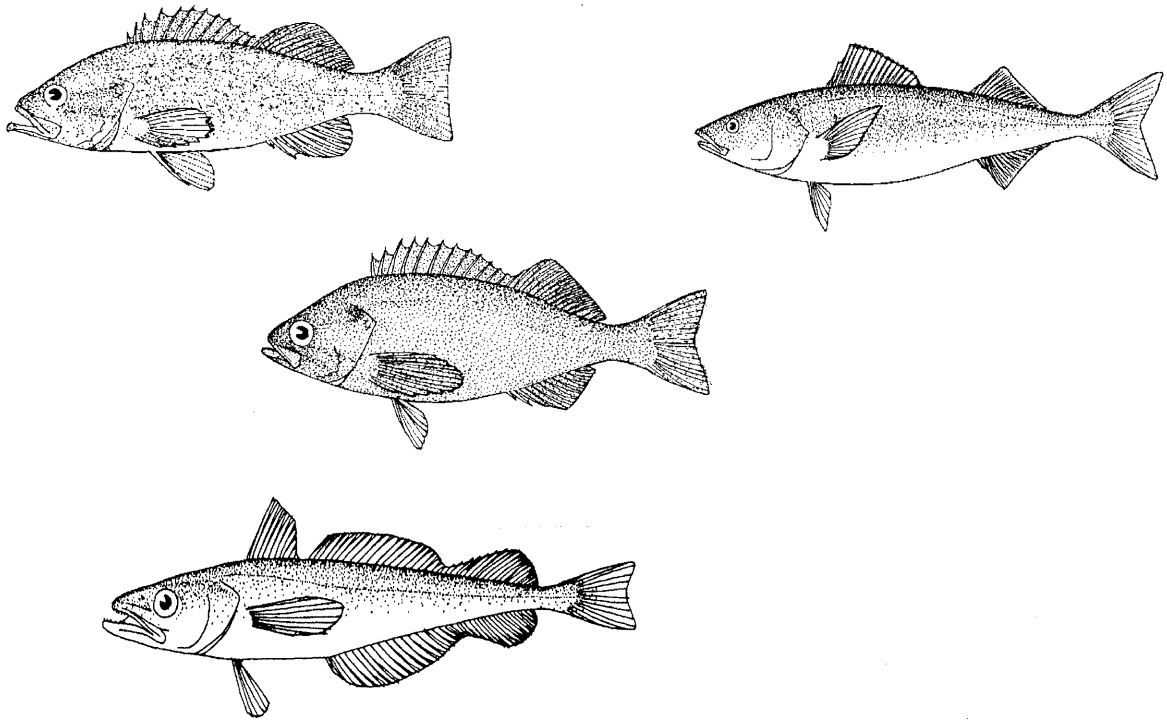
STATUS OF THE PACIFIC COAST GROUNDFISH FISHERY THROUGH 1998 AND RECOMMENDED ACCEPTABLE BIOLOGICAL CATCHES FOR 1999

Stock Assessment and Fishery Evaluation



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ACKNOWLEDGEMENTS

This is the fifteenth in a series of documents which review past years' fishery performance and Council management actions, in addition to assessing the status of a number of groundfish stocks off Washington, Oregon, and California.

Several of the appendices to this document were prepared by scientists other than Groundfish Management Team members. The Groundfish Management Team and Council are deeply indebted to these individuals and gratefully acknowledge the excellent cooperation and diligent efforts that resulted in these documents.

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LIST OF ACRONYMS

ABC	acceptable biological catch
CAGEAN	catch at age analysis
Council	Pacific Fishery Management Council
CPUE	catch per unit effort
DTS	Dover sole/thornyhead/trawl-caught sablefish complex
EEZ	exclusive economic zone
EFP	experimental fishing permit
F	fishing mortality rate
FMP	fishery management plan
GDP	gross domestic product
GMT	Groundfish Management Team
GNP	gross national product
GSG	Groundfish Select Group
INPFC	International North Pacific Fishery Commission
IQ	individual quota
M	natural mortality
Magnuson-Stevens Act	Magnuson-Stevens Fishery Conservation and Management Act
MFCMA	Magnuson Fishery Conservation and Management Act
MSY	maximum sustainable yield
mt	metric ton
NMFS	National Marine Fisheries Service
ODFW	Oregon Department of Fish and Wildlife
OY	optimum yield
PacFIN	Pacific Coast Fisheries Information Network
PSMFC	Pacific States Marine Fisheries Commission
Secretary	U.S. Secretary of Commerce
SSC	Scientific and Statistical Committee
WDFW	Washington Department of Fish and Wildlife
WOC	Washington, Oregon, and California

INTRODUCTION

This is the fifteenth annual status of the Pacific coast groundfish fishery document prepared for the Pacific Fishery Management Council. The purpose of this report is to briefly summarize the development of the fishery management plan (FMP) and to describe the history of the fishery and its management since the enactment of the Magnuson-Stevens Fishery Conservation and Management Act.

Included in this report are a description of landings, fishing patterns, estimates of the status of stocks (including appended status of stocks analyses for major species) and acceptable biological catches (ABC) for 1997-1998, as well as those proposed for 1999. This year, the historical information on the groundfish fishery from 1983-1996 has been inserted into a historical SAFE document, which will not require revision every year.

RECENT HISTORY OF MANAGEMENT, 1997-1998

1997 Fishery

The acceptable biological catches (ABCs) and harvest guidelines for 1997 were approved by the Council at the October 1996 meeting held in South San Francisco, California. For 1997, the Council again set harvest guidelines for Pacific whiting, lingcod, sablefish, jack mackerel, Pacific ocean perch, shortbelly rockfish, widow rockfish, Sebastes complex (northern and southern areas), bocaccio, yellowtail rockfish (northern and southern areas), Dover sole (coastwide and the Columbia area), canary rockfish, shortspine thornyhead, and longspine thornyhead.

Limited entry and open access allocation percentages were nearly identical to 1996 (Table 49). Harvest guidelines were generally set for landed catch, less than the respective ABCs in many cases to take into account anticipated discard resulting from trip limit management. Species for which the harvest guideline was below the ABC include Dover sole, Sebastes complex, widow and canary rockfish, sablefish, and shortspine thornyhead. The yellowtail rockfish harvest guideline was set for total catch, with the intention of adjusting the target inseason based on bycatch in other groundfish fisheries.

For the limited entry fishery, the Council continued the policy of two-month cumulative vessel limits for all species managed with "trip limits," with the target harvest level per month being 50% of the two-month limit. However, limited entry vessels could land as much as 60% of the two-month limit during either of the two months, so long as the total for the two months did not exceed the specified limit. (Open access vessels were limited to 50% per month.) The Council believed the combination of two-month limits and the 60:40 opportunity would both reduce discards and reduce the number of times vessels might be cited for inadvertently exceeding the specified limits. As in 1996, the specified two-month periods were January through February, March through April, May through June, July through August, September through October, and November through December.

Sebastes Complex Harvest guidelines for the Sebastes complex were established for the Vancouver/Columbia area and the Eureka/Monterey/Conception area; harvest guidelines for both areas are substantially below previous years and near the levels of recent landings (6,656 mt and 9,284 mt, respectively, compared to 11,900 mt and 13,200 mt in 1996). A new stock assessment calculated ABCs for several species of the Sebastes complex; the harvest guidelines were calculated as the sums of either the ABC or recent catch, whichever was less, for each species, combined with the recent catch amounts of the other rockfish species.

Bocaccio The 1996 bocaccio rockfish assessment indicated a dramatic decline in that stock also, but in this case, the industry generally agreed that abundance had declined substantially. The harvest guideline for the Monterey and Conception areas combined was reduced from the 1996 level of 1,700 mt to 387 mt in 1997, which again was based on the overfishing harvest rate. The Council stated its intention to reduce the harvest guideline from this level down to the 265 mt ABC in 1998.

Yellowtail rockfish Amid considerable controversy over the 1996 stock assessment, the Council set the 1997 yellowtail rockfish harvest guideline at a fishing rate that would, in the long run, overfish the stock, even under the least conservative scientific assessment of the stock condition. However, the Council clearly stated its intent to return to the standard ($F_{35\%}$) harvest rate in 1998, which would be equal to the ABC. The Council's 1997 ABC recommendation for the Vancouver and Columbia areas combined was 1,773 mt, a reduction of over 70% from the 1996 ABC of 6,540 mt. The harvest guideline was set at 2,762 mt for total catch level rather than landed catch level. Setting the harvest guideline at total catch was part of a strategy to deduct a predicted amount of bycatch for the whiting, shrimp, and other fisheries to begin the year, replacing the predicted values with the actual catches as data became available inseason. There was initially 1,207 mt of yellowtail rockfish for "targeted" fishing by limited entry groundfish vessels in the area. In addition, the open access fisheries were allocated 265 mt (9.6% of the harvest guideline), and bycatch in other limited

entry fisheries (predominantly the whiting fishery) was expected to be 1,290 mt. The choice of ABC and harvest guideline was very controversial due to widely disparate views of the scientific community and industry. Data from resource surveys, along with fish age and length data from recent commercial catches, indicated a steep decline in population and the likelihood the stock has been over harvested in recent years. Spawning stock biomass was estimated at 15% to 22% of the unfished spawning biomass in the southern Vancouver area, 7% to 16% in the northern Columbia area, and 10% to 22% in the south Columbia-Eureka area. A primary factor in this conclusion was the apparent absence of old fish in commercial trawl and survey catches. Many commercial fishers reported they have difficulty avoiding yellowtail rockfish even when fishing for other species, such as Pacific whiting. The Council requested that efforts be made in 1997 to identify all possible additional information sources that might be used in a new assessment, and a new assessment was prepared for consideration in setting harvest levels for 1998.

In developing trip limits for the Sebastes complex, the Council considered the proportion of recent years' landings made up of yellowtail rockfish, canary rockfish, and bocaccio. The Council intended to avoid trip limits that would exacerbate incidental catch and discard of those species. Although the assessment and harvest guideline boundary was the Eureka-Columbia border, the boundary between trip limit areas was Cape Mendocino. The cumulative two-month limit for the Sebastes complex was set at 30,000 pounds north of Cape Mendocino and 150,000 pounds to the south. Within these limits, not more than 6,000 pounds could be yellowtail rockfish taken in the north and not more than 12,000 pounds could be bocaccio taken in the south (the 6,000 pound yellowtail cumulative limit was a reduction of over 90% for the area between Cape Lookout, Oregon and Cape Mendocino, where the two-month trip limit was 70,000 pounds in January 1996. North of Cape Lookout the two-month limit had been 32,000 pounds in 1996). The Council also reduced the groundfish landing allowance for shrimp fishers. There was a 14,000 pound limit for canary rockfish coastwide. The bocaccio limit was reduced to 10,000 pounds effective May 1. As of mid-August, the pace of yellowtail rockfish landings was about 20% below that needed to achieve the harvest guideline, and bocaccio landings (recreational plus commercial) were projected to reach near the ABC.

Pacific Whiting The Council set the Pacific whiting ABC at 290,000 mt and the harvest guideline for U.S. waters at 232,000 mt, 80% of the ABC. The Makah tribe requested the Council to endorse an increased allocation of 25,000 mt for 1997. As in 1996, the Council recommended that NMFS not allocate any whiting for tribal fisheries. However, NMFS established an allocation of 25,000 mt. The Council adopted a new non-Indian allocation program to replace the allocation program that expired at the end of 1996. The new allocation divides the annual harvest guideline with 42% (86,900 mt in 1997) for vessels delivering to shore-based processors, 24% (49,700 mt in 1997) for vessels delivering to at-sea processors (i.e., motherships), and 34% (70,400 mt in 1997) allocated to catcher-processors. Catcher-processor vessels may participate in only one sector's fishery each year and may not deliver whiting to motherships or shore-based processors if they also act as catcher-processors. (They may, however, receive codends during the catcher-processor season, with those catches applying towards the catcher-processor allocation.) Separate seasons may also be adopted for each sector, including shore-based operations in northern California; for 1997, the Council recommended the northern California fishery be delayed to April 15, and the shore-based fishery north of 42° N latitude to June 15. Landings in northern California prior to the other shore-based season were capped at five percent (4,345 mt in 1997) of the shore-based allocation. Because implementation of the regulation occurred in May, the northern California whiting fishery opened March 1 as specified in then current regulations, but fishing started in late April. The mothership and catcher-processor seasons began May 15, the same as in 1996. The regulation states any unused allocation will be re-allocated to the other sectors in proportion to their initial allocations; releases will be made on or after September 15. The allocation regulation will continue indefinitely but will be reviewed in five years. The program includes a provision that allows at-sea processors to process fish waste from shore whiting plants even when other at-sea processing by catcher-processors and mothership processors is prohibited, except for 48 hours before and after the primary seasons for at-sea processing. This is intended to reduce disposal and fish meal production problems during peak shore-based production periods.

The northern California shore-based fishery was temporarily closed at noon on May 27 when 4,334 mt had been landed. The mothership processor sector reached its allocation and was closed at 3 p.m. on June 1. The catcher-processor sector established a cooperative whereby each company limited its production to an agreed percent of the total catcher-processor allocation. The fishery closed at noon on June 11.

The shore-based whiting fishery north of 42° N latitude opened June 15 and proceeded rapidly, closing at noon on August 22. The rate of landings was variable, but there was a trend of increasing average daily rate during the season. The average rate of landings from June 15 through August 2 was nearly 1,202 mt/day, increasing to over 1,321 mt/day in July.

