1	0	0	1	33	33	51	0.0000	0.0000	0.0000	0.0000	8.6797
6.4045	11.4791	42.7597	13.7679	8.0785	5.6347	3.1959	0.0000	0.0000					
1986	1	1	0	0	1	34	34	52	0.0000	0.0000	0.0000	0.0000	13.1925
13.7496	14.7707	29.9679	7.4141	3.7755	7.6056	9.5241	0.0000	0.0000					
1986	1	1	0	0	1	35	35	44	0.0000	0.0000	0.0000	0.0000	5.6336
3.2021	3.6180	41.1576	13.4444	20.5030	3.5862	7.2464	0.0000	1.6086					
1986	1	1	0	0	1	36	36	27	0.0000	0.0000	0.0000	0.0000	7.1960
9.6880	10.1454	28.8542	18.6082	7.9177	4.3929	13.1976	0.0000	0.0000					
1986	1	1	0	0	1	37	37	31	0.0000	0.0000	0.0000	0.0000	0.0000
4.8734	26.4515	8.0357	8.0385	21.7640	19.9697	6.1252	4.7419	0.0000					
1986	1	1	0	0	1	38	38	24	0.0000	0.0000	0.0000	0.0000	3.3165
0.0000	10.9305	23.5946	10.3422	15.5300	0.6608	32.6068	3.0187	0.0000					
1986	1	1	0	0	1	39	39	11	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	13.1401	10.2176	54.2485	4.4825	17.9113	0.0000	0.0000					
1986	1	1	0	0	1	40	40	11	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	13.3719	6.7462	24.4385	0.0000	36.7310	0.0000	18.7125					
1986	1	1	0	0	1	41	41	7	0.0000	0.0000	0.0000	0.0000	0.0000
19.1540	0.0000	0.0000	45.0539	33.5117	0.0000	0.0000	2.2805	0.0000					
1986	1	1	0	0	1	42	42	8	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	59.7499	8.1390	0.0000	0.0000	9.8383	0.0000	22.2728					
1986	1	1	0	0	1	43	43	7	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	13.0566	28.4455	0.0000	28.3271	30.1708	0.0000	0.0000					
1986	1	1	0	0	1	44	44	3	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	14.4723	33.0795	0.0000	52.4482	0.0000	0.0000					
1986	1	1	0	0	1	45	45	6	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	28.2930	17.9409	14.1465	26.8878	0.0000	12.7319	0.0000	0.0000					
1986	1	1	0	0	1	46	46	5	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	38.4089	5.6215	25.3539	0.0000	30.6157					
1986	1	1	0	0	1	47	47	6	0.0000	0.0000	0.0000	0.0000	5.2497
0.0000	0.0000	0.0000	5.2497	10.3457	15.6332	51.8557	0.0000	11.6660					
1986	1	1	0	0	1	48	48	4	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	6.0976	34.7513	0.0000	16.6121	42.5390	0.0000					
1986	1	1	0	0	1	49	49	3	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	14.2360	0.0000	0.0000	14.2360	0.0000	71.5281	0.0000	0.0000					
1986	1	1	0	0	1	50	50	4	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	54.2903	0.0000	45.7097					
1986	1	1	0	0	1	51	51	25	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.7402	40.4089	6.7456	14.1188	14.9227	13.2540	3.9421	5.8676					
1987	1	1	0	0	1	14	14	3	0.0000	100.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					

1987	1	1	0	0	1	15	15	6	0.0000	100.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1987	1	1	0	0	1	16	16	16	0.0000	100.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1987	1	1	0	0	1	17	17	29	0.0000	98.1283	1.8717	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1987	1	1	0	0	1	18	18	60	0.0000	96.1174	3.8826	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1987	1	1	0	0	1	19	19	79	0.0000	90.0349	7.3710	1.1767	0.0000
1.4175	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1987	1	1	0	0	1	20	20	88	0.0000	91.1857	4.7598	0.0000	1.7440
2.3105	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1987	1	1	0	0	1	21	21	97	0.0000	82.5668	2.0659	0.9359	0.0000
14.4314	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1987	1	1	0	0	1	22	22	104	0.0000	76.0266	3.8518	0.0000	0.4346
18.2850	0.2111	1.1908	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1987	1	1	0	0	1	23	23	112	0.0000	50.4828	1.4985	0.8185	3.1888
41.6599	2.3515	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1987	1	1	0	0	1	24	24	121	0.0000	27.4293	2.0092	1.2266	0.7679
65.5771	2.4130	0.0000	0.5769	0.0000	0.0000	0.0000	0.0000	0.0000					
1987	1	1	0	0	1	25	25	117	0.0000	7.1609	4.1659	0.4112	0.4397
82.6755	3.5132	0.0000	1.6336	0.0000	0.0000	0.0000	0.0000	0.0000					
1987	1	1	0	0	1	26	26	113	0.0000	1.3157	0.3105	0.3188	1.5064
85.7803	4.1394	2.4675	4.1613	0.0000	0.0000	0.0000	0.0000	0.0000					
1987	1	1	0	0	1	27	27	106	0.0000	0.1365	0.5715	1.2739	7.3326
78.1265	7.1840	1.2915	3.9818	0.0000	0.0000	0.0000	0.1018	0.0000					
1987	1	1	0	0	1	28	28	102	0.0000	0.0000	0.0000	0.5094	0.1591
73.5867	12.0191	1.7214	12.0043	0.0000	0.0000	0.0000	0.0000	0.0000					
1987	1	1	0	0	1	29	29	92	0.0000	0.0000	0.0000	0.0000	0.2076
73.5537	3.3686	3.5945	18.2291	0.4786	0.0000	0.0000	0.0000	0.5677					
1987	1	1	0	0	1	30	30	83	0.0000	0.4022	0.0000	0.0000	1.2110
66.7604	8.2347	1.1395	21.0149	0.0000	0.0000	0.0000	1.2373	0.0000					
1987	1	1	0	0	1	31	31	59	0.0000	0.0000	0.0000	0.0000	1.1798
56.5002	4.2715	2.6351	31.1788	0.9282	0.0000	0.0000	3.3063	0.0000					
1987	1	1	0	0	1	32	32	40	0.0000	0.0000	0.0000	0.0000	0.0000
34.9739	7.7517	6.6204	36.6074	3.5650	1.6169	0.0000	8.8646	0.0000					
1987	1	1	0	0	1	33	33	31	0.0000	0.0000	0.0000	0.0000	0.0000
36.4833	2.6128	0.9142	50.5027	4.0300	0.0000	0.0000	5.4570	0.0000					
1987	1	1	0	0	1	34	34	18	0.0000	0.0000	0.0000	0.0000	0.0000
7.7880	3.8474	1.6867	62.3238	0.0000	4.5389	0.0000	19.8152	0.0000					
1987	1	1	0	0	1	35	35	14	0.0000	0.0000	0.0000	0.0000	0.0000
34.1487	0.0000	0.0000	45.5263	0.0000	0.0000	0.0000	20.3250	0.0000					
1987	1	1	0	0	1	36	36	8	0.0000	0.0000	0.0000	0.0000	15.9635
3.5058	0.0000	0.0000	57.7202	0.0000	0.0000	9.2357	13.5749	0.0000					
1987	1	1	0	0	1	37	37	5	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	9.1305	0.0000	30.2598	14.3467	0.0000	13.7319	16.6179	15.9132					
1987	1	1	0	0	1	38	38	5	0.0000	0.0000	0.0000	0.0000	11.2693
0.0000	61.9778	0.0000	17.2858	0.0000	0.0000	0.0000	9.4670	0.0000					
1987	1	1	0	0	1	39	39	3	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	20.7264	20.2344	0.0000	0.0000	0.0000	29.5196	29.5196					
1987	1	1	0	0	1	40	40	2	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	77.9273	22.0727	0.0000	0.0000	0.0000	0.0000					
1987	1	1	0	0	1	41	41	5	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	14.0328	0.0000	67.1183	0.0000	0.0000	0.0000	18.8489	0.0000					
1987	1	1	0	0	1	42	42	3	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	27.2156	0.0000	0.0000	0.0000	22.0961	50.6882					
1987	1	1	0	0	1	43	43	6	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	43.3014	35.4391	0.0000	3.5748	8.6902	8.9945					
1987	1	1	0	0	1	44	44	1	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	100.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1987	1	1	0	0	1	45	45	2	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	24.3006	75.6994	0.0000					
1987	1	1	0	0	1	46	46	3	0.0000	0.0000	0.0000	0.0000	0.0000
35.0574	0.0000	39.2052	0.0000	0.0000	0.0000	0.0000	25.7374	0.0000					
1987	1	1	0	0	1	47	47	1	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	100.0000					
1987	1	1	0	0	1	48	48	2	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	43.4906	0.0000	0.0000	0.0000	56.5094	0.0000					
1987	1	1	0	0	1	49	49	3	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	24.0588	43.1656	0.0000	0.0000	0.0000	0.0000	0.0000	32.7756					

1987	1	1	0	0	1	50	50	1	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	100.0000	0.0000					
1987	1	1	0	0	1	51	51	5	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	16.3926	0.0000	0.0000	59.9522	23.6551	0.0000					
1988	1	1	0	0	1	7	7	1	100.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1988	1	1	0	0	1	10	10	1	100.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1988	1	1	0	0	1	12	12	1	100.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1988	1	1	0	0	1	13	13	2	49.3047	50.6953	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1988	1	1	0	0	1	14	14	2	100.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1988	1	1	0	0	1	15	15	3	100.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1988	1	1	0	0	1	16	16	3	47.9261	0.0000	52.0739	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1988	1	1	0	0	1	17	17	3	33.9806	31.9165	34.1030	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1988	1	1	0	0	1	18	18	15	6.7925	6.8787	75.3061	11.0228	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1988	1	1	0	0	1	19	19	56	2.1723	2.3924	93.1697	0.0000	0.0000
0.0000	2.2656	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1988	1	1	0	0	1	20	20	101	0.4201	1.3656	95.2958	2.3197	0.0000
0.0000	0.5988	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1988	1	1	0	0	1	21	21	129	0.0000	0.7022	93.0741	3.5850	0.3544
0.4435	1.8408	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1988	1	1	0	0	1	22	22	141	0.0000	0.3767	92.5575	4.1854	0.6426
0.0000	2.2378	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1988	1	1	0	0	1	23	23	141	0.0000	0.1720	90.5202	2.8664	0.1871
0.0000	5.6962	0.5579	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1988	1	1	0	0	1	24	24	145	0.0000	0.0000	70.4158	3.0278	0.4007
0.7600	24.4605	0.0000	0.0000	0.9351	0.0000	0.0000	0.0000	0.0000					
1988	1	1	0	0	1	25	25	153	0.0000	0.0000	50.6472	1.0389	0.9212
0.8442	42.7893	2.6975	0.0000	1.0616	0.0000	0.0000	0.0000	0.0000					
1988	1	1	0	0	1	26	26	152	0.0000	0.0000	18.5628	1.2500	0.4121
1.5135	71.7940	3.3787	0.3518	2.7371	0.0000	0.0000	0.0000	0.0000					
1988	1	1	0	0	1	27	27	150	0.0000	0.0000	14.3538	1.0310	0.2501
2.7423	74.2662	3.0107	0.4768	3.8692	0.0000	0.0000	0.0000	0.0000					
1988	1	1	0	0	1	28	28	137	0.0000	0.0000	7.4801	1.3008	1.6306
1.3168	78.7411	3.4739	0.0000	6.0568	0.0000	0.0000	0.0000	0.0000					
1988	1	1	0	0	1	29	29	123	0.0000	0.0000	4.7561	0.3408	0.0000
2.1412	77.9720	7.9713	1.1722	5.2384	0.0000	0.4080	0.0000	0.0000					
1988	1	1	0	0	1	30	30	81	0.0000	0.0000	4.2479	0.0000	6.4888
0.3770	55.5970	4.8394	3.9969	22.3469	0.6900	0.0000	0.0000	1.4160					
1988	1	1	0	0	1	31	31	68	0.0000	0.0000	2.1362	0.0000	0.0000
0.7831	40.0842	5.1174	2.4358	47.6989	0.7359	0.0000	0.0000	1.0086					
1988	1	1	0	0	1	32	32	45	0.0000	0.0000	0.5088	0.0000	1.3222
2.3418	45.5029	2.4559	0.0000	32.6000	0.0000	0.0000	0.0000	15.2684					
1988	1	1	0	0	1	33	33	34	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	43.6072	2.8107	10.7474	34.4103	0.0000	0.0000	0.0000	8.4243					
1988	1	1	0	0	1	34	34	22	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	41.2632	6.4782	0.0000	44.9041	3.3008	0.0000	0.0000	4.0536					
1988	1	1	0	0	1	35	35	15	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	7.1332	10.5395	0.0000	58.7733	0.0000	0.0000	0.0000	23.5540					
1988	1	1	0	0	1	36	36	14	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	9.7454	26.5794	0.0000	37.3254	0.0000	0.0000	0.0000	26.3498					
1988	1	1	0	0	1	37	37	8	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	12.9109	0.0000	0.0000	14.3157	0.0000	0.0000	0.0000	72.7733					
1988	1	1	0	0	1	38	38	13	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	21.7848	9.6980	0.0000	52.8390	0.0000	0.0000	0.0000	15.6781					
1988	1	1	0	0	1	39	39	11	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	12.7818	0.0000	0.0000	32.3356	0.0000	28.6812	0.0000	26.2013					
1988	1	1	0	0	1	40	40	4	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	83.0147	16.9853	0.0000	0.0000	0.0000					
1988	1	1	0	0	1	41	41	6	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	36.0329	0.0000	0.0000	63.9671	0.0000	0.0000	0.0000	0.0000					
1988	1	1	0	0	1	42	42	5	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	9.7067	0.0000	0.0000	77.6329	0.0000	0.0000	0.0000	12.6604					

1988	1	1	0	0	1	43	43	1	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	100.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1988	1	1	0	0	1	45	45	4	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	35.8339	0.0000	0.0000	39.8693	0.0000	0.0000	0.0000	24.2968					
1988	1	1	0	0	1	46	46	3	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	33.1898	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	66.8102					
1988	1	1	0	0	1	47	47	4	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	100.0000	0.0000	0.0000	0.0000	0.0000					
1988	1	1	0	0	1	49	49	2	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	32.2114	0.0000	0.0000	0.0000	67.7886					
1988	1	1	0	0	1	50	50	3	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	11.8259	0.0000	0.0000	0.0000	88.1741					
1988	1	1	0	0	1	51	51	12	0.0000	0.0000	0.0000	0.0000	0.0000
1.6938	1.2287	1.6696	0.0000	9.2723	0.0000	0.0000	0.0000	86.1356					
1989	1	1	0	0	1	10	10	2	100.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1989	1	1	0	0	1	11	11	3	100.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1989	1	1	0	0	1	12	12	9	97.4174	2.5826	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1989	1	1	0	0	1	13	13	15	64.1043	35.8957	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1989	1	1	0	0	1	14	14	15	81.1424	18.8576	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1989	1	1	0	0	1	15	15	8	82.7925	17.2075	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1989	1	1	0	0	1	16	16	10	38.2796	33.1207	28.5997	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1989	1	1	0	0	1	17	17	13	35.5929	64.4071	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1989	1	1	0	0	1	18	18	9	17.5138	48.8306	27.9583	5.6973	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1989	1	1	0	0	1	19	19	17	0.0000	24.1292	16.9542	58.9166	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1989	1	1	0	0	1	20	20	40	0.0000	26.8243	7.8609	62.4183	1.1333
1.7632	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1989	1	1	0	0	1	21	21	79	0.0000	9.7324	6.0560	79.2379	3.0442
0.0000	0.0000	1.9295	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1989	1	1	0	0	1	22	22	120	0.0000	3.3641	2.4961	89.6237	2.6904
0.3961	0.1649	1.0535	0.2113	0.0000	0.0000	0.0000	0.0000	0.0000					
1989	1	1	0	0	1	23	23	129	0.0000	0.6006	0.7049	89.4514	3.8274
0.0000	0.0000	5.2295	0.0000	0.1861	0.0000	0.0000	0.0000	0.0000					
1989	1	1	0	0	1	24	24	125	0.0000	0.5319	1.0709	88.7400	0.3393
0.0000	0.0000	9.3179	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1989	1	1	0	0	1	25	25	127	0.0000	0.0000	0.2422	74.4399	0.6471
0.7907	0.0000	22.3372	1.3118	0.0000	0.2310	0.0000	0.0000	0.0000					
1989	1	1	0	0	1	26	26	125	0.0000	0.0000	0.0000	57.8548	0.6671
0.8998	1.8530	35.7317	2.6476	0.3460	0.0000	0.0000	0.0000	0.0000					
1989	1	1	0	0	1	27	27	130	0.0000	0.0000	0.0000	37.5479	1.5665
1.2881	1.1599	54.2024	3.5063	0.2963	0.4328	0.0000	0.0000	0.0000					
1989	1	1	0	0	1	28	28	133	0.0000	0.0000	0.0000	20.7381	2.3105
0.2847	1.0646	72.9754	2.5274	0.0000	0.0994	0.0000	0.0000	0.0000					
1989	1	1	0	0	1	29	29	118	0.0000	0.0000	0.3832	11.4689	2.1330
0.3524	2.0825	74.0360	2.7625	1.7191	5.0624	0.0000	0.0000	0.0000					
1989	1	1	0	0	1	30	30	98	0.0000	0.0000	0.0000	11.9400	0.0000
1.1722	1.2339	77.8667	3.9550	0.0000	3.5785	0.0000	0.2538	0.0000					
1989	1	1	0	0	1	31	31	74	0.0000	0.0000	0.0000	5.1102	2.4776
1.6346	2.4771	67.8919	4.1948	1.5683	14.6456	0.0000	0.0000	0.0000					
1989	1	1	0	0	1	32	32	49	0.0000	0.0000	0.0000	0.0000	0.0000
0.9520	0.0000	68.7447	5.3707	1.1655	21.1990	0.0000	0.0000	2.5680					
1989	1	1	0	0	1	33	33	40	0.0000	0.0000	0.0000	5.9379	0.0000
0.0000	2.2853	70.3585	1.4401	0.0000	19.9782	0.0000	0.0000	0.0000					
1989	1	1	0	0	1	34	34	35	0.0000	0.0000	0.0000	2.1892	0.0000
0.0000	0.0000	54.2439	6.6813	0.0000	28.2517	1.6134	3.1183	3.9022					
1989	1	1	0	0	1	35	35	27	0.0000	0.0000	0.0000	1.7801	3.0672
0.0000	0.0000	40.3566	2.0244	1.7097	39.3937	0.0000	0.0000	11.6682					
1989	1	1	0	0	1	36	36	14	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	38.5749	11.0301	12.2927	7.6330	0.0000	0.0000	30.4693					
1989	1	1	0	0	1	37	37	15	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	17.1644	4.8358	3.3034	71.9674	0.0000	0.0000	2.7291					

1989	1	1	0	0	1	38	38	8	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	50.7933	0.0000	0.0000	49.2067	0.0000	0.0000	0.0000					
1989	1	1	0	0	1	39	39	8	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	12.6550	0.0000	0.0000	84.1191	0.0000	3.2259	0.0000					
1989	1	1	0	0	1	40	40	7	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	57.5048	0.0000	0.0000	33.9821	0.0000	8.5131	0.0000					
1989	1	1	0	0	1	41	41	3	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	27.9965	0.0000	17.1511	0.0000	0.0000	54.8524					
1989	1	1	0	0	1	42	42	6	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	26.8743	0.0000	0.0000	73.1257	0.0000	0.0000	0.0000					
1989	1	1	0	0	1	44	44	3	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	61.4582	38.5418	0.0000	0.0000					
1989	1	1	0	0	1	45	45	1	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	100.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1989	1	1	0	0	1	46	46	1	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	100.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1989	1	1	0	0	1	47	47	2	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	81.0710	0.0000	0.0000	18.9290	0.0000	0.0000	0.0000					
1989	1	1	0	0	1	49	49	4	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	35.4854	15.1459	0.0000	49.3687	0.0000	0.0000	0.0000					
1989	1	1	0	0	1	51	51	4	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	23.6416	0.0000	76.3584	0.0000	0.0000	0.0000					
1990	1	1	0	0	1	9	9	2	100.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1990	1	1	0	0	1	10	10	6	74.4498	25.5502	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1990	1	1	0	0	1	11	11	5	100.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1990	1	1	0	0	1	12	12	15	39.7679	60.2321	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1990	1	1	0	0	1	13	13	22	69.8663	30.1337	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1990	1	1	0	0	1	14	14	24	58.5052	41.2060	0.0000	0.0000	0.2888
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1990	1	1	0	0	1	15	15	45	42.5282	54.2964	0.4260	0.0000	2.7494
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1990	1	1	0	0	1	16	16	51	22.8499	75.6424	1.5078	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1990	1	1	0	0	1	17	17	76	28.5334	66.0324	4.9863	0.0000	0.4479
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1990	1	1	0	0	1	18	18	84	6.6429	87.6006	2.0306	0.0000	3.6343
0.0000	0.0000	0.0000	0.0915	0.0000	0.0000	0.0000	0.0000	0.0000					
1990	1	1	0	0	1	19	19	94	8.1240	80.6478	8.5557	0.0000	2.2535
0.0000	0.0000	0.0000	0.4189	0.0000	0.0000	0.0000	0.0000	0.0000					
1990	1	1	0	0	1	20	20	98	1.7418	89.1505	5.8769	0.1818	2.8646
0.0000	0.0000	0.0000	0.1844	0.0000	0.0000	0.0000	0.0000	0.0000					
1990	1	1	0	0	1	21	21	104	0.7436	83.9361	5.3355	0.0000	9.3772
0.0000	0.0000	0.0000	0.6076	0.0000	0.0000	0.0000	0.0000	0.0000					
1990	1	1	0	0	1	22	22	95	0.0000	70.9688	8.4012	0.9682	17.5767
0.0000	0.0000	0.4891	1.5961	0.0000	0.0000	0.0000	0.0000	0.0000					
1990	1	1	0	0	1	23	23	96	0.0000	40.4456	5.0713	2.1224	47.3206
0.5266	0.0000	0.0000	4.5134	0.0000	0.0000	0.0000	0.0000	0.0000					
1990	1	1	0	0	1	24	24	93	0.0000	10.5464	4.0038	0.0000	76.3268
0.5549	0.0000	0.0000	8.1939	0.0000	0.0000	0.3742	0.0000	0.0000					
1990	1	1	0	0	1	25	25	91	0.0000	2.6623	4.3916	0.0000	67.5856
0.0000	1.1065	0.0000	24.2539	0.0000	0.0000	0.0000	0.0000	0.0000					
1990	1	1	0	0	1	26	26	82	0.0000	1.2109	1.3166	1.1638	60.1754
2.5417	0.6501	1.2363	30.8318	0.5411	0.0000	0.3323	0.0000	0.0000					
1990	1	1	0	0	1	27	27	88	0.0000	0.0000	0.5037	0.9924	55.9146
0.6217	0.0000	0.0000	41.9676	0.0000	0.0000	0.0000	0.0000	0.0000					
1990	1	1	0	0	1	28	28	82	0.0000	0.0000	0.0000	2.0396	43.6282
1.1237	0.0000	0.6080	50.8622	0.0000	0.0000	1.7384	0.0000	0.0000					
1990	1	1	0	0	1	29	29	84	0.0000	0.0000	0.0000	0.0000	30.3357
1.2149	1.3454	0.0000	61.2557	0.0000	0.0000	5.8483	0.0000	0.0000					
1990	1	1	0	0	1	30	30	73	0.0000	0.0000	0.0000	0.0000	27.4868
1.2105	0.0000	1.6292	58.6335	1.1079	0.0000	8.9645	0.0000	0.9676					
1990	1	1	0	0	1	31	31	72	0.0000	0.0000	0.0000	0.0000	26.3777
1.0060	0.0000	0.0000	62.4260	2.2647	0.0000	7.9257	0.0000	0.0000					
1990	1	1	0	0	1	32	32	74	0.0000	0.0000	0.0000	0.0000	11.7882
0.0000	0.0000	0.0000	78.3868	0.0000	0.0000	9.0574	0.0000	0.7675					

1990	1	1	0	0	1	33	33	58	0.0000	0.0000	0.0000	0.0000	3.3758
0.0000	0.0000	0.0000	79.7810	1.4183	0.0000	15.4249	0.0000	0.0000					
1990	1	1	0	0	1	34	34	43	0.0000	0.0000	0.0000	0.0000	0.7269
0.0000	0.0000	0.0000	65.7163	0.0000	0.0000	29.3400	0.0000	4.2168					
1990	1	1	0	0	1	35	35	34	0.0000	0.0000	0.0000	0.0000	2.7457
0.0000	0.0000	0.0000	67.7015	0.0000	0.0000	26.9935	0.0000	2.5592					
1990	1	1	0	0	1	36	36	20	0.0000	0.0000	0.0000	0.0000	0.9625
0.0000	0.0000	0.0000	74.0819	0.0000	0.0000	24.9557	0.0000	0.0000					
1990	1	1	0	0	1	37	37	15	0.0000	0.0000	0.0000	0.0000	2.8944
0.0000	0.0000	0.0000	26.0940	0.0000	0.0000	58.0994	0.0000	12.9122					
1990	1	1	0	0	1	38	38	14	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	61.7954	5.4345	0.0000	29.5756	0.0000	3.1946					
1990	1	1	0	0	1	39	39	14	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	69.4089	4.8251	0.0000	4.4069	0.0000	21.3591					
1990	1	1	0	0	1	40	40	11	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	77.0070	0.0000	0.0000	22.9930	0.0000	0.0000					
1990	1	1	0	0	1	41	41	14	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	4.5790	0.0000	39.9597	0.0000	0.0000	42.4391	0.0000	13.0222					
1990	1	1	0	0	1	42	42	15	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	59.6779	0.0000	0.0000	38.6645	0.0000	1.6576					
1990	1	1	0	0	1	43	43	9	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	84.5512	0.0000	0.0000	3.3079	0.0000	12.1409					
1990	1	1	0	0	1	44	44	9	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	15.7061	0.0000	0.0000	78.2723	0.0000	6.0216					
1990	1	1	0	0	1	45	45	8	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	32.2182	0.0000	0.0000	67.7818	0.0000	0.0000					
1990	1	1	0	0	1	46	46	8	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	39.7351	0.0000	0.0000	60.2649	0.0000	0.0000					
1990	1	1	0	0	1	47	47	8	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	32.1412	0.0000	0.0000	37.9510	0.0000	29.9079					
1990	1	1	0	0	1	48	48	6	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	50.0050	0.0000	0.0000	49.9950	0.0000	0.0000					
1990	1	1	0	0	1	49	49	6	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	72.8901	0.0000	0.0000	25.1520	0.0000	1.9580					
1990	1	1	0	0	1	50	50	7	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	53.9747	0.0000	0.0000	46.0253	0.0000	0.0000					
1990	1	1	0	0	1	51	51	20	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	35.1996	0.0000	1.3861	56.8876	0.0000	6.5267					
1991	1	1	0	0	1	1	1	2	100.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1991	1	1	0	0	1	2	2	2	100.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1991	1	1	0	0	1	3	3	1	100.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1991	1	1	0	0	1	4	4	1	100.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1991	1	1	0	0	1	11	11	1	100.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1991	1	1	0	0	1	12	12	2	100.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1991	1	1	0	0	1	13	13	5	45.8755	54.1245	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1991	1	1	0	0	1	14	14	13	22.7079	77.2921	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1991	1	1	0	0	1	15	15	23	23.8547	64.1375	12.0078	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1991	1	1	0	0	1	16	16	32	14.8478	70.4181	13.3928	1.3413	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1991	1	1	0	0	1	17	17	33	0.0000	71.3779	28.0055	0.6166	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1991	1	1	0	0	1	18	18	39	0.0000	77.4678	22.5322	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1991	1	1	0	0	1	19	19	38	0.0000	70.0557	29.9443	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1991	1	1	0	0	1	20	20	47	0.0000	53.7325	43.4672	2.6014	0.0000
0.0000	0.1989	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1991	1	1	0	0	1	21	21	54	0.1995	34.9188	54.7285	10.1531	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1991	1	1	0	0	1	22	22	63	0.0000	23.3704	63.2448	3.1263	0.0000
9.4313	0.0000	0.0000	0.0000	0.8272	0.0000	0.0000	0.0000	0.0000					

1991	1	1	0	0	1	23	23	66	0.0000	7.0144	60.1485	7.1450	7.0200	12.2489	0.0000	0.0000	0.0000	6.4231	0.0000	0.0000	0.0000	0.0000
1991	1	1	0	0	1	24	24	66	0.0000	4.3115	47.7741	9.1369	2.4553	32.9924	1.3137	0.0000	0.0000	2.0161	0.0000	0.0000	0.0000	0.0000
1991	1	1	0	0	1	25	25	62	0.0000	0.5577	32.6432	6.8459	0.1775	49.6695	1.6136	0.2331	0.7777	6.5496	0.8283	0.0000	0.1039	0.0000
1991	1	1	0	0	1	26	26	61	0.0000	0.1792	14.2372	3.6810	0.0000	67.8558	0.1048	0.0000	0.1960	12.5834	1.1624	0.0000	0.0000	0.0000
1991	1	1	0	0	1	27	27	61	0.0000	0.0000	8.0402	6.4853	0.3773	61.8957	7.0249	1.0051	0.0000	14.2529	0.9186	0.0000	0.0000	0.0000
1991	1	1	0	0	1	28	28	55	0.0000	0.0000	0.8436	2.3421	6.8502	58.6250	1.9811	0.6212	0.8350	23.3137	0.6376	0.0000	3.9505	0.0000
1991	1	1	0	0	1	29	29	56	0.0000	0.0000	0.3924	0.0000	0.0000	53.2805	2.0030	0.1970	0.0000	42.8077	0.0000	0.0000	1.3194	0.0000
1991	1	1	0	0	1	30	30	49	0.0000	0.0000	0.0000	1.8393	0.3186	46.3029	1.7313	0.0000	0.0000	46.0219	0.4904	0.0000	3.2957	0.0000
1991	1	1	0	0	1	31	31	40	0.0000	0.0000	0.0000	0.0000	0.0000	18.3955	5.1803	0.0000	0.0000	66.0616	2.4929	0.0000	7.8697	0.0000
1991	1	1	0	0	1	32	32	20	0.0000	0.0000	0.0000	0.0000	0.0000	41.6237	0.0000	0.0000	0.0000	39.0709	2.9095	0.0000	16.3958	0.0000
1991	1	1	0	0	1	33	33	9	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	8.0788	0.0000	0.0000	59.7357	0.0000	0.0000	32.1856	0.0000
1991	1	1	0	0	1	34	34	6	0.0000	0.0000	0.0000	0.0000	0.0000	12.5354	0.0000	0.0000	0.0000	18.5285	0.0000	0.0000	68.9361	0.0000
1991	1	1	0	0	1	35	35	6	0.0000	0.0000	0.0000	0.0000	0.0000	48.0201	0.0000	0.0000	0.0000	19.4043	11.9351	0.0000	0.0000	20.6406
1991	1	1	0	0	1	36	36	7	0.0000	0.0000	0.0000	0.0000	0.0000	21.4936	10.4409	0.0000	0.0000	11.7785	0.0000	0.0000	56.2870	0.0000
1991	1	1	0	0	1	37	37	2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	18.0284	0.0000	0.0000	0.0000	81.9716
1991	1	1	0	0	1	38	38	3	0.0000	0.0000	0.0000	0.0000	0.0000	40.7365	0.0000	0.0000	0.0000	4.0266	0.0000	0.0000	14.5005	40.7365
1991	1	1	0	0	1	39	39	2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	22.2049	0.0000	0.0000	77.7951	0.0000
1991	1	1	0	0	1	40	40	3	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	56.5367	0.0000	0.0000	43.4633	0.0000
1991	1	1	0	0	1	42	42	3	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	7.4359	0.0000	0.0000	80.6159	0.0000	0.0000	11.9482	0.0000
1991	1	1	0	0	1	43	43	3	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	73.2835	0.0000	0.0000	26.7165	0.0000
1991	1	1	0	0	1	44	44	3	0.0000	0.0000	0.0000	0.0000	0.0000	35.4399	0.0000	0.0000	0.0000	37.6933	0.0000	0.0000	26.8668	0.0000
1991	1	1	0	0	1	46	46	2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	56.8152	0.0000	14.3949	14.3949	0.0000	0.0000	0.0000	14.3949
1991	1	1	0	0	1	47	47	5	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	45.8863	0.0000	0.0000	5.5641	0.0000	0.0000	48.5497	0.0000
1991	1	1	0	0	1	48	48	2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	22.7312	0.0000	0.0000	77.2688	0.0000
1991	1	1	0	0	1	49	49	2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	63.5060	0.0000	0.0000	0.0000	36.4940	0.0000
1991	1	1	0	0	1	50	50	1	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	100.0000	0.0000
1991	1	1	0	0	1	51	51	9	10.6243	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	32.9633	0.0000	0.0000	38.2138	18.1986
1992	1	1	0	0	1	8	8	1	0.0000	100.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
1992	1	1	0	0	1	9	9	2	100.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
1992	1	1	0	0	1	10	10	5	80.0526	19.9474	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
1992	1	1	0	0	1	11	11	6	78.0717	21.9283	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
1992	1	1	0	0	1	12	12	8	87.4689	12.5311	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
1992	1	1	0	0	1	13	13	6	65.8829	34.1171	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
1992	1	1	0	0	1	14	14	6	65.8412	34.1588	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
1992	1	1	0	0	1	15	15	7	92.0365	7.9635	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

1992	1	1	0	0	1	16	16	7	77.4341	22.5659	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1992	1	1	0	0	1	17	17	11	64.4254	33.8068	1.7677	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1992	1	1	0	0	1	18	18	28	21.9802	47.4372	22.2656	8.3170	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1992	1	1	0	0	1	19	19	26	12.6466	34.5625	47.3775	5.4134	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1992	1	1	0	0	1	20	20	61	0.1913	16.8893	55.7853	27.1341	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1992	1	1	0	0	1	21	21	75	0.4866	12.9790	41.2705	42.0436	2.9303
0.0000	0.0000	0.0000	0.0000	0.0000	0.2900	0.0000	0.0000	0.0000					
1992	1	1	0	0	1	22	22	89	0.0000	14.4253	45.5749	33.9861	2.2032
0.0000	3.8105	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1992	1	1	0	0	1	23	23	105	0.0000	3.4905	47.8637	37.7496	0.9869
0.0000	6.6756	0.4863	0.0000	0.0000	2.7473	0.0000	0.0000	0.0000					
1992	1	1	0	0	1	24	24	108	0.0000	0.7646	28.7053	49.5784	3.8657
1.2981	14.1082	0.0000	0.0000	0.0000	1.5073	0.0000	0.1724	0.0000					
1992	1	1	0	0	1	25	25	108	0.0000	1.0271	23.7073	38.8246	3.2166
1.6224	27.1034	0.5531	0.3934	0.0000	3.5520	0.0000	0.0000	0.0000					
1992	1	1	0	0	1	26	26	107	0.0000	0.3178	8.0179	33.9183	2.2067
3.1949	43.4160	0.7735	0.3446	0.5874	7.2229	0.0000	0.0000	0.0000					
1992	1	1	0	0	1	27	27	107	0.0000	0.2152	1.8064	22.4610	3.9025
3.6665	46.9674	2.4033	0.3595	1.4145	16.1193	0.0000	0.0000	0.6844					
1992	1	1	0	0	1	28	28	111	0.0000	0.0000	2.0973	16.8221	3.1321
0.7458	54.3894	1.2622	0.0000	0.0000	21.2140	0.0000	0.0000	0.3370					
1992	1	1	0	0	1	29	29	103	0.0000	0.0000	1.6810	8.8064	3.2057
4.3395	52.3270	2.0593	0.5850	0.0000	26.9962	0.0000	0.0000	0.0000					
1992	1	1	0	0	1	30	30	93	0.0000	0.0000	0.0000	10.3069	0.4116
1.0332	58.4063	2.1180	0.3432	0.0000	25.4214	0.4159	0.0000	1.5435					
1992	1	1	0	0	1	31	31	78	0.0000	0.0000	0.0000	6.3232	3.1591
1.7658	49.1488	2.3060	0.0000	0.0000	32.3243	1.3580	0.0000	3.6147					
1992	1	1	0	0	1	32	32	61	0.0000	0.0000	0.7884	0.9574	1.0303
0.0000	43.2842	0.3321	0.0000	0.0000	48.6143	1.9869	0.0000	3.0062					
1992	1	1	0	0	1	33	33	41	0.0000	0.0000	0.0000	1.1235	0.6339
0.0000	34.0394	0.0000	0.0000	0.0000	32.7681	6.0185	0.0000	25.4166					
1992	1	1	0	0	1	34	34	35	0.0000	0.0000	0.0000	0.0000	0.8325
0.0000	48.1492	2.8822	0.0000	0.4464	42.3703	3.0855	0.0000	2.2339					
1992	1	1	0	0	1	35	35	28	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	30.8000	0.0000	0.0000	0.0000	47.4970	0.6879	0.9017	20.1133					
1992	1	1	0	0	1	36	36	20	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	57.1955	0.0000	2.0268	0.0000	30.1436	0.0000	0.0000	10.6341					
1992	1	1	0	0	1	37	37	16	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	27.4367	0.0000	0.0000	0.9081	49.5406	0.0000	0.0000	22.1146					
1992	1	1	0	0	1	38	38	15	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	24.8579	0.0000	0.0000	27.6942	43.2585	0.0000	0.0000	4.1893					
1992	1	1	0	0	1	39	39	9	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	9.0576	0.0000	0.0000	0.0000	79.8329	0.0000	0.0000	11.1095					
1992	1	1	0	0	1	40	40	9	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	36.4391	0.0000	0.0000	0.0000	42.8326	6.6770	0.0000	14.0513					
1992	1	1	0	0	1	41	41	7	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	15.5506	0.0000	0.0000	0.0000	55.9180	14.4791	0.0000	14.0522					
1992	1	1	0	0	1	42	42	5	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	100.0000	0.0000	0.0000	0.0000					
1992	1	1	0	0	1	43	43	5	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	66.2050	0.0000	0.0000	33.7950					
1992	1	1	0	0	1	44	44	2	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	81.3496	0.0000	0.0000	18.6504					
1992	1	1	0	0	1	45	45	3	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	12.7306	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	87.2694					
1992	1	1	0	0	1	46	46	2	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	49.2229	0.0000	0.0000	0.0000	50.7771	0.0000	0.0000	0.0000					
1992	1	1	0	0	1	47	47	2	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	100.0000	0.0000	0.0000	0.0000					
1992	1	1	0	0	1	49	49	2	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	89.9515	0.0000	0.0000	10.0485					
1992	1	1	0	0	1	51	51	7	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	2.2355	0.0000	0.0000	12.7720	6.4200	0.0000	78.5724					
1993	1	1	0	0	1	12	12	5	92.6781	7.3219	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					

1993	1	1	0	0	1	13	13	1	100.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1993	1	1	0	0	1	14	14	5	0.0000	100.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1993	1	1	0	0	1	15	15	6	12.8531	87.1469	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1993	1	1	0	0	1	16	16	20	1.8715	95.5066	2.6219	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1993	1	1	0	0	1	17	17	39	2.3266	93.8678	0.4176	3.3880	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1993	1	1	0	0	1	18	18	50	2.0361	84.0014	13.3071	0.6554	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1993	1	1	0	0	1	19	19	59	0.0000	87.8246	3.0094	8.7276	0.0000
0.0000	0.0000	0.4384	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1993	1	1	0	0	1	20	20	63	0.0000	92.0633	4.8787	2.5777	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.4802	0.0000	0.0000					
1993	1	1	0	0	1	21	21	59	0.0000	73.7118	9.4365	15.8211	1.0307
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1993	1	1	0	0	1	22	22	49	0.0000	48.3175	11.0798	26.3466	14.2561
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1993	1	1	0	0	1	23	23	67	0.0000	11.2755	11.8321	49.1721	22.9876
0.0000	0.0000	3.7373	0.0000	0.0000	0.0000	0.9955	0.0000	0.0000					
1993	1	1	0	0	1	24	24	77	0.0000	3.8255	6.1879	36.8128	33.5886
6.6681	4.8501	7.7036	0.0000	0.0000	0.0000	0.3636	0.0000	0.0000					
1993	1	1	0	0	1	25	25	86	0.0000	0.5204	0.8395	27.6733	44.8379
2.5921	0.4455	17.3188	0.0000	0.0000	0.0000	5.4158	0.0000	0.3567					
1993	1	1	0	0	1	26	26	87	0.0000	0.4109	1.2636	23.8779	27.9048
1.7050	4.4013	31.7483	0.2784	0.0000	0.0947	7.6167	0.0000	0.6984					
1993	1	1	0	0	1	27	27	85	0.0000	0.0000	0.0000	11.9293	28.5800
0.5543	1.0394	44.2856	1.5045	0.5602	0.0000	9.7262	0.0000	1.8204					
1993	1	1	0	0	1	28	28	79	0.0000	0.0000	0.0000	3.8746	22.6223
0.6754	0.3759	56.2774	7.3891	0.0000	0.0000	8.7852	0.0000	0.0000					
1993	1	1	0	0	1	29	29	78	0.0000	0.0000	0.0000	1.7799	18.6776
2.2581	1.0163	53.2442	0.0000	0.0000	0.0000	21.1804	0.0000	1.8435					
1993	1	1	0	0	1	30	30	59	0.0000	0.0000	0.0000	1.3016	2.6474
5.0208	0.0000	53.5027	1.1477	0.0000	0.0000	36.3798	0.0000	0.0000					
1993	1	1	0	0	1	31	31	37	0.0000	0.0000	0.0000	1.6181	10.3936
0.0000	0.0000	49.3519	0.0000	0.0000	0.0000	36.0297	0.0000	2.6068					
1993	1	1	0	0	1	32	32	26	0.0000	0.0000	0.0000	0.0000	0.0000
1.0356	0.0000	49.1262	8.1290	0.0000	0.0000	40.4265	0.0000	1.2827					
1993	1	1	0	0	1	33	33	9	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	35.7829	0.0000	0.0000	0.0000	54.4858	0.0000	9.7313					
1993	1	1	0	0	1	34	34	4	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	14.8681	0.0000	0.0000	10.0785	0.0000	8.1368	66.9167					
1993	1	1	0	0	1	35	35	7	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	30.1381	0.0000	0.0000	0.0000	69.8619	0.0000	0.0000					
1993	1	1	0	0	1	36	36	7	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	65.7053	0.0000	7.6896	0.0000	10.4486	0.0000	16.1565					
1993	1	1	0	0	1	37	37	1	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	100.0000	0.0000	0.0000					
1993	1	1	0	0	1	38	38	2	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	75.8340	0.0000	0.0000	0.0000	24.1660	0.0000	0.0000					
1993	1	1	0	0	1	40	40	1	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	100.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1993	1	1	0	0	1	42	42	2	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	38.2071	0.0000	0.0000	30.8965	30.8965	0.0000	0.0000					
1993	1	1	0	0	1	50	50	1	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	100.0000	0.0000	0.0000	0.0000	0.0000					
1993	1	1	0	0	1	51	51	1	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	100.0000	0.0000	0.0000					
1994	1	1	0	0	1	11	11	1	0.0000	100.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1994	1	1	0	0	1	14	14	1	0.0000	100.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1994	1	1	0	0	1	16	16	3	0.0000	100.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1994	1	1	0	0	1	17	17	9	0.0000	67.0652	32.9348	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1994	1	1	0	0	1	18	18	20	0.0000	49.0817	50.9183	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					

