Stock Assessment of Petrale Sole: 2004

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Executive Summary

Stock: This is a stock assessment of petrale sole (*Eopsetta jordani*) in U.S. waters off California, Oregon, and Washington. Genetic information and stock structure are not well known for this species. Previous assessments of petrale sole in the U.S. Vancouver and Columbia INPFC areas (named the Northern assessment area for this assessment) were conducted by Demory (1984), Turnock et al. (1993), and Sampson and Lee (1999). In this assessment, petrale sole in the Eureka, Monterey and Conception INPFC areas (the Southern assessment area) are assessed separately from those in the Northern assessment area. Data on growth, CPUE, and the geographical distribution of petrale sole along the U.S. Pacific coast support the use of two separate assessment areas.

Catches: Almost all catches of petrale sole have been taken with trawl gears. Recent petrale sole catch statistics by fishing year are summarized in Table E-1 and Figure E-1. Monthly catches demonstrate a strong seasonality in the two assessment areas with the catches during the winter months (November to February) being higher than during the summer months (March to October). As a result, the assessment is based on winter and summer fishing seasons with a fishing year that starts on November 1 and ends on October 31. In the Northern assessment area, the fisheries are divided into WA-Winter, WA-Summer, OR-Winter and OR-summer fisheries. In the Southern assessment area, the fisheries are divided into winter and summer fisheries. For the period 1981–2004, the calendar year landings (PacFIN database) ranged between 824–1,778 mt in the Northern assessment area and 420–992 mt in the Southern assessment area. Catches for 1956–81 were obtained from Sampson and Lee (1999) based on the HAL database, which has been archived by PacFIN. Pre-1956 catches were estimated from several reports: Heimann and Carlisle (1970) for the Southern assessment area, Cleaver (1951) and Smith (1950) for Oregon, and WDF (1956) and Alverson and Chatwin (1957) for Washington. Discard rates for petrale sole were estimated by Demory (1984) for the period 1977–82, by Sampson and Lee (1999) for the period 1986–87 (based on the studies of Pikitch et al. (1988)), and by the NWFSC Groundfish Observer program for the period 2001–04.

Data and Assessment: A variety of data sources were used in the assessment: 1) biomass indices and length compositions from the NMFS Triennial Surveys in 1980, 1983, 1986, 1989, 1992, 1995, 1998, 2001, and 2004; 2) standardized CPUE indices for 1987–2003 for each fishery; 3) length compositions of ODFW and WDFW commercial landings from the PacFIN BDS database; and 4) length and age compositions of California commercial

landings from the CALCOM database. The data sources included in the assessment were analyzed using the length-and-age structured Stock Synthesis 2 (SS2) Model developed by Dr. Richard Methot (NOAA Fisheries).

Unresolved Problems and Major Uncertainties: The major sources of uncertainty in this stock assessment include: 1) comparability of age data between age-reading laboratories and within laboratories over time (due to changes in ageing methods, and inadequate otolith sampling and between-laboratory variation); 2) the impact of fishery regulations on the utility of CPUE as an index of relative abundance for recent years (i.e., after 1999); 3) the use of an assumed value for the rate of natural mortality; 4) the impact of sampling and ageing methods on the values for the parameters of the von Bertalanffy growth curve; 5) the lack of historical discard rates and lengths, and 6) the impact of assumptions regarding length-based selectivity and retention curves for fisheries and surveys.

Reference Points: The Pacific Fishery Management Council uses the 40:10 control rule as the default harvest rate policy for groundfish. The target (MSY-proxy) harvest rate for petrale sole is $F_{40\%}$. The target spawning biomass levels, 0.4 SB_0, are 5,753 mt and 6,394 mt in the northern and southern areas, respectively. Given the life history of petrale sole, this corresponds to an exploitation rate of 12% and 14%, respectively for the Northern and Southern assessment areas based on the exploitation rates in 2004. At this exploitation rate, the recruits, spawning stock biomass, Maximum Sustainable Yield (MSY), and age 3^+ biomass are:

	Estimates	
	Northern Area	Southern Area
Unfished Spawning Stock Biomass (SB_0)	14,382	15,985
Unfished Summary Biomass, Age 3^+	25,165	28,920
Unfished Recruitment (age0)	12,174	14,829
SB_{MSY}	2,658	4,121
Basis for SB_{MSY}	SB_{MSY}	SB_{MSY}
SPR_{MSY}	0.214	0.330
Basis for SPR_{MSY}	F_{MSY}	F_{MSY}
Exploitation Rate at SPR_{MSY}	0.12	0.14
MSY	1,760	1,404

Stock Biomass: The estimated spawning stock biomass of petrale sole in the Northern assessment area reached the historical low in 1992 (1,267 mt or 8.8% SB_0, Figure E-2). It has increased steadily since that point: to 1,554 mt (11% SB_0) in 1995, and to 4,960 mt (34% SB_0) in 2005 (Table E-1). The estimated spawning stock biomass of petrale sole in the Southern assessment area reached the historical low in 1986 (1,012 mt or 6% SB_0, Figure E-2). The biomass in the Southern assessment area was generally stable over the next ten years, reaching 1,252 mt (8% SB_0) by 1995. However, the estimated spawning biomass has increased rapidly in recent years, with a value of 4,667 mt (29% SB_0) in 2005 (Table E-1).

Recruitment: Annual recruitment was treated as stochastic, and estimated as annual deviations from log-mean recruitment. In the Northern assessment area, recruitment decreased since 1980 and reached the historical low in 1989, but generally increased after

1990 (Figure E-2). In the Southern assessment area, recruitment decreased through the 1980s, reaching the historical low during 1988, but generally increased after 1990 (Figure E-2).

Exploitation Status: The current assessment indicates that petrale sole was below 25% of SB_0 during 1980–2002 in the northern assessment area (Figure E-2) and during 1974–2004 in the southern assessment area (Figure E-2). The depletion level in 2005 is estimated to be 34% and 29% of SB_0 respectively for the northern and southern areas.

Management Performance: Petrale sole off the U.S. west coast have been managed historically using a coastwide ABC which represents the sum of ABCs calculated for the four INPFC areas (U.S. Vancouver-Columbia, Eureka, Monterey, and Conception; Table E-1). During 1995–2000, the coastwide total annual catch (landings and discard combined) did not exceed the ABC. However, the total annual catch in the Northern assessment area has exceeded the portion of the ABC attributed to that area since 2001.

Forecasts: A 12-year forecast of stock abundance and yield was developed using the base model (Table E-2). The 40:10 control rule reduces forecasted yields in the both assessment areas below those corresponding to $F_{40\%}$ because the stocks are estimated to be lower than the management target of $SB_{40\%}$. The 2004 exploitation rate was used to distribute catches among the four fisheries in the Northern assessment area. In contrast, the 5-yr (2000–4) average relative exploitation rate was used to distribute catches between the winter and summer fisheries in the Southern assessment area.

Decision Table: Decision tables (Table E-3) for the Northern and Southern assessment areas were constructed using three possible management actions: 1) catches are set at the forecast (40-10 control rule) catch level using a low spawning biomass model, 2) catches are set at the forecast catch level using the base model, and 3) catches are set at the forecast catch level using a high spawning biomass model. The results for 12-year projections of spawning biomass and stock depletion are evaluated for the base model as well as high and low spawning biomass models.

Research and Data Needs: The STAT identifies the following research needs (not in priority order):

A. Survey age data should be made available. Young individuals are not well represented in the fishery age and length compositions owing to discarding. The 2004 survey age determination data provide the growth parameters used in the assessment model for the Northern assessment area It would be beneficial to future assessments if age data from surveys were available because they provide recruitment information as well as age compositions and information about growth.

B. Increase efforts to collect commercial fishery length and age data. Length and age data are sporadic after 1999. Without age data, the ability to estimate year-class strength and the extent of variation in recruitment is compromised. Uncertainty will continue unless additional length and age composition data become available.

C. Age-error matrices. Estimation of the age compositions and mean-size-at-age for petrale sole may be compromised because of the use of different ageing methods over time and sampling designs that differ among the states. Between-agencies age error matrices should be constructed.

D. Effect of fishery regulations. The impacts of trip-limits and other management approaches, such as closed areas, on discards and fishery selectivity requires further study.

E. Studies on stock structure of petrale sole.

F. Collect length compositions for discarded petrale sole.

G. Winter-summer spawning migration should investigated in the field and be incorporated into future assessment models.

H. Examine the advantages and disadvantages of different ways for constructing age and size compositions.

Table E-1. A summary of reference point statistics.

Element		1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Total Catch (mt)[1]	Coastwide	1,669	1,942	2,061	1,724	1,616	1,892	1,959	2,009	1,832	2,377	
North	Landings	920	932	880	1,015	857	1,059	1,180	1,258	1,270	1,716	
	Predicted Discards*	71	73	70	74	62	78	89	91	87	134	
South	Landings	662	914	1,084	619	680	736	674	644	464	514	
	Predicted Discards	17	23	27	15	17	18	17	16	12	13	
ABC (mt)	Coastwide	2,700	2,700	2,700	2,700	2,700	2,950	2,762	2,762	2,762	2,762	2,736**
	North	1,200	1,200	1,200	1,200	1,200	1,450	1,262	1,262	1,262	1,262	2,045**
	South	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	691**
SPR	North	0.2225	0.2258	0.2445	0.2333	0.3062	0.3039	0.3126	0.3241	0.3573	0.3199	
	South	0.2942	0.2425	0.1881	0.3240	0.3129	0.2877	0.3041	0.3453	0.5355	0.6582	
Age3+ Biomass	Coastwide	8,292	8,763	9,313	10,037	10,985	12,005	12,887	15,392	17,956	20,831	23,056
(mt)	North	4,584	4,660	5,153	6,086	6,843	7,782	8,545	10,347	11,343	11,959	12,032
	South	3,708	4,103	4,159	3,951	4,142	4,223	4,343	5,046	6,613	8,872	11,024
Spawing Biomass	Coastwide	2,807	3,165	3,334	3,358	3,784	4,411	4,813	5,178	5,911	7,687	9,628
(mt)	North Estimate	1,554	1,601	1,639	1,779	2,062	2,602	3,038	3,383	3,863	4,631	4,960
	std deviation	166	173	182	197	227	273	324	378	445	543	644
	South Estimate	1,252	1,564	1,695	1,579	1,723	1,809	1,775	1,795	2,048	3,056	4,667
	std deviation	281	311	335	342	363	380	384	401	455	602	888
Recruitment	Coastwide	18,260	15,427	18,141	22,593	49,709	29,184	24,183	19,034	23,499	18,977	22,191
	North Estimate	13,041	10,832	10,966	11,501	23,398	12,239	10,227	11,522	15,546	9,661	11,401
	std deviation	3,143	2,802	3,372	3,612	4,549	3,987	3,530	4,124	6,945	4,836	503
	South Estimate	5,219	4,595	7,175	11,092	26,311	16,945	13,956	7,512	7,953	9,315	10789.9
	std deviation	1,474	1,393	1,731	2,776	6,701	5,191	5,345	3,577	3,764	4,340	1,014
Depletion	Coastwide	9%	10%	11%	11%	12%	15%	16%	17%	19%	25%	32%
	North	11%	11%	11%	12%	14%	18%	21%	24%	27%	32%	34%
	(std deviation)										(4%)	(5%)
	South	8%	10%	11%	10%	11%	11%	11%	11%	13%	19%	29%
	(std deviation)										(4%)	(5%)

1 All catches are reported by fishing year

* based on assumed discard rates of 10% in summer and 5% in winter

** PFMC GMT projected coastwide OY/ABC = 2,762 mt with the landed catch split 75:25 between the northern and southern areas

Table E-2. 12-yr forecasts for the Northern and Southern assessment areas.

Northern Assessment Area

Year	Age3+ (mt)	SB (mt)	Depletion	age0 (,000)	WA Winter Fishery Total Catch	WA Winter Fishery Retain-ed	WA Winter Fishery Discard-ed	WA Winter Fishery Harvest Rate	WA Summer Fishery Total Catch	WA Summer Fishery Retain-ed	WA Summer Fishery Discard-ed	WA Summer Fishery Harvest Rate	OR Winter Fishery Total Catch	OR Winter Fishery Retain-ed	OR Winter Fishery Discard-ed	OR Winter Fishery Harves t Rate	OR Summer Fishery Total Catch	OR Summer Fishery Retain-ed	OR Summer Fishery Discard-ed	OR Summer Fishery Harvest Rate
2005	12,032	4,960	34%	10,061	353	317	35	4.7%	349	314	35	4.7%	811	730	81	10.9%	583	525	58	7.9%
2006	12,130	4,859	34%	11,378	353	317	35	4.8%	349	314	35	4.8%	811	730	81	10.9%	583	525	58	8.1%
2007	11,718	4,716	33%	11,344	218	196	22	3.0%	213	192	21	2.9%	501	451	50	6.9%	356	321	36	4.8%
2008	11,953	5,077	35%	11,426	239	215	24	3.1%	230	207	23	3.0%	550	495	55	7.2%	385	347	39	5.0%
2009	12,102	5,245	36%	11,461	250	225	25	3.2%	237	213	24	3.0%	574	517	57	7.2%	396	357	40	5.0%
2010	12,170	5,276	37%	11,468	252	226	25	3.2%	238	214	24	3.0%	579	521	58	7.3%	398	358	40	5.0%
2011	12,228	5,299	37%	11,472	252	227	25	3.2%	238	215	24	3.0%	580	522	58	7.3%	399	359	40	5.0%
2012	12,288	5,332	37%	11,478	253	228	25	3.2%	240	216	24	3.0%	583	524	58	7.3%	401	361	40	5.1%
2013	12,343	5,366	37%	11,485	255	230	26	3.2%	242	217	24	3.0%	587	528	59	7.3%	404	364	40	5.1%
2014	12,390	5,396	38%	11,491	257	231	26	3.2%	243	219	24	3.0%	590	531	59	7.3%	406	366	41	5.1%
2015	12,428	5,421	38%	11,496	258	232	26	3.2%	244	220	24	3.0%	594	534	59	7.3%	409	368	41	5.1%
2016	12,458	5,440	38%	11,499	259	233	26	3.2%	245	221	25	3.0%	596	537	60	7.3%	410	369	41	5.1%

Southern assessment area

Year	Biomass Age3+ (mt)	SB (mt)	Depletion Level	Recruits age0 (,000)	Winter Fishery Total Catch	Winter Fishery Retention	Winter Fishery Discard	Winter Fishery Harvest Rate	Summer Fishery Total Catch	Summer Fishery Retention	Summer Fishery Discard	Summer Fishery Harvest Rate
2005	11,024	4,667	29.2%	10,790	400	390	10	7.3%	267	260	7	4.9%
2006	12,485	5,998	37.4%	12,759	400	390	10	6.5%	267	260	7	4.7%
2007	13,346	6,838	42.4%	13,119	1,052	1,025	26	17.0%	576	562	14	11.3%
2008	12,776	6,467	40.1%	12,969	934	911	23	17.0%	509	497	13	11.3%
2009	12,272	5,959	37.0%	12,740	836	815	21	16.5%	465	454	12	11.0%
2010	12,019	5,569	34.6%	12,543	785	766	20	16.1%	451	440	11	10.8%
2011	12,002	5,380	33.4%	12,439	781	762	20	15.9%	460	448	11	10.6%
2012	12,110	5,369	33.4%	12,433	801	781	20	15.9%	474	462	12	10.6%
2013	12,245	5,436	33.8%	12,470	821	801	21	16.0%	485	473	12	10.7%
2014	12,356	5,510	34.3%	12,511	835	814	21	16.1%	492	480	12	10.7%
2015	12,430	5,564	34.6%	12,540	842	821	21	16.2%	495	482	12	10.8%
2016	12,476	5,592	34.8%	12,555	844	823	21	16.2%	495	483	12	10.8%

Table E-3. The decision tables for petrale sole in the northern, southern and coastwide assessment areas.

Northern Assessment Area

Management Action	Year	40:10 adj. Catch	Low Spawning Biomass Model (Base Model 2004 SB-1.25*SD) SB	Depletion	Base Model (Base Model 2004 SB) SB	Depletion	High Spawning Biomass Model (Base Model 2004 SB+1.25*SD) SB	Depletion
Low catch	2005	2,095	4,038	28%	4,960	34%	5,915	41%
(from Low Spawning	2006	2,095	3,742	26%	4,859	34%	6,035	42%
Biomass Model)	2007	818	3,454	24%	4,716	33%	6,054	42%
	2008	1,001	3,977	28%	5,340	37%	6,780	47%
	2009	1,128	4,344	30%	5,735	40%	7,193	50%
	2010	1,207	4,569	32%	5,937	41%	7,356	51%
	2011	1,267	4,744	33%	6,071	42%	7,424	51%
	2012	1,316	4,888	34%	6,167	43%	7,445	51%
	2013	1,356	5,004	35%	6,230	43%	7,428	51%
	2014	1,388	5,099	36%	6,268	44%	7,383	51%
	2015	1,415	5,174	36%	6,285	44%	7,321	51%
	2016	1,436	5,233	37%	6,286	44%	7,246	50%
Medium catch	2005	2,095	4,038	28%	4,960	34%	5,915	41%
(from Base Model)	2006	2,095	3,742	26%	4,859	34%	6,035	42%
	2007	1,289	3,454	24%	4,716	33%	6,054	42%
	2008	1,405	3,721	26%	5,077	35%	6,512	45%
	2009	1,457	3,867	27%	5,245	36%	6,694	46%
	2010	1,466	3,922	27%	5,276	37%	6,685	46%
	2011	1,469	3,985	28%	5,299	37%	6,643	46%
	2012	1,477	4,062	28%	5,332	37%	6,603	46%
	2013	1,487	4,141	29%	5,366	37%	6,561	45%
	2014	1,497	4,216	29%	5,396	38%	6,516	45%
	2015	1,505	4,285	30%	5,421	38%	6,469	45%
	2016	1,511	4,347	30%	5,440	38%	6,421	44%
High catch	2005	2,095	4,038	28%	4,960	34%	5,915	41%
(from High Spawning	2006	2,095	3,742	26%	4,859	34%	6,035	42%
Biomass Model)	2007	1,754	3,454	24%	4,716	33%	6,054	42%
	2008	1,788	3,470	24%	4,818	34%	6,248	43%
	2009	1,769	3,411	24%	4,776	33%	6,215	43%
	2010	1,720	3,313	23%	4,650	32%	6,047	42%
	2011	1,675	3,270	23%	4,565	32%	5,897	41%
	2012	1,642	3,278	23%	4,533	32%	5,794	40%
	2013	1,614	3,313	23%	4,532	32%	5,722	40%
	2014	1,596	3,362	23%	4,551	32%	5,675	39%
	2015	1,584	3,418	24%	4,581	32%	5,643	39%
	2016	1,575	3,475	24%	4,614	32%	5,621	39%

Table E-3. Continued.

Southern Assessment Area

Management Action	Year	40:10 adj. Catch	Low Spawning Biomass Model (Base Model 2004 SB-1.25*SD) SB	Depletion	Base Model (Base Model 2004 SB) SB	Depletion	High Spawning Biomass Model (Base Model 2004 SB+1.25*SD) SB	Depletion
Low catch	2005	667	3,630	22%	4,667	29%	5,735	43%
(from Low Spawning	2006	667	4,431	26%	5,998	38%	7,863	59%
Biomass Model)	2007	1,048	4,960	30%	6,838	43%	9,070	68%
	2008	975	4,897	29%	6,870	43%	9,190	69%
	2009	929	4,730	28%	6,691	42%	8,931	67%
	2010	932	4,620	28%	6,526	41%	8,595	65%
	2011	982	4,640	28%	6,476	41%	8,320	63%
	2012	1,050	4,779	29%	6,543	41%	8,133	61%
	2013	1,109	4,955	30%	6,654	42%	7,988	60%
	2014	1,152	5,111	31%	6,757	42%	7,859	59%
	2015	1,180	5,229	31%	6,835	43%	7,734	58%
	2016	1,200	5,311	32%	6,886	43%	7,612	57%
Medium catch	2005	667	3,630	22%	4,667	29%	5,735	43%
(from Base Model)	2006	667	4,431	26%	5,998	38%	7,863	59%
	2007	1,628	4,960	30%	6,838	43%	9,070	68%
	2008	1,444	4,498	27%	6,467	40%	8,826	67%
	2009	1,301	4,008	24%	5,959	37%	8,269	62%
	2010	1,237	3,677	22%	5,569	35%	7,730	58%
	2011	1,241	3,557	21%	5,380	34%	7,331	55%
	2012	1,275	3,610	22%	5,369	34%	7,078	53%
	2013	1,307	3,729	22%	5,436	34%	6,905	52%
	2014	1,327	3,827	23%	5,510	34%	6,769	51%
	2015	1,337	3,876	23%	5,564	35%	6,651	50%
	2016	1,340	3,879	23%	5,592	35%	6,543	49%
High catch	2005	667	3,630	22%	4,667	29%	5,735	43%
(from High Spawning	2006	667	4,431	26%	5,998	38%	7,863	59%
Biomass Model)	2007	2,458	4,960	30%	6,838	43%	9,070	68%
	2008	2,058	3,934	23%	5,893	37%	8,307	63%
	2009	1,797	3,036	18%	4,965	31%	7,361	55%
	2010	1,648	2,434	15%	4,291	27%	6,556	49%
	2011	1,579	2,146	13%	3,927	25%	5,994	45%
	2012	1,546	2,097	13%	3,820	24%	5,659	43%
	2013	1,524	2,139	13%	3,841	24%	5,461	41%
	2014	1,504	2,151	13%	3,889	24%	5,337	40%
	2015	1,478	2,085	12%	3,918	25%	5,250	40%
	2016	1,456	1,947	12%	3,920	25%	5,185	39%

Table E-3. Continued.

Coastwide

Management Action	Year	40:10 adj. Catch	Low Spawning Biomass Model (Base Model 2004 SB-1.25*SD) SB	Depletion	Base Model (Base Model 2004 SB) SB	Depletion	High Spawning Biomass Model (Base Model 2004 SB+1.25*SD) SB	Depletion
Low catch	2005	2,762	7,667	25%	9,628	32%	11,650	38%
(Projected from Low	2006	2,762	8,173	27%	10,858	36%	13,898	46%
Spawning Biomass	2007	1,866	8,415	28%	11,554	38%	15,124	50%
Model)	2008	1,976	8,873	29%	12,211	40%	15,970	53%
	2009	2,057	9,074	30%	12,426	41%	16,124	53%
	2010	2,139	9,189	30%	12,463	41%	15,951	53%
	2011	2,249	9,385	31%	12,546	41%	15,744	52%
	2012	2,366	9,667	32%	12,710	42%	15,577	51%
	2013	2,465	9,959	33%	12,884	42%	15,416	51%
	2014	2,541	10,210	34%	13,026	43%	15,243	50%
	2015	2,595	10,403	34%	13,121	43%	15,055	50%
	2016	2,635	10,544	35%	13,172	43%	14,857	49%
Medium catch	2005	2,762	7,667	25%	9,628	32%	11,650	38%
(from Base Model)	2006	2,762	8,173	27%	10,858	36%	13,898	46%
	2007	2,916	8,415	28%	11,554	38%	15,124	50%
	2008	2,849	8,220	27%	11,544	38%	15,338	51%
	2009	2,758	7,875	26%	11,204	37%	14,963	49%
	2010	2,702	7,598	25%	10,846	36%	14,415	47%
	2011	2,710	7,542	25%	10,679	35%	13,974	46%
	2012	2,752	7,673	25%	10,701	35%	13,681	45%
	2013	2,794	7,869	26%	10,802	36%	13,466	44%
	2014	2,824	8,043	26%	10,907	36%	13,286	44%
	2015	2,841	8,161	27%	10,985	36%	13,120	43%
	2016	2,851	8,226	27%	11,031	36%	12,964	43%
High catch	2005	2,762	7,667	25%	9,628	32%	11,650	38%
(Projected from High	2006	2,762	8,173	27%	10,858	36%	13,898	46%
Spawning Biomass	2007	4,212	8,415	28%	11,554	38%	15,124	50%
Model)	2008	3,845	7,404	24%	10,711	35%	14,554	48%
	2009	3,566	6,447	21%	9,741	32%	13,577	45%
	2010	3,368	5,746	19%	8,941	29%	12,603	42%
	2011	3,254	5,415	18%	8,492	28%	11,891	39%
	2012	3,189	5,375	18%	8,353	28%	11,452	38%
	2013	3,138	5,451	18%	8,372	28%	11,183	37%
	2014	3,100	5,514	18%	8,440	28%	11,012	36%
	2015	3,062	5,503	18%	8,499	28%	10,893	36%
	2016	3,032	5,422	18%	8,534	28%	10,806	36%

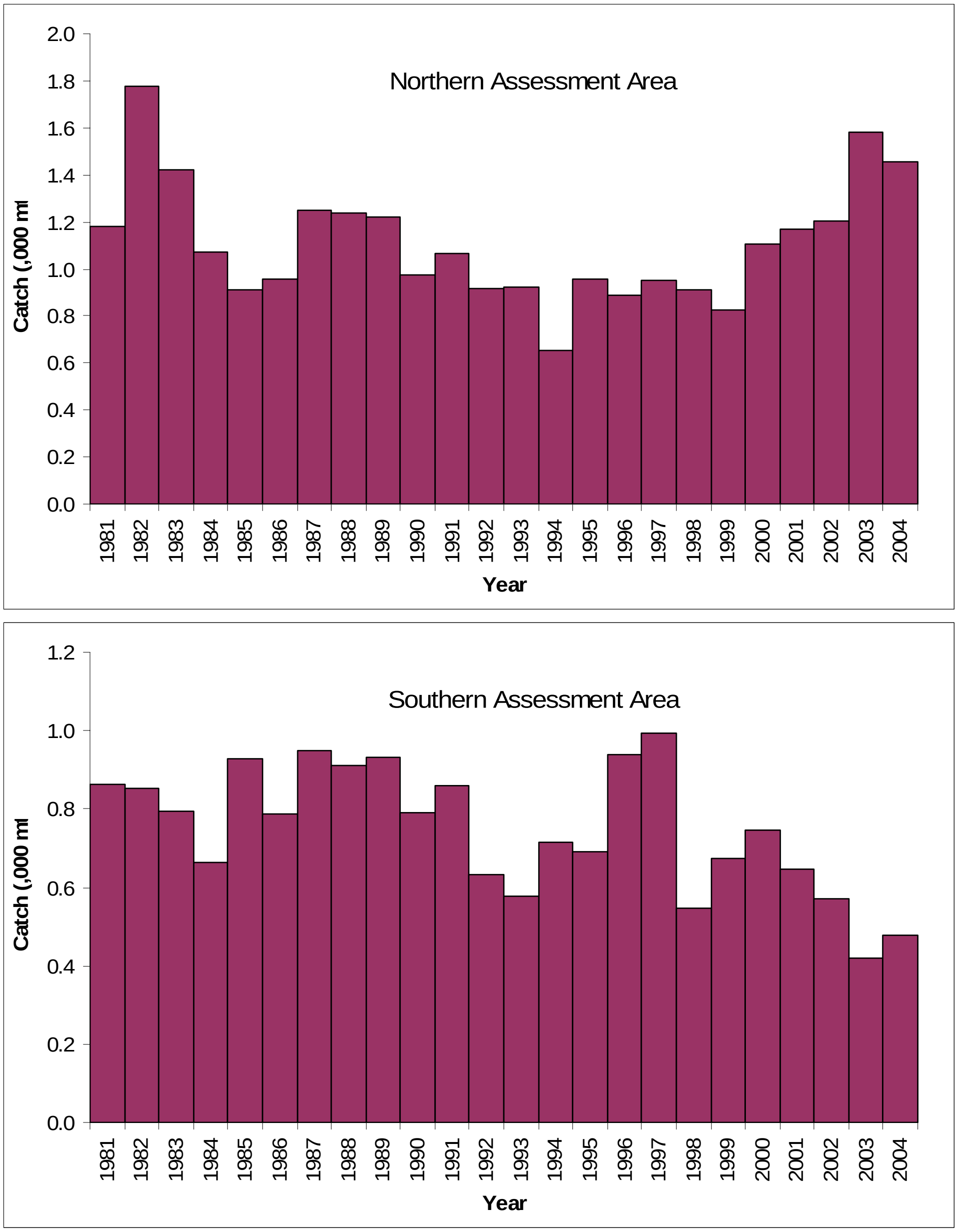

Figure E-1. Annual landings (1982–2004) extracted from the PacFIN database.

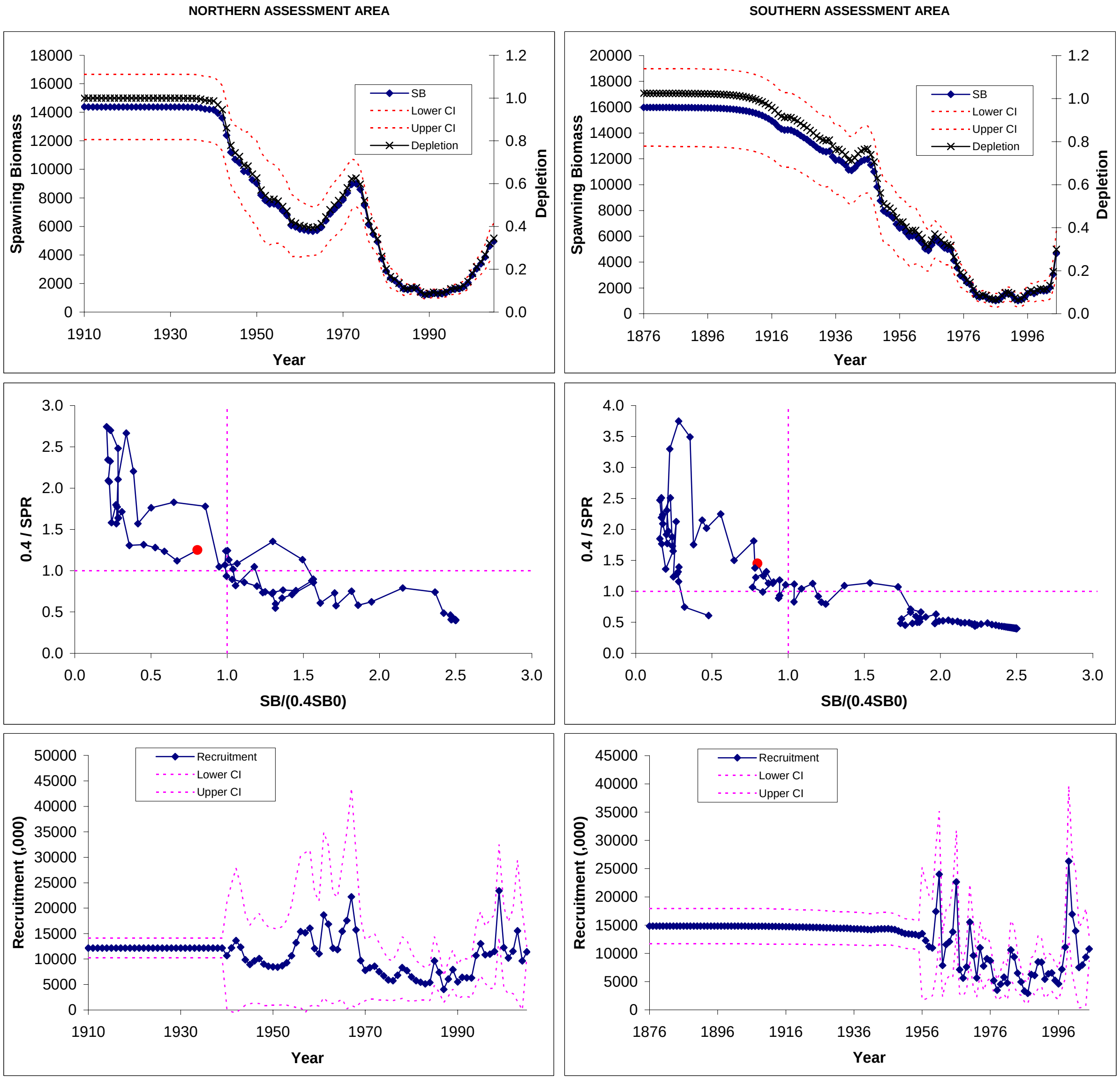

Figure E-2. Trajectories of spawning biomass (SB), depletion, recruitment and spawning potential ratio relative to the proxy target of 40% vs. estimated spawning biomass relative to the proxy 40% level.

1.0 Introduction

This report presents an evaluation of the status of petrale sole through 2004. The coastwide petrale sole resource is divided into two areas for the purposes of this assessment: (i) the Northern assessment area, which includes the U.S. Vancouver and Columbia INPFC areas (Figure 1) and (ii) the Southern assessment area, which includes the Eureka, Monterey and Conception INPFC areas. The Northern assessment area is designed to maintain continuity with the previous stock assessments conducted by Demory (1984), Turnock et al. (1993), and Sampson and Lee (1999). In common with Sampson and Lee (1999), this assessment experienced difficulties when attempts were made to model petrale sole in each of the Eureka, Monterey, and Conception INPFC areas separately. Therefore, these three INPFC areas are combined into a Southern assessment area. Differences in fleets and growth between the Northern and Southern areas support separate assessments for these two areas. The petrale sole fisheries possess a distinct seasonality so the fisheries for each assessment area are divided into winter (November-February) and summer (March-October) fisheries. Finally, the "fishing year" for this assessment (November 1 to October 31) differs from the ordinary calendar year. A hybrid length-age model (SS2), developed by Dr. Richard Methot (NOAA Fisheries), is used for the stock assessment.

1.1 Taxonomy and distribution

Petrale sole (*Eopsetta jordani*) is a right-eyed flounder in the family Pleuronectidae. Other vernacular names are brill, California sole, Jordan's flounder, and round nosed sole. The chemotaxonomic key for petrale sole is available at http://www.cfsan.fda.gov/~frf/rfe1pt.html (FDA Center for Food Safety and Applied Nutrition - Seafood/RFE).

Petrale sole range from the Bering Sea and Aleutian Islands through the Gulf of Alaska to the Coronado Islands, northern Baja California (Hart, 1973; Kramer et al., 1995). This species shows a preference for sand and mud bottoms. Based on the PacFIN logbook database, adults are caught in depths from 10 to 700 fm off the U.S. west coast. The majority of the catches of petrale sole are taken in the depth range 40–120 fm during March through October, and in the depth range 160–240 fm during November through February (see **Sec. 3.3.2**).

1.2 Stock structure

Stock structure for petrale sole is not well understood, and no DNA-analysis has been undertaken for this species off the U.S. west coast. Demory (1984), Turnock et al. (1993), and Sampson and Lee (1999) considered petrale sole in the Columbia and U.S. Vancouver INPFC areas as a single "assessment" stock. Sampson and Lee (1999) assumed that petrale sole in the Eureka and Monterey INPFC areas represented two additional distinct "assessment" stocks. Three "assessment" stocks (i.e., west coast Vancouver Island, Queen Charlotte Sound, and Heceta Strait) are considered for petrale sole in the waters off British Columbia, Canada (Starr and Fargo, 2004).

1.3 Spawning, early life history and recruitment

There are several relatively discrete deepwater spawning sites (150–250 fm) off the US west coast (see Figure 1 of Sampson and Lee, 1999). Spawning occurs from about November through March, but seems to be variable among spawning grounds. Females spawn once each year and fecundity varies with fish size, with one large female laying as many as 1.5 million eggs (Porter, 1964).

Petrale sole eggs are pelagic and are found primarily in water temperatures of 4–10^{o}C and salinities of 25–30 ppt (Ketchen and Forrester, 1966). The favorable conditions for egg incubation and larval growth are 6–7^{o}C and 27.5–29.5 ppt (Ketchen and Forrester, 1966; Alderice and Forrester, 1971; Castillo et al., 1995). Porter (1964) described the identification of petrale sole larvae. Petrale sole larvae spend their first 5–6 months up in the water column before they metamorphose to the adult form and settle to the bottom (Pearcy et al., 1977). No specific areas have been identified as nursery grounds for juvenile petrale sole, but Starr and Fargo (2004) report that larvae are usually found in the upper 50 m far offshore, juveniles at 19–82 m and large juveniles at 25–125 m in the waters off British Columbia, Canada.

Castillo (1992) and Castillo et al. (1995) showed that offshore Ekman transportation of eggs and larvae is an important source of variation in year-classes strength in the Columbia INPFC area. These authors also suggested that density-independent survival is low for the early life stages.

1.4 Migration

Adult petrale sole can tolerate a wide range of bottom temperatures (Perry et al., 1994). Tagging studies indicate some mixing among spawning groups. For example, DiDonato and Pasquale (1970) reported that five fish tagged on the Willapa Deep grounds during the spawning season were recaptured during subsequent spawning seasons at other deepwater spawning grounds, as far south as Eureka (northern California) and the Umpqua River (southern Oregon). However, Pederson (1975) reported that most of the fish (97%) recaptured from spawning grounds in winter were originally caught and tagged on those same grounds.

Mixing of fish from various areas may occur when the fish are feeding on the shelf outside of the spawning season. For example, fish captured, tagged, and released off the northwest coast of Washington during May and September were subsequently recaptured during winter from spawning grounds off Vancouver Island to the north (1 fish), and Heceta Bank (central Oregon, 2 fish), Eureka (northern California, 2 fish), and Halfmoon Bay (central California, 2 fish) to the south (Pederson, 1975). Also, fish tagged south of Fort Bragg (central California) during July 1964 were later recaptured off Oregon (11 fish), Washington (6 fish), and as far north as Swiftsure Bank off the southwestern tip of Vancouver Island (1 fish; D. Thomas, California Department of Fish and Game, Menlo Park, CA, cited by Sampson and Lee, 1999).

Off British Columbia, the highest densities of spawning adults, as well as of eggs, larvae and juveniles, are found in the waters around Vancouver Island. Adults may utilize nearshore areas as summer feeding grounds and non-migrating adults may stay there during winter (Starr and Fargo, 2004).

1.5 Feeding behavior

Pearsall and Fargo (in prep., cited by Starr and Fargo, 2004) state that juvenile petrale sole feed on mobile prey such as cumaceans, carideans and gammarid amphipods, and adults are piscivores with herring (*Clupea harengus*) as the preferred prey in Canadian waters. Other prey includes juvenile pollock (*Theragra chalcogramma*), shrimps and epibenthos (Ketchen and Forrester, 1966; Kravitz et al., 1976; Westrheim and Harling, 1983). In California, the diet of the petrale sole includes crabs, shrimp, and fishes such as anchovies, hake, small rockfish and other flatfish. Lee (2003) studied oceanographic effects on the dynamics of food habits and growth of petrale sole.

1.6 Age determination and growth

Historically, petrale sole have been aged using the otolith surface ageing technique although some otoliths collected by ODFW have been aged using the break-and-burn (BB) technique since 1981. Based on Brass' (ODFW) unpublished data, Turnock et al. (1993) report that ages for males based on surface readings are lower than those based on BB readings from age 10. In contrast to the situation for males, Turnock et al. (1993) did not find differences between surface and BB readings for females. This unpublished information has formed the basis for the last two assessments (Turnock et al., 1993; Sampson and Lee, 1999).

The protocol for age determination for petrale sole before 1999 was: i) surface readings for all males, ii) surface readings for females up to age 10, and iii) BB readings for any females that appeared to be older than 10 years. However, age readers often did not track which animals were males and which were females. As a result, the age readers used the BB technique for any animals that appeared to be older than 10 years, and even for some fish younger than age 7 (Bob Hannah, ODFW, pers. comm.).

Comparisons of surface and BB readings were conducted separately by the NWFSC Age-Determination Laboratory at Newport, OR, and by the WDFW Age-Determination Laboratory. The results of these comparisons are presented in **Sec. 3.4.5**. The NWFSC study concluded that ages based on surface readings are lower than those based on BB readings, but the differences are not statistically significant. However, the results of this study were not consistent with those from the WDFW study. Nevertheless, the differences in age estimates between the surface and BB techniques are smaller than implied by the ageing error matrix reported by Turnock et al. (1993).

Sager and Summler (1982) summarize the growth of petrale sole in length using several growth functions. Female petrale sole grow to 70 cm total length, with males being smaller. Petrale sole can live up to 30 yrs, although few are aged to be older than 17 yrs. This information on growth is subject to error for two reasons: 1) growth determination is difficult because two ageing techniques (otolith surface and break-and-burn) were used in the past, and 2) the observed lengths of young fish may be positively biased due to gear selectivity. Pederson (1975) estimated growth parameters for several locations (see Table 6 of Turnock et al. (1993)). Sampson and Lee (1999) estimated the values of the parameters of the von Bertalanffy growth curve using data based on BB readings for petrale sole older than age 3, and ODFW survey observations (1970–74) for younger ages (see **Sec. 3.5.3**).

1.7 History of fishery and management

Petrale sole are harvested almost exclusively by bottom trawls in the U.S. west coast groundfish fisheries. Alverson and Chatwin (1957) describe the history of the fishery for petrale sole off Washington and British Columbia. Petrale sole fishing grounds range from

Cape Flattery to Destruction Island off the Washington coast. However, the catch off Washington was small until the late 1930s. The petrale sole fishery extended to 200 fm following the development of deepwater rockfish fisheries in 1950s.

Harry and Morgan (1961) report that catches off Oregon can be dated back to 1884, although landings prior to 1939 were very small (Table 1A). In the early days, trawlers stayed close to the ports adjacent to Newport and Astoria, operating at 20–50 fm between Stonewall Bank and Depoe Bay. Gradually, fishing operations extended into deep water. For example, Newport-based trawlers were commonly fishing at about 100 fm in 1949, at depths of 100–200 fm targeting Pacific Ocean Perch by 1952, and by 1953 Oregon trawlers were fishing at depths of 300 fm targeting Dover sole. Harry (1956) reported that petrale sole abundance declined by at least 50% from 1942 to 1947. Sampson and Lee (1999) reported that three fishery regulations were implemented during 1957–67: 1) a winter closure off Oregon, Washington and British Columbia, 2) a 3,000 lb per trip limit, and 3) no more than two trips per month during 1957.

Scofield (1948) reports the development of the trawl fishery and fishery regulations off California. Fishing in San Francisco Bay prior to 1876 was by hand or using set lines and beach seining. By 1880, two trawler companies with total of six boats based at San Francisco started to extend the fishing grounds outside of the Golden Gate and northward to Point Reyes. An estimated 85 fishing boats fished from San Francisco in 1880. Among these boats, six of them used paranzella (three pairs because a set of paranzella was operated by two boats) and landed a greater volume of fish than the other boats combined. Steam trawlers entered the fishery in 1888, and, in 1889, four steam tugs based out of San Francisco were sufficient to flood market with flatfish. By 1915, the San Francisco and Santa Cruz trawlers operated in depths of 25–55 fm. There were usually two tows a day (1.5–2 hours/tow) and daily catches averaged 10,000 lbs per tow or 3,000 lbs per hour. 90% of the catch was flatfishes (soles and sanddabs), of which 20–25% was discarded as unmarketable. The legislative acts of 1915 prohibited dragging in state waters, and declared it illegal to possess a trawl net in the area from Santa Barbara County southward. There were 20 trawlers at San Francisco by 1934, all of which had diesel engines and were 56–72 ft long and fished between 30 and 100 fm. The number of California trawlers fluctuated (from 16 to 46 boats) during 1944–47. The earliest catch statistics for California are reported in Heimann and Carlisle (1970). In this report, the landings of petrale sole off California between 1916 and 1930 were not separated from the total flatfish landings. During 1931–68, the landings of petrale sole averaged about 700 mt annually.

Recent petrale sole catch statistics exhibit marked seasonal variation, with substantial portions of the annual harvest taken from the spawning grounds in December and January (see **Sec. 3.1**). It appears that the winter fishery on the deepwater spawning grounds developed sporadically during the 1950s and 1960s as fishers discovered new locations (e.g., Alverson and Chatwin, 1957; Ketchen and Forrester, 1966).

The two "stocks" of petrale sole off British Columbia are considered to be at low levels. Winter quarter landings of petrale sole were limited to 44,000 lb per trip during 1985–91; to 10,000 lb per trip during 1991–95; and to 2,000 lb per trip in 1996. Since 1996, the British Columbia trawl fishers have been limited to incidental harvests only (Fargo, 1997). The recent assessments for the Canadian stocks have been based on catch histories and limited biological data.

The Pacific Fishery Management Council (PFMC) has established Acceptable Biological Catch (ABC) limits for the annual harvests of petrale sole in the waters off the US west coast (see, for example, PFMC, 2002). Harvesting of this species has been managed using a coastwide ABC. Although individual ABCs for the Eureka, Monterey, and Conception INPFC areas have been specified since 1983, these were originally set on the basis of previous average catches and have remained unchanged since then. Recent coastwide annual landings have not exceeded the ABC. The annual ABCs and landings for the five INPFC areas are:

Year	U.S. Vancouver	Columbia	Eureka	Monterey	Conception	Landings (mt)
1983–92	600	1,100	500	800	200	*
1993–95	1,200		500	800	200	*
1996	1,200		500	800	200	1,828
1997	1,200		500	800	200	1,944
1998	1,200		500	800	200	1,461
1999	1,200		500	800	200	1,497
2000	1,450		500	800	200	1,850
2001	1,262		500	800	200	1,813
2002	1,262		500	800	200	1,775
2003	1,262		500	800	200	2,003
2004	1,262		500	800	200	1,936**

* see Table 1C.
** preliminary

Petrale sole is not designated to be overfished at present, i.e. the last assessment did not conclude that the spawning stock biomass (SB) was below 25% of the unfished spawning stock biomass (SB_0). There is consequently no Rebuilding Plan for this species. The fishery for petrale sole (and groundfish in general) has been impacted by fishery regulations implemented since 1998. Specifically, the PFMC implemented 2-month cumulative vessel limits to reduce discards in 1996. Beginning in 2000, restrictions were placed on the use of large footropes (more than 8”). Large footrope gear has been prohibited from the waters inside of the 150 fm management line following the advent of depth-based management lines. Although the winter petrale sole fishery has not been subject to vessel landing limits, the 2-month limits have restricted petrale sole landings from March through October.

Area closures have been used by the PFMC for groundfish management since 2001. Current area closures are: i) the Cowcod Conservation Area (CCA): agreed upon in 2000 and implemented in 2001; ii) the Yelloweye Rockfish Conservation Area (YRCA): agreed upon in 2002 and implemented in 2003; and iii) the Rockfish Conservation Areas (RCAs) for several rockfish species: agreed upon in 2002, implemented as an emergency regulation during fall of 2002 and through regulatory amendment in 2003. Since then, RCAs have been specified continuously for regions north and south of $40^{o}10'$N for trawl and fixed gear groups. The boundaries of the RCAs are delineated by depth-based management lines, and may be changed throughout the year in an effort to achieve fishery management objectives. The area between the 100 fm and 150 fm management lines has been continuously closed to most trawling since the implementation of the RCAs.

Vessels with exempt fishing permits (EFPs) issued under 50 CFR part 600 are allowed to operate in some conservation areas. Oregon EFP (Experimental Fishing Plan) vessels have fished in the RCA using more selective trawl gear from February–October during 2003 and 2004. The ABC/OYs for several species under Rebuilding Plans have resulted in restricted harvests of other groundfishes in recent years.

1.8 History of assessments

1.8.1 United States

Demory (1984) conducted the first stock assessment (up to 1982) for petrale sole in the Columbia and U.S. Vancouver INPFC areas, using stock-reduction analysis (Kimura and Tagart, 1982). In 1987, Demory reported on changes in catch and catch-per-unit-effort during 1984–86, but provided no new estimates of stock size or MSY. Turnock et al. (1993) conducted the second stock assessment, up to 1992, for petrale sole in the U.S. Vancouver and Columbia INPFC areas using the length-based version of the Stock Synthesis model. Petrale sole in the combined Vancouver-Columbia INPFC areas were treated as a unit stock in these assessments.

Sampson and Lee (1999) used the hybrid length-and-age-based Stock Synthesis 1 model to assess the status of petrale sole in the U.S. Vancouver and Columbia INPFC areas (northern stock), the Eureka area (central stock), and the Monterey area (southern stock) using data for 1977–98. Sampson and Lee (1999) found no acceptable models for the Eureka and Monterey areas. Nevertheless, the 1999 STAR Panel concluded that some of the results of these analyses were useful to provide management advice, even though the fits of the model were poor.

1.8.2 Canada

Ketchen and Forrester (1966) conducted the first assessment of petrale sole off British Columbia. A recent series of petrale sole assessments in Canadian waters were conducted by Tyler and Fargo (1990), Fargo (1997, 1999), and Fargo et al. (2000). The most recent assessment of petrale sole was based on three areas: the west coast of Vancouver Island, Queen Charlotte Sound, and Hecate Strait (Starr and Fargo, 2004; www.dfo-mpo.gc.ca/csac). The current biomass exceeds B_{msy}, but Starr and Fargo (2004) warned that it will fall below B_{msy} given a catch of 400 mt during 2004–5.

2.0 Changes and responses to the 1999 STAR Panel report

Concern 1. The 1999 STAR panel's primary concern was the data themselves. In particular, there are conflicting age readings, years with missing data, year-area combinations with no biological information at all, and areas for which biological sampling has been poor for decades. This assessment concurs with these findings; in general the information content of the data has continued to decline since last assessment in 1999.

Concern 2. The 1999 STAR panel was concerned about model convergence for some scenarios when M was assumed to be $0.24yr^{-1}$. Also, the model runs did not provide estimates of initial biomass consistent with the historical catches for the northern area. The model fits in this assessment converged well for all scenarios, and the initial biomass and the historical catches are now fully consistent.

Concern 3. The 1999 STAR panel was concerned about problems for the central (Eureka INPFC area) and southern (Monterey INPFC area) assessments. In this assessment, such problems remained when the STAT attempted to conduct assessments for these areas separately. However, a reasonable assessment was obtained when the data for the Eureka, Monterey and Conception INPFC areas were combined into a single (Southern) assessment area.

Concern 4. The 1999 STAR panel found that different estimates of q in the northern and southern regions are not easily explained, and that this may be due to inconsistencies between data sources that are not captured by the model. This assessment uses the same data sources as the last assessment. Although more years of data are now available, the discrepancy between the CPUE and survey indices and the lack of biological data for the Southern assessment area remain major concerns.

3.0 Data

This section describes the sources and statistical analyses of the data that are used in the stock assessment modeling. The data are organized into two assessment areas: the Northern assessment area, which includes the U.S. Vancouver and Columbia INPFC areas, and the Southern assessment area, which includes the Eureka, Monterey and Conception INPFC areas (Figure 1).

3.1 Commercial landings

A catch history for petrale sole off the U.S. west coast has been constructed. Catch data for the Northern assessment area were identified from 1928 to present, while catch data for the Southern assessment area were identified from 1916 to present. Commercial landings data were obtained from the following sources:

- i) The PacFIN database (1981–2004);
- ii) The Pacific Marine Fisheries Commission (PMFC) Data Series for 1957–80 (PMFC, 1979), which was compiled into the HAL database, archived in PacFIN (Lynde, 1986), and retrieved by Sampson and Lee (1999);
- iii) CDFG Fish Bulletins for 1916–56 catches (Heimann and Carlisle, 1970);
- iv) Oregon Fish Commission publications for 1943–49 catches (Cleaver, 1951) and for 1950–53 catches (Smith, 1956);
- v) WDF 1955 Commercial Fishing Statistics for 1936–55 (WDF, 1956);
- vi) Alverson and Chatwin (1957) for petrale sole catches off Washington state (1948–55); and
- vii) WDFW for the landings in Washington state during 1956-80, by winter and summer seasons (WDFW, pers. comm.).

The Canadian landings of petrale sole can be found in Starr and Fargo (2004) although they are not used in this assessment. The SAS program used to compile the landings from the PacFIN database for 1981–2004 is archived at ftp://ftp.afsc.noaa.gov/nwfscguest/WCG Stock Assessment/PacFIN SAS Codes/.

3.1.1 California historical landings

Heimann and Carlisle (1970) provide the total flatfish and petrale sole landings off California for 1916–68 and 1931–68 respectively. Only the 1916–55 landings in Heimann and Carlisle

(1970) are used to reconstruct the historical catch series for the Southern assessment area because petrale sole landings off California for 1956–80 are included in the PacFIN HAL database. The catch of petrale sole for 1916–30 (see Table 1A) is computed by multiplying the total flatfish catches for these years by the average proportion of petrale sole that made up the total flatfish catch during 1931–33. The average proportion of petrale sole in the total catch used for these calculations is 13%.

3.1.2 Oregon historical landings

Harry (1956) and Harry and Morgan (1961) indicate that the majority of the catches of petrale sole off Oregon during 1928–55 were from the Northern assessment area. Cleaver (1951) and Smith (1956) provide the Oregon landings of petrale sole in the Northern assessment area for 1942–53. Cleaver (1951) also provides total "sole" landings for 1928–41. The results of a linear regression (through the origin; slope =0.25, R^2 = 0.84; Figure 2A) of petrale sole landings on the total "sole" landings for 1943–49 (1942 is an outlier and is ignored) are used to estimate the petrale sole landings for 1928–41 using the total "sole" landings in Cleaver (1951). Oregon catch statistics are not available for 1954–55. These catches are determined by linear interpolation between the catches for 1953 and 1956.

3.1.3 Washington landings

The annual groundfish landings from Washington (1935–55) (WDF, 1956) combine the catches of flounder and sole into a "sole" category until 1943. Although the catches of flounder and sole were separated after 1943, there is no direct information about petrale sole landings during 1935–55. Also, the majority of the petrale sole landings by the Washington fleets were taken from the waters off Vancouver Island, British Columbia (Alverson and Chatwin, 1957; Ketchen and Forrester, 1966). The following steps were taken to estimate the catches of petrale sole in U.S. waters by the Washington fleets during 1935–55.

1) The total (flounder plus sole) flatfish landings during 1936–43 were prorated into sole and flounder landings by year based on regressions of sole to total flatfish landings during 1944–55 for the three WDF statistical districts (Puget Sound, Grays Harbor and Wallapa Harbor). The three regression lines are statistically significant and pass through zero, with $R^2 > 0.98$ (Figure 2B).
2) The landings of petrale sole during 1948–55 are available for these three WDF statistical districts in WDF (1956). The fraction which petrale sole constituted of "sole" landings declined during 1948–55, but was 49.7% consistently during 1948–50 (Figure 2B). This ratio was therefore used to estimate the Washington landings of petrale sole by year during 1935–47.
3) Alverson and Chatwin (1957) note that the petrale sole catches off Washington constituted 5%, 10.7%, and 7.1% of the total (Washington and British Columbia) catches during 1948–50, 1951–53 and 1954–55 respectively. Since the period 1948–50 is closest to the years for which it is necessary to split catches lumped between Washington and British Columbia (1935–47), it is assumed that 5% of the annual landings of petrale sole by the Washington fleets during 1935–47 were from the Washington coast.
4) Alverson and Chatwin (1957) and Ketchen and Forrester (1966) report that the early Washington catches were mainly from Canadian waters and that the catches between Cape Flattery and Destruction Island were relatively small until the late 1930s.

Therefore, landings of petrale sole by the Washington fleets before 1935 are ignored. Consequently, it is assumed that the petrale sole resource in the Northern assessment area was in equilibrium prior to 1928, and that catches from this area prior to 1928 were negligible.

3.1.4 Catch summary

The annual catches for the two assessment areas are summarized in Tables 1A–C and Figure 2C. Table 1A lists the landings of petrale sole during 1916–55, Table 1B lists the landings of petrale sole retrieved from the PacFIN HAL database (1956–80), and Table 1C lists the landings of petrale sole for the most recent years (1981–2004). The landings of petrale sole by gear types other than groundfish-trawl have been inconsequential, averaging 2.8% of the coastwide landings during 1981–89 and 2.0% during 1990–98 (Sampson and Lee, 1999). The non-trawl landings are included in these tables. Tables 1A–C do not include discarded petrale sole.

There is a distinct seasonality in petrale sole landings for the Northern and Southern assessment areas (Figure 2D), which might correspond to targeting of spawning aggregations during winter (see also **Sec. 3.3.2**). This seasonal harvesting pattern leads this assessment, as well as that of Sampson and Lee (1999), to separate the landings into two time periods: winter (November-February) and summer (March–October). Table 1D lists the catches from 1957 to 2004 by assessment area and fishing year (1 November – 31 October) separated into catches during winter and summer.

The post-1957 landings in the Southern assessment area are divided into winter and summer fisheries. The pre-1957 landings for this assessment area are assumed to be from the summer fishery because no data are available to split fishery catches into winter and summer components, and because it is likely that the fleets operating when the fishery was developing did not fish in deep water during winter. The post-1957 landings in the Northern assessment area are divided into four fisheries (Table 1E) based on the fleets from the states of Washington and Oregon. The four fisheries are Washington-Winter, Washington-Summer, Oregon-Winter and Oregon-Summer. The landings during 1928–56 are assumed to have been taken by the summer fisheries.

3.2 Estimated discards

The catch statistics in Table 1 do not include discards. Several studies have reported estimates of discards. However, in most cases, the original data and estimation methods are not reported. In addition, the measure of discarding is not consistent across studies. In this report, the discard rate for a year-season-area stratum is defined as $p = D/(D+R)$, where D and R are respectively the discarded and retained weight of fish.

3.2.1 Discard rates for the Northern assessment area

Harry (1956) estimated that 32.5% by “number” of the petrale sole caught were discarded based on a limited number of at-sea observations aboard trawlers operating out of Astoria in 1950. The details of how these data were collected as well as the detailed data are missing so this value is not used in the assessment. Demory (1984) reported annual discard factors (= total catch weight / retained catch) for 1977–82 that ranged from 1.1 to 1.4 with an average value of 1.21 (17% by weight of the total catch was discarded). However, Demory (1984) did not provide the data used to derive the discard factor, $f = 1 + D/R$, from which the discard rate is derived as $p = 1 - f^{-1}$. These measures of discards are used for 1977–81 (Table 2). The discard rates for 1986 and 1987 are both assumed to be 8.8% based on the value calculated by Sampson and Lee (1999) using the data collected by Pikitch et al. (1988).

The Northwest Fishery Science Center West Coast Groundfish Observer Program (NWFSC WGGOP) was implemented in August 2001. However, no biological information has been collected for petrale sole because this program has focused on the overfished groundfish species. NWFSC (2004) gives the total discarded (*D*) and retained (*R*) pounds for petrale sole from September 2001 to August 2003 for all observed tows. The data in NWFSC (2004) were stratified by assessment year, season (winter and summer), area (the Northern and Southern assessment areas), and depth (less than 75 fm, 75-150 fm, and greater or equal 150 fm). The procedure to compute discard rates (*p*) by year, season, and area is:

i) Calculate *D*/*R* ratios for each year-season-area-depth stratum.

ii) Calculate the average *D*/*R* ratio (*r*) for each year-season-area stratum by averaging over the three depth strata. The weighting factor (*w*) for each depth stratum is the landings of petrale sole for the corresponding stratum from logbooks, i.e.:

$$r = \frac{\sum w(D/R)}{\sum w}.$$

iii) The average discard rate for each stratum in then calculated as:

$$p = \left(1 + r^{-1}\right)^{-1}.$$

The resulting discard rates are given in Table 2.

Several studies have reported retention curves for petrale sole. TenEyck and Demory (1975) reported that the age-at-50%-retention is 5.6 years for male petrale sole and 5.1 years for females, equivalent to a 30 cm length-at-50%-retention. Turnock et al. (1993) estimated a logistic length-retention curve using the unpublished data collected during a mesh-size study (Wallace et al., 1996), and reported that the length-at-50%-retention was 21.3 cm. Sampson and Lee (1999) estimated the length-at-50%-retention to be 28.6 cm for males and 29.5 cm for females, based on unpublished data from the discard study by Pikitch et al. (1988).

3.2.2 Discard rates for the Southern assessment area

Scofield (1948) reported that 20–25% of the catches of sole were discarded during the 1940s and 1950s, but no specific date, data sources, or analyses were reported, so this value is not used in the assessment. The discard rates after 1999 for the Southern assessment area are estimated using NWFSC WCGOP database, as described above.

3.3 Abundance indices

The abundance indices for petrale sole used in the assessment were obtained from two sources: i) NMFS triennial trawl surveys conducted at three-year intervals since 1977; and ii) vessel-trip logbooks archived in the PacFIN database. A series of trawl surveys was conducted by the ODFW during 1971–74, the data from which is stored in the survey database at the Alaska Fishery Science Center (RACEBASE). However, the data from these surveys are not included in the assessment owing to their limited temporal and spatial coverage.

3.3.1 NMFS triennial trawl surveys

NMFS has carried out a series of triennial shelf trawl surveys since 1977. Haul depths ranged from 50–250 fm (91–457 m) during the 1977 survey and no hauls were completed in depths shallower than 50 fm. The results from the 1977 survey are consequently not included in this assessment. The surveys sampled depths from 30–200 fm (55–366 m) in all subsequent years. Water hauls (Zimmermann et al., 2003) and tows located in Canadian and Mexican waters were excluded for the analyses of this assessment.

Petrale sole are known to form winter spawning aggregations in deep water. It could therefore be expected that large-sized petrale sole would also appear more frequently in deep water. Figure 3 plots the mean lengths of petrale sole against tow depth and shows that the mean length of females increases initially with depth and then levels out (even though the surveys on which Figure 3 was based were conducted during summer (July) rather than during winter). However, this trend is not apparent for males. The survey data were re-stratified into three depth strata to account for the impact of this ontogentic migration, as described below.

The mean length and depth data were modeled using piecewise linear regression (Neter et al., 1985) or as a changepoint problem (Carlin et al., 1992). In this case, the changepoint for females is the depth at which adults appear completely mixed and, presumably, ontogenetic movement ends. The regression has the form:

$$y_i = \alpha_{k[i]} + \beta_{J[i],k[i]}(x_i - X_{c,k[i]}) + e_i \tag{1}$$

where $i = 1,..., n$ observations (observations are combinations of sex and tow),
$k[i] = 1 / 2$ if the i^{th} observation pertains to females / males,
$J[i] = 1 / 2$ if $x_i < X_{c,k[i]}$ / $x_i \geq X_{c,k[i]}$,
y_i is mean length of petrale sole caught in the i^{th} observation,
x_i is the tow depth (m) for the i^{th} observation,
α and β are the sex- and depth-specific intercepts and slopes,
X_c is the sex-specific depth of the changepoint, and
$e_i \sim N(0,\tau^{-1})$ is a normally distributed random error with zero mean and variance τ^{-1}.

The analysis of the data in Figure 3 was accomplished by computing Bayesian posterior distributions for the various parameters (using WinBugs; Spiegelhalter et al., 2003). The WinBugs program and additional results are given in Appendix I. The posterior means and 95% probability intervals for the estimated parameters are given in Table 3 for a sex-specific model. Results are shown for a sex-specific model because this model provides a better fit to the data than a sex-aggregated model according to DIC (see Table 3).

The survey tows are stratified into three (50-100 m, 100-155 m and 155-700 m) depth zones for the U.S. Vancouver-Columbia, Eureka, Monterey and Conception INPFC areas. This post-stratification should be consistent with the geographical distribution of catches in the winter and summer fisheries. The area in km^2 and number of tows for each stratum so defined are given in Table 4. The catch of petrale sole in each tow by weight is divided by its swept area to obtain the catch in weight per km^2 per tow. The stratified random sampling technique is then applied to estimate the biomass and its variance for each depth-INPFC area stratum. The estimated total biomass by stratum is given in Table 4.

3.3.2 Fishery CPUE

3.3.2.1 Data

The logbooks for 1987–2003 for the Washington, Oregon, and California fleets were queried from the PacFIN database and used to construct CPUE indices of abundance. The logbook data for the years prior to 1987 were ignored because information on location is not available for these data, while the data for 2004 were incomplete when the analyses were conducted. The data were further filtered using criteria similar to those used by Sampson and Lee (1999).

Step	**Current Study**
Logbook selection	(1) Washington, Oregon, and California logbooks from PacFIN (2) set_lat > 32°30’ to U.S. Vancouver INPFC area (3) set_depth <= 400 fm
Gears (NET)	PacFIN TRAWL gear group
Bimonth	Jan-Feb, Mar-Apr, ..., etc.
Area	Lat_bin = 30 minute intervals Dep_bin = 0-100, 100-155, and >155 meter
Total Hailed catches in lb (TOT_Hail)	DTS, flatfish, nearshore rf, shelf rf, slope rf, and roundfish in FMP. *Pacific cod, whiting, Pacific markerel, jack makerel, shark, skate* and *prohibited species* are not included.

Expansion factor (LtoH)	See **Note 1**
	if PET_Ticket <=50 and PET_Hail = 0, then LtoH = 1;
	if PET_Hail >0, then LtoH = PET_Ticket / PET_Hail;
	if PET_Ticket > 50 and PET_Hail = 0, then LtoH = - 9999.

Filters	(1) If 0.5 <=1/LtoH <= 2, then Ticket adjusted lbs is calculated by PET_lbs = LtoH * PET_tow_Hail; else eliminate the tows (2) latitude, longitude, depth, TOT_Hail and tow_hr > 0 (3) Tow_hrs <= 6, if depth <= 300 fm and Tow_hrs <= 12, if 300<depth <= 400 fm (4) Only the trips whose trip-aggregated (across all tows in the trip) landing of petrale sole > 50 lbs (5) In a year, only the boats whose annual landings of petrale sole > 100 lbs

Note 1. The algorithms intend to do the following:

	PET_Ticket <= 50	PET_Ticket > 50
PET_Hail = 0	LtoH = 1	* LtoH = -9999
PET_Hail > 0	LtoH = PET_Ticket / PET_Hail	LtoH = PET_Ticket / PET_Hail

*Tows that fall in this cell are omitted from the analysis because something went wrong between the skipper (no hailed weight) and the dealer (a large amount that skipper did not report).

Figures 4A and B show the geographical distribution by season (aggregated into 20’ by 40 fm cells) of the catches of petrale sole, of the positive tows, and of all tows during 1987–2003 in the Northern and Southern assessment areas. The majority of the petrale sole catches are taken between 40 and 120 fm during summer, and between 160 and 200 fm during winter. Figures 3, 4A and 4B imply that the winter fishery is targeting large adults during the spawning season. The CPUE analyses are carried out separately for the winter and summer fisheries.

3.3.2.2 Analytical methods

CPUE was calculated as lbs/hour using the fishticket-adjusted catch and the skipper’s estimate of the duration of the tow. Three periods of data (1987–1998; 1987–2001; 1987–2003) were explored because the changes to management arrangements beginning in 1998 may have impacted the utility of catch rates as an index of relative abundance.

The Delta-Lognormal approach (Maunder and Punt, 2004) was used to standardize the catch and effort data for each season (summer and winter) for the Southern assessment area. This involved first analyzing the presence-absence data using a logistic model assuming a logit link and binomial error distribution to estimate the probability that a tow caught (and retained) petrale sole. It then involved modeling the catch and effort data for the positive tows using a linear model with a log link under the assumption of Gaussian errors to estimate the catch rate given the presence of petrale sole. The CPUE indices for the Northern assessment area are based only on the second of these regressions owing to convergence problems with the software when applying logistic regression.

The factors considered in the GLMs include year, vessel, gear, depth, latitude, port of landing, bimonth, shelf rockfish (SLF) catch, dover-thornyhead-sablefish (DTS) catch, flatfish (FLT) catch, and slope rockfish (SLP) catch. Catches of these species were included in the analyses in an attempt to remove the impact of regulations on the catch-rates for petrale sole due to changes in targeting. The proportions that the total SLF, DTS, FLT and SLP catches constitute of the total tow weight were calculated. These data were then binned by assigning all zero catches to one bin and assigning the remaining tows into bins representing 20% each of the total number of positive values, resulting in a total of six bins for each species. An attempt was made to include year-area and year-bimonth interactions in the GLMs. However, problems with lack of convergence of the software, as well as memory problems, rendered this impossible.

Model selection was carried out using the information theoretic approach (Burnham and Anderson, 1998), which is a data-based way to select the best model from of a set of candidate models using the Akaiki Information Criterion (AIC, Akaiki, 1974). However, care must be taken to ensure that the candidate models are well founded because AIC will always select a model regardless of whether the fit of the best model is good or not (Burnham and Anderson, 1998). The model with the lowest AIC was selected. Models with the smallest AIC values were chosen independently for the binomial and lognormal GLMs. The full model (the model including all of the main effects listed above) was selected for all cases. The quantile-quantile and residual plots for the lognormal GLMs (Figure 5A) indicate that the assumption that the residuals are normally distributed around a zero mean and with common variance appears not be violated.

3.3.2.3 CPUE trends

The CPUE trends for the two assessment areas (Table 5) are generally consistent with that of the survey biomass index (Figure 5B). Large increases in standardized CPUE are seen in the last few years of the time-series for both assessment areas. The increases in CPUE during the 2000s may be caused by either a true increase in stock biomass or due to changing groundfish regulations that have closed areas and potentially changed targeting practices among fishers. The proportion of positive tows increases since 1995 for the Northern assessment area (Figure 5C). Therefore, had it been possible to fit the binomial part of the Delta-Lognormal model, the increasing trend in the CPUE index would have been greater than is the case in Figure 5B and hence more consistent with that of the NMFS triennial survey. The September 2005 STAR Panel concluded that it would not be appropriate to use the GLM analysis for positive tows in the model, and consequently recommended using the CPUE index obtained from the 1999 assessment (only available for the OR-winter and -summer fisheries) in the present assessment.

3.4 Length and age compositions

Length and age composition data for petrale sole were obtained from various sources, but mainly from sampling of commercial catches in port by the state fishery agencies, and from the NMFS Triennial trawl surveys. The PacFIN BDS database contains data from ODFW (1966–2004) and WDFW (1955–2004), but only 2001–4 data from CDFG. The CDFG dataset used for the Southern assessment area for the years prior to 2000 was extracted from CALCOM by Brenda Erwin (CDFG). Demory and Bailey (1967) provide length compositions for the Columbia INPFC area for 1949–51, 1960, and 1963–65. The discard length compositions for the Northern assessment area for 1986–87 are based on data collected by Pikitch et al. (1988).

The length data from the NMFS Triennial Trawl surveys were retrieved from the database stored at the Alaska Fishery Science Center. About half of the otoliths collected from the Northern assessment area during the 2004 NMFS survey were processed.

ODFW and WDFW revised the PacFIN BDS database in April 2005. The most important revisions related to: (i) elimination of duplicate records, (ii) inclusion of additional historical data (since 1955 for WDFW and 1966 for ODFW), and (iii) correction of the codes for ageing method, sex, and other data attributes. As result, only 1,512 (out of 41,252) otoliths from ODFW are now considered to have been read using the BB method. 57 otoliths were ignored for the purposes of this assessment because they were coded incorrectly.

The final length and age data for the Northern assessment area were retrieved and constructed on August 1, 2005 while those for the Southern assessment area were retrieved and constructed on March 16, 2005.

3.4.1 Sample sizes for length and age

Tables 6A and B summarize the number of length and age samples and the number of fish measured respectively, collected from commercial landings in the Northern assessment area. Tables 7A and B list the same information, except for the Southern assessment area. Lengths have been gathered sporadically in the Southern assessment area, particularly in the Conception and Monterey INPFC areas. Age samples have been taken regularly in the

Northern assessment area. However, sample sizes have decreased since 1981. The blocks in Tables 6A and 6B indicate “super years” to which data are aggregated for some of the models investigated. The “super years” are constructed so that there are there are at least five samples for each “super year” so that the length and age compositions are less variable. However, aggregating data in this manner may lead to some loss in signal. The “super years” were used during initial analyses; the final analyses are based on the actual sample sizes and choices of years.

3.4.2 Fishery length compositions

The three coastal states use different sampling designs when collecting biological data. Different methods are therefore needed to estimate the catch length compositions for each state. The length samples collected by WDFW are based on simple random sampling, frequently 50 fish a sample. However, WDFW changed the sampling protocol after 1998 due to a reduction in landings caused by additional management regulations. However, the implications of this change have yet to be evaluated.

The approach used to construct the length compositions is as follows. If the landed weight of the trip from which length sample *i* was collected, W_i, and the sample weight of this length sample, w_i, are available, an expansion factor, ρ_i, is calculated as:

$$\rho_i = W_i / w_i . \qquad (2)$$

If W_i is not available, the length samples are treated as simple random samples and are processed in the same way as the data from WDFW, i.e., if w_i is not available, it is calculated by applying the length-weight equation (see Eq. 7) to the lengths in the sample. The length composition (number of fish in length category l, P_l) is then calculated by:

$$P_l = \sum_i \rho_i P_{li} / \sum_i \rho_i . \qquad (3)$$

where P_{li} is the number of fish in sample *i* recorded to be in length category *l*.

3.4.2.1 Northern assessment area

The length compositions for the four fisheries in the Northern assessment area are given in Appendix II. The length compositions differ among the four fisheries.

1) The large-sized bins are, as expected, dominated by females for all length compositions because females tend to grow larger than males.
2) The small-sized bins are dominated by males in the WA- and OR-winter fisheries. The females less than 40 cm are hardly present in the WA-Winter fishery and those less than 32-cm are hardly present in OR-Winter fishery. Given that the length at 50% maturity is about 31 cm (see **Sec. 3.5.2**), winter fishing concentrates more in the deep water (Figure 4A), large females tend to be found in deep water (Figure 3), and spawning aggregation occurs during winter, the differences between the WA- and OR-Winter fisheries can be attributed to many possible causes, such as temporal and spatial differences in fishing grounds and different size-selectivity patterns. In

addition mis-identification of sex (i.e., small-sized fish are more likely to be designated as males) is a potential problem (T. Tsou, WDFW, pers. comm.).

3) The small-sized bins are dominated by males in the summer fisheries, especially the WA-Summer fishery. However, the sexes are difficult to distinguish for animals 31 cm and smaller when they were not collected during the spawning season (T. Tsou, WDFW, pers. comm.).

3.4.2.2 Southern assessment area

The length compositions for the Southern assessment area are qualitatively similar to those for the Northern assessment area; females dominate the large length bins while males dominate the small length bins.

3.4.3 Fishery age compositions

The procedures described in **Sec. 3.4.2** are also used to estimate fishery age compositions.

3.4.3.1 Northern assessment area

The age composition data are classified into ODFW and WDFW ageing protocols for the Northern assessment area. The age compositions for the four fisheries in the Northern assessment area are given in Appendix II.

3.4.3.2 Southern assessment area

The age compositions collected by different agencies and ageing methods are treated as replicate samples within year-season-sex-ageing method for the Southern assessment area.

3.4.4 Survey length and age compositions

Length samples are collected on a tow-by-tow basis during the NMFS Triennial trawl surveys. As described above, the tows were post-stratified by depth-INPFC area. The length composition from a sampled tow *i* was expanded by the factor:

$$\rho_i = N_i / n_i \qquad (5)$$

where N_i and n_i are respectively the total number of fish caught and the number of fish sampled for tow *i*. The length composition (in number of fish in length category *l*) for year *y* and stratum area *j* is calculated using the formula:

$$P_{lyi} = \sum_k \hat{B}_{yk} P_{lyik} / \sum_k \hat{B}_{yk} \qquad (6)$$

where *k* indicates depth stratum, $\hat{B}_{yk}$ is the estimate of biomass for stratum *k* in year *y*, and P_{lyik} is the number of fish in length category *l*, estimated for tow *i* where tow *i* was located in assessment area *k* during year *y*. The survey length-frequency sample sizes are listed in Table 8. The survey length compositions by year and assessment area are given in Figure 6.

About half of the otoliths collected during the 2004 survey in the Northern assessment area were selected at random for surface readings. The age and its associated length were used to construct an age-length key. The product of the age-length key and the 2004 survey length composition represents the survey age composition information for the Northern assessment area.

3.4.5 Ageing errors

An unpublished study in 1981–82 by W. Barss (ODFW, Newport) indicated that ages based on otolith surface readings are biased relative to ages based on break-and-burn readings for male petrale sole, with significant under-aging for males older than about 10 years. However, ages based on surface and break-and-burn (BB) readings were similar for females. Turnock et al. (1993) reported differences between ages based on surface and break-and-burn readings for males, but argued that there was no apparent bias for females.

Comparisons of ages based on surface and BB readings were made separately by the NWFSC Newport ageing Laboratory and the WDFW ageing laboratory in 2005 (Tables 9A and B). The upper panel of Figure 7A shows the mean BB reading at a given surface age and the standard deviation of the age-reading error for the NWFSC aging laboratory. The standard deviations are based on comparisons between BB and surface ages so over-estimate what is conventionally defined as age-reading error. The ages based on the BB readings are higher than those based on the surface readings, but the differences are not statistically significant. The standard deviation of the age errors increases with age (Figure 7A). The same comparison was made by the two WDFW age readers (Figure 7B). There are large differences between the ages based on the surface and BB readings for young fish. Also, the ages based on the BB readings are lower than those based on the surface readings for animals aged 11 and older.

The September 2005 STAR Panel discussed the ageing error matrices and their implied ageing error coefficients of variation. It was concluded that the current ageing error matrices are not informative and should be used with caution because the ageing method is not standardized between agencies.

3.5 Biological data

3.5.1 Length-weight relationship

Sampson and Lee (1999) used length and weight data from ODFW (1971–86), WDFW market samples, and the ODFW flatfish surveys (1971–72; Demory et al., 1976) to estimate the following length-weight relationships:

$$\begin{aligned} &\text{Males} && W = 0.007168L^{3.1337} \\ &\text{Females} && W = 0.003416L^{3.3462} \end{aligned} \qquad (7)$$

where W is weight in gm and L is length in cm. No new length and weight data have been collected since the last assessment so these length-weight relationships represent the most current information.

3.5.2 Maturity at length

Turnock et al. (1993) estimated a maturity versus length relationship using data from market samples collected by ODFW port agents during 1986–91. The estimated length-at-50%-maturity (L_{50}) for females was 30.6 cm, with a slope of 0.29 cm^{-1}. Turnock et al. (1993)

noted that their estimate of L_{50} was markedly less than the 40 cm value reported by Harry (1956). Starr and Fargo (2004) reported that L_{50} is approximately 33 and 37 cm for males and females respectively, in British Columbia, Canada.

This assessment uses the maturity-at-length curve derived by Hannah et al. (2002) which is based on samples collected prior to spawning (August-September 2000) along the Washington and Oregon coasts, and histological methods to determine maturity status. The maturity observations were fitted to a logistic model:

$$p_l = \frac{e^{\beta_0 + \beta_1 l}}{1 + e^{\beta_0 + \beta_1 l}} \tag{8}$$

where p_l is the proportion of matural fish at length l, and β_0 and β_1 are coefficients. The estimates for females are summarized as follows:

Parameters	**Estimate**	**Std error**	χ^2	**p-value**
β_0	-24.593	4.572	28.936	0.0001
β_1	0.743	0.136	29.759	0.0001
L_{50} (95% CL)	33.10	(32.13-33.93)		

The estimated L_{50} is 33.10 cm with 95% confidence interval (32.13, 33.93), which is almost identical to that obtained by Starr and Fargo (2004), about 2.5 cm greater than that obtained by Turnock et al. (1993), and almost 7 cm smaller than that obtained by Harry (1956). Maturity may have changed over time. However, it is not possible to assess this quantitatively owing to differences in when historical samples on which maturity ogves could be based were taken, and how maturity stage (visual vs. histological) was determined.

3.5.3 Length-at-age

Sampson and Lee (1999) indicate that the average length-at-age for older males estimated using data from ODFW has decreased since 1980, although this is no longer apparent from the updated dataset currently available from PacFIN BDS. The following von Bertalanffy growth equations were derived by Sampson and Lee (1999).

$$\text{males:} \quad L = 44.89\{1 - \exp[-0.1760(t - 0.45)]\}$$
$$\text{females:} \quad L = 57.37\{1 - \exp[-0.1450(t - 0.05)]\} \tag{9}$$

where L is length in cm and t is age in years relative to a November 1st birthday.

The mean-length-at-age data obtained from the 2004 NMFS survey were used to estimate parameters for the growth equation as it is used in SS2. The results (Figure 8) are:

Parameter	Female	Male	Combined	Parameter	Female	Male	Combined
L_{min}	24.6219	24.6219	24.8289	L_∞	59.50669	40.66988	67.87706
L_{max}	55.40987	40.6664	57.3994	K	0.143748	0.308494	0.094837
K	0.143748	0.308494	0.094837				
max.age	17.833	17.833	17.833				

min. age	2.833	2.833	2.933

L_{min} is the mean length at the minimum (min.) age, and L_{max} is the mean length at the maximum (max.) age.

The September 2005 STAR Panel requested that a sex-combined growth curve be estimated. The sex-combined growth curve appears to be nearly linear. The estimate of K (0.09yr^{-1}) is smaller, and that of L_{max} (57.4 cm) is larger, than the corresponding estimates based solely on data for females while the fitted mean length for age 0 is greater than 12 cm. The empirical estimate of the CV of length-at-age using the 2004 survey age data is approximately 0.08 for both females and males (Figure 8). This value was used by Sampson and Lee (1999), as well as in this assessment whenever the assessment pre-specifies the values for the growth parameters.

3.5.4 Natural mortality

The instantaneous rate of natural mortality for a wild fish population is notoriously difficult to estimate. One accepted method is to examine the age distribution of an unexploited or lightly exploited stock. This method cannot readily be applied to petrale sole given the long history of exploitation off the US West Coast. Ketchen and Forrester (1966) estimated that the natural mortality coefficients were 0.18–0.26 yr^{-1} for males and 0.19–0.21 yr^{-1} for females based on a catch curve analyses of relatively early (1943–45) Washington trawl data from Swiftsure Bank, off the southwest corner of Vancouver Island. Starr and Fargo (2004) estimated the instantaneous rate of natural mortality (M) using order statistics (Hoenig, 1983):

$$\ln(M) = 1.44 - 0.984\ln(t_{\max}) \qquad (10)$$

where $t_{\max}$ is maximum age of petrale sole. The estimated M is 0.22 yr^{-1} and 0.15 yr^{-1} for $t_{\max}$ = 20 and 30 years respectively.