Bycatch in the whiting fishery NMFS data indicate that yellowtail rockfish bycatch in the catcher/processor and non-tribal mothership fisheries was 290 mt. The overall chinook salmon bycatch rate for the non-tribal mothership and catcher/processor sectors was 0.016 chinook per mt of whiting. The rate by factory trawlers was again lower than that of the mothership processor sector: 0.008 compared to 0.026.

Preliminary ODFW data indicate that 230 mt of yellowtail and 159 mt of widow rockfish was landed by whiting vessels. The 1997 bycatch rates for these species was substantially lower than the 1996 rates. Coastwide salmon bycatch in the shore-based fishery was 0.019 salmon per metric ton of whiting. Preliminary estimates from observer data indicate that yellowtail rockfish bycatch in the tribal whiting fishery was 113 mt in 1998. The chinook rate in the tribal fishery was 0.102.

Dover sole, thornyheads, and trawl-caught sablefish (DTS) complex The coastwide and Columbia area Dover sole harvest guidelines for landed catch were again set at 11,050 mt and 2,850 mt. The two thornyhead species were managed with separate harvest guidelines as in 1996. For shortspine thornyheads north of Point Conception the harvest guideline remained at 1,500 mt (1,380 mt when anticipated discard was subtracted), which is 50% above the ABC but below the overfishing level in order to allow greater harvest of longspine thornyheads (both species are usually caught together, but in varying proportions). The longspine harvest guideline remained at 6,000 mt, 1,000 mt below its ABC, to help prevent overharvest of shortspines. The sablefish ABC and harvest guideline were also the same as 1996. Harvest by Washington treaty Indian tribes was set at 780 mt, ten percent of the harvest guideline. This amount was taken "off the top" before any nontreaty allocations were established. All tribal harvest inside and outside the tribes' usual and accustomed fishing area north of Point Chehalis apply to this allocation.

Management of the DTS complex was similar to 1996; the Council continued the policy of separating the two thornyhead species, with a separate sublimit for sablefish also. The DTS cumulative limit was set at 70,000 pounds north of Cape Mendocino and 100,000 pounds south of Cape Mendocino, with not more than 12,000 pounds of sablefish, and not more than 20,000 pounds of thornyheads, of which not more than 4,000 pounds may be shortspines. Not more than 500 pounds of sablefish per trip may be smaller than 22 inches. When the Council set these limits at the October 1996 meeting, it noted that the proposed trip limits would probably not slow landings enough for a year-round fishery, and a closure during November to December, and possibly earlier, in 1997 would be likely. At the April meeting, the GMT reported that landings of Dover sole in the Columbia area and shortspine thornyhead were proceeding far too fast, and the Council recommended reduction of the two-month cumulative limit for Dover sole from 38,000 pounds to 30,000 pounds north of Cape Mendocino. For thornyheads coastwide, the two-month limit was reduced from 20,000 pounds to 15,000 pounds, with not more than 3,000 pounds of shortspine thornyhead. The cumulative limit for the DTS complex north of Cape Mendocino was reduced to 57,000 pounds. Even with these reductions, which took effect May 1, it appeared unlikely the fishery would extend through the year. In response to industry recommendations, the Council asked for public comment about whether to impose a mid-summer closure rather than waiting till the end of the year. At the June meeting, the GMT projected the harvest guidelines for Dover sole in the Columbia area and trawl sablefish would be reached in early November and perhaps earlier. Industry comment mostly opposed a mid-summer closure, and rather than further reduce the cumulative limits, which would likely increase regulatory discards, the Council let the fishery proceed to an early closure.

Widow rockfish The Council set the harvest guideline at 6,500 mt, the same as 1996. This was determined by subtracting 1,200 mt from the ABC to account for anticipated discards (this is a 16% discard factor). The cumulative vessel limit remained at 70,000 pounds per two months, with a recommended target of 35,000 pounds per month. Effective May 1, the Council reduced the two-month cumulative limit to 60,000 pounds. Landings were expected to reach the harvest guideline.

Lingcod The trip limit was again set at 40,000 pounds per two months, none smaller than 22 inches, except that trawl vessels could land up to 100 pounds of small lingcod per trip. In June, the GMT projected that commercial landings would reach the commercial harvest guideline in early October. The Council responded by reducing the two-month limit to 30,000 pounds. There were questions about whether the recreational harvest would reach the original expectation of 900 mt; if not, the commercial trip limit might be adjusted upward later in the year.

Nontrawl Sablefish The Council attempted to eliminate the nontrawl sablefish derby in 1997. Initially, the Council recommended the primary fishery be managed as a three-week cumulative limit, equal for all vessels. However, NMFS determined that proposal would be classified as an individual quota, which is prohibited until October 1, 2000. At its March meeting, the Council adopted a proposal for a ten-day fishery with equal cumulative limits (expected to be about 36,000 pounds) for all qualified participants. As in previous years, a mop-up fishery would be established to harvest fish left over from the primary fishery. A sablefish endorsement was required to participate in those seasons. To prevent further growth of the daily-trip-limit (DTL) fishery (and subsequent erosion of the primary fishery), a target of about 915,000 pounds was set for the DTL fishery. To limit landings to this amount, a cumulative monthly limit of 5,100 pounds was established May 1. At its June meeting, the Council recognized the primary season would have to be shorter than ten days in order to avoid the individual quota classification, and recommended it be nine days beginning August 25. It was also discovered that, in spite of the monthly cumulative limit, landings by the DTL fishery would reach 800,000 pounds to 900,000 pounds by the end of June. The Council therefore recommended the monthly cumulative limit be reduced to 600 pounds, effective July 1. At this time, the Council also reduced the open access DTL cumulative monthly limit from 1,500 pounds to 600 pounds, in order to prevent effort shifts.

The primary season opened August 25 at noon and closed September 3 at noon, with an equal cumulative limit for all vessels of 34,100 pounds. The preliminary estimates of landings during the open season were 3.8 million pounds to 4.2 million pounds, less than the 4.5 million pounds expected to be taken. At the September meeting, the Council recommended the primary fishery mop-up season be two weeks beginning in late September or early October. The mop-up season opened October 1 at noon and was expected to close October 15 at noon, with a cumulative limit of 8,500 pounds. Because of inclement weather during the first week of the mop-up season, NMFS extended the mop-up season to close October 22 at noon. Because harvest in the open access fishery was projected to be well below its allocation, the Council raised the open access DTL cumulative monthly limit back to 1,500 pounds beginning October 1. In order to prevent effort shifts, the cumulative monthly limit on the limited entry DTL fishery was also set to 1,500 pounds, commencing at the end of the mop-up fishery. Under these limits, it is expected that the amount by which the limited entry DTL fishery exceeds its target will be balanced by under harvest in the open access fishery.

1998 Fishery

The acceptable biological catches (ABCs) and optimum yields/harvest guidelines (OY/HG) for 1998 were approved by the Council at the November 1997 meeting held in Portland, Oregon. For 1998, the Council again set harvest guidelines for Pacific whiting, lingcod, sablefish, jack mackerel, Pacific ocean perch, shortbelly rockfish, widow rockfish, *Sebastes* complex (northern and southern areas), bocaccio, yellowtail rockfish (northern and southern areas), Dover sole (coastwide and the Columbia area), canary rockfish, shortspine thornyhead, and longspine thornyhead.

Limited entry and open access allocation percentages were identical to 1998 (Table 36). Harvest guidelines were generally set for landed catch, less than the respective ABCs in many cases to take into account anticipated discard resulting from trip limit management. Species for which the landed catch harvest guideline was below the ABC include Dover sole, lingcod, *Sebastes* complex, widow, yellowtail, and canary rockfish, sablefish, shortspine thornyhead, and longspine thornyhead.

For the limited entry fishery, the Council continued the policy of two-month cumulative vessel limits for all species managed with "trip limits," with the target harvest level per month being 50% of the two-month limit. However, limited entry vessels could land as much as 60% of the two-month limit during either of the two months, as long as the total for the two months did not exceed the specified limit. (Open access vessels were limited to 50% per month). The Council believed the combination of two-month limits and the 60:40

opportunity would both reduce discards and reduce the number of times vessels might be cited for inadvertently exceeding the specified limits. As in 1997, the specified two-month periods were January through February, March through April, May through June, July through August, September through October, and November through December.

In 1998, the GMT began a system for tracking the open access fishery for the first time, allowing inseason management changes. Landings in January and February in all fisheries were significantly lower than expected due to severe weather conditions coastwide. As a result, limits for limited entry widow, Sebastes, DTS complex, fixed gear sablefish and open access bocaccio and fixed gear sablefish were increased effective May 1. Open access landings generally proceeded more quickly than expected, leading to restrictions in July, closure of the open access lingcod fishery coastwide on August 1, prohibition of all *Sebastes* landings north of Cape Blanco, Oregon on October 1, and prohibition of canary and widow rockfish landings coastwide on October 1.

Another factor affecting portions of the groundfish fleet in 1998 was a sharp decline in availability of pink shrimp. PacFIN estimates of 1998 pink shrimp landings are around 4,338 mt, compared to 17,472 mt in 1997 and 13,822 mt in 1996.

Sebastes Complex Harvest guidelines for the *Sebastes* complex were established for the Vancouver/Columbia area and the Eureka/Monterey/Conception area; harvest guidelines for the northern area increased from 6,656 mt to 7,057 mt. The southern area harvest guideline decreased from 9,284 mt in 1997 to 8,439 mt due to reductions in yellowtail in the Eureka area, and reductions in bocaccio and chilipepper based on the $F_{40\%}$ harvest rate. The harvest guidelines for the *Sebastes* complex were calculated as the sums of either the ABC or recent catch, whichever was less, for each species, combined with the recent catch amounts of the other rockfish species. The yellowtail rockfish assessment in 1997 provided an ABC of 4,657 mt for the Vancouver-Columbia-Eureka areas, including Canada, compared to a 1997 US ABC of 1,773 mt. The U.S. portion was estimated to be 3,539 mt, 76 percent of the U.S.-Canada ABC, based on the survey biomass estimate for the portion of the assessment area in U.S. waters, The 1998 ABC of 3,118 mt represented a precautionary reduction of 10%. The chilipepper rockfish ABC was reduced to the $F_{40\%}$ level, from 4,000 mt to 3,400 mt. For bocaccio, the harvest guideline for the Monterey and Conception areas combined was reduced from the 1997 level of 387 mt to 230 mt, which was the ABC calculated at $F_{40\%}$. The canary rockfish ABC remained the same as in 1997 at 1,045 mt. The landed catch harvest guideline of 878 mt reflects a 16 percent discard adjustment.

Beginning January 1, the limited entry fishery for the *Sebastes* complex was managed under a 2-month cumulative trip limit of 40,000 lb north of Cape Mendocino and 150,000 lb south of Cape Mendocino. Within these 2-month cumulative limits for the *Sebastes* complex, no more than 11,000 lb could be yellowtail rockfish north of Cape Mendocino, no more than 2,000 lb could be bocaccio south of Cape Mendocino, and no more than 15,000 lb could be canary rockfish coastwide. On May 1, the 2-month cumulative trip limit for yellowtail rockfish was increased to 13,000 lb because landings had been slowed by unusually severe weather during the first quarter of 1998, and increasing the cumulative limit was expected to allow achievement of the yellowtail OY by the end of the year. On July 1, the 2-month cumulative trip limit for *Sebastes* south of Cape Mendocino was lowered to match the 40,000 lb limit north of Cape Mendocino because *Sebastes* landings in the southern area had been proceeding at a faster rate than had been anticipated. In 1998, fishers landing *Sebastes* complex species south of Cape Mendocino were finding unusually large concentrations of splitnose rockfish (also known as "rosefish"), and large splitnose rockfish landings had driven the *Sebastes* harvest rate south of Cape Mendocino sharply upward. On September 1, the 2-month trip limits were converted to 1-month trip limits and were set at 20,000 lb cumulative per month for the *Sebastes* complex, of which no more than 6,500 lb could be yellowtail rockfish north of Cape Mendocino, no more than 1,000 lb could be bocaccio south of Cape Mendocino, and no more than 7,500 lb could be canary rockfish coastwide.

Despite the July 1 reduction to the *Sebastes* trip limit south of Cape Mendocino, rockfish landings in the southern area continued at an unusually fast rate, forcing the Council to reduce limits for that area again in October. On October 1, the monthly cumulative trip limit for *Sebastes* complex species south of Cape Mendocino was reduced to 15,000 lb. Coastwide landings of canary rockfish had also been proceeding at an accelerated rate, and at its September meeting, the Council announced that it expected that the 953 mt limited entry allocation for canary rockfish would be reached by October 1, 1998. The Council further

expected that, even if all landings of canary rockfish were prohibited from October 1, 1998 through the end of the year, fishers would still have to discard at least 500 lb (227 kg) per month of incidentally-caught canary rockfish. Because incidentally-caught canary rockfish are dead when brought to the surface, requiring fishers to discard these fish would not reduce fishing mortality. For this reason, the Council decided to exceed the 1998 limited entry allocation for canary rockfish by allowing a small monthly trip limit of 500 lb within the overall *Sebastes* complex limit, effective October 1, 1998, so that fishers would not have to discard all of their incidentally caught canary rockfish. The Council expected that this amount would be small enough to discourage targeting on canary rockfish. Projected 1998 landings of *Sebastes* complex species north of Cape Mendocino, yellowtail rockfish north of Cape Mendocino, and canary rockfish coastwide are all expected to be within 5 percent of the HG for those species or species groups. Landings of *Sebastes* complex species south of Cape Mendocino were projected to be 5,272 mt, 12.7 percent above the HG, while bocaccio landings were projected to be over 60 percent below that species' HG.

