Exhibit F.1.a
Attachment 1
March 2002

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Northwest Region
7600 Sand Point Way N.E., BLDG. 1
BIN C15700
Seattle, Washington 98115-0070

February 14, 2002

Dear Sablefish Endorsement Holder:

As you know, the primary sablefish season structure has had many changes in the past year. You may remember that last year the National Marine Fisheries Service (NMFS) published a set of proposed and final rules to set the basic permit stacking provisions in place for the 2001 season. You may also remember that in 2001, longliners with sablefish endorsements fishing north of Pt. Chehalis, WA were allowed to retain some incidentally-caught halibut. This letter describes some of the permit stacking provisions that we are working on for 2002 and provides information about retaining incidentally-caught halibut in 2002.

When NMFS published the initial permit stacking program regulations, we reserved some of the more complex provisions for a second set of rules, to be published in 2002:

1. Setting the primary season for April 1 through October 31

2. An owner-on-board requirement for permit owners who did not own sablefish endorsed permits on November 1, 2000

3. Permit owners would be required to document their ownership interests in their permits so that the agency can ensure that no person holds more than three permits

4. Vessels that do not meet minimum frozen sablefish historic landing requirements would not be allowed to process sablefish at sea

2002 season: Of these four items, only the April through October season will occur in 2002. We have some questions regarding the intent of the other measures and will be asking the Pacific Fishery Management Council (Council)to clarify their intent at its March and April 2002 meetings. To ensure that we would have the longer primary sablefish season in 2002, NMFS published the April 1 through October 31 season as part of its proposed rule for the 2002 groundfish specifications and management measures (January 11, 2002, 67 FR 1555). In that proposed rule, we also published proposed tier limits: Tier 1, 36,000 lb; Tier 2, 16,500 lb; Tier 3, 9,500 lb. All limits are in round weight. We are expecting to finalize the overall groundfish specifications and management measures, including the primary sablefish season and limits, in early March.

If you want to transfer a permit (change in vessel registration) to be effective for the April 1 start of season, the Permits Office must receive your current permit and a complete transfer form by **February 28, 2002.** If we receive your transfer request after February 28 and before April 30, the permit will be reissued with an effective date of May 1. If you have questions about permit transfers or need permit transfer forms, please call our Permits Office at (206) 526-4353.

Halibut: As in 2001, longline vessels with sablefish endorsed permits that are operating north of Pt. Chehalis, WA, will be allowed to land halibut taken incidentally during the primary sablefish fishery. The Pacific Fishery Management Council will be discussing 2002 incidental halibut limits at its March and April 2002 meetings. Incidental halibut retention would *not* be permitted until after the Council has set the limits and NMFS has published those limits in the Federal Register.

If you wish to land halibut taken incidentally in the limited entry, fixed gear primary sablefish fishery north of Pt. Chehalis, you must have a commercial halibut license from the IPHC. To apply for a commercial halibut license with the IPHC, you can download the application from their website at: (http://www.iphc.washington.edu/halcom/2aapp.htm) or call the IPHC at (206) 634-1838. The application and the license are free and there are no qualification requirements for a license. To receive an IPHC license, you must apply by **April 30, 2002**. IPHC also requires that all commercial halibut vessels carry, and vessel owners complete, an IPHC halibut logbook. If you need an IPHC logbook please contact the IPHC at the above telephone number. If you are recording halibut information from the Alaskan fishery in an IPHC halibut logbook, you may use that same logbook for West Coast halibut fisheries.

If you think that you would like to land halibut during the sablefish season, please remember these basic points:

1. It is illegal to land commercially-caught halibut south of Pt. Chehalis unless you are participating in the directed halibut fishery or in the salmon troll fishery.

2. It is illegal to have halibut on board if you have any gear other than longline gear on board your vessel.

3. It is illegal to have halibut on board your vessel north of Pt. Chehalis unless you have *both* a limited entry permit and an IPHC halibut license.

Thank you for your patience as we work through some of the difficult permit stacking regulations.

Sincerely,

William L. Robinson
Assistant Regional Administrator
for Sustainable Fisheries

Exhibit F.1.a
Attachment 2
March 2002

FEB 25 2002

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Sustainable Fisheries Division
7600 Sand Point Way N.E., Bldg. #1
Seattle, Washington 98115-0070

FEB 20 2002

Dr. Hans Radtke, Chairman
Pacific Fishery Management Council
7700 NE Ambassador Place
Portland, OR 97220

Dear Dr. Radtke:

On August 7, 2001, the National Marine Fisheries Service (NMFS) published a final rule implementing Amendment 14 to the groundfish fishery management plan with a basic permit stacking program for sablefish endorsed limited entry permits (66 FR 41152). In that *Federal Register* notice, we indicated that the agency would implement the more complex provisions of Amendment 14 through a second set regulations for the start of 2002 primary sablefish season. Due to the recent groundfish litigation and associated workload and due to the need for clarification of the Council's intent regarding some of these provisions, only the April 1 through October 31 season will be implemented for 2002. The remaining measures will be implemented for the 2003 season after further consultation with the Council.

For 2002, NMFS will set a April 1 through October 31 fishing season through the final rule to implement the 2002 groundfish specifications and management measures. Following further consultation with the Council, we will complete implementation of these provisions as regulations for 2003 and beyond:

1) An owner on-board requirement for permit owners who did not own sablefish endorsed permits on November 1, 2000;

2) A requirement that corporations and partnerships provide documentation listing each shareholder in order to determine the number of permits owned by an individual;

3) A determination of which sablefish endorsed vessels have sufficient frozen sablefish landings to qualify for the exemption from a prohibition on the at-sea processing of sablefish.

Of these three items, the latter two items are reasonably straightforward to implement, although their implementation requires Paperwork Reduction Act clearance from the Office of Management and Budget. However, NMFS is reluctant to proceed on the owner-on-board requirement and its possible exemptions without further guidance from the Council. With this letter, I would like to alert the Council and the public to some of the complexities of the owner-on-board provision and ask that the Council and its advisory bodies consider some of the potential consequences to the fishing fleet of implementing the owner-on-board provisions and confirm the Council's intent that these provisions be implemented as currently characterized in Amendment 14. I believe that clarifying these issues would be an appropriate agenda item for the April 2002 Council meeting.

Owner-on-board provision: Under the Council's regulatory recommendations for implementing Amendment 14, "the permit owner would be required to be onboard the vessel during fishing operations, with the exception of those falling under the following grandfather provision:

> Corporations, partnerships, and individuals who hold sablefish endorsed permits as of November 1, 2000 will not be required to be onboard the vessel on which the permit will be used. Grandfathered absentee owners may acquire additional permits to stack with the permits they own, subject to accumulation caps, and still maintain their exemption from the owner on board provision. This exemption will cease if there is any change in the identity of a corporation or partnership owning the stacked permits..." (Amendment 14 regulatory recommendations further defined a change in identity as the addition of a new member to the corporation.)

Last year, the Council provided some clarification for the owner-on-board provision by interpreting it to mean that owners would have to be on board whenever sablefish is landed, starting from April 1 through whenever the vessel takes its primary sablefish limits. Only persons, partnerships or corporations that owned sablefish endorsed permits as of November 1, 2000 would be exempt from this requirement. NMFS would appreciate the Council's consideration of the following issues, several of which have arisen as a result of recent efforts by permit owners to transfer their permits:

1. If Vessel Owner A is exempt from the owner-on-board provision leases a permit from Person B, who is not exempt from the owner-on-board provision, does Vessel Owner A need to carry Person B aboard his/her vessel while fishing against B's permit? Or, would Vessel Owner A have to buy Person B's permit in order to fish that permit without having B aboard?

2. If a vessel owner leases permits from two different permit owners who are *not* exempt from the owner-on-board requirement, do those permit owners need to be on board the vessel beginning April 1 and ending when all of the sablefish limits associated with that vessel have been taken?

3. If a permit owner is exempt from the owner-on-board provision, when does that exemption end? If a permit owner sells all of his/her permits and then some time later buys a new permit, is he/she still exempt from the owner-on-board provision? What if two permit owners who are exempt from the owner-on-board provision want to swap permits? Do they keep their exemptions? If the exemption doesn't end when an original permit owner sells all of his/her permits, then does the exemption from owner-on-board requirement would not end until the death of that permit owner.

4. If a corporation is eligible for the owner-on-board exemption by virtue of having owned one permit as of November 1, 2000, and one of the persons with ownership in that corporation wants to buy additional permits for his/her own use, is that person still exempt from the owner-on-board requirement? Or, is that person subject to the requirement because he/she did not personally own a permit as of November 1, 2000?

5. Under the Council's initial recommendations, adding another person to a corporation dissolves that corporation's ownership privileges and exemption from owner-on-board provisions. A family-owned corporation, with the husband and wife given as the sole shareholders, owns a permit as of the control date. If that corporation later wishes to add a child as an additional owner in that corporation, will that corporation lose its exemption from the owner-on requirement? Similarly, suppose a corporation that includes father, mother and son owns a permit as of the control date. If the son marries after the control date and wishes to add his wife to the corporation, does the corporation lose its owner-on-board exemption?

6. If a married man who is exempt from the owner-on-board requirement is the sole owner of a permit and he dies with his wife as the inheritor of his permit, would she still be exempt from the owner-on-board provision? What if the couple divorces while he still owns the permit? Is she exempt from the owner-on-board provision if she wants to buy another permit for herself? We think that these are particularly difficult issues because Washington and California are common property states, while Oregon is not. If possible, we would like to have regulations that apply equally to all permit owners, regardless of their states of residence.

7. A single person who owned a permit as of the control date adds his girlfriend or a brother as co-owner of the permit after the control date. Does the original permit owner lose his/her owner-on-board grandfather status by adding another individual after the control date or does only the new co-owner (i.e.; girlfriend or brother) of the permit have to be on board?

As you can see, the owner-on-board provision raises many questions for the agency and for the sablefish endorsed fleet. Questions of this nature are usually difficult to predict during the Council's initial deliberations on new regulations affecting a license limitation program. Only the practical application of the regulations brings out questions from our permit owners and from my permits staff. We would appreciate the Council's consideration of these owner-on-board issues.

Sincerely,

William L. Robinson
Assistant Regional Administrator
for Sustainable Fisheries

Exhibit F.1.d
Supplemental SSC Report
March 2002

SCIENTIFIC AND STATISTICAL COMMITTEE REPORT ON NMFS REPORT - STOCK ASSESSMENT REVIEW PROCESS UPDATE

The Scientific and Statistical Committee (SSC) discussed three topics under this agenda item, namely (1) review of the 2001 Stock Assessment Review (STAR) process; (2) terms of reference for the 2002 STAR process; and (3) terms of reference for an abbreviated review process (e.g., as scheduled for sablefish in May 2002). Drs. Rick Methot and Elizabeth Clarke briefed the SSC on each topic.

(1) Review of the 2001 STAR Process

Three STAR Panels were convened in 2001, and an additional panel (for whiting) was held in February 2002. For discussion purposes, herein, all four panels are considered a part of the 2001 STAR process. Generally, the process worked well in terms of stock assessments being completed, reviewed, and provided to the Council family in accordance with the pre- established scheduled. In some cases, the assessment documents, provided to the STAR Panel, could have been more complete. There were also some inconsistencies in the manner in which the respective STAR Panels characterized the full range of uncertainty in assessment results. The STAR terms of reference should be strengthened in both of these areas to further emphasize their importance.

With respect to the whiting STAR panel, it appears the 3-day session was not sufficient to fully explore and evaluate additional modelling scenarios. This has also been an issue with other STAR panels in previous years. The SSC recommends that rather than extending the time period of the STAR meetings, STAT teams should better explore modelling alternatives prior to the STAR panel review. It may be necessary to establish an informal modelling workshop each year prior to the STAR panel meetings. All STAT teams should participate in this workshop to provide informal peer review while assessments are still at the formative stage. This will require support for travel of STAT team members.

(2) Terms of Reference for 2002

The SSC recommends the 2001 terms of reference be used for 2002, and the modifications above be incorporated into the 2003 terms of reference.

(3) Terms of Reference for an Abbreviated Review Process

The SSC suggests that when the Council deems necessary an assessment update outside of the full assessment review cycle, an abbreviated review process may be possible. However, the SSC recommends proceeding with caution on abbreviated reviews. Often what appears to be a simple update can uncover unexpected issues and problems that are difficult to solve in an abbreviated process. In these cases, it may not be possible to simply update the assessment – rather the assessment may need to be revisited in the next full assessment review cycle. The SSC will prepare, for Council consideration at its April meeting, draft terms of reference for an abbreviated review process.

Finally, the SSC is concerned there may be a tendency to schedule accelerated assessment and abbreviated review only for species with apparent high recruitment in recent years. If this indeed becomes the case, the Council's management objectives may be compromised over the long term. To maintain balance, stocks that may be decreasing in abundance should be given equal consideration for accelerated assessment and abbreviated review.

PFMC
03/13/02

Exhibit F.1.e
Public Comment
March 2002

RECEIVED

DEC 3 2001

PFMC

Michael D. Pettis
310 SE Yaquina View Dr.
Newport, Or 97365

November 13, 2001

To: NMFS
Attention: William Robinson, Director

Dear Bill,

As you know, I have been in the fishing business for quite a while now, twenty six years to be exact. I have tried to invest in the facets of the fishing business that I thought would likely be the most viable in the future. This effort resulted in my wife and I being "Grandfathered" with 4 & 2/3 fixed gear (Sablefish endorsed) fishing permits.

After two years of college, and having completed his general education credits, my son Tony came home from school and said he wished to try fishing for a career. He has fished with me in the summers since he was twelve years old.

I wanted him to have a safe platform to work from, and with the plan of eventually being partners with my son, I bought the 60 ft. fishing vessel "HEIDI SUE".

Tony has also invested in two Sablefish fishing permits. He has worked very hard and is ready financially to buy into the "HEIDI SUE". But there is a problem....

If my son buys an interest in the "HEIDI SUE", he will not be able to fish his Sablefish fishing permits on his own boat, as long as his mother and I still own an interest in the boat and our name appears on the Federal Document Papers. A quote from an August 6th letter from Kevin Ford in the NMFS permit office to me states, "Vessel owners are considered permit holders"... Since his mother and I still have our fishing permits and since we will still have an interest in the boat, he will not be able to fish his permits on "his" boat.

It seems the term "Hold" is the key to all of this.

I took my concerns on this issue to Bob Alverson, PFMC voting member who was on the Council when this issue was discussed. It is Bob's view that owning a vessel that a permit is fished on should not constitute "holding" the permit. He feels that the permit OWNER who decides which boat his permit is fished on , actually controls or "HOLDS" the permit. Mr. Alverson suggested that I write you this letter, and that I request NMFS ask for "Clarification" from the PFMC on the term "HOLD". Specifically, should the ownership of a vessel be considered when determining "HOLDING" of a permit.

Mr. Alverson also said I should request this subject be put on the agenda for an up coming council meeting so that clarification on the term "HOLD" could be discussed, perhaps by the Groundfish Advisory Panel first, and then by the Council, with the GAP

Michael D. Pettis
310 SE Yaquina View Dr.
Newport, Or 97365

The NMFS current interpretation would prevent me from helping my son get a start in his desired career choice. Was this the intent of the council?

Thank you for your consideration on this matter.

Sincerely

Michael D.Pettis

cc: Bob Alverson
Don McIsaac

NATIONAL MARINE FISHERIES SERVICE REPORT

Situation: The National Marine Fisheries Service will briefly report on recent developments relevant to the West Coast groundfish fishery. These discussion topics include the status of Amendment 14 to the fishery management plan (FMP) and issues relevant to permit stacking in the fixed gear sablefish fishery, an update on this year's Stock Assessment Review (STAR) process, an Observer Program update, and other issues of interest to the Council.

Council Task:

1. Receive information for discussion.

Reference Materials:

1. February 14, 2002 letter from the National Marine Fisheries Service to sablefish endorsement holders (Exhibit F.1.a, Attachment 1).
2. February 20, 2002 letter from the National Marine Fisheries Service to Dr. Hans Radtke, Chairman, Pacific Fishery Management Council (Exhibit F.1.a, Attachment 2).
3. November 13, 2001 letter from Michael D. Pettis to William Robinson, National Marine Fisheries Service (Exhibit F.1.e, Public Comment).

Agenda Order:

1. NMFS Report	Bill Robinson
a. Status of Amendment 14	Yvonne de Reynier
b. Stock Assessment Review (STAR) Process Update	Elizabeth Clarke
c. Observer Program Update	Elizabeth Clarke
d. Reports and Comments of Advisory Bodies	
e. Public Comment	
f. Council Discussion	

Groundfish Fishery Strategic Plan (GFSP) Consistency Analysis

This agenda item is not expected to require Council decision making that raises issues of consistency with the GFSP.

PFMC
02/27/02

Supplemental Reference Materials

4. Exhibit F.1.d, Supplemental SSC Report.

West Coast Seafood Processors Association
P.O. Box 1477, Portland, OR 97207
503-227-5076 / 503-227-0237 (fax)

Serving the shore based seafood processing industry in California, Oregon and Washington

March 8, 2002

Dr. Hans Radtke
Chairman, Pacific Fishery Management Council
7700 NE Ambassador Place
Suite 200
Portland, OR 97220-1384

Dear Mr. Chairman:

The following public comments on 2002 Pacific whiting harvest levels (agenda item F.2) are provided on behalf of the West Coast Seafood Processors Association (WCSPA). The members of WCSPA process the majority of Pacific whiting landed on shore during the regular whiting season.

I apologize for the late submission of these comments. Unfortunately, the final Stock Assessment Review (STAR) Panel report and the final version of the 2002 Pacific whiting stock assessment have only just been made available.

These comments cover two broad areas that are being considered by the Council: the science involved with the stock assessment and the accompanying STAR Panel report; and the management options that will be considered by the Council during its upcoming meeting.

SCIENCE ISSUES

The Council has received as an attachment under agenda item F.2 a copy of the STAR Panel Report and the dissenting views that I filed as the Groundfish Advisory Subpanel advisory member to the STAR Panel. While I believe my comments are self-explanatory, let me point out that they are further supported by material contained in the final version of the stock assessment document.

On page 28 of the document, the authors describe a sensitivity analysis where the "catchability" parameter - identified as "q" - was modified. To quote the authors: "The best model fits were obtained at intermediate survey catchabilities considered (q=0.5-0.6) for the base model (Model 1)..." The estimated "q" value for Model 4 - the model which I suggest should be considered equally with Model 1 - is 0.53 (page 26 of the assessment). Indeed, the authors also state that: "While model 4 gave generally equally good fits as model 1 to the survey age data composition, the low q estimated from this run seems implausible." While it may seem implausible, in fact model 4 is equally likely to be close to the truth as model 1, if not more so.

Unfortunately, the STAR Panel did not spend much time examining this issue. On the last day of the STAR Panel, according to my notes, our outside reviewer, Dr. Norm Hall, asked for arguments as to why q=1. The discussion was cut short by our Canadian co-chair who said: "We can't investigate q not equaling 1 because we don't have time - it's a matter of further research."

A final point regarding the STAR Panel report: when the Council first established our review system, there was a clear understanding that it was to look at science, not management. While the Terms of Reference have become somewhat muddled over time and are in need of editing, the inference of this separation remains in the section on GMT responsibilities: "Successful separation of scientific (i.e. STAT Team and STAR Panels) from management (i.e., GMT) work depends on..." Yet, the STAR Panel report on whiting provides specific management advice to the reader by stipulating recruitment assumptions, high and low yield options, and F percentage rates that should be used.

Obviously, this is not a fatal flaw, as the Council will no doubt rely on advice and testimony from a variety of other sources when making its management decisions. Still, if we want to keep a viable review process - which WCSPA strongly supports - the Council needs to ensure that everyone fully understands their roles and obligations.

<u>OVERFISHED DESIGNATION</u>

Depending on which choices the Council makes, Pacific whiting could be designated as overfished. If so, this will require preparation of a rebuilding plan. Given the biology of whiting, it is likely that rebuilding will have to be accomplished within 10 years. Keep in mind that, once designated as overfished, whiting will remain in that category until the population reaches $B_{40\%}$. It makes no difference that the population goes below $B_{25\%}$ for one year and then climbs right back up under natural circumstances the following year; once you are designated as overfished, you stay there until fully rebuilt. This means that the conservative harvest levels which will be required by a rebuilding plan will most likely remain in effect for the next 10 years, and even that will depend on whether robust recruitment continues. As noted on page 32 of the stock assessment:

> "under more conservative harvest strategies such as $F_{50\%}$...the probability that female spawning biomass exceeds 40% unfished by 2006 is markedly higher, but still remains below 50%. The short term trade-off, however, would entail significant reductions in total coastwide yield..."

MANAGEMENT ISSUES

If the Council decides to accept the management advice in the STAR Panel report, the allocation break-down would look as follows:

	Coastal OY	US OY	Tribal **	Non-Tribal	Catcher/ Processor	Mothership	On Shore
$F_{45\%}$ Low Recruitment	96,000	76,800	17,500	59,300	20,162	14,232	24,906
$F_{45\%}$ Medium Recruitment	133,000	106,400	17,500	88,900	30,226	21,336	37,338

** **Please Note**: The tribal allocation shown is for illustrative purposes only and is based on the allocation agreement between NMFS and the Makah Tribe which was rejected by the 9th Circuit Court of Appeals on March 6th. WCSPA believes that this number is artificially high and needs to be reduced to reflect the best scientific information available, as ordered by the Court. **

In addition to the scientific arguments noted above, WCSPA contends that this management advice - which, if accepted, will lead to a designation of whiting as being overfished - suffers from several flaws.

First, the recruitment assumptions are too low. Even though the STAR Panel report tried to downplay the strength of year classes entering the fishery over the next few years, evidence from the various surveys - including those conducted by the Pacific Whiting Conservation Cooperative and the Southwest Fisheries Science Center - indicate a strong 1999 year class. Although this does not compare with the two "super spawning" years of 1980 and 1984, it is nevertheless strong enough to use the "high recruitment" assumption in the stock assessment.

But what if we are wrong, and we use the high recruitment assumption when recruitment is actually medium or even low? The decision table on page 15 of the STAR Panel Report provides the answer. Under every fishing rate ($F_{40\%}$, $F_{45\%}$, and $F_{50\%}$) where we assume high recruitment but the actual state of nature is low, we remain above the overfished level in 2003 and 2004. Even if the Council chooses to accept Model 1 (which WCSPA believes is the incorrect choice), assuming the high recruitment rate - an assumption justified by the data - does not lead to an overfished stock.

Second, following the management advice in the STAR Panel report is equivalent to imposing *triple* precaution on the fishery. Precaution 1 is the assumption of an unrealistically low recruitment rate, as noted above. Precaution 2 is the imposition of yield levels mandated under the Council's 40/10 rule. As noted in the Council's Environmental Analysis accompanying Amendment 11 - which established the 40/10 rule - the rule is designed to be risk averse and to set an optimum yield (OY) that will be below acceptable biological catch (ABC). The yield numbers shown in the projection table on page 14 of the STAR Panel report reflect the reduction below ABC to comply with the 40/10 rule. Precaution 3 is the use of anything other than an $F_{40\%}$ harvest policy. The Scientific and Statistical Committee convened a harvest policy workshop in 2000 that resulted in a recommendation that Pacific whiting be managed at $F_{40\%}$. While some will argue that managing at this level will not permit achieving the desired 40% of unfished biomass level, that problem is resolved by using the 40/10 rule.

In short, the Council has a control rule in place that has been accepted by NMFS. That control rule is deliberately designed to keep harvest on track by adjusting yields. The Council should not further reduce harvest by adopting a harvest policy more conservative than recommended by the Scientific and Statistical Committee as the result of an intensive peer-reviewed workshop.

RECOMMENDATION

If the Council chooses to accept the preferred model forwarded by the STAR Panel - a decision which we believe is incorrect - then WCSPA recommends that the Council adopt the high recruitment assumption with the fishery managed at $F_{40\%}$ with the yields specified under the 40/10 control rule. This would lead to an allocation break-down as follows:

	Coastal OY	**US OY**	**Tribal ****	**Non-Tribal**	**Catcher/ Processo r**	**Mothership**	**On Shore**
F40% High Recruitment	219,000	175,200	15,000	160,200	54,468	38,448	67,284

** **Please Note:** the tribal allocation reflects the same "accommodation" provided to the Makah Tribe in 1996 which has now been ruled illegal by the 9th Circuit Court. WCSPA believes that scientific analysis will demonstrate that this amount (9% of the U.S. OY) exceeds the actual tribal entitlement in their Usual and Accustomed Area. Nevertheless, *if* the Council adopts WCSPA's recommendation for harvest in 2002, WCSPA is willing to provide an accommodation <u>for 2002 only</u> that will allow a transition to the appropriate science-based harvest level.

ECONOMIC IMPACT COASTWIDE

In order to assess the economic impact of the alternatives facing the Council, WCSPA surveyed plants which would operate during the main whiting season. A separate survey was taken of the plants which would operate during the early California season. Plants provided information on the revenue that would be generated for local communities through payroll, packaging, transport, and cold storage. Information was also provided on plant overhead. Given the short amount of time available, these figures can only be considered as "best estimate" but they are informative as to the economic cost of the Council's decision. We also suggest that the degree of uncertainty surrounding these economic projections is no greater - and probably much less - than the degree of uncertainty surrounding assumptions and biomass estimates contained in the stock assessment.

Coastal production has averaged 900 mt / day (round weight). For every 900 mt, the following revenue is generated:

Payroll	$109,920.00
Packaging	25,688.00
Transport	73,393.00
Cold Storage	32,440.00
TOTAL	**$241,441.00**

If you look at the estimates in terms of cost, then for every 900 mt by which the allowable on-shore harvest is reduced, there is foregone revenue equaling $241,441.00, plus plant overhead which cannot be met of $119,016.00, for a total of **$360,457.00**.

Putting this in the perspective of the options presented in these comments:

	ONSHORE HARVEST[1]	$ GENERATED[2]	$ LOST[3]	FEDERAL TAXES GENERATED[4]
STAR LOW	23,661 mt	$6,277,466.00	$16,220,565.00	$650,345.45
STAR MEDIUM	35,471 mt	$9,416,199.00	$11,534,624.00	$975,518.19
WCSPA	63,920 mt	$17,142,311.00	$0.00	$1,775,943.20

Remember, this is only the revenue / loss associated with on-shore processing plants. It does not take into account the fishing vessels delivering to those plants, nor the offshore sectors of the fishery.

WCSPA also notes that the estimated Federal taxes generated by the on-shore processing sector of the whiting fishery if the WCSPA recommendation is adopted equals 34% of the amount appropriated under the line item "West Coast Groundfish Research" in the Fiscal Year 2002 NOAA budget - not a bad return on investment .

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[1] Total on-shore harvest minus 5% California season share

[2] Harvest divided by 900 mt multiplied by revenue figure ($241,441.00)

[3] Difference between WCSPA recommendation as adjusted for early California season and harvest level, divided by 900 mt and multiplied by loss figure ($360,457.00)

[4] Based on revenue generated, portion of each component (payroll, etc.), and Federal tax as a percentage of that component

ECONOMIC IMPACT - CALIFORNIA SEASON

Because the early California season involves fewer plants and a smaller quota for the period starting April 1st, the economic impacts were estimated separately. California production is estimated at 55 mt / day round weight (a low estimate, given that all plants possibly processing could not be contacted) which means revenue would be generated as follows:

Payroll	$3,840.00
Packaging	3,967.00
Transport	6,612.00
Cold Storage	2,923.00
TOTAL	**$17,342.00**

In terms of cost, for every 55 mt by which the allowable California on-shore harvest is reduced, there is foregone revenue equaling $17,342.00, plus plant overhead which cannot be met of $7,273.00, for a total of **$24,615.00**.

As above, putting it in the perspective of these comments:

	ONSHORE HARVEST	$ GENERATED	$ LOST	FEDERAL TAXES GENERATED
STAR LOW	1,245 mt	$398,866.00	$959,985.00	$41,322.51
STAR MEDIUM	1,867 mt	$589,628.00	$664,605.00	$61,0[illegible]
WCSPA	3,364 mt	$1,057,862.00	$0.00	$109,594.51

THE BOTTOM LINE

Of the recommendations examined, those provided here by WCSPA are scientifically defensible, provide necessary conservation, generate the most revenue, and result in the smallest loss. We urge the Council to adopt them.

Sincerely,

Rod Moore
Executive Director

TRIBAL MOTION

For 2002, I move that the whiting for the Makah Tribe continue with the sliding scale that has been used in recent years. This would be 25,000 mt or adjusted depending upon the final ABC and OY.

Exhibit F.2
Attachment 1
March 2002

2001 PACIFIC WHITING FISHERY
FOR NON-TRIBAL MOTHERSHIPS AND CATCHER/PROCESSORS
(Based on Preliminary Observer Data)

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

Groundfish	Retention (mt)	Discard (mt)	Total (mt)
Pacific whiting	94,080.26	370.36	94,450.62
Rockfish	162.08	277.78	439.86
Flatfish	23.44	7.33	30.77
All other groundfish	56.15	55.19	111.34
TOTAL	94,321.93	710.65	95,032.59
Prohibited Species		Number of fish	
Halibut		74	
Salmon		3,338	

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

OCKFISH	VANCOUVER - 670			COLUMBIA - 710			EUREKA - 720			TOTAL WOC		
	Ret	Dis	Tot	Ret	Dis	Tot	Ret	Dis	Tot	Ret	Dis	Tot
Bocaccio	0.15	0.06	0.21	0.01	0.08	0.09	0.00	0.00	0.00	0.16	0.13	0.29
Other rockfish	3.23	6.37	9.59	25.56	40.65	66.20	0.27	2.15	2.43	29.06	49.17	78.22
POP	5.40	5.94	11.34	2.20	2.72	4.93	2.23	1.25	3.48	9.84	9.91	19.74
Thornyhead	0.01	0.23	0.24	8.20	6.77	14.97	0.00	0.00	0.00	8.21	7.00	15.21
Canary	0.17	0.10	0.26	0.20	1.07	1.27	0.01	0.06	0.08	0.38	1.23	1.61
Yellowtail	11.64	30.07	41.72	28.75	54.49	83.24	0.00	0.02	0.03	40.40	84.59	124.99
Widow	8.31	58.94	67.25	38.40	61.68	100.09	0.05	1.52	1.57	46.76	122.14	168.91
Chili-pepper	0.00	0.00	0.00	0.58	2.99	3.57	0.00	0.00	0.00	0.58	2.99	3.57
Shortbelly	0.00	0.00	0.00	26.64	0.55	27.19	0.06	0.07	0.13	26.71	0.62	27.33
TOTAL ROCKFISH	28.90	101.71	130.61	130.54	170.99	301.54	2.64	5.08	7.71	162.08	277.78	439.86
TOTAL WHITING	9,901	43	9,944	75,259	327	75,586	8,919	1	8,920	94,080	370	94,451
Rockfish /Whiting (mt/mt)	0.0131			0.0040			0.0009			0.0047		

* Joint venture 11-year average coastwide was 0.007.
Trace = less than 0.5 mt. Slight discrepancies occur due to rounding.

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

	VANCOUVER - 670	COLUMBIA - 710	EUREKA - 720*	TOTAL
Chinook (no.)	355	2,112	101	2,568
Other salmon (no.)	303	453	14	770
TOTAL salmon (no.)	658	2,565	115	3,338
Whiting (mt)	9,944.28	75,586.10	8,920.23	94,450.62
No. chinook/mt whiting	0.0357	0.0279	0.0113	0.0272
JV average 1981-90 (# all sal/mt whiting)	0.16	0.09	0.15	0.11**

* At-sea processing could occur only north of 42°; JV could operate down to 39°.
** Monterey area north of 39° rate was 0.03 salmon per mt whiting.

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

SPECIES	MOTHERSHIP					CATCHER/PROCESSOR					TOTAL WOC
	RETAIN (mt)	(%)	DISCARD (mt)	(%)	TOTAL (mt)	RETAIN (mt)	(%)	DISCARD (mt)	(%)	TOTAL (mt)	
Whiting	35658.33	100	164.68	0	35823.00	58421.93	100	205.68	0	58627.62	94450.62
Rockfish	64.17	37	109.07	63	173.24	97.91	37	168.71	63	266.62	439.86
Flatfish	0.24	16	1.29	84	1.53	23.20	79	6.04	21	29.24	30.77
*All other groundfish	1.04	8	12.31	92	13.35	55.11	56	42.88	44	97.99	111.34
TOTAL	35723.77	99	287.35	1	36011.12	58598.16	99	423.31	1	59021.47	95032.59
SALMON				%	No.				%	No.	
Chinook				73	1,721				85	847	2,568
Other				27	624				15	146	770
Total				100	2,345				100	993	3,338
No.chinook/mt whiting					0.0480					0.0144	0.0272

* does not include jack mackerel

TABLE 5. CATCH OF ROCKFISH BY NON-TRIBAL MOTHERSHIPS AND CATCHER/PROCESSORS (metric tons)

ROCKFISH SPECIES	MOTHERSHIP	CATCHER/PROCESSOR	TOTAL
Bocaccio	0.09	0.21	0.29
Other rockfish	20.48	57.74	78.22
POP	0.05	19.69	19.74
Thornyheads	0.02	15.19	15.21
Canary	0.95	0.65	1.61
Yellowtail	91.82	33.16	124.99
Widow	29.19	139.71	168.91
Chilipepper	3.34	0.22	3.57
Shortbelly	27.28	0.04	27.33
TOTAL ROCKFISH	173.24	266.62	439.86
Mt whiting	35,823.00	58,627.62	94,450.62
Mt rockfish/mt whiting	0.0048	0.0045	0.0047

Trace = less than 0.5 mt. Slight discrepancies occur due to rounding.

Table 6. 1994-2001 PACIFIC WHITING NON-TRIBAL AT-SEA PROCESSING VESSELS (NMFS Observer Data)

	COMMON NAME	WEIGHT (mt)							
		1994	1995	1996	1997	1998	1999	2000	2001
	Pacific whiting	179072.5	102158.0	112776.	121172.2	120452.1	115259.1	114655.0	94,450.6
O	Pacific cod	0.069	0.02	0.00	0.01	0.00	0.04	0.19	0.00
U	Lingcod	0.177	0.02	0.07	0.14	0.11	0.06	0.41	0.66
N	Jack mackerel	62.180	0.05	60.19	13.18	229.14			
D	Sablefish	0.598	9.17	6.57	0.81	27.83	2.10	47.13	21.50
F	Arrowtooth	2.768	1.44	0.57	0.16	1.04	3.21	8.61	3.76
L	Dover sole	0.009	0.00	0.09	0.00	0.01	0.00	0.27	1.53
A	English sole	0.044	0.00	0.01	0.00	0.00	0.02	0.22	0.10
T	Petrale sole	0.002	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F	Rex sole	0.341	0.39	0.22	0.04	0.36	0.02	5.54	18.32
I	Rock sole	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00
S	Starry flounder	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H	All other flatfish	0.253	0.01	0.00	0.05	0.01	0.01	1.32	7.05
R	Bocaccio	1.488	0.38	0.15	0.21	1.21	0.32	2.65	0.29
O	Canary rockfish	4.831	0.31	1.22	1.81	2.72	1.22	1.42	1.61
C	Chilipepper	5.856	28.17	0.00	0.01	0.01	0.54	4.83	3.57
K	Pacific oc. perch	61.557	43.79	5.99	3.28	21.28	14.15	9.61	19.74
F	Shortbelly	1.908	10.16	6.15	0.76	0.02	0.00	0.86	27.33
I	Thornyhead	0.212	5.78	1.93	0.46	2.51	0.02	19.07	15.21
S	Widow rockfish	377.171	240.53	266.57	207.21	292.76	148.95	220.62	168.91
H	Yellowtail	619.823	792.92	630.95	290.15	376.98	684.13	555.56	124.99
	Other rockfish spp	42.862	91.72	35.5	81.56	62.36	33.15	120.34	78.22
	Other groundfish 2/	106.722	211.73	98.30	217.27	218.07	254.05	92.46	89.18
	TOTAL GROUNDFISH	180,361	103,595	113,891	121,989	121,689	116,401	115,746	95,033
N	Pacific mackerel	51.889	0.00	244.34	54.15	458.78	1.47	15.52	47.29
O	Jack mackerel 3/						53.84	52.98	107.43
N	Pacific sardine	1.564	0.220	0.37	0.31	1.94	0.18	0.06	0.23

PROHIBITED SPECIES	1994	1995	1996	1997	1998	1999	2000	2001
Chinook Salmon	3,626	11,578	1,446	1,398	1,477	4,391	6,260	2,568
Other Salmon 4/	375	4,414	279	924	27	802	115	770
TOTAL SALMON	4,001	15992	1,725	2,322	1,504	5,193	6,375	3,338
Percent Chinook Salmon	*90.6*	72.4	83.8	60.2	98.2	84.6	98.2	76.9
No. Chinook/MT whiting	0.0202	0.1133	0.0128	0.0115	0.0123	0.0381	0.0546	0.0272
Pacific Halibut	54	9	42	9	7	47	211	74

1/ Defined as sharks, skates, kelp greenling, cabezon, ratfish, morids, and grenadiers.
2/ Non-groundfish species that are incidental to the whiting fishery, but which are not prohibited.
3/ Managed under Pacific Coast groundfish FMP until 1999 when it was moved to the coastal pelagic species FMP.
4/ In 1995, approximately 1,575 were pink salmon.
e = less than 0.5 mt. Slight discrepancies occur due to rounding.

2001 PACIFIC WHITING FISHERY
ALL SECTORS

Yellowtail Rockfish, Widow rockfish, Salmon, Halibut and Miscellaneous Groundfish in the Pacific Whiting Fishery 2001.

SPECIES	MOTHERSHIPS PROCESSORS						CATCHER/ PROCESSORS		SHORE-BASED PROCESSORS		TOTAL WOC	
	TRIBAL MOTHERSHIPS		NON-TRIBAL MOTHERSHIPS		All [1/] MOTHERSHIPS							
	mt	Rate	mt	Rate	mt	Rate	mt	Rate	mt	Rate	mt	Rate
Whiting Allocation [3/]	17,500		41,496		58,996		58,786		72,618		190,400.00	
WHITING	6,079.96		35,823.00		41,902.96		58,627.62		73,326.00		173,856.58	
Yellowtail Rockfish	86.98	0.0143	91.82	0.0026	178.80	0.0043	33.16	0.0006	95.86	0.0013	307.82	0.0018
Widow Rockfish	3.28	0.0005	29.19	0.0008	32.47	0.0008	139.71	0.0023	42.27	0.0006	214.45	0.0012
All other groundfish	159.72		67.11		226.83		220.98		497.64 [2/]		945.45	
TOTAL GROUNDFISH	6,329.94		36,011.12		42,341.06		59,021.47		73,961.77		175,324.30	
Percent over/under Whiting Allocation	-65%		-14%		-29%		-0%		+1%		-9%	
	Number	Rate	Number	Rate	Number	Rate	Number	Rate	Number	Rate	Number	Rate
Chinook	959	0.1577	1,721	0.0480	2,680	0.0640	847	0.0144	2,634	0.0359	6,161	0.0354
Non-Chinook (including salmon unidentified)	16		624		640		146		371		1,157	
Total Salmon	975		2,345		3,320		993		3,005		7,318	

Data sources: Catcher/processor and mothership data is total catch data (retained plus discard) from Alaska Fisheries Science Center Observer Program. Shore-based data from Oregon Department of Fish and Wildlife.

1/ Sum of tribal and non-tribal data.

2/ Other groundfish for the shore-based fishery may include some non-groundfish species

3/ Values in this column have been adjusted to reflect reapportionment of 10,000 mt from the tribal sector allocation to the commercial sectors.

PACIFIC WHITING HARVEST LEVELS FOR 2002

Situation:. At its November 2001 meeting, the Council elected to defer specifying the U.S. portion of the 2002 Pacific whiting harvest until after the U.S./Canada Pacific whiting stock was assessed this winter. A U.S./Canada Stock Assessment Review (STAR) Panel convened in Seattle on February 20-22, 2002 to review the Pacific whiting assessment and recommended its use for managing 2002 fisheries. The new Pacific whiting stock assessment and associated STAR Panel report are included as Exhibit F.2, Supplemental Attachments 2 and 3, respectively. The Groundfish Management Team (GMT) reviewed the assessment and STAR Panel report and have provided recommendations for 2002 Pacific whiting harvest levels in U.S. waters (Exhibit F.2, Supplemental Attachment 4). Council action is needed to specify the acceptable biological catch (ABC) and optimum yield (OY) for the 2002 Pacific whiting fishery.

Council Action:

1. Adopt Proposed 2002 Whiting Harvest Levels.

Reference Materials:

1. 2001 Pacific Whiting Fishery For Non-Tribal Motherships and Catcher/Processors (Exhibit F.2, Attachment 1).
2. Stock Assessment of Pacific Whiting in U.S. and Canadian Waters in 2001 (Exhibit F.2, Supplemental Attachment 2).
3. Pacific Whiting STAR Panel Meeting Report, February 20-22, 2002 (Exhibit F.2, Supplemental Attachment 3).
4. GMT Statement and Recommendation for 2002 Pacific Whiting Harvest Levels (Exhibit F.2, Supplemental Attachment 4).

Agenda Order:

a. Agendum Overview — John DeVore
b. Reports and Comments of Advisory Bodies
c. Public Comment
d. **Council Action:** Adopt Proposed 2002 Whiting Harvest Levels

Groundfish Fishery Strategic Plan (GFSP) Consistency Analysis

The GFSP supports establishing an allowable level of catch that prevents overfishing while achieving optimum yield based on best available science (Sec. II.A.2). The GFSP also supports establishing and maintaining a management process that is transparent, participatory, understandable, accessible, consistent, effective, and adaptable (Sec. II.C). The Council process of adopting harvest levels and other specifications is consistent with these GFSP principles.

PFMC
02/20/02

Exhibit F.2
Supplemental Attachment 2
March 2002

Stock Assessment of Pacific Whiting in U.S. and Canadian Waters in 2001

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V9R 5K6

February 2002

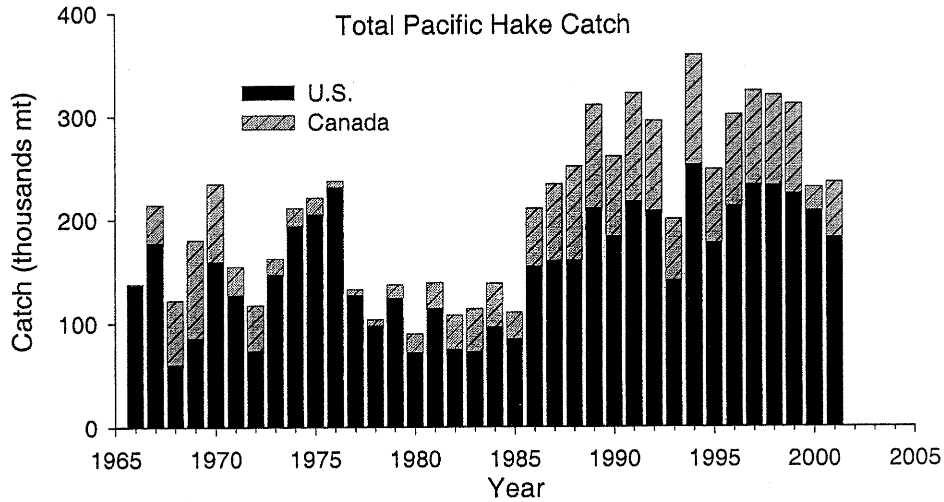
Summary of Stock Status

The coastal population of Pacific whiting (*Merluccius productus*, also called Pacific hake) was assessed using an age-structured assessment model. The U.S. and Canadian fisheries were treated as distinct fisheries in which selectivity changed over time. The primary indicator of stock abundance is the AFSC acoustic survey, and the SWFSC juvenile survey as an indicator of recruitment. Other data examined in the model were the AFSC triennial shelf trawl survey and the Department of Fisheries and Oceans acoustic survey. New data in this assessment included updated catch at age through 2001, recruitment indices from the SWFSC recruit survey, and results from the triennial acoustic and shelf trawl surveys conducted in summer of 2001.

Status of Stock: The whiting stock in 2001 was estimated to be at low biomass levels, however, projected stock biomass is expected to increase. Stock biomass increased to a historical high of 5.8 million t in 1987 due to exceptionally large 1980 and 1984 year classes, then declined as these year classes passed through the population and were replaced by more moderate year classes. Stock size stabilized briefly between 1995-1997, but has declined continuously over the past four years to its lowest point of 711 thousand t in 2001. The mature female biomass in 2001 is estimated to be 20% of an unfished stock. Mature female biomass, however, is projected to rise gradually over the next three years due to the relatively strong 1999 year-class as it enters the mature biomass of the stock. The percentage of unfished stock size depends, however, on the harvest policy chosen. For instance, under the F45% (40-10) harvest policy female spawning biomass increases to 31% (93% probability that females spawning biomass is greater than 25%B0) of an unfished stock in 2003. The exploitation rate was below 10% prior to 1993, but gradually increased to 31% by 2001. Biomass levels below 25%B0 and high exploitation rates indicate that the stock has been overfished in recent years primarily due to over-estimation of biomass in the 1998 assessment used to set optimum yield for 1999-2001. Furthermore, total U.S. and Canadian catches have exceeded the ABC by an average of 12% from 1993-1999 due to disagreement on the allocation between U.S. and Canadian fisheries.

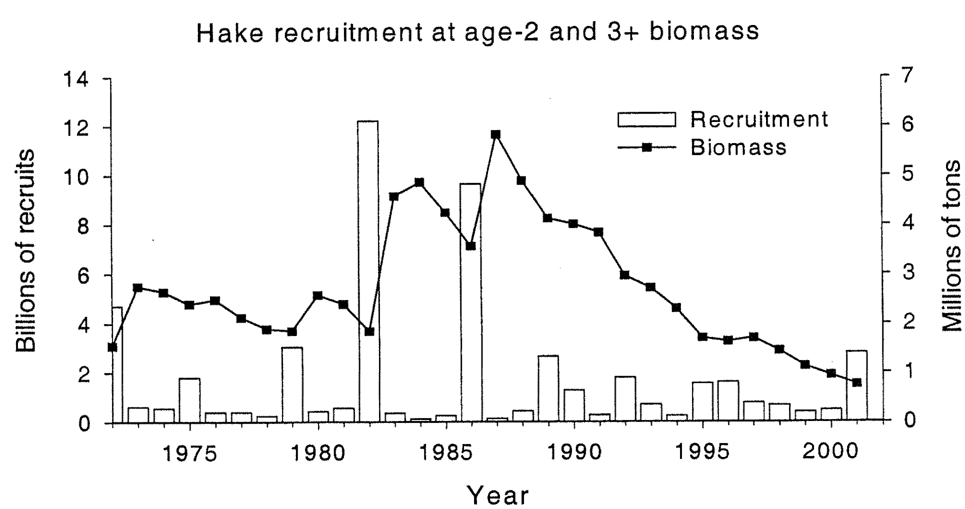
Pacific whiting (hake) catch and stock status table (catches in thousands of metric tons and biomass in millions of metric tons):

Year	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
U.S. landings	218	209	141	253	178	213	233	233	225	208	182
Canadian landings	105	86	59	106	40	88	91	87	87	22	53
Total	323	295	200	359	248	301	324	320	311	231	236
ABC	253	232	178	325	223	265	290	290	290	290	238
Age 3+ stock biomass	3.8	3.0	2.7	2.3	1.7	1.7	1.7	1.5	1.1	1.0	0.7
Female mature biomass	1.9	1.6	1.4	1.2	0.9	0.8	0.8	0.7	0.6	0.5	0.4
Exploitation rate	8.4%	10.0%	7.4%	15.6%	14.5%	18.4%	19.0%	22.1%	27.6%	24.4%	31.1%



Data and Assessment: An age-structured assessment model was developed using AD model builder by Dorn et al. (1998), a modeling environment for developing and fitting multi-parameter non-linear models. Earlier assessments of whiting used the stock synthesis program. Comparison of models showed that nearly identical results could be obtained under the same statistical assumptions. The most recent assessment presented here for 2001 used the same model structure as in the 1998 assessment and examined different model assumptions regarding the strength of recruitment in 2001.

Major Uncertainties: The whiting assessment is highly dependent on acoustic survey estimates of abundance. Since 1993, the assessment has relied primarily on an absolute biomass estimate from the AFSC acoustic survey. The acoustic target strength of Pacific whiting, used to scale acoustic data to biomass, is based on a small number of *in situ* observations. The fit to the acoustic survey time series is relatively poor in the middle years (1983-1992) but improves early on and in more recent years. The AFSC shelf trawl survey biomass shows an increasing trend until 1995, conflicting with a decreasing trend in the acoustic survey since 1986. Both the acoustic and trawl surveys, however, show consistent declining trends since 1995.



Target Fishing Mortality Rates: Target fishing mortality rates used in projections were based on F40%, the fishing mortality rate corresponding to 40% of unfished spawning stock biomass-per-recuit, with the 40-10 policy implemented when biomass falls below 40% of unfished. A Bayesian decision analysis (Dorn et al. 199) produced estimates of FMSY in the F40% to F45% range depending on the degree of risk-aversion. In addition to the F40% (40-10 option), F45% and F50% harvest policies were calculated under different assumed strengths of recruitment in 2001.

Projection table (Coastwide yield in thousands of tons, biomass in millions of tons, and percent unfished female spawning biomass) under different assumptions of recruitment strength in 2001 (low < 10%, medium 10%-90%, and high > 90%; percentiles based on 1,000,000 Markov chain Monte Carlo simulations) and different harvest policies:

Assumed 2001		Coastwide yield			3+ Biomass			Percent unfished biomass		
Recruitment	Harvest policy	2002	2003	2004	2002	2003	2004	2002	2003	2004
Low (2.11 bil.)	F40% (40-10)	117	166	189	1.02	1.11	1.10	0.20	0.27	0.31
	F45%	96	141	166	1.02	1.13	1.15	0.20	0.28	0.32
	F50%	79	120	120	1.02	1.15	1.19	0.20	0.28	0.32
Med. (2.89 bil.)	F40% (40-10)	162	228	228	1.26	1.33	1.26	0.24	0.32	0.34
	F45%	133	185	201	1.26	1.37	1.32	0.24	0.33	0.35
	F50%	109	158	176	1.26	1.39	1.37	0.24	0.33	0.36
High (3.87 bil.)	F40% (40-10)	219	284	282	1.57	1.63	1.45	0.29	0.38	0.38
	F45%	180	242	250	1.57	1.67	1.53	0.29	0.39	0.39
	F50%	149	206	220	1.57	1.71	1.60	0.29	0.40	0.41

Other considerations: Unusual juvenile and adult distribution patterns have been seen in Pacific whiting population in recent years. Juvenile settlement spread northwards during 1994-99 due to El Niño ocean conditions. This was evident as numerous age-1 fish (1997 year class) seen in the 1998 acoustic survey off Queen Charlotte Islands as well as increased numbers of age-2 and age-3 whiting taken in the Canadian fishery in 1994 and 2000, respectively. Equally dramatic was the low occurrence of whiting off Canada in 2000 and 2001 resulting in less than full utilization of their TAC. This shift appears correlated with La Niña conditions in 1999-2000. It is unclear whether these changes will be a benefit or a detriment to stock productivity and stability. Despite the inconsistency in trends in biomass between the acoustic and trawl surveys, recent years (since 1995) have shown similar declines in whiting abundance. Possible strong recruitment in 2001 (1999 year class) along with substantial increases in mean weights at age due to favorable ocean conditions may prove to be positive factors in expected increases in yield and biomass in 2003-2004. However, projections of stock biomass and yields are highly dependent on the relative strength of recruitment in 2001.

INTRODUCTION

This assessment has been developed by U.S. and Canadian scientists through the Pacific hake working group of the Technical Sub-Committee (TSC) of the Canada-U.S. Groundfish Committee. Prior to 1997, separate Canadian and U.S. assessments were submitted to each nation's assessment review process. In the past, this has resulted in differing yield options being forwarded to managers. Multiple interpretations of stock status made it difficult to coordinate overall management policy for this trans-boundary stock. To address this problem, the working group agreed in 1997 to present scientific advice in a single assessment. To further coordinate scientific advice, this report was submitted to a joint Canada-U.S. technical review that satisfied the requirements of both the U.S. Pacific Fisheries Management Council (PFMC) and the Canadian Pacific Stock Assessment Review Committee (PSARC). The Review Group meeting was held in Seattle, WA at the Northwest Fisheries Science Center, during Feb 20-22, 2002. While this report forms the basis for scientific advice to managers, final advice on appropriate yield will be provided to Canadian DFO managers by the PSARC Groundfish Sub-committee and the PSARC Steering Committee, and to the U.S. Pacific Fisheries Management Council by the Groundfish Management Team.

Stock Structure and Life History

Pacific whiting (*Merluccius productus*), also called Pacific hake, is a codlike species distributed off the west coast of North America from 25° N. to 51° N. lat. It is among 11 other species of hakes from the genus, *Mercuccidae*, which are distributed in both hemispheres of the Atlantic and Pacific Oceans and constitute nearly two millions t of catches annually (Alheit and Pitcher 1995). The coastal stock of Pacific whiting is currently the most abundant groundfish population in the California current system. Smaller populations of whiting occur in the major inlets of the north Pacific Ocean, including the Strait of Georgia, Puget Sound, and the Gulf of California. Electrophoretic studies indicate that Strait of Georgia and the Puget Sound populations are genetically distinct from the coastal population (Utter 1971). Genetic differences have also been found between the coastal population and whiting off the west coast of Baja California (Vrooman and Paloma, 1977). The coastal stock is distinguished from the inshore populations by larger body size, seasonal migratory behavior, and a pattern of low median recruitment punctuated by extremely large year classes.

The coastal stock typically ranges from southern California to Queen Charlotte Sound. Spawning occurs off south-central California during January-March. Due to the difficulty of locating major spawning concentrations, spawning behavior of whiting remains poorly understood (Saunders and McFarlane, 1997). In spring, adult Pacific whiting migrate onshore and to the north to feed along the continental shelf and slope from northern California to Vancouver Island. In summer, whiting form extensive midwater aggregations near the continental shelf break, with highest densities located over bottom depths of 200-300 m (Dorn et al. 1994). The prey of whiting include euphausiids, pandalid shrimp, and pelagic schooling fish (such as eulachon and herring) (Livingston and Bailey, 1985). Larger whiting become increasingly piscivorous, and herring are large component of whiting diet off Vancouver Island. Although whiting are cannibalistic, the geographic separation of juveniles and adults usually prevents cannibalism from being an important factor in their population dynamics (Buckley and Livingston, 1997).

Older (age 5+), larger, and predominantly female whiting migrate into the Canadian zone. During El Niños, a larger proportion of the stock migrates into Canadian waters, apparently due to intensified northward transport during the period of active migration (Dorn 1995). Range extensions to the north also occur during El Niños, as evidenced by reports of whiting from S.E. Alaska during warm water years. During the warm period experienced in 1990s, there have been changes in typical patterns of distribution. Spawning activity has been recorded north of California, and frequent reports of unusual numbers of juveniles from Oregon to British Columbia suggest that juvenile settlement patterns have also shifted northwards in the late 1990s. Because of this, juveniles may be subjected to increased predation from cannibalism and to increased vulnerability to fishing mortality. Subsequently, La Niña conditions apparently caused a southward shift in the center of the stock's distribution and a smaller portion was found in Canadian water in the 2001 survey.

Fisheries

The fishery for the coastal population of Pacific whiting occurs primarily during April-November along the coasts of northern California, Oregon, Washington, and British Columbia. The fishery is conducted almost exclusively with midwater trawls. Most fishing activity occurs over bottom depths of 100-500 m, but offshore extensions of fishing activity have occurred. The history of the coastal whiting fishery is characterized by rapid changes brought about by the development of foreign fisheries in 1966, joint-venture fisheries in the early 1980's, and domestic fisheries in 1990's (Fig. 1).

Large-scale harvesting of Pacific whiting in the U.S. zone began in 1966 when factory trawlers from the former Soviet Union began targeting on Pacific whiting. During the mid 1970's, the factory trawlers from Poland, Federal Republic of Germany, the former German Democratic Republic and Bulgaria also participated in the fishery. During 1966-1979, the catch in U.S. waters averaged 137,000 t per year (Table 1). A joint-venture fishery was initiated in 1978 between two U.S. trawlers and Soviet factory trawlers acting as motherships. By 1982, the joint-venture catch surpassed the foreign catch. In the late 1980's, joint-ventures involved fishing companies from Poland, Japan, former Soviet Union, Republic of Korea and the People's Republic of China. In 1989, the U.S. fleet capacity had grown to a level sufficient to harvest entire quota, and no foreign fishing was allowed.

Historically, the foreign and joint-venture fisheries produced fillets and headed and gutted products. In 1989, Japanese motherships began producing surimi from Pacific whiting, using a newly developed process to inhibit myxozoan-induced proteolysis. In 1990, domestic catcher-processors and motherships entered the Pacific whiting fishery in the U.S. zone. Previously, these vessels had engaged primarily in Alaskan pollock fisheries. The development of surimi production techniques made Pacific whiting a viable alternative. In 1991, joint-venture fishery for Pacific whiting ended because of the high level of participation by domestic catcher-processors and motherships, and the growth of shore-based processing capacity. Shore-based processors of Pacific whiting had been constrained historically by a limited domestic market for Pacific whiting fillets and headed and gutted products. The construction of surimi plants in Newport and Astoria led to a rapid expansion of shore-based landings in the early 1990's.

The Pacific whiting fishery in Canada exhibits a similar pattern, although phasing out of the foreign and joint-venture fisheries has lagged a few years relative to the U.S. experience. Since 1968, more Pacific whiting have been landed than any other species in the groundfish fishery on Canada's west coast (Table 1). Prior to 1977, the former Soviet Union caught the majority of whiting in the Canadian zone, with Poland and Japan harvesting much smaller amounts. Since declaration of the 200-mile extended fishing zone in 1977, the Canadian fishery has been divided into shore-based, joint-venture, and foreign fisheries. In 1990, the foreign fishery was phased out. Since the demand of Canadian shore-based processors remains below the available yield, the joint-venture fishery will continue through 2002. Poland is the only country that participated in the 1998 joint-venture fishery. The majority of the shore-based landings of the coastal whiting stock are processed into surimi, fillets, or mince by processing plants at Ucluelet, Port Alberni, and Delta. Small deliveries were made in 1998 to plants in Washington and Oregon. Although significant aggregations of whiting are found as far north as Queen Charlotte Sound, in most years the fishery has been concentrated below 49° N lat. off the south coast of Vancouver Island, where there are sufficient quantities of fish in proximity to processing plants.

Management of Pacific whiting

Since implementation of the Fisheries Conservation and Management Act in the U.S. and the declaration of a 200 mile fishery conservation zone in Canada in the late 1970's, annual quotas have been the primary management tool used to limit the catch of Pacific whiting in both zones by foreign and domestic fisheries. The scientists from both countries have collaborated through the TSC, and there has been informal agreement on the adoption of an annual fishing policy. However, overall management performance has been hampered by a long-standing disagreement between the U.S. and Canada on the division of the acceptable biological catch (ABC) between U.S. and Canadian fisheries. In 1991-1992, U.S. and Canadian managers set quotas that summed to 128% of the ABC, while in 1993-1999, the combined quotas were 108% of the ABC on average. The 2000 and 2001 fishing year were somewhat different from years past in that the ABC of Pacific whiting was not fully utilized.

United States

Prior to 1989, catches in the U.S. zone were substantially below the harvest guideline, but since 1989 the entire harvest guideline has been caught with the exception of 2000 and 2001 which were 90% and 95% of the quota, respectively. The total U.S. catch has not significantly exceeded the harvest guideline for the U.S. zone (Table 2), indicating that in-season management procedures have been very effective.

In the U.S. zone, participants in the directed fishery are required to use pelagic trawls with a codend mesh that is at least 7.5 cm (3 inches). Regulations also restrict the area and season of fishing to reduce the bycatch of chinook salmon. At-sea processing and night fishing (midnight to one hour after official sunrise) are prohibited south of 42° N lat. Fishing is prohibited in the Klamath and Columbia

River Conservation zones, and a trip limit of 10,000 pounds is established for whiting caught inside the 100-fathom contour in the Eureka INPFC area. During 1992-95, the U.S. fishery opened on April 15, however in 1996 the opening date was moved to May 15. Shore-based fishing is allowed after April 1 south of 42° N. lat. But is limited to 5% of the shore-based allocation being taken prior to the opening of the main shore-based fishery. The main shore-based fishery opens on June 15. Prior to 1997, at-sea processing was prohibited by regulation when 60 percent of the harvest guideline was reached. A new allocation agreement, effective in 1997, divided the U.S. non-tribal harvest guideline between factory trawlers (34%) , vessels delivering to at-sea processors (24%), and vessels delivering to shore-based processing plants (42%).

Shortly after this allocation agreement was approved by the PFMC, fishing companies with factory trawler permits established the Pacific Whiting Conservation Cooperative (PWCC). The primary role of the PWCC is to allocate the factor trawler quota between its members. Anticipated benefits of the PWCC include more efficient allocation of resources by fishing companies, improvements in processing efficiency and product quality, and a reduction in waste and bycatch rates relative to the former "derby" fishery in which all vessels competed for a fleet-wide quota. The PWCC also conducts research to support whiting stock assessment. As part of this effort, PWCC sponsored a juvenile recruit survey in summer of 1998 and 2001 in collaboration with NMFS scientists.

Canada

The Canadian Department of Fisheries and Oceans (DFO) is responsible for managing the Canadian whiting fishery. Prior to 1987, the quota was not reached due to low demand for whiting. In subsequent years the quota has been fully subscribed, and total catch has been successfully restricted to ±5% of the quota (Table 2).

Domestic requirements are given priority in allocating yield between domestic and joint-venture fisheries. During the season, progress towards the domestic allocation is monitored and any anticipated surplus is re-allocated to the joint-venture fishery. The Hake Consortium of British Columbia coordinates the day-to-day fleet operations within the joint-venture fishery. Through 1996, the Consortium split the available yield equally among participants or pools of participants. In 1997, Individual Vessel Quotas (IVQ) were implemented for the British Columbia trawl fleet. IVQs of Pacific whiting were allotted to licence holders based on a combination of vessel size and landing history. Vessels are allocated proportions of the domestic or joint-venture whiting quota. There is no direct allocation to individual shoreside processors. Licence holders declare the proportion of their whiting quota that will be landed in the domestic market, and shoreside processors must secure catch from vessel licence holders.

Overview of Recent Fishery and Management

United States

In 1998, the GMT recommended a status quo ABC of 290,000 t for 1998 (i.e. the same as 1997). The ABC recommendation was based on a decision table with alternative recruitment scenarios for the

1994 year class, which was again considered a major source of uncertainty in current stock status. Recommendations were based on the moderate risk harvest strategy. The PFMC adopted the recommended ABC and allocated 80 percent of the ABC (232,000 t) to U.S. fisheries.

The GMT recommended a status quo ABC of 290,000 t for 1999 and 2000. This coastwide ABC was roughly the average coastwide yield of 301,000 t and 275,000 t projected for 1999 and 2000, respectively based on F40% (40-10 option) harvest policy.

In 2000, a Pacific whiting assessment update was performed by Helser et al. (2001). While additional catch and age composition data were available at the time of the assessment, the 2001 coastwide acoustic survey which serves as the primary index of whiting abundance was not. Using the same configuration with the updated fishery composition data and recruitment indices the assessment model showed consistent projections with the 1998 assessment. Based on this, the GMT recommend that the allowable harvest in 2001 be set to the projected yield of 238,000 t based on the F40% (40-10 option) harvest policy.

Landings of the at-sea fishery constituted roughly 54% of the total U.S. fishery catches since 1999. Significant distributional shifts in the Pacific whiting population has cause major fluctuations in the center of the at-sea harvesting sector. Fishing in 1999 by the at-sea fleet was mostly distributed North of the Columbia River (Fig. 2); roughly 91% of the at-sea catches. In 2000, the at sea catches returned to more normal spatial distribution patterns with roughly 60% occurring north and 40% occurring south of the Columbia River. In 2001, the pattern of the at-sea catches were opposite of those seen in 1999 with only roughly 22% north of the Columbia River. In 2001, the at-sea catch of whiting was 102,100 t, with Motherships harvesting 24% (39,096 t) while the catcher/processor sector harvesting 34% (55,389 t) of the whiting allocation.

The total shore-based U.S. landings in 2001 were 73,474 t. The primary ports harvesting Pacific whiting were Newport, Oregon (31,370 t), Astoria, Oregon (19,000 t), Washington coastal ports (Westport and Illwaco) (16,062 t) , and Crescent City, California (2,007 t). The landings from Astoria, Oregon were down roughly 50% from 2000 when landings were 12,140 t. In aggregate, these ports accounted for more than 99% of all shore-based whiting landings. The shore-based fishery in Newport and Astoria began in June and continued to October when the harvest guideline was attained. In Crescent City, landings began in April and continued to August.

Since 1996, the Makah Indian Tribe has conducted a separate fishing in its" Usual and Accustomed Fishing Area." The tribal fishery was allocated 15,000 t of whiting in 1996; 25,000 t in each of 1997 and 1998; 32,500 t in each of 1999 and 2002; and 27,500 t in 2001. The tribal harvest essentially all of its allocated catch between 1996-1999, however, in 2000 and 2001 the Makah Tribe only harvested 6,500 t and 6,774 t, respectively.

Canada

DFO managers allow a 15% discrepancy between the quota and total catch. The quota may be exceeded by up to 15%, which is then taken off the quota for the subsequent year. If less than the quota is taken, up to 15% can be carried over into the next year. For instance, the overage in 1998 (Table 2) is due to carry-over from 1997 when 9% of the quota was not taken. Between 1999-2001 the PSARC groundfish subcommittee recommended to DFO managers yields based on F40% (40-10) option and Canadian managers adopted allowable catches prescribed at 30% of the coastwide ABC (Table 14; Dorn et al. 1999).

The all-nation catch in the Canadian zone was 53,253 t in 2001, up from only 22,257 t in 2000 (Table 1). In 2000, the shore-based landings in the Canadian zone hit a record low since 1990 due to a decrease in availability. Catches in 2001 increased substantially over those of 2000 for both the JV and shore-based sectors over catches in 2000, but were still below recommended TAC.

ASSESSMENT

Modeling Approaches

Age-structured assessment models have been used to assess Pacific whiting since the early 1980's. Modeling approaches have evolved as new analytical techniques have been developed. Initially, a cohort analysis tuned to fishery CPUE was used (Francis et al. 1982). Later, the cohort analysis was tuned to NMFS triennial survey estimates of absolute abundance at age (Hollowed et al. 1988a). Since 1989, a stock synthesis model that utilizes fishery catch-at-age data and survey estimates of population biomass and age composition has been the primary assessment method (Dorn and Methot, 1991). Dorn et al. (1999) converted the age-structured stock synthesis Pacific whiting model to an age-structured model using AD model builder (Fournier 1996). The conversion from stock synthesis to AD model builder consisted of programming the population dynamics and likelihood equations in the model implementation language (a superset of C++). In that assessment, Dorn et al. (1999) provided model validation using a side-by-side comparison of model results between stock synthesis and ADMB, and then extended the approach to take advantage of AD model builder's post-convergence routines to calculate standard errors (or likelihood profiles) for any quantity of interest, allowing for a unified approach to the treatment of uncertainty in estimation and forward projection. The assessment presented here employs the same AD model builder modeling framework.

Data Sources

The data used in the stock assessment model (SAM) included:

- Total catch from the U.S. and Canadian fisheries (1972-2001).
- Catch at age from the U.S. (1973-2001) and Canadian fisheries (1977-2000).

- Biomass and age composition from AFSC acoustic/midwater trawl surveys (1977, 1980, 1983, 1986, 1989, 1992, 1995, 1998, 2001).

- Biomass and age composition from the AFSC bottom trawl surveys (1977, 1980, 1983, 1986, 1989, 1992, 1995, 1998, 2001)

- Biomass and age composition from the DFO acoustic surveys of Pacific whiting (1990-96).

- Indices of young-of-the-year abundance from the SWFSC Tiburon laboratory larval rockfish surveys (1986-2001). In this assessment, Tiburon indices of young -of-the-year was used as an age-2 tuning index for stock reconstruction and for future projections.

The model also uses biological parameters to characterize the life history of whiting. These parameters are used in the model to estimate spawning and population biomass, and obtain predictions of fishery and survey biomass from the parameters estimated by the model:

- Proportion mature at age.

- Weight at age and year by fishery and by survey

- Natural mortality (*M*)

Total catch

Table 1 gives the catch of Pacific whiting for 1966-2001 by nation and fishery. Catches in U.S. waters for 1966-1980 are from Bailey et al. (1982). Prior to 1977, the at-sea catch was reported by foreign nationals without independent verification by observers. Bailey et al. (1982) suggest that the catch from 1968 to 1976 may have been under-reported because the apparent catch per vessel-day for the foreign feet increased after observers were placed on foreign vessels in the late 1970's. For 1981-2001, the shore-based landings are from Pacific Fishery Information Network (PacFIN). Foreign and joint-venture catches for 1981-1990, and domestic at-sea catches for 1991-2001 are estimated by the North Pacific Groundfish Observer Program (NPGOP).

At-sea discards are included in the foreign, joint-venture, at-sea domestic catches in the U.S. zone. Discards have not been included in the shore-based fishery. The majority of vessels in the U.S. shore-based fishery operate under experimental fishing permits that require them to retain all catch and bycatch for sampling by plant observers. Canadian joint-venture catches are monitored by at-sea observers, which are placed on all processing vessels. Observers use volume/density methods to estimate total catch. Domestic Canadian landings are recorded by dockside monitors using total catch weights provided by processing plants.

Fishery age composition

Catch at age for the foreign fishery in the U.S. zone during 1973-1975 is given in Francis and Hollowed (1985), and was reported by Polish and Soviet scientists at bilateral meetings. Estimates of catch at age for the U.S. zone foreign and joint-venture fisheries in 1976-1990, and the at-sea domestic fishery in 1991-2001, were derived from length-frequency samples and length-stratified otolith samples collected by observers. Sample size information is provided in Table 3. In general, strata were defined by the combination of three seasonal time periods and three geographic areas. Methods and sample sizes by strata are given in Dorn (1991, 1992). During 1992-2001, at-sea catch was generally restricted to between May and August in the early part of the year (April-June) north of 42° N. lat., so only two spatial strata were used (north and south of Cape Falcon, 45° 46′ N. lat.), and no seasonal strata were defined. The Makah fishery (1996-2001) was defined as a separate strata because of its restricted geographic limits and different seasons.

Biological samples from the shore-based fishery were collected by port samplers at Newport, Astoria, Crescent City, and Westport from 1997-2001. A stratified random sampling design is used to estimate the age composition of the landed catch (sample size information provided in Table 3). Shore-based strata are defined on the basis of port of landing. In 1997 and 2001, four strata defined 1) northern California (Eureka and Crescent City), 2) southern Oregon (Newport and Coos Bay), and 3) northern Oregon (Astoria and Warrenton), and Washington coastal ports (Illwaco and Westport). No seasonal strata have been used for the shore-based fishery; however, port samplers are instructed to distribute their otolith samples evenly throughout the fishing season.