In this assessment, a constant instantaneous natural mortality coefficient of 0.20 yr^{-1} is assumed for both sexes. This value of M was also used in the three most recent assessments (Demory, 1984; Turnock et al., 1993; Sampson and Lee, 1999). This level of natural mortality implies that 0.92% of two-year-old recruits would survive to age 20 in an unexploited stock, which is in reasonable accord with the observation that fish aged 20 and older are occasionally caught by the fishery.

4.0 Assessment models

This assessment utilizes a hybrid length-age structured model which is based on the general stock-synthesis 2 framework developed by Dr. Richard Methot (NOAA Fisheries). The common features for the Northern and Southern assessment areas are:

1. The fishing year is defined to be from November 1 to October 31. The fishing year is divided into two seasons (winter: November–February; summer: March–October).
2. The assessments are carried out for the Northern (U.S. Vancouver and Columbia INPFC areas) and the Southern assessment areas (Eureka, Monterey and Conception INPFC areas) separately.

3. The catches prior to 1957 are assumed to be taken during the summer season because there is no information on which to split these historical catches seasonally
4. The population dynamics model starts one generation prior to the first substantial catch. The catches between the start of the model (1908–09 for the Northern assessment area and 1874–75 for the Southern assessment area) and the first catch in Table 1A are set to 1mt for the Northern assessment area (1910–28) and 1mt for 1876–80 followed by a harvest that increases annually by the factor 1.18 from 1881 (so that the catch in 1916 equals 386.4 mt; Table 1A). The population is assumed to be in deterministic equilibrium when the model is started.
5. The instantaneous rate of natural mortality (*M*) is assumed to be independent of sex and equal to $0.2yr^{-1}$.
6. The survey biomass indices and the fishery CPUE indices are assumed to be linearly proportional to the population biomass.
7. The steepness of the stock-recruitment relationship (*h*) is estimated, and an "uninformative" normal prior is placed on this quantity. The prior has standard deviation 0.8 for both areas and mean 0.8 / 0.7 for the Northern / Southern assessment areas.

4.1 Northern assessment area

For the Northern assessment area, results are shown for the model presented to the September 2005 STAR Panel (the "pre-STAR" model) and for the model agreed at this STAR Panel (the "post-STAR" model).

4.1.1 Pre-STAR

A range of models (Table 10A) was presented to the September 2005 STAR Panel for the Northern assessment area. Annual deviations in recruitment about the stock-recruitment were estimated for all of the years included in the assessment (1910–2004). However, the extent of variation in these deviations, σ_R, cannot be determined easily because the length and age composition data are blocked into "super years" (Tables 6A and 6B). Furthermore, exploratory analyses indicated a failure of SS2 to converge when σ_R was set to a value less than 0.5. σ_R was therefore set to 0.5. The coefficient of variation for length-at-age was assumed to be independent of age for these models.

The models for the Northern assessment area can be divided into two groups: FULL4 and DISC4 (Table 10A). The difference between these two groups of models is that the DISC4 models ignore the discard rates reported in Demory (1984) because the model is unable to mimic these data adequately (perhaps because of a lack of information on the length-frequency of the discards). The variants of the DISC4 model considered are:

DISC4 2SD:	the standard deviations assumed for the survey biomass indices are set to twice the values in Table 4.
DISC4 cv6:	the coefficient of variation for the ageing errors is set to 0.06 rather than 0.08.
DISC4-sudomal:	female and male selectivity is assumed to be the same as for the NMFS survey (the "do_male" option in SS2).
DISC4-ms:	the mean-size-at-age data are ignored.

DISC4-ms-Gcv:	the DISC4-ms model, except that the growth parameters are pre-specified rather than being estimated.
DISC4-surv04:	the information from the 2004 NWFS survey is ignored.
DISC4-waage:	the WDFW age compositions and mean-size-at-age data are ignored.
DISC4-Rdev:	the recruitment deviations are set to zero (i.e. effectively a stock reduction analysis).
DISC4-cpue:	the CPUE indices are ignored.

Variants of the FULL4 model based on changing the standard deviations assumed for the survey biomass indices and the coefficients of variation for length-at-age are also examined.

The results of the models in Table 10A can be summarizes as follows:

1. The standard deviations assumed for survey indices affect the estimates of 2005 spawning stock biomass (SB), but not SB_0 and, as a result, the 2005 depletion is sensitive to the assumed standard deviations. As expected, increasing the standard deviations for the survey biomass indices reduces the ability to mimic these data.
2. The 2005 depletion level increases from 0.23 to 0.26 when the CV of ageing error is set to 0.06 rather than the value implied by the data (0.08).
3. The estimated growth curves are questionable. For example, the predicted length of a female of age 0 is smaller than that of male of age 0, greater for ages 1-17 and lower beyond age 18. The estimated L_∞ for females is smaller than for males.
4. The fits to the discard rates are poor, specifically the model under-estimates the discard rates reported by Demory (1984). This may be due to changes over time in the willingness to retain small petrale sole. However, information on the length frequency of the discards is lacking so it is not possible to address this issue quantitatively.
5. The model fits the indices of abundance reasonably well although the predicted 2004 survey index is much smaller than the observed value (although it is within the observed 95% confidence interval). The model is therefore unable to capture the observed change in the survey estimates of biomass.
6. The estimates of SB_0 and R_0 are very similar over all models even though the estimated growth and selectivity parameters may be different.
7. The results for model DISC4-ms-Gcv may be questionable as it has large maximum gradient.
8. Ignoring the CPUE indices (model DISC4-CPUE) leads to better fits to the 2004 survey index and hence to a higher depletion level (0.27 rather than 0.24).
9. All models fit to the length composition data for the Oregon fishery reasonably well, but this is not the case for the length composition data for the Washington fishery (especially the length bins that have large observed proportions of fish).
10. All models fit the age composition data poorly. Possible reasons for this include:
    (i) year-class strength is not evident in the age composition data;
    (ii) large ageing error smears the data;
    (iii) the assumed CV for mean-size-at-age is incorrect; and
    (iv) length- and age-based selectivity patterns are different.

The poor fits to the age compositions and the mean-length-at-age data are of major concern for Northern assessment area. The age data are not consistent due to differences in ageing methods, sampling protocols for otoliths, and the statistical methods for constructing age compositions and mean-length-at-age. Furthermore, sporadic discard rates and discard length data make it difficult to estimate the retention curve and to mimic the observed discard rates. All of these problems are caused by, and impact, the ability to estimate recruitment.

4.1.2 The requests from the September STAR Panel

1) The Panel noted that the current ageing error matrix was based on a comparison between surface ages and break-and-burn ages, which is an inappropriate measure of ageing precision for production ages obtained using a single ageing method. Furthermore, there are large and unexplained differences among agencies in the standard deviation of ageing error. The Panel therefore wanted to investigate the effects of the ageing error matrix on model performance and requested an additional set of sensitivity runs (Tables 11A and 11B) in which the coefficient of variation of ageing error was set to 0.01, 0.05, 0.1, 0.15 and 0.2 (models DISC4 cv1, DISC cv5, DISC4 cv10, DISC4 cv15, and DISC4 cv20). The results of these models indicate that the 2005 depletion increases as the assumed level of ageing error is reduced. The fits to the age composition data for these models (and model DISC4) are poor. The ageing error CV used in model DISC4 (0.08) could be considered to be higher than it should be because it is based on comparisons of surface and BB readings. However, given all of the uncertainties associated with ageing, the STAR recommended (and the STAT agreed) that the ageing error CV be set to 0.1.
2) The STAR requested three runs (based on model DISC4 cv10) based on a model formulation in which: a) discard (10% in summer and 5% in winter) is added to the catches, b) the retention curves and discard length compositions are ignored, and c) the values for the growth parameters are set to the estimates obtained from the sex-combined mean-length-at-age data. The three runs differed in terms of assumptions regarding the CPUE data: a) use the CPUE data for 1987-2004 (model DISC cv10A), b) use the CPUE data used in the 1999 assessment (model DISC cv10B), and c) exclude the CPUE data (model DISC cv10C). Model DISC cv10B did not converge, and the problem of poor fits to the age compositions was not resolved in any of the models.
3) Modeling of multiple fisheries with dome-shaped selectivity patterns using sex-specific age data from different agencies complicates the assessment. Model convergence is slow and erratic, suggesting that the model may be overparameterized given the quality and quantity of the available data. The complexity of the assessment model was an impediment to understanding the model's basic properties, and the Panel hoped that simplification of model structure would help clarify matters. Therefore, the Panel requested runs based on the following assumptions: a) all fisheries should have the same selectivity pattern, b) all selectivity patterns should be asymptotic, c) all length data should correspond to one of the fisheries, d) "super years" should be dropped, and the model fitted to year-specific length compositions, e) each length composition should be given an equal effective sample size, f) the age data and the mean length at age data should be ignored, g) the model should be a combined-sex model, h) the 2004 survey data should be used to estimate growth parameters which should then be subsequently fixed in the model, i) the original four CPUE time series and the shelf survey should be used in the model, j) the retention component of the model should be removed and zero discard assumed instead, k)

recruitment deviations should be estimated over the entire modeled period, and l) σ_R should based on recruitment deviations for the years for which information is available to estimate recruitment. A second model run was requested in which recruitment deviations were estimated only for the years for which there is information to inform the model. The specifications for these models (prefix "Simple") are listed in Table 11A and their results in Table 11B.

The simple model fitted the data nearly as well as the more complicated model. The fits to the fishery length composition data appeared adequate. The fit to the shelf survey time series was excellent, but the fit to the post-2000 fishery CPUE indices was poor. However, the reliability of the post-2000 CPUE index is somewhat questionable due to changes in fishing practices. Biomass trends were similar to the complicated models. It appeared reasonable to begin estimating recruitment deviations in 1940. All of these models led to a similar level of depletion in 2005 (0.30-0.35). The CPUE time series in the previous assessment was derived from a GLM analysis that used all the data including zero tows, and the index ends in 1997 prior to the management restrictions that may have changed fishing practices. Therefore, the September 2005 STAR Panel and STAT team agreed to use the CPUE series for OR-Winter and OR-Summer fisheries.

4) Additional models (models Simplex 3, 3A1 and 3A2) based on model Simple 1 were requested in which growth was sex-specific and the model was fitted to sex-specific length composition data. This is because, inter alia, there is a 10 cm difference in maximum length between males and females.

4.1.3 Post-STAR (the Base model)

The base model was analyzed using SS2 version 1.20 (July 22, 2005). The September 2005 STAR Panel and the STAT agreed that model Simple3A2 can be used as the base model for petrale sole in the Northern assessment area (see Table 12 for the parameters estimated for this model). The diagnostic plots for this model are given in Appendix III. In general, the model fits the CPUE series and survey biomass indices reasonably well (Figure III-2) although some large deviations are found between the observed and fitted length compositions (Figures III-3 and III-4). Under this base model, the 2005 depletion level is 0.34.

Figures 9 and 10 plot selectivity as a function of length and age for the fisheries and the survey for the base model. The estimates of spawning stock biomass, recruitment and harvest statistics are summarized in Tables 13 and 14 and Figure 11. Figure 11 also shows the estimated recruitment residuals and the relationship between recruitment and spawning stock biomass. The estimated spawning stock biomass of petrale sole in the Northern assessment area reached the historical low in 1992 (1,267 mt or 8.8% SB_0). It has increased steadily since that point: to 1,554 mt (11% SB_0) in 1995, and to 4,960 mt (34% SB_0) in 2005.

Figure 12 shows a retrospective analysis for the Northern assessment area. There is no evidence in Figure 12 for a retrospective pattern for the assessment of this area.

The base model for the Northern assessment area could probably be modified to fit the various sources better. However, the September 2005 STAR Panel concluded that the current base model would provide reliable management advice until the data and modeling issues can be addressed better.

4.2 Southern assessment area

The following assumptions form part of the base-model runs for the Southern assessment areas:

1. Age composition data from surface age readings are treated as being imprecise and biased. The age composition data from break-and-burn age readings are treated as unbiased in the absence of duplicate readings. The standard deviations for the age-compositions based on the break-and-burn ageing technique are assumed to be the same as those for the surface age readings in the absence of data.
2. The age and length composition data in a year-season stratum from different agencies and ageing methods are treated as independent observations.
3. The parameters of the von Bertalanffy growth curve are estimated. The coefficient of variance (CV) of length-at-age is assumed to be independent of age.
4. The length-weight and maturity-at-length relationships (Eqs 7 and 8) are used for both assessment areas even though these relationships were derived using data collected from the Northern assessment area.
5. The extent of variation about the stock-recruitment relationship (σ_R, 0.46) is found based on the iterative procedure described below.
6. Recruitment deviations are estimated for 1956–2004.
7. For the winter fishery, a 2-parameter logistic selectivity curve is used for females and a dome-shaped selectivity curve is used for males. Sex-specific dome-shaped selectivity is used for the summer fishery and the survey. Figure 13 shows that large-sized petrale sole are absent from the survey length compositions.
8. The Stock Synthesis program determines "the best estimates" for the unknown parameters of the model by iteratively searching for parameter values that maximize a weighted average of several independent likelihood components. In this assessment, all emphasis factors are set to 1.
9. The sample sizes for the length and age composition data are set to be equal to the number of port samples corresponding to each data set.
10. Petrale sole discard data in the south are limited to the WCGOP. During the April 2005 STAR panel it was determined that the discard data were acting in a pathological way with the age and length composition data. At the suggestion of this STAR panel model performance was improved by adding discard to the catch time series (i.e. the catch time series used in the model includes both landed catches and discards). The discard was assumed to be 2.5% of the landed catches for all years, and no discard data were included in the objective function minimized to estimate the values for the parameters of the model.
11. No data on fishery retention exist for the Southern area assessment. Therefore, no retention curves are included in this model.
12. The analyses are based on the version of Stock Synthesis 2 released on April 27, 2005.

Table 15 summarizes the parameters that are estimated for the base models.

The value of σ_R for the southern assessment area was determined using an iterative procedure to ensure that the value of σ_R assumed by the assessment model and the empirical variance in recruitment were self-consistent. This involved setting σ_R to an initial value, fitting the model and calculating the variance of the recruitment deviations for the years for which age composition data are available (1956–2004), replacing the assumed value of σ_R by the calculated value, and repeating the process until convergence occurred.

Generally, the base model fits the CPUE and survey indices well, although the fits to the winter CPUE indices are poor for 1987, 1988, and 2004 (Figure IV.2). The 2004 survey index is substantially larger than that for 2001 and the dynamics of the population are such that it is virtually impossible to capture a change in population size of this magnitude.

The fits to the length and age composition data contribute to the major portion of likelihood value, especially the data from the summer fishery. The model-predicted sample sizes for both the age and length data are generally larger than the actual number of samples indicating that the model is fitting better than the number of samples suggests (Figures IV.3 and IV.5). The model fits the survey length composition data for both females and males reasonably well (Figure IV.4). However, the model under-predicts the proportion of small fish in the winter fishery length compositions (and under-predicts both the proportion of young and old female fish in the winter age compositions (Figure IV.5)). Outliers in the residual plots for young and old females in the winter age compositions may be due to small samples sizes

The estimates of the catchability coefficients (*q*) for the three indices and the growth parameters are listed in Table 16. All of the selectivity curves are dome-shaped with the exception of the female selectivity curve for winter fishery which is logistic (Figures 14 and 15). The estimates of spawning stock biomass, recruitment and harvest statistics are summarized in Table 17 and Figure 16. The spawning stock biomass declined nearly continuously from the assumed start of the fishery until 1986 when it was at 6% of SB_0. The spawning stock biomass is estimated to have been 8% of SB_0 in 1995, and 29% of SB_0 in 2005. Recruitment (at age 0) was relatively low from the early 1970s to the early 1990s (Figure 16). The rapid increase in biomass since 1995 is likely due to several strong year-classes spawned after 1997 and lower fishing intensity since the mid 1980s.

4.2.1 Sensitivity analyses for Southern assessment area

Sensitivity analyses are used to examine the impact of uncertainty regarding the parameters of the model and the data used for parameter estimation. Sensitivity runs based on the model agreed during the April 2005 STAR panel included:

1. The base model with the addition of a fixed retention curve based on models for the Northern assessment area presented to April 2005 STAR Panel (not the Northern assessment area model presented above) and market conditions in the south.
2. σ_R fixed at 0.4 and 0.8 rather than to the value for the base model.
3. Steepness (*h*) either: a) fixed at 0.6, or b) fixed at 1.0.
4. Recruitment deviations estimated for 1910–96 rather than for 1910–2004 (because 1999 is the last year for which age composition data are available for the Southern assessment area and age 4 is the youngest age which is at least 50% selected by the fishery).

5. The CPUE time-series a) truncated in 1998, and b) ignored altogether.
6. Different types of selectivity curves are assumed for males and females in the winter and summer fisheries and the surveys: a) selectivity is logistic for females and domed-shaped for males, b) selectivity is the same for males and females, and logistic for all fisheries and the survey.
7. Natural mortality (*M*) fixed at $0.15yr^{-1}$ and $0.25yr^{-1}$ rather than at the base model value of $0.2yr^{-1}$.
8. The values of the parameters of the von Bertalanffy growth curve (except for the parameters that define the coefficients of variation of length-at-age) set to the values in Eq. 9.
9. The 2004 survey index and length composition data ignored when fitting the model (because this survey index is substantially larger than the 2001 index).
10. A retrospective analysis based on data up to 1998.

The results of the sensitivity tests based on the April 2005 base model indicate that this model is fairly robust. The quality of the fit of the model, as indicated by the negative log-likelihood value corresponding to the "best estimates" of the model parameters, only changes noticeably when selectivity for both sexes is assumed to be logistic for all fisheries and the survey. The SSC review of the April 2005 base model raised concerns with model convergence due to atypical sensitivity patterns. The April 2005 model was adjusted during the September 2005 STAR Panel by 1) changing the prior for survey catchability, and 2) by moving the estimation of recruitment deviations to a later phase of estimation.

Additional sensitivity runs were completed during the September 2005 STAR Panel when a new base case model was chosen (Table 18). Sensitivity runs included varying the years for which recruitment deviations are estimated, ignoring the survey length compositions, and ignoring all of the survey data (see **Sec 7.2.2** for additional details). Results from the September 2005 sensitivity runs indicate that the model is most sensitive to the years in which recruitment deviations are estimated (Table 18). Figure 17 shows a retrospective analysis for the Southern assessment area. There is no evidence in Figure 17 for a retrospective pattern for the assessment of this area.

5.0 Management parameters and forecasts for the base model

The forecasts are based on the 40:10-control rule as applied to FMP-listed flatfish. The target (MSY-proxy) harvest rate for petrale sole is $F_{40\%}$. Table 19 and Figure 18 provide the management report generated by SS2 for the two assessment areas.

The following approach is used to construct a decision table to evaluate the consequences of alternative sequences of future OYs:

(1) The Council's GMT-projected coastwide total catch (include discard) is 2,762 mt for 2005 and 2006, and the split of retained catch between the Northern and Southern assessment areas is 75:25. Assuming that the discards are the same in 2005 and 2006 as in 2004 (134 mt in the Northern assessment area and 13 mt in the Southern assessment area), the projected total catch is 2,095 mt for the Northern assessment area and 667 mt for the Southern assessment area.
(2) The catches for 2005 and 2006 are based on the GMT projected total catches mentioned above.

(3) The states of nature are defined as different levels of 2004 spawning stock biomass. The levels chosen are ± 1.25SD (12.5 and 87.5 percentiles) about the estimated spawning stock biomass from the base model. The 2004 survey biomass index is altered and the assessment re-run the model until the estimated 2004 spawning stock biomass matches the estimated 2004 spawning stock biomass ± 1.25SD from the base model.

(4) The projected catches for 2007-16 for each state of nature are then calculated and used for projections for all three states of nature.

Three states of nature are the Low Spawning Biomass Model (12.5 percentile), the base model, and the High Spawning Biomass Model (87.5 percentile). The management actions are the low catch (projected from the Low Spawning Biomass Model), the medium catch (projected from the base model) and the high catch (projected from the High Spawning Biomass Model).

5.1 Northern assessment area

The relative Fs among the four fleets for the Northern assessment area are based on those for 2004 and the future total catch is split among the four fisheries according to the split of the catch for 2004. The exploitation rate corresponding to the target (MSY-proxy) is 0.124 for the Northern assessment area. Table 20A gives the decision table for the Northern assessment area. The 12-yr projection indicates that petrale sole in the Northern assessment area will be driven below $0.25SB_0$ only if future catches are based on the High Spawning Biomass Model and reality is the Low Spawning Biomass Model. The medium catch series (projected from the base model) will leave the spawning stock biomass in 2016 at around 38% of SB_0 if the base model is correct.

5.2 Southern Assessment Area

The 5yr-average relative F is used as the basis for the forecasts and the calculation of the management parameters because of the uncertainty regarding recruitment (and therefore biomass) since 2003 owing to the lack of age composition data after 2000. The exploitation rate corresponding to the target (MSY-proxy) is 0.14 in the Southern assessment area. Table 20B gives the decision table for the Southern assessment area. The 12-yr projection indicates that petrale sole in the Southern assessment area will be driven below $0.25SB_0$ if future catches are based on the High Spawning Biomass Model and reality is either the base model or the Low Spawning Biomass Model. The medium catch series (projected from the base model) will leave the spawning stock biomass in 2016 at around 35% of SB_0 if the base model is correct.

5.3 Coastwide

The coastwide decision table (Table 20C) is constructed by summing the decision tables for the Northern and Southern assessment areas (Table 20A and 20B). This is the same procedure that has been used for lingcod and yellowtail rockfish. The coastwide petrale sole resource will only be driven below $0.25SB_0$ only if future catches are based on the High Spawning Biomass Model and reality is the Low Spawning Biomass Model. The medium catch series (projected from the base model) will leave the spawning stock biomass in 2016 at around 36% of SB_0 if the base model is correct.

6.0 Discussion

It is very important to reconstruct the historical catch series as close as possible to the start of the fisheries. A preliminary analysis (not shown here) indicates that an assessment based on recent catches would produce an erroneous estimate of depletion level.

The September 2005 STAR Panel did not have time to consider alternative methods of including discard in the model. The assumption of a constant percent discard was agreed to by the Panel and STAT primarily because of concerns about the reliability of historical discard estimates. This relatively crude approach assumes that the discarded and landed catches have the same length distributions, but it is likely that discard is primarily market (i.e., size) based.

The comparability of data collected by different agencies is an issue in this and previous assessments of petrale sole. The initial approach to model the Oregon and Washington fisheries separately seemed to accentuate the difficulties rather than to resolve them. Any real differences among the fisheries or spatial differences in the biology of petrale sole appear to be confounded with differences in sampling and ageing procedures.

Apparent shifts in ageing criteria (break and burn and surface ageing) and poor model fits caused the September 2005 STAR Panel to question the reliability of the age data. The Panel recommended that all age composition data be removed from the model. However, this should be considered an interim solution that should to be revisited future assessments.

The current assessment indicates that spawning stock biomass in the Southern assessment area was less than 25% of SB_0 during 2004. The forecast based on base model indicates that the spawning stock biomass will increase after 2005. However, this forecast is based on the catches not exceeding those calculated using $F_{40\%}$ harvest rate.

Additional caution should also be given to the results for the Southern assessment area because there is uncertainty associated with estimating recruitment and spawning stock biomass owing to insufficient age and length composition data, particularly in recent years. Insufficient biological information for petrale sole in recent and future years implies greater uncertainty in future stock assessments.

6.1 Recommendations for Future Research

A. Survey age data should be made available. Young individuals are not well represented in the fishery age and length compositions owing to discarding. The 2004 survey age determination data provide the growth parameters used in the assessment model for the Northern assessment area It would be beneficial to future assessments if age data from surveys were available because they provide recruitment information as well as age compositions and information about growth.

B. Increase efforts to collect commercial fishery length and age data. Length and age data are sporadic after 1999. Without age data, the ability to estimate year-class strength and the extent of variation in recruitment is compromised. Uncertainty will continue unless additional length and age composition data become available.

C. Age-error matrices. Estimation of the age compositions and mean-size-at-age for petrale sole may be compromised because of the use of different ageing methods over time and sampling designs that differ among the states. Between-agencies age error matrices should be constructed.

D. Effect of fishery regulations. The impacts of trip-limits and other management approaches, such as closed areas, on discards and fishery selectivity requires further study.

E. Studies on stock structure of petrale sole.

F. Collect length compositions for discarded petrale sole.

G. Winter-summer spawning migration should investigated in the field and be incorporated into future assessment models.

H. Examine the advantages and disadvantages of different ways for constructing age and size compositions.

7.0 STAR Panel recommendations

7.1 Northern assessment area (September 2005)

The September 2005 STAR Panel identified the following additional research topics:

1. Appropriate comparisons are needed to estimate ageing error. Potential drifts in the ageing criteria over time also should also be examined.
2. Reanalysis of the fishery CPUE data should be attempted using models that can accommodate both zero and positive tows. Although the CPUE indices appear consistent with trends in biomass from the NMFS triennial survey, consideration should be given to the potential impact of management restrictions on fishing practices.
3. Trends in petrale sole abundance are similar in the Northern and Southern assessment areas. A single coastwide assessment should be considered.

7.2.1 Southern assessment area (April 2005)

A number of runs were conducted during the April 2005 STAR panel to reach agreement on a base model for the Southern assessment area. Only the final sensitivity runs from the agreed base model are discussed in this document. The following points were discussed during the April 2005 STAR panel:

1. The discard data act in a pathological way with the age and length composition data. The estimated discard was added to the catch time series (i.e. the catch time series used in the model includes both landed catches and discards) at the suggestion of the STAR Panel. The discard was assumed to be 2.5% of the landed catches based on data collected by the WCGOP.
2. The STAR Panel suggested including fishery retention curves based on preliminary results for the Northern assessment area as well as knowledge of southern markets for petrale sole. Retention curves are not included in the final base model because there are no length composition data related to fishery retention for the Southern assessment area although sensitivity was explored to assuming various possible retention curves.

3. The ascending limbs of the selectivity curves for males were initially fixed to those for the females. These parameters were estimated rather than being fixed at the suggestion of the STAR Panel. The STAR Panel discussed the fact that the male selectivity curves are highly dome-shaped. Exploration of other reasons for this dome-shaped selectivity, such as a higher rate of natural mortality for males, should be explored in future modeling efforts.
4. The survey catchability in the preliminary model for the Southern assessment area was very small in comparison to that in the preliminary model for the Northern assessment area. This problem was resolved by changing the base model.
5. At the suggestion of the STAR Panel, and in the absence of data, the standard deviations for the age-compositions based on the break-and-burn ageing technique were assumed to be the same as those for the surface age readings.
6. The STAR Panel discussed the possibility of changes in sex ratio over time, in both the data and from the model estimates. While preliminary exploration of this issue indicated relatively constant sex rations, this is a good topic for future research, potentially linked to an exploration of differences in mean body mass-at-age between the sexes.

7.2.2 Southern assessment area (September 2005)

The following requests were made during the second STAR panel which reviewed the assessment for the Southern assessment area.

1. Recruitment deviations should be estimated only for the years for which there is some information about recruitment strength.
2. Evidence for a strong 1999 year class was weak and driven primarily by the large 2004 survey biomass index. The 2001 and 2004 shelf survey length data should be examined for evidence of strong year classes to determine whether there is support in the data for a strong 1999 year class.
3. A sensitivity run should be conducted in which the survey length composition data are removed to determine if this data source is driving the estimated strength of the 1999 year class. Other data in the model tended to support the estimate of a strong 1999 year class, but the support was relatively weak and inconsistent.
4. A model run that does not estimate recruitment deviations after 1998 should be conducted to obtain a lower bracketing model to quantify uncertainty in the assessment. Eventually, an alternative method for bounding uncertainty was adopted (see below).
5. The predicted growth curve from the model should be compared with the mean length at age by sex from the 2004 survey to evaluate whether the model estimates of growth are reasonable. This request could not be done during the September 2005 STAR Panel because the data were not readily available.
6. A decision table showing the consequences if stock biomass is actually higher or lower than implied by the base case model should be created.

8.0 Rebuilding Parameters

Petrale sole was not determined to be overfished on a coastwide basis nor by assessment area, so no rebuilding parameters are listed in this document.

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Table 1A. Annual landings of petrale sole (1916–55) for the Northern and Southern assessment areas (see Figure 1).

Calendar Year	Southern* Assessment Area	Northern** Assessment Area	US Total
1916	386.4		386.4
1917	526.4		526.4
1918	423.8		423.8
1919	333.4		333.4
1920	230.5		230.5
1921	293.8		293.8
1922	424.8		424.8
1923	427.4		427.4
1924	532.9		532.9
1925	528.5		528.5
1926	521.7		521.7
1927	632.0		632.0
1928	620.1	0.0	620.1
1929	706.0	2.8	708.8
1930	658.8	0.9	659.7
1931	623.9	0.9	624.8
1932	556.7	6.2	562.9
1933	432.5	3.9	436.4
1934	1,114.5	2.6	1,117.1
1935	901.9	23.8	925.7
1936	511.0	64.6	575.6
1937	817.7	115.3	933.0
1938	919.1	54.7	973.7
1939	1,160.5	50.3	1,210.8
1940	714.6	378.7	1,093.4
1941	405.3	513.7	918.9
1942	277.4	1,796.9	2,074.3
1943	416.8	1,862.6	2,279.4
1944	509.8	1,023.5	1,533.3
1945	559.2	822.1	1,381.3
1946	1,209.4	1,467.2	2,676.6
1947	1,336.8	748.7	2,085.6
1948	2,308.6	1,309.3	3,618.0
1949	2,246.3	813.8	3,060.1
1950	1,980.7	1,609.3	3,589.9
1951	1,236.6	1,055.2	2,291.8
1952	1,312.5	881.2	2,193.8
1953	1,519.6	487.6	2,007.2
1954	1,892.3	644.9	2,537.2
1955	1,641.8	986.8	2,628.6

* Heimann and Carlisle (1970). See text for detail.

** Oregon: Cleaver (1951) and Smith (1956). Washington: WDF (1956) and Alverson and Chatwin (1957). See text for detail.

Table 1B. Annual landings of petrale sole (1956–80) by assessment and INPFC area, based on PacFIN HAL database.

Calendar Year	Conception	Monterey	Eureka	Southern Area	Columbia	US Vancouver	Northern Area	US Total
1956	220.9	642.6	315.0	1178.5	707.5	268.0	975.5	2153.9
1957	217.7	742.2	566.0	1525.9	1092.6	283.0	1375.6	2901.5
1958	214.7	540.8	589.6	1345.1	929.0	322.0	1251.0	2596.1
1959	342.2	421.8	388.7	1152.6	636.3	459.0	1095.3	2247.9
1960	343.3	452.6	327.0	1122.9	1029.0	407.0	1436.0	2558.9
1961	383.2	608.2	517.5	1508.8	993.3	713.0	1706.3	3215.2
1962	283.4	535.1	565.1	1383.7	1232.8	379.0	1611.8	2995.4
1963	138.3	678.5	675.3	1492.1	1083.9	209.0	1292.9	2785.0
1964	204.1	674.8	384.6	1263.5	806.6	273.0	1079.6	2343.1
1965	176.4	800.5	266.7	1243.5	807.3	292.0	1099.3	2342.8
1966	114.4	855.8	388.2	1358.4	797.8	273.0	1070.8	2429.2
1967	102.0	679.4	498.0	1279.4	847.6	213.0	1060.6	2340.0
1968	102.9	492.1	776.8	1371.8	673.5	235.0	908.5	2280.2
1969	92.5	496.1	859.0	1447.6	709.0	345.0	1054.0	2501.6
1970	118.4	898.4	667.2	1684.0	828.2	202.0	1030.2	2714.2
1971	186.8	977.8	623.6	1788.2	904.3	243.0	1147.3	2935.5
1972	203.6	916.6	547.1	1667.2	884.8	638.0	1522.8	3190.0
1973	193.2	709.8	457.2	1360.1	999.5	563.0	1562.5	2922.7
1974	181.9	838.1	568.0	1587.9	1350.2	749.0	2099.2	3687.1
1975	351.0	734.7	405.1	1490.8	1322.9	943.0	2265.9	3756.7
1976	211.3	765.1	399.4	1375.8	931.1	517.0	1448.1	2823.9
1977	211.3	464.4	335.5	1011.2	923.8	298.0	1221.8	2233.0
1978	213.2	620.6	720.3	1554.0	1194.6	657.0	1851.6	3405.6
1979	248.1	677.7	588.3	1514.0	1236.7	400.0	1636.7	3150.8
1980	126.9	612.0	422.6	1161.5	1084.4	270.0	1354.4	2515.8

Data Source: Sampson and Lee (1999)

Table 1C. Annual landings of petrale sole (1981–2004) by assessment and INPFC area.

Calendar Year	Conception	Monterey	Eureka	Southern Area	Columbia	US Vancouver	Northern Area	US Total
1981	130.5	420.0	312.3	862.8	983.2	194.8	1177.9	2040.7
1982	170.7	418.4	262.8	851.9	1612.6	165.8	1778.4	2630.3
1983	73.8	331.7	389.0	794.5	996.9	422.8	1419.7	2214.2
1984	50.0	297.9	317.1	664.9	701.8	372.6	1074.4	1739.4
1985	138.7	403.4	386.3	928.4	632.8	278.0	910.8	1839.2
1986	220.3	325.6	242.8	788.7	719.6	239.3	959.0	1747.6
1987	122.5	431.6	395.7	949.8	899.0	351.1	1250.1	2199.9
1988	74.5	448.6	389.7	912.7	879.1	357.3	1236.4	2149.1
1989	98.1	465.1	368.7	931.9	828.1	392.5	1220.6	2152.4
1990	83.0	424.1	283.0	790.0	689.5	284.7	974.2	1764.3
1991	64.1	451.8	343.2	859.1	776.7	291.4	1068.1	1927.2
1992	37.9	336.6	259.7	634.2	670.7	246.7	917.4	1551.6
1993	33.9	280.3	263.6	577.7	567.1	356.6	923.8	1501.5
1994	54.2	259.1	403.1	716.4	434.2	221.9	656.1	1372.4
1995	51.5	311.7	329.6	692.8	693.3	265.5	958.8	1651.5
1996	58.5	392.8	487.2	938.4	581.3	308.7	890.0	1828.4
1997	51.2	435.4	505.6	992.2	653.6	298.6	952.2	1944.4
1998	27.1	241.4	279.4	548.0	592.7	320.3	913.0	1461.0
1999	17.6	246.8	409.1	673.5	533.4	290.3	823.7	1497.1
2000	17.9	229.1	498.9	745.9	684.3	419.4	1103.7	1849.7
2001	61.7	212.9	371.5	646.2	744.5	422.2	1166.7	1812.9
2002	31.3	192.9	347.5	571.7	691.5	512.0	1203.5	1775.2
2003	51.0	169.0	199.8	419.8	862.6	720.5	1583.1	2002.9
2004	99.9	151.2	228.4	479.5	795.0	661.2	1456.2	1935.7

Data Source: PacFIN

Table 1D. Landings of petrale sole by fishing year, INPFC area and season (winter: November–February; summer: March–October). The fishing year starts November 1 and ends October 31.

	Conception			Monterey			Eureka			Southern Assessment Area			Northern Assessment Area US Vancouver-Columbia		
Fishing Year	Winter	Summer	% Winter	Winter	Summer	% Winter	Winter	Summer	% Winter	Winter	Summer	% Winter	Winter	Summer	% Winter
1957	142.4	149.4	49%	194.0	676.5	22%	264.2	329.3	45%	600.6	1,155.2	34%	290.6	1410.4	17%
1958	59.0	158.7	27%	223.5	439.9	34%	371.3	423.8	47%	653.8	1,022.5	39%	78.9	979.6	7%
1959	48.8	192.5	20%	177.3	280.3	39%	218.0	311.5	41%	444.1	784.4	36%	517.0	1011.5	34%
1960	191.2	143.3	57%	239.6	357.9	40%	156.0	245.1	39%	586.8	746.4	44%	228.6	1486.6	13%
1961	169.7	247.1	41%	197.0	569.7	26%	251.4	336.9	43%	618.1	1,153.7	35%	195.7	1745.0	10%
1962	125.2	195.0	39%	204.7	429.0	32%	267.0	373.2	42%	596.8	997.3	37%	336.7	1609.9	17%
1963	84.0	93.7	47%	202.7	633.9	24%	353.0	402.2	47%	639.7	1,129.9	36%	425.1	1192.0	26%
1964	30.5	189.5	14%	142.6	589.7	19%	280.9	337.2	45%	454.0	1,116.4	29%	269.2	1073.7	20%
1965	21.4	153.1	12%	308.2	679.3	31%	126.8	196.7	39%	456.4	1,029.1	31%	271.3	1040.1	21%
1966	17.3	105.3	14%	250.3	795.7	24%	129.0	223.0	37%	396.6	1,124.0	26%	193.5	1115.2	15%
1967	5.1	94.1	5%	288.5	606.6	32%	352.5	357.4	50%	646.1	1,058.1	38%	181.4	1076.3	14%
1968	23.6	74.3	24%	161.8	442.1	27%	262.9	581.2	31%	448.2	1,097.6	29%	255.9	860.7	23%
1969	12.0	85.7	12%	63.9	439.9	13%	435.7	640.5	40%	511.6	1,166.1	30%	209.7	928.8	18%
1970	7.7	109.3	7%	268.9	762.9	26%	310.5	547.0	36%	587.1	1,419.2	29%	292.2	994.2	23%
1971	14.1	94.8	13%	365.1	817.0	31%	284.7	402.8	41%	663.8	1,314.5	34%	324.2	1028.2	24%
1972	99.8	176.9	36%	465.6	695.7	40%	400.0	343.9	54%	965.4	1,216.4	44%	404.6	1428.0	22%
1973	24.9	145.6	15%	316.4	498.4	39%	165.2	278.2	37%	506.6	922.1	35%	354.0	1526.5	19%
1974	46.3	149.2	24%	334.4	677.6	33%	422.5	246.2	63%	803.2	1,073.1	43%	391.2	2078.5	16%
1975	42.6	241.7	15%	307.1	604.4	34%	321.0	201.8	61%	670.7	1,047.9	39%	434.5	2242.4	16%
1976	117.5	162.8	42%	429.5	450.9	49%	296.9	183.2	62%	843.9	796.9	51%	408.4	1294.5	24%
1977	69.4	137.9	33%	274.9	282.3	49%	270.1	147.4	65%	614.4	567.5	52%	364.1	1084.8	25%
1978	43.1	159.2	21%	352.5	497.5	41%	437.4	470.4	48%	833.0	1,127.1	42%	542.5	1891.3	22%
1979	57.5	185.3	24%	311.8	438.5	42%	346.1	336.6	51%	715.4	960.4	43%	499.8	1455.5	26%
1980	50.4	94.8	35%	310.6	392.5	44%	260.1	260.8	50%	621.1	748.1	45%	419.1	1079.1	28%
1981	29.6	108.6	21%	181.4	266.5	40%	75.0	207.4	27%	286.0	582.6	33%	412.4	795.6	34%
1982	25.3	145.9	15%	151.7	238.3	39%	92.1	166.7	36%	269.1	550.8	33%	247.9	1247.2	17%
1983	15.2	64.1	19%	164.4	192.5	46%	170.3	194.8	47%	349.8	451.3	44%	643.9	1007.6	39%
1984	9.7	43.7	18%	155.9	153.3	50%	172.6	152.0	53%	338.2	349.0	49%	394.4	735.1	35%
1985	9.7	85.9	10%	152.2	219.5	41%	165.8	176.1	48%	327.7	481.5	40%	407.9	397.8	51%
1986	119.4	85.7	58%	158.2	184.7	46%	172.8	93.7	65%	450.5	364.1	55%	426.5	444.8	49%
1987	80.1	66.3	55%	140.9	293.3	32%	171.3	207.5	45%	392.3	567.2	41%	772.7	557.0	58%
1988	46.4	36.9	56%	173.2	244.3	41%	250.7	140.2	64%	470.3	421.5	53%	621.7	600.0	51%
1989	40.3	40.0	50%	204.1	247.1	45%	265.5	134.0	66%	509.9	421.1	55%	578.7	576.5	50%
1990	59.6	31.0	66%	182.3	242.8	43%	139.7	118.2	54%	381.7	392.0	49%	578.4	440.4	57%
1991	57.5	25.1	70%	246.8	226.0	52%	272.0	68.2	80%	576.2	319.2	64%	664.2	388.1	63%
1992	22.8	22.9	50%	148.7	214.2	41%	178.1	82.7	68%	349.6	319.8	52%	561.6	351.6	61%
1993	12.5	22.6	36%	127.9	163.7	44%	210.0	78.6	73%	350.4	264.8	57%	572.1	359.5	61%
1994	24.5	30.9	44%	105.8	159.0	40%	195.1	175.3	53%	325.4	365.2	47%	438.3	288.3	60%
1995	23.8	17.7	57%	103.1	157.0	40%	201.1	142.8	58%	328.0	317.5	51%	497.9	422.5	54%
1996	40.7	17.0	71%	172.6	220.8	44%	253.4	187.4	57%	466.6	425.2	52%	524.0	408.5	56%
1997	29.7	21.4	58%	203.3	249.1	45%	321.5	232.3	58%	554.5	502.9	52%	511.8	368.6	58%
1998	27.9	15.3	65%	119.8	156.1	43%	123.3	161.5	43%	271.0	332.9	45%	471.9	543.5	46%
1999	6.5	14.0	32%	126.3	128.8	50%	240.1	147.9	62%	372.9	290.8	56%	377.1	479.6	44%
2000	2.7	9.4	22%	104.8	119.2	47%	359.1	122.9	74%	466.5	251.6	65%	509.1	550.2	48%
2001	7.4	36.1	17%	93.1	105.6	47%	280.2	134.9	67%	380.6	276.6	58%	602.2	577.5	51%
2002	30.5	4.1	88%	129.5	69.0	65%	254.7	140.8	64%	414.6	213.9	66%	569.4	688.3	45%
2003	41.7	11.3	79%	121.7	91.0	57%	130.8	56.5	70%	294.2	158.8	65%	490.6	832.5	37%
2004	36.4	32.9	53%	34.5	127.6	21%	154.8	115.4	57%	225.8	275.9	45%	972.7	743.0	57%

Table 1E. Partition of landings (by fishing year) in the Northern Assessment Area into those by the Washington-Winter, Washington-Summer, Oregon-Winter and Oregon-Summer fisheries.

Fishing	Winter			Summer			Total		
Year	WA	OR	Sum	WA	OR	Sum	WA	OR	Sum
1928					0.0	0.0		0.0	0.0
1929					2.8	2.8		2.8	2.8
1930					0.9	0.9		0.9	0.9
1931					0.9	0.9		0.9	0.9
1932					6.2	6.2		6.2	6.2
1933					3.9	3.9		3.9	3.9
1934					2.6	2.6		2.6	2.6
1935				18.6	5.2	23.8	18.6	5.2	23.8
1936				47.7	16.9	64.6	47.7	16.9	64.6
1937				41.3	74.0	115.3	41.3	74.0	115.3
1938				50.9	3.7	54.7	50.9	3.7	54.7
1939				48.1	2.3	50.3	48.1	2.3	50.3
1940				58.1	320.6	378.7	58.1	320.6	378.7
1941				91.7	422.0	513.7	91.7	422.0	513.7
1942				98.1	1698.8	1796.9	98.1	1698.8	1796.9
1943				136.6	1726.0	1862.6	136.6	1726.0	1862.6
1944				107.6	915.9	1023.5	107.6	915.9	1023.5
1945				108.1	714.0	822.1	108.1	714.0	822.1
1946				113.7	1353.6	1467.2	113.7	1353.6	1467.2
1947				93.8	655.0	748.7	93.8	655.0	748.7
1948				103.4	1205.9	1309.3	103.4	1205.9	1309.3
1949				126.7	687.1	813.8	126.7	687.1	813.8
1950				114.9	1494.3	1609.3	114.9	1494.3	1609.3
1951				192.4	862.8	1055.2	192.4	862.8	1055.2
1952				217.9	663.3	881.2	217.9	663.3	881.2
1953				30.6	457.0	487.6	30.6	457.0	487.6
1954				15.0	629.8	644.9	15.0	629.8	644.9
1955				184.2	802.6	986.8	184.2	802.6	986.8
1956				460.9	514.6	975.5	460.9	514.6	975.5
1957	86.7	203.9	290.6	355.8	1054.6	1410.4	442.5	1258.5	1701.0
1958	28.0	50.9	78.9	409.0	570.6	979.6	437.0	621.5	1058.5
1959	60.3	456.7	517.0	661.1	350.4	1011.5	721.4	807.1	1528.5
1960	108.9	119.7	228.6	567.6	919.0	1486.6	676.5	1038.7	1715.2
1961	130.9	64.8	195.7	802.9	942.1	1745.0	933.8	1007.0	1940.8
1962	149.5	187.2	336.7	493.0	1116.9	1609.9	642.5	1304.1	1946.6
1963	111.4	313.7	425.1	526.6	665.4	1192.0	638.0	979.1	1617.1
1964	102.5	166.7	269.2	455.0	618.7	1073.7	557.5	785.4	1342.9
1965	127.4	143.9	271.3	434.6	605.5	1040.1	562.0	749.4	1311.4
1966	91.6	101.9	193.5	414.4	700.8	1115.2	506.0	802.7	1308.7
1967	60.0	121.4	181.4	312.0	764.3	1076.3	372.0	885.7	1257.7
1968	137.4	118.5	255.9	222.6	638.1	860.7	360.0	756.6	1116.6
1969	52.0	157.7	209.7	161.1	767.7	928.8	213.1	925.4	1138.5
1970	32.7	259.5	292.2	148.2	846.0	994.2	180.9	1105.5	1286.4
1971	64.3	259.9	324.2	173.2	855.0	1028.2	237.5	1114.9	1352.4
1972	57.8	346.8	404.6	272.1	1155.9	1428.0	329.9	1502.7	1832.6
1973	167.1	186.9	354.0	472.9	1053.6	1526.5	640.0	1240.5	1880.5
1974	64.5	326.7	391.2	747.1	1331.4	2078.5	811.6	1658.1	2469.7
1975	108.7	325.8	434.5	669.7	1572.7	2242.4	778.4	1898.6	2677.0
1976	103.2	305.2	408.4	508.5	786.0	1294.5	611.7	1091.2	1702.9
1977	112.2	251.9	364.1	259.3	825.5	1084.8	371.5	1077.4	1448.9
1978	267.5	275.0	542.5	481.8	1409.5	1891.3	749.3	1684.5	2433.8
1979	225.7	274.1	499.8	377.8	1077.7	1455.5	603.5	1351.9	1955.4
1980	152.5	266.6	419.1	341.0	738.1	1079.1	493.5	1004.7	1498.2

Table 1E. Continued.

Fishing Year	Winter			Summer			Total		
	WA	OR	Sum	WA	OR	Sum	WA	OR	Sum
1981	145.0	187.7	332.7	229.4	566.2	795.6	374.4	753.9	1128.3
1982	44.0	203.9	247.9	260.2	987.1	1247.2	304.2	1190.9	1495.1
1983	123.3	520.7	643.9	403.6	604.0	1007.6	526.8	1124.7	1651.5
1984	111.6	282.8	394.4	354.7	380.4	735.1	466.3	663.3	1129.6
1985	196.2	211.8	407.9	171.2	226.7	397.8	367.3	438.4	805.8
1986	135.0	291.5	426.5	191.3	253.5	444.8	326.3	545.0	871.3
1987	248.3	524.4	772.7	290.3	266.7	557.0	538.5	791.1	1329.7
1988	162.9	458.8	621.7	276.0	323.9	600.0	438.9	782.7	1221.7
1989	163.8	414.9	578.7	227.4	349.1	576.5	391.2	764.0	1155.2
1990	216.5	362.0	578.4	173.9	266.5	440.4	390.3	628.5	1018.8
1991	151.4	512.8	664.2	125.7	262.4	388.1	277.1	775.2	1052.3
1992	130.0	431.7	561.6	121.1	230.5	351.6	251.1	662.1	913.2
1993	135.9	436.1	572.1	92.7	266.8	359.5	228.7	702.9	931.6
1994	142.9	295.4	438.3	103.0	185.3	288.3	246.0	480.6	726.6
1995	138.8	359.0	497.9	141.5	281.0	422.5	280.4	640.0	920.4
1996	121.1	402.8	524.0	157.2	251.3	408.5	278.3	654.2	932.5
1997	134.6	377.2	511.8	172.7	195.9	368.6	307.3	573.1	880.4
1998	117.4	354.4	471.9	218.9	324.6	543.5	336.3	679.0	1015.3
1999	60.9	316.3	377.1	205.8	273.8	479.6	266.7	590.1	856.7
2000	91.2	418.0	509.1	295.3	254.9	550.2	386.5	672.8	1059.4
2001	118.6	483.6	602.2	205.8	371.7	577.5	324.4	855.2	1179.7
2002	126.7	442.7	569.4	297.1	391.2	688.3	423.8	833.9	1257.7
2003	141.6	319.6	461.2	334.3	474.3	808.6	475.9	793.8	1269.8
2004	294.8	678.0	972.7	278.0	465.0	743.0	572.8	1142.9	1715.7

Table 2. Discard rates [Discarded / (Discarded + Retained)] for petrale sole (see text for details).

Period		Discard Rate		Remarks	
Year	Season	North	South	North	South
1977	summer	0.145		Demory (1984)	
1978	summer	0.286		Demory (1984)	
1979	summer	0.115		Demory (1984)	
1980	summer	0.107		Demory (1984)	
1981	summer	0.237		Demory (1984)	
1986-1987	summer	0.088		Sampson&Lee (1999)	
2001	Summer	0.223	0.037	NWFSC Groundfish Observer Program Report 2004	
2002	Winter	0.020	0.004	NWFSC Groundfish Observer Program Report 2004	
	Summer	0.175	0.041	NWFSC Groundfish Observer Program Report 2004	
2003-04	Winter	0.027	0.004	NWFSC Groundfish Observer Program Report 2004	
	Summer	0.109	0.027	NWFSC Groundfish Observer Program Report 2004	

Table 3. The posterior means and 95% probability intervals for the changepoint at depth (A), and the DIC-statistics for the comparison of the sex-specific and sex-aggregated models (B).

(A) posterior means and intervals (sex-specific model)

node	posterior mean	sd	MC error	2.5%-ile	median	97.5%-ile
α_1	36.33	0.5707	0.008192	35.28	36.29	37.55
α_2	33.24	0.4632	0.003976	32.28	33.26	34.09
$\beta_{1,1}$	0.1192	0.01816	2.35E-04	0.08833	0.1178	0.1592
$\beta_{1,2}$	0.08962	0.007183	4.35E-05	0.07637	0.08934	0.1044
$\beta_{2,1}$	0.0201	0.005455	5.45E-05	0.008725	0.02033	0.03018
$\beta_{2,2}$	6.47E-05	0.007509	4.42E-05	-0.0147	9.22E-05	0.01477
τ	0.05025	0.00165	3.29E-06	0.04708	0.05024	0.05355
$X_{c,1}$	114.8	9.289	0.1442	98.08	113.8	135.5
$X_{c,2}$	143.3	6.35	0.06524	129.6	143.8	154.4

(B) DIC-statistics

	Dbar	Dhat	pD	DIC
Sex-specific model	10,877.1	10,868.3	8.77	10,885.9
Sex-aggregated model	11,355.8	11,351.7	4.051	11,359.8

Dbar = posterior mean of -2logL; Dhat = -2LogL at posterior mean of parameters.

Table 4. Estimates of area (km^2), biomass (mt), standard deviation (S.D.), and number of tows by INPFC area and year from the NMFS triennial shelf surveys.

		Depth Stratum											
		50-100m			100-155m			155-500m			Total		
		Biomass	S.D.	Tows	Biomass	S.D.	Tows	Biomass	S.D.	Tows	Biomass	S.D.	Tows
Conception	Area (km^2)		4,328			2,687			11,790			18,805	
	1977	328,537	147,386	4	167,271	77,377	15	104,839	51,111	91	600,646	174,132	110
	1980	-	-	-	-	-	-	-	-	-	-	-	-
	1983	-	-	-	-	-	-	-	-	-	-	-	-
	1986	-	-	-	-	-	-	-	-	-	-	-	-
	1989	272,284	108,297	13	216,942	76,479	9	1,241,481	486,135	8	1,730,707	503,889	30
	1992	12,413	12,413	7	39,943	27,409	8	-	-	3	52,356	30,088	18
	1995	160,485	34,050	8	255,922	111,900	6	70,728	44,166	29	487,134	125,027	43
	1998	157,212	59,652	8	245,476	150,329	6	178,178	65,678	32	580,867	174,559	46
	2001	192,608	44,619	8	483,316	206,805	6	257,656	187,940	33	933,580	282,985	47
	2004	518,063	189,610	8	806,969	227,672	7	204,473	100,214	23	1,529,504	312,777	38
Monterey	Area (km^2)		4,836			4,007			3,504			12,347	
	1977	384,379	129,189	11	198,745	37,184	41	37,671	18,923	106	620,795	135,759	158
	1980	157,043	74,863	18	86,853	56,873	13	39,257	24,653	20	283,152	97,195	51
	1983	222,907	51,721	24	123,320	41,248	26	53,042	25,444	21	399,269	70,879	71
	1986	198,671	36,124	25	121,206	31,716	32	15,649	8,687	15	335,526	48,850	72
	1989	503,626	105,191	51	687,771	148,684	43	187,102	84,423	26	1,378,498	200,747	120
	1992	88,404	25,873	44	107,464	28,700	41	109,388	28,799	18	305,256	48,192	103
	1995	499,839	118,835	35	407,217	127,951	36	85,284	58,513	44	992,341	184,166	115
	1998	286,056	76,455	40	360,552	85,616	30	97,359	32,868	55	743,967	119,398	125
	2001	528,955	107,133	39	413,078	71,840	34	40,226	24,854	52	982,260	131,363	125
	2004	1,541,235	333,099	28	1,499,596	244,511	25	157,026	80,745	40	3,197,857	421,023	93
Eureka	Area (km^2)		2,160			1,503			2,539			6,202	
	1977	78,385	44,660	2	-	-	4	5,242	3,635	25	83,627	44,808	31
	1980	521,425	283,546	9	7,485	5,141	7	31,969	25,080	10	560,880	284,700	26
	1983	115,804	28,666	18	7,880	4,893	16	716	716	22	124,400	29,089	56
	1986	118,135	29,082	12	30,927	19,698	13	-	-	6	149,062	35,125	31
	1989	150,959	31,693	16	103,508	50,281	14	10,252	5,158	18	264,720	59,659	48
	1992	154,058	39,261	19	12,075	4,054	15	72,224	39,400	18	238,358	55,769	52
	1995	232,096	87,576	15	71,639	25,392	14	6,546	4,544	31	310,281	91,296	60
	1998	412,662	99,911	20	87,945	26,483	15	34,031	12,640	33	534,639	104,132	68
	2001	238,130	58,831	18	67,729	16,330	17	3,291	2,313	31	309,150	61,099	66
	2004	1,598,250	363,364	20	406,309	200,025	11	4,048	4,048	29	2,008,607	414,801	60
Columbia	Area (km^2)		6,768			7,280			9,428			23,477	
	1977	457,298	116,455	11	362,428	100,534	63	358,561	132,082	137	1,178,287	202,767	211
	1980	463,873	103,253	58	198,689	49,106	72	498,182	193,284	71	1,160,745	224,569	201
	1983	380,269	58,423	86	333,999	52,665	107	173,147	39,319	97	887,415	87,937	290
	1986	488,760	107,012	65	310,079	52,662	94	116,619	53,469	49	915,458	130,704	208
	1989	1,180,686	635,001	49	416,799	69,126	79	55,069	18,072	60	1,652,553	639,008	188
	1992	475,402	68,977	58	439,086	59,432	85	233,909	60,043	58	1,148,397	109,065	201
	1995	535,935	90,052	37	343,511	67,889	59	53,934	15,353	85	933,380	113,816	181
	1998	772,694	101,605	41	589,037	67,783	62	277,025	134,408	84	1,638,757	181,613	187
	2001	848,646	184,748	37	1,003,209	166,760	66	103,043	44,048	86	1,954,897	252,747	189
	2004	1,986,925	307,825	34	1,245,094	231,527	52	340,358	107,237	72	3,572,377	399,826	158
US	Area (km^2)		1,027			1,912			2,165			5,104	
Vancouver	1977	1,099,102	1,087,399	2	152,297	34,250	18	61,033	25,641	45	1,312,433	1,088,240	65
	1980	42,834	15,353	4	169,068	160,284	7	135,360	71,218	12	347,262	176,064	23
	1983	51,142	22,243	7	403,384	95,840	26	160,991	65,188	29	615,518	118,023	62
	1986	130,503	43,711	30	154,815	28,349	93	25,405	8,348	49	310,722	52,763	172
	1989	43,220	35,322	8	168,303	33,052	22	34,231	12,689	24	245,754	50,011	54
	1992	36,275	12,424	10	131,619	54,737	19	28,951	16,029	18	196,845	58,373	47
	1995	35,166	23,983	5	161,737	63,468	15	7,395	4,779	18	204,298	68,017	38
	1998	29,429	20,082	5	404,465	115,530	22	26,096	16,878	15	459,990	118,471	42
	2001	91,718	22,421	6	297,081	114,848	16	29,530	16,846	17	418,329	118,222	39
	2004	201,759	60,294	5	457,689	184,278	15	37,315	16,618	15	696,763	194,602	35

-: Not Surveyed

Table 5. The catch rate indices for the Northern and Southern Assessment areas.

Year	Northern Assessment Area		Southern Assessment Area	
	OR-Winter	OR-Summer	Winter	Summer
1987	200.5	54.3	39.87	24.17
1988	135.8	30.6	40.41	26.98
1989	124.7	26.5	27.02	31.27
1990	122.9	29.8	17.79	21.85
1991	87.9	18.3	19.25	25.95
1992	80.1	18.5	20.74	20.50
1993	75.6	17.8	16.51	20.28
1994	70.5	13.9	12.70	23.84
1995	141.6	34.5	25.19	26.85
1996	133.6	34.2	26.90	24.88
1997	87.7	18.5	22.91	21.93
1998			17.50	17.54
1999			16.24	17.82
2000			21.95	24.32
2001			25.08	23.71
2002			33.19	37.88
2003			69.93	40.00

Table 6A. Number of samples and fish for fishery length measurements by season, sampling agency and year in the Northern assessment area. The blocks denote how the "super years" were constructed for each fishery.

	Number of Length Samples				Number of Fish			
	ODFW		WDFW		ODFW		WDFW	
Year	Winter	Summer	Winter	Summer	Winter	Summer	Winter	Summer
1955			1				507	
1956				2				689
1957				4				1,053
1958				3				2,140
1960				4				1,636
1961				1				100
1964				1				200
1965				1				100
1966	1	33		4	100	1,642		1,125
1967	4	39		3	200	1,943		485
1968	11	42		15	562	2,184		3,379
1969	9	48	1	7	451	2,408	328	1,422
1970	8	47	1	13	506	2,372	237	3,344
1971	7	2	4	11	351	201	1,035	5,298
1972		15	4	15		1,422	900	3,476
1973		14	3	5		1,347	650	1,043
1974		12	3	30		1,120	786	8,718
1975		11	10	37		1,000	2,192	12,818
1976			1	6			379	1,593
1977	1	19	1	2	101	1,881	220	529
1978	1	19	3	2	100	1,887	678	570
1979		19	2	4		2,038	219	400
1980	6	22	3	22	595	2,161	473	2,285
1981	5	23	5		502	2,290	500	
1982	5	5			500	502		
1983	2	1			213	100		
1984	1				201			
1985		5				502		
1986	3	9			300	895		
1987	6	16			452	805		
1988	4	7			199	351		
1989	10	13			500	652		
1990	4	10			201	502		
1991	11	7			426	277		
1992	4	11			173	428		
1993	7	8			218	296		
1994	7	8			236	348		
1995	8	2			301	66		
1996	3	4			102	168		
1997	4	10			137	380		
1998	4	15	1	9	118	674	50	443
1999	5	12	2	10	169	548	100	499
2000	7	10	5	13	236	383	250	610
2001	9	8	6	10	303	286	263	499
2002	5	16	5	11	184	538	244	546
2003	13	16	9	19	410	543	381	809
2004	17	10	7	18	431	340	350	859

Table 6B. Number of samples and fish for fishery age measurements by season, sampling agency and year in the Northern assessment area. The blocks denote how the "super years" were constructed for each fishery.

	Number of Age Samples				Number of Otoliths			
	ODFW		WDFW		ODFW		WDFW	
Year	Winter	Summer	Winter	Summer	Winter	Summer	Winter	Summer
1960				1				168
1961				1				100
1964				1				200
1965				1				100
1966		32		3		1,588		525
1967	4	39		3	200	1,933		482
1968	11	41		11	560	2,120		2,176
1969	9	48	1	5	449	2,400	100	512
1970	7	47	1	12	456	2,346	116	2,010
1971	4	11	1	9	198	1,093	140	1,504
1972		15	4	14		1,384	702	2,187
1973		14	3	5		1,331	542	875
1974		12	3	23		1,113	369	2,365
1975		10	9	14		890	864	1,471
1976			1	5			99	499
1977	1	18	1	1	33	1,123	99	100
1978	1	14	3	2	98	868	308	390
1979		18		3		1,921		296
1980	6	22	1	16	465	1,224	78	1,567
1981	5	23	3		457	2,275	295	
1982	5	5			444	348		
1983	1	1			101	95		
1985		5				438		
1986	3	9			246	663		
1987	6	16			345	574		
1988	4	7			98	231		
1989	10	12			404	540		
1990	4	10			116	246		
1991	10	7			212	151		
1992	4	11			158	424		
1993	7	8			218	296		
1994	7	8			236	348		
1995	8	2			299	66		
1996	3	4			102	165		
1997	4	10			137	378		
1998	4	15	1	9	118	673	50	441
1999	3	4	2	9	73	84	100	448
2000			5	12			250	560
2001		1	6	10		12	259	485
2002	5	9	5	10	182	301	242	496
2003	7	6	5	19	220	233	201	793
2004	7	6	7	18	179	205	349	854

Table 7A. Number of fishery length samples by season, sampling agency, and year in the Southern assessment area.

	Number of samples				Number of Fish			
	CDFG		ODFW		CDFG		ODFW	
Fishing Year	Winter	Summer	Winter	Summer	Winter	Summer	Winter	Summer
1962		3				150		
1964	1	22			49	897		
1965	2	14			49	560		
1966	8	32			275	1,346		
1967	13	17			651	623		
1968	8	88			375	3,426		
1969	14	50			449	1,890		
1970	12	29		1	412	866		50
1971	7	22		4	226	631		400
1972	23	39		1	853	1,247		100
1973	12	42			408	1,257		
1974	31	35			1,124	1,134		
1975	11	9			300	400		
1976	7	23			325	1,080		
1977	8	39			386	1,860		
1978	17	33			787	1,648		
1979	7	13			338	647		
1980	6	68			297	3,357		
1981	35	65		14	1,723	3,133		1,405
1982	26	34		12	1,292	1,420		1,197
1983	26	33	2		1,324	1,600	198	
1984	13	19	2		602	943	211	
1985	13	17			650	825		
1986	6	16			300	801		
1987	10	14	1		500	700	50	
1988	6	6			300	266		
1989	9	9	1		441	450	50	
1990	2	1		1	100	38		50
1991	12	1			445	41		
1992	6				184			
1994			2	1			104	23
1997			1	2			66	84
1998			2	6			55	232
1999			3	4			86	126
2000			5	3			197	83
2001		8	10	2		259	384	82
2002	12	8	5	6	316	147	177	237
2003	7	30	5	4	202	450	188	129
2004	5		5	10	108		158	410

Table 7B. Number of samples and fish aged by season, sampling agency, ageing method and year in the Southern assessment area. “BB” and “Surface” denote the break-and-burn and surface readings respectively.

	Number of Age Sample					Number of Otoliths				
	CDFG		ODFW			CDFG		ODFW		
	Winter	Summer	Winter	Summer		Winter	Summer	Winter	Summer	
Fishing Year	Surface	Surface	BB	Surface	BB	Surface	Surface	BB	Surface	BB
1966	6	17				115	401			
1967	9					226				
1968	1	46				4	1,083			
1969	7	26				133	641			
1970	5	20		1		126	472		50	
1971	6	16			4	150	424			398
1972	14	28			1	324	683			100
1973	7	27				183	641			
1974	15	27				367	662			
1975	8	1				200	48			
1976	3	15				75	369			
1977	5					125				
1980	3	50				76	1,228			
1981	18	27			14	450	677			1,397
1982	1	17			11	25	327			395
1983	12	8	2			352	193	190		
1984	6	3	2			148	74	209		
1985	2	4				50	100			
1987			1					25		
1989			1					50		
1990					1					25
1994			2		1			104		23
1997			1		2			66		81
1998			2		6			55		229
1999			2		1			51		37

Table 8. Number of tows and number of petrale sole sampled for length composition from the NMFS Triennial surveys.

A. Number of tows with length samples

INPFC	1977	1980	1983	1986	1989	1992	1995	1998	2001	2004
Southern Assessment Area										
Conception	-	-	-	-	14	3	14	10	17	20
Monterey	-	-	-	-	69	17	46	42	70	63
Eureka	-	-	-	1	8	17	12	39	34	28
Sum	-	-	-	1	91	37	72	91	121	111
Northern Assessment Area										
Columbia	-	1	-	14	36	65	55	114	110	107
U.S. Vancouver	-	-	2	21	14	14	18	29	23	21
Sum	-	1	2	35	50	79	73	143	133	128

B. Number of fish sampled for length measure

INPFC	1977	1980	1983	1986	1989	1992	1995	1998	2001	2004
Southern Assessment Area										
Conception	-	-	-	-	108	9	90	62	167	263
Monterey	-	-	-	-	1,023	110	654	384	829	1,617
Eureka	-	-	-	8	35	256	202	538	340	1,885
Sum	-	-	-	8	1,166	375	946	984	1,336	3,765
Northern Assessment Area										
Columbia	-	16	-	193	749	605	413	1,256	1,523	1,988
U.S. Vancouver	-	-	30	339	70	118	121	405	247	305
Sum	-	16	30	532	819	723	534	1,661	1,770	2,293

Table 9A. Ageing error matrices (otolith surface ages versus break-and-burn ages) obtained by the NWFSC Newport Laboratory.

		Break-and-burn Age																		
sex	Surfac	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	Total
Male	1		1																	1
	2		7	7	1															15
	3	1	9	9	12	2	1													34
	4			10	34	10	6	1												61
	5			1	29	40	12	6	4											92
	6				1	8	22	10	9	1										51
	7						5	8	9	1		1								24
	8						1	2	4	3										10
	9								1		1		1							3
	10											1		1						2
	11											1								1
	12												1							1
	Total	1	17	27	77	60	47	27	27	5	1	3	2	1						295
Female	2		1	6		2														9
	3		7	12	6	1	1	1												28
	4		1	4	32	12	6	3	1		1									60
	5			1	16	65	24	9						1						116
	6					25	67	24	19	3	1	2								141
	7					4	16	34	13	8	2	2								79
	8						2	9	14	4	4	2	1	2						38
	9							2	4	9	5	3	3	2						28
	10									3	2	6	5	1	3	2			1	23
	11									1	2	6	2	4		2				17
	12									1			1	1	1					4
	13													1	1		1			3
	14																			
	15														1			1		2
	Total		9	23	54	109	116	82	51	29	17	21	12	12	6	4	1	1	1	548
Combined	1		1																	1
	2		8	13	1	2														24
	3	1	16	21	18	3	2	1												62
	4		1	14	66	22	12	4	1		1									121
	5			2	45	105	36	15	4					1						208
	6				1	33	89	34	28	4	1	2								192
	7					4	21	42	22	9	2	3								103
	8						3	11	18	7	4	2	1	2						48
	9							2	5	9	6	3	4	2						31
	10									3	2	7	5	2	3	2			1	25
	11									1	2	7	2	4		2				18
	12									1			2	1	1					5
	13													1	1		1			3
	14																			
	15														1			1		2
	Total		9	23	54	109	116	82	51	29	17	21	12	12	6	4	1	1	1	843

Table 9B. Ageing error matrices obtained by the two WDFW readers (BB: break-and-burn).

	BB reading by Reader-1															
Surface Reading	3	4	5	6	7	8	9	10	11	12	13	14	15	16	18	Total
2	1		1	1												3
3	8	11	10	2		2										33
4	11	34	38	17	12	2										114
5	5	41	48	42	15	4	3									158
6	2	12	33	47	31	11	3	1								140
7			7	18	19	7	4									55
8	1		3		6	7	9	1	1	1						29
9			1	2	2	3	5	2	5	1	1		1			23
10					1	1	2	1	4	2	1	1				13
11						1	2	1					1			5
12										2		1	1			4
13										2	1	1	2			6
14											2	1				3
15										1					1	2
16														1		1
Total	28	98	141	129	86	38	28	6	10	9	5	4	5	1	1	589

	BB reading by Reader-2																
Surface Reading	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	20	Total
2	1	1		1													3
3	2	8	11	6	5	1											33
4	3	21	35	34	14	5	2										114
5	1	9	33	66	34	11	2	2									158
6	2	4	9	33	64	19	8	3									142
7			2	6	19	18	6	4	1								56
8			1	2	2	11	8	4	3								31
9					1	7	7	3	1	1		2				1	23
10						5	2		3	2		1					13
11							2		1	1				1			5
12							1	1	1		1						4
13									1		2	1	1	1			6
14									1			2					3
15											1	1					2
16															1		1
Total	9	43	91	148	139	77	38	17	12	4	4	7	1	2	1	1	594

Count of FirstAge	BB by Reader-1															
BB by Reader-2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	18	Total
2	2	2	4	1												9
3	10	10	13	9			1									43
4	8	30	23	19	10											90
5	6	35	60	25	13	7				1						147
6	1	15	24	54	33	8	2									137
7	1	4	10	17	20	11	7	2	2	1			1			76
8		1	5	1	8	6	9	4	1	2		1				38
9		1	2	2	1	4	5		1	1						17
10				1	1	2	3		2	1	1		1			12
11							1		2			1				4
12										1		1	1		1	4
13									1	2	3	1				7
14													1			1
15											1		1			2
16														1		1
20									1							1
Total	28	98	141	129	86	38	28	6	10	9	5	4	5	1	1	589

Table 10A. Summary of the "pre-STAR" models for the Northern assessment area. See text for model descriptions.

Model	Catch	Discard	CPUE	Survey	Ageing Error	Mean Size@age (ms)	Fixed Growth params	WA-Age Comp	Est. Rdev	Super Year
FULL4	1928 - 2004, 1mt 1910-27		on							on
FULL4 cv6	1928 - 2004, 1mt 1910-27		on		6%					on
FULL4 2SD	1928 - 2004, 1mt 1910-27		on	2xSD						on
DISC4	1928 - 2004, 1mt 1910-27	excl. Demory	on							on
DISC4 cv6	1928 - 2004, 1mt 1910-27	excl. Demory	on		6%					on
DISC4 2SD	1928 - 2004, 1mt 1910-27	excl. Demory	on	2xSD						on
DISC4 - sudomal	1928 - 2004, 1mt 1910-27	excl. Demory	on	Selx F = M						on
DISC4 - ms	1928 - 2004, 1mt 1910-27	excl. Demory	on			excl. fish. ms				on
DISC4 - ms-Gcv	1928 - 2004, 1mt 1910-27	excl. Demory	on			excl. fish. ms	by sex			on
DISC4 - surv04	1928 - 2004, 1mt 1910-27	excl. Demory	on	excl. 2004						on
DISC4 - waage	1928 - 2004, 1mt 1910-27	excl. Demory	on					excl.		on
DISC4 - Rdev	1928 - 2004, 1mt 1910-27	excl. Demory	on						No	on
DISC4 - CPUE	1928 - 2004, 1mt 1910-27	excl. Demory	off							on

Table 10B. The results of model fits. See Table 10A for the model features.

RESULTS	FULL4	FULL4 cv6	FULL4 2SD	DISC4	DISC4 cv6	DISC4 2SD	DISC4 - sudomal	DISC4 - ms	DISC4 - ms-Gcv	DISC4 - surv04	DISC4 - waage	DISC4 - Rdev	DISC4 - CPUE
LIKELIHOOD	558.6	540.854	554.8	567.7	547.074	563.6	577.0	386.3	436.5	546.8	430.0	699.6	601.6
indices	-44.2	-46.9281	-45.6	-44.2	-46.4418	-45.8	-41.9	-46.7	-47.6	-49.6	-44.1	-41.9	-8.8
discard	-46.8	-39.677	-45.6	-37.4	-29.7162	-36.7	-36.8	-40.9	-35.0	-35.1	-38.2	-26.1	-36.7
length_comps	411.7	420.091	408.7	411.3	414.145	409.4	417.1	387.8	420.5	403.9	402.2	534.9	409.3
age_comps	92.9	67.2798	92.6	92.7	66.3876	92.8	93.8	129.1	135.2	92.8	49.4	107.7	93.0
size-at-age	144.5	148.219	143.2	144.6	149.311	144.1	145.6	-	-	135.9	100.3	157.2	143.7
M-G PARMS													
Female													
M_young	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
M_old	0	0	0	0	0	0	0	0	0	0	0	0	0
Lmin	24.622	24.6219	24.622	24.622	24.6219	24.622	24.622	24.622	24.622	24.622	24.622	24.622	24.622
Lmax	56.355	53.5821	56.435	56.364	53.5712	56.142	56.661	49.296	55.410	55.642	50.987	53.854	56.291
K	0.121	0.132972	0.118	0.121	0.130466	0.123	0.120	0.232	0.144	0.129	0.174	0.168	0.122
CVmin	0.059	0.107279	0.059	0.059	0.107552	0.060	0.059	0.091	0.080	0.062	0.066	0.092	0.060
CVmax	0	0	0	0	0	0	0	0	0	0	0	0	0
Male													
M_young	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
M_old	0	0	0	0	0	0	0	0	0	0	0	0	0
Lmin	24.622	24.622	24.622	24.622	24.622	24.622	24.622	24.622	24.622	24.622	24.622	24.622	24.622
Lmax	56.152	51.895	55.727	56.147	51.434	56.119	54.877	48.669	40.665	55.928	49.470	53.310	56.242
K	0.041	0.056	0.044	0.041	0.064	0.041	0.046	0.131	0.308	0.041	0.083	0.055	0.040
CVmin	0.031	0.110	0.030	0.030	0.108	0.030	0.030	0.039	0.080	0.030	0.035	0.041	0.030
CVmax	0	0	0	0	0	0	0	0	0	0	0	0	0
Q													
WA Winter	0.0496	0.0445	0.0528	0.0502	0.0438	0.0542	0.0504	0.0446	0.0334	0.0546	0.0573	0.0385	-
WA Summer	0.0206	0.0242	0.0223	0.0208	0.0249	0.0222	0.0266	0.0193	0.0251	0.0222	0.0170	0.0200	-
OR Winter	0.0228	0.0192	0.0258	0.0230	0.0209	0.0247	0.0285	0.0212	0.0244	0.0248	0.0188	0.0175	-
OR Summer	0.0184	0.0170	0.0182	0.0186	0.0155	0.0199	0.0173	0.0151	0.0150	0.0201	0.0147	0.0167	-
Survey	0.4683	0.4724	0.4711	0.4712	0.4755	0.4736	0.5928	0.4564	0.4932	0.4931	0.3833	0.4845	0.4621
PRODUCTIVITY													
B0	37,206	33,365	36,868	36,951	33,365	36,881	36,259	33,697	23,220	37,358	34,863	34,193	36,465
B0(age3+)	35,015	31,088	34,684	34,774	31,088	34,700	34,100	31,881	22,110	35,139	32,650	32,206	34,308
SB0	17,606	15,574	17,443	17,488	15,574	17,414	17,497	16,035	12,636	17,623	16,318	16,847	17,230
R0	15,114	14,748	15,060	15,010	14,748	15,026	14,847	15,701	10,696	15,316	16,544	14,267	14,818
h	0.767	0.744	0.746	0.768	0.748	0.747	0.777	0.693	0.863	0.709	0.712	0.680	0.790
2005 depletion	0.233	0.260	0.181	0.232	0.260	0.181	0.235	0.264	0.337	0.141	0.285	0.092	0.268
CONVERGE (Y/N/?)	Y	Y	Y	Y	Y	Y	Y	Y	?(e+0)	Y	Y	Y	Y

Table 11A. Summary of models requested by the September 2005 STAR Panel.

Model	Catch	Discard	Retention curve	CPUE	Survey	Ageing Error	Mean Size@age (ms)	Fixed Growth params	Sex-comb Len Comp	Age Comp	Start-yr for Rdev	Mirrow Fishery Selx	Length Sample Size	Super Year
DISC4 cv1	1928 - 2004, 1mt 1910-27	excl. Demory		1987-2004	by sex	1%			No		1910		Real	on
DISC4 cv5	1928 - 2004, 1mt 1910-27	excl. Demory		1987-2004	by sex	5%			No		1910		Real	on
DISC4 cv10	1928 - 2004, 1mt 1910-27	excl. Demory		1987-2004	by sex	10%			No		1910		Real	on
DISC4 cv15	1928 - 2004, 1mt 1910-27	excl. Demory		1987-2004	by sex	15%			No		1910		Real	on
DISC4 cv20	1928 - 2004, 1mt 1910-27	excl. Demory		1987-2004	by sex	20%			No		1910		Real	on
DISC4 cv10A	Add D1928 - 2004, 1mt 1910-27	excl. all	No	1987-2004	by sex	10%		Comb	No		1910		Real	on
DISC4 cv10B	Add D1928 - 2004, 1mt 1910-27	excl. all	No	asmt99*	by sex	10%		Comb	No		1910		Real	on
DISC4 cv10C	Add D1928 - 2004, 1mt 1910-27	excl. all	No	excl.all	by sex	10%		Comb	No		1910		Real	on
Simple1	1928 - 2004, 1mt 1910-27	excl. all	No	1987-2004	asym F=M		Excl. all	Female	Yes	excl. all	1910	asym F=M	30	off
Simple2	1928 - 2004, 1mt 1910-27	excl. all	No	1987-2004	asym F=M		Excl. all	Female	Yes	excl. all	1970	asym F=M	30	off
Simple2A	Add D1928 - 2004, 1mt 1910-27	excl. all	No	1987-2004	asym F=M		Excl. all	Female	Yes	excl. all	1970	asym F=M	30	off
Simple2B	Add D1928 - 2004, 1mt 1910-27	excl. all	No	asmt99*	asym F=M		Excl. all	Female	Yes	excl. all	1970	asym F=M	30	off
Simple2C	Add D1928 - 2004, 1mt 1910-27	excl. all	No	excl.all	asym F=M		Excl. all	Female	Yes	excl. all	1970	asym F=M	30	off
Simple3	Add D1928 - 2004, 1mt 1910-27	excl. all	No	1987-2004	asym F=M		Excl. all	by sex	No	excl. all	1940	asym F=M	Real	off
Simple3A1	Add D1928 - 2004, 1mt 1910-27	excl. all	No	asmt99*	asym F=M		Excl. all	by sex	No	excl. all	1940	asym F=M	30	off
Simple3A2	Add D1928 - 2004, 1mt 1910-27	excl. all	No	asmt99*	asym F=M		Excl. all	by sex	No	excl. all	1940	asym F=M	Real	off

*: obtained from 1999 assessment, only for OR-Winter and Summer fisheries.

Table 11B. The results of model fits for the models listed in Table 11A.

RESULTS	DISC4 cv1	DISC4 cv5	DISC4 cv10	DISC4 cv15	DISC4 cv20	DISC4 cv10A	DISC4 cv10B	DISC4 cv10C	Simple 1	Simple 2	Simple 2A	Simple 2B	Simple 2C	Simple 3	Simple 3A1	Simple 3A2
LIKELIHOOD	553.3	550.4	539.3	533.3	534.5	717.2	756.318	756.299	512.1	629.7	639.617	667.091	676.759	590.215	1153.87	294.955
indices	-46.7	-46.5	-45.9	-44.5	-44.0	-48.6	-20.5468	-11.2097	-46.2	-47.4	-48.315	-20.3874	-10.7459	-45.9046	-17.9676	-21.6896
discard	-29.6	-29.6	-30.5	-31.6	-33.0											
length_comps	420.7	417.0	406.4	401.9	399.8	462.6	440.68	464.17	587.8	672.0	698.629	697.487	697.464	668.004	1188.25	345.676
age_comps	64.9	65.6	68.4	72.8	80.4	75.4	82.3365	75.9014								
size-at-age	150.1	150.4	147.5	141.7	135.5	265.2	228.407	264.079								
M-G PARMS																
Female																
M_young	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
M_old	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lmin	24.6219	24.6219	24.6219	24.6219	24.6219	24.8289	24.8289	24.8289	24.6219	24.6219	24.8289	24.8289	24.8289	24.6219	24.6219	24.6219
Lmax	53.2879	53.5725	54.4222	55.6276	57.2913	57.3994	57.3994	57.3994	55.4099	55.4099	57.3994	57.3994	57.3994	55.4099	55.4099	55.4099
K	0.12558	0.12746	0.12688	0.12397	0.11568	0.09484	0.09484	0.09484	0.14375	0.14375	0.09484	0.09484	0.09484	0.14375	0.14375	0.14375
CVmin	0.12068	0.11468	0.10367	0.0927	0.0835	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08
CVmax	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Male																
M_young	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2						0.2	0.2	0.2
M_old	0	0	0	0	0	0	0	0						0	0	0
Lmin	24.622	24.622	24.622	24.622	24.622	24.8289	24.8289	24.8289						24.6219	24.6219	24.6219
Lmax	51.786	51.961	51.128	53.114	55.679	57.3994	57.3994	57.3994						40.6646	40.6646	40.6646
K	0.057	0.057	0.076	0.060	0.044	0.09484	0.09484	0.09484						0.3085	0.3085	0.3085
CVmin	0.113	0.109	0.092	0.074	0.052	0.08	0.08	0.08						0.08	0.08	0.08
CVmax	0	0	0	0	0	0	0	0						0	0	0
Q																
WA Winter	0.0432	0.0443	0.0454	0.0538	0.0536	0.0371			0.0186	0.0170	0.0147			0.0142		
WA Summer	0.0249	0.0250	0.0249	0.0250	0.0232	0.0161			0.0222	0.0202	0.0175			0.0169		
OR Winter	0.0210	0.0210	0.0211	0.0214	0.0222	0.0213	0.0227		0.0149	0.0136	0.0118	0.0569		0.0114	0.0501	0.0543
OR Summer	0.0158	0.0160	0.0153	0.0177	0.0178	0.0140	0.0044		0.0171	0.0156	0.0135	0.0130		0.0131	0.0114	0.0124
Survey	0.4814	0.4800	0.4731	0.4694	0.4574	0.5013	0.1947	0.4874	0.5033	0.4856	0.3978	0.3870	0.3851	0.3547	0.3077	0.3510
PRODUCTIVITY																
B0	32,437	32,371	32,108	33,446	35,682	28,018	64,003	28,081	19,672	24,147	28,821	28,724	28,728	25,556	29,105	26,428
B0(age3+)	30,150	30,140	30,075	31,403	33,588	26,619	60,808	26,680	18,964	23,279	27,508	27,416	27,419	24,334	27,714	25,165
SB0	14,863	14,957	15,262	16,058	17,250	12,122	27,691	12,149	16,940	20,794	24,208	24,127	24,130	13,907	15,839	14,382
R0	14,489	14,344	14,104	14,125	14,352	10,646	24,318	10,670	7,170	8,801	10,630	10,594	10,595	11,772	13,407	12,174
h	0.744	0.749	0.760	0.774	0.781	0.891	0.715	0.900	0.993	0.860	0.846	0.858	0.859	0.864	0.826	0.875
2005 depletion	0.262	0.262	0.259	0.248	0.238	0.348	0.602	0.386	0.347	0.304	0.305	0.340	0.344	0.326	0.350	0.345
CONVERGE (Y/N/?	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y

Table 12. Summary of the parameters in the base-model for the Northern assessment area.