Open access *Sebastes*. Landings in the open access fishery of yellowtail, canary rockfish, bocaccio, and the *Sebastes* complex as a whole were initially constrained in 1998 by cumulative limits that were 50 percent of the 2-month limited entry cumulative limits. Open access limits were linked to limited entry limits when the limited entry limit for yellowtail rockfish north of Cape Mendocino was increased on May 1 and, as a consequence, the open access limit for yellowtail increased from 5,500 lb to 6,500 lb. However these limits were not low enough to keep open access harvest rates at levels that could be sustained throughout the year, particularly for northern rockfish fisheries and for canary rockfish coastwide. Conversely, *Sebastes* complex harvest attainment in the limited entry fishery south of Cape Mendocino was unusually fast, which meant that the associated open access limit did not need to be reduced as quickly as the limited entry limit for that species complex. Open access limits for *Sebastes* complex species were first unlinked from limited entry limits on July 1, when the monthly limit for *Sebastes* complex species coastwide was set at 33,000 lb, and the monthly canary rockfish limit was reduced from 7,500 lb to 200 lb. Following these changes, open access fisheries in the Vancouver and Columbia management areas attained all of their rockfish allocations before the end of the year, and coastwide fisheries attained the canary rockfish allocation before the end of the year. For these reasons, on October 1, all rockfish landings were prohibited north of Cape Blanco (the southern border of the Columbia management area), and all canary rockfish landings were prohibited coastwide.

Pacific Ocean Perch For Pacific ocean perch, the ABC remained at zero for the Vancouver and Columbia areas, and the landed catch harvest guideline was reduced from 750 mt to 650 mt, based on recent landings. The limited entry fishery was managed under a 8,000 lb per two month limit until September 1 when limits became monthly and remained at 4,000 lb per month.

Pacific Whiting: In 1998, the U.S. whiting allocation continued to be fully utilized by the domestic and tribal fishing industries. Eighty percent or 232,000 mt of the 290,000 mt transboundary whiting ABC was apportioned to the U.S. As in 1997, 25,000 mt was set aside for treaty indian tribes on the coast of Washington state, resulting in a commercial harvest guideline of 207,000 mt. The commercial harvest guideline was further divided with 34% going to the catcher/processor sector; 24% going to the mothership sector; and 42% going to the shoreside sector. When applied to the 1998 commercial harvest guideline of 207,000 mt, these percentages resulted in whiting allocations of 70,400 mt for the catcher/processor sector, 49,700 mt for the mothership sector, and 86,900 mt for the shoreside sector. Provisions for reallocating any unused allocation to other sectors were not needed in 1998.

Since mid-1997, when the Department of Justice approved the catcher/processor industry's allocation of whiting shares among the members of the Whiting Conservation Cooperative, this fishery has operated as a voluntary quota share program where each of the catcher/processor companies has agreed to harvest a specific share of the allocation. With harvests assured, the catcher/processors are able to operate more cautiously to avoid areas of salmon and rockfish abundance. During 1998, the mothership and shore-based sectors continued to operate under more competitive conditions (first come first served) for their sector's allocation. The shore-based fishery continued to operate under exempt fishing permits that enabled the fleet to bring unsorted catches to shore.

Season start dates were the same in 1998 as in 1997. The shore-based season in most of the Eureka area (between 42°N. latitude and 40°30' N. latitude) began on April 1, south of 42° N latitude opened April 15, and north of 42° started on June 15. The primary seasons for the mothership and catcher/processor sectors began May 15.

In total 232,509 mt were harvested in 1998, slightly over the 232,000 mt HG. About 1,718 mt of the total catch of whiting was discarded due to small size and poor quality (673 mt by catcher/processors, 382 mt by non-tribal motherships, and 663 mt by the tribal fishery). No discards are expected for the shore-based fishery.

Six mothership vessels received 50,087 mt of whiting (1% over its allocation of the commercial harvest guideline) and closed on May 31, 1998. Seven catcher/processor vessels took 70,365 mt of whiting (virtually equal to its allocation) and closed on August 7, 1998. For the tribal fishery, one mothership processed 24,509 mt of whiting (2% below the tribal allocation). The Washington, Oregon, and California shore-based sector took 87,548 mt (1% over its allocation) and closed on October 13, 1998. Upon closure of the primary season for the shore-based sector, the 10,000 pound trip limit resumed as before the primary season. This small trip limit is intended to accommodate small bait and fresh fish markets and bycatch in other fisheries.

The 1998 Pacific whiting fishery was strongly affected by the downturn in the Asian market. Low prices for surimi resulted in processors, both at-sea and shore-based, converting to different products such as minced blocks, fillets and headed & gutted fish. The fishery was further complicated by smaller fish. Because of a northward population shift, fish of sizes that the Oregon fleet normally catch were off Canada, and the smaller fish, normally off California, were being caught off Oregon. Growth rates also tend to be reduced during El Niño years. While the catcher/processor and mothership sectors were able to overcome the problems associated with fish size and condition by targeting stocks far offshore, the combination of market conditions and fish conditions caused the shore-based fishery to slow its pace with several processors shutting down their lines early in the season.

The major groundfish bycatch species in the whiting fishery are yellowtail and widow rockfish. Bycatch of yellowtail rockfish in the at-sea processing portion of the whiting fishery was 536 mt (64 mt by catcher/processors, 313 mt by non-tribal motherships, 159 mt by the tribal fishery). Bycatch of widow rockfish in the at-sea processing portion of the whiting fishery was 307 mt (121 mt by catcher/processors, 172 mt by non-tribal motherships, 14 mt by the tribal fishery). Yellowtail and widow rockfish bycatch levels from the shoreside sector were not available at the time this report was prepared.

In 1998, preliminary figures indicate chinook salmon bycatch in the at-sea processing fleet remained similar to the low levels of 1996 and 1997. Although final figures are not yet available, it appears the chinook bycatch rate of 0.007 chinook per metric ton of whiting in the catcher-processor fleet is down from the 1997 rate of 0.008 and the 1996 rate of 0.010 chinook per metric ton of whiting, this was well below the guideline of 0.05 chinook per mt. Chinook bycatch in the non-tribal mothership fishery was 0.019, less than half the guideline of 0.05 chinook per mt. This is similar to the 1996 mothership rate of 0.018, but less than the 1997 rate of 0.026 chinook per mt of whiting, but was still half the guideline. Chinook bycatch in the tribal whiting fishery was 0.085 chinook per metric ton of whiting, down from the 1997 rate of 0.102 chinook per metric ton of whiting. The mothership fishery as a whole, tribal and non-tribal therefore had a chinook bycatch rate of .04 chinook per mt of whiting (3051 chinook in 74,596 mt of whiting), which is within the 0.05 rate specified under the biological opinion for the fishery. The salmon rate of fishery bycatch for the shore-based sector were not available at the time this report was prepared.

As in previous years, all at-sea processors carried at least one NMFS trained observer when they participated in the whiting fishery. To provide additional data for monitoring their voluntary individual quota program, catcher/processor vessels carried two observers as did the tribal mothership.

Note: Catch data in this section on the whiting fishery are preliminary and may differ from those found elsewhere in this document.

Dover sole, thornyheads, and trawl-caught sablefish (DTS) complex A new assessment in 1997 evaluated the Dover sole resource north of 36° N. latitude as a unit, and provided an ABC for landed catch based on the $F_{35\%}$ harvest rate. The Conception Area Dover sole ABC was set at the level established in the original FMP. The coastwide Dover sole harvest guideline for landed catch was reduced from 13,900 mt to 8,955 mt. The two thornyhead species were both assessed in 1997 and were managed with separate harvest guidelines as in 1997. For shortspine thornyheads north of Point Conception the landed catch harvest guideline was reduced from 1,380 mt in 1997 to 1,082 mt in 1998. The longspine landed catch harvest guideline was reduced from 6,000 mt to 3,733 mt. Based on a new assessment the sablefish ABC was reduced from 9,125 mt in 1997 to 5,200 mt in 1998 and the landed catch harvest guideline was reduced from 7,800 mt to 4,680 mt . Harvest by Washington treaty Indian tribes was set at 468 mt, ten percent of the harvest guideline. This amount was taken "off the top" before any nontreaty allocations were established.

Management of the DTS complex at the outset of 1998 was similar to 1997; the Council continued the policy of separating the two thornyhead species, with a separate sublimit for sablefish also. In January-February, the 2-month cumulative trip limit for the DTS complex was 59,000 lb. Within this 2-month cumulative limit, no more than 40,000 lb could be Dover sole, no more than 10,000 lb could be longspine thornyheads, no more than 4,000 lb could be shortspine thornyheads, and no more than 5,000 lb could be trawl-caught sablefish. Throughout the year, no more than 500 lb per trip could be sablefish smaller than 22 inches.

At certain times of year, particularly in winter months, it is possible to catch Dover sole in deep water more selectively, without large associations of sablefish and shortspine thornyheads. Therefore, the Dover sole 2-month cumulative trip limit was set high for January-February and lowered to 18,000 lb on March 1, 1998. The 2-month cumulative trip limit for the DTS complex correspondingly decreased to 37,000 lb at that time.

On May 1, the 2-month cumulative trip limits were increased for Dover sole to 22,000 lb; for longspine thornyheads to 12,000 lb; for shortspine thornyheads to 5,000 lb, and; for trawl-caught sablefish to 6,000 lb. Due to difficult winter weather, landings for the DTS complex were well below projections for the first quarter of 1998. The limits were increased on May 1 to allow the fishery the opportunity to achieve the harvest guidelines for these species by the end of the year. Also on May 1, NMFS removed the overall DTS complex limit, because that limit had been a remnant of pre-1998 management, when there was no specific cumulative limit for longspine thornyheads within the complex limit. On September 1, the 2-month cumulative trip limits for the components of the DTS complex were converted to 1-month cumulative limits: for Dover sole, 11,000 lb; for longspine thornyheads, 6,000 lb; for shortspine thornyheads, 2,500 lb; for trawl-caught sablefish, 3,000 lb. On October 1, limits in the DTS complex were adjusted to account for the different harvest rates for each species. The 1-month cumulative trip limits were: increased for Dover sole to 18,000 lb; increased for longspine thornyheads to 7,500 lb; decreased for shortspine thornyheads to 1,500 lb, and; increased for trawl-caught sablefish to 5,000 lb. Finally, on December 1, the Dover sole limit was increased to 36,000 lb in recognition of the ease of targeting Dover sole without catching other species in the winter months, and so that the limited entry fishery might have further access to the Dover sole HG for 1998.

Projected landings for Dover sole, longspine thornyheads, and for trawl-caught sablefish were below the HGs for those species, primarily because the cumulative limits for those species had to be kept low enough to prevent overharvest of the closely associated shortspine thornyheads. Projected landings of shortspine thornyheads for 1998 are 2.3 percent above the HG for that species. The shortspine thornyhead biomass is estimated to be at 32 percent of its unfished state.

Widow rockfish Based on a new assessment in 1997, the widow rockfish ABC was reduced from 7,700 mt in 1997 to 5,750 mt in 1998. The 5,750 mt total catch ABC for widow rockfish was based on the $F_{40\%}$ harvest rate, which was the current MSY proxy for rockfish species. The landed catch harvest guideline was 4,276 mt, based on a more conservative $F_{45\%}$ harvest rate.

For limited entry in 1998, the limited entry 2-month cumulative limit of 25,000 lb was in effect until May 1, at which time it was increased to 30,000 lb. On September 1, when limited entry trip limits were converted to 1-month cumulative limits, the widow rockfish limit of 30,000 lb was converted to 15,000 lb and was in effect until October 1, at which time it was increased to 19,000 lb, where it remained to the end of the year. Landings were projected to be 3,746 mt in 1998, 5.4 percent below the HG. For open access, landings of widow rockfish were initially managed with a monthly limit that was 50-percent of the limited entry 2-month

cumulative limit, or 12,500 lb, until May 1, when it was raised to 15,000 lb. On July 1, the open access widow rockfish limit was separated from the limited entry widow rockfish limit and reduced to 3,000 lb. From October 1 through the end of the year, all open access widow rockfish landings were prohibited, due to early attainment of the open access allocation.

Lingcod The 1998 HG for lingcod was severely reduced from previous years' levels to 838 mt. During Council activities to set 1998 cumulative limits, the U.S. industry disagreed as to whether the lingcod reduction should or could fall equally on both commercial and recreational sectors. The 1998 management measures were intended to divide the HG almost equally between the commercial and recreational sectors, which resulted in a proportionately larger decrease over past years' catch for the commercial fishery. To accommodate the reduced amount of lingcod available to the commercial sector in 1998, the 2-month cumulative trip limit for lingcod in 1998 was 1,000 lb. This limit was in place until it was modified to a monthly cumulative limit of 500 lb on October 1. The open access lingcod monthly cumulative limit was 500 lb until July 1, when it was modified to account for unusually rapid harvest rates to 250 lb for the month of July, and to a prohibition against all open access lingcod landings beginning August 1. Lingcod smaller than 24 inches could not be landed in the commercial or recreational fisheries except for 100-lb per trip for limited entry trawl-caught lingcod. This increase from 22 inches in 1997 to 24 inches in 1998 in the size limit, along with a reduction in the recreational bag limit off California from 5 to 3 lingcod was expected to reduce recreational lingcod harvest. Reducing the California lingcod bag limit brought that state's bag limit down to a level consistent with bag limits off Washington and Oregon.

Nontrawl Sablefish In 1998, as in 1997, a vessel was required to have an endorsement on its limited entry permit in order to participate in the regular or mop-up sablefish seasons. In 1998, this endorsement program was refined to a three-tier system that divided vessels with sablefish endorsements into three different tiers based on cumulative catch history. Each of the three tiers was associated with a different cumulative limit level, which tier members had the opportunity to fish towards during the regular season. Also new in 1998, the post-season closure was reduced from 48 to 30 hours. The season began on August 1, and the cumulative limit levels were: 52,000 lb for Tier 1; 23,500 lb for Tier 2, and; 13,500 lb for Tier 3.