1994	1	1	0	0	1	19	19	50	1.8680	48.6707	47.0787	2.3826	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1994	1	1	0	0	1	20	20	78	0.0000	15.1851	80.2214	1.7943	2.4395
0.3597	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1994	1	1	0	0	1	21	21	92	0.0000	7.4672	81.4237	2.4783	6.7482
1.8826	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1994	1	1	0	0	1	22	22	101	0.0000	2.2666	79.6364	3.2295	12.6035
2.2640	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1994	1	1	0	0	1	23	23	110	0.0000	0.1925	67.5244	0.4179	17.5069
12.0614	0.0000	0.0000	1.1983	0.0000	0.0000	0.0000	1.0985	0.0000					
1994	1	1	0	0	1	24	24	119	0.0000	0.7053	34.7015	1.1278	33.2490
22.2028	0.0000	0.0000	6.0003	0.0000	0.0000	0.0000	2.0131	0.0000					
1994	1	1	0	0	1	25	25	137	0.0000	0.0000	17.3120	1.5657	29.6653
33.2830	0.0000	0.0000	16.9740	0.0000	0.3196	0.0000	0.4824	0.3980					
1994	1	1	0	0	1	26	26	137	0.0000	0.3011	4.5976	1.0668	23.0907
37.0423	0.1912	1.7357	28.9353	0.0000	0.0802	0.0000	2.8166	0.1426					
1994	1	1	0	0	1	27	27	137	0.0000	0.0000	1.2714	0.5974	21.1297
34.7632	0.6325	0.8620	30.5817	0.4105	0.6265	0.0000	8.9734	0.1516					
1994	1	1	0	0	1	28	28	132	0.0000	0.0000	3.1579	0.0000	11.8576
36.3994	0.6855	0.2132	38.4685	0.2357	0.0000	0.0000	8.2000	0.7822					
1994	1	1	0	0	1	29	29	129	0.0000	0.0000	0.0000	0.0000	5.7130
24.4473	2.3976	0.3604	54.2546	0.0000	1.0564	0.0000	9.6954	2.0752					
1994	1	1	0	0	1	30	30	119	0.0000	0.0000	0.0000	0.0000	0.3652
22.6783	0.9316	0.0000	45.0842	0.0000	0.2567	0.0000	27.7171	2.9669					
1994	1	1	0	0	1	31	31	81	0.0000	0.0000	0.9535	0.0000	2.6385
24.3381	4.2003	1.1585	43.4636	0.0000	3.4730	0.6564	16.6180	2.5002					
1994	1	1	0	0	1	32	32	47	0.0000	0.0000	0.0000	0.0000	1.1444
19.6826	0.0000	0.0000	56.1426	0.0000	3.6309	0.0000	19.0465	0.3531					
1994	1	1	0	0	1	33	33	30	0.0000	0.0000	0.0000	0.0000	6.8912
5.3691	0.0000	0.0000	47.7638	0.0000	0.0000	0.0000	32.3602	7.6157					
1994	1	1	0	0	1	34	34	16	0.0000	0.0000	0.0000	0.0000	0.0000
4.4743	0.0000	0.0000	80.0104	0.0000	0.0000	1.7563	13.7590	0.0000					
1994	1	1	0	0	1	35	35	14	0.0000	0.0000	0.0000	0.0000	0.0000
6.4833	16.5006	0.0000	70.7904	0.0000	0.0000	0.0000	6.2257	0.0000					
1994	1	1	0	0	1	36	36	9	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	57.4999	0.0000	12.5099	0.0000	29.5010	0.4892					
1994	1	1	0	0	1	37	37	4	0.0000	0.0000	0.0000	0.0000	0.0000
12.0634	0.0000	0.0000	87.9366	0.0000	0.0000	0.0000	0.0000	0.0000					
1994	1	1	0	0	1	38	38	7	0.0000	0.0000	0.0000	0.0000	0.0000
15.2486	0.0000	0.0000	72.0846	0.0000	0.0000	0.0000	12.6668	0.0000					
1994	1	1	0	0	1	39	39	6	0.0000	0.0000	0.0000	0.0000	0.0000
28.2282	0.0000	0.0000	14.9682	0.0000	0.0000	0.0000	41.1625	15.6411					
1994	1	1	0	0	1	40	40	2	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	82.0092	0.0000	0.0000	0.0000	17.9908	0.0000					
1994	1	1	0	0	1	41	41	3	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	40.7924	0.0000	0.0000	0.0000	59.2076	0.0000					
1994	1	1	0	0	1	42	42	1	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	100.0000	0.0000					
1994	1	1	0	0	1	43	43	1	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	100.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1994	1	1	0	0	1	44	44	1	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	100.0000					
1994	1	1	0	0	1	45	45	1	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	100.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1994	1	1	0	0	1	46	46	2	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	100.0000	0.0000					
1994	1	1	0	0	1	48	48	1	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	100.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1994	1	1	0	0	1	49	49	1	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	100.0000	0.0000					
1994	1	1	0	0	1	50	50	1	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	100.0000	0.0000					
1994	1	1	0	0	1	51	51	5	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	81.4970	18.5030					
1995	1	1	0	0	1	1	1	1	100.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1995	1	1	0	0	1	5	5	1	100.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1995	1	1	0	0	1	6	6	1	100.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					

1995	1	1	0	0	1	7	7	1	100.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1995	1	1	0	0	1	13	13	1	100.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1995	1	1	0	0	1	15	15	1	100.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1995	1	1	0	0	1	17	17	2	63.4467	36.5533	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1995	1	1	0	0	1	18	18	2	55.3854	0.0000	44.6146	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1995	1	1	0	0	1	19	19	4	0.0000	0.0000	5.9505	94.0495	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1995	1	1	0	0	1	20	20	4	0.0000	0.0000	18.2779	81.7221	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1995	1	1	0	0	1	21	21	13	0.0000	0.0000	38.5370	61.4630	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1995	1	1	0	0	1	22	22	35	0.0000	0.0000	44.8025	52.0098	0.0000
1.7842	0.5519	0.0000	0.0000	0.8516	0.0000	0.0000	0.0000	0.0000					
1995	1	1	0	0	1	23	23	58	0.0000	0.0000	19.4350	69.7305	0.9965
7.6541	1.5933	0.0000	0.0000	0.5905	0.0000	0.0000	0.0000	0.0000					
1995	1	1	0	0	1	24	24	68	0.0000	0.0000	16.0224	68.9035	0.5806
5.9278	7.9159	0.0000	0.0000	0.6497	0.0000	0.0000	0.0000	0.0000					
1995	1	1	0	0	1	25	25	71	0.0000	0.0000	7.5018	67.0799	0.7307
10.9663	10.0582	0.3681	0.0000	2.9796	0.0000	0.0000	0.0000	0.3153					
1995	1	1	0	0	1	26	26	71	0.0000	0.0000	1.2067	44.6656	1.4078
11.8586	22.6554	1.8872	0.0000	13.5667	0.0000	0.0000	0.0000	2.7519					
1995	1	1	0	0	1	27	27	71	0.0000	0.0000	1.0630	36.5222	1.4104
8.3606	30.6926	0.8379	0.0000	17.5221	0.0000	0.2895	0.0000	3.3017					
1995	1	1	0	0	1	28	28	74	0.0000	0.0000	0.4740	12.6224	0.7088
6.9174	29.6173	0.4336	1.3302	36.2676	1.4332	0.7977	0.0000	9.3980					
1995	1	1	0	0	1	29	29	71	0.1608	0.0000	0.2887	4.4116	0.0000
10.4859	40.5144	3.5402	0.3229	34.1768	0.6239	0.0000	0.0000	5.4750					
1995	1	1	0	0	1	30	30	64	0.0000	0.0000	0.0000	5.1048	0.0000
2.5184	29.9727	0.2724	0.0000	49.7472	0.0000	0.3457	0.4954	11.5435					
1995	1	1	0	0	1	31	31	53	0.1991	0.0000	0.0000	0.3796	0.0000
8.4351	21.3321	5.8664	0.0000	39.4947	0.7770	0.0000	0.0000	23.5160					
1995	1	1	0	0	1	32	32	39	0.0000	0.0000	0.0000	0.0000	0.4012
5.3716	33.7012	2.0036	0.0000	40.2985	0.0000	0.0000	0.0000	18.2239					
1995	1	1	0	0	1	33	33	28	0.0000	0.0000	0.0000	5.7355	0.0000
2.6653	39.0255	0.0000	0.0000	23.2153	0.0000	1.9497	0.0000	27.4087					
1995	1	1	0	0	1	34	34	16	0.0000	0.0000	0.0000	0.0000	0.0000
6.8872	31.3871	0.0000	0.0000	15.7158	0.0000	2.1774	0.0000	43.8325					
1995	1	1	0	0	1	35	35	14	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	23.7286	0.0000	0.0000	33.6020	0.0000	0.0000	0.0000	42.6694					
1995	1	1	0	0	1	36	36	10	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	34.8921	0.0000	0.0000	45.3075	0.0000	0.0000	0.0000	19.8004					
1995	1	1	0	0	1	37	37	6	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	51.8127	0.0000	0.0000	48.1873	0.0000	0.0000	0.0000	0.0000					
1995	1	1	0	0	1	38	38	5	0.0000	0.0000	0.0000	0.0000	0.0000
5.8698	0.0000	0.0000	0.0000	88.1320	0.0000	0.0000	0.0000	5.9983					
1995	1	1	0	0	1	39	39	7	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	79.8987	0.0000	15.3704	0.0000	4.7309					
1995	1	1	0	0	1	40	40	4	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	65.3264	0.0000	0.0000	0.0000	34.6736					
1995	1	1	0	0	1	41	41	1	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	100.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1995	1	1	0	0	1	42	42	1	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	100.0000					
1995	1	1	0	0	1	43	43	3	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	12.4719	0.0000	80.7038	0.0000	6.8243					
1995	1	1	0	0	1	44	44	1	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	100.0000	0.0000	0.0000	0.0000	0.0000					
1995	1	1	0	0	1	51	51	1	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	100.0000					
1996	1	1	0	0	1	11	11	3	100.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1996	1	1	0	0	1	12	12	9	59.5075	40.4925	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1996	1	1	0	0	1	13	13	17	94.6175	5.3825	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					

1996	1	1	0	0	1	14	14	29	92.8995	7.1005	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1996	1	1	0	0	1	15	15	39	94.3615	5.6385	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1996	1	1	0	0	1	16	16	47	92.2810	7.7190	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1996	1	1	0	0	1	17	17	48	77.9551	21.4170	0.6279	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1996	1	1	0	0	1	18	18	40	45.3134	54.6866	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1996	1	1	0	0	1	19	19	43	42.8753	52.6382	0.7963	3.6902	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1996	1	1	0	0	1	20	20	51	15.4939	79.3988	3.9402	1.1672	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1996	1	1	0	0	1	21	21	55	1.2540	86.8111	3.2412	5.0875	3.6062
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1996	1	1	0	0	1	22	22	53	0.0000	72.9113	2.3922	10.5329	13.6076
0.0000	0.0000	0.0000	0.0000	0.0000	0.5559	0.0000	0.0000	0.0000					
1996	1	1	0	0	1	23	23	54	0.3198	45.5507	5.7994	18.8759	26.5383
1.5425	0.3978	0.9755	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1996	1	1	0	0	1	24	24	71	0.0000	16.6965	3.3639	25.9545	40.3591
0.0000	5.1296	6.8524	0.0000	0.0000	1.6440	0.0000	0.0000	0.0000					
1996	1	1	0	0	1	25	25	88	0.0000	6.2748	1.8776	19.7714	48.0107
0.8813	5.1621	9.5921	0.1831	0.0000	5.5863	0.0000	0.0000	2.6605					
1996	1	1	0	0	1	26	26	95	0.0000	0.0000	0.8307	16.0823	52.3339
0.3209	9.4561	13.2840	0.3481	0.0000	6.7143	0.0000	0.0000	0.6296					
1996	1	1	0	0	1	27	27	96	0.0000	0.0000	0.0000	15.4908	43.7148
0.1568	8.7846	13.2489	0.0000	0.0000	14.3619	0.0000	0.0000	4.2423					
1996	1	1	0	0	1	28	28	92	0.0000	0.0000	0.0000	7.2528	26.8480
0.0000	6.0100	22.6914	0.5921	0.0000	32.9778	0.0000	0.0000	3.6278					
1996	1	1	0	0	1	29	29	86	0.0000	0.0000	0.0000	8.3630	17.5408
0.3264	9.3016	23.4515	0.0000	0.0000	34.6009	0.0000	0.0000	6.4158					
1996	1	1	0	0	1	30	30	71	0.0000	0.0000	0.0000	0.0000	19.0078
0.0000	4.7150	34.0506	0.4689	0.0000	31.3917	0.0000	0.0000	10.3660					
1996	1	1	0	0	1	31	31	58	0.0000	0.0000	0.0000	0.9565	1.6768
0.0000	2.8421	27.7766	0.0000	1.8404	52.0107	0.0000	0.0000	12.8969					
1996	1	1	0	0	1	32	32	35	0.0000	0.0000	0.0000	0.0000	8.9818
1.0959	0.5238	14.2401	0.0000	0.0000	63.1137	0.0000	0.9989	11.0459					
1996	1	1	0	0	1	33	33	32	0.0000	0.0000	0.0000	2.3508	10.5473
0.0000	3.6420	14.4747	0.0000	1.2683	45.4643	0.0000	1.5498	20.7028					
1996	1	1	0	0	1	34	34	11	0.0000	0.0000	0.0000	0.0000	5.7731
0.0000	0.0000	45.0335	0.0000	0.0000	47.2019	0.0000	0.0000	1.9915					
1996	1	1	0	0	1	35	35	12	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	25.3341	3.1237	0.0000	71.5422	0.0000	0.0000	0.0000					
1996	1	1	0	0	1	36	36	7	0.0000	0.0000	0.0000	0.0000	0.0000
4.8400	2.1599	22.2260	0.0000	0.0000	70.7740	0.0000	0.0000	0.0000					
1996	1	1	0	0	1	37	37	4	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	77.5991	0.0000	0.0000	22.4009	0.0000	0.0000	0.0000					
1996	1	1	0	0	1	38	38	3	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	27.3128	0.0000	0.0000	36.5820	0.0000	36.1052	0.0000					
1996	1	1	0	0	1	39	39	3	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	13.0269	0.0000	0.0000	86.9731	0.0000	0.0000	0.0000					
1996	1	1	0	0	1	40	40	3	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	52.5445	47.4555	0.0000	0.0000	0.0000					
1996	1	1	0	0	1	41	41	1	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	100.0000	0.0000	0.0000	0.0000					
1996	1	1	0	0	1	42	42	2	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	100.0000	0.0000	0.0000	0.0000					
1996	1	1	0	0	1	43	43	2	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	76.4494	0.0000	23.5506	0.0000					
1996	1	1	0	0	1	44	44	1	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	100.0000					
1996	1	1	0	0	1	45	45	1	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	100.0000					
1996	1	1	0	0	1	46	46	1	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	100.0000					
1996	1	1	0	0	1	48	48	1	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	100.0000	0.0000	0.0000	0.0000					
1996	1	1	0	0	1	51	51	3	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	18.0895	0.0000	18.0895	63.8211					

1997	1	1	0	0	1	15	15	1	0.0000	100.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
1997	1	1	0	0	1	16	16	1	0.0000	100.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
1997	1	1	0	0	1	17	17	7	0.0000	88.7801	11.2199	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
1997	1	1	0	0	1	18	18	16	17.5711	72.8202	9.6087	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
1997	1	1	0	0	1	19	19	32	0.0000	92.8366	7.1634	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
1997	1	1	0	0	1	20	20	47	0.0000	84.9676	15.0324	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
1997	1	1	0	0	1	21	21	59	0.0000	70.2052	28.3168	0.0000	1.4780	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
1997	1	1	0	0	1	22	22	77	0.0000	63.7515	31.5659	0.3123	3.1367	0.0000	1.2338	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
1997	1	1	0	0	1	23	23	83	0.0000	55.5168	41.9735	0.0000	1.4911	1.0186	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
1997	1	1	0	0	1	24	24	84	0.0000	30.0626	60.6906	0.0000	3.8520	4.3311	0.0000	0.5185	0.0000	0.0000	0.0000	0.5453	0.0000	0.0000
1997	1	1	0	0	1	25	25	70	0.0000	31.0054	42.2872	2.5359	8.4392	10.3865	2.0324	2.5830	0.3739	0.0000	0.0000	0.3565	0.0000	0.0000
1997	1	1	0	0	1	26	26	71	0.0000	3.4994	34.6036	0.0000	11.2650	39.2701	1.5846	1.1669	7.5626	0.0000	0.0000	1.0479	0.0000	0.0000
1997	1	1	0	0	1	27	27	57	0.0000	0.0000	6.5709	0.0000	8.9766	47.3030	1.1424	4.7584	25.1591	0.0000	0.0000	4.2457	0.3690	1.4751
1997	1	1	0	0	1	28	28	53	0.0000	0.0000	1.3275	0.6359	7.3192	41.5941	2.5126	5.7137	14.4586	1.9847	0.3423	20.9463	0.0000	3.1652
1997	1	1	0	0	1	29	29	41	0.0000	0.0000	0.0000	0.4867	5.2923	27.7307	1.0087	11.1256	17.9942	0.0000	0.0000	21.3837	0.0000	14.9781
1997	1	1	0	0	1	30	30	28	0.0000	0.0000	0.0000	0.0000	9.0974	8.9385	0.0000	25.6795	9.0501	0.0000	0.0000	34.3430	1.2664	11.6250
1997	1	1	0	0	1	31	31	27	0.0000	0.0000	0.0000	0.0000	1.2147	41.7978	2.0290	2.5952	11.8538	0.0000	4.1999	27.4161	0.0000	8.8935
1997	1	1	0	0	1	32	32	21	0.0000	0.0000	0.0000	0.0000	0.0000	1.0886	5.4521	17.8316	44.4122	0.0000	1.4664	23.2795	0.0000	6.4696
1997	1	1	0	0	1	33	33	11	0.0000	0.0000	0.0000	0.0000	0.0000	7.6294	13.2769	0.0000	25.5173	0.0000	0.0000	36.3945	0.0000	17.1820
1997	1	1	0	0	1	34	34	11	0.0000	0.0000	0.0000	0.0000	0.0000	16.8148	0.0000	0.0000	25.6379	15.6480	0.0000	19.3959	0.0000	22.5035
1997	1	1	0	0	1	35	35	5	0.0000	0.0000	0.0000	0.0000	0.0000	7.6800	0.0000	0.0000	0.0000	18.5373	0.0000	73.7827	0.0000	0.0000
1997	1	1	0	0	1	36	36	1	0.0000	0.0000	0.0000	0.0000	0.0000	100.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
1997	1	1	0	0	1	37	37	3	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	100.0000	0.0000	0.0000
1997	1	1	0	0	1	38	38	1	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	100.0000
1997	1	1	0	0	1	39	39	1	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	100.0000
1997	1	1	0	0	1	40	40	1	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	100.0000	0.0000	0.0000
1997	1	1	0	0	1	41	41	1	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	100.0000
1997	1	1	0	0	1	42	42	1	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	100.0000	0.0000	0.0000	0.0000	0.0000	0.0000
1997	1	1	0	0	1	44	44	1	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	100.0000
1997	1	1	0	0	1	47	47	1	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	100.0000
1997	1	1	0	0	1	51	51	2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	56.1924	0.0000	43.8076
1998	1	1	0	0	1	4	4	1	100.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
1998	1	1	0	0	1	5	5	1	100.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
1998	1	1	0	0	1	10	10	1	100.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
1998	1	1	0	0	1	11	11	3	84.3624	15.6376	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

1998	1	1	0	0	1	12	12	5	84.0573	15.9427	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1998	1	1	0	0	1	13	13	11	95.5126	4.4874	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1998	1	1	0	0	1	14	14	18	84.9865	15.0135	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1998	1	1	0	0	1	15	15	11	83.5617	14.7077	1.7306	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1998	1	1	0	0	1	16	16	15	54.0935	39.6787	6.2278	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1998	1	1	0	0	1	17	17	28	17.6011	66.7594	13.7605	1.8790	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1998	1	1	0	0	1	18	18	43	6.6987	80.3954	9.9845	2.9213	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1998	1	1	0	0	1	19	19	59	0.0299	81.3565	13.2259	5.3877	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1998	1	1	0	0	1	20	20	62	0.6575	72.1464	20.6063	4.6901	1.8998
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1998	1	1	0	0	1	21	21	75	0.0000	47.0522	32.8580	19.0700	0.0000
0.0000	1.0198	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1998	1	1	0	0	1	22	22	87	0.0000	19.8186	32.6891	42.8161	1.9217
1.3278	1.4267	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1998	1	1	0	0	1	23	23	113	0.0000	3.9827	27.6299	53.4591	5.5008
3.0994	5.7184	0.0000	0.0000	0.6097	0.0000	0.0000	0.0000	0.0000					
1998	1	1	0	0	1	24	24	137	0.0000	1.6524	19.3975	55.5276	7.7690
5.5699	7.5661	0.6460	0.5905	1.2809	0.0000	0.0000	0.0000	0.0000					
1998	1	1	0	0	1	25	25	142	0.0000	0.9564	16.3507	43.8740	5.3304
5.1557	19.0669	1.7902	1.0951	4.5527	0.5967	0.0000	0.9821	0.2492					
1998	1	1	0	0	1	26	26	117	0.0000	0.0117	8.2667	37.8076	5.8029
9.1859	24.3469	2.5185	2.5248	6.6751	0.0000	0.0000	2.8599	0.0000					
1998	1	1	0	0	1	27	27	95	0.0000	0.1861	3.4308	23.4929	4.4030
8.6158	30.9296	3.2865	1.2972	13.1458	1.2393	1.9518	5.3036	2.7176					
1998	1	1	0	0	1	28	28	63	0.0000	0.0000	1.6762	15.5415	2.3650
9.0552	35.0992	2.7475	1.6307	17.9610	0.0000	0.0000	13.7705	0.1534					
1998	1	1	0	0	1	29	29	50	0.0000	0.0000	0.2502	10.3900	3.5439
9.6281	19.5470	0.5881	3.1471	18.1441	0.2985	0.0821	29.7261	4.6548					
1998	1	1	0	0	1	30	30	27	0.0000	0.0000	0.0000	1.0069	1.1001
14.1812	26.2154	9.3837	8.3685	20.6666	0.8194	0.2303	10.2679	7.7600					
1998	1	1	0	0	1	31	31	18	0.0000	0.0000	0.0000	0.0000	0.0000
0.5460	26.4319	0.4085	0.0000	44.4382	0.0000	0.0000	20.9593	7.2162					
1998	1	1	0	0	1	32	32	8	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	11.9887	0.0000	0.0000	0.0000	0.0000	0.0000	80.6457	7.3655					
1998	1	1	0	0	1	33	33	4	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	3.7431	0.0000	0.0000	0.0000	36.1151	0.0000	56.6274	3.5145					
1998	1	1	0	0	1	34	34	4	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	19.9088	1.6194	0.0000	28.6377	0.0000	0.0000	49.8342	0.0000					
1998	1	1	0	0	1	35	35	3	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	25.1189	0.0000	0.0000	12.8626	0.0000	0.0000	62.0185	0.0000					
1998	1	1	0	0	1	36	36	5	0.0000	0.0000	0.0000	2.8677	0.0000
0.0000	9.5078	0.0000	0.0000	0.0000	0.0000	0.0000	87.6245	0.0000					
1998	1	1	0	0	1	37	37	1	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	100.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1998	1	1	0	0	1	38	38	1	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	39.2386	0.0000	0.0000	0.0000	0.0000	0.0000	60.7614	0.0000					
1998	1	1	0	0	1	39	39	1	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	100.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1998	1	1	0	0	1	40	40	2	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	2.2964	0.0000	0.0000	0.0000	97.7036	0.0000	0.0000	0.0000					
1998	1	1	0	0	1	41	41	1	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	60.7614	0.0000	0.0000	39.2386	0.0000					
1998	1	1	0	0	1	43	43	1	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	100.0000	0.0000					
1998	1	1	0	0	1	46	46	1	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	100.0000	0.0000					
1998	1	1	0	0	1	49	49	1	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	100.0000					
1998	1	1	0	0	1	51	51	1	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	27.0847	27.0847	0.0000	0.0000	45.8305	0.0000					
1999	1	1	0	0	1	6	6	1	100.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					

1999	1	1	0	0	1	9	9	1	66.6667	33.3333	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1999	1	1	0	0	1	10	10	3	16.7399	83.2601	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1999	1	1	0	0	1	11	11	10	78.7176	14.9689	6.3136	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1999	1	1	0	0	1	12	12	10	73.8249	20.2209	5.9542	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1999	1	1	0	0	1	13	13	12	52.7214	47.2786	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1999	1	1	0	0	1	14	14	25	64.8728	35.1272	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1999	1	1	0	0	1	15	15	40	43.3581	46.7861	8.2564	1.5994	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1999	1	1	0	0	1	16	16	52	34.2192	58.1022	7.6786	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1999	1	1	0	0	1	17	17	55	15.1224	66.5198	18.3579	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1999	1	1	0	0	1	18	18	59	3.0374	71.2788	22.0782	3.6056	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1999	1	1	0	0	1	19	19	80	1.4366	69.4446	23.4475	4.0797	1.5916
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1999	1	1	0	0	1	20	20	80	0.0000	58.1301	32.1410	6.2737	1.4056
1.0904	0.9593	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1999	1	1	0	0	1	21	21	73	0.0000	27.7772	47.0431	15.6080	6.2386
1.6860	0.0000	0.0000	0.0000	0.0000	0.8235	0.8235	0.0000	0.0000					
1999	1	1	0	0	1	22	22	78	0.0000	16.4514	49.8615	20.3876	7.7908
1.8806	0.8763	1.7526	0.0000	0.8763	0.1229	0.0000	0.0000	0.0000					
1999	1	1	0	0	1	23	23	66	0.0000	5.5692	36.7598	36.6603	14.3764
3.7905	2.7360	0.1078	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1999	1	1	0	0	1	24	24	94	0.0000	1.3046	33.8413	28.8908	21.3883
2.3356	5.7290	3.6238	0.0000	0.0000	0.9622	0.9622	0.9622	0.0000					
1999	1	1	0	0	1	25	25	90	0.0000	0.9476	15.7103	36.9018	20.6983
2.9795	8.6589	7.9110	0.8786	0.7824	2.6570	1.0923	0.0000	0.7824					
1999	1	1	0	0	1	26	26	99	0.0000	0.0000	10.9906	32.8741	20.6172
5.7569	13.5580	7.6005	0.0000	0.0456	3.5294	0.0000	2.0785	2.9490					
1999	1	1	0	0	1	27	27	82	0.0000	0.0000	2.3189	42.1622	21.7602
8.7589	4.2756	8.2643	4.2602	1.8286	2.5842	0.0000	1.7228	2.0640					
1999	1	1	0	0	1	28	28	74	0.0000	0.0000	2.0791	23.6331	23.7682
4.1893	14.1082	9.8305	1.5909	2.3398	7.9025	1.4892	2.9784	6.0909					
1999	1	1	0	0	1	29	29	55	0.0000	0.0000	0.0000	10.1890	9.6222
5.6381	12.5988	19.8664	2.0996	9.7728	15.0654	0.0000	7.3573	7.7903					
1999	1	1	0	0	1	30	30	36	0.0000	0.0000	0.1446	14.4151	4.4422
7.8370	4.9153	24.5844	5.1654	0.9763	19.5735	0.1035	6.5103	11.3324					
1999	1	1	0	0	1	31	31	20	0.0000	0.0000	0.0000	4.9662	0.8617
1.4556	4.9516	10.9021	4.4600	10.6214	21.3847	0.0000	4.4600	35.9366					
1999	1	1	0	0	1	32	32	16	0.0000	0.0000	0.0000	0.4612	13.1892
6.1493	6.3388	31.9878	0.5514	5.2644	10.6259	10.3805	0.0000	15.0513					
1999	1	1	0	0	1	33	33	11	0.0000	0.0000	0.0000	7.6764	0.0000
7.6764	0.0000	9.0443	0.0000	9.1392	24.2482	18.3933	0.0000	23.8221					
1999	1	1	0	0	1	34	34	7	0.0000	0.0000	0.0000	0.0000	0.8750
0.0000	1.4422	12.2047	0.0000	32.5474	1.5067	0.0000	0.0000	51.4239					
1999	1	1	0	0	1	35	35	4	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	16.5898	16.5898	0.0000	27.9354	36.3964	0.0000	0.0000	2.4885					
1999	1	1	0	0	1	36	36	1	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	50.0000	0.0000	0.0000	0.0000	0.0000	0.0000	50.0000					
1999	1	1	0	0	1	37	37	1	0.0000	0.0000	0.0000	0.0000	21.4280
0.0000	0.0000	42.8561	0.0000	0.0000	0.0000	0.0000	0.0000	35.7159					
1999	1	1	0	0	1	38	38	4	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	20.8992	0.0000	0.0000	26.4777	20.8992	0.0000	4.9298	26.7941					
1999	1	1	0	0	1	39	39	2	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	41.1149	0.0000	0.0000	58.8851					
1999	1	1	0	0	1	40	40	1	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	50.0000	0.0000	0.0000	20.8674	0.0000	0.0000	0.0000	29.1326					
1999	1	1	0	0	1	41	41	2	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	6.3173	0.0000	0.0000	0.0000	0.0000	93.6827					
1999	1	1	0	0	1	42	42	3	0.0000	0.0000	0.0000	0.0000	9.7276
0.0000	0.0000	2.9210	0.0000	0.0000	87.3514	0.0000	0.0000	0.0000					
1999	1	1	0	0	1	43	43	2	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	6.0903	0.0000	0.0000	0.0000	93.9097	0.0000	0.0000					

1999	1	1	0	0	1	49	49	1	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	100.0000	0.0000	0.0000	0.0000					
1999	1	1	0	0	1	50	50	1	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	100.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1999	1	1	0	0	1	51	51	1	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	100.0000					
2000	1	1	0	0	1	9	9	3	100.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2000	1	1	0	0	1	10	10	3	100.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2000	1	1	0	0	1	11	11	4	100.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2000	1	1	0	0	1	12	12	4	73.7213	26.2787	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2000	1	1	0	0	1	13	13	3	100.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2000	1	1	0	0	1	14	14	2	38.0530	61.9470	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2000	1	1	0	0	1	15	15	3	89.2710	7.2036	3.5255	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2000	1	1	0	0	1	16	16	4	63.2030	28.7504	0.0000	8.0466	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2000	1	1	0	0	1	17	17	7	64.7649	21.0059	14.2291	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2000	1	1	0	0	1	18	18	19	22.1827	64.3980	13.4193	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2000	1	1	0	0	1	19	19	18	26.3559	43.4415	21.3910	8.8115	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2000	1	1	0	0	1	20	20	28	30.9143	30.0144	23.3670	9.8605	0.5524
0.0000	5.2914	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2000	1	1	0	0	1	21	21	43	6.2583	44.8951	21.3236	15.6613	2.9654
2.9654	5.9308	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2000	1	1	0	0	1	22	22	53	3.5119	25.8254	37.6828	20.9613	4.5247
2.4980	2.4980	0.0000	2.4980	0.0000	0.0000	0.0000	0.0000	0.0000					
2000	1	1	0	0	1	23	23	66	0.9163	7.8170	39.7616	14.7483	25.0143
4.7273	2.4119	0.0000	2.3016	0.0000	0.0000	2.3016	0.0000	0.0000					
2000	1	1	0	0	1	24	24	99	0.0839	20.6140	32.9012	16.0794	15.7941
4.3825	2.1116	4.6634	0.0000	0.0000	1.6850	0.0000	1.6850	0.0000					
2000	1	1	0	0	1	25	25	105	0.0433	6.9693	36.7134	22.8851	16.7679
9.6636	2.9646	3.0896	0.8899	0.0133	0.0000	0.0000	0.0000	0.0000					
2000	1	1	0	0	1	26	26	116	0.0427	3.0924	26.7106	27.9124	19.2771
7.4489	8.3718	1.6807	0.6731	1.5336	2.2538	0.1010	0.0000	0.9019					
2000	1	1	0	0	1	27	27	137	0.0431	1.8367	12.1784	18.7690	29.0003
15.5817	13.5194	4.1899	0.6785	0.3589	1.6578	0.5622	0.0000	1.6242					
2000	1	1	0	0	1	28	28	147	0.0000	0.9625	5.4100	20.2993	27.8947
13.4626	12.8963	8.5213	0.0959	2.1515	3.1566	0.0340	2.0460	3.0695					
2000	1	1	0	0	1	29	29	128	0.0000	0.0305	5.2480	15.9985	22.2338
15.7844	13.0451	6.7125	3.4663	1.4761	5.9539	1.1765	1.7143	7.1601					
2000	1	1	0	0	1	30	30	115	0.0000	0.0000	3.8856	10.3964	25.6470
17.3660	13.0379	9.8670	4.5372	4.3572	3.1664	1.6298	1.9240	4.1854					
2000	1	1	0	0	1	31	31	88	0.0000	0.0000	0.0000	5.8523	23.5276
22.7566	9.9678	11.5889	6.5938	1.7424	2.7764	4.8148	0.0000	10.3794					
2000	1	1	0	0	1	32	32	66	0.0000	0.0000	0.0000	5.1463	32.5426
16.2887	3.8644	9.3523	1.9830	4.7794	4.9797	4.4849	6.7005	9.8782					
2000	1	1	0	0	1	33	33	40	0.0000	0.0000	0.0540	5.6925	24.9033
19.1026	11.5565	12.2908	0.4610	10.3941	0.1645	0.5259	2.4664	12.3884					
2000	1	1	0	0	1	34	34	23	0.0000	0.0000	0.0000	5.2270	21.1771
19.7987	6.1267	15.3353	5.7971	7.4912	5.5258	0.0000	6.0298	7.4912					
2000	1	1	0	0	1	35	35	20	0.0000	0.0000	0.0000	0.0000	18.7127
20.8065	11.0158	18.2115	8.2830	15.0189	0.0000	0.0000	0.0000	7.9516					
2000	1	1	0	0	1	36	36	12	0.0000	0.0000	0.0000	0.0000	35.2334
17.5224	24.0535	6.3134	5.5777	5.6757	0.0231	5.5777	0.0231	0.0000					
2000	1	1	0	0	1	37	37	13	0.0000	0.0000	0.0000	0.0000	17.5409
1.2538	0.0000	23.2508	0.0000	11.4287	3.0309	28.8278	0.0000	14.6671					
2000	1	1	0	0	1	38	38	5	0.0000	0.0000	0.0000	0.0000	0.0000
19.4205	13.8887	33.0222	11.0599	0.6225	0.0000	8.3846	0.0000	13.6017					
2000	1	1	0	0	1	39	39	4	0.0000	0.0000	0.0000	0.0000	0.7385
0.0000	1.4820	0.0000	0.0000	10.7186	28.3164	10.7186	0.0000	48.0260					
2000	1	1	0	0	1	40	40	6	0.0000	0.0000	0.0000	0.0000	7.6149
0.0000	0.0000	32.2634	0.0000	1.8841	0.0000	0.0000	1.2920	56.9457					

2000	1	1	0	0	1	41	41	5	0.0000	0.0000	0.0000	0.0000	0.0000
14.1219	0.0000	33.1925	2.3169	17.5258	0.0000	31.6478	0.0000	1.1951					
2000	1	1	0	0	1	42	42	2	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	65.0793	0.0000	0.0000	0.0000	0.0000	0.0000	34.9207	0.0000					
2000	1	1	0	0	1	43	43	5	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	10.7871	0.0000	0.0000	0.0000	8.3187	0.0000	80.8942	0.0000					
2000	1	1	0	0	1	44	44	2	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	2.4409	29.4190	0.0000	0.0000	68.1401					
2000	1	1	0	0	1	46	46	2	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	100.0000	0.0000	0.0000	0.0000					
2000	1	1	0	0	1	48	48	1	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	100.0000	0.0000	0.0000	0.0000	0.0000					
2000	1	1	0	0	1	50	50	1	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	100.0000					
2000	1	1	0	0	1	51	51	1	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	100.0000	0.0000	0.0000					
2001	1	1	0	0	1	8	8	2	100.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2001	1	1	0	0	1	9	9	1	100.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2001	1	1	0	0	1	10	10	1	100.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2001	1	1	0	0	1	11	11	10	95.9778	4.0222	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2001	1	1	0	0	1	12	12	9	93.5221	6.4779	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2001	1	1	0	0	1	13	13	21	92.9413	1.9074	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	5.1512	0.0000	0.0000	0.0000					
2001	1	1	0	0	1	14	14	24	95.7760	4.2240	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2001	1	1	0	0	1	15	15	31	90.9084	7.8572	1.2344	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2001	1	1	0	0	1	16	16	36	85.1036	14.5686	0.3278	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2001	1	1	0	0	1	17	17	56	88.2366	8.9047	2.8587	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2001	1	1	0	0	1	18	18	62	77.4209	20.2324	0.0000	2.3467	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2001	1	1	0	0	1	19	19	68	74.0227	23.5341	2.4432	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2001	1	1	0	0	1	20	20	65	46.3746	42.9605	2.4435	6.2020	0.0000
0.0000	0.0000	0.0000	0.0000	2.0195	0.0000	0.0000	0.0000	0.0000					
2001	1	1	0	0	1	21	21	70	13.1090	56.0554	23.3298	6.1027	0.2711
1.1320	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2001	1	1	0	0	1	22	22	109	2.7292	65.0400	24.6454	5.9101	0.0000
1.6753	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2001	1	1	0	0	1	23	23	119	1.2550	69.4917	17.6483	8.6518	2.8703
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0829	0.0000	0.0000					
2001	1	1	0	0	1	24	24	123	0.0695	61.7720	16.0545	18.0592	1.9308
2.1141	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2001	1	1	0	0	1	25	25	142	0.0000	35.8368	13.9841	30.9442	11.2071
3.5005	3.2523	1.2750	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2001	1	1	0	0	1	26	26	151	0.0938	17.6416	14.1810	48.6099	11.5474
5.1088	1.9449	0.4494	0.0000	0.0000	0.0000	0.0000	0.4233	0.0000					
2001	1	1	0	0	1	27	27	173	0.0000	10.6480	20.5747	37.2092	16.2353
6.7042	2.4634	2.2876	2.3526	1.1703	0.3547	0.0000	0.0000	0.0000					
2001	1	1	0	0	1	28	28	178	0.0000	5.1329	18.2448	31.1757	15.5091
14.5847	9.0923	0.6600	1.2589	0.9425	1.5540	0.0000	0.6466	1.1984					
2001	1	1	0	0	1	29	29	194	0.0155	2.2958	15.1515	30.5911	18.9474
15.4137	10.3707	1.8362	1.2104	0.6287	1.2201	0.6147	0.6665	1.0375					
2001	1	1	0	0	1	30	30	144	0.0000	0.5489	13.6924	29.8718	9.3637
23.9768	8.6189	1.7795	3.1621	2.0730	2.5536	0.8860	2.2639	1.2094					
2001	1	1	0	0	1	31	31	106	0.0000	1.1652	7.4980	20.2722	14.1639
38.0681	8.3872	2.0978	0.3794	4.5652	1.9881	1.2505	0.0701	0.0942					
2001	1	1	0	0	1	32	32	76	0.0000	0.0000	15.5843	8.4208	21.9056
13.8447	10.8587	7.8062	9.5847	5.9296	1.2831	3.5411	0.1503	1.0910					
2001	1	1	0	0	1	33	33	60	0.0000	0.0000	13.5650	13.5613	7.0499
30.2319	12.6362	2.1519	5.1264	2.2545	4.6611	4.3295	0.0936	4.3386					
2001	1	1	0	0	1	34	34	42	0.0000	0.0000	6.0734	7.4456	13.3753
31.9560	19.9101	4.0477	4.3653	0.9251	3.7582	0.0000	7.6722	0.4710					

2001	1	1	0	0	1	35	35	37	0.0000	0.0000	0.7205	4.8680	15.9894
24.4527	32.5706	0.3114	0.5910	7.0157	6.1728	0.1484	0.0930	7.0664					
2001	1	1	0	0	1	36	36	12	0.0000	0.0000	0.0000	0.0000	13.4074
49.9664	13.7161	0.0000	0.3940	7.9921	9.0519	5.4722	0.0000	0.0000					
2001	1	1	0	0	1	37	37	9	0.0000	0.0000	8.8044	0.0000	4.1820
12.8278	14.9037	43.0546	16.2276	0.0000	0.0000	0.0000	0.0000	0.0000					
2001	1	1	0	0	1	38	38	12	0.0000	19.3100	0.0000	0.0000	1.3829
21.8286	1.0864	22.1189	19.3100	0.5865	0.0000	1.4751	12.2246	0.6770					
2001	1	1	0	0	1	39	39	2	0.0000	0.0000	0.0000	0.0000	27.0015
1.8995	0.0000	0.0000	0.0000	0.0000	27.0015	44.0975	0.0000	0.0000					
2001	1	1	0	0	1	40	40	3	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	2.9322	0.0000	0.0000	0.0000	0.0000	0.0000	48.0951	48.9728					
2001	1	1	0	0	1	41	41	5	0.0000	0.0000	0.0000	44.7025	0.0000
7.4542	1.6916	0.0000	0.0000	0.0000	1.4491	44.7025	0.0000	0.0000					
2001	1	1	0	0	1	42	42	1	0.0000	0.0000	0.0000	0.0000	0.0000
100.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2001	1	1	0	0	1	43	43	1	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	100.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2001	1	1	0	0	1	44	44	1	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	100.0000					
2001	1	1	0	0	1	45	45	1	0.0000	0.0000	0.0000	0.0000	0.0000
100.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2001	1	1	0	0	1	46	46	2	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	95.3846	0.0000	0.0000	0.0000	4.6154					
2001	1	1	0	0	1	47	47	1	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	100.0000					
2001	1	1	0	0	1	51	51	1	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	100.0000	0.0000	0.0000	0.0000					
2002	1	1	0	0	1	12	12	1	0.0000	100.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2002	1	1	0	0	1	15	15	1	0.0000	100.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2002	1	1	0	0	1	16	16	3	0.0000	100.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2002	1	1	0	0	1	17	17	13	0.0000	100.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2002	1	1	0	0	1	18	18	27	2.1247	95.7506	2.1247	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2002	1	1	0	0	1	19	19	64	0.0000	95.3590	2.6181	0.8727	0.1388
0.1388	0.0000	0.8727	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2002	1	1	0	0	1	20	20	113	0.0000	95.1641	4.7887	0.0000	0.0472
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2002	1	1	0	0	1	21	21	153	0.0000	91.9980	6.8703	1.0339	0.0000
0.0000	0.0000	0.0363	0.0000	0.0000	0.0615	0.0000	0.0000	0.0000					
2002	1	1	0	0	1	22	22	176	0.0000	85.3873	13.5144	0.0935	0.6986
0.0000	0.3063	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2002	1	1	0	0	1	23	23	156	0.0000	76.9563	18.7587	3.8293	0.0000
0.0000	0.0000	0.4558	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2002	1	1	0	0	1	24	24	131	0.0000	61.9711	31.2492	1.5222	3.2625
1.3795	0.0000	0.0000	0.0000	0.0000	0.5376	0.0000	0.0778	0.0000					
2002	1	1	0	0	1	25	25	105	0.0000	39.0308	45.9714	5.7554	4.7361
2.4839	0.6742	1.3483	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2002	1	1	0	0	1	26	26	78	0.0000	27.8686	42.5815	7.9604	14.4468
6.0645	0.1414	0.9367	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2002	1	1	0	0	1	27	27	66	0.0000	8.3326	39.6765	13.2185	27.6347
3.7522	5.7478	1.4087	0.2290	0.0000	0.0000	0.0000	0.0000	0.0000					
2002	1	1	0	0	1	28	28	67	0.0000	2.7011	26.9102	33.6869	20.8813
6.9134	1.3533	3.9401	0.4590	0.0000	0.3573	0.1180	2.1619	0.5174					
2002	1	1	0	0	1	29	29	72	0.0000	3.7211	29.3903	16.6517	11.7773
24.6006	3.8595	6.0239	1.8356	0.1292	1.6634	0.0000	0.1200	0.2275					
2002	1	1	0	0	1	30	30	79	0.0000	2.8874	27.1716	21.5811	29.1158
4.5262	6.4876	6.8730	0.7104	0.1656	0.1582	0.0000	0.1286	0.1944					
2002	1	1	0	0	1	31	31	82	0.0000	0.6613	19.9942	13.9671	30.3310
8.3989	12.7945	6.5990	0.4834	2.8304	3.4525	0.2257	0.0000	0.2621					
2002	1	1	0	0	1	32	32	72	0.0000	0.0000	8.2051	23.8282	13.9686
27.3380	11.9489	12.6803	0.6145	0.5761	0.5333	0.0000	0.0000	0.3070					
2002	1	1	0	0	1	33	33	58	0.0000	0.3672	6.2893	16.7879	9.8708
17.8136	12.8968	9.5981	16.4217	0.0000	8.6194	0.6374	0.0000	0.6977					
2002	1	1	0	0	1	34	34	50	0.0000	0.0000	14.7230	9.9641	2.2431
11.0384	33.0824	9.0271	7.5940	7.3923	4.9357	0.0000	0.0000	0.0000					