Parameter	Fixed	Estimate	Initial Value
Females			
Natural Mortality	0.20		
M @ old ages	0		
Length @ Youngest Age	24.6219		
Length @ Oldest Age	55.4099		
K	0.14375		
CV @ Youngest Age	0.08		
CV @ Oldest Age	0		
Males (as exponential offset from females)			
Natural Mortality	0		
M @ old ages	0		
Length @ Youngest Age	0		
Length @ Oldest Age	-0.3094		
K	0.76364		
CV @ Youngest Age	0		
CV @ Oldest Age	0		
Biological Data			
Weight at Length Intercept	3.42.E-06		
Weight at Length Slope	3.346		
Females			
Maturity at Length Intercept	33.10		
Maturity at Length Slope	-0.734		
Males (as exponential offset from females)			
Maturity at Length Intercept	7.17.E-06		
Maturity at Length Slope	3.134		
SR_parms			
Initial Recruitment		9.40707	10.2
Steepness		0.87502	0.8
Recruitment Variability	0.5		
Initial Fishery F			
WA-Winter	0		
WA-Summer	0		
OR-Winter	0		
OR-Summer	0		
Fishery Selectivity (double Logistic, sex and fishery independent)			
Parameter 1	56		
Parameter 2	0		
Parameter 3		0.0679	0.1589
Parameter 4		0.5397	0
Parameter 5		6.9999	1
Parameter 6		0.9998	0.5
Parameter 7		0.1089	0.0001
Parameter 8	10		
Survey Males (double logistic, sex-independent)			
Parameter 1	32		
Parameter 2	0		
Parameter 3		1.2333	0.1589
Parameter 4		0.1311	0
Parameter 5		6.9999	1
Parameter 6		0.9998	0.5
Parameter 7		0.1089	0.0001
Parameter 8	35		

Table 13. Estimates of some key model outputs for the Northern assessment area.

Parameter	Estimates	
ln(R0)	9.4071	
Q OR-Winter CPUE	0.0543	
Q OR-Summer CPUE	0.0124	
Q Survey	0.3510	
Steepness (h)	0.8750	
Growth	Female	Male
Length at min. age	24.6219	24.6219
Length at max. age	55.4099	40.6646
K	0.1438	0.3085
Length at age CV	0.08	0.08

Table 14. Base model estimates of population statistics for the Northern assessment area.

Fishing Year	Total Biomass (mt)	Biomass Age3+(mt)	Spawning Biomass (mt)	WA-Winter Catch (mt)	WA-Winter Harvest Rate	WA-Summer Catch (mt)	WA-Summer Harvest Rate	OR-Winter Catch (mt)	OR-Winter Harvest Rate	OR-Summer Catch (mt)	OR-Summer Harvest Rate	Recruit Age0	Depletion
1910	26428	25165	14382	0.0	0.00	0.0	0.00	0.0	0.00	1.0	0.00	12174	1.00
1911	26427	25164	14381	0.0	0.00	0.0	0.00	0.0	0.00	1.0	0.00	12174	1.00
1912	26426	25163	14381	0.0	0.00	0.0	0.00	0.0	0.00	1.0	0.00	12174	1.00
1913	26425	25162	14380	0.0	0.00	0.0	0.00	0.0	0.00	1.0	0.00	12174	1.00
1914	26425	25162	14380	0.0	0.00	0.0	0.00	0.0	0.00	1.0	0.00	12174	1.00
1915	26424	25161	14379	0.0	0.00	0.0	0.00	0.0	0.00	1.0	0.00	12174	1.00
1916	26423	25161	14379	0.0	0.00	0.0	0.00	0.0	0.00	1.0	0.00	12174	1.00
1917	26423	25160	14378	0.0	0.00	0.0	0.00	0.0	0.00	1.0	0.00	12174	1.00
1918	26423	25160	14378	0.0	0.00	0.0	0.00	0.0	0.00	1.0	0.00	12174	1.00
1919	26422	25159	14378	0.0	0.00	0.0	0.00	0.0	0.00	1.0	0.00	12174	1.00
1920	26422	25159	14378	0.0	0.00	0.0	0.00	0.0	0.00	1.0	0.00	12174	1.00
1921	26422	25159	14378	0.0	0.00	0.0	0.00	0.0	0.00	1.0	0.00	12174	1.00
1922	26422	25159	14377	0.0	0.00	0.0	0.00	0.0	0.00	1.0	0.00	12174	1.00
1923	26421	25159	14377	0.0	0.00	0.0	0.00	0.0	0.00	1.0	0.00	12174	1.00
1924	26421	25158	14377	0.0	0.00	0.0	0.00	0.0	0.00	1.0	0.00	12174	1.00
1925	26421	25158	14377	0.0	0.00	0.0	0.00	0.0	0.00	1.0	0.00	12174	1.00
1926	26421	25158	14377	0.0	0.00	0.0	0.00	0.0	0.00	1.0	0.00	12174	1.00
1927	26421	25158	14377	0.0	0.00	0.0	0.00	0.0	0.00	1.0	0.00	12174	1.00
1928	26421	25158	14377	0.0	0.00	0.0	0.00	0.0	0.00	1.0	0.00	12174	1.00
1929	26422	25159	14378	0.0	0.00	0.0	0.00	0.0	0.00	1.0	0.00	12174	1.00
1930	26420	25157	14376	0.0	0.00	0.0	0.00	0.0	0.00	1.0	0.00	12174	1.00
1931	26420	25157	14376	0.0	0.00	0.0	0.00	0.0	0.00	1.0	0.00	12174	1.00
1932	26420	25157	14376	0.0	0.00	0.0	0.00	0.0	0.00	6.8	0.00	12174	1.00
1933	26414	25152	14372	0.0	0.00	0.0	0.00	0.0	0.00	4.3	0.00	12174	1.00
1934	26412	25149	14371	0.0	0.00	0.0	0.00	0.0	0.00	2.9	0.00	12174	1.00
1935	26411	25148	14370	0.0	0.00	20.4	0.00	0.0	0.00	5.7	0.00	12174	1.00
1936	26389	25126	14354	0.0	0.00	52.5	0.00	0.0	0.00	18.6	0.00	12173	1.00
1937	26326	25064	14310	0.0	0.00	45.4	0.00	0.0	0.00	81.4	0.00	12172	0.99
1938	26218	24956	14233	0.0	0.00	56.0	0.00	0.0	0.00	4.1	0.00	12170	0.99
1939	26184	24922	14207	0.0	0.00	52.9	0.00	0.0	0.00	2.5	0.00	12169	0.99
1940	26121	24898	14187	0.0	0.00	63.9	0.00	0.0	0.00	352.7	0.02	10652	0.99
1941	25769	24539	13935	0.0	0.00	100.9	0.01	0.0	0.00	464.2	0.02	12184	0.97
1942	25293	24079	13605	0.0	0.00	107.9	0.01	0.0	0.00	1868.7	0.10	13631	0.95
1943	23496	22197	12384	0.0	0.00	150.3	0.01	0.0	0.00	1898.6	0.11	12347	0.86
1944	21816	20527	11202	0.0	0.00	118.3	0.01	0.0	0.00	1007.5	0.06	9848	0.78
1945	21206	20067	10698	0.0	0.00	118.9	0.01	0.0	0.00	785.4	0.05	8918	0.74
1946	20844	19847	10449	0.0	0.00	125.0	0.01	0.0	0.00	1488.9	0.10	9652	0.73
1947	19749	18777	9866	0.0	0.00	103.2	0.01	0.0	0.00	720.5	0.05	10104	0.69
1948	19358	18363	9812	0.0	0.00	113.8	0.01	0.0	0.00	1326.5	0.09	9027	0.68
1949	18362	17376	9270	0.0	0.00	139.4	0.01	0.0	0.00	755.8	0.06	8586	0.64
1950	17896	16983	9011	0.0	0.00	126.4	0.01	0.0	0.00	1643.8	0.13	8479	0.63
1951	16584	15700	8198	0.0	0.00	211.6	0.02	0.0	0.00	949.1	0.08	8431	0.57
1952	15904	15020	7826	0.0	0.00	239.7	0.02	0.0	0.00	729.7	0.06	8685	0.54
1953	15436	14534	7576	0.0	0.00	33.7	0.00	0.0	0.00	502.7	0.05	9292	0.53
1954	15429	14465	7579	0.0	0.00	16.5	0.00	0.0	0.00	692.8	0.06	10635	0.53

Table 14 Continued

Fishing Year	Total Biomass (mt)	Biomass Age3+(mt)	Spawning Biomass (mt)	WA-Winter Catch (mt)	WA-Winter Harvest Rate	WA-Summer Catch (mt)	WA-Summer Harvest Rate	OR-Winter Catch (mt)	OR-Winter Harvest Rate	OR-Summer Catch (mt)	OR-Summer Harvest Rate	Recruit Age0	Depletion
1955	15346	14252	7455	0.0	0.00	202.6	0.02	0.0	0.00	882.9	0.08	13213	0.52
1956	15049	13768	7095	0.0	0.00	507.0	0.05	0.0	0.00	566.0	0.05	15398	0.49
1957	14974	13506	6782	91.0	0.01	391.4	0.04	214.1	0.02	1160.1	0.12	15164	0.47
1958	14510	12901	6074	29.4	0.00	449.9	0.05	53.5	0.01	627.7	0.07	16048	0.42
1959	14914	13401	5976	63.3	0.01	727.2	0.08	479.5	0.06	385.5	0.04	12062	0.42
1960	15095	13645	5820	114.3	0.01	624.4	0.07	125.6	0.01	1010.9	0.11	11045	0.40
1961	15314	13914	5763	137.4	0.02	883.2	0.10	68.1	0.01	1036.4	0.11	18675	0.40
1962	15130	13670	5701	157.0	0.02	542.3	0.06	196.6	0.02	1228.6	0.14	16867	0.40
1963	14980	13250	5669	117.0	0.01	579.3	0.07	329.4	0.04	731.9	0.08	12119	0.39
1964	15349	13831	5727	107.6	0.01	500.5	0.05	175.0	0.02	680.6	0.07	11878	0.40
1965	16031	14693	5947	133.8	0.01	478.1	0.05	151.0	0.02	666.1	0.07	15461	0.41
1966	16627	15171	6398	96.2	0.01	455.8	0.04	107.0	0.01	770.9	0.07	17556	0.44
1967	17278	15455	6875	63.0	0.01	343.2	0.03	127.4	0.01	840.8	0.08	22232	0.48
1968	17863	15987	7189	144.3	0.01	244.9	0.02	124.5	0.01	701.9	0.06	15729	0.50
1969	18730	16886	7487	54.6	0.00	177.2	0.02	165.6	0.01	844.5	0.07	9701	0.52
1970	19597	18299	7862	34.3	0.00	163.0	0.01	272.4	0.02	930.6	0.08	7797	0.55
1971	20047	19118	8352	67.5	0.01	190.5	0.01	272.9	0.02	940.5	0.07	8285	0.58
1972	19984	19144	8948	60.7	0.00	299.3	0.02	364.1	0.03	1271.5	0.09	8604	0.62
1973	18989	18143	9008	175.5	0.01	520.2	0.04	196.3	0.01	1159.0	0.09	7520	0.63
1974	17656	16835	8599	67.7	0.01	821.8	0.06	343.0	0.03	1464.5	0.11	6720	0.60
1975	15534	14813	7478	114.1	0.01	736.7	0.07	342.1	0.03	1730.0	0.16	5909	0.52
1976	13159	12504	6126	108.4	0.01	559.4	0.06	320.5	0.03	864.6	0.10	5756	0.43
1977	11845	11212	5449	117.8	0.01	285.2	0.04	264.5	0.03	908.1	0.11	6820	0.38
1978	10823	10136	4928	280.9	0.04	530.0	0.07	288.8	0.04	1550.4	0.22	8338	0.34
1979	8835	8072	3740	237.0	0.04	415.6	0.08	287.8	0.05	1185.5	0.22	7727	0.26
1980	7532	6728	2886	160.1	0.04	375.1	0.09	279.9	0.06	811.9	0.19	6494	0.20
1981	6870	6146	2380	152.2	0.04	252.3	0.07	197.1	0.05	622.8	0.17	5758	0.17
1982	6667	6036	2214	46.2	0.01	286.2	0.08	214.1	0.06	1085.8	0.30	5458	0.15
1983	6075	5501	1943	129.4	0.04	443.9	0.15	546.7	0.18	664.4	0.22	5112	0.14
1984	5335	4778	1632	117.2	0.05	390.2	0.15	297.0	0.12	418.5	0.16	5378	0.11
1985	5174	4521	1570	206.0	0.08	188.3	0.07	222.4	0.09	249.3	0.10	9641	0.11
1986	5230	4528	1639	141.8	0.05	210.4	0.08	306.1	0.12	278.9	0.11	7391	0.11
1987	5270	4462	1634	260.7	0.10	319.3	0.14	550.6	0.21	293.4	0.13	4045	0.11
1988	5034	4373	1349	171.0	0.08	303.6	0.15	481.7	0.22	356.3	0.18	6091	0.09
1989	4901	4337	1204	172.0	0.09	250.2	0.13	435.7	0.23	384.0	0.20	7948	0.08
1990	4734	4077	1253	227.3	0.12	191.3	0.10	380.1	0.19	293.2	0.15	5524	0.09
1991	4773	4041	1334	159.0	0.08	138.3	0.07	538.5	0.26	288.6	0.15	6409	0.09
1992	4753	4140	1267	136.5	0.07	133.3	0.07	453.2	0.22	253.5	0.13	6310	0.09
1993	4861	4201	1298	142.7	0.07	102.0	0.05	457.9	0.22	293.5	0.14	6295	0.09
1994	5066	4300	1386	150.1	0.07	113.3	0.05	310.1	0.14	203.8	0.09	10682	0.10
1995	5505	4584	1554	145.8	0.06	155.7	0.06	377.0	0.16	309.1	0.13	13041	0.11
1996	5823	4660	1601	127.2	0.05	172.9	0.07	423.0	0.17	276.5	0.11	10832	0.11
1997	6405	5153	1639	141.3	0.06	190.0	0.07	396.1	0.15	215.4	0.08	10966	0.11
1998	7230	6086	1778	123.3	0.04	240.7	0.08	372.2	0.13	357.1	0.12	11502	0.12
1999	8311	6843	2062	63.9	0.02	226.4	0.06	332.1	0.10	301.2	0.08	23398	0.14
2000	9251	7782	2602	95.7	0.02	324.9	0.08	438.9	0.11	280.3	0.07	12239	0.18
2001	10392	8545	3038	124.5	0.03	226.4	0.05	507.8	0.11	408.8	0.08	10227	0.21
2002	11554	10347	3383	133.0	0.03	326.8	0.06	464.8	0.09	430.3	0.08	11522	0.24
2003	12568	11343	3863	148.7	0.03	367.8	0.06	335.6	0.06	521.7	0.08	15546	0.27
2004	13194	11959	4631	309.5	0.04	305.8	0.04	711.9	0.10	511.5	0.07	9661	0.32
2005	13411	12032	4960	--	--	--	--	--	--	--	--	11401	0.34

Table 15. Summary of the parameters in the base-model for the Southern assessment area.

Parameter	Fixed	Estimate	Initial Value
Females			
Natural Mortality	0.20		
Length @ Youngest Age		12.45	19.60
Length @ Oldest Age		52.30	52.70
K		0.28	0.16
CV @ Youngest Age		0.10	0.08
CV @ Oldest Age	0.00		
Males (as exponential offset from females)			
Natural Mortality	0.00		
Length @ Youngest Age		0.07	0.00
Length @ Oldest Age		-0.13	-0.29
K		0.05	0.55
CV @ Youngest Age		-0.17	0.00
CV @ Oldest Age	0.00		
Biological Data			
Weight at Length Intercept	0.00		
Weight at Length Slope	3.35		
Females			
Maturity at Length Intercept	33.10		
Maturity at Length Slope	-0.73		
Males (as exponential offset from females)			
Maturity at Length Intercept	0.00		
Maturity at Length Slope	3.13		
SR_parms			
Initial Recruitment		9.60	11.00
Steepness		0.72	0.80
Recruitment Variability	0.46		
Initial Fishery F			
Winter	0.00		
Summer	0.00		
Survey Catchability		-0.35	-0.45

Parameter	Fixed	Estimate	Initial Value
Selectivity			
Winter Fishery Females (logistic)			
Intercept		29.61	34.00
Slope		3.08	5.00
Winter Fishery Males (double logistic, parameters 2-4 as exponential offset from females)			
Parameter 1		34.33	34.00
Parameter 2		1.07	0.00
Parameter 3		0.48	0.00
Parameter 4		-10.00	-3.00
Summer Fishery Females (double logistic)			
Parameter 1	34.00		
Parameter 2	0.00		
Parameter 3		1.57	1.00
Parameter 4		0.47	0.30
Parameter 5		-0.22	-1.50
Parameter 6		-1.51	-1.50
Parameter 7	0.00		
Parameter 8	3.00		
Summer Fishery Males (double logistic, parameters 2-4 as exponetial offset from females)			
Parameter 1		31.45	32.00
Parameter 2		-3.06	0.00
Parameter 3		0.74	0.00
Parameter 4		-5.21	-3.00
Survey Females (double logistic)			
Parameter 1	34.00		
Parameter 2		0.00	0.01
Parameter 3		1.33	1.70
Parameter 4		0.01	0.40
Parameter 5		-0.08	1.00
Parameter 6		0.18	-2.00
Parameter 7		4.00	3.65
Parameter 8	3.00		
Survey Males (double logistic, parameters 2-4 as exponetial offset from females)			
Parameter 1		34.60	30.00
Parameter 2		0.98	0.00
Parameter 3		0.10	0.00
Parameter 4		-11.21	-9.00

Table 16. Estimates of some key model outputs for the Southern assessment area.

Parameter	Estimate	
ln(R0)	9.6044	
Q Winter CPUE	0.0160	
Q Summer CPUE	0.0167	
Q Survey	0.7061	
Steepness (h)	0.7194	
Growth	Female	Male
Length at min. age	12.4494	13.3105
Length at max. age	52.3001	45.9208
K	0.2822	0.2957
Length at age CV	0.1028	0.0870

Table 17. Base model estimates of population statistics for the Southern assessment area.

Fishing Year	Total Biomass (mt)	Biomass Age3+ (mt)	Spawning Biomass (mt)	Winter Catch (mt)	Winter Harvest Rate	Summer Catch (mt)	Summer Harvest Rate	Recruits Age0	Depletion
1874	29868	28920	15985	--	--	--	--	14829	1.00
1875	29868	28920	15985	--	--	--	--	14829	1.00
1876	29868	28920	15985	0	0.000	1.0	0.000	14829	1.00
1877	29867	28919	15984	0	0.000	1.0	0.000	14829	1.00
1878	29866	28918	15983	0	0.000	1.0	0.000	14829	1.00
1879	29865	28917	15983	0	0.000	1.0	0.000	14829	1.00
1880	29865	28916	15982	0	0.000	1.0	0.000	14829	1.00
1881	29864	28915	15981	0	0.000	1.2	0.000	14829	1.00
1882	29863	28914	15981	0	0.000	1.4	0.000	14829	1.00
1883	29862	28913	15980	0	0.000	1.6	0.000	14829	1.00
1884	29861	28912	15979	0	0.000	2.0	0.000	14829	1.00
1885	29860	28911	15979	0	0.000	2.4	0.000	14829	1.00
1886	29858	28909	15977	0	0.000	2.8	0.000	14829	1.00
1887	29856	28907	15976	0	0.000	3.3	0.000	14829	1.00
1888	29854	28905	15975	0	0.000	3.9	0.000	14829	1.00
1889	29851	28902	15973	0	0.000	4.5	0.000	14828	1.00
1890	29848	28899	15971	0	0.000	5.3	0.001	14828	1.00
1891	29844	28896	15968	0	0.000	6.4	0.001	14828	1.00
1892	29840	28891	15965	0	0.000	7.5	0.001	14828	1.00
1893	29835	28886	15962	0	0.000	8.8	0.001	14827	1.00
1894	29829	28880	15957	0	0.000	10.4	0.001	14827	1.00
1895	29822	28873	15953	0	0.000	12.3	0.001	14827	1.00
1896	29813	28865	15947	0	0.000	14.5	0.001	14826	1.00
1897	29803	28855	15940	0	0.000	17.1	0.002	14825	1.00
1898	29792	28843	15932	0	0.000	20.2	0.002	14825	1.00
1899	29778	28829	15922	0	0.000	23.8	0.002	14824	1.00
1900	29762	28813	15911	0	0.000	28.1	0.003	14823	1.00
1901	29742	28794	15898	0	0.000	33.1	0.003	14822	0.99
1902	29720	28771	15882	0	0.000	39.1	0.004	14820	0.99
1903	29693	28745	15864	0	0.000	46.1	0.005	14818	0.99
1904	29661	28713	15842	0	0.000	54.4	0.005	14816	0.99
1905	29624	28676	15817	0	0.000	64.2	0.006	14814	0.99
1906	29580	28632	15787	0	0.000	75.8	0.008	14811	0.99
1907	29528	28581	15751	0	0.000	89.4	0.009	14808	0.99
1908	29467	28520	15709	0	0.000	105.4	0.011	14804	0.98
1909	29395	28448	15659	0	0.000	124.3	0.012	14799	0.98
1910	29310	28363	15601	0	0.000	146.8	0.015	14794	0.98
1911	29209	28262	15532	0	0.000	173.1	0.017	14787	0.97
1912	29090	28144	15450	0	0.000	204.3	0.021	14780	0.97
1913	28950	28004	15354	0	0.000	241.1	0.024	14770	0.96
1914	28784	27839	15241	0	0.000	284.4	0.029	14759	0.95
1915	28589	27644	15107	0	0.000	335.7	0.034	14746	0.95
1916	28358	27414	14950	0	0.000	396.1	0.041	14730	0.94
1917	28085	27142	14764	0	0.000	539.6	0.056	14711	0.92
1918	27687	26746	14493	0	0.000	434.4	0.046	14682	0.91
1919	27431	26492	14319	0	0.000	341.7	0.037	14663	0.90
1920	27305	26366	14233	0	0.000	236.3	0.025	14654	0.89
1921	27314	26376	14242	0	0.000	301.2	0.032	14655	0.89
1922	27269	26332	14218	0	0.000	435.4	0.047	14652	0.89
1923	27092	26155	14104	0	0.000	438.1	0.047	14639	0.88
1924	26922	25986	13992	0	0.000	546.2	0.059	14626	0.88
1925	26652	25717	13811	0	0.000	541.7	0.059	14605	0.86
1926	26406	25472	13646	0	0.000	534.7	0.059	14586	0.85
1927	26191	25258	13502	0	0.000	647.8	0.072	14568	0.84
1928	25881	24950	13296	0	0.000	635.6	0.072	14543	0.83
1929	25611	24681	13116	0	0.000	723.7	0.082	14520	0.82
1930	25276	24348	12895	0	0.000	675.3	0.078	14491	0.81
1931	25022	24095	12727	0	0.000	639.5	0.074	14468	0.80
1932	24835	23909	12606	0	0.000	570.6	0.067	14452	0.79
1933	24745	23820	12551	0	0.000	443.3	0.052	14444	0.79
1934	24807	23882	12598	0	0.000	1142.4	0.133	14451	0.79
1935	24144	23221	12168	0	0.000	924.5	0.111	14389	0.76
1936	23731	22811	11894	0	0.000	523.8	0.064	14348	0.74
1937	23774	22855	11922	0	0.000	838.1	0.102	14353	0.75
1938	23514	22597	11758	0	0.000	942.1	0.115	14327	0.74
1939	23166	22250	11534	0	0.000	1189.5	0.148	14292	0.72

Table 17 Continued.

Fishing Year	Total Biomass (mt)	Biomass Age3+ (mt)	Spawning Biomass (mt)	Winter Catch (mt)	Winter Harvest Rate	Summer Catch (mt)	Summer Harvest Rate	Recruits Age0	Depletion
1940	22580	21667	11155	0.0	0.000	732.5	0.094	14229	0.70
1941	22508	21597	11108	0.0	0.000	415.4	0.053	14221	0.69
1942	22801	21890	11306	0.0	0.000	284.3	0.036	14254	0.71
1943	23244	22331	11609	0.0	0.000	427.2	0.052	14304	0.73
1944	23521	22606	11807	0.0	0.000	522.6	0.063	14335	0.74
1945	23667	22750	11916	0.0	0.000	573.2	0.069	14352	0.75
1946	23731	22813	11964	0.0	0.000	1239.6	0.150	14359	0.75
1947	23077	22160	11533	0.0	0.000	1370.2	0.171	14292	0.72
1948	22295	21381	11007	0.0	0.000	2366.3	0.307	14203	0.69
1949	20510	19606	9828	0.0	0.000	2302.5	0.328	13976	0.61
1950	18882	17990	8755	0.0	0.000	2030.2	0.313	13725	0.55
1951	17662	16786	7969	0.0	0.000	1267.5	0.207	13505	0.50
1952	17370	16504	7791	0.0	0.000	1345.3	0.219	13450	0.49
1953	17096	16235	7656	0.0	0.000	1557.6	0.255	13408	0.48
1954	16645	15789	7424	0.0	0.000	1939.6	0.325	13331	0.46
1955	15807	14957	6952	0.0	0.000	1682.9	0.298	13162	0.43
1956	15267	14413	6641	0.0	0.000	1208.0	0.220	13510	0.42
1957	15229	14403	6655	615.6	0.104	1184.1	0.226	12263	0.42
1958	14606	13827	6287	670.2	0.118	1048.1	0.209	11213	0.39
1959	14103	13374	5995	455.2	0.083	804.0	0.162	10954	0.38
1960	14301	13429	6036	601.5	0.108	765.1	0.154	17424	0.38
1961	14523	13350	6037	633.6	0.114	1182.5	0.238	24011	0.38
1962	13718	12711	5749	611.7	0.116	1022.2	0.219	7855	0.36
1963	13144	12267	5484	655.7	0.132	1158.2	0.265	11574	0.34
1964	12687	11998	5037	465.4	0.101	1144.3	0.264	12087	0.32
1965	13133	12324	4897	467.8	0.097	1054.8	0.215	13809	0.31
1966	13751	12670	5327	406.5	0.072	1152.1	0.212	22637	0.33
1967	13583	12686	5779	662.3	0.120	1084.6	0.222	7120	0.36
1968	12981	12297	5566	459.4	0.090	1125.0	0.244	5610	0.35
1969	12664	12228	5354	524.4	0.107	1195.3	0.266	7595	0.33
1970	12907	12251	5107	601.8	0.124	1454.7	0.310	15539	0.32
1971	12431	11726	5002	680.4	0.132	1347.4	0.282	9625	0.31
1972	11346	10730	4950	989.5	0.211	1246.8	0.328	5640	0.31
1973	9823	9256	4126	519.3	0.144	945.2	0.306	11000	0.26
1974	9286	8758	3560	823.3	0.258	1099.9	0.387	7742	0.22
1975	8500	7916	2970	687.5	0.222	1074.1	0.367	9045	0.19
1976	7716	7168	2787	865.0	0.297	816.8	0.331	8702	0.17
1977	6913	6441	2422	629.8	0.262	581.7	0.266	5190	0.15
1978	6581	6233	2275	853.8	0.352	1155.3	0.537	3473	0.14
1979	5526	5247	1796	733.3	0.375	984.4	0.559	4530	0.11
1980	4806	4503	1427	636.6	0.381	766.8	0.483	5773	0.09
1981	4258	3936	1285	293.2	0.187	597.2	0.374	4760	0.08
1982	4176	3703	1370	275.8	0.180	564.6	0.392	10627	0.09
1983	3972	3426	1302	358.6	0.270	462.6	0.390	9366	0.08
1984	3726	3178	1130	346.7	0.293	357.7	0.321	6517	0.07
1985	3612	3187	1075	335.9	0.277	493.5	0.425	4945	0.07
1986	3631	3329	1012	461.8	0.394	373.2	0.313	3329	0.06
1987	3892	3662	1076	402.1	0.274	581.4	0.361	2906	0.07
1988	4115	3835	1319	482.1	0.279	432.0	0.254	6259	0.08
1989	4195	3857	1530	522.7	0.293	431.6	0.269	6101	0.10
1990	4036	3582	1536	391.2	0.240	401.8	0.280	8476	0.10
1991	3824	3323	1452	590.6	0.416	327.2	0.301	8432	0.09
1992	3427	2963	1133	358.3	0.324	327.8	0.326	5438	0.07
1993	3436	3012	1013	359.2	0.313	271.4	0.241	6361	0.06
1994	3732	3336	1086	333.5	0.255	374.3	0.275	6524	0.07
1995	4089	3708	1252	336.2	0.214	325.4	0.197	5219	0.08
1996	4443	4103	1564	478.3	0.254	435.8	0.245	4595	0.10
1997	4530	4159	1695	568.4	0.308	515.5	0.316	7175	0.11
1998	4466	3951	1579	277.8	0.165	341.2	0.206	11092	0.10
1999	5176	4142	1723	382.2	0.209	298.1	0.176	26311	0.11
2000	5403	4223	1809	478.2	0.259	257.9	0.161	16945	0.11
2001	5511	4343	1775	390.1	0.222	283.5	0.175	13956	0.11
2002	5824	5046	1795	425.0	0.226	219.3	0.116	7512	0.11
2003	7216	6613	2048	301.6	0.124	162.8	0.055	7952	0.13
2004	9408	8872	3056	231.3	0.057	282.8	0.061	9315	0.19
2005	11634	11024	4667	--	--	--	--	10790	0.29

Table 18. Sensitivity runs requested by the September 2005 STAR Panel.

	April Base Case w/ 1) new q prior and 2) higher recruit dev phase	Sept. Base Case (recruit devs est. 1956-2004)	Recruit Devs 1956-1998	No Survey Lengths	No Survey Data
LIKELIHOOD	499.43	500.00	514.40	444.52	485.65
indices	26.06	24.77	29.88	14.19	14.23
length_comps	317.45	318.82	329.26	274.11	319.78
age_comps	132.39	134.13	137.91	136.18	132.05
Recruitment	21.10	20.50	15.56	17.46	17.10
Parm_priors	2.43	1.78	1.80	2.59	2.49
Surv_like					
winter	11.09	10.26	10.73	8.15	10.61
summer	4.37	4.48	4.94	2.51	3.62
survey	10.60	10.03	14.21	3.52	0.00
Length_like					
winter	110.22	112.46	114.00	115.64	110.37
summer	165.32	162.85	170.00	158.47	167.86
survey	41.92	43.50	45.26	0.00	41.55
Age_like					
winter	59.56	61.00	65.36	64.52	59.30
summer	72.83	73.13	72.54	71.67	72.74
survey	0.00	0.00	0.00	0.00	0.00
Productivity					
Bo	34323.10	29868.40	23627.50	24576.50	32120.10
Sbo	18318.60	15984.60	13010.00	13437.30	16959.10
Ro	15789.80	14829.40	12108.10	12448.30	16679.20
h	0.65	0.72	0.76	0.75	0.63
2005 Depletion	0.35	0.29	0.19	0.24	0.25

Table 19. Management report for the base models.

Quantity	Northern area		Southern area
Unfished Recruitment	12174		14829
Unfished spawning biomass	14382		15985
Unfished age 3+ biomass	25165		28920
MSY-related quantities			
SPR at MSY	0.214		0.330
MSY Exploitation rate	0.227		0.144
Spawning biomass	2658		4121
SB_{MSY}/SB_0	0.185		0.258
MSY	1760		1404
MSY-proxy control rule			
SPR	0.400		0.400
Exploitation rate	0.124		0.113
Spawning biomass	5753		6394
Depletion			
2004	0.322		0.191
2005	0.345		0.292
Harvest rates by fishery			
WA-Winter	0.0326	Winter	0.0217
WA-Summer	0.0311	Summer	0.0145
OR-Winter	0.0749		
OR-Summer	0.0520		

Table 20A. Decision table for the Northern assessment area.

Management Action	Year	40:10 adj. Catch	Low Spawning Biomass Model (Base Model 2004 SB-1.25*SD) SB	Depletion	Base Model (Base Model 2004 SB) SB	Depletion	High Spawning Biomass Model (Base Model 2004 SB+1.25*SD) SB	Depletion
Low catch	2005	2,095	4,038	28%	4,960	34%	5,915	41%
(from Low Spawning	2006	2,095	3,742	26%	4,859	34%	6,035	42%
Biomass Model)	2007	818	3,454	24%	4,716	33%	6,054	42%
	2008	1,001	3,977	28%	5,340	37%	6,780	47%
	2009	1,128	4,344	30%	5,735	40%	7,193	50%
	2010	1,207	4,569	32%	5,937	41%	7,356	51%
	2011	1,267	4,744	33%	6,071	42%	7,424	51%
	2012	1,316	4,888	34%	6,167	43%	7,445	51%
	2013	1,356	5,004	35%	6,230	43%	7,428	51%
	2014	1,388	5,099	36%	6,268	44%	7,383	51%
	2015	1,415	5,174	36%	6,285	44%	7,321	51%
	2016	1,436	5,233	37%	6,286	44%	7,246	50%
Medium catch	2005	2,095	4,038	28%	4,960	34%	5,915	41%
(from Base Model)	2006	2,095	3,742	26%	4,859	34%	6,035	42%
	2007	1,289	3,454	24%	4,716	33%	6,054	42%
	2008	1,405	3,721	26%	5,077	35%	6,512	45%
	2009	1,457	3,867	27%	5,245	36%	6,694	46%
	2010	1,466	3,922	27%	5,276	37%	6,685	46%
	2011	1,469	3,985	28%	5,299	37%	6,643	46%
	2012	1,477	4,062	28%	5,332	37%	6,603	46%
	2013	1,487	4,141	29%	5,366	37%	6,561	45%
	2014	1,497	4,216	29%	5,396	38%	6,516	45%
	2015	1,505	4,285	30%	5,421	38%	6,469	45%
	2016	1,511	4,347	30%	5,440	38%	6,421	44%
High catch	2005	2,095	4,038	28%	4,960	34%	5,915	41%
(from High Spawning	2006	2,095	3,742	26%	4,859	34%	6,035	42%
Biomass Model)	2007	1,754	3,454	24%	4,716	33%	6,054	42%
	2008	1,788	3,470	24%	4,818	34%	6,248	43%
	2009	1,769	3,411	24%	4,776	33%	6,215	43%
	2010	1,720	3,313	23%	4,650	32%	6,047	42%
	2011	1,675	3,270	23%	4,565	32%	5,897	41%
	2012	1,642	3,278	23%	4,533	32%	5,794	40%
	2013	1,614	3,313	23%	4,532	32%	5,722	40%
	2014	1,596	3,362	23%	4,551	32%	5,675	39%
	2015	1,584	3,418	24%	4,581	32%	5,643	39%
	2016	1,575	3,475	24%	4,614	32%	5,621	39%

Table 20B. Decision table for the Southern assessment area.

SOUTHERN

Management Action	Year	40:10 adj. Catch	Low Spawning Biomass Model (Base Model 2004 SB-1.25*SD) SB	Depletion	Base Model (Base Model 2004 SB) SB	Depletion	High Spawning Biomass Model (Base Model 2004 SB+1.25*SD) SB	Depletion
Low catch	2005	667	3,630	0.217	4,667	0.292	5,735	0.432
(from Low Spawning	2006	667	4,431	0.265	5,998	0.375	7,863	0.593
Biomass Model)	2007	1,628	4,960	0.296	6,838	0.428	9,070	0.684
	2008	1,444	4,897	0.292	6,870	0.430	9,190	0.693
	2009	1,301	4,730	0.282	6,691	0.419	8,931	0.673
	2010	1,237	4,620	0.276	6,526	0.408	8,595	0.648
	2011	1,241	4,640	0.277	6,476	0.405	8,320	0.627
	2012	1,275	4,779	0.285	6,543	0.409	8,133	0.613
	2013	1,307	4,955	0.296	6,654	0.416	7,988	0.602
	2014	1,327	5,111	0.305	6,757	0.423	7,859	0.592
	2015	1,337	5,229	0.312	6,835	0.428	7,734	0.583
	2016	1,340	5,311	0.317	6,886	0.431	7,612	0.574
Medium catch	2005	667	3,630	0.217	4,667	0.292	5,735	0.432
(from Base Model)	2006	667	4,431	0.265	5,998	0.375	7,863	0.593
	2007	1,628	4,960	0.296	6,838	0.428	9,070	0.684
	2008	1,444	4,498	0.269	6,467	0.405	8,826	0.665
	2009	1,301	4,008	0.239	5,959	0.373	8,269	0.623
	2010	1,237	3,677	0.220	5,569	0.348	7,730	0.583
	2011	1,241	3,557	0.212	5,380	0.337	7,331	0.552
	2012	1,275	3,610	0.216	5,369	0.336	7,078	0.533
	2013	1,307	3,729	0.223	5,436	0.340	6,905	0.520
	2014	1,327	3,827	0.228	5,510	0.345	6,769	0.510
	2015	1,337	3,876	0.231	5,564	0.348	6,651	0.501
	2016	1,340	3,879	0.232	5,592	0.350	6,543	0.493
High catch	2005	667	3,630	0.217	4,667	0.292	5,735	0.432
(from High Spawning	2006	667	4,431	0.265	5,998	0.375	7,863	0.593
Biomass Model)	2007	1,628	4,960	0.296	6,838	0.428	9,070	0.684
	2008	1,444	3,934	0.235	5,893	0.369	8,307	0.626
	2009	1,301	3,036	0.181	4,965	0.311	7,361	0.555
	2010	1,237	2,434	0.145	4,291	0.268	6,556	0.494
	2011	1,241	2,146	0.128	3,927	0.246	5,994	0.452
	2012	1,275	2,097	0.125	3,820	0.239	5,659	0.426
	2013	1,307	2,139	0.128	3,841	0.240	5,461	0.412
	2014	1,327	2,151	0.128	3,889	0.243	5,337	0.402
	2015	1,337	2,085	0.124	3,918	0.245	5,250	0.396
	2016	1,340	1,947	0.116	3,920	0.245	5,185	0.391

Table 20C. The decision table for the coastwide resources of petrale sole.

Management Action	Year	40:10 adj. Catch	Low Spawning Biomass Model (Base Model 2004 SB-1.25*SD) SB	Depletion	Base Model (Base Model 2004 SB) SB	Depletion	High Spawning Biomass Model (Base Model 2004 SB+1.25*SD) SB	Depletion
Low catch	2005	2,762	7,667	25%	9,628	32%	11,650	38%
(Projected from Low	2006	2,762	8,173	27%	10,858	36%	13,898	46%
Spawning Biomass	2007	2,446	8,415	28%	11,554	38%	15,124	50%
Model)	2008	2,445	8,475	28%	12,211	40%	15,970	53%
	2009	2,429	8,352	28%	12,426	41%	16,124	53%
	2010	2,444	8,245	27%	12,463	41%	15,951	53%
	2011	2,508	8,301	27%	12,546	41%	15,744	52%
	2012	2,591	8,499	28%	12,710	42%	15,577	51%
	2013	2,662	8,733	29%	12,884	42%	15,416	51%
	2014	2,716	8,926	29%	13,026	43%	15,243	50%
	2015	2,752	9,050	30%	13,121	43%	15,055	50%
	2016	2,775	9,112	30%	13,172	43%	14,857	49%
Medium catch	2005	2,762	7,667	25%	9,628	32%	11,650	38%
(from Base Model)	2006	2,762	8,173	27%	10,858	36%	13,898	46%
	2007	2,916	8,415	28%	11,554	38%	15,124	50%
	2008	2,849	8,220	27%	11,544	38%	15,338	51%
	2009	2,758	7,875	26%	11,204	37%	14,963	49%
	2010	2,702	7,598	25%	10,846	36%	14,415	47%
	2011	2,710	7,542	25%	10,679	35%	13,974	46%
	2012	2,752	7,673	25%	10,701	35%	13,681	45%
	2013	2,794	7,869	26%	10,802	36%	13,466	44%
	2014	2,824	8,043	26%	10,907	36%	13,286	44%
	2015	2,841	8,161	27%	10,985	36%	13,120	43%
	2016	2,851	8,226	27%	11,031	36%	12,964	43%
High catch	2005	2,762	7,667	25%	9,628	32%	11,650	38%
(Projected from High	2006	2,762	8,173	27%	10,858	36%	13,898	46%
Spawning Biomass	2007	3,382	8,415	28%	11,554	38%	15,124	50%
Model)	2008	3,231	7,404	24%	10,711	35%	15,074	50%
	2009	3,070	6,447	21%	9,741	32%	14,484	48%
	2010	2,957	5,746	19%	8,941	29%	13,777	45%
	2011	2,916	5,415	18%	8,492	28%	13,228	44%
	2012	2,917	5,375	18%	8,353	28%	12,872	42%
	2013	2,921	5,451	18%	8,372	28%	12,627	42%
	2014	2,923	5,514	18%	8,440	28%	12,445	41%
	2015	2,921	5,503	18%	8,499	28%	12,294	40%
	2016	2,915	5,422	18%	8,534	28%	12,164	40%

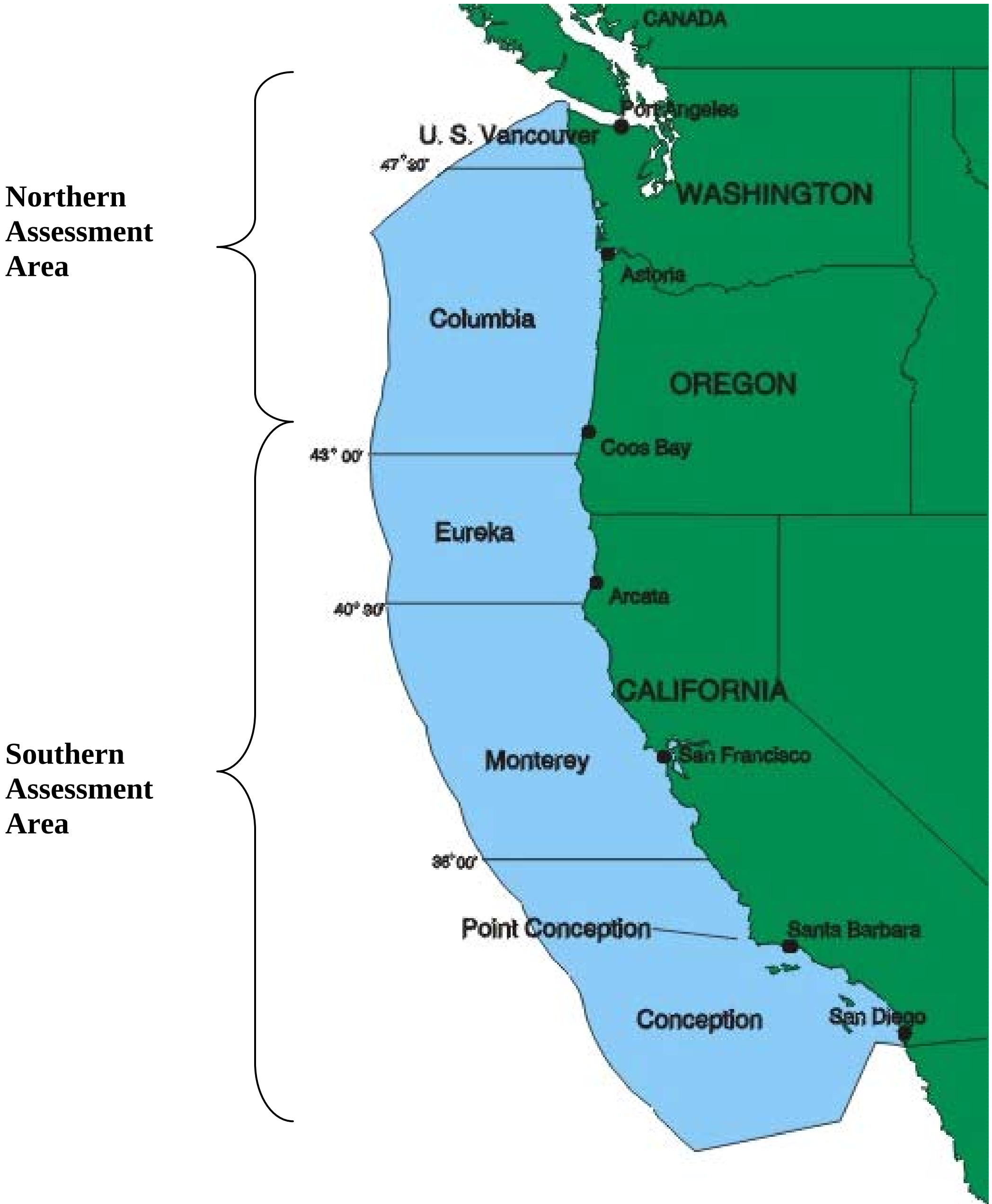


Figure 1. INPFC areas off U.S. Pacific coast. The Northern assessment area for petrale sole includes the U.S. Vancouver and Columbia INPFC areas and the Southern assessment area includes the Eureka, Monterey and Conception INPFC areas.

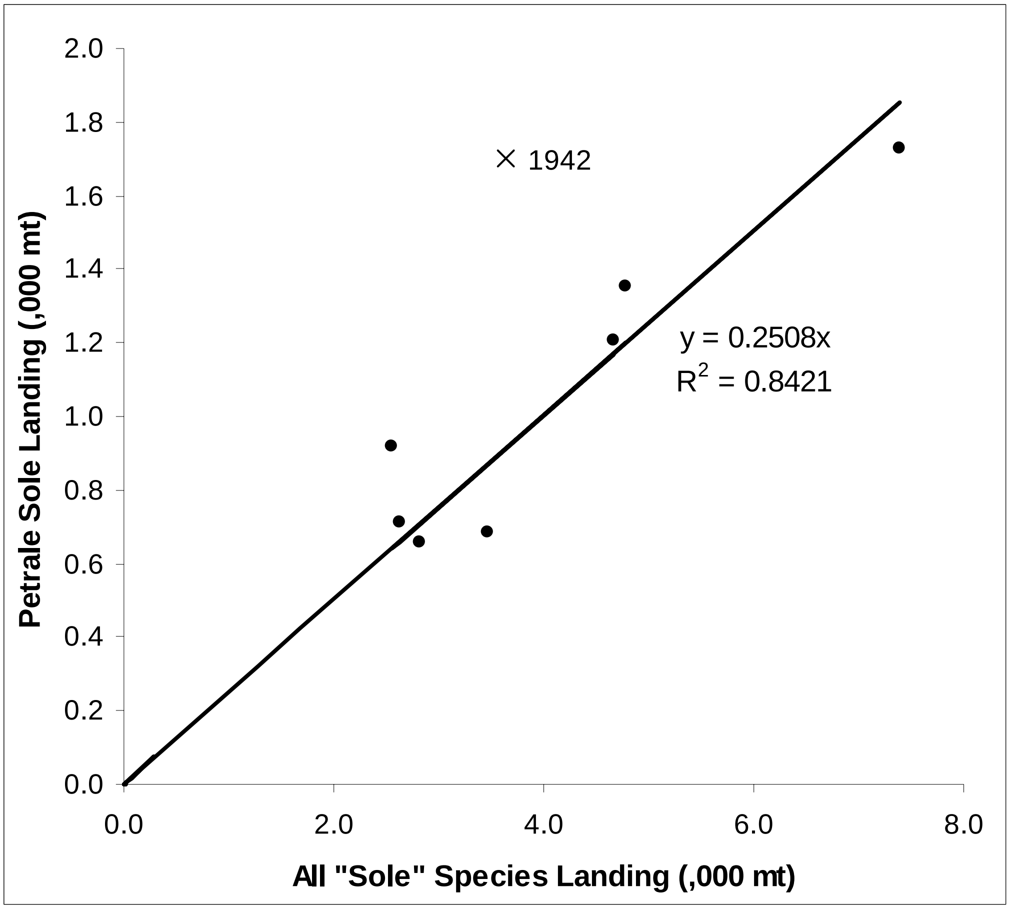


Figure 2A. A linear regression of petrale sole versus all “sole” landings for Oregon, 1942–49 (data from Cleaver (1951)).

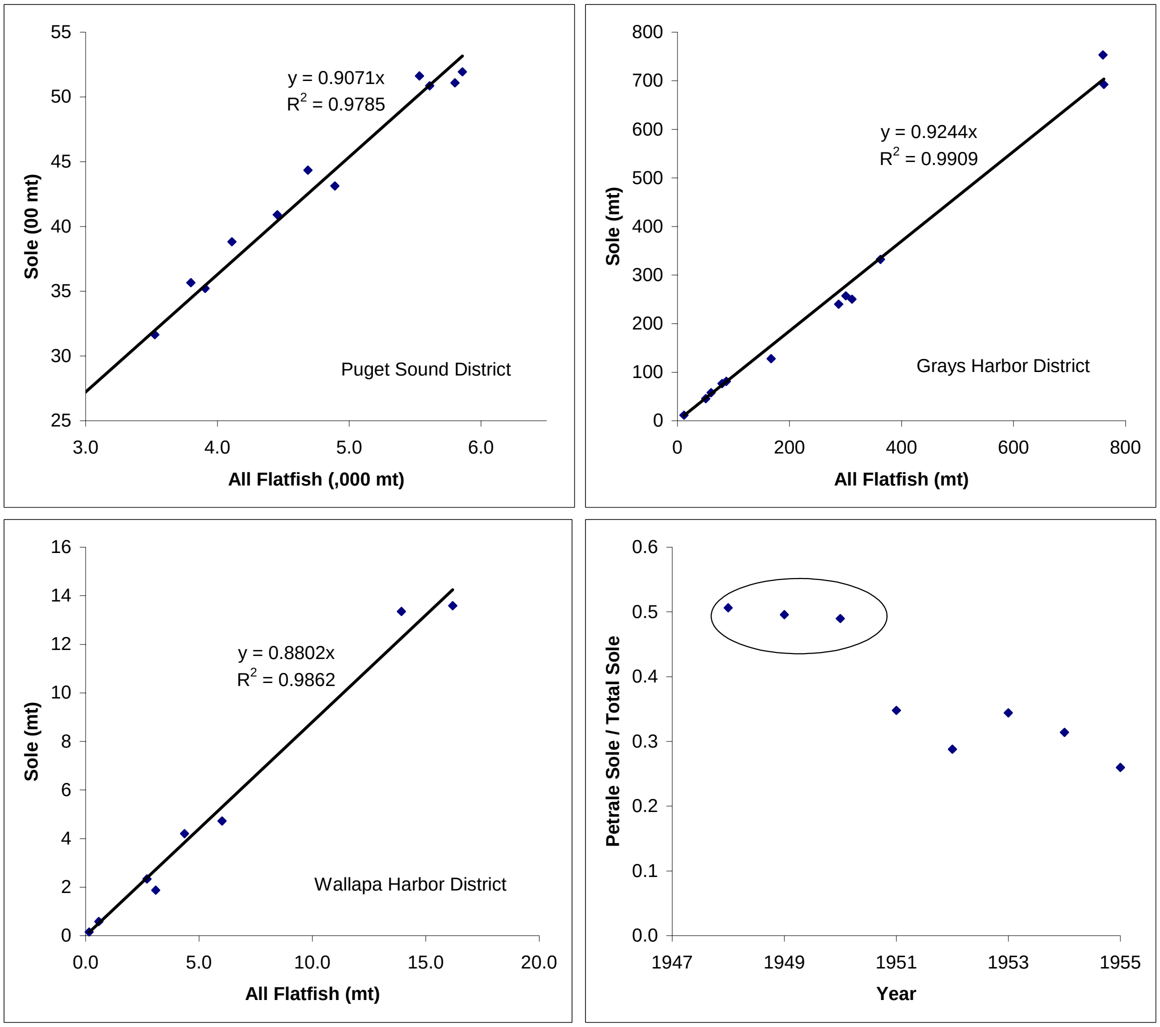


Figure 2B. Linear regressions of sole landings versus landings of all flatfish combined for the three Washington statistical districts during 1944–55 (WDF, 1956), and the ratio of petrale to total sole landings during 1948–55 (Alverson and Chatwin, 1957).

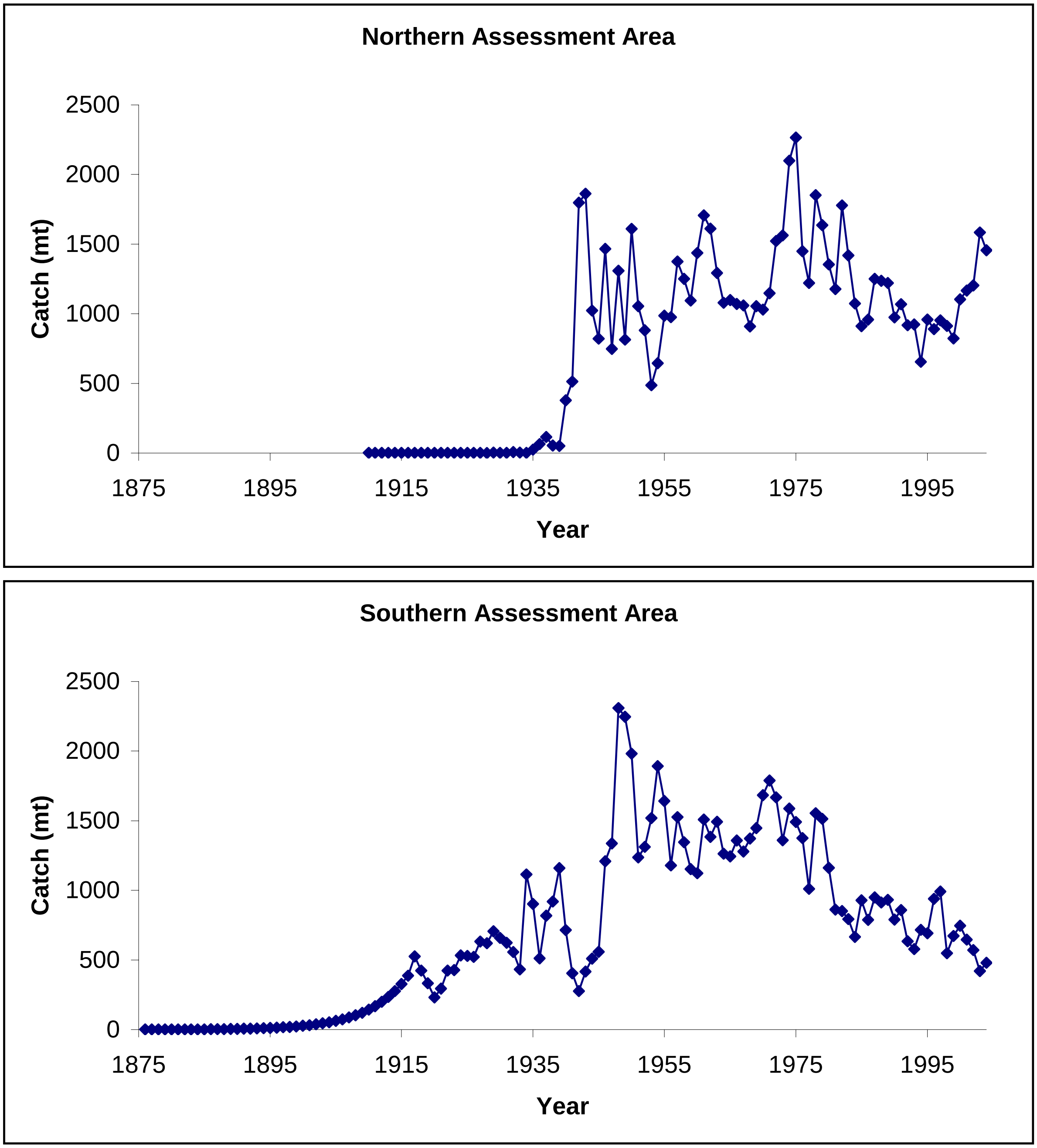


Figure 2C. Annual landings of petrale sole in the Northern and Southern assessment areas.

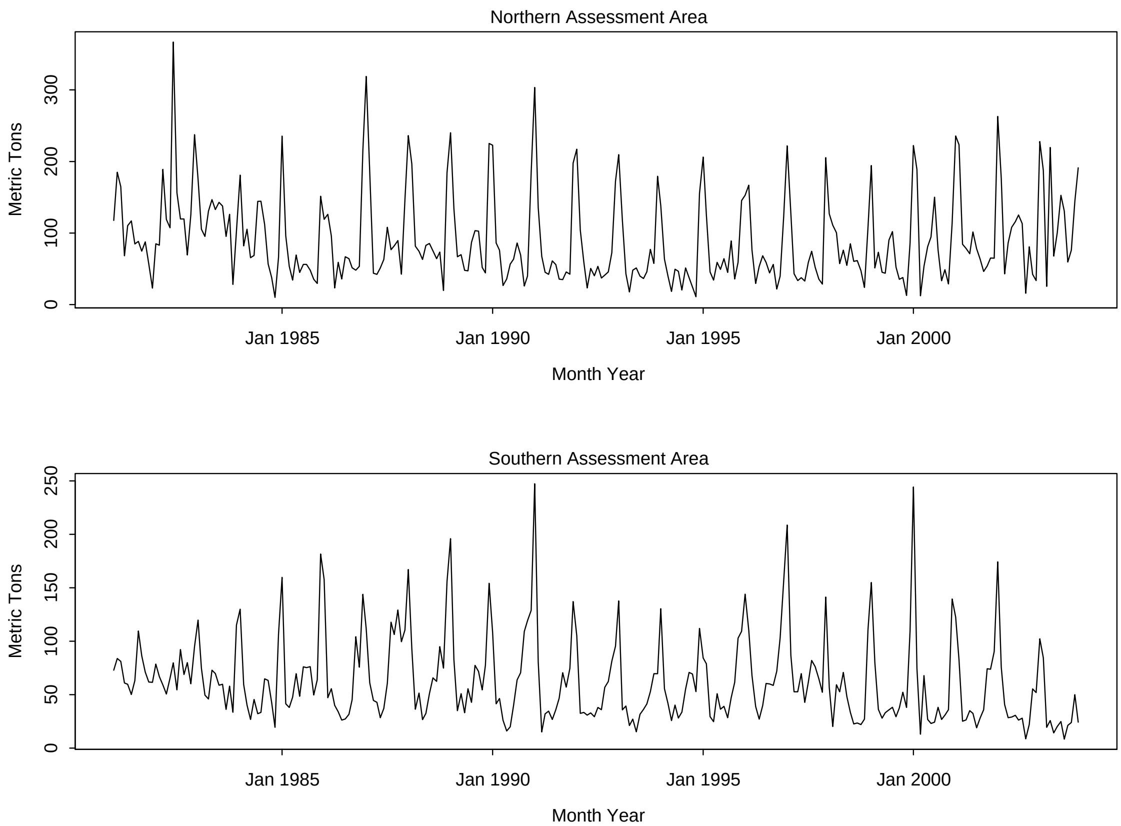


Figure 2D. Monthly landings of petrale sole (Jan. 1981–Dec. 2003) in the Northern (U.S. Vancouver – Columbia) and Southern (conception, Monterey and Eureka) assessment areas.

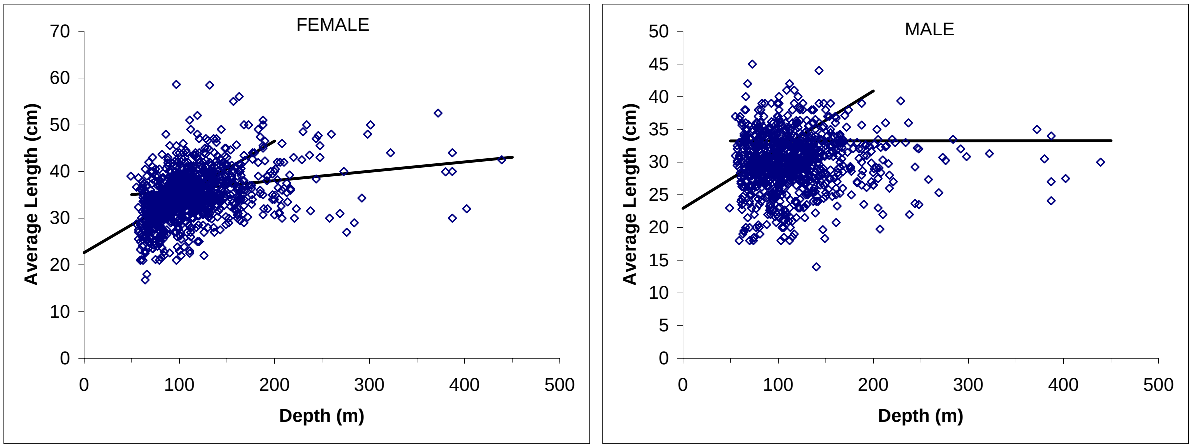


Figure 3. Average length (cm) of petrale sole in a tow versus tow depth (m) based on data from the NMFS triennial trawl survey. Lines indicate the fitted values.

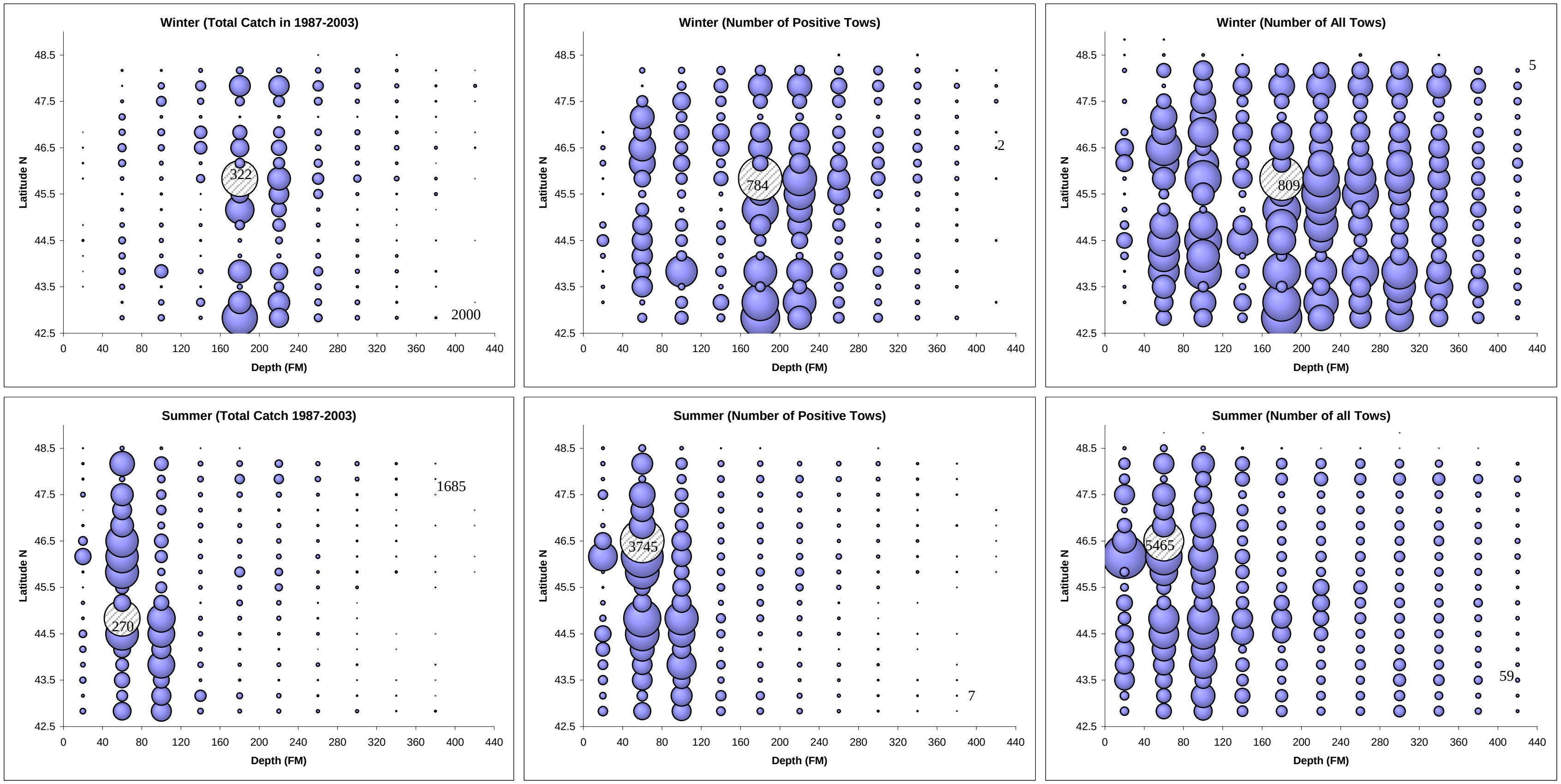


Figure 4A. Spatial distribution (by 20' x 40 fm cell) of the total catch of petrale sole (mt), the number of positive tows for petrale sole, and the total number of tows (including those that caught no petrale catch) for the winter and summer fisheries in the Northern assessment area, 1987–2003. The numbers in figures indicate the size of the associated circles.

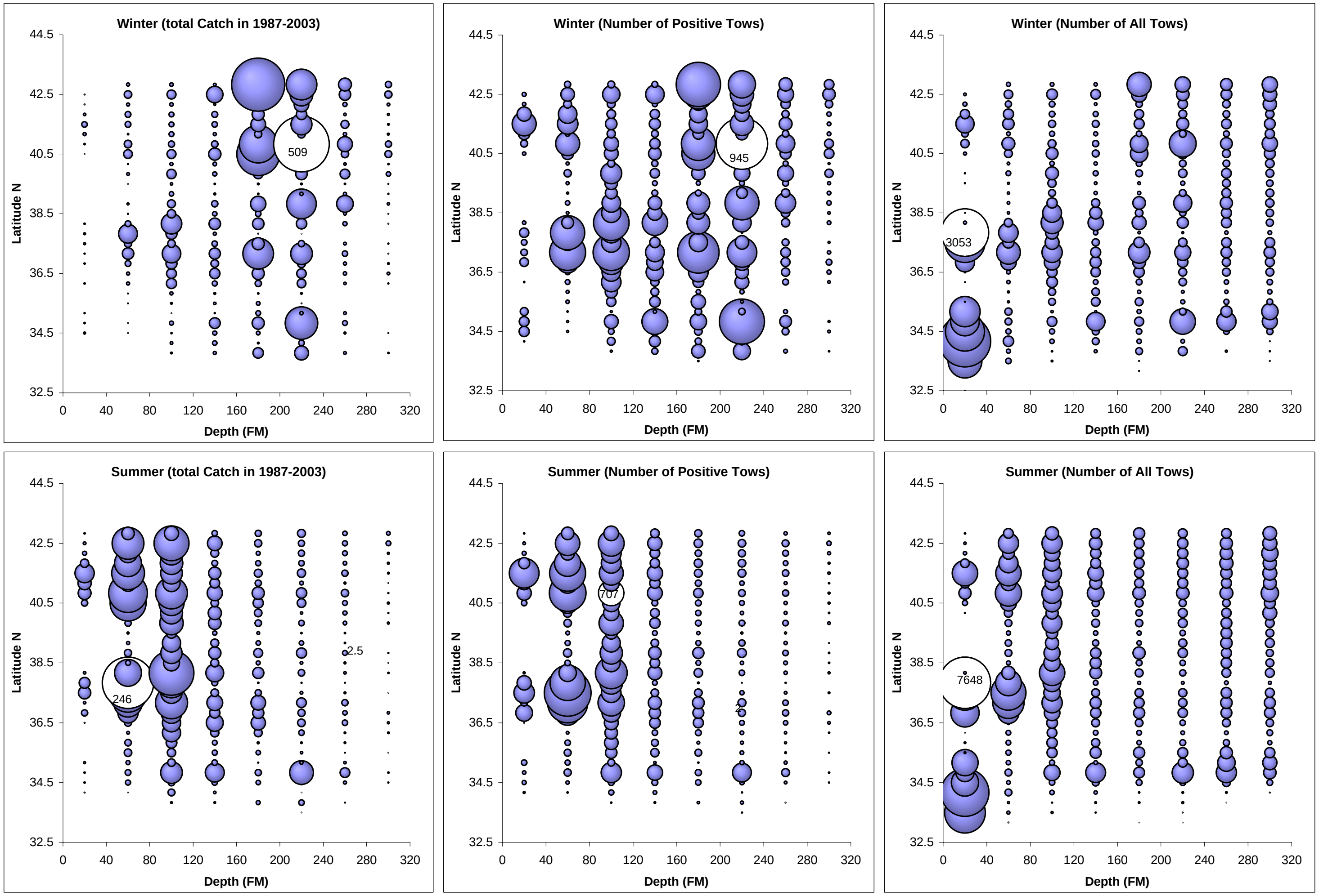


Figure 4B. Spatial distribution (by 20' x 40 fm cell) of the total catch of petrale sole (mt), the number of positive tows for petrale sole, and the total number of tows (including those that caught no petrale catch) for the winter and summer fisheries in the Southern assessment area, 1987–2003. The values indicate the size of the associated circles.

Northern Assessment Area

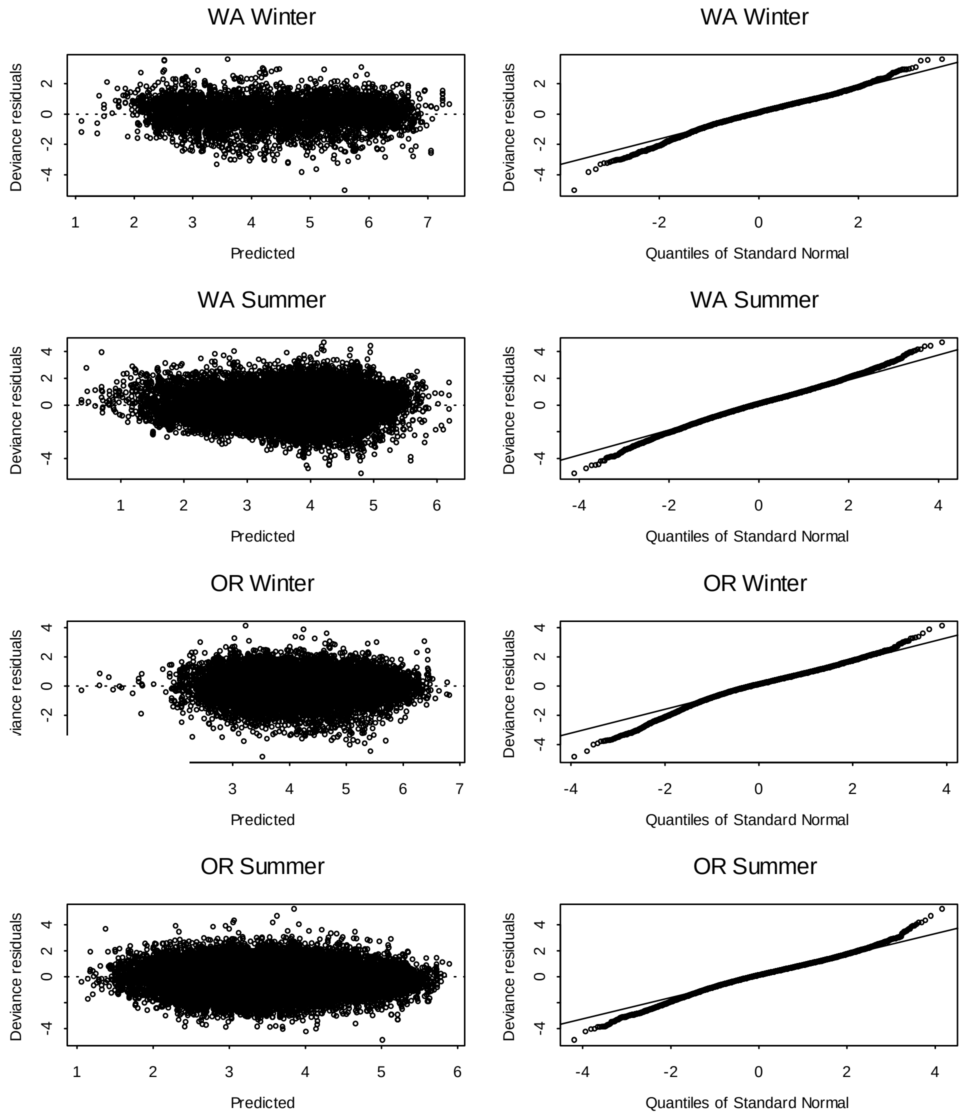


Figure 5A. Quantile-quantile and residual plots for the lognormal GLMs for the Northern and Southern assessment areas.

Lognormal Model Southern Assessment Area

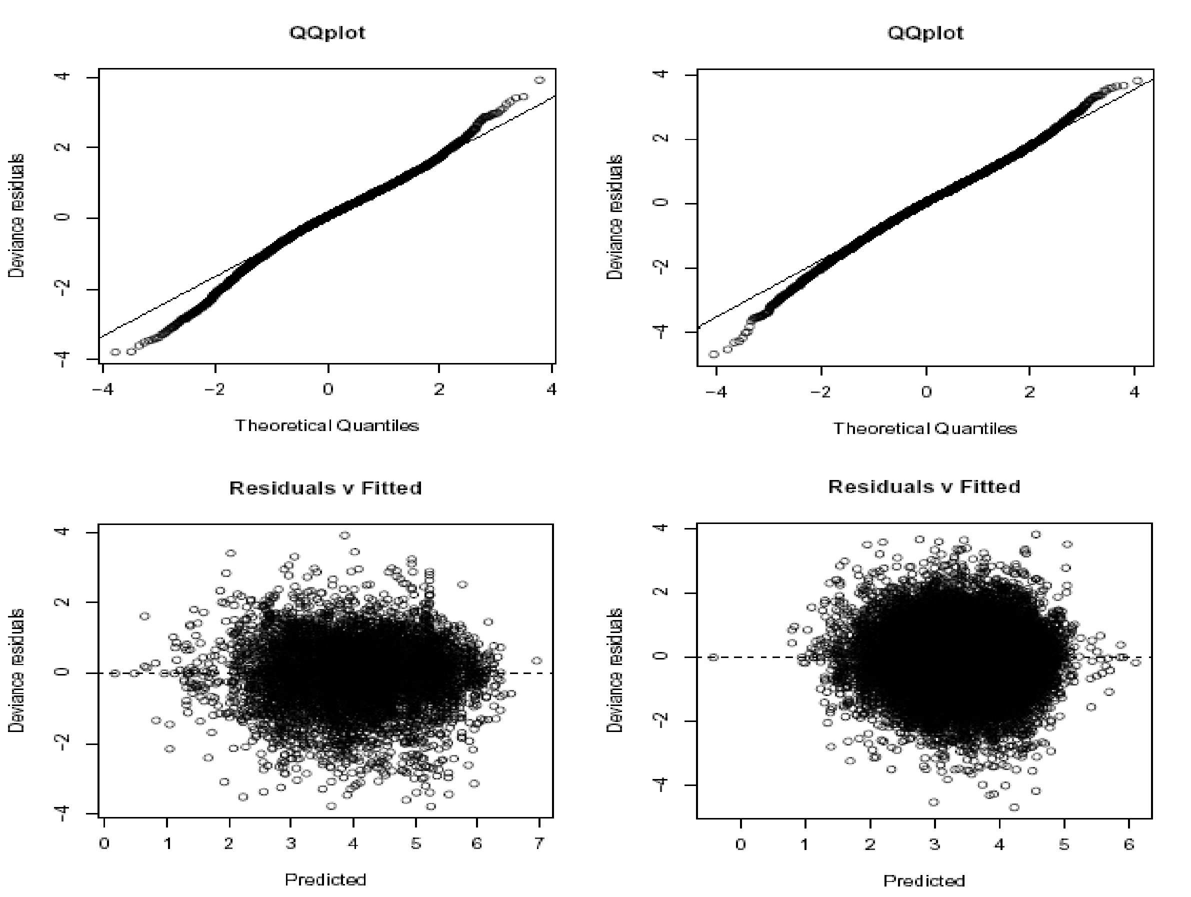
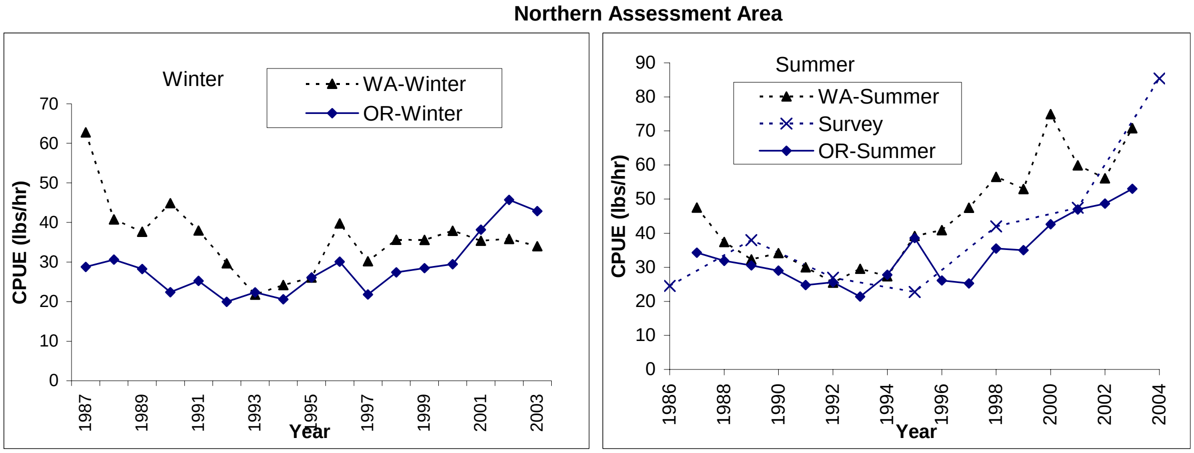


Figure 5A. Continued.



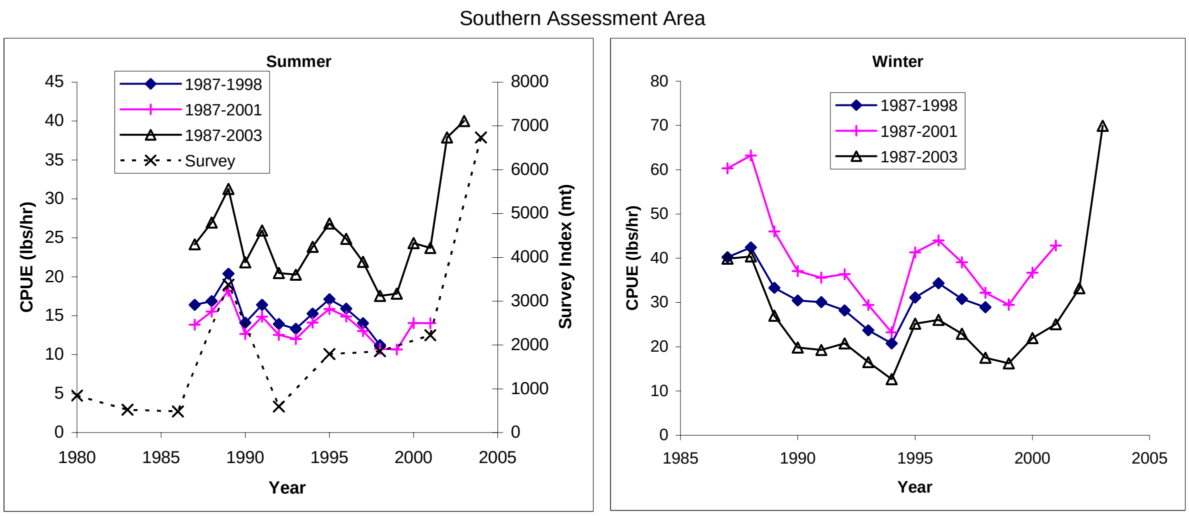


Figure 5B. Trends in standardized CPUE for each assessment area by season for the three time periods. The survey biomass estimates are also shown in the panels for summer season. The lines representing CPUE in each panel are offset due to the varying length of the time series analyzed.