A number of provisions for the 1997 regular season remained in place for 1998. The pre-season closure was 48 hours, and advance set of pot gear was not allowed. The regular season ended at sea rather than at dockside. The trip limit for sablefish smaller than 22 inches of 1,500 lb or 3 percent of all legal sablefish on board, whichever is greater, remained in effect during the regular and mop-up seasons. The mop-up season began about three weeks after the close of the regular season, lasting from August 28 - September 11, and allowing limited entry permit holders with sablefish endorsements to fish against an equal cumulative limit of 3,200 lb. Severe weather was reported in Northern California during both the primary season and the mop-up fishery.

Small daily trip limits were applied to the nontrawl fishery before and after the "regular" and "mop-up" seasons. A 300-lb daily trip limit was applied only north of 36°00' N. lat., with a 2-month cumulative limit of 1,500 lb. Unlike other 2-month cumulative limits, fixed gear sablefish cumulative limits could be taken at any time during the 2-month period. On May 1, the 2-month cumulative limit was increased from 1,500 lb to 1,800 lb. Following the September Council meeting, trip limits were again increased to allow the limited entry nontrawl fishery to achieve its 1,652 mt sablefish allocation by the end of the year. The 2-month limit for the September - October period was increased to 2,700 lb, and the months of November and December were split into two separate month-long cumulative limit periods, each with a cumulative limit of 1,500 lb.

Limited entry, nontrawl sablefish south of 36° N. latitude: In January 1998, the Conception area limited entry daily trip limit was set at 350 lb to accommodate most landings without encouraging excessive effort shifts into that area. There was no cap on the amount that could be landed under the daily trip limit in the Conception area. On May 3, an option was provided that allowed a vessel to either land 350 lb per day, or to make one landing a week above 350 lb but less than 1,050 lb. This measure was intended to allow greater flexibility for fixed gear fishers who target groundfish on fishing trips of several days in duration, while still constraining harvest within the 425 mt HG for this area.

The open access sablefish allocation for north of 36° N. lat. is 6.6 percent of the HG. In 1998, the open access fishery began the year with a 2-month cumulative limit of 600 lb, which stayed in place until May 1,

when it was increased to 700 lb per 2-month period. As with the limited entry daily trip limit fishery, open access daily trip limit landings of sablefish were proceeding at a slower rate than the Council had expected at the beginning of the year. On July 1, the open access 2-month cumulative limit was again increased to 1,800 lb, a level that matched the limited entry 2-month cumulative limit. October and November changes to the open access daily trip limit fishery for sablefish matched the changes to the limited entry daily trip limit fishery for the rest of the year. Open access nontrawl fisheries for sablefish south of 36° N. lat. were managed under a 350 lb daily trip limit with no monthly cumulative limit throughout 1998.

ECONOMIC STATUS OF THE WASHINGTON, OREGON, AND CALIFORNIA COMMERCIAL GROUNDFISH FISHERY IN 1997

This section briefly summarizes economic data presented in Appendix EC. Shoreside landings of groundfish decreased by 4,077 mt in 1997 to 140,884 mt, a decrease of 2.8% from 1996. At-sea processors of whiting (factory trawlers and mothership processors) processed 143,057 mt in 1997, a 34.6% increase, 36,831 mt, from 1996. As a result, total commercial landings of groundfish taken from waters under federal jurisdiction increased by 13.0% from 251,187 mt in 1996 to 283,937 mt in 1997. The value of shoreside landings, after adjusting for inflation, fell by 4.5% to $79.3 million in 1997. The inflation adjusted value to domestic at-sea processors rose by 62.7% to $19.3 million, bringing the total inflation adjusted value of Pacific Coast landings of groundfish to $98.5 million, an increase of 3.9% from 1996. The decrease in value of shoreside landings resulted from a decline in overall groundfish landings and continuation of a general trend toward lower exvessel prices (after adjusting for inflation) except for sablefish, which increased over the last five years. The increase in value of at-sea deliveries during 1997 was due to the increase in quantity delivered, and a $.01 increase in average price per pound. Groundfish continued to be the most valuable commercial fishery on the West Coast, contributing 24.0% of the total exvessel value of marine fish species landed in 1997, although the groundfish share of total exvessel value of marine fish species has shown a general downward trend since 1991.

In the California shore-based fishery, groundfish landings in 1997 increased by 5.7% to 29,007 mt, however, real exvessel value dropped by 8.8% to $31.3 million. A significant increase (118.3%) in relatively low-valued whiting landings together with a decrease in relatively high-valued sablefish and rockfish landings account for these changes in California during 1997. Total groundfish landings in Oregon during 1997 remained virtually unchanged from 1996 while real exvessel value fell 2.6% to $33.8 million. This can be partly attributed to a slight increase in Oregon whiting landings, offset by a decline in rockfish and sablefish landings during 1997. In Washington, total groundfish landings fell 24.5% from 1996 to 1997, to 15,994 mt. The exvessel value, however, increased slightly by 1.6% to $14.2 million. The change in Washington groundfish landings and exvessel value was mainly due to a significant decline in whiting landings along with increased landings of flatfish and other groundfish. From 1981 through 1990, California accounted for the largest state share of annual Pacific coast shoreside groundfish landings, followed by Oregon and Washington (excluding landings from Puget Sound). With the development of the domestic whiting fishery in 1990, Oregon has since replaced California as having the leading share.

FINAL GROUNDFISH MANAGEMENT TEAM ABC AND HARVEST GUIDELINE RECOMMENDATIONS FOR 1999

Stock assessments for West Coast groundfish are conducted by staff scientists of the California Department of Fish and Game (CDFG), Oregon Department of Fish and Wildlife (ODFW), Washington Department of Fish and Wildlife (WDFW), Oregon State University (OSU), Southwest Fisheries Science Center of the National Marine Fisheries Service (NMFS), the Alaska Fisheries Science Center of NMFS, and the Northwest Fisheries Science Center, Fishery Resource Analysis and Monitoring Division of NMFS.

In 1997, the Council implemented a new stock assessment review process in an attempt to improve public participation in the process, to increase the level of scientific peer review, and to provide a greater separation between the scientific and management processes. This process was modified in 1998 to better accomplish these goals (terms of reference for the process and the STAR Panel reports are included in this document). In April 1998, a pre-assessment workshop was held to review and evaluate data and identify problems and modeling assumptions. Stock assessments were prepared by Stock Assessment Teams (STAT Teams) and then were reviewed by three Stock Assessment Review Panels (STAR Panels) at three public workshops. This year, assessments were completed for sablefish, shortspine thornyhead, Pacific ocean perch, blackgill rockfish, and chilipepper rockfish. The Groundfish Management Team (GMT) then met in August to develop acceptable biological catch (ABC) and harvest guideline recommendations based on the "best scientific information" forwarded by the STAR Panels. STAR Panel chairs, several panel members, and several STAT Team members (i.e., assessment authors) attended the August 1998 (GMT) meeting.

The GMT developed final 1999 ABC and harvest guideline recommendations at its September 29-October 3, 1998 meeting. Final ABCs and resulting management measures for 1999 adopted by the Council in November of 1998 are shown in Table 35. In addition, comparison of the ABCs, recent landings, stock conditions, and abundance trends for various groundfish stocks are summarized in Table 37. Following is a synopsis of ABC and harvest guideline estimates for each principal species, including species that were assessed in previous years. Assessments of some stocks are updated only about every three years and, where appropriate, ABCs are based on average potential yields for the three year period following the preparation of the assessment. Other ABCs are based on previous assessments (for example, lingcod and yellowtail rockfish), and some are based on historic landings. The GMT used the available information to calculate ABCs and OYs based on the default harvest policy in the FMP. In a few cases, the GMT deviated from the default policy and recommended more precautionary OYs.

GENERAL FEATURES

Assessment Model

Assessments of West Coast groundfish stocks have generally been conducted through use of stock synthesis.[1/] This tool is similar to other stock assessment tools in its handling of the interaction between a fishery and the exploited stock, but it provides greater flexibility in the types of auxiliary data that can be examined. Perhaps more importantly, synthesis provides a bridge between strictly biomass-based models (such as Stock Reduction Analysis) and strictly age-structured models (such as cohort analysis) and also provides the capability to examine size composition data. The model is structured to simultaneously analyze catch biomass, age and length composition and catch per unit effort from multiple fisheries, and abundance and age and length composition from multiple surveys. This flexibility has allowed quantitative examination

1/ Methot, Richard D. 1990. Synthesis Model: An adaptable Framework for Analysis of Diverse Stock Assessment Data. International Pacific Fishery Commission Bulletin Number 50: 259-277.

of stocks and fisheries that could not be analyzed by other techniques. The model has provided a useful tool for organizing the available data and exploring the limits of our knowledge with regard to the history and current status of each stock, although the nature of the available information often does not provide narrow constraints on the range of feasible model results.

Nineteen-ninety seven marked a significant event in the evolution of population dynamics models used for West Coast groundfish stock assessments. For many years Methot's Stock Synthesis model has been the only computer program used to estimate the status of groundfish stocks. However, the yellowtail rockfish assessment that was conducted in 1997 was based on the application of the Auto-Differentiation Model Builder (ADMB) package developed by Fournier. ADMB uses the same model fitting approach as that used by Synthesis, and given the same inputs and parameter specifications in that assessment, the ADMB produced essentially the same results as the Synthesis model. In many respects the ADMB approach is more computationally efficient than Synthesis, utilizing much improved computing algorithms and producing variance estimates of key model outputs. This latter feature allows the degree of uncertainty in assessment results to be readily characterized. On the other hand, ADMB is not yet able to produce a length-based assessment. Based on the results of the yellowtail rockfish assessment, it is likely the ADMB package will be increasingly utilized by assessment analysts, although many significant programming issues need to be resolved. As this modeling approach becomes more widespread, rigorous comparisons of results between Synthesis and ADMB should be provided.

Exploitation Rate

The GMT generally recommends a fixed fraction of the exploitable stock be harvested each year by applying a constant fishing mortality rate (F). The level of exploitation is designed to achieve a large fraction of MSY while protecting the spawning potential of the stock. Prior to 1997, $F_{35\%}$ was treated as a default target rate for species where it could be calculated and where MSY (the maximum average yield obtainable by application of a fixed fishing mortality rate) was considered an appropriate harvest target. This standard level of exploitation ($F_{35\%}$), is the fishing mortality rate that would reduce average egg production per female to 35% of its unfished level (Figure 4). Acceptable biological catches (ABCs) in some management areas have been based on historical harvest levels because no acceptable stock assessment existed. In other cases, such as shortbelly rockfish and Pacific whiting, the Council adopted harvest policies which intentionally deviated from MSY. The $F_{35\%}$ policy was based on theoretical work by Clark (1991), who determined that the $F_{35\%}$ rate provides a good approximation to F_{msy} for the particular range of conditions he examined.

The problem with F_{msy} is that it is tightly linked to an assumed level of density-dependence in recruitment. For no stock do we have sufficient information to determine the level of density-dependence in recruitment. $F_{35\%}$ strikes a balance between obtaining a large fraction of the MSY if recruitment is highly insensitive to reductions in spawning biomass, and preventing a rapid depletion in stock abundance if recruitment is found to be extremely sensitive to reductions in spawning biomass.

The long-term expected yield under an $F_{35\%}$ policy depends upon the unknown level of density-dependence in recruitment (Figure 5). The recommended level of harvest will reduce the average, lifetime egg production by each female entering the stock to 35% of the lifetime egg production for females that are unfished. If this reduction in total egg production causes no reduction in recruitment, the long-term average female spawning stock level will be 35% of its unfished level and a large long-term average yield will be obtained. However, if the reduction in total egg production causes some reduction in average recruitment, future female spawning stock levels will be less than 35% of the virgin level and future yields will be reduced as well. Thus, the expected, long-term average level of female spawning biomass, relative to the virgin level, is between 35% on the upper end and perhaps no lower than about 20% on the lower end. In some cases, MSY is calculated under the assumption that recruitment declines to 90% as spawning biomass is fished down to 50% of its virgin level. This is just one of several plausible levels of MSY, depending on the true level of density-dependence in recruitment, and is included for reference and continuity with past reports.

The short-term yield under an $F_{35\%}$ policy will vary as the abundance of the exploitable stock varies. This is true for any fishing policy that is based on a constant exploitation rate. The abundance of the stock will vary because of the effects of fishing and because of natural variation in recruitment. When stock abundance

is high (i.e., near its average unfished level), short-term annual yields can be approximately two to three times greater than the expected long-term average annual yield. For many of the long-lived groundfish species common on the West Coast, this "fishing down" transition can take decades. Many of the declines in ABC that occurred during the 1980s were the result of this transition from a lightly exploited, high abundance stock level to a fully exploited, moderately abundant stock level.