2002	1	1	0	0	1	35	35	41	0.0000	0.2562	0.0000	18.6323	1.4458
7.5585	47.3363	10.7860	3.2565	7.2374	3.2565	0.0000	0.0000	0.2345					
2002	1	1	0	0	1	36	36	28	0.0000	0.7756	0.0000	14.8504	13.6231
28.6137	11.3758	25.9824	0.8431	1.9463	0.0000	0.9820	1.0077	0.0000					
2002	1	1	0	0	1	37	37	18	0.0000	0.0000	0.0000	0.0000	32.7828
35.6290	4.5513	2.2117	0.0000	0.0000	1.1863	0.0000	5.3638	18.2751					
2002	1	1	0	0	1	38	38	14	0.0000	0.0000	0.0000	18.8628	0.0000
19.3713	37.8863	0.8121	1.2883	1.4147	0.0000	0.7682	0.0000	19.5962					
2002	1	1	0	0	1	39	39	8	0.0000	0.0000	0.0000	0.0000	4.1331
4.8763	2.1347	10.9486	3.5786	0.0000	4.6230	0.0000	0.0000	69.7056					
2002	1	1	0	0	1	40	40	5	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	93.8252	6.1748	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2002	1	1	0	0	1	41	41	5	0.0000	0.0000	0.0000	2.1014	0.0000
0.0000	3.6248	0.0000	0.0000	3.5704	0.0000	0.0000	0.0000	90.7035					
2002	1	1	0	0	1	42	42	2	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	100.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2002	1	1	0	0	1	43	43	3	0.0000	71.2562	0.0000	0.0000	0.0000
0.0000	25.3191	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.4247					
2002	1	1	0	0	1	44	44	2	0.0000	0.0000	0.0000	0.0000	0.0000
96.2401	3.7599	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2002	1	1	0	0	1	45	45	3	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	2.6431	94.2989	0.0000	0.0000	0.0000	0.0000	3.0580	0.0000					
2002	1	1	0	0	1	46	46	1	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	100.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2002	1	1	0	0	1	47	47	1	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	100.0000					
2002	1	1	0	0	1	49	49	1	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	50.0000	0.0000	0.0000	0.0000	0.0000	0.0000	50.0000					
2002	1	1	0	0	1	51	51	1	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	100.0000	0.0000					
2003	1	1	0	0	1	9	9	1	0.0000	0.0000	100.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2003	1	1	0	0	1	12	12	2	0.0000	0.0000	100.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2003	1	1	0	0	1	14	14	3	25.2301	0.0000	74.7699	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2003	1	1	0	0	1	15	15	2	34.9659	0.0000	65.0341	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2003	1	1	0	0	1	16	16	6	0.0000	0.0000	67.0445	14.1793	0.0000
18.7762	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2003	1	1	0	0	1	17	17	29	0.0000	12.2885	83.2166	1.9813	2.5135
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2003	1	1	0	0	1	18	18	42	1.1988	12.8783	83.0554	2.8676	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2003	1	1	0	0	1	19	19	60	2.2291	7.6961	85.4308	4.1879	0.4560
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2003	1	1	0	0	1	20	20	92	0.0000	2.3275	89.5888	3.2734	2.3196
1.8821	0.2846	0.0000	0.3239	0.0000	0.0000	0.0000	0.0000	0.0000					
2003	1	1	0	0	1	21	21	133	0.0000	4.0689	89.5841	5.2243	0.5236
0.0000	0.2340	0.2564	0.1086	0.0000	0.0000	0.0000	0.0000	0.0000					
2003	1	1	0	0	1	22	22	205	0.0000	2.8459	88.3861	6.9350	0.5548
0.4165	0.8618	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2003	1	1	0	0	1	23	23	264	0.0000	0.4083	89.4417	6.6850	1.4535
0.6877	0.6883	0.4073	0.1332	0.0951	0.0000	0.0000	0.0000	0.0000					
2003	1	1	0	0	1	24	24	283	0.0000	0.1593	86.0198	10.2672	1.1032
1.3384	0.5554	0.3432	0.2136	0.0000	0.0000	0.0000	0.0000	0.0000					
2003	1	1	0	0	1	25	25	246	0.0000	0.2776	79.7670	14.2516	1.7941
2.0656	1.5960	0.1232	0.1249	0.0000	0.0000	0.0000	0.0000	0.0000					
2003	1	1	0	0	1	26	26	181	0.0000	0.1333	77.5086	13.0956	1.8959
3.6664	0.9438	1.0921	0.0000	0.5915	0.7648	0.3079	0.0000	0.0000					
2003	1	1	0	0	1	27	27	121	0.0000	0.2067	65.4895	12.0669	3.3837
9.3931	2.9650	4.2310	0.8764	0.5092	0.0000	0.8786	0.0000	0.0000					
2003	1	1	0	0	1	28	28	77	0.0000	0.0000	33.6670	11.6543	6.0799
20.3503	14.1684	4.8268	5.4192	1.5674	0.0510	1.0221	1.1935	0.0000					
2003	1	1	0	0	1	29	29	57	0.0000	0.0000	35.1596	19.7946	5.2402
9.1708	5.5373	9.7924	7.4154	3.0304	0.0000	2.6344	0.0000	2.2249					
2003	1	1	0	0	1	30	30	39	0.0000	0.0000	19.4786	16.4214	1.5509
7.1147	18.0604	23.1486	9.4697	2.0218	1.0150	1.7189	0.0000	0.0000					
2003	1	1	0	0	1	31	31	38	0.0000	0.0000	15.8513	16.4441	10.9165
9.2181	7.0915	16.1898	6.8618	10.0104	2.4671	2.2992	0.0000	2.6502					

2003	1	1	0	0	1	32	32	20	0.0000	0.0000	4.2346	32.6408	6.4441
9.0262	11.9501	16.3696	0.0000	9.1170	4.1168	6.1008	0.0000	0.0000					
2003	1	1	0	0	1	33	33	16	0.0000	0.0000	6.4424	34.3507	5.4137
6.0061	11.0266	5.7823	20.1238	0.0000	5.2997	0.0000	0.0000	5.5546					
2003	1	1	0	0	1	34	34	5	0.0000	0.0000	33.2167	0.0000	0.0000
25.1978	21.7596	0.0000	0.0000	19.8259	0.0000	0.0000	0.0000	0.0000					
2003	1	1	0	0	1	35	35	7	0.0000	0.0000	13.4015	51.3801	14.1402
10.1843	10.8940	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2003	1	1	0	0	1	36	36	4	0.0000	0.0000	38.2433	16.4437	24.2959
0.0000	21.0171	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2003	1	1	0	0	1	37	37	3	0.0000	0.0000	32.2822	42.7351	0.0000
0.0000	0.0000	0.0000	0.0000	24.9826	0.0000	0.0000	0.0000	0.0000					
2003	1	1	0	0	1	39	39	1	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	100.0000					
2003	1	1	0	0	1	40	40	1	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	100.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2003	1	1	0	0	1	46	46	1	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	100.0000	0.0000					
2004	1	1	0	0	1	1	1	1	0.0000	0.0000	0.0000	100.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2004	1	1	0	0	1	12	12	1	0.0000	100.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2004	1	1	0	0	1	18	18	3	0.0000	63.2642	0.0000	36.7358	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2004	1	1	0	0	1	19	19	11	0.0000	77.3693	0.0000	22.6307	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2004	1	1	0	0	1	20	20	29	0.0000	92.6811	2.2532	5.0657	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2004	1	1	0	0	1	21	21	73	0.0000	50.0519	17.6992	31.7298	0.0000
0.0000	0.5191	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2004	1	1	0	0	1	22	22	138	0.0000	32.4013	25.3699	39.9976	2.2312
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2004	1	1	0	0	1	23	23	197	0.0000	13.8919	16.5786	67.2869	1.1605
0.0000	0.7766	0.0000	0.0000	0.0000	0.3055	0.0000	0.0000	0.0000					
2004	1	1	0	0	1	24	24	284	0.0000	3.0144	12.0693	80.7552	3.4935
0.4686	0.1991	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2004	1	1	0	0	1	25	25	298	0.0000	2.5257	9.1366	84.1121	2.6172
0.2573	0.9314	0.3394	0.0803	0.0000	0.0000	0.0000	0.0000	0.0000					
2004	1	1	0	0	1	26	26	294	0.0000	1.4280	5.8292	83.5539	5.5435
0.8517	1.5154	1.0835	0.1948	0.0000	0.0000	0.0000	0.0000	0.0000					
2004	1	1	0	0	1	27	27	244	0.0000	0.1267	2.9676	80.2288	7.6396
2.4816	2.0360	3.7034	0.2372	0.5790	0.0000	0.0000	0.0000	0.0000					
2004	1	1	0	0	1	28	28	152	0.0000	0.0000	4.0231	69.4477	10.0168
2.8533	7.5588	2.6439	0.3267	2.2272	0.9026	0.0000	0.0000	0.0000					
2004	1	1	0	0	1	29	29	119	0.0000	0.5749	2.6379	53.2718	9.7971
3.9583	15.6514	7.3959	1.7396	1.6748	0.0000	1.8014	0.0000	1.4968					
2004	1	1	0	0	1	30	30	60	0.0000	0.0000	0.6451	41.3696	19.0949
2.8149	19.2128	9.5931	4.0456	2.4869	0.7371	0.0000	0.0000	0.0000					
2004	1	1	0	0	1	31	31	42	0.0000	0.0000	1.2560	31.0031	25.6111
5.6608	16.3221	4.2278	4.7061	8.0432	0.0000	3.1697	0.0000	0.0000					
2004	1	1	0	0	1	32	32	25	0.0000	0.0000	0.0000	24.0461	22.1062
15.8494	8.6043	18.9752	3.4351	0.0000	3.4351	3.5486	0.0000	0.0000					
2004	1	1	0	0	1	33	33	19	0.0000	0.0000	0.0000	16.4877	11.8771
9.7346	17.6822	20.8506	18.3691	0.0000	4.9987	0.0000	0.0000	0.0000					
2004	1	1	0	0	1	34	34	7	0.0000	0.0000	0.0000	0.0000	15.2322
0.0000	35.8547	15.7928	33.1203	0.0000	0.0000	0.0000	0.0000	0.0000					
2004	1	1	0	0	1	35	35	7	0.0000	5.5496	0.0000	0.0000	34.0364
0.0000	10.2865	10.2865	20.4223	19.4187	0.0000	0.0000	0.0000	0.0000					
2004	1	1	0	0	1	36	36	6	0.0000	0.0000	0.0000	30.9837	0.0000
30.3672	21.1318	0.0000	0.0000	0.0000	0.0000	0.0000	17.5173	0.0000					
2004	1	1	0	0	1	37	37	5	0.0000	0.0000	0.0000	0.0000	20.8897
41.7794	12.4672	0.0000	2.0014	14.6808	0.0000	0.0000	0.0000	8.1814					
2004	1	1	0	0	1	38	38	2	0.0000	0.0000	0.0000	0.0000	53.2028
0.0000	0.0000	0.0000	0.0000	0.0000	46.7972	0.0000	0.0000	0.0000					
2004	1	1	0	0	1	39	39	2	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	46.0878	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	53.9122					
2004	1	1	0	0	1	40	40	1	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	100.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2004	1	1	0	0	1	41	41	3	0.0000	0.0000	0.0000	0.0000	0.0000
31.1297	0.0000	33.4506	0.0000	0.0000	0.0000	35.4197	0.0000	0.0000					

2004	1	1	0	0	1	42	42	2	0.0000	0.0000	0.0000	100.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2004	1	1	0	0	1	43	43	1	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	100.0000	0.0000	0.0000	0.0000	0.0000					
2004	1	1	0	0	1	45	45	2	0.0000	0.0000	0.0000	62.4946	0.0000
0.0000	0.0000	37.5054	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2004	1	1	0	0	1	48	48	1	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	100.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2004	1	1	0	0	1	51	51	2	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	31.8608	36.2785	0.0000	31.8608	0.0000	0.0000					
2005	1	1	0	0	1	14	14	1	100.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2005	1	1	0	0	1	15	15	2	100.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2005	1	1	0	0	1	16	16	4	75.9636	0.0000	0.0000	0.0000	24.0364
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2005	1	1	0	0	1	18	18	4	59.1465	0.0000	0.0000	0.0000	20.4268
0.0000	0.0000	0.0000	0.0000	20.4268	0.0000	0.0000	0.0000	0.0000					
2005	1	1	0	0	1	19	19	4	100.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2005	1	1	0	0	1	20	20	12	60.4380	14.8376	15.4973	0.0000	9.2271
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2005	1	1	0	0	1	21	21	34	22.8172	15.4977	25.4324	0.0000	36.2527
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2005	1	1	0	0	1	22	22	74	0.0000	4.1547	43.8205	3.7988	45.9248
2.3011	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2005	1	1	0	0	1	23	23	164	0.0000	1.0947	19.4241	10.5147	60.8563
6.8488	1.2613	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2005	1	1	0	0	1	24	24	295	0.0000	1.1515	18.5480	7.4110	67.5427
4.5849	0.7619	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2005	1	1	0	0	1	25	25	362	0.0000	0.1610	11.0382	7.7153	71.3990
7.2409	1.5930	0.3777	0.4749	0.0000	0.0000	0.0000	0.0000	0.0000					
2005	1	1	0	0	1	26	26	373	0.0000	0.0000	6.2876	7.1447	77.4137
6.2128	1.2949	0.8957	0.2733	0.4774	0.0000	0.0000	0.0000	0.0000					
2005	1	1	0	0	1	27	27	324	0.0000	0.0000	2.7079	4.8809	78.6475
5.4771	4.1960	1.6608	1.4938	0.1942	0.7419	0.0000	0.0000	0.0000					
2005	1	1	0	0	1	28	28	246	0.0000	0.0000	2.4570	5.9689	73.1165
8.1584	1.6351	3.5234	3.3170	0.4923	0.8471	0.0000	0.4844	0.0000					
2005	1	1	0	0	1	29	29	150	0.0000	0.0000	0.0000	5.4446	60.8193
12.2810	2.4857	9.1187	4.7743	1.2780	3.7983	0.0000	0.0000	0.0000					
2005	1	1	0	0	1	30	30	98	0.0000	0.0000	0.0000	0.0000	57.4716
13.7951	9.7457	10.4795	3.1058	1.0874	2.4240	1.8909	0.0000	0.0000					
2005	1	1	0	0	1	31	31	63	0.0000	0.0000	0.0000	0.0000	57.7884
9.1190	3.9215	8.5727	4.4900	5.0715	3.4948	5.2985	0.0000	2.2436					
2005	1	1	0	0	1	32	32	42	0.0000	0.0000	0.0000	2.4743	50.2460
5.5151	1.3506	12.9541	12.1306	6.4064	8.9231	0.0000	0.0000	0.0000					
2005	1	1	0	0	1	33	33	16	0.0000	0.0000	0.0000	0.0000	73.4832
8.8881	0.0000	0.0000	0.0000	17.6287	0.0000	0.0000	0.0000	0.0000					
2005	1	1	0	0	1	34	34	19	0.0000	0.0000	4.2726	0.0000	28.2234
15.9563	20.3060	12.4316	0.0000	8.1613	10.6489	0.0000	0.0000	0.0000					
2005	1	1	0	0	1	35	35	9	0.0000	0.0000	0.0000	18.2674	29.8330
13.0949	9.7737	10.9861	0.0000	0.0000	0.0000	0.0000	0.0000	18.0449					
2005	1	1	0	0	1	36	36	5	0.0000	0.0000	0.0000	0.0000	100.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2005	1	1	0	0	1	37	37	8	0.0000	0.0000	0.0000	0.0000	80.6927
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	19.3073	0.0000	0.0000					
2005	1	1	0	0	1	38	38	8	0.0000	0.0000	0.0000	0.0000	62.5334
0.0000	37.4666	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2005	1	1	0	0	1	39	39	1	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	100.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2005	1	1	0	0	1	40	40	4	0.0000	0.0000	0.0000	0.0000	0.0000
38.7649	0.0000	0.0000	0.0000	0.0000	61.2351	0.0000	0.0000	0.0000					
2005	1	1	0	0	1	42	42	1	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	100.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2005	1	1	0	0	1	47	47	3	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	100.0000	0.0000	0.0000	0.0000	0.0000					
2005	1	1	0	0	1	49	49	1	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	100.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1977	1	2	0	0	1	1	51	60	0.0021	0.0021	0.0516	0.0186	0.0619
0.3773	0.1093	0.1031	0.0866	0.0825	0.0722	0.0330	0.0000	0.0000					

1978	1	2	0	0	1	1	51	60	0.0000	0.0000	0.0339	0.0593	0.0475
0.1797	0.2220	0.1898	0.1051	0.0814	0.0356	0.0305	0.0153	0.0000					
1979	1	2	0	0	1	1	51	60	0.0000	0.0000	0.0188	0.0554	0.1162
0.1019	0.1877	0.2699	0.0983	0.0706	0.0331	0.0223	0.0152	0.0107					
1980	1	2	0	0	1	1	51	60	0.0000	0.0000	0.0000	0.0311	0.0411
0.1629	0.0609	0.0782	0.4464	0.0841	0.0411	0.0411	0.0133	0.0000					
1981	1	2	0	0	1	1	51	60	0.0000	0.0000	0.0488	0.0131	0.0682
0.0667	0.2070	0.0411	0.1141	0.2988	0.0721	0.0290	0.0411	0.0000					
1982	1	2	0	0	1	1	51	60	0.0000	0.0000	0.0221	0.4268	0.0352
0.0460	0.0451	0.1410	0.0320	0.0249	0.1931	0.0189	0.0150	0.0000					
1983	1	2	0	0	1	1	51	60	0.0009	0.2180	0.0160	0.0280	0.4999
0.0201	0.0291	0.0260	0.0869	0.0120	0.0040	0.0530	0.0040	0.0020					
1984	1	2	0	0	1	1	51	60	0.0000	0.0180	0.2150	0.0280	0.1500
0.3380	0.0331	0.0381	0.0250	0.0779	0.0151	0.0130	0.0429	0.0060					
1985	1	2	0	0	1	1	51	60	0.0020	0.0020	0.0808	0.2648	0.0544
0.1072	0.3173	0.0162	0.0181	0.0181	0.0544	0.0122	0.0000	0.0524					
1986	1	2	0	0	1	1	51	60	0.0021	0.0021	0.0043	0.0608	0.5878
0.0369	0.0369	0.1757	0.0196	0.0087	0.0152	0.0217	0.0066	0.0217					
1987	1	2	0	0	1	1	51	60	0.0000	0.0094	0.0063	0.0016	0.0268
0.7414	0.0300	0.0300	0.1088	0.0063	0.0047	0.0126	0.0094	0.0126					
1988	1	2	0	0	1	16	16	1	0.0000	0.0000	100.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1988	1	2	0	0	1	18	18	1	0.0000	0.0000	0.0000	0.0000	0.0000
100.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1988	1	2	0	0	1	19	19	1	0.0000	0.0000	100.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1988	1	2	0	0	1	20	20	3	0.0000	0.0000	100.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1988	1	2	0	0	1	21	21	4	0.0000	0.0000	100.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1988	1	2	0	0	1	22	22	4	0.0000	6.3044	89.6250	0.0000	0.0000
0.0000	4.0706	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1988	1	2	0	0	1	23	23	4	0.0000	0.0000	60.7560	0.0000	0.0000
2.3914	36.8526	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1988	1	2	0	0	1	24	24	5	0.0000	1.5729	41.7798	0.0000	3.5574
1.5437	50.2753	0.0000	0.0000	1.2709	0.0000	0.0000	0.0000	0.0000					
1988	1	2	0	0	1	25	25	5	0.0000	0.0000	26.6184	1.2935	0.9831
1.0017	68.4734	0.0000	0.6468	0.9831	0.0000	0.0000	0.0000	0.0000					
1988	1	2	0	0	1	26	26	5	0.0000	1.1629	17.6282	0.9447	0.9447
0.4196	76.1232	1.2997	0.0000	1.4770	0.0000	0.0000	0.0000	0.0000					
1988	1	2	0	0	1	27	27	5	0.0000	0.0000	9.1513	0.0000	1.5958
2.1765	85.4805	1.5958	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1988	1	2	0	0	1	28	28	5	0.0000	0.0000	5.6998	0.3985	1.7216
1.2115	85.2983	1.1044	0.3985	3.6688	0.4987	0.0000	0.0000	0.0000					
1988	1	2	0	0	1	29	29	5	0.0000	0.0000	4.3091	0.7201	1.1850
1.9050	79.8803	2.7018	1.4401	7.8586	0.0000	0.0000	0.0000	0.0000					
1988	1	2	0	0	1	30	30	5	0.0000	0.0000	0.8354	0.8354	0.0000
2.7857	74.1439	2.3901	1.6865	17.3232	0.0000	0.0000	0.0000	0.0000					
1988	1	2	0	0	1	31	31	5	0.0000	0.0000	1.3332	0.0000	0.5231
0.7951	81.1743	1.3332	1.5663	12.7516	0.0000	0.0000	0.5231	0.0000					
1988	1	2	0	0	1	32	32	5	0.0000	0.0000	0.0000	0.0000	0.0000
2.2722	62.0348	1.2485	5.5389	25.5848	0.0000	0.0000	1.6604	1.6604					
1988	1	2	0	0	1	33	33	5	0.0000	0.0000	0.0000	0.0000	0.0000
3.8442	64.7440	1.5798	0.0000	25.4487	0.0000	2.9553	0.6382	0.7899					
1988	1	2	0	0	1	34	34	5	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	52.9545	1.0714	4.2796	29.8044	0.0000	2.6815	0.0000	9.2085					
1988	1	2	0	0	1	35	35	5	0.0000	0.0000	2.5509	0.0000	0.0000
0.0000	55.9367	6.0172	5.1019	24.0494	2.6389	0.0000	1.0661	2.6389					
1988	1	2	0	0	1	36	36	4	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	49.7658	0.0000	3.8324	19.9592	0.0000	4.0981	0.0000	22.3446					
1988	1	2	0	0	1	37	37	4	0.0000	0.0000	3.9552	0.0000	0.0000
0.0000	40.6330	1.3209	7.9104	36.3443	4.0916	0.0000	0.0000	5.7446					
1988	1	2	0	0	1	38	38	4	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	20.8516	6.9982	7.4834	35.7035	0.0000	10.1257	0.0000	18.8376					
1988	1	2	0	0	1	39	39	4	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	21.9616	4.6980	7.7314	43.6475	0.0000	9.0828	3.7959	9.0828					
1988	1	2	0	0	1	40	40	3	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	46.2006	0.0000	0.0000	38.0590	0.0000	0.0000	0.0000	15.7404					
1988	1	2	0	0	1	41	41	3	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	56.5366	0.0000	0.0000	15.9231	5.8085	0.0000	0.0000	21.7317					

1988	1	2	0	0	1	42	42	2	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	71.5686	0.0000	0.0000	0.0000	28.4314					
1988	1	2	0	0	1	43	43	1	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	50.0000	0.0000	0.0000	0.0000	0.0000	0.0000	50.0000	0.0000					
1988	1	2	0	0	1	44	44	1	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	50.0000	0.0000	0.0000	50.0000	0.0000	0.0000	0.0000	0.0000					
1988	1	2	0	0	1	45	45	1	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	50.0000	0.0000	0.0000	0.0000	50.0000					
1988	1	2	0	0	1	46	46	1	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	100.0000					
1988	1	2	0	0	1	51	51	1	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	100.0000	0.0000	0.0000	0.0000	0.0000					
1989	1	2	0	0	1	21	21	2	0.0000	0.0000	0.0000	100.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1989	1	2	0	0	1	22	22	5	0.0000	5.8167	0.0000	84.1468	0.0000
0.0000	0.0000	10.0365	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1989	1	2	0	0	1	23	23	6	0.0000	0.0000	0.0000	92.2612	0.0000
0.0000	0.0000	7.7388	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1989	1	2	0	0	1	24	24	6	0.0000	0.0000	0.0000	75.6758	0.0000
0.0000	0.0000	24.1465	0.0000	0.0000	0.1777	0.0000	0.0000	0.0000					
1989	1	2	0	0	1	25	25	6	0.0000	0.0000	0.0000	69.7277	0.0000
0.0000	0.0000	30.2723	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1989	1	2	0	0	1	26	26	6	0.0000	0.0000	1.1227	56.4107	0.0000
0.0000	0.0000	41.8502	0.0000	0.6165	0.0000	0.0000	0.0000	0.0000					
1989	1	2	0	0	1	27	27	6	0.0000	0.0000	0.0955	47.7346	0.0000
0.0000	0.7973	49.2166	0.0000	1.5975	0.5584	0.0000	0.0000	0.0000					
1989	1	2	0	0	1	28	28	6	0.0000	0.0000	0.0000	34.2849	0.7332
1.0387	0.0000	61.6335	0.0000	0.0000	2.3097	0.0000	0.0000	0.0000					
1989	1	2	0	0	1	29	29	6	0.0000	0.0000	0.0000	23.6464	0.0000
0.0000	1.0067	65.7410	3.0201	1.4234	3.7389	1.4234	0.0000	0.0000					
1989	1	2	0	0	1	30	30	6	0.0000	0.0000	0.0000	20.8079	0.0000
0.0000	1.9676	71.4979	2.7752	0.0000	1.9676	0.9838	0.0000	0.0000					
1989	1	2	0	0	1	31	31	6	0.0000	0.0000	1.5321	15.1694	0.0000
0.0000	0.0000	74.8774	0.0000	1.7324	6.6887	0.0000	0.0000	0.0000					
1989	1	2	0	0	1	32	32	6	0.0000	0.0000	0.0000	1.6671	0.0000
0.0000	0.0000	86.8619	0.0000	0.0000	11.4709	0.0000	0.0000	0.0000					
1989	1	2	0	0	1	33	33	6	0.0000	0.0000	0.0000	11.1103	0.0000
0.0000	2.2426	53.1446	4.0837	5.7126	23.7062	0.0000	0.0000	0.0000					
1989	1	2	0	0	1	34	34	6	0.0000	0.0000	0.0000	4.0316	0.0000
0.0000	0.0000	73.0170	3.8792	9.7322	9.3399	0.0000	0.0000	0.0000					
1989	1	2	0	0	1	35	35	4	0.0000	0.0000	0.0000	0.0000	0.0000
8.5068	0.0000	67.4896	2.8932	7.0481	13.4653	0.0000	0.0000	0.5969					
1989	1	2	0	0	1	36	36	5	0.0000	3.0608	0.0000	0.0000	0.0000
0.0000	0.0000	71.0214	0.0000	4.2157	17.9739	0.0000	0.0000	3.7283					
1989	1	2	0	0	1	37	37	4	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	59.3457	0.0000	3.9483	27.9484	0.0000	0.0000	8.7576					
1989	1	2	0	0	1	38	38	4	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	65.6347	0.0000	0.0000	30.0995	0.0000	0.0000	4.2659					
1989	1	2	0	0	1	39	39	3	0.0000	0.0000	0.0000	6.8382	0.0000
0.0000	0.0000	71.0408	0.0000	0.0000	12.4522	0.0000	9.6688	0.0000					
1989	1	2	0	0	1	40	40	2	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	26.7426	8.9142	0.0000	64.3432	0.0000	0.0000	0.0000					
1989	1	2	0	0	1	41	41	2	0.0000	0.0000	0.0000	4.0625	0.0000
0.0000	0.0000	47.9688	0.0000	23.9844	23.9844	0.0000	0.0000	0.0000					
1989	1	2	0	0	1	42	42	1	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	33.3333	0.0000	33.3333	0.0000	0.0000	33.3333	0.0000					
1989	1	2	0	0	1	43	43	3	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	49.3889	0.0000	0.0000	50.6111	0.0000	0.0000	0.0000					
1989	1	2	0	0	1	44	44	3	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	51.7326	0.0000	0.0000	21.7610	0.0000	0.0000	26.5064					
1989	1	2	0	0	1	45	45	2	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	41.4164	0.0000	0.0000	29.2918	0.0000	0.0000	29.2918					
1989	1	2	0	0	1	46	46	1	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	100.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1989	1	2	0	0	1	47	47	1	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	50.0000	0.0000	0.0000	0.0000	0.0000	0.0000	50.0000					
1989	1	2	0	0	1	48	48	2	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	64.5512	0.0000	0.0000	35.4488	0.0000	0.0000	0.0000					
1989	1	2	0	0	1	51	51	4	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	71.9844	0.0000	0.0000	4.7915	0.0000	0.0000	23.2241					

1990	1	2	0	0	1	19	19	2	0.0000	100.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1990	1	2	0	0	1	20	20	3	0.0000	35.7231	24.4672	0.0000	15.3425
24.4672	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1990	1	2	0	0	1	21	21	3	0.0000	85.7913	0.0000	0.0000	14.2087
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1990	1	2	0	0	1	22	22	4	0.0000	60.5645	15.5811	0.0000	18.6213
1.1096	0.0000	0.0000	4.1235	0.0000	0.0000	0.0000	0.0000	0.0000					
1990	1	2	0	0	1	23	23	5	0.0000	33.2665	3.2314	0.0000	63.5021
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1990	1	2	0	0	1	24	24	6	0.0000	11.8141	6.7755	0.0000	75.6215
0.9087	0.0000	0.0000	3.1622	0.0000	0.0000	1.7180	0.0000	0.0000					
1990	1	2	0	0	1	25	25	4	0.0000	5.6135	5.1876	1.5057	76.2552
0.0000	1.4233	0.0000	10.0147	0.0000	0.0000	0.0000	0.0000	0.0000					
1990	1	2	0	0	1	26	26	4	0.0000	1.1787	1.4615	0.0000	76.2210
0.0000	0.0000	0.0000	20.1135	1.0254	0.0000	0.0000	0.0000	0.0000					
1990	1	2	0	0	1	27	27	4	0.0000	0.0000	2.3674	0.0000	69.7542
2.0254	0.0000	0.0000	24.6559	0.0000	0.0000	1.1971	0.0000	0.0000					
1990	1	2	0	0	1	28	28	4	0.0000	0.0000	1.9858	0.0000	58.6654
0.0000	0.0000	0.0000	39.3488	0.0000	0.0000	0.0000	0.0000	0.0000					
1990	1	2	0	0	1	29	29	4	0.0000	0.0000	0.0000	0.0000	51.0920
1.2324	1.2324	0.0000	44.0766	1.8843	0.0000	0.4823	0.0000	0.0000					
1990	1	2	0	0	1	30	30	4	0.0000	0.0000	0.0000	0.0000	30.1584
1.1719	0.0000	0.0000	67.4978	1.1719	0.0000	0.0000	0.0000	0.0000					
1990	1	2	0	0	1	31	31	5	0.0000	0.0000	0.0000	0.0000	19.8203
0.0000	0.0000	0.0000	63.7319	0.0000	0.0000	16.4478	0.0000	0.0000					
1990	1	2	0	0	1	32	32	5	0.0000	0.0000	0.0000	0.0000	16.3544
0.0000	0.0000	0.0000	77.5344	1.5708	0.0000	4.5404	0.0000	0.0000					
1990	1	2	0	0	1	33	33	6	0.0000	0.0000	0.0000	0.0000	7.4256
0.0000	0.0000	0.0000	89.1205	0.0000	0.0000	3.4539	0.0000	0.0000					
1990	1	2	0	0	1	34	34	4	0.0000	0.0000	0.0000	0.0000	8.0127
0.0000	0.0000	0.0000	66.4542	0.0000	0.0000	25.5331	0.0000	0.0000					
1990	1	2	0	0	1	35	35	5	0.0000	0.0000	0.0000	0.0000	4.9469
1.8055	0.0000	0.0000	89.6365	0.0000	0.0000	3.6110	0.0000	0.0000					
1990	1	2	0	0	1	36	36	3	0.0000	0.0000	0.0000	0.0000	36.4109
0.0000	0.0000	0.0000	37.7752	18.2054	0.0000	5.0723	2.5362	0.0000					
1990	1	2	0	0	1	37	37	4	0.0000	0.0000	0.0000	0.0000	20.3994
10.1997	1.4209	0.0000	46.6066	0.0000	0.0000	19.9526	0.0000	1.4209					
1990	1	2	0	0	1	38	38	4	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	98.2304	0.0000	0.0000	1.7696	0.0000	0.0000					
1990	1	2	0	0	1	39	39	3	0.0000	0.0000	0.0000	0.0000	4.4949
0.0000	0.0000	0.0000	45.7511	0.0000	0.0000	41.2561	0.0000	8.4979					
1990	1	2	0	0	1	40	40	4	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	91.5065	0.0000	0.0000	5.5551	0.0000	2.9384					
1990	1	2	0	0	1	41	41	3	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	81.1256	0.0000	0.0000	18.8744	0.0000	0.0000					
1990	1	2	0	0	1	42	42	2	0.0000	0.0000	0.0000	0.0000	67.1548
0.0000	0.0000	0.0000	32.8452	0.0000	0.0000	0.0000	0.0000	0.0000					
1990	1	2	0	0	1	43	43	4	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	51.4269	0.0000	0.0000	24.6790	0.0000	23.8942					
1990	1	2	0	0	1	44	44	4	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	97.0837	0.0000	0.0000	2.9163	0.0000	0.0000					
1990	1	2	0	0	1	45	45	2	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	26.8376	0.0000	0.0000	73.1624	0.0000	0.0000					
1990	1	2	0	0	1	46	46	2	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	21.7905	0.0000	0.0000	78.2095	0.0000	0.0000					
1990	1	2	0	0	1	47	47	1	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	100.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1990	1	2	0	0	1	48	48	2	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	100.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1990	1	2	0	0	1	50	50	1	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	50.0000	0.0000	0.0000	50.0000	0.0000	0.0000					
1990	1	2	0	0	1	51	51	1	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	100.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1991	1	2	0	0	1	20	20	1	0.0000	100.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1991	1	2	0	0	1	21	21	1	0.0000	0.0000	0.0000	0.0000	0.0000
100.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1991	1	2	0	0	1	22	22	1	0.0000	0.0000	100.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					

1991	1	2	0	0	1	23	23	3	0.0000	0.0000	19.2376	0.0000	0.0000
33.3563	0.0000	0.0000	0.0000	47.4061	0.0000	0.0000	0.0000	0.0000					
1991	1	2	0	0	1	24	24	6	0.0000	0.0000	50.8965	0.0000	0.0000
14.7887	0.0000	0.0000	0.0000	34.3148	0.0000	0.0000	0.0000	0.0000					
1991	1	2	0	0	1	25	25	14	0.0000	0.0000	19.6483	6.6233	0.0000
40.4406	0.0000	0.0000	0.0000	29.4001	0.0000	0.0000	3.8877	0.0000					
1991	1	2	0	0	1	26	26	16	0.0000	0.0000	5.6833	2.6161	0.0000
63.9009	0.0000	0.0000	0.0000	27.7997	0.0000	0.0000	0.0000	0.0000					
1991	1	2	0	0	1	27	27	16	0.0000	0.0000	7.6819	1.0123	0.0000
59.7111	0.6366	0.0000	0.0000	30.9581	0.0000	0.0000	0.0000	0.0000					
1991	1	2	0	0	1	28	28	16	0.0000	0.0000	7.6250	1.0092	0.5664
52.9652	0.3267	0.0000	0.0000	36.9122	0.3267	0.0000	0.2687	0.0000					
1991	1	2	0	0	1	29	29	16	0.0000	0.0000	2.4189	2.1439	0.0000
57.4609	0.0000	0.0000	0.0000	37.9763	0.0000	0.0000	0.0000	0.0000					
1991	1	2	0	0	1	30	30	16	0.0000	0.0000	3.7635	1.0953	0.0000
52.7777	1.0522	0.0000	0.0000	40.9601	0.0000	0.0000	0.3512	0.0000					
1991	1	2	0	0	1	31	31	16	0.0000	0.0000	0.0000	0.9689	0.6273
58.5972	0.0000	0.0000	0.0000	37.9596	0.0000	0.0000	1.8470	0.0000					
1991	1	2	0	0	1	32	32	16	0.0000	0.0000	1.4660	0.9599	1.2436
51.7808	0.4454	0.0000	0.0000	38.9176	0.0000	0.0000	5.1868	0.0000					
1991	1	2	0	0	1	33	33	13	0.0000	0.0000	0.0000	5.2182	0.0000
56.6579	0.0000	0.0000	0.0000	33.5796	0.0000	0.0000	2.7799	1.7645					
1991	1	2	0	0	1	34	34	13	0.0000	0.0000	1.2305	4.8022	0.0000
47.0160	0.0000	0.0000	0.0000	43.9191	3.0322	0.0000	0.0000	0.0000					
1991	1	2	0	0	1	35	35	8	0.0000	0.0000	5.3333	19.6523	0.0000
38.1907	0.0000	0.0000	0.0000	24.3468	0.0000	0.0000	12.4769	0.0000					
1991	1	2	0	0	1	36	36	4	0.0000	0.0000	0.0000	0.0000	0.0000
39.9216	0.0000	0.0000	0.0000	60.0784	0.0000	0.0000	0.0000	0.0000					
1991	1	2	0	0	1	37	37	8	0.0000	0.0000	0.0000	0.0000	0.0000
5.4106	0.0000	0.0000	0.0000	94.5894	0.0000	0.0000	0.0000	0.0000					
1991	1	2	0	0	1	38	38	3	0.0000	0.0000	0.0000	0.0000	0.0000
15.5855	0.0000	0.0000	0.0000	68.8290	0.0000	0.0000	15.5855	0.0000					
1991	1	2	0	0	1	39	39	5	0.0000	0.0000	0.0000	13.5111	0.0000
33.1684	0.0000	0.0000	0.0000	43.6433	0.0000	0.0000	9.6772	0.0000					
1991	1	2	0	0	1	40	40	3	0.0000	0.0000	0.0000	0.0000	0.0000
48.1802	0.0000	0.0000	0.0000	51.8198	0.0000	0.0000	0.0000	0.0000					
1991	1	2	0	0	1	41	41	2	0.0000	0.0000	0.0000	0.0000	0.0000
61.4689	0.0000	0.0000	0.0000	38.5311	0.0000	0.0000	0.0000	0.0000					
1991	1	2	0	0	1	42	42	2	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	100.0000	0.0000	0.0000	0.0000	0.0000					
1991	1	2	0	0	1	43	43	2	0.0000	0.0000	0.0000	0.0000	0.0000
34.7238	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	65.2762	0.0000					
1991	1	2	0	0	1	45	45	1	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	100.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1991	1	2	0	0	1	47	47	1	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	100.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1991	1	2	0	0	1	49	49	1	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	100.0000	0.0000					
1991	1	2	0	0	1	50	50	1	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	100.0000	0.0000	0.0000	0.0000	0.0000					
1991	1	2	0	0	1	51	51	1	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	100.0000	0.0000	0.0000	0.0000	0.0000					
1992	1	2	0	0	1	18	18	1	0.0000	0.0000	0.0000	100.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1992	1	2	0	0	1	19	19	1	0.0000	0.0000	100.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1992	1	2	0	0	1	20	20	2	0.0000	0.0000	0.0000	85.6597	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	14.3403	0.0000	0.0000	0.0000					
1992	1	2	0	0	1	21	21	3	0.0000	0.0000	80.3424	19.6576	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1992	1	2	0	0	1	22	22	9	0.0000	6.2879	44.7363	38.3101	0.0000
0.0000	10.6657	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1992	1	2	0	0	1	23	23	15	0.0000	7.0722	41.5500	20.0280	2.9101
0.0000	28.4396	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1992	1	2	0	0	1	24	24	22	0.0000	4.5658	31.6650	32.4590	3.7538
0.0000	26.8091	0.0000	0.0000	0.0000	0.7472	0.0000	0.0000	0.0000					
1992	1	2	0	0	1	25	25	27	0.0000	0.0000	15.5741	31.8231	3.3404
1.0983	40.1073	0.0000	0.0000	0.0000	8.0568	0.0000	0.0000	0.0000					
1992	1	2	0	0	1	26	26	29	0.0000	0.1863	7.2162	25.8570	3.1171
0.0000	51.5449	0.0000	0.0000	0.0000	12.0784	0.0000	0.0000	0.0000					

1992	1	2	0	0	1	27	27	29	0.0000	0.3284	4.5688	22.1408	5.4517
0.3489	46.2755	0.3702	0.0000	0.3489	20.1668	0.0000	0.0000	0.0000					
1992	1	2	0	0	1	28	28	29	0.0000	0.0000	2.5722	14.1088	3.9159
0.2611	51.3812	0.2278	0.0000	0.0000	26.7931	0.0000	0.0000	0.7399					
1992	1	2	0	0	1	29	29	29	0.0000	0.0000	0.8081	7.8786	2.9477
0.5650	52.0025	0.8084	0.0000	0.0000	34.6561	0.0000	0.0000	0.3337					
1992	1	2	0	0	1	30	30	29	0.0000	0.4800	0.0000	6.5071	1.1843
0.7626	49.9765	0.5615	0.0000	0.0000	37.5026	1.2594	0.0000	1.7659					
1992	1	2	0	0	1	31	31	27	0.0000	0.0000	0.0000	1.7841	0.6335
0.0000	61.2641	0.0000	0.0000	0.5236	35.3381	0.0000	0.0000	0.4566					
1992	1	2	0	0	1	32	32	28	0.0000	0.0000	0.0000	4.5975	1.0209
0.0000	58.5140	0.0000	0.0000	0.0000	32.1291	0.0000	2.2907	1.4478					
1992	1	2	0	0	1	33	33	16	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	50.8801	0.0000	0.0000	0.0000	46.3370	0.0000	0.0000	2.7828					
1992	1	2	0	0	1	34	34	15	0.0000	0.0000	0.0000	0.0000	6.1009
0.0000	35.9426	0.0000	0.0000	0.0000	38.1745	0.0000	0.0000	19.7821					
1992	1	2	0	0	1	35	35	12	0.0000	0.0000	6.3754	0.0000	0.0000
0.0000	56.9667	0.0000	0.0000	0.0000	25.5639	0.0000	0.0000	11.0940					
1992	1	2	0	0	1	36	36	7	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	28.6995	0.0000	0.0000	0.0000	51.8697	0.0000	0.0000	19.4308					
1992	1	2	0	0	1	37	37	4	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	66.8232	0.0000	0.0000	0.0000	17.0368	0.0000	0.0000	16.1400					
1992	1	2	0	0	1	38	38	4	0.0000	0.0000	0.0000	39.7366	0.0000
0.0000	20.5850	0.0000	0.0000	0.0000	21.7288	0.0000	0.0000	17.9496					
1992	1	2	0	0	1	39	39	4	0.0000	0.0000	0.0000	13.4411	29.3404
0.0000	19.8597	0.0000	0.0000	0.0000	23.9177	0.0000	0.0000	13.4411					
1992	1	2	0	0	1	40	40	1	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	100.0000	0.0000	0.0000	0.0000					
1992	1	2	0	0	1	41	41	3	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	49.1174	0.0000	0.0000	0.0000	50.8826	0.0000	0.0000	0.0000					
1992	1	2	0	0	1	43	43	1	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	100.0000	0.0000	0.0000	0.0000					
1992	1	2	0	0	1	44	44	2	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	100.0000	0.0000	0.0000	0.0000					
1992	1	2	0	0	1	51	51	1	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	100.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1993	1	2	0	0	1	15	15	1	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	100.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1993	1	2	0	0	1	17	17	1	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	100.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1993	1	2	0	0	1	21	21	5	0.0000	26.6898	0.0000	0.0000	18.3235
0.0000	0.0000	10.3733	0.0000	0.0000	0.0000	44.6133	0.0000	0.0000					
1993	1	2	0	0	1	22	22	10	0.0000	37.8464	0.0000	47.5900	14.5636
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1993	1	2	0	0	1	23	23	14	0.0000	4.9041	22.0439	39.1695	23.9205
0.0000	0.0000	2.7889	0.0000	0.0000	0.0000	7.1732	0.0000	0.0000					
1993	1	2	0	0	1	24	24	17	0.0000	0.6494	7.0367	39.8757	33.0115
4.0036	0.0000	13.6150	0.0000	0.0000	0.0000	1.8081	0.0000	0.0000					
1993	1	2	0	0	1	25	25	17	0.0000	1.3388	4.8118	28.2022	24.9771
1.5960	0.0000	33.9739	0.8396	0.0000	0.0000	4.2605	0.0000	0.0000					
1993	1	2	0	0	1	26	26	18	0.0000	0.8310	2.3378	18.2521	26.4722
0.7770	0.1619	44.9885	0.0000	0.0000	0.0000	6.1795	0.0000	0.0000					
1993	1	2	0	0	1	27	27	18	0.0000	0.0000	2.1300	13.8090	16.3809
2.2466	0.4296	51.2941	0.0000	0.0000	0.0000	13.7098	0.0000	0.0000					
1993	1	2	0	0	1	28	28	18	0.0000	0.0000	0.1665	9.7005	20.0005
1.8943	0.9956	47.9483	0.0000	0.0000	0.0000	19.2943	0.0000	0.0000					
1993	1	2	0	0	1	29	29	18	0.0000	0.0000	0.0000	4.0128	19.1813
2.2702	0.0000	54.6354	1.4544	0.0000	0.0000	18.0235	0.0000	0.4223					
1993	1	2	0	0	1	30	30	18	0.0000	0.0000	0.4842	3.2948	19.1826
1.0716	0.0000	47.2305	0.0000	0.0000	0.0000	27.1141	1.6221	0.0000					
1993	1	2	0	0	1	31	31	17	1.4840	0.0000	2.0119	5.1462	5.9392
1.2735	0.0000	60.5888	0.0000	0.0000	0.0000	23.5563	0.0000	0.0000					
1993	1	2	0	0	1	32	32	13	0.0000	0.0000	0.0000	0.0000	6.7564
3.2026	0.0000	56.7488	0.0000	0.0000	0.0000	33.2922	0.0000	0.0000					
1993	1	2	0	0	1	33	33	12	0.0000	0.0000	0.0000	0.0000	4.4877
0.0000	0.0000	46.0230	0.0000	0.0000	0.0000	49.4894	0.0000	0.0000					
1993	1	2	0	0	1	34	34	4	0.0000	0.0000	0.0000	0.0000	10.4251
24.2361	0.0000	52.0746	0.0000	0.0000	0.0000	13.2642	0.0000	0.0000					
1993	1	2	0	0	1	35	35	5	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	90.2191	0.0000	0.0000	0.0000	9.7809	0.0000	0.0000					