Biological samples from the Canadian joint-venture fishery were collected by fisheries observers, placed on all foreign processing vessels in 1997-2001. Shore-based Canadian landings are sampled by port samplers. The Canadian catch at age is estimated from random otoliths samples.

Figure 3 shows the estimated age composition for the shore-based fishery by port in U.S. zone from 1999-2001. The shore-based age compositions show both temporal and spatial variation. For instance, in 1999 between 40% and 80% of the catch in each port was composed of age-3 and age-4 fish. The age-3 fish were numerically dominant in all ports during 1999, however, age-4 fish become abundant in the more northerly ports such as Astoria and Washington coastal port landings. In 2000, age-6 generally dominated the age composition in the shore-based landings. Greater numbers of older fish (> age-8) were observed in 2000, particularly in Crescent City and Newport. In 2001, age-2 and age-3 fish were abundant in Crescent City and Newport. Again, older fish were generally observed in the landings of more northerly ports. The age and size composition in Newport during 1994-2001 show the recruitment of 1993 and 1994 year classes to the fishery (Fig. 4). It is interesting to note that not since the 1994 year class has significant numbers of age-2 fish been observed in Newport landings. In 1998, the mean size of fish was lower (40.6 cm) than in previous years, and the age composition indicated that two previously unobserved year classes, the 1995 year class (age-3) and the 1996 year class (age-2) composed 46% of the catch. The presence of these year classes in the Newport landings may be partly due to northward shifts in distribution brought about by El Niño conditions during 1997 and 1998. It is also interesting to note that in 2000 and 2001 mean weights at age in the shore-based fishery showed a substantial increase over those observed in 1998-1999.

Table 4 (Figs. 5-6) gives the estimated U.S. fishery (1973-2001) and Canadian fishery catch at age (1977-2001). The U.S. fishery catch at age was compiled from the NORPAC database maintained by the North Pacific Groundfish Observer Program, and from an additional database of shore-based biological sampling maintained by the Marine Assessment and Resource Ecology Task at AFSC. The Canadian catch at age for 1997-2000 was compiled from a database at the Pacific Biological Station.

Since aging Pacific whiting was transferred to the Northwest Fisheries Science Center an effort was made to cross-calibrate age reader agreement. Cross-calibration was performed on a total of 29 otoliths from the 2001 acoustic survey between Alaska Fisheries Science Center (AFSC), the Northwest Fisheries Science Center (NWFSC), and Department of Fisheries and Oceans (DFO). Overall agreement between AFSC/NWFSC and between NWFSC/DFO was 48% and 45%, respectively. For ages assigned that were aged within one year the agreement was 76% and 83% between AFSC/NWFSC and between NWFSC/DFO, respectively. As would be expected, agreement between the three labs was better for younger fish than for older fish. These cross-calibration results were somewhat poorer than previous comparisons between AFSC and DFO in 1998; overall agreement was 73% while 90% agreed to with in one year. It should be noted, however, that agreement between two age readers at NWFSC was closer to 80%. Agreement for ages 2-4 and ages 5-10 was 69% and 36%, respectively, with identical values for both the AFSC/NWFSC and NWFSC/DFO comparisons. Also, when ages did not agree between the three labs agers at the NWFSC tended to assign older ages than both the AFSC and DFO. Additional comparisons are needed to further calibrate ageing criteria between agencies.

AFSC Triennial Acoustic Survey (Biomass and Age Composition)

The Alaska Fisheries Science Center has conducted an echo-integration trawl (EIT) survey along the US and Canadian west coasts on a triennial basis since 1977 (Wilson and Guttormsen 1997). Since 1995, the coastwide acoustic survey was conducted cooperatively by AFSC and DFO. However, we refer to this survey as the AFSC survey to distinguish it from the annual DFO survey, which covers only the Canadian zone. This survey is specifically designed to estimate the distribution and abundance of Pacific whiting. The AFSC surveys follow a standard procedure in which echo integration data are collected as the vessel runs a series of transects, laid out to adequately cover the entire geographical range of the target species. Mid-water trawls are also conducted during the survey to identify the species composition of the echo sign, and to provide the biological information needed to estimate whiting abundance.

In 1996, research on whiting acoustic target strength (Traynor 1996) resulted in a new target strength model of TS = 20 log L - 68. Target strength (TS) is a measure of the acoustic reflectivity of the fish and is necessary to scale relative acoustic estimates of fish abundance to absolute estimates of abundance. Biomass estimates for the 1977-89 acoustic surveys were re-estimated using the new target strength. To correct for the limited geographic coverage of these earlier surveys, deep water and northern expansion factors were also used to adjust the total acoustic backscatter (Dorn 1996). The revised acoustic time series averages 31% higher than the original time series for 1977-89, indicating that the decrease in biomass due to the change in target strength is more than offset by the increase due to the northern and deep water expansion factors. Biomass and age composition for the 1992 and 1995 surveys at TS = 20 log L - 68 are given in Wilson and Guttormsen (1997). Because of their dependence on the deep water and northern expansion factors, the 1977-89 biomass estimates were assumed to be more uncertain (CV = 0.5) than the 1992-2001 biomass estimates (CV = 0.1). Age composition and biomass for the AFSC acoustic survey are given in Table 5.

The most recent surveys were cooperative efforts between AFSC and DFO, and was carried out from July 6 to August 27, 1998, and from June 15 to August 21, 2001, by the NOAA ship *Miller Freeman* and the DFO ship *W. E. Ricker.* The area surveyed by the *Miller Freeman* extended from Monterey Bay (36°30' N. lat.) to Queen Charlotte Sound (51° 45' N. lat.). The *W. E. Ricker* carried out simultaneous survey operations to the north of the area surveyed by the *Miller Freeman.*

In 2001, aggregations of Pacific whiting showed a marked contrast relative to the previous 1998 acoustic survey. In 1998, major aggregations were observed off Oregon between Cape Blanco and Coos Bay; near the US-Canada border, between northern Vancouver Island and southern Queen Charlotte Sound, and to lesser extent along the west side of the Queen Charlotte Islands, northern Hecate Strait, and Dixon Entrance. Whiting were found as far north as 58° N. lat. in the Gulf of Alaska. There was also a large northward shift in the distribution of biomass compared to previous surveys. In contrast, most of the biomass of whiting in the 2001 acoustic survey was distributed south of Newport, Oregon (Fig 7). Aggregations of whiting in the 2001 acoustic survey were observed off northern California between Cape Mendocino and San Francisco Bay and off southern Oregon near Cape Blanco. The most notable differences between the 1998 and 2001 survey was the presence of whiting aggregations south of Cape Blanco and the absence of whiting off the Washington coast in the 2001 survey.

The 1995 and 2001 acoustic survey were similar in that 80% and 86%, respectively, of the total whiting biomass occurred south of 47°30'N (i.e., Monterey, Eureka, and Columbia INPFC areas). In contrast, only 35% of the total biomass in 1998 was observed south of 47°30'N. The biomass in Canadian waters in 1998 was nearly triple the level reported in 1995. In 2001, age 3+ whiting biomass was split 80/20 between the U.S. and Canadian zone.

The 1998 survey results indicate a moderate decline of about 15% in whiting biomass relative to the previous coastwide survey in 1995, however the 2001 acoustic survey dropped 62% relative to the 1998 survey.

AFSC Triennial Shelf Trawl Survey (Biomass and Age Composition)

The Alaska Fisheries Science Center has conducted a triennial bottom trawl survey along the west coast of North America since 1977 (Wilkins et al. 1998). This is a multi-purpose survey designed to monitor the abundance and distribution of a variety of groundfish stocks off the Pacific coast between southern California and southern British Columbia. Data are collected from each haul on the weight and number of each species caught, length distributions of commercially important species, and biological data providing information on age, maturity stage, length-weight relationships, and feeding habits. Biomass and population number estimates are calculated from bottom trawl CPUE using area-swept calculations. Changes in depth and latitudinal coverage from survey to survey affect whether an area-swept biomass estimate can be considered index of abundance. The initial trawl survey in 1977 extended inshore to only 91 m, rather than to 55 m as in all subsequent years. The deeper limit of the survey has been 366 m in most years (1980-1992), but extended to 475 m in 1977 and to 500 m since 1995. The trawl survey did not extend into Canadian waters in 1977 and 1986. The biomass estimates for 1977 and 1986 were adjusted as described in Dorn et al. (1991) to make them comparable to the other surveys, which extended north to 49° 30′N lat. The presence of significant densities of whiting both offshore and to the north of the area covered by the trawl survey limits the usefulness of this survey to assess the whiting population.

The most recent survey was carried out from June 8 to August 25, 2001, from Point Conception (34°30′ N. lat.) to the middle of Vancouver Island (49°30′ N. lat.) aboard two chartered commercial trawlers. The vessels were equipped with the RACE Division's standardized high-opening Noreastern bottom trawls, constructed of polyethylene mesh and equipped with 35-cm bobbin roller gear. Pacific whiting were caught at 436 of the 511 successfully sampled stations. Catch rates of whiting were highest in the Columbia and Monterey INPFC areas followed by Eureka, Vancouver and Conception, and catch rates over the entire survey area increased with depth. Figures 8-10 show the distribution of whiting CPUE by size ranges that correspond to age-1, age-2, and age-3+ fish. Since otoliths taken in the trawl survey had not been aged in time for this assessment, an acoustic survey age-length key was developed by INPFC area and applied to the trawl length frequency data to derive age compositions. Age-1 fish, which are not usually detected by the bottom trawl survey, were most prominent in the southernmost hauls in areas near Cape Blanco, north of San Francisco Bay, often in relatively deep hauls. Age-2 whiting were notably abundant in the shallower hauls between San Francisco Bay and Cape Mendocino, between Cape Mendocino and Cape Blanco, and also just north of Point Conception. Age-3+ Pacific whiting occurred in hauls through out the survey area, but in particularly large concentrations off the Oregon coast. It was interesting to note that while the acoustic survey showed a paucity of whiting off the Washington coast age-3+ fish were present in the trawl survey.

Biomass and population numbers within the survey area were estimated to be 383 thousand tons and 1.64 billion fish, respectively, in 2001. This represents a decline of about 33% (497 thousand tons) in biomass and 18% (1.98 billions fish) in numbers from the 1998 survey.

Age composition estimates for the AFSC trawl surveys are given in Table 6, and comparisons between the acoustic and trawl surveys age compositions since 1977 are shown in Figure 11. It is interesting that the acoustic and trawl surveys show similar age compositions over time. In particular, the 1980 and 1984 year classes, the two largest estimated in previous assessments, are evident in both surveys. Also, in the most recent 2001 age compositions age-2 fish appear to be dominant in both the acoustic and trawl surveys. Not since the 1984 year class has the relative dominance of age-2 fish occurred in both surveys, and may represent a strong year class.

DFO Acoustic Survey (Biomass and Age Composition)

The Department of Fisheries and Oceans has conducted an annual acoustic survey of whiting in the Canadian zone since 1990. These surveys occur in August, when the whiting population is thought to be at the northern limit of its annual migration cycle. The objective of the DFO acoustic survey is to estimate the total biomass of whiting in the Canadian zone; however, in some years time constraints have prevented the survey from extending to the northern limit of the stock. In the triennial survey years of 1995 and 1998, surveying operations were coordinated between AFSC and DFO, and a single biomass estimate was produced for the Canadian zone. In 1995, this biomass estimate is used as part of the DFO survey series as well as being included as part of the AFSC total acoustic biomass. Since the fraction of the population migrating into the Canadian zone during the summer can vary substantially from one year to the next, this survey has limited usefulness for monitoring population-wide trends in biomass. Estimated biomass and age composition at a target strength of -35 dB/kg (the DFO survey biomass estimates have not been updated for a target strength of TS = 20 log L - 68) is given in Table 7.

Comparison of Survey Trends

Pacific whiting biomass trends from these surveys show different patterns (Fig. 18). The biomass from the AFSC acoustic survey shows an increase to 1986, followed by a declining trend between 1992 and 2001. The AFSC shelf trawl survey trend is generally upwards through 1995, then shows a declining trend consistent with the acoustic survey. The DFO acoustic survey shows a large increase during the 1992 El Niño, followed by a rapid decline. The AFSC acoustic survey, because of its greater latitudinal and depth coverage, should be considered the most reliable index of abundance, particularly since 1992. The area-swept biomass estimated by the trawl survey is less than 50% of the acoustic biomass estimate, suggesting that catchability is low for this survey. Consequently, relatively small changes in the availability of fish to the trawl survey, as would occur, for example, with an onshore shift in distribution, could significantly affect the catchability. Changes in availability are even more of a problem with the DFO acoustic survey, where the El Niño signal overpowers any information on the trend in total abundance.

SWFSC Midwater Trawl Recruit Survey

The SWFSC has conducted annual surveys since 1983 to estimate the relative abundance of pelagic juvenile rockfish off central California. Although not specifically designed to sample juvenile whiting, young-of-the-year juvenile whiting occur frequently in the midwater trawl catches. In this assessment as in the previous 1998 assessment the index is used to project the relative strength of recruitment (Table 8, fig 13). This index was obtained using from a generalized linear model (GLM) fit to the log-transformed CPUEs (Ralston et al. 1998; Sakuma and Ralston 1996). Specifically, the year effect from the GLM was back-transformed to obtain an index of abundance. Only the Monterey outside stratum was used because of its higher correlation with whiting recruitment. Also, Dorn et al. (1999) showed that the juvenile index was significantly correlated to the predicted recruitment two years later in the stock assessment model. The index in 1999 suggests that recruitment in 2001 may be above average.

PWCC midwater trawl survey

In 1998 and again in 2001, the PWCC conducted a midwater trawl survey from Point Conception (34°30′ N. lat.) to Bodega Bay (38°30′ N. lat.) aboard a chartered commercial trawler during July 8-28 (Wespestad and Shimada 1998). The purpose of the survey was to assess the feasibility of surveying prerecruit Pacific whiting with midwater trawling. In these surveys, a midwater trawl with an 86' headrope and 1/2" codend with a 1/4" liner was fished at night at a 30 m depth. Trawls sets of 15 minutes duration at target depth were conducted along transects located at 30 nm intervals along the coast. Stations were located along each transect from 50m bottom depth seaward to 700 m. with hauls taken over bottom depths of 50, 100, 200, 300, and 500 meters at each transect. Following the surveys, the chartered vessel also towed on low density acoustic targets as directed by the Field Party Chief on the AFSC acoustic survey vessel Information on the species composition of different acoustic targets assists in determining whether or not the echo returns from those targets should be included in the whiting biomass estimate.

The initial survey in 1998 survey found very low whiting CPUE south of Monterey Bay, however CPUE increased to the north of Monterey Bay. In general, Pacific whiting CPUE was low throughout the survey, indicating either low abundance or low vulnerability of whiting to the survey gear. The size distribution of Pacific whiting indicated that age-1 and age-2 fish were the most common age classes the catch, with modal lengths of 20 and 27 cm, respectively. These modes are lower than usual for age-1 and age-2 fish, and may reflect a reduced growth due to the El Niño conditions off the West Coast during the previous year.

The 2001 PWCC-NMFS Whiting Prerecruit Survey was conducted at cross shelf stations between Newport Oregon (44°30'N) and Point Conception California (34° 45' N) in waters less than 1200 m. The prerecruit survey commenced on May 6th and concluded on May 23rd. A total of 102 trawl samples were taken during the survey. The whiting prerecruit survey found young-of-the year (YOY) whiting at one station south of Coos Bay, OR (43° 30' N) and nearly continuously from south of Crescent City, CA (41° 30' N) to the southern most station at 34° 36' N. YOY whiting were the most abundant species encountered, followed by small unidentified squid. Third most abundant item in the catch was older whiting, primarily age 2 whiting. The distribution of YOY whiting by depth indicated a pattern observed in previous years of a concentration along the outer continental shelf and slope. The density of YOY whiting was less on the inner shelf in waters less than 100 m, and in deep water off the Continental slope. The modal length of YOY whiting in the 2001 survey was 3 cm, with a length range of 2 to 13 cm. A few larger whiting were also taken, primarily in the high 20 to low 30 cm range that corresponds to age 2 whiting.

Weight at age

Year-specific weights at age are used in all years for each fishery and survey and for the population because significant variation in Pacific whiting weight at age has been observed (Table 9) (Dorn 1995). In particular, weight at age declined substantially during the 1980's, then remained fairly constant to 1998. Interestingly, average weights at age increased substantially in 2000 and 2001 in both the fishery and surveys, suggesting more favorable growth in recent years. Weight at age is inversely correlated with sea-surface temperature and (to a lesser extent) adult biomass (Dorn 1992). Weight at age estimates for 1977-87 are given in Hollowed et al. (1988b). Weight-at-age vectors since 1987 were derived from the length-weight relationship for that year and unbiased length at age calculated using age length keys (Dorn 1992). In some cases, a linear interpolation of the weight at age of the strong year classes was used for the weaker year classes whose weight at age was poorly estimated or not available due to small sample sizes. This was necessary only for the older or less abundant age groups.

Population weight at age, used to calculate spawning biomass, was assumed to be equal to the nearest AFSC acoustic survey weight-at-age.

Age at Maturity

Dorn and Saunders (1997) estimate female maturity at age with a logistic regression using ovary collections and visual maturity determinations by observers as

Age														
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
0.000	0.176	0.661	0.890	0.969	0.986	0.996	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000

Natural mortality

The natural mortality currently used for Pacific whiting stock assessment and population modeling is 0.23. This estimate was obtained by tracking the decline in abundance of a year class from one triennial acoustic survey to the next (Dorn et. al 1994). Pacific whiting longevity data, natural mortality rates for Merluciids worldwide, and previously published estimates of Pacific whiting natural mortality indicate that natural morality rates in the range 0.20-0.30 could be considered plausible for Pacific whiting (Dorn 1996).

Model Development

Population dynamics

The age-structured model for whiting describes the relationships between population numbers by age and year. The modeled population includes individuals from age 2 to age 15, with age 15 defined as a "plus" group, i.e., all individuals age 15 and older. The model extends from 1972 to 1998 (27 yrs). The Baranov (1918) catch equations are assumed, so that

$$c_{ijk} = N_{ij} \frac{F_{ijk}}{Z_{ij}} [1 - \exp(-Z_{ij})]$$

$$N_{i+1\,j+1} = N_{ij} \exp(-Z_{ij})$$

$$Z_{ij} = \sum_k F_{ijk} + M$$

except for the plus group, where

$$N_{i+1,15} = N_{i,14}\exp(-Z_{i,14}) + N_{i,15}\exp(-Z_{i,15})$$

where N_{ij}= population abundance at the start of year i for age j fish, F_{ijk} = fishing mortality rate in year i for age j fish in fishery k, and c_{ijk} = catch in year i for age j fish in fishery k. A constant natural mortality rate, M, irrespective of year and age, is assumed.

The U.S. and Canadian fisheries are modeled as distinct fisheries. Fishing mortality is modeled as a product of year-specific and age-specific factors (Doubleday 1976)

$$F_{ijk} = s_{jk} f_{ik}$$

where s_{jk} = age-specific selectivity in fishery k, and f_{ik} = the annual fishing mortality rate for fishery k. To ensure that the selectivities are well determined, we require that $\max(s_{jk}) = 1$ for each fishery. Following previous assessments, a scaled double-logistic function (Dorn and Methot 1990) was used to model age-specific selectivity

$$s_j' = \left(\frac{1}{1 + \exp[-\beta_1(j - \alpha_1)]}\right)\left(1 - \frac{1}{1 + \exp[-\beta_2(j - \alpha_2)]}\right)$$

$$s_j = s_j' / \max_j (s_j')$$

where α_1 = inflection age, β_1 = slope at the inflection age for the ascending logistic part of the equation, and α_2 , β_2= the inflection age and slope for the descending logistic part. The subscript k , used to index a fishery or survey, has been suppressed in the above and subsequent equations in the interest of clarity.

Measurement error

Model parameters were estimated by maximum likelihood (Fournier and Archibald 1982, Kimura 1989, 1990, 1991). Fishery observations consist of the total annual catch in tons, C_i, and the proportions at age in the catch, p_{ij}. Predicted values from the model are obtained from

$$\hat{C}_i = \sum_j w_{ij}\, c_{ij}$$

$$\hat{p}_{ij} = c_{ij} \,/\, \sum_j c_{ij}$$

where w_{ij} is the weight at age j in year i. Year- and fishery-specific weights at age are used because of the changes in weight at age during the modeled time period.

Log-normal measurement error in total catch and multinomial sampling error in the proportions at age give a log-likelihood of

$$\log L_k = -\sum_i [\log(C_i) - \log(\hat{C}_i)]^2 \,/\, 2\sigma_i^2 + \sum_i m_i \sum_j p_{ij} \log(\hat{p}_{ij} \,/\, p_{ij})$$

where σ_i is standard deviation of the logarithm of total catch (~ CV of total catch) and m_i is the size of the age sample. In the multinomial part of the likelihood, the expected proportions at age have been divided by the observed proportion at age, so that a perfect fit to the data for a year gives a log likelihood value of zero (Fournier and Archibald 1982). This formulation of the likelihood allows considerable flexibility to give different weights (i.e. emphasis) to each estimate of annual catch and age composition. Expressing these weights explicitly as CVs (for the total catch estimates), and sample sizes (for the proportions at age) assists in making reasonable assumptions about appropriate weights for estimates whose variances are not routinely calculated.

Survey observations from age-structured surveys (AFSC acoustic, AFSC bottom trawl, DFO acoustic) consist of a total biomass estimate, B_i, and survey proportions at age π_{ij}. Predicted values from the model are obtained from

$$\hat{B}_i = q \sum_j w_{ij} \, s_j \, N_{ij} \exp[-\phi_i \, Z_{ij}]$$

where q = survey catchability, s_j = selectivity at age for the survey, and ϕ_i = fraction of the year to the mid-point of the survey. Survey selectivity was modeled using a double-logistic function of the same form used for fishery selectivity. The expected proportions at age in the survey in the ith year are given by

$$\hat{\pi}_{ij} = s_j \, N_{ij} \exp[-\phi_i \, Z_{ij}] \,/\, \sum_j s_j \, N_{ij} \exp[-\phi_i \, Z_{ij}]$$

Log-normal errors in total biomass and multinomial sampling error in the proportions at age give a log-likelihood for survey k of

$$\log L_k = -\sum_i [\log(B_i) - \log(\hat{B}_i)]^2 / 2\sigma_i^2 + \sum_i m_i \sum_j \pi_{ij} \log(\hat{\pi}_{ij} / \pi_{ij})$$

where σ_i is the standard deviation of the logarithm of total biomass (~ CV of the total biomass) and m_i is the size of the age sample from the survey.

For surveys that produce only an index of recruitment at age 2, R_i , predicted values from the model are

$$\hat{R}_i = q\, N_{i2}$$

Log-normal measurement error in the survey index gives a log-likelihood of

$$\log L_k = -\sum_i [\log(R_i) - \log(\hat{R}_i)]^2 / 2\sigma_i^2$$

where σ_i is the standard deviation of the logarithm of recruitment index. Since the recruitment surveys occur several years before recruitment at age 2, the indices need to be shifted forward the appropriate number of years.

Process error and Bayes priors

Process error refers to random changes in parameter values from one year to the next. Annual variation in recruitment and fishing mortality can be considered types of process error (Schnute and Richards 1995). In the whiting model, these are estimated as free parameters, with no additional error constraints. We use a process error to describe changes in fisheries selectivity over time using a random walk (Gudmundsson 1996).

To model temporal variation in a parameter γ , the year-specific value of the parameter is given by

$$\gamma_i = \bar{\gamma} + \delta_i$$

where $\bar{\gamma}$ is the mean value (on either a log scale or linear scale), and δ_i is an annual deviation subject to the constraint $\Sigma\, \delta_i = 0$. For a random walk process error where annual *changes* are normally distributed, the log-likelihood becomes

$$\log L_{Proc.\ Err.} = -\sum \frac{(\delta_i - \delta_{i+1})^2}{2\sigma_i^2}$$

where σ_i is the standard deviation of the annual change in the parameter. We use a process error model for all four parameters of the U.S. fishery double-logistic curve. For the Canadian fishery double-logistic curve, a process error model was used only for the two parameters of the ascending part of the curves. Since the descending portion is almost asymptotic, little improvement in fit can be obtained by including process error for those parameters.

Bayesian methods offer a number of conceptual and methodological advantages in stock assessment (Punt and Hilborn 1997). We adopt an incremental approach of adding Bayes priors to what is essentially a maximum likelihood model. In non-linear optimization, the usual practice is to place upper and lower bounds on estimated parameters (a feature of both stock synthesis and AD model builder). From a Bayesian perspective, placing bounds on the possible values of a parameter corresponds to using a uniform prior for that parameter. Additional constraints are imposed on a parameter γ by adding the log likelihood for a log-normal prior,

$$\log L_{Prior} = \frac{-[\log(\gamma) - \log(\tilde{\gamma})]^2}{2\sigma^2}$$

where $\tilde{\gamma}$ is the prior mean, and σ is the standard deviation of the logarithm of the prior. In this assessment, we continue to use a prior for the slope of the ascending part of the AFSC acoustic survey double-logistic function.

The total log likelihood is the sum of the likelihood components for each fishery and survey, plus terms for process error and priors,

$$Log\ L = \sum_k Log\ L_k + \sum_p Log\ L_{Proc.\ Err.} + Log\ L_{Prior}\ .$$

Likelihood components and variance assumptions for the base-run assessment model are given in the following table:

Likelihood component	Error model	Variance assumption
U.S. fishery total catch	Log-normal	CV = 0.05
U.S. age composition	Multinomial	Sample size = 80

Canadian fishery total catch	Log-normal	CV = 0.05
Canadian fishery age composition	Multinomial	Sample size = 80
AFSC acoustic survey biomass	Log-normal	CV = 0.10, CV = 0.50 for 1977-89
AFSC acoustic survey age composition	Multinomial	Sample size = 80
AFSC shelf trawl survey biomass	Log-normal	CV = 100.0 (de-emphasized)
AFSC shelf trawl survey age composition	Multinomial	Sample size = 0.01 (de-emphasized)
DFO survey age biomass	Log-normal	CV = 100.0 (de-emphasized)
DFO survey age composition	Multinomial	Sample size = 0.01 (de-emphasized)
Tiburon larval rockfish survey	Log-normal	CV = 0.5
Age-1 index from AFSC shelf trawl survey	Log-normal	CV = 10.0
Fishery selectivity random walk process error	Slope: Log-normal Inflection age: Normal	CV = 0.25 SE = 1.0
Prior on acoustic survey slope	Log-normal	Prior mean = 0.9, Prior CV = 0.2

Ageing error

The model was configured to accumulate the marginal age groups at different ages to prevent obvious instances of aging error from affecting the model fit. This approach was used most frequently when a portion of an incoming strong year classes was misaged into an adjacent year class. We also used this approach to obtain reliable estimates of initial age composition in 1972. Marginal age groups were combined in the following situations:

- Accumulate the older fish at age 13 in 1973 at age 14 in 1974. Rationale: an age 12+ group is estimated for the initial age composition in 1972.

- Accumulate the older fish in the fishery and survey data at age 7 in 1978, age 8 in 1979, age 9 in 1980, etc.. The Canadian age data was only accumulated in 1978 and 1979, but not in subsequent years. Rationale: large numbers of the strong 1970 year class were misaged into the 1971 year class starting in 1978.

- Accumulate the younger fish at age-3 fish in 1979. Rationale: The strong 1977 year class appeared as 3-year-old fish in 1979 due to a small sample size in the age-length key for that year.

- Accumulate the younger fish to age 4 in 1984 and age 5 in 1985 in the Canadian fishery age composition. Rationale: The strong 1980 year class was misaged into the 1981 year class.

- Accumulate the younger fish to age 3 in the 1986 U.S. fishery age composition. Rationale: The strong 1984 year class (2-year-old fish) was misaged into the 1983 year class (3-year-old fish).

● Accumulate the younger fish to age 5 in 1995 and age 6 in 1996 in the Canadian fishery age composition. Rationale: In the 1995 Canadian age composition, the number of 4-year-old fish was greater than the number of 5-year-old fish. In 1996, the age 5-fish were 75% as abundant as the age-6 fish in the Canadian fishery age composition, but only 35% as abundant in the U.S. fishery age composition. The 1991 year class (4-year-old fish in 1995) has been much less common in U.S. fishery samples than the 1990 year class (5-year-old fish in 1995) in each year during 1992-95. It is likely that the 4-year-old fish in the Canadian age composition data are misaged fish from the 1990 year class.

Optimization algorithm and convergence criteria

The optimizer in AD model builder is a quasi-Newton routine that uses auto-differentiation to obtain the gradient (Press et al. 1972). The model is determined to have converged when the maximum gradient component is less than a small constant (set to 1×10^{-4} for the whiting model). Optimization occurs over a number of phases, in which progressively more parameters are estimated. Typically the initial phase consists of a catch curve analysis (Ricker 1973) to obtain rough estimates of mean recruitment and fishing mortality. The intermediary stages correspond to separable age-structured models (Deriso et al 1987), while the final stages also include the parameters for time varying selectivity. Thus the model mimics the entire historical development of quantitative stock assessment during a single estimation run. Identical parameter estimates (to 5 decimal places) were obtained when the initial values for mean recruitment and mean fishing mortality were halved and doubled (R = 0.5, 1.0, 2.0 billion, F = 0.1, 0.2, 0.4), suggesting that final parameter estimates were independent of initial values. After the model converges, the Hessian is estimated using finite differences. Standard errors are obtained using the inverse Hessian method. We also assess uncertainty using AD model builder routines for obtaining likelihood profiles and Markov chain Monte Carlo samples from the likelihood function.

Model parameters can be classified as follows:

Population process modeled	Number of parameters estimated	Estimation details
Initial age structure	Ages 3-12 (age 12 is the plus group in 1972) = 10	Estimated as log deviances from the log mean
Recruitment	Years 1972-98 = 30	Estimated as log deviances from the log mean
Average selectivity to fisheries and age-structured surveys	4 * (No. of fisheries + No. of surveys) = 4 * (2 + 3) = 20	Slope parameters estimated on a log scale, a prior is used for the acoustic survey ascending slope parameter.
Annual changes in fishery selectivity	4 * (No. of fisheries) * (No. of yrs -1) = 4 * 1.5 * 26 = 174	Estimated as deviations from mean selectivity and constrained by random walk process error
Year and age-specific selectivity for the 1994 & 1997 year class	U.S fishery: 1996 & 1997 = 2 Canadian fishery: 1999 & 2000 = 2	Bounded by (0,1)

Survey catchability	No. of surveys = 5	Acoustic survey catchability not estimated, other catchabilities estimated on a log scale
Natural mortality	Age- and year-invariant = 1	Not estimated
Fishing mortality	No. of fisheries * (No. of yrs) = 2 * 27 = 60	Estimated as log deviances from the log mean
Total	125 conventional parameters + 174 process error parameters + 4 fixed parameters = 303	

Model selection and evaluation

This assessment used the AD model builder software using the same model structure and assumptions as in the 1998 assessment. Since Dorn et al. (1999) confirmed consistency with the previous assessment using the stock synthesis program and confirmed model estimates of recruitment and biomass with simulated data, there was little need for further testing and confirmation. The steps toward model selection and evaluation taken in this assessment were to first compare model results between the 1998 and present assessment using updated catch at age information and survey biomass data without changes to the model structure or assumptions. The basic model structure included 1) acoustic survey biomass CVs = 0.1 during 1992-2001 and CVs = 0.5 during 1977-1989 to better reflect uncertainty in the earlier years, 2) use of time varying fishery selectivity functions modeled as a random walk process error, and 3) use of a prior on the slope parameter of the acoustic survey selectivity. For the most part, the addition of these features was to account for changes in fishery selectivity which was strongly influenced by El Niño (1983, 1992, 1997) driven distribution changes in the whiting population.

Comparison of preliminary model results with the 1998 assessment using only updated data show similar trends in biomass and recruitment over time. In particular, the decline in biomass between 1987-1995 was identical (Fig. 14). Biomass estimated in this assessment, however, was slightly higher during the early years (<1982) relative to biomass estimated in the 1998 assessment and also showed a less optimistic view of biomass in recent years (1996-98). Recruitment shows a similar pattern between assessments. Of particular note is that recent recruitment (1996-2000) was less optimistic than previously estimated in the 1998 assessment and thus biomass shows a continued decline since 1998. Model fits to the observed acoustic and trawl survey biomass estimates also show similar patterns between this assessment and the 1998 assessment (Fig. 15). While both assessment results show relative poor fits to the acoustic survey, this assessment shows slightly more biomass between 1983-1989. Results were qualitatively similar for model fits to the shelf trawl survey. Finally, estimated selectivity, averaged for 1998-2001, were compared between the two assessments (Fig. 16). The U.S. fishery and trawl survey selectivity showed little change between assessments. However, the Canadian fishery selectivity as well as the acoustic survey selectivity appears to have increased toward younger fish in this assessment The increased selectivity toward younger fish in the acoustic survey is most likely responsible for slightly lower recruitment estimated for recent years in this assessment.

The next step was then to examine alternative possible model structure and evaluate different variance assumptions for the base model run. In particular, it was clear that the 1997 year class was unusually abundant as age-2 and age-3 fish in the 1999 and 2000 Canadian catch at age data, respectively (fig. 6). This pattern in the age composition data was unlike any other year and apparently due to the extreme northward extension of juvenile whiting in 1997. Since age-specific selectivity is estimated as smooth functions over time the model was unable to accommodate this rapid shift in catch at age. Thus, we estimated year- and age-specific selectivity patterns for the 1997 year class in the 1999 and 2000 Canadian fishery. Dorn et al. (1999) provided similar model accomodation by estimating year- and age-specific selectivity parameters for the 1994 year class in the 1996 and 1997 U.S. fishery.

In addition, the base model used in this assessment included the Tiburon YOY index as a tuning index of stock reconstruction. This was based on the significant correlation of the Tiburon YOY index and predicted recruitments from the stock assessment model found earlier by Dorn et al. (1999), and suggestions by the STAR Panel that the index be included as a tuning index for stock reconstruction. For this, the CVs associated with the index were set to lower values (CV=0.5) relative to the earlier 1998 assessment (CV=10). The correlation between the log observed index and the predicted log recruitment remained relatively strong with the addition of the 1997-1999 data (indexes 1999-2001 age-2 recruitment in the model). A retrospective look at the performance of the YOY index shows that predicted recruitment generally meet the expectation of the 1999 and 2001 index (Figure 17). Age-2 recruitment in 2002 predicted in the model was somewhat higher than what was predicted by the observed index.

The whiting assessment, like most assessments, is highly dependent on survey estimates of trends in abundance. Since 1993, the base-run whiting assessment model has relied primarily on an absolute biomass estimate from the AFSC acoustic surveys starting with the 1992 survey. Earlier acoustic surveys were de-emphasized because of incomplete geographic coverage and a number of other considerations (Dorn 1996), as were the AFSC shelf trawl survey and DFO acoustic surveys. The base-run model used here along with the three variants given below also incorporated the Tiburon YOY index based on above considerations. Thus, we examined three models with alternative variance assumptions for the survey biomass estimates:

Model 1: A base-run model with an acoustic survey biomass CV of 0.5 in 1977-89 and a CV = 0.1 in 1992-2001. The AFSC shelf trawl survey is de-emphasized (CV = 100.0). SWFSC juvenile index survey CV=0.5.

Model 2: Acoustic survey as in base-run model, but with a CV of 0.1 for the AFSC shelf trawl survey.

Model 3: The entire acoustic survey time series has an assumed CV = 0.1.

Model 4: Identical to the base-run model (Model 1) except that acoustic survey catchability (q) was estimated freely with no priors on ascending limb selectivity parameters.

Model 5: Identical to the base-run model (Model 1) but priors were used on both ascending limb acoustic selectivity parameters.

Models 1 and 3 estimate a similar biomass trend except that the increase in biomass in the mid-1980s is not as large in model 3 (Fig. 19). Also, Model 3 shows a slightly more optimistic picture of biomass in recent years but the decline in biomass since 1990 is equally strong. This result was somewhat unexpected since the same variances are used for the surveys in both model configurations since 1992. Models 1 and 3 again show similar trends in recruitment except the two largest year classes (age-2 in 1982 and 1986) are estimated to be lower in Model 3 relative to Model 1. Model 3 also shows a more optimistic view of the recruitment in 2001. Model 3 improves the fit to the earlier surveys by shifting the selectivity curve to right toward older fish, so that the estimated selectivity of the age 3-5 fish, which make up a large fraction of the population biomass, have lower selectivity (Fig. 19). Because the acoustic survey covers the entire latitudinal range of the U.S. fishery, it is difficult to reconcile this selectivity pattern with the U.S. fishery selectivity, which is close to 1.0 by age 5 (fig. 15). The biomass for Model 2 begins at a lower level, but increases and peaks in 1987 like Models 1 and 3. After 1992, the biomass for model 2 again increases to over 5.0 million t in 1998. However, unlike model 1 and 3 which show a steady decline in biomass until 2001, Model 2 shows that biomass declines only until 1995 and then stabilizes at about 3 million t. While all the model alternatives examined here show an increase in recruitment in 2001, Model 2 predicts recruitment to be of equal magnitude to the 1980 and 1984 year classes (Fig. 18). This was due to the strong shift in both the acoustic and trawl survey selectivity toward older fish. Model 2 also shows an adequate fit to both the acoustic and trawl survey biomass, however the estimated acoustic selectivity pattern is even less plausible for Model 3. These alternative models suggest that biomass in 2001 is unlikely to be lower than estimated by base-run model.

Again, the two additional model formulations show similar trends in expected biomass and recruitment as model 1. However, biomass in model 4 was predicted to be substantially higher over the entire time series, particularly during the middle years (Figure 20). This result was mostly likely due to the fact that acoustic survey biomass catchability (q) was estimated to be nearly 50% (q=0.53; CV=28%) lower than the q=1 assumed in the base model. Correspondingly, recruitment at age-2 was also estimated to be higher in model 4 compared to models 1 and 4. The competing models here show little variation in U.S. fishery age composition -log likelihoods (Figure 20). While not exactly comparable between models due to different assumptions regarding variances (Model 1 vs. Models 4 and 5), the acoustic survey age composition likelihoods when compared across years and within a model show a degradation of fit to the survey age composition data with Model 5. Moreover, model 5 shows a relatively poorer fit to the acoustic survey biomass time series compared to models 1 and 4 (Figure 21).

Model 4, on the other hand, generally shows equally good fits to the acoustic survey as model 1 (Figure 21). Estimated acoustic selectivity curves for models 4 and 5 show significant changes in the "domed-shaped" selectivity curve expected from model 1 (Figure 21). Here, the selectivity curves for models 4 and 5 are shifted to higher values on younger fish, but has lower selectivity for older fish. This is not unexpected for model 5 since priors were placed on the ascending limb selectivity parameters "to force" the selectivity to be higher for younger ages. As mentioned, however, this degraded the fit to both the acoustic biomass time series and fits to the age composition. For this reason, model 5 seems somewhat implausible. While model 4 gave generally equally good fits as model 1 to the survey data age composition, the low q estimated from this run also seems implausible. Significant advances and standardization have been made with acoustic technology since 1992 and values closer to unity should be expected. Also, there appears to be a strong interaction between the acoustic survey q and survey selectivity, which produces ambiguity in model fits. At present, it is intractable to resolve this apparent inconsistency.

Model Evaluation

Residual plots were prepared to examine the goodness of fit of the base-run model to the age composition data. The Pearson residuals for a multinomial distribution are

$$r_i = \frac{p_i - \hat{p}_i}{\sqrt{(\hat{p}_i(1-\hat{p}_i)/m)}} ,$$

where p_i is the observed proportion at age, and m is the nominal sample size (McCullagh and Nelder 1983). Figures 22-24 show Pearson residuals of the fit to the U.S. fishery, Canadian fishery, and acoustic survey age compositions. Although there are large residuals for some ages and years, no severe pattern of residuals is evident in the fishery age composition. There is a moderate residual pattern of positive residuals for the strong year classes and negative residuals for the weak year classes, particularly for the older fish. This pattern is strongest in the Canadian fishery age composition, but is also present to some degree in the U.S. fishery age composition. A tendency for age readers to prefer the strong year classes as fish become older and more difficult to age could account for this pattern (Kimura et al. 1992).

The model shows an improved fit to the AFSC acoustic biomass estimates compared to previous assessment models, although the overall fit is still relatively poor (Fig. 19). The model fits closely the most recent surveys in 1998 and 1995, particularly compared to 1992. As in previous assessments, the age composition data favors an increased biomass to 1986 followed by a decline to at least 1995. The acoustic biomass time series is highest in 1986, but otherwise is relatively flat. Both the 1983 and 1986 acoustic surveys may have underestimated the biomass present in those years. In 1983, the onset of El Niño conditions off the west coast produced strong northward transport which may have displaced fish beyond the northern limits of the survey (Dorn 1995). In 1986, there was a 1.7 dB drop in the acoustic source level between pre- and post-survey calibrations. Biomass was estimated using the pre-survey source level, because the resulting biomass was consistent with 1983 biomass estimate. Had the post-survey source level been used, the biomass would have been 48% higher (Hollowed 1988a) and more consistent with the model's estimate of biomass in 1986.

Base-run Results

Parameter estimates and model output for the base-run model are presented in a series of tables and figures. Estimated selectivity for the U.S. and Canadian fisheries is shown in Figure 25. U.S. fishery selectivity was strongly dome-shaped in the early years (<1980) with ages 6-12 being fully selected by the fishery. Over time the age-specific selectivity in the U.S. fishery increased on both younger and older fish. Average selectivity in recent years (1998-2001) is 20% on age-2, 70% on age-3 and 90% on age-4 fish. Changes in Canadian fishery selectivity is equally pronounced over time and generally shows the same pattern with increasing selectivity toward younger fish. The descending limb of the Canadian fishery selectivity was time-invariant and thus selectivity on the oldest age groups remained constant through time.

Selectivity of AFSC triennial acoustic and shelf trawl surveys are given in Table 10 and Figure 19. Selectivity in the acoustic survey was high on age-2 fish relative to the fishery selectivity, but increased on ages 3-5 somewhat more slowly by comparison; 50% at age-2, 70% at age-3, 85% at age-4, etc. Selectivity in the trawl survey showed an even more gradual selection with increasing age.

Table 11 gives the estimated population numbers at age for the years 1972-2001 for the base-run model and Table 12 provides estimated time series of population biomass, age-2 recruitment, and percent utilization of the total age 3+ biomass by the U.S. and Canadian fisheries for 1972-2001 (see also Fig. 26). In the early 1970s to early 1980s biomass was relatively stable at around 2-3 millions t with relatively low levels (0.25 to 0.84 billions fish) of recruitment punctuated by two relatively larger year classes (1972 and 1979 at 4.7 and 3.0 billions fish, respectively). Biomass increased substantially during the middle 1980s as the 1980 (1982 recruitment at 12.2 billion fish) and 1984 (1986 recruitment at 9.6 billions fish) year classes recruited to the population. Population biomass peaked in 1987, then declined as the 1980 and 1984 year class were replaced by more moderate year classes. In more recent years (1997 -2001), biomass is at its lowest level in the time series. The harvest rate of age-3+ Pacific whiting was generally below 10% during 1972-93, then increased to above 20% in 1994-2001.

Uncertainty and Sensitivity Analyses

Sensitivity to survey catchability assumptions

The base-run model assumes an acoustic survey catchability of 1.0. The sensitivity of the base-model results to this assumption was examined with likelihood profiles for different values of survey catchability. A likelihood profile was obtained for survey catchabilities ranging from 0.1 to 1.5 with natural mortality held constant at 0.23. The likelihood profile was then performed as above on Model 3 (equal CVs of 0.1 on acoustic survey biomass for all years). The base run de-emphasized the acoustic biomass survey estimates from 1977-1989 principally due to uncertainty regarding biomass in those years. In particular, biomass could have been greater during that time period and thus survey q may have been lower due to the problems mentioned earlier. The purpose of this exercise was to examine the relative change in direction and magnitude of acoustic survey catchability between these two models.

The best model fits were obtained at intermediate survey catchabilities considered (q = 0.5-0.6) for the base model (Model 1) and at relatively lower survey catchabilities (q = 0.2-0.5) for Model 3 (Fig. 27). These results translated into substantially higher biomass for model results when q is assumed to be less than 1.0. Likelihood profiling over q in this assessment was substantially more determined (domed likelihood profile) than in the previous 1998 assessment. This is due to increased information content with an additional year of survey biomass data and more contrast in biomass over the last decade when the survey data is not down-weighted.

Uncertainty in 2001 stock size and female spawning biomass

Uncertainty in current stock size was explored using a Markov chain Monte Carlo simulation in AD model builder. Although MCMC has been used mostly in Bayesian applications, it can also be used to obtain likelihood-based confidence regions. It has the advantage of producing the true marginal likelihood of the parameter, rather than the conditional mode, as with the likelihood profile. The results of the MCMC with 1,000,000 simulations was then plotted to evaluate the uncertainty of the state variables of interest. Results show that 2001 stock biomass has high probability (>95%) of being withing 600 and 900 thousand t (Fig. 28). Uncertainty in female spawning biomass was also evaluated using the MCMC. Female spawning biomass in 2001 was estimated at 414 thousand t and there is a 90% probability that this point estimate is less than 25% of unfished biomass. It should be stressed that these estimates of uncertainty depend on model assumptions of a known natural mortality rate and survey catchability, and thus would underestimate the actual uncertainty.

Retrospective analyses

A retrospective analysis was conducted for the base-run assessment model. The final year of the base-run assessment model was stepped backwards one year at a time from 2001 to 1994. The retrospective comparison of stock assessment models for the years 1993-2001 is given in Figure 29 (upper panel) and shows estimates of female spawning biomass and age-3+ biomass (lower panel). The current estimates of spawning biomass for 1977-2001 are fairly consistent with previous estimates, although spawning biomass estimated in 1998 was slightly higher relative to the 2001 assessment. The entire time series show a similar pattern of increasing spawning biomass to early 1980's, followed by a decrease. Years that use the same series of survey biomass estimate produce highly consistent results. This effect is particularly noticeable for age-3+ biomass shown in the lower panel of Figure 29. The 1994 assessment stands out and shows a biomass trajectory substantially below all the other years. The biomass time series shifts downwards with the addition of the 2001 biomass estimate, while with the addition of the 1998 assessment the biomass in 1995 shifted upward. These results imply no consistent retrospective pattern in estimates of ending year stock biomass and female spawning biomass. The greatest differences occur in the first part of the time series, reflecting both the lack of survey data, and the high CV's assigned to the early acoustic surveys.

TARGET FISHING MORTALITY RATES

The Magnuson-Stevens Act and the NMFS National Standards Guidelines (NSG) establish new guidelines for setting harvest rates in U.S. fisheries. The PFMC is required to update its Fisheries Management Plan (FMP) to conform to these guidelines. The FMP amendment includes definitions of 1) a MSY rule (F_{MSY}) that maximizes long-term average yield; 2) an OY rule that reduces fishing mortality when stock size is below B_{MSY}; 3) and guidelines for reducing OY to account for uncertainty in stock status. Default proxies used in this assessment are defined for F_{MSY} and B_{MSY} based on spawning biomass per recruit (SPR).

To evaluate harvesting strategies and target fishing mortality rates for projections, we employed the 40-10 option that provides a more gradual response to declining stock sizes by reducing *catches* linearly, rather than fishing mortality. The 40-10 option can be expressed approximately in fishing mortality as

$$F_{ABC} = F_{40\%} \frac{B_{40\%}}{B} \left[\frac{B - B_{10\%}}{B_{40\%} - B_{10\%}} \right],$$

Dorn et al. (1999) evaluated the 40-10 option relative to the hybrid F strategy (Shuter and Koonce, 1985) that was formerly used to manage the whiting stocks and found approximately the same overall reduction in harvest rates. In general, they concluded that as a control law the general form of 40-10 policy was an improvement over the hybrid F strategy. Moreover, using a Bayesian meta-analysis of Merluciid stock recruit relationships, Dorn et al. (1999) showed that F40-F45% may be appropriate proxies for F_{MSY} depending of the level of risk aversion.

The following estimates of F40%, F45%, and F50% under the 40-10 option were obtained using the life history vectors in Table 13. Since the whiting stock in 2001 was clearly below B40%, we did not evaluate harvest rates strategies less than F40% as this would not be viable alternatives under the SFA guidelines. The Canadian F multiplier is used to scale the Canadian fishing mortality so that the mean yield per recruit for the U.S. and Canadian fisheries corresponds to the historical distribution of catches (~25%). Previous work has demonstrated that overall yield per recruit is relatively insensitive to the allocation of yield within the range in dispute. Unfished spawning biomass was based on mean 1972-2001 recruitment (1.708 billion) from the base-run model and SPR at F=0 (1.223 kg/recruit).

SPR rate	U.S. Fishing mortality	Canadian F multiplier	Equilibrium harvest rate
F40%	0.227	0.545	21.2%
F45%	0.185	0.514	17.6%
F50%	0.152	0.490	14.6%
Unfished female spawning biomass	2.088 million t		
B40%	0.835 million t		

HARVEST PROJECTIONS

For harvest projections, model estimates of population numbers at age in 2001 and their variance were projected forward for the years 2002-2006. Estimates of future recruitment, N_{i2}, are also needed for the projections. Survey indices of age-0 abundance in 2000 and 2001 available from the Tiburon larval rockfish survey are used to represent projected recruitment in 2002 and 2003. An index of age-1 recruitment was not available from the bottom trawl survey for future projected recruitment. Recruitment estimates projected in future years were modeled to account for two sources of variability: random variation in recruitment (process error), and sampling variability of the index (measurement error). For example, if recruitment itself is not highly variable, an index that shows an extremely low or high value should be shrunk towards the mean, particularly if it is known that sampling variability for that index is large. The appropriate tradeoff between these different sources of uncertainty is obtained by adding a log likelihood term for future recruitments in the final estimation phase. Assuming that both recruitment variability and sampling variability are log normal,

$$\log L_{Fut.\ Recr.} = -\frac{1}{2\sigma_r^2}\sum_i[\log(N_{i2}) - \overline{\log(N_2)}]^2 - \sum_k \frac{1}{2\sigma_k^2}\sum_i[\log(q_k N_{i2}) - \log(R_i)]^2$$

where $\overline{\log(N_2)}$ is the mean log recruitment as estimated by the base-run model, σ_r is the standard deviation of log recruitment, and σ_k is the standard deviation of the log index from survey k, which can be estimated using the prediction error of the index in the assessment model. These parameters were fixed at the values estimated by the base-run model. The standard deviations for log recruitment ($\sigma_r = 1.34$) and the Tiburon log index ($\sigma_k = 1.43$) were similar implying that estimates of future recruitment should be roughly an average of the mean recruitment from the assessment model run and the Tiburon survey prediction. In years when no indices are available, as in 2004-2006, the estimated log recruitment will be drawn toward the mean log recruitment from the assessment model and thus uncertainty will be equal to the process error in recruitment.

In order to characterize the uncertainty in projections, a Markov chain Monte Carlo simulation was used. There were several reasons why this approach was used. First, the MCMC simulation would better reflect the level of uncertainty in both the assessment model in terms of estimation error and future recruitment. The second, was that projections in future years will also be highly sensitive to the relative strength of recruitment in the terminal year (age-2 in 2001) of the assessment, which also tends to have the highest CV. In this regard, the MCMC simulation was used to characterize the outcome of projections from different levels of assumed recruitment in 2001. Discrete intervals of possible recruitment states were chosen corresponding to percentile ranges of (0%-10%, 10%-90%, and 90%-100%) associated with recruitment realizations generated from the MCMC simulation. Realizations of recruitment in 2001along with the other state variable corresponding to that particular simulation sample were categorized within each interval. The resulting projected states variables were then summarized in terms of the mean and CV within each 2001 recruitment interval and for each harvesting strategy to quantify the expected outcome of different management decisions under more or less optimistic recruitment scenarios. Thus, recruitment in 2001 within the 0%-10% along with its associated projections of yield and biomass would represent a less optimistic scenario of recruitment, and would therefore be a more conservative harvesting policy as opposed to recruitment within the 10%-90% or >90% intervals.

Depending on what is believed about the relative strength of recruitment in 2001, total yield in 2002 ranges from 117,000 mt (0%-10%) to 219,000 mt (90%-100%) for the 40-10 option with F40% as the proxy for FMSY. Under this option, total biomass ranges between 1.02 and 1.57 million t and females spawning biomass ranges between 421,000 t and 503,000 t. In 2003, total yield ranges between 166,000 t (0%-10%) and 284,000 t (90%-100%) with total biomass increasing to 1.1 and 1.63 millions t. Female spawning biomass also increases substantially in 2003 and ranges between 522,000 t and 757,000 t for the low (0%-10%) and high (90%-100%) recruitment scenarios, respectively. Under the F40% (40-10) harvest policy, female spawning biomass is expected to increase from it low of 411,000 t in 2001 to 613,000 t by 2003 (90% probability female spawning biomass exceeds 25% B0). While increases in yield and total biomass are forecasted to increase over the next 5 years, female spawning biomass has a low probability of exceeding 40% B0 under the F40% (40-10) harvesting option.

This expectation is somewhat different, however, under more conservative harvesting strategies, such as F50% (40-10). Here, the probability that female spawning biomass exceeds 40% unfished by 2006 is markedly higher, but still remains below 50%. The short term trade-off, however, would entail significant reductions in total coastwide yield ranging from 110,000 t in 2002 to 220,000 t in 2006 under the medium recruitment scenario. The CVs of population biomass, spawning biomass, and yield are similar in magnitude, and increase from roughly 10%-18% in 2002 to approximately 40%-60% in 2006, indicating that projections of these quantities are increasingly uncertain they become influenced by the variability in future recruitment.

Finally, decision table was constructed to evaluate repercussions under different assumptions regarding the strength of recruitment in 2001 (1999 year-class). For this analysis, results of the Markov chain Monte Carlo simulation were used to derive the basic data requirements to generate three "true" states of nature and three "assumed" states of nature. Figure 30 provides the bivariate posterior density functions of projected catch for 2002-2004 and recruitment in 2001 under the F40% (40-10) harvesting policy based on the results of the MCMC simulation. Realizations of recruitment in 2001 were partitioned into three percentile ranges (<10%, 10%-90%, and < 90%) and the average recruitment in each range was use to represent the "true" states of nature. Further, the conditional expected projected catch was calculated within each percentile range and was used to represent the "assumed" state of nature. The conditional expected catches are shown in table 14. Deterministic projections were then performed by setting the "true" state of nature at one of three average recruitment levels and then removing catches each year from 2002-2004 in accordance with the "assumed" state of nature. In this way and 3x3x3 decision table (Table 15) was generated corresponding to three "true"and three "assumed" states of nature as well as for the F40%, F45%, and F50% harvest policy. As an example, female spawning biomass increases to only 25% unfished in 2004 compared to 31% under the F40% harvest policy if catches are taken under high assumed recruitment levels when the true state of nature is low recruitment. In addition, exploitation rates end up being nearly 50% higher in 2004.

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Table 1. Annual catches of Pacific whiting (1,000 t) in U.S. and Canadian management zones by foreign, joint venture (JV), domestic at-sea, domestic shore-based, and tribal fisheries, 1966-2001. Catches in 2001 are preliminary.

	U.S.						Canada				U.S. and Canada
			Domestic								
Year	Foreign	JV	At-sea	Shore	Tribal	Total	Foreign	JV	Shore	Total	total
1966	137.000	0.000	0.000	0.000	0.000	137.000	0.700	0.000	0.000	0.700	137.700
1967	168.699	0.000	0.000	8.963	0.000	177.662	36.713	0.000	0.000	36.713	214.375
1968	60.660	0.000	0.000	0.159	0.000	60.819	61.361	0.000	0.000	61.361	122.180
1969	86.187	0.000	0.000	0.093	0.000	86.280	93.851	0.000	0.000	93.851	180.131
1970	159.509	0.000	0.000	0.066	0.000	159.575	75.009	0.000	0.000	75.009	234.584
1971	126.485	0.000	0.000	1.428	0.000	127.913	26.699	0.000	0.000	26.699	154.612
1972	74.093	0.000	0.000	0.040	0.000	74.133	43.413	0.000	0.000	43.413	117.546
1973	147.441	0.000	0.000	0.072	0.000	147.513	15.125	0.000	0.001	15.126	162.639
1974	194.108	0.000	0.000	0.001	0.000	194.109	17.146	0.000	0.004	17.150	211.259
1975	205.654	0.000	0.000	0.002	0.000	205.656	15.704	0.000	0.000	15.704	221.360
1976	231.331	0.000	0.000	0.218	0.000	231.549	5.972	0.000	0.000	5.972	237.521
1977	127.013	0.000	0.000	0.489	0.000	127.502	5.191	0.000	0.000	5.191	132.693
1978	96.827	0.856	0.000	0.689	0.000	98.372	3.453	1.814	0.000	5.267	103.639
1979	114.909	8.834	0.000	0.937	0.000	124.680	7.900	4.233	0.302	12.435	137.115
1980	44.023	27.537	0.000	0.792	0.000	72.352	5.273	12.214	0.097	17.584	89.936
1981	70.365	43.556	0.000	0.839	0.000	114.760	3.919	17.159	3.283	24.361	139.121
1982	7.089	67.464	0.000	1.024	0.000	75.577	12.479	19.676	0.002	32.157	107.734
1983	0.000	72.100	0.000	1.050	0.000	73.150	13.117	27.657	0.000	40.774	113.924
1984	14.722	78.889	0.000	2.721	0.000	96.332	13.203	28.906	0.000	42.109	138.441
1985	49.853	31.692	0.000	3.894	0.000	85.439	10.533	13.237	1.192	24.962	110.401
1986	69.861	81.640	0.000	3.463	0.000	154.964	23.743	30.136	1.774	55.653	210.617
1987	49.656	105.997	0.000	4.795	0.000	160.448	21.453	48.076	4.170	73.699	234.147
1988	18.041	135.781	0.000	6.876	0.000	160.698	39.714	50.182	0.594	90.490	251.188
1989	0.000	203.578	0.000	7.418	0.000	210.996	31.589	66.256	1.687	99.532	310.528
1990	0.000	170.972	4.713	8.115	0.000	183.800	3.976	69.293	3.411	76.680	260.480
1991	0.000	0.000	196.905	20.600	0.000	217.505	6.043	76.254	22.225	104.522	322.027
1992	0.000	0.000	152.449	56.127	0.000	208.576	0.000	68.000	18.370	86.370	294.946
1993	0.000	0.000	99.103	42.119	0.000	141.222	0.000	47.172	11.611	58.783	200.005
1994	0.000	0.000	179.073	73.656	0.000	252.729	0.000	84.154	22.018	106.172	358.901
1995	0.000	0.000	102.624	74.965	0.000	177.589	0.000	26.580	43.838	70.418	248.007
1996	0.000	0.000	112.776	85.127	14.999	212.902	0.000	65.596	22.644	88.240	301.142
1997	0.000	0.000	121.173	87.410	24.840	233.423	0.000	42.565	48.065	90.630	324.053
1998	0.000	0.000	120.452	87.856	24.509	232.817	0.000	39.664	47.074	86.738	319.555
1999	0.000	0.000	115.259	83.419	25.844	224.522	0.000	17.915	68.722	86.637	311.159
2000	0.000	0.000	116.090	85.828	6.500	208.418	0.960	15.059	6.238	22.257	230.675
2001	0.000	0.000	102.129	73.474	6.774	182.377	0.000	21.650	31.603	53.253	235.630
Average 1966-2001						156.482				51.295	207.777

Table 2. Harvest strategies, coastwide ABCs, quotas or havest guidelines for U.S. and Canadian zones, and Pacific whiting catches (t) in the U.S. and Canadian zone (1978-98).

Year	Harvest strategy	Acceptable Biological Catch (t) (coastwide)	U.S. harvest guideline or quota (t)	U.S. catch (t)	% of U.S. harvest guideline utilized	Canadian scientific recommendations, low to high risk (t), (CAN) = Canadian zone only	Canadian quota (t)	Canadian catch (t)	% of Canadian quota utilized	Total Catch (t)	% of ABC harvested
1978	N/A	---	130,000	98,372	75.7	NA	NA	5,267	NA	103,639	---
1979	N/A	---	198,900	124,681	62.7	35,000 (CAN)	35,000	12,435	35.5	137,116	---
1980	N/A	---	175,000	72,353	41.3	35,000 (CAN)	35,000	17,584	50.2	89,937	---
1981	N/A	---	175,000	114,762	65.6	35,000 (CAN)	35,000	24,361	69.6	139,123	---
1982	N/A	---	175,500	75,578	43.1	35,000 (CAN)	35,000	32,157	91.9	107,735	---
1983	N/A	---	175,500	73,151	41.7	35-40,000 (CAN)	45,000	40,774	90.6	113,925	---
1984	N/A	270,000	175,500	96,381	54.9	35-40,000 (CAN)	45,000	42,109	93.6	138,490	51.3
1985	N/A	212,000	175,000	85,440	48.8	45-67,000 (CAN)	50,000	24,962	49.9	110,402	52.1
1986	N/A	405,000	295,800	154,963	52.4	75-150,000 (CAN)	75,000	55,653	74.2	210,616	52.0
1987	N/A	264,000	195,000	160,449	82.3	75-150,000 (CAN)	75,000	73,699	98.3	234,148	88.7
1988	Variable effort	327,000	232,000	160,690	69.3	98-176,000 (CAN)	98,000	90,490	92.3	251,180	76.8
1989	Variable effort	323,000	225,000	210,992	93.8	87-98,000 (CAN)	98,000	99,532	101.6	310,524	96.1
1990	Variable effort - high risk	245,000	196,000	183,800	93.8	32-70,000 (CAN)	73,500	76,680	104.3	260,480	106.3
1991	Hybrid -mod. risk	253,000	228,000	217,505	95.4	175-311,000	98,000	104,522	106.7	322,027	127.3
1992	Hybrid -mod. risk	232,000	208,800	208,576	99.9	160-288,000	90,000	86,370	96.0	294,946	127.1
1993	Hybrid -mod. risk	178,000	142,000	141,222	99.5	122-220,000	61,000	58,783	96.4	200,005	112.4
1994	Hybrid-low risk	325,000	260,000	252,729	97.2	325-555,000	110,000	106,172	96.5	358,901	110.4
1995	Hybrid-low risk	223,000	178,400	176,107	98.7	223-382,000	76,500	70,418	92.0	246,525	110.5
1996	Hybrid-low risk	265,000	212,000	212,900	100.4	161-321,000	91,000	88,240	97.0	301,140	113.6
1997	Hybrid-moderate risk	290,000	232,000	233,423	100.6	161-321,000	99,400	90,630	91.2	324,053	111.7
1998	Hybrid-moderate risk	290,000	232,000	232,509	100.2	116-233,000	80,000	86,738	108.4	319,247	110.1
1999	40-10 option-moderate risk	290,000	232,000	242,522	104.5	90,300	90,300	86,637	95.9	329,159	113.5
2000	40-10 option-moderate risk	290,000	232,000	208,418	89.8	90,300	90,300	22,257	24.6	230,675	79.5
2001	40-10 option-moderate risk	238,000	190,400	182,377	95.8	81,600	81,600	53,257	65.3	235,634	99.0

Table 3. Length and age sample sizes for estimates of Pacific whiting age composition for U.S. surveys and fisheries. A. AFSC acoustic survey, B. AFSC bottom trawl survey, C. U.S. shore-based fishery, D. U.S. at-sea fishery.

A. AFSC acoustic survey

Year	No. hauls	No. lengths	No. aged
1977	116	11,695	4,262
1980	72	8,296	2,952
1983	38	8,614	1,327
1986	48	12,702	2,074
1989	25	5,606	1,730
1992	62	15,852	2,184
1995	95	22,896	2,118
1998	108	33,347	2,417
2001	90	16,442	2,536

B. AFSC bottom trawl survey

Year	No. hauls	No. lengths	No. aged
1977	189	36,927	4,456
1980	133	14,828	3,619
1983	224	36,345	4,419
1986	215	32,781	1,999
1989	240	38,774	946
1992	305	45,896	966
1995	281	55,165	572
1998	491	84,377	783
2001	510	10,907	-

C. U.S. shore-based fishery

Year	Number of samples	No. aged
1990	15	660
1991	26	934
1992	47	1,062
1993	36	845
1994	50	1,457
1995	51	1,441
1996	34	1,123
1997	58	1,759
1998	66	2,021
1999	61	1,452
2000	75	1,314
2001	39	1,983

D. U.S. at-sea fishery

Year	No. hauls	No. lengths	No. aged
1973		NA	
1974		NA	
1975		NA	
1976	279	53,429	4,077
1977	1,103	142,971	7,698
1978	832	124,771	5,839
1979	1,156	173,356	3,124
1980	682	102,248	5,336
1981	905	135,740	4,268
1982	1,145	171,816	4,258
1983	1,112	166,858	3,232
1984	1,625	243,684	3,310
1985	1,780	267,010	2,440
1986	3,161	474,107	3,070
1987	2,876	431,454	3,175
1988	2,801	420,144	3,043
1989	2,666	368,807	3,041
1990	2,101	268,083	3,112
1991	1,022	112,477	1,335
1992	848	78,626	2,175
1993	423	33,100	1,196
1994	645	47,917	1,775
1995	434	30,285	690
1996	530	33,209	1,333
1997	632	49,592	1,147
1998	744	47,789	998
1999	2,180	49,246	1,047
2000	2,118	48,143	1,257
2001	2,133	48,426	1,104

Estimation methods:
A. Acoustic survey. Age-length keys by geographic strata (Wilson and Guttormsen 1997)
B. Bottom trawl survey. Age-length keys by geographic strata (Dorn et al. 1994). Number of hauls are those where length samples were taken.
C. U.S. shore-based fishery. Stratified random design with strata based on port groups.
D. U.S. at-sea fishery. Age-length keys by geographic strata (Dorn 1991). Number of hauls are those where length samples were taken.

Table 4. Catch at age (millions of fish) for the Pacific whiting fisheries, 1973-2001. Separate tables are given for U.S. and Canadian fisheries. The aggregate catch from all foreign, joint venture, domestic fisheries is included in these estimates.

Year	Age 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Total
								U.S. fisheries								
1973	0.00	0.00	55.92	9.67	21.72	40.22	25.16	23.01	21.51	10.33	4.51	1.94	1.08	0.00	0.00	215.07
1974	29.31	1.30	0.98	150.14	20.52	35.50	44.29	25.73	11.40	3.58	1.63	0.98	0.33	0.00	0.00	325.69
1975	0.00	88.43	2.69	3.70	128.11	21.86	23.54	38.00	17.15	7.40	3.70	1.35	0.34	0.00	0.00	336.27
1976	0.00	0.33	36.85	29.29	29.62	185.27	27.65	13.82	4.93	0.99	0.33	0.00	0.00	0.00	0.00	329.09
1977	0.00	1.81	3.80	54.35	11.23	19.93	68.11	11.05	5.80	2.72	1.45	0.73	0.18	0.00	0.00	181.16
1978	0.01	0.02	4.56	8.58	51.87	9.48	20.32	38.57	5.74	2.48	1.28	0.52	0.20	0.05	0.01	143.69
1979	0.00	4.34	8.74	17.41	10.15	48.01	15.47	29.48	20.82	4.25	1.70	0.50	0.22	0.05	0.03	161.17
1980	0.00	0.13	24.67	2.16	6.90	7.16	20.11	9.57	11.99	9.92	1.74	1.35	1.01	0.59	0.14	97.44
1981	13.38	1.25	2.30	97.62	6.89	9.64	6.77	23.33	6.26	7.24	7.05	0.95	0.48	0.12	0.13	183.41
1982	0.00	27.51	1.93	1.57	57.88	5.02	5.78	5.02	11.96	2.43	2.53	4.64	0.34	0.13	0.03	126.77
1983	0.00	0.00	86.60	7.22	3.63	36.79	4.68	3.72	3.32	5.24	1.62	1.00	1.00	0.16	0.14	155.12
1984	0.00	0.00	2.59	164.97	7.18	5.18	17.54	2.17	1.24	0.82	1.34	0.21	0.20	0.31	0.03	203.78
1985	2.27	0.55	1.32	12.36	113.50	9.74	4.30	6.75	0.61	0.34	0.24	0.36	0.00	0.00	0.00	152.34
1986	0.00	62.92	12.88	1.85	9.34	171.79	21.55	10.76	12.45	1.53	1.05	0.38	0.79	0.15	0.05	307.49
1987	0.00	0.00	124.20	6.58	1.68	2.72	151.56	7.89	3.09	14.87	0.57	0.15	0.15	1.25	0.00	314.71
1988	0.00	1.22	1.31	172.76	8.02	1.40	2.60	96.93	5.16	0.72	8.32	0.15	0.24	0.00	0.65	299.48
1989	0.00	8.65	9.57	3.88	257.20	7.80	2.46	2.74	106.63	6.62	0.87	5.37	0.03	0.12	0.57	412.51
1990	0.00	5.69	85.34	10.97	1.92	152.02	2.56	1.14	0.71	95.97	0.47	0.00	6.07	0.00	0.41	363.27
1991	0.00	0.95	43.96	98.32	19.35	6.00	151.49	6.63	1.31	0.93	60.10	2.11	0.00	9.74	0.65	401.54
1992	0.97	18.53	9.94	51.95	109.58	10.27	5.09	131.94	4.84	2.38	0.79	42.06	0.63	0.20	1.88	391.05
1993	0.00	1.90	70.49	9.07	42.90	59.65	3.75	3.06	81.86	1.81	0.43	0.20	20.95	0.12	2.47	298.66
1994	0.00	0.23	16.48	121.89	4.82	76.93	104.64	3.29	2.04	115.38	0.46	2.06	0.22	29.13	3.65	476.31
1995	0.20	1.02	0.41	19.96	114.38	3.32	27.40	66.22	3.09	0.53	58.19	1.09	0.91	0.10	18.55	315.36
1996	0.00	102.26	71.90	6.75	34.60	97.87	1.81	17.17	46.84	0.90	0.17	50.38	0.00	0.49	14.81	445.94
1997	0.00	2.00	173.73	163.98	3.01	27.17	48.41	3.05	10.71	18.59	0.39	0.77	17.33	0.47	8.38	477.97
1998	0.00	26.97	117.63	103.21	133.25	16.56	20.27	41.66	4.83	2.35	17.29	1.52	0.48	11.85	3.32	501.20
1999	0.00	47.58	112.33	100.72	91.74	54.50	16.20	19.69	19.86	3.94	6.16	9.99	1.34	1.68	9.92	495.66
2000	2.13	15.24	34.58	50.95	46.19	62.31	40.85	21.48	13.48	7.83	6.52	6.74	2.83	2.72	7.44	321.30
2001	0.00	52.82	59.10	40.31	59.74	29.69	25.99	15.21	3.99	4.54	3.64	2.31	1.80	1.55	2.86	303.57

Table 4. Continued. Canadian catch at age.