More recent work (Clark 1993, Mace 1994, and Ianelli 1995) indicates that $F_{35\%}$ may not be the best approximation of F_{msy}, given more realistic information about recruitment than was initially used by Clark in 1991. In his 1993 publication Clark extended his 1991 results by improving the realism of his simulations and analysis. In particular he (1) modeled stochasticity into the recruitment process, (2) introduced serial correlation into recruitment time series, and (3) performed separate analyses for the Ricker and Beverton-Holt spawner-recruit functions. For rockfish, these changes improved the realism of his SPR harvest policy calculations, because these species are known to have stochastic recruitment and they appear to display serial correlation in recruitments (especially on interdecadal time scales), and because the Beverton-Holt spawner-recruit curve is biologically the most plausible recruitment model. The effect of each of these changes, in isolation and in aggregate, was to decrease F_{msy}. Consequently, the estimated SPR reduction needed to provide an optimal F_{msy} proxy (defined as that level of fishing which produces the largest assured proportion of MSY), must necessarily be increased. Clark concluded that $F_{40\%}$ is the optimal rate for fish stocks exhibiting recruitment variability similar to Alaska groundfish stocks. Likewise, Mace (1994) recommended the use of $F_{40\%}$ as the target mortality rate when the stock-recruitment relationship is unknown. Lastly, Ianelli (1995) determined that $F_{44\%}$ was a good F_{msy} proxy for Gulf of Alaska Pacific ocean perch, although he subsequently indicated that a recent recruitment to that stock was larger than expected and that $F_{44\%}$ may be too conservative in that case.

The GMT considered the results cited above, and concluded that $F_{40\%}$ should be used in this and future annual ABC specification cycles as the proxy for F_{msy} for rockfish, in the absence of specific knowledge of recruitment or life history characteristics which would allow a more accurate determination of F_{msy}. The GMT intends to continue the discussion of F_{msy} proxies for rockfish, and other groundfish species, and may recommend further changes as warranted by new information.

Overfishing Considerations

The Magnuson-Stevens Act defines optimum yield (OY) as the amount of fish that is prescribed on the basis of Maximum Sustainable Yield (MSY) from the fishery, as reduced by any relevant economic, social, or ecological factors. By definition then, a stock is overfished if it is harvested at a level in excess of MSY. Moreover, it is required that overfished stocks be rebuilt to a level that is consistent with producing MSY. To accomplish these goals, the Act requires that each stock have designated an explicit MSY biomass target and an overfishing threshold. The Council adopted these alterations in management approach in Amendment 11 in October 1998, but the amendment has not yet been approved by NMFS. In the interim, the Council has developed its recommended 1999 ABCs and OYs consistent with the provisions of the amendment.

The current FMP defines overfishing as the fishing mortality rate (F) that would reduce spawning potential to 20 percent of the unfished level. This is referred to as a $F_{20\%}$ rate. The Council has a policy of setting the acceptable biological catch (ABC) according to a constant fishing mortality rate that would approximate maximum sustainable yield (MSY). This rate has typically been $F_{35\%}$, so is more conservative than the $F_{20\%}$ overfishing rate. Under the revised Magnuson-Stevens Act, the FMP must prevent overfishing, which is defined in the National Standard guidelines (63 FR 24212, May 1, 1998) as exceeding the fishing mortality rate needed to produce the maximum sustainable yield (F_{msy}). Therefore the 1999 ABCs are based on, and cannot exceed, F_{msy}, as this would constitute overfishing. This new approach is more conservative and less flexible than allowed by the current FMP.

In 1999, the Council continued its use of default harvest rates as a proxy for F_{msy} (and thus for ABC). In most cases, the default F_{msy} proxy is $F_{40\%}$ for rockfish and $F_{35\%}$ for other groundfish species, but it may be superseded based on better scientific information. "$F_{40\%}$" means the fishing mortality rate that reduces the spawning potential per recruit to 40 percent of the unfished condition. For faster growing stocks, or stocks with quicker recruitment, a higher fishing mortality rate may be used, such as $F_{35\%}$, which reduces the

spawning potential to 35 percent of the unfished condition, and therefore means higher catches than $F_{40\%}$. Under this policy, MSY is a constant fishing mortality rate (i.e. exploitation rate) that is a limit. In other words, a constant fraction of the stock may be harvested each year. The ABC for a species generally is derived by multiplying the exploitation rate ($F_{40\%}$ or $F_{35\%}$) times the current biomass estimate.

Figure 1 (below)) illustrates the relationship between current biomass levels and recommended catch. The default exploitation rate ($F_{35\%}$ or $F_{40\%}$) is represented by the line labeled "ABC." ABC is graphically determined by finding the current biomass level on the horizontal axis, then finding the corresponding point on the line labeled ABC, and then reading the corresponding catch off the vertical axis.

Default OY Policy: The Council also has adopted a new, precautionary policy for establishing OY, which is intended to comply with the new Magnuson-Stevens Act requirements (Figure 1).

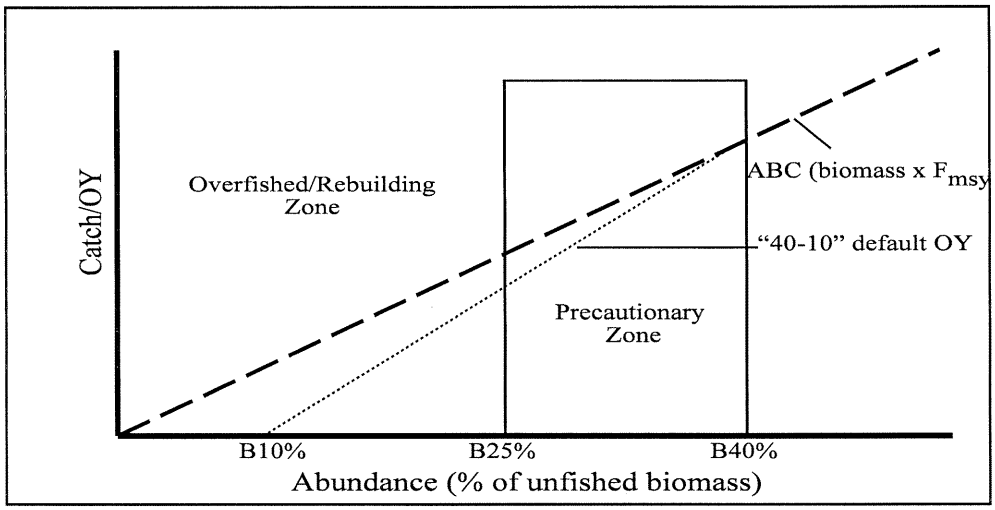

Figure 1. Illustration of default OY rule compared to ABC.

Regarding this policy, if the stock biomass is larger than the MSY biomass (B_{msy}, i.e. $B_{40\%}$ in Figure 1, where $F_{40\%}$ is the proxy for Fmsy), the OY may be set equal to or less than ABC.

If the stock biomass is believed to be equal to or smaller than B_{msy}, a precautionary OY threshold is established at the MSY biomass size. A stock whose current biomass is between 25 percent of the unfished level and the precautionary threshold is said to be in the "precautionary zone." The Council's default OY harvest policy (represented by the line labeled "40-10 default OY" in Figure 1) reduces the exploitation rate when a stock is at or below its precautionary threshold. The farther the stock is below the precautionary threshold, the greater the reduction in OY will be relative to the ABC, until, at $B_{10\%}$, the OY would be set at zero. This is, in effect, a default rebuilding policy that will foster quicker return to the B_{msy} level than would fishing at the ABC level.

If a stock falls below 25 percent of its unfished biomass ($B_{25\%}$), it is considered overfished, and the Council is required to develop a formal rebuilding plan is developed within the following year. However, the Council may set the OY higher than the default OY harvest policy requires if justified, and as long as the OY does not exceed the ABC (F_{msy}) harvest rate and is consistent with the requirements of the Magnuson-Stevens Act and NOAA National Standard Guidelines. Additional precaution may be added on a case-by-case basis at any level of current biomass, and may be warranted by uncertainty in the data or by higher risks of being overfished.

Discard Mortality

Stock assessments must account for total mortality in order to be accurate. The GMT's recommendations dealing with discard mortality were submitted to the Council in April 1990. Discards of commercial species are usually related to fish size, lack of immediate market (e.g., bycatch in the at-sea whiting fishery), and trip limits. Trip limits cause discard when a fisher catches more than an intended amount when making a

targeted tow, and when bycatch occurs after a species' trip monthly or two-month cumulative limit has already been taken. Generally, the recommended harvest guideline is set below the ABC to account for the expected discard. However, discarded rockfish bycatch in the at-sea whiting fishery is always counted towards the harvest guidelines inseason because this source of discard is measured accurately and is variable from year to year. Assumed levels of discard in other fisheries are generally based on field observations,[2/] but there is no monitoring to verify the current level of discard. The assumed level of discard for widow rockfish is 16% of landed catch annually, based on discard levels measured in 1985 to 1987, and 16% of total catch for yellowtail and canary rockfish. A lower level of nine percent is used for the deep water fishery for longspine thornyheads. For shortspine thornyheads, the GMT used an increased discard level of 30% for 1998 (compared to eight percent in 1997). The discard rate in the trawl sablefish fishery is set at 25% of the total trawl catch. The discard rate of Dover sole is set at five percent of the total catch. In 1998, the GMT began applying a lingcod discard rate of 25% inseason, based on historical discard rates.

Bycatch Information

Under the Magnuson-Stevens Act, bycatch is defined as "fish which are harvested in a fishery, which are not sold or kept for personal use, and includes economic discards and regulatory discards." Although the term bycatch is commonly used to describe nontargeted species that are landed and sold or used, and the term "discard" used to describe those that are not landed or used, the term "bycatch" in this section is consistent with the definition in the Magnuson-Stevens Act. Bycatch information in the groundfish fishery is scarce. However, the Council has taken measures to reduce trip limit-induced bycatch, and to account for that bycatch in its calculations and tracking of ABCs. Bycatch occurs as a result of market forces and regulations. The fishery is managed with cumulative bimonthly or monthly limits to extend delivery of groundfish products year round. Recent reductions in ABCs for some groundfish species have caused smaller trip limits, and greater regulatory-induced bycatch.

Based on limited studies in the mid-1980s and information on species compositions in landings, the GMT has developed assumed discard rates for sablefish, longspine and shortspine thornyheads, widow rockfish, canary rockfish, yellowtail rockfish, Dover sole, and lingcod. These discard rates are used to calculate an amount of assumed discard which is subtracted from the annual total catch OY to yield a landed catch target. Although there is no exact measure of bycatch amounts, the assumed amounts are taken into account in this way to prevent total landings from exceeding the ABC.

In 1996, the Council changed most monthly cumulative limits to bimonthly (2-month) cumulative limits, with the restriction that a vessel may not land more than 60% of that trip limit in any one month. The Council's intent was that vessels should continue to target 50% of the bimonthly limit, but if a vessel inadvertently exceeded that target, it did not need to immediately discard amounts over that target. The 60% allowance provides some flexibility intended to prevent or reduce discard.

In addition, the GMT has been able to estimate the proportions in which some species are caught in a complex, such as the deep water complex of dover sole, sablefish, and thornyhead rockfish. Using these proportions, the GMT attempts to set trip limits in proportion to how species occur in landings. This can mean reducing trip limits on more abundant species to prevent bycatch of less abundant species, or setting different trip limits in different times of the year, depending on when the species tend to associate.

There are several efforts underway that attempt to measure bycatch in the groundfish fishery. The Enhanced Data Collection program (a cooperative industry-state program), which is near completion, is a pilot observer and logbook program that has collected some bycatch information in the trawl fishery. Data from the pilot phase are currently being analyzed. In addition, the NMFS Northwest Fisheries Science Center recently received a grant from the Office of Science and Technology to develop an electronic logbook program that may collect information on total catch in a timely and useable form. In 1998, the Council has appointed and convened the Groundfish Total Catch Determination Committee, whose charge is to consider a range of methods to collect information on total groundfish catch in a cost-effective manner. Also in 1998, the Council

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2/ Pikitch, Ellen, K., Daniel L. Erickson and John R. Wallace. 1988. An evaluation of the effectiveness of trip limits as a management tool. NWAFC Processed Report 88-27, 33p.

has stated its intent to reconstitute its legal gear committee to evaluate gear selectivity and potential modifications to reduce bycatch. A related issue is the Council's consideration of a program to allow fishers to land trip limit overages for contribution to a groundfish research fund. This voluntary program does not attempt to measure bycatch in the fishery, but at least serves to capture value from these fish that would otherwise be bycatch.

Safety Considerations

Safety considerations in the groundfish fishery primarily relate to flexibility afforded to fishers so that they are not compelled to harvest fish in short time periods of adverse weather conditions. In the groundfish limited entry and open access fisheries, trip limits are *generally* set for monthly or bimonthly periods to allow fishers discretion within that time period over when to go fishing. Bimonthly periods are structured so that fishers can land up to 60% of the bimonthly limit in any one month. If a fisher can only safely harvest 40% in the first month, he/she can harvest 60% in the second month.

For fisheries that operate within certain seasons within the year, such as fixed gear limited entry sablefish and limited entry whiting, the Council has built in flexibility in setting the season each year based on safety related factors such as expected weather conditions and tidal patterns. Also, in the whiting fishery, the Pacific Whiting Conservation Cooperative has developed a system to divide the catcher-processor allocation among participating vessels, allowing flexibility in times of operation.

The limited entry fixed gear sablefish fishery season had been reduced to an eight day derby fishery in 1994, and a five day derby by 1996. After exploring other remedies, in 1997 the Council replaced the unrestricted derby with an equal cumulative limit fishery that lasted 10 days. For 1998, the management regime was changed from equal limits for all fixed gear sablefish vessels to a 3-tier cumulative limit system. With reduced sablefish harvest guidelines in 1998, derby management would have been projected to result in a season lasting two or three days. With the three tier system, the duration was set for 6 days. The Council reviewed extensive and conflicting information on whether or not the derby would be safer than the three-tier system and determined in its judgement that the three-tier system would offer fishers greater safety. It is possible that a year-round series of cumulative limits could allow greater safety benefits, however, such an option would cause a substantial social and economic dislocation as a result of a rapid change in the harvest distribution. The Council viewed the three-tier program as a balance between improving safety and reallocation. The Council has tried to identify and acted on other ways to improve safety in the fixed gear sablefish fishery. These have included: (1) moving the fishery from spring to late summer when weather conditions tended to be more consistently better throughout the entire length of the fishing area, (2) ending the opening with vessels at-sea to avoid dangerous rushes to ports under adverse circumstances, and (3) recommending a framework that, if implemented and used, would allow the Council to establish the three-tier fishery as a series of openings from among which fishers would choose to participate in one. This setup would provide fishers an opportunity to defer participation to a subsequent opening if it appeared that weather or other safety related conditions warranted it.