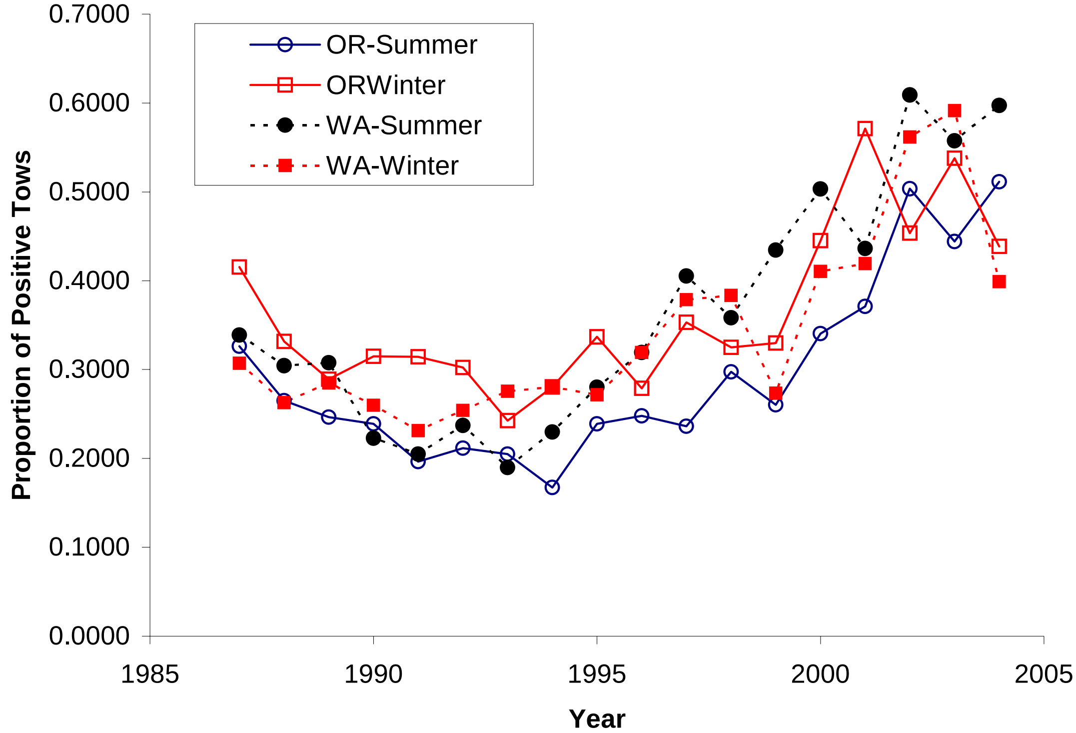


Figure 5C. The empirical proportion of tows, by fishery, that have caught petrale sole in the northern assessment area.

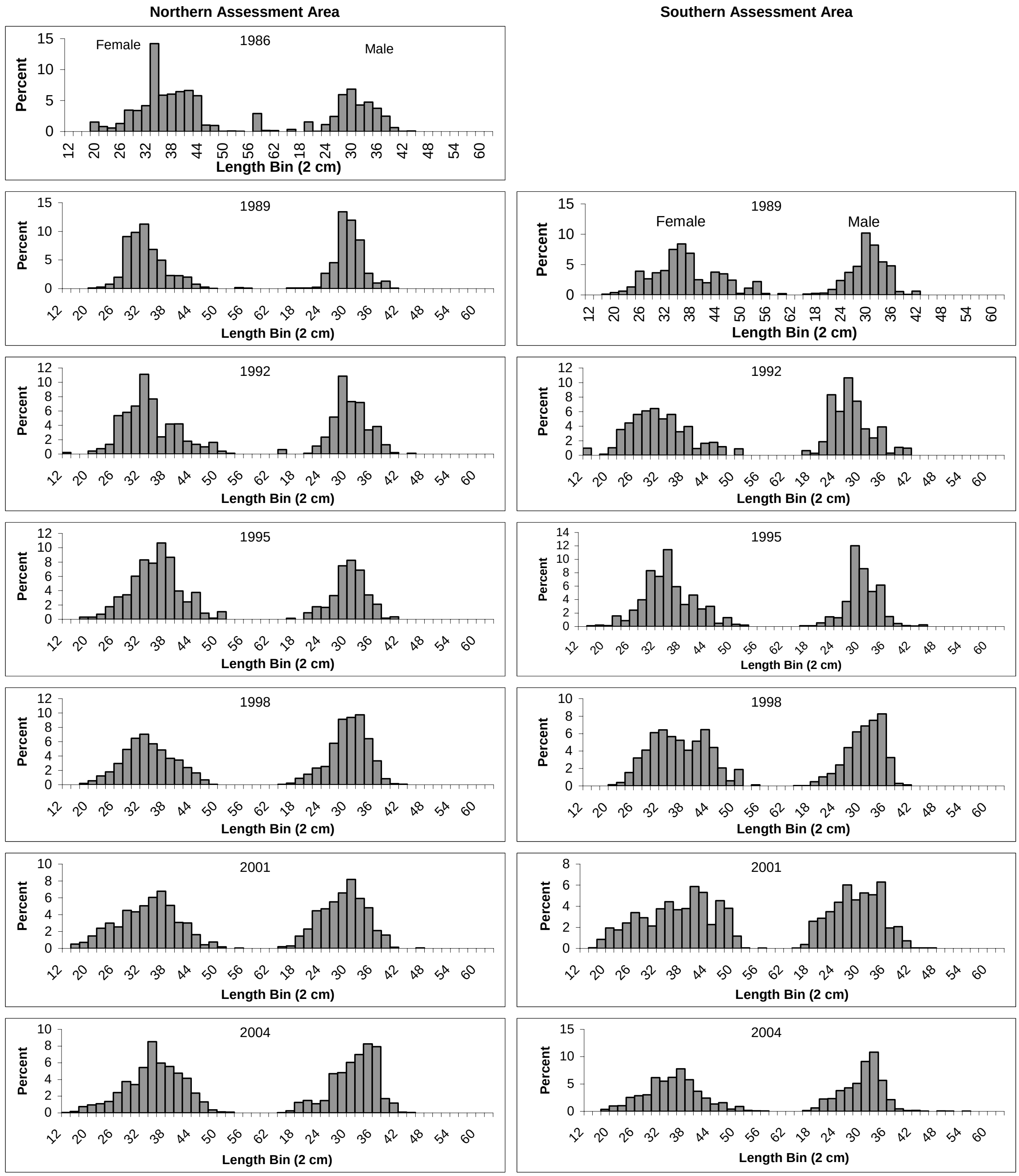


Figure 6. Length compositions for petrale sole obtained from the NMFS triennial shelf surveys in the Northern and Southern assessment areas.

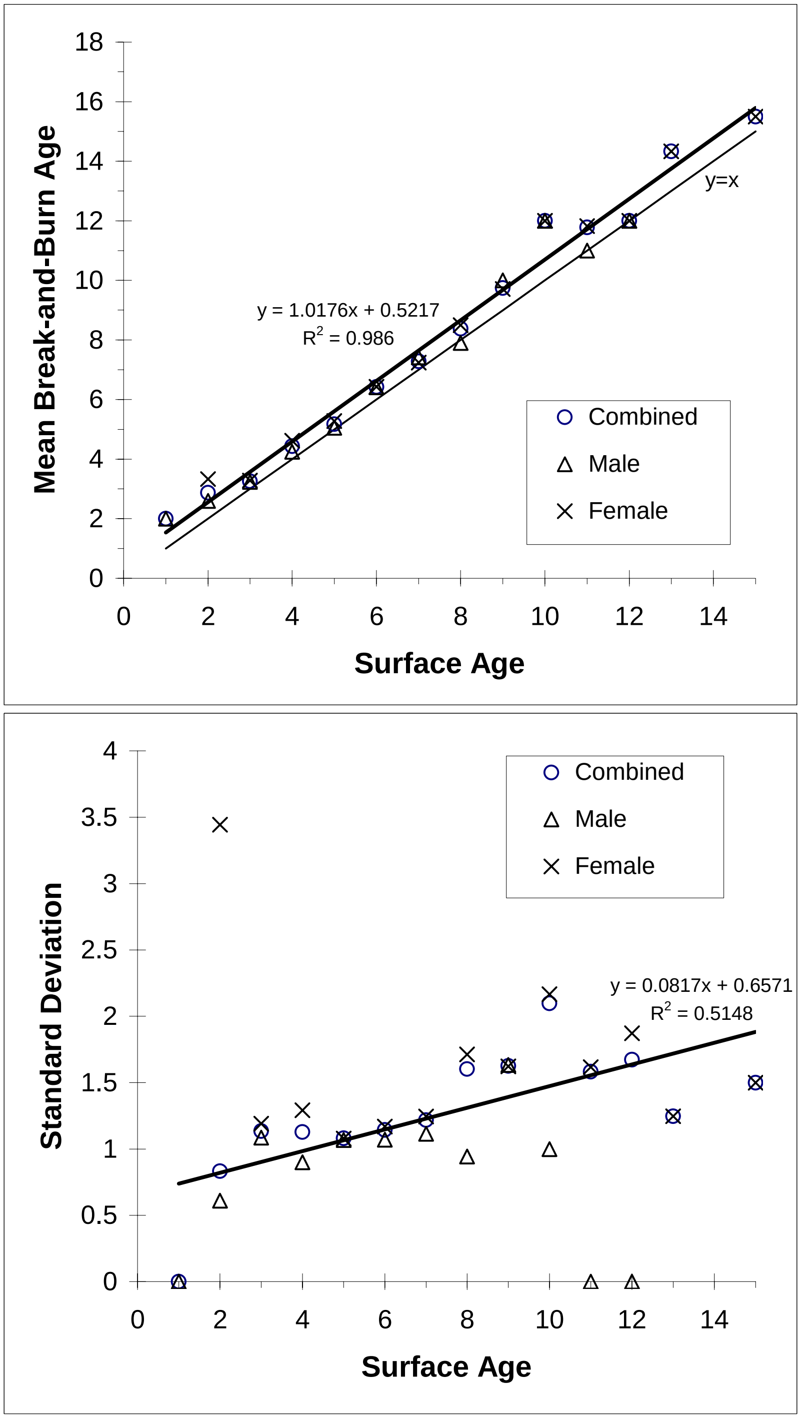


Figure 7A. Upper panel: comparison of surface and break-and-burn ages by the NWFSC age reader; the line labeled y=x is the 45^o-line (perfect agreement) and the heavy line is the fitted regression line. Lower panel: standard deviation of ageing error against age for surface readings; the three zero standard deviations (each has one observation) are not included in regression analysis which is based on data for males and females.

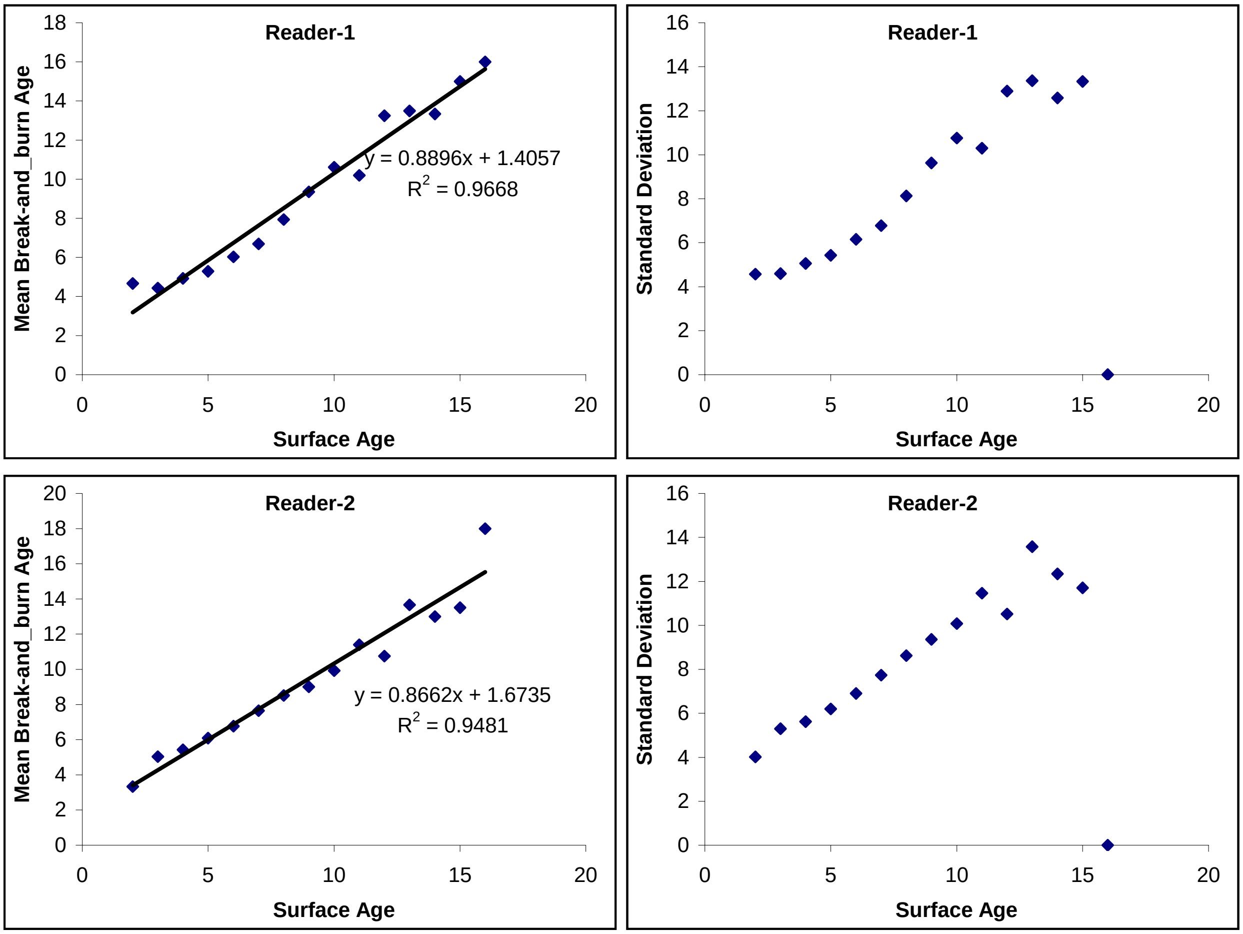


Figure 7B. Comparison of surface and break-and-burn ages by the WDFW age readers.

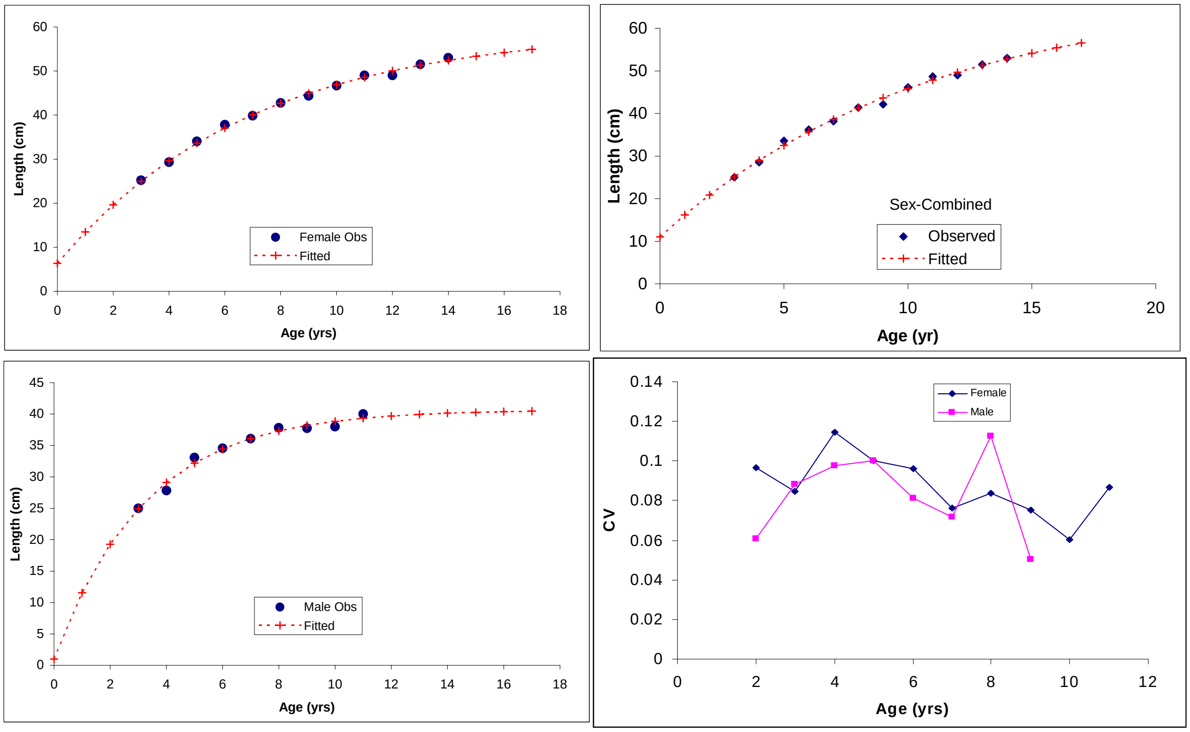


Figure 8. Growth curves and the CV of length-at-age estimated using the age data from the 2004 NMFS survey.

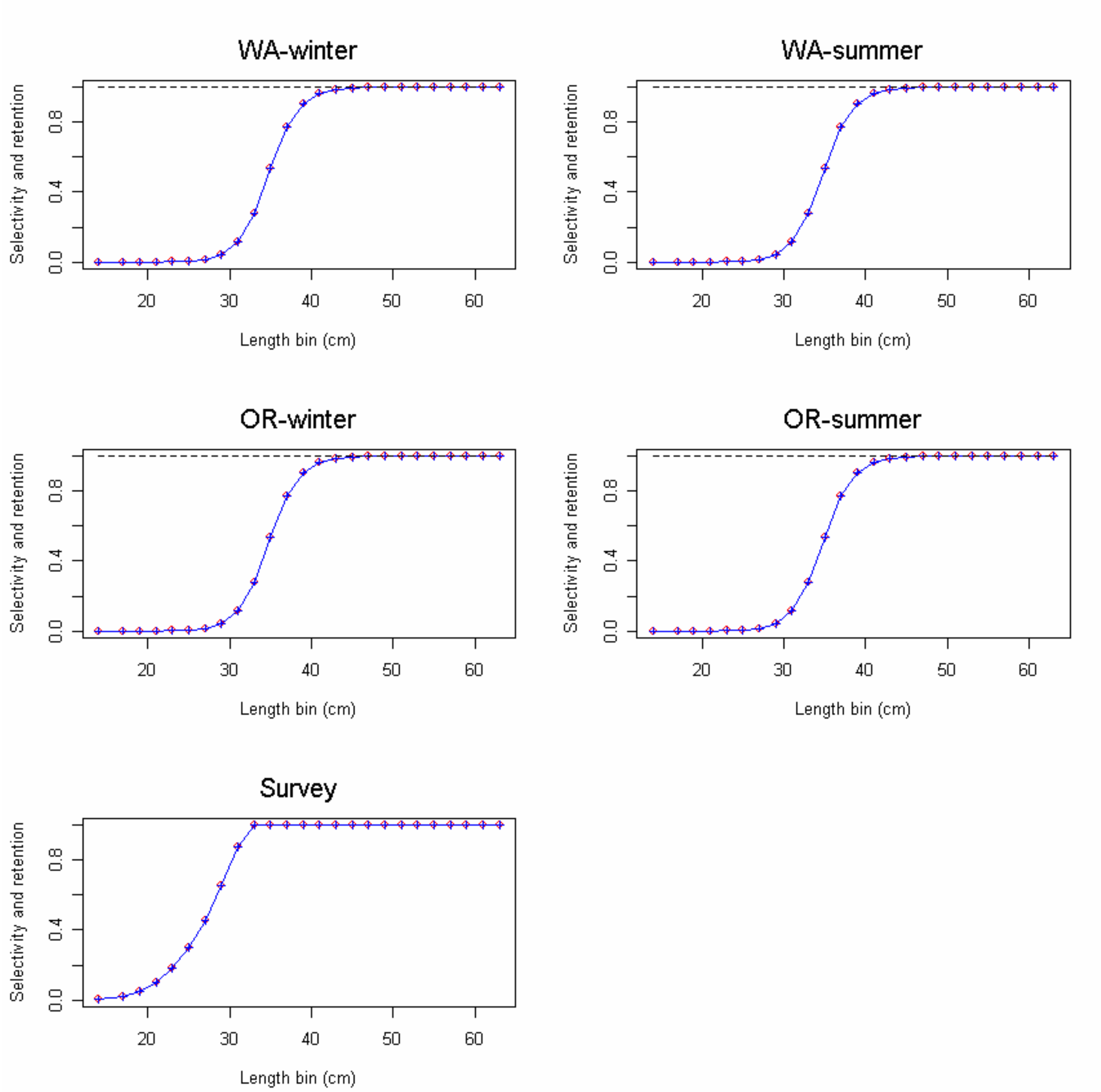


Figure 9. Selectivity (solid lines) and retention (dashed lines) as a function of length for petrale sole in the Northern assessment area.

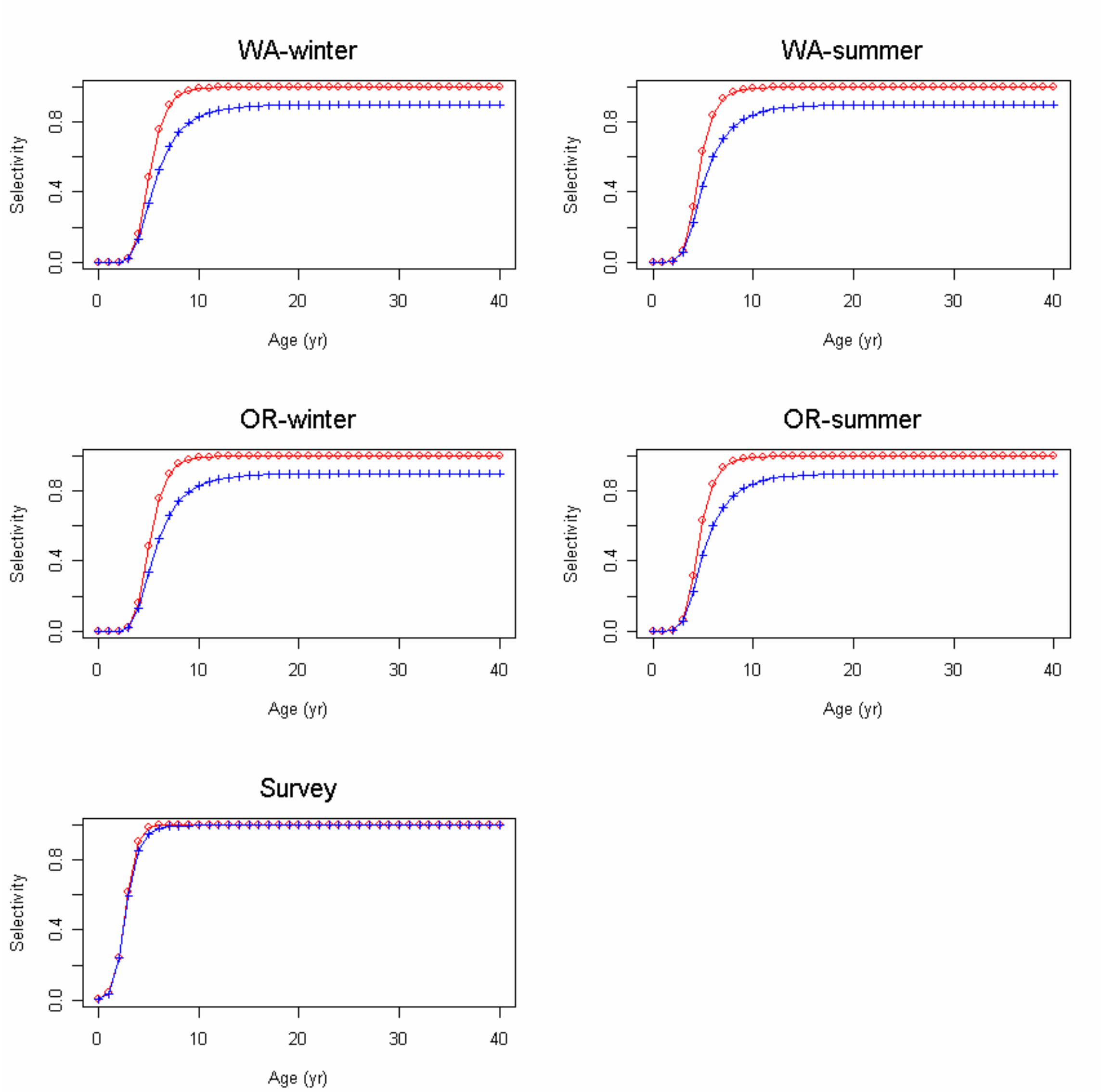


Figure 10. Selectivity (solid lines) and retention (dashed lines) as a function of length for petrale sole in the Northern assessment area (open circle: females; pluses: males).

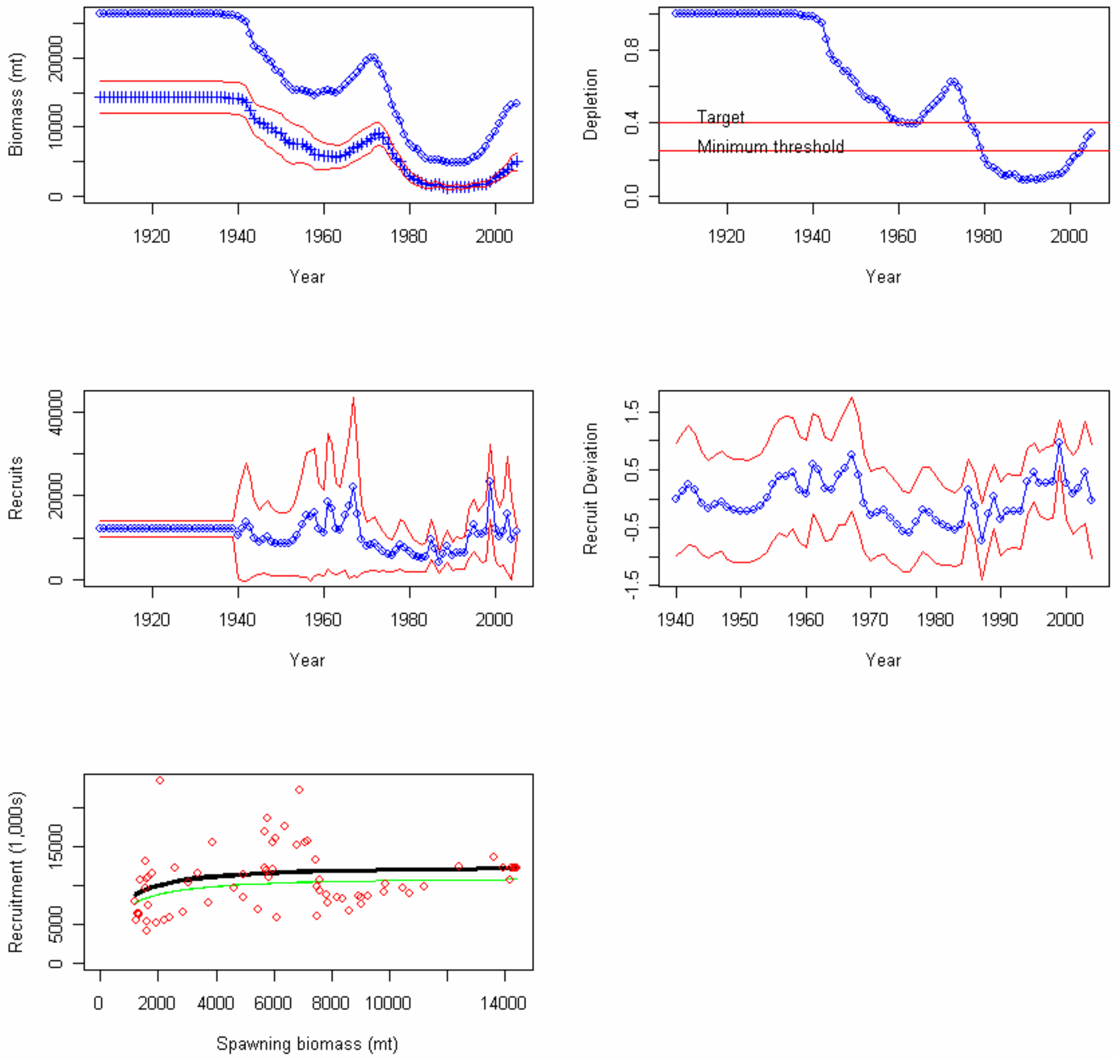


Figure 11. Time-trajectories of biomass, depletion, and recruitment for the Northern assessment area.

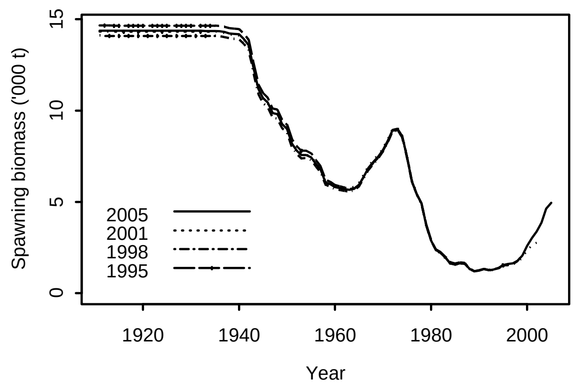


Figure 12. Retrospective analysis for the Northern assessment area.

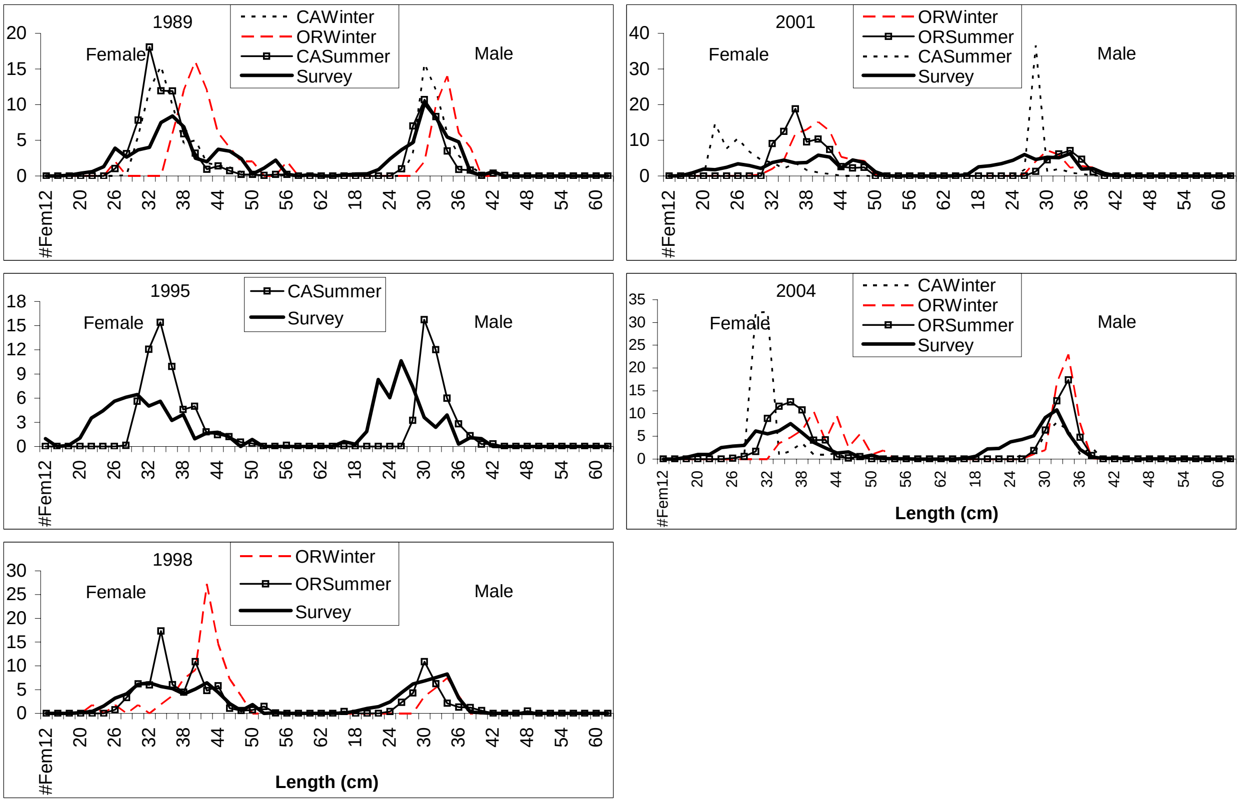


Figure 13. Length compositions (expressed as percentages) for the surveys and fisheries in the Southern assessment area.

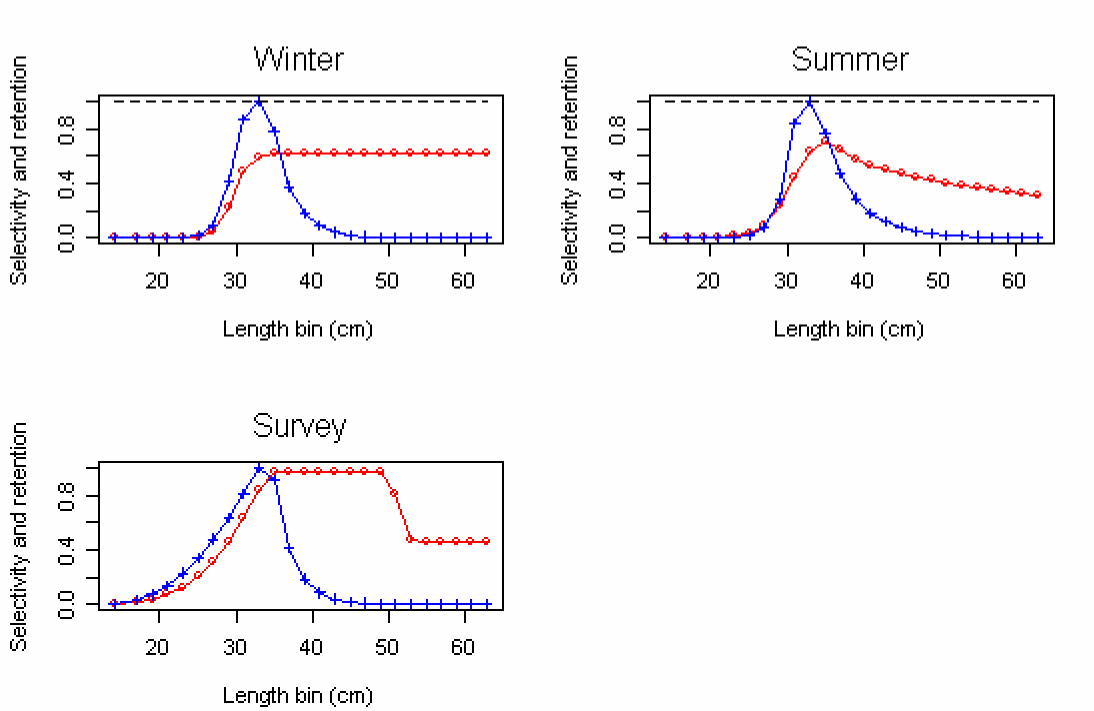


Figure 14. Selectivity (solid lines) and retention (dashed lines) as a function of length for petrale sole in the Southern assessment area. Males are indicated by pluses and females by circles.

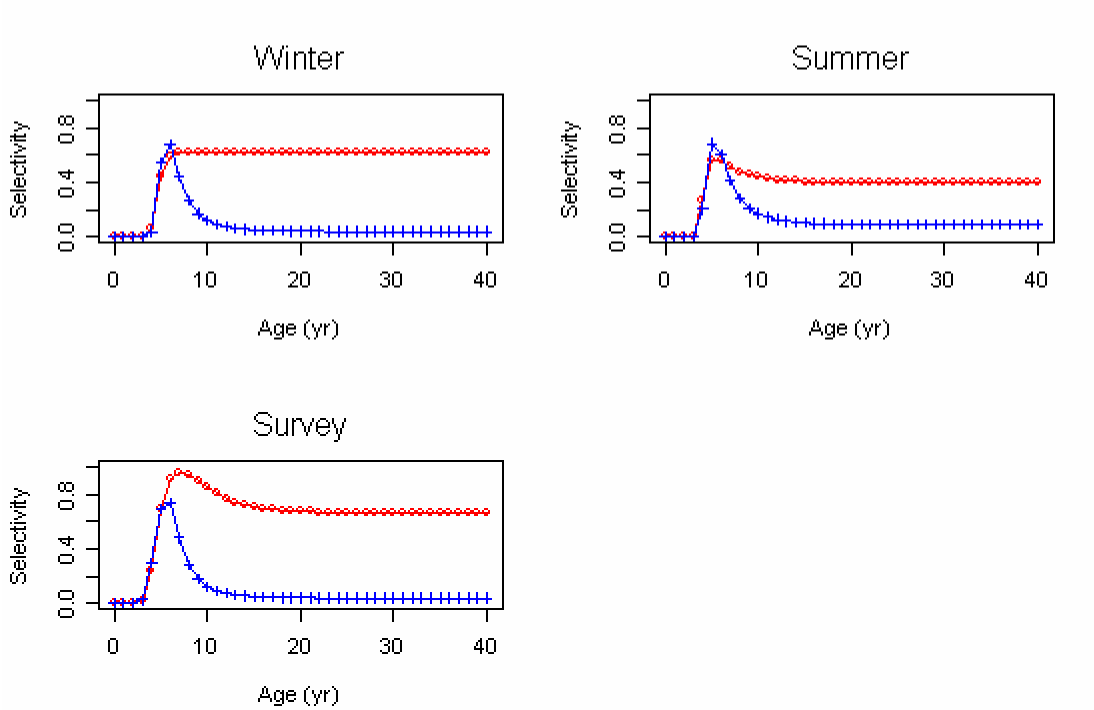


Figure 15. Selectivity (solid lines) and retention (dashed lines) as a function of age for petrale sole in the Southern assessment area. Males are indicated by pluses and females by circles.

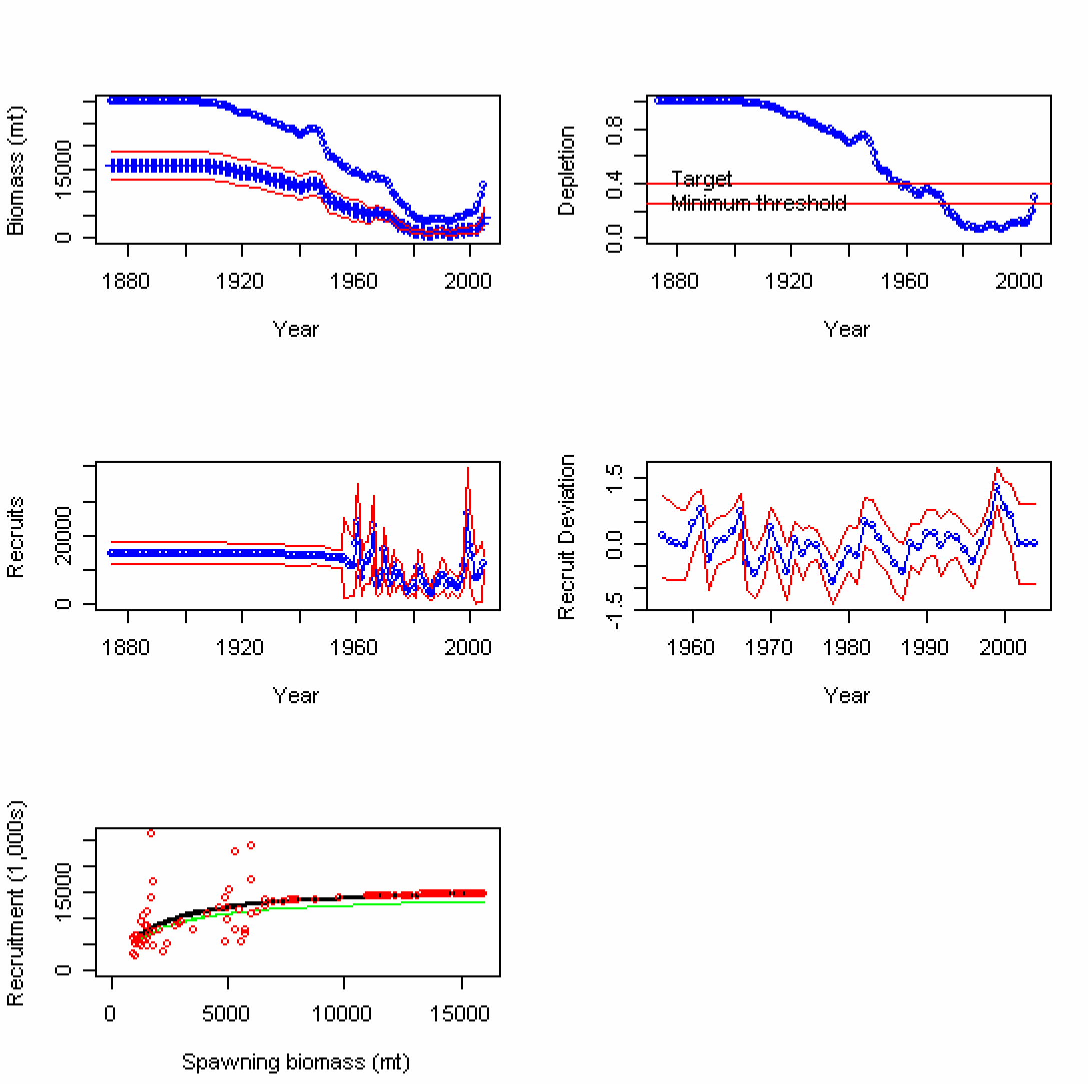


Figure 16. Time-trajectories of biomass, depletion, and recruitment for the Southern assessment area.

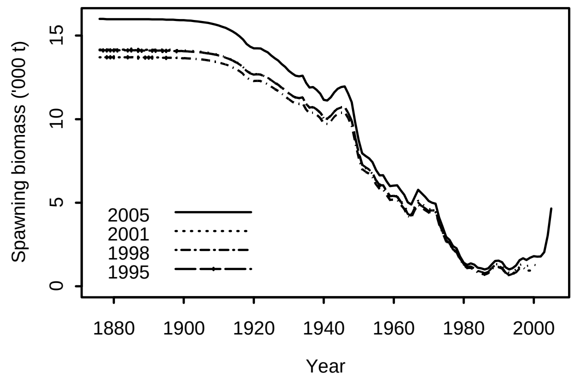


Figure 17. Retrospective analysis for the Southern assessment area.

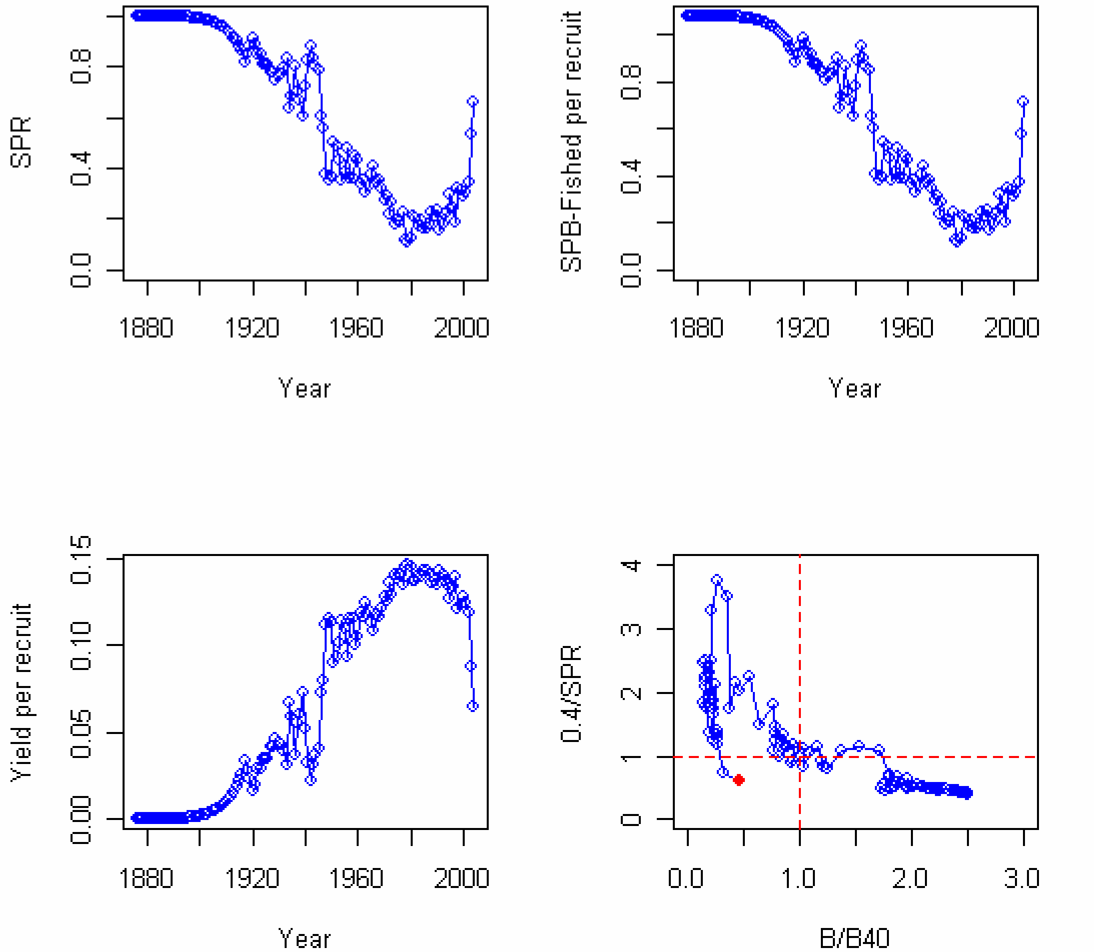


Figure 18A. Time-trajectories of spawning biomass-per-recruit and yield-per-recruit for the base model for the Northern assessment area and a plot of spawning biomass-per-recruit versus spawning stock biomass for this assessment area.

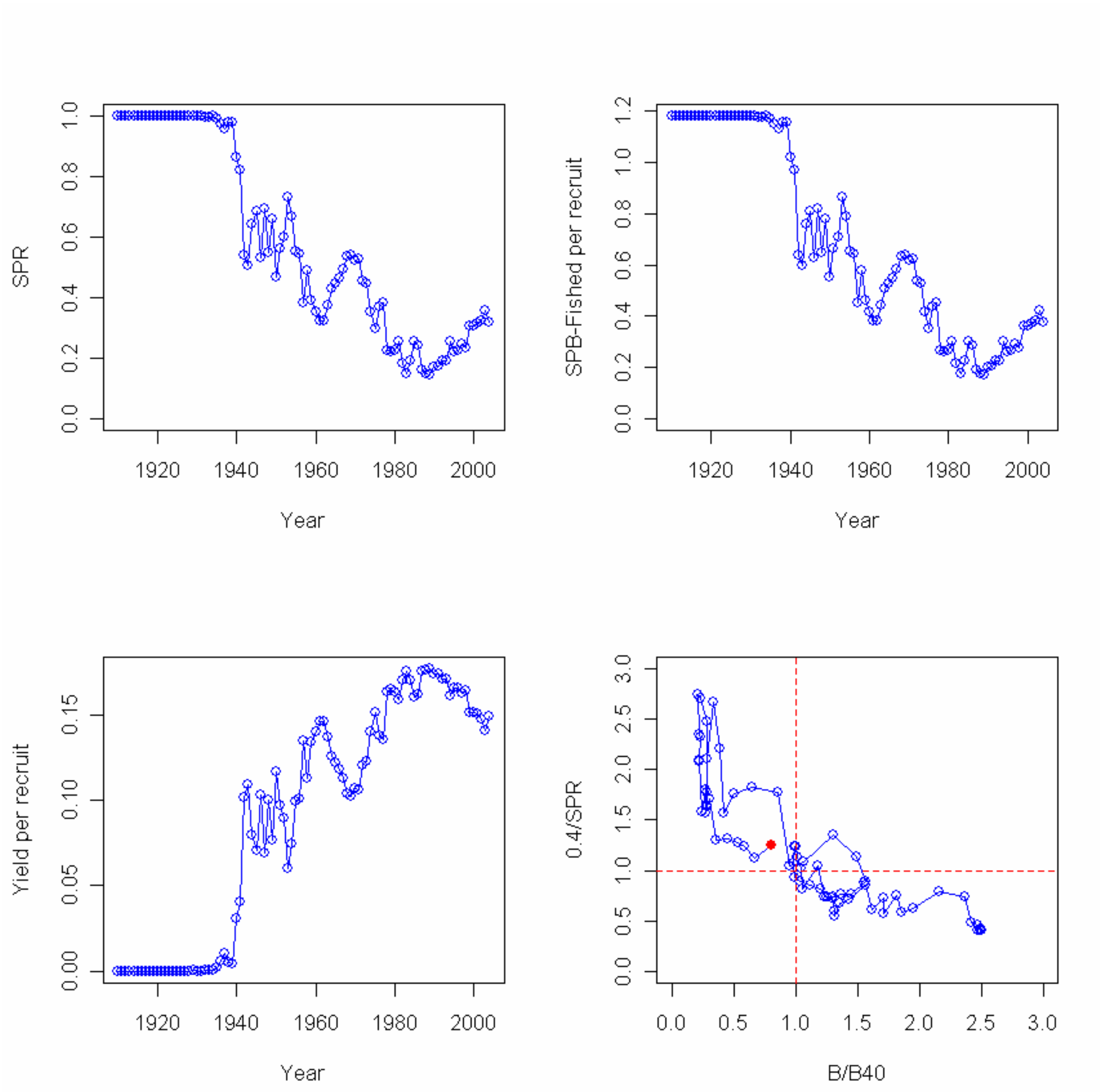


Figure 18B. Time-trajectories of spawning biomass-per-recruit and yield-per-recruit for the base model for the Southern assessment area and a plot of spawning biomass-per-recruit versus spawning stock biomass for this assessment area.

Appendix I. Analyzing the length-depth relationship for petrale sole using WinBugs

The model described by Eq. (1) can be rewritten as:

$$Y_i \sim N(\mu_i, \tau)$$
$$\mu_i = \alpha_{k[i]} + \beta_{J[i],k[i]}(x_i - x_{c,k[i]})$$

where Y is length, x is depth and x_c is the depth at which the relationship changes. The parameters α, β, and x_c are sex-specific (i.e. $k[i]$ is 1 for females and is 2 for males) and β depends on whether $x < x_c$ or not. The prior distributions for these parameters and the variance τ are:

$$\tau \sim G(a, b)$$
$$\alpha_{k[i]} \sim N(\mu_{\alpha k}, \sigma^2_{\alpha k})$$
$$\beta_{J[i],k[i]} \sim N(\mu_{\beta Jk}, \sigma^2_{\beta Jk})$$
$$x_{c,k[i]} \sim U(x_{low,k}, x_{up,k})$$

where G, N, and U are the gamma, normal, and uniform distributions respectively. Relatively flat prior distributions are specified for these parameters because there is no independent prior knowledge about them. The parameters of the prior distributions are given in the following Winbugs program. This program and the dataset can be obtained from the first author.

```
model
{
   for(i in 1 : N) {
     Y[i] ~ dnorm(mu[i], tau)
    mu[i] <- alpha[sex[i]] + beta[J[i],sex[i]] * (x[i] - x.change[sex[i]])
    J[i] <- 1 + step(x[i] - x.change[sex[i]])
   }
   tau ~ dgamma(0.001, 0.001)
   sigma <- 1 / sqrt(tau)
   for(k in 1:2) {
   x.change[k] ~ dunif(50,200)
   alpha[k] ~ dnorm(30.0,1.0E-6)
   for(j in 1 : 2) {
      beta[j,k] ~ dnorm(0.05,1.0E-6)
   }
   }
}
```

The model was run with two chains, each starting from different starting values:

```
list(alpha = c(52.1, 52.1), beta = structure(.Data = c(0.5, 0.5, 0.7, 0.7), .Dim = c(2,2)),
      tau = 10, x.change = c(70.0, 70.0))
list(alpha = c(10.5, 10.5), beta = structure(.Data = c(0.089, 0.089, -0.090, -0.090), .Dim = c(2,2)),
      tau = 0.2, x.change = c(140.0, 140.0))
```

Figure I-1 shows the traces of the two chains for the first 2,000 iterations. The two chains come together within 200 iterations. The traces of 502,000 iterations indicate that there is reasonable mixing for all parameters. However, autocorrelation is high for all of the parameters, which indicates that thinning is essential. The final results are based on selecting every 100^{th} parameter vector after discarding the first 2000 iterations as a burn-in period. The autocorrelations become negligible with this extent of thinning, except at lag-1 (Figure I-2). The posterior distributions for the parameters are smooth enough to be considered to be uni-modal (Figure I-3).

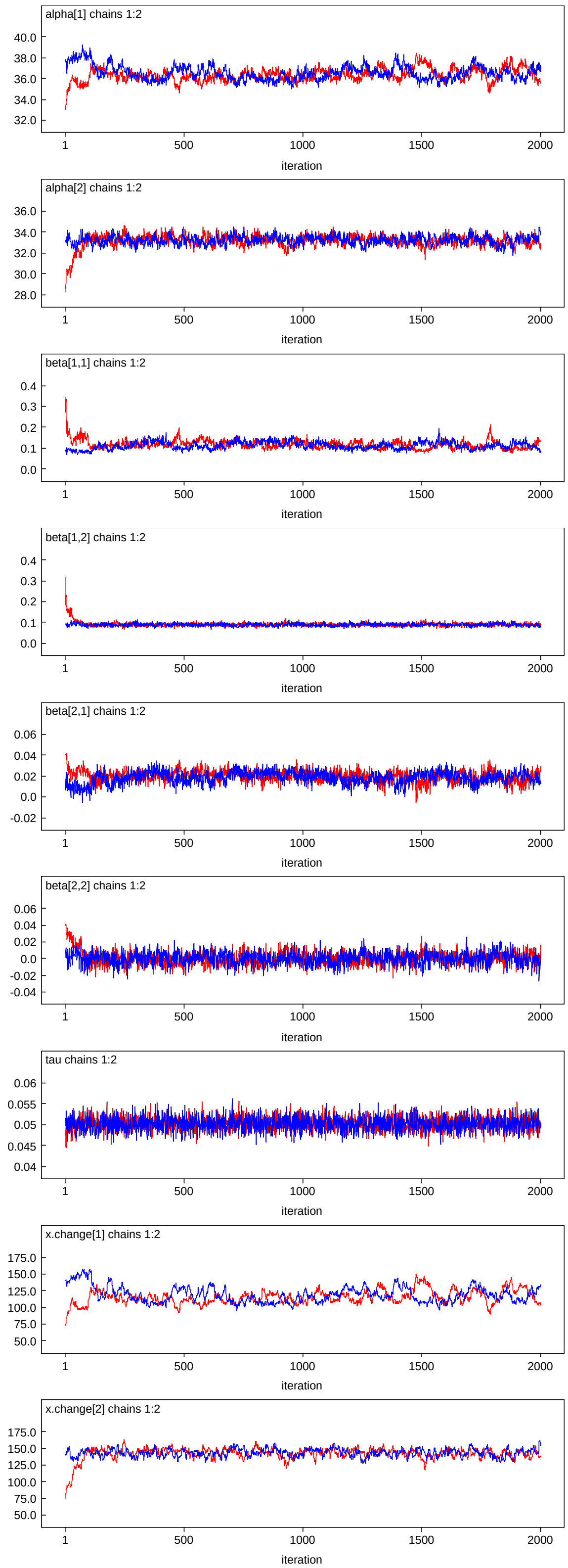


Figure I-1. Traces of the first 2,000 iterations for the two chains.

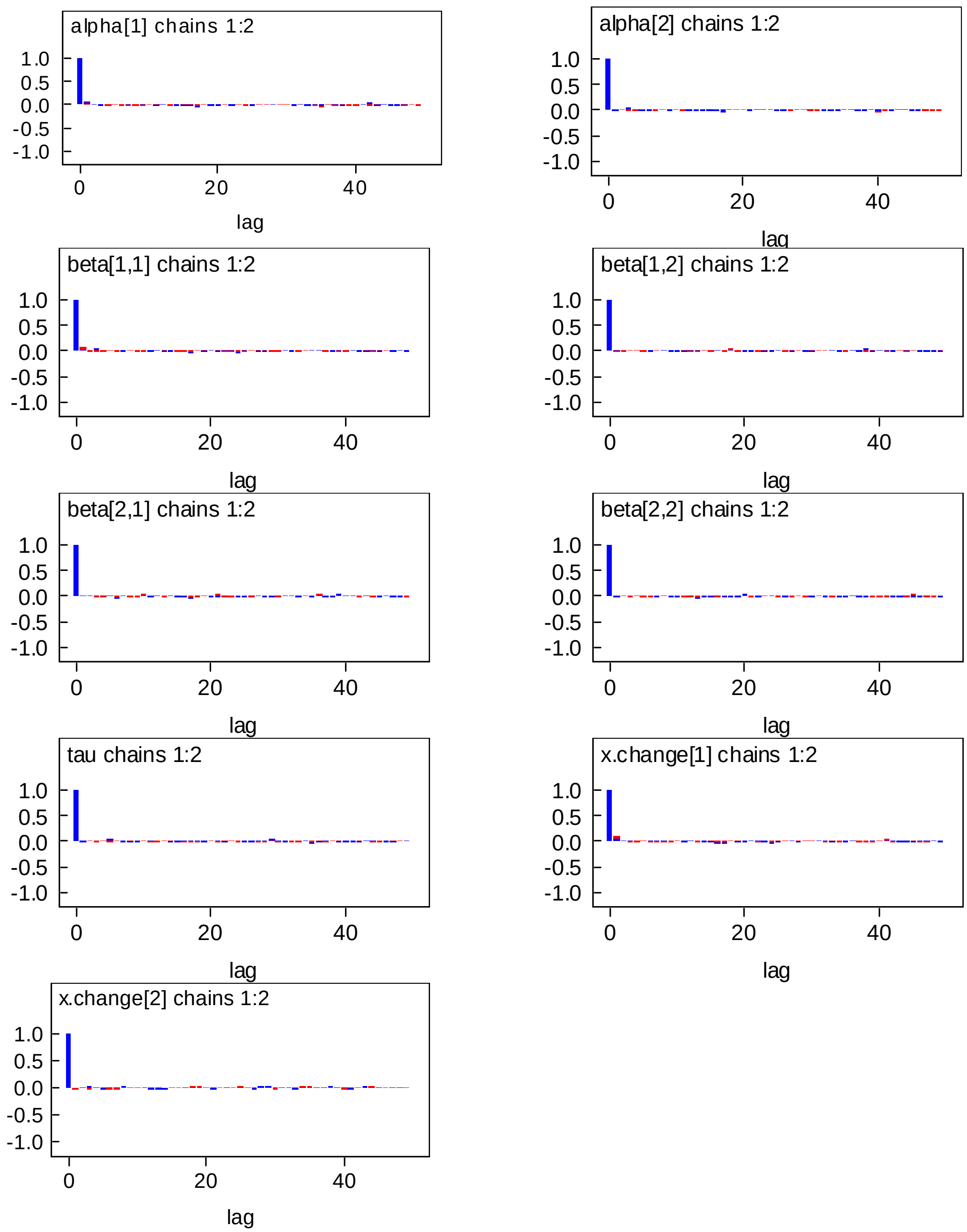


Figure I-2. Autocorrelation (lags 1-50) for the parameters of the model.

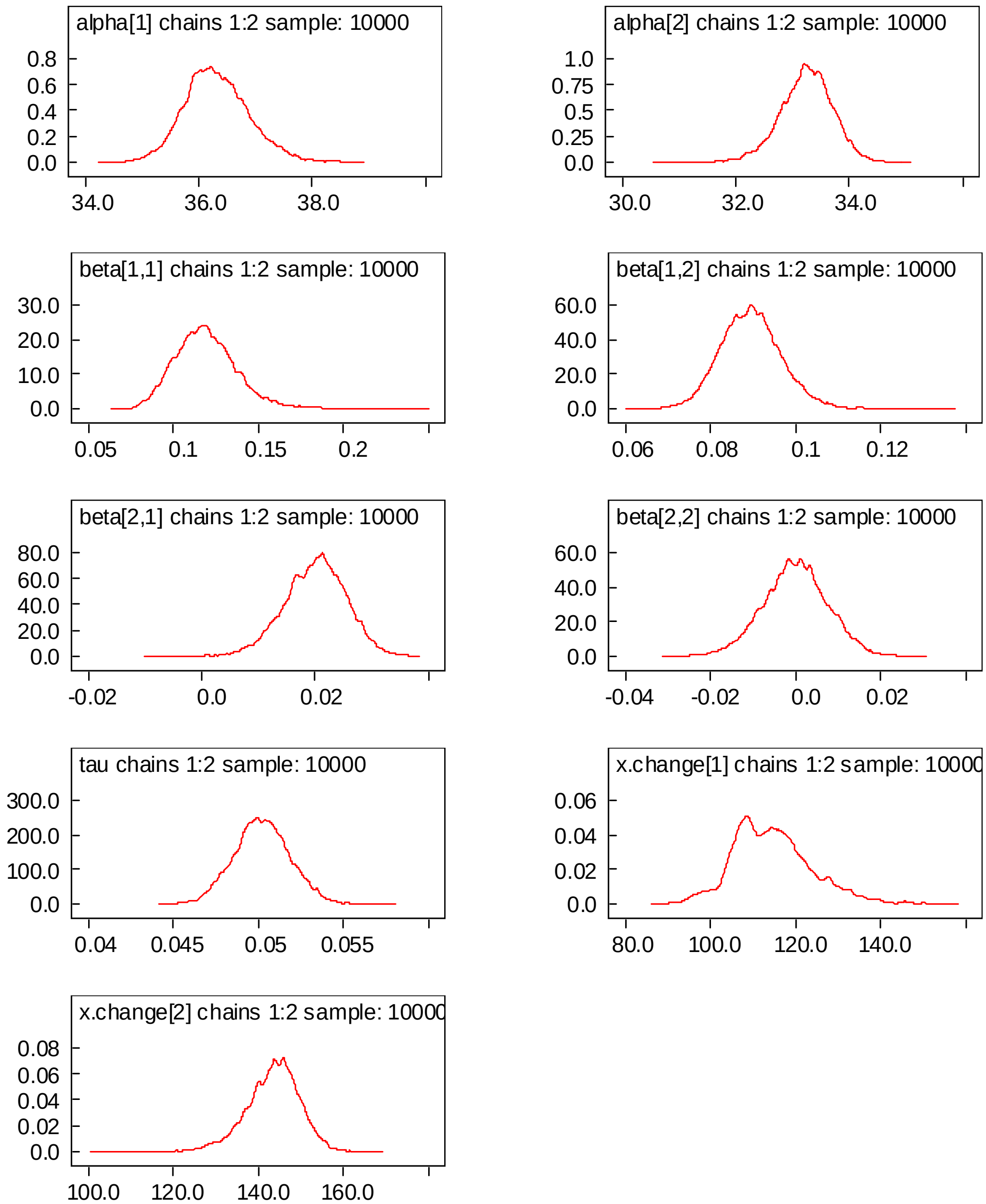
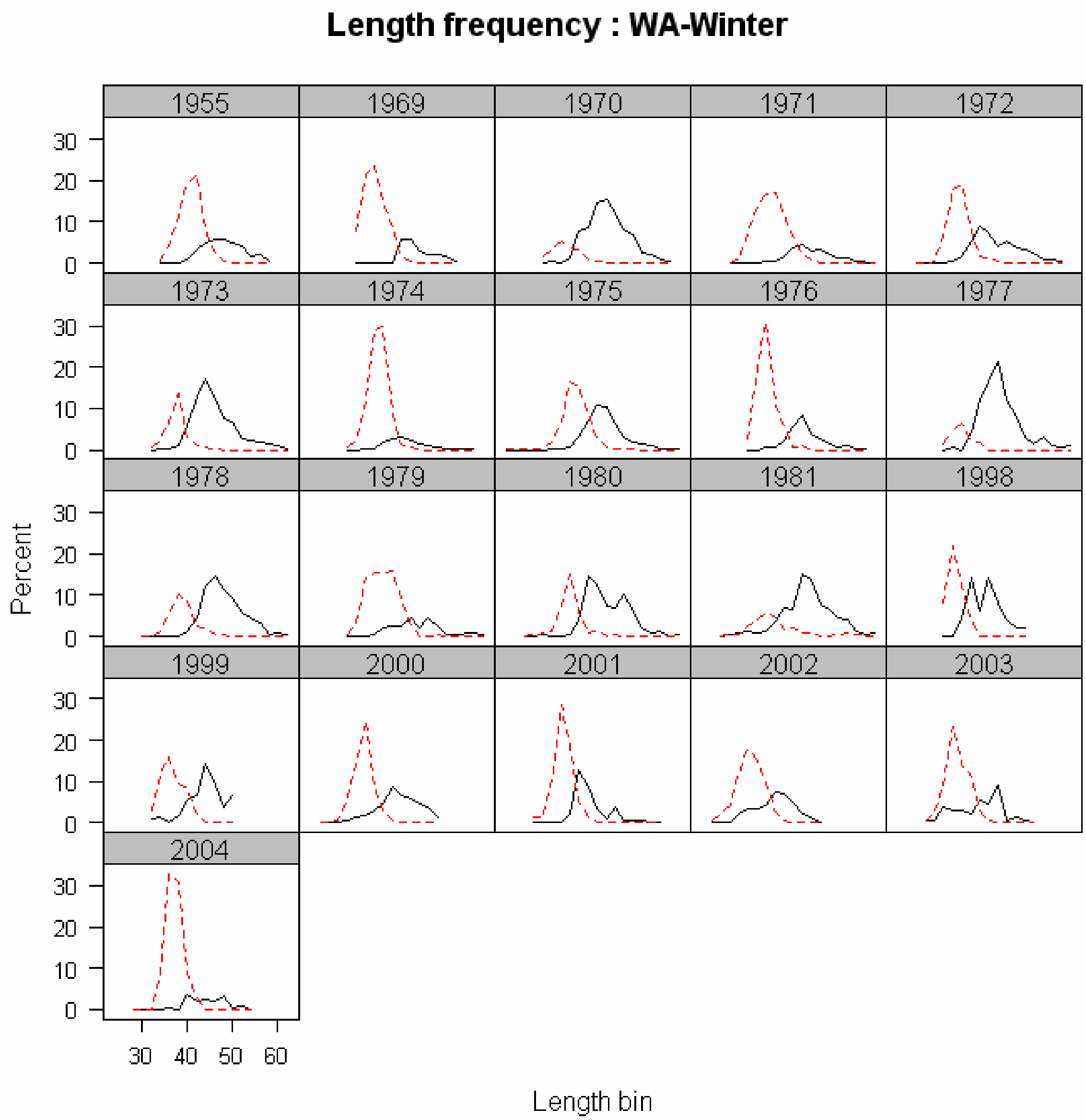


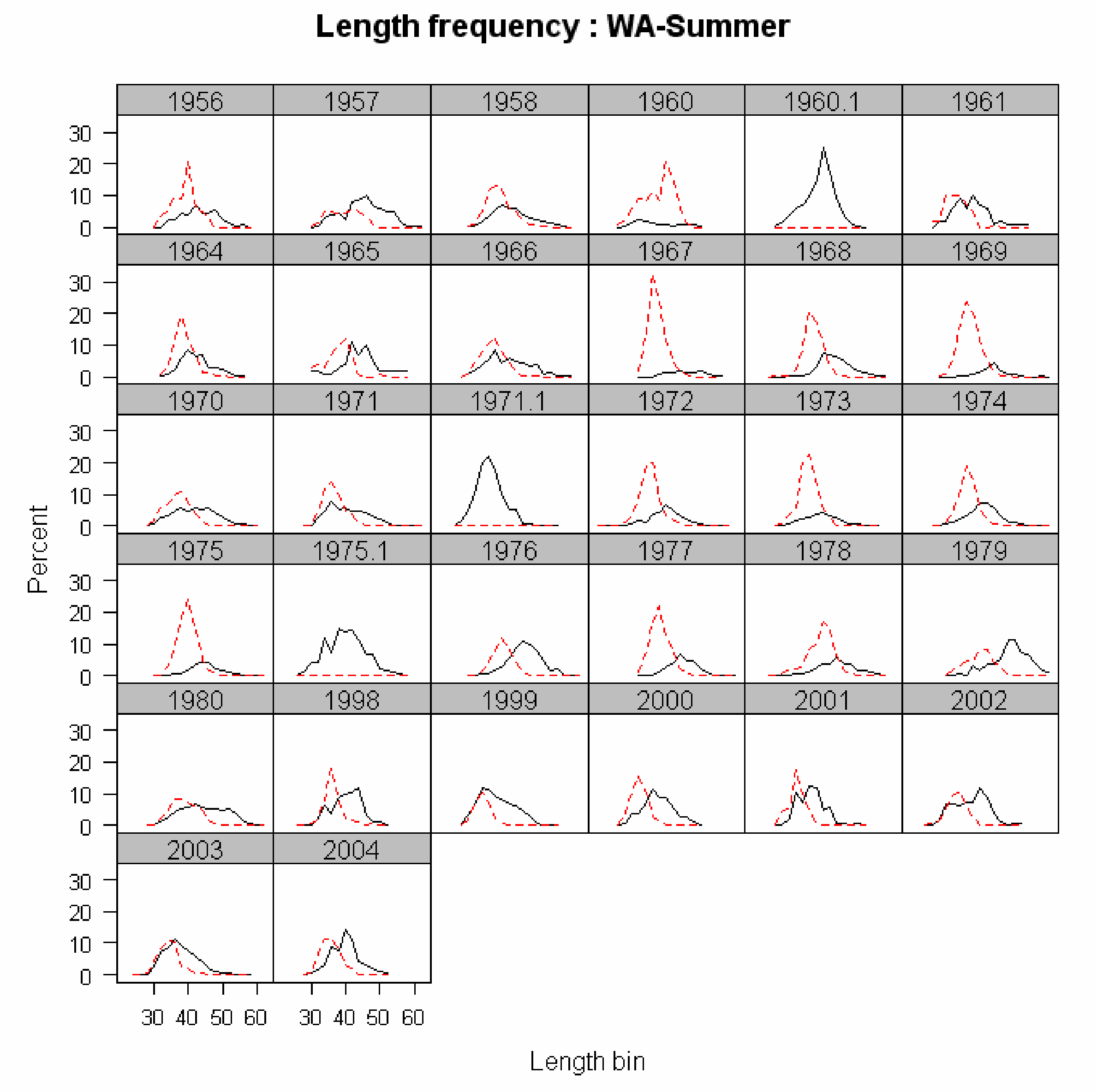
Figure I-3. The posterior distributions for the parameters of model 1.

Appendix II. Plots of length compositions, age compositions and mean lengths at age for petrale sole for the four fisheries in Northern assessment area.

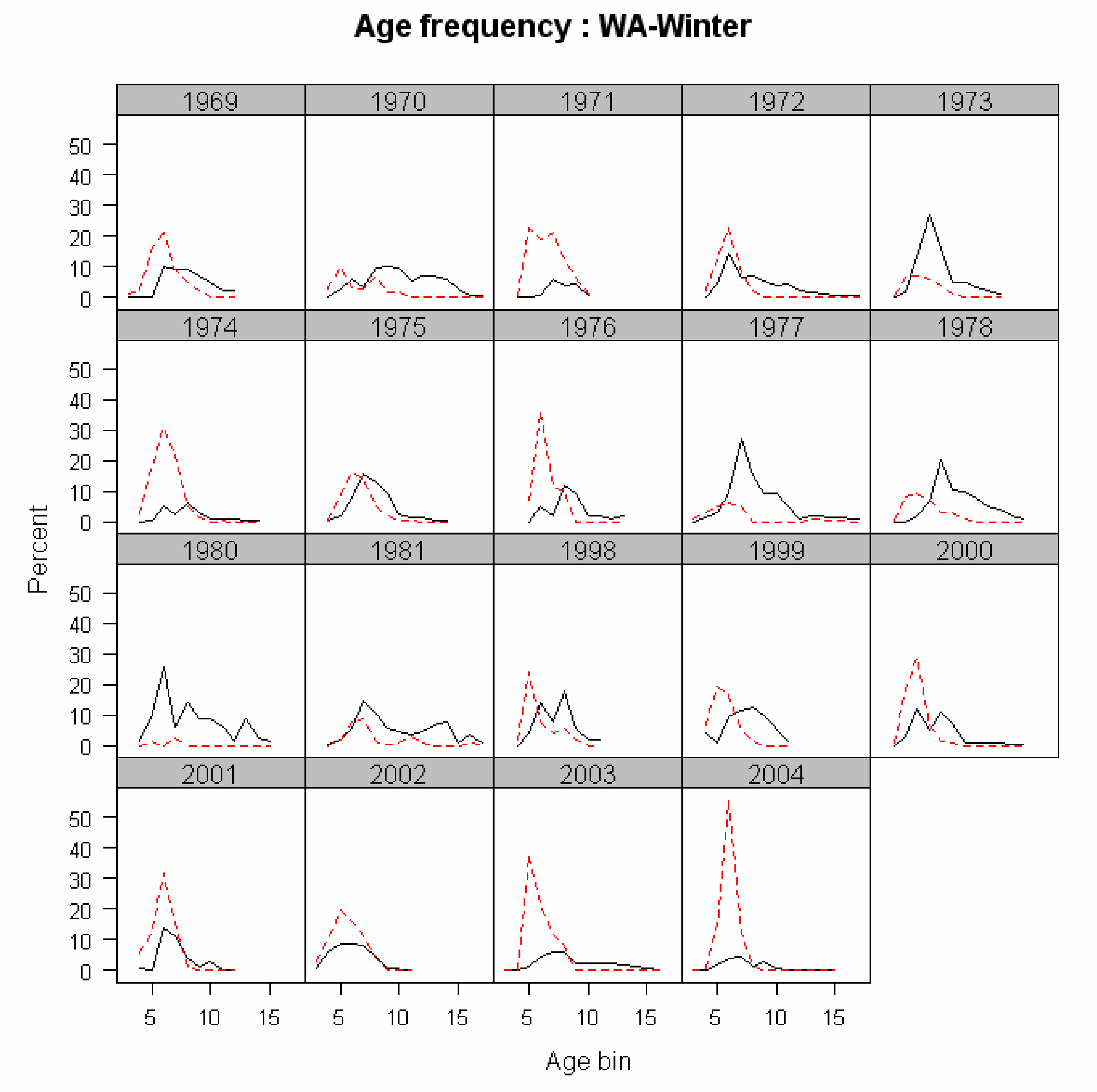
The solid lines in the figures showing the length-frequency and age-frequency data pertain to females while the dotted lines pertain to males. The open circles and solid line in the length-at-age plots pertain to females while the open triangles and solid lines pertain to males. The upper and lower dashed lines in the length-at-age plots pertain to average length-at-age (females and males) across years.

A. Washington Fleets

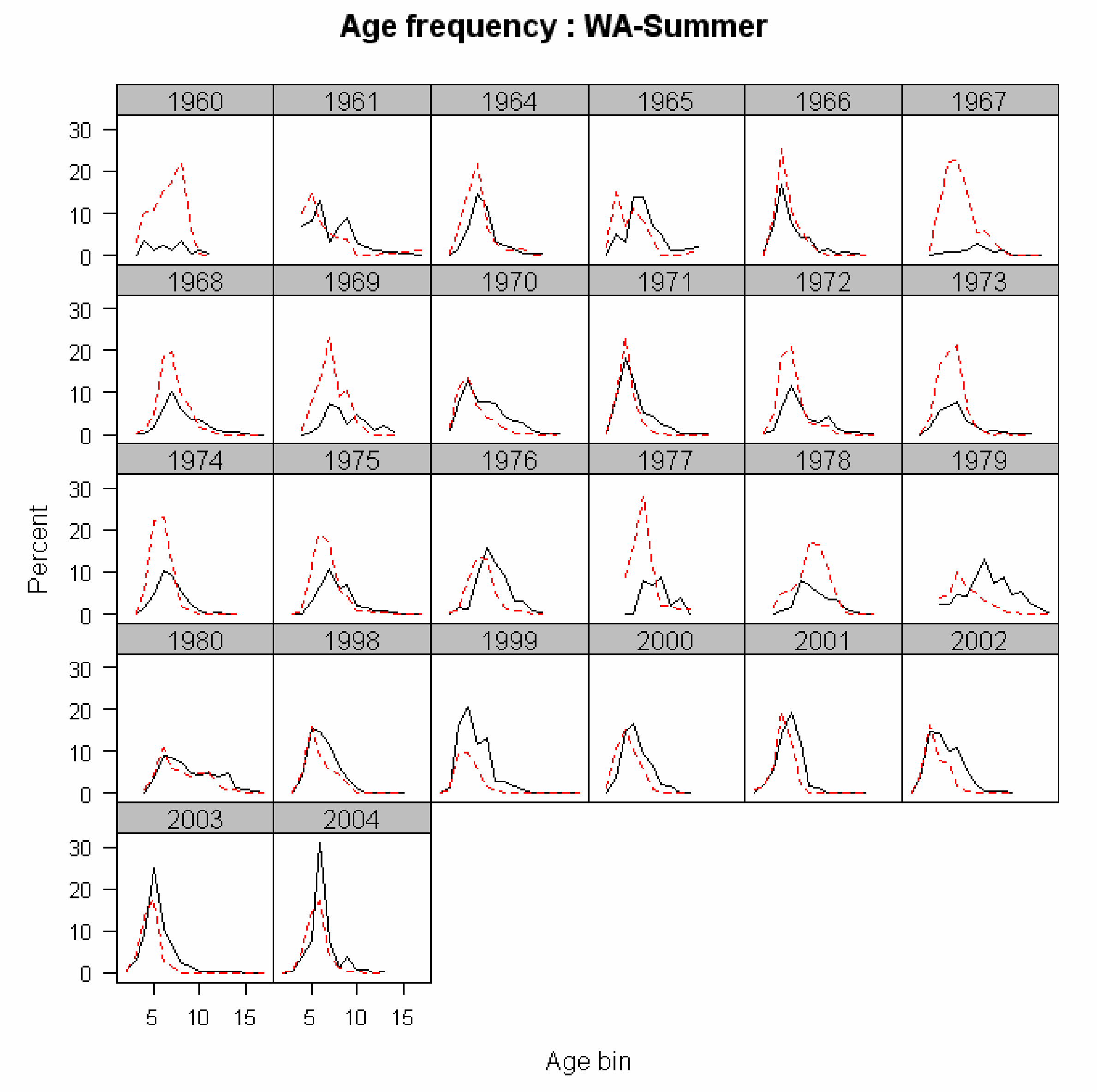


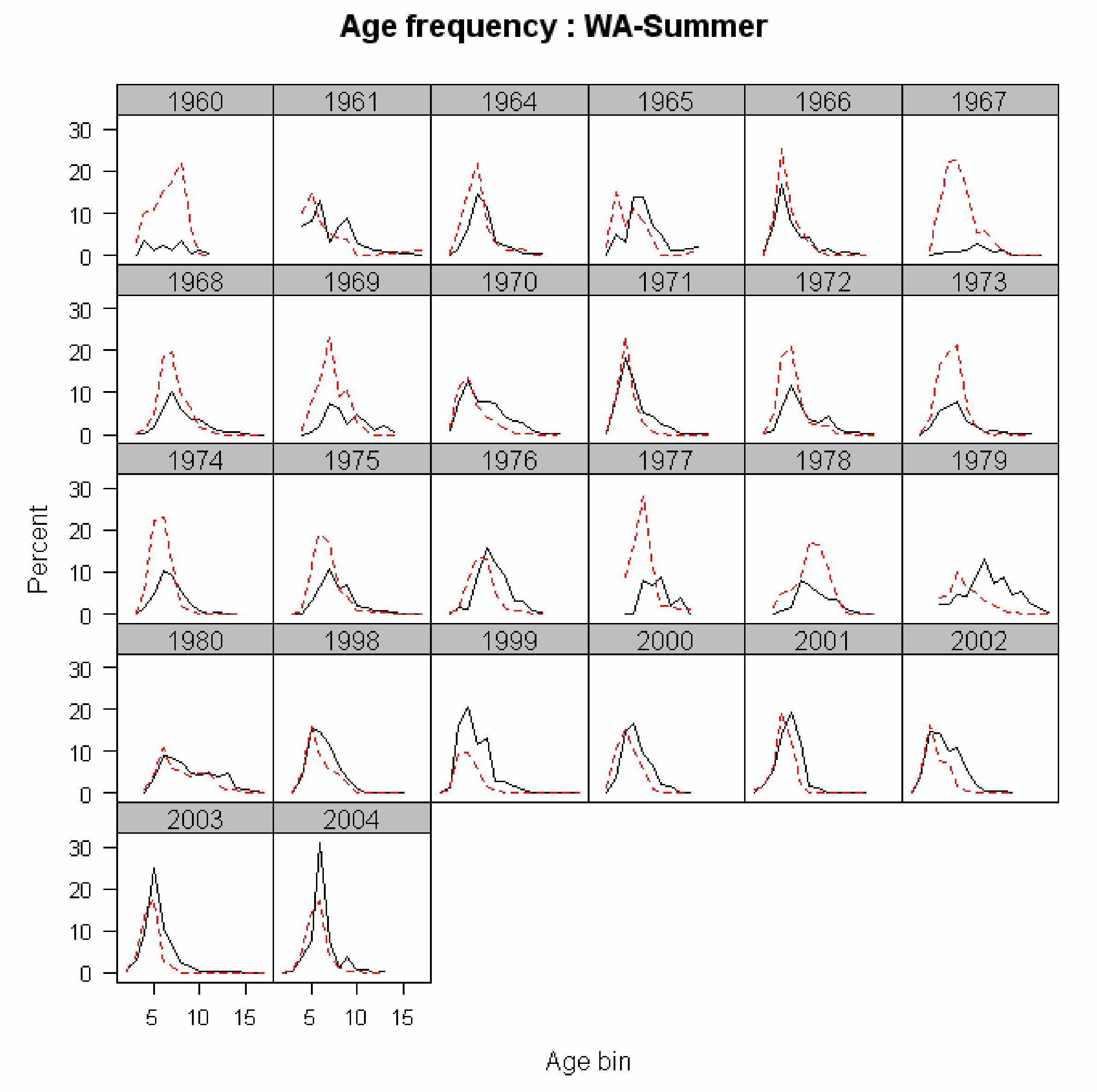


yyyy.1 indicates an additional sex-unidentified composition in the year of yyyy.