1993	1	2	0	0	1	36	36	1	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	100.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
1993	1	2	0	0	1	39	39	5	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	84.4475	0.0000	0.0000	0.0000	15.5525	0.0000	0.0000
1994	1	2	0	0	1	14	14	1	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	100.0000
1994	1	2	0	0	1	16	16	1	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	100.0000	0.0000
1994	1	2	0	0	1	17	17	1	0.0000	0.0000	0.0000	100.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
1994	1	2	0	0	1	18	18	1	0.0000	0.0000	0.0000	0.0000	100.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
1994	1	2	0	0	1	22	22	6	0.0000	14.4585	31.9991	5.9410	2.6279	14.4585	0.0000	0.0000	12.3868	18.1283	0.0000	0.0000	0.0000	0.0000
1994	1	2	0	0	1	23	23	10	0.0000	6.0661	47.4744	8.1868	9.2152	12.2838	0.0000	0.0000	13.2767	0.0000	0.0000	0.0000	3.4970	0.0000
1994	1	2	0	0	1	24	24	20	0.0000	11.2990	12.4229	16.6869	20.5798	20.3017	10.5249	0.0000	6.1926	0.0000	0.0000	0.0000	1.9922	0.0000
1994	1	2	0	0	1	25	25	24	0.0000	0.8490	6.3622	3.9495	20.7882	29.5400	1.9631	1.8837	27.1227	0.0000	0.0000	0.0000	7.5416	0.0000
1994	1	2	0	0	1	26	26	28	0.0000	1.2578	3.6380	5.6402	18.2769	22.2773	3.2224	0.4621	38.9595	0.8383	0.0000	0.0000	5.2828	0.1446
1994	1	2	0	0	1	27	27	29	0.0000	0.0000	3.0747	2.3867	14.4386	21.4523	1.7714	0.2478	42.5464	0.5635	0.0000	0.0000	13.3054	0.2130
1994	1	2	0	0	1	28	28	30	0.0000	0.0000	0.3694	1.0625	9.8580	18.5671	3.1453	1.3310	50.7316	0.5218	0.0000	0.0000	13.9831	0.4302
1994	1	2	0	0	1	29	29	31	0.0000	0.1746	0.3953	1.7092	12.9185	19.5231	2.7557	1.4986	45.0807	0.6697	0.2670	0.0000	14.6172	0.3905
1994	1	2	0	0	1	30	30	30	0.0000	0.0000	0.6154	0.9075	7.1674	16.6082	2.4943	0.0000	48.5380	1.0980	1.0605	0.0000	20.9602	0.5506
1994	1	2	0	0	1	31	31	28	0.0000	0.0000	0.0000	0.6276	4.9702	10.5820	2.3404	0.4291	57.6936	0.1380	0.0000	0.0000	21.6141	1.6052
1994	1	2	0	0	1	32	32	28	0.0000	0.0000	1.2824	0.4869	9.3177	16.0695	2.2733	0.0000	49.1590	0.0000	1.2578	0.0000	20.1535	0.0000
1994	1	2	0	0	1	33	33	27	0.0000	0.0000	0.0000	0.0000	4.3780	6.9685	6.5269	0.0000	63.4885	0.7242	0.0000	0.0000	17.2196	0.6942
1994	1	2	0	0	1	34	34	23	0.0000	0.0000	0.0000	2.1538	2.8669	10.8352	2.1653	1.2172	43.7358	1.2603	0.0000	0.0000	35.7654	0.0000
1994	1	2	0	0	1	35	35	18	0.0000	0.0000	0.0000	0.0000	0.0000	14.6412	1.8250	0.0000	68.8108	0.0000	0.0000	0.0000	12.0511	2.6720
1994	1	2	0	0	1	36	36	21	0.0000	0.0000	0.0000	0.0000	1.5690	5.6967	0.0000	0.0000	77.2324	0.0000	0.0000	0.0000	13.1471	2.3548
1994	1	2	0	0	1	37	37	12	0.0000	0.0000	0.0000	0.0000	20.1111	6.8357	6.7826	0.0000	50.7438	0.0000	0.0000	0.0000	6.1955	9.3312
1994	1	2	0	0	1	38	38	9	0.0000	0.0000	0.0000	0.0000	0.0000	11.1169	0.0000	0.0000	67.0520	0.0000	0.0000	0.0000	21.8311	0.0000
1994	1	2	0	0	1	39	39	6	0.0000	0.0000	0.0000	0.0000	20.5179	0.0000	0.0000	0.0000	71.0039	0.0000	0.0000	0.0000	8.4782	0.0000
1994	1	2	0	0	1	40	40	8	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	31.8341	0.0000	0.0000	0.0000	68.1659	0.0000
1994	1	2	0	0	1	41	41	6	0.0000	0.0000	0.0000	0.0000	0.0000	17.4656	0.0000	0.0000	35.5239	0.0000	0.0000	0.0000	21.2441	25.7665
1994	1	2	0	0	1	42	42	5	0.0000	0.0000	0.0000	0.0000	19.2392	0.0000	0.0000	0.0000	34.7734	0.0000	0.0000	0.0000	45.9874	0.0000
1994	1	2	0	0	1	43	43	3	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	72.6101	0.0000	0.0000	0.0000	27.3899	0.0000
1994	1	2	0	0	1	44	44	2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	48.5051	0.0000	0.0000	0.0000	51.4949	0.0000
1994	1	2	0	0	1	45	45	3	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	62.6427	0.0000	0.0000	0.0000	0.0000	37.3573
1994	1	2	0	0	1	46	46	5	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	73.9850	0.0000	0.0000	0.0000	26.0150	0.0000
1994	1	2	0	0	1	47	47	1	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	100.0000	0.0000	0.0000	0.0000	0.0000	0.0000
1994	1	2	0	0	1	51	51	2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	24.8900	75.1100
1995	1	2	0	0	1	4	4	1	100.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
1995	1	2	0	0	1	5	5	2	100.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

1995	1	2	0	0	1	6	6	2	100.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1995	1	2	0	0	1	7	7	1	100.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1995	1	2	0	0	1	8	8	1	100.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1995	1	2	0	0	1	9	9	1	100.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1995	1	2	0	0	1	14	14	1	100.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1995	1	2	0	0	1	22	22	1	0.0000	0.0000	100.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1995	1	2	0	0	1	23	23	6	0.0000	10.6538	28.3016	39.8779	17.4412
3.7255	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1995	1	2	0	0	1	24	24	11	0.0000	0.0000	46.0288	24.6433	19.3823
1.1377	3.9358	0.0000	0.0000	4.8721	0.0000	0.0000	0.0000	0.0000					
1995	1	2	0	0	1	25	25	18	2.0151	1.7489	37.7617	21.5169	3.6474
10.0192	10.2279	3.9071	0.0000	9.1559	0.0000	0.0000	0.0000	0.0000					
1995	1	2	0	0	1	26	26	21	0.0000	0.0000	21.4840	15.2299	8.2037
16.7580	12.4910	5.4090	1.8969	13.1973	0.0000	1.2699	0.0000	4.0603					
1995	1	2	0	0	1	27	27	21	0.0000	1.4621	13.1683	10.0681	4.3691
11.8982	20.2917	3.0899	0.0000	29.5313	1.8141	0.0000	0.0000	4.3072					
1995	1	2	0	0	1	28	28	21	0.0000	0.3626	7.5269	9.0344	3.7396
13.4012	17.2258	2.1148	0.0000	36.7460	1.0195	0.0000	0.0000	8.8292					
1995	1	2	0	0	1	29	29	21	0.0000	0.9273	3.3657	1.7649	1.0752
11.9957	20.7637	2.8561	1.1670	41.3078	1.5160	0.0000	0.0000	13.2606					
1995	1	2	0	0	1	30	30	21	0.0000	0.6254	1.3095	1.4513	4.4794
14.6152	17.6470	4.5295	0.0000	42.0861	0.7842	0.0000	0.0000	12.4724					
1995	1	2	0	0	1	31	31	21	0.0000	0.0000	1.9459	1.7132	0.5627
12.0681	19.1760	3.4602	1.9755	43.7541	0.3082	0.0000	0.0000	15.0361					
1995	1	2	0	0	1	32	32	21	0.0000	0.0000	1.2182	2.6063	0.9849
7.0741	18.5017	7.9863	1.1466	38.1765	0.0000	0.0000	0.0000	22.3055					
1995	1	2	0	0	1	33	33	17	0.0000	0.0000	2.8853	0.0000	4.8046
8.8804	9.0454	7.5949	1.9407	48.4562	0.5610	0.0000	0.0000	15.8316					
1995	1	2	0	0	1	34	34	17	0.0000	0.0000	0.0000	2.8075	4.5812
3.1857	10.2594	8.3558	2.6622	51.0211	0.6556	0.0000	0.0000	16.4716					
1995	1	2	0	0	1	35	35	14	0.0000	0.0000	0.0000	0.0000	0.0000
3.3670	9.6102	9.5458	0.0000	55.3611	0.0000	0.0000	0.0000	22.1159					
1995	1	2	0	0	1	36	36	11	0.0000	0.0000	0.0000	0.0000	3.1627
3.1627	12.7777	8.9619	0.0000	51.7997	0.0000	0.0000	0.0000	20.1352					
1995	1	2	0	0	1	37	37	7	0.0000	0.0000	0.0000	0.0000	0.0000
11.2047	5.6975	2.8488	0.0000	71.7243	0.0000	0.0000	0.0000	8.5247					
1995	1	2	0	0	1	38	38	5	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	17.6680	10.1958	0.0000	57.2601	0.0000	0.0000	0.0000	14.8761					
1995	1	2	0	0	1	39	39	9	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	4.9656	0.0000	92.3786	0.0000	0.0000	0.0000	2.6558					
1995	1	2	0	0	1	40	40	6	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	24.3890	0.0000	7.1372	35.3064	0.0000	0.0000	0.0000	33.1674					
1995	1	2	0	0	1	41	41	4	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	60.0368	0.0000	0.0000	0.0000	39.9632					
1995	1	2	0	0	1	42	42	4	0.0000	0.0000	0.0000	0.0000	43.8814
0.0000	24.7729	0.0000	0.0000	8.1002	0.0000	0.0000	0.0000	23.2455					
1995	1	2	0	0	1	43	43	1	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	100.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1995	1	2	0	0	1	44	44	2	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	69.2498	0.0000	0.0000	0.0000	30.7502					
1995	1	2	0	0	1	45	45	3	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	14.8730	52.8292	0.0000	0.0000	0.0000	32.2978					
1995	1	2	0	0	1	46	46	1	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	100.0000					
1995	1	2	0	0	1	47	47	1	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	100.0000	0.0000	0.0000	0.0000	0.0000					
1995	1	2	0	0	1	48	48	1	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	100.0000					
1995	1	2	0	0	1	50	50	1	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	100.0000	0.0000	0.0000	0.0000	0.0000					
1995	1	2	0	0	1	51	51	1	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	100.0000	0.0000	0.0000	0.0000	0.0000					
1996	1	2	0	0	1	12	12	2	100.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					

1996	1	2	0	0	1	13	13	2	100.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
1996	1	2	0	0	1	14	14	3	78.0076	11.7577	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	10.2347	0.0000	0.0000	0.0000
1996	1	2	0	0	1	15	15	3	100.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
1996	1	2	0	0	1	16	16	4	100.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
1996	1	2	0	0	1	17	17	8	94.8812	5.1188	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
1996	1	2	0	0	1	18	18	9	89.5886	6.7133	0.0000	0.0000	3.6981	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
1996	1	2	0	0	1	19	19	12	100.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
1996	1	2	0	0	1	20	20	7	85.7299	11.7351	0.0000	0.0000	0.0000	0.0000	0.0000	2.5350	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
1996	1	2	0	0	1	21	21	8	72.3487	16.5795	7.2300	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.8418	0.0000	0.0000	0.0000
1996	1	2	0	0	1	22	22	6	38.8745	32.0014	0.0000	0.0000	29.1241	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
1996	1	2	0	0	1	23	23	14	9.0684	33.2724	3.5870	30.8600	14.7298	2.4478	2.4478	0.0000	0.0000	0.0000	3.5870	0.0000	0.0000	0.0000
1996	1	2	0	0	1	24	24	15	3.9226	18.4714	6.1814	16.5173	33.7676	2.6727	13.0775	1.6947	3.6948	0.0000	0.0000	0.0000	0.0000	0.0000
1996	1	2	0	0	1	25	25	22	0.0000	3.4021	4.8187	20.9632	26.9642	3.9740	16.3547	16.1433	0.0000	0.0000	7.3798	0.0000	0.0000	0.0000
1996	1	2	0	0	1	26	26	24	0.0000	2.2983	2.6885	21.2818	20.5699	3.7905	12.4498	12.8256	1.8007	2.5754	15.7647	0.5282	0.0000	3.4265
1996	1	2	0	0	1	27	27	24	0.0000	0.0000	0.2881	16.0579	20.4885	4.8585	14.5075	15.8043	0.2539	0.4841	22.3987	0.0000	0.0000	4.8586
1996	1	2	0	0	1	28	28	24	0.0000	0.3435	0.8692	8.5083	12.3609	4.8758	12.7770	17.6452	1.2519	0.0000	34.4438	0.0000	0.0000	6.9243
1996	1	2	0	0	1	29	29	24	0.0000	0.0000	0.0000	6.2472	8.8435	1.7685	14.1130	17.4975	2.1947	2.8530	37.8727	0.0000	0.0000	8.6100
1996	1	2	0	0	1	30	30	23	0.4097	0.9982	0.0000	4.1682	9.3085	3.8703	13.8288	20.7596	4.5244	1.1307	32.3307	0.0000	0.0000	8.6710
1996	1	2	0	0	1	31	31	23	0.0000	0.0000	0.0000	7.8320	2.5326	4.3156	9.3034	10.5391	6.5604	0.0000	42.3445	0.0000	0.0000	16.5724
1996	1	2	0	0	1	32	32	22	0.0000	0.0000	0.0000	2.0489	4.9198	2.0025	12.4525	10.6265	5.8694	0.0000	46.5845	0.0000	0.0000	15.4960
1996	1	2	0	0	1	33	33	17	0.0000	0.0000	0.0000	3.2628	4.9063	4.6609	12.3902	16.0379	1.7591	0.0000	44.9328	0.0000	0.0000	12.0500
1996	1	2	0	0	1	34	34	11	0.0000	0.0000	0.0000	4.1464	8.1333	0.0000	0.0000	22.0496	9.3078	0.0000	38.7191	0.0000	0.0000	17.6438
1996	1	2	0	0	1	35	35	12	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	17.5558	4.8629	0.0000	42.6823	0.0000	0.0000	34.8990
1996	1	2	0	0	1	36	36	4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	27.2358	33.8671	38.8971	0.0000	0.0000	0.0000
1996	1	2	0	0	1	37	37	7	0.0000	0.0000	0.0000	16.3021	0.0000	17.7081	19.0753	17.2038	0.0000	0.0000	29.7107	0.0000	0.0000	0.0000
1996	1	2	0	0	1	38	38	7	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	22.8103	0.0000	0.0000	61.2434	0.0000	0.0000	15.9463
1996	1	2	0	0	1	39	39	6	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	6.1202	0.0000	0.0000	0.0000	53.6431	0.0000	0.0000	40.2366
1996	1	2	0	0	1	40	40	1	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	100.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
1996	1	2	0	0	1	41	41	4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	39.4312	0.0000	0.0000	60.5688
1996	1	2	0	0	1	42	42	4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	74.0428	0.0000	0.0000	25.9572
1996	1	2	0	0	1	43	43	1	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	100.0000	0.0000	0.0000	0.0000
1996	1	2	0	0	1	46	46	2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	100.0000	0.0000	0.0000	0.0000
1996	1	2	0	0	1	47	47	1	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	100.0000
1996	1	2	0	0	1	49	49	1	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	100.0000
1997	1	2	0	0	1	19	19	1	100.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

1997	1	2	0	0	1	20	20	7	0.0000	81.0768	0.0000	18.9232	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1997	1	2	0	0	1	21	21	10	0.0000	20.1115	77.5042	0.0000	2.3844
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1997	1	2	0	0	1	22	22	17	2.1862	92.9427	3.5760	0.4681	0.0000
0.5445	0.0000	0.0000	0.0000	0.0000	0.0000	0.2826	0.0000	0.0000					
1997	1	2	0	0	1	23	23	21	0.3374	20.1641	28.0504	33.5001	0.3238
0.3847	17.0506	0.1889	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1997	1	2	0	0	1	24	24	22	0.2630	46.0588	43.4534	1.6216	4.6346
1.7022	0.7184	0.2724	1.2215	0.0000	0.0000	0.0000	0.0000	0.0541					
1997	1	2	0	0	1	25	25	22	0.6131	17.7140	37.2391	1.0979	7.2643
28.2294	0.4949	2.7945	2.4103	0.0000	0.0000	2.1425	0.0000	0.0000					
1997	1	2	0	0	1	26	26	23	0.0000	10.9674	13.8762	0.9089	11.0178
14.3445	2.0475	3.5702	36.3197	0.7429	0.0000	5.1554	0.0000	1.0494					
1997	1	2	0	0	1	27	27	23	0.0000	1.5181	24.6070	0.7182	27.2289
6.5875	10.7247	4.5754	15.3888	1.0711	0.4813	6.1515	0.3350	0.6125					
1997	1	2	0	0	1	28	28	23	0.0000	1.1386	1.5768	7.2051	18.7021
24.5253	7.4987	9.5959	10.3645	0.8885	0.0000	10.9969	6.8443	0.6634					
1997	1	2	0	0	1	29	29	23	0.0000	0.0000	1.3438	0.7895	15.8022
5.8932	11.7198	15.1517	16.3505	1.7849	0.2569	18.1323	11.8292	0.9459					
1997	1	2	0	0	1	30	30	22	0.0000	0.1541	0.5176	0.9401	31.0157
32.4702	0.4122	2.5547	7.7589	14.2932	0.6151	6.9604	0.2961	2.0117					
1997	1	2	0	0	1	31	31	22	0.0000	0.0000	0.0000	0.3708	18.6354
17.1067	0.8573	1.6956	19.5074	32.6800	0.0000	6.9234	1.1089	1.1146					
1997	1	2	0	0	1	32	32	18	0.0000	0.0000	0.0000	0.0000	15.5198
4.9636	6.2072	17.2204	15.7121	0.0000	0.0000	21.4871	2.8185	16.0713					
1997	1	2	0	0	1	33	33	18	0.0000	0.0000	0.0000	0.7487	2.2570
39.5750	0.1133	42.4071	4.0059	1.6902	1.6300	4.6953	0.9947	1.8828					
1997	1	2	0	0	1	34	34	14	0.0000	0.0000	0.0000	3.3503	9.4937
3.2181	0.0000	18.3153	20.7841	3.2181	0.0000	30.5483	5.7422	5.3298					
1997	1	2	0	0	1	35	35	9	0.0000	0.0000	0.0000	0.0000	8.4445
0.0000	0.0000	33.4947	0.9728	0.0000	0.0000	47.4580	9.6301	0.0000					
1997	1	2	0	0	1	36	36	5	0.0000	0.0000	0.0000	0.0000	4.1527
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	74.5960	0.0000	21.2513					
1997	1	2	0	0	1	37	37	2	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	8.3875	0.0000	0.0000	91.6125	0.0000	0.0000					
1997	1	2	0	0	1	38	38	3	0.0000	0.0000	0.0000	0.0000	97.5437
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.2854	1.8855	0.2854					
1997	1	2	0	0	1	40	40	1	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	100.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1997	1	2	0	0	1	41	41	1	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	100.0000					
1997	1	2	0	0	1	45	45	1	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	100.0000	0.0000	0.0000					
1997	1	2	0	0	1	49	49	1	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	100.0000	0.0000	0.0000					
1998	1	2	0	0	1	1	1	1	100.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1998	1	2	0	0	1	9	9	1	0.0000	100.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1998	1	2	0	0	1	15	15	1	0.0000	0.0000	100.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1998	1	2	0	0	1	17	17	4	3.4454	0.0000	1.8946	34.4925	0.0000
0.0000	25.6750	0.0000	34.4925	0.0000	0.0000	0.0000	0.0000	0.0000					
1998	1	2	0	0	1	18	18	8	0.0000	59.8556	37.4926	2.6519	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1998	1	2	0	0	1	19	19	10	12.5619	57.8007	17.7805	11.8568	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1998	1	2	0	0	1	20	20	17	0.0000	85.3760	12.0469	1.7238	0.0000
0.0000	0.0000	0.8533	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1998	1	2	0	0	1	21	21	18	0.0000	51.3866	38.1005	8.9539	1.5590
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1998	1	2	0	0	1	22	22	19	0.0000	44.6087	22.1469	27.6094	0.6415
1.3630	3.3097	0.0000	0.0000	0.0000	0.0000	0.0000	0.3208	0.0000					
1998	1	2	0	0	1	23	23	25	0.0000	11.6714	34.1848	46.6291	2.5282
1.7490	2.4290	0.0000	0.6648	0.1436	0.0000	0.0000	0.0000	0.0000					
1998	1	2	0	0	1	24	24	24	0.0000	3.0898	38.3291	33.5845	2.4741
13.7499	5.0000	1.0441	2.6143	0.1142	0.0000	0.0000	0.0000	0.0000					
1998	1	2	0	0	1	25	25	25	0.0000	0.0000	28.5037	47.6535	3.1239
9.2539	6.2631	1.1773	1.7497	2.1919	0.0000	0.0000	0.0830	0.0000					

1998	1	2	0	0	1	26	26	25	0.0000	3.5922	23.1875	33.6465	2.7300
10.1321	15.0962	0.0742	2.9252	7.1627	1.2619	0.0000	0.0000	0.1915					
1998	1	2	0	0	1	27	27	25	0.0000	0.2230	28.7138	18.8379	0.2059
7.8917	18.1749	5.1758	7.7714	8.1353	1.9907	0.1274	2.2193	0.5329					
1998	1	2	0	0	1	28	28	25	0.0000	1.4067	17.1958	16.2242	2.3773
13.9308	14.2595	3.6962	9.8896	11.1114	2.2326	0.0000	5.2154	2.4605					
1998	1	2	0	0	1	29	29	23	0.0000	3.4917	5.4887	6.5722	0.7343
21.2336	16.7645	0.1795	6.4888	14.3573	2.1027	0.0000	21.1978	1.3890					
1998	1	2	0	0	1	30	30	21	0.0000	0.0000	1.9862	5.3427	2.1193
24.0337	11.7148	0.3332	7.1828	9.9537	0.0000	0.7037	25.7308	10.8990					
1998	1	2	0	0	1	31	31	22	0.0000	0.0000	4.9417	11.6114	0.0000
8.6283	22.0083	0.0000	23.7538	2.3777	0.0000	0.0000	24.0849	2.5940					
1998	1	2	0	0	1	32	32	17	0.0000	0.0000	7.1689	4.6363	3.8814
26.2762	15.0353	2.5905	1.6836	7.4968	0.0000	0.3902	30.2303	0.6103					
1998	1	2	0	0	1	33	33	8	0.0000	0.0000	0.0000	0.0000	0.0000
2.6130	2.6130	0.0000	0.0000	28.8912	0.0000	7.4230	56.7110	1.7488					
1998	1	2	0	0	1	34	34	8	0.0000	0.0000	0.0000	29.3671	0.0000
18.5193	2.9120	0.0000	7.6187	8.1788	0.0000	0.0000	33.4042	0.0000					
1998	1	2	0	0	1	35	35	6	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	3.3786	0.0000	45.4246	39.9996	0.0000	0.0000	0.0000	11.1973					
1998	1	2	0	0	1	36	36	2	0.0000	0.0000	0.0000	0.0000	0.0000
29.3114	0.0000	0.0000	0.0000	29.3114	41.3772	0.0000	0.0000	0.0000					
1998	1	2	0	0	1	37	37	2	0.0000	0.0000	0.0000	0.0000	0.0000
47.9537	47.9537	4.0926	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1998	1	2	0	0	1	38	38	3	0.0000	0.0000	0.0000	14.9752	0.0000
0.0000	0.0000	0.0000	19.2433	65.7815	0.0000	0.0000	0.0000	0.0000					
1998	1	2	0	0	1	39	39	2	0.0000	0.0000	0.0000	76.8209	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	23.1791	0.0000					
1998	1	2	0	0	1	40	40	1	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	100.0000	0.0000	0.0000	0.0000					
1998	1	2	0	0	1	44	44	1	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	100.0000	0.0000					
1999	1	2	0	0	1	2	2	1	100.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1999	1	2	0	0	1	3	3	1	100.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1999	1	2	0	0	1	4	4	2	100.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1999	1	2	0	0	1	7	7	2	100.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1999	1	2	0	0	1	10	10	1	100.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1999	1	2	0	0	1	11	11	1	100.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1999	1	2	0	0	1	12	12	3	100.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1999	1	2	0	0	1	13	13	5	100.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1999	1	2	0	0	1	14	14	10	94.6376	1.1095	4.2529	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1999	1	2	0	0	1	15	15	7	97.8549	0.0000	0.0000	2.1451	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1999	1	2	0	0	1	16	16	10	97.0726	0.4496	2.4778	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1999	1	2	0	0	1	17	17	16	87.7470	6.7411	5.5119	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1999	1	2	0	0	1	18	18	17	71.3126	17.6973	4.4448	6.5452	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1999	1	2	0	0	1	19	19	19	46.6888	27.1769	22.5983	3.5361	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1999	1	2	0	0	1	20	20	26	22.7967	39.3763	28.6332	5.1512	4.0426
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1999	1	2	0	0	1	21	21	27	0.3731	35.3539	46.4436	14.6905	3.1390
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1999	1	2	0	0	1	22	22	30	0.0000	18.4635	41.5785	22.2615	17.1277
0.0000	0.0000	0.5689	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1999	1	2	0	0	1	23	23	35	1.7355	10.3823	40.7963	22.6283	22.7352
0.0000	0.0000	1.7224	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1999	1	2	0	0	1	24	24	36	0.0000	2.4391	33.9976	25.9733	31.3929
4.3700	0.1568	1.6703	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					

1999	1	2	0	0	1	25	25	35	0.1611	2.8790	20.7361	39.2493	27.5741
3.5539	2.9799	1.6229	0.0000	0.0000	0.0000	0.0000	0.0000	1.2436					
1999	1	2	0	0	1	26	26	37	0.0000	1.4461	11.0482	41.6282	32.3638
3.7816	1.8844	1.8343	1.0996	2.2007	1.1518	0.0000	0.7399	0.8215					
1999	1	2	0	0	1	27	27	38	0.6285	1.2510	2.2789	39.8713	28.6417
3.1423	7.7646	8.8872	1.3478	2.1132	1.7500	0.0000	0.3966	1.9270					
1999	1	2	0	0	1	28	28	38	0.0000	0.0601	3.1758	36.1888	23.5396
3.0589	11.8537	9.3516	2.0086	3.4823	2.6113	1.8079	0.0000	2.8613					
1999	1	2	0	0	1	29	29	34	0.0000	0.0000	1.8395	24.9310	21.3679
4.0757	11.5135	8.1371	5.6077	7.8070	6.6966	1.7415	0.8717	5.4109					
1999	1	2	0	0	1	30	30	35	0.0000	0.0000	1.9482	37.5050	16.0633
0.8513	7.6020	15.3154	3.7622	4.5159	6.8102	0.9994	0.0000	4.6271					
1999	1	2	0	0	1	31	31	31	0.0000	0.0000	5.8809	30.4247	12.5163
0.0000	5.8766	11.0245	3.3369	2.4130	9.0141	4.1931	0.0000	15.3199					
1999	1	2	0	0	1	32	32	27	0.0000	2.5650	2.9423	12.1110	8.2400
7.0375	22.2208	10.7310	7.9834	2.7027	2.9876	2.2656	3.8632	14.3498					
1999	1	2	0	0	1	33	33	22	0.0000	0.0000	0.0000	11.2155	17.3296
0.0000	29.6857	9.5058	4.3954	10.0074	0.0000	6.6200	0.0000	11.2407					
1999	1	2	0	0	1	34	34	14	0.0000	0.0000	0.0000	6.7945	0.0000
0.6924	3.5969	15.9741	4.3380	7.6923	8.8294	5.2370	6.7129	40.1324					
1999	1	2	0	0	1	35	35	11	1.5017	0.0000	0.0000	6.4688	10.0428
0.0000	15.9582	14.9952	0.0000	0.0000	38.5261	10.4125	0.0000	2.0947					
1999	1	2	0	0	1	36	36	9	0.0000	0.0000	0.0000	22.6029	24.4873
0.0000	0.0000	0.0000	0.0000	20.6949	15.0158	0.0000	3.1319	14.0671					
1999	1	2	0	0	1	37	37	6	0.0000	0.0000	0.0000	2.3928	0.0000
19.5809	13.7001	0.0000	20.9967	2.3928	2.3928	19.1556	0.0000	19.3884					
1999	1	2	0	0	1	38	38	2	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	100.0000	0.0000	0.0000	0.0000	0.0000					
1999	1	2	0	0	1	39	39	4	0.0000	0.0000	0.0000	5.2727	0.0000
0.0000	0.0000	24.7555	0.0000	36.6476	33.3242	0.0000	0.0000	0.0000					
1999	1	2	0	0	1	40	40	4	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	29.4820	0.0000	0.0000	28.0885	6.8730	0.0000	35.5565	0.0000					
1999	1	2	0	0	1	41	41	1	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	100.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1999	1	2	0	0	1	42	42	1	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	100.0000	0.0000	0.0000	0.0000					
1999	1	2	0	0	1	43	43	1	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	100.0000	0.0000	0.0000	0.0000					
1999	1	2	0	0	1	45	45	1	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	100.0000					
1999	1	2	0	0	1	47	47	2	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	51.6311	0.0000	0.0000	0.0000	48.3689	0.0000	0.0000	0.0000					
2000	1	2	0	0	1	12	12	1	0.0000	100.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2000	1	2	0	0	1	15	15	1	0.0000	100.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2000	1	2	0	0	1	16	16	3	0.0000	100.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2000	1	2	0	0	1	17	17	4	0.0000	84.1370	15.8630	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2000	1	2	0	0	1	18	18	5	0.0000	100.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2000	1	2	0	0	1	19	19	6	0.0000	100.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2000	1	2	0	0	1	20	20	5	0.0000	90.7037	6.0536	0.0000	3.2426
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2000	1	2	0	0	1	21	21	9	2.8502	95.9526	0.0000	0.0000	1.1972
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2000	1	2	0	0	1	22	22	13	0.0000	88.0052	9.5750	2.4198	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2000	1	2	0	0	1	23	23	14	1.1740	88.4699	4.3847	2.3944	1.4019
0.0000	0.0000	2.1750	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2000	1	2	0	0	1	24	24	14	0.0000	84.5189	11.1647	3.3775	0.0000
0.0000	0.0000	0.0000	0.9389	0.0000	0.0000	0.0000	0.0000	0.0000					
2000	1	2	0	0	1	25	25	17	0.7002	71.2600	15.0732	3.5931	6.2459
2.8172	0.0000	0.0000	0.3103	0.0000	0.0000	0.0000	0.0000	0.0000					
2000	1	2	0	0	1	26	26	16	0.0000	45.9027	17.9657	8.2848	19.2957
6.9211	0.0000	0.7748	0.8552	0.0000	0.0000	0.0000	0.0000	0.0000					
2000	1	2	0	0	1	27	27	18	0.8062	34.1155	12.1712	16.2378	15.6014
13.2997	2.0121	2.9699	1.3277	0.6934	0.0000	0.0000	0.0000	0.7653					

2000	1	2	0	0	1	28	28	19	0.0000	14.0509	8.1382	10.2016	35.5219
19.6965	2.1266	3.0109	1.9057	3.6632	0.6577	1.0267	0.0000	0.0000					
2000	1	2	0	0	1	29	29	19	0.0000	7.9601	5.3036	14.4351	32.6668
25.1905	4.4965	2.9822	0.8918	0.7408	3.3722	0.5991	0.0000	1.3612					
2000	1	2	0	0	1	30	30	19	0.0000	1.8032	1.3350	10.5989	35.3355
23.8926	2.8062	7.9534	7.3059	0.6828	3.1039	0.5522	0.8460	3.7844					
2000	1	2	0	0	1	31	31	20	0.0000	0.9093	1.0448	3.7114	30.3537
29.9134	3.4956	6.9947	2.6153	1.3367	3.4113	12.8183	1.5953	1.8002					
2000	1	2	0	0	1	32	32	18	0.0000	0.9603	2.1467	7.9871	33.1434
15.2018	2.1201	12.1199	6.4598	4.2997	0.7020	4.6431	3.9872	6.2289					
2000	1	2	0	0	1	33	33	16	0.0000	0.0000	0.0000	8.2190	31.6499
18.8080	1.1624	12.7034	10.0289	7.0599	4.7562	1.4951	0.0000	4.1172					
2000	1	2	0	0	1	34	34	17	0.0000	0.0000	1.2085	2.0017	31.6943
19.7651	2.1221	21.3663	3.4694	1.2991	4.1445	10.5558	1.3574	1.0158					
2000	1	2	0	0	1	35	35	15	0.0000	0.0000	0.0000	0.4818	33.8017
19.3591	1.2685	12.9634	0.9512	0.4818	2.5955	0.6592	3.4017	24.0360					
2000	1	2	0	0	1	36	36	9	0.0000	0.5887	0.0000	0.0000	66.6340
8.2161	0.0000	0.0000	6.9103	0.0000	9.4295	6.4698	0.5887	1.1628					
2000	1	2	0	0	1	37	37	10	0.0000	0.0000	0.0000	11.5220	15.9183
0.0000	1.6331	26.5578	2.1208	1.7212	13.3548	12.6561	0.8487	13.6673					
2000	1	2	0	0	1	38	38	6	0.0000	3.0321	0.0000	0.0000	12.9927
5.2606	0.0000	5.6906	0.0000	57.8144	5.2606	0.0000	0.0000	9.9489					
2000	1	2	0	0	1	39	39	6	0.0000	0.0000	20.0439	0.0000	4.8480
0.0000	20.0439	5.1614	1.9729	0.0000	24.5484	20.0439	0.0000	3.3375					
2000	1	2	0	0	1	40	40	8	0.0000	0.0000	0.0000	0.0000	55.2635
0.0000	4.9076	4.3060	0.0000	0.0000	32.8521	2.6709	0.0000	0.0000					
2000	1	2	0	0	1	41	41	4	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	16.4847	0.0000	55.4426	0.0000	14.7289	0.0000	0.0000	13.3438					
2000	1	2	0	0	1	42	42	4	0.0000	0.0000	0.0000	0.0000	6.8087
6.8087	0.0000	46.8738	0.0000	0.0000	20.5300	0.0000	0.0000	18.9789					
2000	1	2	0	0	1	44	44	2	0.0000	0.0000	0.0000	0.0000	3.1611
0.0000	0.0000	0.0000	0.0000	96.8389	0.0000	0.0000	0.0000	0.0000					
2000	1	2	0	0	1	45	45	1	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	100.0000	0.0000	0.0000	0.0000					
2000	1	2	0	0	1	47	47	1	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	100.0000					
2000	1	2	0	0	1	48	48	1	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	100.0000	0.0000	0.0000					
2000	1	2	0	0	1	51	51	1	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	100.0000					
2001	1	2	0	0	1	12	12	1	100.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2001	1	2	0	0	1	22	22	1	0.0000	0.0000	0.0000	100.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2001	1	2	0	0	1	23	23	3	0.0000	0.0000	25.2248	0.0000	74.7752
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2001	1	2	0	0	1	24	24	4	0.0000	35.0968	64.9032	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2001	1	2	0	0	1	25	25	6	0.0000	12.5619	38.6885	29.3046	8.1788
0.0000	8.1788	0.0000	3.0873	0.0000	0.0000	0.0000	0.0000	0.0000					
2001	1	2	0	0	1	26	26	11	0.0000	10.6051	47.9065	1.8855	18.6558
17.2688	3.6782	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2001	1	2	0	0	1	27	27	15	0.0000	0.0000	49.8991	6.5348	26.5859
7.5934	5.4393	2.4826	0.0000	0.0000	1.4649	0.0000	0.0000	0.0000					
2001	1	2	0	0	1	28	28	18	0.0000	8.2561	42.8702	10.5765	9.7779
10.4295	7.9146	1.2916	0.0000	4.2439	1.4980	2.3998	0.7419	0.0000					
2001	1	2	0	0	1	29	29	20	0.0000	4.9425	37.8272	12.1583	19.0817
10.7765	6.2054	2.3492	1.2178	2.3304	0.0000	1.4246	0.7058	0.9807					
2001	1	2	0	0	1	30	30	20	0.0000	1.6174	23.0089	9.9997	14.7910
23.1580	17.5764	1.9380	2.0128	2.1124	0.4453	0.7993	2.0101	0.5306					
2001	1	2	0	0	1	31	31	20	0.0000	1.6219	22.3448	5.6923	12.2921
30.2529	5.3492	3.5770	3.1349	4.9783	1.3018	4.3030	2.8388	2.3131					
2001	1	2	0	0	1	32	32	20	0.0000	0.7375	21.6876	10.6965	8.8968
28.8062	12.3512	2.0641	5.2578	3.3536	0.2201	1.6195	2.5782	1.7309					
2001	1	2	0	0	1	33	33	20	0.0000	1.7561	16.8479	4.8175	7.7288
30.2077	13.7698	4.0777	3.3433	5.9727	2.0526	2.4755	2.3848	4.5656					
2001	1	2	0	0	1	34	34	19	0.0000	0.0000	6.6062	1.0494	5.2167
37.8560	24.3453	0.9989	4.9287	7.3963	4.7019	1.2642	3.7703	1.8660					
2001	1	2	0	0	1	35	35	18	0.0000	1.4872	1.2159	0.9395	6.3342
37.9015	24.7375	4.3686	6.8019	4.7427	0.0000	4.6578	3.0184	3.7948					

2001	1	2	0	0	1	36	36	19	0.0000	0.0000	0.0000	1.9467	9.2585
25.4506	18.8768	6.4191	0.9494	10.3323	3.6184	12.6713	0.9494	9.5274					
2001	1	2	0	0	1	37	37	17	0.0000	0.0000	1.3305	3.2822	10.1370
33.5628	12.0628	4.1253	6.7308	10.9591	0.0000	1.5370	8.7205	7.5519					
2001	1	2	0	0	1	38	38	17	0.0000	0.0000	0.0000	0.0000	11.4294
27.6693	18.6110	3.5874	10.9540	9.9317	2.5622	4.6699	3.3864	7.1987					
2001	1	2	0	0	1	39	39	17	0.0000	0.0000	0.0000	0.0000	5.4466
34.8437	20.6244	11.3742	7.0159	9.2641	5.0713	3.1561	3.2036	0.0000					
2001	1	2	0	0	1	40	40	12	0.0000	0.0000	0.0000	0.0000	0.0000
36.0220	5.3011	0.0000	11.0325	13.6640	9.9940	3.3418	7.7238	12.9208					
2001	1	2	0	0	1	41	41	9	0.0000	0.0000	6.8589	0.0000	7.1619
49.7460	0.0000	6.8589	22.2123	7.1619	0.0000	0.0000	0.0000	0.0000					
2001	1	2	0	0	1	42	42	7	0.0000	0.0000	0.0000	0.0000	6.9324
21.2889	5.3734	12.7642	18.0418	14.3104	21.2889	0.0000	0.0000	0.0000					
2001	1	2	0	0	1	43	43	4	0.0000	0.0000	0.0000	0.0000	0.0000
52.5958	0.0000	0.0000	23.6052	13.9290	9.8700	0.0000	0.0000	0.0000					
2001	1	2	0	0	1	44	44	2	0.0000	0.0000	0.0000	0.0000	0.0000
33.6671	33.6671	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	32.6658					
2001	1	2	0	0	1	45	45	2	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	28.2727	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	71.7273					
2001	1	2	0	0	1	46	46	3	0.0000	0.0000	0.0000	0.0000	0.0000
48.5839	27.9563	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	23.4599					
2001	1	2	0	0	1	47	47	1	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	100.0000	0.0000	0.0000					
2001	1	2	0	0	1	48	48	2	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	48.9195	0.0000	51.0805	0.0000	0.0000	0.0000	0.0000					
2002	1	2	0	0	1	18	18	1	0.0000	100.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2002	1	2	0	0	1	24	24	8	0.0000	42.3639	45.1912	12.4449	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2002	1	2	0	0	1	25	25	3	0.0000	17.1018	82.8982	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2002	1	2	0	0	1	26	26	5	0.0000	33.5639	17.2156	38.7468	0.0000
10.4737	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2002	1	2	0	0	1	27	27	11	0.0000	10.1682	42.7429	4.1362	31.5825
11.3703	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2002	1	2	0	0	1	28	28	15	0.0000	0.0000	21.0578	26.8497	24.8504
7.2586	8.3690	6.1733	2.0629	3.3782	0.0000	0.0000	0.0000	0.0000					
2002	1	2	0	0	1	29	29	22	0.0000	1.0663	22.9492	28.9467	8.3092
5.9522	15.1476	7.8443	1.0165	3.2895	2.7009	0.0000	2.7776	0.0000					
2002	1	2	0	0	1	30	30	24	0.0000	1.0806	10.4197	32.7813	11.5939
8.6118	16.2868	13.5632	1.2248	0.0000	0.0000	0.0000	2.8768	1.5611					
2002	1	2	0	0	1	31	31	25	0.0000	0.0000	10.2991	39.2676	10.2788
9.6153	13.0745	8.1587	2.9222	2.6789	2.7661	0.0000	0.9387	0.0000					
2002	1	2	0	0	1	32	32	26	0.0000	0.0000	8.9592	31.1028	14.7763
9.0802	16.5015	11.0516	1.7012	1.1197	4.2000	0.0000	0.0000	1.5074					
2002	1	2	0	0	1	33	33	26	0.0000	1.1350	5.9499	40.2491	6.7256
6.3068	20.4834	8.1864	0.6422	1.5461	2.7718	0.0000	3.0604	2.9432					
2002	1	2	0	0	1	34	34	26	0.0000	0.0000	4.8161	33.8745	6.3276
9.1029	18.4557	13.8195	3.9930	2.3153	4.1518	0.5827	0.0000	2.5609					
2002	1	2	0	0	1	35	35	26	0.0000	0.7673	8.9400	30.5344	6.4356
8.6302	19.3262	13.2542	2.8175	1.5265	2.0964	1.1651	0.8161	3.6906					
2002	1	2	0	0	1	36	36	26	0.0000	0.0000	4.9976	20.3347	7.5862
15.9785	30.3148	10.7139	1.1348	5.0741	0.7193	0.0000	1.1421	2.0041					
2002	1	2	0	0	1	37	37	25	0.0000	0.0000	3.3938	18.1511	8.8107
9.1303	37.3568	9.8545	0.8651	1.9355	2.4102	1.3884	2.0345	4.6692					
2002	1	2	0	0	1	38	38	25	0.0000	0.0000	5.1217	13.7079	6.2973
11.6000	30.2736	12.6475	3.9881	0.9051	7.1326	0.0000	2.8971	5.4292					
2002	1	2	0	0	1	39	39	21	0.0000	0.0000	0.0000	9.9737	2.1620
9.5299	35.3383	16.8471	2.4629	3.2460	8.5750	2.2157	0.0000	9.6493					
2002	1	2	0	0	1	40	40	13	0.0000	0.0000	3.7014	0.0000	3.1279
16.8292	40.9721	27.4825	3.3522	4.5347	0.0000	0.0000	0.0000	0.0000					
2002	1	2	0	0	1	41	41	18	0.0000	0.0000	4.0782	3.6010	8.7241
10.1919	24.4442	5.0716	4.1021	8.4367	10.1702	8.3743	0.0000	12.8057					
2002	1	2	0	0	1	42	42	12	0.0000	0.0000	5.5343	0.0000	0.0000
25.3984	17.3582	11.5257	7.9052	5.0439	8.9366	0.0000	4.8582	13.4395					
2002	1	2	0	0	1	43	43	12	0.0000	0.0000	0.0000	0.0000	0.0000
11.9223	61.8329	13.6021	0.0000	6.2803	0.0000	6.3624	0.0000	0.0000					
2002	1	2	0	0	1	44	44	7	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	44.3172	21.2872	0.0000	10.5131	0.0000	0.0000	0.0000	23.8824					