Calculation of Limited Entry And Open Access Shares

In 1998, some harvest guidelines represented total catch (e.g. *Sebastes* complex and its component species) and some represented landed catch (thornyheads). In 1999, the GMT recommends using only optimum yields (OYs) (harvest guidelines or quotas) that represent total catch (landings plus discards). A total catch OY provides more flexibility in accounting for discards during the season as data are available, as from the whiting at-sea processing fishery. A total catch OY also provides a clearer link with a total catch ABC.

Although total catch OYs more accurately indicate fishing mortality goals, they also do not reflect the amount of fish that may be landed. For this reason, the GMT will provide both total catch OYs and landed catch equivalents where practicable.

In previous years, the limited entry and open access allocations were in the same terms as the harvest guidelines: total catch for some species and landed catch for others. For the 1999 fishery, the GMT is proposing to apply open access and limited entry percentages to the total catch OYs, so that the limited entry and open access allocations will be expressed as total catch, and to assess appropriate discard amounts

within each fleet. Default discard rates used in recent years for the limited entry fishery will be continued, while discard rates for open access will be evaluated using trip frequency analysis, discussions with industry, and other relevant information, and applied during the season. Similar adjustments may need to be made during the season for limited entry *Sebastes* species for which zero discard was previously assumed.

ROUNDFISH

Pacific Whiting

The 1998 NMFS/Canadian survey of the Pacific whiting stock has been completed but results have not been analyzed. In setting up the 1998 stock assessment review process, the Council understood this assessment would be delayed and endorsed a STAR panel meeting in early 1999, probably late January or February. The assessment will be prepared jointly by U.S. and Canadian scientists and, due to the unusual northward extension of the stock during the survey, the assessment will rely heavily on data collected by the Canadian research vessel. At its October meeting, the GMT put forth a proposal to establish a preliminary ABC range based on the previous assessment, which suggested a lower bound be 222,000 mt and upper bound of 290,000 mt (for the U.S. plus Canada). Assuming the Council recommends the U.S. share remain at 80%, the preliminary OY range would be 178,000-232,000 mt. Subsequently, the GMT received a recommendation from the primary U.S. author consistent with this ABC range, including his belief the final result of the assessment will be near the midpoint of this range. The GMT believes the Council should consider advising the public the final OY may fall outside the range, depending on the final biomass estimate.

Sablefish

Two stock assessment teams (STAT1 and STAT2) conducted independent evaluations of the status of the Pacific coast sablefish population in 1998. Both assessments used very similar data and modeled the sablefish population as a unit stock extending from the US-Vancouver INPFC area in the north to the Monterey INPFC area in the south. STAT1 employed an "age-structured" model, the same type of model used in the 1997 sablefish assessment. STAT2 used a simpler "delay difference" model, that required the estimation of far fewer parameters.

The STAR Panel noted that, due to uncertainty regarding the amount of the sablefish population measured by the NMFS slope survey (Q), and limitations of available fishery data, neither model provided a reliable estimate of current biomass. In an effort to incorporate this uncertainty into its recommendations, the STAR Panel elected to characterize model results using a simple "Bayesian" approach with respect to uncertainty in Q.

As a first step, the STAT Teams and the STAR Panel identified a plausible range of Q values (0.25, 0.5, 0.75, 1.0, 1.5). Next, each value of Q was assigned a probability based on comparative studies, personal experience, and qualitative information provided by those present at the meeting, including industry representatives. A Bayesian approach was used to integrate these probabilities across the range of values of Q, in order to estimate posterior probability distributions for Q and model results. A weighted average of model outputs was calculated using the posterior probabilities for Q as weighting factors.

Results from both STAT Teams were generally similar for a particular value of Q. However, the assessment models provided different posterior probabilities for Q, except for the value Q=1.5 which had zero posterior probability for both assessments. The posterior probabilities for the STAT1 model were highest for Q-values in the 0.25-0.5 range, whereas the posterior probabilities for the STAT2 model were highest for Q-values in the 0.5-0.75 range.

Because the value of Q is inversely related to stock biomass, the STAT1 model estimated a higher biomass in 1998 than did the STAT2 model. Sablefish biomass estimates from the STAT1 model ranged from 35,000 to 290,000 mt, with an expected value of 173,000 mt. Estimates of 1998 biomass from the STAT2 model ranged from 30,000 to 250,000 mt, with an expected value 104,000 mt. For comparison, terminal-year biomass estimates from the age-structured assessment of sablefish conducted in 1997 were between 48,000 mt and 126,000 mt, depending on the model scenario. During its August meeting, the GMT reviewed

the summary reports from the STAT teams and STAR Panel, and discussed ways of combing the range of model outcomes into a harvest recommendation. Because the range of biomasses associated with plausible values of Q was so large, the GMT adopted a Bayesian approach similar to that used by the STAT Teams and STAR Panel. In particular, the GMT used expected values from the posterior distributions of both assessment models to derive a risk-neutral yield recommendation. Because the STAR Panel found the modeling and results of both STAT teams to be plausible, the GMT weighted the posterior outcomes from both models equally in developing their preliminary harvest recommendations. Subsequent to the August GMT meeting, the Team requested clarification from the STAR Panel on the appropriateness of weighting the STAT1 and STAT2 models equally and the STAR Panel agreed with the weights used by the GMT.

Accordingly, the GMT's recommended annual ABC for 1999-2001, based on an $F_{35\%}$ harvest rate, is 9,692 mt (see Table 1 below). Although the GMT's formal F_{MSY} proxy for sablefish remains $F_{35\%}$, new analysis provided at the August meeting, along with the range of uncertainty embodied in the assessments, led the GMT to recommend an OY of 7,919 mt, based on an $F_{40\%}$ harvest rate for 1999 and application of the "40-10" harvest policy. The GMT plans a more thorough review of the adequacy of harvest rates used as proxies for F_{MSY} for several species, during the coming year. A separate ABC/OY of 472 mt is recommended for the Conception INPFC area based on recent average landings. Applying a 10% discard rate results in a landed catch equivalent of 425 mt.

Table 1. Combined Decision Table for Sablefish

	Distinct State of Nature					
	Q=0.25	**Q=0.5**	**Q=0.75**	**Q=1**		
Approximate Probability	21%	42%	28%	9%		
Quantity					**Expected**	**Coefficient of**
Unfished Stock Biomass	475657	345389	299164	278161	355019	17%
Stock Biomass in 1998	270009	127640	77770	53969	138815	49%
B1998/Unfished Stock	57%	37%	26%	20%	**37%**	30%
F35% Yield (mt)	18914	9149	5658	3938	**9692**	47%
F40% Yield (mt)	16246	7840	4844	3367	8340	47%
F40-10 Yield at F35% (mt)	18914	8907	4652	2554	9200	54%
F40-10 Yield at F40% (mt)	16246	7630	3980	2182	**7919**	54%
Annual Catch			**Stock Biomass in 2001**			
3000 mt	289958	142663	90101	63893	153874	46%
4000 mt	287258	140183	87787	61742	151329	46%
5000 mt	284558	137630	85074	59050	148600	47%
6000 mt	283308	135753	82760	56632	146739	48%
7000 mt	280608	132598	80047	54207	143810	49%
8000 mt	276658	130720	77732	51789	141365	50%
9000 mt	275409	128241	75418	49097	139255	51%
Annual Catch			**Ratio of Stock Biomass in 2001 to 1998 Level**			
3000 mt	108%	112%	116%	119%	114%	3%
4000 mt	107%	110%	113%	115%	111%	2%
5000 mt	106%	108%	110%	110%	109%	1%
6000 mt	105%	107%	107%	105%	106%	1%
7000 mt	104%	104%	103%	101%	104%	1%
8000 mt	103%	103%	100%	96%	101%	2%
9000 mt	102%	101%	97%	91%	99%	3%
Annual Catch			**Ratio of Spawning Stock Biomass in 2001 to Unfished**			
3000 mt	61%	42%	30%	23%	41%	27%
4000 mt	60%	41%	30%	22%	40%	28%
5000 mt	60%	40%	29%	21%	40%	29%
6000 mt	60%	40%	28%	21%	39%	30%
7000 mt	59%	39%	27%	20%	38%	31%
8000 mt	58%	38%	26%	19%	37%	31%
9000 mt	58%	37%	25%	18%	37%	32%

The combined decision table for sablefish (Table 1) is based on the integration of the two assessments. The states of nature are values of the NMFS slope survey catchability (Q) which is the fraction of the stock measured by this survey. Each state of nature (Q=0.25 to Q=1.0) has a probability of being the truth based on the combination of the assessment results. For example, the probability that Q=0.75 is the true state of nature is 28%. Assessment results for the possible states of nature are listed by column. For example, if Q=0.75 is the true state of nature then the level of unfished biomass of the sablefish stock is 299,164 mt with probability 28%.

Based on the combined decision table, there is roughly a 9% chance that the sablefish stock is below 25% of its unfished biomass and a 70% chance that it is in the precautionary zone of 25% to 40% of its unfished biomass. Similarly, there is a 21% chance that the stock is above the precautionary level of 40% of its unfished biomass.

The likely consequences of 3-year constant catches ranging from 3,000 to 9,000 mt are also listed below each of the possible states of nature. For catch levels of 5,000 to 7,000 mt, stock biomass would be projected to increase by the year 2001. At catch levels of 5,000 to 6,000 mt, there would be a 28% chance that the stock would be in the precautionary zone in 2001 and a 9% chance that it would be below 25% of its unfished level. At a catch level of 7,000 mt, there would be a 70% chance that the stock would be in the precautionary zone by the year 2001. At a catch level of 8,000 mt, there is a 63% chance that the stock biomass would increase, a 28% chance it would be constant, and a 9% chance it would decline by the year 2001, while there would be a 70% chance that the stock would be in the precautionary zone in 2001. At a catch level of 9,000 mt, there is a 63% chance that the stock would increase and a 37% chance that it would decrease by the year 2001. In addition, there would be a 70% chance that the stock would be in the precautionary zone and a 9% chance that it would be overfished by the year 2001. Based on the GMT recommended OY level of 7,919 mt, the combined assessment results indicate that sablefish biomass would likely remain in the precautionary zone with an expected value of roughly 37% of its unfished level in the year 2001.

Pacific Cod

The GMT recommends no change in the coastwide ABC for Pacific cod from the previous level of 3,200 mt which was set in 1989 at the highest catch on record. The coastwide catch reported by the Pacific Coast Fisheries Information Network (PacFIN) shows a steady decline each year since then to about 1,500 mt in recent years. No quantitative assessment is attempted for Pacific cod off Washington, Oregon, and California, because changes in stock abundance in this area are probably dominated by environmental factors which influence the contribution of fish from the north.

Lingcod

The most recent assessment of the lingcod stock was prepared in 1997 for the 1998 fishing year. The assessment addressed only the Columbia and Vancouver areas (including the Canadian portion of the Vancouver management area). The STAR panel endorsed a single model for the stock, including a point estimate of the 1997 biomass of 6,714 mt. The proportion of younger fish in the commercial catch has increased in recent years, which could reflect strong incoming year-classes or increased selectivity toward younger fish. These two scenarios imply very different capacities for the stock to support the projected $F_{35\%}$ catch amounts. In addition, the current biomass estimate has wide confidence bounds, which led the STAR panel to develop a decision table incorporating alternative ending biomass scenarios set at one standard deviation above and below the point estimate.

The GMT calculated the lingcod ABC for the assessment area would be 1,021 mt, based on $F_{35\%}$ yield from the preferred model. This amount is 46.4% of the 1997 amount, which is a 53.6% reduction. Based on advice from the National Marine Fisheries Service (NMFS) Tiburon Lab that the southern stock was in at least as bad a shape, the GMT recommended the ABCs in the Eureka, Monterey and Conception areas be reduced by the same percent to 139 mt, 325 mt, and 46 mt, respectively. The coastwide sum is 960 mt.

When the GMT prepared its recommendations for the 1998 fishing year, it noted that current egg production is estimated to be only about 9% of the pristine level and recommended the harvest guideline be set below ABC. Based on the projected ability of the stock to reverse its decline under an $F_{40\%}$ harvest rate, even under the pessimistic state of nature portrayed in the decision table, the GMT suggested the harvest guideline for the Columbia and (U.S.) Vancouver areas combined be based on the $F_{40\%}$ yield of the preferred model (392 mt), which represents 40.5% of the 1997 level, a reduction of 59.5%. The percent reduction was applied to each of the non-assessed area ABCs, which were then summed to create the coastwide harvest guideline of 838 mt. This was the 1998 harvest total catch harvest guideline.

In September 1998, the California Department of Fish and Game (CDFG) presented a series of indices on lingcod they believe indicates better stock condition in the (southern) unassessed portion of the range, but the GMT considered this information inconclusive.

Applying the default harvest policy adopted with Amendment 11, the OY for total catch would be zero because the stock is believed to be below 10% of pristine egg production. The GMT has noted this catch level could only be achieved by elimination of all fisheries that target lingcod and substantial reductions in other fisheries that inadvertently take lingcod. This would include recreational fisheries also. The GMT understands the Council will consider allowing minimal retention of lingcod in order to prevent massive disruption of commercial and recreational fisheries.