Year	Age 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Total
Canadian fisheries																
1977	0.00	0.01	0.01	0.25	0.09	0.30	1.83	0.53	0.50	0.42	0.40	0.35	0.16	0.00	0.00	4.85
1978	0.00	0.00	0.00	0.20	0.35	0.28	1.06	1.31	1.12	0.62	0.48	0.21	0.18	0.09	0.00	5.90
1979	0.00	0.00	0.00	0.21	0.62	1.30	1.14	2.10	3.02	1.10	0.79	0.37	0.25	0.17	0.12	11.19
1980	0.00	0.00	0.00	0.00	0.47	0.62	2.46	0.92	1.18	6.74	1.27	0.62	0.62	0.20	0.00	15.10
1981	0.00	0.00	0.00	1.01	0.27	1.41	1.38	4.28	0.85	2.36	6.18	1.49	0.60	0.85	0.00	20.68
1982	0.00	0.00	0.00	0.69	13.35	1.10	1.44	1.41	4.41	1.00	0.78	6.04	0.59	0.47	0.00	31.28
1983	0.00	0.06	14.02	1.03	1.80	32.15	1.29	1.87	1.67	5.59	0.77	0.26	3.41	0.26	0.13	64.31
1984	0.00	0.00	1.11	13.27	1.73	9.26	20.86	2.04	2.35	1.54	4.81	0.93	0.80	2.65	0.37	61.72
1985	0.00	0.06	0.06	2.45	8.03	1.65	3.25	9.62	0.49	0.55	0.55	1.65	0.37	0.00	1.59	30.32
1986	0.00	0.14	0.14	0.28	3.97	38.41	2.41	2.41	11.48	1.28	0.57	0.99	1.42	0.43	1.42	65.35
1987	0.00	0.00	0.90	0.60	0.15	2.56	70.71	2.86	2.86	10.38	0.60	0.45	1.20	0.90	1.20	95.37
1988	0.00	0.00	0.31	15.28	0.62	1.13	2.36	66.66	2.26	1.44	7.90	0.51	0.21	0.21	0.62	99.51
1989	0.00	0.00	0.20	0.59	35.55	0.20	0.39	0.59	69.34	1.76	1.37	8.59	0.39	0.20	1.17	120.34
1990	0.00	0.00	2.80	2.08	0.21	48.67	0.73	0.21	0.00	27.50	0.42	0.00	1.25	1.04	2.08	86.99
1991	0.00	0.00	0.11	6.11	2.46	0.43	70.60	0.54	0.00	0.21	47.47	0.21	0.11	2.25	0.11	130.61
1992	0.00	0.00	0.67	7.63	17.81	3.55	0.40	56.83	0.27	0.00	0.13	30.79	0.07	0.13	1.21	119.49
1993	0.00	0.07	0.77	2.52	12.91	17.54	1.89	0.21	40.62	0.21	0.14	0.14	12.49	0.21	0.21	89.93
1994	0.00	0.00	0.70	2.87	3.07	15.20	26.86	4.20	0.80	67.45	0.87	0.27	0.13	22.73	1.33	146.48
1995	4.88	0.04	0.53	6.31	5.03	3.21	10.72	15.96	3.25	0.67	33.81	0.68	0.04	0.15	9.41	94.70
1996	0.00	12.46	2.89	1.44	12.03	16.06	4.31	14.28	17.05	2.84	1.10	34.27	0.06	0.00	10.01	128.80
1997	0.00	0.81	22.17	19.19	2.52	17.21	16.22	2.25	11.08	14.42	3.24	0.54	18.65	1.35	4.06	133.73
1998	0.14	0.14	9.15	39.39	38.25	3.56	13.74	14.27	1.64	7.74	7.17	0.99	0.67	5.50	1.91	144.26
1999	1.45	26.28	9.65	18.35	40.74	25.71	1.94	8.39	8.47	2.65	3.66	4.26	0.56	0.19	4.05	156.36
2000	0.00	0.11	9.45	1.96	2.38	7.03	4.16	0.53	1.94	1.07	0.34	0.79	0.49	0.25	0.79	31.28

Table 5. AFSC acoustic survey estimates of Pacific whiting biomass and age composition. Surveys in 1995 and 1998 were cooperative surveys between AFSC and DFO. Biomass and age composition for 1977-89 were adjusted as described in Dorn (1996) to account for changes in target strength, depth and geographic coverage. Biomass estimates at 20 log l - 68 in 1992 and 1995 are from Wilson and Guttormson (1997). The biomass in 1995 includes 27,251 t of Pacific whiting found by the DFO survey vessel W.E. Ricker in Queen Charlotte Sound. (This estimate was obtained from 43,200 t, the biomass at -35 dB/kg multiplied by 0.631, a conversion factor from -35 dB/kg to 20 log l - 68 for the U.S. survey north of 50°30' N lat.). In 1992, 1995, and 1998, 20,702 t, 30,032 t, and 8,034 t of age-1 fish respectively is not included in the total survey biomass. In 2001 no age one fish were captured in survey trawls.

	Total biomass at 20 log l - 68 (1,000 t)					Number at age (million)										
Year		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1977	1596.422	0.22	135.48	121.24	718.01	63.29	87.41	745.78	106.23	78.20	40.90	39.47	21.80	8.49	2.18	2.25
1980	1701.482	0.00	14.45	1641.32	151.15	91.20	70.79	326.83	110.38	248.08	97.65	60.94	9.71	16.66	3.71	2.89
1983	1364.656	0.00	1.23	2918.17	50.86	20.64	304.29	31.84	34.78	26.00	51.01	12.46	13.39	14.84	2.69	0.00
1986	2397.386	0.00	3610.65	91.38	17.56	112.09	1701.85	179.58	131.65	181.21	21.62	21.03	1.47	10.37	2.35	0.00
1989	1805.603	0.00	571.25	200.82	39.29	1864.35	38.91	15.27	24.54	626.89	30.64	2.77	53.71	0.00	0.00	2.00
1992	1417.327	190.54	227.03	45.97	235.77	502.09	57.21	19.85	994.22	28.52	16.85	6.93	323.37	17.19	0.00	14.81
1995	1385.205	316.41	880.52	117.80	32.62	575.90	26.58	88.78	403.38	5.90	0.00	429.34	0.96	17.42	0.00	130.39
1998	1185.932	98.31	414.33	460.41	386.81	481.76	34.52	135.59	215.61	26.41	39.14	120.27	7.68	4.92	104.47	29.19
2001	737.743	0.00	1471.36	185.56	109.35	117.25	54.26	54.03	29.41	17.11	12.03	5.07	4.48	8.73	0.83	3.10

Table 6. AFSC trawl survey estimates of Pacific whiting biomass (1,000 t) and age composition (million). The biomass estimates for 1977 and 1986, when the trawl survey did not extend into the Canadian zone, were adjusted as described in Dorn et al. (1991). In 1995, 53,730 t of age-1 fish is not included in the biomass estimate. In 1998, 20,658 t of age-1 fish is not included in the biomass estimate. Age composition data for 2001 should be considered preliminary. AFSC acoustic survey age-length key was applied to trawl survey length compositions to derive numbers and biomass at age.

	Area-swept biomass estimate (1,000 t)					Number at age (million)										
Year		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1977	76.307	0.57	7.96	4.05	16.87	3.28	7.46	33.45	7.70	6.11	3.96	2.21	1.14	0.41	0.02	0.08
1980	188.299	0.30	1.80	234.42	6.91	12.53	11.37	22.31	14.32	16.93	11.96	4.63	2.28	1.20	0.99	1.43
1983	128.808	0.11	0.27	201.77	7.40	1.43	34.06	8.53	6.63	8.57	10.71	4.36	3.16	2.20	0.24	0.43
1986	254.566	0.00	203.50	8.95	2.81	1.33	202.20	10.37	5.21	59.96	2.23	2.20	0.55	8.88	0.20	0.69
1989	379.810	114.10	44.57	14.09	11.93	172.32	10.24	15.84	4.97	270.64	9.69	1.43	36.48	0.14	0.33	2.65
1992	352.538	56.14	47.95	5.72	28.12	78.63	9.10	3.32	202.78	3.60	3.25	2.61	74.35	3.43	0.00	4.85
1995	529.527	592.70	171.38	22.12	20.88	97.14	6.48	49.25	233.89	0.00	0.00	181.53	0.00	4.61	0.00	142.41
1998	476.459	212.14	442.40	285.14	132.36	151.01	12.48	34.31	72.23	12.36	7.24	46.03	0.68	4.55	33.74	14.03
2001	379.276	36.74	398.62	93.26	50.07	78.97	45.24	55.03	27.47	11.10	12.92	6.52	4.31	4.46	1.30	0.86

Table 7. DFO acoustic survey estimates of Pacific whiting biomass (1,000 t) and age composition (proportion in numbers) in the Canadian zone. The biomass and age composition in 1995 are from the U.S.-Canadian joint survey of the Canadian zone, and is reported in Wilson and Guttormsen (1997).

Year	Total biomass at -35 dB/kg (1,000 t)	Number at age (million)														
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1990	317.338	0.00	0.00	37.40	10.33	0.98	287.37	2.95	0.00	0.00	145.16	1.97	0.00	3.94	0.00	0.98
1991	563.308	0.00	0.00	2.96	54.46	10.69	1.48	448.06	1.48	0.00	1.48	346.79	3.49	1.48	23.97	0.00
1992	1101.328	0.00	0.00	8.58	88.95	214.54	54.69	1.04	840.57	3.24	0.00	0.00	351.39	0.52	4.29	7.77
1993	638.906	0.00	0.35	12.34	14.79	97.23	154.49	24.32	9.55	421.22	4.03	1.86	2.49	173.32	1.44	7.66
1994	224.907	0.00	1.44	5.96	7.87	8.34	36.86	53.37	10.35	2.33	138.50	1.08	0.00	0.00	37.16	0.74
1995	374.400	112.05	0.00	0.00	1.49	71.19	7.40	29.33	144.78	2.84	0.00	181.00	0.00	10.15	0.00	38.41
1996	447.410	1.18	77.89	21.83	7.08	79.07	61.96	29.51	57.83	92.06	18.88	8.26	175.26	17.11	3.54	41.31
1997	649.793	0.00	1.30	179.48	143.06	15.61	120.95	115.75	13.01	72.83	94.94	10.40	5.20	146.97	1.30	24.71

Table 8. Tiburon Midwater trawl laval rockfish survey estimates of log whiting abundance (Sakuma and Ralston 1997).

		All Strata		Monterey outside stratum only	
Year class	Year of recruitment	log(numbers)	SE	log(numbers)	SE
1986	1988	1.679	0.192	3.160	0.528
1987	1989	3.129	0.172	6.258	0.511
1988	1990	3.058	0.161	4.630	0.480
1989	1991	0.979	0.170	2.008	0.511
1990	1992	1.323	0.173	3.553	0.511
1991	1993	2.134	0.167	3.769	0.511
1992	1994	0.583	0.166	1.053	0.339
1993	1995	3.095	0.173	7.048	0.511
1994	1996	2.152	0.177	3.470	0.511
1995	1997	0.768	0.173	1.940	0.511
1996	1998	1.968	0.174	4.593	0.528
1997	1999	1.487	0.197	2.592	0.528
1998	2000	0.602	0.177	1.249	0.466
1999	2001	-	-	4.589	0.479
2000	2002	-	-	2.584	0.499
2001	2003			3.415	0.480

Table 9. Weight at age (kg) used in the stock assessment model.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
U.S. fishery weight at age															
1972-78	0.119	0.264	0.407	0.514	0.610	0.656	0.696	0.743	0.812	0.880	0.956	0.993	1.065	1.093	1.125
1979	0.143	0.264	0.456	0.570	0.667	0.734	0.793	0.831	0.905	0.944	1.016	1.088	1.156	1.071	1.208
1980	0.141	0.298	0.470	0.559	0.646	0.722	0.790	0.825	0.867	0.899	0.995	1.046	1.050	1.040	1.159
1981	0.137	0.286	0.429	0.547	0.632	0.697	0.760	0.809	0.858	0.888	0.934	1.000	1.055	1.075	1.176
1982	0.143	0.253	0.396	0.509	0.605	0.669	0.730	0.788	0.856	0.877	0.901	0.976	1.053	1.061	1.016
1983	0.150	0.253	0.328	0.447	0.525	0.589	0.637	0.680	0.721	0.791	0.806	0.850	0.878	1.005	0.999
1984	0.187	0.293	0.387	0.434	0.550	0.607	0.658	0.712	0.753	0.798	0.863	0.906	0.934	0.952	1.113
1985	0.213	0.321	0.412	0.491	0.545	0.619	0.679	0.796	0.777	0.831	0.920	0.961	1.023	1.004	1.111
1986	0.192	0.294	0.386	0.464	0.518	0.538	0.617	0.663	0.735	0.755	0.816	0.877	0.919	0.928	1.094
1987	0.187	0.297	0.394	0.460	0.517	0.546	0.563	0.627	0.681	0.720	0.748	0.834	0.856	0.893	0.975
1988	0.197	0.303	0.395	0.466	0.520	0.570	0.572	0.596	0.641	0.702	0.733	0.803	0.874	0.886	0.955
1989	0.192	0.232	0.320	0.402	0.454	0.502	0.538	0.565	0.577	0.584	0.668	0.752	0.826	0.900	0.854
1990	0.195	0.248	0.364	0.418	0.515	0.522	0.553	0.559	0.542	0.589	0.616	0.759	0.707	0.779	0.851
1991	0.195	0.291	0.374	0.461	0.505	0.527	0.576	0.629	0.604	0.566	0.641	0.601	0.802	0.866	0.887
1992	0.216	0.275	0.367	0.472	0.513	0.554	0.579	0.581	0.600	0.581	0.600	0.617	0.763	0.521	0.797
1993	0.196	0.283	0.348	0.402	0.468	0.511	0.509	0.524	0.557	0.556	0.569	0.603	0.587	0.636	0.615
1994	0.196	0.236	0.357	0.428	0.458	0.518	0.562	0.613	0.563	0.612	0.566	0.638	0.765	0.656	0.645
1995	0.120	0.277	0.468	0.488	0.493	0.514	0.591	0.590	0.601	0.619	0.636	0.617	0.651	0.655	0.669
1996	0.120	0.278	0.378	0.451	0.519	0.547	0.568	0.574	0.599	0.583	0.760	0.629	0.625	0.647	0.630
1997	0.097	0.340	0.421	0.471	0.536	0.532	0.572	0.584	0.603	0.625	0.746	0.657	0.684	0.623	0.716
1998	0.204	0.261	0.369	0.460	0.492	0.518	0.529	0.552	0.588	0.606	0.603	0.612	0.634	0.625	0.655
1999	-	0.244	0.338	0.414	0.505	0.527	0.548	0.572	0.638	0.582	0.722	0.698	0.846	0.750	0.713
2000	0.184	0.401	0.478	0.556	0.630	0.687	0.707	0.730	0.810	0.782	0.825	0.770	0.883	0.818	1.134
2001	-	0.319	0.485	0.591	0.632	0.681	0.740	0.749	0.767	0.826	0.780	0.823	0.838	0.801	0.887
Canadian fishery weight at age															
1972-76	0.135	0.370	0.606	0.742	0.827	0.861	0.905	0.987	1.221	1.111	1.163	1.206	1.222	1.213	1.247
1977	0.143	0.355	0.570	0.744	0.824	0.871	0.875	0.957	1.020	1.104	1.164	1.222	1.240	1.207	1.273
1978	0.133	0.313	0.502	0.658	0.783	0.818	0.825	0.858	0.922	0.992	1.072	1.153	1.171	1.132	1.205
1979	0.141	0.332	0.532	0.701	0.830	0.916	0.935	0.969	0.989	1.046	1.137	1.175	1.266	1.237	1.299
1980	0.140	0.319	0.496	0.655	0.780	0.869	0.979	0.955	0.970	1.037	1.073	1.180	1.229	1.225	1.301
1981	0.136	0.309	0.479	0.660	0.741	0.829	0.891	0.985	0.961	0.977	1.137	1.096	1.172	1.204	1.272
1982	0.126	0.288	0.449	0.584	0.674	0.779	0.842	0.902	0.904	0.959	0.987	1.028	1.097	1.127	1.269
1983	0.120	0.264	0.399	0.515	0.607	0.630	0.730	0.785	0.824	0.789	0.890	0.926	0.883	0.960	1.091
1984	0.137	0.296	0.439	0.557	0.643	0.710	0.723	0.816	0.856	0.896	0.911	0.975	0.987	0.957	1.076
1985	0.142	0.311	0.465	0.584	0.712	0.740	0.792	0.871	0.889	0.931	0.978	1.048	1.037	1.012	1.067
1986	0.125	0.281	0.431	0.548	0.633	0.659	0.742	0.795	0.888	0.880	0.932	0.986	1.143	0.988	1.048
1987	0.149	0.314	0.457	0.566	0.643	0.692	0.706	0.768	0.801	0.827	0.877	0.919	0.943	0.940	0.978
1988	0.120	0.270	0.533	0.523	0.443	0.602	0.501	0.685	0.828	0.792	0.886	1.060	1.020	1.318	1.080
1989	0.192	0.232	0.689	0.723	0.757	0.795	0.838	0.879	0.909	0.952	0.998	1.051	1.117	1.203	1.289
1990	0.195	0.248	0.488	0.528	0.567	0.614	0.669	0.725	0.798	0.881	0.966	1.044	1.122	1.189	1.255
1991	0.195	0.291	0.616	0.669	0.723	0.781	0.828	0.867	0.902	0.923	0.937	0.972	1.029	1.094	1.159
1992	0.216	0.275	0.581	0.593	0.645	0.677	0.706	0.701	0.713	0.713	0.713	0.729	0.764	0.791	0.864
1993	0.196	0.283	0.525	0.590	0.609	0.634	0.658	0.663	0.667	0.676	0.677	0.677	0.685	0.685	0.685
1994	0.196	0.236	0.695	0.605	0.664	0.707	0.728	0.732	0.737	0.752	0.677	0.677	0.768	0.685	0.685
1995	0.120	0.220	0.658	0.664	0.680	0.722	0.759	0.768	0.785	0.804	0.803	0.801	0.811	0.842	0.842
1996	0.120	0.358	0.527	0.593	0.689	0.682	0.697	0.731	0.737	0.729	0.699	0.754	0.856	0.798	0.740
1997	0.120	0.499	0.532	0.570	0.671	0.696	0.682	0.743	0.737	0.752	0.745	0.803	0.790	0.858	0.817
1998	-	0.311	0.422	0.555	0.566	0.602	0.665	0.653	0.679	0.696	0.724	0.803	0.809	0.801	0.775
1999	-	0.277	0.397	0.486	0.627	0.612	0.635	0.667	0.723	0.671	0.816	0.792	0.742	1.056	0.837
2000	-	0.221	0.527	0.615	0.707	0.806	0.778	0.857	0.874	0.859	0.867	0.970	0.918	0.900	0.982

Table 9. Weight at age (kg) used in the stock assessment model (cont).

	1	2	3	4	5	6	7	8	9	10	11	12	13
					AFSC acoustic survey weight at age								
1977	0.123	0.256	0.388	0.492	0.589	0.662	0.724	0.796	0.860	0.892	0.949	1.008	1.057
1980	0.107	0.261	0.455	0.561	0.672	0.759	0.861	0.894	0.948	1.003	1.081	1.122	1.170
1983	0.122	0.228	0.308	0.457	0.570	0.667	0.723	0.776	0.826	0.891	0.917	0.935	0.985
1986	0.165	0.262	0.367	0.465	0.532	0.558	0.658	0.715	0.815	0.823	0.865	0.908	1.006
1989	0.143	0.321	0.387	0.461	0.521	0.561	0.599	0.621	0.634	0.638	0.682	0.729	0.870
1992	0.119	0.205	0.357	0.508	0.554	0.578	0.654	0.642	0.688	0.655	0.758	0.705	0.697
1995	0.097	0.220	0.344	0.438	0.548	0.605	0.639	0.624	0.630	0.682	0.717	0.701	0.727
1998	0.081	0.189	0.343	0.527	0.534	0.587	0.658	0.631	0.645	0.766	0.709	0.830	0.735
2001	-	0.250	0.421	0.584	0.627	0.716	0.813	0.834	0.895	1.154	0.994	0.870	0.878
					AFSC bottom trawl survey weight at age								
1977	0.123	0.256	0.388	0.492	0.589	0.662	0.724	0.796	0.860	0.892	0.949	1.008	1.057
1980	0.107	0.261	0.455	0.561	0.672	0.759	0.861	0.894	0.948	1.003	1.081	1.122	1.170
1983	0.122	0.228	0.308	0.457	0.570	0.667	0.723	0.776	0.826	0.891	0.917	0.935	0.985
1986	0.165	0.262	0.367	0.465	0.532	0.558	0.658	0.715	0.815	0.823	0.865	0.908	1.006
1989	0.143	0.321	0.387	0.461	0.521	0.561	0.599	0.621	0.634	0.638	0.682	0.729	0.870
1992	0.119	0.205	0.357	0.508	0.554	0.578	0.654	0.642	0.688	0.655	0.758	0.705	0.697
1995	0.091	0.204	0.279	0.408	0.476	0.530	0.609	0.659	0.682	0.704	0.727	0.730	0.733
1998	0.097	0.189	0.339	0.480	0.502	0.532	0.534	0.575	0.583	0.655	0.669	0.639	0.762
2001	-	0.189	0.339	0.480	0.502	0.532	0.534	0.575	0.583	0.655	0.669	0.639	0.762
					DFO acoustic survey weight at age								
1990	0.119	0.205	0.533	0.575	0.592	0.647	0.623	0.646	0.646	0.669	0.656	0.957	0.957
1991	0.119	0.205	0.533	0.560	0.592	0.641	0.615	0.633	0.633	0.650	0.656	0.657	0.657
1992	0.119	0.205	0.629	0.600	0.653	0.685	0.686	0.705	0.657	0.698	0.698	0.739	0.744
1993	0.196	0.283	0.541	0.595	0.624	0.641	0.688	0.718	0.704	0.827	0.847	0.624	0.741
1994	0.196	0.567	0.585	0.614	0.654	0.694	0.720	0.782	0.775	0.761	1.083	0.935	0.935
1995	0.098	0.235	0.371	0.508	0.642	0.778	0.739	0.740	0.691	0.739	0.787	0.769	0.752
1996	0.330	0.403	0.482	0.582	0.655	0.650	0.665	0.693	0.686	0.688	0.684	0.705	0.779
1997	0.330	0.488	0.572	0.598	0.673	0.710	0.722	0.731	0.746	0.785	0.749	0.713	0.761
					Population weight at age								
1972-78	0.123	0.256	0.388	0.492	0.589	0.662	0.724	0.796	0.860	0.892	0.949	1.008	1.057
1979-81	0.107	0.261	0.455	0.561	0.672	0.759	0.861	0.894	0.948	1.003	1.081	1.122	1.170
1982-84	0.122	0.228	0.308	0.457	0.570	0.667	0.723	0.776	0.826	0.891	0.917	0.935	0.985
1985-87	0.165	0.262	0.367	0.465	0.532	0.558	0.658	0.715	0.815	0.823	0.865	0.908	1.006
1988-90	0.143	0.321	0.387	0.461	0.521	0.561	0.599	0.621	0.634	0.638	0.682	0.729	0.870
1991-93	0.119	0.205	0.357	0.508	0.554	0.578	0.654	0.642	0.688	0.655	0.758	0.705	0.697
1994-96	0.097	0.220	0.344	0.438	0.548	0.605	0.639	0.624	0.630	0.682	0.717	0.701	0.727
1997-99	0.081	0.189	0.343	0.527	0.534	0.587	0.658	0.631	0.645	0.766	0.709	0.830	0.735
1999-02	-	0.250	0.421	0.584	0.627	0.716	0.813	0.834	0.895	1.154	0.994	0.870	0.878
					Female multiplier for spawning biomass								
All yrs.	0.511	0.510	0.511	0.510	0.512	0.522	0.525	0.535	0.543	0.547	0.569	0.568	0.572

Table 10. Selectivity at age for Pacific whiting fisheries and surveys for base-run model. The fisheries and surveys were modeled using double logistic selectivity functions, with random walk process error for the U.S. and Canadian fisheries. The fishery selectivity coefficients reported below are the average of the annual selectivity coefficients for all years (1972-2001), and for the last ten years (1992-2001).

Age	U.S. fishery, all years	U.S. fishery, 1992-01	Canadian fishery, all years	Canadian fishery, 1992-01	Acoustic survey	Bottom trawl survey	DFO acoustic survey
2	0.102	0.150	0.029	0.077	0.553	0.252	0.030
3	0.419	0.634	0.066	0.168	0.744	0.314	0.069
4	0.722	0.908	0.110	0.219	0.875	0.390	0.151
5	0.881	0.993	0.280	0.475	0.947	0.482	0.300
6	0.946	1.000	0.520	0.738	0.982	0.589	0.509
7	0.977	1.000	0.734	0.901	0.996	0.709	0.717
8	0.983	0.999	0.869	0.970	1.000	0.832	0.865
9	0.958	0.996	0.943	0.992	0.995	0.938	0.946
10	0.887	0.987	0.980	0.999	0.979	1.000	0.984
11	0.762	0.963	0.995	1.000	0.941	0.987	1.000
12	0.597	0.901	0.995	0.993	0.862	0.891	1.000
13	0.421	0.760	0.952	0.948	0.721	0.735	0.954
14	0.256	0.525	0.730	0.726	0.520	0.560	0.704
15	0.127	0.281	0.283	0.281	0.315	0.401	0.240

Table 11. Numbers at age (billions of fish) for the coastal stock of Pacific whiting estimated by the base-run model, 1972-2001.

	Age													
	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1972	4.753	0.708	0.562	0.599	0.341	0.240	0.163	0.069	0.041	0.022	0.015	0.000	0.000	0.000
1973	0.621	3.759	0.557	0.436	0.454	0.249	0.166	0.108	0.044	0.026	0.014	0.010	0.000	0.000
1974	0.555	0.490	2.938	0.427	0.324	0.320	0.165	0.105	0.066	0.027	0.016	0.009	0.007	0.000
1975	1.817	0.435	0.378	2.210	0.309	0.224	0.213	0.107	0.068	0.043	0.018	0.012	0.007	0.005
1976	0.406	1.404	0.330	0.281	1.600	0.218	0.155	0.146	0.073	0.047	0.031	0.014	0.009	0.010
1977	0.398	0.317	1.073	0.243	0.198	1.095	0.148	0.106	0.102	0.053	0.036	0.024	0.011	0.015
1978	0.247	0.313	0.246	0.806	0.178	0.143	0.793	0.108	0.078	0.076	0.041	0.028	0.019	0.020
1979	3.061	0.196	0.245	0.187	0.597	0.130	0.105	0.583	0.080	0.059	0.059	0.032	0.022	0.031
1980	0.430	2.421	0.152	0.183	0.135	0.426	0.093	0.075	0.419	0.059	0.044	0.045	0.025	0.041
1981	0.575	0.341	1.903	0.117	0.137	0.100	0.313	0.068	0.055	0.310	0.044	0.034	0.035	0.052
1982	12.264	0.455	0.266	1.430	0.085	0.098	0.070	0.220	0.048	0.039	0.228	0.033	0.026	0.068
1983	0.361	9.722	0.359	0.206	1.069	0.062	0.071	0.051	0.160	0.035	0.029	0.171	0.025	0.074
1984	0.115	0.286	7.635	0.275	0.154	0.788	0.045	0.052	0.037	0.118	0.026	0.022	0.130	0.078
1985	0.250	0.091	0.224	5.910	0.210	0.115	0.586	0.034	0.039	0.028	0.088	0.020	0.017	0.162
1986	9.646	0.198	0.072	0.174	4.578	0.162	0.088	0.445	0.026	0.029	0.021	0.068	0.015	0.141
1987	0.142	7.601	0.152	0.054	0.131	3.421	0.119	0.064	0.326	0.019	0.022	0.016	0.052	0.122
1988	0.439	0.112	5.924	0.116	0.041	0.098	2.513	0.087	0.047	0.238	0.014	0.016	0.012	0.135
1989	2.712	0.348	0.088	4.524	0.087	0.030	0.072	1.831	0.063	0.034	0.174	0.010	0.012	0.115
1990	1.307	2.146	0.268	0.065	3.321	0.063	0.022	0.051	1.302	0.045	0.024	0.126	0.008	0.099
1991	0.246	1.031	1.631	0.199	0.048	2.426	0.046	0.016	0.037	0.944	0.033	0.018	0.093	0.083
1992	1.741	0.194	0.779	1.196	0.145	0.034	1.720	0.032	0.011	0.026	0.667	0.023	0.013	0.133
1993	0.705	1.368	0.144	0.560	0.847	0.101	0.024	1.191	0.022	0.008	0.018	0.468	0.017	0.112
1994	0.238	0.556	1.030	0.105	0.403	0.603	0.072	0.017	0.842	0.016	0.005	0.013	0.339	0.098
1995	1.662	0.189	0.428	0.702	0.068	0.256	0.372	0.044	0.010	0.511	0.010	0.003	0.008	0.301
1996	1.587	1.319	0.149	0.316	0.467	0.044	0.161	0.231	0.027	0.006	0.317	0.006	0.002	0.225
1997	0.724	1.165	0.974	0.097	0.200	0.285	0.026	0.094	0.135	0.016	0.004	0.187	0.004	0.162
1998	0.703	0.570	0.761	0.626	0.060	0.121	0.170	0.015	0.056	0.080	0.009	0.002	0.115	0.119
1999	0.392	0.530	0.356	0.449	0.355	0.034	0.067	0.094	0.009	0.031	0.044	0.005	0.001	0.160
2000	0.316	0.249	0.306	0.195	0.236	0.183	0.017	0.034	0.048	0.004	0.016	0.023	0.003	0.113
2001	2.796	0.238	0.145	0.175	0.110	0.131	0.101	0.010	0.019	0.027	0.002	0.009	0.014	0.084

Table 12. Time series of estimated biomass, recruitment, and utilization for 1972-2001 for the base-run assessment model. U.S. and Canadian exploitation rate is the catch in biomass divided by the total biomass of age 3+ fish at the start of the year. Population biomass is in millions of tons of age-3 and older fish at the start of the year. Recruitment is given in billions of age-2 fish.

Year	Population biomass (million t)	Female spawning biomass	Recruits (billion)	U.S. exploitation rate	Canada exploitation rate	Total exploitation rate
1972	1.566	0.852	4.753	4.7%	2.8%	7.5%
1973	2.783	1.177	0.621	5.3%	0.5%	5.8%
1974	2.674	1.275	0.555	7.3%	0.6%	7.9%
1975	2.430	1.242	1.817	8.5%	0.6%	9.1%
1976	2.515	1.210	0.406	9.2%	0.2%	9.4%
1977	2.157	1.085	0.398	5.9%	0.2%	6.2%
1978	1.919	0.985	0.247	5.1%	0.3%	5.4%
1979	1.874	1.044	3.061	6.7%	0.7%	7.3%
1980	2.599	1.180	0.430	2.8%	0.7%	3.5%
1981	2.420	1.205	0.575	4.7%	1.0%	5.7%
1982	1.863	1.193	12.264	4.1%	1.7%	5.8%
1983	4.603	1.861	0.361	1.6%	0.9%	2.5%
1984	4.887	2.316	0.115	2.0%	0.9%	2.8%
1985	4.267	2.164	0.250	2.0%	0.6%	2.6%
1986	3.585	2.086	9.646	4.3%	1.6%	5.9%
1987	5.854	2.563	0.142	2.7%	1.3%	4.0%
1988	4.905	2.418	0.439	3.3%	1.8%	5.1%
1989	4.139	2.192	2.712	5.1%	2.4%	7.5%
1990	4.036	2.005	1.307	4.6%	1.9%	6.5%
1991	3.872	1.944	0.246	5.6%	2.7%	8.3%
1992	2.989	1.581	1.741	7.0%	2.9%	9.9%
1993	2.723	1.369	0.705	5.2%	2.2%	7.3%
1994	2.310	1.178	0.238	10.9%	4.6%	15.5%
1995	1.710	0.927	1.662	10.4%	4.1%	14.5%
1996	1.664	0.831	1.587	12.8%	5.3%	18.1%
1997	1.732	0.826	0.724	13.5%	5.2%	18.7%
1998	1.451	0.714	0.703	16.0%	6.0%	22.0%
1999	1.139	0.561	0.392	19.7%	7.6%	27.3%
2000	0.958	0.482	0.316	21.7%	2.3%	24.1%
2001	0.712	0.415	2.796	25.6%	7.5%	33.1%
Avg. 1972-98	2.744	1.363	1.707	7.94%	2.37%	10.31%

Table 13. Life history and fishery vectors used to estimate spawning biomass per recruit (SPR) fishing mortalities.

Age	Natural mortality	U.S. fishery selectivity (Avg. 1992-2001)	Canadian fishery selectivity (Avg 1992-2001)	U.S. fishery weight at age (kg) (Avg. 1978-2001)	Canadian fishery weight at age (kg) (Avg. 1976-2001)	Population weight at age (kg) (Avg. 1977-2001)	Proportion of mature females	Multiplier for female weight at age
2	0.23	0.1503	0.0774	0.278	0.294	0.243	0.176	0.510
3	0.23	0.6339	0.1684	0.392	0.530	0.369	0.661	0.511
4	0.23	0.9077	0.2190	0.472	0.619	0.489	0.890	0.510
5	0.23	0.9932	0.4753	0.538	0.689	0.565	0.969	0.512
6	0.23	0.9998	0.7379	0.581	0.742	0.622	0.986	0.522
7	0.23	0.9997	0.9009	0.622	0.778	0.689	0.996	0.525
8	0.23	0.9987	0.9696	0.659	0.829	0.712	1.000	0.535
9	0.23	0.9956	0.9922	0.688	0.872	0.756	1.000	0.543
10	0.23	0.9871	0.9988	0.715	0.894	0.794	1.000	0.547
11	0.23	0.9634	0.9997	0.766	0.937	0.835	1.000	0.569
12	0.23	0.9011	0.9932	0.801	0.985	0.867	1.000	0.568
13	0.23	0.7600	0.9483	0.853	1.027	0.906	1.000	0.572
14	0.23	0.5255	0.7259	0.853	1.038	0.939	1.000	0.581
15+	0.23	0.2813	0.2810	0.917	1.082	0.976	1.000	0.589

Table 14 (continued). Projections of whiting yield for 2002-2006 under different harvest rate policies and scenarios for reruitment in 2001 from the base-run model. Shown are discrete intervals of possible recruitment states corresponding to percentile ranges (0-10%, 10%- 90%, and 90%-100%) associated with recruitment realizations generated from the MCMC simulation (Values shown give the mean and coefficients of variation (in parentheses) based on 1,000,000 MCMC simulations.)

F40% (40-10) Harvest Rate Policy

Harvest Policy	Year	Age 3+ biomass (million t)		Spawning Biomass (SSB, million t)		Prob (SSB>25% B0)	Prob (SSB>40% B0)	Age-2 Recruits (billion)		Exploitation rate		Total yield (t)	
0%-10%	2002	1.018	(0.07)	0.421	(0.09)	-	-	0.589	(0.92)	11.4%	(0.13)	116,842	(0.18)
0%-10%	2003	1.111	(0.15)	0.522	(0.12)	-	-	0.927	(1.08)	14.8%	(0.10)	165,548	(0.22)
0%-10%	2004	1.109	(0.29)	0.541	(0.22)	-	-	1.688	(1.24)	17.0%	(0.18)	189,212	(0.35)
0%-10%	2005	1.373	(0.48)	0.624	(0.38)	-	-	1.128	(1.44)	16.3%	(0.15)	227,323	(0.50)
0%-10%	2006	1.442	(0.54)	0.703	(0.48)	-	-	1.342	(1.84)	18.4%	(0.39)	265,226	(0.58)
10%-90%	2002	1.261	(0.10)	0.503	(0.10)	-	-	0.582	(0.98)	12.7%	(0.11)	161,691	(0.18)
10%-90%	2003	1.334	(0.15)	0.624	(0.13)	-	-	0.991	(1.00)	16.2%	(0.08)	217,120	(0.19)
10%-90%	2004	1.264	(0.27)	0.610	(0.22)	-	-	1.502	(1.70)	18.0%	(0.17)	228,103	(0.31)
10%-90%	2005	1.420	(0.57)	0.663	(0.44)	-	-	1.452	(1.41)	17.6%	(0.15)	249,655	(0.52)
10%-90%	2006	1.549	(0.64)	0.726	(0.57)	-	-	1.569	(1.50)	17.5%	(0.18)	273,432	(0.64)
90%-100%	2002	1.565	(0.06)	0.606	(0.07)	-	-	0.637	(0.93)	14.0%	(0.08)	219,307	(0.13)
90%-100%	2003	1.633	(0.12)	0.757	(0.10)	-	-	0.987	(0.89)	17.4%	(0.06)	284,138	(0.13)
90%-100%	2004	1.451	(0.21)	0.704	(0.19)	-	-	1.600	(1.92)	19.6%	(0.17)	283,211	(0.25)
90%-100%	2005	1.563	(0.60)	0.735	(0.45)	-	-	1.572	(1.63)	18.8%	(0.16)	289,480	(0.52)
90%-100%	2006	1.681	(0.70)	0.792	(0.61)	-	-	1.820	(1.95)	18.3%	(0.19)	306,001	(0.67)
0%-100%	2002	1.267	(0.09)	0.505	(0.11)	0.380	0.000	0.588	(0.97)	12.7%	(0.12)	162,968	(0.23)
0%-100%	2003	1.341	(0.15)	0.627	(0.10)	0.900	0.030	0.984	(1.00)	16.2%	(0.09)	218,665	(0.22)
0%-100%	2004	1.267	(0.26)	0.613	(0.12)	0.740	0.070	1.530	(1.68)	18.1%	(0.17)	229,724	(0.32)
0%-100%	2005	1.430	(0.57)	0.667	(0.22)	0.690	0.160	1.432	(1.44)	17.6%	(0.15)	251,404	(0.52)
0%-100%	2006	1.551	(0.64)	0.730	(0.44)	0.680	0.240	1.686	(1.66)	17.6%	(0.22)	275,868	(0.64)

Table 14 (continued). Projections of whiting yield for 2002-2006 under different harvest rate policies and scenarios for reruitment in 2001 from the base-run model. Shown are discrete intervals of possible recruitment states corresponding to percentile ranges (0-10%, 10%- 90%, and 90%-100%) associated with recruitment realizations generated from the MCMC simulation (Values shown give the mean and coefficients of variation (in parentheses) based on 1,000,000 MCMC simulations.)

F45% (40-10) Harvest Rate Policy

Assumed 2001 Recruitment	Year	Age 3+ biomass (million t)		Spawning Biomass (SSB, million t)		Prob (SSB>25 %B0)	Prob (SSB>40 %B0)	Age-2 Recruits (billion)		Exploitation rate		Total yield (t)	
0%-10%	2002	1.018	(0.07)	0.421	(0.09)	-	-	0.589	(0.92)	9.4%	(0.13)	95,909	(0.18)
0%-10%	2003	1.134	(0.15)	0.533	(0.12)	-	-	0.927	(1.08)	12.4%	(0.10)	141,047	(0.21)
0%-10%	2004	1.154	(0.29)	0.563	(0.22)	-	-	1.688	(1.24)	14.3%	(0.17)	165,956	(0.33)
0%-10%	2005	1.437	(0.47)	0.656	(0.37)	-	-	1.128	(1.44)	13.9%	(0.14)	201,191	(0.47)
0%-10%	2006	1.526	(0.53)	0.746	(0.47)	-	-	1.342	(1.84)	15.6%	(0.35)	236,114	(0.55)
10%-90%	2002	1.261	(0.10)	0.503	(0.10)	-	-	0.582	(0.98)	10.5%	(0.11)	132,706	(0.18)
10%-90%	2003	1.365	(0.15)	0.639	(0.13)	-	-	0.991	(1.00)	13.5%	(0.08)	185,325	(0.19)
10%-90%	2004	1.323	(0.26)	0.640	(0.22)	-	-	1.502	(1.70)	15.2%	(0.15)	201,401	(0.29)
10%-90%	2005	1.500	(0.55)	0.704	(0.42)	-	-	1.452	(1.41)	15.0%	(0.14)	223,441	(0.48)
10%-90%	2006	1.648	(0.62)	0.776	(0.55)	-	-	1.569	(1.50)	14.9%	(0.16)	246,339	(0.60)
90%-100%	2002	1.565	(0.06)	0.606	(0.07)	-	-	0.637	(0.93)	11.5%	(0.08)	179,976	(0.13)
90%-100%	2003	1.676	(0.12)	0.778	(0.10)	-	-	0.987	(0.89)	14.5%	(0.06)	242,569	(0.12)
90%-100%	2004	1.530	(0.21)	0.744	(0.18)	-	-	1.600	(1.92)	16.5%	(0.16)	250,927	(0.23)
90%-100%	2005	1.667	(0.57)	0.787	(0.43)	-	-	1.572	(1.63)	16.0%	(0.14)	261,242	(0.48)
90%-100%	2006	1.803	(0.67)	0.854	(0.59)	-	-	1.820	(1.95)	15.6%	(0.17)	278,197	(0.62)
0%-100%	2002	1.267	(0.14)	0.505	(0.13)	0.380	0.000	0.588	(0.97)	10.5%	(0.12)	133,754	(0.23)
0%-100%	2003	1.373	(0.17)	0.643	(0.15)	0.930	0.040	0.984	(1.00)	13.5%	(0.09)	186,622	(0.22)
0%-100%	2004	1.327	(0.27)	0.642	(0.22)	0.840	0.090	1.530	(1.68)	15.3%	(0.16)	202,809	(0.30)
0%-100%	2005	1.511	(0.55)	0.707	(0.42)	0.790	0.200	1.432	(1.44)	15.0%	(0.14)	224,996	(0.49)
0%-100%	2006	1.651	(0.62)	0.781	(0.55)	0.780	0.290	1.686	(1.66)	15.1%	(0.19)	248,503	(0.60)

Table 14 (continued). Projections of whiting yield for 2002-2006 under different harvest rate policies and scenarios for reruitment in 2001 from the base-run model. Shown are discrete intervals of possible recruitment states corresponding to percentile ranges (0-10%, 10%- 90%, and 90%-100%) associated with recruitment realizations generated from the MCMC simulation (Values shown give the mean and coefficients of variation (in parentheses) based on 1,000,000 MCMC simulations.)

F50% (40-10) Harvest Rate Policy

Assumed 2001 Recruitment	Year	Age 3+ biomass (million t)		Spawning Biomass (SSB, million t)		Prob (SSB>25% B0)	Prob (SSB>40% B0)	Age-2 Recruits (billion)		Exploitation rate		Total yield (t)	
0%-10%	2002	1.018	(0.07)	0.421	(0.09)	-	-	0.589	(0.92)	7.7%	(0.13)	79,231	(0.18)
0%-10%	2003	1.152	(0.15)	0.542	(0.12)	-	-	0.927	(1.08)	10.4%	(0.10)	119,943	(0.21)
0%-10%	2004	1.191	(0.28)	0.581	(0.22)	-	-	1.688	(1.24)	12.1%	(0.16)	144,441	(0.32)
0%-10%	2005	1.492	(0.46)	0.683	(0.36)	-	-	1.128	(1.44)	11.8%	(0.13)	176,643	(0.45)
0%-10%	2006	1.601	(0.52)	0.784	(0.46)	-	-	1.342	(1.84)	13.2%	(0.32)	208,580	(0.52)
10%-90%	2002	1.261	(0.10)	0.503	(0.10)	-	-	0.582	(0.98)	8.6%	(0.11)	109,622	(0.18)
10%-90%	2003	1.391	(0.15)	0.651	(0.13)	-	-	0.991	(1.00)	11.3%	(0.08)	157,812	(0.19)
10%-90%	2004	1.373	(0.26)	0.665	(0.21)	-	-	1.502	(1.70)	12.8%	(0.14)	176,147	(0.28)
10%-90%	2005	1.570	(0.53)	0.739	(0.41)	-	-	1.452	(1.41)	12.7%	(0.13)	197,857	(0.45)
10%-90%	2006	1.737	(0.60)	0.821	(0.54)	-	-	1.569	(1.50)	12.7%	(0.14)	219,703	(0.57)
90%-100%	2002	1.565	(0.06)	0.606	(0.07)	-	-	0.637	(0.93)	9.5%	(0.08)	148,661	(0.13)
90%-100%	2003	1.711	(0.12)	0.794	(0.10)	-	-	0.987	(0.89)	12.1%	(0.06)	206,518	(0.12)
90%-100%	2004	1.596	(0.20)	0.776	(0.18)	-	-	1.600	(1.92)	13.8%	(0.14)	219,950	(0.22)
90%-100%	2005	1.757	(0.55)	0.832	(0.41)	-	-	1.572	(1.63)	13.6%	(0.13)	232,710	(0.44)
90%-100%	2006	1.913	(0.65)	0.910	(0.57)	-	-	1.820	(1.95)	13.3%	(0.15)	249,857	(0.58)
0%-100%	2002	1.267	(0.14)	0.505	(0.13)	0.380	0.000	0.588	(0.97)	11.3%	(0.12)	110,487	(0.23)
0%-100%	2003	1.399	(0.17)	0.655	(0.15)	0.940	0.050	0.984	(0.99)	12.9%	(0.90)	158,895	(0.22)
0%-100%	2004	1.377	(0.26)	0.667	(0.22)	0.890	0.110	1.530	(1.68)	12.7%	(0.15)	177,357	(0.29)
0%-100%	2005	1.581	(0.53)	0.743	(0.41)	0.870	0.250	1.432	(0.14)	12.8%	(0.13)	199,221	(0.46)
0%-100%	2006	1.741	(0.60)	0.826	(0.53)	0.850	0.330	1.686	(1.66)	1741.9%	(0.17)	221,606	(0.57)

Table 15. Decision table showing the repercussions of different assumptions for 2001 recruitment (1999 year-class) and under different harvest strategies. Values given show spawning biomass (as percent unfished) and exploitation rates as outcomes of choosing TACs for 2002-2004 associated with low (<10%), medium (10%-90%) or high (>90%) levels of 2001 recruitment (assumed state of nature) against low, medium and high true levels of recruitment (True state of nature).

		True state of nature 2001 Recruitment (billions)					
		Low (2.12)		Medium (2.89)		High (3.87)	
		Spawning biomass (as percent unfished)					
Management action	Assumed state of nature	2003	2004	2003	2004	2003	2004
F40% (40-10)	Low	27%	31%	33%	36%	41%	43%
F45% (40-10)	Low	28%	32%	34%	37%	41%	44%
F50% (40-10)	Low	28%	32%	34%	38%	42%	45%
F40% (40-10)	Medium	26%	28%	32%	34%	39%	40%
F45% (40-10)	Medium	27%	30%	33%	35%	40%	42%
F50% (40-10)	Medium	28%	31%	33%	36%	41%	43%
F40% (40-10)	High	25%	25%	31%	31%	38%	38%
F45% (40-10)	High	26%	27%	32%	33%	39%	39%
F50% (40-10)	High	27%	29%	32%	34%	40%	41%
		Outcome: Exploitation rate (2003-2004)					
Management action	Assumed state of nature	2003	2004	2003	2004	2003	2004
F40% (40-10)	Low	14%	14%	11%	12%	9%	10%
F45% (40-10)	Low	11%	12%	9%	10%	8%	9%
F50% (40-10)	Low	10%	10%	8%	9%	6%	7%
F40% (40-10)	Medium	19%	18%	15%	15%	12%	13%
F45% (40-10)	Medium	15%	15%	13%	13%	10%	11%
F50% (40-10)	Medium	13%	13%	11%	11%	9%	9%
F40% (40-10)	High	26%	25%	21%	21%	17%	17%
F45% (40-10)	High	21%	21%	17%	17%	14%	15%
F50% (40-10)	High	17%	17%	14%	15%	12%	12%

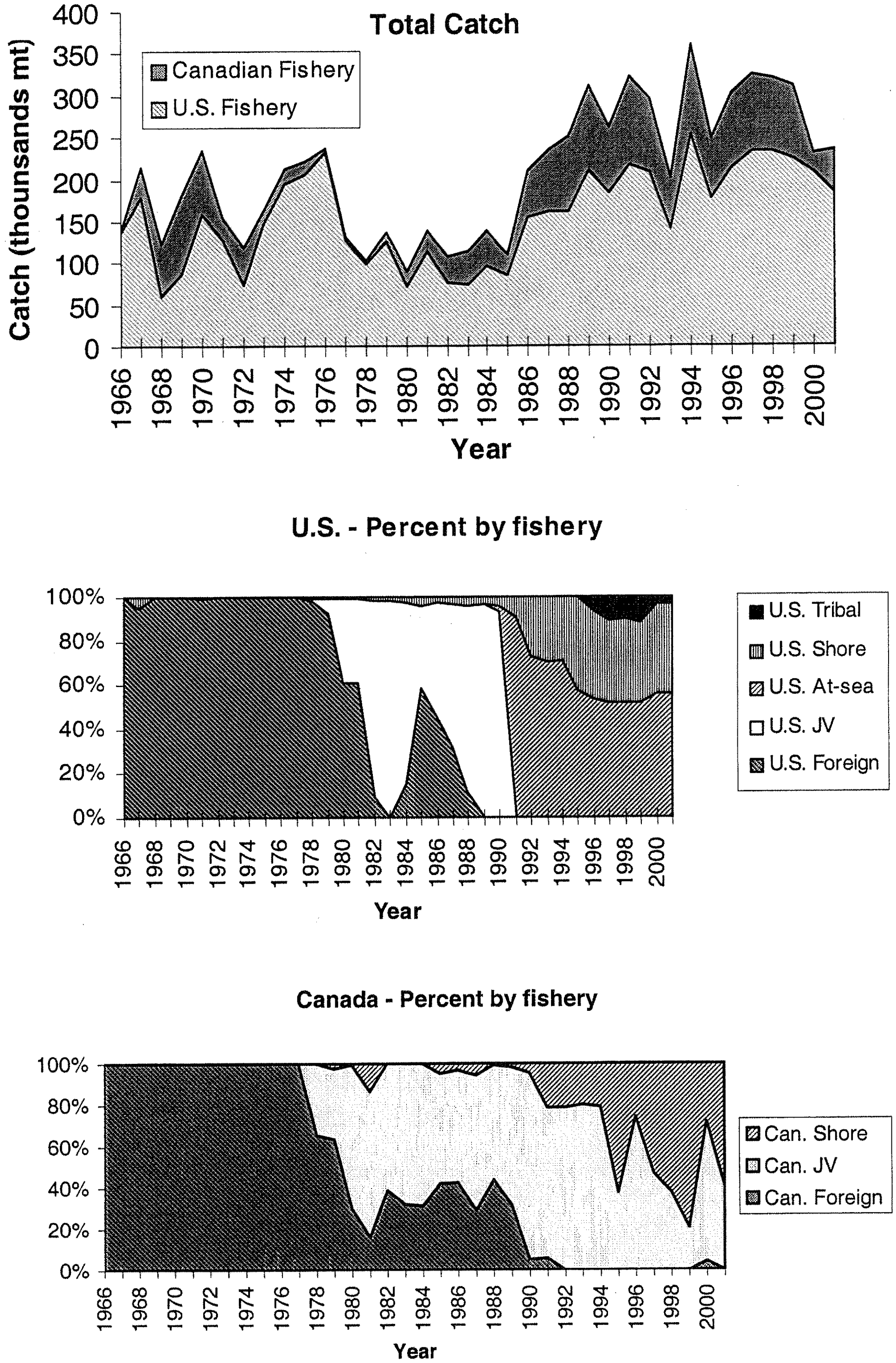


Figure 1. Total catch of Pacific whiting in the U.S. and Canadian zones (1966-2001) (upper panel). Percent catch by fishery within each zone (lower panels).

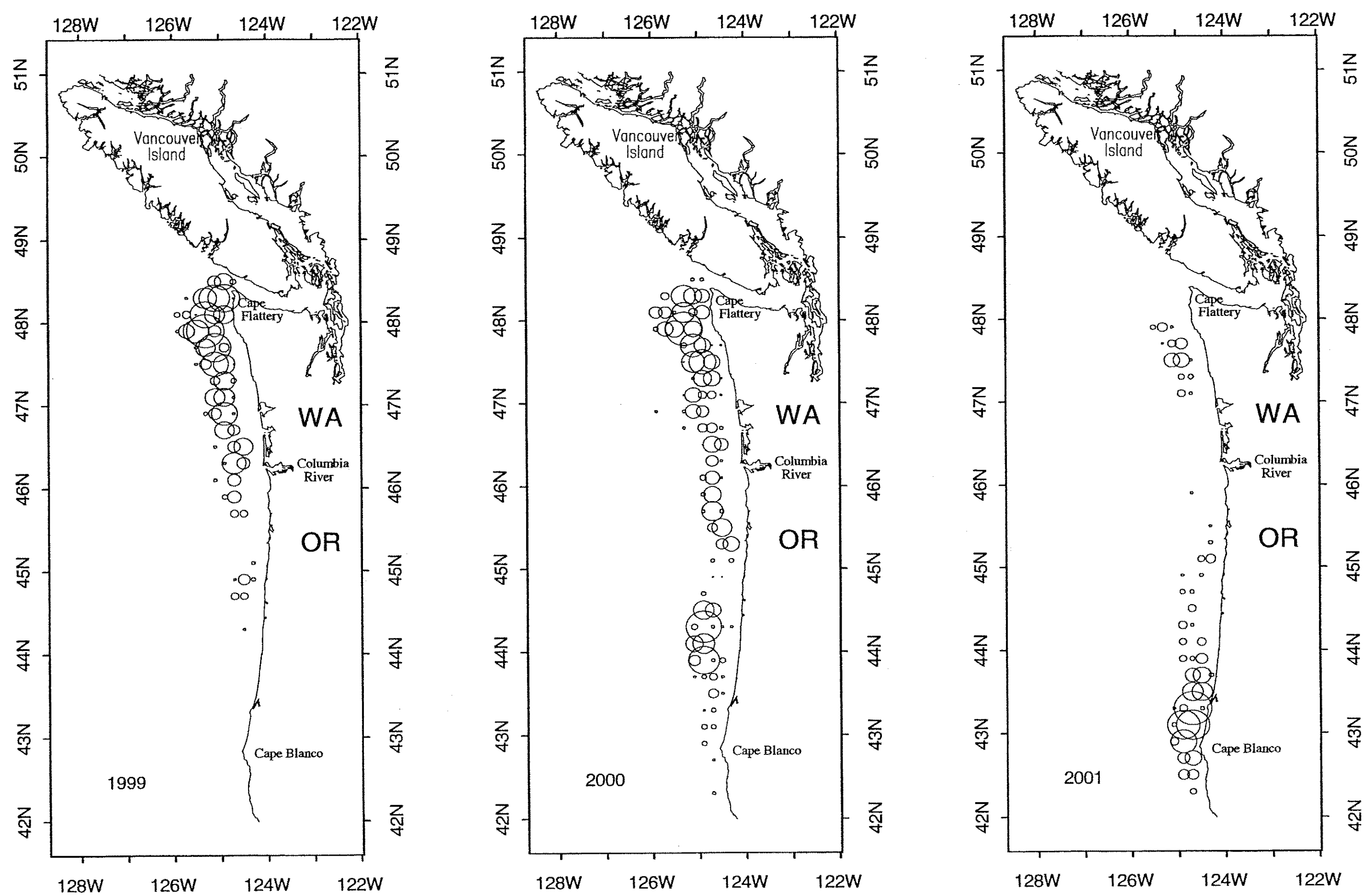


Figure 2. Catch by 20 km^2 block for factory and catcher boats in the 1999-2001 at-sea fishery for Pacific whiting. Area of circle is proportional to the total catch within the block.

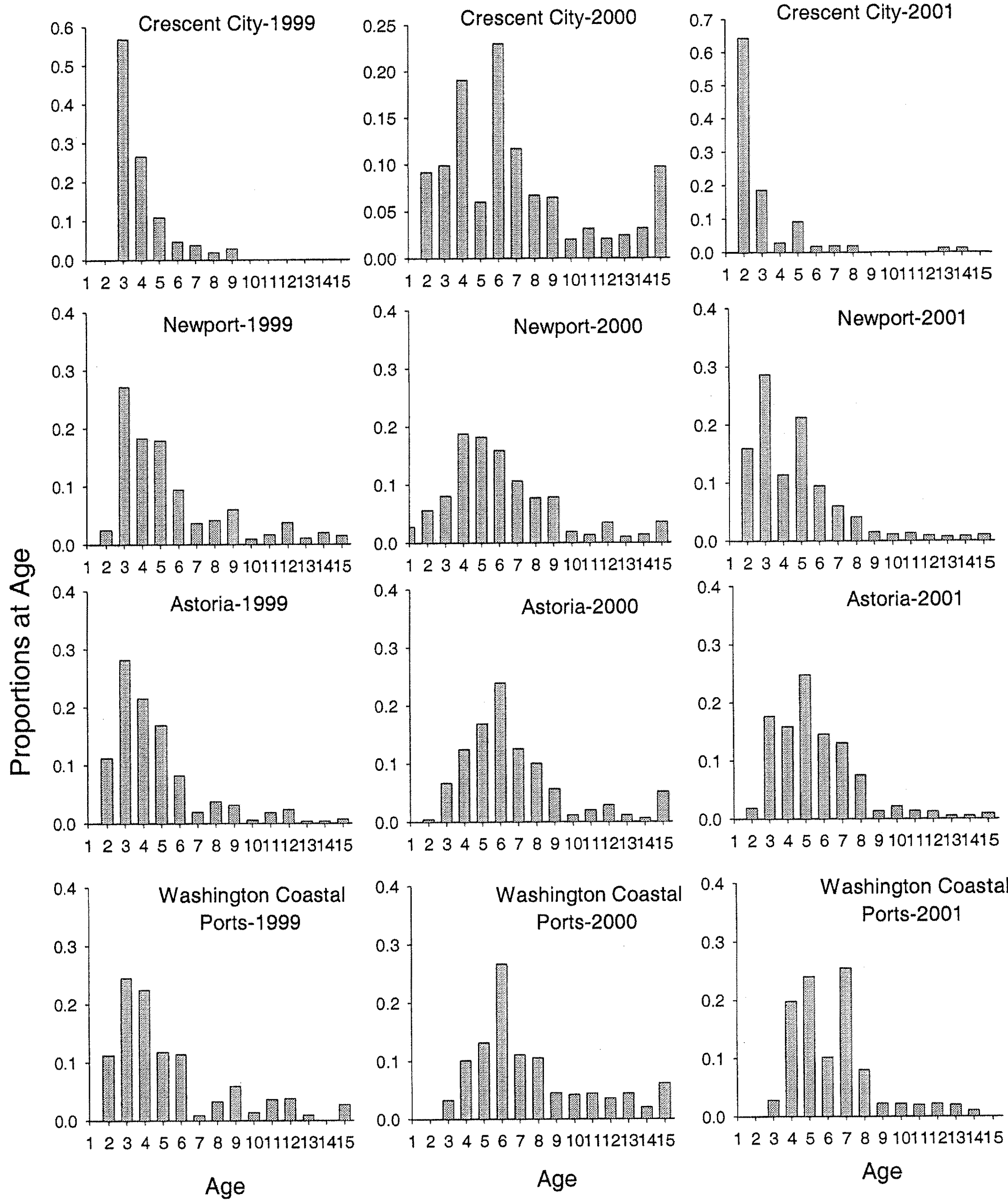


Figure 3. Pacific whiting proportion by age from shore-based landings in the U.S. zone, 1999-2001.

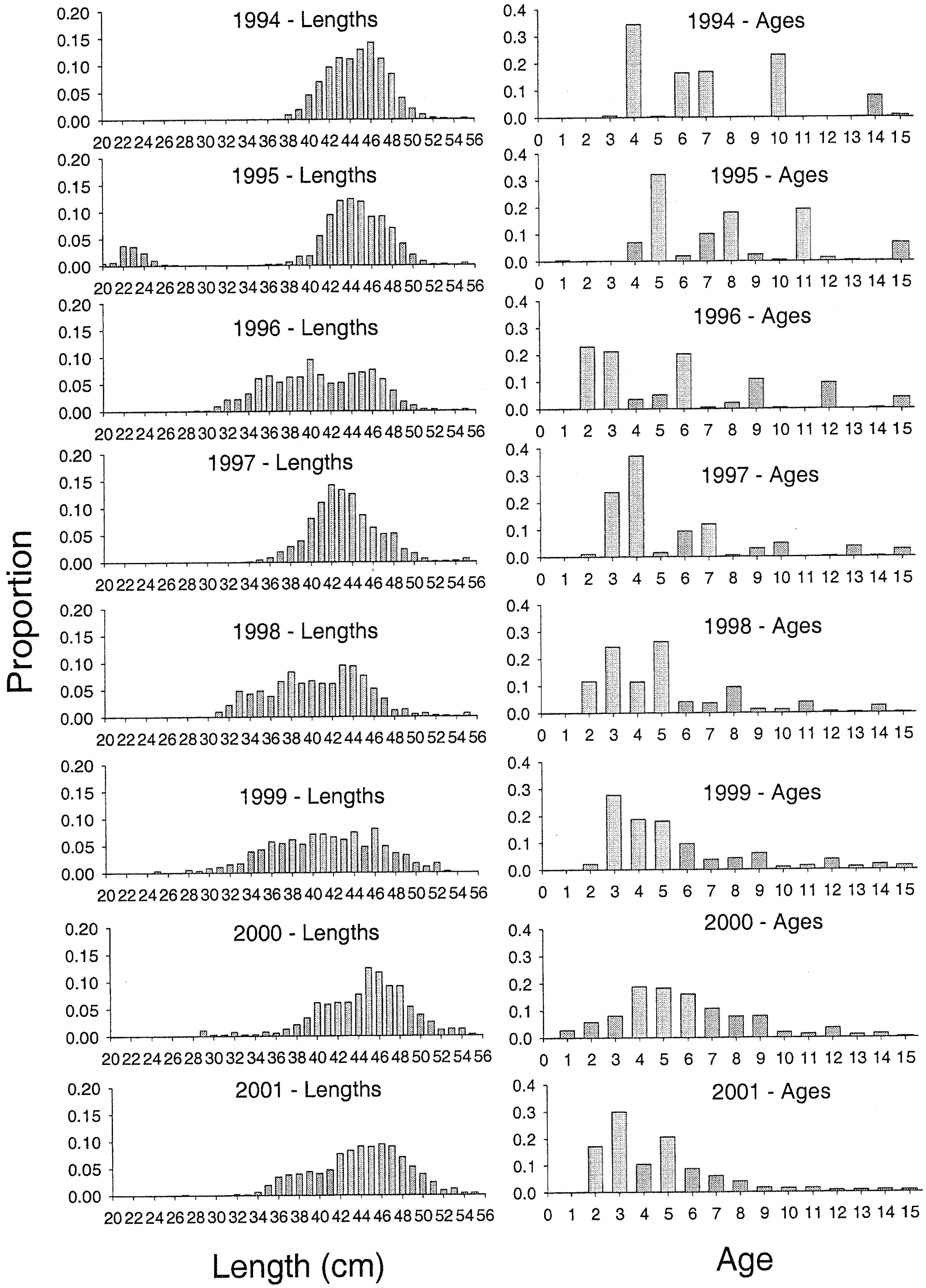


Figure 4. Pacific whiting length and age compositions from the shore-based whiting fishery sampled from Newport, 1994-2001.

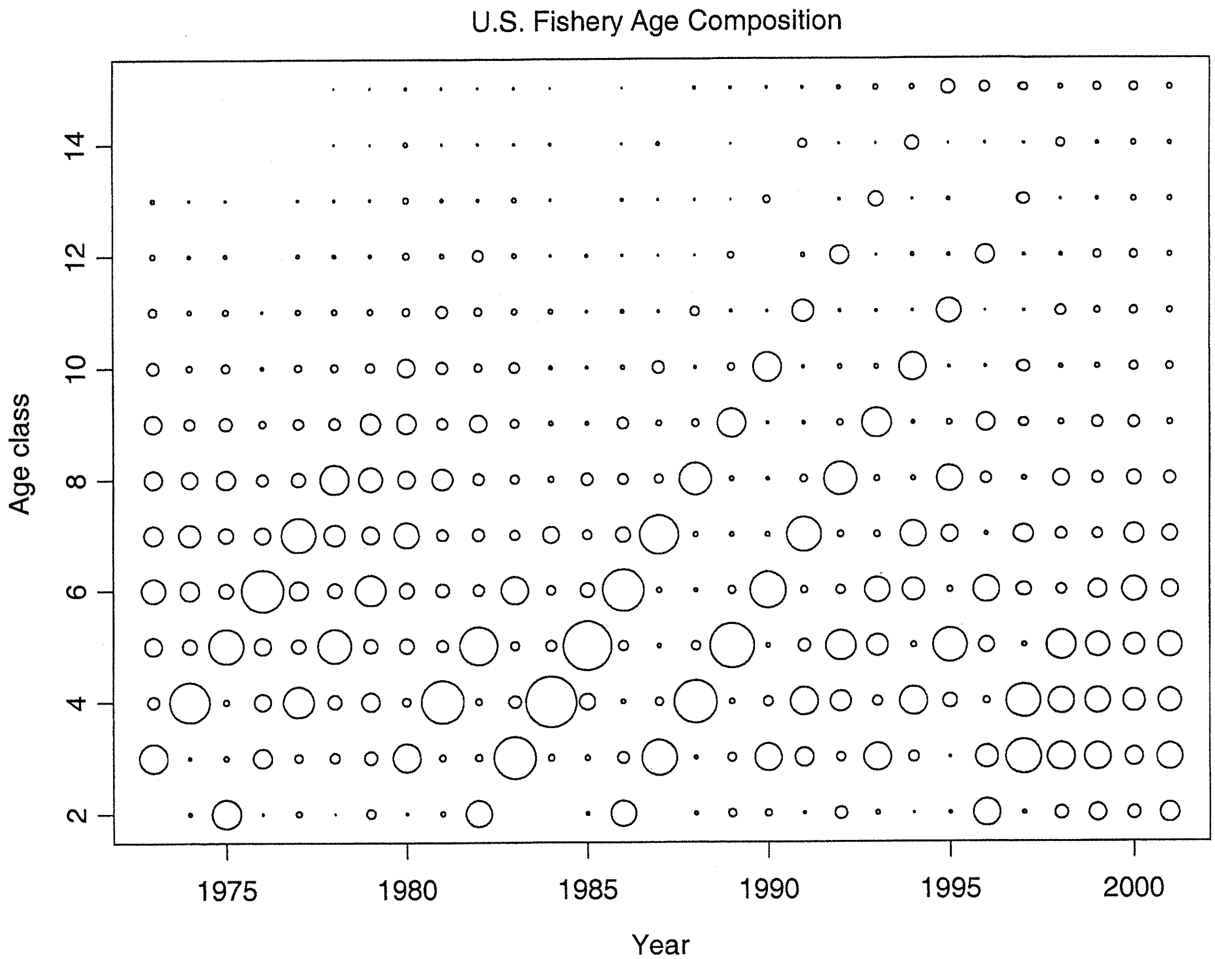


Figure.5. Catch at age of Pacific whiting in the U.S. fisheries during 1973-2001. The diameter of the circle is proportional to the catch at age

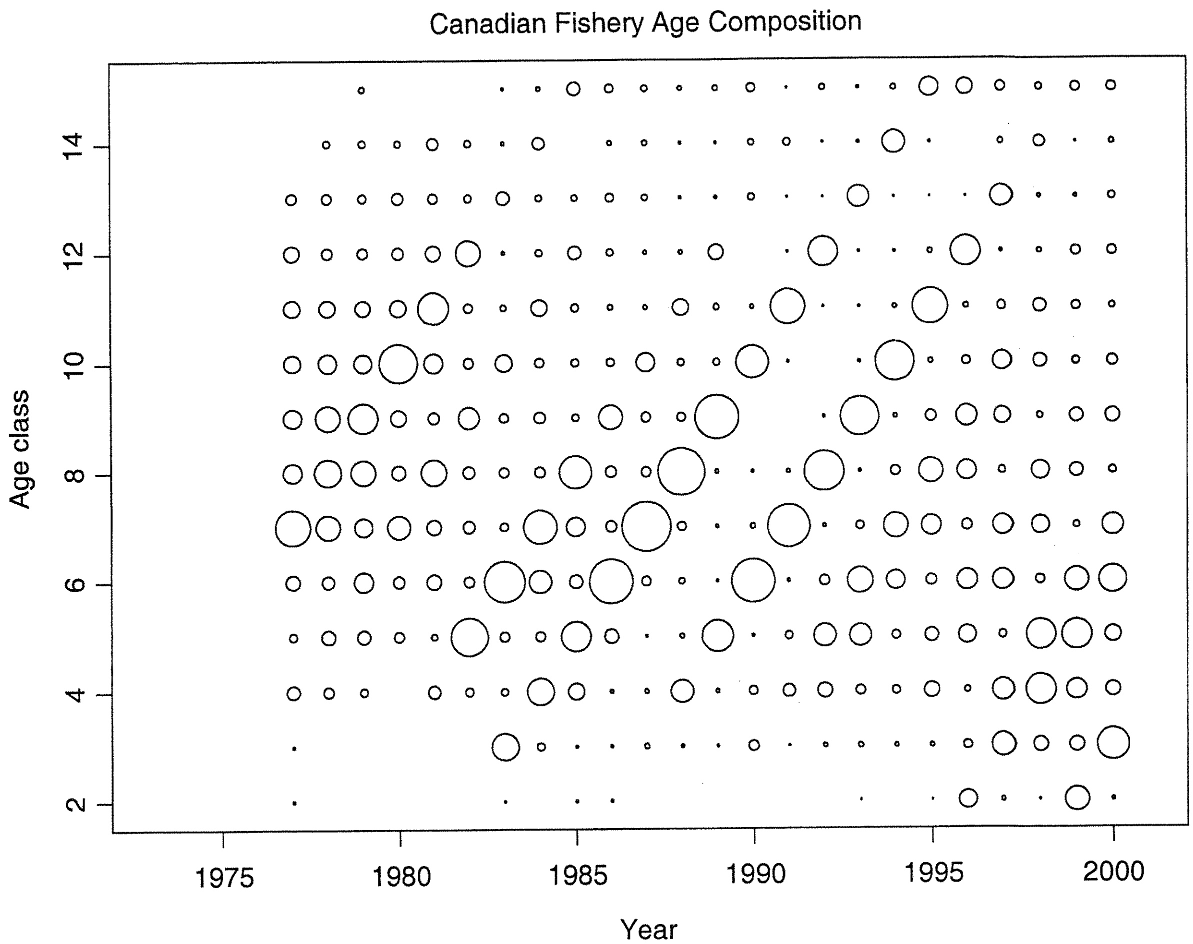


Figure 6. Catch at age of Pacific whiting in the Canadian fisheries during 1977-2000. The diameter of the circle is proportional to the catch at age

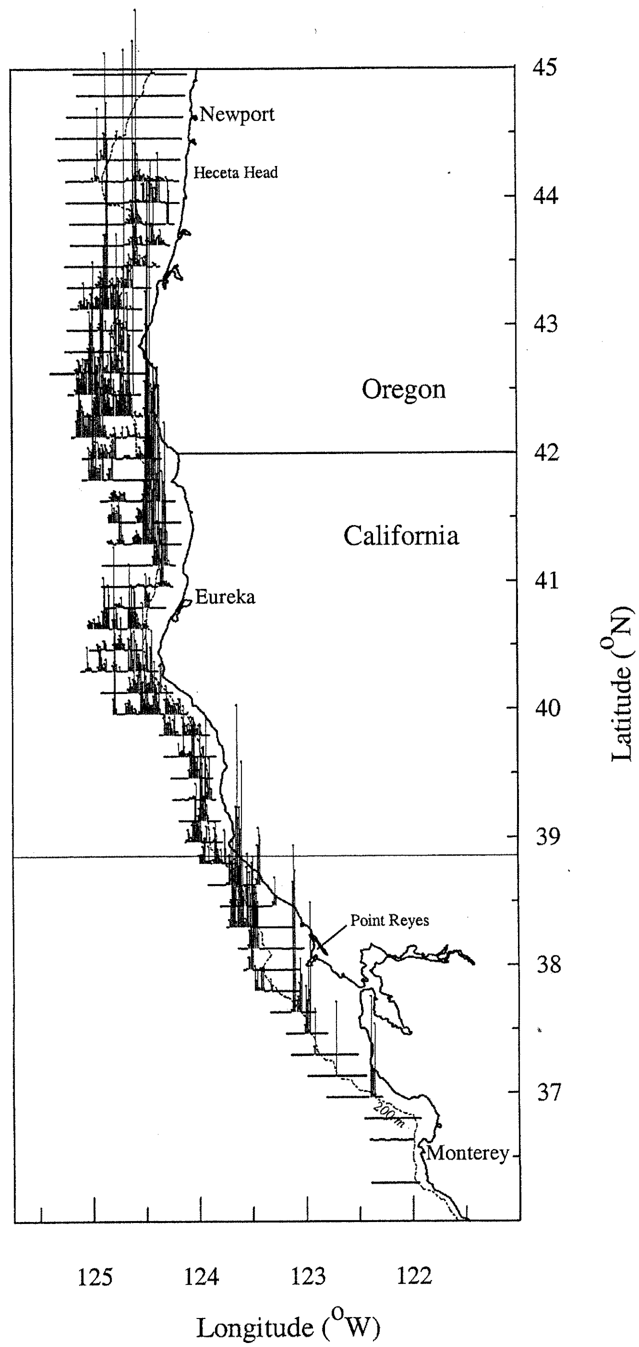


Figure 7. Acoustic backscattering (SA) attributed to Pacific whiting along transects off the U.S. and Canada west coast shelf and slope between Monterey, CA, and Newport, OR, during the 2001 AFSC echo integration-trawl survey.