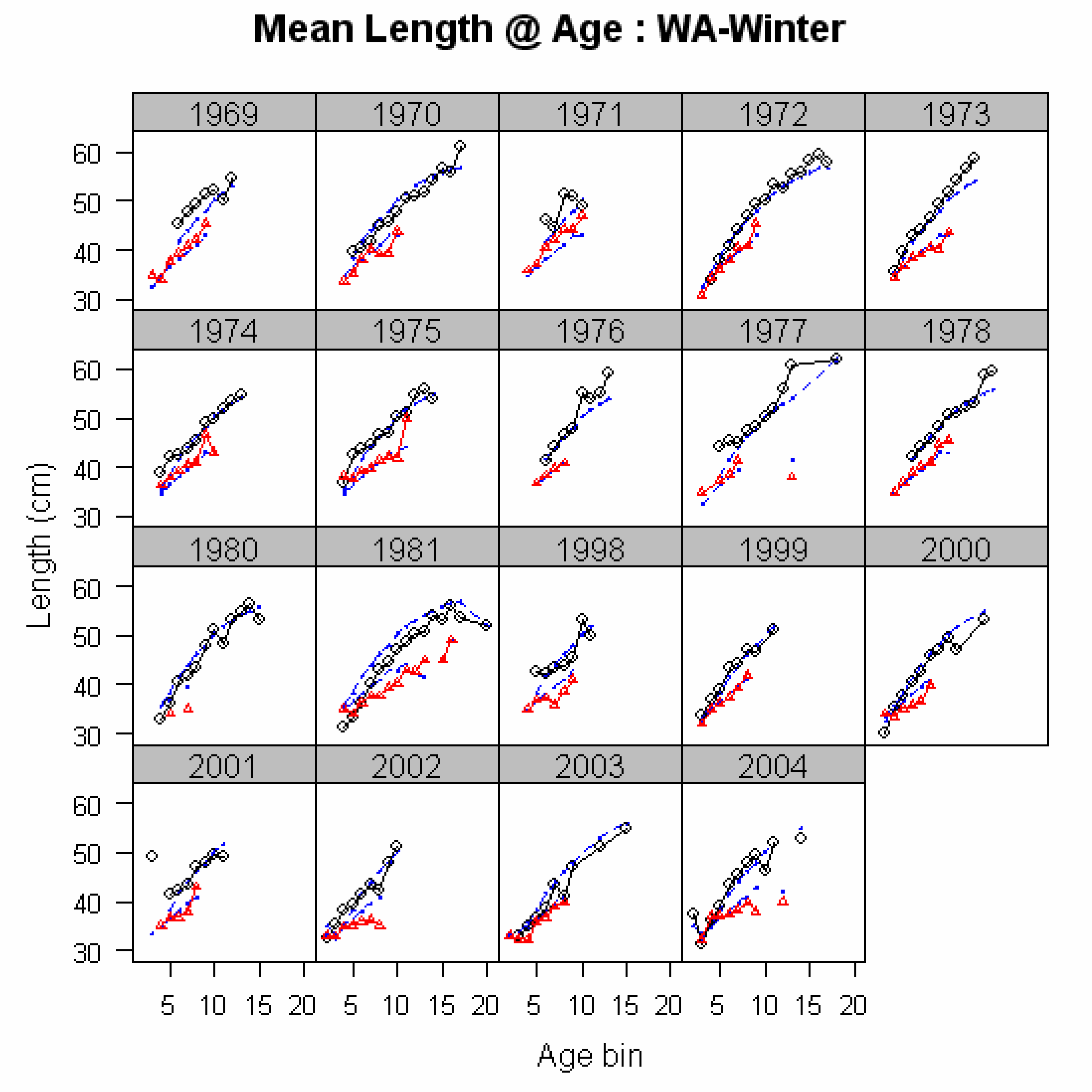


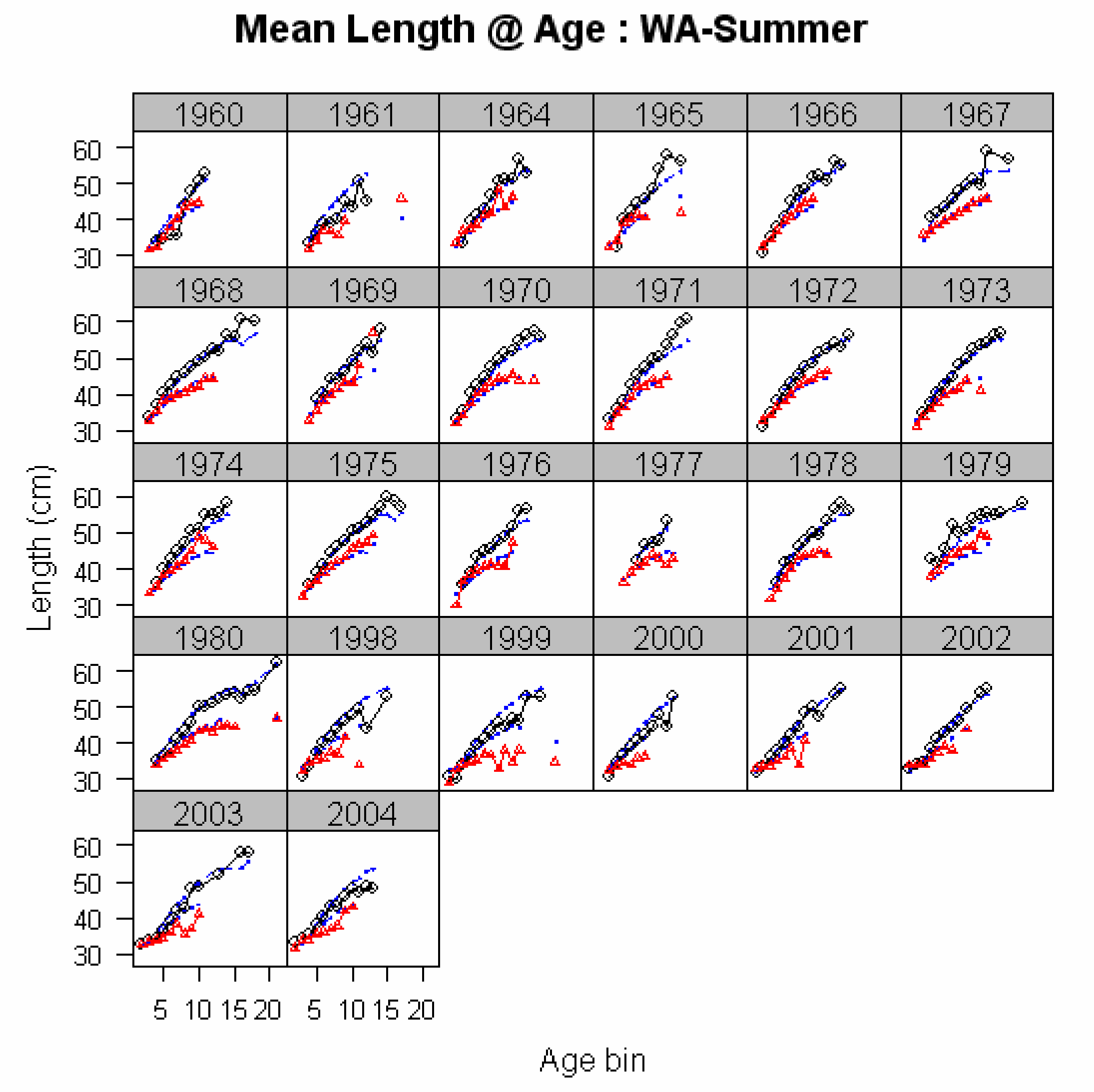
Age frequency : WA-Winter
1969
1970
1971
1972
1973
1974
1975
1976
1977
1978
1980
1981
1998
1999
2000
2001
2002
2003
2004
Percent
50
40
30
20
10
0
5
10
15
Age bin


Age frequency : WA-Summer
1960
1961
1964
1965
1966
1967
1968
1969
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1998
1999
2000
2001
2002
2003
2004
Percent
0
10
20
30
5
10
15
Age bin

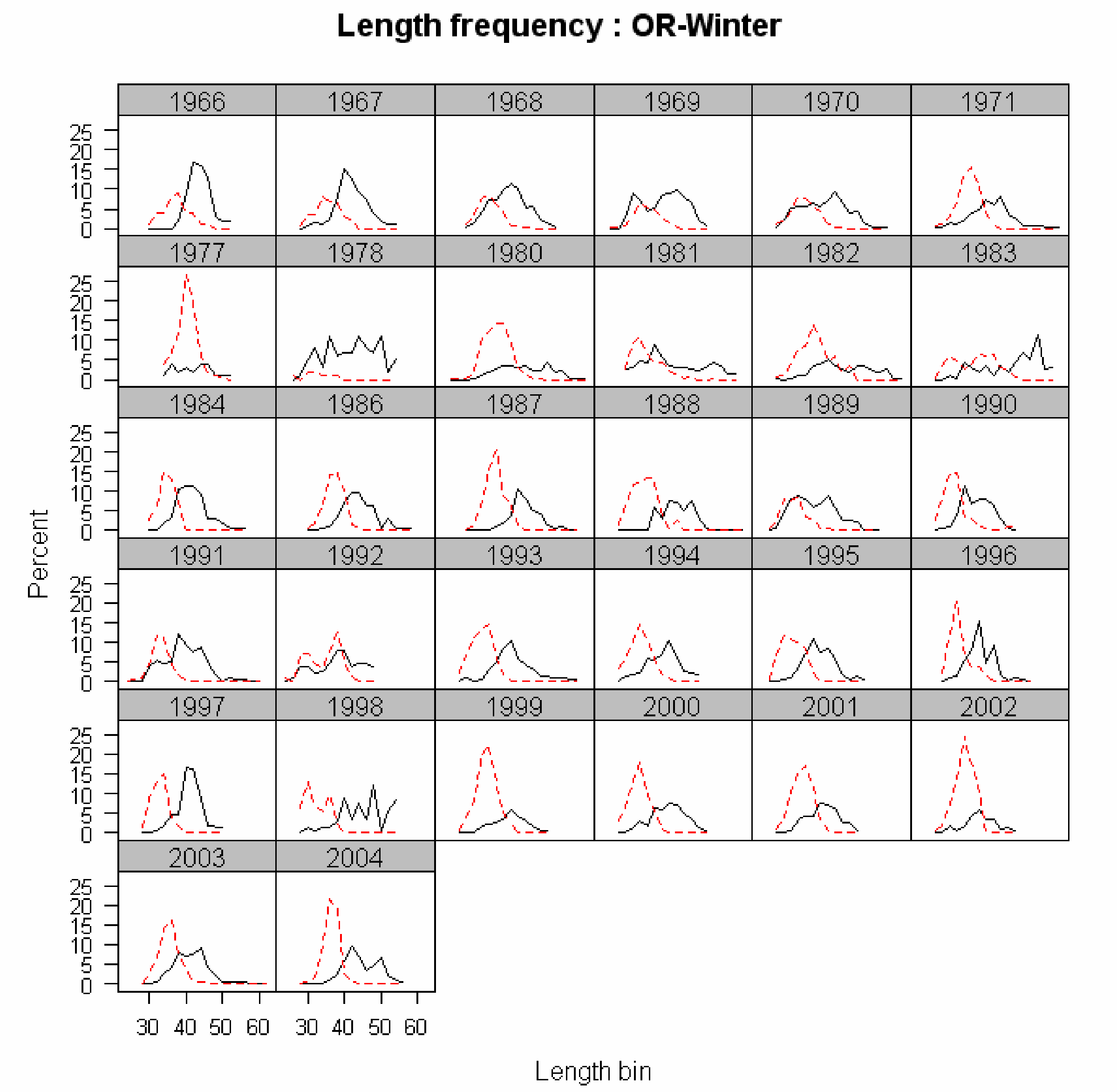


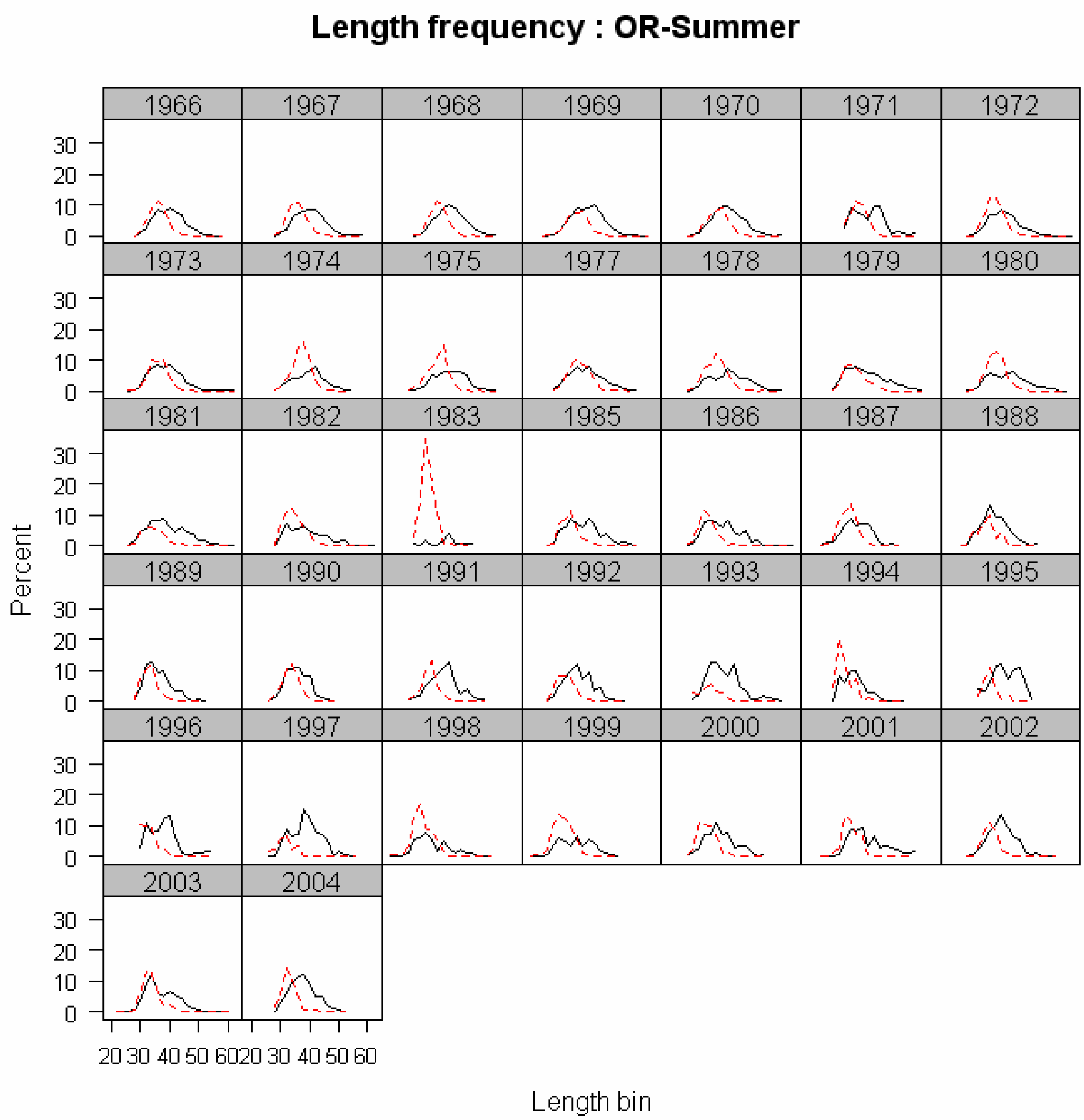
Age frequency : WA-Summer
1960
1961
1964
1965
1966
1967
1968
1969
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1998
1999
2000
2001
2002
2003
2004
30
20
10
0
Percent
5
10
15
Age bin


Mean Length @ Age : WA-Winter
1969
1970
1971
1972
1973
1974
1975
1976
1977
1978
1980
1981
1998
1999
2000
2001
2002
2003
2004
Length (cm)
60
50
40
30
5
10
15
20
Age bin

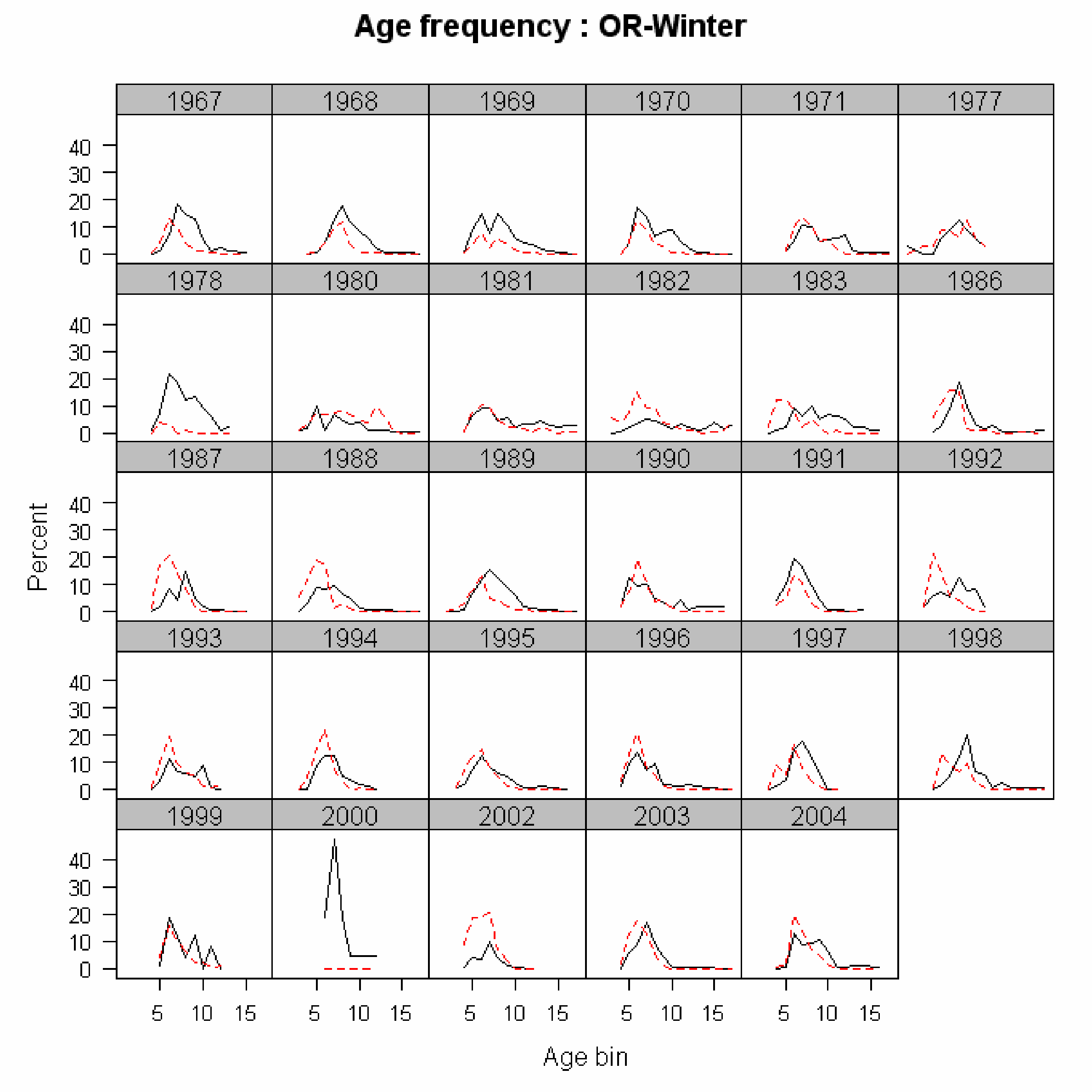

Mean Length @ Age : WA-Summer
1960
1961
1964
1965
1966
1967
1968
1969
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1998
1999
2000
2001
2002
2003
2004
Length (cm)
30
40
50
60
5
10
15
20
Age bin

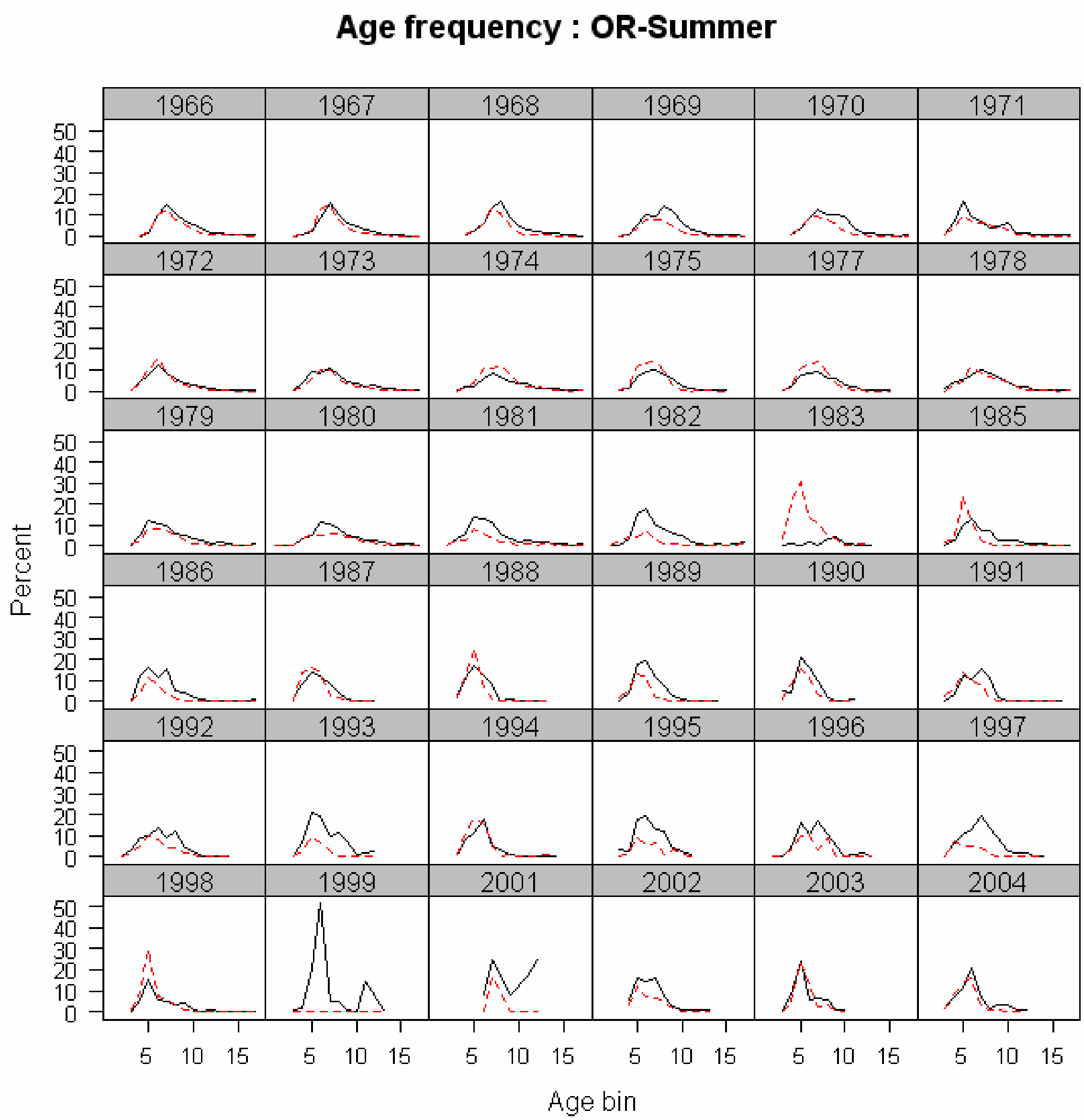
B. Oregon Fleets

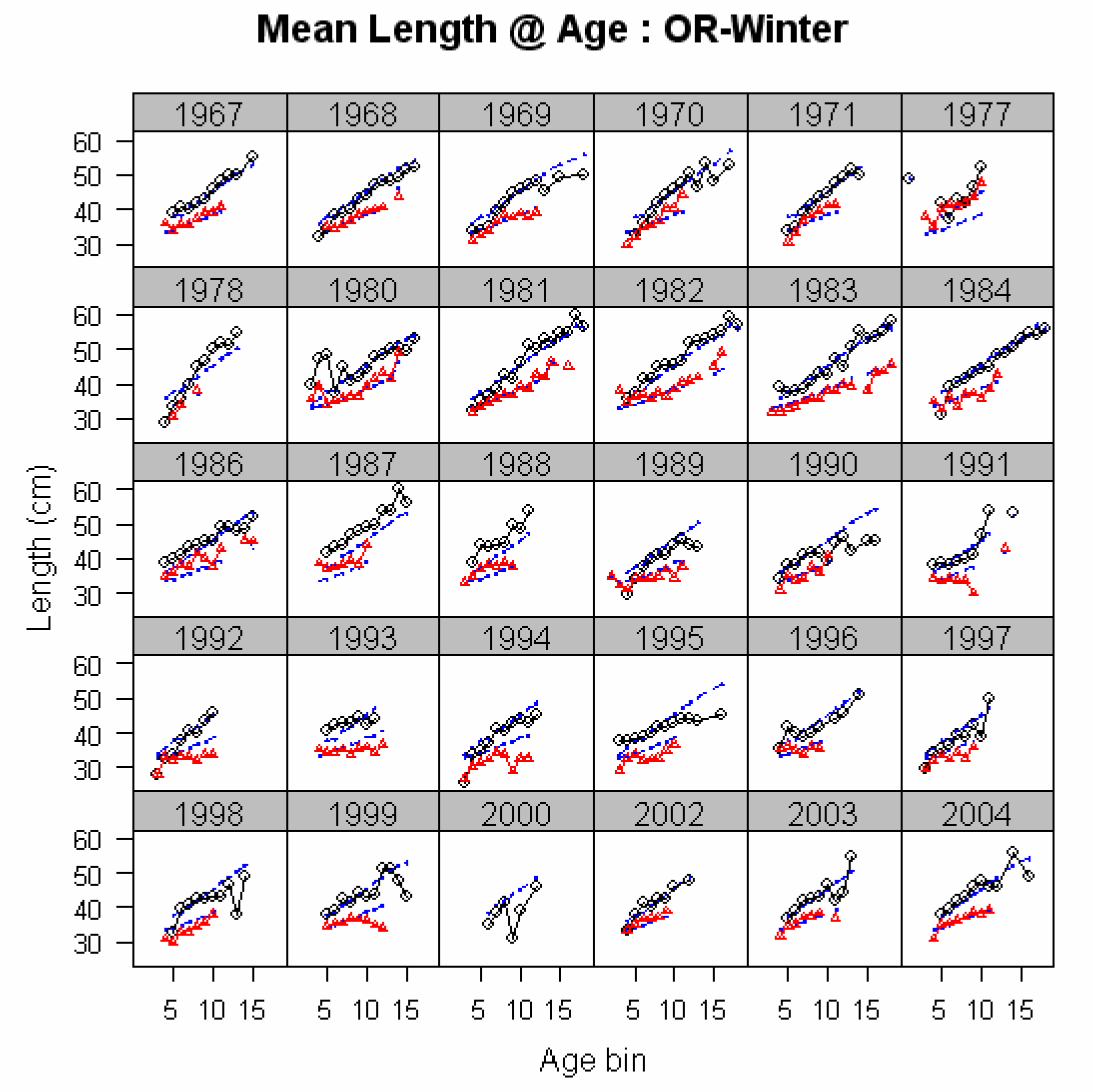


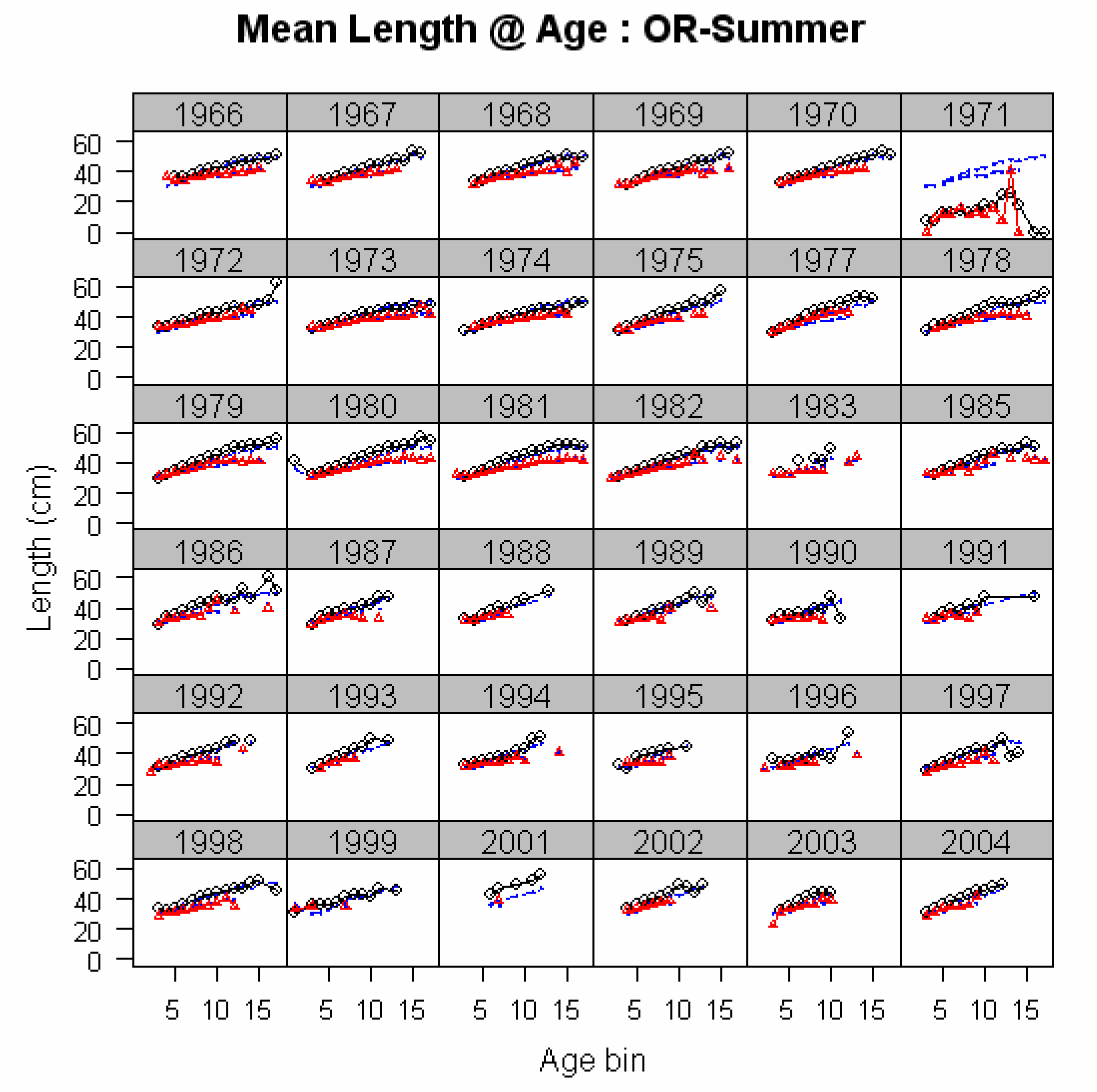


Length frequency : OR-Summer
1966
1967
1968
1969
1970
1971
1972
1973
1974
1975
1977
1978
1979
1980
1981
1982
1983
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
Percent
0
10
20
30
20 30 40 50 60
Length bin


Age frequency : OR-Winter
1967
1968
1969
1970
1971
1977
1978
1980
1981
1982
1983
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2002
2003
2004
Percent
Age bin
0
10
20
30
40
5
10
15


Age frequency : OR-Summer
1966
1967
1968
1969
1970
1971
1972
1973
1974
1975
1977
1978
1979
1980
1981
1982
1983
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2001
2002
2003
2004
Percent
Age bin


Mean Length @ Age : OR-Winter
1967
1968
1969
1970
1971
1977
1978
1980
1981
1982
1983
1984
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2002
2003
2004
Length (cm)
Age bin
60
50
40
30
5
10
15



Mean Length @ Age : OR-Summer
1966
1967
1968
1969
1970
1971
1972
1973
1974
1975
1977
1978
1979
1980
1981
1982
1983
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2001
2002
2003
2004
Length (cm)
Age bin

Appendix III. The diagnostic plots for the base model for the Northern assessment area.

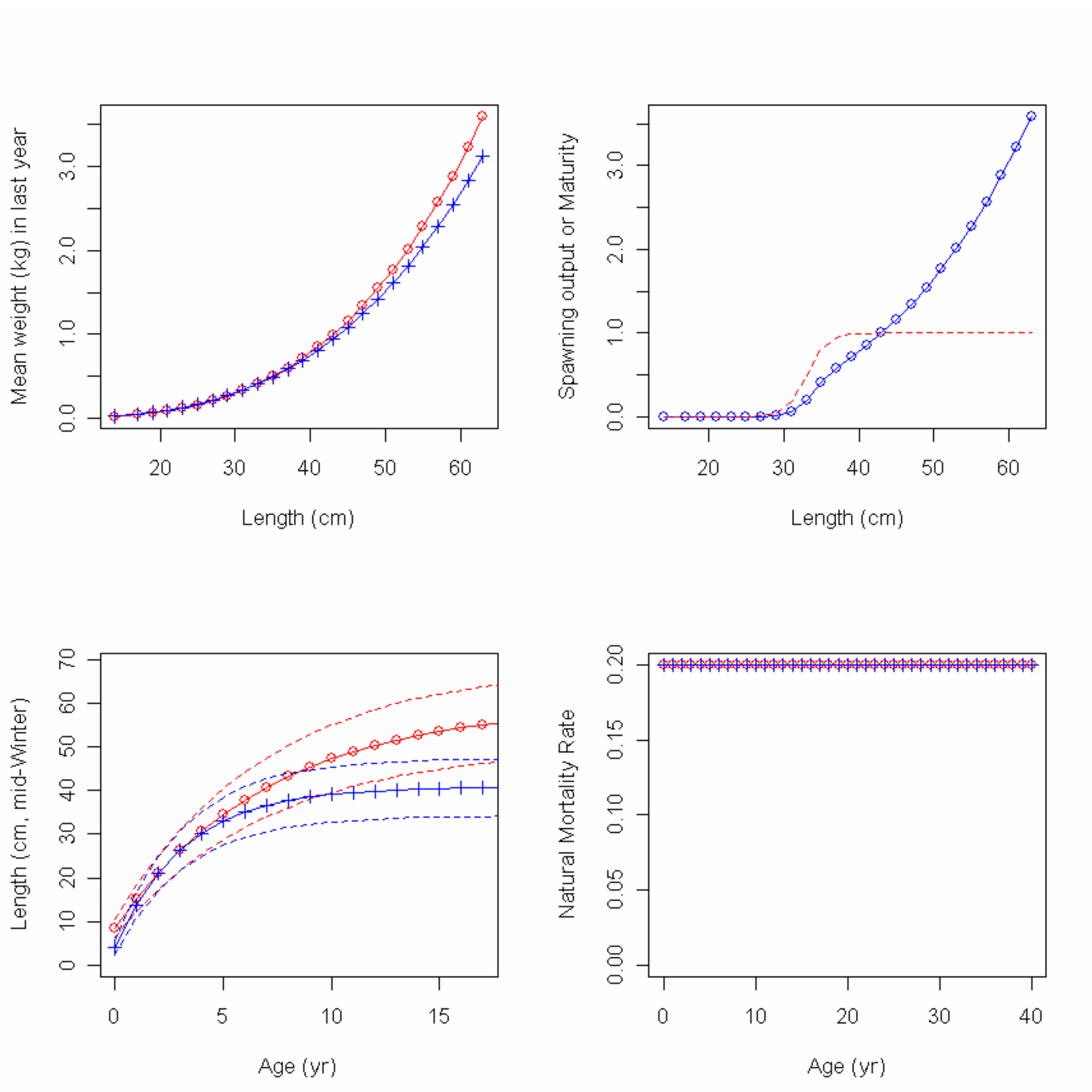


Figure III-1. Biological parameters for the Northern assessment area.

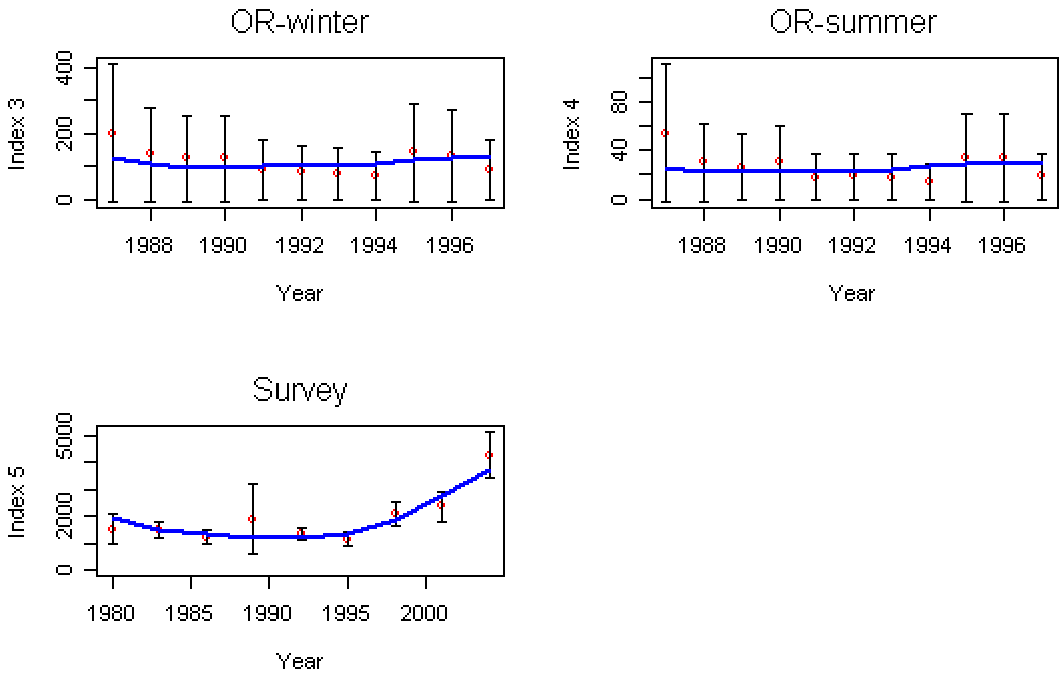


Figure III-2. Fits to the indices of abundance for the Northern assessment area.

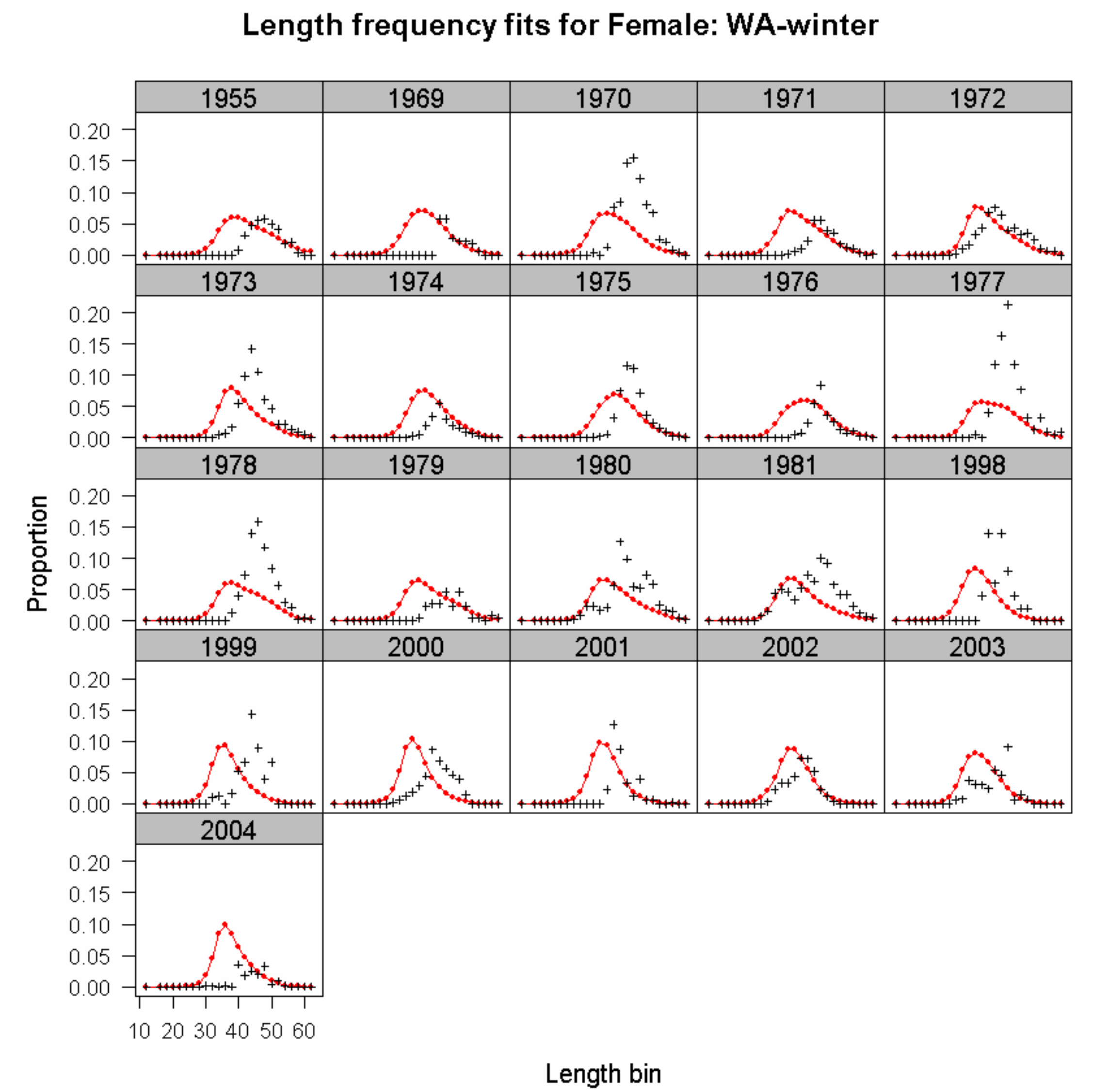


Figure III-3. Fits to the length composition data for Northern assessment area.

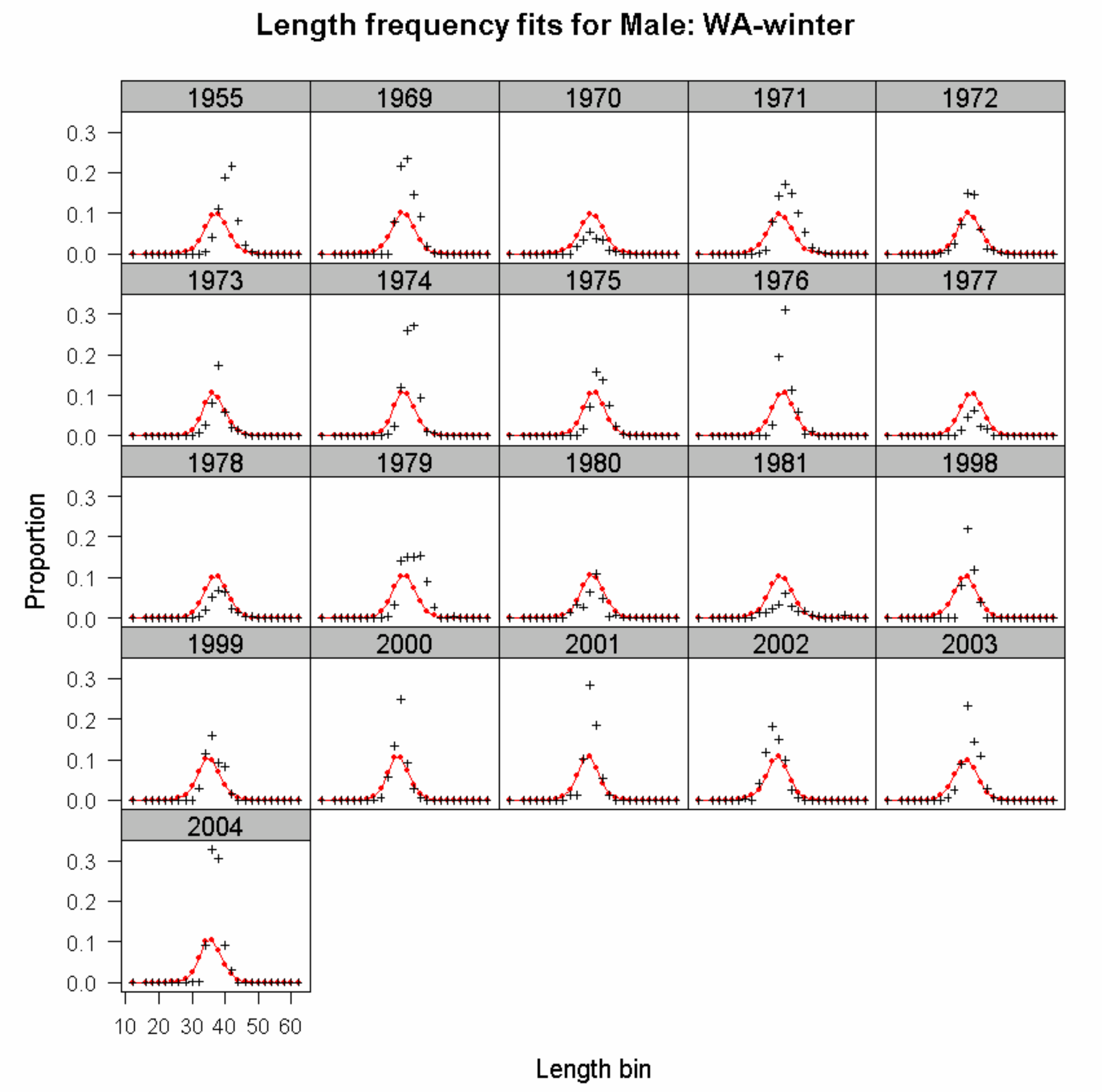


Figure III-3 Continued

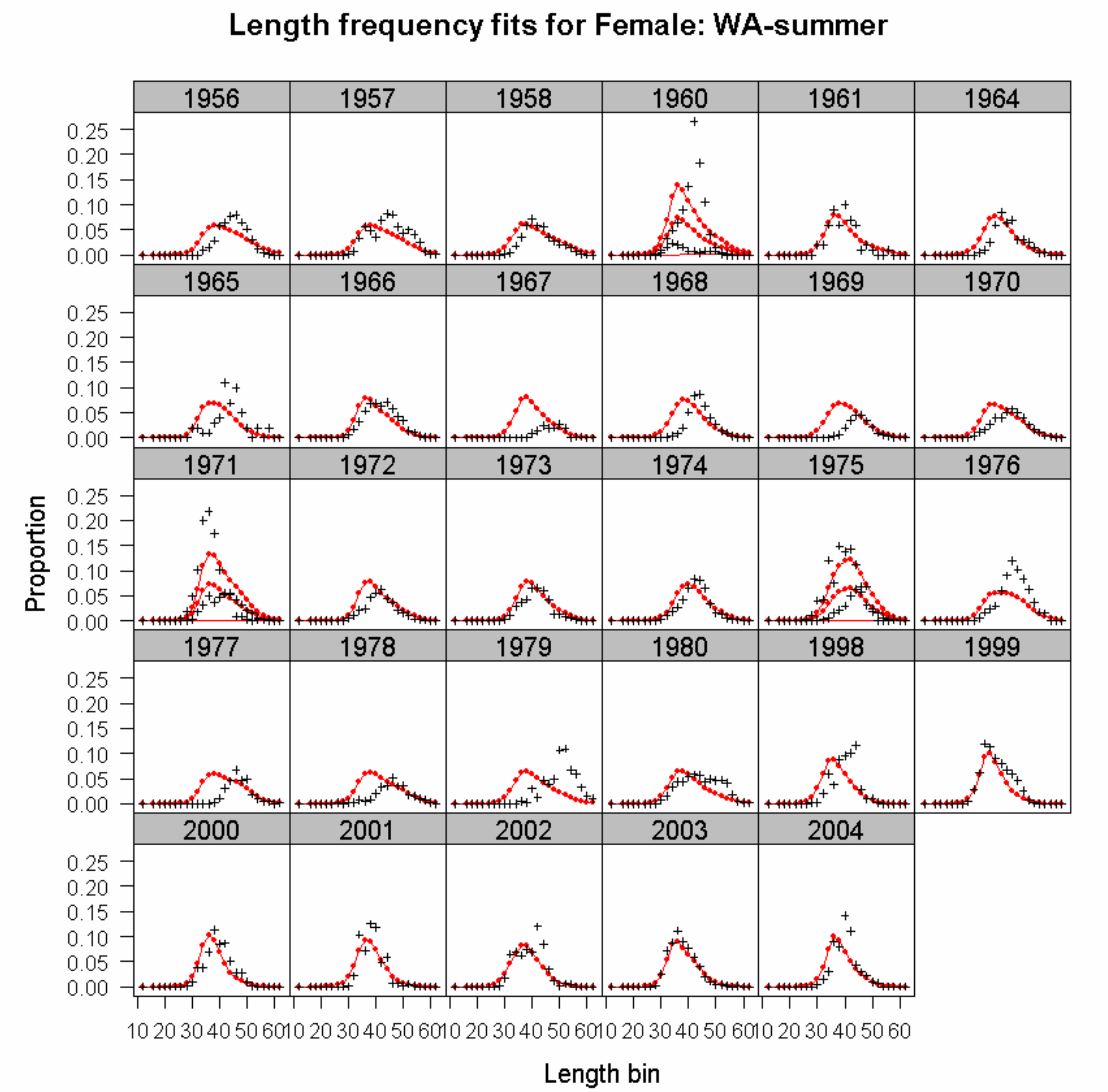


Figure III-3 Continued

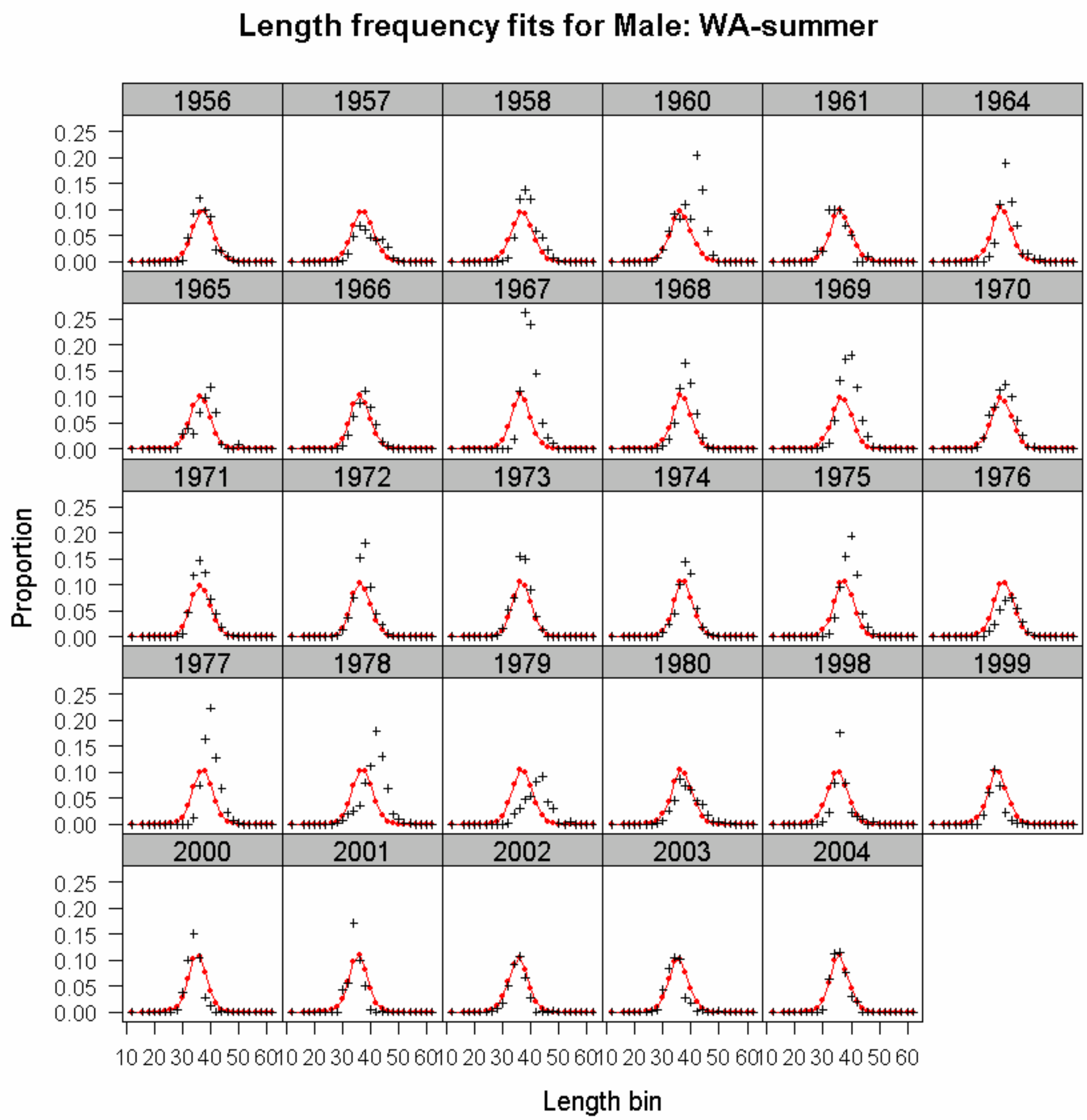


Figure III-3 Continued

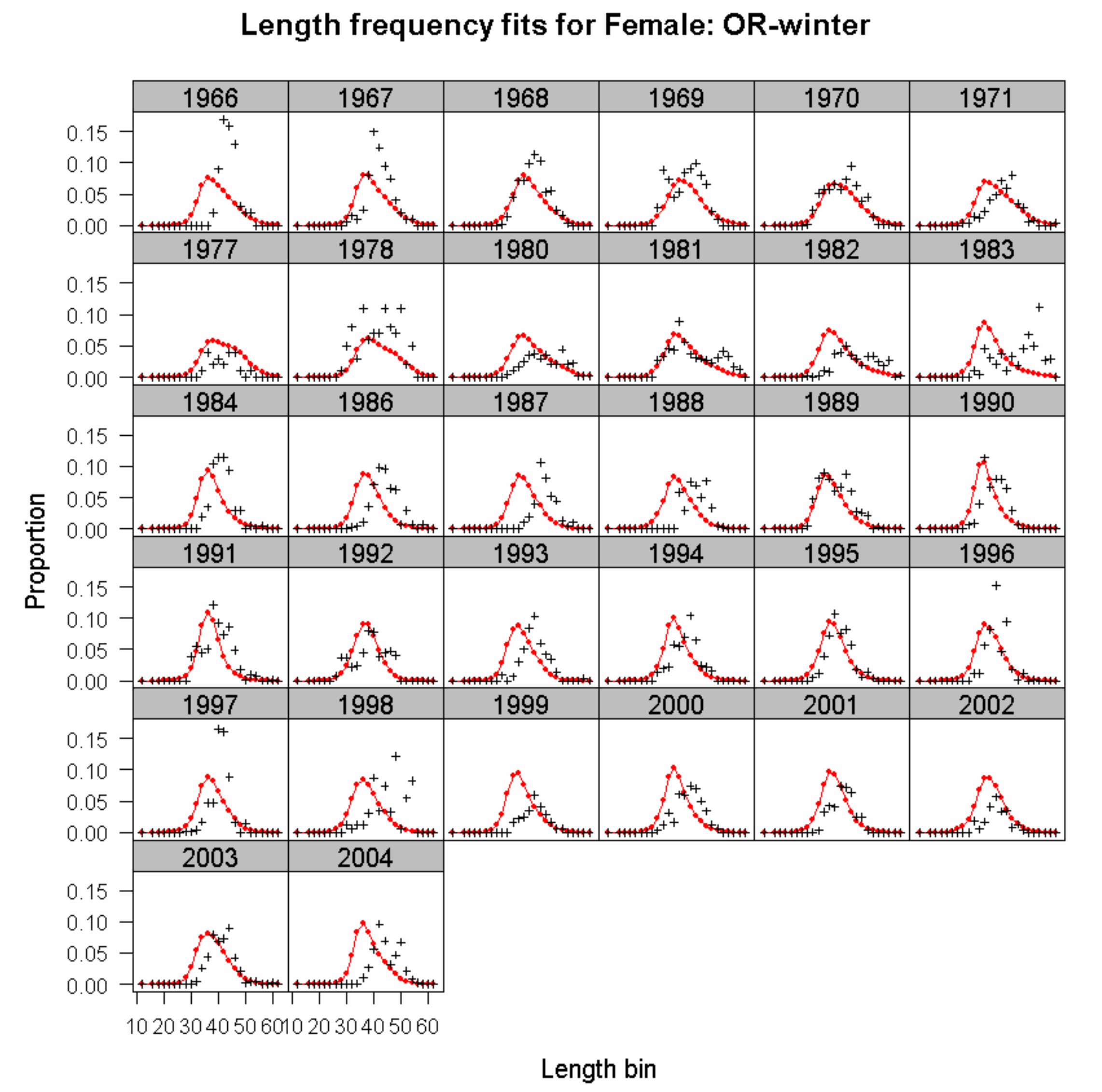


Figure III-3 Continued

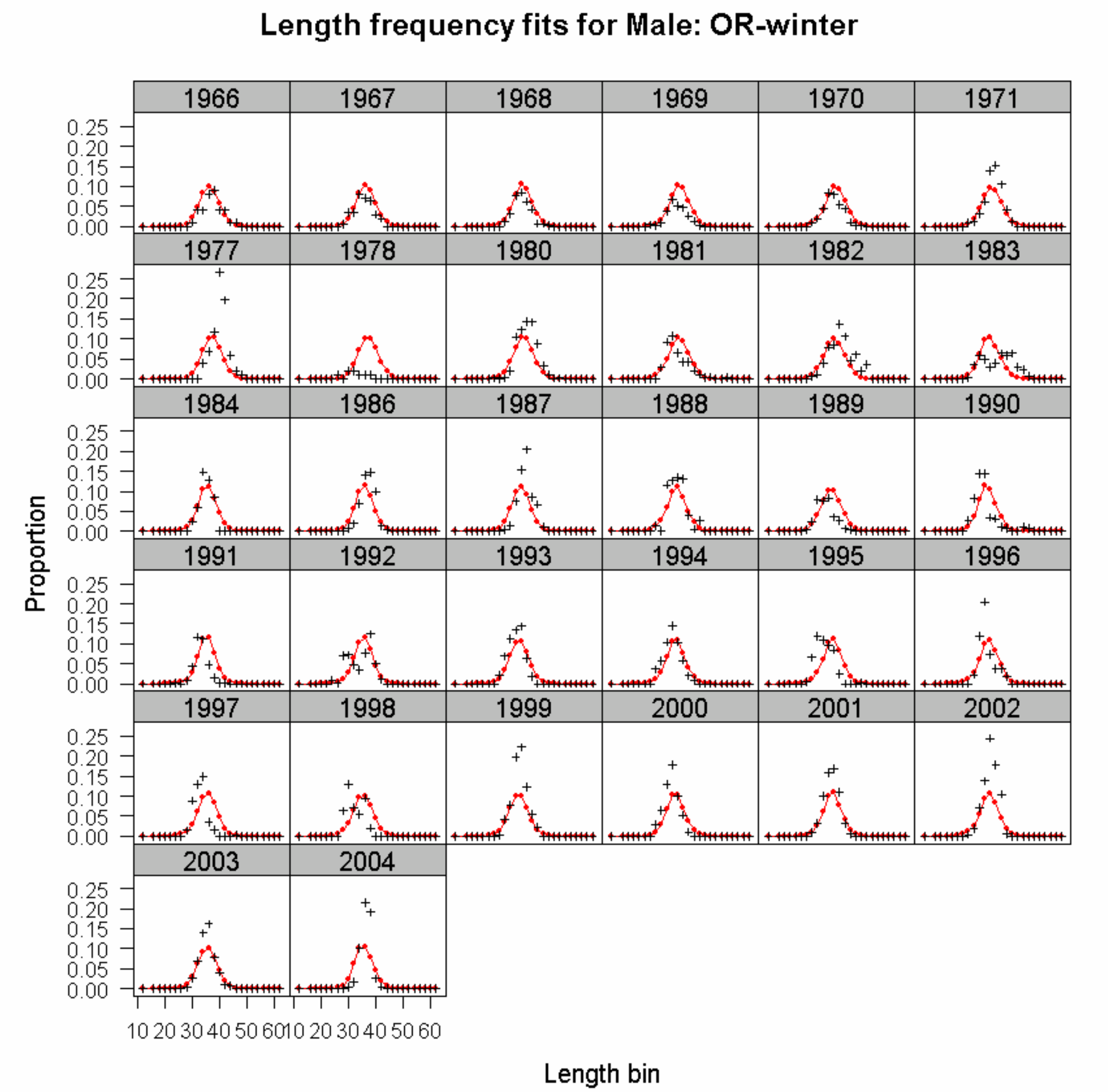


Figure III-3 Continued

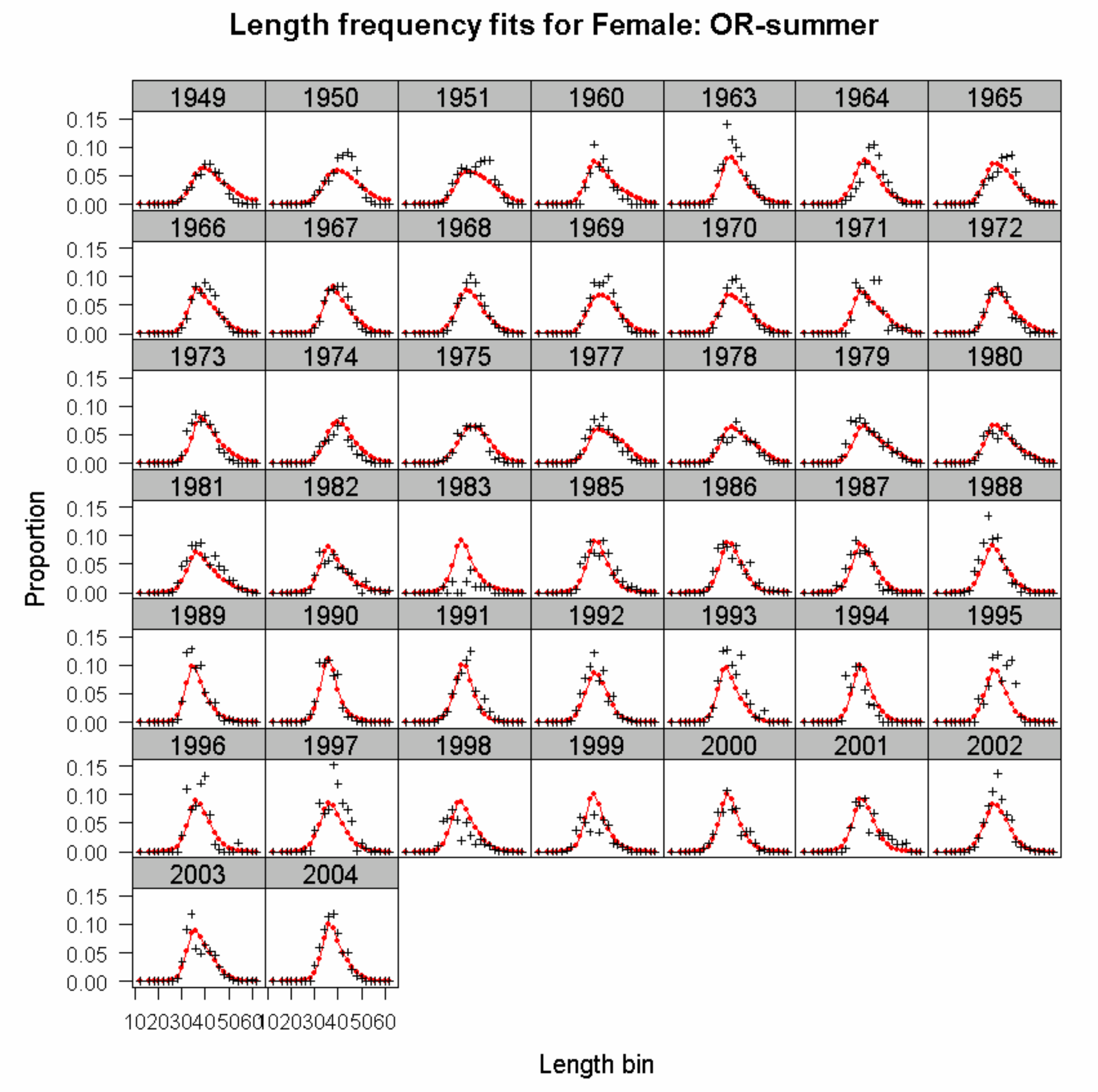


Figure III-3 Continued

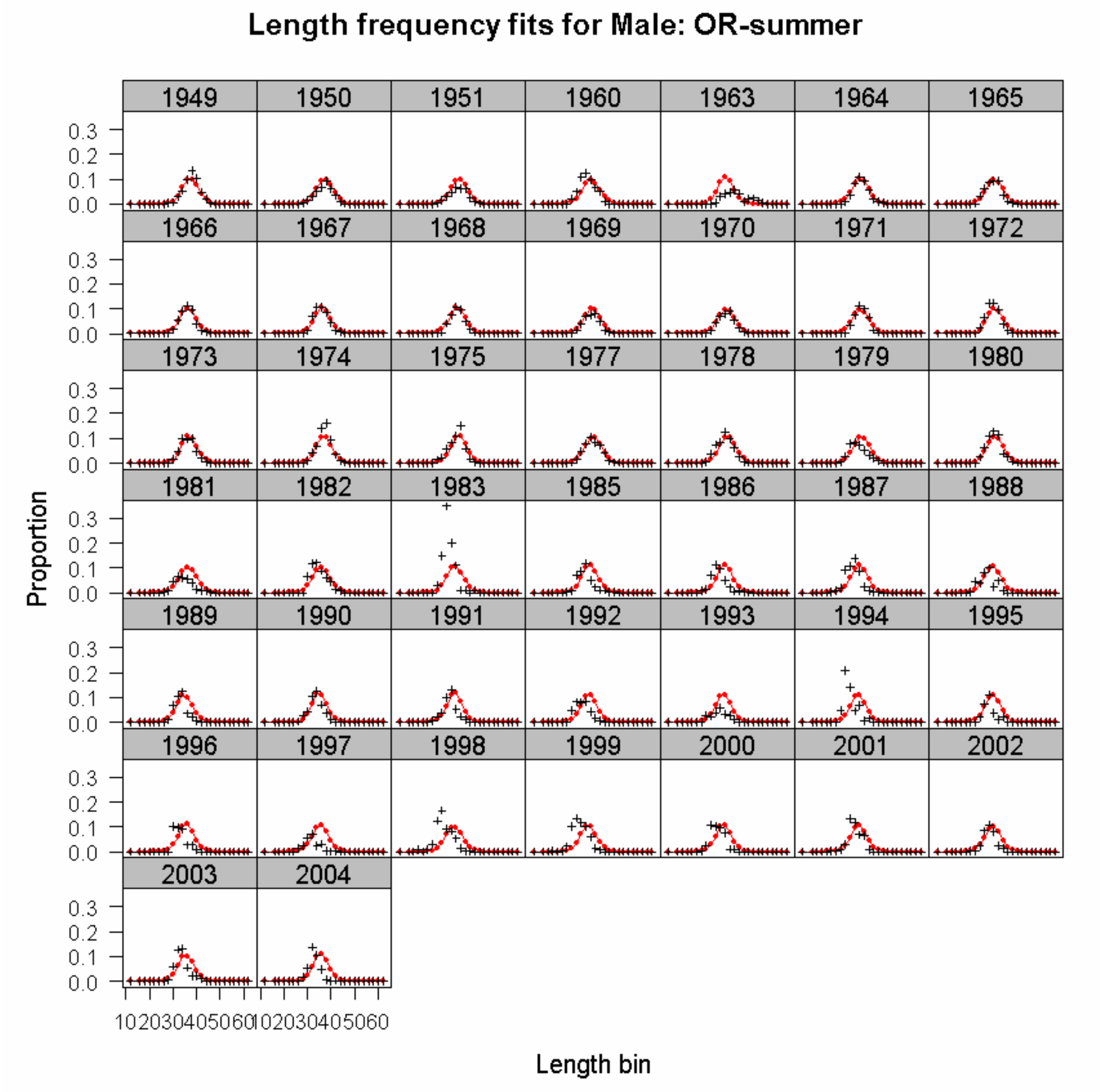


Figure III-3 Continued

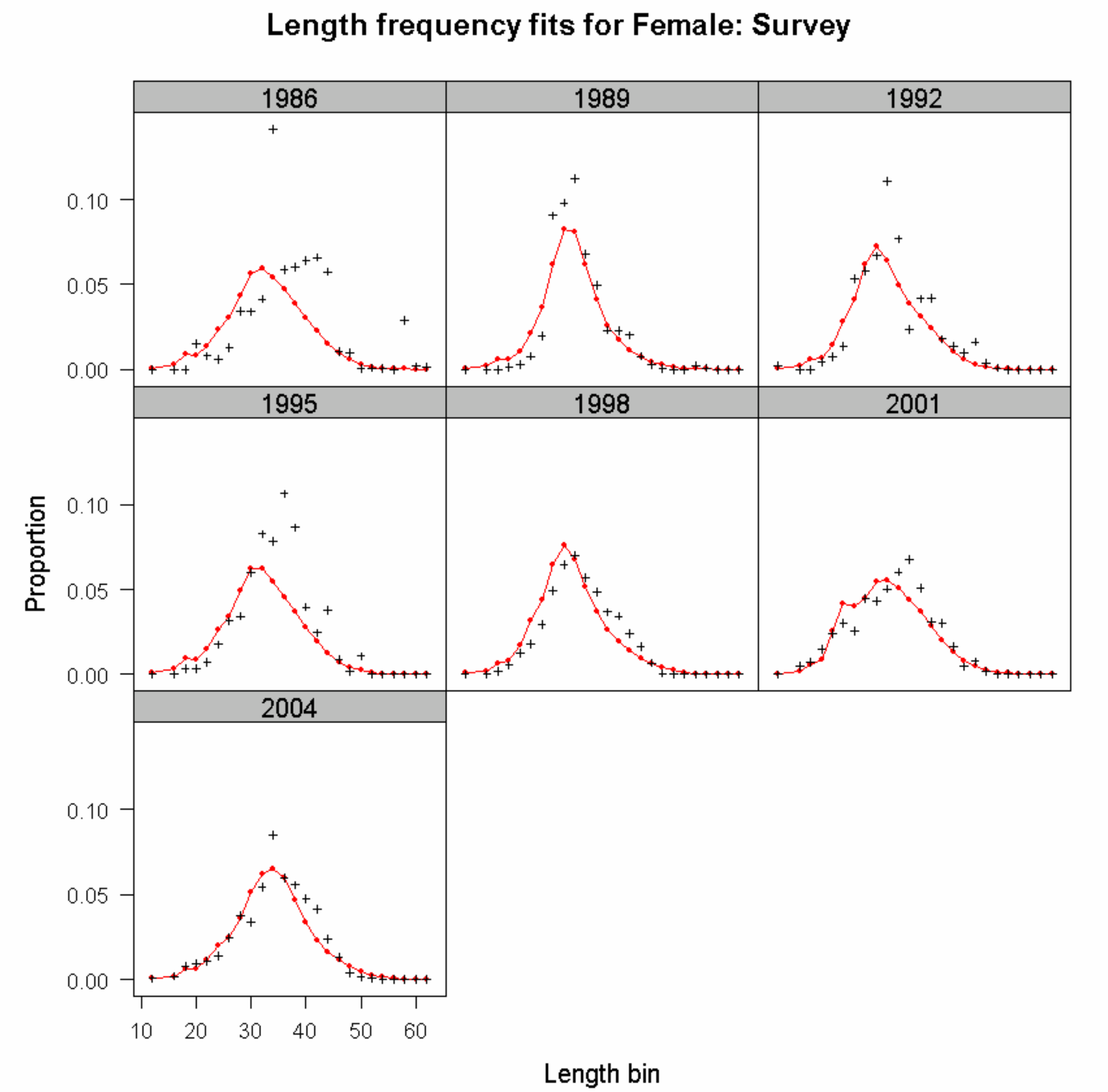


Figure III-4. Fits to the survey length composition data for the Northern assessment area.

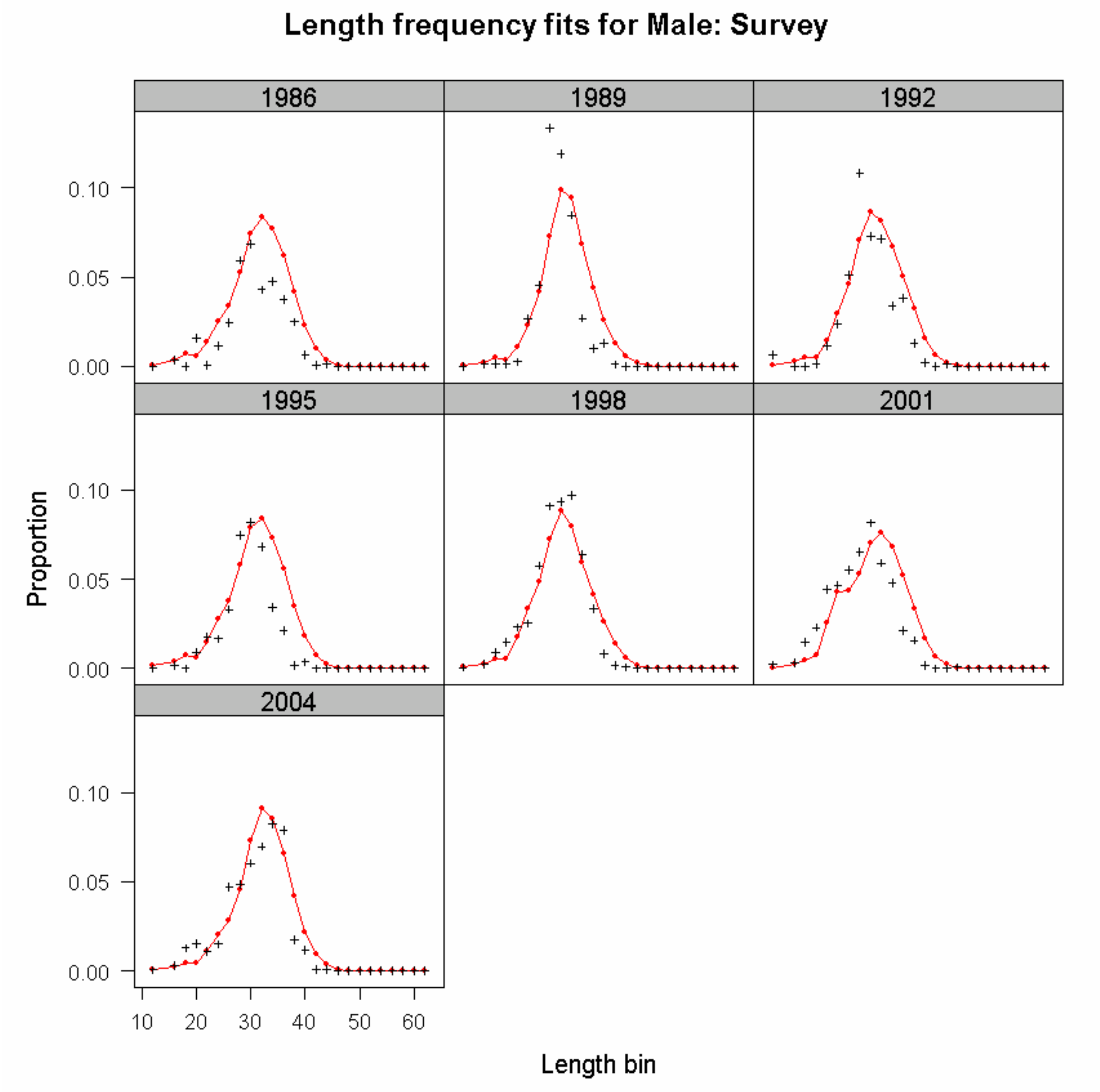


Figure III-4 Continued

Appendix IV. The diagnostic plots for the base model in the Southern assessment area.

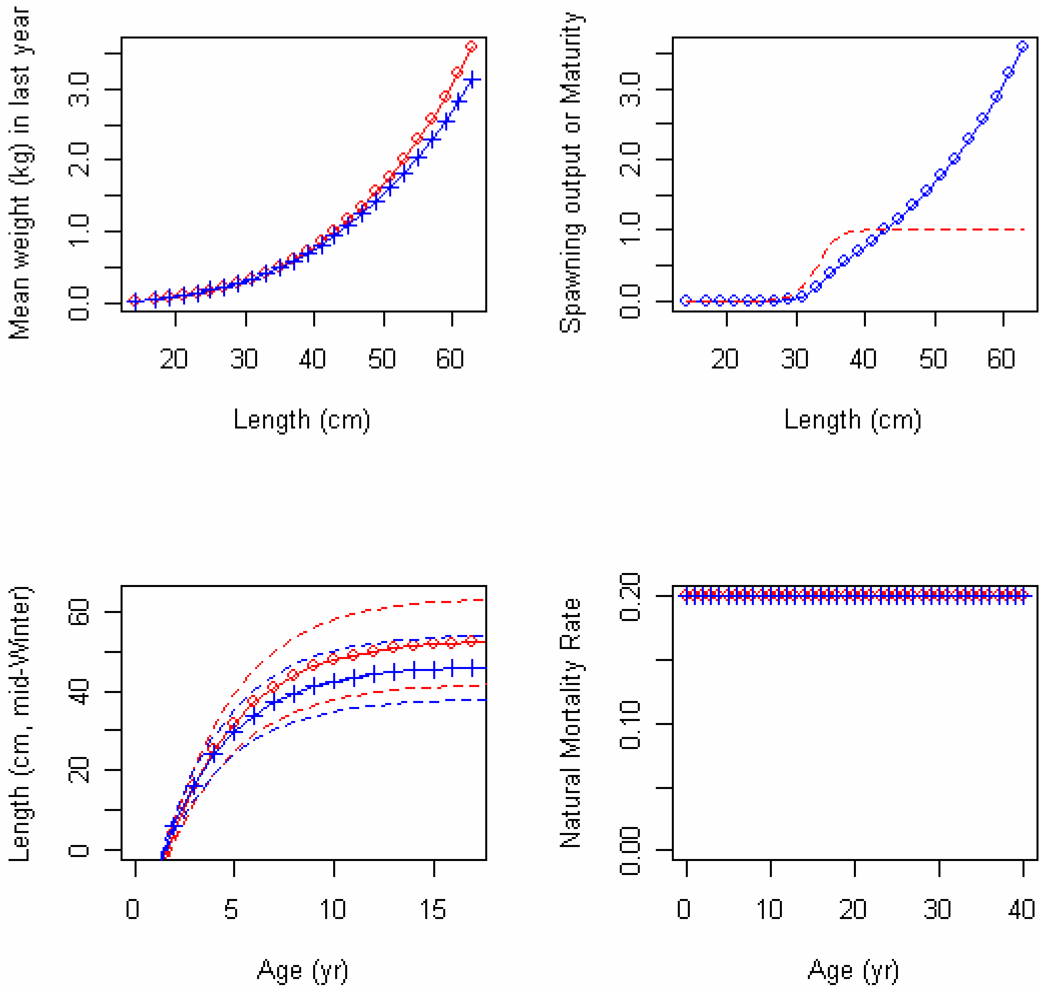


Figure IV-1. Biological parameters for the Southern assessment area.

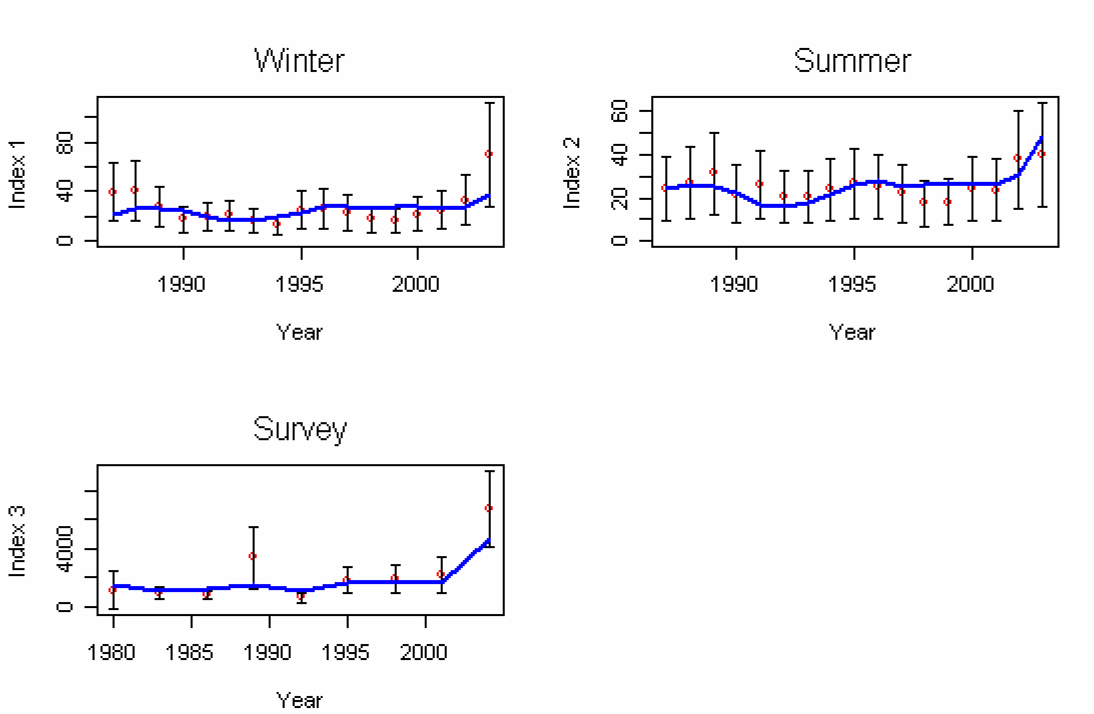


Figure IV-2. Fits to the indices of abundance for the Southern assessment area.