Jack Mackerel

Jack mackerel are being deleted from the Pacific Coast Groundfish FMP and added to the Northern Anchovy FMP. However, since both plan amendments do not have final approval from NMFS, the ABC under the Groundfish FMP will remain in effect until the plans are approved. The jack mackerel ABC was revised in 1990. Available data indicated that the current, nearly unfished spawning biomass is about 1.4 million mt, the natural mortality rate is in the range of 0.1 to 0.2, a fishery located north of 39° N latitude would harvest fish that are mostly older than age 16, and the long-term potential yield for this age range is 19,000 mt. The GMT recommends continuation of the 52,600 mt ABC on the basis of a constant exploitation rate (equal to natural mortality) applied to estimates of current biomass of ages 16 and over. Biomass and short-term yield are expected to slowly decline under this level of exploitation. If this level of exploitation reduces long-term biomass to approximately 30% to 50% of the current biomass, the long-term average yields for this age range would be near 19,000 mt. The GMT recommends close tracking of this fishery, especially with regard to catches outside the exclusive economic zone (EEZ) and to the age composition of the harvested fish.

ROCKFISH OTHER THAN SEBASTES COMPLEX

Pacific Ocean Perch

At its August meeting, the GMT received a report from the Pacific Ocean Perch (POP) STAR Panel which forwarded a single, preferred model along with five other models that provided a sensitivity analysis of key model assumptions. The preferred model was adopted by the GMT as the basis for its 1999 ABC recommendations.

Subsequent to the August meeting, the GMT was informed by the primary assessment author that a computational error had been made in the assessment; the term for spawner per recruit was incorrectly computed as the total adult spawners per individual recruit, instead of female spawners only. Since the stock recruitment part of the model used female spawners to predict recruitment, the spawner per recruit part should also have been expressed as only females.

While this computational correction does not alter the basis for the STAR Panel's selection of preferred model, the STAR panel did not review the actual outcome of the correction. Therefore, the GMT felt it appropriate to use the revised projected yield at the default rockfish MSY proxy of $F_{40\%}$ rather than the F_{MSY} calculated directly from the model as was the case in August.

The revised model indicates the POP stock is currently at 13% of its unfished spawning biomass size, which is below the default overfished threshold recently approved by the Council. Therefore, the ABC would be reduced according to the default "40-10" harvest policy, resulting in a default OY of 214 mt. Typically, a 16% discard rate would be applied to POP catches to determine the landed catch equivalent, but the GMT believes this rate is probably unrealistically low for such a small OY. Values for the GMT recommendations for 1999 POP total and landed catch are as follows.

	Total Catch	Landed Catch (discard applied)
$F_{40\%}$	695	584
40-10 Policy	214	180 [a/]

a/ This value is based on a 16% assumed discard rate. However, both the GMT and SSC have expressed doubts about the validity of this assumption.

It does not appear reasonable that trip or cumulative limits could be imposed to constrain POP catches within the total catch of 214 mt dictated by the 40-10 policy applied to the $F_{40\%}$ yield. If current landings are all truly incidental, then imposing lower limits will simply create discards from a portion of current landings. Under this assumption, POP mortality likely cannot be reduced without some form of effort control on other fishing strategies--e.g. reductions in limits for other species or time/area closures. To the extent that some current POP catches result from targeting, there is a potential to reduce current catch levels by lowering current limits, though this would likely increase the discards by some fishers. The recent history of relatively low limits for POP and the lack of discard information would make it very difficult to validate the assumption that no targeting of POP is occurring under current limits. The GMT notes that a rebuilding plan will need to be developed for POP. The assessment indicates that continuing the current approach of accommodating catches incidental to other fishing strategies while a rebuilding plan is being developed does not appear to lead to further stock decline.

Shortbelly Rockfish

The potential yield of shortbelly rockfish was last examined in 1989. Shortbelly rockfish remains an unexploited stock at present, thus is difficult to quantitatively assess. The extremes of the MSY estimates from two alternative yield calculations were 13,900 mt to 47,000 mt, and a value of 23,500 mt is the midpoint of recently revised estimates.[3/] In addition, the short-term yield of an unexploited stock may be about three times as high as the long-term potential yield (MSY). Because this species is important to seabirds, marine mammals, and other marine life, and also, because of assessment uncertainty, the GMT recommends continuation of 23,500 mt for the ABC and harvest guideline until more is known about this stock.

Widow Rockfish

The 1997 widow rockfish STAR Panel reviewed several variations of a time-varying, age-selectivity formulation of stock synthesis, and were able to agree on a single preferred model, which they determined to be "complete and credible." The assessment addressed the Conception through U.S. Vancouver areas and used two new sources of data: an Oregon bottom trawl logbook index of fisheries CPUE (1984 to 1995), and a midwater pre-recruit abundance survey (1984 to 1996) used as an age-one abundance index.

Reported landings (1980 to 1996) ranged from a high of 28,248 mt in 1981 to a low of 5,562 mt in 1996. The fishery appears to have been supported by a strong 1970 year-class and a series of moderate year-classes from 1977 to 1981. Since 1982 there has been no strong recruitment. The model estimates, using projected recruitment from the pre-recruit survey, that at the $F_{40\%}$ harvest rate the stock size will decline from 1998 through the year 2000. Projected landings at $F_{40\%}$ average 4,960 mt for the three year period and total catch (including discard) averages 5,750 mt.

3/ Pearson, D.E., J.E. Hightower, and J.T.H. Chan. 1991. Age, growth, and potential yield for shortbelly rockfish *Sebastes jordani*. Fish. Bull., U.S. 402-409.

In 1998, the GMT recommended setting the ABC for 1998-2000 mt at 5,750 mt, the projected three-year average total catch at the $F_{40\%}$ harvest rate. However, the GMT recognized that at that fishing rate there may be a further reduction in spawning output through the year 2000, compared to 1995 and 1997. As a precautionary measure, recognizing the uncertainties surrounding the model projections, the GMT recommended that the harvest guideline for 1998 to 2000 be set at 4,276 mt, the projected three year average landed catch at the $F_{45\%}$ fishing level. Setting the harvest guideline at the $F_{45\%}$ rate should help stabilize the stock decline at a temporary equilibrium. In 1999, the GMT recommends the ABC be set at 5,750 mt, as in 1998. The widow rockfish stock is estimated to be at 29% of its pristine reproductive potential, and application of the default harvest policy results in a total catch OY of 5,023 mt. The landed catch OY would be reduced to account for 42 mt of anticipated recreational catch, a limited entry fishery discard rate of 16%, and anticipated bycatch in the whiting fishery.

Thornyhead Rockfish

The individual assessments for shortspine thornyhead and longspine thornyhead in 1997 covered the area from central California at 36°00' N latitude (the southern boundary of the Monterey management area) to the Canadian border at 48°29' N latitude (the northern boundary of the U.S.-Vancouver management area). The STAR Panel expressed concern that current management requires more detailed information on thornyheads than can be obtained from the available data. Given the kinds and quality of data, there are major uncertainties in the assessments regarding (1) growth and natural mortality for shortspine thornyhead; (2) problems with separating longspine and shortspine thornyheads in the historic landings; (3) difficulties estimating year class strength; and (4) unknown discard rates.

For longspine thornyhead, in 1997, total biomass and expected catches were projected for 1998 to 2000 under different harvest policies, assumptions about historic discards, and constant recruitment. Harvest policies ranged from $F_{20\%}$ to $F_{45\%}$. Two historic discard scenarios were considered: (1) a moderate discard rate where the discard rate gradually declined from a 1964 initial value of 35% to a 1997 ending value of nine percent and (2) a steep discard rate, 1964 value of 70% and 1997 value of five percent. For each harvest policy under both discard scenarios total biomass decreased from 1998 through 2000, as did expected catch. There was consensus at the GMT meeting among industry representatives and STAR Panel members attending that the moderate discard rate was more realistic. The GMT based its preliminary ABC and harvest guideline recommendations for 1998 on the model that incorporated the moderate discard rate.

Based on the $F_{35\%}$ harvest policy, and assuming the moderate historic discard scenario reflects industry activities, the mean ABC for 1998 to 2000 would be 4,102 mt north of the Conception area. The landed catch harvest guideline would be 3,733 mt, the ABC minus nine percent for discards.

For the Conception area, the GMT recommends the ABC be set at 509 mt, which is the 1995 to 1996 average total catch. The landed catch harvest guideline would be 463 mt, the ABC minus nine percent for discard. The coastwide ABC would be 4,611 mt with a corresponding harvest guideline of 4,196 mt.

For shortspine thornyhead, two assessment models were presented: "STAT2" and "STAT3," which independently evaluated the status of the shortspine thornyhead stock using similar data sources. The STAR Panel preferred the STAT3 model, but there was some uncertainty in the posterior probability distribution for STAT3 (section 3.8 of the STAR Panel Report). The GMT considered two proposals to deal with uncertainty.

1. Combine assessment models with unequal weighting.
2. Use the STAT3 model under strong interpretation of Star Panel report; request clarification from STAR Panel.

The GMT noted there was inconsistency in the STAR Panel's opinion of the STAT2 model and decided to combine the models, but give more weight to the STAT3 model.

The GMT developed an integrated approach that used results from both the posterior and prior distributions from the STAT3 model and the prior distribution from the STAT2 model. Suggested weights were 40% for the STAT3 posterior, 40% for the STAT3 prior and 20% for the STAT2 prior. The GMT also requested clarification from the STAR Panel and the STAR Panel agreed with the weights used by the GMT.

The GMT used $F_{35\%}$ to determine ABC but recommended $F_{40\%}$ be used to determine the OY. The GMT endorsed the more precautionary approach due to uncertainties in the assessment results and the F_{MSY} harvest rate. Moreover, work in progress suggests that the shortspine thornyhead stock is not as productive as the $F_{35\%}$ MSY proxy would indicate.

The combined decision table for shortspine thornyhead (Table 2) is based on the integration of the two assessments. The states of nature are values of the NMFS slope survey catchability (Q) which is the fraction of the stock measured by this survey. Each state of nature (Q=0.25 to Q=1.0) has a probability of being the truth based on the combination of the assessment results. For example, the probability that Q=1.0 is the true state of nature is approximately 43%. Assessment results for the possible states of nature are listed by column. For example, if Q=1.0 is the true state of nature then the level of unfished spawning biomass of the shortspine thornyhead stock is 75,285 mt with probability 43%. Similarly, if Q=1.0 is the true state of nature then the level of spawning biomass in 1998 is 17,518 mt with probability 43%. Based on the combined assessment results, the ABC level for shortspine thornyhead is 1,260 mt from the expected value of the $F_{35\%}$ yield. The GMT recommends that the OY level for shortspine thornyhead be 970 mt, based on the application of the "40-10" harvest policy at the $F_{40\%}$ target harvest rate.

The expected value of the ratio of current spawning biomass to its unfished level is about 32%; however, there is considerable uncertainty in this ratio under the various possible states of nature. In particular, there is roughly a 43% chance that the shortspine thornyhead stock is currently at 23% of its unfished spawning biomass and overfished based on the default threshold of 25% for an overfished stock. In addition, there is a 27% chance that the stock is in the precautionary zone of 25% to 40% of its unfished spawning biomass and a 30% chance that the stock is relatively healthy and above 40% of its unfished level.

The likely consequences of 3-year constant catches ranging from 500 to 1,700 mt are also listed below. Note that values for 500 mt are extrapolated based on assessment results for 700 mt and 900 mt. For catch levels of 500 to 1,700 mt, there is a 43% chance that the stock would be overfished in 2001. Similarly, for catch levels of 500 to 1,700 mt, there would be a 27% the stock would be in the precautionary zone and a 30% chance it would be above 40% of its unfished level in the year 2001. For catch levels of 500 to 700 mt, combined assessment results indicate that the spawning biomass would increase by the year 2001. At a catch level of 900 mt, there is roughly a 57% chance that spawning biomass would increase by 1% to 3% and a 43% chance it would decrease by 1% in the year 2001. At catch levels of 1,100 to 1,300 mt, there is a 70% chance that the stock would decline by 1% to 6% in the year 2001 and a 30% chance that it would remain unchanged or increase by up to 3%. At catch levels of 1,500 to 1,700 mt, there is a 94% chance that the stock would decrease by 1% to 12% by 2001 while there is 6% chance that the stock would increase by 1% to 2%. Based on the GMT recommended OY level of 970 mt, the combined assessment results indicate that shortspine thornyhead spawning biomass would likely remain in the precautionary zone with an expected value of roughly 32% of its unfished level in the year 2001.