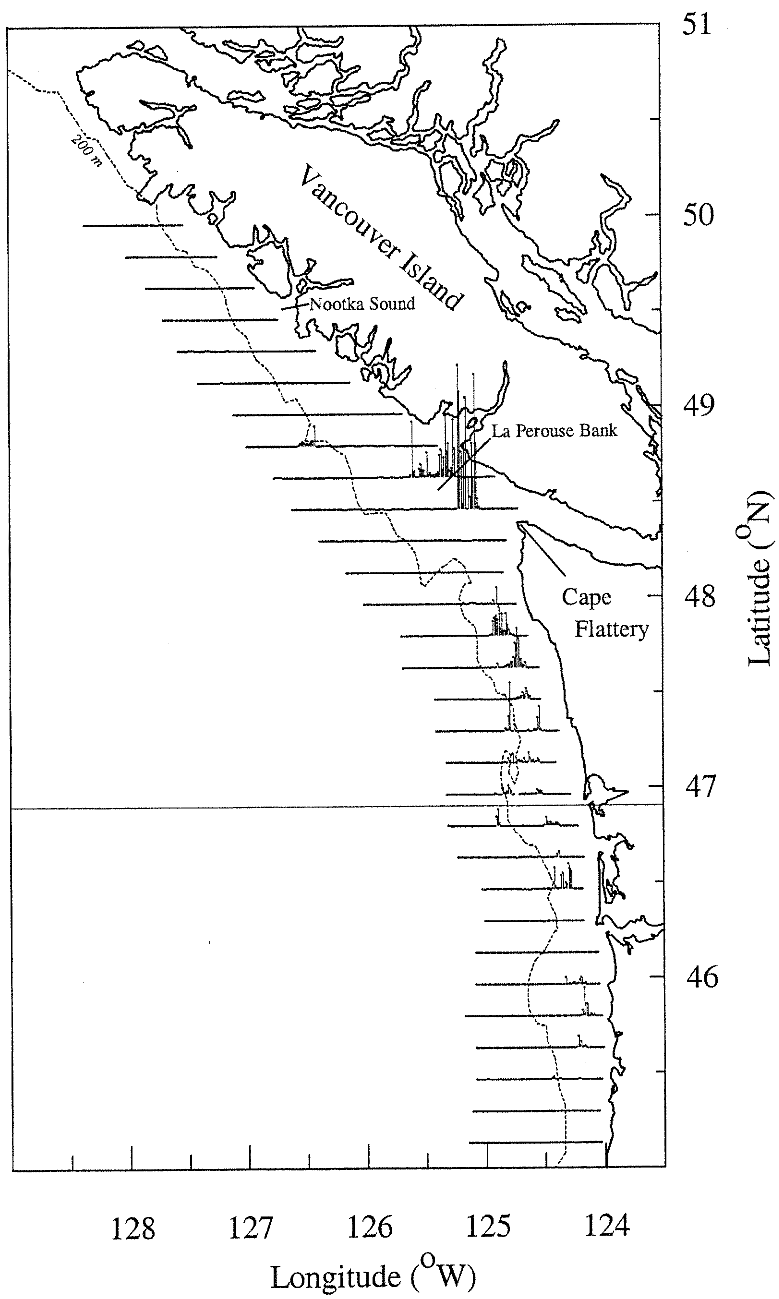


Figure 7 (Continued). Acoustic backscattering (SA) attributed to Pacific whiting along transects off the U.S. and Canada west coast shelf and slope from northern Oregon to Queen Charlotte Sounc, BC during the 2001 AFSC echo integration-trawls.

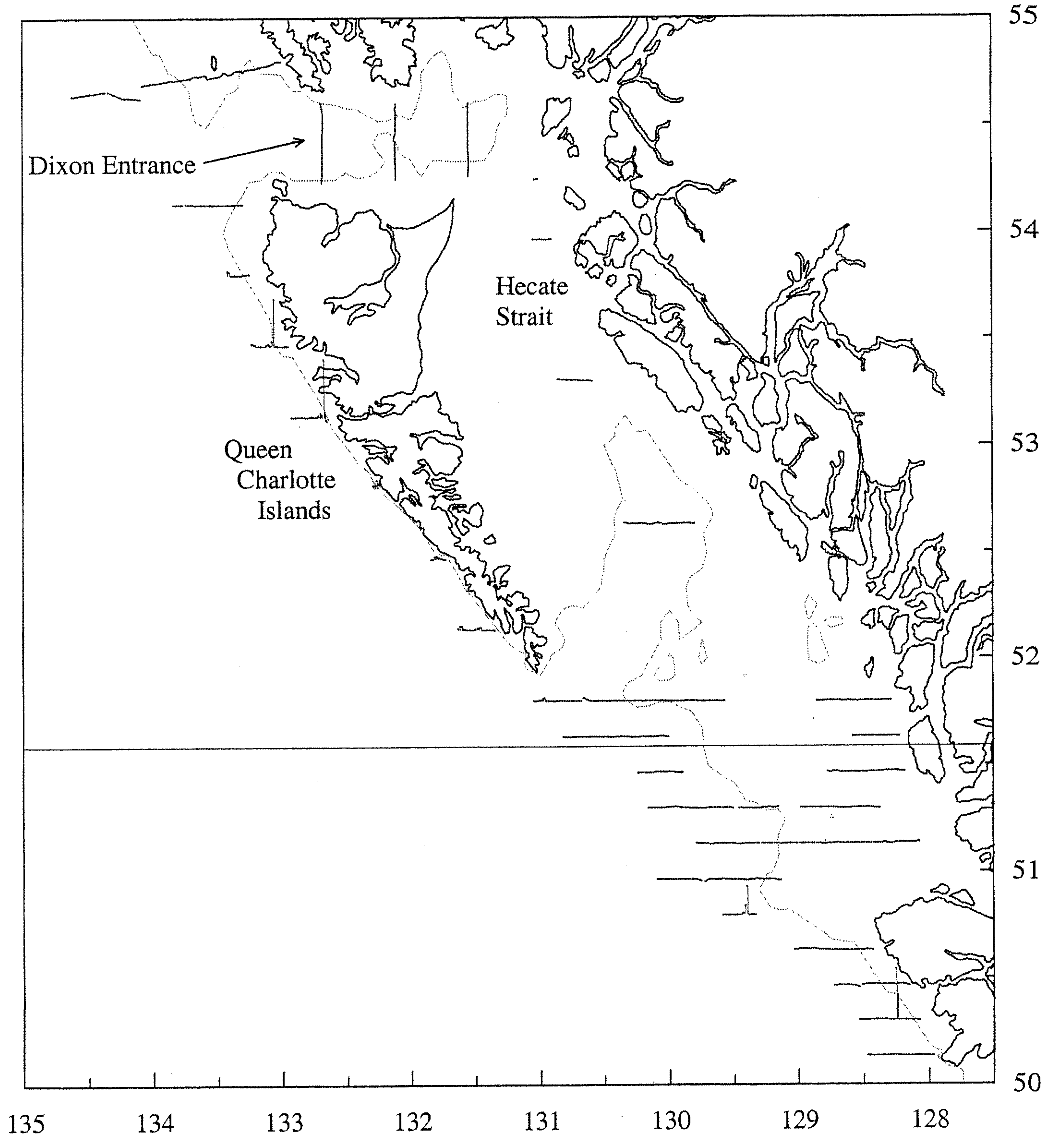


Figure 7 (Continued). Acoustic backscattering (SA) attributed to Pacific whiting along transects off the Canadian west coast shelf and slope from Queen Charlotte Sounc, BC to Dixon Entrance during the 2001 AFSC echo integration-trawls.

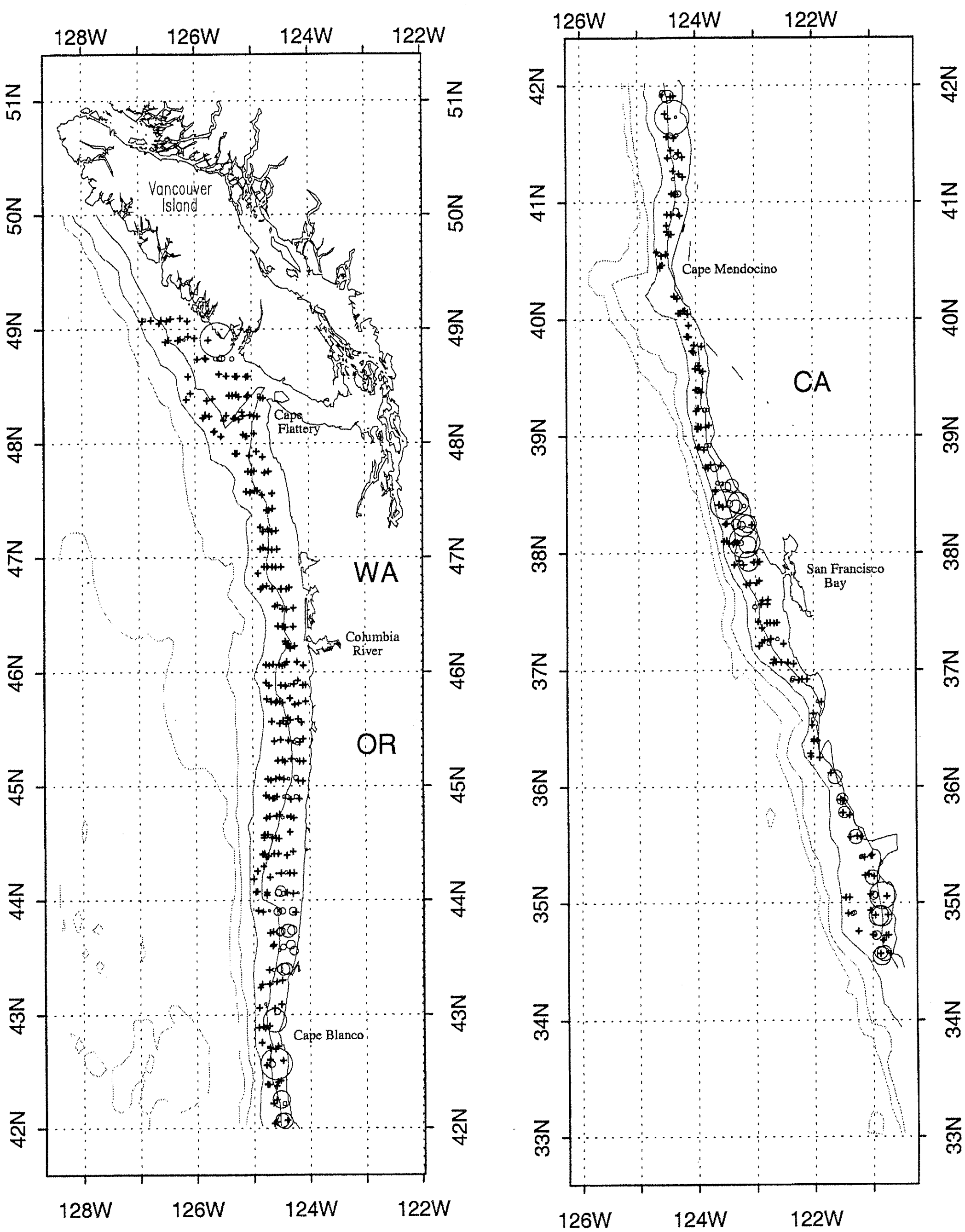


Figure 8. Catch rate (kg/ha) of age-1 Pacific whiting during the AFSC 2001 triennial shelf survey of groundfish resources.

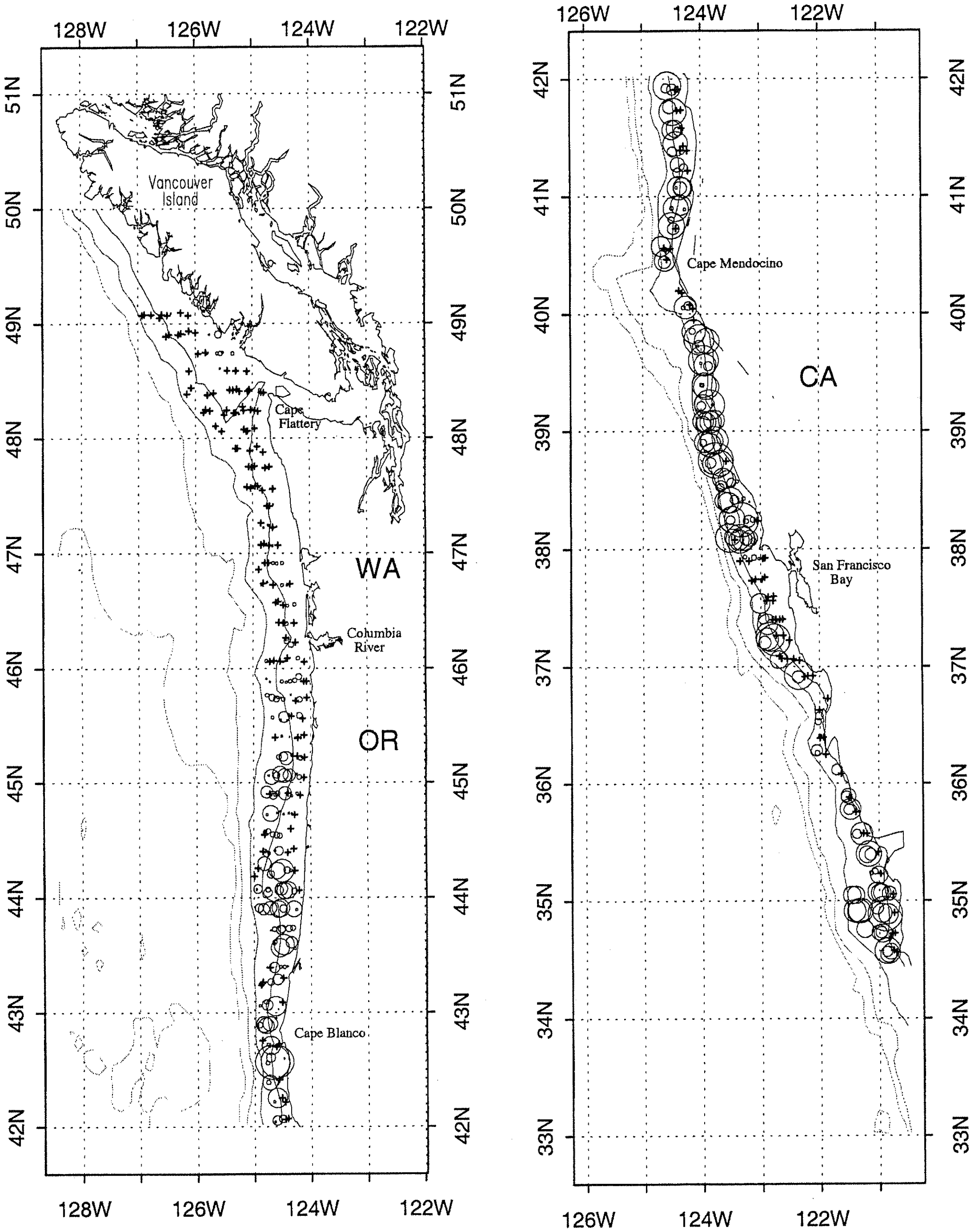


Figure 9. Catch rate (kg/ha) of age-2 Pacific whiting during the AFSC 2001 triennial shelf survey of groundfish resources.

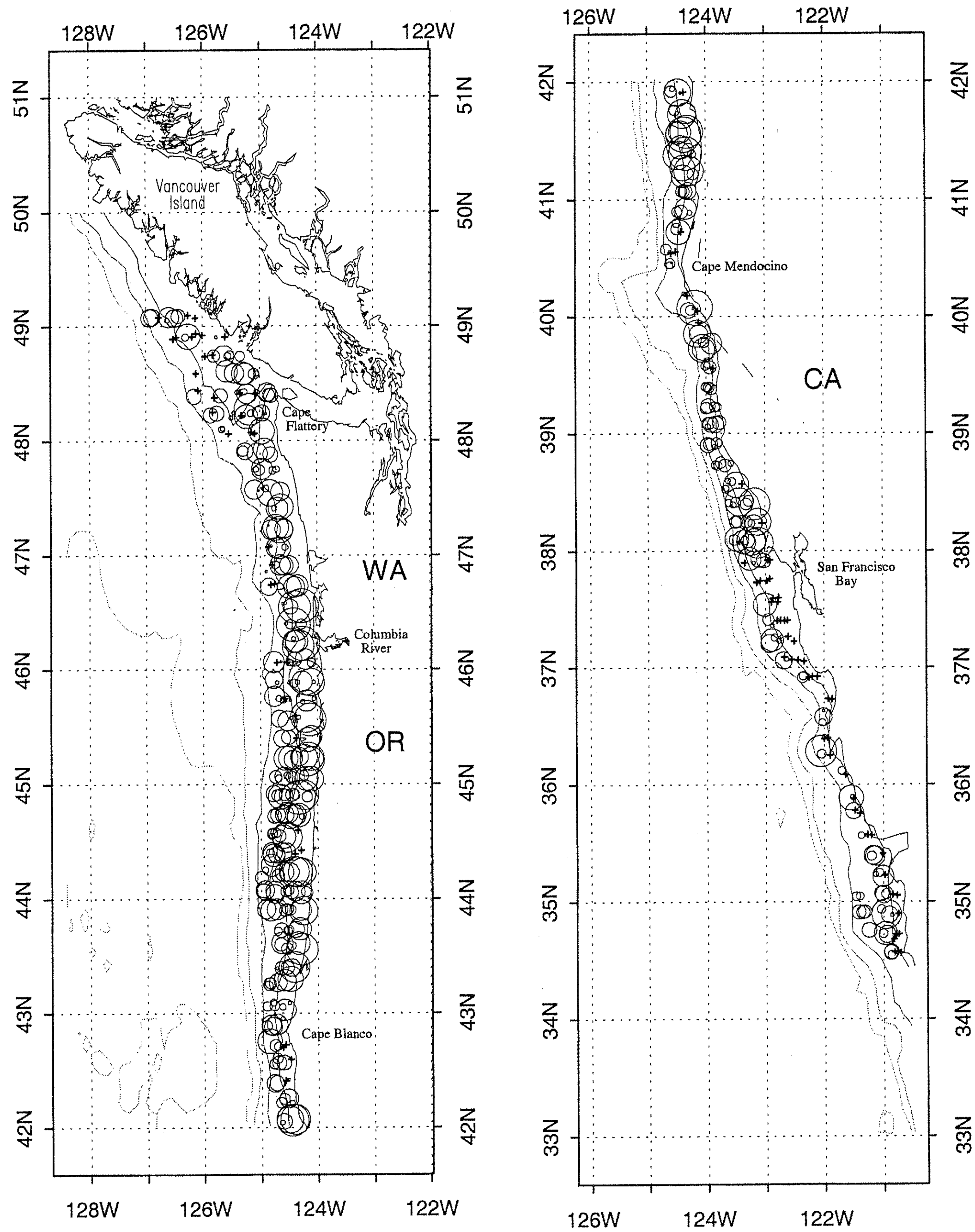


Figure 10. Catch rate (kg/ha) of age-3+ Pacific whiting during the AFSC 2001 triennial shelf survey of groundfish resources.

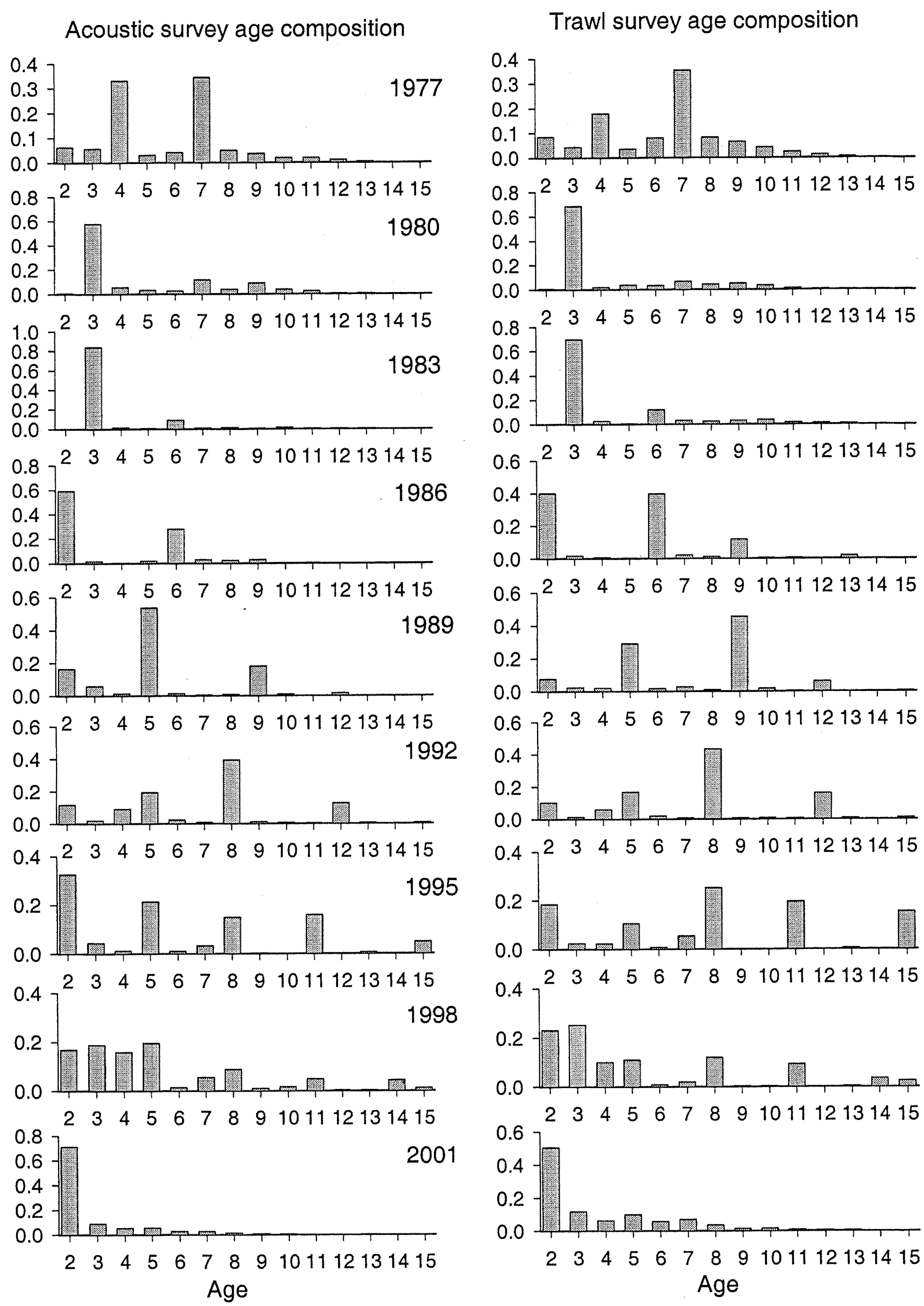


Figure 11. Comparison of age compositions from the AFSC acoustic and triennial shelf trawl survey, 1997-2001.

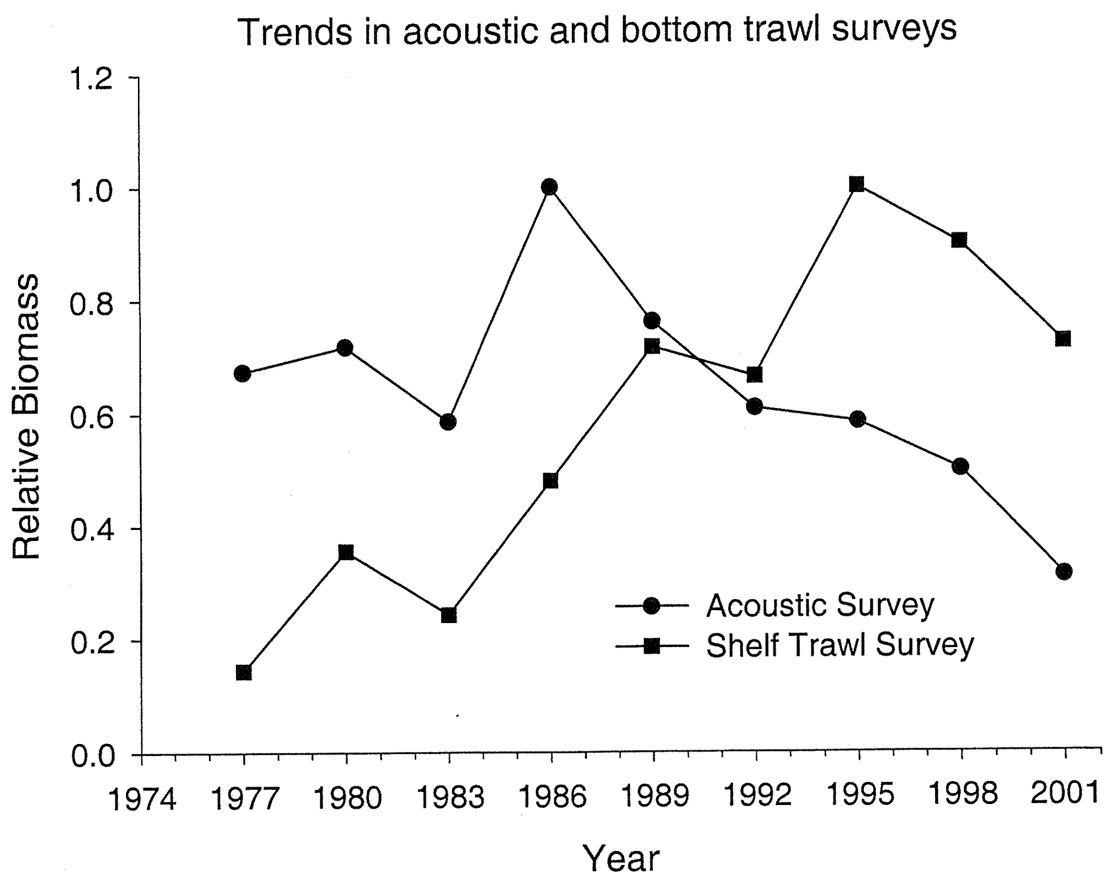


Figure 12. Trends in Pacific whiting biomass in the AFSC acoustic and triennial shelf trawl survey, 1977-2001.

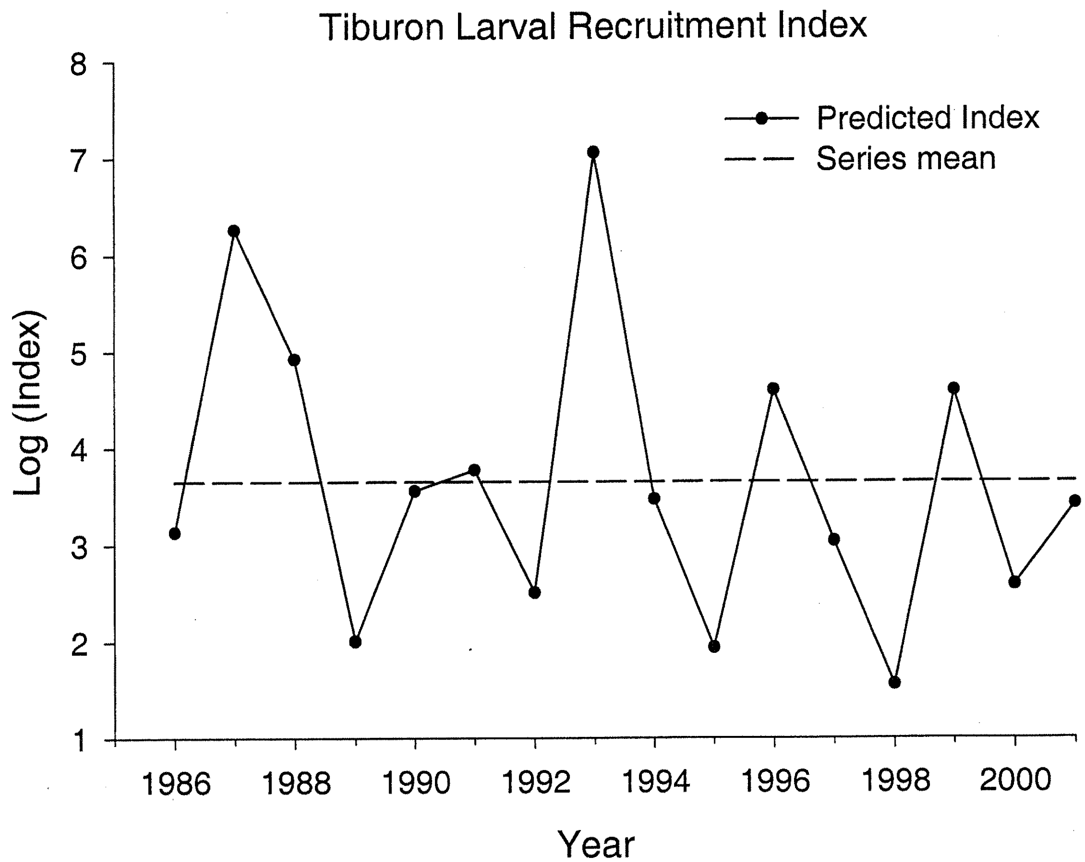


Figure 13. Tiburon larval recruitment index (Monterey inside stratum only), 1986-2001. Index is obtained from a generalized linear model fit to the log-transformed CPUEs (Ralston et al. 1998).

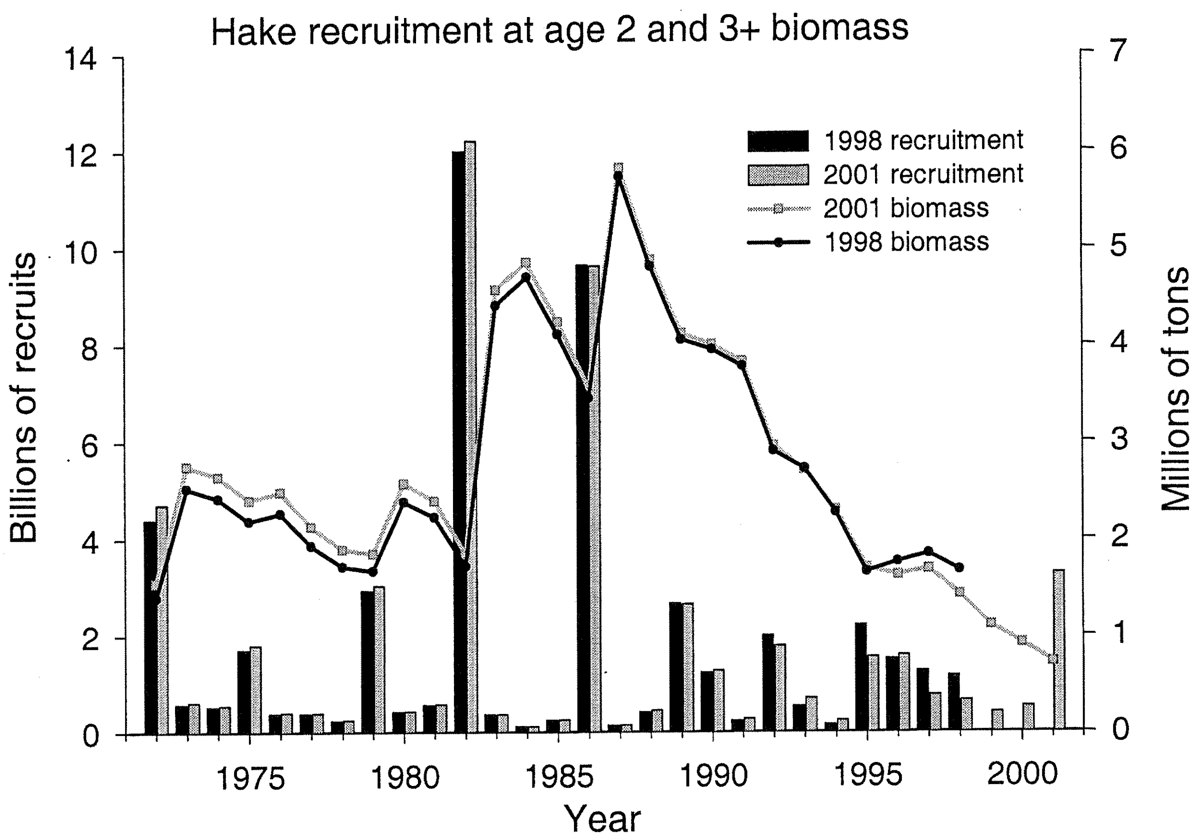


Figure 14. Comparion of trends in biomass and recruitment between the most recent assessment presented in this document and the 1998 Pacific whiting assessment. Both models employed the same model structure and assumptions.

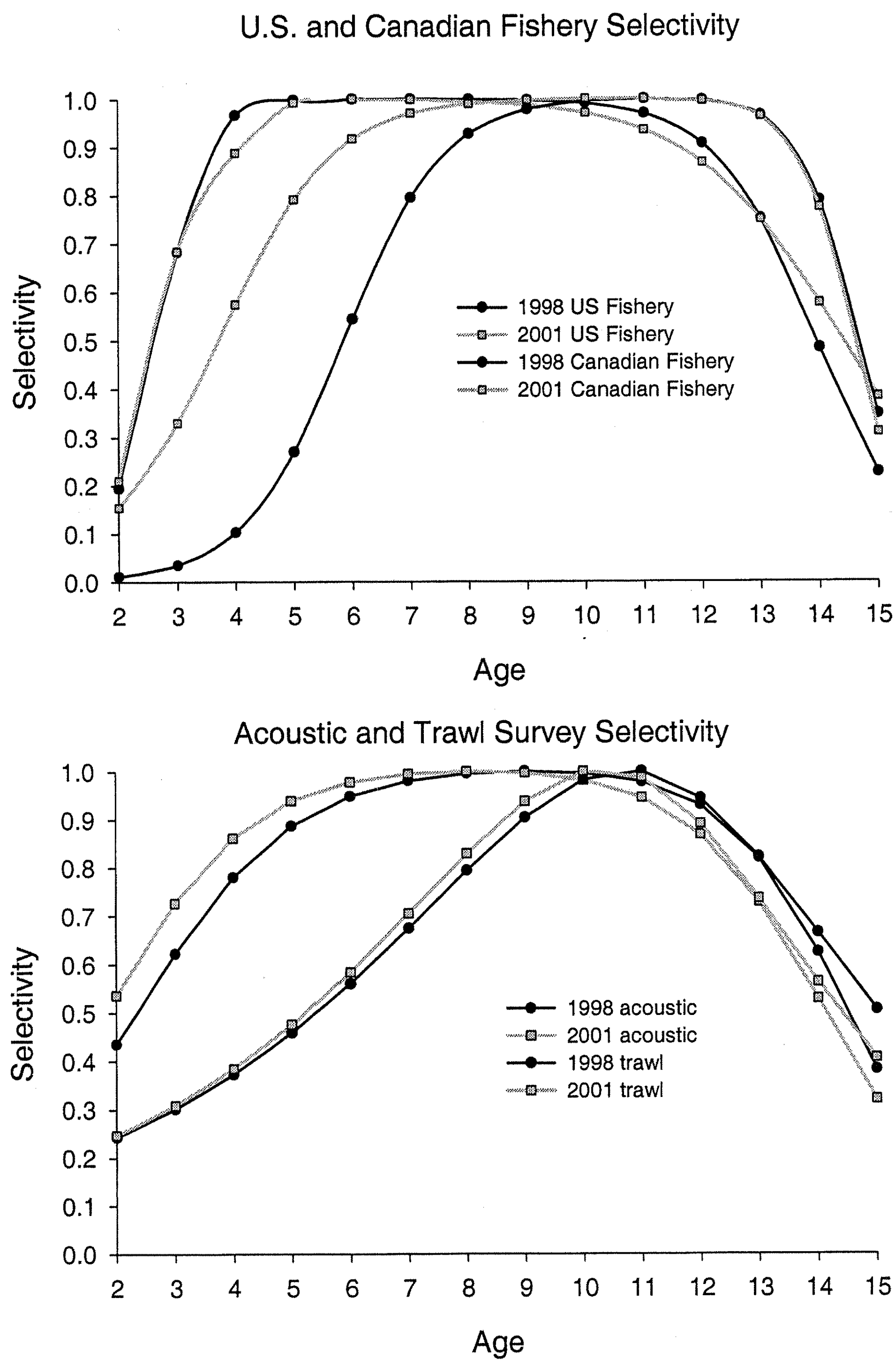
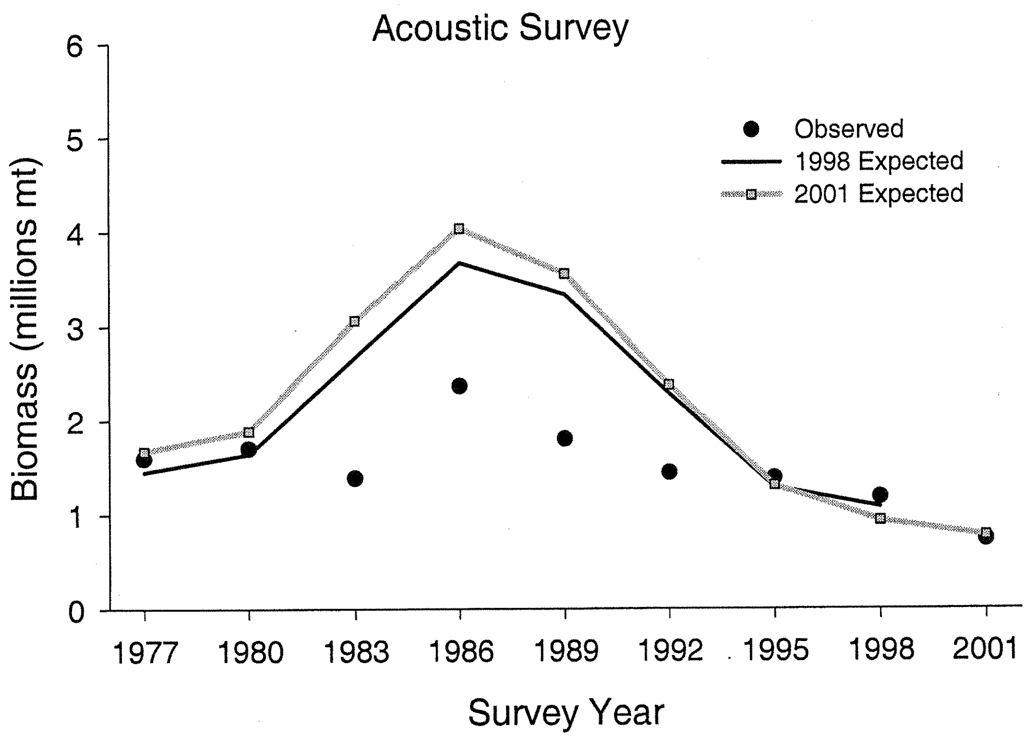


Figure 15. Comparion of average fishery and survey selectivity (most recent three years) estimated from the most recent assessment presented in this document and the 1998 Pacific whiting assessment. Both models employed the same model structure and assumptions.



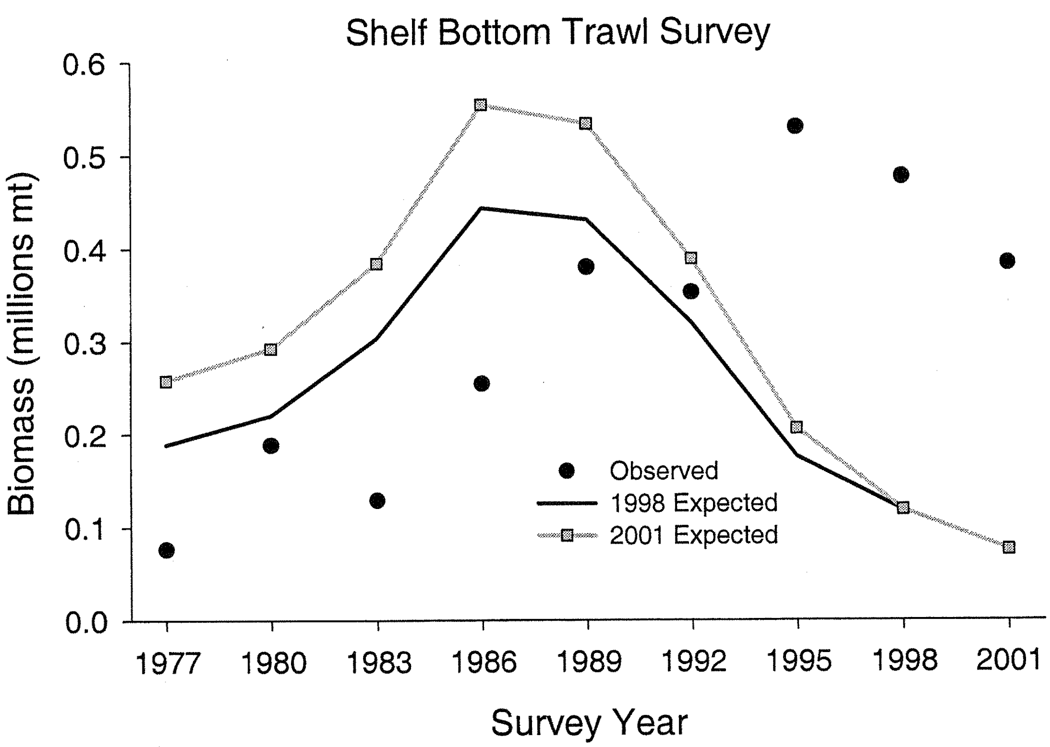


Figure 16. Comparion of observed and predicted acoustic and trawl survey biomass indices estimated from the most recent assessment presented in this document and the 1998 Pacific whiting assessment. Both models employed the same model structure and assumptions.

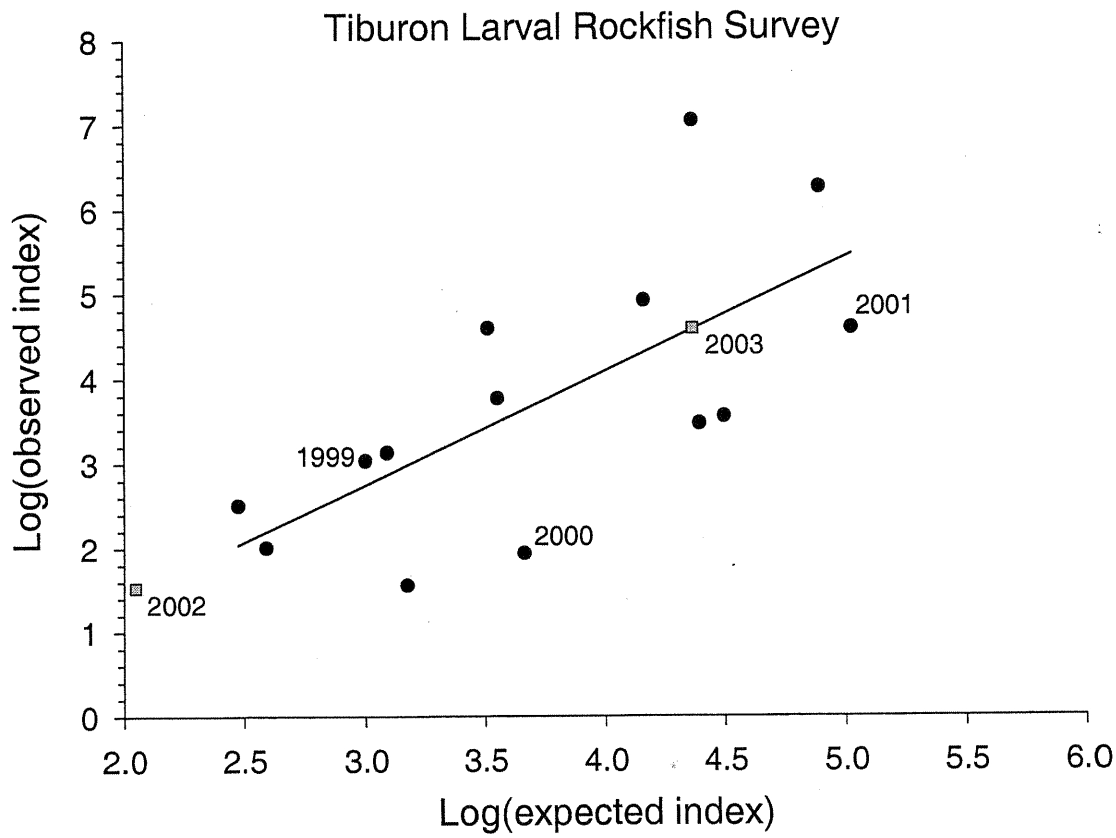


Figure 17. Observed and predicted recruitment indices (on log scale) from the Tiburon larval rockfish survey. Values for 2002 and 2003 show level of expected recruitment.

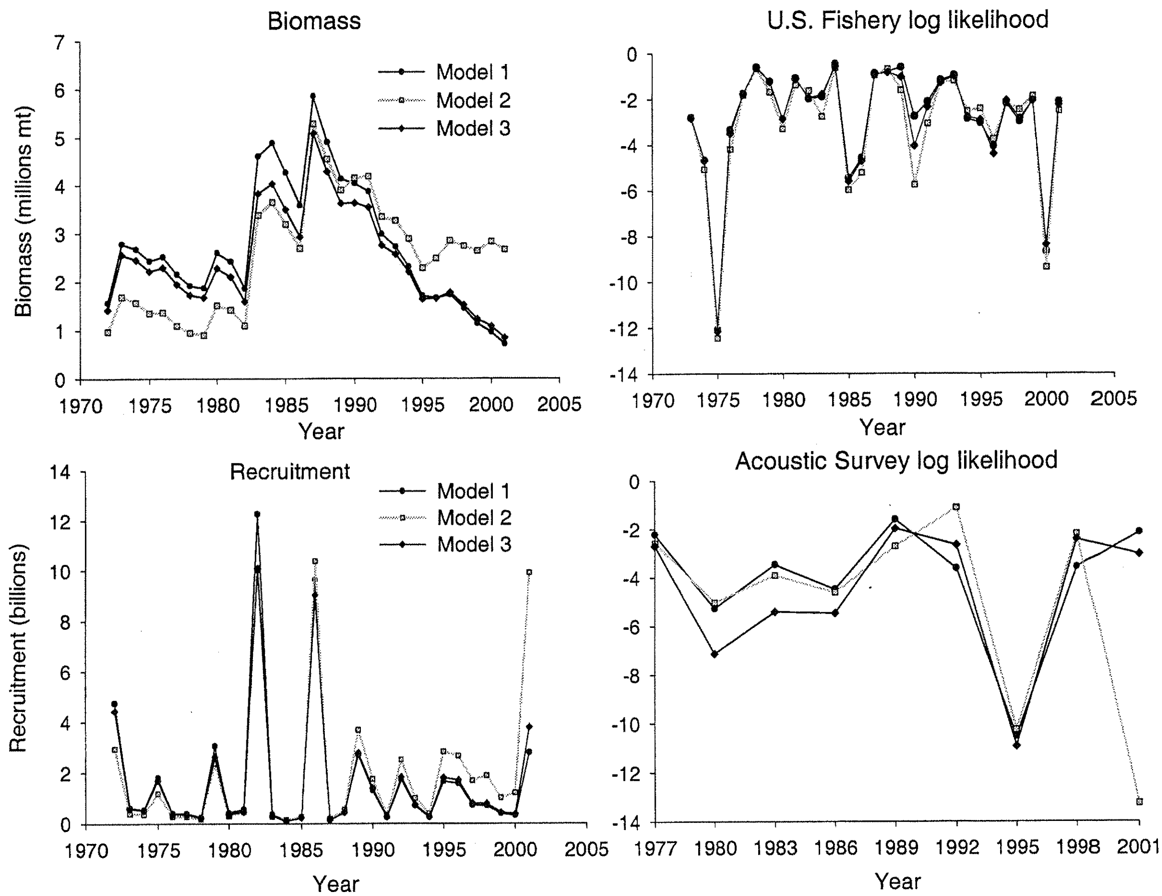


Figure 18. Sensitivity analysis comparing results of three models with different variance assumptions. Model 1 is the base-run model with an acoustic biomass CV = 0.5 in 1977-1989 and CV = 0.1 in 1992-2001. Model 2 using the acoustic survey as in the base-run, but with a CV = 0.1 for the AFSC trawl survey. Model 3 applies equal weights (CV = 0.1) to the entire acoustic survey time series, 1977-2001.

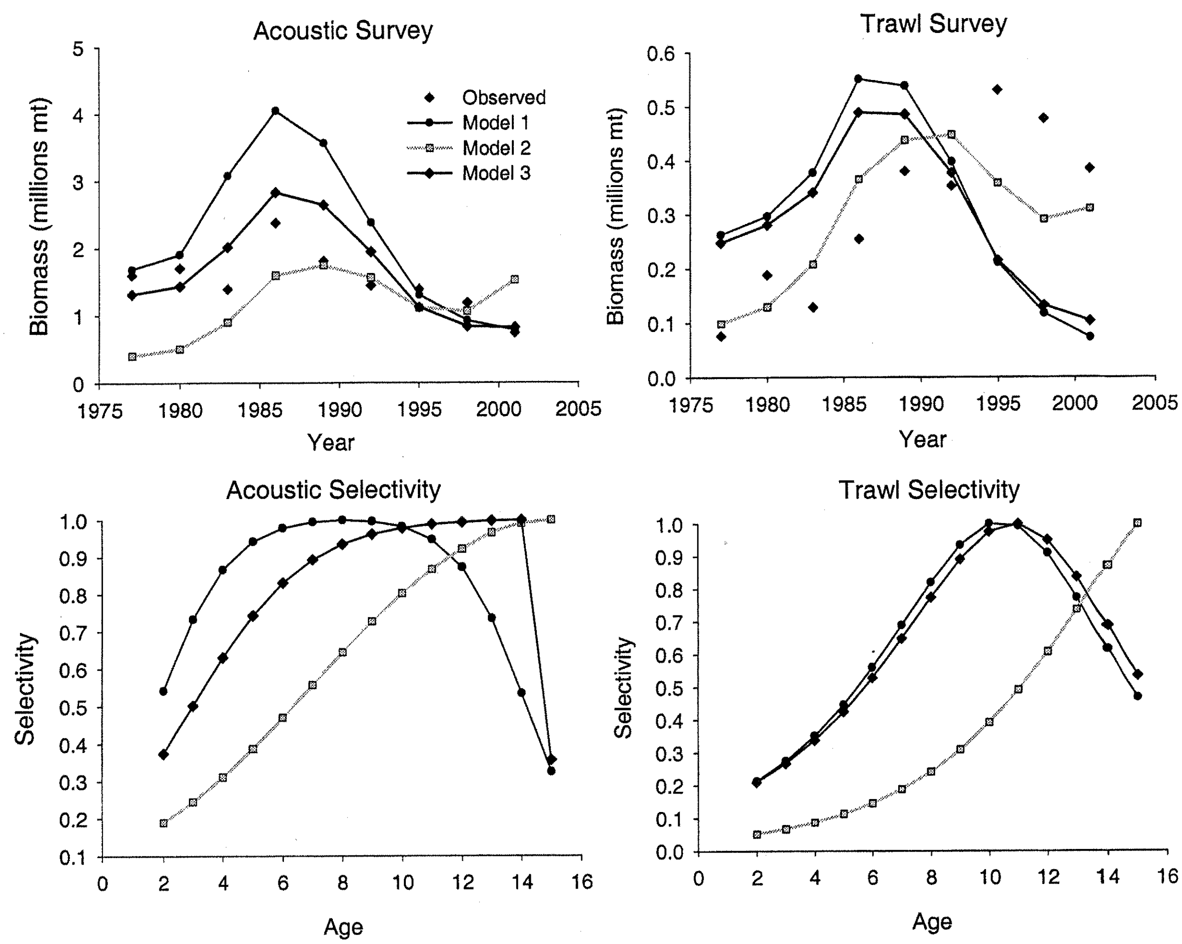


Figure 19. Sensitivity analysis comparing results of three models with different variance assumptions. Model 1 is the base-run model with an acoustic biomass CV = 0.5 in 1977-1989 and CV = 0.1 in 1992-2001. Model 2 using the acoustic survey as in the base-run, but with a CV = 0.1 for the AFSC trawl survey. Model 3 applies equal weights (CV = 0.1) to the entire acoustic survey time series, 1977-2001.

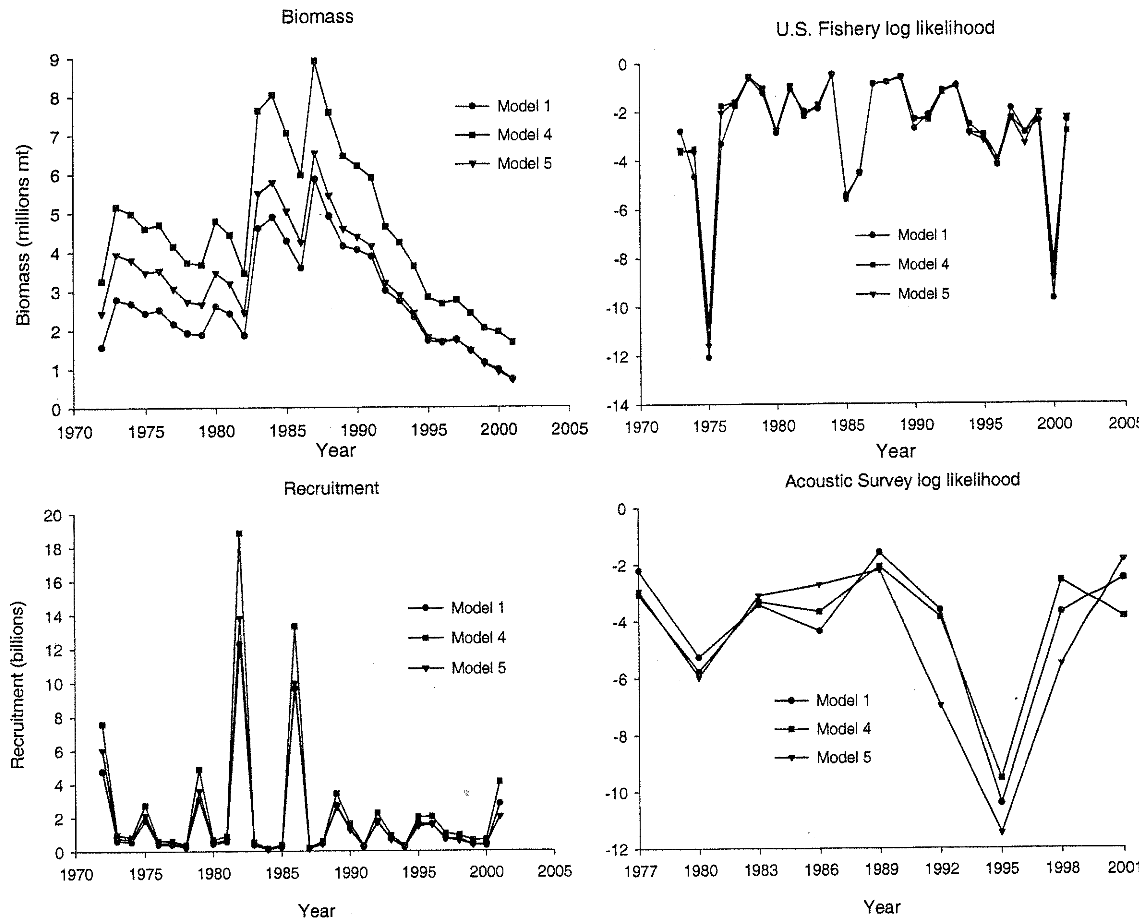


Figure 20. Sensitivity analysis comparing results of two additional models to the base-run model. Model 1 is the base-run model with an acoustic bimoass CV=0.5 in 1977-1989 and CV=0.1 in 1992-2001. Model 2 as in the base-run model but acoustic survey catchability (q) is estimated freely and no priors on selectivity. Model 3 as in the base-run model but priors on acoustic survey ascending limb selectivity parameters.

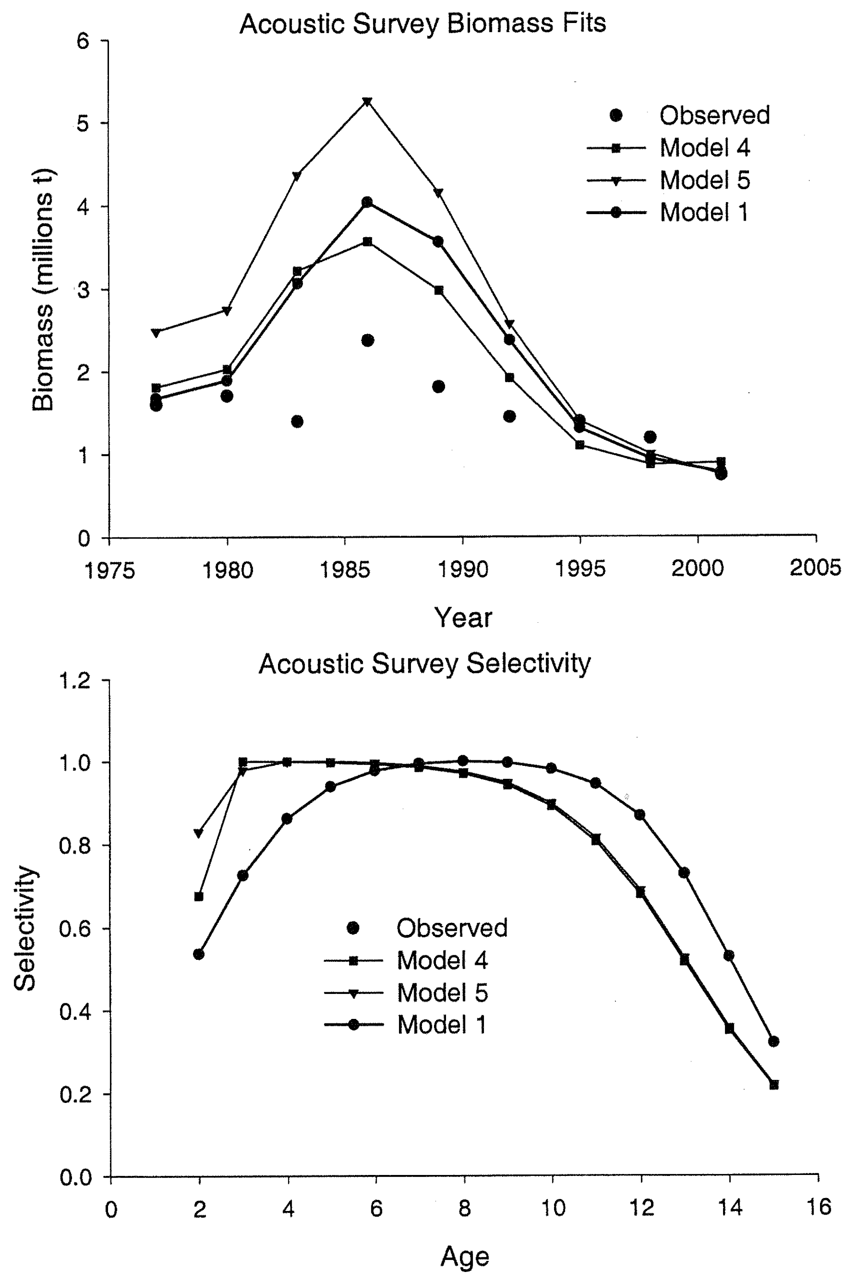


Figure 21. Sensitivity analysis comparing results of two additional models to the base-run model. Model 1 is the base-run model with an acoustic bimoass CV=0.5 in 1977-1989 and CV=0.1 in 1992-2001. Model 2 as in the base-run model but acoustic survey catchability (q) is estimated freely and no priors on selectivity. Model 3 as in the base-run model but priors on acoustic survey ascending limb selectivity parameters.

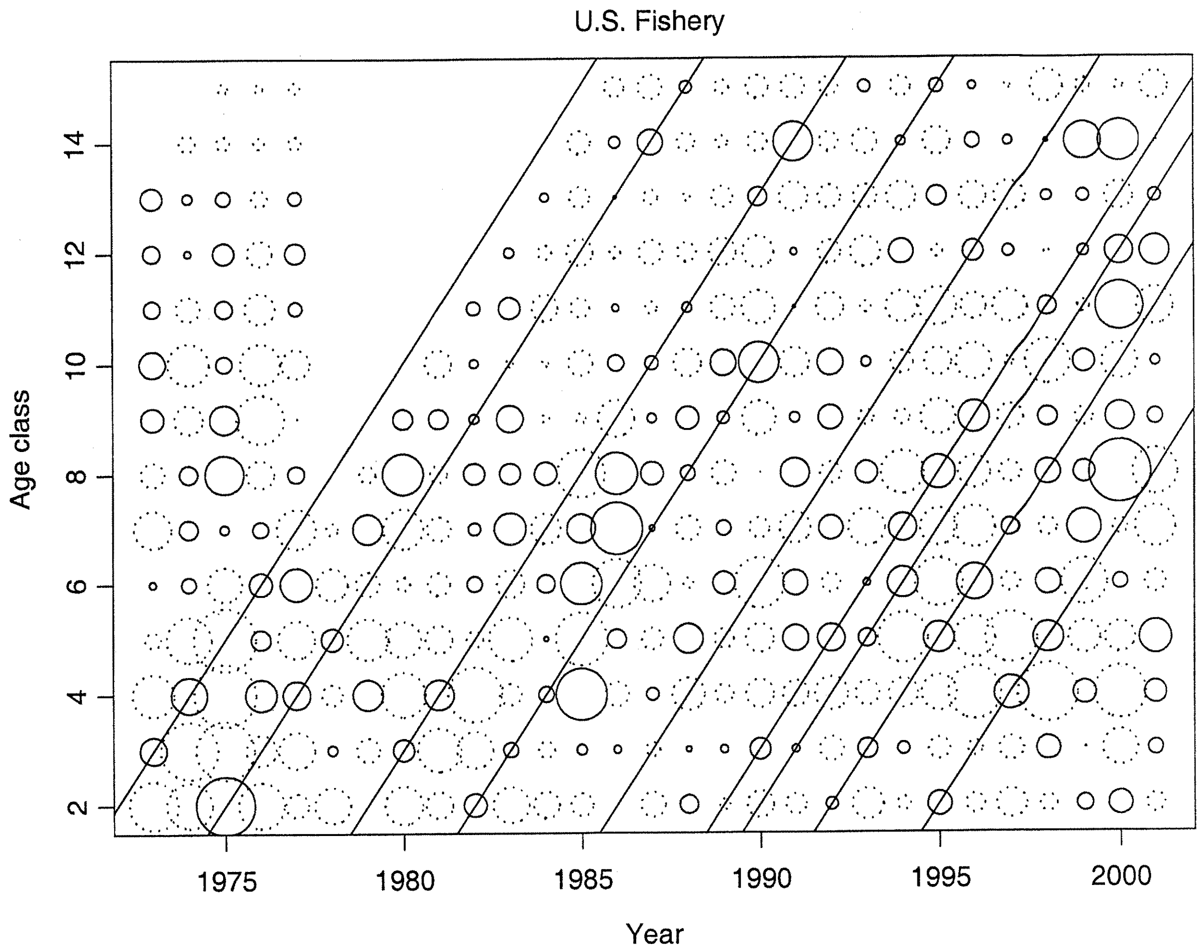


Figure 22. Pearson residuals from base-run model for the U.S. fishery age composition. Circle areas are proportional to the magnitude of the residual. Circles drawn with dotted lines indicate negative residuals. The largest residual in absolute value is 3.7 for the age-2 fish in 1975. Diagonal lines show strong year classes (1970, 1973, 1977, 1980, 1984, 1988, 1990, and 1993).

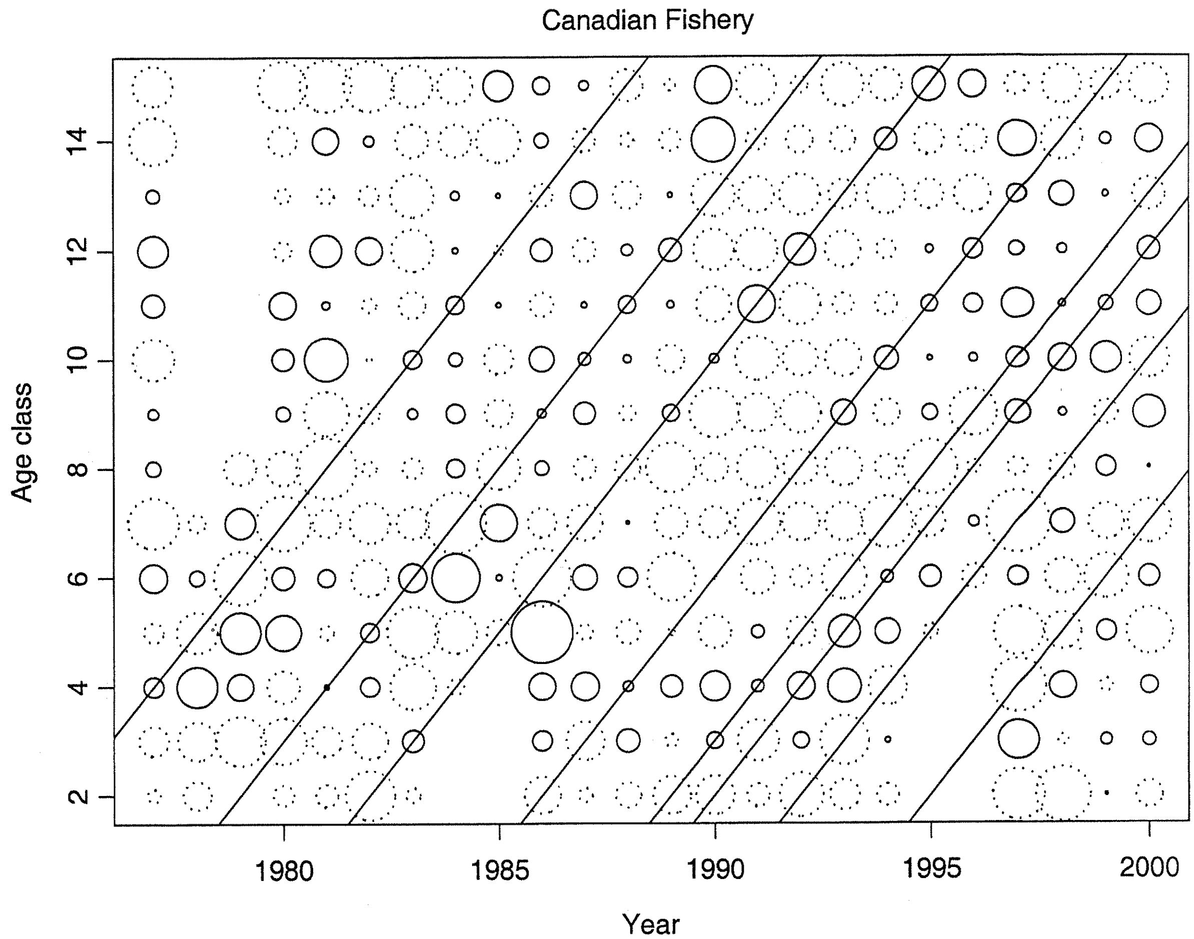


Figure 23. Pearson residuals from base-run model for the Canadian fishery age composition. Circle areas are proportional to the magnitude of the residual. Circles drawn with dotted lines indicate negative residuals. The largest residual in absolute value is 5.1 for the age-5 fish in 1986. Diagonal lines show strong year classes (1973, 1977, 1980, 1984, 1987, 1988, 1990, and 1993).