2002	1	2	0	0	1	45	45	2	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	50.3248	0.0000	0.0000	49.6752	0.0000	0.0000	0.0000					
2002	1	2	0	0	1	46	46	1	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	100.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2002	1	2	0	0	1	47	47	2	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	34.7540	30.4919	34.7540	0.0000	0.0000	0.0000	0.0000	0.0000					
2002	1	2	0	0	1	48	48	1	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	100.0000	0.0000					
2002	1	2	0	0	1	49	49	1	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	100.0000	0.0000					
2003	1	2	0	0	1	13	13	2	0.0000	0.0000	0.0000	100.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2003	1	2	0	0	1	14	14	2	0.0000	0.0000	0.0000	100.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2003	1	2	0	0	1	17	17	1	0.0000	0.0000	0.0000	100.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2003	1	2	0	0	1	21	21	1	0.0000	0.0000	100.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2003	1	2	0	0	1	22	22	3	0.0000	0.0000	75.1993	0.0000	0.0000
0.0000	0.0000	24.8007	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2003	1	2	0	0	1	23	23	11	0.0000	0.0000	68.0069	11.9223	6.5124
10.1511	3.4072	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2003	1	2	0	0	1	24	24	14	0.0000	0.0000	68.5910	20.7945	2.7590
3.9542	1.9883	1.9129	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2003	1	2	0	0	1	25	25	14	0.0000	2.2715	56.1839	27.1537	4.6842
5.8375	1.0781	0.9145	1.8766	0.0000	0.0000	0.0000	0.0000	0.0000					
2003	1	2	0	0	1	26	26	15	0.0000	1.8347	58.2497	15.9159	5.4840
7.1744	3.1595	3.2125	2.8268	1.0581	0.0000	1.0843	0.0000	0.0000					
2003	1	2	0	0	1	27	27	15	0.0000	0.0000	37.9090	25.6187	4.1695
11.1978	7.9117	4.7170	5.6703	0.7105	1.3675	0.7281	0.0000	0.0000					
2003	1	2	0	0	1	28	28	15	0.0000	0.0000	41.1892	24.7730	3.1076
10.5619	5.5564	6.3114	4.6666	1.5611	0.0000	1.4044	0.0000	0.8685					
2003	1	2	0	0	1	29	29	15	0.0000	0.0000	27.3169	20.1340	8.1287
17.6890	8.4899	10.7135	5.5262	2.0018	0.0000	0.0000	0.0000	0.0000					
2003	1	2	0	0	1	30	30	15	0.0000	0.0000	29.7089	11.6836	5.8189
20.9520	7.7314	12.1244	3.8823	2.0193	1.4668	3.4105	0.0000	1.2020					
2003	1	2	0	0	1	31	31	15	0.0000	0.0000	12.7050	23.0225	11.3418
15.6006	7.2251	11.3127	13.4500	2.0643	0.0000	1.7657	0.0000	1.5122					
2003	1	2	0	0	1	32	32	13	0.0000	0.0000	14.9922	10.2756	19.6119
11.5581	15.5361	12.5532	5.5570	6.1898	0.0000	3.7262	0.0000	0.0000					
2003	1	2	0	0	1	33	33	13	0.0000	0.0000	5.1573	25.0678	17.7324
19.4986	13.4747	4.5097	9.1017	2.3121	0.0000	0.0000	3.1456	0.0000					
2003	1	2	0	0	1	34	34	11	0.0000	0.0000	10.2821	11.9718	16.1300
25.4043	6.6695	11.3009	8.4387	0.0000	3.7301	3.0363	3.0363	0.0000					
2003	1	2	0	0	1	35	35	11	0.0000	0.0000	0.0000	14.6259	5.3860
18.7776	10.2861	25.0699	7.1959	15.6727	0.0000	2.9858	0.0000	0.0000					
2003	1	2	0	0	1	36	36	9	0.0000	0.0000	7.4336	18.6799	31.6749
25.9355	0.0000	6.1934	0.0000	5.0413	0.0000	0.0000	0.0000	5.0413					
2003	1	2	0	0	1	37	37	7	0.0000	0.0000	8.1690	8.4396	6.9973
6.9973	0.0000	46.0660	6.9973	16.3335	0.0000	0.0000	0.0000	0.0000					
2003	1	2	0	0	1	38	38	6	0.0000	0.0000	0.0000	13.9593	0.0000
9.8441	10.1687	44.6501	7.4971	13.8807	0.0000	0.0000	0.0000	0.0000					
2003	1	2	0	0	1	39	39	8	0.0000	0.0000	0.0000	8.8864	25.5914
12.1233	0.0000	18.3589	0.0000	0.0000	10.7181	11.4809	0.0000	12.8410					
2003	1	2	0	0	1	40	40	5	0.0000	0.0000	0.0000	0.0000	0.0000
35.3488	0.0000	46.5278	0.0000	0.0000	0.0000	0.0000	0.0000	18.1233					
2003	1	2	0	0	1	41	41	5	0.0000	0.0000	0.0000	0.0000	30.4629
0.0000	29.8403	12.3816	12.3816	0.0000	14.9337	0.0000	0.0000	0.0000					
2003	1	2	0	0	1	42	42	3	0.0000	0.0000	0.0000	0.0000	31.2604
29.9916	0.0000	38.7480	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2003	1	2	0	0	1	43	43	1	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	100.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2003	1	2	0	0	1	44	44	1	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	50.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	50.0000					
2003	1	2	0	0	1	45	45	1	0.0000	0.0000	0.0000	0.0000	100.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2003	1	2	0	0	1	46	46	1	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	100.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2003	1	2	0	0	1	49	49	1	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	100.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					

2004	1	2	0	0	1	10	10	1	0.0000	0.0000	0.0000	100.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2004	1	2	0	0	1	11	11	1	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	100.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2004	1	2	0	0	1	13	13	1	0.0000	0.0000	0.0000	0.0000	100.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2004	1	2	0	0	1	14	14	1	0.0000	0.0000	0.0000	0.0000	100.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2004	1	2	0	0	1	15	15	2	58.5058	0.0000	0.0000	0.0000	41.4942
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2004	1	2	0	0	1	16	16	1	0.0000	0.0000	0.0000	100.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2004	1	2	0	0	1	17	17	1	0.0000	0.0000	0.0000	20.0000	80.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2004	1	2	0	0	1	18	18	2	0.0000	0.0000	0.0000	0.0000	70.3463
0.0000	0.0000	29.6537	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2004	1	2	0	0	1	19	19	2	0.0000	0.0000	69.7592	15.1204	15.1204
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2004	1	2	0	0	1	20	20	3	0.0000	18.5905	12.3094	12.3094	0.0000
56.7906	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2004	1	2	0	0	1	21	21	11	0.0000	59.5820	0.0000	28.2325	12.1855
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2004	1	2	0	0	1	22	22	20	0.0000	15.7398	5.3963	68.3498	6.0162
4.4979	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2004	1	2	0	0	1	23	23	26	0.0000	12.1471	4.2035	75.1852	7.0790
0.5242	0.8610	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2004	1	2	0	0	1	24	24	31	0.0000	3.3954	3.1360	83.0647	7.4869
1.9282	0.5061	0.4828	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2004	1	2	0	0	1	25	25	32	0.0000	0.4806	3.3481	73.8552	16.8292
1.3742	1.0506	1.6342	0.7833	0.6446	0.0000	0.0000	0.0000	0.0000					
2004	1	2	0	0	1	26	26	32	0.0000	0.1480	1.6040	77.4460	11.8914
1.5654	2.3193	2.9626	1.4027	0.6608	0.0000	0.0000	0.0000	0.0000					
2004	1	2	0	0	1	27	27	32	0.0000	0.0000	1.0505	71.5285	14.3562
3.7921	4.6284	2.2864	0.9735	0.8338	0.5506	0.0000	0.0000	0.0000					
2004	1	2	0	0	1	28	28	32	0.0000	0.0000	0.3648	66.9496	11.6435
1.6843	9.3227	3.2830	3.6290	2.4464	0.4998	0.1771	0.0000	0.0000					
2004	1	2	0	0	1	29	29	31	0.0000	0.6148	1.6688	52.8248	18.4309
5.1258	9.0259	3.9787	5.3783	1.9338	0.6384	0.1424	0.2374	0.0000					
2004	1	2	0	0	1	30	30	31	0.0000	0.0000	0.8168	48.1210	15.9151
7.1241	7.1275	8.3661	6.0448	4.0745	0.9355	0.0000	1.4747	0.0000					
2004	1	2	0	0	1	31	31	31	0.0000	0.0000	1.3335	28.9472	12.6999
5.3087	21.7823	10.7703	9.1874	3.3931	1.7166	2.5684	0.0000	2.2926					
2004	1	2	0	0	1	32	32	27	0.0000	0.0000	1.3629	38.0457	12.4769
2.8790	18.3370	8.6651	5.2718	7.0365	3.8091	0.3186	0.0000	1.7974					
2004	1	2	0	0	1	33	33	18	0.0000	0.0000	5.0351	30.3249	7.4597
14.4638	13.2756	10.1302	4.3905	12.4469	0.0000	0.0000	2.4733	0.0000					
2004	1	2	0	0	1	34	34	17	0.0000	0.0000	4.7410	27.2558	6.4929
16.5327	17.6294	14.5815	4.9506	0.0000	0.0000	7.8160	0.0000	0.0000					
2004	1	2	0	0	1	35	35	13	0.0000	0.0000	0.0000	16.2430	21.1304
37.7515	6.4001	2.2887	0.0000	3.5434	0.0000	0.0000	5.9357	6.7072					
2004	1	2	0	0	1	36	36	11	0.0000	0.0000	0.0000	18.7749	17.3509
16.7304	20.5671	9.8512	1.4830	0.0000	6.2013	0.0000	2.8398	6.2013					
2004	1	2	0	0	1	37	37	5	0.0000	0.0000	0.0000	33.4903	25.3500
0.0000	0.0000	0.0000	6.9906	6.9906	0.0000	0.0000	27.1784	0.0000					
2004	1	2	0	0	1	38	38	7	0.0000	0.0000	0.0000	27.2174	34.5735
10.2453	5.9507	16.0624	5.9507	0.0000	0.0000	0.0000	0.0000	0.0000					
2004	1	2	0	0	1	39	39	3	0.0000	0.0000	0.0000	0.0000	21.3531
23.2676	0.0000	55.3793	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2004	1	2	0	0	1	40	40	1	0.0000	0.0000	0.0000	0.0000	50.0000
0.0000	0.0000	0.0000	50.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2004	1	2	0	0	1	41	41	5	0.0000	0.0000	0.0000	16.4672	0.0000
36.7710	15.1911	0.0000	16.3795	0.0000	0.0000	0.0000	15.1911	0.0000					
2004	1	2	0	0	1	42	42	2	0.0000	0.0000	0.0000	0.0000	0.0000
27.4407	72.5593	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2004	1	2	0	0	1	43	43	1	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	100.0000	0.0000	0.0000	0.0000	0.0000					
2004	1	2	0	0	1	44	44	2	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	100.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2004	1	2	0	0	1	46	46	1	0.0000	0.0000	0.0000	100.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					

2004	1	2	0	0	1	47	47	1	0.0000	0.0000	0.0000	0.0000	0.0000	100.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
2004	1	2	0	0	1	49	49	1	0.0000	0.0000	0.0000	0.0000	100.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
2004	1	2	0	0	1	50	50	1	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	100.0000	0.0000	0.0000	0.0000	0.0000
2005	1	2	0	0	1	19	19	2	0.0000	0.0000	48.1581	0.0000	51.8419	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
2005	1	2	0	0	1	21	21	1	0.0000	0.0000	33.3333	0.0000	66.6667	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
2005	1	2	0	0	1	22	22	3	0.0000	0.0000	0.0000	54.9785	23.3997	0.0000	21.6217	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
2005	1	2	0	0	1	23	23	12	0.0000	0.0000	2.1305	9.6919	81.3755	1.0653	5.7368	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
2005	1	2	0	0	1	24	24	17	0.0000	0.0000	5.7333	0.7260	78.4467	10.0868	0.0000	0.0000	5.0073	0.0000	0.0000	0.0000	0.0000	0.0000
2005	1	2	0	0	1	25	25	19	0.0000	0.0000	1.2904	0.4253	75.3246	20.2576	2.7022	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
2005	1	2	0	0	1	26	26	20	0.0000	0.0000	2.9404	5.2453	61.1145	19.0020	2.2002	7.5969	1.9007	0.0000	0.0000	0.0000	0.0000	0.0000
2005	1	2	0	0	1	27	27	20	0.0000	0.0000	2.7307	0.5408	78.2032	13.5949	0.0560	4.2289	0.6455	0.0000	0.0000	0.0000	0.0000	0.0000
2005	1	2	0	0	1	28	28	20	0.0000	0.0000	1.8891	0.7415	59.2870	14.5850	5.9192	4.5569	12.7027	0.0445	0.2742	0.0000	0.0000	0.0000
2005	1	2	0	0	1	29	29	19	0.0000	0.0000	0.0000	7.8885	56.7435	8.0792	1.7191	15.0864	5.0461	2.3092	2.6023	0.0000	0.0000	0.5257
2005	1	2	0	0	1	30	30	17	0.0000	0.0000	0.0000	5.5995	51.0252	16.4191	5.6248	6.6792	0.0000	7.1602	2.8124	2.4402	0.0000	2.2394
2005	1	2	0	0	1	31	31	12	0.0000	0.0000	0.0000	3.5818	50.9193	14.7590	0.0000	1.6819	12.1680	4.7397	7.8140	0.0000	0.0000	4.3362
2005	1	2	0	0	1	32	32	12	0.0000	0.0000	0.0000	0.0000	35.9155	23.6230	1.3729	5.6135	25.9310	7.3158	0.2282	0.0000	0.0000	0.0000
2005	1	2	0	0	1	33	33	2	0.0000	0.0000	0.0000	0.0000	71.8001	0.0000	28.1999	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
2005	1	2	0	0	1	34	34	5	0.0000	0.0000	0.0000	0.0000	24.3379	34.4539	0.0000	41.2082	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
2005	1	2	0	0	1	35	35	7	0.0000	0.0000	0.0000	0.0000	51.3215	1.1804	0.0000	2.1615	0.0000	24.9166	1.1804	19.2397	0.0000	0.0000
2005	1	2	0	0	1	36	36	6	0.0000	0.0000	0.0000	0.0000	19.4059	21.6556	0.0000	0.0000	19.8919	23.1695	15.8771	0.0000	0.0000	0.0000
2005	1	2	0	0	1	37	37	4	0.0000	0.0000	0.0000	0.0000	69.2278	0.0000	28.6446	0.0000	0.0000	2.1276	0.0000	0.0000	0.0000	0.0000
2005	1	2	0	0	1	38	38	2	0.0000	0.0000	0.0000	0.0000	40.5194	29.7403	0.0000	0.0000	29.7403	0.0000	0.0000	0.0000	0.0000	0.0000
2005	1	2	0	0	1	39	39	2	0.0000	0.0000	0.0000	0.0000	0.0000	89.6871	0.0000	0.0000	10.3129	0.0000	0.0000	0.0000	0.0000	0.0000
2005	1	2	0	0	1	40	40	1	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	100.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
2005	1	2	0	0	1	42	42	1	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	100.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
2005	1	2	0	0	1	45	45	1	0.0000	0.0000	0.0000	0.0000	0.0000	100.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
2005	1	2	0	0	1	46	46	1	0.0000	0.0000	0.0000	0.0000	0.0000	100.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
1977	1	3	0	0	1	7	7	1	100.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
1977	1	3	0	0	1	9	9	1	100.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
1977	1	3	0	0	1	10	10	1	66.6667	33.3333	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
1977	1	3	0	0	1	11	11	1	57.1429	42.8571	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
1977	1	3	0	0	1	12	12	2	92.8571	7.1429	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
1977	1	3	0	0	1	13	13	3	85.7143	14.2857	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
1977	1	3	0	0	1	14	14	4	82.9268	17.0732	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
1977	1	3	0	0	1	15	15	3	80.0000	20.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

1977	1	3	0	0	1	16	16	9	67.2414	24.1379	8.6207	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1977	1	3	0	0	1	17	17	14	68.2540	20.6349	9.5238	0.0000	0.0000
1.5873	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1977	1	3	0	0	1	18	18	16	60.6061	30.3030	9.0909	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1977	1	3	0	0	1	19	19	14	53.5211	29.5775	16.9014	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1977	1	3	0	0	1	20	20	17	50.0000	26.3889	22.2222	1.3889	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1977	1	3	0	0	1	21	21	20	25.6757	31.0811	41.8919	1.3514	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1977	1	3	0	0	1	22	22	22	10.0000	22.3077	61.5385	4.6154	0.7692
0.0000	0.7692	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1977	1	3	0	0	1	23	23	24	2.7027	16.8919	72.9730	4.7297	2.0270
0.6757	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1977	1	3	0	0	1	24	24	29	0.0000	16.0976	75.6098	3.4146	0.9756
3.9024	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1977	1	3	0	0	1	25	25	34	0.0000	6.2500	82.5000	5.0000	1.2500
4.5833	0.4167	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1977	1	3	0	0	1	26	26	40	0.0000	3.1873	72.1116	5.5777	4.3825
13.9442	0.3984	0.0000	0.0000	0.3984	0.0000	0.0000	0.0000	0.0000					
1977	1	3	0	0	1	27	27	41	0.3215	3.5370	54.9839	4.5016	6.1093
29.5820	0.3215	0.0000	0.3215	0.3215	0.0000	0.0000	0.0000	0.0000					
1977	1	3	0	0	1	28	28	45	0.0000	0.2283	31.5068	7.0776	9.1324
47.7169	3.1963	1.1416	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1977	1	3	0	0	1	29	29	48	0.0000	0.0000	19.4707	3.0246	8.5066
63.1380	4.1588	1.1342	0.1890	0.3781	0.0000	0.0000	0.0000	0.0000					
1977	1	3	0	0	1	30	30	48	0.0000	0.1724	12.2414	4.4828	9.1379
65.5172	5.5172	1.2069	0.8621	0.1724	0.6897	0.0000	0.0000	0.0000					
1977	1	3	0	0	1	31	31	45	0.0000	0.0000	6.9243	2.4155	7.2464
68.9211	9.1787	2.5765	2.0934	0.3221	0.3221	0.0000	0.0000	0.0000					
1977	1	3	0	0	1	32	32	47	0.0000	0.0000	2.9240	1.1696	5.8480
64.3275	12.4756	6.6277	4.0936	1.3645	0.9747	0.0000	0.1949	0.0000					
1977	1	3	0	0	1	33	33	46	0.0000	0.0000	1.3921	0.4640	4.6404
55.9165	16.0093	10.4408	6.9606	3.0162	0.6961	0.4640	0.0000	0.0000					
1977	1	3	0	0	1	34	34	44	0.0000	0.0000	2.5890	1.6181	3.5599
46.6019	16.5049	11.0032	7.7670	7.7670	2.2654	0.0000	0.3236	0.0000					
1977	1	3	0	0	1	35	35	40	0.0000	0.0000	0.4202	0.8403	0.8403
47.8992	15.5462	13.4454	11.3445	3.7815	3.7815	1.6807	0.4202	0.0000					
1977	1	3	0	0	1	36	36	38	0.0000	0.0000	0.0000	0.0000	2.9070
33.7209	16.8605	18.6047	13.9535	7.5581	2.3256	4.0698	0.0000	0.0000					
1977	1	3	0	0	1	37	37	31	0.0000	0.0000	0.0000	0.0000	2.1583
33.0935	14.3885	22.3022	10.0719	10.7914	5.7554	1.4388	0.0000	0.0000					
1977	1	3	0	0	1	38	38	33	0.0000	0.0000	0.0000	0.7042	0.0000
21.8310	19.7183	17.6056	16.9014	9.8592	9.1549	3.5211	0.7042	0.0000					
1977	1	3	0	0	1	39	39	27	0.0000	0.0000	0.0000	0.0000	2.6316
22.3684	14.4737	17.1053	22.3684	7.8947	7.8947	2.6316	2.6316	0.0000					
1977	1	3	0	0	1	40	40	19	0.0000	0.0000	1.8182	0.0000	0.0000
14.5455	9.0909	16.3636	23.6364	16.3636	9.0909	3.6364	3.6364	1.8182					
1977	1	3	0	0	1	41	41	18	0.0000	0.0000	0.0000	0.0000	2.0000
20.0000	14.0000	16.0000	22.0000	14.0000	4.0000	6.0000	2.0000	0.0000					
1977	1	3	0	0	1	42	42	16	0.0000	0.0000	0.0000	0.0000	0.0000
10.2564	12.8205	20.5128	5.1282	23.0769	15.3846	12.8205	0.0000	0.0000					
1977	1	3	0	0	1	43	43	11	0.0000	0.0000	0.0000	0.0000	2.7778
5.5556	13.8889	11.1111	19.4444	19.4444	19.4444	2.7778	2.7778	2.7778					
1977	1	3	0	0	1	44	44	11	0.0000	0.0000	0.0000	0.0000	0.0000
13.7931	17.2414	31.0345	20.6897	10.3448	6.8966	0.0000	0.0000	0.0000					
1977	1	3	0	0	1	45	45	10	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	4.7619	33.3333	23.8095	14.2857	9.5238	4.7619	0.0000	9.5238					
1977	1	3	0	0	1	46	46	8	0.0000	0.0000	0.0000	0.0000	0.0000
27.7778	11.1111	11.1111	16.6667	16.6667	5.5556	5.5556	5.5556	0.0000					
1977	1	3	0	0	1	47	47	8	0.0000	0.0000	0.0000	0.0000	0.0000
10.0000	0.0000	0.0000	10.0000	60.0000	10.0000	0.0000	0.0000	10.0000					
1977	1	3	0	0	1	48	48	8	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	11.1111	33.3333	22.2222	11.1111	11.1111	11.1111	0.0000	0.0000					
1977	1	3	0	0	1	49	49	7	0.0000	0.0000	0.0000	0.0000	0.0000
12.5000	12.5000	12.5000	0.0000	0.0000	25.0000	25.0000	0.0000	12.5000					
1977	1	3	0	0	1	50	50	4	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	50.0000	16.6667	33.3333	0.0000	0.0000	0.0000	0.0000					

1977	1	3	0	0	1	51	51	7	0.0000	0.0000	9.0909	0.0000	0.0000
18.1818	0.0000	9.0909	0.0000	9.0909	9.0909	0.0000	9.0909	36.3636					
1980	1	3	0	0	1	10	10	1	100.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1980	1	3	0	0	1	15	15	4	0.0000	100.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1980	1	3	0	0	1	16	16	7	0.0000	100.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1980	1	3	0	0	1	17	17	9	2.0833	93.7500	4.1667	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1980	1	3	0	0	1	18	18	10	1.5385	95.3846	3.0769	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1980	1	3	0	0	1	19	19	12	1.1236	94.3820	4.4944	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1980	1	3	0	0	1	20	20	10	0.0000	93.3036	6.6964	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1980	1	3	0	0	1	21	21	12	0.0000	92.6316	6.8421	0.5263	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1980	1	3	0	0	1	22	22	11	0.0000	86.1111	13.1944	0.6944	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1980	1	3	0	0	1	23	23	10	0.0000	70.3704	29.6296	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1980	1	3	0	0	1	24	24	12	0.0000	55.8824	32.3529	0.0000	2.9412
8.8235	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1980	1	3	0	0	1	25	25	13	0.0000	22.2222	22.2222	27.7778	11.1111
16.6667	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1980	1	3	0	0	1	26	26	16	0.0000	8.6957	8.6957	30.4348	21.7391
13.0435	13.0435	0.0000	4.3478	0.0000	0.0000	0.0000	0.0000	0.0000					
1980	1	3	0	0	1	27	27	18	0.0000	1.8182	5.4545	34.5455	16.3636
27.2727	1.8182	10.9091	1.8182	0.0000	0.0000	0.0000	0.0000	0.0000					
1980	1	3	0	0	1	28	28	19	0.0000	0.0000	0.0000	25.3333	16.0000
38.6667	12.0000	5.3333	2.6667	0.0000	0.0000	0.0000	0.0000	0.0000					
1980	1	3	0	0	1	29	29	21	0.0000	0.0000	0.0000	18.0124	14.9068
36.6460	9.3168	18.0124	3.1056	0.0000	0.0000	0.0000	0.0000	0.0000					
1980	1	3	0	0	1	30	30	24	0.0000	0.0000	0.4386	13.5965	13.1579
42.1053	12.7193	14.0351	2.6316	0.8772	0.0000	0.4386	0.0000	0.0000					
1980	1	3	0	0	1	31	31	22	0.0000	0.0000	0.0000	6.2500	5.8594
42.9688	11.3281	25.3906	6.2500	1.5625	0.0000	0.3906	0.0000	0.0000					
1980	1	3	0	0	1	32	32	22	0.0000	0.0000	0.0000	4.0359	4.4843
38.1166	8.0717	32.2870	7.6233	4.4843	0.4484	0.4484	0.0000	0.0000					
1980	1	3	0	0	1	33	33	21	0.0000	0.0000	0.0000	2.6432	5.2863
37.4449	5.2863	30.3965	13.2159	3.9648	1.3216	0.0000	0.0000	0.4405					
1980	1	3	0	0	1	34	34	19	0.0000	0.0000	0.0000	2.2599	0.5650
30.5085	14.1243	31.6384	9.0395	7.9096	1.1299	1.6949	0.5650	0.5650					
1980	1	3	0	0	1	35	35	18	0.0000	0.0000	0.0000	0.7463	3.7313
27.6119	6.7164	29.8507	19.4030	8.2090	2.2388	0.7463	0.0000	0.7463					
1980	1	3	0	0	1	36	36	17	0.0000	0.0000	0.0000	0.9901	1.9802
23.7624	9.9010	30.6931	16.8317	8.9109	3.9604	2.9703	0.0000	0.0000					
1980	1	3	0	0	1	37	37	19	0.0000	1.3699	0.0000	1.3699	2.7397
15.0685	2.7397	31.5068	23.2877	8.2192	5.4795	4.1096	4.1096	0.0000					
1980	1	3	0	0	1	38	38	16	0.0000	0.0000	0.0000	0.0000	0.0000
20.0000	8.0000	30.0000	16.0000	22.0000	2.0000	2.0000	0.0000	0.0000					
1980	1	3	0	0	1	39	39	11	0.0000	0.0000	0.0000	0.0000	0.0000
9.3750	6.2500	21.8750	34.3750	25.0000	3.1250	0.0000	0.0000	0.0000					
1980	1	3	0	0	1	40	40	14	0.0000	0.0000	0.0000	0.0000	4.5455
9.0909	4.5455	22.7273	22.7273	22.7273	4.5455	4.5455	0.0000	4.5455					
1980	1	3	0	0	1	41	41	7	0.0000	0.0000	0.0000	5.8824	0.0000
5.8824	5.8824	29.4118	11.7647	29.4118	11.7647	0.0000	0.0000	0.0000					
1980	1	3	0	0	1	42	42	4	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	18.1818	18.1818	36.3636	9.0909	9.0909	9.0909	0.0000					
1980	1	3	0	0	1	43	43	3	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	50.0000	25.0000	0.0000	25.0000	0.0000	0.0000					
1980	1	3	0	0	1	44	44	2	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	40.0000	40.0000	20.0000	0.0000	0.0000					
1980	1	3	0	0	1	45	45	2	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	28.5714	57.1429	14.2857	0.0000	0.0000	0.0000					
1980	1	3	0	0	1	46	46	3	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	33.3333	33.3333	0.0000	0.0000	0.0000	33.3333					
1980	1	3	0	0	1	47	47	2	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	100.0000	0.0000	0.0000	0.0000	0.0000	0.0000					

1980	1	3	0	0	1	48	48	2	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	50.0000	0.0000	50.0000	0.0000	0.0000					
1980	1	3	0	0	1	49	49	4	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	14.2857	28.5714	0.0000	28.5714	28.5714	0.0000	0.0000					
1980	1	3	0	0	1	50	50	3	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	33.3333	33.3333	0.0000	0.0000	33.3333	0.0000	0.0000					
1980	1	3	0	0	1	51	51	3	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	25.0000	0.0000	25.0000	25.0000	25.0000					
1983	1	3	0	0	1	14	14	2	0.0000	100.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1983	1	3	0	0	1	15	15	4	5.8824	94.1176	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1983	1	3	0	0	1	16	16	3	3.1250	96.8750	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1983	1	3	0	0	1	17	17	5	1.6393	98.3607	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1983	1	3	0	0	1	18	18	7	0.0000	97.3333	1.3333	0.0000	1.3333
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1983	1	3	0	0	1	19	19	8	0.0000	100.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1983	1	3	0	0	1	20	20	9	0.0000	98.1132	1.8868	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1983	1	3	0	0	1	21	21	13	0.0000	96.2963	1.2346	2.4691	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1983	1	3	0	0	1	22	22	11	0.0000	100.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1983	1	3	0	0	1	23	23	11	0.0000	90.3226	6.4516	3.2258	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1983	1	3	0	0	1	24	24	9	0.0000	80.7692	9.6154	3.8462	5.7692
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1983	1	3	0	0	1	25	25	13	0.0000	49.0566	5.6604	5.6604	35.8491
3.7736	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1983	1	3	0	0	1	26	26	12	0.0000	27.5862	6.8966	5.1724	55.1724
3.4483	1.7241	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1983	1	3	0	0	1	27	27	13	0.0000	7.2464	4.3478	4.3478	79.7101
1.4493	1.4493	0.0000	1.4493	0.0000	0.0000	0.0000	0.0000	0.0000					
1983	1	3	0	0	1	28	28	12	0.0000	3.1915	2.1277	3.1915	78.7234
6.3830	3.1915	1.0638	2.1277	0.0000	0.0000	0.0000	0.0000	0.0000					
1983	1	3	0	0	1	29	29	13	0.0000	0.0000	1.0638	4.2553	81.9149
6.3830	3.1915	2.1277	0.0000	0.0000	1.0638	0.0000	0.0000	0.0000					
1983	1	3	0	0	1	30	30	12	0.0000	0.0000	1.2195	2.4390	74.3902
8.5366	6.0976	2.4390	4.8780	0.0000	0.0000	0.0000	0.0000	0.0000					
1983	1	3	0	0	1	31	31	12	0.0000	0.0000	0.0000	1.4085	60.5634
2.8169	7.0423	8.4507	11.2676	4.2254	4.2254	0.0000	0.0000	0.0000					
1983	1	3	0	0	1	32	32	11	0.0000	0.0000	0.0000	0.0000	58.1818
9.0909	10.9091	7.2727	7.2727	3.6364	1.8182	1.8182	0.0000	0.0000					
1983	1	3	0	0	1	33	33	10	0.0000	0.0000	0.0000	0.0000	39.2157
7.8431	7.8431	11.7647	21.5686	3.9216	7.8431	0.0000	0.0000	0.0000					
1983	1	3	0	0	1	34	34	9	0.0000	0.0000	0.0000	0.0000	22.7273
2.2727	11.3636	13.6364	22.7273	9.0909	4.5455	11.3636	2.2727	0.0000					
1983	1	3	0	0	1	35	35	8	0.0000	0.0000	0.0000	0.0000	13.3333
3.3333	23.3333	20.0000	26.6667	10.0000	3.3333	0.0000	0.0000	0.0000					
1983	1	3	0	0	1	36	36	6	0.0000	0.0000	0.0000	0.0000	5.8824
5.8824	11.7647	11.7647	23.5294	11.7647	11.7647	17.6471	0.0000	0.0000					
1983	1	3	0	0	1	37	37	5	0.0000	0.0000	0.0000	0.0000	9.0909
0.0000	18.1818	18.1818	9.0909	9.0909	9.0909	27.2727	0.0000	0.0000					
1983	1	3	0	0	1	38	38	7	0.0000	0.0000	0.0000	0.0000	9.0909
0.0000	0.0000	18.1818	36.3636	18.1818	9.0909	0.0000	9.0909	0.0000					
1983	1	3	0	0	1	39	39	2	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	20.0000	20.0000	40.0000	20.0000	0.0000	0.0000	0.0000	0.0000					
1983	1	3	0	0	1	40	40	3	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	66.6667	0.0000	0.0000	16.6667	16.6667	0.0000					
1983	1	3	0	0	1	41	41	1	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	100.0000	0.0000	0.0000	0.0000	0.0000					
1983	1	3	0	0	1	42	42	2	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	100.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1983	1	3	0	0	1	43	43	2	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	50.0000	0.0000	50.0000	0.0000	0.0000	0.0000					
1983	1	3	0	0	1	44	44	1	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	50.0000	0.0000	0.0000	50.0000	0.0000	0.0000					

1983	1	3	0	0	1	46	46	1	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	100.0000	0.0000	0.0000	0.0000	0.0000					
1983	1	3	0	0	1	47	47	1	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	100.0000	0.0000	0.0000	0.0000					
1983	1	3	0	0	1	50	50	1	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	100.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1986	1	3	0	0	1	10	10	2	100.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1986	1	3	0	0	1	11	11	3	100.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1986	1	3	0	0	1	12	12	6	100.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1986	1	3	0	0	1	13	13	8	96.3855	3.6145	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1986	1	3	0	0	1	14	14	8	97.6190	2.3810	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1986	1	3	0	0	1	15	15	9	98.1595	1.8405	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1986	1	3	0	0	1	16	16	9	97.6471	2.3529	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1986	1	3	0	0	1	17	17	11	89.3617	8.5106	2.1277	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1986	1	3	0	0	1	18	18	8	76.4706	17.6471	5.8824	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1986	1	3	0	0	1	19	19	10	80.0000	20.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1986	1	3	0	0	1	20	20	5	20.0000	20.0000	20.0000	0.0000	40.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1986	1	3	0	0	1	21	21	6	0.0000	0.0000	11.1111	0.0000	88.8889
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1986	1	3	0	0	1	22	22	12	0.0000	0.0000	0.0000	20.0000	80.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1986	1	3	0	0	1	23	23	21	0.0000	0.0000	2.0202	7.0707	84.8485
4.0404	2.0202	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1986	1	3	0	0	1	24	24	21	0.0000	0.0000	1.3245	5.2980	88.7417
3.3113	1.3245	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1986	1	3	0	0	1	25	25	20	0.0000	0.0000	0.9050	5.4299	86.8778
6.3348	0.4525	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1986	1	3	0	0	1	26	26	21	0.0000	0.0000	0.4630	2.3148	90.2778
4.6296	1.8519	0.4630	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1986	1	3	0	0	1	27	27	21	0.0000	0.0000	0.5848	4.6784	80.1170
9.9415	4.0936	0.5848	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1986	1	3	0	0	1	28	28	17	0.0000	0.0000	0.0000	2.4390	67.4797
13.0081	4.8780	12.1951	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1986	1	3	0	0	1	29	29	18	0.0000	0.0000	0.0000	2.1505	61.2903
12.9032	13.9785	9.6774	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1986	1	3	0	0	1	30	30	16	0.0000	0.0000	0.0000	4.1096	46.5753
17.8082	9.5890	20.5479	0.0000	1.3699	0.0000	0.0000	0.0000	0.0000					
1986	1	3	0	0	1	31	31	16	0.0000	0.0000	0.0000	0.0000	41.3793
12.0690	17.2414	27.5862	1.7241	0.0000	0.0000	0.0000	0.0000	0.0000					
1986	1	3	0	0	1	32	32	16	0.0000	0.0000	0.0000	0.0000	18.0000
18.0000	18.0000	42.0000	2.0000	2.0000	0.0000	0.0000	0.0000	0.0000					
1986	1	3	0	0	1	33	33	11	0.0000	0.0000	0.0000	0.0000	12.1951
9.7561	12.1951	56.0976	4.8780	2.4390	0.0000	2.4390	0.0000	0.0000					
1986	1	3	0	0	1	34	34	13	0.0000	0.0000	0.0000	0.0000	25.7143
2.8571	14.2857	34.2857	8.5714	8.5714	2.8571	2.8571	0.0000	0.0000					
1986	1	3	0	0	1	35	35	8	0.0000	0.0000	0.0000	0.0000	13.0435
0.0000	4.3478	43.4783	13.0435	13.0435	0.0000	13.0435	0.0000	0.0000					
1986	1	3	0	0	1	36	36	9	0.0000	0.0000	0.0000	0.0000	15.0000
0.0000	5.0000	40.0000	10.0000	20.0000	0.0000	10.0000	0.0000	0.0000					
1986	1	3	0	0	1	37	37	4	0.0000	0.0000	0.0000	0.0000	0.0000
7.6923	15.3846	38.4615	7.6923	15.3846	0.0000	15.3846	0.0000	0.0000					
1986	1	3	0	0	1	38	38	4	0.0000	0.0000	0.0000	0.0000	0.0000
7.6923	7.6923	30.7692	15.3846	7.6923	7.6923	15.3846	7.6923	0.0000					
1986	1	3	0	0	1	39	39	3	0.0000	0.0000	0.0000	0.0000	0.0000
8.3333	8.3333	33.3333	16.6667	8.3333	0.0000	25.0000	0.0000	0.0000					
1986	1	3	0	0	1	40	40	3	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	55.5556	22.2222	11.1111	0.0000	11.1111	0.0000	0.0000					
1986	1	3	0	0	1	41	41	4	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	33.3333	0.0000	0.0000	16.6667	33.3333	16.6667	0.0000					

1986	1	3	0	0	1	42	42	3	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	50.0000	0.0000	0.0000	25.0000	25.0000	0.0000					
1986	1	3	0	0	1	43	43	2	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	75.0000	0.0000	25.0000					
1986	1	3	0	0	1	45	45	3	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	33.3333	0.0000	0.0000	66.6667	0.0000	0.0000	0.0000					
1986	1	3	0	0	1	46	46	1	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	100.0000	0.0000	0.0000	0.0000					
1986	1	3	0	0	1	48	48	1	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	100.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1986	1	3	0	0	1	49	49	1	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	100.0000	0.0000	0.0000	0.0000					
1986	1	3	0	0	1	50	50	1	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	100.0000	0.0000					
1986	1	3	0	0	1	51	51	1	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	50.0000	50.0000					
1989	1	3	0	0	1	8	8	1	100.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1989	1	3	0	0	1	14	14	1	100.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1989	1	3	0	0	1	15	15	3	100.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1989	1	3	0	0	1	16	16	4	100.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1989	1	3	0	0	1	17	17	6	77.7778	22.2222	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1989	1	3	0	0	1	18	18	8	88.5714	8.5714	2.8571	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1989	1	3	0	0	1	19	19	7	82.0513	15.3846	2.5641	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1989	1	3	0	0	1	20	20	9	71.0526	23.6842	2.6316	2.6316	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1989	1	3	0	0	1	21	21	10	8.3333	37.5000	8.3333	41.6667	4.1667
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1989	1	3	0	0	1	22	22	15	0.0000	7.6923	0.0000	74.3590	5.1282
2.5641	0.0000	10.2564	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1989	1	3	0	0	1	23	23	20	0.0000	1.6667	1.6667	90.0000	0.8333
0.0000	0.0000	5.0000	0.0000	0.0000	0.8333	0.0000	0.0000	0.0000					
1989	1	3	0	0	1	24	24	20	0.0000	0.8475	1.6949	86.8644	1.6949
0.4237	0.4237	7.2034	0.4237	0.0000	0.4237	0.0000	0.0000	0.0000					
1989	1	3	0	0	1	25	25	20	0.0000	0.0000	0.3571	76.0714	0.3571
1.0714	0.3571	20.0000	1.0714	0.0000	0.7143	0.0000	0.0000	0.0000					
1989	1	3	0	0	1	26	26	20	0.0000	0.0000	0.0000	65.4110	1.7123
0.0000	1.7123	28.4247	1.7123	0.3425	0.6849	0.0000	0.0000	0.0000					
1989	1	3	0	0	1	27	27	20	0.0000	0.0000	0.0000	48.6772	1.0582
1.0582	1.5873	43.3862	2.6455	0.0000	1.5873	0.0000	0.0000	0.0000					
1989	1	3	0	0	1	28	28	18	0.0000	0.0000	0.8197	32.7869	0.8197
0.8197	2.4590	59.8361	0.8197	0.0000	1.6393	0.0000	0.0000	0.0000					
1989	1	3	0	0	1	29	29	16	0.0000	0.0000	0.0000	19.5652	2.1739
1.0870	3.2609	64.1304	2.1739	2.1739	5.4348	0.0000	0.0000	0.0000					
1989	1	3	0	0	1	30	30	16	0.0000	0.0000	0.0000	18.1818	0.0000
0.0000	0.0000	70.4545	4.5455	0.0000	6.8182	0.0000	0.0000	0.0000					
1989	1	3	0	0	1	31	31	10	0.0000	0.0000	0.0000	8.3333	0.0000
4.1667	0.0000	75.0000	0.0000	0.0000	12.5000	0.0000	0.0000	0.0000					
1989	1	3	0	0	1	32	32	8	0.0000	0.0000	0.0000	20.0000	0.0000
0.0000	0.0000	60.0000	6.6667	0.0000	13.3333	0.0000	0.0000	0.0000					
1989	1	3	0	0	1	33	33	9	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	80.0000	0.0000	0.0000	0.0000	0.0000	0.0000	20.0000					
1989	1	3	0	0	1	34	34	6	0.0000	0.0000	0.0000	0.0000	0.0000
12.5000	0.0000	50.0000	0.0000	0.0000	37.5000	0.0000	0.0000	0.0000					
1989	1	3	0	0	1	35	35	5	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	57.1429	0.0000	0.0000	42.8571	0.0000	0.0000	0.0000					
1989	1	3	0	0	1	36	36	2	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	50.0000	0.0000	0.0000	50.0000	0.0000	0.0000	0.0000					
1989	1	3	0	0	1	37	37	2	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	33.3333	0.0000	0.0000	66.6667	0.0000	0.0000	0.0000					
1989	1	3	0	0	1	39	39	3	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	66.6667	0.0000	0.0000	0.0000	0.0000	0.0000	33.3333					
1989	1	3	0	0	1	40	40	2	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	50.0000	0.0000	0.0000	0.0000	0.0000	0.0000	50.0000					