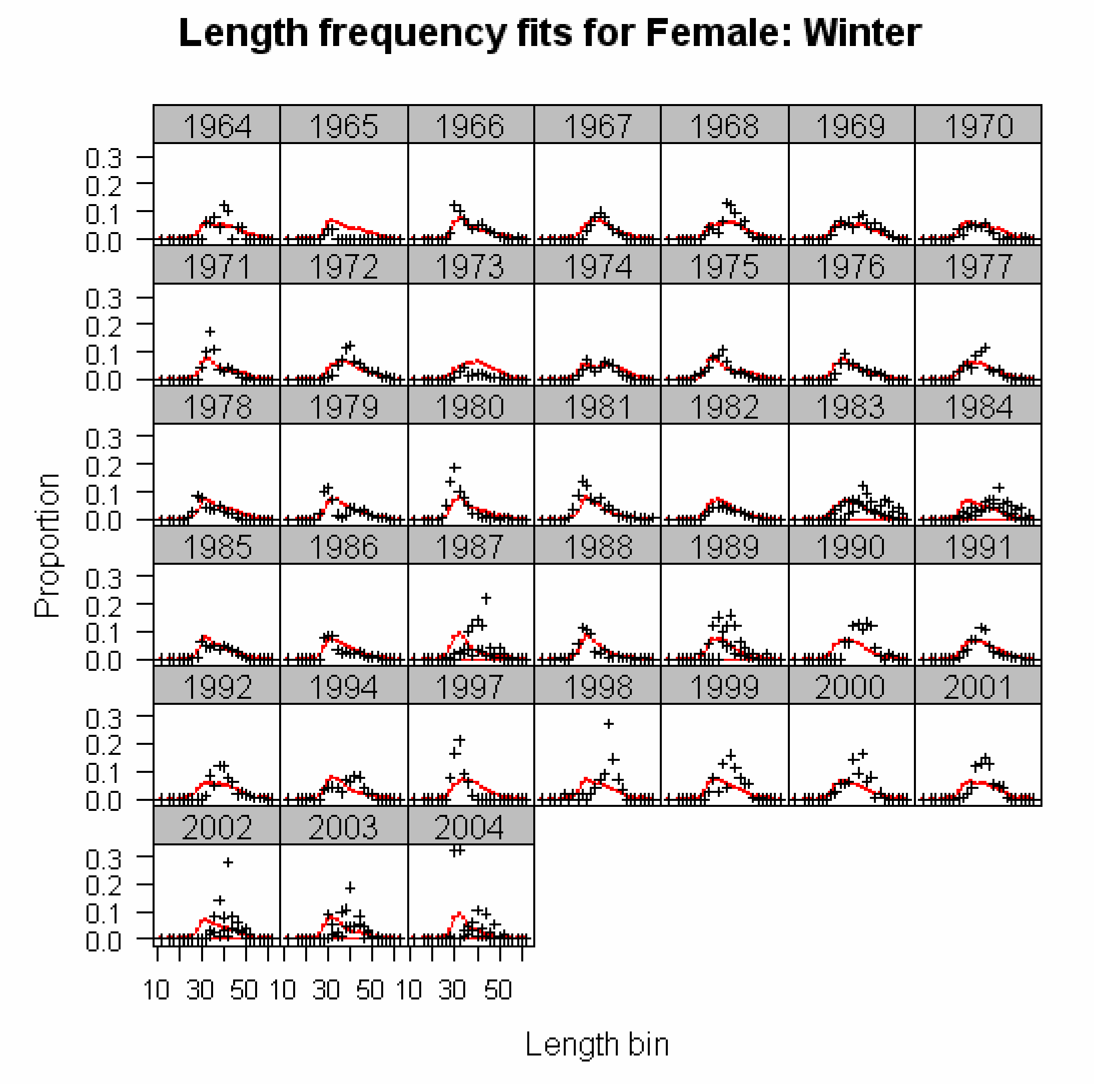


Figure IV-3. Fits to the length composition data for Southern assessment area.

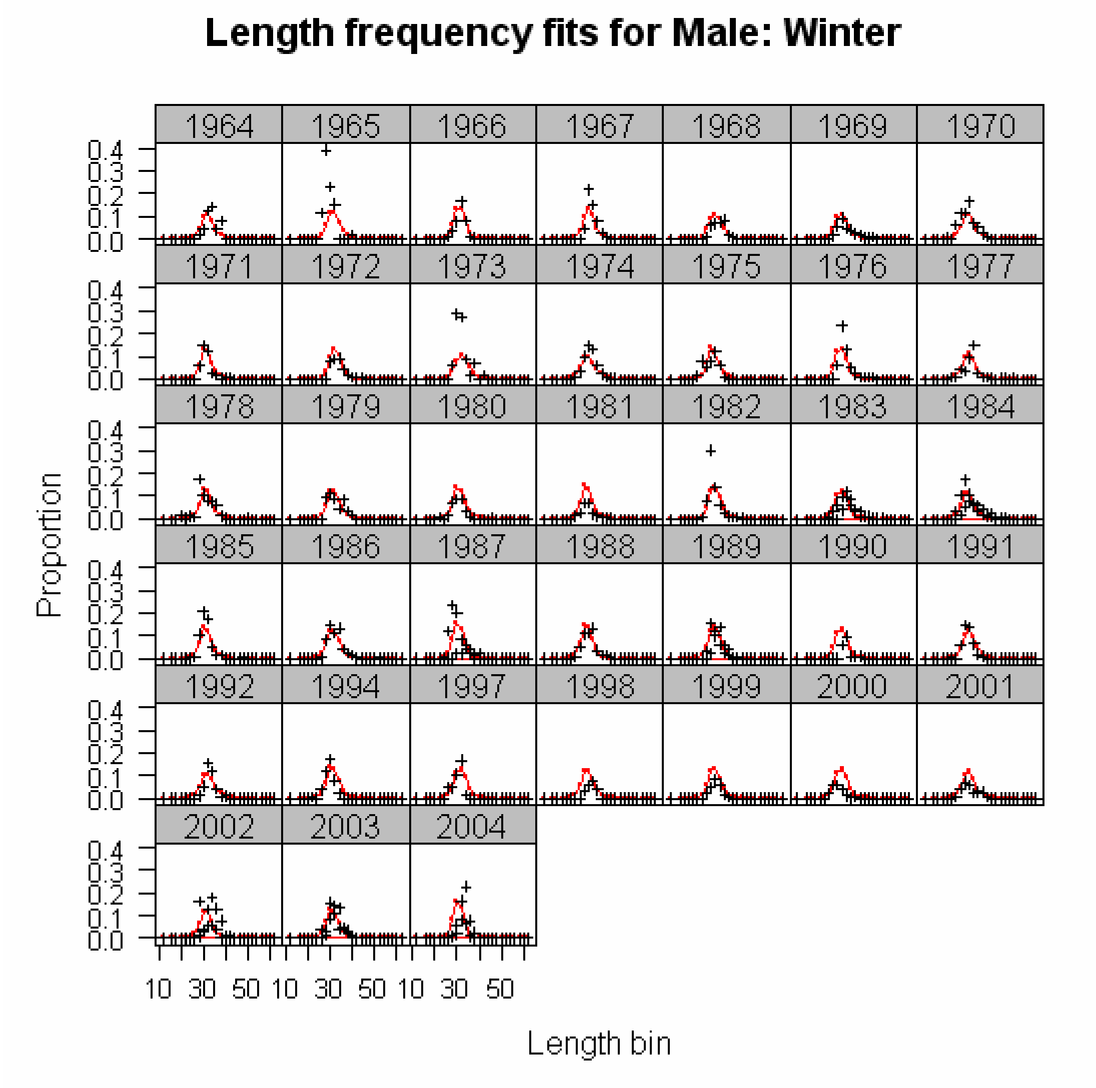


Figure IV-3 Continued

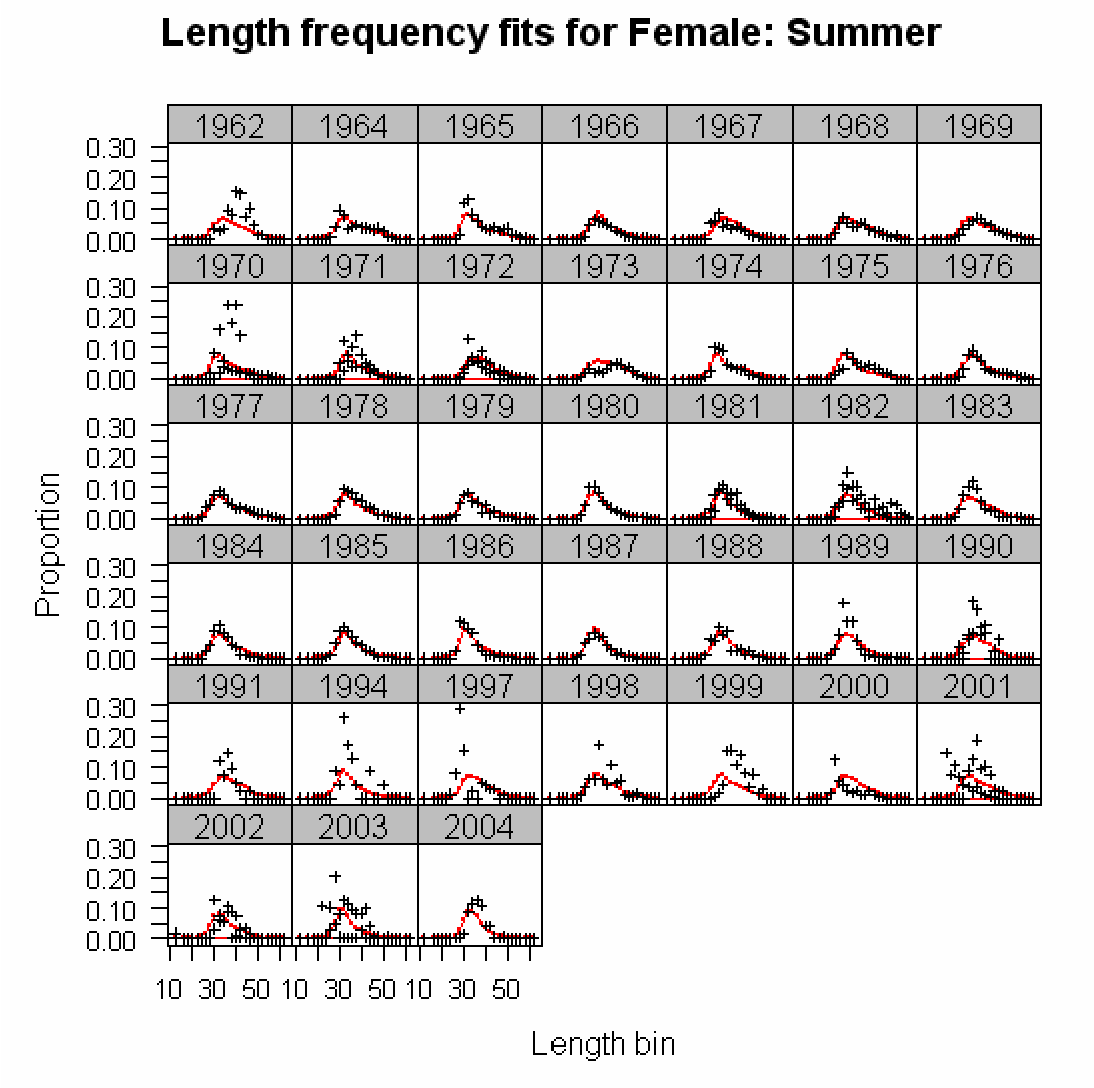


Figure IV-3 Continued

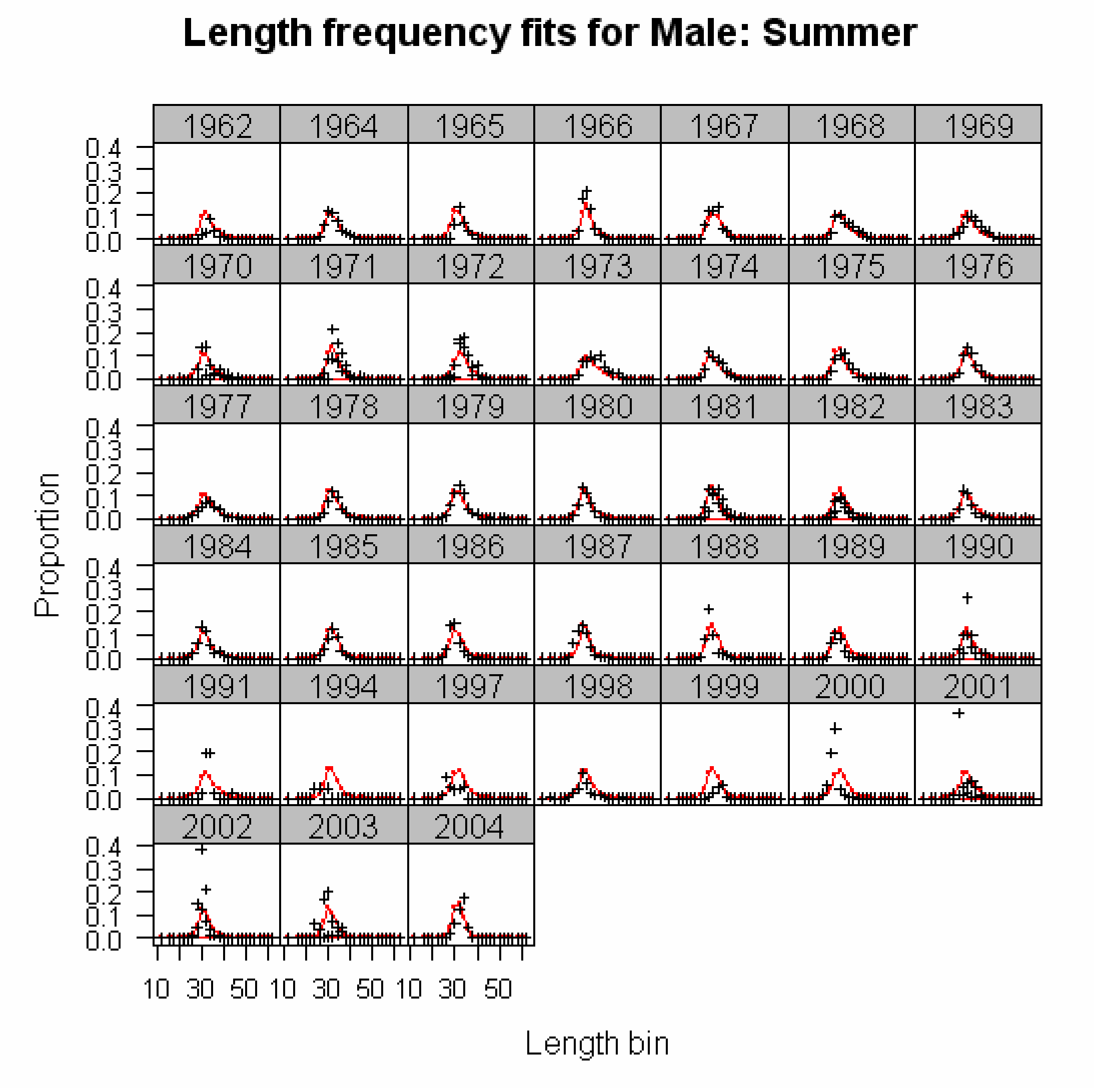


Figure IV-3 Continued

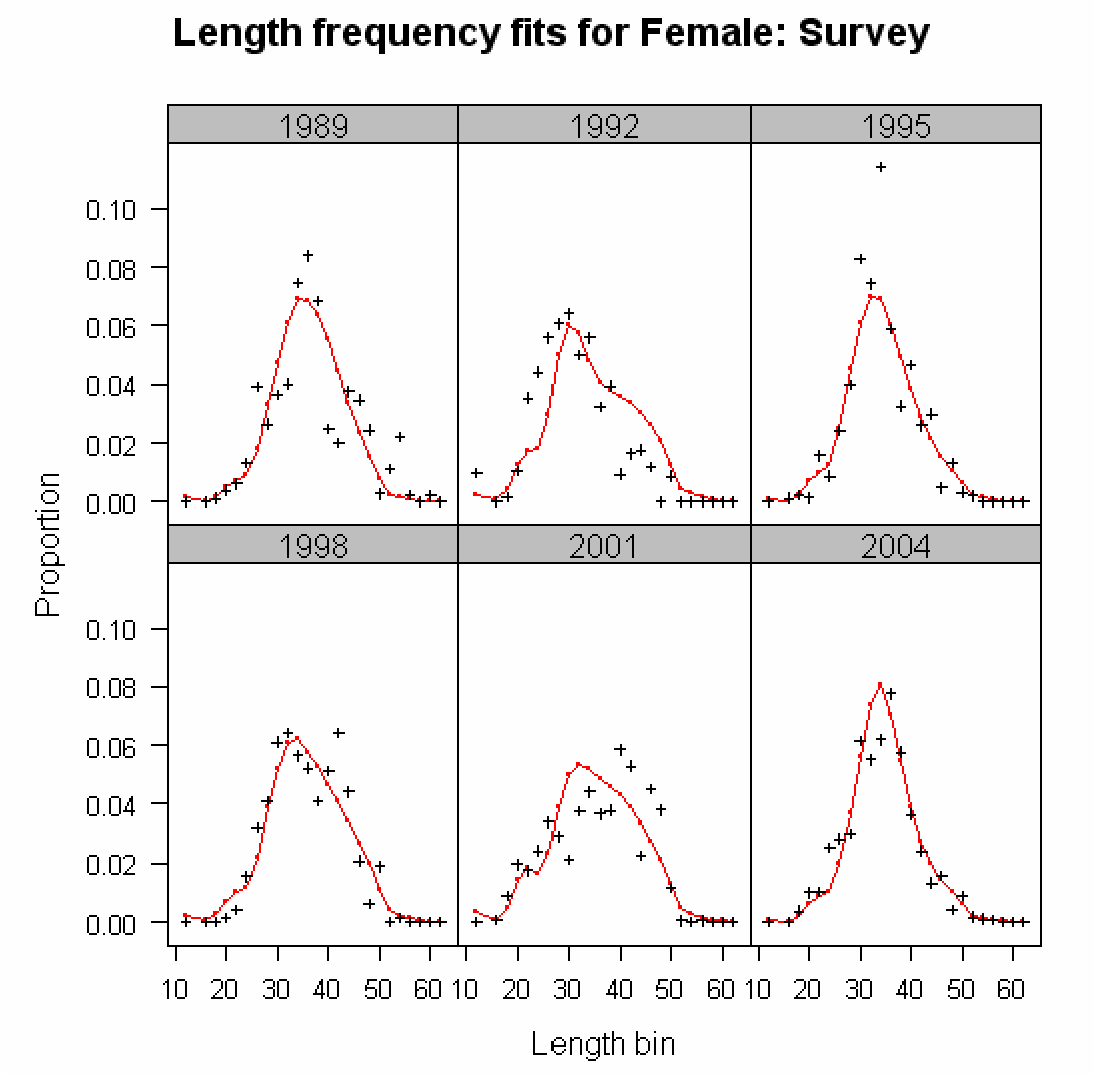


Figure IV-4. Fits to the survey length composition data for the Southern assessment area.

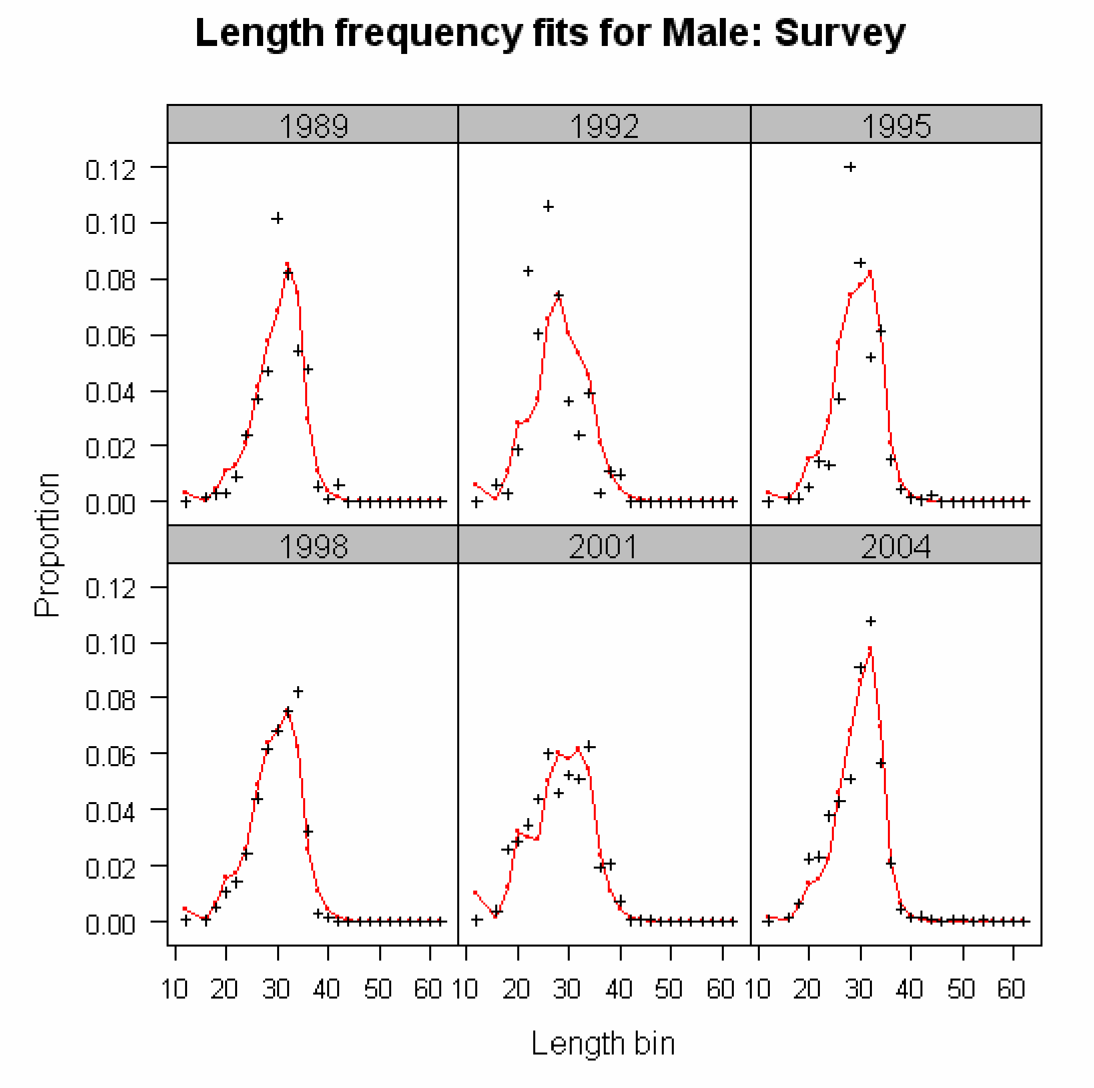


Figure IV-4 Continued

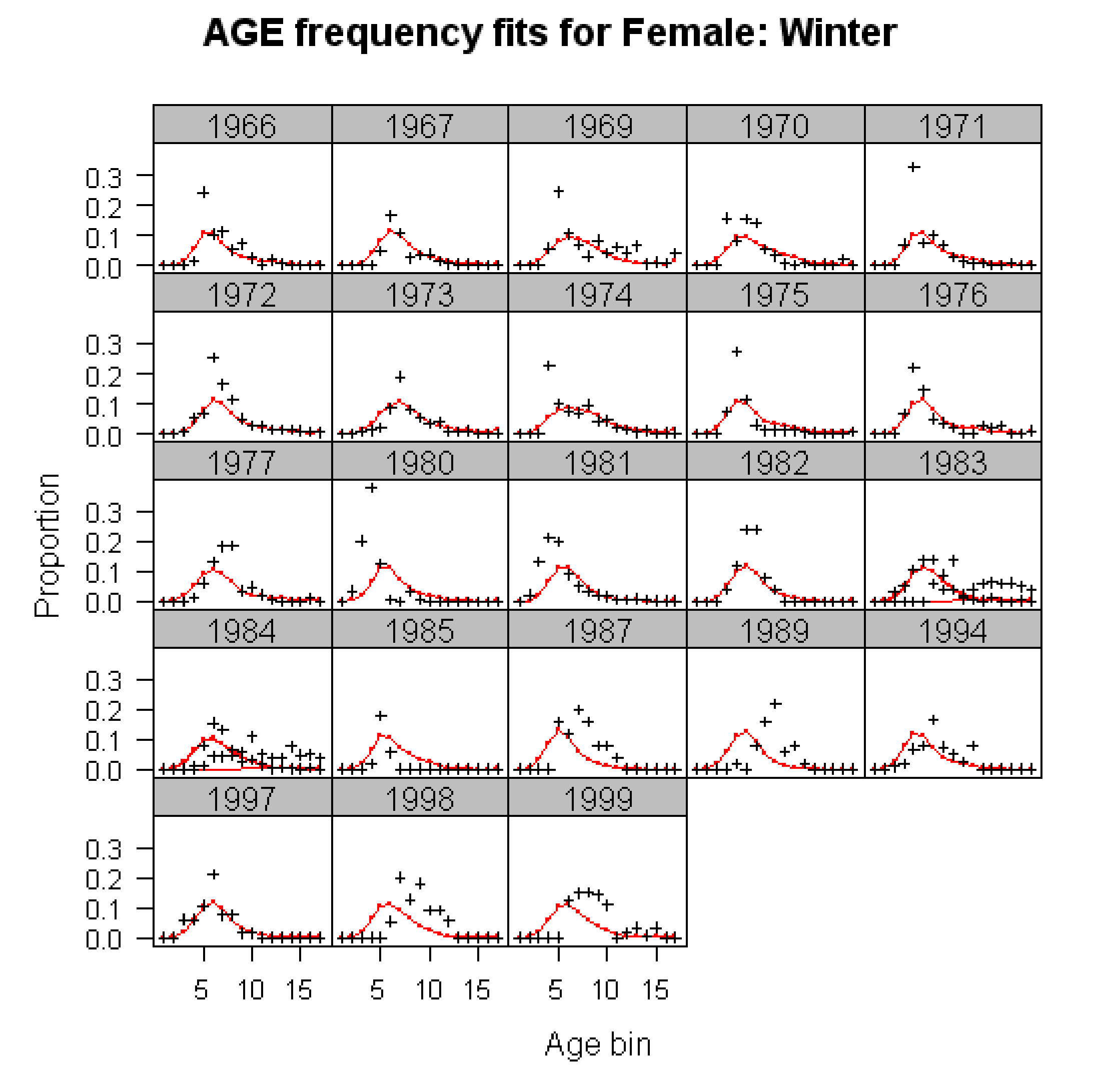


Figure IV-5. Fits to the age composition data for Southern assessment area.

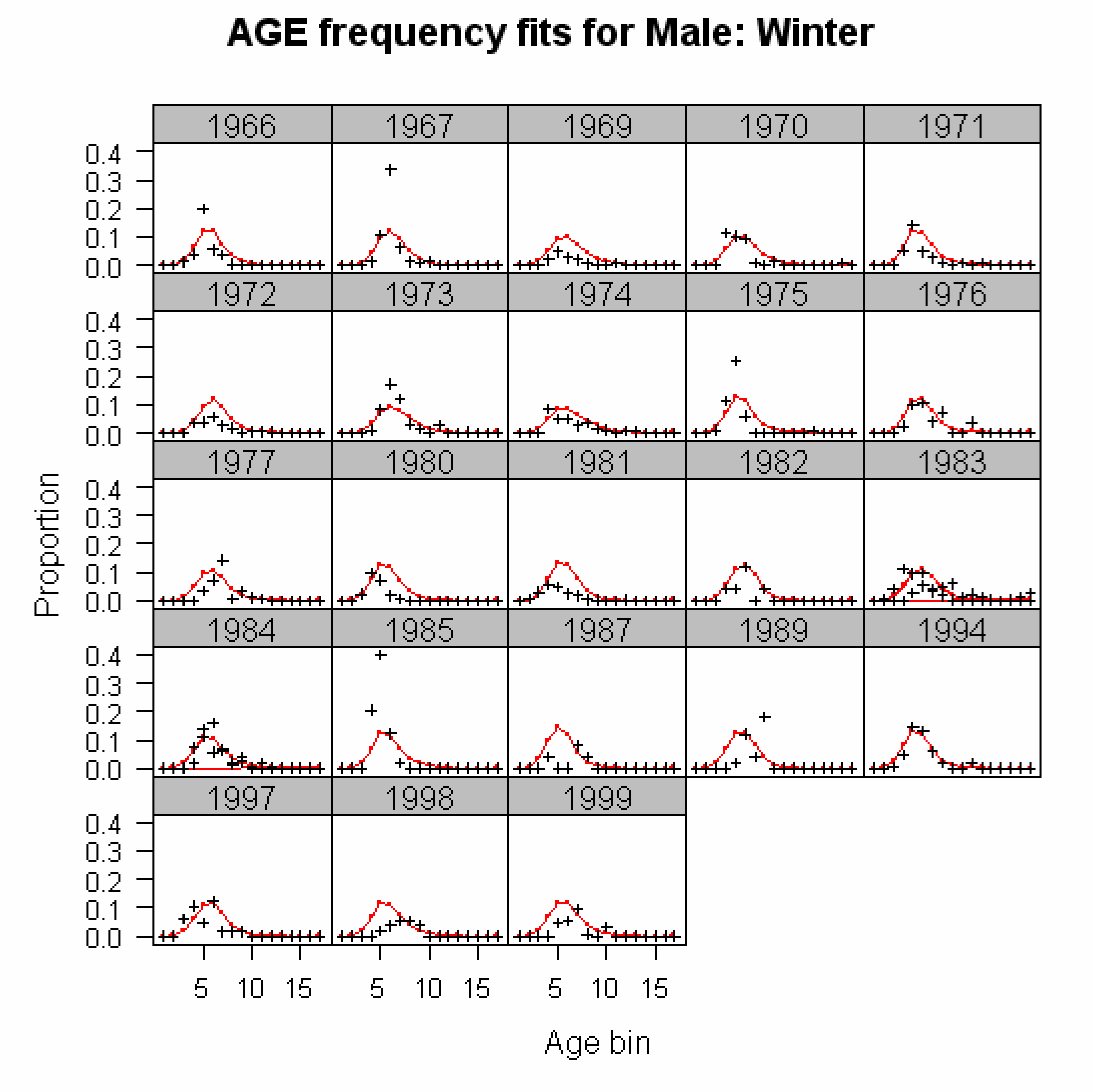


Figure IV-5 Continued

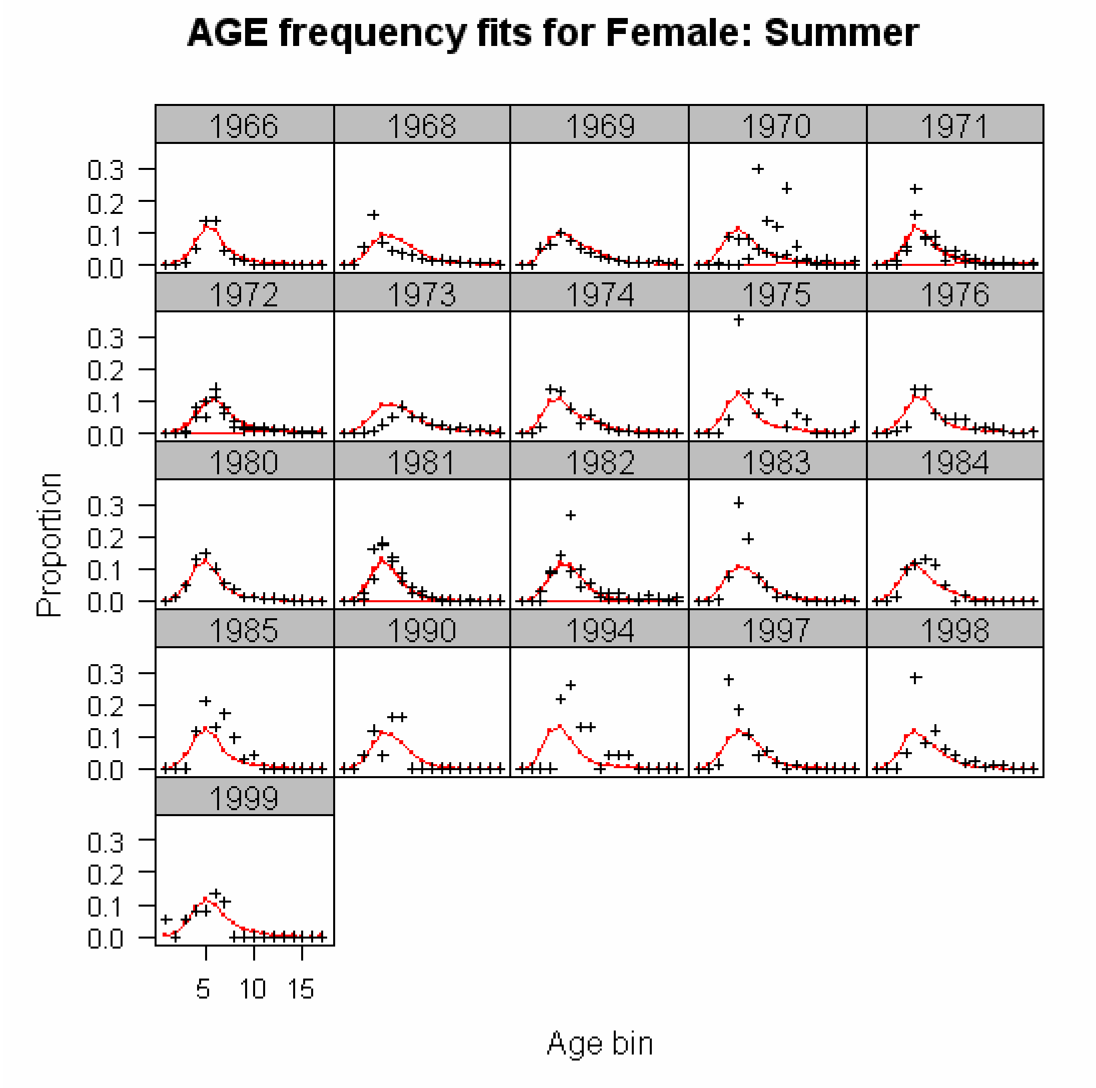


Figure IV-5 Continued

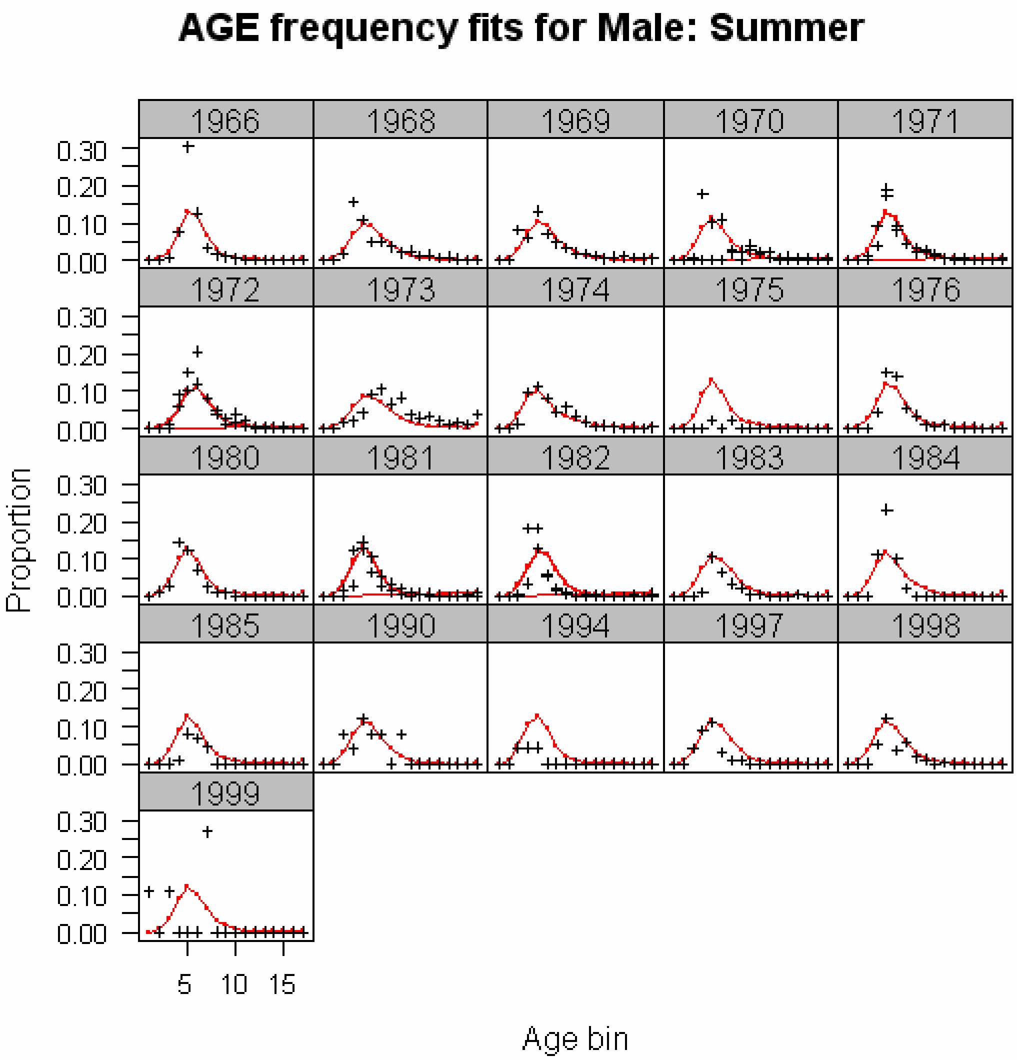


Figure IV-5 Continued

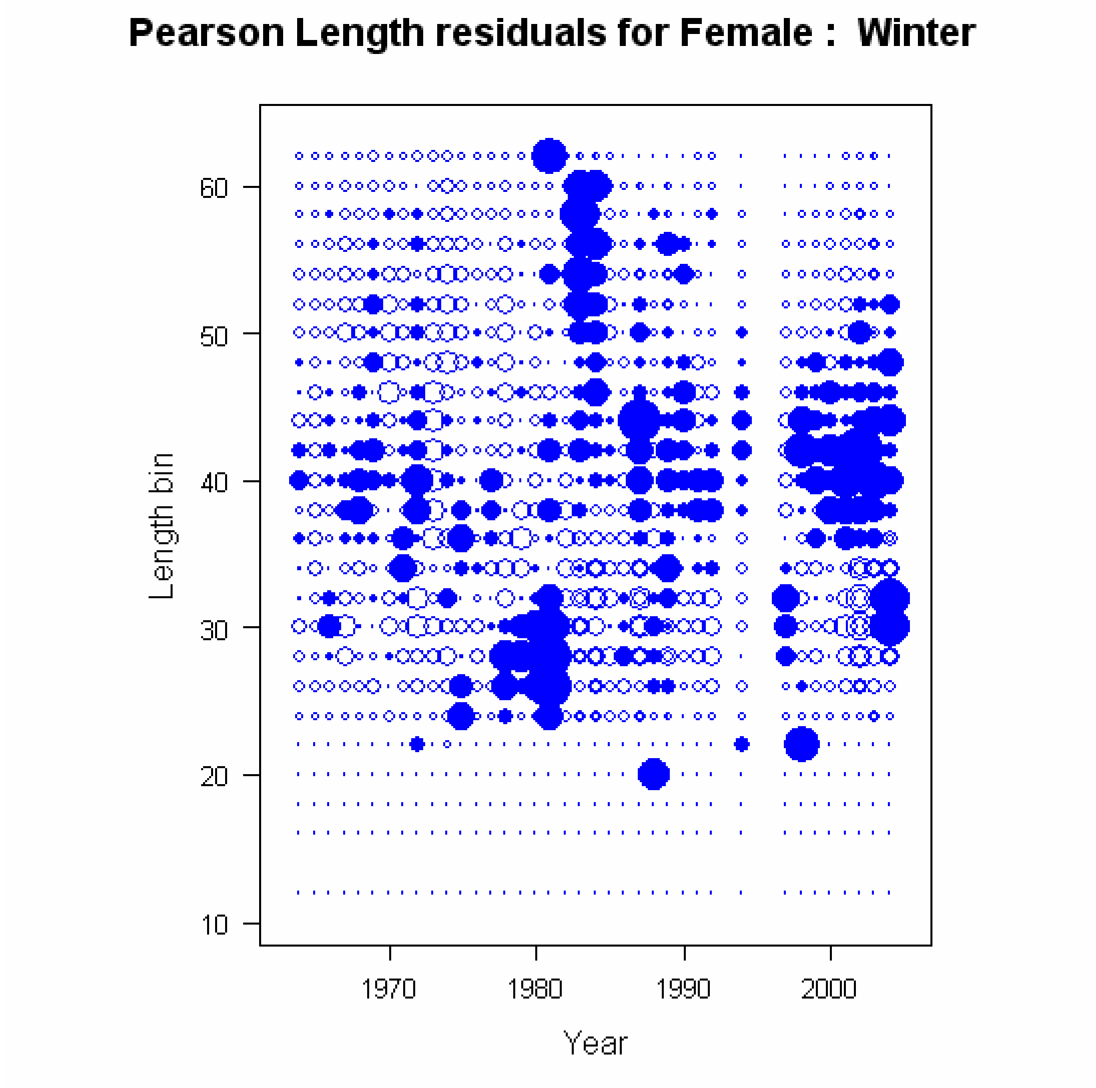


Figure IV-6. Pearson residuals for the Southern assessment area.

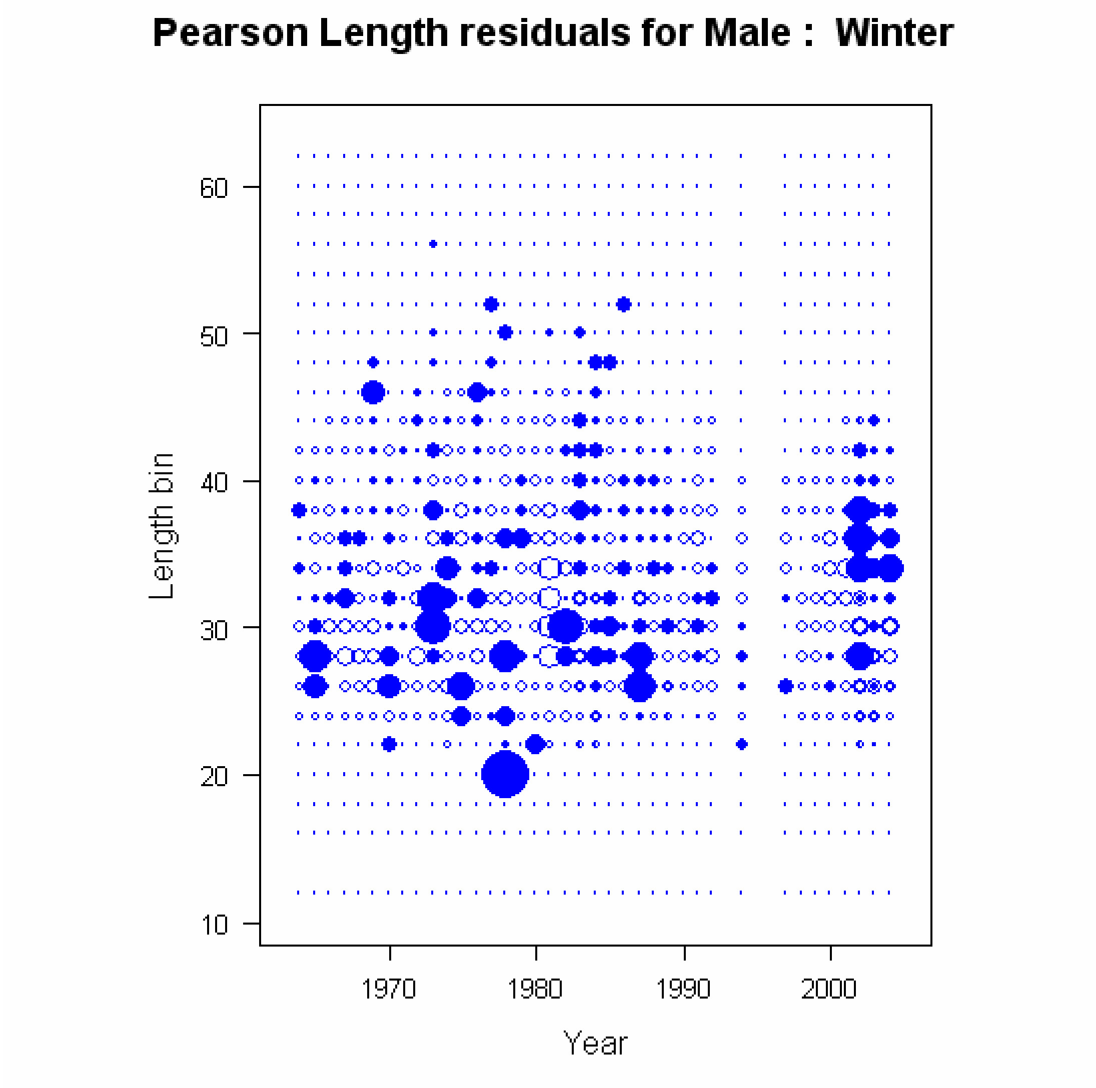
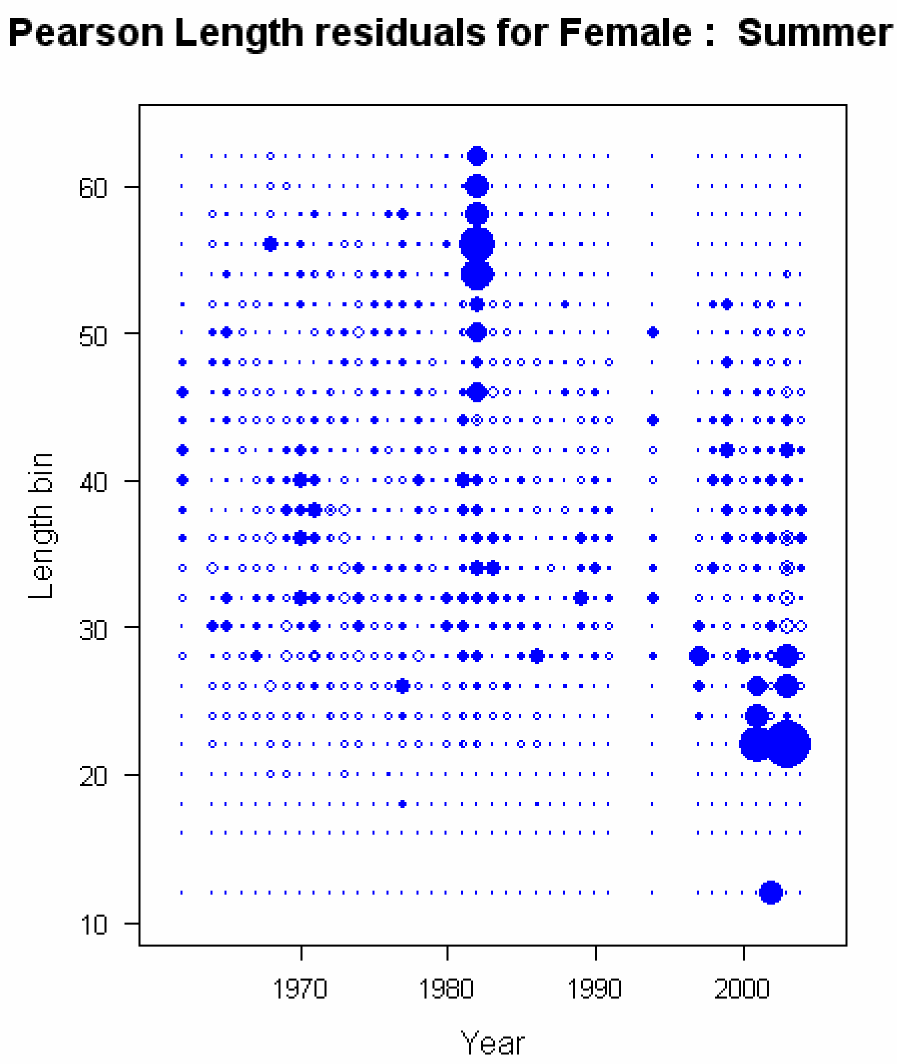


Figure IV-6 Continued.


Pearson Length residuals for Female : Summer
Length bin
Year
10
20
30
40
50
60
1970
1980
1990
2000

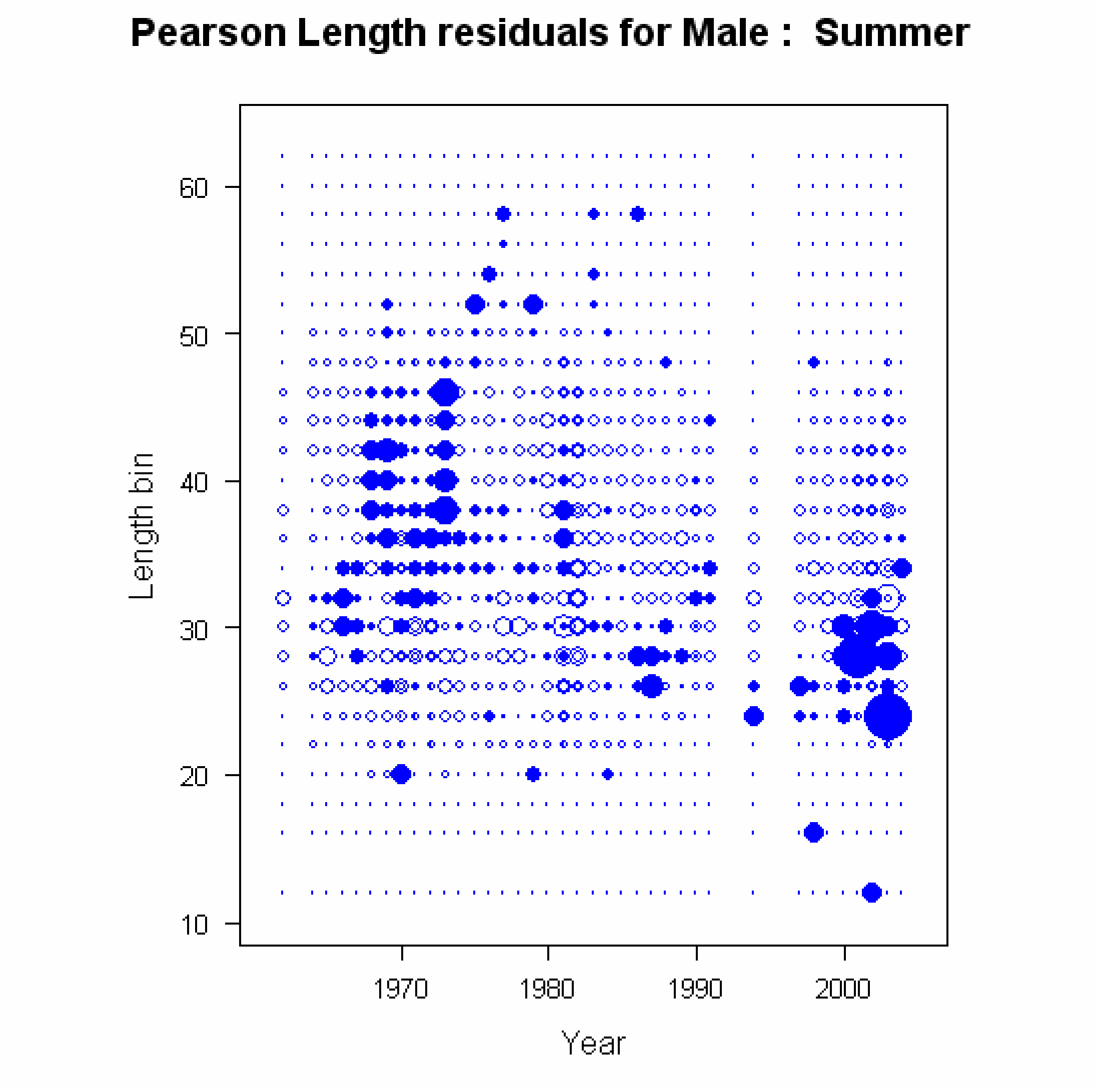


Figure IV-6 Continued.

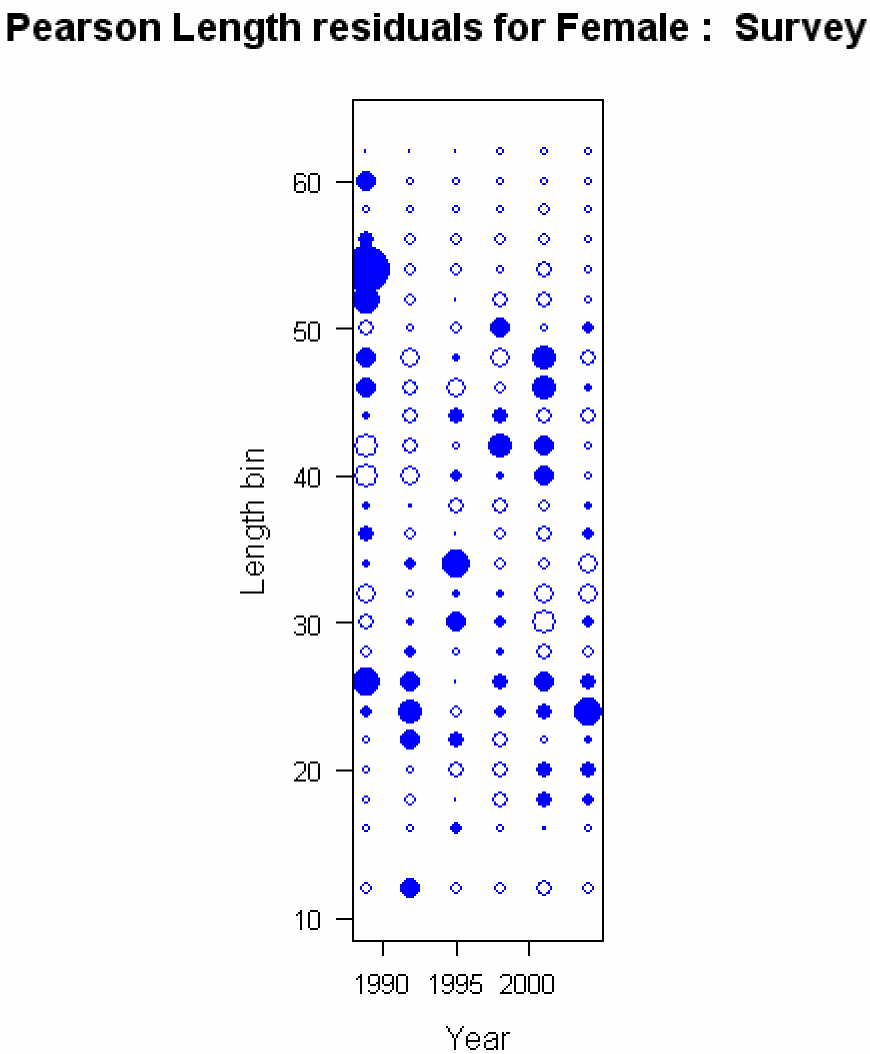


Figure IV-6 Continued.

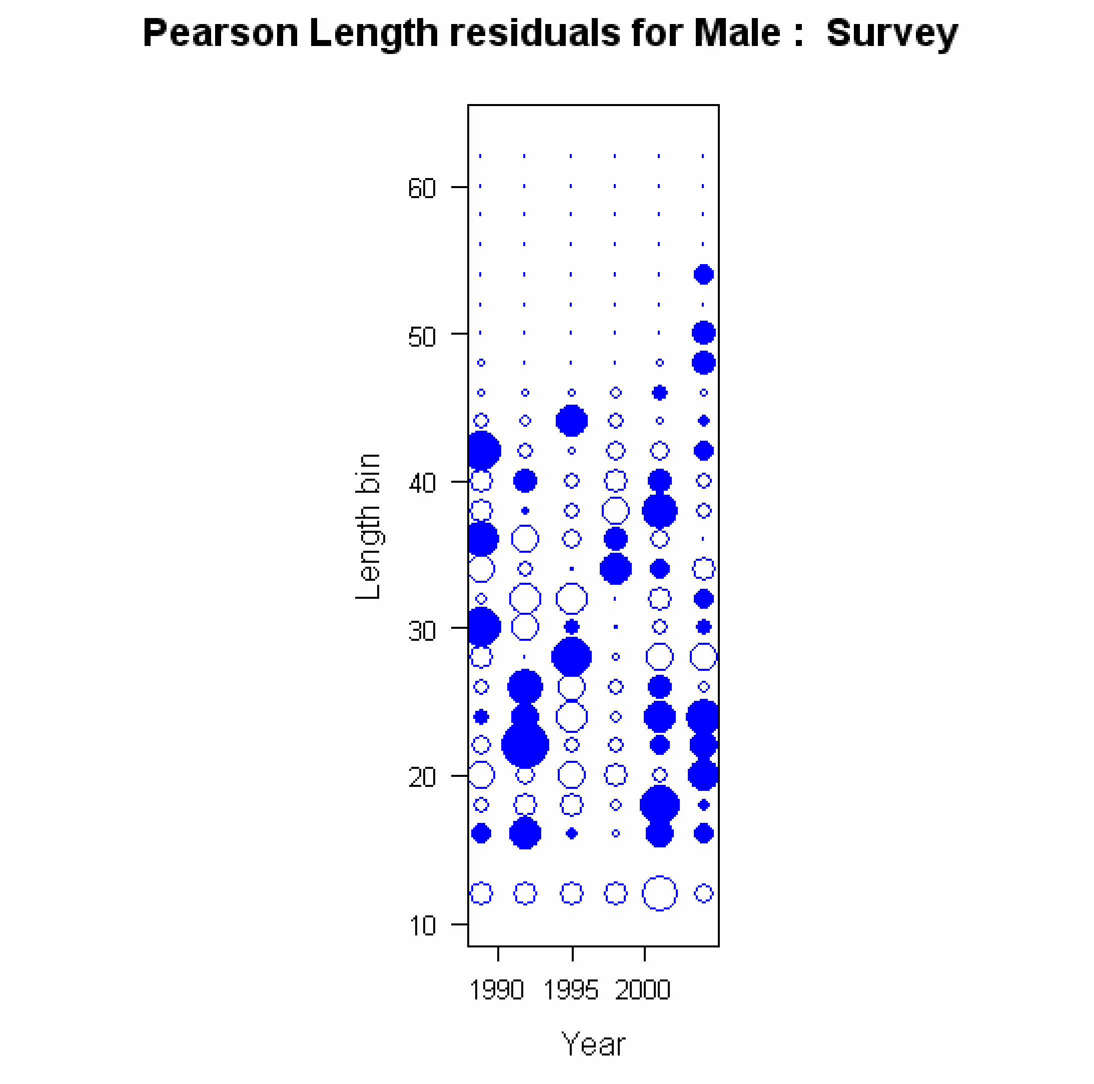


Figure IV-6 Continued.

Appendix V : The DAT and CTL Files for the Northern assessment area

#2005_petrale_sole_assessment:US VANCOUVER - COLUMBIA AREA

```
#DAT file
#  catch = Ret + Disc (10% in summer, 5% in winter)
#  cpue--1999assessment
#  no disc rates
#  turn off super years
#  nsamp=real
#  no age comp and ms
#CTL file:
#  Fixed growth curves F!=M
#  Rdev--1940~2004
#  mirro all fishery selx (asymp and F=M)
#  no retention curve
#  asymp survey selx and F=M


#Model_dimension
1910	#styr	#start_year
2004	#endyr	#end_year
2	#nseas	#N_seasons_per_year
4	8	#seasdur(1,nseas)	#Vector_with_N_months_in_each_season	#season1=4mons_and_season2=8mons
1	#spawn_seas	#spawning_season_spawning_will_occur_at_beginning_of_this_season
4	#Nfleet	#N_fishing_fleets
1	#Nsurv	N_surveys;_data_type_numbers_below_must_be_sequential_with_the_N_fisheries
WAWinter_Fishery%WASummer_Fishery%ORWinter_Fishery%ORSummer_Fishery%Triennial_Shelf
#names_of_fleets_and_survey	#%_is_deliminator
0.5	0.5	0.5	0.5	0.5625	#Timing_for_winter&summer_CPUEs_and_survey_index
2	#gender	#_number_of_genders(1/2)
40	#nages	#_accumulator_age;_model_always_starts_with_age_0

#Catch_bio_mt_retention_only
0	0	0	0	#	Assumed eq_catch
#catch_bioT(styr,TimeMax,1,Nfleet)
#WA_Winter	WA_Summer	OR_Winter	OR_Summer
0.0	0.0	0.0	0.0	#	1910	1
0.0	0.0	0.0	1.0	#	1910	2
0.0	0.0	0.0	0.0	#	1911	1
0.0	0.0	0.0	1.0	#	1911	2
0.0	0.0	0.0	0.0	#	1912	1
0.0	0.0	0.0	1.0	#	1912	2
0.0	0.0	0.0	0.0	#	1913	1
0.0	0.0	0.0	1.0	#	1913	2
0.0	0.0	0.0	0.0	#	1914	1
0.0	0.0	0.0	1.0	#	1914	2
0.0	0.0	0.0	0.0	#	1915	1
0.0	0.0	0.0	1.0	#	1915	2
0.0	0.0	0.0	0.0	#	1916	1
0.0	0.0	0.0	1.0	#	1916	2
0.0	0.0	0.0	0.0	#	1917	1
0.0	0.0	0.0	1.0	#	1917	2
0.0	0.0	0.0	0.0	#	1918	1
0.0	0.0	0.0	1.0	#	1918	2
0.0	0.0	0.0	0.0	#	1919	1
0.0	0.0	0.0	1.0	#	1919	2
0.0	0.0	0.0	0.0	#	1920	1
0.0	0.0	0.0	1.0	#	1920	2
0.0	0.0	0.0	0.0	#	1921	1
0.0	0.0	0.0	1.0	#	1921	2
0.0	0.0	0.0	0.0	#	1922	1
0.0	0.0	0.0	1.0	#	1922	2
0.0	0.0	0.0	0.0	#	1923	1
0.0	0.0	0.0	1.0	#	1923	2
0.0	0.0	0.0	0.0	#	1924	1
0.0	0.0	0.0	1.0	#	1924	2
0.0	0.0	0.0	0.0	#	1925	1
0.0	0.0	0.0	1.0	#	1925	2
0.0	0.0	0.0	0.0	#	1926	1
```

0.0	0.0	0.0	1.0	#	1926	2
0.0	0.0	0.0	0.0	#	1927	1
0.0	0.0	0.0	1.0	#	1927	2
0	0	0	0	#	1928	1
0	0.0	0	0.0	#	1928	2
0	0	0	0.0000	#	1929	1
0.0	0	0.0	3.076623491	#	1929	2
0	0	0	0	#	1930	1
0	0.0	0	1.0	#	1930	2
0	0	0	0.0	#	1931	1
0.0	0	0.0	0.981701427	#	1931	2
0	0	0	0	#	1932	1
0	0.0	0	6.8	#	1932	2
0	0	0	0.0	#	1933	1
0.0	0	0.0	4.306221734	#	1933	2
0	0	0	0	#	1934	1
0	0.0	0	2.9	#	1934	2
0	0	0	0.0	#	1935	1
0.0	20.43758132	0.0	5.706256861	#	1935	2
0	0	0	0	#	1936	1
0	52.5	0	18.6	#	1936	2
0	0	0	0.0	#	1937	1
0.0	45.40412957	0.0	81.38924259	#	1937	2
0	0	0	0	#	1938	1
0	56.0	0	4.1	#	1938	2
0	0	0	0.0	#	1939	1
0.0	52.85688081	0.0	2.495236004	#	1939	2
0	0	0	0	#	1940	1
0	63.9	0	352.7	#	1940	2
0	0	0	0.0	#	1941	1
0.0	100.8523223	0.0	464.1964874	#	1941	2
0	0	0	0	#	1942	1
0	107.9	0	1868.7	#	1942	2
0	0.0	0	0.0	#	1943	1
0.0	150.2651258	0.0	1898.560024	#	1943	2
0	0	0	0	#	1944	1
0	118.3	0	1007.5	#	1944	2
0	0.0	0	0.0	#	1945	1
0.0	118.8561884	0.0	785.4221136	#	1945	2
0	0	0	0	#	1946	1
0	125.0	0	1488.9	#	1946	2
0	0.0	0	0.0	#	1947	1
0.0	103.1516588	0.0	720.4550444	#	1947	2
0	0	0	0	#	1948	1
0	113.8	0	1326.5	#	1948	2
0	0.0	0	0.0	#	1949	1
0.0	139.3987626	0.0	755.793833	#	1949	2
0	0	0	0	#	1950	1
0	126.4	0	1643.8	#	1950	2
0	0.0	0	0.0	#	1951	1
0.0	211.6101188	0.0	949.0829259	#	1951	2
0	0	0	0	#	1952	1
0	239.7	0	729.7	#	1952	2
0	0.0	0	0.0	#	1953	1
0.0	33.68925257	0.0	502.6788744	#	1953	2
0	0	0	0	#	1954	1
0	16.5	0	692.8	#	1954	2
0	0.0	0	0.0	#	1955	1
0.0	202.610019	0.0	882.9138198	#	1955	2
0	0	0	0	#	1956	1
0	507.0	0	566.0	#	1956	2
91.035	0.0	214.0954236	0.0	#	1957	1
0.0	391.38	0.0	1160.072064	#	1957	2
29.4	0	53.46640938	0	#	1958	1
0	449.9	0	627.7	#	1958	2
63.315	0.0	479.5269451	0.0	#	1959	1
0.0	727.21	0.0	385.4725224	#	1959	2
114.345	0	125.6367795	0	#	1960	1
0	624.4	0	1010.9	#	1960	2
137.445	0.0	68.06179192	0.0	#	1961	1

0.0	883.19	0.0	1036.359947	#	1961	2
156.975	0	196.5679643	0	#	1962	1
0	542.3	0	1228.6	#	1962	2
116.97	0.0	329.4314542	0.0	#	1963	1
0.0	579.26	0.0	731.8869637	#	1963	2
107.625	0	175.0298221	0	#	1964	1
0	500.5	0	680.6	#	1964	2
133.77	0.0	151.0477688	0.0	#	1965	1
0.0	478.06	0.0	666.0999839	#	1965	2
96.18	0	107.0400648	0	#	1966	1
0	455.8	0	770.9	#	1966	2
63	0.0	127.4271748	0.0	#	1967	1
0.0	343.2	0.0	840.7541272	#	1967	2
144.27	0	124.4523717	0	#	1968	1
0	244.9	0	701.9	#	1968	2
54.6	0.0	165.5541398	0.0	#	1969	1
0.0	177.21	0.0	844.4922532	#	1969	2
34.335	0	272.4388688	0	#	1970	1
0	163.0	0	930.6	#	1970	2
67.515	0.0	272.9057107	0.0	#	1971	1
0.0	190.52	0.0	940.4843655	#	1971	2
60.69	0	364.1043702	0	#	1972	1
0	299.3	0	1271.5	#	1972	2
175.455	0.0	196.2623019	0.0	#	1973	1
0.0	520.19	0.0	1158.985453	#	1973	2
67.725	0	343.0264485	0	#	1974	1
0	821.8	0	1464.5	#	1974	2
114.135	0.0	342.1408938	0.0	#	1975	1
0.0	736.67	0.0	1730.017214	#	1975	2
108.36	0	320.4701393	0	#	1976	1
0	559.4	0	864.6	#	1976	2
117.81	0.0	264.4915225	0.0	#	1977	1
0.0	285.23	0.0	908.0535836	#	1977	2
280.875	0	288.7993554	0	#	1978	1
0	530.0	0	1550.4	#	1978	2
236.985	0.0	287.8214986	0.0	#	1979	1
0.0	415.58	0.0	1185.514091	#	1979	2
160.125	0	279.9168445	0	#	1980	1
0	375.1	0	811.9	#	1980	2
152.2393425	0.0	197.1201645	0.0	#	1981	1
0.0	252.323632	0.0	622.83804	#	1981	2
46.241769	0	214.0673745	0	#	1982	1
0	286.2	0	1085.8	#	1982	2
129.416133	0.0	546.7042245	0.0	#	1983	1
0.0	443.908817	0.0	664.443175	#	1983	2
117.1797165	0	296.9721405	0	#	1984	1
0	390.2	0	418.5	#	1984	2
205.9683675	0.0	222.353544	0.0	#	1985	1
0.0	188.30757	0.0	249.319433	#	1985	2
141.8	0	306.1	0	#	1986	1
0	210.4	0	278.9	#	1986	2
260.6944515	0.0	550.6287045	0.0	#	1987	1
0.0	319.294503	0.0	293.376919	#	1987	2
171.0	0	481.7	0	#	1988	1
0	303.6	0	356.3	#	1988	2
171.9543945	0.0	435.65508	0.0	#	1989	1
0.0	250.154652	0.0	383.970158	#	1989	2
227.3	0	380.1	0	#	1990	1
0	191.3	0	293.2	#	1990	2
158.9716905	0.0	538.4861265	0.0	#	1991	1
0.0	138.249672	0.0	288.644829	#	1991	2
136.5	0	453.2	0	#	1992	1
0	133.3	0	253.5	#	1992	2
142.7460195	0.0	457.9284465	0.0	#	1993	1
0.0	101.974884	0.0	293.500152	#	1993	2
150.1	0	310.1	0	#	1994	1
0	113.3	0	203.8	#	1994	2
145.7798895	0.0	376.986393	0.0	#	1995	1
0.0	155.673595	0.0	309.082444	#	1995	2
127.2	0	423.0	0	#	1996	1

```
0	172.9	0	276.5	#	1996	2
141.3210225	0.0	396.076359	0.0	#	1997	1
0.0	189.997511	0.0	215.449047	#	1997	2
123.3	0	372.2	0	#	1998	1
0	240.7	0	357.1	#	1998	2
63.918162 0.0	332.084361	0.0	#	1999	1
0.0	226.385566	0.0	301.179538	#	1999	2
95.7	0	438.9	0	#	2000	1
0	324.9	0	280.3	#	2000	2
124.536216	0.0	507.7594095	0.0	#	2001	1
0.0	226.405069	0.0	408.83546 #	2001	2
133.0	0	464.8	0	#	2002	1
0	326.8	0	430.3	#	2002	2
148.6818165	0.0	335.566392	0.0	#	2003	1
0.0	367.756224	0.0	521.677508	#	2003	2
309.5	0	711.9	0	#	2004	1
0	305.8	0	511.5	#	2004	2

#Indices--CPUE in 1999 Assessment
31	#nobs
#Year	Seas	Fleet	Value	CV	#
1987	1	3	200.5	0.5	#	OR-Winter
1988	1	3	135.8	0.5	#	OR-Winter
1989	1	3	124.7	0.5	#	OR-Winter
1990	1	3	122.9	0.5	#	OR-Winter
1991	1	3	87.9	0.5	#	OR-Winter
1992	1	3	80.1	0.5	#	OR-Winter
1993	1	3	75.6	0.5	#	OR-Winter
1994	1	3	70.5	0.5	#	OR-Winter
1995	1	3	141.6	0.5	#	OR-Winter
1996	1	3	133.6	0.5	#	OR-Winter
1997	1	3	87.7	0.5	#	OR-Winter
1987	2	4	54.3	0.5	#	OR-Summer
1988	2	4	30.6	0.5	#	OR-Summer
1989	2	4	26.5	0.5	#	OR-Summer
1990	2	4	29.8	0.5	#	OR-Summer
1991	2	4	18.3	0.5	#	OR-Summer
1992	2	4	18.5	0.5	#	OR-Summer
1993	2	4	17.8	0.5	#	OR-Summer
1994	2	4	13.9	0.5	#	OR-Summer
1995	2	4	34.5	0.5	#	OR-Summer
1996	2	4	34.2	0.5	#	OR-Summer
1997	2	4	18.5	0.5	#	OR-Summer
1980	2	5	1508.01	0.189	#Survey_biomass_estimates
1983	2	5	1502.93	0.098	#Survey_biomass_estimates
1986	2	5	1226.18	0.115	#Survey_biomass_estimates
1989	2	5	1898.31	0.338	#Survey_biomass_estimates
1992	2	5	1345.24	0.092	#Survey_biomass_estimates
1995	2	5	1137.68	0.117	#Survey_biomass_estimates
1998	2	5	2098.75	0.103	#Survey_biomass_estimates
2001	2	5	2373.23	0.118	#Survey_biomass_estimates
2004	2	5	4269.14	0.104	#Survey_biomass_estimates

#Discards_fraction
2	#disc_type #(1=biomass,2=fraction)
0	#nobs_disc	#disc_N_observations

#Mean_BodyWt
0	#nobs_mnwt
#mnwtdata(1,nobs_mnwt,1,6) #nobs_mnwt<=0,_skip_reading_mnwtdata

-1	#min_tail	#min_proportion_for_compressing_tails_of_observed_composition
0.0001	#min_comp	#constant_added_to_expected_frequencies

#Length_Composition_Data
25	#nlength	#N_length_bins
#len_bins(1,nlength)	#_lower_edge_of_length_bins
12	16	18	20	22	24	26	28	30	32	34	36
	38	40	42	44	46	48	50	52	54	56	58
	60	62	# Len Cat
```

#LENGTH_COMPOSITIONS--Turn off super years, 2genders

136	#										
#year	seas	fleet	gender	mkt	Nsamp	12	16	18	20	22	24
	26	28	30	32	34	36	38	40	42	44	46
	48	50	52	54	56	58	60	62	12	16	18
	20	22	24	26	28	30	32	34	36	38	40
	42	44	46	48	50	52	54	56	58	60	62
	#	#									
1949	2	4	3	2	30	0	0	0	0	0	0
	0	10	27	71	83	138	142	191	195	157	149
	102	49	26	6	3	1	0	0	0	0	0
	0	0	0	3	11	20	80	149	273	371	288
	133	55	7	4	0	0	0	0	0	0	0
	#OR-Demory										
1950	2	4	3	2	30	0	0	0	0	0	0
	3	11	66	105	169	173	230	340	356	378	348
	244	127	49	17	4	1	0	0	0	0	0
	0	0	0	0	15	64	123	220	285	385	258
	151	43	9	0	0	0	0	0	0	0	0
	#OR-Demory										
1951	2	4	3	2	30	0	0	0	0	0	0
	0	8	46	102	142	174	168	152	182	206	214
	212	118	96	32	4	0	0	0	0	0	0
	0	0	0	0	8	40	86	122	189	172	173
	76	27	7	4	0	0	0	0	0	0	0
	#OR-Demory										
1955	1	1	3	2	1	0	0	0	0	0	0
	0	0	0	0	0	0	0	4	16	24	28
	29	25	21	9	10	2	0	0	0	0	0
	0	0	0	0	0	0	0	2	21	56	96
	110	41	11	2	0	0	0	0	0	0	0
	#WA										
1956	2	2	3	2	2	0	0	0	0	0	0
	0	0	0	0	7	10	20	40	44	53	55
	45	36	21	9	3	1	0	0	0	0	0
	0	0	0	0	0	1	31	64	84	68	59
	15	14	7	2	0	0	0	0	0	0	0
	#WA										
1957	2	2	3	2	4	0	0	0	0	0	0
	0	0	1	7	36	60	51	38	73	87	85
	59	47	53	43	27	8	2	1	0	0	0
	0	0	0	0	0	1	15	50	73	64	49
	42	44	30	6	1	0	0	0	0	0	0
	#WA										
1958	2	2	3	2	3	0	0	0	0	0	0
	0	0	3	8	40	77	124	155	124	121	78
	57	45	41	29	13	4	1	0	0	0	0
	0	0	0	0	0	2	13	100	257	298	256
	128	100	49	14	2	1	0	0	0	0	0
	#WA										
1960	2	2	1	2	2	0	0	0	0	0	0
	0	1	6	18	28	36	51	77	150	104	60
	23	9	1	1	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
	#WA										
1960	2	2	3	2	2	0	0	0	0	0	0
	0	0	1	4	6	5	4	2	2	1	2
	2	2	1	0	0	0	0	0	0	0	0
	0	0	0	0	2	6	15	23	21	28	21
	52	35	15	3	0	0	0	0	0	0	0
	#WA										
1960	2	4	3	2	30	0	0	0	0	0	0
	0	0	0	6	11	21	13	16	12	6	5
	2	2	0	0	0	0	0	0	0	0	0
	0	0	0	0	4	10	22	25	20	13	10
	2	0	0	0	0	0	0	0	0	0	0
	#OR-Demory										
1961	2	2	3	2	1	0	0	0	0	0	0
	0	0	2	2	6	9	6	10	7	6	1

	2	1	0	0	1	0	0	0	0	0	0
	0	0	0	0	2	2	10	10	10	7	5
	0	0	1	0	0	0	0	0	0	0	0
	#WA										
1963	2	4	3	2	30	0	0	0	0	0	0
	0	0	3	18	21	42	34	30	25	15	10
	8	5	2	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	2	9	12	14	17
	12	3	6	7	4	1	0	0	0	0	0
	#OR-Demory										
1964	2	2	3	2	1	0	0	0	0	0	0
	0	0	0	1	2	5	12	17	13	14	6
	6	5	3	1	1	0	0	0	0	0	0
	0	0	0	0	0	0	2	7	22	38	23
	14	3	3	1	1	0	0	0	0	0	0
	#WA										
1964	2	4	3	2	30	0	0	0	0	0	0
	0	1	14	30	55	82	147	211	220	180	111
	79	45	25	7	2	2	0	0	0	0	0
	0	0	0	0	2	18	74	180	232	199	117
	47	19	10	3	0	0	0	0	0	0	0
	#OR-Demory										
1965	2	2	3	2	1	0	0	0	0	0	0
	0	0	2	2	1	1	3	4	11	7	10
	5	2	0	2	0	2	0	0	0	0	0
	0	0	0	0	0	3	4	3	7	10	12
	7	1	0	0	1	0	0	0	0	0	0
	#WA										
1965	2	4	3	2	30	0	0	0	0	0	0
	0	4	43	89	120	125	146	211	215	222	148
	78	47	19	5	7	0	0	0	0	0	0
	0	0	0	2	4	86	166	223	240	244	97
	32	11	5	1	0	0	0	0	0	0	0
	#OR-Demory										
1966	2	2	3	2	4	0	0	0	0	0	0
	0	1	6	20	37	61	77	77	71	81	66
	49	40	16	12	4	2	1	0	0	0	0
	0	0	0	0	0	8	31	70	100	127	90
	53	15	8	1	1	0	0	0	0	0	0
	#WA										
1966	1	3	3	2	1	0	0	0	0	0	0
	0	0	0	0	0	0	2	9	17	16	13
	3	2	2	0	0	0	0	0	0	0	0
	0	0	0	0	0	1	4	4	8	9	4
	4	1	1	0	0	0	0	0	0	0	0
	#OR										
1966	2	4	3	2	33	0	0	0	0	0	0
	0	1	18	43	97	135	119	148	130	110	61
	41	22	5	2	1	1	0	0	0	0	0
	0	0	0	0	1	27	90	150	182	157	66
	21	9	4	1	0	0	0	0	0	0	0
	#OR										
1967	2	2	3	2	3	0	0	0	0	0	0
	0	0	0	0	0	0	0	4	7	12	9
	10	13	9	0	1	1	0	0	0	0	0
	0	0	0	0	0	0	0	9	54	128	117
	71	24	11	5	0	0	0	0	0	0	0
	#WA										
1967	1	3	3	2	4	0	0	0	0	0	0
	0	0	1	3	2	5	16	30	25	19	15
	8	4	2	2	0	0	0	0	0	0	0
	0	0	0	0	1	7	7	16	14	13	6
	4	0	0	0	0	0	0	0	0	0	0
	#OR										
1967	2	4	3	2	39	0	0	0	0	0	0
	0	1	18	42	111	148	153	161	161	125	81
	38	17	7	0	3	2	0	0	0	0	0
	0	0	0	0	6	27	134	207	208	164	85
	28	12	4	0	0	0	0	0	0	0	0
	#OR										