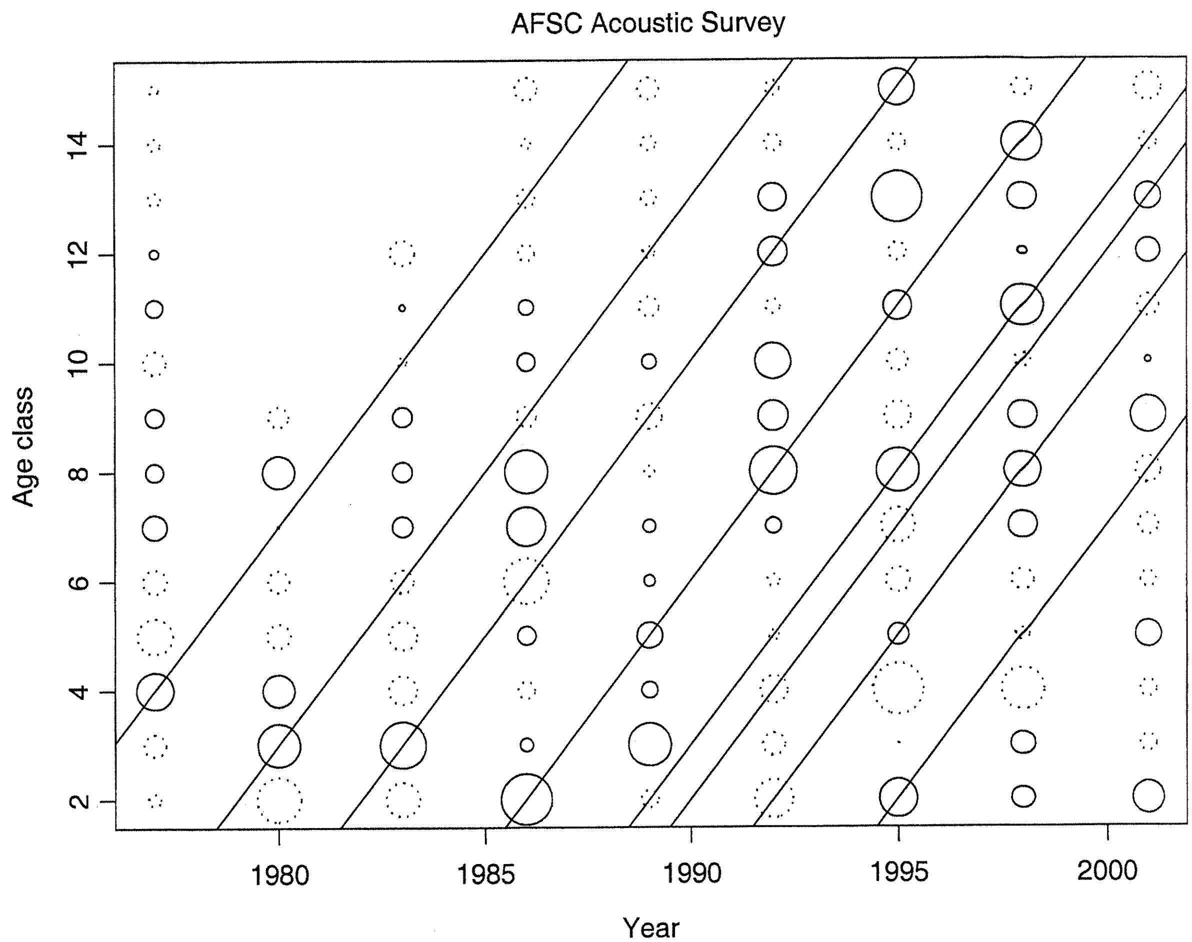


Figure 24. Pearson residuals from base-run model for the AFSC acoustic survey age composition. Circle areas are proportional to the magnitude of the residual. Circles drawn with dotted lines indicate negative residuals. The largest residual in absolute value is -2.9 for the age-6 fish in 1986. Diagonal lines show strong year classes (1973, 1977, 1980, 1984, 1988, 1990, and 1993).

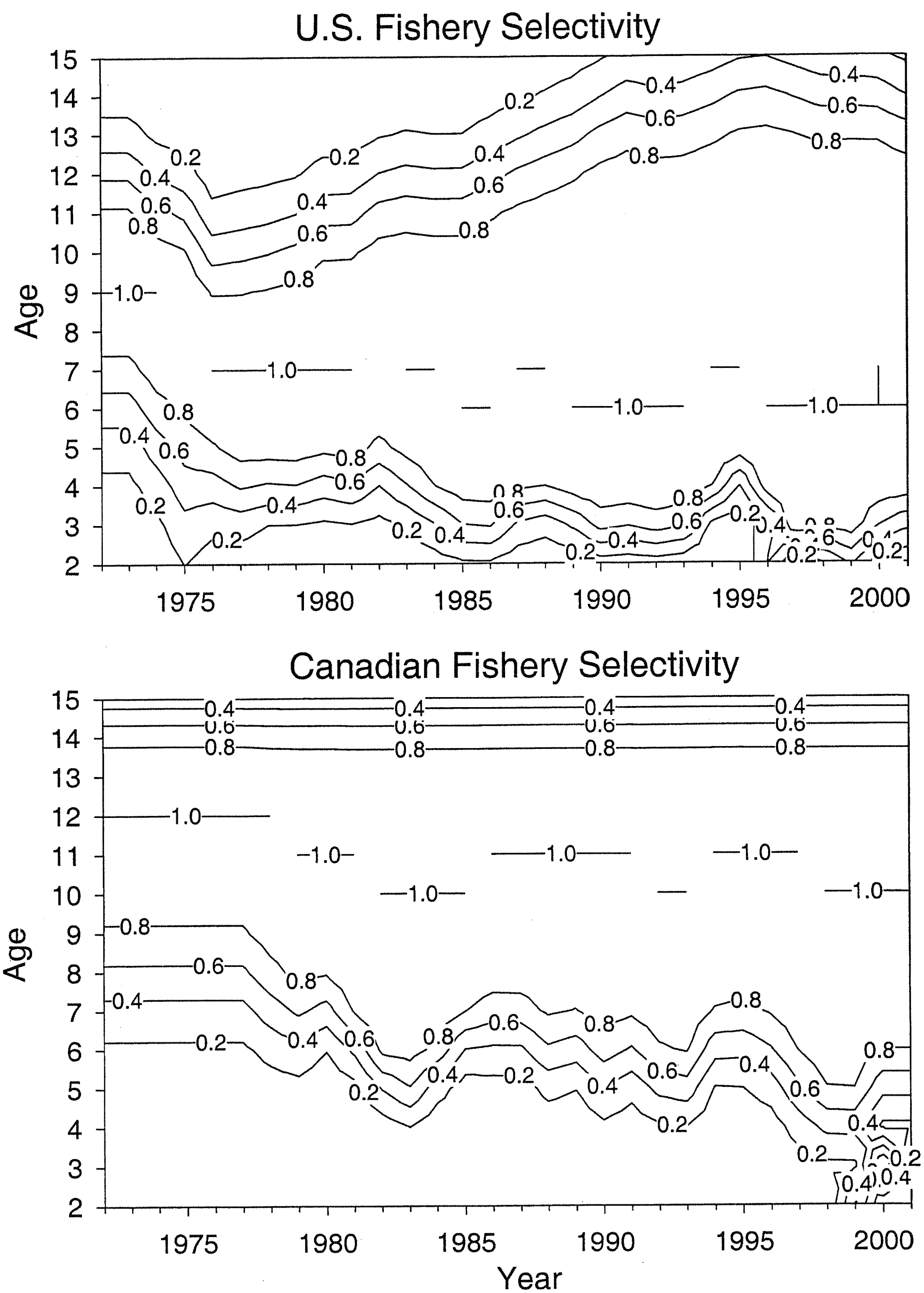


Figure 25. Contour plot showing annual changes in the U.S. and Canadian fishery selectivity at age estimated by the base-run model. Time varying selectivity was estimated using a random walk process error for parameters associated with both the ascending and descending limb of the selectivity function in the U.S. fishery. In the Canadian fishery annual variation was assumed for only the ascending portion of the double logistic function.

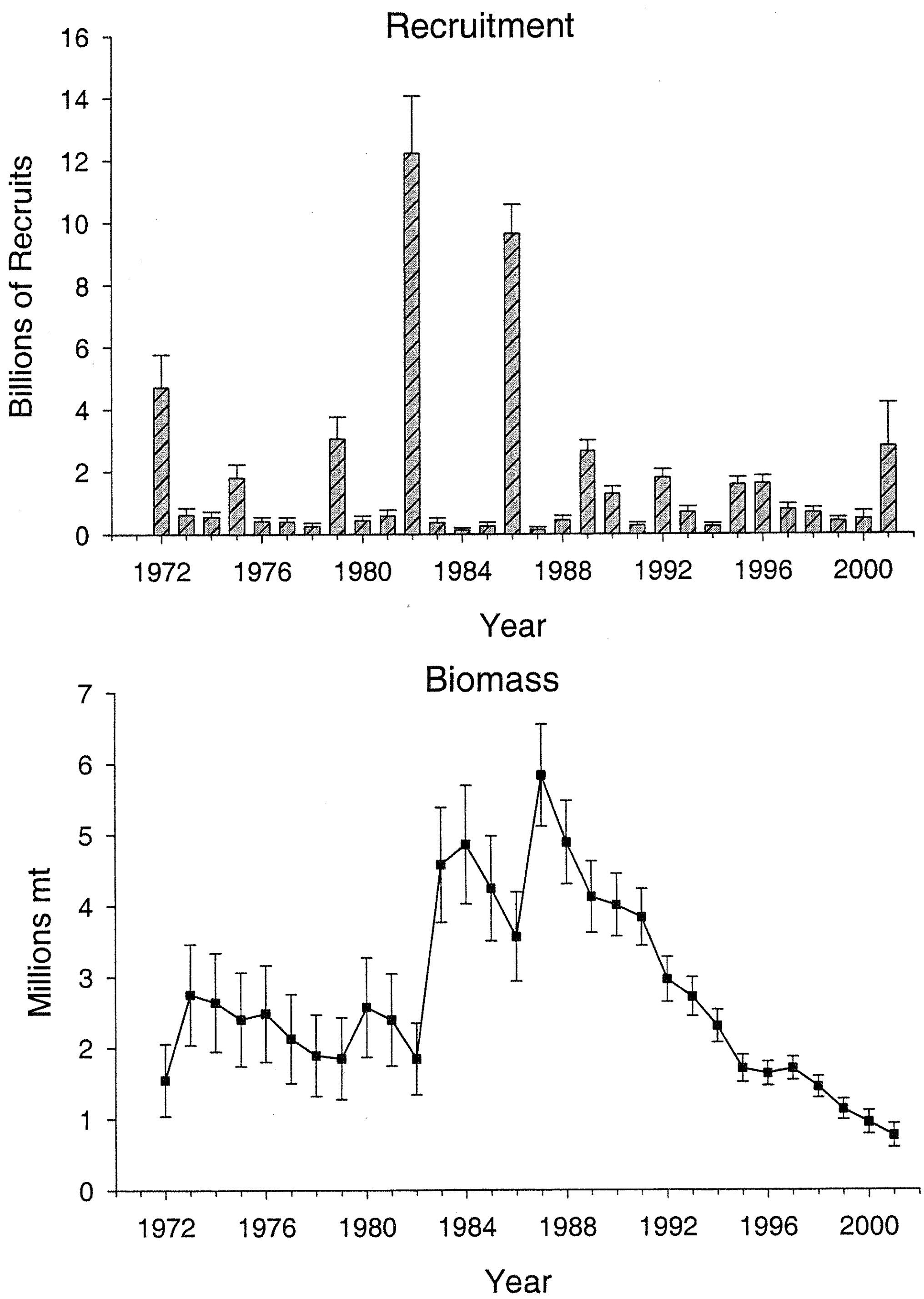
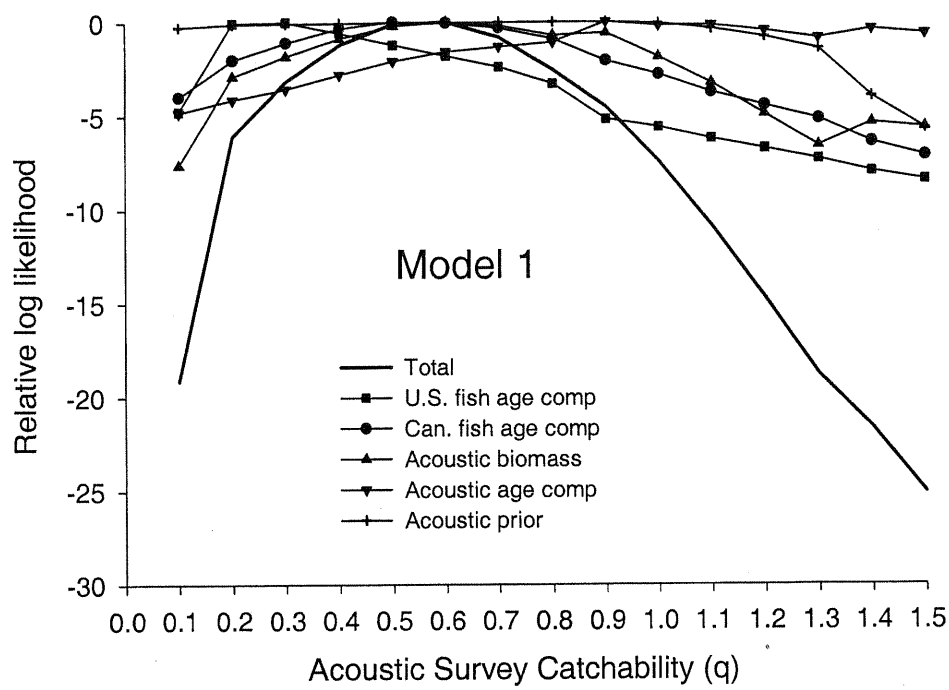


Figure 26. Estimated time series of Pacific whiting age 3+ biomass (million mt) and age-2 recruitment (billions of fish) during 1972-2001. Vertical bars represent two standard deviations.



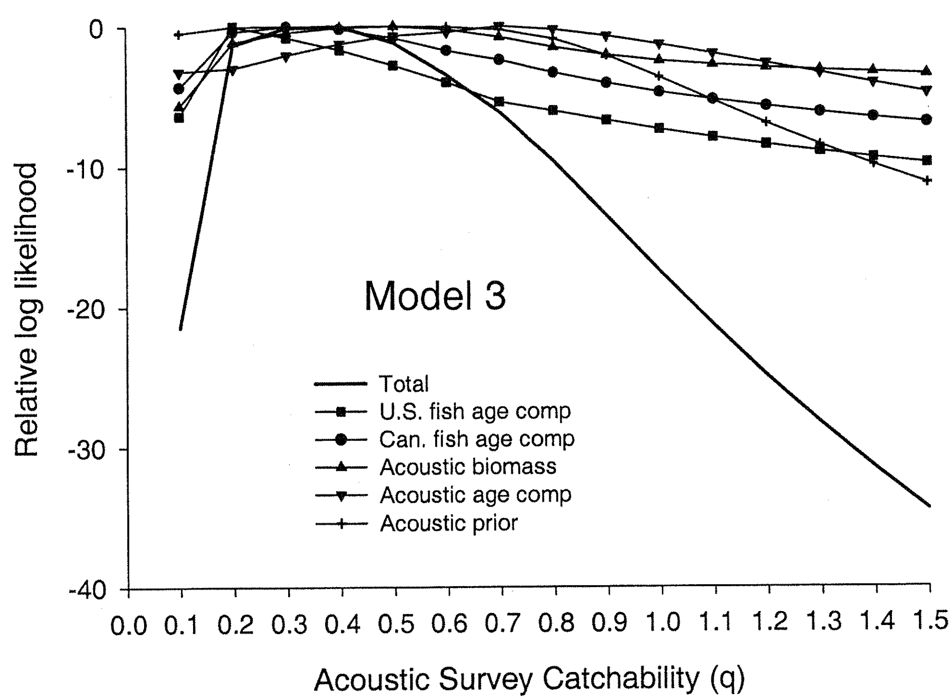


Figure 27. Likelihood profile for AFSC acoustic survey catchability (q) for the base-run model.

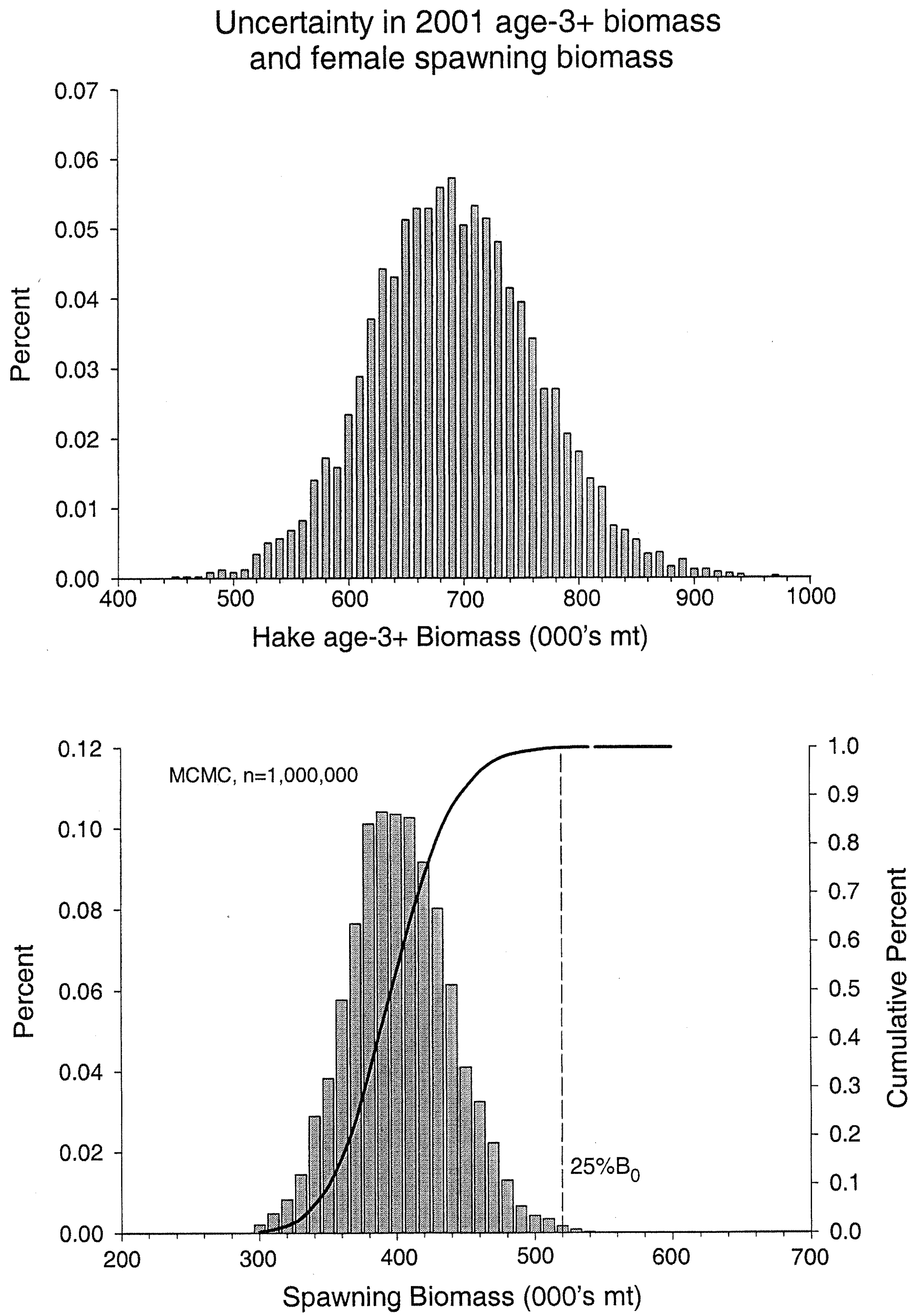


Figure 28. Uncertainty in 2001 age 3+ biomass and female spawning biomass for the base-run model as shown by a Markov chain Monte Carlo sampling distribution, n=1,000,000.

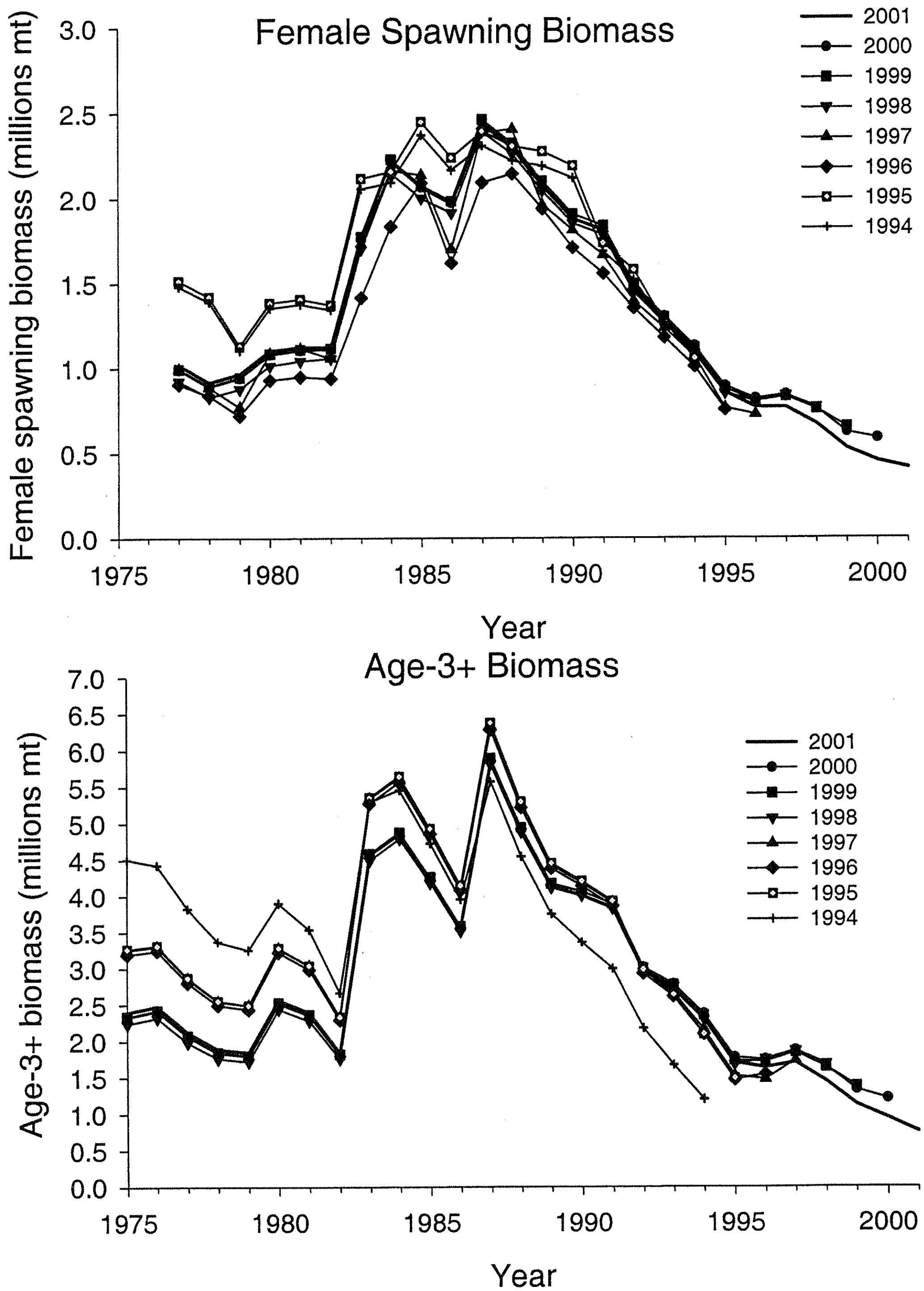


Figure 29. Retrospective analysis of estimated female spawning biomass (upper panel) and age-3+ biomass (lower panel) for stock assessments in the years 1994-2001.

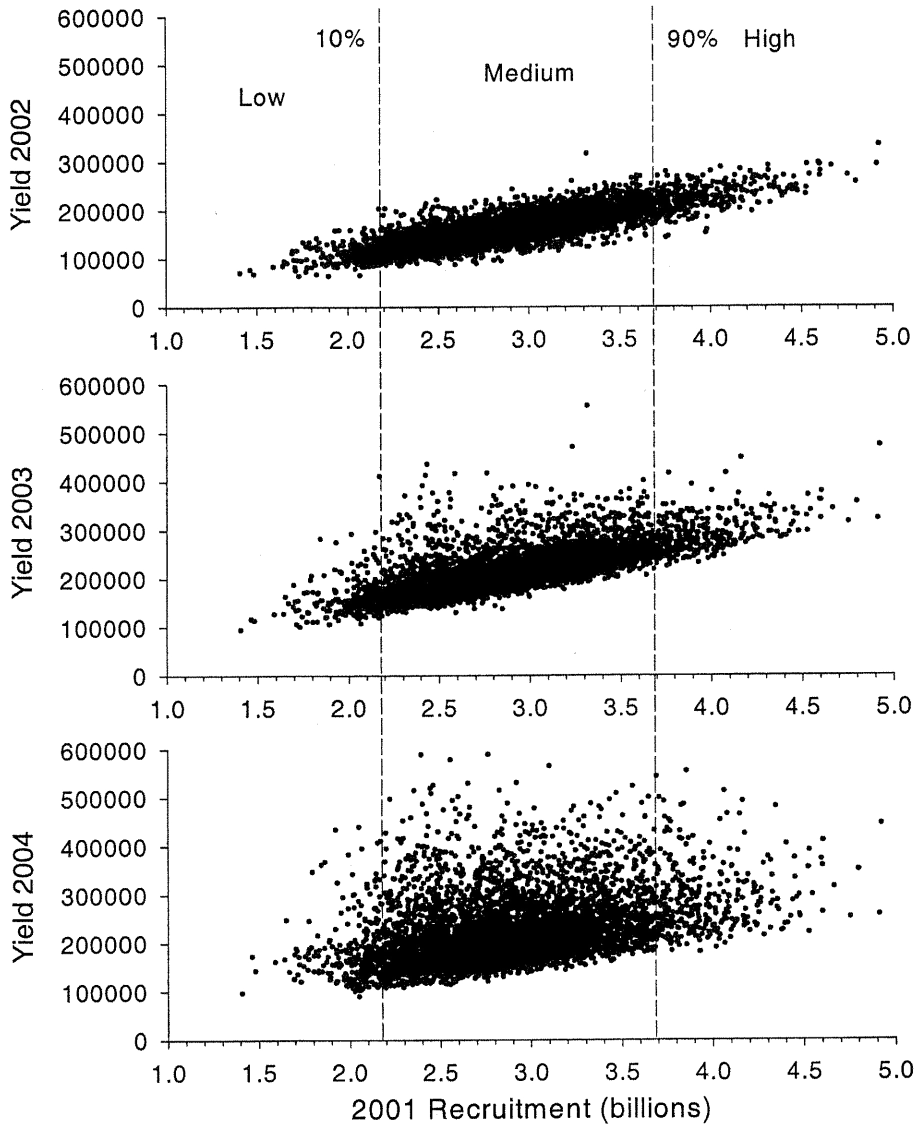


Figure 30. Bivariate posterior density functions for projected 2002-2004 yields and recruitment at age-2 in 2001 under the F40% (40-10) harvest policy generated from 1,000,000 Markov chain Monte Carlo simulations. Average 2001 recruitment and conditional expected catches within the percentile ranges shown were used to derive projected catches and construct decision table.

Report of the Joint Canada – USA Review Panel on the Stock Assessment of the Coastal Pacific Hake/Whiting Stock Off the West Coast of North America

National Marine Fisheries Service
Montlake Laboratory

Seattle, WA. U.S.A.

20-22 February 2002

Introduction

The second joint meeting of the Canadian Pacific Scientific Advice Review Committee (PSARC) Groundfish Subcommittee on Pacific Hake and the USA Pacific Fishery Management Council's Stock Assessment Review (STAR) Panel for Pacific Whiting was held at the NMFS Montlake Laboratory , Seattle, WA, USA during 20-22 February 2002. The list of participants is given as Appendix 1.

The joint PSARC Subcommittee – PFMC STAR Panel (hereafter referred to as the Panel), received the primary draft assessment document prior to the meeting:

Helser, T.E., M. W. Dorn, M.W. Saunders, C.D. Wilson, M.A. Guttormsen, K. Cooke, and M.E. Wilkins. 2002. Status of Pacific hake/whiting stock in U.S. and Canadian waters in 2001.

Alan Sinclair (Canada) and Tom Jagielo (USA) served as co-chairs. Following a welcome by Dr. Elizabeth Clarke and introduction of attendees, the Panel heard the following presentations:

Overview of the Assessment	T. Helser (NMFS -- Seattle)
Results of the 2001 NMFS Acoustic Survey	M. Guttormsen (NMFS -- Seattle)
Results of the 2001 NMFS Shelf Survey	M. Wilkins (NMFS -- Seattle)
Results of the 2001 Canadian Acoustic Survey	M. Saunders (DFO – Nanaimo)

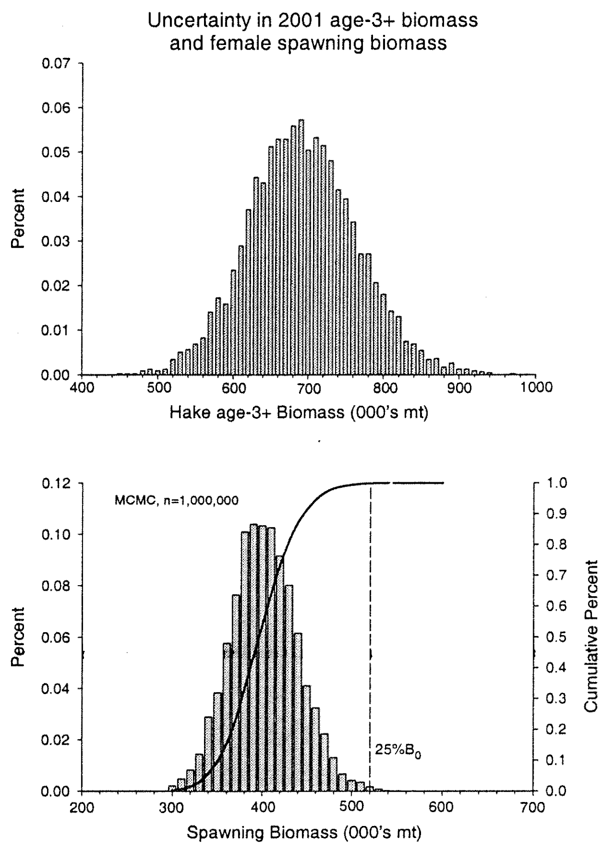
During their presentations and over the course of the 3-day review, the Stock Assessment Team (STAT) provided additional information and data at the request of the Panel that greatly assisted the Panel in carrying out its work.

A summary of the draft assessment document (prepared by the authors) is given as Appendix 2.

Summary of Stock Status

The Panel agreed with the Helser et al. (2002) assessment that the best estimate of 2001 stock abundance is 0.7 million mt, with uncertainty as indicated from the approximate probability density functions (Figure 26 of Helser et al., reproduced below). The Panel concurred with the assessment methods used in the analysis, and the approximate density functions for the stock projections.

- Stock size has declined continuously over the past four years to its lowest point of 711 thousand mt in 2001.
- The exploitation rate increased from below 10% prior to 1993, to 31% in 2001.
- The mature female biomass in 2001 is estimated to be 20% of an unfished stock.
- Mature female biomass is projected to rise over the next three years as the above average 1999 year class enters the mature biomass of the stock.
- The percentage of unfished stock size, and the future yield trajectory, depend heavily on the estimated strength of the 1999 year class, persistance in the recent increases in weight-at-age, and harvest policy chosen.



Detailed Comments from the Review

Surveys

It was generally agreed that the current approach of relying primarily on the results from the NMFS acoustic survey was appropriate for abundance estimation. The NMFS bottom trawl survey and the DFO acoustic survey do not cover the full geographical range of Pacific hake, and abundance trends derived from them may be biased due to changes in local availability. The last four NMFS acoustic surveys (1992, 1995, 1998 and 2001) have been the most reliable, in the sense that these surveys have unambiguously covered the entire area of the mature whiting distribution, including areas to the north and offshore that were not covered in previous years.

There were dramatic changes in the abundance and distribution of biomass between 1998 and 2001. The population biomass declined approximately 38% from the 1998 survey. In 2001 the majority of the biomass was present south of Newport, Oregon and in very low amounts off Washington and Canada, in contrast to 1998 when hake were present into the Gulf of Alaska with half of the biomass in the Canadian zone.

The Panel noted the strong selectivity at age evident in the model results for the NMFS acoustic surveys. Note that the selectivity function actually represents the confounded effects of acoustic selectivity, survey trawl net selectivity, and stock availability. The dome-shaped curve permitted by the double-logistic parameterization of selectivity resulted in lower apparent selectivity for younger and older age groups. A Bayes prior was imposed on the slope parameter of the ascending limb of the acoustic selectivity to achieve sensible results. Without the prior, peak selectivity shifts to older ages and results in an unreasonably large biomass of "unseen" young fish. The Panel recommended that possible explanatory factors for the dome-shaped selectivity be further explored prior to the next assessment, and that simpler parameterizations without a descending limb be considered; specifically:

1. Is the more complicated double-logistic selectivity formulation supported by the data;
2. Are there independent data to support the existence of older fish implied by a descending selectivity curve that are not available to the acoustic survey.

The STAT team presented an analysis of biomass distributions in the acoustic and AFSC bottom trawl surveys to address the issue of why the bottom trawl survey should be de-emphasized. The analysis indicated that hake biomass had shifted to shallower waters between 1995 and 2001. This suggests that the bottom trawl survey would be sensitive to changes in hake distribution rather than actual changes in stock abundance. Thus, the Panel agreed that the bottom trawl survey should retain low emphasis in the assessment model.

An index of juvenile hake abundance derived from the Southwest Fishery Science Center (SWFSC) midwater trawl juvenile recruit survey (Tiburon survey) was used in the catch forecast but not in the stock reconstruction. A plot of the index vs. hake recruitment estimates from the stock reconstruction indicated a significant correlation, although it was relatively weak ($R^2 = 0.55$, $p = 0.002$). Over the 1986 to 2001 time-series of the Tiburon index, the 1999 year class is ranked 4th highest in the Tiburon time series but is the largest year class in the stock reconstruction. The Panel requested that a model run be completed where the Tiburon index is given the same weight at the acoustic survey. This run was requested since the Tiburon index represents a perspective on recruitment independent of the population dynamics model and thereby provides a second estimate of the size of the 1999 year-class. The runs emphasizing the Tiburon survey reduced the estimate of the size of the 1999 year class by approximately 50%. However, the increased emphasis degraded the fit of the model to the age compositions from the acoustic survey and the fishery. The Panel recommended that the Tiburon survey index be incorporated into the base-line reconstruction runs using a CV of 0.5; 5 times that of the acoustic survey. This was considered reasonable given the apparent correlation between the index and the stock reconstruction and the use of the index in stock forecasts.

Biological Assumptions

The panel noted that weight and size-at-age has been variable over time. Declines during the 1980's were followed by an increase in 2000. The current weight-at-age vector is comparable to that seen in the mid-1970's. These changes are potentially linked to the following:

- changes in secondary productivity resulting in enhanced growth.
- environmentally induced shifts in distribution.
- ageing error.

Weight at age of Pacific hake tends to increase with latitude. For example, fish of a given age in the Canadian zone tend to be heavier than those distributed south of the zone. Thus, increased weight at age observed in the US zone in 2000 and 2001 could result from a southward shift in the distribution of hake, as well as from improved environmental conditions for growth.

The panel noted that the weight-at-age values used in the forward projections will have considerable influence on the resulting yields. It may be more appropriate to use a more conservative long term mean rather than the mean of the last three years (1999, 2000, and 2001observations). The forecast increase in biomass depends in part on increased weight at age, thus, if the weight at age values are biased high over the term of the projections increased numbers of fish will be harvested to achieve the quota assigned in terms of weight.

The panel noted several issues related to the reproductive potential of the stock: First, the previous panel reported that the effect of a biomass consisting of a larger number of smaller individuals on true spawning potential is not well understood. They pointed out that spawning biomass appeared to have become progressively more heavily dependent on the contribution of 3, 4, and 5 yr old females. The growing dependence on a few younger age classes has increased in 2002 with the population dependent on one year class of age 3's. Second, an important assumption in the current model runs is that the maturity ogive is time invariant. This ogive is based on a rather limited number of samples taken during the early 1990's. Given the current dependence on younger fish, the assumption of a constant maturity ogive needs to be examined in the next assessment.

Fisheries Data

The basic fisheries data for Pacific whiting appear to be sound, however the panel recommends that the next assessment include a more detailed description of the catch monitoring and sampling regime for each fishery. Future assessments should also include distributional plots for all fisheries and consider reporting a measure of fishing effort.

Model Evaluation

The draft assessment document distributed prior to the meeting presented three stock assessment models: Model 1, with status quo assumptions used to provide management advice since 1993, where acoustic biomass CV=0.5 in 1977-1989 and

CV=0.1 in 1992-2001 (the AFSC trawl survey was de-emphasized for the entire time series (CV=100); Model 2, which treated the acoustic survey the same as Model 1 but increased the influence of the AFSC trawl survey (CV=0.1); and Model 3, which applied equal weight (CV=0.1) to the entire acoustic time series (1977-2001).

At the beginning of the meeting, the STAT team distributed summary results for two additional models: 1) Model 4, which relaxed the assumption of acoustic survey catchability (q=1) by estimating q for the entire time series (q=0.53), and Model 5, which explored alternative acoustic survey selectivity for young fish by applying a penalty on ascending limb inflection and slope selectivity parameters.

The Panel expressed concern regarding the poor fit to the acoustic survey biomass under Model 1, and requested the STAT team to conduct additional model runs to consider alternative assumptions of the acoustic survey selectivity at age and q. Recognizing that selectivity and q are confounded, and that the available data are not sufficient to obtain year specific estimates, the Panel requested the STAT team to consider alternative models which treated the acoustic survey biomass time series as two separate indices of abundance; a pre-1992 time stanza, and a post-1992 time stanza. The rationale for the break in 1992 is drawn from uncertainty in the acoustic survey time series and environmentally driven changes in hake distribution.

The pre-1992 stanza is characterized by:

1. use of a single beam acoustic system (Biosonics 101).
2. required adjustments for northern and offshore expansion and
3. required adjustment for target strength.
4. Juvenile 0-2 age hake were primarily found in south-central California where plankton make acoustic assessment less effective.
5. The sphere calibrations at the start and end of the 1986 survey differed by 48% and the reconstruction uses the more conservative number.

The post 1992 stanza is characterized by:

1. Use of a new EK500 split beam acoustic system.
2. Adequate coverage of northern and offshore distribution.
3. Uses an appropriate target strength model adjusted for length.
4. Increased occurrence of Juvenile 0-2 age throughout the zone in most years.

Explorations of the two-stanza model structure included varying the treatment of acoustic survey selectivity (domed vs asymptotic) and q (fixed at q=1 vs. estimated) in the second time stanza. It appeared that this approach could improve the overall fit to the acoustic biomass time series, and some scenarios suggested increased catchability in the recent stanza. The panel attempted to evaluate the properties of the two-stanza models in more detail by 1) performing a catch curve analysis on the acoustic survey and US fishery catch at age data, and 2) examining reasons for the degradation in the fit to the age composition data under some of the two-stanza scenarios. The Panel noted that the 1992 survey had substantially lower than expected numbers of age 2 and age 5 fish which contributed to lack of fit to age compositions and estimates of selectivity. However, the magnitude of the estimated increase in catchability was not supported by catch curve analysis of the survey data. Catch curve analysis of the US fishery catch at age suggested that the change in fit to the 2 stanza model may be influenced by changes in the commercial fishery data. Plots showed some indication of ageing error in 2001 and future assessments should consider incorporating year specific ageing error. In the time available, the Panel was unable to satisfactorily evaluate the full suite of two-stanza models presented, however, the Panel recommended that the two-stanza approach should be investigated further in the next assessment.

For the present assessment, the Panel agreed that Model 1 (with the SWFSC recruit index set at CV=0.5) should be used as the preferred assessment model. This model de-emphasized the earlier portion of the survey time series and provides a better fit to the more recent data. However, because the earlier part of the time series is de-emphasized, the fit to the entire acoustic time series is poor and a two stanza approach should be examined in the next assessment.

In contrast to the Panel consensus, the PFMC Groundfish Advisory Panel (GAP) member, who served as an advisor to the Panel at the meeting, did not concur with the sole use of Model 1, and suggested that Model 1 and Model 4 be forwarded to define the range within which management decisions should be made. He indicated that he would present his reasons in a separate statement to the PFMC.

Harvest Projections

Recruitment for the harvest projections was determined as a function of: 1) the mean log recruitment from the base-run model, 2) the SWFSC index of age-0 abundance, and 3) estimates of variability for the recruitment time series and the SWFSC recruitment index. The Panel did not discuss at length the merits of the SWFSC midwater trawl juvenile survey as a predictor of coastwide whiting recruitment, other than noting the limited geographic range of the juvenile survey and the typically high sampling error associated with juvenile surveys in general. The Panel recognized the high variance associated with forecasting recruitment and noted that caution in the use of the projections for forecasting future biomass levels may be prudent.

Stock Status

The Panel agreed with the assessment that the best estimate of 2001 stock abundance is 0.7 million mt, with uncertainty as indicated from the approximate probability density function (Figure 26 of Helser et al.). The Panel concurred with the assessment methods used in the analysis, and the stock projections shown in the projection table of the Summary of Stock Status (Appendix 2).

Harvest Recommendations

The Panel recommended exercising considerable caution in setting harvest levels for 2002. The caution is warranted given the following:

- The population biomass estimates have been declining continuously since 1987 and are at the lowest level observed.
- The 2002 stock is composed predominantly (63% by weight) of the 1999 year-class which is 3 years old and only 66% mature.
- Exploitation rates in the last three years were in excess of the 40-10 policy and the highest on record. The higher than projected harvest rates were primarily due to overestimation of stock size in the 1998 assessment and the fact that the combined Canada-US coastwide TAC's were set above the management target.

The Panel notes that the projected increase in yields between 2002 and 2004 is due to the estimated size of the 1999 year-class, the associated increase in stock size, and the increase in harvest rate due to the 40-10 rule. However, given concerns with the current formulation of the stock reconstruction model and the dependence of yield options beyond 2002 on continued recruitment of the 1999 year-class and recruitment from year-classes not actually observed, the Panel recommends against adopting 2003 projections until another assessment is conducted.

Management Goals and Objectives

Included in Appendix 2 is a projection table which provides: 1) coastwide yield, 2) 3+ biomass, and 3) percent unfished biomass under three arbitrarily assumed levels of recruitment in 2001 (derived from Low<10%, medium=10-90%, and High>90%; percentiles based on 1,000,000 Markov chain Monte Carlo simulations). For each assumed level of recruitment, projections are given under three harvest policies using the 40-10 rule (F40%, F45%, and F50%). Additionally, a decision table analysis is presented (Appendix 3) which shows the projected consequence of each management action under three states of nature, as if the assumed Low, Medium, or High recruitment levels are actually realized.

The Panel concluded that the F45% policy along with the 40-10 rule is the most appropriate for this stock. A yield range for 2002 (namely 96,000 – 133,000 mt) would be bounded by the low and medium 1999 year-class recruitment assumptions.

Summary of Panel Recommendations for Future Work (Not Prioritized)

- The next assessment should include a detailed description of the catch monitoring and sampling regime for each fishery.

- Possible explanatory factors for the dome-shaped selectivity curve should be further explored prior to the next assessment.

- The assumption of a constant maturity ogive should be examined in the next assessment.

- Reasons for the poor model fit to the acoustic survey biomass estimates of abundance should be further explored and model runs employing the two time-stanza approach should be investigated further in the next assessment.

- Given concerns with the current formulation of the stock reconstruction model and the dependence of yield options beyond 2002 on continued recruitment of the 1999 year-class and recruitment from year-classes not actually observed, the Panel recommends against adopting 2003 projections until another assessment is conducted.

Appendix 1. List of Participants February 20-22, 2002

Name	Affiliation	20	21	22	Role
Richard Methot	NMFS/NWFSC	X	X	X	Observer
Mike Guttormsen	NMFS/AFSC	X	X		Author
Tom Helser	NMFS/NWFSC	X	X	X	Primary author
Chris Wilson	NMFS/AFSC	X			Author
Elizabeth Clarke	NMFS/AFSC	X	X	X	Observer
Kevin Piner	NMFS/NWFSC/GMT	X	X	X	STAR advisor
Sandy McFarlane	DFO/Pacific Biological Station	X	X	X	PSARC member
Tom Jagielo	WDFW/SSC	X	X	X	Co-chair STAR member
Alan Sinclair	DFO/Pacific Biological Station	X	X	X	Co-chair PSARC/Star member
Norm Hall	CIE/Murdoch Univ. Perth	X	X	X	STAR member
Jeff Fargo	DFO/Pacific Biological Station	X	X	X	PSARC member
Rob Kronlund	DFO/Pacific Biological Station	X	X	X	PSARC member/STAR member
Mark Wilkins	NMFS/AFSC	X	X		Author
Rod Moore	Groundfish Advisory Panel	X	X	X	STAR advisor
Mark Saunders	DFO/Pacific Biological Station	X	X	X	PSARC member/Rapporteur
Ian Stewart	NMFS/University of Wash.	X		X	Observer
Vera Agostini	SAFS/University of Wash.	X	X		Observer
Ken Stump	Consultant- Environment	X	X		Observer
Rick Dunn	Hake Consortium of B.C.	X	X		Observer
Athol Laing	Hake Consortium of B.C.	X	X		Observer
Joe Bersch	Supreme Alaska Seafoods	X	X		Observer
Steve Joner	Makah Tribe	X			Observer
Jan Jacobs	American Seafoods	X	X		Observer
Guy Fleischer	NMFS/NWFSC	X	X	X	Observer
Barry Ackerman	DFO/Groundfish Management	X	X	X	PSARC member
Mark Saelens	ODFW/GMT	X	X		Observer
Vidar Wespedstad	PWCC		X	X	Observer
Patrick Higgins	Canadian Consulate Seattle		X		Observer
John Wallace	NMFS/NWFSC	X		X	Observer

Appendix 2. Summary of Stock Status (Helser et al. 2002)

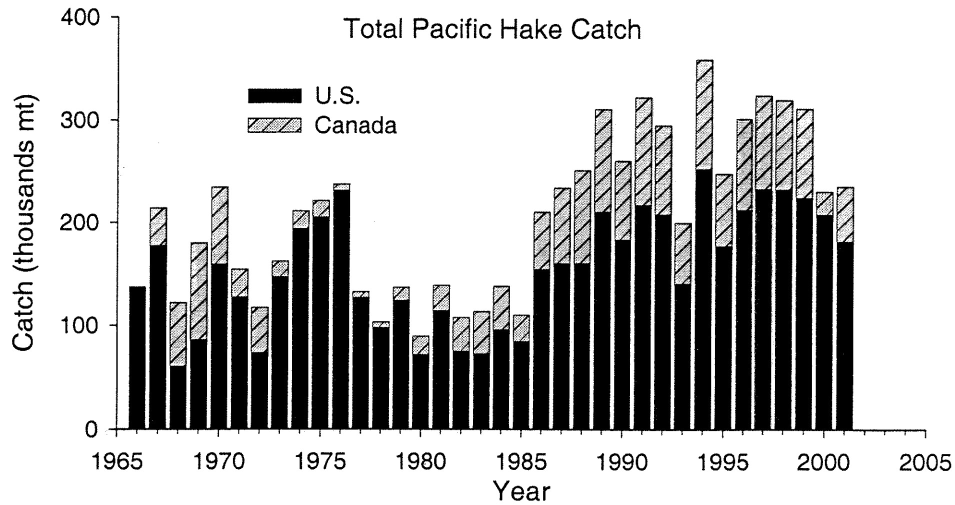
Summary of Stock Status

The coastal population of Pacific whiting (*Merluccius productus*, also called Pacific hake) was assessed using an age-structured assessment model. The U.S. and Canadian fisheries were treated as distinct fisheries in which selectivity changed over time. The primary indicator of stock abundance is the AFSC acoustic survey, and the SWFSC juvenile survey as an indicator of recruitment. Other data examined in the model were the AFSC triennial shelf trawl survey and the Department of Fisheries and Oceans acoustic survey. New data in this assessment included updated catch at age through 2001, recruitment indices from the SWFSC recruit survey, and results from the triennial acoustic and shelf trawl surveys conducted in summer of 2001.

Status of Stock: The whiting stock in 2001 was estimated to be at low biomass levels, however, projected stock biomass is expected to increase. Stock biomass increased to a historical high of 5.8 million t in 1987 due to exceptionally large 1980 and 1984 year classes, then declined as these year classes passed through the population and were replaced by more moderate year classes. Stock size stabilized briefly between 1995-1997, but has declined continuously over the past four years to its lowest point of 711 thousand t in 2001. The mature female biomass in 2001 is estimated to be 20% of an unfished stock. Mature female biomass, however, is projected to rise gradually over the next three years due to the relatively strong 1999 year-class as it enters the mature biomass of the stock. The percentage of unfished stock size depends, however, on the harvest policy chosen. For instance, under the F45% (40-10) harvest policy female spawning biomass increases to 31% (93% probability that females spawning biomass is greater than 25%B0) of an unfished stock in 2003. The exploitation rate was below 10% prior to 1993, but gradually increased to 31% by 2001. Biomass levels below 25%B0 and high exploitation rates indicate that the stock has been overfished in recent years primarily due to over-estimation of biomass in the 1998 assessment used to set optimum yield for 1999-2001. Furthermore, total U.S. and Canadian catches have exceeded the ABC by an average of 12% from 1993-1999 due to disagreement on the allocation between U.S. and Canadian fisheries.

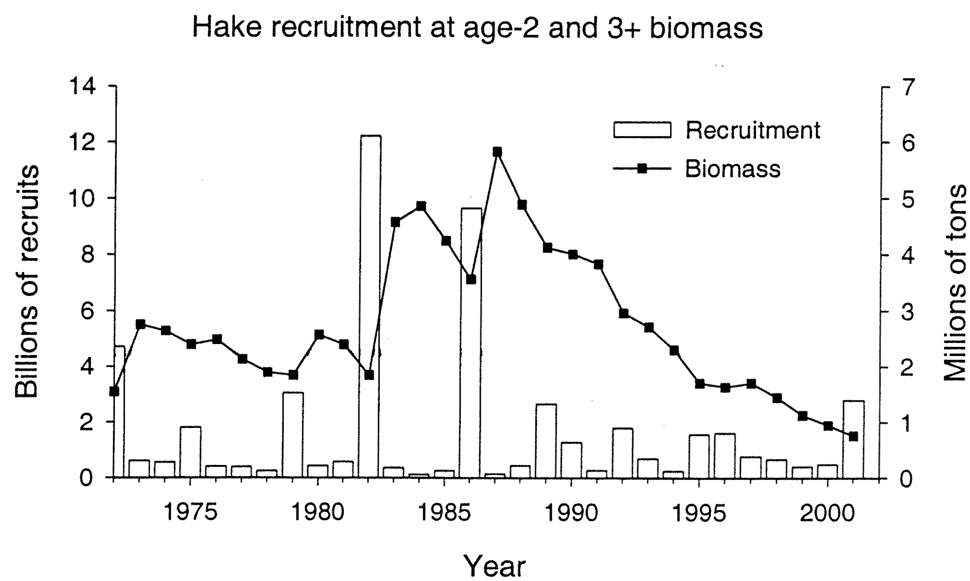
Pacific whiting (hake) catch and stock status table (catches in thousands of metric tons and biomass in millions of metric tons):

Year	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
U.S. landings	218	209	141	253	178	213	233	233	225	208	182
Canadian	105	86	59	106	40	88	91	87	87	22	53
Total	323	295	200	359	248	301	324	320	311	231	236
ABC	253	232	178	325	223	265	290	290	290	290	238
Age 3+ stock	3.8	3.0	2.7	2.3	1.7	1.7	1.7	1.5	1.1	1.0	0.7
Female mature	1.9	1.6	1.4	1.2	0.9	0.8	0.8	0.7	0.6	0.5	0.4
Exploitation rate	8.4%	10.0	7.4%	15.6	14.5	18.4	19.0	22.1	27.6	24.4	31.1



Data and Assessment: An age-structured assessment model was developed using AD model builder by Dorn et al. (1998), a modeling environment for developing and fitting multi-parameter non-linear models. Earlier assessments of whiting used the stock synthesis program. Comparison of models showed that nearly identical results could be obtained under the same statistical assumptions. The most recent assessment presented here for 2001 used the same model structure as in the 1998 assessment and examined different model assumptions regarding the strength of recruitment in 2001.

Major Uncertainties: The whiting assessment is highly dependent on acoustic survey estimates of abundance. Since 1993, the assessment has relied primarily on an absolute biomass estimate from the AFSC acoustic survey. The acoustic target strength of Pacific whiting, used to scale acoustic data to biomass, is based on a small number of *in situ* observations. The fit to the acoustic survey time series is relatively poor in the middle years (1983-1992) but improves early on and in more recent years. The AFSC shelf trawl survey biomass shows an increasing trend until 1995, conflicting with a decreasing trend in the acoustic survey since 1986. Both the acoustic and trawl surveys, however, show consistent declining trends since 1995.



Target Fishing Mortality Rates: Target fishing mortality rates used in projections were based on F40%, the fishing mortality rate corresponding to 40% of unfished spawning stock biomass-per-recuit, with the 40-10 policy implemented when biomass falls below 40% of unfished. A Bayesian decision analysis (Dorn et al. 199) produced estimates of FMSY in the F40% to F45% range depending on the degree of risk-aversion. In addition to the F40% (40-10 option), F45% and F50% harvest policies were calculated under different assumed strengths of recruitment in 2001.

Projection table (Coastwide yield in thousands of tons, biomass in millions of tons, and percent unfished female spawning biomass) under different assumptions of recruitment strength in 2001 (low < 10%, medium 10%-90%, and high > 90%; percentiles based on 1,000,000 Markov chain Monte Carlo simulations) and different harvest policies:

Assumed 2001 Recruitment	Harvest Policy (40-10)	Coastwide yield 2002	2003	2004	3+ Biomass 2002	2003	2004	Percent unfished 2002	2003	2004
Low (2.12) bil.)	F40%	117	166	189	1.02	1.11	1.10	0.20	0.27	0.31
	F45%	96	141	166	1.02	1.13	1.15	0.20	0.28	0.32
	F50%	79	120	144	1.02	1.15	1.19	0.20	0.28	0.32
Med. (2.89) bil.)	F40%	162	217	228	1.26	1.33	1.26	0.24	0.32	0.34
	F45%	133	185	201	1.26	1.37	1.32	0.24	0.33	0.35
	F50%	109	158	176	1.26	1.39	1.37	0.24	0.33	0.36
High (3.87 bil.)	F40%	219	284	282	1.57	1.63	1.45	0.29	0.38	0.38
	F45%	180	242	250	1.57	1.67	1.53	0.29	0.39	0.39
	F50%	149	206	220	1.57	1.71	1.60	0.29	0.40	0.41

Other considerations: Unusual juvenile and adult distribution patterns have been seen in Pacific whiting population in recent years. Juvenile settlement spread northwards during 1994-99 due to El Niño ocean conditions. This was evident as numerous age-1 fish (1997 year class) seen in the 1998 acoustic survey off Queen Charlotte Islands as well as increased numbers of age-2 and age-3 whiting taken in the Canadian fishery in 1994 and 2000, respectively. Equally dramatic was the low occurrence of whiting off Canada in 2000 and 2001 resulting in less than full utilization of their TAC. This shift appears correlated with La Niña conditions in 1999-2000. It is unclear whether these changes will be a benefit or a detriment to stock productivity and stability. Despite the inconsistency in trends in biomass between the acoustic and trawl surveys, recent years (since 1995) have shown similar declines in whiting abundance. Possible strong recruitment in 2001 (1999 year class) along with substantial increases in mean weights at age due to favorable ocean conditions may prove to be positive factors in expected increases in yield and biomass in 2003-2004. However, projections of stock biomass and yields are highly dependent on the relative strength of recruitment in 2001.

Appendix 3. Decision table showing the repercussions of different assumptions for 2001 recruitment (1999 year-class) under different harvest strategies (Table 15 of Helser et al., 2002)

Values given show spawning biomass (as percent unfished) and exploitation rates as outcomes of choosing TACs for 2002-2004 associated with low (<10%), medium (10%-90%) or high levels (>90%) of 2001 recruitment (assumed state of nature) against low, medium and high true levels of recruitment (True state of nature).

		True state of nature 2001 Recruitment (billions)					
		Low (2.12)		Medium (2.89)		High (3.87)	
		Spawning biomass (as percent unfished)					
Management action	Assumed state of nature	2003	2004	2003	2004	2003	2004
F40% (40-10)	Low	27%	31%	33%	36%	41%	43%
F45% (40-10)	Low	28%	32%	34%	37%	41%	44%
F50% (40-10)	Low	28%	32%	34%	38%	42%	45%
F40% (40-10)	Medium	26%	28%	32%	34%	39%	40%
F45% (40-10)	Medium	27%	30%	33%	35%	40%	42%
F50% (40-10)	Medium	28%	31%	33%	36%	41%	43%
F40% (40-10)	High	25%	25%	31%	31%	38%	38%
F45% (40-10)	High	26%	27%	32%	33%	39%	39%
F50% (40-10)	High	27%	29%	32%	34%	40%	41%

		Outcome: Exploitation rate (2003-2004)					
Management action	Assumed state of nature	2003	2004	2003	2004	2003	2004
F40% (40-10)	Low	14%	14%	11%	12%	9%	10%
F45% (40-10)	Low	11%	12%	9%	10%	8%	9%
F50% (40-10)	Low	10%	10%	8%	9%	6%	7%
F40% (40-10)	Medium	19%	18%	15%	15%	12%	13%
F45% (40-10)	Medium	15%	15%	13%	13%	10%	11%
F50% (40-10)	Medium	13%	13%	11%	11%	9%	9%
F40% (40-10)	High	26%	25%	21%	21%	17%	17%
F45% (40-10)	High	21%	21%	17%	17%	14%	15%
F50% (40-10)	High	17%	17%	14%	15%	12%	12%

Dissenting Views.

The following dissent to the "Report of the Joint Canada-USA Review Panel on the Stock Assessment of the Coastal Pacific Hake/Whiting Stock Off the West Coast of North America" is provided by Mr. Rod Moore, who served as the Groundfish Advisory Subpanel (GAP) advisor to the Panel. The views are his own and do not necessarily reflect the views of the GAP. Further, while reasonable people can reasonably disagree on modeling assumptions and the management decisions that are derived from scientific analysis, this dissent is limited to the decision by the majority of the Panel to forward a single model run to the Pacific Fishery Management Council. It should not be construed as criticism of the work performed by the Panel or the Stock Assessment (STAT) Team.

As noted in the report, presentations were made on the NMFS acoustic and shelf surveys for Pacific whiting. The report further briefly describes the 3 models presented to the Panel prior to convening and 2 additional models presented at the beginning of the Panel meeting. Models requested and / or presented during the meeting are not at issue here. The section of the report which discusses "Model Evaluation" states that "the Panel agreed that Model 1...should be used as the preferred assessment model." It is here that the author of these views disagrees with the rest of the Panel. *For reasons discussed below, the GAP advisor believes that Model 1 **and** Model 4 should be forwarded to the Scientific and Statistical Committee and the Council as equally plausible models.*

Acoustic Catchability

The presentation on the 2001 acoustic and trawl surveys discussed why the trawl survey has consistently shown a higher calculated biomass and why the acoustic survey better characterizes the biomass. However, the presenters made clear that even the acoustic survey did not fully "catch" all available whiting. Small fish, fish outside the survey area (especially in the south), fish located at or near the bottom, fish diving or climbing vertically in the water column, and fish that have undergone a rapid change in water pressure all tend to be missed by the acoustic signal. While the number of these missing fish cannot be accurately calculated, there is agreement that the true "catchability" - or the value of Q, as used in the assessment model - is less than 1.0.

Model Differences

As described by the STAT Team, Model 1 and Model 4 differ in only one way: Model 1 sets a prior value of Q for the acoustic survey (since the trawl survey value is de-emphasized in both models, it will be ignored here) at 1.0; Model 4 allows the model to estimate the value of Q, which gives it a value of .53 for the entire acoustic time series. While the Model 4 value of Q may be more accurate for the earlier years of the acoustic survey, it is probably low for the current years. However, as noted above in the discussion on survey catchability, even the most recent acoustic surveys do not fully "catch" all the fish available and thus the value of Q cannot be 1.0. The real value thus lies someplace in between the values shown in these two models, which leads to the suggestion that both models be presented as equally plausible and thus representing the range of likely biomass estimates.

Precedents

Failure to present a preferred model is not something new. For example, the Canary Rockfish STAR Panel in 1999 reviewed two different modeling approaches for northern and southern stocks and could not characterize either as being correct. In the same year, a STAR Panel examining petrale sole assessments concurred on a model for the northern stocks but could not recommend a model for the southern stocks. In 2001, the STAR Panel reviewing the sablefish assessment agreed on a single model, but could not agree on a single state of nature that resulted in an apparent recruitment failure, resulting in two different sets of recommendations for management based on two different assumptions of future recruitment.

Establishing a value for Q via model estimation has also been done previously, including in the sablefish model in 2001, where the accepted model imposed a Q greater than 1.0 for younger fish and less than 1.0 for older fish, a scenario similar in many ways to Model 4 of the whiting assessment.

Conclusion

Thus, for the reasons noted above and based on the precedents used in other stock assessments that have been subject to STAR Panel review and have been accepted by the Council, the author recommends that Model 1 and Model 4 be considered equally plausible and be used to define the range within which management decisions should be made.

Groundfish Management Team (GMT) Recommendations for Pacific Whiting Allowable Biological Catch, Optimum Yield, and Allocations for the 2002 Fishery

The GMT reviewed the Pacific whiting STAR/PSARC Panel report, the 2002 assessment document prepared by Helser, et al., and additional 10-year stock projections under alternative harvest rates provided by Dr. Helser. The STAR/PSARC Panel endorsed assessment Model 1, and also recommended that the strength of the1999 year-class be assumed, at this time, to fall within the range of values referred to as "Low" and "Medium" within the assessment. The SSC has chosen to forward the "Low" through "High" scenarios for Council consideration, noting that the "Medium" assumption is most consistent with a risk-neutral characterization of the strength of the 1999 year-class. It is emphasized that under any of these scenarios, the 1999 year-class is larger than the mean recruitment during the assessment period. Over the full range of recruitment assumptions, the model results indicate a 62% likelihood that the whiting spawning stock biomass is below 25% of the currently estimated unfished level, which is the Council's approved threshold for determining that a stock is "overfished". Only under the "High" scenario for 1999 recruitment is there a greater than 50% likelihood that the 2002 biomass is greater than 25% of the unfished level. However, there remains considerable uncertainty regarding the specification of unfished biomass.

The STAR/PSARC Panel recommended use of an $F_{45\%}$ harvest policy (with use of the 40-10 rule) for setting ABCs and OYs for whiting. However, the SSC supports continued use of the current default harvest rate policy of $F_{40\%}$ for the 2002 fishery.

Using an $F_{40\%}$ harvest policy, the range of ABCs and OYs corresponding to the three recruitment scenarios is shown below. Management recommendations based on integration over all three scenarios would be essentially the same as for the "Medium" scenario.

Harvest rate	1999 strength	ABC		OY Adjusted by 40-10 rule		Percent of B_0
		Coastwide	US	Coastwide	US	
$F_{40\%}$	Low	174,000	139,000	117,000	93,600	20.16%
$F_{40\%}$	Medium	208,000	166,000	162,000	129,600	24.09%
$F_{40\%}$	High	251,000	200,000	219,000	175,200	29.02%

Several considerations bear upon the determination of where within this range the 2002 ABCs and OYs should be set. In prior years, when assessments have determined species to be below the "overfished" threshold, the GMT has attempted to identify interim harvest specifications that would be consistent with the yield recommendations from subsequent, more exhaustive rebuilding analyses. To this end, Dr. Helser provided the GMT with a set of 10-year projections, based on a "Medium" 1999 year-class strength and deterministic recruitment near the long-term mean. The projections indicate that if mean levels of recruitment occurred annually, an $F_{40\%}$ policy (adjusted by the 40-10 rule) would rebuild the spawning stock to $B_{40\%}$ by the 2009-2011 time frame (Figure 1). With an $F_{45\%}$ policy, $B_{40\%}$ would be achieved by 2006. However, it is important to note that because of the highly skewed nature of the historical recruitment distribution, there is less than a 50% likelihood that annual recruitments would average at least the long term mean over this short period. It is equally important to acknowledge that these projections do not represent a thorough rebuilding analysis, and that adopting an approach for 2002 does not imply that the same policy would be continued until rebuilding was achieved.

The decision table in Appendix 3 of the STAR Panel report also provides valuable insight regarding the implications of alternative 2002 decisions. Regardless of which state of nature is assumed for 1999 recruitment, use of an $F_{40\%}$ harvest rate in 2002 is estimated to result in a higher spawning biomass in 2003, even if the "Low" recruitment scenario is the true state. The table also reveals that the 2003 spawning biomass, under any of the three "true" states of nature, is very similar under OYs representing the $F_{40\%}$ "Medium" scenario (162,000 mt) and the $F_{45\%}$ "High" scenario (180,000 mt).

OYs at the upper end of the identified range increase the risk of not being able to rebuild the stock to $B_{40\%}$ within 10 years, particularly if below average recruitments are encountered over the next several years. The view of the current stock structure which emerges from the assessment indicates that the fishery will be heavily dependent upon the 1999 year class in 2002 and potentially for several future years. We are even less certain about the strength of year classes that will enter the fishery over the next five years. If we were to see average or above average annual recruitments throughout this period, the stock would likely rebuild to $B_{40\%}$ within 10 years. However, several low recruitments during this period, combined with an aggressive short term harvest policy, could jeopardize the ability to rebuild in a timely manner without imposing more severe future reductions in yields.

OYs at the low end of the range increase risks to the financial viability of not only the whiting fleet, but the remainder of the groundfish trawl fleet as well. Total U.S. ex-vessel revenue from whiting in 2001 was about $18 million. Under the low, medium, and high OY options, whiting revenue would be roughly $9 million, $13 million, and $17 million, respectively. For the low to medium OY values identified above, the shoreside allocations for whiting would range from roughly 37,000 mt to 45,000 mt. More than 70,000 mt were caught by shoreside vessels in 2001, and more than 80,000 mt in each of the two preceding years. Not only would these reductions decrease ex-vessel revenues by $3-4 million in that sector, they would also dramatically reduce the duration of the shoreside season. The bi-weekly cumulative landings summary provided in Table 1 indicates that fishery would likely not run beyond late July with the higher OY, and early to mid July at the low end of the range.

Shortening of the shoreside season to this degree would have profound implications for management of the remaining groundfish fishery. As shown in Table 2, shoreside whiting vessels have accounted for roughly 50% of the annual harvest of DTS species in each of the past three years, as well as 20% or more of the non-Dover flatfish species. Table 3 shows the seasonal nature of participation in these other fisheries, and clearly illustrates that participation in them can be expected to resume when the whiting fishery closes. As a consequence, participation in DTS and flatfish fisheries will likely be considerably higher during August and September, and possibly July, than was projected for purposes of setting trip limits during the Fall of 2001. Thus, in order to effectively constrain landings of these target species, as well as the bycatch associated with them, the GMT will have to consider trip-limit reductions for at least the July-August cumulative period to counter this anticipated effort shift. The lower the whiting OY, the more pronounced this trip-limit reduction will need to be.

Regardless of the Council's harvest decision for 2002, the GMT's intention would be to conduct a thorough rebuilding analysis before recommending harvest specifications for the 2003 fishery. This would hopefully include further examination of the uncertainty surrounding the current estimate for unfished biomass.

Figure 1.--Ten-year deterministic projections of Pacific whiting spawning stock biomass under alternative harvest policies using the 40-10 adjustment.

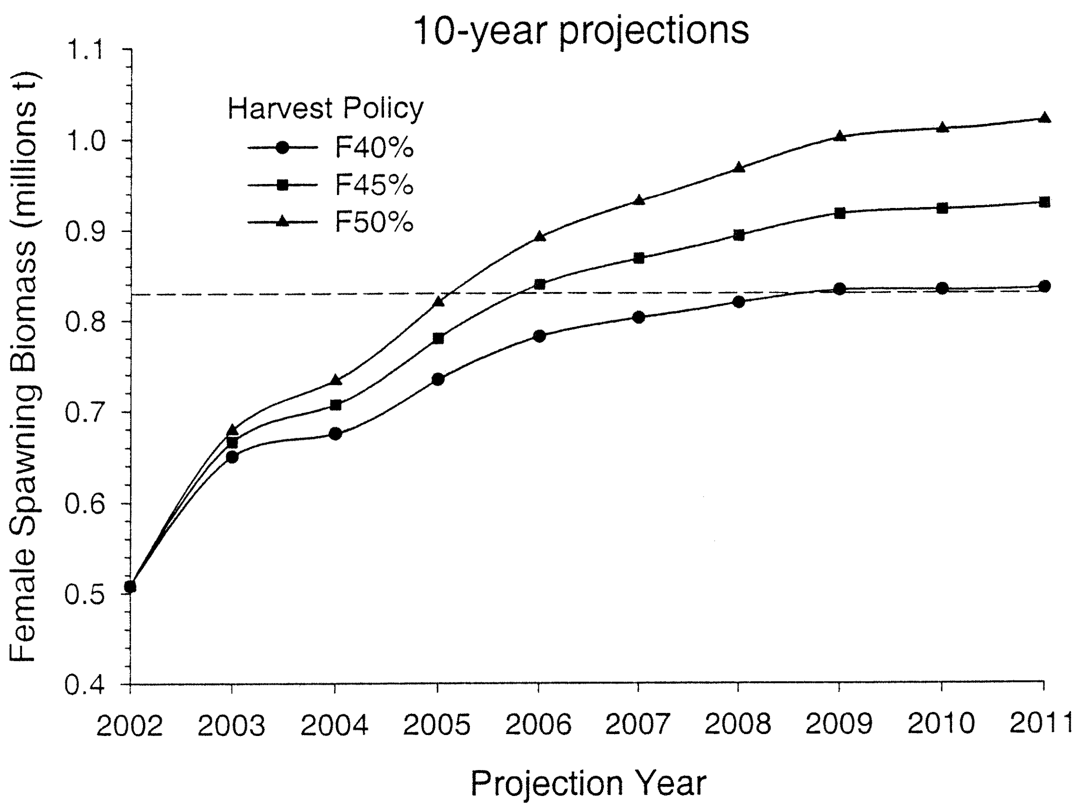


Table 1.--Bi-weekly catch rates and numbers of deliveries in the shoreside whiting fishery, 1999-2001.

Bi-weekly period		1999			2000			2001		
		# of	metric tons		# of	metric tons		# of	metric tons	
number	start date	deliveries	in period	cumulative	deliveries	in period	cumulative	deliveries	in period	cumulative
1	4/1							7	309	309
2	4/15				6	403	403	4	233	542
3	4/29	2	77	77	11	655	1,057	12	738	1,280
4	5/13			77	27	1,741	2,799	11	639	1,919
5	5/27			77	21	1,302	4,100	7	288	2,207
6	6/10	122	8,488	8,565	61	4,895	8,996	94	6,997	9,204
7	6/24	218	13,345	21,910	111	9,050	18,046	165	11,842	21,046
8	7/8	157	10,628	32,538	122	10,293	28,339	176	12,252	33,298
9	7/22	227	17,302	49,840	151	11,903	40,242	206	16,290	49,588
10	8/5	202	15,176	65,016	173	14,707	54,949	195	15,493	65,081
11	8/19	172	12,496	77,512	180	15,322	70,272	32	2,596	67,677
12	9/2	76	5,676	83,188	183	15,400	85,672	1	18	67,694
13	9/16			83,188			85,672	79	5,612	73,306
Total		1,176	83,188		1,046	85,672		989	73,306	

Table 2.--Comparison of aggregate groundfish species-group tonnage landed by trawl vessels, grouped by their participation in the shoreside whiting fishery, 1999-2001.