1989	1	3	0	0	1	41	41	2	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	50.0000	0.0000	0.0000	50.0000	0.0000	0.0000	0.0000					
1989	1	3	0	0	1	44	44	1	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	100.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1989	1	3	0	0	1	45	45	1	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	100.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1989	1	3	0	0	1	46	46	1	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	100.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1989	1	3	0	0	1	50	50	1	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	100.0000					
1989	1	3	0	0	1	51	51	2	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	66.6667	0.0000	0.0000	33.3333					
1992	1	3	0	0	1	5	5	2	100.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1992	1	3	0	0	1	6	6	2	100.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1992	1	3	0	0	1	7	7	2	100.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1992	1	3	0	0	1	8	8	4	100.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1992	1	3	0	0	1	9	9	2	100.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1992	1	3	0	0	1	10	10	5	100.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1992	1	3	0	0	1	11	11	7	100.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1992	1	3	0	0	1	12	12	7	100.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1992	1	3	0	0	1	13	13	8	96.1538	3.8462	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1992	1	3	0	0	1	14	14	8	96.6102	3.3898	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1992	1	3	0	0	1	15	15	8	86.2745	13.7255	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1992	1	3	0	0	1	16	16	7	89.7959	10.2041	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1992	1	3	0	0	1	17	17	6	87.5000	12.5000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1992	1	3	0	0	1	18	18	6	50.0000	16.6667	33.3333	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1992	1	3	0	0	1	19	19	5	12.5000	50.0000	25.0000	12.5000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1992	1	3	0	0	1	20	20	8	10.0000	20.0000	50.0000	20.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1992	1	3	0	0	1	21	21	7	0.0000	11.1111	38.8889	44.4444	5.5556
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1992	1	3	0	0	1	22	22	10	0.0000	3.8462	38.4615	53.8462	3.8462
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1992	1	3	0	0	1	23	23	24	0.0000	5.2632	47.3684	36.8421	1.7544
0.0000	8.7719	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1992	1	3	0	0	1	24	24	28	0.0000	2.6316	26.3158	48.2456	5.2632
0.8772	13.1579	0.8772	0.0000	0.0000	2.6316	0.0000	0.0000	0.0000					
1992	1	3	0	0	1	25	25	36	0.0000	2.0725	12.9534	37.3057	3.1088
1.0363	36.7876	1.5544	0.0000	0.0000	4.6632	0.5181	0.0000	0.0000					
1992	1	3	0	0	1	26	26	38	0.0000	0.0000	9.5238	23.8095	2.1978
0.7326	46.8864	0.7326	1.0989	0.3663	14.6520	0.0000	0.0000	0.0000					
1992	1	3	0	0	1	27	27	39	0.0000	0.0000	3.8596	15.4386	4.2105
0.7018	56.8421	1.4035	0.7018	0.7018	14.0351	1.4035	0.0000	0.7018					
1992	1	3	0	0	1	28	28	37	0.0000	0.0000	1.2658	13.5021	2.1097
0.4219	60.7595	2.1097	1.2658	0.0000	16.4557	0.4219	0.0000	1.6878					
1992	1	3	0	0	1	29	29	34	0.0000	0.0000	0.6024	9.0361	1.2048
3.0120	50.6024	3.0120	0.6024	0.0000	30.1205	1.2048	0.0000	0.6024					
1992	1	3	0	0	1	30	30	30	0.0000	0.0000	0.9524	6.6667	0.0000
0.9524	50.4762	0.9524	2.8571	0.9524	33.3333	1.9048	0.0000	0.9524					
1992	1	3	0	0	1	31	31	22	0.0000	0.0000	0.0000	1.4706	1.4706
0.0000	47.0588	1.4706	1.4706	1.4706	42.6471	1.4706	0.0000	1.4706					
1992	1	3	0	0	1	32	32	18	0.0000	0.0000	0.0000	0.0000	2.3256
4.6512	34.8837	2.3256	0.0000	2.3256	39.5349	4.6512	0.0000	9.3023					
1992	1	3	0	0	1	33	33	14	0.0000	0.0000	0.0000	0.0000	0.0000
6.6667	50.0000	3.3333	0.0000	0.0000	30.0000	3.3333	0.0000	6.6667					

1992	1	3	0	0	1	34	34	6	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	35.2941	5.8824	0.0000	5.8824	41.1765	0.0000	0.0000	11.7647					
1992	1	3	0	0	1	35	35	3	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	25.0000	8.3333	0.0000	0.0000	58.3333	8.3333	0.0000	0.0000					
1992	1	3	0	0	1	36	36	4	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	77.7778	0.0000	0.0000	0.0000	22.2222	0.0000	0.0000	0.0000					
1992	1	3	0	0	1	37	37	5	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	33.3333	0.0000	0.0000	11.1111	55.5556	0.0000	0.0000	0.0000					
1992	1	3	0	0	1	38	38	4	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	16.6667	16.6667	0.0000	0.0000	33.3333	0.0000	0.0000	33.3333					
1992	1	3	0	0	1	39	39	3	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	40.0000	0.0000	0.0000	0.0000	60.0000	0.0000	0.0000	0.0000					
1992	1	3	0	0	1	40	40	1	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	25.0000	0.0000	0.0000	0.0000	75.0000	0.0000	0.0000	0.0000					
1992	1	3	0	0	1	41	41	1	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	100.0000	0.0000	0.0000	0.0000					
1992	1	3	0	0	1	42	42	1	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	100.0000	0.0000	0.0000	0.0000					
1992	1	3	0	0	1	43	43	2	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	50.0000	0.0000	0.0000	50.0000					
1992	1	3	0	0	1	44	44	3	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	75.0000	0.0000	0.0000	25.0000					
1995	1	3	0	0	1	9	9	2	100.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1995	1	3	0	0	1	10	10	1	100.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1995	1	3	0	0	1	11	11	2	100.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1995	1	3	0	0	1	12	12	4	100.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1995	1	3	0	0	1	13	13	9	100.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1995	1	3	0	0	1	14	14	13	97.9167	2.0833	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1995	1	3	0	0	1	15	15	15	95.4023	3.4483	1.1494	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1995	1	3	0	0	1	16	16	21	89.3443	10.6557	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1995	1	3	0	0	1	17	17	20	85.7143	13.0952	0.0000	1.1905	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1995	1	3	0	0	1	18	18	17	73.5849	24.5283	1.8868	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1995	1	3	0	0	1	19	19	14	51.8519	33.3333	3.7037	11.1111	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1995	1	3	0	0	1	20	20	6	11.1111	22.2222	11.1111	55.5556	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1995	1	3	0	0	1	21	21	11	0.0000	28.5714	7.1429	57.1429	0.0000
0.0000	7.1429	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1995	1	3	0	0	1	22	22	15	0.0000	3.4483	6.8966	82.7586	0.0000
3.4483	3.4483	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1995	1	3	0	0	1	23	23	26	0.0000	1.9231	5.7692	65.3846	3.8462
7.6923	13.4615	0.0000	0.0000	1.9231	0.0000	0.0000	0.0000	0.0000					
1995	1	3	0	0	1	24	24	40	0.0000	1.0101	5.0505	67.6768	2.0202
10.1010	8.0808	0.0000	0.0000	5.0505	0.0000	0.0000	0.0000	1.0101					
1995	1	3	0	0	1	25	25	45	0.0000	0.0000	2.7027	56.0811	4.0541
5.4054	16.8919	0.6757	0.0000	12.1622	0.0000	0.0000	0.0000	2.0270					
1995	1	3	0	0	1	26	26	49	0.0000	0.0000	1.5228	41.1168	0.0000
10.1523	25.8883	1.5228	0.0000	14.7208	0.0000	1.5228	0.0000	3.5533					
1995	1	3	0	0	1	27	27	53	0.0000	0.0000	0.0000	28.3721	0.9302
4.6512	26.9767	0.0000	0.0000	30.2326	0.0000	0.9302	0.0000	7.9070					
1995	1	3	0	0	1	28	28	50	0.0000	0.0000	0.4651	17.2093	1.8605
4.1860	26.5116	0.9302	0.0000	35.8140	0.4651	1.3953	0.0000	11.1628					
1995	1	3	0	0	1	29	29	47	0.0000	0.0000	0.0000	7.9545	1.7045
3.9773	34.6591	0.5682	0.0000	36.9318	0.0000	1.1364	0.0000	13.0682					
1995	1	3	0	0	1	30	30	38	0.0000	0.0000	0.0000	5.2632	1.5038
5.2632	34.5865	0.0000	0.0000	39.8496	0.0000	3.0075	0.0000	10.5263					
1995	1	3	0	0	1	31	31	27	0.0000	0.0000	0.0000	3.1915	2.1277
4.2553	27.6596	0.0000	0.0000	51.0638	0.0000	2.1277	0.0000	9.5745					
1995	1	3	0	0	1	32	32	17	0.0000	0.0000	0.0000	1.9231	1.9231
7.6923	25.0000	0.0000	0.0000	44.2308	0.0000	3.8462	0.0000	15.3846					

1995	1	3	0	0	1	33	33	14	0.0000	0.0000	0.0000	3.3333	0.0000
0.0000	30.0000	0.0000	0.0000	46.6667	0.0000	0.0000	0.0000	20.0000					
1995	1	3	0	0	1	34	34	10	0.0000	0.0000	0.0000	0.0000	0.0000
5.8824	29.4118	0.0000	0.0000	47.0588	0.0000	0.0000	0.0000	17.6471					
1995	1	3	0	0	1	35	35	7	0.0000	0.0000	0.0000	0.0000	8.3333
0.0000	33.3333	0.0000	0.0000	41.6667	0.0000	0.0000	0.0000	16.6667					
1995	1	3	0	0	1	36	36	5	0.0000	0.0000	0.0000	0.0000	0.0000
10.0000	10.0000	0.0000	0.0000	70.0000	0.0000	0.0000	0.0000	10.0000					
1995	1	3	0	0	1	37	37	6	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	16.6667	0.0000	0.0000	83.3333	0.0000	0.0000	0.0000	0.0000					
1995	1	3	0	0	1	38	38	3	0.0000	0.0000	0.0000	0.0000	0.0000
25.0000	0.0000	0.0000	0.0000	50.0000	0.0000	0.0000	0.0000	25.0000					
1995	1	3	0	0	1	39	39	5	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	71.4286	0.0000	14.2857	0.0000	14.2857					
1995	1	3	0	0	1	40	40	2	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	100.0000					
1995	1	3	0	0	1	41	41	2	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	25.0000	0.0000	0.0000	25.0000	0.0000	25.0000	0.0000	25.0000					
1995	1	3	0	0	1	42	42	1	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	100.0000	0.0000	0.0000					
1995	1	3	0	0	1	43	43	4	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	25.0000	0.0000	0.0000	0.0000	75.0000					
1995	1	3	0	0	1	44	44	2	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	20.0000	0.0000	0.0000	40.0000	0.0000	0.0000	0.0000	40.0000					
1995	1	3	0	0	1	45	45	1	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	100.0000	0.0000	0.0000	0.0000	0.0000					
1995	1	3	0	0	1	46	46	2	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	100.0000	0.0000	0.0000	0.0000	0.0000					
1995	1	3	0	0	1	47	47	2	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	50.0000	0.0000	50.0000	0.0000	0.0000					
1995	1	3	0	0	1	48	48	2	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	33.3333	0.0000	33.3333	0.0000	33.3333					
1995	1	3	0	0	1	50	50	1	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	100.0000					
1995	1	3	0	0	1	51	51	3	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	75.0000	0.0000	25.0000	0.0000	0.0000					
1998	1	3	0	0	1	5	5	1	100.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1998	1	3	0	0	1	6	6	3	100.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1998	1	3	0	0	1	7	7	2	100.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1998	1	3	0	0	1	8	8	4	100.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1998	1	3	0	0	1	9	9	10	100.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1998	1	3	0	0	1	10	10	13	95.2381	4.7619	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1998	1	3	0	0	1	11	11	16	95.1613	4.8387	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1998	1	3	0	0	1	12	12	20	86.2069	12.6437	1.1494	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1998	1	3	0	0	1	13	13	23	89.4737	10.5263	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1998	1	3	0	0	1	14	14	23	84.0580	15.9420	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1998	1	3	0	0	1	15	15	31	73.6842	26.3158	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1998	1	3	0	0	1	16	16	31	52.3810	42.8571	3.1746	1.5873	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1998	1	3	0	0	1	17	17	30	22.7273	72.7273	3.0303	1.5152	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1998	1	3	0	0	1	18	18	36	11.1111	78.8889	6.6667	3.3333	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1998	1	3	0	0	1	19	19	39	1.9417	92.2330	5.8252	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1998	1	3	0	0	1	20	20	50	0.8333	80.8333	16.6667	1.6667	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1998	1	3	0	0	1	21	21	44	0.0000	78.9474	13.6842	5.2632	0.0000
2.1053	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					

1998	1	3	0	0	1	22	22	55	0.0000	39.2308	31.5385	26.9231	0.7692
0.7692	0.7692	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
1998	1	3	0	0	1	23	23	62	0.0000	20.1258	32.7044	37.7358	0.6289
5.0314	1.8868	0.6289	0.0000	1.2579	0.0000	0.0000	0.0000	0.0000					
1998	1	3	0	0	1	24	24	66	0.0000	4.1667	39.8148	38.8889	3.7037
5.0926	6.4815	1.3889	0.0000	0.4630	0.0000	0.0000	0.0000	0.0000					
1998	1	3	0	0	1	25	25	64	0.0000	3.2558	22.3256	49.7674	2.7907
4.6512	11.6279	1.3953	0.9302	2.3256	0.0000	0.0000	0.9302	0.0000					
1998	1	3	0	0	1	26	26	57	0.0000	1.1834	20.7101	37.2781	2.3669
6.5089	20.1183	2.3669	0.5917	5.9172	0.0000	0.0000	2.9586	0.0000					
1998	1	3	0	0	1	27	27	49	0.0000	0.0000	14.0625	30.4688	3.1250
11.7188	17.1875	1.5625	2.3438	10.9375	0.0000	0.7813	7.0313	0.7813					
1998	1	3	0	0	1	28	28	51	0.0000	0.0000	12.7119	11.0169	2.5424
12.7119	18.6441	5.0847	3.3898	19.4915	0.0000	1.6949	7.6271	5.0847					
1998	1	3	0	0	1	29	29	46	0.0000	1.0753	10.7527	8.6022	5.3763
6.4516	27.9570	4.3011	3.2258	12.9032	1.0753	1.0753	11.8280	5.3763					
1998	1	3	0	0	1	30	30	31	0.0000	0.0000	7.6923	5.7692	0.0000
3.8462	28.8462	5.7692	1.9231	26.9231	0.0000	0.0000	17.3077	1.9231					
1998	1	3	0	0	1	31	31	22	0.0000	0.0000	2.9412	8.8235	0.0000
2.9412	23.5294	0.0000	0.0000	23.5294	2.9412	0.0000	26.4706	8.8235					
1998	1	3	0	0	1	32	32	9	0.0000	0.0000	0.0000	0.0000	0.0000
10.0000	20.0000	0.0000	0.0000	0.0000	0.0000	10.0000	50.0000	10.0000					
1998	1	3	0	0	1	33	33	5	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	33.3333	0.0000	0.0000	33.3333	0.0000	0.0000	16.6667	16.6667					
1998	1	3	0	0	1	34	34	6	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	14.2857	14.2857	0.0000	28.5714	0.0000	0.0000	28.5714	14.2857					
1998	1	3	0	0	1	35	35	4	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	25.0000	25.0000	25.0000	0.0000	0.0000	0.0000	25.0000					
1998	1	3	0	0	1	36	36	2	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	50.0000	50.0000					
1998	1	3	0	0	1	37	37	2	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	50.0000	50.0000	0.0000					
1998	1	3	0	0	1	38	38	3	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	33.3333	0.0000	0.0000	0.0000	66.6667					
1998	1	3	0	0	1	39	39	5	0.0000	0.0000	0.0000	20.0000	0.0000
0.0000	0.0000	0.0000	20.0000	40.0000	0.0000	0.0000	20.0000	0.0000					
1998	1	3	0	0	1	41	41	1	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	100.0000	0.0000	0.0000	0.0000	0.0000					
1998	1	3	0	0	1	42	42	2	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	50.0000	0.0000	0.0000	50.0000	0.0000					
1998	1	3	0	0	1	50	50	1	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	100.0000	0.0000	0.0000	0.0000	0.0000					
2001	1	3	0	0	1	8	8	2	100.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2001	1	3	0	0	1	11	11	3	100.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2001	1	3	0	0	1	12	12	8	100.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2001	1	3	0	0	1	13	13	14	98.1132	1.8868	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2001	1	3	0	0	1	14	14	17	96.1538	2.8846	0.9615	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2001	1	3	0	0	1	15	15	20	93.9394	4.2424	1.8182	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2001	1	3	0	0	1	16	16	20	94.1558	3.8961	1.2987	0.6494	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2001	1	3	0	0	1	17	17	20	86.7470	9.6386	3.6145	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2001	1	3	0	0	1	18	18	17	90.4762	9.5238	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2001	1	3	0	0	1	19	19	13	69.6970	27.2727	3.0303	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2001	1	3	0	0	1	20	20	10	29.4118	41.1765	23.5294	5.8824	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2001	1	3	0	0	1	21	21	17	3.0303	75.7576	15.1515	3.0303	0.0000
3.0303	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2001	1	3	0	0	1	22	22	14	0.0000	87.0968	3.2258	9.6774	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2001	1	3	0	0	1	23	23	18	2.0408	73.4694	14.2857	8.1633	2.0408
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					

2001	1	3	0	0	1	24	24	22	0.0000	50.0000	15.9091	29.5455	2.2727	2.2727	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
2001	1	3	0	0	1	25	25	17	0.0000	33.3333	18.1818	33.3333	12.1212	3.0303	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
2001	1	3	0	0	1	26	26	29	0.0000	11.1111	22.2222	37.5000	12.5000	9.7222	6.9444	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
2001	1	3	0	0	1	27	27	29	0.0000	2.1505	27.9570	33.3333	13.9785	6.4516	9.6774	3.2258	1.0753	2.1505	0.0000	0.0000	0.0000	0.0000
2001	1	3	0	0	1	28	28	30	0.0000	2.5316	25.9494	29.1139	15.1899	8.8608	8.8608	1.8987	3.1646	1.8987	1.2658	0.6329	0.0000	0.6329
2001	1	3	0	0	1	29	29	30	0.0000	0.5952	31.5476	23.8095	18.4524	14.2857	5.9524	2.9762	1.7857	0.5952	0.0000	0.0000	0.0000	0.0000
2001	1	3	0	0	1	30	30	28	0.0000	0.9950	21.3930	23.3831	18.9055	11.4428	10.9453	2.9851	2.9851	1.9900	0.9950	2.9851	0.4975	0.4975
2001	1	3	0	0	1	31	31	27	0.0000	1.1976	18.5629	17.9641	16.1677	19.1617	11.9760	2.9940	4.7904	2.9940	1.7964	1.7964	0.0000	0.5988
2001	1	3	0	0	1	32	32	25	0.0000	0.0000	10.4478	11.1940	11.9403	32.8358	14.1791	5.2239	4.4776	2.9851	2.2388	1.4925	0.7463	2.2388
2001	1	3	0	0	1	33	33	26	0.0000	0.0000	10.0840	7.5630	15.1261	24.3697	15.9664	5.0420	5.0420	2.5210	5.0420	3.3613	1.6807	4.2017
2001	1	3	0	0	1	34	34	24	0.0000	0.0000	5.6180	13.4831	14.6067	29.2135	11.2360	6.7416	4.4944	5.6180	3.3708	1.1236	0.0000	4.4944
2001	1	3	0	0	1	35	35	25	0.0000	0.0000	1.5385	1.5385	9.2308	30.7692	13.8462	12.3077	9.2308	4.6154	6.1538	0.0000	1.5385	9.2308
2001	1	3	0	0	1	36	36	18	0.0000	0.0000	2.4390	0.0000	7.3171	31.7073	19.5122	4.8780	4.8780	12.1951	0.0000	7.3171	2.4390	7.3171
2001	1	3	0	0	1	37	37	13	0.0000	0.0000	0.0000	0.0000	12.5000	37.5000	20.8333	4.1667	4.1667	4.1667	0.0000	4.1667	0.0000	12.5000
2001	1	3	0	0	1	38	38	10	0.0000	0.0000	0.0000	0.0000	15.0000	35.0000	10.0000	10.0000	5.0000	10.0000	10.0000	0.0000	0.0000	5.0000
2001	1	3	0	0	1	39	39	10	0.0000	5.0000	0.0000	0.0000	5.0000	40.0000	10.0000	0.0000	15.0000	5.0000	10.0000	0.0000	0.0000	10.0000
2001	1	3	0	0	1	40	40	7	0.0000	0.0000	0.0000	0.0000	12.5000	50.0000	12.5000	12.5000	0.0000	12.5000	0.0000	0.0000	0.0000	0.0000
2001	1	3	0	0	1	41	41	8	0.0000	0.0000	0.0000	0.0000	7.1429	14.2857	7.1429	0.0000	21.4286	14.2857	0.0000	21.4286	7.1429	7.1429
2001	1	3	0	0	1	42	42	5	0.0000	0.0000	0.0000	0.0000	0.0000	14.2857	0.0000	28.5714	14.2857	0.0000	14.2857	14.2857	0.0000	14.2857
2001	1	3	0	0	1	43	43	3	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	33.3333	33.3333	0.0000	0.0000	33.3333	0.0000	0.0000
2001	1	3	0	0	1	44	44	2	0.0000	0.0000	0.0000	0.0000	0.0000	50.0000	0.0000	0.0000	50.0000	0.0000	0.0000	0.0000	0.0000	0.0000
2001	1	3	0	0	1	45	45	4	0.0000	0.0000	0.0000	0.0000	0.0000	25.0000	25.0000	0.0000	25.0000	0.0000	0.0000	0.0000	0.0000	25.0000
2001	1	3	0	0	1	46	46	3	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	25.0000	25.0000	0.0000	25.0000	0.0000	25.0000	0.0000	0.0000
2001	1	3	0	0	1	47	47	2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	50.0000	0.0000	50.0000	0.0000	0.0000	0.0000
2001	1	3	0	0	1	48	48	1	0.0000	0.0000	0.0000	0.0000	0.0000	50.0000	0.0000	0.0000	0.0000	0.0000	50.0000	0.0000	0.0000	0.0000
2001	1	3	0	0	1	49	49	2	0.0000	0.0000	0.0000	0.0000	0.0000	16.6667	16.6667	0.0000	0.0000	0.0000	50.0000	16.6667	0.0000	0.0000
2001	1	3	0	0	1	50	50	4	0.0000	0.0000	0.0000	0.0000	0.0000	25.0000	50.0000	0.0000	0.0000	25.0000	0.0000	0.0000	0.0000	0.0000
2001	1	3	0	0	1	51	51	4	0.0000	0.0000	0.0000	0.0000	0.0000	22.2222	0.0000	0.0000	33.3333	11.1111	0.0000	11.1111	11.1111	11.1111
2003	1	3	0	0	1	6	6	1	100.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
2003	1	3	0	0	1	9	9	1	100.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
2003	1	3	0	0	1	11	11	2	100.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
2003	1	3	0	0	1	12	12	2	100.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
2003	1	3	0	0	1	13	13	4	75.0000	5.0000	5.0000	15.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
2003	1	3	0	0	1	14	14	4	91.6667	4.1667	0.0000	4.1667	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
2003	1	3	0	0	1	15	15	8	58.6207	13.7931	6.8966	20.6897	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

2003	1	3	0	0	1	16	16	8	53.8462	0.0000	3.8462	38.4615	3.8462
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2003	1	3	0	0	1	17	17	8	55.2632	0.0000	7.8947	28.9474	7.8947
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2003	1	3	0	0	1	18	18	9	14.2857	23.8095	28.5714	33.3333	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2003	1	3	0	0	1	19	19	14	17.1429	17.1429	40.0000	25.7143	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2003	1	3	0	0	1	20	20	14	9.3750	18.7500	68.7500	0.0000	0.0000
3.1250	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2003	1	3	0	0	1	21	21	29	0.0000	4.5455	80.3030	13.6364	1.5152
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2003	1	3	0	0	1	22	22	43	0.0000	8.5938	86.7188	4.6875	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2003	1	3	0	0	1	23	23	56	0.0000	1.7007	88.0952	7.4830	1.3605
0.3401	0.6803	0.3401	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2003	1	3	0	0	1	24	24	55	0.0000	1.4327	90.5444	5.7307	0.5731
1.4327	0.2865	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2003	1	3	0	0	1	25	25	59	0.0000	0.8746	79.5918	12.8280	1.1662
3.4985	1.4577	0.2915	0.2915	0.0000	0.0000	0.0000	0.0000	0.0000					
2003	1	3	0	0	1	26	26	61	0.0000	0.6173	61.7284	12.6543	3.7037
10.1852	4.9383	2.4691	1.8519	1.2346	0.3086	0.3086	0.0000	0.0000					
2003	1	3	0	0	1	27	27	53	0.0000	0.0000	47.1264	16.8582	3.4483
16.4751	7.6628	3.4483	3.8314	0.0000	0.3831	0.3831	0.0000	0.3831					
2003	1	3	0	0	1	28	28	55	0.0000	0.0000	28.9256	12.3967	4.9587
17.3554	14.4628	5.3719	8.2645	2.0661	0.8264	2.8926	0.0000	2.4793					
2003	1	3	0	0	1	29	29	43	0.0000	0.0000	20.9581	10.1796	6.5868
19.7605	15.5689	7.7844	10.7784	2.9940	1.1976	1.7964	1.1976	1.1976					
2003	1	3	0	0	1	30	30	41	0.0000	0.0000	16.4286	10.0000	7.1429
15.7143	14.2857	5.7143	12.1429	5.7143	2.8571	2.1429	5.0000	2.8571					
2003	1	3	0	0	1	31	31	32	0.0000	0.0000	13.7931	13.7931	5.7471
21.8391	12.6437	11.4943	11.4943	2.2989	3.4483	0.0000	1.1494	2.2989					
2003	1	3	0	0	1	32	32	28	0.0000	0.0000	8.7500	7.5000	6.2500
18.7500	16.2500	13.7500	10.0000	5.0000	5.0000	0.0000	5.0000	3.7500					
2003	1	3	0	0	1	33	33	24	0.0000	0.0000	5.3571	5.3571	19.6429
16.0714	12.5000	17.8571	8.9286	5.3571	1.7857	3.5714	3.5714	0.0000					
2003	1	3	0	0	1	34	34	19	0.0000	0.0000	11.9048	11.9048	14.2857
7.1429	11.9048	16.6667	9.5238	4.7619	7.1429	2.3810	2.3810	0.0000					
2003	1	3	0	0	1	35	35	12	0.0000	0.0000	0.0000	11.4286	25.7143
14.2857	20.0000	14.2857	5.7143	0.0000	0.0000	2.8571	0.0000	5.7143					
2003	1	3	0	0	1	36	36	12	0.0000	0.0000	0.0000	4.1667	29.1667
20.8333	8.3333	29.1667	0.0000	0.0000	0.0000	4.1667	0.0000	4.1667					
2003	1	3	0	0	1	37	37	7	0.0000	0.0000	0.0000	11.7647	35.2941
0.0000	5.8824	17.6471	17.6471	5.8824	0.0000	5.8824	0.0000	0.0000					
2003	1	3	0	0	1	38	38	6	0.0000	0.0000	0.0000	13.3333	33.3333
6.6667	6.6667	13.3333	0.0000	6.6667	0.0000	13.3333	0.0000	6.6667					
2003	1	3	0	0	1	39	39	5	0.0000	0.0000	0.0000	12.5000	0.0000
12.5000	37.5000	25.0000	0.0000	12.5000	0.0000	0.0000	0.0000	0.0000					
2003	1	3	0	0	1	40	40	3	0.0000	0.0000	0.0000	25.0000	0.0000
0.0000	25.0000	25.0000	12.5000	0.0000	12.5000	0.0000	0.0000	0.0000					
2003	1	3	0	0	1	41	41	6	0.0000	0.0000	0.0000	14.2857	14.2857
0.0000	28.5714	14.2857	14.2857	0.0000	0.0000	0.0000	0.0000	14.2857					
2003	1	3	0	0	1	42	42	2	0.0000	0.0000	0.0000	0.0000	28.5714
14.2857	14.2857	28.5714	0.0000	0.0000	0.0000	0.0000	0.0000	14.2857					
2003	1	3	0	0	1	43	43	5	0.0000	0.0000	0.0000	0.0000	57.1429
0.0000	0.0000	0.0000	28.5714	0.0000	0.0000	0.0000	0.0000	14.2857					
2003	1	3	0	0	1	45	45	2	0.0000	0.0000	0.0000	50.0000	0.0000
50.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2003	1	3	0	0	1	46	46	2	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	50.0000	0.0000	50.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2003	1	3	0	0	1	47	47	2	0.0000	0.0000	0.0000	0.0000	50.0000
0.0000	50.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2003	1	3	0	0	1	48	48	2	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	100.0000	0.0000	0.0000	0.0000					
2003	1	3	0	0	1	50	50	2	0.0000	0.0000	0.0000	0.0000	0.0000
50.0000	0.0000	0.0000	0.0000	50.0000	0.0000	0.0000	0.0000	0.0000					
2003	1	3	0	0	1	51	51	6	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	14.2857	28.5714	0.0000	28.5714	14.2857	0.0000	0.0000	14.2857					
2005	1	3	0	0	1	9	9	1	100.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					

2005	1	3	0	0	1	10	10	1	100.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2005	1	3	0	0	1	11	11	4	100.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2005	1	3	0	0	1	12	12	6	100.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2005	1	3	0	0	1	13	13	7	100.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2005	1	3	0	0	1	14	14	10	100.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2005	1	3	0	0	1	15	15	8	100.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2005	1	3	0	0	1	16	16	10	100.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2005	1	3	0	0	1	17	17	9	91.8919	8.1081	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2005	1	3	0	0	1	18	18	10	86.9565	8.6957	4.3478	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2005	1	3	0	0	1	19	19	8	50.0000	28.5714	21.4286	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2005	1	3	0	0	1	20	20	10	33.3333	40.0000	26.6667	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2005	1	3	0	0	1	21	21	6	25.0000	37.5000	12.5000	25.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2005	1	3	0	0	1	22	22	22	0.0000	9.0909	36.3636	12.1212	42.4242
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2005	1	3	0	0	1	23	23	28	0.0000	5.1948	25.9740	15.5844	48.0519
3.8961	1.2987	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2005	1	3	0	0	1	24	24	36	0.0000	1.1173	12.2905	7.2626	73.1844
5.0279	1.1173	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2005	1	3	0	0	1	25	25	41	0.0000	0.0000	12.3016	7.1429	73.8095
5.1587	0.7937	0.3968	0.0000	0.3968	0.0000	0.0000	0.0000	0.0000					
2005	1	3	0	0	1	26	26	42	0.0000	0.0000	5.1471	5.8824	75.3676
8.0882	1.4706	1.8382	1.1029	1.1029	0.0000	0.0000	0.0000	0.0000					
2005	1	3	0	0	1	27	27	41	0.0000	0.0000	3.2653	5.3061	69.3878
8.5714	4.8980	4.4898	1.2245	1.6327	0.0000	0.4082	0.0000	0.8163					
2005	1	3	0	0	1	28	28	39	0.0000	0.0000	1.5957	7.4468	65.4255
10.6383	3.7234	6.3830	2.1277	2.1277	0.5319	0.0000	0.0000	0.0000					
2005	1	3	0	0	1	29	29	32	0.0000	0.0000	0.8333	1.6667	66.6667
10.0000	3.3333	6.6667	5.0000	2.5000	2.5000	0.8333	0.0000	0.0000					
2005	1	3	0	0	1	30	30	27	0.0000	0.0000	0.0000	4.4776	55.2239
5.9701	1.4925	14.9254	8.9552	5.9701	0.0000	1.4925	0.0000	1.4925					
2005	1	3	0	0	1	31	31	23	0.0000	0.0000	2.1277	4.2553	44.6809
6.3830	4.2553	10.6383	8.5106	2.1277	8.5106	4.2553	2.1277	2.1277					
2005	1	3	0	0	1	32	32	12	0.0000	0.0000	0.0000	0.0000	33.3333
9.5238	9.5238	9.5238	19.0476	9.5238	4.7619	4.7619	0.0000	0.0000					
2005	1	3	0	0	1	33	33	12	0.0000	0.0000	0.0000	0.0000	20.0000
26.6667	13.3333	13.3333	0.0000	20.0000	6.6667	0.0000	0.0000	0.0000					
2005	1	3	0	0	1	34	34	9	0.0000	0.0000	0.0000	8.3333	25.0000
25.0000	8.3333	16.6667	8.3333	0.0000	8.3333	0.0000	0.0000	0.0000					
2005	1	3	0	0	1	35	35	5	0.0000	0.0000	0.0000	0.0000	25.0000
25.0000	0.0000	0.0000	37.5000	12.5000	0.0000	0.0000	0.0000	0.0000					
2005	1	3	0	0	1	36	36	3	0.0000	0.0000	0.0000	0.0000	100.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2005	1	3	0	0	1	37	37	5	0.0000	0.0000	0.0000	0.0000	20.0000
40.0000	0.0000	20.0000	20.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2005	1	3	0	0	1	38	38	2	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	50.0000	0.0000	0.0000	50.0000	0.0000	0.0000	0.0000					
2005	1	3	0	0	1	39	39	1	0.0000	0.0000	0.0000	0.0000	0.0000
100.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2005	1	3	0	0	1	40	40	1	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	100.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2005	1	3	0	0	1	45	45	1	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	100.0000	0.0000	0.0000	0.0000					
2005	1	3	0	0	1	46	46	1	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	100.0000	0.0000	0.0000	0.0000	0.0000					
2005	1	3	0	0	1	49	49	1	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	100.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
2005	1	3	0	0	1	50	50	1	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	100.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					

2005	1	3	0	0	1	51	51	6	0.0000	0.0000	0.0000	0.0000	14.2857
0.0000	0.0000	0.0000	42.8571	14.2857	14.2857	0.0000	14.2857	0.0000					

0 #_N_MeanSize-at-Age_obs
#Yr Seas Flt/Svy Gender Part Ageerr Ignore datavector(female-male)
samplesize(female-male)

0 #_N_environ_variables
0 #_N_environ_obs

999

Report

of the

Joint Canadian and U.S. Pacific Hake/Whiting Stock Assessment Review Panel

conducted on
February 6-9, 2006

Northwest Fisheries Science Center
2725 Montlake Blvd. East, Seattle Washington

Overview

On February 6th - 9th a joint Canada-US Pacific Hake/Whiting STAR Panel met in Seattle, Washington to review the stock assessment by Helser et al. (2006). The Panel operated according to the Terms of Reference for STAR Panels (SSC 2004), but as in 2005, the Panel attempted to adhere to the spirit of the Treaty on Pacific Hake/Whiting. As was the case in 2004 and 2005, both a Panel member and Advisor from Canada participated in the review (see List of Attendees). The revised stock assessment and the STAR Panel review will be forwarded to the Pacific Fishery Management Council, council advisory groups, and to Canadian DFO managers and the PSARC Groundfish Sub-committee.

The STAT Team was represented at the meeting by Thomas Helser, Guy Fleischer, Ian Stewart, and Steve Martell. Public comment was entertained during the meeting. The STAR Panel members received a draft of the assessment over two weeks prior to the meeting, which was sufficient time to adequately review the assessment. The meeting commenced on February 6th, 2006 with introductions followed by a review of the 2005 acoustic survey by Guy Fleischer. After the acoustic survey presentation, Tom Helser began a detailed description of the stock assessment. He noted that the new assessment was conducted in Stock Synthesis II version 1.21 (SS2) (Methot 2005), and explained how this modeling environment afforded improvements over the previous ADMB Pacific hake model. A presentation of the input data and modeling results from the 2006 assessment followed. Steve Martell gave a presentation on time varying and cohort based growth of Pacific hake. He explained why time varying k was used in the SS2 modeling. On the second day of the meeting, Tom Helser concluded his presentation of the assessment results. Panel discussion continued until the meeting was adjourned on February 9th. The Panel recognized and appreciated the contributions of the STAT team.

The Panel recommended acceptance of two equally plausible models to represent the uncertainty in the relative depletion level and productivity of the stock, one in which q was fixed at 1 and the other in which q was estimated with an informative prior (mean of 1 and a standard deviation equivalent to 0.1).

The STAT Team conducted a retrospective that sequentially removed the most recent years data back to 2000 in the q=1 model. The most prominent divergence from the general trend was the downward trend of the model that used data only to the year 2000, which failed to capture the upturn in stock biomass associated with the 1999 year class. This analysis revealed no obvious model pathologies.

The STAT Team proposed and is intending to construct a post-STAR Panel review Bayesian model run that would be integrated over the range of q implied by the prior distribution. The STAR Panel acknowledges the value of this approach, but due to the time constraints associated with producing these results, the STAR panel did not have the opportunity to review this work.

The Panel concurred that the assessment is suitable for use by the Council and Council advisory bodies for ABC and OY projections.

The STAR Panel commends the STAT team for the quality of the document provided for review and their cooperation in performing additional analyses requested during the meeting (see list of new analyses requested by the STAR Panel, below).

Summary of stock assessment and Panel discussion

The assessment highlights focused on the migration of the 2005 hake assessment model (programmed in ADMB, Helser et al. 2005) into SS2 (Version 1.21). The overarching objective focused on bringing the model to the data (in other words, keeping the data in it's most pure, elemental form), explicitly estimating growth dynamics, and achieving parsimony in terms of model complexity. For example, selectivity was previously modeled as a random walk process (to characterize removals as best as possible), and previous review panels thought this may have led to over-parameterization.

. The dynamic growth model has reduced the need for this approach. The STAT Team recognized that future directions for research and modeling include incorporating migration into the model, evaluating the increased use of covariates, modeling different sectors of the hake fishery in the U.S. and Canada independently, and further evaluating cohort-specific growth.

There was some discussion regarding interesting occurrences in both age and length composition data and in growth rates. For example, Canadian length composition data suggest a strong 1994 year class (observed as age 1 fish in 1995, age 2 fish in 1996, with apparently rapid growth rates), not observed in any other data. The possibility has been discussed that these fish may have been spawned in the north and never migrated south. Similarly, there is a lack of fit in 2001 and 2002 that may be due to a limited migration of the main stock and changes in the spatial distribution of fishing effort.

Other issues related to the acoustic survey were discussed, such as the varying spatial coverage (both latitudinal and across depth), and the use or removal of the 1986 data point, without which, the survey is essentially flat. The relative flatness of the acoustic time series is difficult to reconcile with the age and length composition data. In general, the fit to the age composition data dominate the objective function. The possibility of disregarding the pre-1992 data altogether has also been discussed, as acoustic technology has changed substantially since this period, and raw data for early years are difficult to reconstruct and reanalyze.

List of New Analyses Requested by the STAR Panel

The following list describes each request made of the STAT team, followed by the reason for the request and outcomes of the analysis:

1) Use the biomass at age and the survey selectivity curve to assess what proportion of the spawning biomass is less vulnerable with respect to the acoustic survey. Rationale: there are concerns regarding the inability of the survey to “see” the entire biomass.

Response: The STAT Team presented a graph of both the absolute and relative proportions of SSB that is not observed by the survey due to estimated selectivity. The fraction of this biomass was on the order of 15% throughout the early part of the time series, increased to as much as 30% during the mid- and late 1990s when the 1980 and the 1984 cohorts moved into older age classes. Over recent years, the fraction of biomass not seen by the survey has fallen to 5 to 10%, as the population is composed primarily of younger fish. This suggests that the current SSB is reflecting fish that are being seen in the survey. The Panel suggested that a figure such as the one produced by the STAT Team should be included in the final assessment document.

2) Run the model using asymptotic selectivity for the acoustic survey, both with age of full selectivity free and with a prior on the ascending slope of the selectivity curve that would approximate full selectivity at age 5. Rationale is same as above.

Response: The STAT Team reported that there was a degradation of fit to the age composition data by assuming asymptotic selectivity to the acoustic survey. Although the trend in depletion is comparable with the STAT base model (depletion is slightly greater, such that the 2006 biomass is below $B_{25\%}$), there is a generally downward scaling of the total stock biomass over time. The SSB time series with the age of full selectivity moved forward to age 5, there was little change relative to the base model result.

3) Explore the results when pre-1992 acoustic survey data points (both biomass and age/size comps) are removed from the model. Rationale: The higher CVs used in the early acoustic survey data lead the Panel to question what impact those data are having in the model. Similarly, the observation that full selectivity is not reached until age 9, whereas 9 year old fish rarely comprise a major fraction of the catch at age, lead to questions regarding the true shape of the acoustic survey selectivity curve.

Response: The resulting model shows a shift in the selectivity of acoustic survey towards older age classes, the relative size of the 1999 year class is increased, and the 2006 SSB is estimated to be at approximately target levels (B_{40}): very little else changes in the model.

4) Down-weight the input sample sizes to the 2001-2002 Canadian age-composition data (as well as conditional length at age) to assess what the impact is to the model. Rationale: This will allow the STAT and STAR to evaluate what the consequences of these patterns may be to the model (particularly the strength of the 1999 year class).

Response: The input sample sizes were set to 1 for these years, and the selectivity block for 2001-2002 was merged with that for 2003-2005. The bottom line was that there is very little overall change, the model comes up with the same expected values for those years, but they are no longer contributing to the objective function.

5) Following up on request #2 to use asymptotic selectivity for acoustic survey, repeat this run, but (1) allow q to be estimated in one of the asymptotic selectivity runs, (2) allow M to be estimated with a uninformative prior, if feasible.

Response: The resulting objective function was degraded from the base model (dome-shaped selectivity), the estimated value for M was 0.33, and the ending biomass is approximately $B_{25\%}$. Essentially, the model predicts fewer older fish, and forces fishery selectivity curves into unusual configurations. In this run, the STAT Team used a very uninformative prior on M, with a standard deviation of 0.8. When estimated, q fell to unrealistically low values, indicating some sort of informative prior was necessary to fit it.

6. With respect to the catchability coefficient (q), run the model with an informative prior on q (mean of 1 and a standard deviation of 0.1), both with the entire acoustic biomass time series as well as without the pre-1992 data. Rationale: Fixing q at 1 underestimates the true uncertainty in the model.

Response: The STAT Team noted that q in the model is estimated in log space, so the prior had a mean of 0 with a standard deviation of 0.112, which provides an equivalent probability density to the request. The result of the first run gave an estimated q of 0.69, consistent with the general tendency of this model to estimate a lower q. The greatest change was in global scaling upward in total biomass, a slightly greater upswing relative to the 1999 year class, and slightly lower depletion level (close to 0.4) in 2006. The question was raised as to whether there would be significant changes to the confidence intervals in the forecasts, the STAT Team opined that any resulting changes would be modest. The catch forecasts from this model were on the order of 1 million tons (942,000) in 2006, dropping to 587,000 in 2007; nearly double those of the base model.

With the pre-1992 data excluded, q ends up at about 0.76 rather than 0.69, the trend is similar throughout the beginning of the time series, but towards the end of the time series the size of the 1999 year class is substantially increased (to the second-largest in the time series, after 1980), and depletion is less (on the order of 0.5). This implies that q was lower in the early survey years. In general, the STAT Team thinks that by leaving the entire time series in the model, being forthcoming about the additional uncertainty in the early part of the time series, the model may provide a more appropriate reflection of the survey index over time. The overall improvement in fit was extremely small, suggesting that there is little information in the data to inform an estimate of q.

7. Run the model with a steepness value (h) of 0.75. Rationale: There is some resistance to the idea that recruitment is entirely independent of SSB. In a meta-analysis of steepness values for thirteen assessed Merluciid stocks, Dorn (1999) had earlier estimated a posterior mode of approximately 0.6, with a wide posterior distribution that was indicative of a great deal of uncertainty. The STAR Panel suggests that a reasonable expectation for steepness might be 0.75, based on theoretical considerations as well as Myers et al. 2002.

The resulting biomass and relative depletion trends were nearly identical to the base model, as the observed recruitments have been driven by age data. However the forecasts are considerably less optimistic as there is an element of density dependence in future mean recruitment. Catch projections for 2006 were nearly identical, but projections for future catches declined somewhat more rapidly than the base model. The objective function reflected an extremely small change in overall fit. There was general agreement expressed by both the STAT and the STAR Panel that the lower steepness value may represent a more realistic expectation for h.

8. Provide the relative contributions to changes in likelihood in the model runs in request # 2 (asymptotic versus dome-shaped selectivity, and a freely estimated M). Rationale: the Panel was interested in what factors actually contributed to the relative changes in likelihood.

Response: Where there were changes in likelihood components, the greatest changes were observed in fits to age composition data, which comprised the largest part of the overall likelihood. By forcing asymptotic selectivity, there was a slight improvement in fit to the Canadian age composition data, but degradation in fit to the U.S. fishery and acoustic survey data. Perhaps the Canadian fishery should be modeled with asymptotic selectivity in future assessments.

9. Evaluate the relative proportion of older hake in the triennial versus the acoustic survey over time. Rationale: There are questions lingering regarding where the older fish (i.e. those not seen in the acoustic survey) might be. If feasible, explore doing this with the Canadian catch-at-age data as well.

Response: A cursory attempt was made using acoustic and bottom trawl survey age composition data to evaluate whether there was empirical evidence for dome-shaped selectivity. The analysis conducted by the STAT team during the meeting provided preliminary evidence in support of dome-shaped selectivity. However, a more through analysis is needed to adequately address this issue.