1968	2	2	3	2	15	0	0	0	0	0	0
	0	0	0	5	13	26	69	175	286	295	214
	137	90	49	34	14	4	3	0	0	0	0
	0	0	0	1	3	19	63	171	400	564	428
	230	71	12	3	0	0	0	0	0	0	0
	#WA										
1968	1	3	3	2	11	0	0	0	0	0	0
	0	0	1	8	25	40	40	56	64	58	30
	31	14	9	2	0	0	0	0	0	0	0
	0	0	0	0	0	7	18	43	48	35	24
	4	4	1	0	0	0	0	0	0	0	0
	#OR										
1968	2	4	3	2	42	0	0	0	0	0	0
	0	1	12	46	115	138	194	223	194	144	106
	68	36	20	6	2	0	0	0	0	0	0
	0	0	0	0	2	11	90	168	239	212	103
	40	11	1	2	0	0	0	0	0	0	0
	#OR										
1969	1	1	3	2	1	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	19	19
	9	7	7	6	2	0	0	0	0	0	0
	0	0	0	0	0	0	0	26	71	77	48
	30	6	1	0	0	0	0	0	0	0	0
	#WA										
1969	2	2	3	2	7	0	0	0	0	0	0
	0	0	0	0	0	6	9	29	49	65	65
	48	30	14	8	6	1	3	1	0	0	0
	0	0	0	0	0	6	17	78	189	247	258
	169	79	34	6	4	0	0	1	0	0	0
	#WA										
1969	1	3	3	2	9	0	0	0	0	0	0
	0	0	13	40	33	20	24	38	41	45	36
	30	10	4	0	0	0	0	0	0	0	0
	0	0	0	2	1	4	17	30	23	21	12
	6	1	0	0	0	0	0	0	0	0	0
	#OR										
1969	2	4	3	2	48	0	0	0	0	0	0
	0	4	40	97	150	214	207	213	241	172	111
	62	31	10	3	0	0	1	0	0	0	0
	0	0	1	0	4	36	96	167	184	194	118
	34	16	2	0	0	0	0	0	0	0	0
	#OR										
1970	1	1	3	2	1	0	0	0	0	0	0
	0	0	0	0	1	0	3	18	20	35	37
	29	19	16	6	5	2	1	0	0	0	0
	0	0	0	0	0	0	4	8	13	9	8
	2	1	0	0	0	0	0	0	0	0	0
	#WA										
1970	2	2	3	2	13	0	0	0	0	0	0
	0	0	10	39	53	89	132	137	172	192	169
	136	87	54	35	16	9	4	0	0	0	0
	0	0	0	0	12	71	223	274	379	416	336
	183	87	16	12	1	0	0	0	0	0	0
	#WA										
1970	1	3	3	2	8	0	0	0	0	0	0
	0	1	12	26	29	29	33	29	37	48	32
	20	23	7	1	1	1	0	0	0	0	0
	0	0	0	0	5	10	23	42	40	28	22
	5	1	1	0	0	0	0	0	0	0	0
	#OR										
1970	2	4	3	2	47	0	0	0	0	0	0
	0	2	23	75	126	192	224	228	192	152	119
	61	34	17	8	1	2	0	0	0	0	0
	0	0	0	1	0	32	103	165	194	219	130
	56	13	3	0	0	0	0	0	0	0	0
	#OR										
1971	1	1	3	2	4	0	0	0	0	0	0
	0	0	0	0	0	1	6	10	23	57	57
	41	37	18	12	10	4	0	1	0	0	0
	0	0	0	0	0	1	9	82	149	179	155

	104	55	16	7	1	0	0	0	0	0	0
	#WA										
1971	2	2	1	2	11	0	0	0	0	0	0
	2	8	21	44	86	94	75	44	23	22	4
	4	1	0	1	1	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
	#WA										
1971	2	2	3	2	11	0	0	0	0	0	0
	0	1	5	39	70	109	82	106	121	123	95
	73	45	33	12	7	4	2	1	0	0	0
	0	0	0	0	1	13	102	262	327	273	162
	98	42	7	4	0	0	0	0	0	0	0
	#WA										
1971	1	3	3	2	7	0	0	0	0	0	0
	0	1	1	5	4	8	14	17	25	21	28
	12	10	2	3	0	0	0	1	0	0	0
	0	0	0	0	3	4	11	22	49	54	37
	15	4	0	0	0	0	0	0	0	0	0
	#OR										
1971	2	4	3	2	2	0	0	0	0	0	0
	0	0	0	5	18	16	14	11	19	19	8
	1	3	2	1	2	0	0	0	0	0	0
	0	0	0	0	0	0	7	15	23	20	13
	3	1	0	0	0	0	0	0	0	0	0
	#OR										
1972	1	1	3	2	4	0	0	0	0	0	0
	0	0	1	9	15	30	39	62	68	58	36
	39	29	31	22	9	6	6	0	0	0	0
	0	0	0	0	1	7	22	66	135	131	55
	12	8	3	0	0	0	0	0	0	0	0
	#WA										
1972	2	2	3	2	15	0	0	0	0	0	0
	1	3	18	39	76	85	161	195	219	153	130
	76	54	36	15	11	6	1	0	0	0	0
	0	1	0	0	7	45	128	263	532	629	332
	152	78	20	6	3	0	1	0	0	0	0
	#WA										
1972	2	4	3	2	15	0	0	0	0	0	0
	1	4	20	53	99	100	119	104	91	41	38
	29	15	2	5	1	1	0	1	0	0	0
	0	0	0	0	1	32	95	175	177	135	57
	19	3	4	0	0	0	0	0	0	0	0
	#OR										
1973	1	1	3	2	3	0	0	0	0	0	0
	0	0	0	0	3	5	11	36	64	93	69
	40	30	14	14	9	6	3	1	0	0	0
	0	0	0	0	0	0	5	17	53	114	39
	13	9	2	0	0	0	0	0	0	0	0
	#WA										
1973	2	2	3	2	5	0	0	0	0	0	0
	0	0	4	11	30	38	45	69	68	64	43
	14	13	9	7	2	1	0	0	0	0	0
	0	0	0	0	3	17	55	79	161	157	95
	42	15	1	0	0	0	0	0	0	0	0
	#WA										
1973	2	4	3	2	14	0	0	0	0	0	0
	0	3	19	75	96	116	98	113	93	73	33
	23	8	7	1	0	0	0	1	0	0	0
	0	0	0	1	2	22	64	137	130	133	65
	27	5	1	1	0	0	0	0	0	0	0
	#OR										
1974	1	1	3	2	3	0	0	0	0	0	0
	0	0	0	0	0	2	4	15	27	43	24
	16	13	7	5	3	1	1	0	0	0	0
	0	0	0	0	0	0	4	19	94	205	214
	74	9	5	1	0	0	0	0	0	0	0
	#WA										
1974	2	2	3	2	30	0	0	0	0	0	0
	0	1	26	99	168	242	372	570	729	705	571

	300	139	115	48	21	18	5	2	0	0	0
	0	0	0	0	9	68	215	395	870	1266	1068
	467	158	47	16	3	4	1	0	0	0	0
	#WA										
1974	2	4	3	2	12	0	0	0	0	0	0
	0	1	15	34	44	45	57	73	88	47	33
	17	16	6	3	0	0	0	0	0	0	0
	0	0	0	0	1	13	48	78	158	182	105
	39	12	4	1	0	0	0	0	0	0	0
	#OR										
1975	1	1	3	2	10	0	0	0	0	0	0
	0	0	0	0	1	5	13	72	165	254	245
	157	80	51	35	19	7	6	1	0	0	0
	0	0	1	0	0	0	5	39	157	345	302
	167	51	8	3	2	1	0	0	0	0	0
	#WA										
1975	2	2	1	2	37	0	0	0	0	0	0
	1	4	14	15	42	26	52	48	50	39	24
	24	8	0	0	0	1	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
	#WA										
1975	2	2	3	2	37	0	0	0	0	0	0
	0	0	2	11	35	96	124	182	307	385	343
	196	117	92	33	18	18	6	1	0	0	0
	0	0	0	0	0	4	34	218	580	938	1181
	727	261	108	39	3	1	1	0	0	0	0
	#WA										
1975	2	4	3	2	11	0	0	0	0	0	0
	2	4	9	19	53	48	65	64	64	65	49
	21	6	9	2	1	0	0	0	0	0	0
	0	0	0	1	14	23	59	81	108	150	60
	18	3	1	0	1	0	0	0	0	0	0
	#OR										
1976	1	1	3	2	1	0	0	0	0	0	0
	0	0	0	0	0	0	2	3	9	21	32
	14	10	5	3	4	1	1	0	0	0	0
	0	0	0	0	0	0	0	10	74	118	43
	23	2	4	0	0	0	0	0	0	0	0
	#WA										
1976	2	2	3	2	6	0	0	0	0	0	0
	0	0	1	10	27	37	48	96	144	190	164
	132	100	60	27	24	2	2	2	0	0	0
	0	0	0	0	0	2	18	38	84	112	120
	87	44	15	3	2	1	0	1	0	0	0
	#WA										
1977	1	1	3	2	1	0	0	0	0	0	0
	0	0	0	0	0	1	0	9	26	36	47
	26	17	7	3	7	2	1	2	0	0	0
	0	0	0	0	0	0	0	3	10	14	5
	4	0	0	0	0	0	0	0	0	0	0
	#WA										
1977	2	2	3	2	2	0	0	0	0	0	0
	0	0	0	0	0	0	1	6	16	24	36
	25	26	10	5	2	2	0	1	0	0	0
	0	0	0	0	0	0	0	7	40	87	119
	68	37	12	4	1	0	0	0	0	0	0
	#WA										
1977	1	3	3	2	1	0	0	0	0	0	0
	0	0	0	0	1	4	2	3	2	4	4
	1	0	1	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	4	7	12	27
	20	6	2	1	0	0	0	0	0	0	0
	#OR										
1977	2	4	3	2	19	0	0	0	0	0	0
	0	12	32	83	110	146	122	153	112	85	67
	39	38	13	10	2	0	0	0	0	0	0
	0	0	0	0	5	27	88	147	197	155	134
	76	16	6	4	1	1	0	0	0	0	0
	#OR										

1978 1 1 3 2 3 0 0 0 0 0 0
0 0 0 0 0 0 9 27 50 95 108
80 57 38 20 15 2 3 2 0 0 0
0 0 0 0 0 1 2 13 35 47 44
15 10 3 2 0 0 0 0 0 0 0
#WA
1978 2 2 3 2 2 0 0 0 0 0 0
1 0 1 1 4 3 5 12 19 21 30
20 21 10 9 6 4 1 0 0 0 0
0 0 0 0 2 5 11 15 21 46 64
103 75 40 11 6 2 1 0 0 0 0
#WA
1978 1 3 3 2 1 0 0 0 0 0 0
0 5.204957102 26.02478551 41.63965682 15.61487131 57.25452812
31.22974261 36.43469971 36.43469971 57.25452812 41.63965682
36.43469971 57.25452812 10.4099142 26.02478551 0 0 0
0 0 0 0 0 0 0 5.204957102 0
10.4099142 10.4099142 5.204957102 5.204957102 5.204957102 0
0 0 0 0 0 0 0 0 0 0 0
#OR
1978 2 4 3 2 19 0 0 0 0 0 0
0 38.55813321 205.1861564 458.6882253 523.472687 426.8650725
513.0278894 843.5960369 662.4150682 443.0784773 443.1510908
419.1555578 215.6784029 149.9590857 47.4947409 41.68756338
12.80032428 0 0 0 0 0 0
17.04321875 71.52040662 422.600131 864.5658395 978.357007
1433.709777 1116.905409 739.5490477 294.9183379 65.35552057
23.72198508 8.336764176 0 13.60141928 0 0 0 0
0 #OR
1979 1 1 3 2 2 0 0 0 0 0 0
0 0 0 0 0 0 1 5 6 6 10
5 10 5 1 1 0 2 1 0 0 0
0 0 0 0 0 0 1 7 31 33 33
34 20 6 0 0 1 0 0 0 0 0
#WA
1979 2 2 3 2 4 0 0 0 0 0 0
0 0 0 0 0 2 1 12 5 19 16
20 43 44 27 24 13 6 4 0 0 0
0 0 0 0 0 0 1 8 12 19 22
33 37 17 12 1 0 2 0 0 0 0
#WA
1979 2 4 3 2 19 0 0 0 0 0 0
0 444.3311271 1458.128435 3131.302454 3059.364974 3310.814425
2936.710405 2353.934892 2310.280014 1900.338693 1260.674731
1541.457399 769.5332907 861.0709254 363.4026973 261.9852001
61.61615717 0 0 0 0 0 0 0 0 0
121.8364335 1059.818077 3217.199088 3457.896865 3086.745738
2239.675878 1353.237488 893.9463876 352.4015759 89.00280942 0
0 0 0 0 0 0 0 #OR
1980 1 1 3 2 3 0 0 0 0 0 0
0 1 4 11 11 8 10 27 60 47 26
25 35 28 12 8 7 2 1 0 0 0
0 0 0 0 0 7 16 13 30 52 23
2 4 1 1 1 0 0 0 0 0 0
#WA
1980 2 2 3 2 22 0 0 0 0 0 0
0 1 18 35 76 100 100 124 134 129 102
113 108 109 94 44 13 7 3 0 0 0
0 0 0 0 5 15 61 107 200 172 154
103 86 40 13 10 6 3 0 0 0 0
#WA
1980 1 3 3 2 6 0 0 0 0 0 0
0 0 0 37.84285714 121.8039806 187.7247724 277.0599169
381.7277632 407.862519 326.3273967 379.9743445 235.517586
232.6502173 487.2548029 224.3824062 238.8428571 21.41428571
21.41428571 21.41428571 0 0 0 0 0 0
21.41428571 0 19.16187981 204.6156566 1155.121538 1344.867764
1569.067128 1556.927928 965.7915699 344.9087087 117.7419355
15.45059718 21.41428571 0 0 0 0 0 0 #OR

1980 2 4 3 2 22 0 0 0 0 0 0
34.46530612 194.5726377 630.0014669 1903.878486 2316.889463
2083.628756 1718.567325 2299.369164 2602.336813 1716.109707
1405.380816 986.5344747 515.7089332 577.3368265 302.4556724
239.3633953 3.323863636 3.323863636 0 0 0 0 0
0 0 0 62.25293738 966.4472811 2572.905313 4380.577971
5153.868098 4591.840325 1557.518664 978.5470452 315.8004168
106.0325934 3.323863636 0 1.937172775 0 0 0 0
0 #OR
1981 1 1 3 2 5 0 0 0 0 0 0
0 4 8 22 25 23 17 26 37 32 50
46 29 21 21 12 6 3 2 0 0 0
0 0 0 0 1 7 7 12 17 30 14
8 9 4 2 0 0 1 3 1 0 0
#WA
1981 1 3 3 2 5 0 0 0 0 0 0
0 0 117.9983578 144.6306158 199.0745468 192.6554332
388.1225891 248.5448316 158.6029331 136.1784085 130.8774915
117.558716 99.68203863 133.2480868 182.5279495 146.8905665
72.19671642 55.87936284 0 0 0 0 0 0 0
0 0 121.9362162 405.2339 470.8437982 288.8636533 187.1161188
185.0521732 91.54173957 47.89179104 9.578358209 19.15671642 0
0 9.578358209 0 0 0 0 #OR
1981 2 4 3 2 23 0 0 0 0 0 0
19.0180649 293.7152783 835.1085704 1004.723324 1506.764514
1513.317872 1597.112769 1149.849157 868.2481729 1167.572595
848.3602201 716.9191993 384.3424694 374.8339749 149.0473119
129.6867912 10.95390569 4.764801298 1.405405405 0 0 0
0 0 0 32.6650085 161.802239 855.026543 1168.056337
1120.999939 975.7618439 704.7989462 259.8367533 145.5373561
159.0888726 15.23222481 4.716981132 0 0 0 0 0
0 0 #OR
1982 1 3 3 2 5 0 0 0 0 0 0
0 57.14589235 0 73.15007645 296.0783584 233.1919175
1023.228481 1095.162983 1370.824781 956.6535787 794.7376536
531.7725266 913.6576423 938.2636737 659.0441207 489.0976921
739.6418221 18.43721981 81.32366071 0 0 0 0
0 0 171.4376771 301.7336459 1084.962743 2195.707084
2307.485992 3759.733962 2921.086043 1277.707751 1658.380843
562.3962864 962.1452514 0 0 0 0 0 0 0
#OR
1982 2 4 3 2 5 0 0 0 0 0 0
0 66.01893546 414.126167 990.2282351 706.6348238 782.1611667
927.088093 624.7456306 590.7368383 499.5921303 460.9273802
159.1149984 0 261.7131582 62.99741106 42.1542738 41.68627451
0 42.1542738 0 0 0 0 0 0 0 0
912.6773177 1611.40287 1664.020707 1226.093621 842.5349328
619.3841156 178.0067806 91.98557167 0 0 0 0 0
0 0 0 0 #OR
1983 1 3 3 2 2 0 0 0 0 0 0
0 0 0 166.1265523 55.37551745 719.8817268 498.379657
332.2531047 591.6717009 166.1265523 539.2947281 297.3351228
725.878816 1081.588001 801.711869 1790.007826 428.5436932
466.4602197 0 0 0 0 0 0 0 0
55.37551745 553.7551745 941.3837966 795.7147798 463.4616751
615.1277811 1026.212483 932.9204394 1026.212483 466.4602197
373.1681758 93.29204394 0 0 0 0 0 0 #OR
1983 2 4 3 2 1 0 0 0 0 0 0
0 31.05648536 0 62.11297071 0 0 62.11297071
124.2259414 31.05648536 31.05648536 31.05648536 31.05648536 0
0 0 0 0 0 0 0 0 0 0 0
0 0 93.16945607 465.8472803 1086.976987 621.1297071
341.6213389 31.05648536 31.05648536 0 31.05648536 0 0
0 0 0 0 0 0 0 #OR
1984 1 3 3 2 1 0 0 0 0 0 0
0 0 0 0 170.7537092 298.8189911 896.4569733
981.8338279 981.8338279 811.0801187 256.1305638 256.1305638 0
42.6884273 0 42.6884273 0 0 0 0 0 0
0 0 0 0 0 213.4421365 512.2611276 1280.652819

1109.89911 725.7032641 0 0 0 0 0 0 0
0 0 0 0 0 #OR
1985 2 4 3 2 5 0 0 0 0 0 0
0 25.9168818 202.0739761 253.9345905 357.3104643 283.4882787
257.2273612 367.55028 282.129171 123.8643344 162.4320932 76.53578657
31.00126729 44.56713761 22.76725964 4.117003827 0 0 0
0 0 0 0 0 0 8.234007654 25.9168818
286.3585967 356.7323712 468.2099904 200.0876694 88.20345998
42.53428852 39.98721423 7.586206897 13.08823529 0 0 0
0 0 0 0 0 #OR
1986 1 3 3 2 3 0 0 0 0 0 0
0 0 4.327586207 7.109090909 14.21818182 37.40219436
127.8411876 251.3547889 350.1863225 343.6097057 230.3381745
225.6591137 24.41943574 104.9270171 24.06796117 0 24.06796117
0 0 0 0 0 0 0 0 0
25.65485893 68.30940439 249.8087074 507.7578476 527.4982226
358.6302036 45.7058922 15.76426332 4.327586207 0 0 0
0 0 0 0 0 #OR
1986 2 4 3 2 9 0 0 0 0 0 0
6.368752313 80.63062706 297.5850239 620.1328592 668.114423
625.6162181 469.116383 642.703162 378.8483142 252.4003089
411.7004876 101.1776303 130.4905847 33.33310863 24.44645275
31.64617258 17.51002234 14.13615023 1.686936053 0 0 0
0 0 0 54.10376242 115.2577701 552.1241436 899.0684343
746.9403399 402.9153985 173.0010764 37.99626187 47.60698074
15.82308629 5.06080816 1.686936053 1.686936053 0 0 0
0 0 0 #OR
1986 2 5 3 0 35 0 0 0 1.513688742
0.801797954 0.584716995 1.300846339 3.445638173 3.403909562
4.162867572 14.18100426 5.884450448 6.034489899 6.450047008
6.623508982 5.775422736 1.033238862 0.988285223 0.044953529
0.092576363 0.044953529 0 2.916294238 0.179814114 0.134860586
0 0.355945394 0 1.55864238 0.044953529 1.121032225
2.435780717 5.959481743 6.858083349 4.302162117 4.75992887
3.746762198 2.488102265 0.632895552 0.046288182 0.092576363 0
0 0 0 0 0 0 0 0 #N86
1987 1 3 3 2 6 0 0 0 0 0 0
0 0 0 0 0 23.11627907 280.0432433 536.3179807
1090.533171 2946.019997 2258.964942 1445.484878 1244.441105
351.7460743 109.4612867 278.3088203 3.921015515 7.84203103 0
0 0 0 0 0 0 0 0 91.38292011
388.6479595 2073.073528 4278.874052 5687.419689 2398.467416
1867.205121 322.5688973 3.921015515 0 0 0 0 0
0 0 0 #OR
1987 2 4 3 2 16 0 0 0 0 0 0
189.7928511 165.2250234 661.5380565 1038.879331 1420.38598
1079.470126 1150.367953 1126.120576 721.7434424 231.7431996
43.73069603 94.52327302 51.68685927 0 0 0 0 0
0 0 0 0 0 0 38.90826237 111.0722719
261.0568843 1411.778188 1680.705472 2171.031419 1354.381819
345.0066337 115.9439157 20.515625 51.68685927 0 0 0 0
0 0 0 0 0 #OR
1988 1 3 3 2 4 0 0 0 0 0 0
0 0 0 0 0 0 1132.922037 572.5863896
1464.422172 1360.255252 987.1112691 1487.555016 657.986529
86.18181818 43.09090909 0 0 17.05676856 17.05676856 0
0 0 0 0 0 0 267.9324324 0 2264.799445
2462.562198 2635.072489 2546.2902 759.3988069 104.2832168 535.8648649
0 0 0 0 0 0 0 0 0 #OR
1988 2 4 3 2 7 0 0 0 0 0
6.202365309 39.05626134 414.3649033 629.8028352 953.6434356
1473.121908 1026.218232 1059.0357 667.059353 437.7716313 188.7617725
160.9635366 6.202365309 93.5060279 0 0 0 0 0
0 0 0 0 0 0 0 39.05626134 495.9825413
411.8804239 875.9202359 1093.679839 264.1204081 517.0382627
96.10568915 0 0 0 0 0 0 0 0 0
0 0 #OR
1989 1 3 3 2 10 0 0 0 0 0 0
0 103.886162 1205.294363 2055.535286 2306.207676 2047.980046
1539.61308 1706.471636 2220.345041 1527.163761 693.8679795

674.6616024 555.5715118 27.98251593 92.276325 7.973509934 0 0
0 0 0 0 0 0 0 105.6288115 591.4077783
2006.152401 1967.102713 2130.768698 907.1842747 706.7903114
158.8223259 119.5425335 24.81818182 0 0 0 0 0
0 0 0 0 #OR
1989 2 4 3 2 13 0 0 0 0 0 0
0 60.41018034 428.8013652 1389.878692 1464.300606 1076.540879
1133.007673 604.6570918 400.8801378 390.204889 134.8038541
29.5112289 52.41148683 24.01869159 0 0 0 0 0
0 0 0 0 0 0 0 95.65452154 796.8531064
1217.539541 1404.443306 392.2568988 245.6196545 70.05043762 0
0 0 0 0 0 0 0 0 0 0 #OR
1989 2 5 3 0 50 0 0 0 0.121398207
0.292796522 0.782540286 1.982501193 9.084273288 9.837409122
11.26145254 6.839076379 4.963965911 2.317923233 2.284068233
2.019686367 0.777681013 0.292796522 0.072697257 0 0
0.192634874 0.093933815 0 0 0 0 0.121398207
0.121398207 0.121398207 0.242796415 2.676263777 4.548603586
13.39997895 11.96030755 8.502849334 2.691716914 1.003938888
1.29381414 0.098701058 0 0 0 0 0 0 0
0 0 0 0 #N89
1990 1 3 3 2 4 0 0 0 0 0 0
0 0 24.92882562 36.99059561 167.1089458 479.3659163
280.0340559 337.6830415 332.016176 272.9111125 124.9487301
31.32373008 0 0 0 0 0 0 0 0 0
0 0 0 0 0 111.7770725 346.5877018 611.9001234
613.3562012 147.101348 132.340617 44.76433121 31.97452229
6.394904459 0 46.8125 31.20833333 0 0 0 0 0
0 #OR
1990 2 4 3 2 10 0 0 0 0 0 0
25.85620915 132.4416555 334.4057104 975.5167766 986.4662669
1033.414524 764.7798284 787.6843821 240.6782277 94.64198056
76.2359848 13.75565611 0 0 0 0 0 0 0
0 0 0 0 0 0 26.68376068 230.9588407
417.5100479 998.3099199 1178.040746 659.1829715 332.8615697
87.32876712 0 0 0 0 0 0 0 0 0
0 0 #OR
1991 1 3 3 2 11 0 0 0 0 0 0
0 0 1089.188733 1571.936634 1285.386193 1468.007885
3440.743894 2624.911992 2104.153393 2447.841931 1407.399977
531.0797847 39.2019347 268.8720158 211.54 0 0 47.44 0
0 0 0 0 0 55.53398058 0 215.8426121
1224.680258 3341.071571 3167.262432 1324.56072 450.5220353 74.68
48.8 0 0 0 0 0 0 0 0 0 0
#OR
1991 2 4 3 2 7 0 0 0 0 0 0
34.01960784 90.85305228 134.8880903 376.6072347 562.7049553
658.8840724 819.0130884 949.0644035 413.0845234 169.9850855
307.579855 132.9468889 34.01960784 34.01960784 0 0 0
0 0 0 0 0 0 0 0 40.19920319
150.9908141 283.1522555 743.512123 979.8564367 397.8193268
175.7184189 72.57960784 0 0 0 0 0 0 0
0 0 0 0 #OR
1992 1 3 3 2 4 0 0 0 0 0 0
71.04417671 355.2208835 355.2208835 213.1325301 229.1206325
433.0694891 762.6646059 744.4639114 373.421578 429.5512851
456.2506845 385.2065078 0 0 0 0 0 0 0
0 0 0 0 0 71.04417671 4.591836735 673.7530396
687.4078638 461.9067611 330.3170859 727.3085234 1186.160464
472.627451 118.1568627 0 0 0 0 0 0 0
0 0 0 #OR
1992 2 4 3 2 11 0 0 0 0 0 0
32.73469388 279.1443734 709.7131988 1076.90704 1363.331927
1699.949607 1015.737366 1273.957839 511.5848657 642.4728386
199.1589937 88.12611826 52.28627451 37.56627451 0 0 0
0 0 0 0 0 0 0 0 0 674.7834996
1145.974506 1129.127482 1150.324854 577.5400202 209.3324192
63.33469388 24.42 19.8 0 0 0 0 0 0 0
0 0 #OR

1992 2 5 3 0 79 0.217910707 0 0 0.418290003
0.752594619 1.352894918 5.362311106 5.817805542 6.701444981
11.13112757 7.701434757 2.384035575 4.172571262 4.197047784
1.798710347 1.341339307 0.994615429 1.621278607 0.389126262 0.0944993
0 0 0 0 0 0.616618241 0 0 0.1050132
1.121840705 2.367991082 5.155074918 10.88089533 7.330072829
7.188788983 3.372992294 3.824478004 1.289242391 0.203454654 0
0.0944993 0 0 0 0 0 0 0 0 0 #N92
1993 1 3 3 2 7 0 0 0 0 0 0
0 0 295.9143969 0 216.9960474 1053.502582 1709.455861
2887.95473 3543.788591 2055.979697 1423.985172 1178.117107
481.2869459 0 0 0 0 134.88 0 0 0 0
0 0 0 0 700.3268175 2363.902631 3843.663396
4591.035452 4932.828742 2160.623521 609.0576471 0 0 0
0 0 0 0 0 0 0 0 #OR
1993 2 4 3 2 8 0 0 0 0 0 0
0 25.33916667 71.84564626 211.5937585 362.2460374 364.1855952
290.5028401 243.6538291 340.7892909 141.8456201 93.39539901
26.72769231 20.60769231 56.70571429 0 0 3.653846154 0
0 0 0 0 0 0 0 0 75.30488095
68.09416667 113.4554592 162.5704592 94.54814626 78.54769231
30.25384615 0 0 0 0 0 0 0 0 0
0 0 #OR
1994 1 3 3 2 7 0 0 0 0 0 0
0 0 209.1665134 315.4891468 362.8619632 960.828135
911.1528084 1171.095701 1728.425383 1074.32693 402.7341942
355.0576203 268.9241579 0 0 0 0 0 0 0
0 0 0 0 0 0 598.7695675 933.6317918
1734.088982 2397.637764 1730.114149 972.8131217 327.4285714
125.1153846 0 0 0 0 0 0 0 0 0
0 #OR
1994 2 4 3 2 8 0 0 0 0 0 0
0 34.7826087 1495.365217 1111.420976 1786.42087 1790.813043
1040.762201 563.4893878 525.5405679 213.8124046 7.489795918 6.74
0 10.31142857 0 0 0 0 0 0 0 0
0 0 0 0 845.3026087 3819.534996 2567.499077
821.9423602 1266.898846 76.54791482 256.7546051 0 0 0
0 0 0 0 0 0 0 0 #OR
1995 1 3 3 2 8 0 0 0 0 0 0
0 0 199.1783567 501.3833081 1744.752028 3217.023132
4730.007938 3410.142756 3641.217654 2541.147845 799.4952835
275.5333092 618.8557142 175.0588235 0 0 0 0 0
0 0 0 0 0 0 260.1233187 2909.336016
5272.309487 4884.771726 4250.865556 3768.982723 1048.63804 0
0 0 73.8976378 0 0 0 0 0 0 0
0 #OR
1995 2 4 3 2 2 0 0 0 0 0 0
0 0 39.68947579 30.64865946 61.29731893 110.027611
113.5538215 70.33813525 95.47218888 104.5130052 64.82352941
9.040816327 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 18.08163265 70.33813525
106.5014006 36.16326531 9.040816327 21.60784314 0 0 0
0 0 0 0 0 0 0 0 #OR
1995 2 5 3 0 73 0 0 0.320899211 0.320899211
0.73164167 1.764995124 3.142787679 3.442353705 6.036374763
8.291705419 7.840834926 10.66084542 8.664477934 3.968183041
2.451850155 3.765828963 0.870940264 0.179637033 1.06770712 0
0 0 0 0 0 0 0.160449606 0 0.92204295
1.769458398 1.666667369 3.313352363 7.476941058 8.230232693
6.867382323 3.420836986 2.111763517 0.179637033 0.359274066 0
0 0 0 0 0 0 0 0 0 0 #N95
1996 1 3 3 2 3 0 0 0 0 0 0
0 0 0 93.57289528 98.68610282 478.0908915 695.0847887
1301.70989 389.6312038 799.4264151 157.84 5.113207547 93.57289528
0 5.113207547 0 0 0 0 0 0 0 0
0 0 0 0 192.2589981 1020.991204 1751.037307
618.2249707 320.7932075 325.9064151 157.84 0 0 0 0
0 0 0 0 0 0 #OR
1996 2 4 3 2 4 0 0 0 0 0 0
0 0 134.3642105 514.3589404 351.7252 380.4020842 564.3799439

621.8452491 304.508407 61.65577544 19.82 0 0 0
74.48421053 0 0 0 0 0 0 0 0 0
0 0 0 483.4862807 453.4768281 431.0410526 126.019986
126.019986 41.83577544 0 0 0 0 0 0 0
0 0 0 0 #OR
1997 1 3 3 2 4 0 0 0 0 0 0
0 6.163265306 6.163265306 30.81632653 149.880784 409.442195
412.6627602 1455.913403 1415.858085 781.771773 140.4969535 0
130.3657463 0 0 0 0 0 0 0 0 0
0 0 0 0 124.202481 776.9116145 1142.052685
1315.005559 303.3186198 140.4969535 0 0 0 15.26923077
0 0 0 0 0 0 0 0 #OR
1997 2 4 3 2 10 0 0 0 0 0 0
7.545638945 20.17192305 417.582798 965.2842924 749.5078716
828.7712092 1711.196692 1339.921984 954.1944257 829.3310014
599.5377736 12.6953125 167.3945606 77.34962406 0 12.6953125
0 0 0 0 0 0 0 0 0 164.5838776
280.7074967 648.5990555 778.9532024 253.7794477 351.1853121
39.44095592 15.24193548 12.6953125 0 0 5.080645161 0
0 0 0 0 0 0 #OR
1998 1 1 3 2 1 0 0 0 0 0 0
0 0 0 0 0 0 245.4675242 859.1363348
368.2012864 859.1363348 490.9350485 245.4675242 122.7337621
122.7337621 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 490.9350485 1350.071383
736.4025727 245.4675242 0 0 0 0 0 0 0
0 0 0 0 #WA
1998 2 2 3 2 9 0 0 0 0 0 0
8.428714834 33.71485934 50.79256011 340.7912281 954.697181
599.4294416 1403.624391 1539.024535 1616.437685 1865.047443
463.6053891 161.2686079 168.0001793 35.62899612 0 0 0
0 0 0 0 0 0 0 0 0 16.85742967
84.4191852 377.738643 1278.268845 2813.137467 1264.511245
360.0057441 254.2941736 154.6014904 0 96.03331297 0 0
0 0 0 0 0 #WA
1998 1 3 3 2 4 0 0 0 0 0 0
0 0 90.88 45.44 93.91826087 96.95652174 242.3913043
694.2726645 268.2819755 583.6994025 254.6652353 966.8795987
48.47826087 434.9615385 652.4423077 0 0 0 0 0
0 0 0 0 0 0 499.84 1020.353398 562.310689
431.6167159 755.0248563 160.0316589 0 0 0 0 0
0 0 0 0 0 0 0 #OR
1998 2 4 3 2 15 0 0 0 0 0 0
297.9728288 1543.909026 1645.36163 2106.507545 1593.096028
542.2165247 1446.574627 828.285028 391.6835324 600.6347905
385.6456421 291.3372004 87.50542004 12.2970297 28.96078431 0
0 0 0 0 0 0 205.8634538 0 205.8634538
893.1394551 3543.360174 4742.68612 2627.607955 2367.442355
1498.439883 418.8049418 35.3123162 17.28682171 0 0 0
0 0 0 0 0 0 0 #OR
1998 2 5 3 0 143 0 0 0.170067833 0.537821132
1.231439511 1.782632465 2.959146388 4.927075731 6.483020755
7.041526591 5.708604915 4.860318807 3.685550355 3.439128034
2.389333575 1.655086252 0.675624168 0.060752563 0 0 0
0 0 0 0 0.056689278 0.226757098 0.904461995
1.473942626 2.321158016 2.534937895 5.782000006 9.130778655
9.378580173 9.76118742 6.419006038 3.345939515 0.837640571
0.147818122 0.071973519 0 0 0 0 0 0 0
0 0 0 #N98
1999 1 1 3 2 2 0 0 0 0 0 0
0 0 0 36.71721309 48.95628412 0 63.38797156
200.2103693 251.3592698 543.8209856 339.2253835 151.2540852
253.5518862 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 112.3442557 439.3305681
607.2089571 353.6570709 316.9398578 63.38797156 0 0 0
0 0 0 0 0 0 0 #WA
1999 2 2 3 2 10 0 0 0 0 0 0
0 42.22887299 323.4427922 682.3532287 1344.494457 1261.937754
1006.776288 891.8364284 749.8400789 672.1227995 511.4061516
286.0525838 82.51389018 17.17301331 0 2.900392993 0 0

0 0 0 0 0 0 0 0 2.655870668
204.9522902 689.5310763 1169.887352 831.4247933 256.0527149
91.93831576 25.7476148 22.84722181 0 0 0 0 0
0 0 0 0 #WA
1999 1 3 3 2 5 0 0 0 0 0 0
0 0 0 0 229.9035207 309.4383683 345.9666749
496.9462827 849.7210186 591.1712808 421.8235207 224.9783028
88.6888454 88.6888454 0 0 0 0 0 0 0
0 0 0 0 0 40.32945736 591.9300569 1105.632639
2829.87386 3188.795683 1761.771766 780.2322117 319.2033008 0
0 0 0 0 0 0 0 0 0 #OR
1999 2 4 3 2 12 0 0 0 0 0
94.97991968 313.8693044 1474.929044 2360.823636 1984.969649
1326.31596 2497.279508 1316.072049 2132.378635 1776.54545
594.4245339 478.4943677 338.1582852 120.377186 0 0 0
0 0 0 0 0 0 115 0 156.9346522
843.3077008 3929.203724 5237.429172 4559.973046 3896.905124
2260.948999 556.9133779 223.6763316 7.666666667 0 0 0
0 0 0 0 0 0 0 #OR
2000 1 1 3 2 5 0 0 0 0 0 0
0 0 28.50247901 91.08875548 168.5506986 267.9423296
402.3254965 622.4567342 1209.770918 955.4675431 800.6254437
651.3712152 548.8647203 204.8603168 0 0 0 0 0
0 0 0 0 0 0 5.700495801 17.1014874
88.48637575 782.7695964 1890.68467 3497.171169 1278.045547
410.9881832 73.98726807 0 0 0 0 0 0 0
0 0 0 #WA
2000 2 2 3 2 13 0 0 0 0 0 0
0 113.4606029 423.7980892 1872.528591 1964.173562 3535.011434
5726.816092 4336.024442 4371.016923 2554.057601 1368.621831
1395.265521 480.2899296 129.9573696 0 0 0 0 0
0 0 0 0 0 0 0 157.7996686 1869.209422
5087.843848 7640.785113 5312.480621 1446.378202 594.5406857 0
117.1197885 0 0 0 0 0 0 0 0 0
#WA
2000 1 3 3 2 7 0 0 0 0 0 0
0 0 83.42684512 345.452267 941.8880384 490.143102
1811.075907 1795.365675 2214.85552 2080.167798 1488.754728
1014.765693 388.312267 183.2941176 0 0 0 0 0
0 0 0 0 0 0 0 881.0982243 1919.713494
3868.823497 5308.552756 2946.792399 1579.781114 309.7654219 0
0 0 0 0 0 0 0 0 0 0 #OR
2000 2 4 3 2 10 0 0 0 0 0 0
103.5787972 237.7956647 525.198216 1183.102578 1201.096795
1834.588911 1271.198753 1293.079032 489.3363963 607.4378433
607.7213918 270.4813148 11.64356436 72.10820896 0 0 0
0 0 0 0 0 0 0 0 67.10843373
430.7864513 1868.573251 1740.611346 1684.26232 1310.33177
178.8647444 186.5928998 0 0 0 0 0 0 0
0 0 0 0 #OR
2001 1 1 3 2 6 0 0 0 0 0 0
0 0 0 0 0 0 502.4960602 2830.603257
1956.709538 734.0256825 257.412367 883.5029396 136.4358847
151.3536068 0 0 46.11128765 0 0 0 0 0
0 0 0 0 0 272.2206246 272.2206246 2295.814576
6389.872769 4131.380728 1204.417067 289.5780053 0 0 0
0 0 0 0 0 0 0 #WA
2001 2 2 3 2 10 0 0 0 0 0 0
0 2.597687286 15.89285148 401.9414545 1940.29309 1347.46299
2334.372907 2208.850485 896.8346437 1098.537374 113.8923193
110.4538171 17.15215323 101.421047 41.46749043 0 0 0
0 0 0 0 0 0 0 0 2.480285011
801.3189559 1052.334274 3205.249087 1876.153317 940.5792151
78.90562699 3.58159198 17.15215323 0 0 0 0 0
0 0 0 0 #WA
2001 1 3 3 2 9 0 0 0 0 0 0
0 0 16.62 83.1 896.9263328 1151.319303 1093.957006
2013.981382 1947.180112 1732.168676 686.3227657 656.4076949
94.09836066 0 0 0 0 0 0 0 0 0
0 0 0 0 242.614792 864.6270388 2737.307664

4327.63939 4593.742548 3002.705813 868.3272715 148.2772277 0
0 0 0 0 0 0 0 0 0 #OR
2001 2 4 3 2 8 0 0 0 0 0 0
0 0 78.48617088 673.3563724 1362.23129 1274.035799
1458.588804 530.0725932 1060.739922 442.4135508 530.1663654
431.5282331 341.0096961 215.7641165 215.7641165 234.2519685 0
0 0 0 0 0 0 0 43.79844961 39.22772277
142.4365819 436.258698 2068.289609 1812.08926 1076.288277
1018.169443 115.9973556 0 0 0 0 0 0 0
0 0 0 0 #OR
2001 2 5 3 0 133 0 0.508670219 0.720576883
1.483347331 2.38373211 2.99713314 2.549510595 4.494154602
4.330140949 5.050486289 6.043164504 6.783752892 5.097578777
3.079717169 3.020918877 1.630023588 0.450595108 0.761319464
0.181386436 0 0.038958771 0 0 0 0 0.213641492
0.29841986 1.463235412 2.29895373 4.463967068 4.701561608
5.527984539 6.573048032 8.192351386 5.928034235 4.812282275
2.120475988 1.58153022 0.148132627 0 0 0.071213827 0
0 0 0 0 0 0 0 #N01
2002 1 1 3 2 5 0 0 0 0 0 0
0 0 62.27542301 454.6874942 662.4636108 665.2554412
865.533764 1448.509157 1412.48274 1026.111027 440.2207615
247.3004492 62.27542301 0 0 0 0 0 0 0
0 0 0 0 0 86.36090765 0 803.6558335
2319.095493 3570.958407 2953.385812 1936.538609 509.8541951
134.4781912 0 0 0 0 0 0 0 0 0
0 #WA
2002 2 2 3 2 11 0 0 0 0 0 0
0 31.13481262 293.3517204 1087.343013 1148.144289 1040.286407
1240.322282 1161.466688 2003.469417 1425.595952 571.9001708
204.1525363 26.82128907 99.7836321 92.45580259 0 0 0
0 0 0 0 0 0 0 15.56740631 94.16134814
286.6403943 849.5463187 1548.391589 1784.494294 1117.530522
446.175693 3.738478595 32.44493022 0 49.89181605 0 0
0 0 0 0 0 #WA
2002 1 3 3 2 5 0 0 0 0 0 0
0 0 0 695.05 199.8 670 1618.3 2230.05 1316.453535
1356.710606 316 504.9035354 158 0 0 0 0 0
0 0 0 0 0 0 0 0 158 748.5 2746.55
5411.360606 9594.881818 7029.328283 4118.414141 205.3535354 0
0 0 0 0 0 0 0 0 0 #OR
2002 2 4 3 2 16 0 0 0 0 0 0
93.50806452 212.4904591 686.7581076 1498.999936 2303.548385
3044.363071 3956.934847 2660.813014 1898.981457 1639.670741
490.557021 227.359137 265.9531964 93.50806452 12.30769231
12.30769231 0 0 0 0 0 0 0 0 0
93.50806452 70.61386139 651.5715879 2426.742905 3155.491696
2324.583252 690.4655219 350.8935645 10.98 12.30769231 0 0
0 0 0 0 0 0 0 #OR
2003 1 1 3 2 9 0 0 0 0 0 0
0 0 176.074029 200.7728406 1031.701354 861.0630194
827.0788829 661.0728028 1491.369005 1277.80414 2490.506974
161.0992833 381.1616231 194.4519913 1.32152621 0 0 0
0 0 0 0 0 0 0 0 0 175.3400071
673.5565402 2446.780595 6384.172199 3984.917042 3018.792476
777.8079653 194.4519913 0 0 0 0 0 0 0
0 0 #WA
2003 2 2 3 2 19 0 0 0 0 0
1.228976535 1.228976535 89.62328593 826.5681424 2429.985038
3019.184984 3807.677631 3048.509154 2658.9124 1989.835596 1354.099161
673.7129783 358.4950377 152.9645034 164.6827521 35.4666095 0
36.4666095 0 0 0 0 0 0 0 0
32.57194752 160.8762421 1470.126649 2869.780481 3600.741427
3499.707301 911.7568599 621.6490549 27.55104294 122.0498894 0
0 95.73234706 0 0 0 0 0 0 #WA
2003 1 3 3 2 13 0 0 0 0 0 0
0 0 23.82352941 192.9594701 1123.514537 1882.096159
3424.825529 2973.451196 3167.292268 3901.475361 1833.460113
922.6204824 127.3560151 217.9633028 217.9633028 0 0
94.45098039 53.10891089 0 0 0 0 0 0 0

87.4789916 1154.746102 2947.528788 6009.783869 7001.168374
3380.685527 1757.993142 387.4038462 258.2692308 0 0 0
0 0 0 0 0 0 #OR
2003 2 4 3 2 16 0 0 0 0 0 0
0 247.1175882 1595.070912 4212.264722 5419.97077 2658.835096
2255.207268 2932.09352 2405.980393 2079.214436 1115.253968
519.5528088 297.3651376 72.01956858 0 54.92156863 0
70.07782101 0 0 0 0 0 49.27021696 0
49.27021696 297.1613615 2768.230076 5896.400918 6050.341017
2542.532334 915.4357667 999.3970057 479.1830769 0 0 0
0 0 0 0 0 0 0 #OR
2004 1 1 3 2 7 0 0 0 0 0 0
0 6.947524566 69.47524566 48.63267196 27.79009827 154.6360019
27.79009827 2907.83647 1465.58318 2044.529009 1579.103316
2697.561431 341.5763275 719.6207117 110.8389742 0 0 0
0 0 0 0 0 0 0 0 0 55.58019653
48.63267196 7458.826571 26726.63005 25022.65467 7551.555655
2422.272923 0 0 0 0 0 0 0 0 0
0 #WA
2004 2 2 3 2 18 0 0 0 0 0 0
0 4.277224955 158.2202156 678.3948644 1376.102838 4116.091871
3657.399796 6570.103607 5146.465978 1998.541053 1354.202021
988.6212455 455.4220717 283.9178676 0 0 0 0 0
0 0 0 0 0 0 0 11.87003158 173.3323196
2965.137549 5207.736232 5354.658006 3484.369987 1429.39763
886.9998254 2.177181617 5.683383343 4.343747904 0 0 0
0 0 0 0 #WA
2004 1 3 3 2 17 0 0 0 0 0 0
0 25.96153846 0 25.96153846 110.3094778 936.1686041
2463.489942 5250.428805 9036.497401 6507.923161 2991.460359
4367.325722 6295.440597 1982.803805 725.4678546 242.7260824 0
0 0 0 0 0 0 0 0 0 51.92307692
352.4169231 1592.366162 9469.549979 20164.31184 17897.82033
2324.74612 489.2077828 0 38.37524178 0 19.18762089
19.18762089 0 0 0 0 0 #OR
2004 2 4 3 2 10 0 0 0 0 0 0
0 0 871.8908469 1803.865175 2767.32702 3467.776866
3630.14403 2601.110627 1503.486429 1563.814297 635.6907124
308.3658477 170.2634752 21.56435644 0 0 0 0 0
0 0 0 0 0 0 0 500.7692308 1605.915438
4237.508191 3174.819052 1439.031761 145.2904913 7.188118812
97.13207547 0 0 0 0 0 0 0 0 0
0 #OR
2004 2 5 3 0 128 0.043818263 0.175273053 0.74491044
0.951124223 1.084268977 1.357660135 2.438598279 3.758616923
3.394828186 5.429866152 8.515834634 5.958846588 5.564026356
4.770023806 4.141584909 2.372941542 1.318399601 0.356244662
0.118577264 0.093448507 0 0 0 0 0.030940738
0.262909571 1.270729573 1.5026012 1.084512808 1.483303352 4.691158131
4.83938818 6.049397987 6.993208552 8.263558501 7.918437267
1.717678589 1.169548959 0.082337415 0.051396677 0 0 0
0 0 0 0 0 0 #N04
#_AGE_DATA

17 #n_abins #_N_agebins #(<=_#_of_age,_the_model_always_start_at_age_0)

#age_bins1(1,n_abins) #_lower_age_of_agebins

1 2 3 4 5 6 7 8 9 10 11 12
13 14 15 16 17 #

#_Age_error

```
3	#N_ageerr #3_ageerr_types_1:no_error__2:WDFW_AGEING__3:ODFW_AGEING

#age_err(1,N_ageerr,1,2,0,nages)#_vector_with_stddev_of_ageing_precision_for_each_AGE_and_type

#TYEP_1:_perfect_age_(not_used)

#Age0	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	#
-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
	-1	-1	-1	-1	-1	-1	-1	#
0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
	0.001	0.001	0.001	0.001	0.001	0.001	0.001	#
#TYPE_2:_WDFW_Age

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	16.5	17.5	18.5	19.5	20.5	21.5	22.5
	23.5	24.5	25.5	26.5	27.5	28.5	29.5	30.5	31.5	32.5	33.5
	34.5	35.5	36.5	37.5	38.5	39.5	40.5	#
0.05	0.15	0.25	0.35	0.45	0.55	0.65	0.75	0.85	0.95	1.05	1.15
	1.25	1.35	1.45	1.55	1.65	1.75	1.85	1.95	2.05	2.15	2.25
	2.35	2.45	2.55	2.65	2.75	2.85	2.95	3.05	3.15	3.25	3.35
	3.45	3.55	3.65	3.75	3.85	3.95	4.05	#
#TYEP_3:_ODFW_Age

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	16.5	17.5	18.5	19.5	20.5	21.5	22.5
	23.5	24.5	25.5	26.5	27.5	28.5	29.5	30.5	31.5	32.5	33.5
	34.5	35.5	36.5	37.5	38.5	39.5	40.5	#
0.05	0.15	0.25	0.35	0.45	0.55	0.65	0.75	0.85	0.95	1.05	1.15
	1.25	1.35	1.45	1.55	1.65	1.75	1.85	1.95	2.05	2.15	2.25
	2.35	2.45	2.55	2.65	2.75	2.85	2.95	3.05	3.15	3.25	3.35
	3.45	3.55	3.65	3.75	3.85	3.95	4.05	#
#_AGE_COMPOSITIONS

0	#nobs_a

#sizeagedata(1,nobsal,1,7+2gender*n_abins)
0	#nobsal, include supper years,  combine sexes prior to 1981 for WA samples

#_environmental_data
1	#N_envvar#N_variables
-1	#N_envdata		#N_observations
#1980	1	1	#env_temp(1,N_envdata,1,3)

999	#fid	#end_of_data_file
```

#Control_file_for_petrale_sole_assessment_2005_:::_US_Vancouver-Columbia_4Fleets.

```
#DAT file
#  catch = Ret + Disc (10% in summer, 5% in winter)
#  cpue--1999assessment
#  no disc rates
#  turn off super years
#  nsamp=real
#  no age comp and ms
#CTL file:
#  Fixed growth curves F!=M
#  Rdev--1940~2004
#  mirro all fishery selx (asymp and F=M)
#  no retention curve
#  asymp survey selx and F=M


#Define_Morphs_See_Tag_020
2                   #gmorph   #Number_of_growth_morphs
1        2          #sx(1,gmorph)        #1=female;_2=male)

#Area_and_Migration
1        #N_areas_or_(N_subpops)
#WAWint_WASumm_ORWint_ORSummer_survey
1        1        1        1        1        #assign_fleets_and_survey_to_area
#do_migration_between_areas
0        #0=no_migration_1=migration between_areas

#Time_blocks_for_time-varying_parameters

0        #N_Block_Designs

#Natural_mortality_and_growth_parameters_for_each_morph
0        #natM_amin        #Last_age_for_natmort_young   #constant_M_for_all_ages-sex-yrs
0        #natM_amax        #First_age_for_natmort_old    #so_I_give_these_0s
2.833    #AFIX             #youngest_age_in_data                  #See_VanCol_ctl.xls
17.833   #AFIX2            #oldest_age_in_data
-4       #MGparm_dev_PH

#MGparm_1(1,N_MGparm,1,12)#N_MGparm=7*gmorph
#LO      HI       INIT     PRIOR    PR_TYPE SD     PHASE    env_var  use_dev  dev_yr1  dev_yr2  dev_sd
         block    holder   #
#Morph_1_Female
0.0875   0.25     0.2      0.2      0        0.8      -3       0        0        0        0        0.5
         0        0        #M1_M_young
-3       3        0        0        0        0.8      -3       0        0        0        0        0.5
         0        0        #M1_M_old=ln(M_old/M_young)
0        45       24.6219  19.6     0        10       -3       0        0        0        0        0.5
         0        0        #M1_L@AFIX
45       80       55.4099  53.08    0        10       -3       0        0        0        0        0.5
         0        0        #M1_L@AFIX2
0.01     0.5      0.14375  0.186    0        0.8      -3       0        0        0        0        0.5
         0        0        #M1_VBK
0.02     0.5      0.08     0.08     0        0.8      -3       0        0        0        0        0.5
         0        0        #M1_CV@AFIX
-3       3        0        0        0        0.8      -3       0        0        0        0        0.5
         0        0        #M1_CV@AFIX2=ln(CV@AFIX2/CV@AFIX)
#Morgh_2:::Male
-3       3        0        0        0        0.8      -3       0        0        0        0        0.5
         0        0        #M2_M_young=ln(M2_M_young/M1_M_young)
-3       3        0        0        0        0.8      -3       0        0        0        0        0.5
         0        0        #M2_M_old=ln(M2_M_old/M2_M_young)
-3       3        0        0        0        0.8      -3       0        0        0        0        0.5
         0        0        #M2_L@AFIX=ln(M2_L@AFIX/M1_L@AFIX)
-3       3        -0.3094  -0.2     0        0.8      -3       0        0        0        0        0.5
         0        0        #M2_L@AFIX2=ln(M2_L@AFIX2/M1_L@AFIX2)
-3       3        0.76364  0.2      0        0.8      -3       0        0        0        0        0.5
         0        0        #M2_VBK=ln(M2_VBK/M1_VBK)
-3       3        0        0        0        0.8      -3       0        0        0        0        0.5
         0        0        #M2_CV@AFIX=ln(M2_CV@AFIX/M1_CV@AFIX)
```

```
-3	3	0	0	0	0.8	-3	0	0	0	0	0.5
	0	0	#M2_CV@AFIX2=ln(M2_CV@AFIX2/M2_CV@AFIX)
#LW_female
-3	3	3.42E-06	3.4E-06	0	0.8	-3	0	0	0	0	0.5
	0	0	#WL_intercept_female
-3	3	3.346	3.346	0	0.8	-3	0	0	0	0	0.5
	0	0	#WL_slope_slope_female
#Female_maturity
-3	3	33.1	33.1	0	0.8	-3	0	0	0	0	0.5
	0	0	#mat_intercept	#L50
-3	3	-0.734	-0.734	0	0.8	-3	0	0	0	0	0.5
	0	0	#mat_slope
#Fecundity_Assume_same_as_spawning_biomass
-3	3	1	1	0	1	-3	0	0	0	0	0.5
	0	0	#mat_intercept	#L50
-3	3	0	0	0	1	-3	0	0	0	0	0.5
	0	0	#mat_slope
#LW_Male
-3	3	7.17E-06	7.2E-06	0	0.8	-3	0	0	0	0	0.5
	0	0	#WL_intercept_male
-3	3	3.134	3.134	0	0.8	-3	0	0	0	0	0.5
	0	0	#WL_slope_slope_male

#Allocate_R_by_areas_x_gmorphs_(1_area_2morphs_in_this_case)
0	1	0.5	0.2	0	9.8	-3	0	0	0	0	0.5
	0	0	#frac to morph 1 in area 1
0	1	0.5	0.2	0	9.8	-3	0	0	0	0	0.5
	0	0	#frac to morph 2 in area 1

#Allocate_R_by_areas_(1_areain_this_case)
0	1	1	1	0	9.8	-3	0	0	0	0	0.5
	0	0	#frac R in area 1

0	#customMGenvsetup  #0=read_one_setup_and_apply_to_all;_1=Custom_so_read_each_env
#	-10	10	0.1	0.2	4	3	#Env_link_parameter #NONE

0	#customblocksetup_MG
#0=read_one_setup_and_apply_to_all;_1=see_detailed_instructions_for_N_rows_in_Custom_setup
#	-10	10	0	0	1	5	3block-parm_setup	#NONE

#SR_function_(1=B-H;2=notused)
1
#SR_parm_1(1,4,1,6) #_Spawner-Recruitment_parameters
#LO	HI	INIT	PRIOR	PR_TYPE SD	PHASE	use_env_number
3	31	10.2	9	0	10	1	#Ln(R0)
0.2	1	0.8	0.7	0	5	7	#steepness(h)---est
0	2	0.5	0.9	0	0.8	-99	#sigmaR
-5	5	0	0	0	1	-99	#Env_link_parameter
-5	5	0	0	0	1	-2	#init_eq---Nov 27

0	#SR_env_link	#env-var_for_link	#NONE

#rec_residuals
#start_rec  end_rec	LO_rec	HI_rec	PH_rec
1940		2004	-15	15	8

#init_F_parm_1(1,Nfleets,1,6)	#_setup_for_each_fleet
#LO	HI	INIT	PRIOR	PR_TYPE SD	PHASE
0	1	0	0	0	1	-3	#Fleet1_(WAWinter)__should_not_be_estimated
0	1	0	0	0	1	-3	#Fleet2_(WASummer)__because_Ceq=0_(see_.dat)
0	1	0	0	0	1	-3	#Fleet3_(ORWinter)__should_not_be_estimated
0	1	0	0	0	1	-3	#Fleet4_(ORSummer)__because_Ceq=0_(see_.dat)

#Q_setup(1,Ntypes,1,5)		#add_parm_row_for_each_positive_entry_below(row_then_column)
#floatQ	Do-pow	Do-env	Do-dev	env-var	N(0)B(1)#The_first_4_cols_should_be_0/1.
0	0	0	0	0	1	#Fleet1_(WA_Winter)
0	0	0	0	0	1	#Fleet2_(WA_Summer)
0	0	0	0	0	1	#Fleet3_(OR_Winter)
0	0	0	0	0	1	#Fleet4_(OR_Summer)
0	0	0	0	0	1	#Survey
```

```
#Seltype(1,2*Ntypes,1,4)          #SELEX_&_RETENTION_PARAMETERS_at_Tag_025
#N_selparm        Do_retain  Do_male  Mirror_Another_Selex
2                 0                   0        0        #Fleet1(WAwinter)_is_Double_Logistic_do-RET_do-male
5                 0                   0        1        #Fleet2(WAsummer)_is_Double_Logistic_do-
RET_COMBINESEX
5                 0                   0        1        #Fleet3(ORwinter)_is_Double_Logistic_do-RET_do-male
5                 0                   0        1        #Fleet4(ORsummer)_is_Double_Logistic_do-RET_do-male
2                 0                   0        0        #Survey_is_Double_Logistic_do-male

#Age_selectivity  #set_to_1
10      0       0       0       #Fleet_1(WAwinter)  #Let_ALK_works_for_age_selx
10      0       0       0       #Fleet_2(WAsummer)
10      0       0       0       #Fleet_3(ORwinter)  #Let_ALK_works_for_age_selx
10      0       0       0       #Fleet_4(ORsummer)
10      0       0       0       #Survey   #No_age_data_for_surveys.

#selparm(1,N_selparm,1,12)
#Size_selex_needs_Ntypes_panels_(2_fleets_and_1_survey).
#LO     HI      INIT    PRIOR   PR_TYPE SD      PHASE   env-var use_dev dev_yr1 dev_yr2 dev_sd
        nblks   blk_pat #       #
#Size_selectivity_for_FLEET1(WAwinter)
#LO     HI      INIT    PRIOR   PR_TYPE SD      PHASE   env-var use_dev dev_yr1 dev_yr2 dev_sd
        nblks   blk_pat #       #
30      60      56      58      0       99      -3      0       0       0       0       0.5
        0       0       #L@peak_FEMALE          #B1
0.      0.1     0.0     0.001   0       99      -3      0       0       0       0       0.5
        0       0       #slx@L0                 #B2
-5      4       0.15888 1       0       99      3       0       0       0       0       0.5
        0       0       #asc_infl(Logit)  #B3
0.0001  10      0.39    0.4     0       99      3       0       0       0       0       0.5
        0       0       #asc_slope      #B4
-10     10      1       7       0       99      4       0       0       0       0       0.5
        0       0       #des_slx@Lmax(Logit)    #B5
-5      4       0.5     1       0       99      4       0       0       0       0       0.5
        0       0       #des_infl(Logit)  #B6
0.0001  10      0.1     0.1     0       99      4       0       0       0       0       0.5
        0       0       #des_slope      #B7
0.1     20      10      4       0       99      -4      0       0       0       0       0.5
        0       0       #width_of_top           #B8
#Size_selectivity_for_FLEET2(WAsummer)
1       25      1       1       0       99      -4      0       0       0       0       0.5
        0       0       #fleet2 start lo bin
25      30      25      25      0       99      -4      0       0       0       0       0.5
        0       0       #fleet2 start HI bin
#Size_selectivity_for_FLEET3(ORwinter)
1       25      1       1       0       99      -4      0       0       0       0       0.5
        0       0       #fleet2 start lo bin
25      30      25      25      0       99      -4      0       0       0       0       0.5
        0       0       #fleet2 start HI bin
#Size_selectivity_for_FLEET4(ORsummer)
1       25      1       1       0       99      -4      0       0       0       0       0.5
        0       0       #fleet2 start lo bin
25      30      25      25      0       99      -4      0       0       0       0       0.5
        0       0       #fleet2 start HI bin
#Size_selectivity_for_SURVEY
#...FEMALE
30      60      32      58      0       99      -3      0       0       0       0       0.5
        0       0       #L@peak_FEMALE          #B1
0.      0.1     0.0     0.001   0       99      -3      0       0       0       0       0.5
        0       0       #slx@L0                 #B2
-5      4       0.15888 1       0       99      3       0       0       0       0       0.5
        0       0       #asc_infl(Logit)  #B3
0.0001  10      0.39    0.4     0       99      3       0       0       0       0       0.5
        0       0       #asc_slope      #B4
-10     10      1       7       0       99      4       0       0       0       0       0.5
        0       0       #des_slx@Lmax(Logit)    #B5
-5      4       0.5     1       0       99      4       0       0       0       0       0.5
        0       0       #des_infl(Logit)  #B6
```

```
0.0001  10      0.1     0.1     0       99      4       0       0       0       0       0.5
        0       0       #des_slope      #B7
0.1     50      35      4       0       99      -4      0       0       0       0       0.5
        0       0       #width_of_top           #B8
#...DO_MALE
#10     60      34      36      0       10      5       0       0       0       0       0.5
        0       0       #LD=L@Male_selx_!=_Female  #SEE_Dlogistic
#-5     4       0       1       0       99      -5      0       0       0       0       0.5
        0       0       #exp_offset_selx@Lmin      #SEE_Dlogistic
#-5     4       0       0.1     0       99      5       0       0       0       0       0.5
        0       0       #exp_offset_selx@LD        #SEE_Dlogistic
#-20    20      -10     -10     0       10      5       0       0       0       0       0.5
        0       0       #exp_offset_selx@Lmax      #SEE_Dlogistic


#since_age_selex_is_constant_of_1,_no_entry_below.
#Age_selectivity_for_FLEET1
#Age_selectivity_for_FLEET2
#Age_selectivity_for_SURVEY

#custom-env_setup_for_SELEX
0       #customenvsetup    #0=read_one_setup_and_apply_to_all;_1=Custom_so_read_1_each;

#custom-block_read_for_SELEX
0       #customblocksetup
        #0=read_one_setup_and_apply_to_all;_1=Custom_so_see_detailed_instructions_for_N_rows_in_Custom_setup

#phase_for_selex_parm_devs
-4      #_sleparm_dev_PH

#Adjust_for_variance_and_sample_size_for_Ntype_fisheries

0       0       0       0       0       #Survey
0       0       0       0       0       #Discard
0       0       0       0       0       #Mean_weight
1       1       1       1       1       #Len_comp
1       1       1       1       1       #Age_comp
1       1       1       1       1       #mean_len_at_age

#lambdas
1       #max_lambda_phase  #lambdas_won't_change_by_phase
1       #switch_for_sd_offset_in_Likelihood
1       1       1       1       1       #surv_lambda(1,Ntypes)      #4_fleets_and_1_survey
1       1       1       1       0       #disc_lambda(1,Ntypes)      #4_fleets_only
0       #mnwt_lambda(mean_wt_lambda_one_for_all_sources)
1       1       1       1       1       #length_lambda(1,Ntypes)
0       0       0       0       0       #age_lambda(1,Ntypes)
0       0       0       0       0       #sizeage_lambda(1,Ntypes)
1       #lambda_init_equ
1       #lambda_rec
1       #lambda_parmprior
1       #lambda_parm_dev

# crashpen lambda
100
#max F
0.9

999     #fid    #end-of-control-file
```

Appendix VI : The DAT and CTL Files for the Southern assessment area

#Datafile_for_2005_petrale_sole_assessment:Conception_Monterey_Eureka AREA

#Updated_on_04/21/2005

#Model_dimension

1876 #styr #start_year

2004 #endyr #end_year

2 #nseas #N_seasons_per_year

#Vector_with_N_months_in_each_season

4 8 #seasdur(1,nseas) #season1=4mons_and_season2=8mons

1 #spawn_seas #spawning_season_-_spawning_will_occur_at_beginning_of_this_season

2 #Nfleet #N_fishing_fleets

1 #Nsurv N_surveys;_data_type_numbers_below_must_be_sequential_with_the_N_fisheries

Winter_CPUE%Summer_CPUE%Triennial_Shelf #names_of_fleets_and_survey #%_is_deliminator

0.5 0.5 0.5625 #Timing_for_winter&summer_CPUEs_and_survey_index

2 #gender #_number_of_genders(1/2)

40 #nages #_accumulator_age;_model_always_starts_with_age_0

#Catch_bio_mt_retention_only

0 0 #Assumed_equ_catch(1,Nfleet)

#catch_bioT(stry,TimeMax,1,Nfleet)

#fleet1	fleet2	#	y	s
0.00	0.00	#	1876	1
0.00	1.03	#	1876	2
0.00	0.00	#	1877	1
0.00	1.03	#	1877	2
0.00	0.00	#	1878	1
0.00	1.03	#	1878	2
0.00	0.00	#	1879	1
0.00	1.03	#	1879	2
0.00	0.00	#	1880	1
0.00	1.03	#	1880	2
0.00	0.00	#	1881	1
0.00	1.23	#	1881	2

0.00	0.00	#	1882	1
0.00	1.44	#	1882	2
0.00	0.00	#	1883	1
0.00	1.64	#	1883	2
0.00	0.00	#	1884	1
0.00	1.95	#	1884	2
0.00	0.00	#	1885	1
0.00	2.36	#	1885	2
0.00	0.00	#	1886	1
0.00	2.77	#	1886	2
0.00	0.00	#	1887	1
0.00	3.28	#	1887	2
0.00	0.00	#	1888	1
0.00	3.90	#	1888	2
0.00	0.00	#	1889	1
0.00	4.51	#	1889	2
0.00	0.00	#	1890	1
0.00	5.33	#	1890	2
0.00	0.00	#	1891	1
0.00	6.36	#	1891	2
0.00	0.00	#	1892	1
0.00	7.48	#	1892	2
0.00	0.00	#	1893	1
0.00	8.82	#	1893	2
0.00	0.00	#	1894	1
0.00	10.35	#	1894	2
0.00	0.00	#	1895	1
0.00	12.30	#	1895	2
0.00	0.00	#	1896	1
0.00	14.45	#	1896	2
0.00	0.00	#	1897	1
0.00	17.12	#	1897	2
0.00	0.00	#	1898	1
0.00	20.19	#	1898	2
0.00	0.00	#	1899	1

0.00	23.78	#	1899	2
0.00	0.00	#	1900	1
0.00	28.09	#	1900	2
0.00	0.00	#	1901	1
0.00	33.11	#	1901	2
0.00	0.00	#	1902	1
0.00	39.05	#	1902	2
0.00	0.00	#	1903	1
0.00	46.13	#	1903	2
0.00	0.00	#	1904	1
0.00	54.43	#	1904	2
0.00	0.00	#	1905	1
0.00	64.17	#	1905	2
0.00	0.00	#	1906	1
0.00	75.75	#	1906	2
0.00	0.00	#	1907	1
0.00	89.38	#	1907	2
0.00	0.00	#	1908	1
0.00	105.37	#	1908	2
0.00	0.00	#	1909	1
0.00	124.33	#	1909	2
0.00	0.00	#	1910	1
0.00	146.78	#	1910	2
0.00	0.00	#	1911	1
0.00	173.12	#	1911	2
0.00	0.00	#	1912	1
0.00	204.28	#	1912	2
0.00	0.00	#	1913	1
0.00	241.08	#	1913	2
0.00	0.00	#	1914	1
0.00	284.44	#	1914	2
0.00	0.00	#	1915	1
0.00	335.69	#	1915	2
0.00	0.00	#	1916	1
0.00	396.06	#	1916	2

0.00	0.00	#	1917	1
0.00	539.56	#	1917	2
0.00	0.00	#	1918	1
0.00	434.40	#	1918	2
0.00	0.00	#	1919	1
0.00	341.74	#	1919	2
0.00	0.00	#	1920	1
0.00	236.26	#	1920	2
0.00	0.00	#	1921	1
0.00	301.15	#	1921	2
0.00	0.00	#	1922	1
0.00	435.42	#	1922	2
0.00	0.00	#	1923	1
0.00	438.09	#	1923	2
0.00	0.00	#	1924	1
0.00	546.22	#	1924	2
0.00	0.00	#	1925	1
0.00	541.71	#	1925	2
0.00	0.00	#	1926	1
0.00	534.74	#	1926	2
0.00	0.00	#	1927	1
0.00	647.80	#	1927	2
0.00	0.00	#	1928	1
0.00	635.60	#	1928	2
0.00	0.00	#	1929	1
0.00	723.65	#	1929	2
0.00	0.00	#	1930	1
0.00	675.27	#	1930	2
0.00	0.00	#	1931	1
0.00	639.50	#	1931	2
0.00	0.00	#	1932	1
0.00	570.62	#	1932	2
0.00	0.00	#	1933	1
0.00	443.31	#	1933	2
0.00	0.00	#	1934	1

0.00	1142.36	#	1934	2
0.00	0.00	#	1935	1
0.00	924.45	#	1935	2
0.00	0.00	#	1936	1
0.00	523.78	#	1936	2
0.00	0.00	#	1937	1
0.00	838.14	#	1937	2
0.00	0.00	#	1938	1
0.00	942.08	#	1938	2
0.00	0.00	#	1939	1
0.00	1189.51	#	1939	2
0.00	0.00	#	1940	1
0.00	732.47	#	1940	2
0.00	0.00	#	1941	1
0.00	415.43	#	1941	2
0.00	0.00	#	1942	1
0.00	284.34	#	1942	2
0.00	0.00	#	1943	1
0.00	427.22	#	1943	2
0.00	0.00	#	1944	1
0.00	522.55	#	1944	2
0.00	0.00	#	1945	1
0.00	573.18	#	1945	2
0.00	0.00	#	1946	1
0.00	1239.64	#	1946	2
0.00	0.00	#	1947	1
0.00	1370.22	#	1947	2
0.00	0.00	#	1948	1
0.00	2366.32	#	1948	2
0.00	0.00	#	1949	1
0.00	2302.46	#	1949	2
0.00	0.00	#	1950	1
0.00	2030.22	#	1950	2
0.00	0.00	#	1951	1
0.00	1267.52	#	1951	2

0.00	0.00	#	1952	1
0.00	1345.31	#	1952	2
0.00	0.00	#	1953	1
0.00	1557.59	#	1953	2
0.00	0.00	#	1954	1
0.00	1939.61	#	1954	2
0.00	0.00	#	1955	1
0.00	1682.85	#	1955	2
0.00	0.00	#	1956	1
0.00	1207.96	#	1956	2
615.62	0.00	#	1957	1
0.00	1184.08	#	1957	2
670.15	0.00	#	1958	1
0.00	1048.06	#	1958	2
455.20	0.00	#	1959	1
0.00	804.01	#	1959	2
601.47	0.00	#	1960	1
0.00	765.06	#	1960	2
633.55	0.00	#	1961	1
0.00	1182.54	#	1961	2
611.72	0.00	#	1962	1
0.00	1022.23	#	1962	2
655.69	0.00	#	1963	1
0.00	1158.15	#	1963	2
465.35	0.00	#	1964	1
0.00	1144.31	#	1964	2
467.81	0.00	#	1965	1
0.00	1054.83	#	1965	2
406.52	0.00	#	1966	1
0.00	1152.10	#	1966	2
662.25	0.00	#	1967	1
0.00	1084.55	#	1967	2
459.41	0.00	#	1968	1
0.00	1125.04	#	1968	2
524.39	0.00	#	1969	1

0.00	1195.25	#	1969	2
601.78	0.00	#	1970	1
0.00	1454.68	#	1970	2
680.40	0.00	#	1971	1
0.00	1347.36	#	1971	2
989.54	0.00	#	1972	1
0.00	1246.81	#	1972	2
519.27	0.00	#	1973	1
0.00	945.15	#	1973	2
823.28	0.00	#	1974	1
0.00	1099.93	#	1974	2
687.47	0.00	#	1975	1
0.00	1074.10	#	1975	2
865.00	0.00	#	1976	1
0.00	816.82	#	1976	2
629.76	0.00	#	1977	1
0.00	581.69	#	1977	2
853.83	0.00	#	1978	1
0.00	1155.28	#	1978	2
733.29	0.00	#	1979	1
0.00	984.41	#	1979	2
636.63	0.00	#	1980	1
0.00	766.80	#	1980	2
293.15	0.00	#	1981	1
0.00	597.17	#	1981	2
275.83	0.00	#	1982	1
0.00	564.57	#	1982	2
358.55	0.00	#	1983	1
0.00	462.58	#	1983	2
346.66	0.00	#	1984	1
0.00	357.73	#	1984	2
335.89	0.00	#	1985	1
0.00	493.54	#	1985	2
461.76	0.00	#	1986	1
0.00	373.20	#	1986	2

402.11	0.00	#	1987	1
0.00	581.38	#	1987	2
482.06	0.00	#	1988	1
0.00	432.04	#	1988	2
522.65	0.00	#	1989	1
0.00	431.63	#	1989	2
391.24	0.00	#	1990	1
0.00	401.80	#	1990	2
590.61	0.00	#	1991	1
0.00	327.18	#	1991	2
358.34	0.00	#	1992	1
0.00	327.80	#	1992	2
359.16	0.00	#	1993	1
0.00	271.42	#	1993	2
333.54	0.00	#	1994	1
0.00	374.33	#	1994	2
336.20	0.00	#	1995	1
0.00	325.44	#	1995	2
478.27	0.00	#	1996	1
0.00	435.83	#	1996	2
568.36	0.00	#	1997	1
0.00	515.47	#	1997	2
277.78	0.00	#	1998	1
0.00	341.22	#	1998	2
382.22	0.00	#	1999	1
0.00	298.07	#	1999	2
478.16	0.00	#	2000	1
0.00	257.89	#	2000	2
390.12	0.00	#	2001	1
0.00	283.52	#	2001	2
424.97	0.00	#	2002	1
0.00	219.25	#	2002	2
301.56	0.00	#	2003	1
0.00	162.77	#	2003	2
231.34	0.00	#	2004	1

0.00 282.80 # 2004 2END_OF_CATCH

43 #nobs #N_observations

#indexdata(1,nobs,1,5)

#<=Fleet<=Ntype;_the_first_Nfleet_must_be_ordered_as_catch_bioT

#Here_Fleet=1,2_are_Fleet1_and_Fleet2

#Other_types_of_indices(surveys,etc)_must_be_order_by_Nfleet+1,Nfleet+2,...,Ntype

#Year	Seas	Fleet	Value	CV		
1987	1	1	39.87	0.3	#	CPUE w
1988	1	1	40.41	0.3	#	CPUE w
1989	1	1	27.02	0.3	#	CPUE w
1990	1	1	17.79	0.3	#	CPUE w
1991	1	1	19.25	0.3	#	CPUE w
1992	1	1	20.74	0.3	#	CPUE w
1993	1	1	16.51	0.3	#	CPUE w
1994	1	1	12.7	0.3	#	CPUE w
1995	1	1	25.19	0.3	#	CPUE w
1996	1	1	26.9	0.3	#	CPUE w
1997	1	1	22.91	0.3	#	CPUE w
1998	1	1	17.5	0.3	#	CPUE w
1999	1	1	16.24	0.3	#	CPUE w
2000	1	1	21.95	0.3	#	CPUE w
2001	1	1	25.08	0.3	#	CPUE w
2002	1	1	33.19	0.3	#	CPUE w
2003	1	1	69.93	0.3	#	CPUE w
1987	2	2	24.17	0.3	#	CPUE s
1988	2	2	26.98	0.3	#	CPUE s
1989	2	2	31.27	0.3	#	CPUE s
1990	2	2	21.85	0.3	#	CPUE s
1991	2	2	25.95	0.3	#	CPUE s
1992	2	2	20.5	0.3	#	CPUE s
1993	2	2	20.28	0.3	#	CPUE s
1994	2	2	23.84	0.3	#	CPUE s
1995	2	2	26.85	0.3	#	CPUE s
1996	2	2	24.88	0.3	#	CPUE s

1997	2	2	21.93	0.3	#	CPUE s
1998	2	2	17.54	0.3	#	CPUE s
1999	2	2	17.82	0.3	#	CPUE s
2000	2	2	24.32	0.3	#	CPUE s
2001	2	2	23.71	0.3	#	CPUE s
2002	2	2	37.88	0.3	#	CPUE s
2003	2	2	40.00	0.3	#	CPUE s
1980	2	3	1127.2	0.56	#Survey_biomass(mt)	
1983	2	3	922.9	0.22	#Survey_biomass(mt)	
1986	2	3	820.1	0.18	#Survey_biomass(mt)	
1989	2	3	3373.9	0.32	#Survey_biomass(mt)	
1992	2	3	596.0	0.26	#Survey_biomass(mt)	
1995	2	3	1789.8	0.26	#Survey_biomass(mt)	
1998	2	3	1859.5	0.26	#Survey_biomass(mt)	
2001	2	3	2225.0	0.28	#Survey_biomass(mt)	
2004	2	3	6736.0	0.20	#Survey_biomass(mt)	

#_Discards

2 #disc_type #(1=biomass,2=fraction)

0 #nobs_disc #disc_N_observations(from_Sampson)

#Year	Seas	Fleet	Value	CV	#discdata(1,nobs_disc,1,5)
#2001	2	2	0.015	0.2	#WCGOP
#2002	1	1	0.026	0.2	#WCGOP
#2002	2	2	0.046	0.2	#WCGOP
#2003	1	1	0.019	0.2	#WCGOP
#2003	2	2	0.031	0.2	#WCGOP
#2004	1	1	0.019	0.2	#WCGOP
#2004	2	2	0.031	0.2	#WCGOP

#_Mean_BodyWt

0 #nobs_mnwt #N_observations

#mnwtdata(1,nobs_mnwt,1,6) #nobs_mnwt<=0,_skip_reading_mnwtdata

#Year	Seas	Type	Mkt	Value	CV

-1 #min_tail #min_proportion_for_compressing_tails_of_observed_composition

0.0001 #min_comp #constant_added_to_expected_frequencies

#_Length_Composition_Data

25 #nlength #N_length_bins

#len_bins(1,nlength) #_lower_edge_of_length_bins

12 16 18 20 22 24 26 28 30 32 34 36
38 40 42 44 46 48 50 52 54 56 58
60 62 #

#LENGTH_COMPOSITIONS:Replicates_(by_state)_must_be_contigent_within_Year-Seas-Fleet-Sex

98 #nobsl #UP_to_2003, include Demory+Baley

#lendata(1,nobsl,1,6+gender*nlength) #Sorted_by_year_fleet_mkt:_0:Survey_1:Discard_2:Fisheries

#year seas fleet sex mkt Nsamps #Fem12 16 18 20 22 24
26 28 30 32 34 36 38 40 42 44 46
48 50 52 54 56 58 60 62 #Mal12 16 18
20 22 24 26 28 30 32 34 36 38 40
42 44 46 48 50 52 54 56 58 60 62
agid

1962 2 2 3 2 3 0 0 0 0 0 0
0 0 3.333333333 2.666666667 3.333333333 9.333333333 8
15.33333333 14.66666667 7.333333333 10 4.666666667 1.333333333
1.333333333 0 0 0 0 0 0 0 0 0
0 0 0 0 2 2.666666667 8.666666667 3.333333333
0.666666667 1.333333333 0 0 0 0 0 0 0
0 0 0 0 #CA

1964 1 1 3 2 2 0 0 0 0 0 0
0 0 0 6.12244898 6.12244898 8.163265306 4.081632653
12.24489796 10.20408163 0 4.081632653 4.081632653 0 0
0 0 0 0 0 0 0 0 0 0 0
0 2.040816327 4.081632653 12.24489796 14.28571429 4.081632653
8.163265306 0 0 0 0 0 0 0 0 0

0 0 0 #CA

1964 2 2 3 2 22 0 0 0 0 0 0
0.505435223 3.827487476 9.31408952 7.522967516 3.328136211
4.020661385 4.461136442 3.684643749 3.623919011 3.337653929
3.12614772 3.540288542 2.421900524 0.539188229 0.669640929 0
0 0 0 0 0 0 0 0 0.168478408
1.052224236 5.685273587 11.73465687 11.18060053 7.485122034
3.861356198 2.676428939 1.614139042 0.551816006 0.066607743 0
0 0 0 0 0 0 0 0 #CA

1965 1 1 3 2 2 0 0 0 0 0 0
0 1.719272278 3.438544557 3.438544557 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 11.74749306 39.31125008
23.15217268 15.4734505 0 0 0 1.719272278 0 0
0 0 0 0 0 0 0 0 0 #CA

1965 2 2 3 2 14 0 0 0 0 0 0
0 1.638514455 11.796673 12.72202263 8.130107536 6.172658353
3.849278246 3.350366711 3.000951442 3.69888659 2.690550494
3.039264546 3.50345815 1.074419563 1.282552109 0.377702343
0.208682629 0 0 0 0 0 0 0 0 0
0.308046585 6.514661386 13.57668284 7.181937478 3.525052275
1.581481456 0.397533801 0.281537755 0.096977629 0 0 0
0 0 0 0 0 0 #CA

1966 1 1 3 2 8 0 0 0 0 0 0
0 2.518939911 12.37895639 10.50529655 7.056970009 5.336157148
3.702609441 4.89238883 5.467447996 3.595164864 2.980324536
2.120148412 0.632860214 0.435970369 0.290646913 0.145323456
0.438076506 0 0 0 0 0 0 0 0
0.795454709 3.270202692 7.629133799 16.43907615 8.046604684
0.812561262 0.36436171 0.145323456 0 0 0 0 0
0 0 0 0 0 0 #CA

1966 2 2 3 2 32 0 0 0 0 0 0
0.255176247 0.876546978 4.275706981 6.293470553 5.692860562
5.23791456 4.801555444 3.916137424 2.508478812 1.848330059
1.131907259 0.559033132 0.446928389 0.227135147 0.28761879
0.220555803 0.020838328 0 0 0 0 0 0 0
0 0.186319164 3.183677385 17.60899372 20.47701772 12.82223108
4.653609159 1.716392582 0.53638583 0.182525012 0.032653874 0
0 0 0 0 0 0 0 0 #CA