	Landed groundfish (mt), by species group				
	Whiting	DTS species	Non-Dover flatfish	*Sebastes* species	Other groundfish
1999					
Non-whiting vessels	126	1,280	1,215	662	257
Whiting vessels	83,293	1,335	502	2,594	93
% by whiting vessels	100%	51%	29%	80%	26%
# of ves > 40 mt of species	35	13	5	22	0
2000					
Non-whiting vessels	54	1,326	1,106	895	112
Whiting vessels	85,775	1,270	281	2,019	70
% by whiting vessels	100%	49%	20%	69%	38%
# of ves > 40 mt of species	35	14	3	21	0
2001					
Non-whiting vessels	65	962	1,226	475	254
Whiting vessels	73,354	904	260	916	302
% by whiting vessels	100%	48%	18%	66%	54%
# of ves > 40 mt of species	28	11	1	11	2

Table 3.--Monthly summary of groundfish tonnage and participation by vessels landding at least 50 mt of whiting in a year, 1999-2001.

	Month											
	1	2	3	4	5	6	7	8	9	10	11	12
1999												
# of ves > 20 mt of whiting					1	31	30	33	24			
whiting tonnage				10.2	77.4	16,202	28,474	31,725	6,804	0.7		
# of ves > 1 mt of DTS	9	7	13	13	14	14	1	1	13	15	12	6
DTS tonnage	94.9	103.0	209.7	177.2	91.8	139.4	6.1	5.3	145.1	154.5	130.6	77.8
# of ves > 1 mt of flatfish	4	4	4	5	5	11			9	10	8	5
Flatfish tonnage	16.2	10.1	16.8	12.0	189.9	141.5	1.4	1.0	23.2	45.2	18.9	26.3
# of ves > 1 mt of *Sebastes*	15	9	15	14	12	32	29	28	20	19	17	14
Sebastes tonnage	329.9	143.8	251.1	172.9	94.4	314.8	238.8	212.3	196.6	252.3	222.2	164.7
# of ves > 1 mt of other GF		1		1	1	3	8	4	3	2		
Other groundfish tonnage	2.8	2.5	2.6	4.6	11.6	12.2	24.0	17.3	8.6	4.4	1.6	0.3
2000												
# of ves > 20 mt of whiting				3	6	27	29	26	25			
whiting tonnage				411.6	2,785	9,690	23,416	33,231	16,235	1.7	0.8	3.3
# of ves > 1 mt of DTS	11	10	9	11	10	7	6	5	3	15	16	9
DTS tonnage	157.0	100.4	205.0	167.6	104.7	22.6	52.0	45.2	33.1	142.8	145.6	94.0
# of ves > 1 mt of flatfish	9	8	4	8	3	2	1	2		3	6	5
Flatfish tonnage	58.1	42.8	12.3	24.6	34.1	5.6	6.6	11.1	2.0	12.9	24.0	47.4
# of ves > 1 mt of *Sebastes*	12	5	5	13	13	23	27	22	21	17	15	8
Sebastes tonnage	139.6	70.8	72.7	133.6	195.3	146.5	299.9	98.8	277.6	249.8	225.7	108.6
# of ves > 1 mt of other GF			1		3	1	2	6	4	2	2	1
Other groundfish tonnage	2.0	0.8	3.2	1.2	5.2	2.6	7.7	20.7	14.0	4.9	4.5	3.3
2001												
# of ves > 20 mt of whiting				2	4	25	25	25	13	1		
whiting tonnage	0.5			606.2	1,382	12,667	30,111	22,958	5,582	47.0		
# of ves > 1 mt of DTS	10	11	9	9	9	9	9	13	12			
DTS tonnage	118.2	113.7	142.7	113.5	99.7	93.9	49.8	86.3	86.0			0.3
# of ves > 1 mt of flatfish	8	10	6	6	6	6		1	4	1	2	1
Flatfish tonnage	56.5	71.2	35.4	21.0	24.8	15.9	0.8	4.2	9.2	1.8	7.5	12.3
# of ves > 1 mt of *Sebastes*	10	7	8	13	8	15	21	16	10		12	1
Sebastes tonnage	92.3	114.3	112.8	141.4	52.4	85.5	66.2	48.1	27.4	0.9	163.3	11.6
# of ves > 1 mt of other GF					2	3	6	5	3			
Other groundfish tonnage	1.3	0.6	1.0	0.4	3.3	8.6	256.8	21.0	8.7	0.1		

FOR PUBLICATION
UNITED STATES COURT OF APPEALS
FOR THE NINTH CIRCUIT

MIDWATER TRAWLERS CO-OPERATIVE; WEST COAST SEAFOOD PROCESSORS ASSOCIATION; FISHERMEN'S MARKETING ASSOCIATION,
Plaintiffs-Appellants,

and

STATE OF OREGON; STATE OF WASHINGTON,
Plaintiffs,

v.

DEPARTMENT OF COMMERCE; THE NATIONAL MARINE FISHERIES SERVICE; DONALD EVANS, Secretary of Commerce; PENELOPE D. DALTON, Assistant Administrator for Fisheries, National Oceanic and Atmospheric Administration; WILLIAM W. STELLE, JR., Director, National Marine Fisheries Service,
Defendants-Appellees,

MAKAH INDIAN TRIBE,
Defendant-Intervenor-Appellee,

v.

STATE OF OREGON,
Plaintiff-Intervenor.

No. 00-35717

D.C. No.
CV-96-01808-BJR

MIDWATER TRAWLERS CO-OPERATIVE,
Plaintiff,

and

STATE OF OREGON,
Plaintiff-Appellant,

v.

DEPARTMENT OF COMMERCE;

DONALD EVANS, Secretary of

Commerce; NATIONAL MARINE FISHERIES SERVICE; PENELOPE D.

DALTON, Assistant Administrator for Fisheries, National Oceanic and Atmospheric Administration; WILLIAM STELLE, JR., Director, National Marine Fisheries Service,
Defendants-Appellees,

MAKAH INDIAN TRIBE,
Defendant-Intervenor-Appellee.

No. 00-35853

D.C. No.
CV-96-1808-BJR

OPINION

Appeal from the United States District Court for the Western District of Washington
Barbara J. Rothstein, Chief Judge, Presiding

Argued and Submitted
January 7, 2002--Seattle, Washington

Filed March 5, 2002

Before: Sidney R. Thomas, Susan P. Graber and Ronald M. Gould, Circuit Judges.

Opinion by Judge Thomas

3615

3617

COUNSEL

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David S. Vogel, Law Offices of David S. Vogel, P.L.L.C., Seattle, Washington; Richard Reich, Office of the Reservation Attorney, Quinault Indian Nation, Mercer Island, Washington; for amici curiae Quileute Tribe and Quinault Nation.

Bill Tobin, Vashon, Washington; Alix Foster, Swinomish Tribal Community, LaConner, Washington; Mason D. Morisset, Morisset, Schlosser, Ayer & Jozwiak, Seattle, Washington; for amici curiae Tulalip Tribes of Washington, Swinomish Tribal Community, and Nisqually Indian Tribe.

OPINION

THOMAS, Circuit Judge:

We consider in this appeal a challenge by fishing industry groups and the States of Oregon and Washington to a federal regulation that increased the amount of Pacific whiting fish allocated to four Indian tribes. We affirm in part and reverse in part, with instructions to the district court to remand to the agency for more specific findings.

I

Isaac I. Stevens, Washington's first Territorial Governor and the first Superintendent of Indian Affairs of the Washington Territory, negotiated a series of treaties in the mid-1850s involving a number of Indian tribes located in the Northwest.1

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1 See, e.g., Treaty of Medicine Creek, 10 Stat. 1132 (Dec. 26, 1854); Treaty of Point Elliot, 12 Stat. 927 (Jan. 22, 1855); Treaty of Point No

These treaties, commonly referred to as the "Stevens Treaties," reserved to the signing Tribes certain fishing rights. The treaties at issue in this action are the Treaty of Neah Bay, a treaty with the Makah Tribe; and the Treaty of Olympia, a treaty with the Quinault, Quileute and Hoh Tribes. As to the right of the Makah Tribe, the Treaty of Neah Bay provided that:

> [t]he right of taking fish and of whaling or sealing at usual and accustomed grounds and stations is further secured to said Indians in common with all citizens of the United States, and of erecting temporary houses for the purpose of curing, together with the privilege of hunting and gathering roots and berries on open and unclaimed lands: Provided, however, That they shall not take shell-fish from any beds staked or cultivated by citizens.

Treaty of Neah Bay, 12 Stat. 939, art. 4 (1855).

We have construed similar treaty language2 as entitling "the Tribes to take fifty percent of the salmon and other free-swimming fish in the waters controlled by Washington State." U.S. v. Wash., 135 F.3d 618 (9th Cir. 1998), opinion amended

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Point, 12 Stat. 933 (Jan. 26, 1855); Treaty of Neah Bay, 12 Stat. 939 (Jan. 31, 1855); Treaty with the Yakamas, 12 Stat. 951 (June 9, 1855); Treaty of Olympia, 12 Stat. 971 (July 1, 1855). See generally Wash. v. Wash. State Commercial Passenger Fishing Vessel Ass'n, 443 U.S. 658, 661-69 (1979). Affected Indian tribes include the following: Hoh; Lower Elwha Band of Clallam Indians; Lummi; Makah; Muckleshoot; Nisqually; Nooksack; Port Gamble Band of Clallam Indians; Puyallup; Quileute; Quinault; Sauk-Suiattle; Skokomish; Squaxin Island; Stillaguamish; Suquamish; Swinomish; Tulalip; Upper Skagit; and Yakama.

2 The precise language at issue in Shellfish II was the "right of taking fish, at all usual and accustomed grounds and stations . . . in common with all citizens of the Territory . . . ." Shellfish II, 157 F.3d at 638 (emphasis supplied).

and superceded by 157 F.3d 630, 638-39 (9th Cir. 1998) ("Shellfish II").3

More than a century after the execution of the Stevens Treaties, Congress responded to concerns about preservation of the nation's fishery resources and enacted the Magnuson-Stevens Fishery Conservation and Management Act, 16 U.S.C. §§ 1801-1883 ("the Magnuson-Stevens Act" or "the Act"). "The purpose of the Magnuson[-Stevens] Act was to protect United States fisheries by extending the exclusive fisheries zone of the United States from 12 to 200 miles and to provide for management of fishing within the 200-mile zone." Wash. State Charterboat Ass'n v. Baldrige, 702 F.2d 820, 823-24 (9th Cir. 1983) (citing H.R. Rep. No. 445, 94th Cong., 1st Sess. 21 (1975), reprinted in 1976 U.S.C.C.A.N. 593, 593-94).

The Magnuson-Stevens Act vested the National Marine Fisheries Service ("NMFS") of the Department of Commerce with the authority to issue fishery management regulations. 16 U.S.C. §§ 1853, 1855; see generally Wash. v. Daley, 173 F.3d 1158, 1162 (9th Cir. 1999). However, under the Act, fishery management regulations must be consistent with "applicable law" defining Native American treaty fishing rights. See, e.g., Parravano v. Babbitt, 70 F.3d 539, 544 (9th Cir. 1995). In 1996, the NMFS promulgated a regulation (the "Framework Regulation") that established a limit on the total number of Pacific whiting fish to be taken in any year and a framework for allocating these fish to the Hoh, Makah, Quileute, and Quinault Tribes. 50 C.F.R. § 660.324. The regulation stipulated coordinates that identified "usual and accustomed" fishing areas ("U&As") for the tribes, extending about forty miles into the ocean off the coast of Washington. Daley, 173 F.3d at 1163. In so doing, the NMFS recognized that the"Stevens

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3 The district court's opinion in the same case, U.S. v. Wash., 873 F. Supp. 1422 (W.D. Wash. 1994), has generally been referred to as "Shellfish I."

Treaties" reserved rights to harvest Pacific whiting in the tribes' U&As. The Framework Regulation also made a specific allocation of 15,000 metric tons of Pacific whiting to the Makah Tribe for 1996.

Shortly after the 1996 regulation was enacted, Midwater Trawlers Co-operative, West Coast Seafood Processors, and the Fishermen's Marketing Association (collectively,"Midwater"), the State of Oregon, and the State of Washington challenged the regulation and its annual allocations of Pacific whiting to the Makah. The action originally was brought in the Oregon federal district court, but was transferred to the federal district court in Washington. In 1997, the district court dismissed the plaintiffs' claims for failure to join the tribes as necessary and indispensable parties. In 1999, this Court reversed the dismissal of the claims and remanded for further proceedings. See Daley, 173 F.3d at 1169.

In 1999, Midwater and Oregon challenged in Oregon federal district court another NMFS regulation, which increased the 1999 amount of Pacific whiting allocated to the Makah Tribe to 32,500 metric tons. 64 Fed. Reg. 27928 (May 24, 1999). This case was transferred to Washington federal district court and consolidated with the 1996 suit pending on remand. The federal government moved for summary judgment, which the district court granted in 2000 for all the cases. The Washington district court held that (1) the federal defendants did not act arbitrarily and capriciously in recognizing the tribes' right to harvest Pacific whiting, because the Stevens Treaties are "other applicable law" under the Magnuson-Stevens Act; (2) the Secretary of Commerce did not act arbitrarily and capriciously in recognizing the U&A fishing areas beyond the three-mile territorial limit off Washington's coast; and (3) the NMFS's allocation of whiting in 1999 was not arbitrary and capricious. Midwater and Oregon appealed.

We review the district court's grant of summary judgment de novo. Robi v. Reed, 173 F.3d 736, 739 (9th Cir. 1999).

Under Section 305(f) of the Magnuson-Stevens Act, 16 U.S.C. 1855(f), which adopts the standard of review set forth in the Administrative Procedure Act ("APA") at 5 U.S.C. § 706, regulations promulgated by the Secretary may be set aside only if they are "arbitrary, capricious, an abuse of discretion, or otherwise not in accordance with law." 5 U.S.C. 706(2)(A). Our only task is to determine whether the Secretary has considered the relevant factors and articulated a rational connection between the facts found and the choices made. Wash. Crab Producers, Inc. v. Mosbacher, 924 F.2d 1438, 1441 (9th Cir. 1990).

II

Midwater lacks standing to challenge that portion of the Framework Regulation that identified U&A areas for the Hoh, Quileute, and Quinault Tribes beyond three miles. In order to have standing, a plaintiff must have suffered an "injury in fact"--an invasion of a legally protected interest that is (a) concrete and particularized, and (b) actual or imminent, not conjectural or hypothetical. U.S. v. Hays, 515 U.S. 737, 743 (1995). Although none of the tribes disclaims its right to seek an allocation through the Framework Regulation in the future, the NMFS has not allocated any Pacific whiting to them. Thus, any injury Midwater suffered in connection with the Hoh, Quileute, and Quinault Tribes was "conjectural or hypothetical" rather than "actual or imminent." In short, Midwater has not suffered the requisite injury in fact and lacks standing to challenge the portion of the regulation identifying U&As with respect to the Hoh, Quileute, and Quinault Tribes. Thus, the only tribal allocation properly at issue is that to the Makah Tribe.

III

Midwater argues that tribal treaty rights to Pacific whiting could not be recognized as "applicable law" at the time the 1996 Framework Regulation was adopted, because no express judicial adjudication of tribal treaty rights to Pacific whiting had been made. Contrary to Midwater's contention, we need not determine tribal fishing rights under the Stevens Treaties on a case by case, "fish by fish," basis. Indeed, to do so would contravene settled law of this circuit and prior Supreme Court determinations. Indeed, we previously rejected this notion in Shellfish II. There, the State of Washington had argued to the district court that the tribes should be required to prove their historic fishing for Pacific whiting. We rebuffed the argument as inconsistent with the language of the Stevens Treaties, the law of the case, and the intent and understanding of the signatory parties. As explained by the district court in Shellfish I and adopted by us in Shellfish II:

> At [Treaty] time, . . . the Tribes had the absolute right to harvest any species they desired, consistent with their aboriginal title . . . . The fact that some species were not taken before treaty time--either because they were inaccessible or the Indians chose not to take them--does not mean that their right to take such fish was limited. Because the "right of taking fish" must be read as a reservation of the Indians' pre-existing rights, and because the right to take any species, without limit, pre-existed the Stevens Treaties, the Court must read the "right of taking fish" without any species limitation.

Shellfish II, 157 F.3d at 644 (quoting Shellfish I, 873 F. Supp. at 1430) (ellipses and emphasis in the original).

Our reasoning in Shellfish II was a natural outgrowth of the Supreme Court's detailed analysis of tribal fishing rights under the Stevens Treaties in Wash. v. Wash. State Commercial Passenger Fishing Vessel Ass'n, 443 U.S. 658 (1979). In that case, the Court concluded:

> In our view, the purpose and language of the treaties are unambiguous; they secure the Indians' right to

> take a share of each run of fish that passes through tribal fishing areas.

Id. at 679.

The fact that we considered tribal rights concerning shellfish specifically in Shellfish II was not incongruous with this treaty interpretation: the Stevens Treaties contained a separate proviso for shellfish, requiring an analysis distinct from that governing free-swimming fish. See Shellfish II , 157 F.3d at 639-40.

Pacific whiting are not shellfish. They are free-swimming fish, managed by the NMFS as a unitary stock, that range from the Gulf of California to the Gulf of Alaska. Adult whiting migrate annually from spawning grounds off southern California and northern Mexico to feeding grounds, which range from northern California to British Columbia. They migrate through the Makah Tribe's usual and accustomed fishing grounds. The fact that whiting pass through the U&A in a manner different from anadromous fish, such as salmon, is not relevant. The analysis of the Stevens Treaties conducted in Passenger Fishing Vessel and in Shellfish II applies with equal force to Pacific whiting. The term "fish " as used in the Stevens Treaties encompassed all species of fish, without exclusion and without requiring specific proof. Shellfish II, 157 F.3d at 643 (quoting Shellfish I, 873 F. Supp. at 1430).4 The district court did not err in so holding.

IV

The Framework Regulation described the U&A fishing grounds for the four tribes as extending to 125 degrees 44' W. longitude, or approximately forty miles off the Washington

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4 In addition, we note that the Makah Tribe submitted undisputed evidence supporting the conclusion that they harvested Pacific whiting at treaty time. 61 Fed. Reg. 28786; 28788 (June 6, 1996).

coast. See 50 C.F.R. § 660.324(c). Although no U&A had been adjudicated beyond three miles for the Hoh, Quileute, and Quinault Tribes, the NMFS extended the Makah Tribe's U&A coordinates south to provide U&As for these other three tribes. 61 Fed. Reg. 28789. The district court did not err in upholding the Secretary of Commerce's recognition of U&A fishing areas beyond the three-mile territorial limit.

The Treaty of Neah Bay, which is the applicable treaty with respect to the Makah tribal interests, provides that the fishing rights are "secured to said Indians in common with all citizens of the United States." 12 Stat. 939, art. 4. **5** Nothing in the plain language of the treaty provides a geographic limitation, and longstanding case law establishes that U&A fishing grounds properly extend into waters under United States jurisdiction. See, e.g., Passenger Fishing Vessel, 443 U.S. at 685-87 (salmon); U.S. v. Wash., 459 F. Supp. 1020, 1065 (W.D. Wash. 1978) (herring); Makah v. Brown, No. C85-1606R, and U.S. v. Wash., Civil No. 9213 - Phase I, Subproceeding No. 92-1 (W.D. Wash.), Order on Five Motions Relating to Treaty Halibut Fishing, at 6, Dec. 29, 1993 (halibut); U.S. v. Wash., 873 F. Supp. 1422, 1445 & n.30 (W.D. Wash. 1994), aff'd in part and rev'd in part, 157 F. 3d 630, 651-52 (9th Cir. 1998) (shellfish); U.S. v. Wash., Subproceeding 96-2 (Order Granting Makah's Motion for Summary Judgment, etc. at 4, Nov. 5, 1996) (Pacific whiting); see also Seufert Bros. Co. v. U.S., 249 U.S. 194, 199 (1919) (rejecting an argument that tribal fishing rights are limited to historic territorial boundaries).

Indeed, we have held specifically that the Makah's "historic fishing grounds extend forty miles out to sea. The

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5 As noted earlier, some of the other Stevens Treaties employed the more restrictive phrase "in common with all citizens of the Territory." See, e.g., Treaty of Olympia, 12 Stat. 971, art. III (July 1, 1855); Passenger Fishing Vessel, 443 U.S. at 662. Thus, Midwater's argument that the Makah's rights are confined to the territorial rights of the citizens of the State of Washington lacks even a textual basis in this case.

Makah are guaranteed the right to fish in these grounds by treaty." Makah Indian Tribe v. Verity, 910 F.2d 555, 556 (9th Cir. 1990). Thus, the Secretary of Commerce's recognition of U&A fishing areas beyond the three-mile territorial limit was entirely appropriate.

V

After a careful examination of the administrative record, we conclude that the specific allocation in 1999 to the Makah Tribe was inconsistent with the scientific principles set forth in the Magnuson-Stevens Act. Thus, a remand to the NMFS is required.

The starting point for any examination of the rightful allocation of Pacific whiting to the Makah Tribe must be the tribe's right under the Treaty of Neah Bay. The Supreme Court provided the analytical framework in Passenger Fishing Vessel:

> [A]n equitable measure of the common right should initially divide the harvestable portion of each run that passes through a "usual and accustomed" place into approximately equal treaty and nontreaty shares, and should then reduce the treaty share if tribal needs may be satisfied by a lesser amount.

443 U.S. at 685.

The concept of "harvestable portion " embraces the "conservation necessity principle," meaning that government regulation must not cause "demonstrable harm to the actual conservation of fish." U.S. v. Wash., 384 F. Supp. 312, 415 (W.D. Wash. 1974). Conversely, the conservation necessity principle also permits regulation of marine fisheries as necessary to conserve the fish resource, including regulation of Native American fishers harvesting under treaty rights. Passenger Fishing Vessel Ass'n, 443 U.S. at 682 ("Although nontreaty fishermen might be subjected to any reasonable state fishing regulation serving any legitimate purpose, treaty fishermen are immune from all regulation save that required for conservation."). In the NMFS allocation context, the conservation necessity principle became incorporated in the description of the available stock for harvesting, namely the "harvestable surplus."

Applying these general principles to the case at hand, the Makah Tribe is entitled, pursuant to the Treaty of Neah Bay, to one-half the harvestable surplus of Pacific whiting that passes through its usual and accustomed fishing grounds, or that much of the harvestable surplus as is necessary for tribal subsistence, whichever is less. See Passenger Fishing Vessel Ass'n, 443 U.S. at 685-86.

In making regulatory allocations of fish based on these legal principles, the NMFS is also bound by the requirements of the Magnuson-Stevens Act, which dictates that the NMFS base fishery conservation and management measures on the "best scientific information available." 16 U.S.C. § 1851(a)(2).

The immediate origins of the present controversy date to 1996, when the NMFS sought public comment on its initial proposal to determine the Makah allocation based on a "biomass" theory, that is, an estimate of the percentage of Pacific whiting in the Makah's usual and accustomed area. The initial proposal included a multiplier, based on deviations from average harvest rates in prior years. Under the proposal, the Makah allocation was estimated to be 6.5% of the harvest available to all United States fishermen, or approximately 13,000 to 18,000 metric tons.

The Makah Tribe argued that the NMFS should employ a harvest-based approach, under which it would be entitled to half the whiting harvested in the North Columbia/Vancouver area, or 25% of the total United States harvest. This contention was based on the Makah Tribe's assertion that the majority of the unitary stock of whiting pass through the Makah Tribe's usual and accustomed area. Therefore, it reasoned, it was entitled to up to 50% of all whiting on the Pacific coast.

The NMFS never implemented the biomass-based methodology it had proposed, in part because that methodology had been rejected in United States v. Washington, which involved allocation of halibut, as contrary to the conservation necessity principle. The NMFS was apparently also concerned about legal proceedings that the tribe had instituted. Instead, the NMFS and the Makah Tribe entered into a compromise agreement, under which the Tribe was to be allocated 15,000 metric tons in 1996. 61 Fed. Reg. 28787.

Subsequently, the tribe proposed a two-year interim allocation of 10.8% of the United States Harvest Guidelines for 1997 and 1998. After determining that the proposal would have a negligible biological impact, the NMFS approved the proposal.

In 1998, the Makah Tribe made a five-year compromise proposal to the NMFS, under which the tribe would receive a treaty share not to exceed 17.5% of the United States harvest guideline in any one year. In 1999, the NMFS proposed an allocation to the Makah Tribe, in accordance with the compromise agreement, of 32,500 metric tons, or 14% of the estimated total United States harvest. Subsequently, the NMFS published a proposed rule requesting comments on (1) the Makah Tribe's sliding-scale proposal, which under the 1999 United States Harvest Guidelines would result in an allocation of 32,500 metric tons or 14% of the total United States harvest; (2) a "status quo" allocation of 25,000 metric tons. 64 Fed. Reg. 1341, 1341-42. In an environmental assessment prepared for the 1999 tribal allocation, the NMFS concluded that the Makah proposal would have no significant impact on the environment. 64 Fed. Reg. 27928, 27933. In the end, the

NMFS approved the Makah proposal. Id. at 27930. In doing so, the agency stated:

> The Makah have made a proposal for 32,500 mt of whiting in 1999 that NMFS accepts as a reasonable accommodation of the treaty right for 1999 in view of the remaining uncertainty surrounding the appropriate quantification. This 1999 amount of 32,500 mt (14 percent of the 232,000-mt OY) is not intended to set a precedent regarding either quantification of the Makah treaty right or future allocations. NMFS will continue to attempt to negotiate a settlement in U.S. v. Washington regarding the appropriate quantification of the treaty right to whiting. If an appropriate methodology or allocation cannot be developed through negotiations, the allocation will ultimately be resolved in the pending subproceeding in U.S. v. Washington.

Id.

The difficulty with the published justification for the rule is, of course, that it is devoid of any stated scientific rationale. The Magnuson-Stevens Act requires the Secretary to describe the "nature and extent" of the tribal fishing right, 16 U.S.C. § 1853(a)(2), based on the "best scientific information available." 16 U.S.C. § 1851(a)(2). In sum, the best available politics does not equate to the best available science as required by the Act.

An agency's action is "normally " considered arbitrary and capricious when it:

> has relied on factors which Congress has not intended it to consider, entirely failed to consider an important aspect of the problem, offered an explanation for its decision that runs counter to the evidence before the agency, or is so implausible that it could

not be ascribed to a difference in view or the product of agency expertise.

Motor Vehicle Mfrs. Ass'n of U.S., Inc. v. State Farm Mut. Auto. Ins. Co., 463 U.S. 29, 43 (1983). Indeed, in our review of agency action under FDA v. Brown & Williamson Tobacco Corp., 529 U.S. 120 (2000), our first inquiry is" `whether Congress has directly spoken to the precise question at issue.' " Id. at 132 (quoting Chevron U.S.A., Inc. v. Natural Res. Def. Council, Inc., 467 U.S. 837, 842 (1984)). If the answer is affirmative, "the inquiry is at an end; the court `must give effect to the unambiguously expressed intent of Congress.' " Id. (quoting Chevron , 467 U.S. at 842-43). In examining the Magnuson-Stevens Act, there is little doubt of congressional intent: the agency was directed to employ the "best available scientific information" as its methodology in making its decisions.

A plain reading of the proposed NMFS rule, and the undisputed history leading up to the allocation decision, demonstrate that the rule was a product of pure political compromise, not reasoned scientific endeavor. Although the NMFS allocation may well be eminently fair, the Act requires that it be founded on science and law, not pure diplomacy.

For these reasons, a remand to the NMFS is required to either promulgate a new allocation consistent with the law and based on the best available science, or to provide further justification for the current allocation that conforms to the requirements of the Magnuson-Stevens Act and the Treaty of Neah Bay.

AFFIRMED IN PART; REVERSED IN PART; REMANDED FOR FURTHER PROCEEDINGS CONSISTENT WITH THIS OPINION.

DRAFT

Environmental Assessment and Regulatory Impact Review

Emergency Rule for the Pacific Whiting Allowable Biological Catch and Optimum Yield Specifications for the 2002 Pacific Coast Groundfish Fishery

Prepared by
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
Northwest Region

Drafted March 2002

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1.0 PURPOSE AND NEED FOR ACTION

The purpose of this environmental assessment (EA) is to determine whether the impacts to the human environment resulting from the setting of the 2002 Pacific whiting (whiting) ABC and OY are significant. If impacts predicted to result from the chosen alternative are determined to be insignificant, no further analysis is necessary to comply with the requirements of the National Environmental Policy Act.

The Pacific Coast groundfish fishery management plan (FMP) requires the fishery specifications for species or species groups under the plan be evaluated annually and revised as necessary. In addition, the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) and the FMP require NMFS to end overfishing and to restore stocks to sustainable biomass levels.

Harvest specifications for the 2002 groundfish fishery were finalized by the Council at its October 28 through November 2, 2001 meeting, with the exception of whiting. Following that meeting, proposed and final rules, to establish the 2002 specification and management measures, were published in the Federal Register (67 FR 1555, January 11, 2002; 67 FR 10490, March 7, 2002.) NMFS and the Council realized that the whiting biomass had decreased from 1990 levels. In anticipation of a new whiting stock assessment that would be available in early 2002 and given the small amount of whiting typically landed under trip limits prior to the April 1 start of the primary season, the Council chose to delay its final whiting recommendation until its March 2002 meeting. Whiting harvest specifications from 2001 were carried over into 2002 and remain in place until new specifications are established through a federal rulemaking. The new assessment, which incorporated the 2001 hydroacoustical survey data, was complete and made available for examination by the Council's groundfish assessment review team for whiting in late February. The final harvest recommendations based on the new assessment will be presented to the Council on March 13, 2002.

As a result of the new whiting stock assessment, NMFS has determined that the spawning stock biomass has substantially declined and has been lower during the past several years than previously estimated. The stock assessment estimated that biomass in 2001 was 0.7 million mt, and that the female spawning biomass was less than 20 percent of the unfished biomass. Because the overfished threshold under the FMP is 25 percent of the unfished biomass, the whiting stock was overfished in 2001. In retrospect NMFS has determined that the harvest rates in 1999 through 2001, which were based on the results of the previous assessment, were above the overfishing level. A large amount of juvenile fish, spawned in 1999, are expected to mature and enter the fishery in the near future, however the spawning biomass is not expected to increase above 40 percent of its unfished biomass (B40%) for several years. Any increases in biomass depends on the magnitude of juvenile fish that mature and enter the fishery as well as the exploitation rates. Given the results of the new assessment, the whiting harvest specifications carried over from 2001 and currently in place for 2002 have been determined to be too aggressive. Continuing to harvest whiting at the 2001 level would likely result in overfishing and may further reduce the spawning stock biomass.

The U.S. Secretary of Commerce (Secretary) has the authority of take emergency regulatory action as provided for in Section 305(c) of the Magnuson-Stevens Act if an emergency exists involving any groundfish resource or to take other such regulatory action as may be necessary to discharge the Secretary's responsibilities under Section 305(d) of the Magnuson-Stevens Act. For reasons explained above, the 2002 annual specifications for whiting will not be recommended by the Council until its March 2002 meeting. Following the Council's recommendation on March 13, 2002, an emergency rule to implement the final whiting allowable biological catch (ABC) and optimum yield (OY) will be prepared and submitted before the April 1, 2002 start of the primary whiting season. This action is necessary to prevent overfishing.

2.0 ALTERNATIVES MANAGEMENT ACTIONS

The range of alternatives presented here are variations of amounts of ABCs and OYs that could be set to manage whiting in 2002. Additional variations of ABCs and OYs that are within this range may be considered. When combined with the 2002 ABCs and OYs adopted for the other groundfish species and species groups, the total catch would be expected to remain within the parameters already discussed in the EA prepared for the 2002 annual specification and management measures which was prepared by the Council staff and submitted to NMFS in February 2002. This document may obtained from Council office.

Alternative 1: ***(No action)*** *Maintain the 2001 U.S. ABC and OY of 190,400 mt based on a 1998 assessment as updated for 2001. The 2001 ABC was based on an* F_{MSY} *control rule of F40%. The 40/10 default harvest policy was applied to obtain the OY.*

Discussion: The 1998 assessment was updated for 2001 using limited new data. Under this alternative, the U.S.-Canada ABC (266,000 mt) would continue to be based on the updated 1998 survey with the application of an Fmsy proxy of F40%. Because the biomass was estimated to be within the precautionary zone (less than 40% of its unfished biomass), application of the 40/10 default harvest policy reduced the coastwide ABC to 238,000 mt. The U.S. whiting ABC would continue to be 80 percent (190,400 mt) of the 238,000 mt. The U.S. total catch OY would be set equal to the U.S. ABC. The commercial OY for whiting would continue to be 162,900 mt (the 190,400 mt OY minus the 27,500 mt tribal allocation), and would be allocated with 42 percent (68,418 mt) going to the shore-based sector, 24 percent (39,096 mt) going to the mothership sector, and 34 percent (55,386 mt) going to the catcher/processor sector.

Alternative 2: ***(Low recruitment with an F50% Fmsy proxy)*** *Adopt U.S. ABC of 94,041 mt and OY of 63,200 mt based on the 2002 assessment with a low recruitment scenario (2.12 billion mt) for 2001, an* F_{MSY} *control rule of F50%, and the application of the 40/10 default harvest policy.*

Discussion: The U.S.-Canada ABC of 117,551 mt is based on the 2002 assessment results with the application of an Fmsy proxy harvest rate of F50%. The U.S. whiting ABC would be 80% or 94,041 mt. Because the biomass is estimated to be at 20 percent of its unfished biomass, application of the 40/10 default harvest policy reduces the coastwide ABC to 79,000 mt. The U.S. whiting OY would be 80 percent or 63,200 mt. The commercial OY for whiting would be 52,140 mt (the 63,200 mt OY minus the 11,060 mt tribal allocation), and would be allocated with 42 percent (21,899 mt) going to the shore-based sector, 24 percent (12,514 mt) going to the mothership sector, and 34 percent (17,728 mt) going to the catcher/processor sector.

Alternative 3: ***(Medium recruitment with an F45% Fmsy proxy)*** *Adopt U.S. ABC of 136,436 mt and OY of 106,400 mt based on the 2002 assessment with a medium recruitment scenario (2.89 billion mt) for 2001, an* F_{MSY} *control rule of F45%, and the application of the 40/10 default harvest policy.*

Discussion: The U.S.-Canada ABC of 170,545 mt is based on the 2002 assessment results with the application of an Fmsy proxy harvest rate of F45%. The U.S. whiting ABC would be 80% or 136,436 mt. Because the biomass is estimated to be at 24 percent of its unfished biomass, application of the 40/10 default harvest policy reduces the coastwide ABC to 133,000 mt. The U.S. whiting OY would be 80 percent or 106,400 mt. The commercial OY for whiting would be 87,780 mt (the 106,400 mt OY minus the 18,620 mt tribal allocation), and would be allocated with 42 percent (36,868 mt) going to the shore-based sector, 24 percent (21,067 mt) going to the mothership sector, and 34 percent (29,845 mt) going to the catcher/processor sector.

Alternative 4: ***(Medium recruitment with an F40% Fmsy proxy)*** *Adopt U.S. ABC of 166,185 mt and OY of 129,600 mt based on the 2002 assessment with a medium recruitment scenario*

(2.89 billion mt) for 2001, an F_{MSY} control rule of F40% and the application of the 40/10 default harvest policy.

Discussion: The U.S.-Canada ABC of 207,731 mt is based on the 2002 assessment results with the application of an Fmsy proxy harvest rate of F40%. The U.S. whiting ABC would be 80% or 166,185 mt. Because the biomass is estimated to be at 24 percent of its unfished biomass, application of the 40/10 default harvest policy reduces the coastwide ABC to 162,000 mt. The U.S. whiting OY would be 80 percent or 129,600 mt. The commercial OY for whiting would be 106,920 mt (the 129,600 mt OY minus the 22,680 mt tribal allocation), and would be allocated with 42 percent (44,906 mt) going to the shore-based sector, 24 percent (25,661mt) going to the mothership sector, and 34 percent (36,353 mt) going to the catcher/processor sector.

Alternative 5: ***(High recruitment with an F40% Fmsy proxy)*** *Adopt U.S ABC 200,474 mt and OY of 175,200 mt based on the 2002 assessment with a high recruitment scenario (3.87 billion mt) for 2001, an F_{MSY} control rule of F40%, and the application of the 40/10 default harvest policy.*

Discussion: The U.S.-Canada ABC of 250,593 mt is based on the 2002 assessment results with the application of an Fmsy proxy harvest rate of F40%. The U.S. whiting ABC would be 80% or 200,474 mt. Because the biomass is estimated to be at 29 percent of its unfished biomass, application of the 40/10 default harvest policy reduces the coastwide ABC to 219,000 mt. The U.S. whiting OY would be 80 percent or 175,200 mt. The commercial OY for whiting would be 147,700 mt (the 175,200 mt OY minus the 27,500 mt tribal allocation), and would be allocated with 42 percent (62,034 mt) going to the shore-based sector, 24 percent (35,448 mt) going to the mothership sector, and 34 percent (50,218 mt) going to the catcher/processor sector. This is the most biologically conservative alternative with the highest probability of returning the stock to B_{MSY} within the shortest time period.

Table 2.0.1 2002 whiting specifications for alternatives 1-5, in metric tons.

	Alternative 1 No Action ABC & OY Same as 2001	Alternative 2 Low recruitment with F50%	Alternative 3 Med. recruitment with F45%	Alternative 4 Med. recruitment with F40%	Alternative 5 High recruitment with F40%
U.S. ABC	190,400	94,041	136,436	166,185	200,474
U.S. OY	**190,400**	**63,200**	**106,400**	**129,600**	**175,200**
Tribal Allocation	27,500	11,060	18,620	22,680	27,500
Shore-based Allocation	68,418	21,899	36,868	44,906	62,034
Catcher/Processor	55,386	17,728	29,845	36,353	50,218
Mothership Allocation	39,096	12,514	21,067	25,661	34,448

3.0 AFFECTED ENVIRONMENT

The purpose of this section of the document is to describe the existing fishery and the resources that would be affected by the proposed action. The physical environment is addressed in section 3.1, the biological characteristics of the whiting stocks and a description of other species that are affected by the fishery are addressed in section 3.2, and the socio-economic environment is addressed in section 3.3.

3.1 Physical Characteristics of the Affected Resource

The groundfish fishery occurs in the U.S. EEZ from 3 to 200 miles off the coasts of Washington, Oregon, and California. The offshore ocean includes a diverse range of habitats including rocky and non-rocky shelf regions, deep submarine canyons, and continental slopes and basins. Shoreline topographic features, such as Cape Blanco, Point Conception, and other shoreline capes, as well as bathymetric features such as banks, canyons, and other submerged features, often create large-scale current patterns such as eddies, jets, and squirts. These complex local currents can entrain and disperse water masses and marine organisms across and along the shelf. The California current is the eastward portion of the clockwise flowing Pacific Ocean Gyre, which transports low salinity, cool water towards the equator. The California current is southward-flowing with associated northward counter-currents and sub-currents. The California current system and its associated marine ecosystem are affected on numerous time scales, by substantial changes in oceanic and atmospheric conditions including long-scale basin-wide regime shifts, episodic phenomena such as El Niño-La Niña events, and seasonal upwelling and downwelling events.

3.2 Biological Characteristics of the Affected Resource

The Pacific Coast groundfish FMP manages over 80 species, many of which are caught in multi-species fisheries. These species which include an array of flatfish, rockfish, and roundfish, occur throughout the EEZ and occupy diverse habitats at all stages in their life history. Information on the interactions between the various groundfish species and between groundfish and non-groundfish species varies in completeness. While a few species have been intensely studied, there is relatively little information on most. Fewer of the groundfish species have ever been comprehensively assessed.

Each fishing year, the Council assess the biological condition of the Pacific Coast groundfish fishery and develops estimates of the ABC for major groundfish stocks. Species and species groups with ABCs in 2002 include lingcod, Pacific whiting, sablefish, POP, shortbelly rockfish, shortspine thornyhead, longspine thornyhead, widow rockfish, chilipepper rockfish, splitnose rockfish, cowcod, darkblotched rockfish, yellowtail rockfish, bocaccio, canary rockfish, yelloweye rockfish, Dover sole, and the minor rockfish complexes (northern and southern for nearshore, continental shelf, and continental slope species). The following eight groundfish stocks have been designated as "overfished" (less than 25% of its B_{MSY}): POP, bocaccio, lingcod, canary rockfish, cowcod, darkblotched rockfish, widow rockfish, and yelloweye rockfish.

When setting the 2002 ABCs, the Council maintained a policy of using a default harvest rate as a proxy (also called a harvet control rule) for the fishing mortality rate that is expected to achieve the maximum sustainable yield. The ABC for a species or species group is generally derived by multiplying the harvest rate proxy by the current estimated biomass. The Council continued to use default harvest rate proxies recommended by the Council's Scientific and Statistical Committee (SSC) for 2001 (66 FR 2338, January 11, 2001.) The proxy adopted in 2001 for whiting was F40%.

Pacific Whiting

Whiting, also known as Pacific hake, is a semi-pelagic merlucciid (a cod-like fish species) distributed off the West Coast of North America from 25° N. to 51° N. latitude. Smaller populations of Pacific whiting occur in several of the larger semi-enclosed inlets of the northeast Pacific Ocean, including the Strait of Georgia, Puget Sound, and the Gulf of California. The whiting stock ranges from southern California to Queen Charlotte Sound with spawning primarily occurring off southern California from January to March. Adult whiting migrate seasonally, wintering and spawning along the continental shelf and offshore from Baja California to Point Conception, California. Spawning is greatest at depths between 130 and 500 m. Eggs and larvae of whiting are pelagic and are generally found in depths between 40 and 140 m. Eggs of the Pacific hake are neritic and float to neutral buoyancy. Adult whiting are epi-mesopelagic. Juveniles reside in shallow coastal waters, bays, and estuaries. Highest densities of whiting are usually between 50 and 500 m, but adults occur as deep as 920 m and as far offshore as 400 km. During the summer they move inshore and northward as far as Vancouver Island, British Columbia. Older (age 5+), larger, and predominantly female whiting migrate into Canadian waters. During El Niño years, a larger proportion of the stock migrates into Canadian waters, apparently due to intensified northward currents during the period of inactive migration (Dorn 1995). Whiting feeds on a variety of small fish, shrimp, and squid.

Smith (1995) recognizes three habitats used by the coastal stock of Pacific hake: a narrow 30,000 km2 feeding habitat near the shelf break of British Columbia, Washington, Oregon and California populated 6-8 months per year; a broad 300,000 km2 open-sea area of California and Baja California populated by spawning adults in the winter and embryos and larvae for 4-6 months; and a continental shelf area of unknown size off California and Baja California where juveniles brood. (Bailey 1981, Bailey et al. 1982, NOAA 1990).

Mathematical models that use a variety of survey and observer data to assess stock size, harvest levels, recruitment, etc. are used to estimate a single ABC for the entire U.S. Canadian coastal stock. The whiting stock biomass increased to a historical high of 5.8 million metric tons (mt) in 1987 due to exceptionally large 1980 and 1984 year classes, then declined as these year classes passed through the population and were replaced by more moderate year classes. The stock size stabilized briefly between 1995-1997, but has declined continuously over the past four years to its lowest point of 800 thousand mt.

The 2002 stock assessment estimated that the biomass in 2001 was 0.7 million mt, and that the female spawning biomass was less than 20 percent of the unfished biomass. Because the overfished threshold under the FMP is 25 percent of the unfished biomass, the whiting stock was overfished in 2001. The female spawning biomass is estimated to increase over the next 3 years due to the incoming 1999 year-class, but the increase will be dependent upon the magnitude of that cohort as well as the exploitation rate.

Non-Whiting Fish Interactions

Pacific whiting undertake a diurnal vertical migration and tend to form extensive mid-water aggregations in the daytime. During the day, whiting concentrate in dense schools between the depths of 100 and 250 meters (Stauffer 1985). Because whiting disperse throughout the water column at dusk and remain near the surface at night, fishing has traditionally occurred during the daylight hours. The results of fishing on concentrated mid-water schools is almost pure catches, with incidental catch typically amounting to less than 3% of the total catch by weight. Species that are incidentally taken in the whiting fishery may be commingled with whiting or merely in the vicinity of whiting schools, depending on the relationships between the various species. Major factors affecting bycatch are area, depth, season, time of day, and environmental conditions. Overall abundance of a particular species is also relevant.

The most common groundfish species, by weight, that were incidentally[1] taken in the 2001 whiting fishery were in were yellowtail rockfish (*Sebastes flavidus*), widow rockfish (*Sebastes entomelas*), Pacific Ocean perch (*Sebastes alutus*), sablefish *(Anoplopoma fimbria)*, walleyed pollock (*Theragra chalcogramma*), spiny dogfish (*Squalus acanthias*), and several "other rockfish" species. Table 2.1.1 shows the 2001 estimates of incidental take of these species as well as the incidental take of overfished groundfish species.

Several species managed under the Coastal Pelagic Species Fishery Management Plan, were also incidentally taken in 2001, these include jack mackerel (*Trachurus symmetricus*), Pacific mackerel (*Scomber japonicus*), and squid. Like whiting, these are schooling fish that are not associated with the ocean bottom, and that migrate in coastal waters. American shad (*Alosa sapidissima*) were also observed in the 2001 fishery. Table 3.1.1 shows estimates of the incidental take of these species in the 2001 fishery. Small amounts of other species were also incidentally taken, but were of small magnitude and are not shown here.

[1] Limited entry trip limits for non-whiting groundfish applies to incidental catch taken by vessels in both the shore-based and at-seas processing sectors. In addition, regulations at 50 CFR 660.323 (a)(3)(vi) provide for bycatch reduction and full utilization for at-sea processors. Shore-based vessels participating under exempted fishing permits retain all incidental catch and are required by the terms and conditions of the permit to forfeit those fish in excess of the limited entry limits to the states.

Table 3.1.1. Total catch (including discards) and incidental catch rates (kg/mt whiting) of major bycatch species taken by each sector of the whiting fleet in 2001

2001	Non-tribal At-sea		Tribal		Shore-based		All Sectors	
Species	Catch [1] (mt)	Bycatch Rate	Catch [1] (mt)	Bycatch Rate	Catch [2] (mt)	Bycatch Rate	Catch (mt)	Bycatch Rate
Groundfish Species that have not been declared as overfished								
Whiting	94,451		6,080		73,262		173,793	
Yellowtail Rockfish	125	1.32	87	14.31	96	1.31	308	1.72
Sablefish	22	0.23	0	0.00	47	0.64	69	0.40
Walleyed Pollock	6	0.06	360	59.21	unknown	unknown	366	2.11
Rex Sole	18	0.19	0	0.00	unknown	unknown	18	0.10
Spiny Dogfish Shark	78	0.83	153	25.16	unknown	unknown	231	1.33
Shortspine Thornyhead	15	0.16	0	0.00	unknown	unknown	15	0.09
Redstripe Rockfish	18	0.19	0	0.00	unknown	unknown	18	0.10
Shortbelly Rockfish	27	0.29	0	0.00	unknown	unknown	27	0.16
Rougheye Rockfish	20	0.21	0	0.00	unknown	unknown	20	0.12
Splitnose Rockfish	25	0.26	0	0.00	unknown	unknown	25	0.14
Overfished Groundfish Species (<25% of unfished biomass)								
Bocaccio Rockfish	0	0.00	1	0.16	unknown	unknown	1	0.01
Canary Rockfish	2	0.02	2	0.33	unknown	unknown	4	0.02
Cowcod	0	0.00	0	0.00	unknown	unknown	0	0.00
Darkblotched Rockfish	12	0.13	0	0.00	unknown	unknown	12	0.07
Lingcod	1	0.01	0	0.00	unknown	unknown	1	0.01
POP	20	0.21	1	0.16	unknown	unknown	21	0.12
Yelloweye Rockfish	0	0.00	0	0.00	unknown	unknown	0	0.00
Widow Rockfish	169	1.79	3	0.99	42	0.57	214	1.23
Non Groundfish Species								
Jack Mackerel	107	1.13	3	0.49	211	2.88	321	1.85
Pacific Mackerel	47	0.50	19	3.13	403	5.50	469	2.70
American Shad	57	0.60	59	9.70	unknown	unknown	116	0.67
Squid, unidentified	55	0.58	0	0.00	unknown	unknown	55	0.32

1/ Estimates based on 2001 NORPAC observer data
2/ Shoreside Whiting Observation Program:2001, prepared by Steve Parker, Oregon Department of Fish and Wildlife, 12/27/01
3/ Where shore-side data was unknown, the all sector values represent the available data from the at-sea fleet only

Salmonids
The following salmonids, which may be incidentally taken with groundfish gear, have been listed under the ESA: Sacramento River winter chinook, Snake river fall chinook, Snake River spring/summer chinook, Central Valley spring chinook, California coastal chinook, Puget Sound chinook, lower Columbia River chinook, upper Willamete River chinook, Upper Columbia River spring chinook, Hood Canal summer run chum, Columbia River chum, Central California coastal coho, Oregon coastal coho, Snake river sockeye, Ozette lake sockeye, southern California steelhead, south-central California steelhead, central California coast steelhead, upper Columbia River steelhead, Snake River Basin steelhead, lower Columbia River steelhead, California Central Valley steelhead, upper Willamette River steelhead, middle Columbia River steelhead, Umpqua river cutthroat trout, and the southwest Washington/Columbia cutthroat trout. Review of observer data indicates that the steelhead, sockeye, and cutthroat are rarely, if ever, encountered in the whiting fishery. Chum and coho are caught in relatively low numbers and chinook are the most common salmonid encountered in the whiting fisheries (NMFS, December 15, 1999).

Most salmon caught in the whiting fishery are chinook salmon. Because several chinook salmon runs are listed under the ESA, bycatch of chinook salmon is a concern. In 2001, 847 chinook or 0.0144 chinook per mt of whiting were taken by the catcher/processor fleet, 1,721 chinook or 0.0480 chinook per mt whiting were taken by the non-tribal mothership fleet, 2,634 chinook or 0.0359 chinook permt of whiting were taken by the shoreside fleet, and 959 chinook or 0.1577 chinook per mt of whiting were taken by the tribal whiting fishery (Table 3.1.2). Overall in 2001, 6,161 chinook were taken in all sectors of the whiting fishery with a bycatch rate of 0.0354 chinook per mt of whiting. This is well below the 0.05 chinook per mt of whiting theshold in the biological opinion.

Table 3.1.2. Total catch of salmon (number) and chinook salmon bycatch rates (number of salmon/mt) taken by each sectors of the whiting fisheri in 2001

2001	Non-tribal At-sea		Tribal		Shore-based		All Sectors	
Species	Catch [1] (No.)	Bycatch Rate	Catch [1] (No.)	Bycatch Rate	Catch[2] (No.)	Bycatch Rate	Catch (No.)	Bycatch Rate
Chinook Salmon	2,568		959		2,634		6,161	0.04
Chum Salmon	49		6		32		87	
Pink Salmon	313		0		304		617	
Sockeye Salmon	3		0		0		3	
Coho Salmon	93		10		35		138	

1/ Estimates based on NORPAC observer data
2/ Shoreside Whiting Observation Program:2001, prepared by Steve Parker, Oregon Department of Fish and Wildlife, 12/27/01

Table 3.1.3. Incidental catch of Chinook Salmon in the whiting Fishery 1991-2001 (includes at-sea and shorebased sectors)

Year	Whiting (mt)	Chinook Salmon (No.)	Bycatch Rate (no/mt whiting)
1991	222,114	6,194	0.0279
1992	201,168	4,753	0.0236
1993	135,516	5,387	0.0398
1994	248,768	4,605	0.0185
1995	175,255	15,062	0.0859
1996	212,739	2,327	0.0109
1997	232,958	5,896	0.0253
1998	232,587	5,262	0.0226
1999	224,459	10,579	0.0471
2000	202,527	11,516	0.0569
2001	173,783	6,161	0.0354

Estimates based on NORPAC observer data & Shoreside Whiting Observation Program:2001, prepared by Steve Parker, Oregon Department of Fish and Wildlife, 12/27/01

Marine Mammal Interactions
The waters off Washington, Oregon, and California support a wide variety of marine mammals. Approximately thirty species, including seals and sea lions, sea otters, and whales, dolphins, and porpoise, occur within the EEZ. Many marine mammal species seasonally migrate through West Coast waters, while others are year around residents. Incidental take of marine mammals by the Pacific whiting fishery is infrequent (Table 3.1.4).

The Marine Mammal Protection Act (MMPA) and the Endangered Species Act (ESA) are the federal legislation that guide marine mammal species protection and conservation policy. Under the MMPA on the West Coast, NMFS is responsible for the management of cetaceans and pinnipeds, while the U.S. Fish and Wildlife Service (FWS) manages sea otters. Stock assessment reports review new information every year for strategic stocks (those whose human- caused mortality and injury exceeds the potential biological removal (PBR)) and every three years for non-strategic stocks. Marine mammals whose abundance falls below the optimum sustainable population (OSP) are listed as depleted according to the MMPA. Under the ESA, a species is listed as endangered if it is in danger of extinction throughout a significant portion of its range and threatened if it is one that is likely to become an endangered species within the foreseeable future throughout all, or a significant portion, of its range.

Under the ESA, threatened species occurring off the West Coast include:
- Steller sea lion (*Eumetopias jubatus*) Eastern Stock,
- Guadalupe fur seal (*Arctocephalus townsendi*), and
- Southern sea otter (*Enhydra lutris*) California Stock

Under the MMPA, depleted species occurring off the West Coast include:
- Sperm whale (*Physeter macrocephalus*) WOC Stock,
- Humpback whale (*Megaptera novaeangliae*) WOC - Mexico Stock,
- Blue whale (*Balaenoptera musculus*) Eastern North Pacific Stock, and
- Fin whale (*Balaenoptera physalus*) WOC Stock.

Fisheries that interact with species listed as depleted, threatened, or endangered may be subject to management restrictions under the MMPA and ESA. NMFS publishes an annual list of fisheries in the *Federal Register* separating commercial fisheries into one of three categories, based on the level of serious injury and mortality of marine mammals that occurs incidentally in that fishery. The categorization of a fishery in the list of fisheries determines whether participants in that fishery are subject to certain provisions of the MMPA, such as registration, observer coverage, and take reduction plan requirements. The West Coast groundfish fisheries are in Category III, indicating a remote likelihood of or no known serious injuries or mortalities to marine mammals.

Table 3.1.4 Mortality levels of marine mammals incidentally caught by at-sea processing trawl vessels in the Pacific whiting fishery, 1991-1999

Species	Year	Observed Mortality	Estimated Annual Mortality
California sea lion (*Zalophus californianus*)	1994	1	2
	1995	0	0
	1996	0	0
	1997	0	0
	1998	1	1
	1999	2	2
Pacific white-sided dolphin (*Lagenorhynchus obliquidens*)	1994	0	0
	1995	0	0
	1996	0	0
	1997	0	0
	1998	1	1
	1999	0	0
Dall's porposie (*Phocoenoides dalli*)	1994	0	0
	1995	0	0
	1996	0	0
	1997	5	27
	1998	2	3
	1999	1	2
Northern elephant seal (*Mirounga augustirostris*)	1994	*	*
	1995	*	*
	1996	*	*
	1997	0	0
	1998	1	1
	1999	1	*
Stellar sea lion (*Eumetopias jubatus*)	1994	*	*
	1995	*	*
	1996	*	*
	1997	2	11
	1998	0	0
	1999	0	0
Harbor seal (Phoca vitulina)	1994	0	0
	1995	0	0
	1996	1	0
	1997	1	5
	1998	0	0
	1999	0	0

* indicates these data were not available from the sources used to complete this table
Sources: U.S. Pacific Marine Mammal Stock Assessments: 2000; Implementation of an Observer Program for the At-sea Processing Vessel in the Pacific Coast Groundfish Fishery, 2001; M. Perez, biologist, NMML, July 24, 2000.

Seabirds Interactions

Impacts of human activities on seabirds occur through direct mortality from collisions with vessels, entanglement with fishing gear, entanglement with discarded plastics and other debris, and shooting. Indirect impacts include competition with fisheries for food, alteration of the food web dynamics due to commercial and recreational removals, disruption of avian feeding habits resulting from dependency on fish wastes, fish-waste related increases in gull populations that prey of other bird species, and marine pollution and changes in water quality.

Seabirds are caught incidentally to all types of fishing operations, but the vulnerability of bird species to gear types differ with feeding ecology. Pelagic trawl fishing gear is used in the Pacific whiting fishery. Trawl gear appears to catch surface-feeding and diving birds that are feeding and scavenging while the net is being retrieved. Since 1996, observers in the Pacific whiting fishery have observed incidental takes of the following seabirds: puffin, northern fulmar, shearwater, and unidentified tubenose (Table 3.1.5)

Table 2.1.5 Incidental Catch of Seabird in Pacific Whiting Observer Samples, 1996-2000

Year	Species		Number is samples
1996	Unidentified puffin	*Fratercula spp.*	1
1997	Northern fulmar	*Fulmarus glacialis*	1
	Dark shearwater	*Puffinus tenuirostris*	1
	Unidentified tubenose	*Procellariiformes*	1
1999	Unidentified seabird		1
2000	Unidentified petrel/shearwater	*Procellariidae*	1

Source: NORPAC observer data

Sea Turtle Interactions

Four species of sea turtles are found in the EEZ off Washington, Oregon, and California; three of these species are listed as endangered (green turtle, leatherback turtle, and olive ridely turtle) and one is listed as threatened (loggerhead turtle) under the ESA. Whiting observer data does not contain any occurrences of incidental sea turtles takes.

Endangered Species

Specific discussion of species listed under the Endangered Species Act can be found above in the sections titled salmonids, marine mammals, seabirds and sea turtles.

3.2 The Socio-economic Environment

History of the Fishery

During the late 1970s and 1980s, the whiting fishery was conducted primarily by foreign fishing vessels and by joint venture partnerships between foreign and U.S. firms. (Joint ventures were arrangements between U.S. catcher vessels and foreign companies, where the U.S. fishers would catch and deliver whiting to foreign processing vessels.) Fishing operations during this period were low intensity compared to those of the 1990s, and fishing lasted from April through September or October. In the late 1980s, surimi technology was introduced and the fishery immediately changed to a fast-paced competition for the available quota. (Surimi is a thick, paste-like or gel product made from washing and de-watering fish flesh. It is further processed to create such products as artificial crab lets, shrimp, etc.) This pattern continued in the early 1990s when U.S. firms preempted all foreign fishing and processing activities.

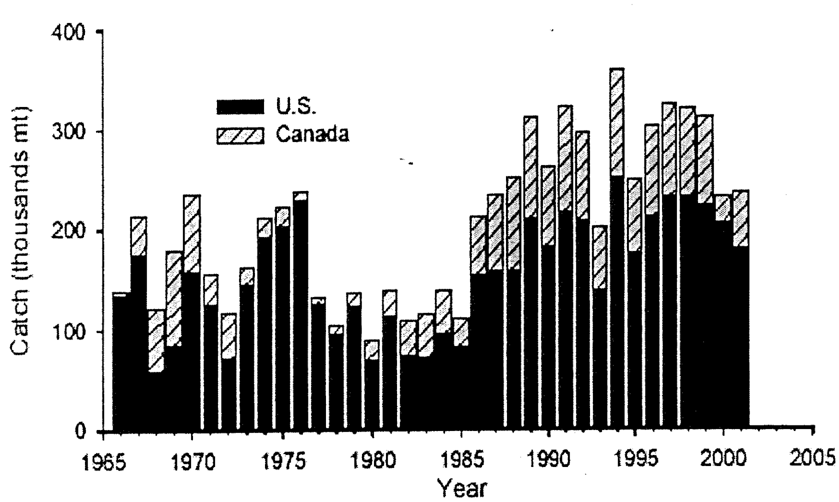

Figure 3.2.1 Coastwide Pacific whiting catch 1965-2001
From Helser et al. 2002

By 1991, surimi technology and market conditions for whiting were sufficiently developed to allow for large scale production. This resulted in an influx of high capacity domestic catcher/processors and mothership processors which were capable of fully harvesting the whiting allocation. As these high volume domestic processors joined the fishery, the fishing pattern of the 1980s and early 1990s was replaced by a fast-paced fishery concentrated earlier in the season and farther south (PFMC 1998). The pattern of earlier and more southern fishing changed in 1992 with the implementation of regulations designed to minimize the bycatch of salmon and rockfish in the whiting fishery.

The Current Whiting Fishery
The whiting fishery occurs primarily during April-November along the coasts of northern California, Oregon, Washington, and British Columbia. The fishery is conducted almost exclusively with midwater trawls. Most fishing activity occurs over bottom depths of 100-500 m, but offshore extensions of fishing activity have occurred. Whiting is a high volume species, but it commands a relatively low price per pound.

The domestic whiting industry is generally described as being composed of the tribal and commercial fisheries each of which has their own allocations. The commercial fishery is composed of the shore-based sector, and the at-sea sector which includes both the catcher/processor and mothership sectors. These sectors are not completely distinct. Separate allocations of the commercial OY have been provided to the shore-based, catcher/processor, and mothership sectors since 1997.

In 2001, the primary seasons for the mothership and catcher/processor sectors began May 15. The shore-based season in most of the Eureka area (between 42°- 40°30' N. lat.) began on April 1 and the fishery south of 40° 30' N. lat. opened April 15. The primary season for the shore-based fishery north of 42° N. lat. began on June 15.

Shore-based Sector
The shore-based sector is made up of processing plants, fishing vessels (catcher vessels) that deliver to them, and the support network that supplies goods and services. In 2001, 29 trawl catcher vessels participated in the shore-side whiting fishery. This number is down from previous years when the number of participating vessels was in the mid to upper 30s. Whiting were landed at 12 processing facilities in 2001; Cresent City, CA (1), Eureka, CA (2), Charleston, OR (2), Newport, OR (3), Astoria, OR (2), Ilwaco (1), and Westport, OR (1). Some shore-based processing plants process a variety of species and produce a variety of products, while others concentrate exclusively on whiting products or even a single whiting product. Companies may own one or more processing plants that process other groundfish such as rockfish and flatfish, and non-groundfish species such as salmon, crab, and shrimp. Catcher vessels may fall into any of several categories. Some harvest whiting almost exclusively, and others primarily target other West Coast groundfish and make only occasional or seasonal landings of whiting. Some deliver primarily to processing vessels at-sea or on shore; some do both. Some vessels move between the West Coast and Alaska fisheries; some remain entirely off Washington, Oregon, and California. In 2001, the vast majority of whiting (about 73%) was landed in Oregon; Washington landings represented 24% of the total and California andings represented about 3.1%.

The At-sea Fishery
The at-sea sector includes vessels that both catch and process fish (known as catcher/processors or factory trawlers), vessels that process but do not catch fish (referred to as mothership processors or motherships), vessels that are capable of both fishing and processing but lack permits to harvest groundfish in the Washington, Oregon, and California areas (also referred to as motherships in the whiting fishery), and vessels that catch whiting and other species for delivery to motherships. As noted above, some vessels may deliver exclusively to motherships off Alaska and the West Coast, but in recent years, about half deliver whiting both at sea and on shore. In 2001, the overall 20 non-tribal catcher vessels and 4 tribal catcher vessels delivered to motherships at sea.

The at-sea processing vessels have onboard surimi production capacity and were initially designed to fish for pollock in the groundfish fisheries off Alaska. Because whiting is a similar species to pollock, harvesting and processing technology and equipment used in the Alaskan fisheries is also used for whiting. In addition, to surimi, most of these vessels have the capacity to produce frozen fillet blocks and have fish meal plants to process small whiting, incidentally caught groundfish species and fish offal. Table 3.2.1 shows the number of at-sea processing vessels for that participated in the fishery from 1997-2001.

Table 3.2.1. Number of at-sea whiting processors by sector, 1997 - 2001

	Catcher-processor	Mothership	Tribal
1997	10	6	1[1]
1998	7	6	1[1]
1999	6	6	1[1]
2000	8	6	1[1]
2001	7	5	1[1]

1/ this vessel participates in both the tribal and mothership fisheries

Since May 1997, when the Department of Justice approved allocation of whiting shares among the members of the Whiting Conservation Cooperative, the catcher-processor fishery has operated as a voluntary quota share program where each of the catcher-processor companies has agreed to take a specific share of the harvest. With harvests assured, the catcher-processors are able to operate more cautiously to avoid areas of salmon and rockfish abundance. The motherships however, operate under more competitive conditions (first come first served) for their sector's allocation. Table 3.2.2 shows the at-sea whiting landings by year from 1997 through 2001.

Table 3.2.2. Whiting landings (retained) by at-sea processing sectors, 1997 - 2001, mts

	Catcher-processor	Mothership	Tribal	All Sectors
1997	68,796	49,460	24,748	143,004
1998	69,692	49,705	23,846	143,243
1999	67,679	47,580	25,844	141,103
2000	67,649	46,710	6,251	120,610
2001	58,628	35,823	6,080	100,531

Source: NORPAC observer data

At-sea Tribal Whiting Fishery

The Pacific Coast treaty Indian fishing rights, described at 50 CFR 660.324, allow for the allocation of fish to the tribes through the annual specification and management process. Since 1999 the tribal allocation has been based on a framework that is a sliding scale related to the U.S. whiting OY (Table 3.2.3).

The tribal allocation is subtracted from the species OY before limited entry and open access allocations are derived. The tribes regulate these fisheries so as not to exceed their allocations. To date only the Makah tribe has fished on the tribal whiting allocation. In 2001, one processing vessel and 4 catcher vessels participated in this fishery.

Table 3.2.3 Tribal a framework for whiting allocation	
U.S. Optimum Yield (OY)	Makah Allocation
Up to 145,000 mt	17.5% of the U.S. OY
145,001 to 175,000 mt	25,000 mt
175,001 to 200,000 mt	27,500 mt
200,001 to 225,000 mt	30,000 mt
225,001 mt to 250,000 mt	32,500 mt
Over 250,001 mt	35,000 mt

Community Description

What nontribal shore-based communities are most dependent on whiting? To answer this question successive criteria were applied to 1991-98 PacFIN landings data. At least 1 ton of whiting was landed in sixteen different ports during the 1991-1998 period. For thirteen of these ports, ex-vessel whiting revenues exceeded $5,000 in at least one year. Nine ports had ex-vessel whiting revenues that exceeded $100,000 in any one year. However, only 6 ports had landings of at least $100,000 of whiting for each of the years 1996 through 1998: Newport, Astoria, Westport, Crescent City, Ilwaco, and Anacortes. For all of these ports, in terms of ex-vessel revenues, whiting was at least 3% of all of the species landed at the port. For Newport and Astoria, the 2 largest whiting ports, whiting revenues exceeded 10% in at least one year during the 1996-98 period. During this period, whiting revenues ranged from 9-16% of Newport ex-vessel revenues and from 7-15% of Astoria's revenues.

The above analysis assumes that all whiting landed in a port is processed in that port. This is not always the case as whiting has been landed in one port and then shipped to another port or site for processing. Information on the quantities associated with such transfers is unavailable. It is also noted that most of the whiting processed in Anacortes, Bellingham, and Blaine is likely to be Puget Sound whiting and/or Canadian whiting landed in U.S. ports.

Shore-based processors of whiting process other species as well. For example, during 1991, whiting revenues were an estimated 8% of the revenue earned by seven shore-based plants processing whiting and other fish. During that year, other groundfish accounted for 43% of their revenues, and crab and shrimp accounted for 39% of their revenues. However, there are processors that produce surimi shoreside that currently are specialized, depending entirely on whiting for their surimi product.

Note: There have been substantial reductions in OYs for several species, including whiting since these data were collected. These changes are not reflected here.

What are the socio-economic characteristics that describe whiting communities and user-groups? To answer this question, U.S. population and census data, community internet sites, and available studies were reviewed. Most of the available data on whiting communities and their associated counties is based on the 1990 U.S. Population Census and predates much of the expansion of shoreside and tribal whiting fisheries. Tables 3.2.4 -3.2.7 provide various statistics on race, gender, population, employment, and the relative importance of fishing to the community or county. (Makah reservation is assumed to be associated with Clallam County, Washington.).