10. Provide graphs of the time series from beginning of the modeled time period to 2009 that includes catch, spawning biomass, depletion, and exploitation rate (relative to vulnerable biomass). Present the time series to 2005 and the forecasts with a different set of symbols. Do these for the STAT base model with steepness set at 0.75.

Response: The STAT Team provided a graphic of the proportion of the ABC that the OY would represent in the forecasts (presented as Figure 1, below), such that in 2006 the OY would be close to 90% of the ABC, and in 2009 the OY would be roughly 55% of the ABC. The forecasts were then shown plotted with the historical trajectories, which showed that the SSB would decline to the lowest level of the time series by 2009. Depletion would fall below 25% in 2007 and drop to ~20% in 2008. The OY in 2006 would be well above any historical catch, and the exploitation rate would be significantly greater than any historical rate. Both catch and exploitation rate would drop from 2007 to 2009, while SSB and depletion would remain relatively constant.

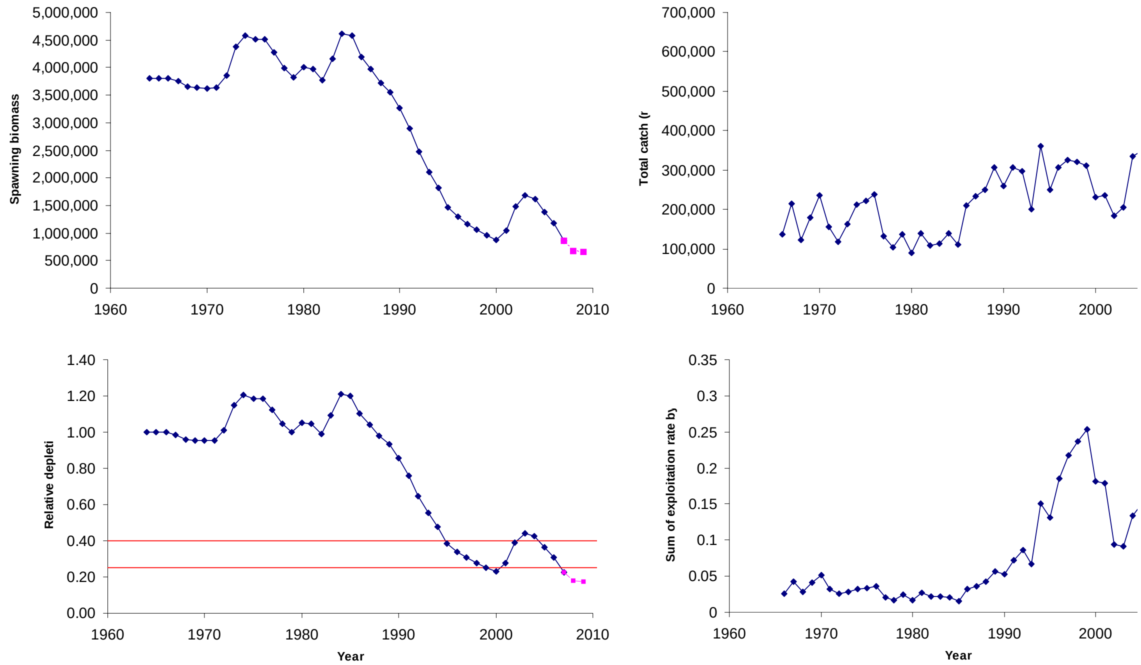


Figure 1: Graphs of the time series from beginning of the modeled time period to 2009 that includes catch, spawning biomass, depletion, and exploitation rate (relative to vulnerable biomass).

11) The STAR Panel requests that the base model be run with steepness fixed at 0.75 and acoustic survey catchability (q) estimated with a mean of 1 and a standard deviation of 0.1 in the equivalent log domain. Rationale: The STAR Panel would like to evaluate the STAT base model with steepness fixed at 0.75, with q estimated.

Response: The absolute scale of spawning biomass shows a relatively modest difference in total spawning biomass, with the q estimated scenario scaling the biomass upwards by nearly 1 million tons in the early part of the time series. From the perspective of relative depletion, trends are nearly identical until the year 2001, where there is a greater difference in the relative strength of the 1999 year class, such that depletion is greater (~0.31) with the q=1 scenario than the q estimated scenario (~0.37).

12) The STAR would like to see projections of the base model with a range of catches (0 to 400,000 tons in 100,000 ton increments) to evaluate the relative impact of harvest on the biomass trajectory. Rationale: Given that the strict application of the 40:10 harvest rule in this run will result in stock biomass falling below the 25% depletion level,

the STAR Panel would like to explore the relative impact of fishing on future stock biomass.

Response: With catch set at 0 in 2006 onward, the biomass continues to decline, albeit modestly, until 2009 when it increases slightly (Results shown as Figure 2a). Only this scenario, and that in which the catch equals 100,000 mt show the biomass remaining above $B_{25\%}$ through 2009. The scenarios in which the annual catch was fixed at 200,000 to 400,000 mt show increasing declines through 2009 (the former only modestly, the latter substantially). It was agreed that this graph was informative, and the STAT and STAR agreed that this result should be included in the final assessment document. There was agreement that it would be beneficial to produce this graph, and the accompanying tables of SSB and depletion, for any of the alternative states of nature included in the decision table.

13) The STAR Panel would like to see the same graphic as in request #12 with the q estimated scenario (as in request #11). Rationale: Same as request # 12.

Response: Provided as Figure 2b (below). In this scenario, only catch streams of 400,000 tons or greater drive the stock below the $B_{25\%}$ threshold (and this only in later years).

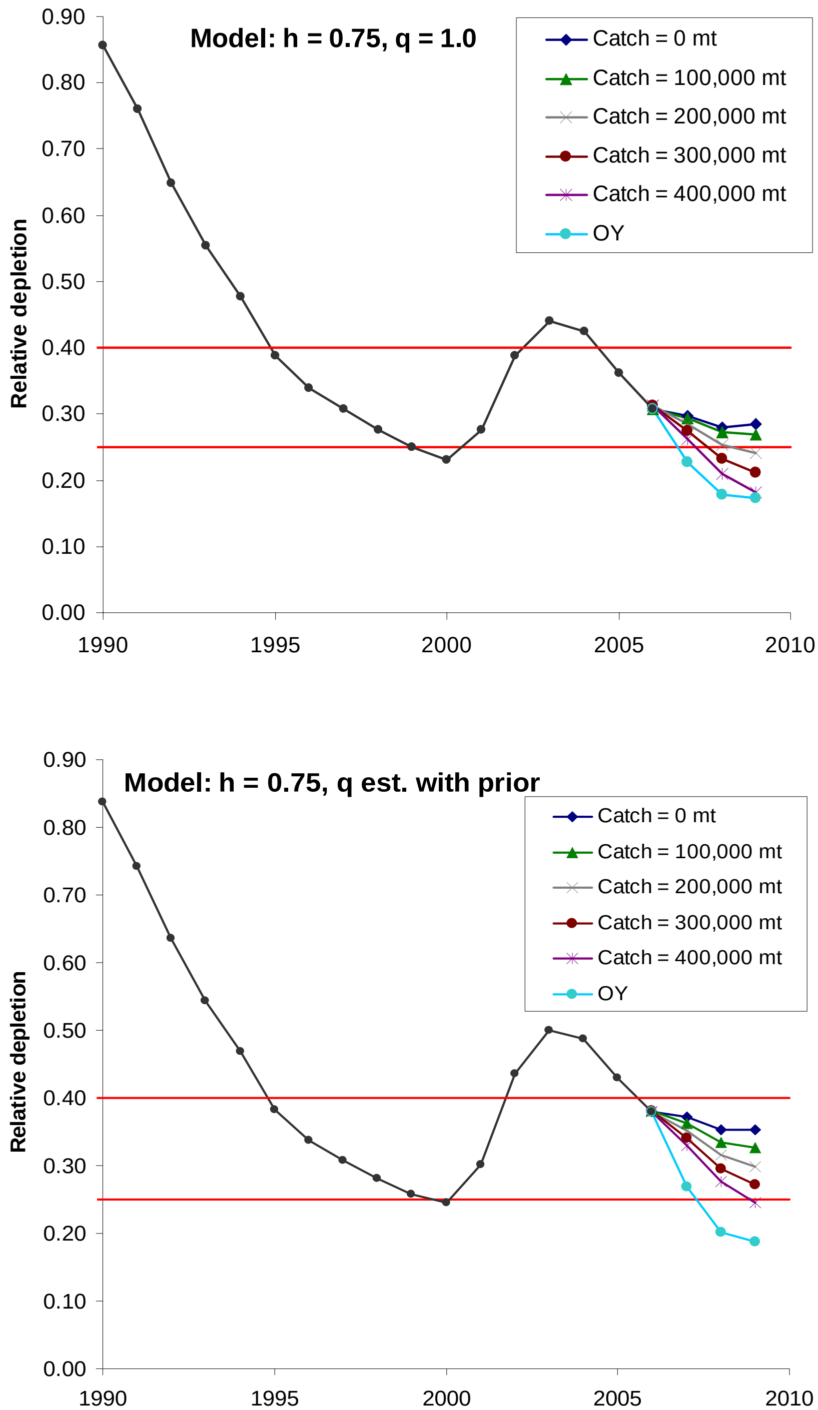


Figure 2a and 2b. Projections of the two base models (q fixed at 1, top; q estimated with an informative prior, bottom) with a range of catches (0 to 400,000 tons in 100,000 ton increments) to evaluate the relative impact of harvest on the biomass trajectory.

14) The STAR Panel would like to see a draft decision table, based on the two scenarios presented as preliminary base and alternative models in request # 11 (the STAT base model with steepness fixed at 0.75 and acoustic survey catchability (q) estimated with an informative prior with mean of 1 and a standard deviation of 0.1 in the equivalent log domain). Rationale: The STAR Panel considers these two models to be the two most important alternative states of nature for the final document. The decision table will include the following management actions: OY from model 1, OY from model 2, and 200,000 and 400,000 mt total coast-wide catch for 2006-2008.

The STAT Team produced a decision table as requested (Table 1, below). In all of the resulting scenarios, the biomass trended downward over time, in nearly all of the scenarios the stock was projected to be depleted (below $B_{25\%}$) by 2009. Assuming the more optimistic state of nature (q estimated), when the true state of nature was q=1 resulted in substantial depletion by 2009, although this scenario was associated with what might be considered an unrealistic catch in 2006 (880,000 mt).

In the scenario in which both the assumed and the true state of nature was q=1, depletion was 0.31 in 2006, 0.23 in 2007, and 0.14 in 2008. In the scenario in which both the assumed and the true state of nature was the q as estimated, depletion was 0.38 in 2006, 0.27 in 2007, and 0.20 in 2008.

Table 1: Decision Table for the 2006 Pacific hake assessment

			State of nature	
Relative probability			**50%**	**50%**
Model			**1**	**2**
Details			h = 0.75, q = 1.0	h = 0.75, q est. with prior
Management action				
	Catch (mt)	Year	Relative depletion	Relative depletion
OY Model 1	593,746	2006	0.308	0.380
	358,416	2007	0.227	0.310
	213,223	2008	0.178	0.263
	183,620	2009	0.172	0.254
OY Model 2	883,490	2006	0.308	0.380
	522,511	2007	0.202	0.268
	302,298	2008	0.144	0.202
	240,702	2009	0.136	0.188
Catch = 200,000 mt (coastwide)	200,000	2006	0.308	0.380
	200,000	2007	0.282	0.351
	200,000	2008	0.250	0.315
	200,000	2009	0.239	0.299
Catch = 400,000 mt (coastwide)	400,000	2006	0.308	0.380
	400,000	2007	0.258	0.330
	400,000	2008	0.207	0.276
	400,000	2009	0.178	0.245

Technical merits and deficiencies

There was considerable discussion of the merits of using time varying growth and cohort-based fits of the growth curves, as SS2 can allow any of the growth parameters to vary over time. The STAT Team experimented with fitting three different growth models using survey data (assuming constant size selectivity), noting that fish of a given age were almost 40% smaller (in mass) in the mid-1980s relative to recent years. Time varying growth in the base model was implemented using differences in both L_{max} and K in pre- and post- 1980 blocks. The STAR Panel requested that supporting documentation of the time-varying growth analysis be included in the final stock assessment document.

Areas of Major Uncertainty

All model runs provided by the STAT Team showed similar results with respect to depletion trends. With respect to absolute abundance, the run with asymptotic acoustic selectivity provides a substantially lower SSB estimate over time (with greater depletion and exploitation rates), and the runs with lower (estimated) q has a higher scaled total biomass. The model with steepness fixed at 0.75 diverges very little from the base, with the greatest differences arising in longer term forecasts. With the exception of the poorer fits in the asymptotic acoustic selectivity run, the most striking observation was the wide range of estimated optimum yields, with very little changes in the total likelihood value. The biomass trend is robust, what is observed is a scaling issue of the total biomass over time. Most of the harvest rates estimated in these models indicate that these rates would be among the highest ever observed for all model formulations.

The acoustic survey q continues to be a major source of uncertainty in the stock assessment. Future work is needed to help resolve the *q* issue (see Research Recommendations). Past STAR Panels bounded uncertainty with q=0.6 and q=1.0. This Panel decided to represent uncertainty over the states of nature by the model with q fixed at 1, and the model with q estimated (but a prior placed on 1, with a standard deviation equivalent to 0.1). Although the approach differed from past panels, the end result with respect to the two scenarios was consistent, reflecting the model's tendency to estimate lower q values and scale the total biomass and trend accordingly. The Panel and STAT team concluded that sufficient information was not available at the meeting to determine *q* more precisely.

The Southwest Fisheries Science Center Santa Cruz Lab juvenile survey was used to provide a recruitment index for Pacific hake from 1986 to 2005, and the index was used to inform the 2004 and 2005 recruitment levels for projections. The results of a similar survey conducted jointly by the Northwest Fisheries Science Center (NWFSC) and the Pacific Whiting Conservation Cooperative (PWCC), which covers a larger geographic area, were presented to the STAR Panel but were not used in this assessment. It was noted that the two surveys had conflicting results in 2003, but were in agreement that the 2004 year class was likely above average. Due to the high CV's associated with the index, the model essentially disregards the index in the presence of informative age or length information. Specifically the presence of large number of age-2 fish in the 2005 survey has led the model to estimate close to average recruitment in 2003, which is the lowest data point in the survey index. Plans are underway to have a workshop related to application of the juvenile indices, which should focus on addressing many of the issues related to the use of these data.

For Pacific hake, with its particularly high recruitment variability, it would be advisable to utilize projections with time horizons shorter than 10 years. A reasonable projection time frame would be 3-4 years. In this assessment, 2009 (a four year projection) was the last year in which biomass projections were not substantially affected by the model assumption of recruitment based on the spawner recruit curve.

Areas of Disagreement

There were no substantial areas of disagreement between the STAT team and the STAR Panel.

Research Recommendations

The Panel considered the topic of research recommendations in two parts: 1) review of the status of old recommendations (made by the 2005 STAR Panel) and 2) development of new recommendations. The Panel prioritized each of the old recommendations as “S” (short term; to be addressed in the 2007 assessment), “M” (medium term; to be addressed by the 2008 assessment), and “L” (long term; to be addressed by the 2009 assessment and beyond).

Review of Old Recommendations

1. Continue to compare spatial distributions of hake across all years and between bottom trawl and acoustic surveys to estimate changes in catchability/availability across years. The two primary issues are related to the changing spatial distribution of the survey as well as the environmental factors that may be responsible for changes in the spatial distribution of hake. This issue is also important with respect to the acoustic survey selectivity curve, and with respect to the potential inclusion of environmental covariates in selectivity. **(M-in progress).**

2. Initiate analysis of the acoustic survey data to determine variance estimates for application in the assessment model. The analysis would provide a first cut to define the appropriate CV for the weighting of the acoustic data **(M to L-in progress)**

3. Continue to analyze proportions at age for the acoustic survey, as well as with the bottom trawl survey and commercial fisheries, to further evaluate the evidence for dome-shaped selectivity. Evaluate the changes in growth on selectivity. **(S- in progress)**

4. Continue to evaluate the current target strength for possible biases, and explore

alternative methods for estimating target strength. **(S- in progress)**

5. Develop an informed prior for the acoustic *q*. This could be done either with empirical experiments (particularly in off-years for the survey) or in a workshop format with technical experts. There is also the potential to explore putting the target strength estimation in the model directly. This prior should be used in the model when estimating the q parameter. **(M)**

6. Investigate covariates that may influence fishery selectivity **(L)**

7. Hold a workshop (currently in early planning stages) that focuses on evaluating the methodology and utility of the two ongoing juvenile surveys. Issues to be considered include investigating how the surveys are conducted and how the resulting indices are brought into assessment models. **(S)**

8. As a diagnostic exercise, conduct a VPA (Virtual Population Analysis) of the existing data. **(M).**

9. Address the inconsistencies in age reading, attempt to standardize the criteria and methods between the two labs, preferably thorough the Committee of Age Reading Experts (CARE). **(S)**

New Recommendations

10 Review the acoustic data to assess whether there are spatial trends in the acoustic survey indices that are not being captured by the model. The analysis should include investigation of the migration (expansion/contraction) of the stock in relation to variation in environmental factors. This would account for potential lack of availability of older animals and how it affects the selectivity function. **(M)**

11. Consider localized depletion experiments to estimate trawl and acoustic survey catchability coefficients (q's) and selectivity. Begin this process with consideration of experimental procedures and design, including smaller-scale trial experiments **(M)**

12. Evaluate harvest strategies and stock-size thresholds, through simulation studies or other means, that may better account for the variability and dynamics of the hake resource. This should include management strategies based on trend data, rather than absolute abundance estimates, similar to the current approach for managing Pacific cod in Canada. **(L)**

13. Consider the carrying capacity of the California Current to Pacific hake from an ecosystem perspective. For example, use existing information on the relative abundance and productivity of hake prey, from available data and/or ecosystem models (Ecopath, Atlantis), to consider plausible bounds on the total hake biomass in the California Current **(L)**

14. Investigate aspects of the life history characteristics for Pacific hake and their possible effects on the interrelationship of growth rates and maturity at age. This should include additional data collection of maturity states and fecundity, as current information is limited **(L)**

List of STAR Panel Participants

Tom Jagielo SSC, WDFW Panel Chair
Alan Sinclair DFO Panel Participant
Paul Medley CIE Reviewer
Jeff Fargo DFO Advisor
Marion Larkin GAP Advisor
John Field GMT Advisor (STAR Panel Rapporteur)

List of STAT Team Participants

Tom Helser NWFSC Lead Author
Ian Stewart NWFSC Co-Author
Guy Fleischer NWFSC Co-Author
Steve Martell UBC Co-Author

References

Dorn, M.W., M.W. Saunders, C.D. Wilson, M.A. Guttormsen, K. Cooke, R. Kieser, and M. Wilkins. 1999. Status of the coastal Pacific hake/whiting stock in U.S. and Canada in 1998. Status of the Pacific Coast Groundfish Fishery through 2003, Stock Assessment and Fishery Evaluation. Pacific Fishery Management Council, Portland OR.

Helser, T.E., Fleischer, G.W., Martell, S., and Nathan Taylor. 2005. Stock Assessment of Pacific Hake (Whiting) in U.S. and Canadian Waters in 2004. SSC. 2005. Groundfish stock assessment and review process for 2005-2006. Pacific Fishery Management Council.

Martell, S., Taylor, N., Helser, T. and Guy Fleischer. 2005. Estimating selectivity and natural mortality in the statistical catch-at-age model for Pacific hake *Merluccius productus.* Appendix A to: Stock Assessment of Pacific Hake (Whiting) in U.S. and Canadian Waters in 2004.

Methot, Richard. 2005. User Manual for the Assessment Program Stock Synthesis 2 (SS2). Model Version 1.18.April 8, 2005.NOAA Fisheries Seattle, WA.

Myers, R., Barrowman, N.J., and Ray Hilborn. 2002. Inferring Bayesian Priors with Limited Direct Data: Applications to Risk Analysis. North American Journal of Fisheries Management. 22-351-364.

STAR Panel. 2004. STAR Panel report on the stock assessment of Pacific Hake (Whiting) in US and Canadian Waters in 2003.

Agenda Item F.4.b
Supplemental GAP Report
March 2006

GROUNDFISH ADVISORY SUBPANEL COMMENTS ON
PACIFIC WHITING MANAGEMENT FOR 2006

The GAP heard a presentation from whiting stock assessment authors Tom Hesler and Guy Fleisher with a follow-up presentation from GMT representative to the STAR Panel John Field.

2006 Assessment

The GAP accepts the current assessment. The GAP understands that the model is sensitive to recruitment and that there is uncertainty surrounding the 2003 year class. The PWCC juvenile hake survey showed above average 2003 and strong 2004 year classes; this data was not included in the current assessment. Therefore, the GAP recommends that future assessments use all available data, including the PWCC survey.

The GAP recognizes there is a great deal of uncertainty in the current model, for example, the virgin biomass estimate seems unrealistically high, harvest level projections also seem unrealistically high, and recent recruitment, e.g. 2003 and 2004 year classes do not appear to be fully accounted for in the model. The hake stock is dependent on strong year classes to maintain its biomass. As noted, the PWCC survey provides evidence that the 2003 year class is above average and the 2004 year class is strong. Moreover, young fish started to appear in the 2005 fishery. While it is undetermined what their contributions will be to the stock, the GAP is confidant that this recent recruitment will provide for a stable fishery.

Proposed OY

The GAP recommends status quo management for the 2006 whiting fishery, which results in a 365,000 mt coast-wide OY. Subsequently this results in a 270,000 mt harvest guideline for the U.S.

Justification for status quo can be seen in Table 1 from Document F4a. If we set 2006 OY at Status Quo of 365,000, this is below the 400,000 in the table. Relative to the 400,000 harvest level, status quo harvest of 365,000 mt would result in a slower rate of depletion. The two models produce different relative depletion levels. Under status quo harvest, there is no risk of reaching overfished in 2007 under the freely estimated q model. Conversely, there is the potential to approach the overfished level if q=1 is the true state of nature. However, this time next year we will have new assessment information, including data from the 2006 fishery. If the declining trend continues, the council can adjust harvest levels in 2007 to prevent reaching the overfished level. But the GAP reiterates that evidence exists of incoming recruitment from the 2003 and 2004 year classes. Therefore, the GAP believes that status quo management is a precautionary response to the status of the whiting stock and meets the needs of the whiting fishery.

Management Measures

The GAP supports status quo bycatch caps of 4.7 mt on canary rockfish and 200 mt for widow rockfish, but believes that an additional cap on darkblotch rockfish is unwarranted.

GROUNDFISH MANAGEMENT TEAM REPORT PACIFIC WHITING MANAGEMENT FOR 2006

The Groundfish Management Team (GMT) reviewed the Pacific Hake (Whiting) stock assessment and stock assessment review (STAR) Panel report. As with past whiting assessments, the STAR Panel recommended two equally plausible models to represent the uncertainty in the relative depletion level and productivity of the stock; one in which q was fixed at 1 and the other in which q was estimated with an informative prior. The result of the second model gave an estimated q of 0.69, consistent with the general tendency of this model to estimate a lower q.

Whiting Stock Trajectories and Risk Assessment

In both models, the estimated biomass trends are robust. The greatest difference from the q=0.69 relative to the q=1 model was a scaling upward in total biomass across the entire time series, a slightly greater upswing in the strength of the 1999 year class, and a slightly lower level of depletion (0.38) in 2006. By contrast, the q=1 scenario estimated a depletion of 0.31 in 2006. The most striking difference is the wide range of resulting optimum yields (OYs) from the two models, with very little change in overall goodness of fit. The projected OYs under either scenario indicate that if the entire OY were harvested, the harvest rates and total catches would be among the highest ever observed, at a time when the relative biomass is close to the lowest measured, and projected to decline regardless of the harvest level as the 1999 year class declines. These are displayed in Figure 1 from the STAR Panel Report, which is reproduced here because the report inadvertently cut off the right-hand side of the figure.

The STAR panel requested projections from both models with a range of coastwide catches (from 0 to 400,000 mt, in 100,000 mt increments) to explore the relative impact of fishing levels on future stock biomass. These are presented graphically in figures 2a and 2b of the STAR Panel report. For both models, even with zero harvest in 2006 onward, the biomass continues to decline (albeit modestly) until 2009 when it increases slightly. All of these estimates are presented in a decision table format in Table 1 of this report. Summarizing these results, both models predict that over the next few years the spawning biomass will decline to levels very close to 25% of the unfished biomass. Exactly how close depends on which model best represents the true condition of the stock, what the allowable catch is, and the strength of incoming 2003 and 2004 year classes.

Assuming the two models are equally plausible, any catch level above 200,000 mt will result in overfishing for the q=1 model. Section 104-297 (e) of the Magnuson-Stevens Act states that "a fishery shall be classified as approaching a condition of being overfished if, based on trends in fishing effort, fishery resource size, and other appropriate factors, the Secretary estimates that the fishery will become overfished within two years." The GMT notes that while there is no specific guidance with respect to a scenario in which a fishery has what is essentially a 50:50 chance of being overfished, there is reason to be concerned over the projected trends in whiting abundance. The GMT also estimated that coastwide catch streams of 370,000 mt and 267,000 mt would result in depletion levels of 0.25 in 2008 and 2009, respectively, when depletion is blended across the two models.

Adopting an OY at or above the status quo for 2006 could require lower OYs in future years, depending upon the results of the next (2007) assessment, particularly estimates of future recruitment. Currently, the assessment predicts close to mean recruitment in both 2003 and 2004; with the former being informed by the age composition results from the 2005 hydroacoustic survey, and the latter being informed by the Santa Cruz Lab juvenile survey. Should either, or both, of these year classes prove to be stronger than estimated by the model, stock biomass should increase more rapidly than expected. Conversely, if these year classes prove to be weaker than estimated by the model, stock biomass may increase more slowly than expected.

Sector Allocations and Estimated Bycatch Impacts for the US Portion of the OY

Sector allocations and estimated bycatch of overfished species associated with three potential OY values are reported in Table 2 for three potential OY values. These three OY values are intended to bracket the status quo (365,000 mt coastwide) with substantially lower and higher OYs (200,000 mt and 594,000 mt). Bycatch estimates for the 2006 whiting season were developed using the weighted average approach used to predict overfished species mortality in 2004 and 2005, with updated data from the 2005 fishery. Bycatch estimates in the whiting fishery are characterized by varying degrees of uncertainty depending on the species. For example, the bycatch rate of widow rockfish appears to have been increasing over the past couple of years, while canary rockfish has been characterized by large year-to-year variations.

In March 2004 the Council approved the inclusion of bycatch limits as a management tool available for the 2005 and 2006 fishery. Although each sector of the whiting fishery is monitored for total catch, only the at-sea sectors have a catch tracking system in place that can provide estimated catch totals in a near real-time manner. The GMT considered a bycatch limit for the at-sea sectors, however this would require a formal allocation, which involves a two meeting process and full rulemaking (proposed and final), as specified in the Groundfish FMP. Therefore, sector specific bycatch limits are not available for 2006. However, the GMT understands that sector specific bycatch limits may be available for 2007 and beyond if the necessary monitoring and tracking of catch is adequate in all sectors of the whiting fishery, and is analyzed in the 2007-2008 EIS.

In 2004 and 2005, participants in the Pacific whiting fishery were able to demonstrate successful avoidance of overfished species to stay within established bycatch limits, thereby attaining higher levels of whiting catch relative to predicted bycatch. However, disaster events still occurred as demonstrated in the 2004 fishery. Due to the high bycatch ratio of canary rockfish in the 2004 fishery, canary appears to be the most constraining species relative to the current bycatch limits. For example, keeping the non-tribal whiting fishery to within the 2005 bycatch limit of 4.7 mt of canary could require setting the US portion of the whiting OY to 234,330 mt (coastwide OY equals 317,150). Under this OY, widow bycatch is predicted to be 110 mt, and darkblotched bycatch is predicted to be 13.9 mt. However, as demonstrated in the 2004 and 2005 fisheries, participants in the whiting fishery are able to successfully avoid species with a bycatch limit.

Management Considerations for the 2006 Whiting Fishery

In 2004 the Council established bycatch limits for darkblotched and canary rockfish, while in 2005 the Council established bycatch limits for widow and canary rockfish. The Council may want to consider maintaining or revising the bycatch limits for canary and widow because canary rockfish remains a constraining species to multiple sectors and widow can potentially be caught in large amounts by the whiting fishery. The Council may also wish to consider establishing a bycatch limit for darkblotched rockfish due to the reduction in the 2006 darkblotched OY to 200 mt.

- Considerations for revising the canary bycatch limit: Federal regulations set the 2006 canary rockfish bycatch limit at 7.3 mt. With a US portion of the whiting OY ranging from 147,760 to 438,847 mt, the predicted US bycatch of canary rockfish ranges from 4.0 to 11.0 mt (non-tribal bycatch of canary rockfish is 2.8 to 9.5 mt.) In 2005, the bycatch limit was initially set at 7.3 mt, which the Council later revised to just affect the non-tribal fishery at 4.7 mt.
- Considerations for revising the widow bycatch limit: Federal regulations set the 2006 widow rockfish bycatch limit at 243.2 mt. With a US portion of the whiting OY ranging from 147,760 to 438,847 mt, the predicted US bycatch of widow rockfish ranges from 67.5 to 216.4 mt (non-tribal bycatch of widow rockfish is 63.2 to 210.3 mt.). In 2005 the non-tribal bycatch limit was originally set at 200 mt, but adjusted inseason to 212 mt.
- Considerations for setting a darkblotched bycatch limit: The amount of darkblotched caught in the fishery from 1998-2005 has ranged from 3.2 mt to 22.1 mt. With a US portion of the whiting OY ranging from 147,760 to 438,847 mt, the predicted US bycatch of darkblotched rockfish is 8.4 to 28 mt (non-tribal bycatch of darkblotched rockfish is 8.4 to 27.9 mt). In 2005, the predicted bycatch was 22.3 mt and would be equivalent to 26.8 mt in 2006 once adjusted by the SPR harvest rate (the method partially used to justify a 2006 darkblotched OY of 200 mt). The GMT notes that if the Council wishes to establish a darkblotched bycatch limit, that it be weighed appropriately so as not to discourage the whiting fleet from fishing deep to avoid salmon. That is, if the whiting fishery moves further offshore inseason in order to reduce Chinook salmon bycatch, darkblotched rockfish encounter rates may increase.

The GMT suggests that if the Council wishes to establish a darkblotched bycatch limit, that it is set at a level that is not unduly constraining to the whiting fishery. The GMT views a darkblotched bycatch limit as insurance against the possibility of the whiting fishery taking amounts of darkblotched that would require further constraints on other fisheries.

In summary, the GMT would like to draw the Council's attention to several considerations for managing the 2006 Pacific Whiting season.

- Option 1: Set a coastwide ABC. The GMT recommends setting the ABC with the value calculated from the q=1 model (661,680 mt). Although the GMT does not recommend one model over the other, the GMT notes that the q=1 ABC is more risk averse.

- Option 2a: Set the OY based on the risk of being below 25% of unfished biomass in 2 years. Adoption of either OY estimated by the 40-10 policy, which are both substantially above the status quo OY, would have a moderately high probability of resulting in an overfished condition by 2007, and a very high probability of being overfished by 2009. These values are the lower two scenarios shown in Table 1. The risk of being in an overfished condition in the near term should be weighed against the risk of foregone yield in setting an OY for 2006.

- Option 2b: Set a U.S. whiting OY which is constrained by bycatch of canary rockfish. The current status-quo non-tribal bycatch limit of 4.7 mt corresponds to a US OY of 234,330 mt (and a coast wide OY of 317,150)

- Option 2c: Status-quo approach. Set a U.S. whiting OY that is higher than the OY associated with the 4.7 mt canary bycatch limit and close the whiting fishery sectors when the sector allocations are attained or when a whiting fishery bycatch limit is reached – whichever comes first. If current bycatch limits remain in place, the non-tribal fishery would close when their catch of canary reaches 4.7 mt, or when the total non-tribal whiting sector catch of widow reaches the established bycatch limit (which is currently 243.2 mt in federal regulations), or when the whiting OY is attained – whichever comes first.

- Option 3: Set a bycatch limit for darkblotched rockfish in addition to canary and widow rockfish bycatch limits, in order to avoid early closure of winter bottom trawl fisheries. The level should be high enough to not unduly constrain the fishery, so that fishing in deeper water to avoid salmon bycatch can continue.

Options 2b and 2c reflect differing levels of risk with regard to bycatch and fishery revenue. The GMT feels that the risk of exceeding bycatch limits in the whiting fishery is less with Option 2b. Under Option 2c, delays in processing catch data could lead to the fishery exceeding bycatch limits before managers have the opportunity to close the fishery, although this was avoided in 2005 and 2004. Additionally, the whiting sectors may have an increased incentive to achieve attainment of their whiting allocation before a bycatch limit is reached. If this results in an incentive to race for fish, participants may focus more on whiting catch than on bycatch reduction, potentially leading to an earlier closure than if a lower whiting OY was specified. Due to the differential season timing among sub-sectors, and the fact that sub-sector bycatch caps cannot be specified in 2006, higher OYs pose an increased risk to the shore-based fleet that an overall bycatch limit will be reached before their whiting allocation has been achieved.

Relative to bycatch limits, the GMT recommends that under this agenda item, the Council decide whether they want to adopt bycatch limits for canary, widow or darkblotched rockfish, and whether other sectors' bycatch should be accommodated prior to setting the amount for any whiting bycatch limit. If so, the GMT notes that bycatch estimates for all fisheries in 2006 will be provided in an updated 2006 bycatch scorecard during Consideration of Inseason Adjustments (Agenda Item F.5). The scorecard will reflect the amount of the OYs that are not assigned to any fishery, and may inform the Council relative to setting the amounts of the catch limits for the whiting fishery (should the Council adopt them under this agenda item).

<u>GMT Recommendations:</u>

1. Adopt a coastwide ABC
2. Adopt a coastwide and U.S. whiting OY
3. Consider bycatch limits for canary, widow and darkblotched rockfish

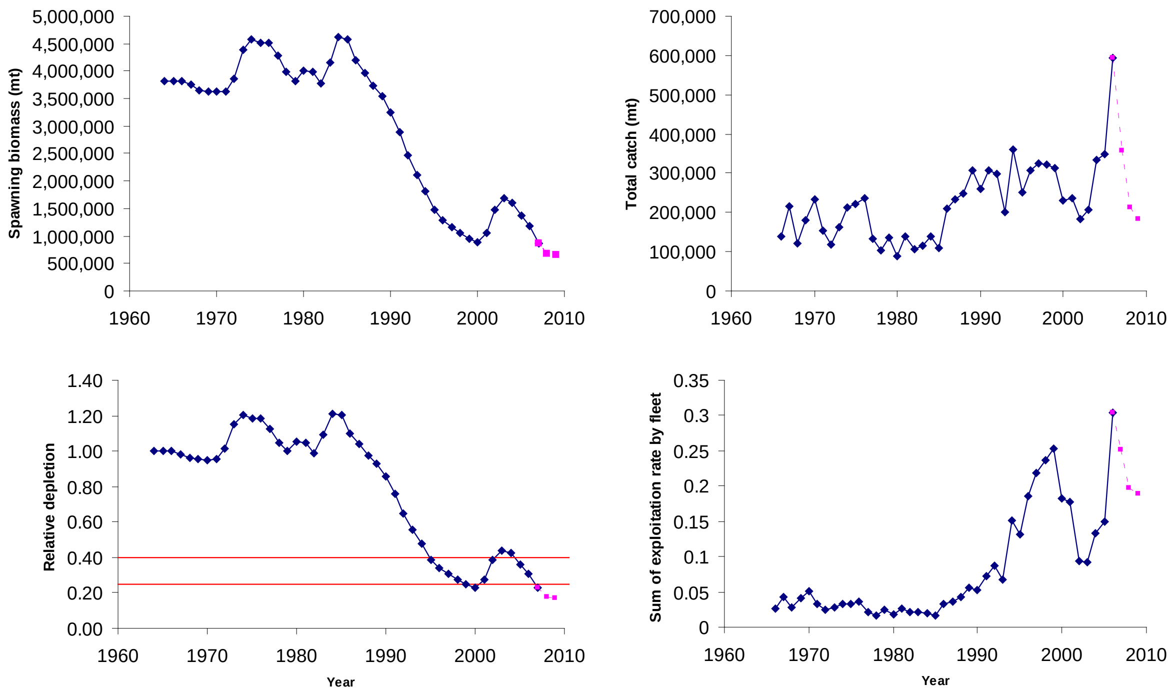
Table 1: Expanded decision table provided by STAT Team

Relative probability				**State of nature**	
Model				**0.50**	**0.50**
Management action				q = 1.0	q=0.69
	Total coastwide Catch (mt)	U.S. Catch (mt)	Year	Relative depletion (2.5%-97.5% interval)	
Total coastwide	0	0	2006	0.308 (0.247-0.369)	0.380 (0.304-0.457)
catch = 0 mt	0	0	2007	0.305 (0.233-0.376)	0.372 (0.287-0.458)
	0	0	2008	0.293 (0.212-0.374)	0.354 (0.260-0.447)
	0	0	2009	0.299 (0.187-0.411)	0.353 (0.231-0.475)
Total coastwide	100,000	73,880	2006	0.308 (0.247-0.369)	0.380 (0.304-0.457)
catch = 100,000 mt	100,000	73,880	2007	0.293 (0.221-0.365)	0.362 (0.275-0.448)
	100,000	73,880	2008	0.272 (0.190-0.354)	0.334 (0.240-0.429)
	100,000	73,880	2009	0.269 (0.156-0.381)	0.326 (0.203-0.449)
Total coastwide	200,000	147,760	2006	0.308 (0.247-0.369)	0.380 (0.304-0.457)
catch = 200,000 mt	200,000	147,760	2007	0.282 (0.209-0.354)	0.351 (0.264-0.438)
	200,000	147,760	2008	0.250 (0.167-0.333)	0.315 (0.219-0.411)
	200,000	147,760	2009	0.239 (0.125-0.352)	0.299 (0.175-0.423)
Total coastwide	300,000	221,640	2006	0.308 (0.247-0.369)	0.380 (0.304-0.457)
catch = 300,000 mt	300,000	221,640	2007	0.274 (0.201-0.348)	0.341 (0.253-0.429)
	300,000	221,640	2008	0.232 (0.148-0.316)	0.296 (0.199-0.393)
	300,000	221,640	2009	0.212 (0.097-0.326)	0.272 (0.147-0.398)
Total coastwide	400,000	295,520	2006	0.308 (0.247-0.369)	0.380 (0.304-0.457)
catch = 400,000 mt	400,000	295,520	2007	0.258 (0.184-0.332)	0.330 (0.241-0.419)
	400,000	295,520	2008	0.207 (0.122-0.292)	0.276 (0.177-0.375)
	400,000	295,520	2009	0.178 (0.063-0.294)	0.245 (0.118-0.372)
OY, q=1.0 model	593,746	438,660	2006	0.308 (0.247-0.369)	0.380 (0.304-0.457)
(ABC=661,681)	358,416	264,798	2007	0.227 (0.181-0.272)	0.310 (0.219-0.401)
	213,223	157,529	2008	0.178 (0.135-0.221)	0.263 (0.164-0.363)
	183,620	135,658	2009	0.172 (0.092-0.253)	0.254 (0.127-0.380)
OY, q=0.69 model	883,490	652,722	2006	0.308 (0.247-0.369)	0.380 (0.304-0.457)
(ABC=904,944)	522,511	386,031	2007	0.202 (0.125-0.279)	0.268 (0.215-0.322)
	302,298	223,338	2008	0.144 (0.056-0.232)	0.202 (0.155-0.249)
	240,702	177,831	2009	0.136 (0.020-0.252)	0.188 (0.104-0.273)

Table 2: Whiting sector allocations and estimated bycatch of selected groundfish species for three potential OY alternatives

Optimal Yield				Bycatch (mt)				Depletion in 2007		
Coast wide	U.S.	Sector	Allocatn	Cnry	Drkbl	POP	Wdow	Mod 1 (q=1)	Avg	Mod 2 (q=0.69)
200,000	147,760	Tribal	25,000	1.1	0	0.5	4.3	0.28	0.32	0.35
		Mothersh	28,982	1.8	2.4	0.5	15			
		CP	41,058	0.4	3.3	1.5	26			
		Shoreside	50,719	0.7	2.7	0.9	22.2			
		Total	145,760	4	8.4	3.4	67.5			
		non-tribal sum	120,760	2.8	8.4	2.9	63.2			
316,730	234,330	Tribal	32,500	1.46	0.03	0.6	5.62	~.30	~.34	~.38
		Mothersh	47,959	2.9	4.01	0.83	24.8			
		CP	67,942	0.61	5.4	2.52	43.0			
		Shoreside	83,929	1.19	4.5	1.51	36.7			
		Total	232,330	6.15	13.9	5.46	110			
		non-tribal sum	199,830	4.69	13.9	4.9	104.4			
365,000	269,662	Tribal	35,000	1.6	0	0.6	6	0.27	0.3	0.33
		Mothersh	55,839	3.4	4.7	1	28.9			
		CP	79,105	0.7	6.3	2.9	50.2			
		Shoreside	97,718	1.4	5.2	1.8	42.8			
		Total	267,662	7	16.2	6.3	127.8			
		non-tribal sum	232,662	5.5	16.2	5.7	121.8			
594,000	438,847	Tribal	35,000	1.6	0	0.6	6	0.23	0.27	0.31
		Mothersh	96,443	5.8	8.1	1.7	49.9			
		CP	136,628	1.2	10.9	5.1	86.6			
		Shoreside	168,776	2.4	9	3	73.8			
		Total	436,847	11	28	10.4	216.4			
		non-tribal sum	401,847	9.5	27.9	9.8	210.3			
Current 2006 non-tribal bycatch Limit				4.7			243.2			
Non-Tribal Fisheries										
2005 scorecard projections (total)				6.7	22.3	5.6	213.9			
2005 Bycatch limits				4.7			212			
2005 Actual catch				3.3	16.4	1.6	155.8			

Figure 1: (From STAR Panel report). Graph of the time series from the beginning of the modeled time period to 2009 for the q=1 model that includes catch (based on the estimated OY from the q=1 model), spawning biomass, depletion and exploitation rate (relative to vulnerable biomass).