1967 1 1 3 2 13 0 0 0 0 0 0
0 0 0.174073986 2.78865338 5.334547714 8.045358125
9.815517796 8.012357633 5.312220133 3.471142263 2.47444614
1.52649593 0.334553059 0.109941465 0 0 0 0 0
0 0 0 0 0 0 0 0 4.522048272
21.91172675 15.28185915 7.765223389 2.290115292 0.717413731
0.112305797 0 0 0 0 0 0 0 0 0
0 #CA

1967 2 2 3 2 17 0 0 0 0 0 0
0.34139541 5.240129646 6.186953379 8.265854652 4.162751137
4.850248022 3.375768962 3.920383633 3.550407759 2.628259134
1.373524512 1.088498031 0.841708245 0.272850684 0.258830969
0.196256813 0 0 0 0 0 0 0 0 0
0 5.861189627 12.22927147 12.25353067 13.54387007 4.466542649
3.50402918 1.178676349 0.200128344 0.20894065 0 0 0
0 0 0 0 0 0 #CA

1968 1 1 3 2 8 0 0 0 0 0 0
0 1.384381852 4.153145557 3.756164434 2.515449579 6.487577461
13.06232933 12.1171401 9.641828753 5.424639023 6.33798516
2.268884333 0.661636771 0.235439502 0.473750217 0 0 0
0 0 0 0 0 0 0 0 0.692190926
6.000452821 6.732826232 7.547526745 8.411556462 1.385905023
0.709189719 0 0 0 0 0 0 0 0 0

0 0 #CA

1968 2 2 3 2 88 0 0 0 0 0
0.096346136 0.192692272 2.297008777 5.032749438 7.116522298
5.106984487 4.114571258 4.163889487 5.196400882 4.756453783
3.005120005 2.406711489 2.383103307 1.572860892 1.137392935
0.763351431 1.083261245 0.069180345 0 0 0 0 0
0 0 0 0.186670638 2.783673558 9.803878335 10.52613534
6.84806149 6.548006836 5.529827622 3.271016088 2.408304132
1.108434336 0.479641635 0 0.011749529 0 0 0 0
0 0 #CA

1969 1 1 3 2 14 0 0 0 0 0 0
0 1.760594898 4.314081241 6.31617477 5.057258179 6.192776084
4.164903156 8.115088224 8.791876695 6.02718413 3.852226637
5.682005387 3.334839811 3.122790478 1.601160742 1.001270889
0.112993404 0 0 0 0 0 0 0 0 0
1.408475919 5.614530321 9.230439551 4.763641716 3.91507983
2.333883997 1.473884965 0.622331609 0.29688463 0.745180421
0.148442315 0 0 0 0 0 0 0 #CA

1969 2 2 3 2 50 0 0 0 0 0 0
0.415695691 1.114151764 3.281337672 4.875610006 5.906234915
6.833818607 6.511724633 5.111027829 4.470816247 2.803795402
2.570151821 1.995490292 1.524572179 1.108924399 0.706718561
0.46697651 0.148978928 0 0 0 0 0 0 0
0.044296577 2.026276538 2.36744343 5.148526825 9.152718215
9.911637358 8.108634235 4.910894385 3.574181754 3.040405989
1.086293523 0.472009384 0.136648474 0.115868602 0.058139257 0
0 0 0 0 #CA

1970 1 1 3 2 12 0 0 0 0 0 0
0.797509546 3.463470028 1.682998024 4.337489594 5.26580998
4.895968754 4.565796894 5.925951088 3.208599624 2.045126579
0.220839565 0.162416706 0.41875906 0.136715922 0.222560804
0.273431844 0.546863689 0 0 0 0 0 0
0.398754773 0 6.380076368 11.225292 11.48243618 16.60268822
6.906832113 5.173337845 2.387750931 1.13580795 0 0.136715922
0 0 0 0 0 0 0 0 0 #CA

1970 2 2 3 2 29 0 0 0 0 0 0
0.252283037 2.001099837 8.305413421 15.98651069 6.080277415
3.271305681 2.534797966 2.521516424 2.232970683 1.698215735
1.376065418 1.555154295 1.071051148 1.375287241 1.009539446
0.717233418 0.208576605 0 0 0 0 0 0.252283037
0 0 0 4.525128442 13.67263734 14.00291659 6.26516829
2.478727329 1.795958002 1.128185905 2.086480614 0.889608628
0.658477568 0.047129798 0 0 0 0 0 0 0
#CA

1970 2 2 3 2 2 0.00 0.00 0.00 0.00 0.00 0.00
0.00 0.00 0.00 2.00 4.00 24.00 18.00 24.00 14.00 2.00 2.00
0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00
0.00 0.00 0.00 0.00 0.00 0.00 2.00 0.00 2.00 4.00 2.00
0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00
#OR

1971 1 1 3 2 7 0 0 0 0 0 0
0 0 4.353694726 9.92133299 17.43035988 10.90802027
3.859321481 2.901526357 4.413576326 3.740079015 2.29498424
0.509933679 0.169977893 0.608483275 0 0 0 0 0
0 0 0 0 0 0 0 5.826447832 14.60270618
12.70259516 2.475420597 1.866937322 0.169977893 0.622312441
0.622312441 0 0 0 0 0 0 0 0 0
0 #CA

1971 2 2 3 2 22 0 0 0 0 0 0
0.522739222 0 5.002323945 12.15218533 5.641100999 3.946414446
4.064053767 3.690813014 3.751089427 2.10424661 2.555873752
1.485173429 0.69564287 0.895058203 0.254994381 0.257953015

0.374117286 0 0 0 0 0 0 0 0
0.926410066 2.82714796 8.538656636 21.45886975 7.414626302
3.557808445 3.729882858 1.761756132 0.952155542 1.067543962
0.371362656 0 0 0 0 0 0 0 0 #CA

1971 2 2 3 2 8 0.00 0.00 0.00 0.00 0.00 0.00
0.00 0.00 0.00 2.67 7.67 10.34 13.99 7.99 5.00 4.66 3.00
1.33 0.33 0.33 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00
0.00 0.00 0.00 0.00 0.00 0.00 9.00 15.67 11.34 5.67 0.67
0.33 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00
#OR

1972 1 1 3 2 23 0 0 0 0 0.093484785
0 0 0.452913224 0.90385844 1.612072263 5.061857689
7.119394236 11.25585617 12.44340246 6.77050268 5.777951914
4.322768649 2.746678261 2.732867838 2.383807326 0.742518628
1.228791328 0.510520611 0.134204629 0 0 0 0 0
0 0 0 0.246680242 7.486259392 8.936282394 9.058598155
4.206872002 1.750232405 0.991808658 0.409209878 0.468398793
0.152206958 0 0 0 0 0 0 0 0 #CA

1972 2 2 3 2 39 0 0 0 0 0 0
0.100994761 0.737212964 3.00332643 4.798935313 5.942512939
5.268142175 3.608595146 5.485499531 4.864319179 2.781045258
2.730999818 2.310009011 1.068918251 0.847562305 0.220634708
0.452542527 0.134659681 0.079471287 0 0 0 0 0
0 0 0.544579592 1.573999335 5.840305909 15.18808621
13.55534459 10.36614727 5.451945987 2.022459987 0.599891012
0.287581703 0.134277125 0 0 0 0 0 0 0
0 #CA

1972 2 2 3 2 2 0.00 0.00 0.00 0.00 0.00 0.00
0.00 0.00 2.00 13.00 7.00 6.00 9.00 3.00 2.00 2.00 0.00
1.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00
0.00 0.00 0.00 0.00 0.00 1.00 17.00 18.00 10.00 2.00 6.00
0.00 1.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00
#OR

1973 1 1 3 2 12 0 0 0 0 0 0
0 0.252602755 0.875297917 3.203641196 4.235803451 1.115062956
1.599461844 1.936875079 1.87155774 1.403842984 0.689603699
0.638464948 0.379099558 0.273488758 0.196995436 0.043275356
0.044258886 0 0 0 0 0 0 0 0 0
6.205687362 28.69165705 27.49073343 8.678942346 1.37518774
6.856450897 0.044383934 1.637972552 0.043275356 0.043275356
0.086550711 0.043275356 0 0 0.043275356 0 0 0
#CA

1973 2 2 3 2 42 0 0 0 0 0 0
0.554573838 1.870969162 3.435648214 1.886814887 2.641863688
1.874496114 3.073643627 4.351220096 4.99338671 4.797194798
3.312108513 3.79885981 2.290565755 1.373398898 0.681842815
0.197378863 0.274184376 0.05995579 0 0 0 0 0
0.055820908 0 0.062261782 1.655126541 7.361437132 7.498865521
9.711546065 8.621357911 9.961161065 5.357122957 3.266057224
2.249282918 2.338410274 0.393443748 0 0 0 0 0
0 0 #CA

1974 1 1 3 2 31 0 0 0 0 0
0.060659598 0.308525812 1.272668975 3.496100572 7.198120896
4.619936724 2.980136211 4.538441696 6.347412797 5.643318122
5.331155171 3.174304409 1.423712328 1.130205557 0.48418077
0.054469843 0.129270973 0 0 0 0 0 0 0
0 0 0.490504606 3.480092678 10.10523285 14.64325123
13.37386041 5.977230687 2.282628079 0.974581541 0.185893283
0.294104175 0 0 0 0 0 0 0 0 0
#CA

1974 2 2 3 2 35 0 0 0 0 0 0
0.895038741 2.475223414 10.1440372 9.970991949 9.264468087

4.723693925 3.91793961 3.243132628 3.056193967 2.726460015
1.324021538 1.228998764 0.406360522 0.171701575 0.046594729 0
0.076142605 0 0 0 0 0 0 0 0
0.948148624 3.959905954 11.64025208 9.35358424 7.996752751
6.638169452 3.033720061 1.933153615 0.628071965 0.078046171
0.072601089 0.046594729 0 0 0 0 0 0 0
#CA

1975 1 1 3 2 11 0 0 0 0 0
1.114280197 2.377131086 3.039182946 4.538189105 7.812836851
8.828440669 10.88806039 6.524595985 3.704181592 2.299764858
2.675235284 2.230640816 1.071114387 0.599232738 0 0.215036529
0 0 0 0 0 0 0 0 0 1.485706929
8.130987307 5.63806732 7.519156306 12.10835104 6.349541608
0.629417733 0 0.220848327 0 0 0 0 0 0
0 0 0 0 0 #CA

1975 2 2 3 2 9 0 0 0 0 0 0
0.226563626 1.179542314 2.779850741 3.137884879 8.233932223
6.135669424 4.877801195 4.176492579 3.804839228 4.590649534
3.529429686 3.120879125 1.949970479 1.931980013 1.350341665 0
0 0 0 0 0 0 0 0 0 0.36527605
3.602873918 8.678011758 10.52849662 10.91880958 6.806715165
4.41065983 1.094264707 0.983120287 0 0.453127252 0.453127252
0.226563626 0.453127252 0 0 0 0 0 #CA

1976 1 1 3 2 7 0 0 0 0 0 0
0 0 1.813919728 6.082167175 9.252754467 5.553971537
5.535847771 4.343515186 2.839867368 3.399655854 1.508417971
2.996683304 1.893344545 1.07980806 0 0 0 0.069356214
0 0 0 0 0 0 0 0 0.285934271
6.133489604 23.56367792 12.91342457 5.056989093 2.318723233
1.011407784 0.656117299 0.656117299 1.034809743 0 0 0
0 0 0 0 0 #CA

1976 2 2 3 2 23 0 0 0 0.120319432 0.083947
0 0.144831638 0.866416781 3.019148257 8.032576556 9.226580826
7.023134331 5.984063354 3.48066423 2.559783205 2.022454632
1.943407163 1.651618974 1.701919554 1.218041226 0.941022729
0.202922573 0.52030125 0 0 0 0 0 0 0
0.355732368 0.621213703 2.736837559 9.954783653 13.59683224
11.34890351 5.806961807 3.194483864 0.926505282 0.586555495 0
0 0 0 0 0.128036811 0 0 0 0 #CA

1977 1 1 3 2 8 0 0 0 0 0 0
0.262869433 2.64066334 5.01399692 5.37115316 3.988223151
8.864491395 10.2291726 11.43878541 3.479593769 2.956082447
3.370945929 1.535673479 0.806841309 0.446127323 0.245297288
0.399229838 0 0 0 0 0 0 0 0
0.711938047 0.711938047 4.343838206 3.517910902 9.377969631
15.10064129 2.599600242 0.752185618 0.838297469 0.194965823
0.091364737 0.269349249 0.262869433 0 0.177984512 0 0
0 0 0 #CA

1977 2 2 3 2 39 0 0 0.071759324 0 0
0.725337171 3.947173081 4.737420146 7.491829274 8.808487884
7.983737988 5.321841237 4.633078021 3.109345328 3.478449048
2.992494671 2.435885813 2.032848385 1.36006152 1.396285474
0.984432607 0.638802291 0.484798164 0 0.022163803 0 0
0 0 0 0.292521904 1.152662585 3.015510153 5.276542463
7.187497887 7.729387398 5.420188983 3.829605398 1.362405044
0.886432299 0.670357039 0.284464254 0.039365561 0 0.039365561
0 0.039365561 0.118096682 0 0 #CA

1978 1 1 3 2 17 0 0 0 0 0
0.340721862 2.571905684 8.3453801 7.973811795 4.321140181 4.028021071
3.615131323 4.69180576 2.804049058 2.401784391 2.023379405
0.838300842 0.18536872 0.188613888 0 0.068906023 0 0
0 0 0 0 0 1.30401216 0.095473912 1.362887449
0.872391548 17.71037568 10.73676178 7.940251993 7.421227057

6.479914427 1.254091518 0.188613888 0 0.047064605 0 0
0.188613888 0 0 0 0 0 0 #CA

1978 2 2 3 2 33 0 0 0 0 0 0
0.289487584 1.421734595 5.425235514 9.610006877 8.782132085
8.291954522 6.331053572 5.984819492 3.666176072 3.56855547
2.862162826 1.413298602 0.966900296 0.974399758 0.331472963
0.310451085 0.140005569 0 0 0 0 0 0 0
0.154943858 0.562227733 2.624891761 7.281190737 11.52499059
9.249923039 4.379980375 2.660633057 0.839549126 0.351822843 0
0 0 0 0 0 0 0 0 0 #CA

1979 1 1 3 2 7 0 0 0 0 0 0
1.822293447 10.34526836 11.2785189 7.209777497 1.548581461
0.549829919 1.549786746 4.03391148 3.804270399 2.794454285
3.309657802 1.825205266 1.254811456 0.719044048 0.693243498
0.451160344 0 0 0 0 0 0 0 0 0
0 9.357723104 11.4033281 8.533728975 4.061952587 8.409751761
3.253852765 1.789847799 0 0 0 0 0 0 0
0 0 0 0 #CA

1979 2 2 3 2 13 0 0 0 0 0
0.353675443 0.922055571 4.813577034 7.621124061 8.189030334
5.49227515 5.279095302 2.145747543 4.2003659 1.517430995 2.33227299
0.834693188 0.42055236 0.641761487 0.57488457 0.200630751
0.156610502 0.066876917 0 0 0 0 0 0.249624762
0 0.31818178 1.363924258 5.996724247 10.92775809 14.52332233
10.75490639 4.541192607 2.348128128 1.915518835 0.095796665
0.171126229 0.403211258 0.095796665 0.12658845 0.405539215 0
0 0 0 0 #CA

1980 1 1 3 2 6 0 0 0 0 0
0.337159776 5.253560008 13.59060744 18.85902172 10.36801839
7.699000223 5.073891782 2.157837141 1.773285922 0.609983143
1.011803698 0.406655429 0.813310857 0 0.692094695 0.420841083
0 0 0 0 0 0 0 0 0.841682166 0
1.196508962 7.294154508 8.659878818 8.573092809 3.425195264
0.605148269 0.203327714 0 0 0 0.133940185 0 0
0 0 0 0 0 0 #CA

1980 2 2 3 2 68 0 0 0 0 0.026143506
0 0.915953531 4.273604943 10.10934875 10.58662065 8.284107121
5.742924149 4.559867391 3.40275164 2.606892829 1.561652314
1.185716804 0.807620571 0.619351092 0.385020394 0.35452137
0.270099311 0.01809935 0.031342499 0.039875295 0 0 0
0 0 0.072312536 1.256114436 6.278091516 13.53668 11.03182628
6.971504918 3.329568476 1.079505555 0.470602908 0.081381853 0.0361987
0 0.038894086 0.035805236 0 0 0 0 0 0
#CA

1981 1 1 3 2 35 0 0 0 0 0
0.591503001 3.764227471 8.93604021 13.89315281 12.51093945
7.426276408 6.503426937 7.681629154 3.776860824 4.606593839
3.159231792 0.981820382 1.208916445 1.053948281 0.419595678
0.806383215 0.094935711 0.084751981 0.019051648 0.608010857 0
0 0 0 0 0.019051648 1.193476732 2.401803036
7.019009594 6.725419355 2.199653225 1.299397227 0.478280846
0.400129153 0.108866558 0 0 0 0.027616535 0 0
0 0 0 0 #CA

1981 2 2 3 2 65 0 0 0 0 0
0.141198146 0.717500739 3.354366126 7.85529675 9.903776633
9.891830715 6.295465967 4.49768375 4.247658746 2.937777891
2.29136945 1.16394036 0.949007128 0.532483694 0.355028264
0.262823037 0.224264205 0 0.030987207 0 0 0 0
0 0 0.026761679 0.77102159 5.373444252 12.89391607
11.35275812 6.657311804 3.559596611 1.940629403 0.988059684
0.319193552 0.29651767 0.168330753 0 0 0 0 0
0 0 0 #CA

1981 2 2 3 2 28 0.00 0.00 0.00 0.00 0.00 0.00
0.00 0.27 2.77 9.13 10.67 8.48 7.87 8.14 4.12 3.41 1.82
0.62 0.20 0.01 0.22 0.06 0.00 0.00 0.00 0.00 0.00 0.00
0.00 0.00 0.00 0.00 0.63 3.17 10.15 12.85 8.32 4.33 1.81
0.95 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00
#OR

1982 1 1 3 2 26 0 0 0 0 0 0
0.219984434 1.659987868 3.062730926 4.180526653 4.532568147
4.641920807 3.935121337 3.648908686 3.013159935 2.702357009
1.718847272 1.438921775 0.822842587 0.419083864 0.126421341
0.123892914 0 0 0 0 0 0 0 0 0
0.627023002 8.192652926 30.24429003 13.9012502 5.918821017
2.564501692 1.11870665 0.527516006 0.592946234 0.06501669 0
0 0 0 0 0 0 0 0 #CA

1982 2 2 3 2 34 0 0 0 0 0
0.160387329 0.804952022 3.659134529 5.028725708 6.023377359
9.754762518 5.89745105 6.132902665 3.254437567 3.214251391
0.804052354 6.340655687 2.865822357 3.830097446 2.067690308
4.928933284 4.405950058 1.517152294 1.269446667 0.595926719 0
0 0 0 0 0.054500549 0.535140597 2.124961829
7.630021052 8.46831308 4.689384197 2.626190448 0.901055397
0.303938682 0.110384858 0 0 0 0 0 0 0
0 0 0 #CA

1982 2 2 3 2 24 0.00 0.00 0.00 0.00 0.00 0.00
0.00 0.55 3.93 10.76 15.01 10.47 10.44 7.55 5.23 3.04 3.35
1.05 1.04 0.53 0.21 0.01 0.00 0.00 0.00 0.00 0.00 0.00
0.00 0.00 0.00 0.00 0.51 3.61 9.39 6.92 3.15 2.22 0.28
0.32 0.31 0.10 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00
#OR

1983 1 1 3 2 26 0 0 0 0 0 0
0.318102584 1.880315191 3.152528817 4.701578044 6.594303817
6.160710926 6.911186067 5.771397316 5.032831051 3.729572395
3.436812131 2.239822545 2.17976264 1.28481899 0.981544909
0.413242022 0.177398279 0.196564008 0 0 0 0 0
0 0.159051292 0.873828085 3.239114778 6.319975899 9.841266418
12.23342463 5.799512154 4.183040826 0.807348508 0.998689561
0.323256398 0.058999725 0 0 0 0 0 0 0
0 #CA

1983 1 1 3 2 4 0.00 0.00 0.00 0.00 0.00 0.00
0.00 0.00 0.00 0.00 0.00 2.00 2.82 6.77 12.36 9.53 6.13
3.12 5.01 6.83 6.07 3.00 3.95 1.94 0.00 0.00 0.00 0.00
0.00 0.00 0.00 0.00 0.00 0.00 3.83 9.83 8.31 3.42 3.12
0.60 1.12 0.00 0.06 0.18 0.00 0.00 0.00 0.00 0.00 0.00
#OR

1983 2 2 3 2 33 0 0 0 0 0.095962706
0 0.406218428 3.137577648 7.48890894 10.26644399 12.24424528
9.512459894 5.532886634 3.408711095 2.626125127 2.202819705
0.762838868 0.669137826 0.507325772 0.267303636 0.472740505
0.286671286 0.039789415 0 0 0 0 0 0 0
0.072505156 0.657290136 4.533500522 12.34066882 10.77820357
5.725793046 2.626585158 0.889071244 1.419433326 0.495381773
0.127286829 0.127286829 0.083783735 0.040280642 0.040280642
0.057240912 0 0.057240912 0 0 #CA

1984 1 1 3 2 13 0 0 0 0 0 0
0 1.147397066 2.526073133 2.022023926 4.07845423 3.01322573
3.55846393 6.267162506 4.298804291 5.422056918 4.178155941
2.956524674 1.59622833 1.769015559 0.483931227 0 0.086900947
0 0 0 0 0 0 0 0 3.085509489
10.60562467 17.27001 10.69247428 7.116877835 3.564472302 1.973512133
1.387459931 0.581687551 0.158976702 0.158976702 0 0 0
0 0 0 0 0 #CA

1984 1 1 3 2 4 0.00 0.00 0.00 0.00 0.00 0.00
0.00 0.40 0.79 0.79 1.19 1.58 2.67 6.29 7.27 6.88 11.53
5.84 6.08 4.75 3.26 4.06 0.54 1.63 0.00 0.00 0.00 0.00
0.00 0.00 0.00 0.00 1.58 5.15 7.57 5.89 5.64 4.16 0.94
2.18 0.40 0.54 0.40 0.00 0.00 0.00 0.00 0.00 0.00 0.00
#OR

1984 2 2 3 2 19 0 0 0 0 0 0
2.456675743 4.126800893 8.801979801 10.6576679 8.008030795
6.796728888 4.66515478 3.593882974 1.306984986 0.970525761
0.524598972 0.388160953 0.225551282 0 0.132350687 0.074741087
0 0 0 0 0 0 0.137025325 0 0.199492753
1.9828175 6.359721444 13.77502991 11.66670065 6.049440899 2.383200133
2.913054542 1.13502219 0.304967006 0.22666682 0 0
0.137025325 0 0 0 0 0 0 #CA

1985 1 1 3 2 13 0 0 0 0 0 0
0.217979376 0.796987094 6.594056162 4.684832185 4.209400703
4.724660453 3.491593645 4.825661725 4.048076399 3.120816756
2.464503452 1.341138316 0.421920837 0.108989688 0.091597912
0.091597912 0 0 0 0 0 0 0 0
0.302863716 0.610941538 10.68705874 20.70381203 17.46745832
5.372443637 1.566752421 1.555144946 0.116579161 0.091597912 0
0 0.291534969 0 0 0 0 0 0 0 #CA

1985 2 2 3 2 17 0 0 0 0 0
0.368030738 1.004671339 4.735805077 8.628247803 10.16528474
8.640500472 6.710608089 5.046970697 4.422496799 2.575770987
2.260433657 1.376357997 0.451135525 0.458546946 0.578411805
0.297121509 0 0.089526994 0 0 0 0 0 0
0 0.090805952 1.128060603 4.383127523 8.616499097 13.09379274
9.116311802 3.4643265 1.432904981 0.663520681 0.066909649 0.133819297
0 0 0 0 0 0 0 0 0 #CA

1986 1 1 3 2 6 0 0 0 0 0 0
0 7.800986875 8.448520235 8.306420939 3.512267731 2.242436874
2.757443034 1.81410029 2.137248109 2.498822311 1.535460947
0.442285148 0.994859921 0.802890154 0 0 0 0 0
0 0 0 0 0 0 0.326488113 8.217827533
14.87828355 11.26038819 13.22693348 4.120729763 2.515412711
1.48154212 0.401445077 0 0 0 0 0.277206889 0
0 0 0 0 #CA

1986 2 2 3 2 16 0 0 0.086253546 0 0
0.100900374 2.548177035 11.92555711 11.40930263 9.424348656
8.146922662 4.245760112 2.479726478 0.845136124 1.144600368
0.897619192 0.767177606 0.176892864 0.358777279 0.257391533
0.086253546 0 0 0 0 0 0 0 0
0.403839656 3.839266087 14.22499986 15.08816394 6.932269899
2.922864745 1.203734184 0.116254779 0.205757625 0 0 0
0 0 0 0 0 0.162052116 0 0 #CA

1987 1 1 3 2 10 0 0 0 0 0 0
0.566851813 0.566851813 1.841204671 2.376239285 3.72527087
3.706849706 1.386302011 3.156003457 2.877770507 1.350679393
1.149836645 0.529893004 0.624807945 0.269028865 0.065344291
0.378388327 0.065344291 0 0 0 0 0 0 0
0.566851813 12.22081332 23.78823983 20.46930776 8.788628077
5.551060439 2.313517074 1.493329759 0.104355808 0.067229222 0
0 0 0 0 0 0 0 0 0 #CA

1987 1 1 3 2 2 0.00 0.00 0.00 0.00 0.00 0.00
0.00 0.00 0.00 2.00 2.00 10.00 12.00 14.00 12.00 22.00 4.00
2.00 4.00 2.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00
0.00 0.00 0.00 0.00 0.00 2.00 2.00 4.00 4.00 0.00 2.00
0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00
#OR

1987 2 2 3 2 14 0 0 0 0 0
0.231213827 0.979937163 5.124678271 6.367086154 8.350422109

6.892167206 6.907128091 4.144190871 2.969465188 1.135681451
1.734459157 0.504013409 0.722975768 0.496925107 0.1020061 0
0.096339095 0.106714074 0 0 0 0 0 0 0
0.231213827 6.790696276 11.89279215 14.32627317 11.06595163
5.15931437 1.765056895 0.988796238 0.580573498 0.333928919 0
0 0 0 0 0 0 0 0 0 #CA

1988 1 1 3 2 6 0 0 0 0.584503577 0
0 1.623621047 5.455366717 11.42974484 10.7686144 9.361542467
2.346013706 2.281919042 3.399289697 0.827967596 0.933967622
0.942399627 0.617358951 0.427059947 0.245192948 0 0.190299004
0.223684794 0 0 0 0 0 0 0 0
1.03911747 5.063225785 10.98110188 11.16848144 13.31091076
3.590787212 1.636160674 1.306475854 0.245192948 0 0 0
0 0 0 0 0 0 0 #CA

1988 2 2 3 2 6 0 0 0 0 0 0
1.029820509 6.078330085 5.913767643 10.23295087 7.514122973
8.682322166 2.491266212 2.683373697 3.143521885 1.241842378
2.374788688 1.015585382 0.177406054 0.689912432 0 0 0
0 0 0 0 0 0 0 0 0.514910254
8.344186686 21.52758944 9.945818081 2.228235861 1.912873691
1.29064058 0.48336722 0 0 0 0.48336722 0 0
0 0 0 0 0 #CA

1989 1 1 3 2 9 0 0 0 0 0 0
0 0.13901475 5.604942053 12.05777439 15.4003975 9.92084018
4.600592236 4.992757186 1.815102164 1.463163066 1.207697167
0.549619535 0.372161024 0 0 0.13901475 0 0 0
0 0 0 0 0 0 0 3.249344893 15.72811209
12.00847134 5.986633008 2.800542277 1.332382715 0.305016502
0.326421169 0 0 0 0 0 0 0 0 0
0 #CA

1989 1 1 3 2 2 0.00 0.00 0.00 0.00 0.00 0.00
2.00 0.00 0.00 0.00 0.00 6.00 12.00 16.00 12.00 6.00 4.00
2.00 2.00 0.00 0.00 2.00 0.00 0.00 0.00 0.00 0.00 0.00
0.00 0.00 0.00 0.00 0.00 2.00 10.00 14.00 6.00 4.00 0.00
0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00
#OR

1989 2 2 3 2 9 0 0 0 0 0 0
1.048439382 3.145318146 7.841308752 18.06819467 11.94548187
11.91670699 5.908630677 3.207701205 0.940145218 1.406745497
0.741682863 0.201395136 0.204867466 0.102433733 0.204867466
0.204867466 0 0 0 0 0 0 0 0 0
1.011652035 7.007989554 10.7144527 8.328229342 3.510275633
0.911486605 0.815997532 0.102433733 0.406262601 0.102433733 0
0 0 0 0 0 0 0 0 #CA

1989 2 3 3 0 91 0 0 0.112830149 0.390811544
0.613686785 1.31231062 3.917469381 2.655683092 3.647241029
4.026340896 7.485979795 8.423558299 6.891141938 2.497942056
2.009806265 3.764954923 3.472728749 2.440779969 0.269644393
1.105433822 2.210867635 0.23203434 0 0.194424287 0 0
0.150440202 0.274006716 0.303462555 0.903689937 2.393548339
3.693911249 4.691371314 10.2098033 8.202799049 5.453845615
4.791531846 0.553111333 0.079194785 0.623613793 0 0 0
0 0 0 0 0 0 0 #S89

1990 1 1 3 2 2 0 0 0 0 0 0
0 0 0 0 6.114120178 6.057060089 12.17118027
12.97146996 10.85734978 13.08559013 12.05706009 4.057060089
0.971469956 0 2.057060089 1.028530045 0 0 0 0
0 0 0 0 0 0 0 0 5.885879822
9.771759644 0.971469956 0.971469956 0.971469956 0 0 0
0 0 0 0 0 0 0 0 #CA

1990 2 2 3 2 2 0 0 0 0 0 0
0 0 0 7.894736842 18.42105263 15.78947368 7.894736842

10.52631579 0 2.631578947 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0
2.631578947 26.31578947 5.263157895 2.631578947 0 0 0
0 0 0 0 0 0 0 0 0 0 #CA

1990 2 2 3 2 2 0.00 0.00 0.00 0.00 0.00 0.00
0.00 4.00 2.00 6.00 8.00 16.00 10.00 8.00 0.00 0.00 6.00
0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00
0.00 0.00 0.00 0.00 4.00 10.00 10.00 10.00 2.00 2.00 2.00
0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00
#OR

1991 1 1 3 2 12 0 0 0 0 0 0
0 0.801946855 2.391849575 3.166373863 7.043435774 6.937141979
11.56742432 10.83300462 4.58099651 2.436544785 2.110056591
1.104143982 1.30866915 0.94890465 0.417891288 0.257501917 0
0 0 0 0 0 0 0 0.262651955 0
5.892433756 14.7151876 13.86395491 6.603121805 1.910681462
0.846082652 0 0 0 0 0 0 0 0 0
0 0 0 #CA

1991 2 2 3 2 2 0 0 0 0 0 0
0 0 0 12.19512195 7.317073171 14.63414634 9.756097561
4.878048781 2.43902439 0 2.43902439 0 0 0 0
0 0 0 0 0 0 0 0 0 0
0 2.43902439 19.51219512 19.51219512 2.43902439 0 0
0 2.43902439 0 0 0 0 0 0 0 0
0 #CA

1992 1 1 3 2 6 0 0 0 0 0 0
0 0 0 1.066124048 8.640098351 4.863362392 11.91254114
11.7276921 7.672516783 5.966521763 1.636221395 2.140514564
1.636221395 1.123661756 0.561830878 0.561830878 0.561830878 0
0 0 0 0 0 0 0 0 1.045621662
5.367655561 15.75905072 12.13839495 3.932816147 0.561830878
1.123661756 0 0 0 0 0 0 0 0 0
0 0 #CA

1992 2 3 3 0 37 0.977176017 0 0.137932945
1.040319787 3.544758251 4.437144616 5.610358509 6.100054604
6.441028905 5.013231027 5.621436654 3.233856708 3.959570139
0.933118116 1.636140514 1.758687367 1.189275703 0 0.873674124
0 0 0 0 0 0 0 0.626520953 0.275865889
1.867917454 8.317518615 6.047515284 10.64363371 7.430851843
3.629290076 2.38692059 3.911752881 0.306597163 1.074009666
0.973841895 0 0 0 0 0 0 0 0 0
0 0 #S92

1994 1 1 3 2 2 0.00 0.00 0.00 0.00 0.48 0.00
0.00 3.36 4.32 4.32 3.92 2.40 6.95 6.47 8.47 7.99 4.00
2.00 2.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00
0.00 0.48 0.00 3.84 11.67 17.34 7.99 2.00 0.00 0.00 0.00
0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00
#OR

1994 2 2 3 2 2 0.00 0.00 0.00 0.00 0.00 0.00
0.00 8.70 4.35 26.09 17.39 13.04 4.35 0.00 0.00 8.70 0.00
0.00 4.35 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00
0.00 0.00 4.35 4.35 0.00 4.35 0.00 0.00 0.00 0.00 0.00
0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00
#OR

1995 2 3 3 0 72 0 0.107371501 0.214743003
0.136337292 1.56878912 0.869249344 2.432482164 3.996897622
8.309125935 7.464699063 11.45762241 5.923014289 3.271786707
4.680859875 2.606145546 2.994484789 0.465836004 1.327056339
0.319745024 0.204505939 0 0 0 0 0 0
0.107371501 0.107371501 0.522203525 1.426414131 1.308699262
3.722289229 12.04019528 8.610944117 5.218884184 6.173649265
1.496663897 0.464245171 0.136337292 0.068168646 0.245811038 0

	0	0	0	0	0	0	0	0	#S95		
1997	1	1	3	2	2	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	7.58	16.67	21.21	9.09	6.06	1.52	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	4.55	4.55	10.61	16.67	1.52	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	#OR										
1997	2	2	3	2	2	0.00	0.00	0.00	0.00	0.00	1.31
	7.87	28.85	15.55	0.00	2.03	0.00	5.06	4.05	3.04	3.04	0.00
	1.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	1.31	9.18	4.95	3.64	4.05	5.06	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	#OR										
1998	1	1	3	2	2	0.00	0.00	0.00	0.00	1.78	0.00
	1.78	0.00	1.78	0.00	1.86	3.72	7.27	9.13	27.22	14.62	7.19
	3.63	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	3.55	5.41	7.44	3.63	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	#OR										
1998	2	2	3	2	6	0.00	0.00	0.00	0.00	0.00	0.00
	0.78	3.33	6.24	5.98	17.34	6.03	4.48	10.87	4.82	5.82	1.11
	0.59	0.73	1.46	0.07	0.00	0.00	0.00	0.00	0.00	0.39	0.00
	0.00	0.00	0.39	2.34	4.29	10.87	6.27	2.16	1.32	1.25	0.59
	0.00	0.00	0.00	0.52	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	#OR										
1998	2	3	3	0	91	0	0	0	0.133182902		
	0.391286964		1.540715094		3.212399333		4.105874316		6.123053591		
	6.427406842		5.665182879		5.228258676		4.092014954		5.132184375		
	6.455442574		4.426069499		2.074280678		0.597394553		1.891427692		0
	0.124921159		0	0	0	0	0.044394306		0.044394306		
	0.491915775		1.045322918		1.408748137		2.410627997		4.406392248		
	6.197671017		6.872462818		7.527102237		8.255358635		3.253175438		
	0.296416928		0.124921159		0	0	0	0	0	0	0
	0	0	0	0	#S98						
1999	1	1	3	2	3	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	2.46	7.37	2.58	12.93	4.17	16.04	11.44	7.63	5.68
	5.56	0.53	0.00	0.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	2.46	4.91	8.20	5.56	1.83	0.53	0.00
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	#OR										
1999	2	2	3	2	4	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.46	1.76	4.37	15.45	15.58	10.90	13.99	8.10	3.59
	7.75	1.44	2.88	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.46	2.22	4.58	5.56	0.92	0.00
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	#OR										
2000	1	1	3	2	5	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	1.97	2.42	5.63	5.42	6.41	14.52	9.50	16.48	6.59	8.06
	0.35	2.17	0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	2.13	5.81	5.82	4.26	1.18	0.17	0.92	0.00
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	#OR										
2000	2	2	3	2	3	0.00	0.00	0.00	0.00	0.00	0.00
	1.78	12.43	5.33	4.55	2.27	1.78	2.44	0.94	1.17	2.38	0.94
	0.44	0.44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	1.78	5.33	19.54	30.19	4.05	1.78	0.22	0.22	0.00
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	#OR										
2001	1	1	3	2	10	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.15	0.44	2.00	4.41	11.78	12.95	15.15	12.59	5.34	4.60

```
4.27 0.28 0.05 0.00 0.04 0.00 0.00 0.00 0.00 0.00 0.00
0.00 0.00 0.00 0.55 4.06 7.11 5.94 2.30 2.88 2.53 0.57
0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00
#OR

2001 2 2 3 2 8 0 0 0 0 14.64159309
7.674242614 10.47586183 6.759140692 4.444070793 3.780851452
2.065958317 3.576384807 1.637811558 1.011801053 0.565867707
0.105435804 0.009561505 0.052717902 0.009561505 0.009561505 0
0 0 0 0 0 0 0 0 0 0
1.718911073 36.61220641 1.085393211 2.101119729 0.903073881
0.632669066 0.126204498 0 0 0 0 0 0 0
0 0 0 0 0 #CA

2001 2 2 3 2 2 0.00 0.00 0.00 0.00 0.00 0.00
0.00 0.00 0.00 9.10 12.49 18.83 9.55 10.34 7.46 2.60 2.26
2.43 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00
0.00 0.00 0.00 0.00 1.30 4.52 6.16 7.12 4.69 1.13 0.00
0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00
#OR

2001 2 3 3 0 121 0 0.06814068 0.868307715 1.9483493
1.755371996 2.418484293 3.402348417 2.915417663 2.129661467
3.751521343 4.434282326 3.670927162 3.790703483 5.867011858
5.302953415 2.259576766 4.532996122 3.800691566 1.162349751
0.042524088 0 0.03407034 0 0 0 0.03407034
0.369977212 2.57173376 2.858433124 3.478012369 4.385221597
6.019172395 4.608233063 5.252029736 5.098212272 6.290418333
1.949825968 2.063706196 0.733523681 0.042524088 0.046692027
0.042524088 0 0 0 0 0 0 0 0 #S01

2002 1 1 3 2 12 0 0 0 0 0
0.106997206 0 0 0 0 1.572151275 2.509669486
0.955693409 3.40754896 1.049245756 4.254706062 3.264539926
2.64575076 4.112515614 1.82663531 0.147567324 0 0 0
0 0 0 0 0 0 0 0 16.33015383
3.374383383 12.96505449 18.13172101 13.18113611 7.807655291
1.231022582 1.125852209 0 0 0 0 0 0 0
0 0 0 #CA

2002 1 1 3 2 5 0.00 0.00 0.00 0.00 0.00 0.00
0.00 0.00 0.27 0.60 3.24 8.20 14.23 7.96 27.95 8.01 6.52
3.26 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00
0.00 0.00 0.00 0.13 0.93 3.53 5.43 5.76 3.90 0.00 0.08
0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00
#OR

2002 2 2 3 2 8 0 0 0 0 0 0
0.029952701 0.074881751 12.78432421 5.983739526 5.756692114
8.664613777 0.240544955 0.798763094 0.317673183 0.439730461 0
0.154256455 0.398537609 0 0.244281155 0 0 0 0
0 0 0 0 0 0 0.01497635 14.68350551
38.39529388 7.684554058 1.465718481 1.136805147 0.56773886
0.163416728 0 0 0 0 0 0 0 0 0
0 0 #CA

2002 2 2 3 2 6 1.78 0.00 0.00 0.00 0.00 0.00
0.00 0.52 3.19 7.68 5.46 10.63 8.96 7.39 3.18 3.51 1.42
0.29 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.36 0.00 0.00
0.00 0.00 0.00 0.87 4.41 12.78 21.20 3.90 1.15 1.04 0.29
0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00
#OR

2003 1 1 3 2 7 0 0 0 0 0 0
0 0.351023487 9.054304753 5.297995346 1.176463871 1.243368269
4.351289167 4.391396411 4.371900932 5.279443785 4.872376996
2.770485138 1.262561708 1.004199747 0 0 0 0 0
0 0 0 0 0.175511744 0 0 3.490096507
15.67720214 11.11622355 13.49965118 4.730535945 3.514274681
1.365494892 0.500476064 0.503723683 0 0 0 0 0
```

0 0 0 0 #CA

2003 1 1 3 2 5 0.00 0.00 0.00 0.00 0.00 0.00
0.00 0.00 0.19 1.53 2.35 10.09 10.85 18.79 4.73 8.58 0.59
3.30 0.00 0.00 0.13 0.00 0.00 0.00 0.00 0.00 0.00 0.00
0.00 0.00 0.00 3.98 1.20 8.65 14.63 4.31 4.11 1.99 0.00
0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00
#OR

2003 2 2 3 2 30 0 0 0 0 10.8440827
0 10.19811282 20.11787987 0.518871694 0.239963352 0.419197192
0.321971308 0.43665805 2.665938148 0.391857594 0.039833172
0.023069768 0.008781825 0.266133358 0.526385074 0 0 0
0 0 0 0 0 0 0 6.499559163 3.850536732
17.22186159 19.97543278 1.059699508 1.431775618 2.659307719
0.021492814 0.261598145 0 0 0 0 0 0 0
0 0 0 0 #CA

2003 2 2 3 2 4 0.00 0.00 0.00 0.00 0.00 0.53
2.65 4.77 7.93 12.35 11.58 9.54 8.41 8.07 9.81 4.22 1.03
0.55 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00
0.00 0.00 0.00 0.00 0.53 1.06 7.61 4.89 4.36 0.05 0.07
0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00
#OR

2004 1 1 3 2 5 0 0 0 0 0 0
0 0.848092174 32.15571831 32.34881656 0.918487972 1.772190728
3.468375076 1.020647677 0.972373115 1.220934998 0.048274562
0.048274562 0.027731818 0.027731818 0 0 0 0 0
0 0 0 0 0 0 0.848092174 0.896366736
5.505915347 8.085389768 6.323822108 0.918487972 2.544276522 0
0 0 0 0 0 0 0 0 0 0 0
#CA

2004 1 1 3 2 5 0.00 0.00 0.00 0.00 0.00 0.00
0.00 0.00 0.00 0.00 3.44 4.75 6.30 10.40 4.04 9.41 2.53
5.51 1.00 1.90 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00
0.00 0.00 0.00 0.00 1.06 1.94 16.64 22.95 7.86 0.13 0.00
0.13 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00
#OR

2004 2 2 3 2 10 0.00 0.00 0.00 0.00 0.00 0.00
0.20 0.59 1.69 8.94 11.60 12.55 10.78 4.17 4.19 0.54 0.24
0.54 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00
0.00 0.00 0.00 0.00 1.87 6.33 12.79 17.40 4.79 0.78 0.00
0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00
#OR

2004 2 3 3 0 111 0 0 0.366772388 0.987419043
1.018782785 2.5421599 2.838105722 3.010967032 6.176070326 5.527941312
6.200158818 7.789080541 5.771453049 3.653769419 2.426931288
1.324045697 1.581997807 0.388365843 0.870865348 0.153640441
0.090798605 0.053363948 0 0 0 0.015626637 0.146310729
0.636966968 2.257690862 2.329241934 3.791730974 4.295614767
5.106799909 9.114412832 10.81421442 5.669591017 2.11239932
0.455279802 0.130829692 0.171567527 0.048203604 0 0.053363948
0.048203598 0 0.029262146 0 0 0 0 #S04

#_AGE_DATA

17 #n_abins #_N_agebins #(<=_#_of_age,_the_model_always_start_at_age_0)

#age_bins1(1,n_abins) #_lower_age_of_agebins

1 2 3 4 5 6 7 8 9 10 11 12
13 14 15 16 17 #

#_Age_error

3 #N_ageerr #3_ageerr_types_see_belows

#age_err(1,N_ageerr,1,2,0,nages)#_vector_with_stddev_of_ageing_precision_for_each_AGE_and_type

#Age0 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

#perfect_age_(ageerr=1_given_but_not_used)

-1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1
-1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1
-1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1
-1 -1 -1 -1 -1 -1 -1

0.001 0.001 0.001 0.001 0.001 0.001 0.001 0.001 0.001 0.001 0.001 0.001
0.001 0.001 0.001 0.001 0.001 0.001 0.001 0.001 0.001 0.001 0.001
0.001 0.001 0.001 0.001 0.001 0.001 0.001 0.001 0.001 0.001 0.001
0.001 0.001 0.001 0.001 0.001 0.001 0.001

#imprecise_age_(ageerr=2_BBage_petrale_sole)_from_Sampson and Lee (1999)

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 16.5 17.5 18.5 19.5 20.5 21.5 22.5
23.5 24.5 25.5 26.5 27.5 28.5 29.5 30.5 31.5 32.5 33.5
34.5 35.5 36.5 37.5 38.5 39.5 40.5

0.6571 0.7388 0.8205 0.9022 0.9839 1.0656 1.1473 1.229 1.3107 1.3924 1.4741 1.5558
1.6375 1.7192 1.8009 1.8826 1.9643 2.046 2.1277 2.2094 2.2911 2.3728 2.4545
2.5362 2.6179 2.6996 2.7813 2.863 2.9447 3.0264 3.1081 3.1898 3.2715 3.3532
3.4349 3.5166 3.5983 3.68 3.7617 3.8434 3.9251

#bias_age_(ageerr=3_surface_age_petrale_sole)_see_AllDATA.xls

0.5217 1.5393 2.5569 3.5745 4.5921 5.6097 6.6273 7.6449 8.6625 9.6801 10.6977 11.7153
12.7329 13.7505 14.7681 15.7857 16.8033 17.8209 18.8385 19.8561 20.8737 21.8913 22.9089
23.9265 24.9441 25.9617 26.9793 27.9969 29.0145 30.0321 31.0497 32.0673 33.0849 34.1025
35.1201 36.1377 37.1553 38.1729 39.1905 40.2081 41.2257

0.6571 0.7388 0.8205 0.9022 0.9839 1.0656 1.1473 1.229 1.3107 1.3924 1.4741 1.5558
1.6375 1.7192 1.8009 1.8826 1.9643 2.046 2.1277 2.2094 2.2911 2.3728 2.4545
2.5362 2.6179 2.6996 2.7813 2.863 2.9447 3.0264 3.1081 3.1898 3.2715 3.3532
3.4349 3.5166 3.5983 3.68 3.7617 3.8434 3.9251

#_AGE_COMPOSITIONS(duplicates_must_be_contigent_within_Year-Seas-Fleet-Sex_because_of_ageerr_and_states)

51 #nobsa #ageerr:_2:imprecision_age(BB)_3:Biased_age(Surface)

#year seas fleet sex mkt agerr Lobin Hibin Nsamps #Fem1 2 3
4 5 6 7 8 9 10 11 12 13 14
15 16 17 #Mal1 2 3 4 5 6 7 8
9 10 11 12 13 14 15 16 17 # agid

1966 1 1 3 2 3 1 25 6 0 0 0
1.543230259 24.43401315 10.4248607 11.19428134 5.268149088
7.260090319 2.496566343 0.315283601 1.912263582 0.610861978 0
0 0 0 0 0 1.332789769 3.998369308 19.81182815
5.575541581 3.506587231 0.315283601 0 0 0 0 0
0 0 0 0 #CA SURF

1966 2 2 3 2 3 1 25 17 0 0
0.594933437 5.240362258 13.88479136 13.81732753 4.419122955
1.691958604 1.551822917 0.180045645 0.373052524 0 0.180045645
0 0 0 0 0 0.198311146 0.621975866 7.624289338
30.44506081 12.71200647 3.309954988 1.508697257 0.958075679
0.463846408 0.224319165 0 0 0 0 0 0 #CA
SURF

1967 1 1 3 2 3 1 25 9 0 0 0
0 4.791832072 16.49602221 10.70590819 2.503612679 3.541568724
3.655440251 1.590900616 0.578536654 0.289268327 0.329703685 0
0 0 0 0 0 1.277601778 10.65354428 33.7714487
6.249130051 1.264497121 0.982169924 1.318814739 0 0 0
0 0 0 0 #CA SURF

1968 2 2 3 2 3 1 25 46 0 0.307585278
5.576319985 15.76861186 7.214461653 4.504540389 3.624489106
3.005913757 1.848733841 1.461942273 1.674409799 1.393984645
0.958037224 0.641296768 0.601466587 0.700621042 0.237865256 0
0 1.752796934 15.75351094 10.79770731 4.860866045 4.868340923
3.606266174 2.032668909 2.44121676 1.152888887 1.323101276
0.532760675 0.807289274 0.302579571 0.079238483 0.16848838 #CA
SURF

1969 1 1 3 2 3 1 25 7 0 0 0
5.744750278 24.55732847 10.50834807 6.822562891 2.966065127
8.442359924 4.138389308 6.251319963 4.426549919 6.47741021
0.550714779 1.101429557 0.867170286 4.190540477 0 0 0
2.003129283 4.714180822 2.741853476 2.07214531 0.508482805 0
0 0.915269049 0 0 0 0 0 0 #CA SURF

1969 2 2 3 2 3 1 25 26 0 0
5.315573684 6.221890446 10.19212288 7.484112193 5.35966791
3.804709866 2.847655637 1.942093494 1.253363124 0.934647224
0.953124684 0.742731601 1.251188932 0.516848434 0.348861358 0
0 8.114934439 5.92079046 13.18198398 7.068814876 4.690658507
3.235443994 1.895547902 1.685833953 1.255668852 0.448247005
0.81762847 0.973709579 0.723587807 0.385913497 0.43264521 #CA
SURF

1970 1 1 3 2 3 1 25 5 0 0 0
15.81001369 8.287895545 15.44677757 14.08245164 5.612102528
3.14516471 0.530399975 0 0.685439968 0.155039993 0.310079985
0 2.239404752 0 0 0 0 11.38798076 10.17279988
9.426331632 0.746468251 0 1.215180873 0 0 0 0
0 0 0.746468251 0 #CA SURF

1970 2 2 3 2 3 1 25 20 0 0
0.708236111 8.955012289 7.951904759 8.078997236 4.799012215
3.745760961 2.618456479 3.185256901 1.084149395 1.654812415
0.941055611 1.601019364 0.405999732 0.185291297 1.118582572 0
0 0.438989325 17.74452695 10.09709186 11.0365581 2.889617152

2.45594737 2.522608488 1.669091684 0.552020795 0.496650734
0.873179106 0.556815302 0.733866598 0.264453306 0.6350359 #CA SURF

1970 2 2 3 2 3 1 25 2 0 0 0
0 0 2 30 14 12 24 6 2 0 0
0 0 0 0 0 0 0 0 0 2 0
4 2 2 0 0 0 0 0 0 #OR SURF

1971 1 1 3 2 3 1 25 6 0 0 0
6.981895924 32.77953066 7.419805542 10.03865044 6.889049709
2.907618952 1.273525557 0.45647886 0.817046697 0 0
0.817046697 0.22823943 0 0 0 0 5.233322264
14.08885107 4.845572375 2.716518008 0.83561594 0 0.83561594
0 0.83561594 0 0 0 0 0 #CA SURF

1971 2 2 3 2 3 1 25 16 0 0
1.538850633 5.438658675 15.62348081 7.929390295 6.427636331
4.194162915 2.760090495 1.132865628 0.55534332 0.977653942
0.643485928 0.256475106 0.720896203 0 0.572242843 0 0
0.978879986 9.125430835 19.11650307 7.912232663 4.591284042
3.152652834 2.039776328 1.223320823 0.588384066 0.587179219
0.749596217 0 0.241819385 0.264489953 0.657217458 #CA SURF

1971 2 2 3 2 2 1 25 8 0 0
0.249580541 4.51278239 23.86603504 8.552141491 9.062028425
1.508293547 4.52222029 2.996338896 1.768684387 0.25095294
0.254985691 1.003727315 0 0 0 0 0 0
3.755975265 17.33369977 9.066230069 4.274096593 2.012944225 2.7576531
1.752468939 0.499161083 0 0 0 0 0 0 #OR
BB

1972 1 1 3 2 3 1 25 14 0 0
0.577727993 5.079044913 6.803504974 25.30704003 16.46034156
11.47625329 4.96093864 2.585519086 2.447932076 1.338385319
1.34847714 1.262270435 1.022543872 0.732069579 0.384794711 0
0 0 3.464933781 3.837584793 5.560847555 2.661046347
1.668341226 0 0.388724834 0.388724834 0.242953021 0 0
0 0 0 #CA SURF

1972 2 2 3 2 3 1 25 28 0 0
0.723891397 5.051721487 5.142488753 11.31791021 8.285656327
3.66130945 2.07776002 1.809167845 1.871514202 0.731036139
0.970688188 0.216635146 0.403995272 0.468400316 0.230836725
0.153693854 0 1.097436255 5.837996644 10.11746151 20.63089858
7.990137842 4.740132354 2.709832179 1.50230506 0.750979814
0.490147135 0.339989434 0.211991522 0.384145381 0 0.079840963
#CA SURF

1972 2 2 3 2 2 1 25 2 0 0 0
8 10 14 6 2 1 1 1 1 1 0
0 0 0 0 0 0 9 15 12 8 4
1 4 2 0 0 0 0 0 0 #OR BB

1973 1 1 3 2 3 1 25 7 0 0
0.579454161 1.158908322 2.066067899 8.43708062 19.01571431
8.096563784 5.319403775 3.323451029 3.819336027 0.579454161
0.579454161 0.907811519 0 0 0 0 0 0
0.907811519 8.307657004 17.30269922 12.0908729 3.029842957
1.273900642 0.328357358 2.547801283 0 0 0.328357358 0
0 0 #CA SURF

1973 2 2 3 2 3 1 25 27 0 0
0.318461345 0.572163903 2.679454019 5.133153857 8.404918911
5.146134502 4.852884331 2.692192163 2.385797653 1.29557731
1.895751883 0.887799442 1.052329144 0.867621804 0.301314189 0
0 1.511710802 2.025533941 4.186100448 9.226064466 10.57750287
6.643157661 8.29906078 3.621979521 2.856633204 3.210243252
1.928287071 1.058067503 1.497223777 1.098995698 3.773884547 #CA
SURF

1974 1 1 3 2 3 1 25 15 0 0 0
22.87920534 9.98170918 7.559153277 6.981503093 9.674174726
4.253325493 4.461988869 2.135483473 1.33282147 0.405526561
1.185667314 0.183287644 0.248325195 0.199985702 0 0 0
8.539102544 4.811112818 5.028835692 2.592168197 3.505991303
1.351088632 0.998648117 0.181131318 0.694403567 0.481130065
0.183287644 0 0.150942765 0 #CA SURF

1974 2 2 3 2 3 1 25 27 0 0
1.821093056 13.73501793 13.00357193 7.778660034 2.888189513
5.833485615 2.937201509 1.534563974 0.779715354 0.924561189
0.197680768 0.153493689 0 0 0.13966797 0 0
1.344582068 9.759596883 11.31817222 8.141554075 4.560823332
5.675614134 3.393433049 1.811176562 0.518024354 0.738103676
0.305473361 0 0.227410535 0.116931324 0.362201906 #CA SURF

1975 1 1 3 2 3 1 25 8 0 0 0
7.500445169 27.53447381 11.28456137 2.916625728 1.193048992
1.202804856 1.102412705 1.160338151 0.370722857 0.360966992 0
0 0 0.721933984 0 0 0.914449713 11.27965338
25.51540191 5.947949083 0 0 0.370722857 0 0 0
0.623488441 0 0 0 0 #CA SURF

1975 2 2 3 2 3 1 25 2 0 0 0
4.166666667 35.41666667 12.5 6.25 12.5 10.41666667 2.083333333
6.25 4.166666667 0 0 0 0 2.083333333 0 0
0 0 2.083333333 0 2.083333333 0 0 0 0
0 0 0 0 0 0 #CA SURF

1976 1 1 3 2 3 1 25 3 0 0 0
6.653977922 21.95964979 14.43014846 4.991244766 3.58736201
1.982489532 0 0 2.784925771 1.793681005 2.784925771 0
0 0.991244766 0 0 0 2.430148458 9.793681005
10.7118386 3.964979064 7.363532547 0 0 3.776170537 0
0 0 0 0 0 #CA SURF

1976 2 2 3 2 3 1 25 15 0.250479672 0
0.552528687 2.154940911 13.5397498 13.58258332 6.066783769
4.095745291 4.627307528 4.151294981 1.44078721 1.685591785
1.562445397 0.900908304 0 0 0.422370041 0 0 0
4.202704466 15.14916681 13.87178411 5.28760195 3.391869599
0.897244321 0.53166143 0.924056598 0.276264344 0.157865339
0.276264344 0 0 0 #CA SURF

1977 1 1 3 2 3 1 25 5 0 0 0
1.168463769 6.126571188 13.36205837 18.32936547 18.59110446
3.49471837 4.863335687 2.100076774 0.584231885 0 0 0
1.01056326 0 0 0 0 0 3.505391307 7.311326569
14.33187328 0.50528163 3.120842836 1.089513514 0.50528163 0
0 0 0 0 0 #CA SURF

1980 1 1 3 2 3 1 25 3 0 3.529387034
20.25561255 37.88468006 12.50840831 0.518161944 0 3.261372236
0.518161944 0 0 0 0 0 0 0 0 0
0 2.225048348 9.801984361 7.156520642 1.822500631 0.518161944
0 0 0 0 0 0 0 0 0 0 #CA
SURF

1980 2 2 3 2 3 1 25 50 0.057462171
1.044190917 4.672955653 12.84561733 14.82848091 10.20521019
5.297770703 3.700781756 1.190432395 1.16806314 0.81892933
0.783368224 0.555630233 0.090416094 0.184804183 0 0 0
1.242185027 2.886220891 14.52815803 12.18612657 7.074920843
2.455928954 1.111167311 0.856007283 0.151235079 0 0.063936781
0 0 0 0 0 #CA SURF

1981 1 1 3 2 3 1 25 18 0 2.218358393
13.27754158 21.242968 19.83039654 9.088769621 5.096469798 3.427307386
2.268403687 1.666532969 0.488598825 0.596168215 0.884848482
0.526177623 0.189154918 0.189928067 0.19836298 0 0.58103622

2.977934927 5.646402812 4.896894805 2.477165487 1.721761763
0.290437445 0.100509378 0 0 0.117870089 0 0 0
0 0 #CA SURF

1981 2 2 3 2 3 1 25 27 0 0
2.513571399 16.23044722 17.27750114 12.26846172 6.410485156
2.684151005 2.045951027 1.150531137 0.339263046 0.10498963
0.084403428 0.257323511 0.084403428 0.151037713 0 0 0
1.758840974 12.35860608 12.69488335 6.513893999 2.540316418
1.365720651 0.465000366 0.187155427 0.268523477 0.126605142
0.117933557 0 0 0 0 #CA SURF

1981 2 2 3 2 2 1 25 28 0 0
0.277655788 6.850453248 18.33705675 13.66740963 8.940709343
4.440932845 3.070523198 1.12362245 0.153520429 0.172725812
0.158114768 0.143105284 0.080962461 0.080962461 0.139780403 0
0 0.095158993 2.758067382 14.66628184 10.43886691 5.489756798
3.299174233 1.999543302 0.826618488 0.628955505 0.647909956
0.058817942 0 0.180645031 0.347121334 0.925547418 #OR BB

1982 1 1 3 2 3 1 25 2 0 0 0
4 12 24 24 8 4 0 0 0 0 0
0 0 0 0 0 0 4 4 12 0 4
0 0 0 0 0 0 0 0 0 #CA SURF

1982 2 2 3 2 3 1 25 17 0 0
2.811883264 8.749799598 14.39391266 9.143334043 4.559101397
5.599344028 1.399074492 2.52687449 2.353830453 0.556506501
0.208012257 1.740536705 0.312018385 0.684518291 0.125521322 0
0 0.472125494 18.29081142 18.19102093 5.74111983 1.543007628
0.597646816 0 0 0 0 0 0 0 0 0
#CA SURF

1982 2 2 3 2 2 1 25 11 0 0
0.101203519 9.357125054 14.25450471 26.8408243 9.749832701
5.623425871 2.678633324 0.750315029 0.659392731 0.51510239
0.867699484 0.664923296 0.740754071 0 1.05545993 0 0
0.177022408 3.325411329 12.74282668 5.348921442 1.94409671
0.798583066 0.062236735 0.337335921 0.275099186 0.177022408 0
0 0.332461648 0 0.619786058 #OR BB

1983 1 1 3 2 3 1 25 12 0 0
3.312140917 5.030894374 10.69519531 13.63947273 14.05254819
4.05083239 4.09298697 1.065168112 0.675341723 0.20176937
1.129412143 0 0 0.274630531 0.262808843 0 0.602207439
4.056297252 11.10374211 9.599002969 9.86798825 3.987105004
1.844778763 0.223387517 0.131404422 0.100884685 0 0 0
0 0 0 #CA SURF

1983 1 1 3 2 2 1 25 4 0 0 0
0 0 0.062344573 5.889269609 8.865076699 13.78319214
2.254031208 4.196339554 6.013958754 6.325681617 5.951614181
6.263337044 5.042804581 4.071650408 0 0 0 0
2.913462518 5.229838299 3.162840808 4.855770863 6.076303326
1.282877036 2.254031208 1.220532463 0.124689145 0 0.124689145
1.282877036 2.752787789 #OR BB

1983 2 2 3 2 3 1 25 8 0 0
0.361520699 7.708367252 30.8019177 19.54001098 7.273506985
4.472687446 1.371220398 1.761796778 1.282029436 0 0 0
0 0.47568513 0 0 0 0 0.95137026 10.46633405
6.510105994 3.364855667 2.283288624 0.334741388 0.564876092 0
0 0 0.47568513 0 0 0 #CA SURF

1984 1 1 3 2 3 1 25 6 0 0 0
1.009391441 7.764792118 15.39504983 13.30210011 6.224714319
2.834313015 3.039856422 1.535171162 0.243502711 0.730508132
0.243502711 0 0.356550715 0 0 0 0 7.369369691
13.66870428 15.94505195 6.931258308 1.108426443 2.297736659 0

0 0 0 0 0 0 0 #CA SURF

1984 1 1 3 2 2 1 25 4 0 0 0
0 1.186038935 4.272226802 4.195644176 4.826954956 5.859828639
11.01176387 5.305100485 3.564333396 3.883097081 7.683394946
4.833171548 4.99255339 3.723715239 0 0 0 1.740767089
11.15249594 5.700446797 6.408340203 2.295495244 4.195644176
0.554728155 2.059530775 0.554728155 0 0 0 0 0
#OR BB

1984 2 2 3 2 3 1 25 3 0 0
1.422560253 9.755186383 11.58995277 12.98907382 11.36543959
4.870902683 0 1.623634228 0 0 0 0 0 0
0 0 0 0 11.18780482 23.18156695 9.976376723
2.037501776 0 0 0 0 0 0 0 0 0
0 #CA SURF

1985 1 1 3 2 3 1 25 2 0 0 0
1.855072464 17.85507246 5.565217391 0 0 0 0 0
0 0 0 0 0 0 0 0 0 20.57971015
40 12.28985507 1.855072464 0 0 0 0 0 0
0 0 0 0 #CA SURF

1985 2 2 3 2 3 1 25 4 0 0 0
11.57820906 20.93416152 12.97884316 17.13597023 9.590307942
3.034176992 4.273905361 0 0 0 0 0 0
0 0 0 0.924430593 8.11444632 6.916110365 4.519438457
0 0 0 0 0 0 0 0 0 0 #CA
SURF

1987 1 1 3 2 2 1 25 2 0 0 0
0 16 12 20 16 8 8 4 0 0 0
0 0 0 0 0 0 4 0 0 8 4
0 0 0 0 0 0 0 0 0 #OR BB

1989 1 1 3 2 2 1 25 2 0 0 0
0 2 0 8 16 22 6 8 2 0 0
0 0 0 0 0 0 0 2 12 4 18
0 0 0 0 0 0 0 0 0 #OR BB

1990 2 2 3 2 2 1 25 2 0 0 4
12 4 16 16 0 0 0 0 0 0 0
0 0 0 0 0 8 4 12 8 8 0
8 0 0 0 0 0 0 0 0 #OR BB

1994 1 1 3 2 2 1 25 2 0 0
0.959592008 1.919184017 6.717144058 7.834397349 16.38508263
7.433431986 4.955621324 2.477810662 7.992058631 0 0 0
0 0 0 0 0 0.479796004 4.876790683 14.63037205
13.34864532 5.994043973 1.998014658 0 0 1.998014658 0
0 0 0 0 0 #OR BB

1994 2 2 3 2 2 1 25 2 0 0 0
0 21.73913044 26.08695652 13.04347826 13.04347826 0
4.347826087 4.347826087 4.347826087 0 0 0 0 0
0 0 4.347826087 4.347826087 4.347826087 0 0 0
0 0 0 0 0 0 0 0 0 #OR BB

1997 1 1 3 2 2 1 25 2 0 0
6.060606061 6.060606061 10.60606061 21.21212121 7.575757576
7.575757576 1.515151515 1.515151515 0 0 0 0 0
0 0 0 0 6.060606061 10.60606061 4.545454546
12.12121212 1.515151515 1.515151515 1.515151515 0 0 0
0 0 0 0 0 #OR BB

1997 2 2 3 2 2 1 25 2 0 0
1.397135855 27.79067599 18.39801924 10.63775148 4.039366447
5.436502302 2.019683224 0 1.009841612 0 0 0 0
0 0 0 0 4.191407566 9.0053625 11.02504572 3.029524835
1.009841612 1.009841612 0 0 0 0 0 0 0

0 0 #OR BB

1998 1 1 3 2 2 1 25 2 0 0 0
0 0 5.410100679 19.94942491 12.76405461 18.08986347
9.044931737 9.129223553 5.578684312 0 0 0 0 0
0 0 0 0 1.775269621 3.634831058 5.410100679
5.494392495 3.719122874 0 0 0 0 0 0 0
0 #OR BB

1998 2 2 3 2 2 1 25 6 0 0 0
4.730734228 28.32138515 7.999233495 11.90309531 6.135762519
4.050408123 1.672001339 2.063369557 0.598778523 1.242768553
0.878295594 0.123648037 0 0 0 0 0 5.300440448
12.12817552 3.581687848 5.748736615 1.849298768 1.102592236
0.053470364 0.516117767 0 0 0 0 0 0 #OR
BB

1999 1 1 3 2 2 1 25 2 0 0 0
0 0 12.23111321 14.87408804 15.099239 14.15705659 10.79705031
0 1.434062899 3.360006286 0.717031449 3.360006286 0 0
0 0 0 0 4.794069185 5.511100634 9.58813837
0.717031449 0 3.360006286 0 0 0 0 0 0
0 #OR BB

1999 2 2 3 2 2 1 25 2 5.405405405 0
5.405405405 8.108108108 8.108108108 13.51351351 10.81081081 0
0 0 0 0 0 0 0 0 0 10.81081081
0 10.81081081 0 0 0 27.02702703 0 0 0
0 0 0 0 0 0 0 #OR BB

0 #nobsal #_Number_of_size_at_age_observations #Skip_reading

#2003 2 2 2 2 3 110 10 10 10 10 10
10 10 10 10 10 10 10 10 10 10 10
10 4 30 62 42 18 19 7 10 1 10
10 10 10 10 10

10 10 10 10 10 10 10 10 10 10 10
10 10 10 10 10 10 4 30 62 42 18
19 7 10 1 10 10 10 10 10 10

#skip_reading #sizeagedata(1,nobsal,1,7+2gender*n_abins)

#_environmental_data

1 #N_envvar#N_variables

-1 #N_envdata #N_observations

#1980 1 1 #env_temp(1,N_envdata,1,3) #Skip

999 #fid #end_of_data_file

```
#Control_file_for_petrale_sole_assessment_2005:: SouthernAssessment Area.
#Updated 02/11/2005
#Constant CV (est) LatAge; sigmaR=0.5

#Define_Morphs_See_Tag_020
2         #gmorph   #Number_of_growth_morphs
1         2         #sx(1,gmorph)       #assign_sex_to_each_morph_(1=female;_2=male)

#Area_and_Migration
1         #South_area_(N_subpop)
#Winter   #Summer   #survey
1         1         1         #assign_fleets_and_survey_to_area
#do_migration_between_areas
0         #none_for_1_area

#Time_blocks_for_time-varying_parameters,_Sampson_did_NONE_for_PETRALE_SOLE
0         #N_Block_Designs

#Natural_mortality_and_growth_parameters_for_each_morph
0         #natM_amin          #Last_age_for_natmort_young   #constant_M_for_all_ages-sex-yrs
0         #natM_amax          #First_age_for_natmort_old    #so_I_give_these_0s
2.833     #AFIX               #youngest_age_in_data                   #See_VanCol_ctl.xls
17.833    #AFIX2              #oldest_age_in_data
-4        #MGparm_dev_PH

#MGparm_1(1,N_MGparm,1,12)#N_MGparm=7*gmorph
#Matrix_for_mortality_and_growth_and_their_controls
#LO       HI        INIT      PRIOR     PR_TYPE SD        PHASE     env_var   use_dev   dev_yr1   dev_yr2   dev_sd
          block     holder    #         #
#Morph_1_Female
0.0875    0.25      0.2       0.2       0         0.8       -3        0         0         0         0         0.5
          0         0         #FIX      #M1_M_young
-3        3         0         0         0         0.8       -3        0         0         0         0         0.5
          0         0         #FIX      #M1_M_old=ln(M_old/M_young)
10        45        19.6      19.6      0         10        3         0         0         0         0         0.5
          0         0         #FIX      #M1_L@AFIX
45        80        52.70     53.08     0         10        3         0         0         0         0         0.5
          0         0         #FIX      #M1_L@AFIX2
0.04      0.5       0.162     0.186     0         0.8       3         0         0         0         0         0.5
          0         0         #EST      #M1_VBK
0.02      0.15      0.08      0.08      0         0.8       3         0         0         0         0         0.5
          0         0         #FIX      #M1_CV@AFIX
-3        3         0         0         0         0.8       -3        0         0         0         0         0.5
          0         0         #FIX      #M1_CV@AFIX2=ln(CV@AFIX2/CV@AFIX)
#Morgh_2:::Male
-3        3         0         0         0         0.8       -3        0         0         0         0         0.5
          0         0         #FIX      #M2_M_young=ln(M2_M_young/M1_M_young)
-3        3         0         0         0         0.8       -3        0         0         0         0         0.5
          0         0         #FIX      #M2_M_old=ln(M2_M_old/M2_M_young)
-3        3         0         0         0         0.8       3         0         0         0         0         0.5
          0         0         #FIX      #M2_L@AFIX=ln(M2_L@AFIX/M1_L@AFIX)
-3        3         -0.292    -0.2      0         0.8       3         0         0         0         0         0.5
          0         0         #FIX      #M2_L@AFIX2=ln(M2_L@AFIX2/M1_L@AFIX2)
-3        3         0.554     0.2       0         0.8       3         0         0         0         0         0.5
          0         0         #EST      #M2_VBK=ln(M2_VBK/M1_VBK)
-3        3         0         0         0         0.8       3         0         0         0         0         0.5
          0         0         #FIX      #M2_CV@AFIX=ln(M2_CV@AFIX/M1_CV@AFIX)
-3        3         0         0         0         0.8       -3        0         0         0         0         0.5
          0         0         #FIX      #M2_CV@AFIX2=ln(M2_CV@AFIX2/M2_CV@AFIX)
#LW_female
-3        3         3.42E-06  3.4E-06   0         0.8       -3        0         0         0         0         0.5
          0         0         #WL_intercept_female
-3        3         3.346     3.346     0         0.8       -3        0         0         0         0         0.5
          0         0         #WL_slope_slope_female
#Female_maturity
-3        3         33.1      33.1      0         0.8       -3        0         0         0         0         0.5
          0         0         #mat_intercept      #L50
-3        3         -0.734    -0.734    0         0.8       -3        0         0         0         0         0.5
          0         0         #mat_slope
#Fecundity___Assume_same_as_spawning_biomass
```

```
-3	3	1	1	0	1	-3	0	0	0	0	0.5
	0	0	#mat_intercept		#L50
-3	3	0	0	0	1	-3	0	0	0	0	0.5
	0	0	#mat_slope
#LW_Male
-3	3	7.17E-06	7.2E-06	0	0.8	-3	0	0	0	0	0.5
	0	0	#WL_intercept_male
-3	3	3.134	3.134	0	0.8	-3	0	0	0	0	0.5
	0	0	#WL_slope_slope_male

#Allocate_R_by_areas_x_gmorphs_(1_area_2morphs_in_this_case)
0	1	0.5	0.2	0	9.8	-3	0	0	0	0	0.5
	0	0	#frac to morph 1 in area 1
0	1	0.5	0.2	0	9.8	-3	0	0	0	0	0.5
	0	0	#frac to morph 2 in area 1

#Allocate_R_by_areas_(1_areain_this_case)
0	1	1	1	0	9.8	-3	0	0	0	0	0.5
	0	0	#frac R in area 1

0	#customMGenvsetup	#0=read_one_setup_and_apply_to_all;_1=Custom_so_read_each_env
#	-10	10	0.1	0.2	4	3	#Env_link_parameter #NONE

0	#customblocksetup_MG
#0=read_one_setup_and_apply_to_all;_1=see_detailed_instructions_for_N_rows_in_Custom_setup
#	-10	10	0	0	1	5	3block-parm_setup	#NONE

#SR_function_(1=B-H;2=notused)
1
#SR_parm_1(1,4,1,6) #_Spawner-Recruitment_parameters
#LO	HI	INIT	PRIOR	PR_TYPE SD	PHASE	use_env_number
3	31	11	9	0	10	1	#Ln(R0)
#0.2	1	0.8	0.7	0	0.8	-4	#steepness(h)---base_case
0.2	1	0.8	0.7	0	50	7	#steepness(h)---est_w/_uninformative_Normal_prior
0	2	0.46	0.9	0	5	-99	#sigmaR---base_case
-5	5	0	0	0	1	-99	#Env_link_parameter
-5	5	0	0	0	0.2	-2	#init_eq

0	#SR_env_link		#env-var_for_link	#NONE

#1940-2001_have_rec_residuals,_MinMax_of_ln(resid),_phase_to_activate_resid
#start_rec	end_rec	LO_rec	HI_rec	PH_rec
1956	2004	-15	15	2	#est_rec_devs_if_PH>0
#0	0	-15	15	-4	#use this to avoid the use of bias correction

#init_F_parm_1(1,Nfleets,1,6)	#_setup_for_each_fleet
#LO	HI	INIT	PRIOR	PR_TYPE SD	PHASE
0	1	0	0.0001	0	1	-1
	#Fleet1_(Winter)_Not_est._catch_in_Summer_this_period
0.00001	1	0	0.001	0	1	-2	#Fleet2_(Summer)

#Q_setup(1,Ntypes,1,5)		#add_parm_row_for_each_positive_entry_below(row_then_column)
#floatQ	Do-power	Do-env	Do-dev	env-var	num(0)/bio(1)	#The_first_4_cols_should_be_0/1.
0	0	0	0	0	1	#Fleet1_(Winter)
0	0	0	0	0	1	#Fleet2_(Summer)
1	0	0	0	0	1	#Survey

#q param
#LO	HI	INIT	PRIOR	PR_TYPE SD	PHASE	#
-5	5	-0.4462	-0.4	0	5	1	#


#Seltype(1,2*Ntypes,1,4)		#SELEX_&_RETENTION_PARAMETERS_at_Tag_025
#Size_Slectivity,_enter_4_cols
#N_selparm		Do_retain	Do_male	Use_Another_Selex
1		0		1	0	#Fleet1_is_Logistic
2		0		1	0	#Fleet2_is_Double_Logistic_do-RET
2		0		1	0	#Survey_is_Double_Logistic
#Age_selectivity		#set_to_1
10	0	0	0	#Fleet_1	#Let_ALK_works_for_age_selx
```

```
10       0        0        0        #Fleet_2
10       0        0        0        #Survey  #No_age_data_for_surveys.

#selparm(1,N_selparm,1,14)
#Size_selex_needs_Ntypes_panels_(2_fleets_and_1_survey).
#LO      HI       INIT     PRIOR    PR_TYPE SD       PHASE    env-var  use_dev  dev_yr1  dev_yr2  dev_sd
         nblks    blk_pat  #        #
#Size_selectivity_for_FLEET1
#...FEMALE
10       60       34       35       0        5        4        0        0        0        0        0.5
         0        0        #L50     #B1
0        30       5        8        0        5        4        0        0        0        0        0.5
         0        0        #L95-L50 #B2
#...DO_MALE
10       60       34       36       0        99       5        0        0        0        0        0.5
         0        0        #LD=L@Male_selx_!=_Female #SEE_Dlogistic
-5       4        0        1        0        99       5        0        0        0        0        0.5
         0        0        #exp_offset_selx@Lmin      #SEE_Dlogistic
-5       4        0        0.1      0        99       5        0        0        0        0        0.5
         0        0        #exp_offset_selx@LD        #SEE_Dlogistic
-20      20       -3       -0.5     0        99       5        0        0        0        0        0.5
         0        0        #exp_offset_selx@Lmax      #SEE_Dlogistic
#Size_selectivity_for_FLEET2
#...FEMALE
10       60       34       41       0        99       -4       0        0        0        0        0.5
         0        0        #L@peak_FEMALE  #B1
0        0.1      0        0.001    0        99       -4       0        0        0        0        0.5
         0        0        #slx@L0  #B2
-5       4        1        1        0        99       4        0        0        0        0        0.5
         0        0        #asc_infl(Logit)  #B3

0.0001   10       0.3      0.2      0        99       4        0        0        0        0        0.5
         0        0        #asc_slope#B4
-10      10       -1.5     7        0        99       5        0        0        0        0        0.5
         0        0        #des_slx@Lmax(Logit)       #B5
-5       4        -1.5     1        0        3        5        0        0        0        0        0.5
         0        0        #des_infl(Logit)  #B6
0.0001   10       0.0005   0.1      0        3        -5       0        0        0        0        0.5
         0        0        #des_slope#B7
0.1      10       3        4        0        99       -5       0        0        0        0        0.5
         0        0        #width_of_top     #B8
#...DO_MALE

10       60       32       36       0        99       6        0        0        0        0        0.5
         0        0        #LD=L@Male_selx_!=_Female #SEE_Dlogistic
-5       4        0        1        0        99       5        0        0        0        0        0.5
         0        0        #exp_offset_selx@Lmin      #SEE_Dlogistic
-5       4        0        0.1      0        99       5        0        0        0        0        0.5
         0        0        #exp_offset_selx@LD        #SEE_Dlogistic
-20      20       -3       -0.5     0        99       6        0        0        0        0        0.5
         0        0        #exp_offset_selx@Lmax      #SEE_Dlogistic
#Size_selectivity_for_SURVEY

#...FEMALE
10       60       34       43       0        99       -4       0        0        0        0        0.5
         0        0        #L@peak_FEMALE  #B1
0        1        0.0148   0.0148   0        99       4        0        0        0        0        0.5
         0        0        #slx@L0  #B2
-5       4        1.7      1        0        99       4        0        0        0        0        0.5
         0        0        #asc_infl(Logit)  #B3
0.0001   5        0.4      0.5902   0        99       4        0        0        0        0        0.5
         0        0        #asc_slope#B4
-10      10       1        7        0        99       5        0        0        0        0        0.5
         0        0        #des_slx@Lmax(Logit)       #B5
-5       4        -2       1        0        3        5        0        0        0        0        0.5
         0        0        #des_infl(Logit)  #B6
1E-06    5        3.65     3.283    0        99       5        0        0        0        0        0.5
         0        0        #des_slope#B7
0        10       3        1        0        99       -5       0        0        0        0        0.5
         0        0        #width_of_top     #B8
```

```
#...DO_MALE

10	60	30	34	0	99	5	0	0	0	0	0.5
	0	0	#LD=L@Male_selx_!=_Female	#SEE_Dlogistic
-5	4	0	1	0	99	5	0	0	0	0	0.5
	0	0	#exp_offset_selx@Lmin	#SEE_Dlogistic
-5	4	0	0.1	0	99	5	0	0	0	0	0.5
	0	0	#exp_offset_selx@LD	#SEE_Dlogistic
-20	20	-9	-10	0	99	5	0	0	0	0	0.5
	0	0	#exp_offset_selx@Lmax	#SEE_Dlogistic

#since_age_selex_is_constant_of_1,_no_entry_below.
#Age_selectivity_for_FLEET1
#Age_selectivity_for_FLEET2
#Age_selectivity_for_SURVEY

#custom-env_setup_for_SELEX
0	#customenvsetup	#0=read_one_setup_and_apply_to_all;_1=Custom_so_read_1_each;

#custom-block_read_for_SELEX
0	#customblocksetup
	#0=read_one_setup_and_apply_to_all;_1=Custom_so_see_detailed_instructions_for_N_rows_in_Custom_setup

#phase_for_selex_parm_devs
-4	#_sleparm_dev_PH	#phase_for_selex_parm_devs

#lambdas
1	#max_lambda_phase	#lambdas_won't_change_by_phase
0	#switch_for_sd_offset_in_Likelihood
1	1	1	#surv_lambda(1,Ntypes)	#2_fleets_and_1_survey
1	1	0	#disc_lambda(1,Ntypes)	#2_fleets_only
0	#mnwt_lambda(mean_wt_lambda_one_for_all_sources)
1	1	1	#length_lambda(1,Ntypes)
1	1	0	#age_lambda(1,Ntypes)
0	0	0	#sizeage_lambda(1,Ntypes)
1	#lambda_init_equ
1	#lambda_rec
1	#lambda_parmprior
1	#lambda_parm_dev
# crashpen lambda
100
#max F
0.9
999	#fid	#end-of-control-file
```