Table 3.2.4. Major Non-tribal Whiting Ports, 1991-1998

Port	State	Ports with at least 1 ton of whiting landed in any one year	Ports with at least $5,000 in whiting ex-vessel revenues any year	Ports with at least $100,000 in whiting ex-vessel revenues any year	Ports with at least $100,000 in whiting ex-vessel revenues annually for each year	Ports with whiting ex-ves revenues at least 3% of all species ex-ves revenues in any one year	Ports with whiting ex-ves revenues at least 10% of all species ex-ves revenues in any one year	Major Shorebased Non-Tribal Whiting Communities Expected in 1999
		1991-1998	1991-98	1991-98	1996-98	1996-98	1996-98	
Newport	OR	*	*	*	*	*	*	*
Astoria	OR	*	*	*	*	*	*	*
Westport	WA	*	*	*	*	*		*
Cresent City	CA	*	*	*	*	*		*
Ilwaco	WA	*	*	*	*	*		*
Anacortes	WA	*	*	*	*	*		
Bellingham	WA	*	*	*				
Eureka/Fields Landing	CA	*	*	*				
Fields Landing	CA	*	*	*				
Eureka	CA	*	*					
Charleston	OR	*	*					
Aberdeen	WA	*	*					
Blaine	WA	*	*					
Garabaldi	OR	*						
Newport Dory	CA	*						
Florence	OR	*						

Crystal Ocean Seafoods the major Anacortes/Burlington plant--moved to Astoria in 1998

Data (PacFIN: 2/99; NMFS NWR Programming)

Table 3.2.5. Fisheries Employment-Socio-economic Information on Race and Gender

1990 U.S, Population Census	County-level Data											
	Cresent City	Cresent City	Newport	Newport	Astoria	Astoria	Ilwaco	Illwaco	West Port	West Port	Neah Bay	Neah Bay
County	Del Norte	Del Norte	Lincoln	Lincoln	Clatsop	Clatsop	Pacific	Pacific	Grays Harbor	Grays Harbor	Clallam	Clallam
State	CA	CA	OR	OR	OR	OR	WA	WA	WA	WA	WA	WA
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
Captains and other officers, fishing vessels												
Total	12	0	60	0	59	0	28	0	21	5	2	0
Hispanic	0	0	0	0	0	0	0	0	2	0	0	0
White	12	0	60	0	59	0	28	0	19	5	2	0
Black	0	0	0	0	0	0	0	0	0	0	0	0
Native American	0	0	0	0	0	0	0	0	0	0	0	0
Asian	0	0	0	0	0	0	0	0	0	0	0	0
Other	0	0	0	0	0	0	0	0	0	0	0	0
Fishers												
Total	160	0	283	3	285	12	292	22	382	7	244	8
Hispanic	0	0	0	0	0	0	17	0	10	0	2	0
White	154	0	272	3	282	10	256	22	349	3	123	8
Black	0	0	0	0	0	0	0	0	0	0	0	0
Native American	6	0	11	0	0	2	19	0	23	4	119	0
Asian	0	0	0	0	3	0	0	0	0	0	0	0
Other	0	0	0	0	0	0	0	0	0	0	0	0
Butcher and meat, poultry, and fish cutters												
Total	60	30	28	71	58	120	50	20	57	13	40	6
Hispanic	7	21	0	2	0	0	0	0	7	0	3	0
White	53	9	28	66	58	99	41	20	50	13	30	0
Black	0	0	0	0	0	0	0	0	0	0	0	0
Native American	0	0	0	0	0	0	9	0	0	0	7	6
Asian	0	0	0	0	0	21	0	0	0	0	0	0
Other	0	0	0	0	0	0	0	0	0	0	0	0

Table 3.2.6. Summary Demographics

County-level Data												
County	**Cresent City**		**Newport**		**Astoria**		**Illwaco**		**West Port**		**Tribal**	
	Del Norte		**Lincoln**		**Clatsop**		**Pacific**		**Grays Harbor**		**Clallam**	
State	**CA**		**OR**		**OR**		**WA**		**WA**		**WA**	
Earnings by Industry-1996	(1000$)											
Total	236724	100%	494544	100%	471281	100%	171744	100%	751141	100%	645963	100%
Farming	13929	6%	2195	0%	3897	1%	6334	4%	9876	1%	2495	0%
Agric.Services	1255	1%	1301	0%	1180	0%	429	0%	2217	0%	1901	0%
Forestry	1005	0%	478	0%	1533	0%	240	0%	2707	0%	4323	1%
Fishing	15241	6%	22467	5%	10899	2%	10888	6%	12937	2%	8520	1%
Mining	74	0%	1382	0% (L)			1361	1% (D)			1643	0%
Construction	8652	4%	35324	7%	30861	7%	6157	4%	49577	7%	50290	8%
Manufacturing	12760	5%	57078	12%	120973	26%	36055	21%	199059	27%	94613	15%
*Food and Kindred Products	4034	2%	5966	1%	16221	3%	8476	5%	14850	2%	1407	0%
Transportation & Public utilities	9129	4%	20641	4%	20927	4%	4068	2%	40835	5%	29304	5%
Wholesale Trade	3657	2%	8434	2%	9028	2%	1008	1%	21316	3%	18209	3%
Retail Trade	26455	11%	88386	18%	75377	16%	21030	12%	90889	12%	87521	14%
Financial and Real Estate	4835	2%	21310	4%	12986	3%	6345	4% (D)			27661	4%
Services	51164	22%	127573	26%	103438	22%	30820	18%	149386	20%	147649	23%
*Hotels & lodging	4073	2%	33671	7%	14219	3%	4717	3%	10225	1%	6104	1%
Government	88568	37%	107975	22%	80160	17%	47009	27%	143293	19%	171753	27%
*State	48650	21%	13407	3%	10348	2%	9278	5%	22419	3%	43017	7%
*Local	32555	14%	82911	17%	53083	11%	32965	19%	107597	14%	101911	16%
		102%		107%		103%						

(D) Not shown to avoid disclosure of confidential information. (L) less than $50,000.

Table 3.2.7 Summary Social Demographics by Community (Population D~ta-1990, Income Data-1989)
1990 U.S. sus Data

County State	Cresent City Del Norte CA	Newport Lincoln OR	Warrenton Clatsop OR	Astoria Clatsop OR	Ilwaco Pacific WA	Westport Grays Harbor WA	NeahBay Clallam WA
General							
Population-1990	4380	8437	2681	10069	815	1892	916
*Percent 65 years & older	14	17	14	17	16	21	5
Median age-years	31	37	34	35	37	38	26
Total households	1645	3545	1041	4216	329	848	307
*Family	1097	2224	740	2597	234	538	222
**Married couple	773	1779	608	2039	203	434	131
Percent of Population							
*Black	1	0	0	0	1	0	1
*Native American	5	2	2	1	3	2	78
*Asian	3	1	2	2	0	0	1
*Hispanic	8	2	2	3	2	1	5
Civilian labor force	1784	4111	1193	4722	293	803	397
*Percent unemployed	12	7	6	6	13	8	17
Employed persons 16 years and older	1565	3838	1119	4429	280	742	329
*Farming, forestry and fishing occupations	42	233	75	194	35	120	69
Median Household Income	19885	24137	24667	24325	26705	19781	17321
Median Family Income	22847	30510	30163	30017	30100	23971	19861
Per capita income	9809	12884	11542	12320	13356	12977	7244
Percent below poverty levels							
*All persons	23	12	14	17	6	17	30
*All families	23	8	11	13	4	15	25
Percent high school grad or higher	72	84	74	82	82	73	66
Percent bachelor's degree or higher	12	20	7	16	25	7	12

4.0 ANALYSIS OF THE ALTERNATIVES

This section forms the analytic basis for the issue comparisons across the alternatives. The potential of each alternative to affect one of more components of the human environment is discussed in the following section. Direct and indirect effects are discussed in this analysis. Direct effects are caused by the action and occur at the same time and place, while indirect effects occur later in time and/or further removed in distance from the direct effects (40 CFR 1508.27). Direct effects include the removal of non-target species from the environment as incidental catch in the whiting fishery. Indirect effects include habitat disturbance by fishing gear.

4.1 Physical Impacts

Physical impacts generally associated with fishery management actions are effects resulting from changes in the physical and structure of the benthic environment as a result of fishing practices (e.g., gear effects and fish processing discards). The proposed action applies to a mid-water trawl fishery and is therefore not expected to have a substantial effect on the structure of the benthic environment. The offal from the majority of whiting processed at sea is processed into fish meal rather than being discharged from the processing vessels. In 2001, 4 out of 12 at-sea processing vessels did not process fish meal on board and in 2000, 3 out of 14 at-sea processing vessels did not process fish meal. It is assumed that the processors will likely continue to process the vast majority of their fish waste into fish meal, resulting in little differences between the proposed alternatives and the no action alternative.

4.2. Biological Impacts

The biological impacts generally associated with fishery management actions are effects resulting from: 1) harvest of fish stocks that may result in changes in food availability to predators, changes in population structure of target fish stocks, and changes in community structure; 2) entanglement/entrapment of non-target organisms in active or inactive fishing gear; and 3) major shifts in the abundance and composition of the marine community as a result of fishing pressure. In the following section, the type of impact is assessed, whether beneficial or adverse, and the degree of risk. Where sufficient information is known, the assessment of impacts are quantitative and where information is minimal or unknown, the assessment is qualitative.

Whiting

Could fishing mortality reasonably be expected to jeopardize the long term health of the stock?

The ABC for whiting is derived by applying the harvest or fishing rate to the current estimate of biomass for the stock. A harvest rate policy must account for several complicating factors, including the relative fecundity of mature individuals over time, and the optimal stock size for the highest level of productivity within the stock.

Because the harvest rate is dependent on the productivity of the stock, it can mean very different things for different stocks. For a fast growing stock, one that has a strong ability to maintain a moderate level of recruitment even when the spawning biomass is reduced, a higher fishing mortality rate may be used, such as F40%. A rate of F40% can be explained as that which reduces spawning potential per female to 40 percent of what it would have been under natural conditions (if there were no mortality due to fishing), and is therefore a more aggressive rate than F45% or F50%. Alternatives 1, 4 and 5 are based on a harvest rate of F40%, while Alternative 2 has the most conservative harvest rate of F50%. Alternative 3 is based on the more conservative F45% harvest rate and is more conservative than Alternatives 1, 4 or 5, but is less conservative than Alternative 2 which is based on F50%. Because the whiting stock in 2001 was determined to be below B40%, (the biomass size necessary to produce MSY) harvest rate strategies that were more aggressive than F40% were not considered to be viable alternatives, and are therefore not presented here. If the chosen harvest rate is too aggressive, the risk of overfishing is greatest and may result in a further decline of the spawning stock biomass. The more conservative harvest rates of F45% or F50%, as seen in Alternatives 2 and 3 reduce the risk of overfishing as compared to F40% in Alternatives 1, 4 and 5.

[insert Helser's findings]

Possible strong recruitment in 2001 (1999 year class) along with substantial increases in mean weights at age due to favorable ocean conditions may prove to be positive factors in expected increases in yield and biomass in 2003 and 2004. However, projections of stock biomass and yields are highly dependent on the relative strength of recruitment in 2001. Alternative 1 is based on biomass and recruitment assumptions from the 1998 assessment as updated for 2001 and is least likely to reflect the current status of the stock. Alternative 2 is based on the lowest and most conservative recruitment scenario of 2.12 billion mt. Alternatives 3 and 4 are based on a medium level recruitment scenario of 2.89 billion mt. Alternative 5 is based on a high recruitment scenario of 3.87 billion mt and is therefore the least conservative alternative. If the chosen recruitment scenario is lower that what was accounted for, the spawner abundance may increase at a rate that was greater than expected. If the chosen recruitment scenario is higher than what actually occurs, the spawning biomass may decline further. Alternative 2 is the most risk averse alternative while Alternative 5 is the least risk averse in regards to the assumed recruitment level.

Unusual distribution patterns have been seen in whiting populations in recent years. These include reports of more northward juvenile settlement during 1997 and 1998 due to El Nino ocean conditions and low occurrence of adult whiting off Canada in 1999 and 2000. It is unclear how such changes affect the stock productivity.

The OYs presented under for each alternative are the ABCs reduced by the 40/10 default harvest policy because the stock biomass is estimated to be below B40%. When a stock is at or below B40%, the 40/10 policy reduces the fishing mortality rate. The further a stock is below the B40% threshold, the greater the reduction in the OY, until at B10% the OY would be set at zero. This is a default rebuilding policy that is intended to reduce fishing pressure or mortality in hope of increasing the stock biomass.

The high degree of harvest monitoring in the whiting fishery should be noted here. The at-sea sectors of the whiting fishery have been well documented by fishery observers. Since 1991, each processor has voluntarily carried 1-2 observers who estimate total whiting catch (retained +discard). This level of catch monitoring is expected to continue in 2002. The vast majority whiting in the shore-based sector were landed under exempted fishing permits that allow unsorted catch to be landed shoreside were state biologists sample the catch.

<u>Is there evidence that harvest would lead to a detectable decrease in reproductive success such that it jeopardizes the stocks ability to sustain itself</u>? The primary whiting fishery occurs after the spawning period and in a different geographical location from the spawning grounds. The greatest pressure is on the adult population during the late spring and early summer months and does not specifically target one sex nor does one sex appear to be more vulnerable to the fishery than the other. It is unlikely that any of the alternatives will result in a detectable decrease in reproductive success such that it jeopardizes the stock's ability to sustain itself.

<u>Is the distribution of harvest likely to lead to a detectable reduction in genetic diversity such that it jeopardizes the stock</u>? The coastal stock of whiting is believed to be one stock which is distributed from Queen Charlotte Sound to Baja California. Genetic diversity of a stock would be affected if its abundance became so low that the stock becomes dependent on a low number of spawners to sustain the population. If a stock were to break into isolated populations they could become genetically isolated.

The coastal stock is geographically dispersed over a large area. Although greatest fishing pressure occurs over a relatively short period during the late spring and early summer, over the course of the season the fishing effort is spead out with most effort being along the shelf break. To maintain an adequate spawning biomass, the 40/10 harvest policy is a precautionary measure that reduces the amount of harvest when a stock is below the B_{MSY} threshold of B40%. The further a stock is below the B40% threshold, the greater the reduction in the OY, until at B10% the OY would be set at zero. It is unlikely that any of the alternatives will result in the stock size being reduce to the point that genetic diversity is affected over the no action alternative such that it jeopardizes the survival of the stock. As discussed above, the spawning stock biomass is expected to increase under alternatives XXXX insert Helser findings XXXXXXXX.

Is there evidence that the harvest levels would lead to changes in prey availability such that it affects the stock's sustainability? The whiting fishery begins in the late spring when adult whiting begin to migrate north along the continental shelf and slope from California to Vancouver Island. The primary season extends into the summer months when whiting form extensive mid-water aggregations near the continental shelf break with the greatest concentrations over 200-300 m (Dorn et al. 1994). Although whiting are cannibalistic, the geographic separation of juveniles and adults usually prevents cannibalism from being an important factor in their population dynamics (Buckley and Livingston 1997 – Buckley, T.W. and P.A. Livingston 1997. Geographic variation in the diet of Pacific hake, with a note on cannibalism. Calif. Coop. Oceanic Fish. Invest. Rep. 38:53-62.)

During the warm ocean conditions, such as occurred in the 1990s, there is some evidence that typical distribution patterns may have changed and cannibalism may have been more prevalent.
In addition, the separation typically seen between juveniles and adults means that there is a low vulnerability of juvenile fishing related mortality. The potential harvest of adult whiting under each of the alternatives is not expected to change the prey availability over the no action alternative such that it affects the ability of the whiting stock to sustain itself.

Is there evidence that habitat disturbances are sufficient to lead to a decrease in spawning or rearing success such that they jeopardize the stock's ability to sustain itself? Adult whiting spawn in an open sea area off California and Baja California. In the winter, embryos and larvae are found in this same area for 4-6 months. Eggs of the whiting are neritic and float to neutral buoyancy. Juvenile whiting brood in an area on the continental shelf off California and Baja California. Adult whiting feed near the continental shelf break off British Columbia, Washington, Oregon, and California for 6-8 months of the year.

Because the whiting fisheries primary occur from late spring to early fall when adult populations aggregate along the shelf break, the vulnerability of juveniles to fishing related mortality would be low under any of the proposed alternatives. In addition, participants in the primary season fishery are required to use pelagic trawls with at least a 7.5 cm (3 inch) mesh under all of the alternatives. Few juveniles would be expected to be taken with this mesh size. The harvest of whiting with pelagic trawl gear is not expected to result in damage of fragile biota used by whiting or to reduce the habitat complexity.

Table 4.2.1 Comparison of the biological impact of the alternative ABC and OYs on Pacific whiting

Biological Issue	Threshold	Alternative 1 No action	Alternative 2 Low recruitment with F50%	Alternative 3 Med. recruitment with F45%	Alternative 4 Med. recruitment with F40%	Alternative 5 High recruitment with F40%
1) Fishing mortality	Could fishing mortality reasonably be expected to jeopardize the capacity of the stock to achieve MSY?	Least conservative harvest rate Recruitment assumptions based on older survey data.	Most conservative harvest rate Most conservative assumptions about recruitment. Stock could return to B40% within X years	Mid level harvest rate Mid-level recruitment assumptions. Stock could return to B40% within X years	Least conservative harvest rate Mid-level recruitment assumptions. Stock could return to B40% within X years	Least conservative harvest rate Least conservative recruitment assumptions. Stock could return to B40% within X years
2) Change in the reproductive success	Is there evidence that harvest distribution would lead to a detectable decrease in reproductive success such that it jeopardizes the stock?	Minimal effect Fishery occurs after spawning in different geographic area	No measurable change over, alternative 1	No measurable change over alternative 1	No measurable change over alternative 1	No measurable change over alternative 1
3) Genetic Diversity	Is the distribution of harvest likely to lead to a detectable reduction in genetic diversity such that it jeopardizes the stock?	Least conservative alternative. If population is reduced to very low biomass diversity may be affected	Most conservative alternative. Not expected to effect genetic diversity	Moderate level of risk. Not expected to effect genetic diversity	Moderate level of risk. Not expected to effect genetic diversity	If population is reduced to very low biomass diversity may be effected
4) Change in prey availability	Is there evidence that the harvest levels would lead to changes in prey availability such that it affects the stocks sustainability?	Minimal effect Cannibalism is not a major factor in whiting survival Spatial separation between the fishery for adults and juvenile populations	No measurable change over alternative 1	No measurable change over alternative 1	No measurable change over alternative 1	No measurable change over alternative 1
5) Habitat change	Is there evidence that habitat disturbance are sufficient to lead to a decrease in spawning or rearing success such that it jeopardizes the stocks ability to sustain itself?	Minimal effect Primary fishery does not occur during the spawning period or in known spawning areas	No measurable change over alternative 1	No measurable change over alternative 1	No measurable change over alternative 1	No measurable change over alternative 1

Impacts of the alternatives on non-whiting fish species

Table 4.2.2 show the potential catch of non-whiting groundfish species under each alternative. These estimates are based on the bycatch rates seen in the 2001 whiting fishery. These rates were applied to OY proposed under each of the alternatives to derive a rough estimate of the expected catch of species taken incidentally in the whiting fishery. In general, lowering the whiting OY could be expected to reduce the i catch of non-whiting species, assuming that fishing patterns and fish distributions were similar to those seen in 2001.

Groundfish

Yellowtail rockfish, a schooling rockfish, is a common species seen in the whiting fishery. The greatest incidental catch (327 mt) of yellowtail rockfish is expected to occur under the no action alternative while the lowest catch would be expected to occur under Alternative 2 (109 mt). The catch set aside for yellowtail rockfish in the whiting fishery for 2002 is 550 mt (400 mt for the at-sea fisheries and 150 mt for the shore-based fishery) all of the alternatives are well within the expected catch levels for yellowtail rockfish.

Incidental catch of sablefish was fairly higher in 2001. Using the 2001 rate, the greatest incidental catch (76 mt) of sablefish is expected to occur under the no action alternative followed by Alternative 5 (70 mt) while the lowest catch would be expected to occur under Alternative 2 (25 mt). These amounts would be expected to be much lower during the average whiting season. Retained amounts would be deducted from the limited entry trawl allocation of 2,052 mt. Therefore, none of the alternatives would be expected to result in overfishing of the sablefish OY.

Other groundfish species incidentally taken in the 2001 whiting fishery include walleye pollock, spiny dogfish shark, rex sole, shortspine thorneyhead, redstriped, shortbelly, rougheye and splitnose rockfishes.

As with sablefish, there are no specific set asides for the whiting fishery; however, retained amounts would be deducted from the limited entry trawl allocations and would not be expected to result in overfishing of the OYs for those species of species groups.

Several overfished species, bocaccio rockfish, canary rockfish, darkblotched rockfish, lingcod, and POP are also encountered in low numbers in the 2001 whiting fishery (see Table 3.1.1.). Widow rockfish, a schooling rockfish are encountered more frequently (214 mt in 2001) in the whiting fishery than other overfished species. Estimates of the expected incidental catch levels under each of the alternatives can be seen in Table 4.2.2. Some overfished species such as canary, darkblotched and widow rockfishes have specific OY set asides for the at-sea whiting fishery (tribal & non-tribal), while other species are managed under the overall limited entry allocations.

For 2002 the canary rockfish set aside is 3 mt for the at-sea portion of the fishery (tribal and non-tribal). If the 2002 bycatch rates are similar to 2001, none of the alternatives would be expected to result in an at-sea harvest that exceed the 3 mt set aside. The shore-based fishery would be managed under the overall limited entry allocation. For 2002 the darkblotched rockfish set aside is 5 mt for the at-sea portion of the fishery (tribal and non-tribal). If the 2002 bycatch rates are similar to 2001, it could reasonable be expected that 7 mt would be taken by the at-sea sector under Alternatives 1 and 5, exceeding the at-sea set aside of 5 mt. If Alternative 1 or 5 were selected, the darkblotched rockfish set asides for the whiting fishery for 2002 may need to be reconsidered, so that the groundfish fishery as a whole does not exceed the 2002 darkblotched rockfish OY. The 2002 widow rockfish set aside for the whiting fishery is 190 mt (150 mt for the at-sea fishery and 40 for the shore-side fishery). Similar to darkblotched rockfish, If the 2002 bycatch rates are similar to 2001, it could reasonabley be expected that the 190 mt set aside would be exceeded under Alternatives 1 (234 mt) and 5 (215 mt). The incidental catch of widow rockfish under Alternatives 2, 3, and 4 would be expected within the 190 mt set aside.

Non-groundfish species

CPS species include northern anchovy, Pacific sardine, Pacific mackerel, jack mackerel, and market squid and are incidentally taken in whiting fisheries. The take of CPS species in the Pacific whiting fishery has been well documented. CPS species may benefit from reduced whiting OYs. The differences between the effects of the alternatives on Pacific mackerel, jack mackerel, and market squid can be seen in Table 4.2.2

The July 1, 2001 - June 30, 2002, harvest guideline for Pacific mackerel is 13,837 mt. With the assumed bycatch rate (2.7 kg/mt) in the at-sea whiting fishery, 3.7% of the Pacific mackerel harvest guideline would be taken under Alternative 1, 1.2% would be taken under Alternative 2, 2.1 % would be taken under Alternative 3, 2.5 % would be taken under Alternative 4, and 3.4% would be taken under Alternative 5. There is no harvest quota for jack mackerel and no evidence of significant exploitation of this species off the Pacific Coast. There is no current harvest guideline for market squid, however, an amendment to the Coastal Pelagic Species Fishery Management Plan that addresses a market squid MSY control rule is being developed. As noted earlier, because these estimates are based on the OY proposed under each alternative the greatest incidental catch for each species is expected to occur under the no action alternative (OY of 190,4000) while the lowest catch would be expected to occur under Alternative 2 (OY of 63,200).

Table 4 .2.2. **Estimated incidental catch by species under alternative management actions**

Species	Byctach Rate (kg/mt)	Alternative 1 No action Estimated Catch (mt)	Alternative 2 Low recruitment with F50% Estimated Catch (mt)	Alternative 3 Med. recruitment with F45% Estimated Catch (mt)	Alternative 4 Med. recruitment with F40% Estimated Catch (mt)	Alternative 5 High recruitment with F40% Estimated Catch (mt)
Groundfish Species that have not been declared as overfished						
Whiting		190,400	63,200	106,400	129,600	175,200
Yellowtail Rockfish	1.72	327	109	183	223	301
Sablefish	0.40	76	25	43	52	70
Walleyed Pollock	2.11	402	133	225	273	370
Spiny Dogfish Shark	1.33	253	84	142	172	233
Rex Sole	0.10	19	6	11	13	18
Shortspine Thornyhead	0.09	17	6	10	12	16
Redstripe Rockfish	0.10	19	6	11	13	18
Shortbelly Rockfish	0.16	30	10	17	21	28
Rougheye Rockfish	0.12	23	8	13	16	21
Splitnose Rockfish	0.14	27	9	15	18	25
Overfished Groundfish Species (<25% of unfished biomass)						
Bocaccio Rockfish	0.01	2	1	1	1	2
Canary Rockfish (at-sea only)	0.02	4 (2)	1 (1)	2 (1)	3 (2)	4 (2)
Cowcod	0.00	0	0	0	0	0
Darkblotched Rockfish (at-sea only)	0.07	13 **(7)**	4 (2)	7 (4)	9 (5)	12 (7)
Lingcod	0.01	2	1	1	1	2
POP	0.12	23	8	13	16	21
Yelloweye Rockfish	0.00	0	0	0	0	0
Widow Rockfish	1.23	**234**	78	131	159	**215**
Non Groundfish Species						
Jack Mackerel	1.85	352	117	197	240	324
Pacific Mackerel	2.70	514	171	287	350	473
American Shad	0.67	128	42	71	87	117
Squid, unidentified	0.32	61	20	34	41	56

* Numbers in bold text indicate that the exceed the amounts set aside for the fishery

Salmonids

During the 2000 whiting season, the chinook salmon incidental take for the at-sea and shore-based whiting fisheries combined exceeded 11,000 fish, the amount specified in the section 7 ESA consultation incidental take statement. Exceeding the amount specified in the incidental take statement triggered reinitiation of the consultation on the Biological Opinion issued on December 15, 1999. In the 2001 whiting season, however, the whiting fishery's chinook bycatch was well below the 11,000 fish incidental take estimates. By applying the average bycatch rates from the 1991-2001 whiting fisheries (and assuming they are the best available information to estimate likely bycatch rates in 2002), the estimated bycatch of chinook salmon was calculated for each alternative and is shown in Table 4.2.3. Relative to the no action alternative (6,818 chinook salmon), the estimated catch of chinook salmon would be reduced under Alternatives 2 through 5 with the lowest take (2,263 chinook) occurring under Alternative 2 and the greatest take (6,274) occurring under Alternative 5. None of the proposed alternatives are expected to result in total chinook take that exceeds of the11,000 fish incidental take threshold specified in the Biological Opinions.

Table 4.2.3. Estimated incidental catch of chinook salmon in the whiting fishery under each alternative ABC/OYs

Year	Bycatch Rate [1/] (no/mt whiting)	Alternative 1 No Action	Alternative 2 Low with F50%	Alternative 3 Med. with F45%	Alternative 4 Med. with F40%	Alternative 5 High with F40%
Whiting		190,400	63,200	106,400	129,600	175,200
Chinook Salmon	0.03581	6,818	2,263	3,810	4,641	6,274

1 /Based on Norpac observer data average bycatch rate from 1991-2001

Marine Mammals

Marine mammals may be directly and indirectly affected by the Pacific whiting trawl fishery, however, incidental take the whiting fishery is infrequent. Indirect effects of the Pacific whiting fishery on marine mammals are more difficult to quantify due to a lack of behavioral and ecological information about marine mammals. However, marine mammals may be affected by increased noise in the oceans, change in prey availability, vessel traffic in and around important habitats, at-sea garbage dumping, and diesel or oil discharged into the water associated with pelagic trawl fisheries. If the whiting OY is reduced and fishing effort is decreased, the potential for interactions with marine mammals may be reduced. If that is the case, marine mammals may directly benefit from reduced OYs under Alternatives 2-5, as compared to the no action alternative. Because the level of interaction is of a very small scale and infrequently occurring, the differences between the alternatives is expected to be minor.

Seabirds

Seabirds are directly affected by fisheries when there is an opportunity for incidental take. In West Coast groundfish fisheries, seabirds are only occasionally taken by trawl. If the whiting OY is reduced and fishing effort is decreased, the potential for interactions with seabirds may be reduced. If that is the case, seabirds may directly benefit from reduced OYs under Alternatives 2-5, as compared to the no action alternative. Because the level of interaction is on a small scale and infrequently occurring, the differences between the alternatives is expected to be minor.

In addition to incidental take, seabirds may be indirectly affected by changes in prey availability, vessel traffic, garbage dumping, and diesel or oil discharge that can result from commercial fisheries. If reduced harvest guidelines decrease fishing effort, seabirds may indirectly benefit from Alternatives 2-5, as compared to the no action alternative. The differences between the alternatives are expected to be minimal because of the low level of interaction between the whiting fishery and seabirds.

Sea Turtle

There is no information to indicate that sea turtles directly interact with the whiting fishery, therefore there is assumed to be no measurable differences between alternatives. In addition to incidental take, sea turtles may be vulnerable to collisions with vessels, entanglement in abandoned fishing gear, the dumping of garbage, and the discharge of diesel or oil. If reduced harvest guidelines decrease fishing effort, and if whiting vessels operate in areas where sea turtles occur, there may be a benefit to the turtles. However, any differences between the alternatives would likely be unmeasurable.

4. 3. Socio-ecomonic impacts of the alternatives

Harvesters & Processors –Table 4.3.1 is a summary of the 2001 whiting fishery with an estimate of the gross revenue. Gross revenues associated with each of the five alternatives are estimated in Table 4.3.2. These are crude estimates of gross revenue which are presented here to show the basic impacts and their significance with respect to the change between the alternatives and the year 2001. In 2001 the estimated gross revenue for whiting was estimated to be $13,415,000. Under the proposed Alternatives, Alternative 1 would be expected to produce the greatest revenue, $14,692,000 to harvesters and processors while Alternative 2 is expected to produce the least revenue, $4,877,000. Gross revenues from the other alternatives range in between these, with Alternative 3 producing $8,211,000, Alternative 4 producing $10,000,000 and Alternative 5 producing $13,519,000. The gross revenue under Alternatives 1 and 5 would exceed 2001 if the full allocations were taken. Alternative 2 would be expected to result in a substantial decrease in gross revenue. In relation to recent harvests, the potential harvest opportunity for the tribal sector would be an increase over what was taken by that sector in 2000 and 2001. However, it must be noted that if the whiting biomass remains low into the future, the availability of whiting for the tribes to harvesting in the Makah areas is reduced.

Table 4.3.1 Summary whiting catch and gross revenue by sector for the 2001 fishery

Number of motherships	Catch of Pacific whiting (mt) 1/	Range of Pacific whiting caught by catcher vessels (mt)	Average catch of Pacific whiting per catcher vessel (mt) 1/	Estimated Pacific whiting revenue per mothership ($1000) 2/	Estimated average Pacific whiting revenue per catcher vessel ($1000) 2/
5	35,823	5 - 4339	1,327	553	106
Number of catcher processors		Pacific whiting (mt) 1/		Estimated revenue per catcher processor for Pacific whiting ($1000) 2/	
7		58,628		646	
Number of states with shoreside processors		Catch of Pacific whiting (mt) 3/		Estimated revenue per state for Pacific whiting ($1000) 2/	
3		73,326		1,886	
Number of tribal processors	Catch of Pacific whiting (mt) 1/	Range of Pacific whiting caught by catcher vessels (mt)	Average catch of Pacific whiting per catcher vessel (mt) 1/	Estimated Pacific whiting revenue per mothership ($1000) 2/	Estimated average Pacific whiting revenue per catcher vessel ($1000) 2/
1	6,080	881 - 1,900	1,517	469	117

1/ The source of catch information was NORPAC observer data.
2/ The price ($.035/lb) of whiting was obtained from PACFIN. It is the price for July 2001; July had the greatest number of whiting landings coastwide.
3/ The source of catch information was the report "Shoreside Whiting Observer Program: 2001" prepared by Steve Parker, Marine Resource Program, Oregon Department of Fish and Wildlife, Newport, Oregon, 97365.

Table 4.3.2. Gross revenue estimates for alternative whiting ABC and OYs 2001and 2001, based on the 2001ex-vessel price of $0.035/lb

Sector	Year 2001	Alternative 1 - no action	Alternative 2 - low with F50% Fmsy	Alternative 3 - medium with F45% Fmsy	Alternative 4 - medium with F40% Fmsy	Alternative 5 - high with F40% Fmsy
	Estimated revenue from 2001 catch of 173,857 mt ($1000) 1/	Estimated revenue with 190,400 mt OY ($1000) 1/	Estimated revenue with 63,200 mt OY ($1000) 1/	Estimated revenue with 106,400 mt OY ($1000) 1/	Estimated revenue with 129,600 mt OY ($1000) 1/	Estimated revenue with 175,200 mt OY ($1000) 1/
MP (average)	2,764 (553) 2/	3,017 (603)	966 (193)	1,626 (325)	1,980 (396)	2,735 (547)
CP (average)	4,524 (646) 2/	4,274 (611)	1,368 (195)	2,303 (329)	2,805 (401)	3,875 (554)
SB	5,658 4/	5,279	1,690	2,845	3,465	4,787
SB Washington 3/	1,358	1,267	406	683	832	1,149
SB Oregon 3/	4,122	3,846	1,231	2,073	2,524	3,487
SB California 3/	178	166	53	89	109	150
Tribal	469 2/	2,122	853	1,437	1,750	2,122
Total	13,415	14,692	4,877	8,211	10,000	13,519

1/ The price ($.035/lb) of whiting was obtained from PACFIN. It is the price for July 2001; July had the greatest number of whiting landings coastwide.
2/ The source of catch information was NORPAC observer data.
3/ The estimated revenue for each state in the shoreside sector was based on their level of participation in the 2001 fishery.
4/ The source of catch information was the report "Shoreside Whiting Observer Program: 2001" prepared by Steve Parker, Marine Resource Program, Oregon Department of Fish and Wildlife, Newport, Oregon, 97365.

Alternatives 2 and 3, particularly Alternative 2, would have major impacts on the amount of whiting processed in 2002, which in turn will have major effects on the processing sector as well as the communities they are associated with, especially if the OYs remain at low levels for an extended period. These impacts are not so much from the effects of price change, but from the reduced revenues from production. Less production implies reduced ability for operations to not only cover their variable costs, but also their fixed costs.

Under Alternative 2, it is likely that the season length would be greatly reduced and may make it more difficult to retaining workers, this is less likely under Alternatives 3 and 4. Alternative 5 could be expected to be similar to the no action alternative. Communities with less dependence on whiting may lose workers or be unable to lure workers away from other employment opportunities. Processors that process species other than whiting, however may have additional opportunities that affect worker behavior.

Fish prices – Changes in the supply of a fish species should be associated with changes in the price received in the market for that species. Alternatives 2 and 3 and 4 may, because of their large reductions, have an effect on ex-vessel prices. The information necessary to fully analyze the impacts of quantity changes on whiting prices is very limited.

Safety to human life -- There is a certain degree of danger associated with groundfish fishing, however little is known about the connection between fisheries management measures and incident, injury, or fatality rates. Moreover, little is known about risk aversion among fishers or the values placed on increases or decreases in different risks. There is no real way to connect the changes in harvest levels under the proposed alternatives with changes in different risks and the costs or benefits of these changes to the fishers.

Decreased harvest may lead to less investment in fishing vessels safety and less care by skippers. If this were to occur, the rate of safety related incidents, injury, or fatality rates could increase. However if the number of harvesters decreases, and the time at sea decreases, the rates of safety related incidents, injury, or fatality could decrease. Without better information it is difficult to determine with a high degree of accuracy, the effect of a given alternative on safety to human life. For the most part, the differences between the alternatives is expected to be minimal as compared to no action. Alternative 2, which produces the least amount of revenue to the fishery having the most potential to result in less investment in safety and more skippers taking greater risks.

Management & Enforcement -- Enforcement and management budgets for fiscal year 2002 have already been set and are unlikely to change as a result of this action. However, resources could be reallocated within the enforcement and management programs. Enforcement expenses are somewhat related to OYs in that the larger the OY the more offloads, deliveries, or hauls would need to be monitored to attain the same level of coverage as with a lower OY. If the resources were not available to monitor more offloads, deliveries, or hauls then there would be a cost to enforcement associated with the lower proportion that could be monitored. Inseason enforcement is more closely related to the nature and complexity of the regulations governing the fishery (for example: the number of separate trip limits that must be monitored and the length of the cumulative period) than to the OYs.

In-season management costs to the states and federal governments are largely fixed regardless of the ABC or OY. Under Alternative 2, the management and enforcement costs to the state and federal governments could be expected to reduced slightly higher than the other alternatives. The differences between the other alternatives and no action would be expected to be minimal. However, in the at-sea whiting processing fleet, the individual vessels bears the costs of the fisheries observers who are voluntarily carried to sample the catches and provide valuable data on species composition, total catch, biology of the harvested fish. If the same number of participants continue in the fishery, the burden of carrying the observer would be expected to consume a larger portion of the individual vessels revenue. On the other hand, if the number of participants drops, the burden to the individual vessel may be similar to the no action alternative, Alternative 1 and management would see no difference. In 2001, all at-sea processing vessels carried 2 observers which resulted in a very high level of catch monitoring. If vessels choose to reduce their costs by carrying only one observer per processing vessel (or possibly less), the ability to monitor the fishery inseason would be affected. If the same number of participants continue to operate in the fishery, this scenario would most likely occur under Alternative 2, and would be less likely to occur under Alternatives 3 and 4, and would not be expected under Alternative 5.

Communities -- In 2001, the shore-based fishery landed and processed in XX communities in California, Oregon and Washington. Reduced OYs under Alternatives 2 through 5 mean less fish overall coming into those communities. However, it is difficult to understand how processor behavior and delivery agreements, which may have a greater affect and be unrelated to the whiting OY, will effect the individual communities. Fish taken under a lower OY are divided among the same number of communities. The availability of jobs and the duration of those job, and the retention of workers as well as their contribution to the community, would be most affected under Alternative 2 and to a lesser degree under Alternatives 3 and 4. Alternative 5 would be expected to be similar to the no action alternative. Supporting services for the processing facilities in such a community would also be affected in proportion to the reduction in the OY. This is most true for Alternative 2. However, if those processors in communities that are less dependent on whiting cease to process whiting, the effect on the remaining communities may be neutral over the no action alternative. As discussed above, there are many factors that affect a processor's decision to remain in the fishery and the impacts on a given community, these include changes in the value of the fish, the processor's debt load, the processor's dependence on whiting as compared to other species, agreements with harvesters, the importance of whiting related jobs and services to the individual community, etc.

In 2000 and 2001, the tribal fishery was unable to fully harvest their whiting allocation and took 6,251 mt and 6,080 mt respectively. This was primarily because sufficient quantities of whiting were not available to the fishery. Under the sliding scale framework (described in section 3), originally adopted in 1999, the tribal fishery would have 27,500 mt available under Alternative 1 or 5, the least conservative alternatives, and 11,060 mt available under Alternative 2, the most conservative. The potential harvest opportunity under all of the alternatives is greatest for the tribal community in relation to recent harvests. However, it must be noted that if the whiting biomass remains low into the future, the tribes may not have the full opportunity to harvesting the whiting in the Makah areas, which is likely to result community impacts over several years.

4.4 Cumulative Impacts

Table X.X.X Summary of direct and indirect impacts of the alternatives

Issue	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Groundfish Species					
Sustainability of whiting					
Reporductive success of whiting					
Prey availability of whiting					
Habitat change					
Affect on sustainability of incidentally taken species					
Non-groundifsh fish species including: CPS, forage fish, prohibited species, and unlisted salmonids					
Incidental take -Affect on sustainability	N	N	N	N	N
Prey availability	N	N	N	N	N
Habitat	N	N	N	N	N
ESA listed Salmonids					
Incidental take -Affect on sustainability	N	N	N	N	N
Prey availability	N	N	N	N	N
Habitat	N	N	N	N	N
Marine mammals					
Incidental take -Affect on sustainability	N	N	N	N	N
Prey availability	N	N	N	N	N
Habitat	N	N	N	N	N
Seabirds					
Incidental take -Affect on sustainability	N	N	N	N	N
Prey availability	N	N	N	N	N
Habitat	N	N	N	N	N
Sea Turtles					
Incidental take -Affect on sustainability	N	N	N	N	N
Prey availability	N	N	N	N	N

Habitat	N	N	N	N	N
Marine Habitat					
Damage to biota	N	N	N	N	N
Damage to benthic habitat	N	N	N	N	N
Impacts on related non-groundfish fisheries					
Direct effect on state managed fisheries	N	N	N	N	N
Direct effect on tribal managed fisheries	N	N	N	N	N
Direct effect of federally managed fisheries	N	N	N	N	N
Socio-economic factors					
Harvesters					
Processors					
Fish prices					
Gross revenue to industry					
Safety of human life	N	U	N	N	N
Management and Enforcement	N	U	U	U	N
Costs to consumers	N	U	U	U	N
Communities	N	U	U	U	N

N=nonsignificant impact expected S=significant impact either positive (+) or negative (-) U=unknown

5.0 Consistency with Fmp and Other Applicable Law

5.1 Magnuson-Stevens Conservation and Management Act
5.2 Consistency with the FMP
5.3 Paperwork Reduction Act
5.4 Marine mammal Protection Act
5.5 National Environmental Poicy ACt (NEPA)
5.6 Executive Order 12866_
5.7 Endangered Species Act
5.8 Coastal Zone Management Act
5.9 Executive Order 13175
5.10 Migratory Bird Treaty Act

6.0 REGULATORY IMPACT REVIEW (RIR) AND REGULATORY FLEXIBILITY ANALYSIS

The RIR and IRFA analyses have many aspects in common with each other and with EAs. Much of the information required for the RIR and IRFA analysis has been provided above in the EA. Table 6.0.1 identifies where previous discussions relevant to the EA and IRFA can be found in this document. In addition to the information provided in the EA, above, a basic economic profile of the fishery is provided annually in the Council's SAFE document.

Table 6.0.1 Regulatory Impact Review and Regulatory Flexibility Analysis

RIR Elements of Analysis	Corresponding Sections in EA	RFA Elements of Analysis	Corresponding Sections in EA
Description of management objectives	1.0	Description of why actions are being considered	1.0
Description of the Fishery	3.3	Statement of the objectives of, and legal basis for actions	1.0
Statement of the Problem	1.0	Description of projected reporting, recordkeeping and other compliance requirements of the proposed action	5.3
Description of each selected alternative	2.0	Identification of all relevant Federal rules	5.1-5.10
An economic analysis of the expected effects of each selected alternative relative to no action	4.3		

Regulatory Impact Review

The RIR is designed to determine whether the proposed actions could be considered "significant regulatory actions" according to E.O. 12866. Table 6.0.2 identifies E.O. 12866 test requirements used to assess whether or not an action would be a "significant regulatory action", and identifies the expected outcomes of the proposed management alternatives: 1) Have a annual effect on the economy of $100 million or more or adversely affect in a material way the economy, a sector of the economy, productivity, competition, jobs, the environment, public health or safety, or state, local, or tribal governments or communities; 2) Create a serious inconsistency or otherwise interfere with action taken or planned by another agency; 3) Materially alter the budgetary impact of entitlement, grants, user fees, or loan programs or the rights and obligations of recipients thereof; or 4) Raise novel legal or policy issues arising out of legal mandates, the President's priorities, or the principles set forth in this executive Order. For the purposes of E.O. the proposed alternatives are not expected to be significant regulatory actions.

[Insert a discussion of the alternatives here]

Table 6.0.2 Summary of E.O. 12866 Test Requirements

E.O 12866 Test of "Significant Regulatory Actions	Alternative 1: No Action	Alternative 2	Alternative 3	Alternative 4	Alternative 5
1) Have a annual effect on the economy of $100 million or more or adversely affect in a material way the economy, a sector of the economy, productivity, competition, jobs, the environment, public health or safety, or state, local, or tribal governments or communities;	No	No	No	No	No
2) Create a serious inconsistency or otherwise interfere with action taken or planned by another agency;	No	No	No	No	No
3) Materially alter the budgetary impact of entitlement, grants, user fees, or loan programs or the rights and obligations of recipients thereof; or	No	No	No	No	No
4) Raise novel legal or policy issues arising out of legal mandates, the President's priorities, or the principles set forth in this executive Order,	No	No	No	No	No

7.0 List of Preparers

This document was prepared by NMFS staff from the Sustainable Fisheries Division, Northwest Region 7600 Sand Point Way N.E., Seattle, WA 98115-0070, in consultation with NOAA General Council, Northwest Region.

8.0 References

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GROUNDFISH MANAGEMENT TEAM REPORT AND RECOMMENDATIONS FOR REVISING REBUILDING PLANS AND FISHERY MANAGEMENT PLAN AMENDMENTS

The Groundfish Management Team (GMT) met in early February and discussed revisions to the Pacific Coast Groundfish Fish Management Plan (FMP) to incorporate rebuilding plans for eight overfished West Coast groundfish species. The GMT was also advised of potential management and rebuilding implications of new stock assessments for bocaccio and canary rockfish. The GMT discussions focused on the content and development schedule of rebuilding plans and amendments. The following points and recommendations are offered by the GMT relative to rebuilding plans.

The GMT expects that some, but not all of the rebuilding parameters, such as the rebuilding time frame (T_{target}), maximum rebuilding time frame (T_{MAX}), biomass target ($B_{40\%}$), biomass overfishing threshold ($B_{25\%}$), and biomass trajectory, will be fixed in rebuilding plans. A significant difficulty is that "fixed" rebuilding targets such as the biomass trajectory and T_{MAX} are relative, not fixed. They represent probability distributions based on significant scientific uncertainty. The GMT recognizes the tradeoff in establishing "fixed" rebuilding targets to ground rebuilding plans with some certainty versus having the flexibility to change rebuilding strategies and targets, if compelled by future assessments, without having to go through a formal amendment process.

The GMT discussed the required periodic two year Council review process. Options include the Council reviewing how well management measures are meeting rebuilding objectives and checkpoints, a set "STAR-light" assessment for all overfished species every two years, and/or new "STAR-bright" (full reparameterization of assessment models) for overfished species on a periodic basis (every four years?).

The GMT was advised by the relevant stock assessment authors (Dr. MacCall for bocaccio and Dr. Piner for canary rockfish) that the new assessments for these two species would likely change rebuilding plans and recommended management measures designed to achieve rebuilding. On that basis, the GMT recommends the bocaccio and canary rockfish rebuilding plans be incorporated in the second amendment tentatively scheduled for adoption in November. The Council is expected to adopt new management measures for bocaccio and canary rockfish in September. There could be a problem adopting management measures based on new stock assessments that are inconsistent with rebuilding plans that are incorporated in the first amendment scheduled for Council adoption in June. Therefore, the GMT recommends the second rebuilding amendment incorporate bocaccio, canary rockfish, and yelloweye rockfish and be scheduled for final Council adoption at the November meeting.

PFMC
02/27/02

F.3.b
Supplemental HSG Report
March 2002

HABITAT STEERING GROUP COMMENTS ON
UPDATE ON REVISION OF AMENDMENT 12 – REBUILDING PLANS

The Habitat Steering Group (HSG) received an update from Council staff on the status of the rebuilding plans and the inclusion of habitat protection measures. The understanding of the HSG is that habitat-based protection measures will be included in selected rebuilding plans. The broader issue of whether to use protection measures such as marine reserves, gear restrictions, and habitat areas of particular concern (HAPCs) as rebuilding tools will be addressed in the essential fish (EFH) environmental impact statement (EIS).

The HSG has a couple of concerns:

- The proposed timing of the completion of the EFH EIS lags behind the scheduled adoption of the groundfish rebuilding plans.
- Some of the habitat protection measures proposed for the EFH EIS warrant more immediate attention and will not occur until after the rebuilding plans have been adopted.

The HSG proposes that the HAPC process occur concurrent with the development of the EFH EIS. To that end, the HSG will continue its work on the HAPC process and will coordinate with the EFH EIS process and the rebuilding plan process.

PFMC
03/12/02

Exhibit F.3.b
Supplemental SSC Report
March 2002

SCIENTIFIC AND STATISTICAL COMMITTEE COMMENTS ON
UPDATE ON REVISION OF AMENDMENT 12 - REBUILDING PLANS

The Scientific and Statistical Committee (SSC) reviewed and discussed "Some Issues Related to Conducting Rebuilding Analyses for Overfished Groundfish Resources" by Dr. Andre Punt (Exhibit F.3, Supplemental Attachment 1, March 2002), which describes the effect of Monte Carlo uncertainty on rebuilding projections of overfished groundfish stocks. In addition, the effect of a computer coding error on projections of the 2002 optimum yield (OY) of widow rockfish is documented and described. Based upon that discussion, the SSC has the following comments and recommendations regarding groundfish rebuilding projections:

- Rebuilding analyses should consider the effect of Monte Carlo sample size (N) on the variance of rebuilding projections and should adopt a value for final projections that reduces the variance to an acceptable level (e.g., $N \geq 1{,}000$). The SSC will consider modification of the Terms of Reference for Groundfish Rebuilding Analyses to reflect this recommendation.

- The 2002 OY for widow rockfish is probably slightly underestimated in the existing rebuilding analysis. An effort should be made to update the OY so the pending rebuilding plan amendment will include the best available scientific information. For completeness, rebuilding projections for the other overfished stocks should be checked to insure results are unaffected by the computer coding error, although no effect is anticipated.

- The Council should expect numeric details of rebuilding plans to change over time, whether due to technical errors or revised rebuilding analyses arising from updated stock assessments. The SSC recognizes that rebuilding plans must be implemented as fishery management plan (FMP) amendments. In order to streamline the amendment process, it may be desirable, to the extent legally possible, to minimize the use of hard numbers in rebuilding plans as they are described in FMP amendments.

PFMC
03/13/02

Exhibit F.3
Situation Summary
March 2002

UPDATE ON REVISION OF AMENDMENT 12 - REBUILDING PLANS

Situation: An August 2001 decision in NRDC v. Evans ruled that rebuilding plans for overfished West Coast groundfish species are to be Pacific Coast Groundfish Fishery Management Plan (FMP) amendments or regulations to comply with Magnuson-Stevens Act rebuilding provisions.

At the November 2001 Council meeting, the National Marine Fisheries Service (NMFS) recommended the Council revise Amendment 12 of the FMP and develop rebuilding plans as part of an FMP amendment for bocaccio, canary rockfish, cowcod, darkblotched rockfish, lingcod, Pacific ocean perch, and widow rockfish in a two-meeting process for April and June 2002. A rebuilding plan for yelloweye rockfish, which NMFS declared overfished in January 2002, could follow on a separate FMP amendment track, because a rebuilding plan would not be required for that species until January 2003.

The proposed development schedule for the first rebuilding amendment (Amendment 16) would be a draft for Council consideration in April and final Council adoption in June 2002. Some of the provisions in Amendment 12 that frameworked rebuilding plans will be revised in proposed Amendment 16, and it would include rebuilding plans for at least five and possibly up to seven species (all except yelloweye). The proposed second rebuilding amendment, Amendment 18 (Amendment 17 is proposed for frameworking a multi-year management process), would contain the yelloweye rockfish rebuilding plan and any other species not covered in Amendment 16. The Council would consider approving Draft Amendment 18 for public review at its September meeting and take final action in November. The NMFS will brief the Council on the recommended content and development schedule of rebuilding amendments and plans.

Based on discussions at its February 4-7, 2002 meeting, the Groundfish Management Team (GMT) recommends the Council consider including rebuilding plans for bocaccio and canary rockfish in the later rebuilding amendment (proposed Amendment 18) (Exhibit F.3.b, GMT Report on Rebuilding Plans). Revised rebuilding analyses for bocaccio and canary rockfish are expected later this year following new stock assessments. The Stock Assessment Review (STAR) Panel process for 2002 assessments and development of rebuilding analyses has been accelerated this year to be available for Council consideration in June. A rockfish STAR Panel will convene in April to review the new bocaccio and canary rockfish assessments. Therefore, the new stock assessments and revised rebuilding analyses for these two species will be available at the June Council meeting. Given the GMT expectation of significant changes in the bocaccio and canary rockfish outlook from these new assessments, there may be consideration for including these two species' rebuilding plans in Amendment 18 proposed for adoption late in 2002.

Council Task:

1. Provide guidance to NMFS and Council staff on completing rebuilding plans and associated FMP amendments.

Reference Materials:

1. GMT Report and Recommendations for Revising Rebuilding Plans and FMP Amendments (Exhibit F.3.b, GMT Report on Rebuilding Plans).

Agenda Order:

a. Agendum Overview — John DeVore
b. Reports and Comments of Advisory Bodies
c. Public Comment
d. Council Guidance on Completing Rebuilding Plan Amendments

Groundfish Fishery Strategic Plan (GFSP) Consistency Analysis

Rebuilding overfished species, as mandated by the Magnuson-Stevens Fishery Conservation and Management Act, was a primary motive for developing and implementing the GFSP. Many sections of the GFSP describe how rebuilding plans factor into short- and long-term Council priorities for conducting groundfish conservation and management. GFSP objectives such as developing sustainable and effective harvest policies (Sec. II.A.2), achieving fleet capacity reduction (Sec. II.A.3.(b)), allocating groundfish resources (Sec. II.A.4), developing an effective Observer Program (Sec. II.A.5), and development of marine reserves as a groundfish management tool (Sec. II.A.6) are grounded by the need to accomplish the goal of rebuilding overfished groundfish stocks.

PFMC
02/27/02

Some Issues Related to Conducting Rebuilding Analyses for Overfished Groundfish Resources

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Background

The rebuilding analyses for overfished groundfish species are based on conducting projections into the future for a range of different levels of constant fishing mortality or constant catch. The projections all start from the best estimates of the age-structure of the population based on the most recent assessment. Future recruitment is determined by either generating a recruitment from a sub-set of historical estimates or by generating a recruits/spawner ratio from a sub-set of the historical estimates and multiplying this by the spawner stock size for the year for which a recruitment is needed. A large number of simulations are conducted for a range of fishing mortalities / constant catches to identity the levels that correspond to a set of pre-specified probabilities of the spawner stock size exceeding the target level of 40% of the virgin spawner stock size in some future year (10 years after the species was first declared overfished or the minimum time to rebuild plus one mean generation).

Although the algorithm for conducting rebuilding analyses is fully specified, it involves Monte Carlo simulation so a rebuilding analysis should be considered to be a form of estimation rather than of calculation. This is because there is some (Monte Carlo) uncertainty associated with the outcomes from a rebuilding analysis due to the fact that it is not feasible to conduct projections for every combination of year and recruits/spawner ratio for example. The extent of Monte Carlo uncertainty would be greater if aspects of the rebuilding analysis, other than just future recruitment (e.g. the initial age-structure), were considered uncertain.

Implications of Monte Carlo uncertainty

Table 1 lists 2002 OYs for widow rockfish for a range of recovery probabilities from 50% to 80% and illustrates the sensitivity of the results to the number of simulations, N, from 100 (the value on which the original widow rockfish rebuilding analysis was based) to 1000. Ten analyses for each choice of N are shown in Table 1. The key result in this table is that the 2002 OYs differ among runs due to Monte Carlo uncertainty. As expected, the extent of Monte Carlo uncertainty, as quantified by the coefficient of variation (CV) of the 2002 OY, is reduced when the number of simulations, N is increased from 100 to 1000 (although the reduction in CV once N reaches 500 is perhaps not as large as expected, several of the CVs actually increase when N is increased from 500 to 1000). It is pleasing to note that the average values for the 2002 OYs for the three values for N are very similar, as expected.

It should be noted that the generation of future recruitment when selecting the fishing mortalities / constant catches is not the only source of Monte Carlo uncertainty in Table 1. Another source for this uncertainty is the calculation of the minimum rebuild time, which is also determined using Monte Carlo methods. Therefore, the values in the rows in Table 1 may differ slightly (by 1 year) because the minimum time to rebuild differs.

The Widow Rockfish Rebuilding Analysis

The results in Table 1 differ quite substantially from those presented in MacCall and Punt (2001). For example, the 2002 OY for a 50% probability of recovery is 921 mt in MacCall and Punt (2001), which is lower than any of the values in Table 1 for this quantity. Detailed examination of the computer code used for the calculations in MacCall and Punt (2001) [an early version of the rebuilding software] revealed a computational problem when conducting the Monte Carlo simulations, which meant that the number of simulations actually conducted was less than intended.

Recommendations

1. Quantification of the extent of Monte Carlo uncertainty should be a standard component of all rebuilding analyses. The software developed to conduct rebuilding analyses has been modified to allow this source of uncertainty to be quantified in a relatively straightforward fashion.
2. The SSC should consider specifying the number of simulations chosen to ensure that the CV for the key output quantities is less than a pre-specified value (noting that the CV for the 2002 OY is sensitive to the probability of recovery).
3. The rebuilding analysis for widow rockfish should be replaced by one based on the most recent version of the rebuilding software.
4. All existing rebuilding analyses should be repeated to determine the extent of Monte Carlo uncertainty associated with the 'key model outputs'. The SSC needs to specify these 'key model outputs'.

Reference

MacCall, A.D. and A.E. Punt. 2001. Revised rebuilding analysis for widow rockfish. Pacific Fishery Management Council, 7700 NE Ambassador Place, Suite 200, Portland, OR 97220-1384 (9pp).

Table 1. 2002 OYs for widow rockfish based on 10 applications of the rebuilding analysis software for each of three choices for the number of simulations, *N*. Results are shown for rebuilding probabilities of 50%, 60%, 70% and 80%.

	Probability of recovery											
	N=100				*N*=500				*N*=1000			
Run	**50**	**60**	**70**	**80**	**50**	**60**	**70**	**80**	**50**	**60**	**70**	**80**
1	1028	928	783	678	977	891	791	691	965	879	794	686
2	1016	954	828	684	1004	918	824	720	1009	938	835	725
3	1036	918	834	729	1009	919	848	747	1005	918	840	736
4	1013	901	842	767	986	906	822	713	999	912	828	717
5	986	875	772	691	981	889	809	713	978	886	798	705
6	1000	862	787	708	1024	931	838	741	1021	930	834	747
7	936	882	835	724	989	898	821	739	1009	911	823	724
8	990	890	835	718	1008	904	817	709	986	886	792	688
9	990	936	847	719	1018	936	864	769	1001	921	832	726
10	976	895	792	695	990	920	809	697	963	877	788	681
Average	997	904	815	711	999	911	824	724	994	906	816	714
SD	28.9	29.1	28.4	26.4	16.2	16.1	21.0	24.3	19.7	22.1	20.9	22.5
CV	2.90	3.22	3.48	3.71	1.62	1.77	2.55	3.35	1.98	2.44	2.56	3.15

AD HOC GROUNDFISH MULTI-YEAR MANAGEMENT COMMITTEE REPORT

Introduction

The purpose of the Groundfish Multi-year Management Committee (GMMC) was to scope multi-year management approaches for the West Coast groundfish fishery. The approaches developed by the GMMC are to be synchronized with a multi-year groundfish stock assessment schedule, as well as full accommodation of federal notice and comment requirements.

Overarching this change to the groundfish management process is the need to balance changing groundfish management with working on the myriad other groundfish items (e.g., capacity reduction, Environmental Impact Statement (EIS), rebuilding plans, strategic plan initiatives). Moreover, these groundfish workload items must also be balanced against the suite of other Council managed fisheries and related projects (e.g., salmon, coastal pelagic species, highly migratory species, halibut, habitat).

This report reviews current management constraints and a variety of solutions discussed by the GMMC. Detailed multi-year management approaches are provided in the attached tables. The approaches in these tables represent the range of scenarios discussed by the GMMC. The committee's recommendations focus on the management approaches deemed most practical by the GMMC.

Two public meetings of the GMMC were held – December 13-14, 2001 and January 31-February 1, 2002.

This report is organized as follows: this Introduction provides background to the work of the GMMC; Issues and Solutions discussed by the GMMC are then presented; Multi-year Management is discussed, including rationale, constraints, science considerations, fishery start date considerations, and a recommended range of alternatives; Transition issues and recommendations are discussed; and a summary of specific Recommendations is provided at the end.

Issues and Solutions

As noted above, the central issues considered by the GMMC included:

- optimize development of management specifications and measures;
- fully accommodate federal rulemaking, public notice and comment;
- ensure timeliness of science; and
- ease management process burden (i.e., optimization should decrease the burden).

Associated issues (i.e., issues to be considered and issues that shape available solutions) included:

- How many Council meetings are needed to develop specifications and management measures?
- When should the fishing season start?
- What needs to be done to coordinate with state management?
- How many transition years will be necessary prior to implementation of the revised management process?
- How quickly can the fishery management plan (FMP) amendment be developed and implemented?
- Will single year or multi-year specifications be used?
- When will new assessments be done? How many? How will assessment updates be handled in the Stock Assessment Review (STAR) process?
- When will new science be used in the management process?
- It is estimated that it takes (at least) 3 months to develop specifications and the environmental assessment (EA) prior to final Council action, and 5 months for federal rulemaking process after final Council action. Any option that does not provide (adequate) time for developing EA, Council consideration, and rulemaking process will not be considered as viable.

Three general scenarios were discussed as means to provide for development of specifications and management measures, and time for federal rulemaking –

1. Multi-year management.
2. Change fishery start date (e.g., from January 1 to March 1 or May 1).
3. Change Council meeting schedule.

For multi-year management to be effective (i.e., provide the time necessary) it would have to be combined with, at least, (2) and, possibly, (3). If accommodating federal rulemaking is the only objective, changing the fishery start date could provide the time necessary for public notice and comment. Both scenarios 1 and 2 require an amendment to the FMP. Changing the fishing season start date could have several negative impacts – market disruption, compromise data time series, timing of specific fisheries (e.g., whiting) – and will likely require broad public discussion.

Multi-Year Management

The GMMC discussed numerous reasons in support of multi-year management:

- At least 8 months is required to develop and implement groundfish specifications and management measures, multi-year management may provide a better fit than annual management.

- Long-lived, slow growing species predominate the groundfish species complex. Year-to-year management changes might not significantly affect these populations. Thus, multi-year management may be a better fit.

- Multi-year management could make time available for other groundfish workload items, e.g., capacity reduction and strategic plan implementation.

- Multi-year management could make time available to improve the science process. If designed with an "off" year (i.e., assessments done every other year) scientists might have more time to develop and review new methodologies. These science improvements could facilitate more assessments during "on" years.

- At present, major management changes are introduced with new specifications. Thus, full rulemaking and public notice and comment is necessary to provide time for stakeholders to review and comment on the recommended management actions.

- Current management complexity (i.e., rebuilding depleted stocks, constructing trip limits, maintaining year-round fishing opportunities, balancing recreational and commercial opportunities) necessitates several Council meetings to develop specifications and management measures. If multi-year management reduces this complexity, fewer meeting might be necessary for the management process.

The GMMC also discussed constraints on multi-year management:

- Multi-year management could create a larger lag between when science is developed and when it is used to manage the fishery. The design of the program can minimize the lag, but it is still likely to be greater than at present.

- Multi-year management would have to be synchronized with development, use, and two-year mandated review of rebuilding plans and rebuilding analyses.

- If species assessments are to occur only every other year, resources (staff and funding) would be needed to effectively do a larger number of assessments.

- As resource surveys become more frequent, more information will be available annually. A concerted effort will be necessary to prevent unprocessed data from triggering mid-cycle changes to the management specifications. A process might be needed to perform mid-cycle reviews of fisheries and new data to ensure management is on the right track.

Several issues related to science will need to be considered in crafting a multi-year management process:

- The timeliness of the science is critical to management effectiveness. Any management scenario will need to provide the necessary time to develop and review science.
- In analyzing the current management process versus a new system, current delays will need to be compared to the expected delays from a revised process.
- The earliest that the science can be ready for the management process is prior to the June Council meeting. Assessments are done the first of the year and the STAR process occurs in Spring.
- Some fishery dependent data might be available earlier, e.g., catch data. However, age composition information and resource survey data are not available prior to January.
- There was some discussion of not doing stock assessments in 2003. However, these assessments will be needed to set 2004 (or 2004-2005 if multi-year) specifications.

Relative to the fishery start date two major themes emerged:

- Starting the fishery January 1 is impractical given the amount of time needed for development of the management specifications and the federal rulemaking process. That is, even if the Council were to take final action on management specifications in September there is not enough time for rulemaking and notice and comment prior to January 1.
- In contrast, fishing interests provided several reasons against a change from January 1. These include ensuring even year-round product flow to preserve markets. In addition, West Coast fisher are very diverse, different sectors fish at different times of the year. The timing of the whiting fishery is also of concern, the April shoreside whiting fishery would need to be accommodated.

Timeliness of science will also influence the fishery start date. Accommodating a January 1 fishery start date requires the Council to take final action on management specifications and measures in June of the prior year. Because new science is not available until June, this management scenario would require use of the previous year's science. For example, for January 1, 2004 fishery – specifications and measures would be set in June 2003, but based on science from June 2002.

In contrast, with a May 1 fishery start, final Council action could be in September and based on science from June of the same year. For example, for May 1, 2004 fishery – specifications and measures would be set in September 2003 based on June 2003 science. A May 1 start date might also provide enough time for a 3-meeting Council process (e.g., June, September, November), with 5 months for federal rulemaking and notice and comment.

In addition to the issue of timeliness, a change to the start date would alter historic fishery dependent data series. In the short term, work would be necessary to ensure the data collected under the new fishing regime would be comparable to historic data.

Alternatives:

The attached tables provide a wide range of possible multi-year management scenarios. The attachments also include a description of the various issues involved.

Based on the considerations above, the GMMC suggests the Council consider evaluating the following alternatives as a reasonable range of what is most practical:

A. 2-meeting annual process, Sept. (proposed) and Nov. (final), Fishing Year starts Jan 1.
B. 2-meeting biennial process, June (proposed) and mid-August (final), Fishing Year starts Jan 1.
C. 3-meeting biennial process, April (proposed ABC/OY), June (final ABC/OY, proposed management), and Sept (final management) Fishing year starts March 1.

D. 3-meeting biennial process, Nov (proposed ABC/OY), April (final ABC/OY, proposed management), and June (final management) Fishing year starts Jan 1.
E. 3-meeting biennial process, June (proposed ABC/OY), Sept. (final ABC/OY, proposed management), and Nov. (final management) Fishing year starts May 1.
F. 2-meeting biennial process, June (proposed) and Sept (final), Fishing Year starts March 1.

Transition to the Revised Management Process

Setting 2003 Specifications

For setting 2003 specifications, neither a June, September, November process with the fishery starting January 1; nor a June, September process with the fishery starting January 1 accommodate the 5 months needed for rulemaking/notice and comment after a Council decision. Delaying the start of the fishery would make either June-November or June-September possible. However, delaying the start of the fishery requires an FMP amendment, which might not be in place by January 1, 2003.

Given the time needed for rulemaking and the inability to delay the fishery start, the GMMC discussed the possibility of using interim regulations to cover the period prior to March 1 (if the Council takes final action in September) or May 1 (if the Council takes final action in November).

Two transition options were suggested:

1. June, September, November Council process with EA developed prior to the November meeting; December through April 30 rulemaking and notice and comment period; fishery start May 1; 4 months of interim regulations.

2. June, September Council process with EA developed prior to the September meeting; October through February 28 rulemaking and notice and comment period; fishery start March 1; 2 months of interim regulations.

It was highlighted that while the two-meeting process (June-September) provides time for federal rulemaking, it confines the Council process and workload into two meetings. Conversely; the three-meeting process provides more time for the Council, but makes it harder to accommodate the (5 month) rulemaking process.

It was suggested that interim regulations of two months might be deemed more reasonable than interim regulations for five months. Thus, the GMMC suggests the June-September alternative would be more practical.

In 2002, the management process would be as follows – in June the Council takes preliminary action on ABC/OY and management measures for 2003; final action occurs in September; for January 1 through February 28, either interim regulations are used or management specifications from this time period in 2002 are used. This would provide October through February 28 for federal rulemaking and notice and comment. Concurrent to developing 2003 specifications an FMP amendment would be developed for multi-year management and/or modification of the fishery start date.

Interim regulations could be developed during 2002 (based on new information), i.e., "revised interim." Or, 2002 regulations for the January through February period could be used, i.e., "roll over interim."

Prior to the June Council meeting, the Ad-hoc Allocation Committee would need to be apprized of preliminary ABC and OY values, and begin to devise management measure recommendations.

Beyond 2003 Specifications

Relative to transitioning to multi-year management, if the expectation is that multi-year management will be implemented starting in 2004 specifications could be developed for longer than 12 months. For example, 16 month regulations (January 2003 - February 28, 2004) would provide for a multi-year management approach with a new fishing year starting in March 2004. Other transition options also exist

Recommendations

The GMMC recommends the Council forward the issues and options related to multi-year management, federal rule making, timeliness of science, and fishery start date to the SSC and groundfish advisory bodies for consideration at the April Council meeting. Further, the GMMC recommends that in April the Council consider initiating the FMP amendment process to address multi-year management and/or changing the fishery start date. The aim would be to complete the FMP amendment in 2002, the new process would be used in 2003 for developing the 2004 (2004-2005) specifications.

For setting 2003 specifications, the GMMC recommends altering the three-meeting process adopted for use in 2002 to a June-September Council meeting process with interim regulations for January and February 2003.

PFMC
02/27/02

Groundfish Multi-Year Management Issues

The Groundfish Multi-Year Management Committee (GMMC) met December 13-14, 2001 and January 31-February 1, 2002 to discuss multi-year management alternatives to the current annual groundfish management process and ways to accommodate notice and comment rulemaking into the specifications and management measures process. Several issues arose in discussion that would affect the timing of both the science process and the Council/NMFS management process. The GMMC also discussed transitional issues for moving from the current annual specifications and management measures cycle to a multi-year cycle.

Process Issues	
Council Meeting Discussion Two-meeting or three- meeting Council processes	Whether two-meeting or three-meeting, the Council process would include development of ABCs/OYs, management measures to achieve ABCs/OYs of healthy stocks while protecting overfished stocks, and a National Environmental Policy Act (NEPA)/ Regulatory Flexibility Act (RFA) analysis of the environmental and socio-economic effects of setting the specifications and management measures. • In a two-meeting process, both specifications *and* management measures would be proposed in Meeting 1 and finalized in Meeting 2, with complete NEPA/RFA analysis available prior to Meeting 2. For Council staff workload, work time is needed between proposed and final meetings – six-week September-November period in 2001 proved inadequate. • In a three-meeting process, specifications would be proposed in Meeting 1 and nearly finalized in Meeting 2, then management measures would be proposed in Meeting 2 and finalized along with specifications in Meeting 3; complete NEPA/RFA analysis available prior to Meeting 3. For Council staff workload, work time is most needed between 2nd and 3rd meetings – six-week September-November period in 2001 proved inadequate. • Regardless of how many meetings are chosen, if preferred alternative includes an April meeting, could be a conflict with typically salmon-intensive meetings.
NMFS Publication/ Decision Proposed and Final Rule notice and comment process mandated by courts	For 2002, the annual specifications and management measures are expected to be finalized by 3/1/02, four months after the Council's 11/1/01 final recommendation. This publication has been on the fast track at all levels of NOAA and was still slowed by factors not under the agency's control (Federal Register publication difficulties.) The publication/decision process from Council recommendation to final rule commonly takes 6 months. For future specifications proposed rule drafting, 30-day comment period and response time, agency/public will require no less than 5 months. • Jan. 1 season start date requires Council final decision by end of July • March 1 season start date requires Council final decision by end of Sept. • May 1 season start date requires Council final decision by end of Nov.

Process Issues, continued	
Stock Assessments Scientific process of moving from survey to completed assessment, with peer review	For species with stock assessments, an assessment for a particular species is now conducted once every 3 years. These assessments use data from a variety of sources, but rely most heavily on the NMFS shelf and slope survey data. • Science centers developing new groundfish survey schedules, with surveys likely occurring biennially or annually. • Science centers developing new STAR process that would continue rigorous STAR process for new modeling and assessment methodology, or for newly assessed species, but with an accelerated review for already-assessed species in which data is plugged into peer-reviewed models ("STAR-lite" review for "turn-the-crank" assessments) Science Centers could go to a two-year schedule of Assessment Year, Modeling Year, Assessment Year, Modeling Year, etc. Full STAR processes could occur in each year, depending on the models/species considered.
"Age" of Data" When is survey data assessed and used in fishing?	Because stocks are assessed every 3 years, harvest levels in any one year will be based on survey data that is 3-5 years old for the different species managed, when assessments are completed on schedule. For those species not assessed on schedule, harvest levels may be based on 6-7 year old data. • How does management option chosen affect the use of best available data? • Is the most *recently* available data also the *best* available data? Up-to-the-minute data may not be the best available data if it has not been reviewed for completeness and accuracy.
Mid-Cycle Review End-of-year review for harvest levels and specifications in a multi- year process	Even if the Council goes to a multi-year specifications and management measures process, new stock status information from surveys will be available to government agencies and the groundfish-interest public. • If stock assessments are available only every other year, should Council build prohibitions into the FMP that would disallow mid-cycle adjustments to ABCs/OYs based on assumptions about survey data? • Alternatively, could Council build in a mid-cycle review with triggers for changes to harvest levels when new stock information indicates that the stock is above or below pre-established trigger points?