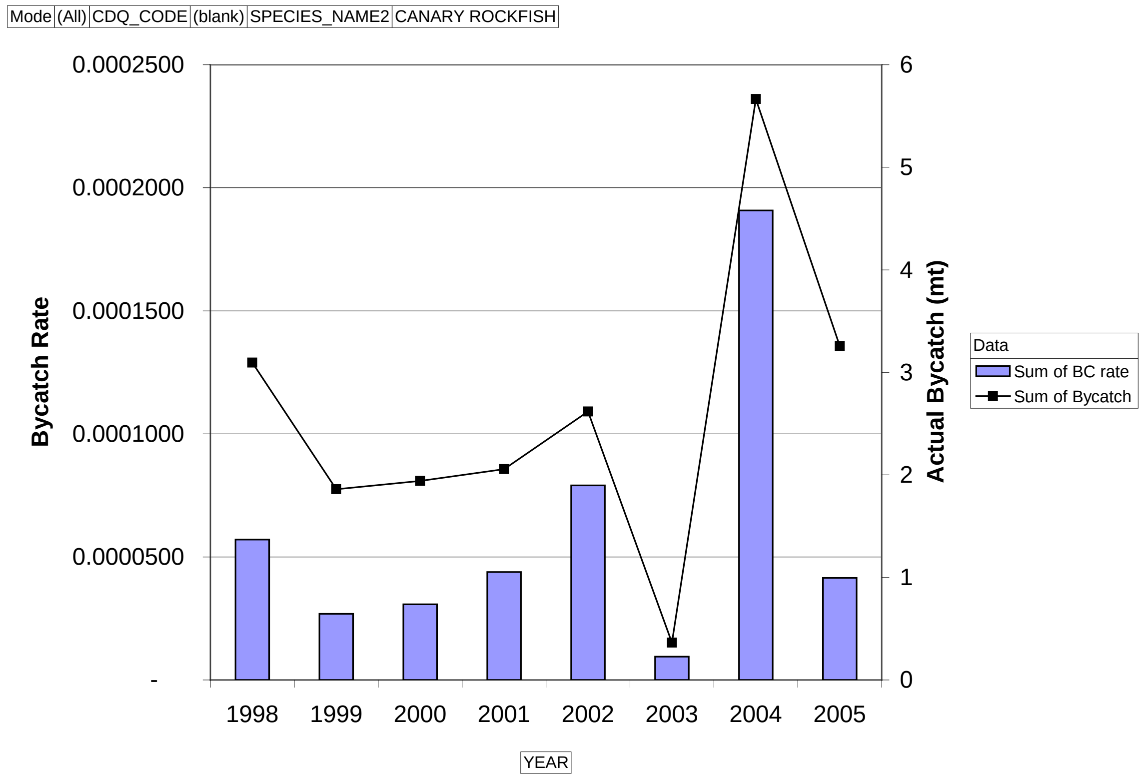


Figure 2

Annual Canary Bycatch Rate by non-tribal Sector

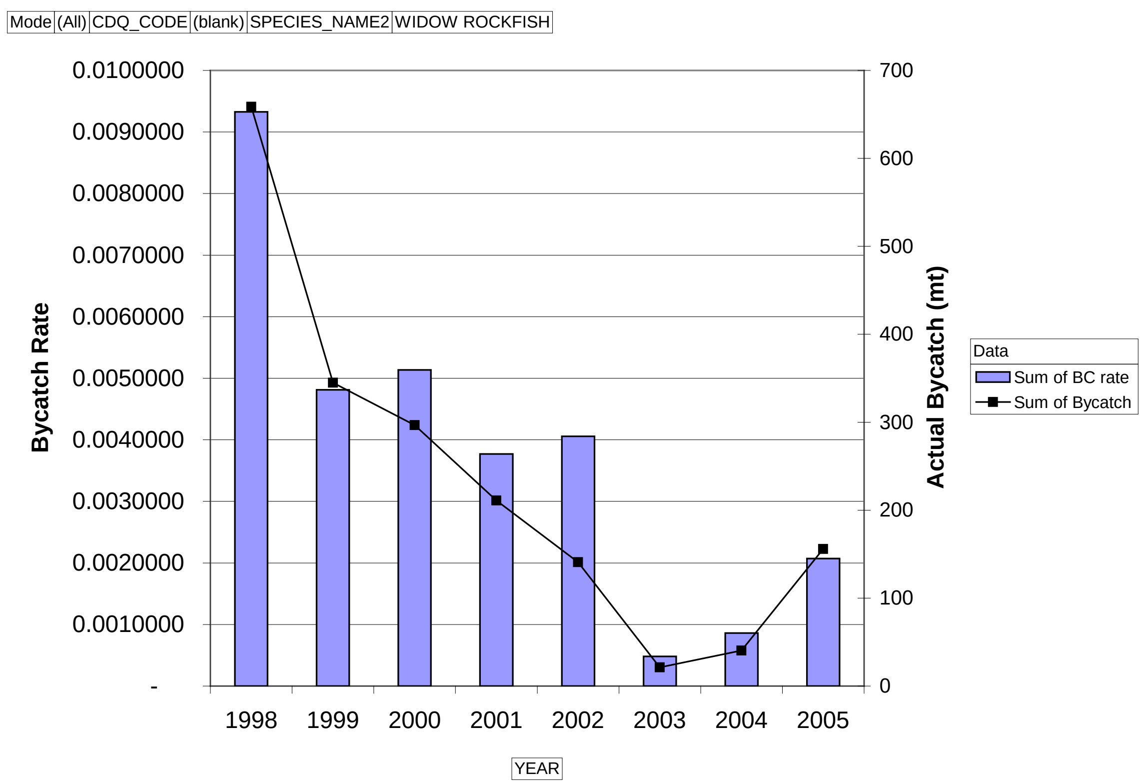


Figure 3 Annual Widow Bycatch Rate by non-tribal Sector

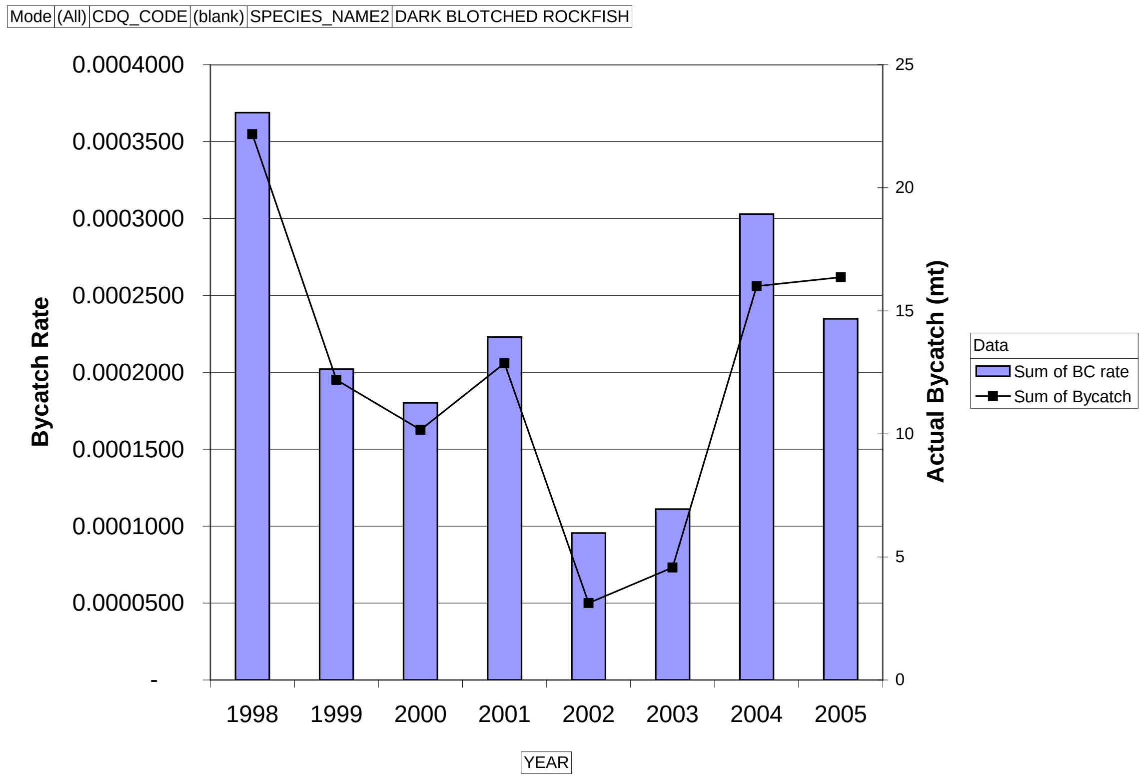


Figure 4 Annual Darkblotched Bycatch Rate by non-tribal Sector

Agenda Item F.4.b
Supplemental SAS Report
March 2006

The Salmon Advisory Subpanel (SAS) has not been provided any by-catch data, which would be the basis for their concern over activities in the Pacific whiting fishery. The SAS respectfully requests the information be provided before the Council makes any decisions regarding renewal of the Pacific whiting EFP or provisions associated with salmon bycatch by the fleet.

PFMC
03/08/06

SCIENTIFIC AND STATISTICAL COMMITTEE REPORT ON PACIFIC WHITING MANAGEMENT FOR 2006

Mr. Tom Jagielo from the Scientific and Statistical Committee (SSC), and Chair of the Joint Canadian and U.S. Stock Assessment and Review (STAR) Panel for Pacific whiting, presented the SSC with an overview of the STAR Panel report. Members of the Stock Assessment (STAT) Team responded to questions arising during the SSC discussions. The Panel was conducted using Terms of Reference for Groundfish Stock Assessments.

Unlike the 2005 assessment, the 2006 assessment is based on the stock assessment package Stock Synthesis 2 (SS2). The assessment authors compared the results from SS2 with those from a variant of the model applied for the 2005 assessment. The time-series of biomass estimates from the two models are very similar.

The assessment considered two alternative and equally plausible models based on the value for the catchability coefficient (q) for the hydroacoustic survey. One of these values (q=1) is the same as that included in the 2005 assessment. The alternative model involved estimating q taking into account a prior distribution on q selected by the STAR Panel. The value of q from this alternative model is 0.69, which is higher than the value used in the last assessment (0.6). The SSC endorses the use of the 2006 Pacific whiting assessment for management purposes. The SSC notes that the results from both models could be combined to form the basis for management advice giving each model equal weight.

The 2006 assessment was based on setting the steepness of the stock-recruitment relationship to 0.75 whereas the 2005 assessment was based on a value of 1. Assuming a steepness of 1 in a stock assessment implies that recruitment is expected to be the same at high as well as low stock size. As a result, assuming that steepness is 1 can lead to over-optimistic projections. The SSC agrees with the STAT Team that assuming a steepness value less than 1 is appropriate. However, little justification is provided in the assessment report for the value for steepness actually used in the assessment (0.75). The SSC recommends that the basis for the value of steepness be explored further in the next assessment.

The projections based on the models are driven by the 1999 year-class, which has been sustaining the stock in recent years. The spawning biomass is predicted to decline in the future for almost any level of harvest. If the 40-10 control rule is used to determine Optimum Yields (OYs), the stock is predicted to drop to below the overfished threshold of 25% of the unfished biomass (25% B_0) even though the OYs are predicted to decline from over 500,000t to, for the base model, 184,000t. As such, the whiting stock should be considered to be “Approaching an Overfished State” if catches are to be based on the 40-10 control rule. The catch for 2005 was 360,306t. The results of the assessment can be used to determine the ability to remain above the overfished threshold. For example, a constant catch of 200,000t would maintain the spawning biomass above the overfished threshold until 2009 with 50% probability while a constant catch of 400,000t would result in the stock being below the overfished threshold in 2008 with at least 50% probability.

$F_{40\%}$ was selected as an F_{MSY} proxy for Pacific whiting based on the results of a meta-analysis that used stock and recruitment data for other whiting species. However, the Pacific whiting stock is predicted to fall below 25% B_0 if management is based on $F_{40\%}$ owing to the impact of variable recruitment. There is therefore a lack of consistency for Pacific whiting between aiming to maximize yield on average and preventing depletion to below 25% of B_0. The SSC can examine the issue of how to develop a control rule which maximizes yield subject to keeping the spawning biomass above the overfishing threshold with a pre-specified probability at its B_0 workshop.

PFMC
03/07/06

SSC-related notes [Not for the Council]

1. *There is a discrepancy between the indices of recruitment for 2003 and 2004 from the SWFSC and the PWCC/NWFSC surveys with the SWFSC surveys suggesting that the 2003 year-class was below average and the 2004 year-class was average above and the PWCC/NWFSC surveys suggesting that the 2003 year-class was average and the 2004 year-class was strong.*

2. *B_0 was based on the weight-at-age in the first year of the modeled period whereas other biological parameters (such as MSY) as based on weight-at-age for the most recent year. The issue of how to define B_0 (and MSY) when biological parameters (and recruitment) change over time should be discussed at the B_0 workshop.*

3. *For the 2007 assessment, the assessment authors should consider: a) using a sex-structured model, b) incorporating ageing error, c) allowing for Canadian fish to be larger at age than US fish, and d) examine the sensitivity to allowing the initial biomass to be treated as an estimable fraction of B_0.*

4. *The selectivity pattern for the acoustic survey and the fisheries are notably different. The selectivity pattern for the acoustic survey suggests that selectivity is much lower than 1 for animals aged 2-4 whereas it is expected from the survey design that acoustic selectivity should be close to 1 for animals aged 2 and older. Previous Pacific whiting assessments imposed a prior on the ascending limb of the selectivity pattern for the acoustic survey. It might be possible examine this issue by collecting age data from different parts of large aggregations.*

Agenda Item F.5
Situation Summary
March 2006

CONSIDERATION OF INSEASON ADJUSTMENTS

The Council set optimum yield (OY) levels and various management measures for the 2006 groundfish management season with the understanding these management measures will likely need to be adjusted periodically through the year with the goal of attaining, but not exceeding, the OYs.

Proposed inseason adjustments for Washington and Oregon recreational fisheries are outlined in Agenda Item(s) F.5.c., WDFW Report and ODFW Report, respectively. Agenda Item F.5.c, CDFG Report describes the proposed methodology for projecting impacts in the California recreational groundfish fishery. This methodology was reviewed and approved by the Groundfish Management Team in February. Specific proposals for inseason adjustments to the 2006 California recreational groundfish fishery are anticipated to be forthcoming at the March Council meeting. There may also be some proposed adjustments to ongoing commercial fisheries for Council consideration at this meeting.

Under this agenda item, the Council is to consider advisory body advice and public comment on the status of ongoing fisheries and adopt inseason adjustments to ongoing groundfish fisheries as necessary.

Council Action:

1. **Consider information on the status of ongoing fisheries.**
2. **Consider and adopt inseason adjustments as necessary.**

Reference Materials:

1. Agenda Item F.5.c, WDFW Report: Washington Department of Fish and Wildlife Report on Consideration of Inseason Adjustments.
2. Agenda Item F.5.c, ODFW Report: Inseason Adjustments to the 2006 Oregon Recreational Groundfish Fishery.
3. Agenda Item F.5.c, CDFG Report: Draft California Department of Fish and Game Report on Inseason Management Proposals for the 2006 California Recreational Fishing Season.
4. Agenda Item F.5.e, Public Comment.

Agenda Order:

a. Agenda Item Overview — John DeVore
b. Report of the Groundfish Management Team — Susan Ashcraft
c. Agency Comments
d. Reports and Comments of Advisory Bodies
e. Public Comment
f. **Council Action:** Adopt Recommendations for Adjustments to 2006 Fisheries

PFMC
02/16/06

GROUNDFISH MANAGEMENT TEAM (GMT) REPORT ON CONSIDERATION OF INSEASON ADJUSTMENTS

The Groundfish Management Team (GMT) reviewed the recreational fishery measures taken by the states of Washington and Oregon. To maintain consistency between state and Federal recreational regulations the GMT considered the issues outlined below.

RECREATIONAL FISHERIES

WASHINGTON

In 2005, the canary rockfish harvest in the Washington recreational fishery did not exceed the state's harvest target of 1.7 mt; however, the yelloweye rockfish harvest in the Washington recreational fishery was 5.2 mt. Therefore, to reduce the catch of yelloweye rockfish to stay within the Washington recreational harvest target, the Washington Department of Fish and Wildlife proposes to:

- Prohibit retention of rockfish and lingcod seaward of a line approximating the 20 fm depth contour from May 22, 2006, through September 30, 2006, in Marine Areas 3 and 4 (the areas between Neah Bay and La Push) on days that halibut fishing is closed.

- Prohibit retention of rockfish and lingcod seaward of a line approximating the 30 fm depth contour from March 18, 2006, through June 15, 2006, in Marine Area 2 (Westport)

This measure is consistent with the inseason action taken in August 2005 when a 20-fm closure off Washington's northern coast was implemented to reduce the canary and yelloweye recreational fishery catch. The 2005 action was taken only in the north coast area because canary and yelloweye catches are highest in that area.

Because the 20-fm line has not been previously analyzed, the following modification will be made: where the line approximating the 20 fm depth contour extends beyond state waters and into the EEZ, the line will follow the seaward boundary of the state coastal waters.

- Halibut fishery regulations for the 2006 fishery became effective March 5, 2006. It is necessary to modify the recreational groundfish regulations to conform to the new halibut regulations.
    - South of Leadbetter Point, WA to the Washington/Oregon border, when Pacific halibut are onboard the vessel, groundfish may not be taken and retained, possessed or landed, except sablefish and Pacific cod.

OREGON

- In December, 2005, the Oregon Fish and Wildlife Commission (OFWC) refined management measures for the 2006 Oregon recreational groundfish fishery, based on the angler effort patterns observed in 2005. Because there was a significant increase in angler effort targeting groundfish in 2005, due primarily to the poor salmon season in the waters off Oregon, the OFWC adopted a marine fish bag limit of 6 fish in aggregate. The reduced bag limit was necessary to keep the fishery within the 2006 Oregon harvest guideline for black rockfish and to provide a 12 month fishing season. All other management measures (i.e. length restrictions for lingcod, cabezon, and kelp greenling, >40 fm closure during June-September) remain at status quo. To conform with the Oregon State regulations it's necessary to revise the bag limits in federal regulation from 10 marine fish per day to 6 marine fish per day.

- Halibut regulations for the 2006 fishery become effective March 5, 2006. It is necessary to modify the recreational groundfish regulations to conform to the new halibut regulations.

  - South of the Washington/Oregon border to Cape Falcon, OR, when Pacific halibut are onboard the vessel, groundfish may not be taken and retained, possessed or landed, except sablefish and Pacific cod.
  - South of the Cape Falcon, OR, to Humbug Mountain, OR, when Pacific halibut are onboard the vessel, groundfish may not be taken and retained, possessed or landed, except sablefish, during days open to the Oregon Central Coast "all-depth" sport halibut fishery.

- The GMT reviewed the supplemental report provided by the Oregon Department of Fish and Wildlife (Agenda Item F.5.c: Supplemental ODFW Report 2) detailing the development of discard mortality calculations that will be used for 2006 recreational catch estimates. The GMT endorses the use of these discard mortality rates for the 2006 fishery in Oregon.

CALIFORNIA

- The GMT received a supplemental report provided by the California Department of Fish and Game detailing the 2005 recreational catch estimates from the California Recreational Fisheries Survey (CRFS). The GMT also reviewed the 2005 catch estimates in relation to the 2005 harvest targets, which reflected that catches were well below the recreational harvest guidelines for canary rockfish and yelloweye rockfish. As the current management structure is expected to keep catches within 2006 harvest guidelines, and there is uncertainty regarding the 2006 recreational salmon fishery that could increase effort directed at groundfish, California has no inseason actions for 2006 for the Council's consideration.

<u>COMMERCIAL FISHERIES</u>

LIMITED ENTRY AND OPEN ACCESS DAILY TRIP LIMIT FISHERY (DTL)

- The GMT received a request to consider an increase in the sablefish daily limit from 300 lb/day to 400 lb/day for the limited entry fixed gear and open access DTL fisheries coastwide. Given the increased participation in the open access portion of the fishery in recent years and the potential effort shifts as a result of salmon fishery restrictions, the GMT does not believe that an increase should be made at this time. If fishery participation increases substantially over previous years, liberalizing the daily limit early in the season could result in reductions below 300 lb/day later in the year or closures. Reducing the limit below 300 lb/day later in the year could result in increased discards of sablefish and co-occurring species. Therefore, the GMT would prefer to assess the fishery as the season progresses and information becomes available on DTL fishery participation and catch levels.

BYCATCH LIMITS IN THE PACIFIC WHITING FISHERY

The GMT discussed bycatch limits for canary and widow rockfish in the non-tribal whiting fishery and believes that limits that are equal to those set for the commercial portion of the whiting fishery in 2005 are appropriate given the Council-adopted Pacific whiting OY, estimated bycatch in other fisheries, and industry requests for limits that are the same as those adopted for the commercial fishery last year. Specifically, the GMT recommends that the 2006 bycatch limits for the non-tribal Pacific whiting fishery be set at 4.7 mt for canary rockfish and 200 mt for widow rockfish and, if necessary, these limits can be revisited and adjusted inseason.

BYCATCH SCORECARD UPDATE

An updated bycatch scorecard is attached to this report. These changes include updates to limited entry groundfish trawl impacts, whiting fishery impacts for the adopted whiting OY, 2006 EFPs, and specified 2006 OYs. Recreational impact estimates were not changed due to anticipated effort shifts from potential reductions in salmon fishing opportunities. With regard to the bycatch estimates in the non-tribal whiting fishery, all numbers reflect projected impacts except for widow and canary rockfish, which reflect the GMT-recommended bycatch caps under this agenda item. These bycatch caps and updates leave a reserve of 2.7 mt for canary rockfish and 31.7 mt for widow rockfish relative to the 2006 OYs. Projected darkblotched rockfish impacts in the whiting fishery reflect the GMT's best estimate of total mortality in each sector and do not represent a GMT recommendation for a darkblotched bycatch cap. The GMT will more thoroughly review levels of darkblotched rockfish that are available for Council consideration of a whiting fishery bycatch cap at the April Council meeting.

PFMC
03/09/06

DRAFT CALIFORNIA DEPARTMENT OF FISH AND GAME REPORT ON INSEASON MANAGEMENT PROPOSALS FOR THE 2006 CALIFORNIA RECREATIONAL FISHING SEASON

BACKGROUND AND PROPOSED ACTION

The Pacific Fisheries Management Council (Council) approved inseason changes to California's recreational 2005 season and depth structure at its March 2005 meeting. The Council, in adopting these changes, took into account a number of factors including: 1) the 2004 annual California Recreational Fisheries Survey (CRFS) estimates of recreational take which showed that harvest of overfished species was below their respective California recreational harvest targets in 2004; and 2) the improved ability for real-time inseason catch monitoring through the new CRFS program. The March 2005 inseason changes provided more recreational fishing opportunity while keeping projected impacts (derived from California's recreational catch model) within recreational harvest guidelines or allocations for overfished and constraining species.

In early February 2006, complete CRFS estimates of recreational take for 2005 (through December) became available. These estimates indicated that even under the modified management structure (with increased fishing opportunities), the California recreational harvest guidelines or allocations for overfished species were not exceeded and, in some cases, catch was well below the projected impacts. These results suggest that the current 2006 management structure could be further modified to allow for additional fishing opportunities while still remaining within recreational harvest targets for overfished and constraining species. The California Department of Fish and Game is exploring what specific options would be appropriate for inseason consideration, and intends to provide these options at the March PFMC meeting for discussion. The modeling approach for projecting impacts is described below. This approach has already been reviewed and approved by the Groundfish Management Team for use in crafting 2007-2008 recreational fishery management options.

PROPOSED METHODOLOGY FOR PROJECTING IMPACTS

Impacts from the proposed changes to the current 2006 management structure will be evaluated using an updated version of California's recreational catch projection model using 2004 and 2005 data to project future fishing behavior.

I. Background

The recreational catch model incorporates a number of parameters and assumptions, all of which are either risk-neutral or risk-adverse. The basic analytical approach is the same as that used for the 2005-06 model projections. Because the estimates from the CRFS program and the original Marine Recreational Fisheries Statistics Survey program have not been calibrated, only the 2004 and 2005 annual catch estimates obtained from the new CRFS program serve as the baseline catches. The model uses a 0.67 decay function (which translates into a weighting of 60% for 2005 and 40% for 2004). Reasons for weighting the 2005 estimates more heavily than the 2004 estimates include: the recognition that constraints placed on salmon fishing in 2005 will likely persist over the next several years; and the acknowledgement that the expanded distribution and greater abundance of blue rockfish (as well as other groundfish species) due to cooler oceanographic conditions will also likely persist into 2007 and 2008. Model output predicts expected catch under any combination of season and depth fishing restrictions by region. Reasons for using 2004 data include: the recognition that oceanographic conditions in 2005 were unusual while conditions in 2004 are more in line with what might be expected in 2007-2008 under a colder water regime; and the expectation that the bulk of blue rockfish take (and potentially brown and olive rockfish take) will occur within deeper nearshore waters as was observed in 2004 rather than in the shallow nearshore waters as in 2005.

<u>Management Region Definitions:</u>

North Region:	North of 40˚10' N lat to CA/OR border
North-Central Region:	South of 40˚10' N lat to 37˚11' N lat (Pigeon Pt.)
South-Central Monterey Region:	South of 37˚11' N lat (Pigeon Pt.) to 36˚ N lat (Lopez Pt.)
South-Central Morro Bay Region:	South of 36˚ N lat (Lopez Pt.) to 34˚27' N lat (Pt. Conception)
South Region:	South of 34˚27' N lat (Pt. Conception) to CA/Mexico Border

II. CDFG/California Recreational Groundfish Model Assumptions

- <u>Effort Shift Inshore</u>: The model includes a 27.6% increase in expected landings when fishing is restricted to less than 30 fm and a 39.3% increase in expected landings when fishing is restricted to less than 20 fm. The increase, or effort shift, is to account for increased effort in a smaller fishing area.

- <u>Discard Mortality</u>:
  1) Canary, cowcod, and yelloweye rockfish are non-retention species. Therefore, expected mortality estimates for these species also include B2 fish (fish reported to be released live) with hooking mortality rates as follows:
  2) CA scorpionfish hooking mortality rate is assumed to be 5%. This rate is applied to expected landings of CA scorpionfish when fishing is allowed for species which associate with CA scorpionfish, but fishing for CA scorpionfish is not allowed.

III. Inputs and Key Parameters for the Model

- <u>Base Year Catch</u>: Initially, CRFS catch estimates in WEIGHT of fish were summed for caught and retained (CRFS "A" catch), filleted/caught and released dead (CRFS "B1" catch), and for species of concern, a proportion of CRFS "B2" catch (released alive) derived using depth-based mortality estimates. Base year catch estimates are assumed to be for an unrestricted fishing year with no months closed and no depths closed. Therefore, for 2004 and 2005, a back calculation method was used to add a catch estimate for what the catch would have been if all months and all depths had been open.

This back calculation uses percent catch by month and depth derived from historical catch estimates.

- Historical Catch By Month: Estimates of historical percent catch by two-month period were calculated for each region based on RecFIN Marine Recreational Fisheries Statistics Survey (MRFSS) data (weight of A+B1) from 1993-1999, which was a time period when seasons and depths were unconstrained. Proxies were considered on a species by species basis for regions where there was a lack of catch data for that area. Monthly estimates of percent catch then were divided equally (50:50) for each pair of months.

- Historical Catch By Depth: Estimates of percent catch by depth were calculated for each region based on RecFIN MRFSS depth sample data (numbers caught A+B1 for CPFV and A+B1+B2 for PR) from 1999-2000, which was a time period when depths were unconstrained. Proxies were considered on a species by species basis for regions where there was a lack of catch data for that area.

Agenda Item F.5.c
ODFW Report
March 2006

INSEASON ADJUSTMENTS TO THE 2006 OREGON RECREATIONAL GROUNDFISH FISHERY

At its November 2005 meeting, the Council approved inseason adjustments to the 2006 Oregon recreational groundfish fishery, reverting the regulations to those set in the pre-season process. In December 2005, the Oregon Fish and Wildlife Commission (OFWC) refined management measures for the 2006 Oregon recreational groundfish fishery, based on the angler effort patterns observed in 2005. There was a significant increase in angler effort targeting groundfish in 2005, due primarily to the poor salmon season in the waters off Oregon. In order to remain within the 2006 Oregon harvest guideline for black rockfish and provide a twelve-month fishing season, the OFWC adopted a marine fish bag limit of 6 fish in aggregate. All other management measures (i.e. length restrictions for lingcod, cabezon, and kelp greenling, >40 fms closure during June-September) remain status quo.

Currently, a discard mortality rate of 100% is applied to all rockfish (except canary rockfish) released in the Oregon recreational groundfish fishery. In an effort to provide the best data available, the Oregon Department of Fish and Wildlife (ODFW) has developed a series of discard mortality rate calculations to be applied to the estimated amount of fish reported released in this fishery. Using several years of data collected by Oregon's recreational at-sea observer program, the fishery was profiled over depth, to determine the proportion of fish discarded at each depth increment. This data was combined with the mortality rates (by depth stratum) calculated by the Groundfish Management Team using both mortality studies by Albin and Karpov, and Tom Barnes (CDFG), and logbook data collected in the Oregon commercial nearshore fishery. The ODFW will be providing a detailed report of the development of these discard mortality calculation to the GMT and the Council at the March Council meeting with the goal of implementing these discard mortality calculations in the 2006 Oregon recreational groundfish fishery.

PFMC
02/16/06

Agenda Item F.5.c
Supplemental ODFW Report 2
March 2006

OREGON DEPARTMENT OF FISH AND WILDLIFE REPORT ON CONSIDERATION OF INSEASON ADJUSTMENTS

The Oregon Department of Fish and Wildlife (ODFW) proposes adopting revised mortality rates for several species of management concern discarded in the Oregon recreational groundfish fishery. Historically, in the Marine Recreational Fisheries Statistical Survey (MRFSS) sampling program, anglers reported their discarded fish as either dead or alive. Often a fish discarded alive would eventually die due to the effect of barotrauma. Thus, total discard mortality was underestimated by this approach. Currently, in the Ocean Recreational Boat Survey (ORBS), anglers are asked how many fish were discarded, and a mortality rate of 100% is applied to all rockfish (except canary rockfish), overestimating total discard mortality.

At-sea observations were conducted on recreational charter vessels off Oregon during 2001, 2003-2005. A total of 360 vessels trips were conducted. Each year the observations were distributed across the state in an effort to represent the relative magnitude of catch by area. The annual goal was to conduct 100 observations, but that goal was not always achieved due to inseason closures. The number of rockfish observed by species or species group, discarded in the nearshore recreational fishery is reported in Table 1.

ODFW recommends adopting a similar approach as is used for the commercial open-access nearshore fishery to determine mortality of discarded groundfish. The approach incorporates at-sea observations of catch by species, stratified by depth, with angler reported discard, and the stratum based mortality rates by species adopted for the commercial open-access fishery.

The species of rockfish caught inside of 20-fathoms, and for which mortality rates are derived, include black, blue, other nearshore rockfish, canary, and yelloweye. The distribution of discarded fish by species and depth bin (fm) based on at-sea observations are identified in Table 2. Observed distributions are presented for all-depth fisheries, and predicted distributions are presented for fisheries closed seaward of 40-fathoms, 30-fathoms, 20-fathoms, and 10-fathoms.

Mortality rates for fish discarded by depth strata are detailed in Table 3 and represent the same rates used for commercial open-access nearshore fisheries. Consistent with the open-access nearshore commercial fishery, a mortality rate of 100% would be applied to all rockfish caught and discarded in waters deeper than 20-fathoms. These mortality rates were applied to the species distributions (Table 2) to determine the comprehensive mortality rates detailed in Table 4. These mortality rates are applied to estimated discard, calculating estimated mortality.

ODFW recommends applying a seven percent mortality rate in the Oregon recreational groundfish fishery for discarded lingcod, cabezon, and greenling species, as is used in the commercial open-access nearshore fishery. In addition, ODFW recommends a seven percent mortality rate be used for shore and estuary boat fisheries for all species discarded because, as barotrauma is not an issue, mortality is mostly related to hook location.

Table 1. 2001, 2003-2005 Count of released fish by depth bin (fm). Canary and yelloweye data from open all depth periods only; black, blue, and other nearshore rockfish data from all periods. Other nearshore rockfish includes brown, copper, quillback and china rockfishes (no discards of other nearshore rockfish species were observed).

Species	<=10	11-20	21-30	31-40	>40	Grand Total
Black rockfish	296	372	20	0	0	688
Blue rockfish	183	622	53	0	0	858
Other nearshore rockfish	1	8	2	0	0	11
Canary rockfsih	13	107	31	5	52	208
Yelloweye rockfish	0	5	2	0	13	20

Table 2. Distribution of released fish by depth bin (fm) when open all depths.

Species	<=10	11-20	21-30	31-40	>40	Sample Size
Black rockfish	43%	54%	3%	0%	0%	688
Blue rockfish	21%	72%	6%	0%	0%	858
Other nearshore rockfish	9%	73%	18%	0%	0%	11
Canary rockfish	6%	51%	15%	2%	25%	208
Yelloweye rockfish	0%	25%	10%	0%	65%	20

Predicted distribution of released fish when closed seaward of 40 fm

Species	<=10	11-20	21-30	31-40	Sample Size
Black rockfish	43%	54%	3%	0%	688
Blue rockfish	21%	72%	6%	0%	858
Other nearshore rockfish	9%	73%	18%	0%	11
Canary rockfish	8%	69%	20%	3%	156
Yelloweye rockfish	0%	71%	29%	0%	7

Predicted distribution of released fish when closed seaward of 30 fm

Species	<=10	11-20	21-30	Sample Size
Black rockfish	43%	54%	3%	688
Blue rockfish	21%	72%	6%	858
Other nearshore rockfish	9%	73%	18%	11
Canary rockfish	9%	71%	21%	151
Yelloweye rockfish	0%	71%	29%	7

Predicted distribution of released fish when closed seaward 20 fm

Species	<=10	11-20	Sample Size
Black rockfish	44%	56%	668
Blue rockfish	23%	77%	805
Other nearshore rockfish	11%	89%	9
Canary rockfish	11%	89%	120
Yelloweye rockfish	0%	100%	5

Table 3. Mortality rates developed by the GMT for use in the commercial open access model.

Species	≤10 fm	11-20 fm	21-30	31-40	> 40 fm
Black rockfish	10%	40%	100%	100%	100%
Blue rockfish	10%	40%	100%	100%	100%
Other nearshore rockfish	10%	50%	100%	100%	100%
Canary rockfish	10%	55%	100%	100%	100%
Yelloweye rockfish	50%	90%	100%	100%	100%

Table 4. Recommended mortality rates for all-depth fisheries and fisheries closed seaward of 40-fathoms, 30-fathoms, 20-fathoms and 10-fathoms.

Species	<=10 fm	<= 20 fm	<= 30 fm	<= 40 fm	All depth
Black rockfish	10%	27%	29%	29%	29%
Blue rockfish	10%	33%	37%	37%	37%
Other nearshore rockfish	10%	46%	55%	55%	55%
Canary rockfish	10%	50%	60%	62%	71%
Yelloweye rockfish	50%	90%	93%	93%	98%

PFMC
03/08/06

Agenda Item F.5.c
WDFW Report
March 2006

WASHINGTON DEPARTMENT OF FISH AND WILDLIFE
REPORT ON CONSIDERATION OF INSEASON ADJUSTMENTS

For 2005 and 2006, the Washington recreational harvest target for yelloweye rockfish was 3.5 mt and, for canary rockfish, it was 1.7 mt. The Council adopted these targets to be implemented as recreational harvest guidelines, which are shared with Oregon.

In July, working with recreational catch data through the end of June, the Washington Department of Fish and Wildlife (WDFW) anticipated that the harvest target for canary rockfish would be exceeded. To address this projected overage, WDFW took inseason action to prohibit the retention of bottom fish seaward of a line approximating 30 fms off the majority of the coast (from Cape Flattery south to Leadbetter Pt.), beginning August 5, 2005. WDFW anticipated that this action would significantly reduce canary (and subsequently, yelloweye) rockfish impacts.

However, port sampling data from July through September indicates that catches were even higher than originally projected. As such, the final catch estimates for the Washington recreational fishery are 5.2 mt of yelloweye rockfish and 1.88 mt of canary rockfish, which exceed the harvest targets for these two species.

To help ensure that the Washington harvest targets for canary and yelloweye rockfish are not exceeded in 2006, WDFW recommends the following inseason actions be taken:

<u>Neah Bay and La Push (Marine Areas 3 and 4)</u>

- Prohibit retention of rockfish and lingcod deeper than a line approximating 20 fms from May 22, 2006, through September 30, 2006 on days that halibut fishing is closed (i.e., except June 22 and 24, and all other days halibut fishing is open).

<u>Westport (Marine Area 2)</u>

- Prohibit retention of rockfish and lingcod deeper than a line approximating 30 fms from March 18, 2006, through June 15, 2006.

It is anticipated, based on the data from 2005, that these measures will result in catches that achieve, but not exceed, the Washington recreational harvest targets. WDFW will monitor the catches inseason, consult with the Oregon Department of Fish and Wildlife on the attainment of the shared harvest guideline, and will recommend further inseason action, as appropriate.

PFMC
02/16/06

Agenda Item F.5.d
Supplemental GAP Report
March 2006

GROUNDFISH ADVISORY SUBPANEL REPORT ON CONSIDERATION OF INSEASON ADJUSTMENTS

The Groundfish Advisory Subpanel (GAP) concurs with the recommendations of the Washington Department of Fish and Wildlife (Agenda Item F.5.c, WDFW Report) and Oregon Department of Fish and Wildlife (Agenda Item F.5.c, ODFW Report) with respect to recommendations for inseason adjustments to the recreational management measures in their respective states. No recommended changes were provided for the California recreational fishery management measures (Agenda Item F.5.c, CDFG Report). The GAP does not believe there is a need for inseason adjustments for any of the commercial fisheries.

PFMC
03/09/06

Agenda Item F.5.e
Public Comment
March 2006

Subject: Catch for blackcod
From: "michael salerno" <blackcod@cuisp.com>
Date: Fri, 13 Jan 2006 19:32:36 -0800 (Pacific Standard Time)
To: <pfmc.comments@noaa.gov>
CC: "bob kraig" <bkraig@myhome.net>, "chuck smith" <csmith1@surfbest.net>, "don warner" <dwarner@localaccess.com>, "tiny" <tycos@centurytel.net>, <Salmon_Cod_Man@hotmail.com>

Dear Sir:
I am writing you to look into the catch Limit of the Black cod, To increase the daily limit from 300Lbs. up to 400Lbs. and instead of 12 trips ,it would be 9 ,during May- June , July- August because it would help out the small fisherman . I fish with fishing poles & Jigger , out of a 21 ft. boat for blackcod. There is 4 other boats that do the same out of La-push as I do and we feel that if you could help us out that would save us lots of money on fuel as you know the fuel prices are so High and the weather has not been good for us small boats ether.

You could increase the limit like you did the end of 2005 but it did no good because the water was so bad to even the big boat could not get out ether. You try to help but the weather does no want to cooperate ether. It seams that if you could have a readjustment too the quota during the season that you, Know that the weather is bad and help out the same fisherman this would be greatly helpful to.

Could you please check into this and help us out ?In the state of Washing they have taken all the fishing away from us that was near shore and for the reason that sound that they just don't know what they are doing. It has not heart Oregon or California for near shore fishing!!

Thank you

Michael Salerno

Agenda Item F.5e
Supplemental Public Comments
March 2006

Subject: Blackcod quota's
From: "michael salerno" <blackcod@cuisp.com>
Date: Tue, 21 Feb 2006 10:21:10 -0800 (Pacific Standard Time)
To: <john.devore@noaa.gov>
CC: "chuck smith" <csmith1@surfbest.net>

Dear: Sir

I fish for blackcod out of La-push . I fish from a 23ft. boat with poles and a jigger and I would appreciate if there is something that you could do to raise the daily poundage of the blackcod to 400lbs or even higher like the quota was last Nov / Dec, that was 9000 lbs.for the two months , because of the bad season that we had last year. Since they have raised the catch up to 5000lbs for two month period for the rest of 2006, fishing in small boats and the price of fuel is costly. We only have a few months during the summer for which we can fish and that is if we got good weather to boot .What I an other's in the small group of fisherman would like to see is during the good weather and summer months that the cod limit be raised up higher during this time to off-set the cost of fuel and bad weather.

Please contact me if you have any questions .

Thank you for your assistance

Michael William Salerno
Spokane Wa.
509-326-4027

<>

Subject: open access blackcod quotas
From: "chuck smith" <csmith1@surfbest.net>
Date: Tue, 21 Feb 2006 09:40:11 -0800
To: <john.devore@noaa.gov>

My name is Charles smith. I have been open access commercial fishing (rod and reel) for about 30 yrs. I run a 20 ft boat out of La Push WA. With the changes in the rules over the past 30 yrs. I have been pushed further and further off shore. Now I am not allowed to fish in less then 100 fathoms, which is about 20 nautical miles off shore at the closes point.
Last year we paid $3.20 a gal. for fuel.

The weekly quota for black cod has been change two or three times and is now 1000 lbs. I am asking you to consideration increasing the daily quota to 400 lbs.

I can often catch over 300# but, because of my boat size and safety concerns I must be back to port before dark and can never catch the weekly quota.

A increase in the quota daily to 400# would cut down the number of days I must fish to catch the 2 month quota and would save a lot of fuel.

Please consider this matter
thank you
Charles smith

Subject: Black Cod Quotas
From: "THOMAS INGRAM" <salmon_cod_man@hotmail.com>
Date: Tue, 21 Feb 2006 12:44:41 -0800
To: john.devore@noaa.gov

Sir,

I am writing to you appealing for your assistance. I am asking you to please attempt to have the Black Cod (Sablefish) quota raised to 400 lbs. per trip for those of us in the small boat open access fishery out of LaPush, Washington.

With the cost of fuel, it is very difficult to continue "driving" 50-60 miles per day at 2 1/2 miles per gallon. The continuing rise in our costs without an adjustment offered to us in the price we receive per pound makes it very difficult to barely break even each year.

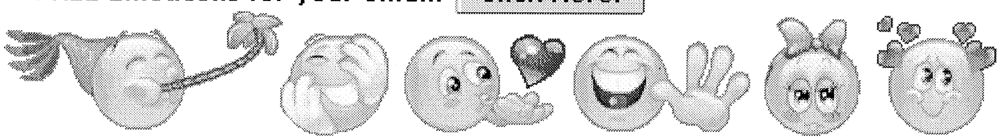
Thank you for your assistance,

Thomas S. Ingram
FV Marcia Lynne III

Subject: Fw: blackcod
From: "Erwin Aanderud" <tycos@centurytel.net>
Date: Thu, 23 Feb 2006 08:16:17 -0800 (Pacific Standard Time)
To: <john.devore@noaa.gov>

.
I am asking them to increase the daily quota too 400# because of the price of fuel. comments must be received by 1 march

john.devore@noaa.gov



```
No virus found in this incoming message.
Checked by AVG Free Edition.
Version: 7.1.375 / Virus Database: 267.15.11/264 - Release Date: 2/17/2006
```

ATT1.txt	**Content-Type:** text/plain **Content-Encoding:** 7bit

Subject: [Fwd: Fw: Blackcod quota's]
From: "PFMC Comments" <pfmc.comments@noaa.gov>
Date: Thu, 23 Feb 2006 09:08:58 -0800
To: DeVo <John.DeVore@noaa.gov>
CC: Jim Seger <Jim.Seger@noaa.gov>

--
Pacific Fishery Management Council
7700 NE Ambassador Place, Suite 200
Portland, OR 97220-1384
Phone: 503-820-2280
Toll Free: 1-866-806-7204
Fax: 503-820-2299
Email: pfmc.comments@noaa.gov
Visit us on the web at: http://www.pcouncil.org

Subject: Fw: Blackcod quota's
From: "michael salerno" <blackcod@cuisp.com>
Date: Thu, 23 Feb 2006 08:56:24 -0800 (Pacific Standard Time)
To: <pfmc.comments@noaa.gov>

Subject: Blackcod quota's

Dear: Sir

I commerical fish for blackcod out of La-push Washington. My name is Michael Salerno. I fish from a 23ft. boat with poles and a jigger . I would appreciate if there is something that you could do to raise the daily poundage of the blackcod to 400lbs or even higher like the quota that was last Nov / Dec,2005 that was 9000 lbs. for the two months , because of the bad season that we had last year. Since they have raised the catch up to 5000lbs for two month period's for the rest of 2006, fishing in small boat ,when the fishing is good ,it is hard to catch the big weekly limit and not many

hours in a day to fish and be out late and be safe too. the price of fuel is costly at $3.20 gallon in 2005and was not good. We only have a few months during the summer for which we can fish because , our in shore fishing for bass and ling cod has been taken and now having too fish 100 fathoms I have to go about 25 nautical miles off shore to fish. and that is if we got good weather to boot .What I an other's in the small group of fisherman would like to see is during the good weather and summer months that the cod limit be raised up higher during this time to off-set the cost of fuel and bad weather or at least raise it to the same as found south of us to 350lbs a day.
Please contact me if you have any questions .
Thank you for your assistance
Michael William Salerno
Spokane Wa.
509-326-4027

Fw: Blackcod quota's	**Content-Type:**	message/rfc822
	Content-Encoding:	7bit

Subject: [Fwd: groundfish in season adjustments]
From: "PFMC Comments" <pfmc.comments@noaa.gov>
Date: Thu, 23 Feb 2006 15:56:56 -0800
To: DeVo <John.DeVore@noaa.gov>

--
Pacific Fishery Management Council
7700 NE Ambassador Place, Suite 200
Portland, OR 97220-1384
Phone: 503-820-2280
Toll Free: 1-866-806-7204
Fax: 503-820-2299
Email: pfmc.comments@noaa.gov
Visit us on the web at: http://www.pcouncil.org

Subject: groundfish in season adjustments
From: "John Law test" <wildwest@general-net.com>
Date: Thu, 23 Feb 2006 15:45:30 -0800
To: <pfmc.comments@noaa.gov>

I am happy to see the opening of the shelf rockfish fishery in the southern area for the March-April period. However I do not like the idea of the bocaccio and deeper nearshore being closed because these fish are taken in the same area as shelf rockfish in my area. Some degree of take should be considered so incidental catches could be kept and marketed instead of being discarded. The small bocaccio that were 1/2 lb. are now 2 lbs. and plentiful.
The 60 fathom line should be moved seaward along the San Diego coast as it runs through water as shallow as 45 fathoms and cuts off up to 8/10ths of a mile near the Mexican border.
Consider the possibility of stopping new entrants to the shelf fishery and allowing a larger take for those currently involved. Whatever happened to this proposal in the "strategic plan"?

groundfish in season adjustments	**Content-Type:** message/rfc822 **Content-Encoding:** 7bit