Process Issues, continued	
Rebuilding Plans From stock assessment through declaration as overfished to FMP amendment	The Council must integrate the rebuilding plan process into the management plan process. When a stock assessment is prepared during the management development process, it could show that a stock is overfished. As is currently the case, when the final ABC/OY are adopted, they will be adopted based on this information and the stock will be declared overfished. The following year, an off-year for management, the rebuilding plan must be developed as an FMP amendment and submitted to NMFS for review and approval. The approval decision should be made prior to action on the specifications and management measures so that implementation of the rebuilding plan can be taken into account in development of the specifications and management measures, the on-year for management. • A two year cycle would be: Rebuilding Amendment Year, Specifications Development Year, Rebuilding Amendment year, Specifications Development Year, etc. • Overfished species, particularly newly declared overfished species, will likely involve more rigorous Science Center efforts than other species. How do we integrate two-year science schedule with two-year management schedule?
Changing Fishing Year	• Changing the fishing year from current calendar year schedule would have initial "start up" costs for science programs to ensure that BEFORE and AFTER data were comparable. • If fishing year start date is altered, new start date should be a MRFSS wave start date. • With March/May start date, Council and industry would need to be disciplined about calling for inseason increases that might lead to early closures at the end of the cycle, which would occur during stronger winter marketing months. • May 1 start date would force Council family to re-think whiting and fixed-gear primary sablefish seasons, which now begin in April. May 1 start date could also disrupt marketing opportunities during Lent, a stronger fish-marketing period. • How would the proposed change in fishing year affect our ability to monitor and structure catch inseason, particularly in the November through April period? GAP/GMT meetings in March? • Any state-managed fisheries that would be negatively affected by changing the fishing year?

"Getting There" Issues	
Transition Year	For each multi-year management option considered by the Council, we will likely need a transition year for moving from the current process to the new process: • Moving to multi-year management would require an FMP amendment. GMMC has proposed April 2002 (scoping), June 2002 (proposed), September 2002 (final) for Council process. • How would the two-year science schedule fit into transition year? • If 2003 is the transition year, how much of 2002 specifications and management measures package could be used as draft for 2003? • Should 2003 EA be written to cover 2004 management in case we have to change fishing start dates?
Changing Council Schedule	Could any of the scenarios devised under "Process Issues" be improved for participants through a change in the timing of Council meetings? For example, an August meeting instead of a September meeting? • What kind of lead time does Council staff need to change hotel arrangements? • Will we need to hold GAP/GMT meetings in March? • Would changing Council schedule affect non-groundfish fisheries management schedules?

Groundfish Multi-Year Management Options Considerations

("Y" = "Year")

Option	**Science Process** *Stock assessments occur Jan-May needed for all options. Different schedule indicated when more time available.*	**Data/Stock Assessment Use** *May not survey all stocks in all years. Y1 survey data used in Y2 assessment process.*	**Council Process** *Council process and workload more or less burdensome depending on whether 2- or 3-meeting process*	**NMFS Process** * 5 months minimum needed for proposed rule, comment period and response time*	**Industry Needs/Effects** *Where process is 2-years, discipline is needed in 1st fishing year to not push limits higher in Council process – otherwise fewer fish available for 2nd year, possible early closures*
A. Status quo, 2-meeting annual process, 1/1 start, same PFMC dates. Annual process PFMC meets Sept. (proposed) and Nov. (final), Fishing Year starts Jan 1.	• 1/3 of stocks each year (labelled as groups A, B, and C in next box ➔) • STAR process for all assessed species, each year	• Year 1 survey info used in Y3 fishing for stock group A • Y1-2 survey info used in Y4 fishing for stock group B • Y1-3 survey info used in Y5 fishing for stock group C	• 7 months for Council staff and committees work on NEPA/RFA, SAFE documents • Less overall Council time for issues other than specifications	• 2 months for implementation, inadequate • Less overall NMFS time for issues other than specifications	• Start date the same, process same, so little/no industry adjustment • Less Council/NMFS time to work on other industry issues
B. 2-meeting, biennial process, 1/1 start, change PFMC dates. PFMC meets June (proposed) and mid-August (final), Fishing Year starts Jan 1	• All stocks assessed every other year with STAR or STAR-lite review • Intervening years have STAR process for models, new overfished spp.	• Year 1 survey info used in Y3-4 fishing for all stocks • Y2 survey info used in Y5-6 fishing • Y3 survey info used in Y5-6 fishing	• 7 months for Council staff and committees work on NEPA/RFA, SAFE documents • More time for issues other than specifications • Change in meeting dates required	• 4.5 months for implementation, inadequate • More NMFS time for issues other than specifications	• Start date the same • 2-year process, possible early closures if limits not controlled • More Council/ NMFS time to work on other industry issues

Option	Science Process *Stock assessments occur Jan-May for all options. Different schedule indicated when more time available.*	Data/Stock Assessment Use *May not survey all stocks in all years. Y1 survey data used in Y2 assessment process.*	Council Process *Council process and workload more or less burdensome depending on whether 2- or 3-meeting process*	NMFS Process * 5 months minimum needed for proposed rule, comment period and response time*	Industry Needs/Effects *Where process is 2-years, discipline is needed in 1st fishing year to not push limits higher in Council process – otherwise fewer fish available for 2nd year, possible early closures*
C. 3-meeting, biennial process, 3/1 start, same PFMC dates. PFMC meets April (proposed ABC/OY), June (final ABC/OY, proposed management), and Sept (final management) Fishing year starts March 1	• Stock assessments could occur Jan-Mar of following Y • All stocks assessed every other year with STAR or STAR-lite review • Intervening years have STAR process for models, new overfished spp.	• Year 1 survey info used in Y4-5 fishing for all stocks • Y2 survey info used in Y6-7 fishing • Y3 survey info used in Y6-7 fishing	• 11-19 months for Council staff and committees work on NEPA/RFA, SAFE documents • More time for issues other than specifications • Inseason adjustments for last 3 months made at Nov meeting. • Conflict with salmon management schedule	• 5.5 months for implementation, adequate • More NMFS time for issues other than specifications	• Change in fishing year requires business planning changes for industry • 2-year process, possible early closures if limits not controlled • More Council/ NMFS time to work on other industry issues • Fishing based on older data than in options A, B, E, F
D. 3-meeting, biennial process, 1/1 start, same PFMC dates. PFMC meets Nov (proposed ABC/OY), April (final ABC/OY, proposed management), and June (final management) Fishing year starts Jan 1	• Stock assessments occur Jan-Oct • All stocks assessed every other year with STAR or STAR-lite review • Intervening years have STAR process for models, new overfished spp.	• Year 1 survey info used in Y4-5 fishing for all stocks • Y2 survey info used in Y6-7 fishing • Y3 survey info used in Y6-7 fishing	• 14 months for Council staff and committees work on NEPA/RFA, SAFE documents • More time for issues other than specifications • No change in meeting dates • Conflict with salmon management schedule	• 6.5 months for implementation, adequate time • More NMFS time for issues other than specifications	• Start date the same • 2-year process, possible early closures if limits not controlled • Fishing based on older data than in options A, B, E, F • More Council/ NMFS time to work on other industry issues

Option	Science Process *Stock assessments occur Jan-May for all options. Different schedule indicated when more time available.*	Data/Stock Assessment Use *May not survey all stocks in all years. Y1 survey data used in Y2 assessment process.*	Council Process *Council process and workload more or less burdensome depending on whether 2- or 3-meeting process*	NMFS Process * 5 months minimum needed for proposed rule, comment period and response time*	Industry Needs/Effects *Where process is 2-years, discipline is needed in 1st fishing year to not push limits higher in Council process – otherwise fewer fish available for 2nd year, possible early closures*
E. 3-meeting, biennial process, 3/1 start, same PFMC dates. PFMC meets June (proposed ABC/OY), Sept. (final ABC/OY, proposed management), and Nov. (final management) Fishing year starts May 1	• All stocks assessed every other year with STAR or STAR-lite review • Intervening years have STAR process for models, new overfished spp. • Database adjusting for change in fishing year	• Year 1 survey info used in Y3-4 fishing for all stocks • Y2 survey info used in Y5-6 fishing • Y3 survey info used in Y5-6 fishing	• 9 months for Council staff and committees work on NEPA/RFA, SAFE documents • More time for issues other than specifications • Inseason adjustments in Nov. and March possibly ill-timed for May 1 fishery start • Re-evaluation of whiting and fixed gear sablefish season management required	• 6 months for implementation, adequate • More NMFS time for issues other than specifications	• Change in fishing year requires business planning changes for industry • 2-year process, possible early closures if limits not controlled • 5/1 fishery start conflicts with current whiting and fixed gear sablefish seasons, interrupts Lenten marketing period. • More Council/ NMFS time to work on other industry issues
F. 2-meeting, biennial process, 3/1 start, same PFMC dates. PFMC meets June (proposed) and Sept (final), Fishing Year starts March 1	• All stocks assessed every other year with STAR-lite • Intervening years have STAR process for models, new overfished spp. • Database adjusting for change in fishing year	• Year 1 survey info used in Y3-4 fishing for all stocks • Y2 survey info used in Y5-6 fishing • Y3 survey info used in Y5-6 fishing	• 9 months for Council staff and committees work on NEPA/RFA, SAFE documents • More time for issues other than specifications • No change in meeting dates • Inseason adjustments for last 2-3 months made at Nov meeting	• 5.5 months for implementation, adequate • More NMFS time for issues other than specifications	• Change in fishing year requires business planning changes for industry • 2-year process, possible early closures if limits not controlled • More Council/ NMFS time to work on other industry issues

UPDATE REPORT FROM THE OPEN ACCESS PERMITTING SUBCOMMITTEE

The Open Access Permitting Subcommittee, a subcommittee of the Ad Hoc Groundfish Strategic Plan Oversight Committee (SPOC), met January 30-31, 2002. Mr. LB Boydstun agreed to serve as the chair for the committee. The committee adopted preliminary goals and objectives and requested certain data on the open access fishery. The committee will meet again in a conference call starting at 10 a.m. on March 26th. At that time, it will review any preliminary results from its data request. The committee intends to provide a full report on its efforts to date for review by the Council and advisory bodies at the April 2002 Council meeting.

The preliminary goals and objectives the committee adopted at its January meeting pertain only to the directed segment of the fishery and were an adaptation of those used for the groundfish Amendment 6 license limitation program. Goals and objectives for the incidental sector of the open access fishery would likely vary substantially from those established to guide development of a program for the directed segment.

The data request developed by the committee will involve an attempt to divide open access landings into directed and incidental harvest (draft request attached). Numerous gear and species combinations will be evaluated over a long time period (1990 to the most recent data available). Results will be provided for Washington, Oregon, and three subregions of California (divided at Cape Mendocino and Point Conception).

PFMC
02/27/02

DRAFT - Open Access Fishery Descriptive Data Request

Overall request: coordinate development of direct and incidental open access fishery categories with the effort being under taken for the programmatic EIS.

Groundfish Species Categories

Provide catch and bycatch information on the following groundfish categories.

Sablefish
Lingcod
Cabezon
Kelp Greenling
Other Roundfish

Dover
Other Flatfish

Thornyheads
Widow Rockfish
Yellowtail Rockfish
Chilipepper Rockfish
Canary Rockfish (there will be bad resolution prior to 1994 or 1995)
Bocaccio
Black Rockfish
Blue Rockfish
Other Rockfish (Split between live and dead using a price criteria. Explore $2.50/lb. Adjust by time and area.)

Dogfish
Other Groundfish

Geographic Splits

Use port of landing as a proxy for catch area. The catch area field is not very reliable and is often filled out based on port of landing.

Areas

Washington
Oregon
Northern - north of Coos Bay
Southern - Coos Bay south
California -
Northern - north of Cape Mendocino
Central - Cape Mendocino to Point Conception
South - south of Pont Conception

Time Periods

Provide data for 1990 through 2001.

Directed Open Access Groundfish Fisheries

Provide data on the following directed groundfish gears.

Deadfish

Other Hook and Line Gears
- Vertical Hook and Line
- Jig
- Rod and Reel

Longline
Troll/Dinglebar
Pot
Trawl (Sculpin targeted with prawn trawl gear. These may be short tows targeted on live fish.)

Livefish

Stick
Rod and Reel
Pot

Incidental Harvest Fisheries

Provide additional information from the perspective of the nongroundfish target fishery–e.g.,

for the halibut fishery provide number of halibut vessels,
total pounds of halibut caught by all vessels,
number of halibut vessels with groundfish bycatch,
amount of groundfish bycatch, and
amount of halibut as bycatch in the groundfish fishery.

Provide information on the following open access incidental fisheries:

			State		
Species	Gear	Other Notes	WA	OR	CA
Pink Shrimp	Trawl		Y	Y	Y
Spot Prawn	Trawl Pot		No GF	No GF	Y
California Halibut	Trawl Hook & Line		NA	NA	Y
Pacific Halibut	Longline		Y	Y	Y
Dungeness Crab	Pot		No GF	Y	Y
Salmon	Troll	Split out Trips with - Halibut bycatch - Gf bycatch	Y	Y	Y
Sea Cucumber	Trawl		NA	NA	Y
CPS Squid	Round Hall		No GF	No GF	Y

Species	Gear	Other Notes	State		
			WA	OR	CA
	Setnet				Y
CPS Finfish	Round Hall Setnet		No GF	No GF	Y
Sheephead	Traps		NA		Y
HMS	Troll Longline Pole & Line Driftnet Purse Seine Harpoon		Y	Y	Y
Gillnet Complex (California Halibut, White Sea Bass, Sharks, White Croaker	Drift Gillnet		NA	NA	Y

Note: "No gf" means groundfish may not be legally retained in this fishery.

State of California - The Resources Agency
DEPARTMENT OF FISH AND GAME
http://www.dfg.ca.gov
1416 Ninth Street
Sacramento, CA 95814
(916) 653-7667

Exhibit F.4.e
RECEIVED Supplemental CDFG Propsal
March 2002

MAR 5 2002

PFMC

February 20, 2002

Dr. Donald O. McIsaac, Executive Director
Pacific Fishery Management Council
7700 NE Ambassador Place, Suite 200
Portland, Oregon 97220-1384

Dear Dr. McIsaac:

We request the Pacific Fishery Management Council (Council) please consider a proposal for the transfer of management authority for cabezon, kelp greenling, and all minor nearshore rockfish harvested off California to the State. The proposal would involve the removal, deferral or delegation of these species from the Pacific Coast Groundfish Management Plan, which would require an amendment to the federal plan.

California's request for management authority comes after a decade of decline in nearshore groundfish stocks, aggravated relations between recreational and commercial fishermen, gear conflicts between different components of the fisheries, and a change in oceanographic conditions that has reduced productivity and recruitment of nearshore groundfish stocks. The California Legislature passed the Marine Life Management Act (MLMA) in 1998. The Act provides that fishery management plans will form the basis for managing California's recreational and commercial marine fisheries and requires the California Fish and Game Commission to adopt a fishery management plan for the nearshore fishery. A total of 19 species has been identified in our draft nearshore fishery management plan. Sixteen of these species are managed by the Council under the Groundfish Plan (see enclosed table). Consequently, we cannot implement our nearshore plan and address the concerns of our constituents and the status of our resources without the management authority for those nearshore groundfish listed in the federal plan and for which we have overlapping jurisdictions.

We request the opportunity to discuss our proposal at the March 2002 meeting under the agenda item set aside for issues related to Groundfish Strategic Plan Implementation. As you will recall, transfer of management authority for certain nearshore groundfish stocks is one of the recommendations contained in the Council's Groundfish Strategic Plan. In our Council discussion, we will provide the basis for our request and lay out a proposed time line for completion of a groundfish plan amendment. We recognize the heavy work load that Council and National Marine Fisheries Service staff are currently facing, so we will offer to undertake (with Council and NMFS guidance) most of the workload associated with the plan amendment process.

The Department's Intergovernmental Affairs Representative, Mr. LB Boydstun, will be available at your meeting to discuss our proposal.

Sincerely,

ROBERT C. HIGHT
Director

Enclosure

cc: L. B. Boydstun, Representative
Intergovernmental Affairs Office

Robert R. Treanor, Executive Director
California Fish and Game Commission

INFORMATIONAL TABLE FOR 16 NEARSHORE GROUNDFISH
UNDER CONSIDERATION FOR TRANSFER OF AUTHORITY TO CALIFORNIA

SPECIES	Coastal Distribution	Depth* (ft) Distribution				Harvest Recreational	Harvest Commercial			Harvest % Rec		Location % Com		Landings by % Weight California**					Landing*** Condition		Mangement Measures		
		< or = 180	< or = 360	< or = 540	>540		CA	OR	WA	CA Waters	Federal Waters	CA Waters	Federal Waters	Hook-and-line	Trap	Trawl	Net	Misc/unknown	% Live	% Dead	Min-Size Limits	Species OY+	Group OY++
Black RF	[illegible]		x			[illegible]	x	x	x	91	9	70	30	96		3		1	6	94		x	
Blue RF	[illegible]	x				[illegible]	x	x		81	19	60	40	96	1	1		2	6	94			x
Cabezon	[illegible]	x				[illegible]	x	x		86	14	94	6	73	26			1	84	16	x	x	
China RF	[illegible]		x			[illegible]	x	x		100	0	78	22	97		2		1	40	60	x		x
Kelp Grn	[illegible]	x				[illegible]	x			92	8	81	19	69	24	6		1	82	18	x	x	
Scorpionfish	[illegible]			x		[illegible]	x			67	33	50	50	55	7	32	5	1	48	52	x		x
Copper RF	[illegible]			x		[illegible]	x	x		84	16	68	32	97		1		2	22	78			x
Brown RF	[illegible]	x				[illegible]	x			100	0	83	17	88	1	9		2	51	49			x
Gopher RF	[illegible]	x				[illegible]	x			100	0	95	5	88	10	1	1		66	34	x		x
Quillback RF	[illegible]	x				[illegible]	x	x	x	[illegible]	[illegible]	74	25	98			1	1	45	55			x
Grass RF	[illegible]	x				[illegible]	x			99	1	99	1	90	9			1	88	12	x		x
Kelp RF	[illegible]	x				[illegible]	x			100	0	98	2	93	5	1	1		71	29	x		x
Treefish	[illegible]	x				[illegible]	x			91	9	100	0	85	3	11	1		55	45			x
Olive RF	[illegible]	x				[illegible]	x			67	33	85	15	95	2	3			28	72			x
Blk&Ylw RF	[illegible]	x				[illegible]	x			100	0	99	1	72	28				63	37	x		x
Calico RF	[illegible]		x			[illegible]	x																x

** Common Distribution*

*** Cmaster Data From 1994-2000*

**** Percent Live Verses Dead Based on Condition Recorded on Market Receipts, 1994-2000*

+ Species specific OY black rf PFMC; cabezon and greenlings California

++ Group OY for minor rockfish PFMC

DRAFT SUMMARY MINUTES

Groundfish Multi-Year Management Committee

Ad Hoc Groundfish Strategic Plan Implementation Oversight Committee
Pacific Fishery Management Council
West Conference Room
7700 NE Ambassador Place, Suite 200
Portland, Oregon 97220-1384
December 13-14, 2001

Call to Order

The meeting was called to order by Dr. Donald McIsaac. After introductions and approval of the agenda, Dr. McIsaac was selected as chairman of the Groundfish Multi-Year Management Committee (GMMC). It was noted that under the first agenda topic (Initial Scoping of Alternatives) the committee would discuss the federal notice and comment period. Synchronization of the management process with the science process (Stock Assessment Review process) will also be discussed.

Members in Attendance

Mr. Phil Anderson, Washington Department of Fish and Wildlife
Mr. Burnell Bohn, Oregon Department of Fish and Wildlife
Mr. LB Boydstun, California Department of Fish and Game
Mr. Ralph Brown, Pacific Fishery Management Council
Ms. Eileen Cooney, National Oceanic and Atmospheric Administration - General Counsel
Dr. Jim Hastie, National Marine Fisheries Service
Mr. Jim Lone, Pacific Fishery Management Council
Dr. Richard Methot, National Marine Fisheries Service
Dr. Donald McIsaac, Executive Director, Pacific Fishery Management Council
Mr. Rod Moore, West Coast Seafood Processors Association
Dr. Steve Ralston, National Marine Fisheries Service
Mr. Bill Robinson, National Marine Fisheries Service

Others in Attendance

Mr. Brian Culver, Washington Department of Fish and Wildlife
Ms. Yvonne de Reynier, National Marine Fisheries Service
Mr. John DeVore, staff, Pacific Fishery Management Council
Mr. Joe Easley, Oregon Trawl Commission
Mr. Jim Glock
Mr. Herb Hoover
Mr. Tom Jagielo, Washington Department of Fish and Wildlife
Dr. Kevin Piner, National Marine Fisheries Service
Dr. Hans Radtke, Pacific Fishery Management Council
Mr. Mark Saelens, Oregon Department of Fish and Wildlife
Mr. Jim Seger, staff, Pacific Fishery Management Council
Mr. Chuck Tracy, staff, Pacific Fishery Management Council
Ms. Marija Vojkovich, California Department of Fish and Game
Mr. Dan Waldeck, staff, Pacific Fishery Management Council

Meeting Summary

Purpose of the GMMC and Scope of Meeting

The GMMC will provide recommendations to the Council at the March 2002 meeting. The recommendations will relate to multi-year management approaches, accommodation of federal notice and comment requirements and the stock assessment process. The GMMC will also recommend alternatives for getting through the transition period, i.e., how to handle the 2003 specification setting process and move toward implementation of multi-year management.

The composition and purpose of the Council's Allocation Committee and its relationship to the Strategic Plan was discussed. A concern was noted that attendance at, and general participation in, Allocation Committee business is somewhat limited relative to the broader participation under the Strategic Plan Implementation Oversight Committee (SPOC) process. The Allocation Committee has evolved into a committee focused on emerging issues and development of management alternatives for species of concern. For example, lingcod and bocaccio in 1999; canary rockfish in 2000; several rockfish species, sablefish, and Dover sole in 2001. Their role has evolved into addressing emerging issues, providing a forum for public input, and developing management alternatives for Council consideration prior to the annual specification process. The Allocation Committee is distinct from the Strategic Plan process in that the SPOC is charged with overseeing implementation of the Strategic Plan and the formation of development teams to target implementation of specific initiatives.

It was suggested a separate committee is necessary to scope the principles for allocation decisions and address long-term allocation decisions. There is a strong need to resolve the allocation question. The GMMC agreed that, for the long-term, one committee to address emerging issues (i.e., the role of the current Allocation Committee) and another to scope and initiate long-term allocative decisions are needed. The Allocation Committee may need a new name, to minimize confusion.

The GMMC briefly discussed the stock assessment schedule for 2002. It was noted an update to the assessment for sablefish is planned, and STAR coordinators are working on how to fit the update into the STAR process. Full assessments and STAR panels are scheduled for Pacific whiting, bocaccio, and canary rockfish. Relative to sablefish, new survey data will be run through the existing model, and a "STAR-light" will be used to review the results. This will include involvement from: SSC (lead), chair from previous STAR, GAP, and GMT representatives. It was also noted that NWFSC is revamping the survey design and schedule. Into the future, this could draw energy away from stock assessments and STAR panels. These items were discussed more thoroughly on Day 2.

Relative to the management schedule and notice/comment requirements, rebuilding plans (in the form of FMP amendments) will also have to be accommodated. That is, time will need to be included for development, Council action, and federal notice and comment.

<u>Federal Notice and Comment</u>

Relative to the question of when notice and comment is required, the GMMC discussed what requires notice and comment rulemaking. In the past, annual specifications and management measures were set through what has been known as a "notice" action, in which there is no proposed rule published in the Federal Register, just a final notice. This was established with Amendment 4 to the FMP in 1990, with the underlying theory being that because of the timing of the receipt of the science used in the process and the time it takes for development of specifications through the Council process, there was "good cause" under the Administrative Procedures Act to publish the action without a proposed rule. Additionally, the Council process provides notice to the public and opportunity to participate in the rulemaking process, and provides much of the same opportunity as a proposed rule. The recent court decision found this process unlawful. Therefore, following the Council recommendation to NMFS, NMFS is required to publish a proposed rule in the Federal Register, provide opportunity for public comment, and respond to public comment and publish the a final rule that implements the specifications and management measures. Moreover, the Council is required to document the decision process and complete an environmental analysis (EA) package prior to final decision making.

Rulemaking requires several steps:
- conceiving purpose and need;
- scoping alternatives;
- analyzing alternatives;
- publishing proposed rule in FR;
- providing notice and opportunity for comment; and
- publishing final rule in FR (with response to comments received).

This entails, in essence, describing the intended purpose, action to be taken to meet the purpose, alternatives considered, analysis of the action and alternatives, and rationale for proposed action. It also includes analysis required for other laws/mandates (notably, NEPA and the Regulatory Flexibility Act). A 30-60 day comment period is required, 30 days is most common. Finally, NMFS must respond to comments and publish the final implementing regulations.

This may change if the court decision is appealed, but at least for the 2003 specifications setting process, the notice and comment requirements (as described above) will be necessary. It will not be acceptable for 2003 to adopt emergency regulations because of the extended regulatory timeline. This is because there is sufficient time to follow the normal rulemaking process in adopting the 2003 regulations. Thus, for 2003, it will be necessary to either advance the rulemaking schedule or delay the start of the 2003 fishing year.

Relative to the fishing year, two approaches were suggested. Move final adoption of management specifications to the September Council meeting, which could provide sufficient time for notice and comment prior to start of the fishery on January 1. Conversely, the fishery start could be later in the year, which could accommodate notice and comment following final Council action in November.

The GMMC discussed how it would work if final Council action was targeted for the September meeting. This assumes that the EA is completed prior to Council final action, NMFS needs 30 days (minimum) to develop proposed rule, 30 days for internal review prior to publication, and 30 day comment period prior to start of fishery. For example:

September	final Council action;
October	develop proposed rule;
November	internal review;
December	notice and comment;
January	fishery start.

Thus, for the fishery to start on January 1, the Council might need to take final action on the proposed management specifications in early September. A final Council decision in September could provide 90-120 days to complete the proposed/final rule (including notice/comment requirements).

If public comment raises an issue that leads to a change, NMFS would need to revise the proposed action.

Ways to accomplish notice/comment (under either multi-year or annual management) were discussed:

1 (for 2002) two-meeting process, June-September, proposed rule in November.

2 three-meeting process, April-June-September, proposed rule in November.

3 three-meeting process, June September-November, proposed rule January, fishery start March or April. Changing the fishing year could negatively affect the scientific data series. Thus, up-front work would be needed to accommodate change in data series.

Other considerations:

FMP amendment is required to do multi-year management. But, notice and comment is an absolute requirement for setting 2003 specifications. Therefore, GMMC needs to develop specific recommendations for Council action for this year.

The notice and comment options for this year may not be the same as for the long-term. That is, options are needed to address short-term and long-term management.

Changing Council Schedule – The committee discussed changing the April through November Council meeting schedule. It may be that, in future years, the meeting schedule could be revised to provide more flexibility to accommodate science and management needs, as well as necessary public comment period. If the schedule were changed, what kind of lead time does Council staff need to change hotel arrangements?

Delaying Start of Season

The GMMC discussed the option of delaying the start of the fishing season. Moving the start of the season (e.g., March, April, or May) could provide more time for the federal notice and comment process, while allowing the Council to take final action on management specifications in November. However, this delay could have significant impacts both on the fishery and the scientific data underlying management. As it would be controversial and requires analysis of trade-offs, implementing a delayed season in 2003 might not be possible. It was also noted that delaying the start of the fishery would build in time for notice and comment regardless of annual or multi-year management.

The discussion raised several issues:

Delay could cause disruption of fishery-dependent data series.

January-March are best groundfish markets. It is important to have fish available to meet demand, otherwise markets could go elsewhere.

Fishing year would have to be synchronized with RecFIN ("wave structure"). Could use same waves, but under a different fishing year. For example, wave 1 (January-February) would be part of 2003-2004 fishing year. The start of wave 2 would coincide with the start of the 2004-2005 season.

Current lag in data is already a problem, creating a larger time lag could be even worse. Should try to synchronize as best as possible.

Requires FMP amendment.

Heightens importance of inseason management.

Timing of NMFS survey could pose a problem, time series of fishery independent data could be compromised.

If stock assessment cycle is not adjusted, a delayed season complicates availability of fishery dependent data, which could be out of phase with fishery independent (survey) information.

The bottom line is that delaying the season might be possible and provide the benefit of more time, but not without problems.

Multi-Year Management

Several key themes arose that influence development of multi-year management:

- time required for rulemaking and federal notice/comment requirements;
- workload, e.g., on-year/off-year scheme might provide some relief from the current burden and allow time to deal with issues other than annual management; and
- data comparability/compromises from changes in fishery start and/or survey schedule/design.

One reason suggested in support of multi-year management is that uncertainty and imprecision are quite large in regard to our knowledge of the West Coast environment, and groundfish are long-lived and slow-growing. Incremental, year-to-year changes might not have too great an effect on stock status (relative to the influence of the environment and their life history characteristics). Thus, annual management may not be necessary. Moreover, the length of time required to rebuild several overfished stocks might lend additional credence to multi-year management.

However, under the current oceanographic regime (i.e., generally unproductive), stock declines and newly discovered overfished species drive management. Multi-year management would still need to be able to react to overfished species.

Given this conflict, the rationale for multi-year management needs to be clearly specified. Is the motivation for multi-year management a reaction to workload, or because it is a more appropriate management structure because the system is not affected by year-to-year management, or both?

The GMMC discussed whether assessments would be necessary every year under multi-year management. It is critical that the scientific cycle meshes with the management cycle. Assessments could be done every other year, but it is unclear if resources are available to assess a greater number of stocks, but less frequently.

Currently, assessments are done every year. However, no species is assessed every year. That is, most assessed species are assessed every three years. If we moved to a multi-year process, one proposal is that in the year the specifications and management measures are developed, assessment updates are done for all assessed species. In the other year, new assessment methodologies are developed and reviewed, and other longer term issues are dealt with.

Currently, Rebuilding Plan-analysis is used to craft management specifications well ahead of adoption of formal Rebuilding Plan. Most assessments include basic rebuilding analyses, which could be used to craft interim measures. These could be incorporated into management well in advance of adoption of the Rebuilding Plan.

If assessments are not done every year, the question of use of "best available science" arises. Rationale for (and ramifications of) increasing the lag between data collection and use in management would need to be thoroughly articulated, reviewed, and analyzed.

The committee discussed which elements in the management and science processes are open to change. It was stressed that the previous change (i.e., moving the STAR process earlier in the year) used up much of the flexibility on the science side. The speaker stressed that the science process should not be compromised to meet management needs.

The committee discussed how to ensure best science is used and whether a problem is caused from not acting. That is, if the year-to-year influence of management over stock status is minor, then there might be less cause for alarm in holding off on using the latest information.

Under multi-year management, an off-science year could provide time to revise current methodologies and to develop methods for un-assessed species. This could provide long-term improvements to assessment techniques.

Multi-year management, where science is collected annually and species are not assessed annually, could be workable. However, if species are assessed annually, it will be harder to justify not using most current assessment in management, especially, when an assessment shows a species is in decline.

Scientists thoughts on multi-year management –

- It is still undecided how to handle mandated two-year Rebuilding Plan review. The number of assessments has not kept pace with the species needing assessment. A two-year assessment schedule for every overfished species could cause further delay.

- A possible multi-year assessment scenario –

  On-year – full assessment, full STAR.
  Off-year – assessment updates, less-formal review, ensure no problems requiring management action.

- Surveys are an ongoing data collection process used by, but independent from, the management process. The stock assessment process will need to be re-tooled to mesh with the revised management process. Multi-year management will require a streamlined assessment process, especially for updates to assessed species. Buy-off on assessment models will be necessary to streamline the process. This could be facilitated by off-year review of assessment methods.

- However, "stocks of concern" need to be identified and should be the focus of formal assessments and reviews during the on-year.

- For the benefits of on-year/off-year to be realized, care would be needed to ensure that assessment "updates" or research survey results in off-years are not used to set ABC/OY or management specifications unless there is a clear and compelling need.

- The goal would be to increase and improve capacity to do assessments during the on-year. This improvement would be critical to ameliorate problems from the lag between data collections and its use in management.

- Methodology review during off years would provide for ground-truthing the models and building capacity to do more and better assessments in the on-year.

- Multi-year assessment would be facilitated by more surveys to provide more data for more in-depth assessments in on-year.

- The stock assessment schedule would need to be synchronized with Rebuilding Plan two-year review.

The GMMC discussed the need to clarify when information indicating a stock is overfished would trigger a management response. For example – during on-year, assessment indicates stock is overfished; rebuilding parameters are included in the assessment; rebuilding analysis is developed; the analysis is used to develop management alternatives for multi-year specifications. During off-year, Rebuilding Plan is developed, adopted by Council, and approved by NMFS. This scenario hinges on Rebuilding Plan-analysis being unchanged in the final Rebuilding Plan, otherwise management specifications might need to be revised.

If assessments are not conducted during off-year, no new overfished species would be detected. This could necessitate political will to dampen pressure to do new assessments or change management specifications during the off year.

Mr. Rod Moore reviewed his handout (attachment 2). He noted that – because flexibility in how to alter the management process is limited – the choices are to either change the start of the fishery or begin the science process earlier in the year.

He suggests an on-year/off-year approach, but with management and science in separate years. For example, management on/science off; management off/science on.

By providing more time for assessments and review, better information could be developed that would plug into management in the following year and be used in a June-September specification setting process. Final Council action in September provides the time necessary for notice and comment prior to fishery start on January 1.

It will be critical to coordinate data collection, assessments, review, and specification setting to ensure appropriate and timely management is used.

After discussing (1) the reasons for multi-year management, (2) the need to coordinate science and management, and (3) Mr. Moore's proposal two tentative options were put forward for further discussion.

- On-year/off-year approach:
  On-year – assessments, review, specifications; and
  Off-rear – methodology review, Rebuilding Plan developed/reviewed as necessary.

- Mr. Moore's proposal:
  On-year – assessments, Off-year – management; and
  Off-year – assessments, On-year – management.

In addition, two suboptions are to be included – (a) if fishing year starts January 1, Council adopts specifications June-September; and (b) if fishing year starts April 1, Council adopts specifications September-November.

Transition Year

As time will be needed to develop and implement multi-year management, the GMMC discussed options for transition, notably in 2002.

One way could be to rollover 2002 specifications as interim regulations. For example, 2002 management specifications could be extended into April 2003, with the new fishing year starting May 1, 2003.

A second way could be to not do assessments in 2002 and not change specifications for the duration of 2003. This would treat 2002 as an off-year. 2003 would be on-year, with full assessments and reviews, and management specifications set for 2004-2005.

However, a Pacific whiting assessment will occur in 2002. This information would need to be accounted for in 2003 specifications. Additionally, the two other species scheduled for full assessment are of special concern (canary rockfish and bocaccio). If the rockfish assessments showed the stocks are stable, not change 2002 specifications could be justified. However, if the assessments indicate significant change in stock status, new management specifications would need to be developed.

Moreover, assessments for bocaccio and canary rockfish should not be cancelled solely to accommodate rollover of 2002 specifications.

Another option could be to set interim specifications for the fishery starting January 1, 2003. This would require developing a bases for the interim regulations.

A possible transition year schedule was discussed:

- April 2002 – Highlight that: (1) the only new science will be whiting, canary rockfish, bocaccio assessments and sablefish update; (2) this information will be received at the June meeting; (3) final action will occur at the September meeting. Thus, in June good preliminary numbers need to be developed along with management alternatives for analysis prior to September.

- June 2002 – Receive canary rockfish and bocaccio updates, adopt proposed ABC/OY and develop preliminary management measures.

  (June through September EA/RIR/IRFA is developed. States conduct public meetings to narrow the range and scope of management measures.)

- September 2002 – adopt final specifications and management measures.

  (September through December proposed rule is developed, reviewed, and published; final rule and response to comments is published.)

- January 2003 – fishery starts.

This schedule would require:

In April, the Council would need some indication of canary rockfish and bocaccio status to initiate consideration of ABC/OY ranges for these stocks.

By June, must have reasonable range of ABC/OY and management alternatives.

Must also consider bycatch and discard analysis, which was fairly raw in 2001. The analysis could use refinement and documentation.

Accomplishing the science and management components in a shorter time period will be difficult, but changing the fishing start date requires an FMP amendment. Thus, options for transition are limited.

Both multi-year management and delayed season will require public input, a clear rationale, and range of alternatives. It cannot simply be for the convenience of the management process.

If final Council action occurs in November 2002, interim regulations would be needed for January-March (or April) 2003 to provide time for rulemaking/notice/comment. If final Council action occurred in September, rulemaking/notice/comment could be done prior to January 1, 2003 fishery start.

Summing up

Multi-year Alternatives – (assumes January 1 fishery start date and full rulemaking/notice/comment process)

1. *alternating on and off years, management and science during the same year –*
   - *1.a. management process – June, September, November (w/ interim regulations Jan-Mar/Apr)*
   - *1.b. management process – April, June, September*

2. *alternating on and off years, management and science in separate (i.e., alternate) years –*
   - *2.a. management process – April, June, September*
   - *2.b. management process – November, April, June*

The committee requested these options be drawn up within the matrix format for an extended period (2002-2005) to illustrate time structure and where FMP amendment fits.

New management process will start in 2004 (DOES THIS MEAN THAT MANAGEMENT SPECIFICATIONS FOR 2004-2005 WOULD BE SET DURING 2003???). During 2002-2003, FMP amendment developed.

The GMMC should also discuss why a three year multi-year alternative is not practical (e.g., lack of fit with mandated two-year Rebuilding Plan review). The committee should also consider whether multi-year process would set an OY for each year or a two-year OY.

Also need to consider forming an oversight committee, charged with monitoring the fishery and determining when management intervention is required during an off year. For example, inseason management (trip limit changes) could be accomplished within multi-year framework. Significant change to management measures would likely require a more formal process that should be specified in advance.

A major benefit of multi-year management is that off years would provide time for implementation of strategic plan initiatives.

Build in a mechanism for year-to-year change to occur when necessary, but only in special cases.

Council and NWR staff will coordinate on putting the options together and developing the matrices. After the matrices are complete, advice from the scientific staff will be sought to see how/where the science fits, with the aim to keep the management based on the science as current as possible.

The rationale for multi-year management should also discuss potential impacts on groundfish stocks if greater delays are built into the management process (i.e., science sits on the shelf for a year). Need credible rationale and analysis of potential impacts. It was also noted that, depending on the timing of the STAR process, science would not necessarily sit on the shelf for a year. For example, if STAR panels are held later in the year (e.g., October/November) and the management process is started in April, the lag time would be much shorter.

Need analysis of potential fishery impacts.

Need analysis of fishery start date options – (1) January 1, (2) April 1.

Need transition strategy recommendations for the March Council meeting.

Additional considerations:

- Noted that multi-species fishery complicates multi-year management.
- Need to add "trigger point" that compels review and provides for mid-cycle adjustments.
- To be in compliance with NEPA, the multi-year options should encompass the full range of reasonable alternatives, rather than focused on one or two preferred options. Careful and complete articulation of the rationale and implications for both science and management needs to be developed.
- It may be necessary into the future to also consider how to meet the requirements imposed on the groundfish fishery if they were imposed on other managed species/fisheries (salmon, CPS, HMS). That is, it would be wise to get out front of problems before they arise.

PFMC
02/27/02

ATTACHMENT 1

FINAL AGENDA

Ad Hoc Groundfish Multi-Year Management Committee

Pacific Fishery Management Council
West Conference Room
7700 NE Ambassador Place, Suite 200
Portland, Oregon 97220-1384
(503) 326-6352
December 13-14, 2001

Public comment will be accepted each day at a time determined by the chair.

THURSDAY, DECEMBER 13, 2001 - 1 P.M.

A. ***Call to Order***

B. ***Introductions***

C. ***Approve Agenda***

D. ***Select Committee Chair***

E. ***Review Committee Purpose and General Schedule***

F. ***Review Council Adopted 3-Meeting Process***
   1. Components and timing
   2. Current stock assessment schedule

G. ***Review Federal Notice and Comment Requirements***

H. ***Review Most Recently Considered Multi-Year Management Framework***
   1. Synchrony (or lack of) with stock assessments and rebuilding plan development
   2. Synchrony (or lack of) with mandated 2-year rebuilding plan review

FRIDAY, DECEMBER 14, 2001 - 8 A.M.

H. ***Review Most Recently Considered Multi-Year Management Framework, continued if necessary***
   1. Synchrony (or lack of) with stock assessments and rebuilding plan development
   2. Synchrony (or lack of) with mandated 2-year rebuilding plan review

I. ***Initial Scoping of Alternatives***

J. ***Post-Meeting Work Assignments – flesh out/analyze alternatives***

K. ***Next Meeting Topics***

L. ***February Meeting Date, Time, Location***

ADJOURN

PFMC
12/13/01

ATTACHMENT 2

ROD'S MULTI YEAR MANAGEMENT PROPOSAL

(Based on Table 2 handed out on 12/13)

2002 (Transition year)

Surveys, data collection continue as planned

Stock assessments continue as planned, with whiting assessment providing an ABC projection for 2002 through 2004 (NOTE: Can Tom Helser do this?)

Overfishing - preliminary indication, rebuilding analysis as planned

Management - April, June, September, November Council meetings

April - approve for public comment an FMP amendment providing for multi-year management

June - preliminary OY/ABC, final approval on FMP amendment

September - FINAL ABC/OY, preliminary management measures for 2003 and 2004

November - final management measures for 2003 and 2004, including whiting based on projection (see above - may result in low OY for 2003, slightly higher for 2004) (NOTE: dependent on Secretarial approval of FMP amendment; if approval not final, see "fallback")

Management actions in November, 2002, would take effect March 1 / April 1 2003. For January 1st through beginning of new management measures, 2002 cumulative limits and management measures would remain in effect per existing FMP, except that cumulative limits would be adjusted (if necessary) via in-season action (NOTE: Legal ramifications of making in-season adjustments for Jan - April 2003 in November 2002?)

2003 (Year 1 of new schedule)

Surveys, data collection under normal schedule

Stock assessments - schedule what is needed, including any 2 year reviews of overfished species; can be spread out over the year and start later in the year than in 2002

Overfishing - NMFS designation of overfished species (if any), prepare / approve rebuilding plans

Management - in-season adjustments only; other non-specification management issues

2004 (Year 2 of new schedule)

Surveys, data collection as normal

Stock assessments - none unless 2 year review of overfished species needed (NOTE: possibly do any STAR-lite reviews?)

Overfishing - preliminary indications based on stock assessments done in 2003, rebuilding analysis

Management - 3 meeting process to do preliminary/final ABC/OY (first 2 meetings), preliminary/final management measures (last 2 meetings), shift meeting schedule to May, July, September (NOTE: should provide sufficient time for Federal Register process to be completed by January 1, 2005; can remain as April/June/September if Council willing to do both preliminary ABC/OY and salmon in April). Management measures will be for 2 years. Include in-season adjustments as appropriate.

2005 and beyond

Repeat pattern of 2003 / 2004

FALLBACK

In the event that we cannot get a multi-year management FMP amendment approved in time for the November, 2002, meeting, then 2003 will be a second "Transition Year", 2004 will be "Year 1", and 2005 will be "Year 2".

RATIONALE

Obviously, there are some legal and procedural questions that need to be answered as noted, and there may be others that will arise. But, assuming that this proposal is legally and technically sufficient, what will it do for us after we get past the difficult transition year?

Data collection will continue as normal. There will be no interruption in obtaining fisheries dependent and independent data. However, the time allowed to analyze that data for use in stock assessments will increase, since stock assessments are scheduled only once every 2 years instead of every year.

Stock assessments will start falling on a different schedule and more time will be available to complete and review them, since management actions based on those stock assessments will not occur until the succeeding year. This gives assessment authors some time off to pursue other scientific inquiries. Stock assessments will still use the most recent data, which in many cases means using the analysis of the prior year survey results. This is really no different than what occurs now, since surveys (especially triennial surveys) and assessments are getting more and more out of sync. Assessments on key species that are now done every 3 years will be done every 4 years, although an opportunity exists to have them done every 2 years if there are crucial questions raised (or even in back-to-back years if a turn-the-crank / STAR-lite process can be used).

Overfishing / rebuilding actions will occur as shown in Table 2 and in practice as occurs now using preliminary estimates and management actions.

The management crunch of setting ABCs / OYs / annual management specifications will only occur every other year. That will give the Council opportunity to consider other management issues during the off-years, relieving burdens on Council, staff, advisory bodies, and the public.

Setting 2 year management levels will provide some stability to the commercial and recreational communities instead of trying to change things every year.

The public process will be protected by allowing ample time for administrative procedures following final Council action in September.

GROUNDFISH STRATEGIC PLAN IMPLEMENTATION

Situation: There are several matters for Council consideration under this agendum. The first are the recommendations of the Ad Hoc Groundfish Multi-year Management Committee (GMMC); the second is a progress report from the Trawl Permit Stacking Work Group; the third is a progress report from the Open Access Permitting Subcommittee; lastly, California Department of Fish And Game (CDFG) will provide a report on delegation of nearshore groundfish management authority.

GMMC: The Council appointed the GMMC to scope multi-year management approaches for the West Coast groundfish fishery and asked that the approaches developed by the GMMC be synchronized with a multi-year groundfish stock assessment schedule, as well as full accommodation of federal notice and comment requirements.

Two public meetings of the GMMC were held – December 13-14, 2001 and January 31-February 1, 2002. At these meetings the committee discussed issues related to revising the groundfish management process. The minutes of the first meeting are attached (Attachment 1). A report based on the second meeting will be reviewed for the Council (Exhibit F.4.b). This report outlines the suite of issues discussed by the GMMC, and provides specific recommendations for Council consideration.

The primary recommendation is to schedule formal consideration of a groundfish FMP amendment for multi-year management at the April 2002 Council meeting.

To accommodate the August 2001 Ninth Circuit Court decision on required federal notice and comment rulemaking procedures after a final Council decision, the GMMC also recommended shortening the adopted three-Council-meeting process for 2002 (June-September-November Council meetings) and accelerating the timing to a June-September Council meeting process.

Trawl Permit Stacking: The Council appointed the Trawl Permit Stacking Work Group in June 2001, however, this group did not meet in 2001 due to other groundfish workload. The Work Group is scheduled to have had its first meeting prior to this Council meeting (February 26). A full report on the Work Group meeting will be provided at the April 2002 Council meeting, when the Groundfish Advisory Subpanel will be present. Depending on the outcome of the February 26 meeting, an interim report or request for guidance may be provided to the Council at this meeting.

Open Access Permitting: The Open Access Permitting Subcommittee met January 30-31, 2002 to continue laying conceptual groundwork for limiting entry to the open access fishery. The committee developed preliminary goals and objectives and requested certain data on the open access fishery. The committee will meet next on March 26, 2002 via a conference call. The subcommittee will provide a progress report to the Council (Exhibit F.4.d).

Delegation of Nearshore Groundfish Management Authority: CDFG will provide information to the Council about California's Marine Life Management Act and Nearshore Fishery Management Plan (FMP). The FMP's goals and objectives, management regime, and species covered will be discussed in the context of implications and expectations to the Council groundfish FMP.

Council Task:

1. **Discuss the recommendations of the GMMC; provide guidance to the committee and staff for further consideration of GMMC recommendations.**
2. **As necessary, provide guidance to the Trawl Permit Stacking Work Group and Open Access Permitting Subcommittee.**
3. **Discuss the information presented by CDFG regarding delegation of nearshore groundfish management authority and provide guidance in the consideration of this issue at the April or future Council meetings.**

Reference Materials:

1. Exhibit F.4, Attachment 1, GMMC Meeting Summary, December 13-14, 2001.
2. Exhibit F.4.b, GMMC Report.
3. Exhibit F.4.d, Open Access Permitting Committee Report.
4. Exhibit F.4.e, Supplemental CDFG Proposal for Delegation of Nearshore Management Authority.

Groundfish Strategic Plan (GFSP) Consistency Analysis
This agenda item is consistent with the implementation process detailed in the GFSP. Issues covered under this item conform to the implementation priorities adopted by the Council in April 2001.

Agenda Order:

a. Agendum Overview	Dan Waldeck
b. Multi-Year Management Cycle Update	Dan Waldeck
c. Trawl Permit Stacking Update	Jim Seger
d. Open Access Update	Jim Seger
e. Delegation of Nearshore Groundfish Management Authority	LB Boydstun
f. Reports and Comments of Advisory Bodies	
g. Public Comment	
h. Council Discussion	

PFMC
02/27/02

GROUNDFISH FISHERY MANAGEMENT PLAN (FMP) ENVIRONMENTAL IMPACT STATEMENT (EIS)

Situation: At the November Council meeting, the National Marine Fisheries Service (NMFS) briefed the Council that the ongoing groundfish EIS would be segregated into two components: a programmatic EIS to analyze groundfish management policy alternatives; and a groundfish essential fish habitat (EFH) EIS to satisfy the AOC v. Daley litigation settlement terms. This agendum deals only with the programmatic EIS.

The programmatic EIS will review the current status of the federal groundfish management program, condition of the groundfish resource, and the socioeconomic conditions of the fishery. The Programmatic EIS will discuss a range of future policy alternatives and implementation options, including provisions in the Council's Groundfish Fishery Strategic Plan (GFSP). At the September 2001 meeting, the Council established an ad hoc oversight committee with technical support from the Scientific and Statistical Committee, Groundfish Management Team, and Habitat Steering Group to provide focused participation in development of the Programmatic EIS. Mr. Jim Glock, the NMFS Groundfish Programmatic EIS project manager, will summarize progress to date in Programmatic EIS development and will request activation of the Council's Ad Hoc EIS Oversight Committee.

Council Task:

1. Provide guidance to NMFS on developing the Groundfish Programmatic EIS.

Reference Materials:

1. Draft Proposed Alternatives for the Programmatic Groundfish EIS (Exhibit F.5, Supplemental Attachment 1).

Agenda Order:

a. NMFS Report — Jim Glock
b. Council Discussion and Guidance

GFSP Consistency Analysis

The GFSP broadly supports effective public involvement during and beyond the transition to sustainable groundfish fishery management. The GFSP also specifically seeks to update the goals and objectives in the current groundfish FMP to incorporate GFSP visions and goals (Sec. II.C.(d)3). The Programmatic EIS will provide a public forum vehicle for assessing and incorporating GFSP visions and goals into the Groundfish FMP.

PFMC
02/25/02

ORIGINAL
FILED
DEC 1 7 2001
NANCY MAYER WHITTINGTON, CLERK
U.S. DISTRICT COURT

IN THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF COLUMBIA

AMERICAN OCEANS CAMPAIGN, et al.,

Plaintiffs.

v.

DONALD EVANS, Secretary of Commerce, et al.,

Defendants.

Civil No. 99-982 GK

RECEIVED
DEC 2 6 2001
BY: CRS

JOINT STIPULATION AND [PROPOSED] ORDER

WHEREAS, plaintiffs in this case challenged the federal defendants' approval (in whole or in part) of certain fishery management plan amendments concerning essential fish habitat (EFH) in the following fishery management regions: Caribbean, Gulf of Mexico, New England, North Pacific, and Pacific (hereinafter "the EFH Amendments");

WHEREAS, plaintiffs alleged that federal defendants' approval of the EFH Amendments violated the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) and federal defendants' own regulations, because federal defendants had (1) failed to analyze adequately the potential adverse effects of fishing gear on EFH; (2) failed to analyze adequately whether there were any practicable steps to minimize any such adverse effects of fishing on EFH; and (3) failed to take all practicable steps to minimize any such adverse effects of fishing on EFH;

WHEREAS, plaintiffs also alleged that federal defendants' approval of the EFH Amendments violated the National Environmental Policy Act (NEPA), because federal defendants had failed to analyze adequately the potential direct and indirect environmental impacts of fishing on EFH and to develop and analyze adequately a range of alternatives for minimizing any such adverse effects of fishing on EFH;

WHEREAS, the Texas Shrimp Association and Wilma Anderson (defendant-intervenors) intervened to defend the partial approval of the Gulf of Mexico EFH Amendment;

WHEREAS, in a Memorandum Opinion and Order filed on September 14, 2000, the Court denied defendant-intervenors' motion to dismiss plaintiffs' Magnuson-Stevens Act claim as to the Gulf of Mexico EFH Amendment, and granted federal defendants' and defendant-intervenors' summary judgement motions as to plaintiffs' Magnuson-Stevens Act claims;

WHEREAS, in its September 14, 2000, Memorandum Opinion and Order, the Court granted plaintiffs' summary judgment motion as to the NEPA claims relating to the EFH Amendments at issue in this case;

WHEREAS, in its September 14, 2000, Memorandum Opinion and Order, the Court remanded the EFH Amendments at issue in this case to the federal defendants to comply with NEPA; and

WHEREAS, in its September 14, 2000, Memorandum Opinion and Order, the Court enjoined federal defendants "from enforcing the EFH Amendments until such time as they perform a new, thorough, and legally adequate EA [environmental assessment] or EIS [environmental impact statement] for each EFH Amendment";

NOW, THEREFORE, IT IS HEREBY STIPULATED AND ORDERED AS FOLLOWS:

I. JURISDICTION AND SCOPE

1. This Court has jurisdiction over the parties and subject matter of this action pursuant to 16 U.S.C. §§ 1855(f) and 1861(d) and 28 U.S.C. §§ 1331 and 1361.

2. This Joint Stipulation and Order constitutes full settlement of all of plaintiffs' claims

under the Magnuson-Stevens Act and NEPA in this case. Further, the Joint Stipulation and Order provides the basis for plaintiffs' dismissal of their appeal of the Court's summary judgment ruling on their Magnuson-Stevens Act claims. Additionally, the Joint Stipulation and Order does not constitute a settlement of plaintiffs' claims for litigation costs, including attorney fees.

II. ENVIRONMENTAL IMPACT STATEMENTS

A. General EIS Provisions

3. Federal defendants, acting through the National Marine Fisheries Service (NMFS), will prepare EISs for all of the fisheries that were challenged in this lawsuit.

4. In preparing the EISs pursuant to this Joint Stipulation and Order, NMFS will comply with the requirements of all applicable statutes and regulations, including NEPA; the Council on Environmental Quality (CEQ) NEPA implementing regulations, 40 C.F.R. Parts 1500-1508; and National Oceanic and Atmospheric Administration (NOAA) Administrative Order 216-6.

5. Each EFH Amendment amends one or more fishery management plans (FMPs). For each EFH Amendment, the scope of the EISs prepared pursuant to this Joint Stipulation and Order will include analyses of the environmental impacts of fishing on EFH, including direct and indirect effects, as defined in the EFH regulations at 50 C.F.R. § 600.810, and analyses of the environmental impacts of alternatives for implementing the requirement of the Magnuson-Stevens Act, 16 U.S.C. § 1853(a)(7), that the FMP "minimize, to the extent practicable, adverse effects on [EFH] caused by fishing."

6. Each EIS (or, where appropriate, the portions thereof relating to EFH) prepared pursuant to this Joint Stipulation and Order will consider a range of reasonable alternatives for minimizing the adverse effects (as defined by the EFH regulations at 50 C.F.R. § 600.810) of fishing

on EFH, including potential adverse effects. This range of alternatives will include "no action" or status quo alternatives and alternatives setting forth specific fishery management actions that can be taken by NMFS under the Magnuson-Stevens Act. The alternatives may include a suite of fishery management measures. and the same fishery management measures may appear in more than one alternative.

7. Each draft and final EIS prepared pursuant to this Joint Stipulation and Order will identify one preferred alternative, except that, in the draft EIS, NMFS may elect, if it deems appropriate, to designate a subset of the alternatives considered in the draft EIS, as the preferred range of alternatives, instead of designating only one preferred alternative.

8. Each draft and final EIS (or, where appropriate, the portions thereof relating to EFH) prepared pursuant to this Joint Stipulation and Order will present the environmental impacts of the proposed action and the alternatives in comparative form, thus sharply defining the issues and providing a clear basis for choice among the options, as set forth in CEQ regulation 40 C.F.R. § 1502.14.

B. EIS Preparation Schedule

9. NMFS will prepare the EISs pursuant to this Joint Stipulation and Order in accordance with the schedule attached hereto as Attachment 1. NMFS will make good-faith efforts to complete EIS preparation tasks prior to the milestones set forth in Attachment 1 and to stagger the comment periods for the EISs so as to facilitate the provision of public comment.

C. NMFS Decisionmaking Based on EISs and RODs

10. In the Record of Decision (ROD) for each EIS prepared pursuant to this Joint Stipulation and Order, NMFS will determine either that action is necessary or that action is not

necessary to comply with the requirements of Section 303(a)(7) of the Magnuson-Stevens Act. If NMFS determines that action is necessary to comply with the requirements of Section 303(a)(7) of the Magnuson-Stevens Act, NMFS will determine whether the FMP will be amended in accordance with the preferred alternative identified in the Final EIS, and, if not, what other action, if any, is necessary.

11. Except as provided in Paragraph 12 below, if NMFS determines in a ROD that action is necessary and that the applicable FMP will be amended so as to comply with the requirements of Section 303(a)(7) of the Magnuson-Stevens Act, NMFS will approve an FMP amendment and implementing regulations no later than 24 months after the date of the ROD, unless the Secretary subsequently determines that an FMP amendment and implementing regulations are no longer necessary. If NMFS determines that action other than an FMP amendment and implementing regulations is necessary, NMFS will approve that other action no later than 24 months after the date of the ROD, unless the Secretary subsequently determines that such other action is no longer necessary.

a. If NMFS determines in a ROD that an FMP will be amended, NMFS will confer with plaintiffs, the appropriate Council, and other members of the interested public, regarding the schedule for the Council to develop and submit to NMFS an FMP amendment and implementing regulations. Based in part on the comments of plaintiffs, the Council, and other members of the interested public, NMFS will develop and recommend a schedule to the Council that will enable NMFS to approve an FMP amendment and any necessary implementing regulations, as quickly as practicable, but, in any event, no later than 24 months from the date of the ROD, pursuant to the appropriate decisions made in accordance with the provisions of Paragraphs 11(b) and (c) below.

If NMFS determines in a ROD that action other than an FMP amendment is necessary, NMFS will confer with plaintiffs, the appropriate Council, and other members of the interested public, regarding the schedule for the Council to take that other action. Based in part on the comments of plaintiffs, the Council, and other members of the interested public, NMFS will develop and recommend a schedule to the Council that will enable NMFS to take that other action, as quickly as practicable, but, in any event, no later than 24 months from the date of the ROD, pursuant to the appropriate decisions made in accordance with the provisions of Paragraphs 11(b) and (c) below.

b. If the Council transmits a proposed FMP amendment and implementing regulations to NMFS in accordance with the schedule that NMFS recommends to the Council pursuant to Paragraph 11(a) above, NMFS will evaluate the FMP amendment and implementing regulations pursuant to the standards and deadlines set forth in 16 U.S.C. §§ 1851 and 1854(a)-(b). If the Council transmits a proposed action other than an FMP amendment to NMFS, in accordance with the schedule that NMFS recommends to the Council pursuant to Paragraph 11(a) above, NMFS will review; approve, disapprove, or partially approve; and, if appropriate, implement such action pursuant to the standards and time-frames established by the Magnuson-Stevens Act and other applicable law.

c. If NMFS disapproves, in whole or in part, the EFH provisions of a proposed FMP amendment and/or proposed implementing regulations submitted to NMFS pursuant to Paragraph 11(b) above, or if the Council fails to comply with the schedule recommended by NMFS pursuant to Paragraph 11(a) above. NMFS will issue a written determination, stating either that NMFS will develop an FMP amendment and/or implementing regulations or other appropriate action, or that an FMP amendment and/or implementing regulations or other actions are no longer necessary within the timeframe proposed. If NMFS disapproves, in whole or in part, an action other than an FMP amendment submitted to NMFS pursuant to Paragraph 11(b) above, or if the Council fails to comply with the schedule recommended by NMFS pursuant to Paragraph 11(a) above for such other action, NMFS will issue a written determination, stating either that NMFS will develop an appropriate action or that no action is necessary within the timeframe proposed.

d. Nothing in this Joint Stipulation and Order will limit the discretion of NMFS to decide to issue the EISs prepared pursuant to this Joint Stipulation and Order in combination with other FMP amendments. In the event that it decides to do so, NMFS will notify the Court and plaintiffs in writing within seven days after making such a decision. Further, NMFS will not exceed the EIS preparation schedule set forth in Paragraph 9 above and Attachment 1 hereto. Nothing in this sub-paragraph will be construed to limit plaintiffs' right to sue on any grounds, including NEPA, regardless of whether NMFS decides to integrate the EISs prepared pursuant to this Joint Stipulation and Order into an EIS already being prepared for an FMP amendment.

12. As to the New England Fishery Management Council, if NMFS determines in a ROD that action is necessary and that the applicable FMP will be amended so as to comply with the requirements of Section 303(a)(7) of the Magnuson-Stevens Act, NMFS will approve an FMP amendment and implementing regulations by no later than February 1, 2005, for the groundfish and the scallop fisheries, and by no later than September 10, 2005, for the herring, monkfish, and salmon fisheries, unless the Secretary subsequently determines that an FMP amendment and implementing regulations are no longer necessary. If NMFS determines that action other than an FMP amendment and implementing regulations is necessary, NMFS will approve that other action by no later than February 1, 2005, for the groundfish and the scallop fisheries, and by no later than September 10,

2005, for the herring, monkfish, and salmon fisheries, unless the Secretary subsequently determines that such other action is no longer necessary.

a. If the Council transmits a proposed FMP amendment and implementing regulations to NMFS in a timely manner that would allow NMFS to meet its schedule for approving an FMP amendment and implementing regulations by no later than February 1, 2005, for the groundfish and the scallop fisheries, and by no later than September 10, 2005, for the herring, monkfish, and salmon fisheries, NMFS will evaluate the FMP amendment and implementing regulations pursuant to the standards and deadlines set forth in 16 U.S.C. §§ 1851 and 1854(a)-(b). If the Council transmits a proposed action other than an FMP amendment to NMFS in a timely manner that would allow NMFS to meet its schedule for approving that other action by no later than February 1, 2005, for the groundfish and the scallop fisheries, and by no later than September 10, 2005, for the herring, monkfish, and salmon fisheries, NMFS will review; approve, disapprove, or partially approve; and, if appropriate, implement such action pursuant to the standards and time-frames established by the Magnuson-Stevens Act and other applicable law.

b. If NMFS disapproves, in whole or in part, the EFH provisions of a proposed FMP amendment and/or ~~proposed~~ implementing regulations submitted to NMFS pursuant to Paragraph 12(a) above, or if the Council fails to act in a timely manner that would allow NMFS to meet its schedule for approving an FMP amendment and implementing regulations by no later than February 1, 2005, for the groundfish and the scallop fisheries, and by no later than September 10, 2005, for the herring, monkfish, and salmon fisheries, NMFS will issue a written determination, stating either that NMFS will develop an FMP amendment and/or implementing regulations or other appropriate action, or that an FMP amendment and/or implementing regulations or other actions are no longer necessary within the timeframe proposed. If NMFS disapproves, in whole or in part, an action other than an FMP amendment submitted to NMFS pursuant to Paragraph 12(a) above, or if the Council fails to act in a timely manner that would allow NMFS to meet its schedule for approving such other action by no later than February 1, 2005, for the groundfish and the scallop fisheries, and by no later than September 10, 2005, for the herring, monkfish, and salmon fisheries, NMFS will issue a written determination, stating either that NMFS will develop an appropriate action or that no action is necessary within the timeframe proposed.

III. STATUS REPORTS AND NOTIFICATIONS

13. For each EFH Amendment that is the subject of the Joint Stipulation and Order, NMFS will provide notice to the Court and plaintiffs, as soon as possible, upon the occurrence of each of the events specified in Sections II.B. and II.C. of this Joint Stipulation and Order.

14. NMFS will send to plaintiffs, by regular, first-class United States mail only, ten copies of each of the following documents, on the date of their release to the public: the Draft EIS, the Final EIS, the ROD, the proposed FMP Amendment and implementing regulations (if any), and the Final FMP Amendment and implementing regulations (if any). NMFS may provide the documents to plaintiffs on CD-ROM in a mutually acceptable file format, instead of paper copies.

15. Every 90 days, NMFS will file a status report with the Court describing the work that has been done by NMFS and the Councils, and the milestones that have been achieved, in preparing the EISs and, if applicable, the FMP Amendments, that are the subject of this Joint Stipulation and Order. NMFS will file the first status report within 90 days of the date of the entry of this Joint Stipulation as an Order of the Court.

16. All written notices, status reports, and documents referenced in this Joint Stipulation

and Order will be served on counsel for the parties at the following addresses and, whenever appropriate, by facsimile, at the following facsimile numbers, unless otherwise provided herein:

For Plaintiffs:
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IV. GENERAL PROVISIONS

17. This Joint Stipulation will become effective upon the date of its entry as an Order of the Court. On that date, the injunction that is set forth in the Court's Memorandum Opinion and Order filed on September 14, 2000, and that prohibits federal defendants from enforcing the EFH Amendments is dissolved. Also, upon entry of this Joint Stipulation as an Order of the Court, plaintiffs will dismiss their appeal of the Court's summary judgment ruling on their Magnuson-Stevens Act claims.

18. The terms and provisions of this Joint Stipulation and Order will apply to and be binding upon the parties hereto.

19. If there is a dispute over compliance with any term or provision of this Joint Stipulation and Order, the disputing party will notify the other parties in writing of the dispute. The parties will attempt to work out the dispute informally before seeking judicial review by this Court.

20. The disputing party will engage the other parties in informal dispute resolution. During this informal dispute resolution period, which will not exceed 21 days (unless the parties agree to an extension of the period), the parties will meet as many times as both deem necessary to discuss and attempt to resolve the dispute.

21. If the parties are unable to resolve the dispute through informal dispute resolution, either party may file a motion asking that the Court enforce the relevant term(s) and provision(s) of the Joint Stipulation and Order.

22. Each party expressly reserves the right to move the Court for relief from the provisions of this Joint Stipulation and Order, pursuant to Rule 60 of the Federal Rules of Civil Procedure.

23. Plaintiffs expressly reserve the right to apply to the Court for litigation costs, including attorney fees and expenses. Federal defendants expressly reserve all rights and defenses regarding plaintiffs' application(s) for costs.

24. The Court will retain jurisdiction over this case for the purpose of enabling the parties to this Joint Stipulation and Order to apply to the Court for any further order that may be necessary to construe, carry out, or enforce the terms of this Joint Stipulation and Order.

25. Upon formal written request by plaintiffs, transmitted by facsimile and mail, NMFS will produce, within 45 days of the date on which the agency receives the written request by facsimile, any document that pertains to the EISs, RODs, and any applicable FMP amendments prepared pursuant to this Joint Stipulation and Order, that is not already in the possession of plaintiffs or that is not already readily available to plaintiffs, unless the requested document is deemed by federal defendants to be protected from disclosure by privilege and/or unless the parties have agreed to a separate production schedule, as provided in this paragraph below. Federal defendants expressly reserve the right to assert the applicable privilege(s) as to any document(s) requested by plaintiffs and, based on that assertion, withhold the document(s) from production. In the event that federal defendants withhold from disclosure a document or documents requested by plaintiffs based upon their assertion of privilege, federal defendants will inform plaintiffs of their action and explain the basis for their action, promptly and in writing. In the event that plaintiffs' request for production of documents and/or NMFS's response thereto is complex or voluminous, the parties will confer and, if appropriate, agree to a period longer than 45 days for NMFS to produce the requested documents.

26. No term or provision of this Joint Stipulation and Order will constitute or will be

construed as a commitment or a requirement that federal defendants obligate or pay funds in contravention of the Anti-Deficiency Act, 31 U.S.C. § 1341, and any other applicable law or regulation.

27. This Joint Stipulation and Order is the entire agreement between the parties in this case. All prior conversations, meetings, discussions, drafts, and writings of any kind are specifically superseded by this Joint Stipulation and Order. The terms of this Joint Stipulation and Order will not be changed, revised, or modified, except as provided (1) by a written instrument signed by the parties to this Joint Stipulation and Order and approved and entered by this Court as an Order; or (2) by an Order of the Court based on a party's motion for relief pursuant to Rule 60 of the Federal Rules of Civil Procedure, as set forth in Paragraph 22 above.

28. The undersigned representative(s) for each party certifies that he or she is fully authorized by the party or parties whom he or she represents to enter into the terms and conditions of this Joint Stipulation and Order and to bind such party or parties legally to it.

Respectfully submitted this 5th day of December, 2001,

STEPHEN E. ROADY
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Attorneys for Texas Shrimp Association and
Wilma Anderson

~~[PROPOSED]~~ ORDER

APPROVED and ENTERED as an Order of this Court, on this 12th day of December, 2001.

HON. GLADYS KESSLER
United States District Judge

The following counsel should be notified of the entry of this Order:

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Eric Bilsky
Monica B. Goldberg
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Council/ Fisheries	Notice of Intent to Prepare EIS Published in Federal Register	Scoping Period	Scoping Meetings	Draft EIS Published	Draft EIS Public Comment Period	Issuance of Final EIS	Issuance of Record of Decision
NEFMC / groundfish	2/1/01	2/1/01 - 4/4/01	Gloucester 2/22/01	10/31/03	10/31/03 - 1/30/04	5/31/04	7/1/04
NEFMC / scallops	2/1/01	2/1/01 - 4/4/01	Gloucester 2/22/01	10/31/03	10/31/03 - 1/30/04	5/31/04	7/1/04
NEFMC / herring, monkfish, salmon	9/10/01	9/10/01 - 11/21/01	Gloucester 11/7/01	10/31/03	10/31/03 - 1/30/04	5/31/04	7/1/04
CFMC / all fisheries challenged in AOC v. Daley	3/19/01	3/19/01 - 4/18/01 and 6/4/01 - 6/27/01	St. John 6/12/01 St. Thomas 6/13/01 St. Croix 6/14/01 Halo Rey 6/18/01 Arecibo 6/19/01 Mayaguez 6/20/01 Ponce 6/21/01 Culebra 6/25/01 Vieques 6/26/01 Fajardo 6/27/01	12/30/02	12/30/02 - 3/31/03	9/30/03	10/30/03
GMFMC / all fisheries challenged in AOC v. Daley	3/19/01	3/19/01 - 4/18/01 and 6/8/01 - 6/30/01	Corpus Christi 6/14/01 Houston 6/15/01 Kenner 6/18/01 Biloxi 6/19/01 Panama City 6/21/01 Key West 6/25/01 Tampa 6/28/01	1/30/03	1/30/03 - 4/30/03	11/28/03	12/30/03
PFMC / groundfish	4/10/01	4/10/01 - 6/30/01	Newport 5/22/01 Astoria 5/23/01 Eureka 5/29/01 Los Alamitos 5/30/01 Seattle 6/5/01 Burlingame 6/12/01	8/8/03	8/8/03 - 11/10/03	4/2/04	5/2/04
NPFMC / all fisheries challenged in AOC v. Daley	6/6/01	6/6/01 - 7/21/01	Kodiak 6/4/01 Unalaska 6/8/01 Anchorage 6/11/01 Seattle 6/19/01 Juneau 6/20/01 Sitka 6/21/01	8/1/03	8/1/03 - 10/31/03	6/1/04	8/13/04

CERTIFICATE OF SERVICE

I hereby certify that a true and accurate copy of the foregoing JOINT STIPULATION AND [PROPOSED] ORDER was served on December 5, 2001, by regular, first-class United States mail, postage pre-paid, on the following counsel:

Stephen E. Roady
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