Table 2. Combined Decision Table for Shortspine Thornyhead

	Distinct State of Nature					
	Q=0.25	**Q=0.5**	**Q=0.75**	**Q=1**		
Approximate	6%	24%	27%	43%		
Quantity					**Expected**	**Coefficient**
Unfished Spawning	139879	97151	82346	75285	86505	13%
Spawning Stock	88249	40497	24944	17518	29423	42%
SB1998/Unfished	63%	42%	30%	23%	**32%**	22%
F35% Yield (mt)	3647	1713	1075	776	**1260**	40%
F40% Yield (mt)	3073	1447	909	658	1063	40%
F40-10 Yield at F35%	3647	1713	960	591	1150	47%
F40-10 Yield at F40%	3073	1447	812	501	**970**	47%
Annual Catch			**Spawning Stock Biomass in 2001**			
500 mt	92156	42391	26068	18341	30720	42%
700 mt	91686	41912	25582	17849	30236	42%
900 mt	91217	41439	25104	17370	29760	43%
1100 mt	90749	40966	24630	16892	29285	44%

Table 2. Combined Decision Table for Shortspine Thornyhead

1300 mt	90277	40496	24152	16409	28807	45%
1500 mt	89809	40023	23674	15931	28331	45%
1700 mt	89340	39550	23200	15449	27855	46%
Annual Catch			**Ratio of Spawning Stock Biomass in 2001 to 1998**			
500 mt	104%	105%	105%	105%	104%	0%
700 mt	104%	104%	103%	102%	102%	1%
900 mt	103%	102%	101%	99%	100%	1%
1100 mt	103%	101%	99%	96%	99%	1%
1300 mt	102%	100%	97%	94%	97%	2%
1500 mt	102%	99%	95%	91%	95%	2%
1700 mt	101%	98%	93%	88%	93%	3%
Annual Catch			**Ratio of Spawning Stock Biomass in 2001 to Unfished**			
500 mt	66%	44%	32%	24%	33%	22%
700 mt	66%	43%	31%	24%	33%	23%
900 mt	65%	43%	31%	23%	32%	23%
1100 mt	65%	42%	30%	22%	32%	24%
1300 mt	65%	42%	29%	22%	31%	24%
1500 mt	64%	41%	29%	21%	31%	25%
1700 mt	64%	41%	28%	21%	30%	26%

SEBASTES COMPLEX

Sebastes Complex in the Vancouver and Columbia areas

The northern *Sebastes* complex includes rockfish of the genus *Sebastes* except Pacific ocean perch , widow rockfish and shortbelly rockfish. The ABC and OY for this complex is the sum of the individual species. The primary components of the northern *Sebastes* are yellowtail rockfish, canary rockfish, a portion of the *remaining rockfish* category and a portion of the *other rockfish* category. The *remaining rockfish* category includes bocaccio, darkblotched, redstripe, sharpchin, silvergrey, splitnose, yelloweye, and yellowmouth rockfish, each of which has an individual ABC based on historical catch or a simple assessment. The *other rockfish* category includes all other rockfish species that have not been assessed; the ABC for this group is based on historical catch records. The final GMT ABC recommendation for the northern *Sebastes* complex is 8,647 mt, which is the sum of the ABCs for yellowtail rockfish (3,465 mt), canary rockfish (1,045 mt), *remaining rockfish* (1,871 mt, plus 424 mt for bocaccio) and *other rockfish* (1,842 mt). The GMT's final (total catch) OY recommendation is the sum of the GMT's recommended canary and yellowtail rockfish total catch OYs (857 mt and 3,091 mt), plus 75% of the *remaining rockfish* ABC and 50% of the *other rockfish* ABC (2,324 mt). The GMT's final OY recommendation differs from the preliminary recommendation due to revision of the canary rockfish OY. The landed catch equivalent reflects discard deductions for canary and yellowtail rockfish.

The current ABC levels for both the *remaining rockfish* and *other rockfish* components of the *Sebastes* complex are based on limited data. There is great uncertainty about the current biomass of these components of the complex and a serious lack of quantitative information on long-term sustainable yields. Recent ABC estimates were developed for the *remaining rockfish* component based on NMFS survey biomass estimates, assumed levels of catchability, and an assumption that a sustainable fishing mortality rate would be equal to the natural mortality rate for each species. ABC levels for the *other rockfish* component have been based on less information than the remaining rockfish component.

The GMT recommends the *Sebastes* complex be reduced below current levels; individual members supported different degrees of reduction. The disagreement was over whether this constituted a "data-poor" or a "data-moderate" situation and also about whether the F=M approach used to derive ABC levels for the remaining rockfish component was useful. At the September 1998 meeting, the Council endorsed a proposal to reduce the *remaining rockfish* component by 25% (i.e., to 75% of the current level) and the *other rockfish* component by 50%. The proposed reductions of 25% and 50% were based on suggested target catch levels

for data-poor situations from Restrepo et al. (1998. Technical Guidance on the Use of Precautionary Approaches to Implementing National Standard 1 of the Magnuson-Stevens Fishery Conservation and Management Act. Draft NOAA Tech. Memo.). This technical guidance suggests a 25% reduction for stocks above the B_{MSY} level and a 50% reduction for stocks between the minimum stock size threshold (i.e., the overfished/ rebuilding threshold) and the B_{MSY} level. The GMT concurs with the Council decision.

Sebastes Complex in the Eureka, Monterey and Conception Areas

The southern *Sebastes* complex includes rockfish of the genus *Sebastes* except widow rockfish and shortbelly rockfish. The ABC and OY for this complex is the sum of the individual species. The primary components of the southern *Sebastes* are chilipepper and bocaccio rockfish, a portion of the *remaining rockfish* category (including splitnose rockfish, also called "rosefish"), and a portion of the *other rockfish* category. The *remaining rockfish* category includes bank, blackgill, canary, darkblotched, Pacific ocean perch, sharpchin, and splitnose rockfish, each of which has an individual ABC based on historical catch or a simple assessment. The *other rockfish* category includes all other rockfish species that have not been assessed; the ABC for this group is based on historical catch records. The final GMT ABC recommendation (9,323 mt) is the sum of the ABCs for chilipepper (3,724 mt), bocaccio (230 mt), *remaining rockfish* (1,766 mt, including 74 mt for yellowtail rockfish in the Eureka area) and *other rockfish* (3,603 mt). The GMT's final (total catch) OY recommendation is the sum of the GMT's recommended chilipepper and bocaccio total catch OYs (2,000 mt and 0-230 mt), plus 75% of the *remaining rockfish* ABC and 50% of the *other rockfish* ABC (3,126 mt).

As in the northern area, the current ABC levels for both the *remaining rockfish* and *other rockfish* components of the southern *Sebastes* complex are based on limited data. There is great uncertainty about the current biomass of these components of the complex and a serious lack of quantitative information on long-term sustainable yields. Therefore, the GMT recommends the same reductions be applied to the southern *Sebastes*. Specifically, the *remaining rockfish* component would be reduced by 25% (i.e., to 75% of the current level) and the *other rockfish* component by 50%.

Bocaccio

When setting the 1998 ABC for bocaccio, the Council endorsed the $F_{40\%}$ harvest policy for rockfish in the *Sebastes* complex. This resulted in reduction of the bocaccio ABC to 230 mt, which was also established as the harvest guideline. Under the new harvest policy adopted in Amendment 11, the default overfished threshold is defined as 25% of the pristine (unfished) biomass. The GMT calculates the bocaccio stock is currently about 7% of pristine and therefore overfished. According to the "40-10" policy, the default OY for bocaccio would be zero for total harvest. The GMT does not offer an alternative to this default value, but understands the Council will consider harvest levels up to the ABC. A rebuilding plan will have to be developed for this stock.

Canary Rockfish

The GMT revised its preliminary OY recommendation after reviewing the 1996 canary rockfish assessment. The authors of that assessment included two models to explain the absence of older females in the data. The first model assumes old female canary rockfish are alive but not caught by the fishery. The second model assumes most older females die. The participants in the 1996 stock assessment workshop concluded both assumptions were equally valid, partly because, in the short term, both models predict similar ABCs. The GMT averaged the results in developing its ABC recommendation for 1997. However, the long term results are very different; the first model estimates current stock biomass is about 33% of the 1967 level. The second model, which assumes most older females die, results in a much more pessimistic evaluation and estimates the stock is only 18% of pristine. Upon reviewing the assessment and workshop comments, the GMT concluded the long term results should be combined. The arithmetic average of 18% and 33% is 26%, less than the 30% used in the preliminary OY. The GMT applied the "40-10" harvest policy and calculated the default OY at 857 mt. Applying a 16% discard rate to limited entry landings results in a landed catch equivalent of 732 mt.

Chilipepper Rockfish

During its August meeting, the GMT reviewed the STAR Panel summary report for the 1998 chilipepper assessment. The last chilipepper assessment was completed in 1993. Based on the results of that assessment, the ABC was increased from 3,600 mt to 4,000 mt in 1994. The ABC was reduced to 3,400 mt in 1998 with the adoption of the $F_{40\%}$ harvest policy for all rockfish.

The new assessment includes data for the Eureka, Monterey, and Conception INPFC areas from 1970 through 1998. Estimated stock biomass for this area declined from about 50,000 mt in 1980 to approximately 32,000 mt in 1998. Biomass was at a low point in 1986 at 25,700 mt, but increased again to 38,300 mt in 1991 due to the recruitment of a very strong 1984 year class. Recruitment was relatively stable from 1986-1994, but appears to be poor in recent years.

In spite of recent ABCs ranging from 4,000 mt to the current 3,400 mt, recent landings (1992-1997) averaged about 2,000 mt. The inability to harvest the full ABC may signal a decline in chilipepper abundance, market limitations or an artifact of management measures imposed on other components of the Sebastes complex.

Harvest projections for 1999-2001 are presented in the assessment for $F_{40\%}$, $F_{50\%}$, and $F_{60\%}$. The three-year mean ABCs at those rates are 3,724 mt, 2,744 mt, and 1,978 mt respectively. The GMT recommends ABC be set at the $F_{40\%}$ three-year average of 3,724 mt. Fishing at this rate with average recruitments (1993-1998) would reduce the spawning output to 43% of virgin in three years and 33% in five years.

The GMT recommends setting an OY below ABC as a precautionary measure due to the uncertainty in the strength of recent year classes (in particular the 1993 year class), uncertainty in future recruitment, and due to the five-year projection which suggests that the biomass will fall into the precautionary zone. In addition, the GMT recognizes that chilipepper are often found in association with bocaccio rockfish, a species which will most likely be placed in rebuilding status. Not wanting to exacerbate the take of bocaccio and yet maintain chilipepper landings at recent levels, the GMT recommends the OY for 1999-2001 be set at 2,000 mt for 1999. This OY is nearly equal to the $F_{60\%}$ three-year average yield of 1,978 mt presented in the assessment document (Table 21, Page 51). If the Council chooses to set the OY higher than 2,000 mt, the GMT recommends that chilipepper be removed from the southern Sebastes complex and managed as a separate category with its own trip limit.

The GMT notes that an open access allocation should be created if a separate OY for chilipepper is established.

Blackgill Rockfish

A first assessment of blackgill rockfish in the Conception area was reviewed by the GMT at its August meeting. North of the Conception area, blackgill are primarily taken as bycatch in the trawl fishery. Blackgill landed in the Conception area are taken in a directed fixed gear fishery (set longline and setnet).

The directed fishery in the Conception area developed in the mid-1970s. Landings peaked in 1983 at 1,112 mt and declined to a low of 153 mt in 1997.

A simple two-parameter stock assessment model was developed based on stock reduction analysis and an assumption of constant recruitment. Average fishing mortality during 1980 to 1997 based on catch curve analysis was an essential element in the assessment model.

The Stock Assessment Review (STAR) Panel had concerns that the total mortality estimated in the model may be low and should be interpreted with caution. The STAR Panel's preferred model configuration indicates catches above recent levels of 150 mt and 250 mt per year would likely lead to a spawning biomass decrease.

The GMT, recognizing the uncertainties inherent in the model results, recommends that an ABC be set for the Conception area derived from $F_{40\%}$ three-year average catch estimates based on three assumed levels of natural mortality. Using assumed natural mortality estimates for the decision table (Table 15, Page 54) of 0.037, 0.047, and 0.57, the resulting mean ABC is 365 mt. The ABC will be added to the remaining rockfish category.

In addition, the GMT, recognizing the STAR panel's concerns over exceeding 150 mt to 250 mt catch levels, recommends that a "point of concern" threshold be established at 300 mt for the Conception area. If landings reached this level, more intensive monitoring of this fishery would be initiated. If the Monterey area were to be included, then the threshold should be set at 400 mt to 450 mt.

Yellowtail Rockfish

The GMT has revised its 1999 yellowtail rockfish OY recommendation based on new information that has just become available. The GMT estimates the stock is at 39% of its pristine level and near the default precautionary threshold. There is substantial uncertainty in the stock assessment, and the GMT's preliminary recommendation was to apply the "40-10" default harvest policy after deducting 10% from the ABC, which resulted in a total catch OY of 3,090 mt. However, at its recent meeting the Team was presented preliminary NMFS triennial survey results which indicate the yellowtail biomass has not declined to the extent indicated in the 1995 survey. In fact, the biomass may have increased in previous years. Therefore, the GMT no longer believes a 10% OY reduction is necessary. Application of the 40-10 default harvest policy results in a total catch OY of 3,435 mt. (As in 1998, an additional 74 mt has been transferred to the Eureka area.) The landed catch equivalent (2,434 mt) reflects reductions to account for bycatch in the whiting and other fisheries.

The 1997 STAR panel recommended a single preferred model (Model 8) in the yellowtail rockfish assessment, which included new indices of abundance based on yellowtail bycatch in the whiting fishery and Oregon trawl logbook catch per unit effort (CPUE) information. Although a single model was identified by the panel as reflecting the best available science, they also acknowledged the rather large confidence bounds around the ending-biomass point estimate of 56,736 mt. The GMT based its 1998 ABC recommendation on the STAR panel's preferred model biomass. Projections at the $F_{40\%}$ harvest rate indicated a three-year average yield of 4,657 mt, which was endorsed as the ABC for the entire assessment area. In order to determine the U.S. ABC, the GMT applied the percent distribution of biomass in U.S. waters (76%), based on NMFS triennial trawl survey results, which yielded 3,539 mt as the U.S. share. Of this, 74 mt was transferred to the Eureka-area Sebastes complex ABC, leaving 3,465 mt for the Vancouver-Columbia areas combined.

Remaining Rockfish

Assessment of the Sebastes complex has been identified as a critical need in groundfish management. In the 1995 SAFE document, the GMT presented a methodology for assessing the remaining (unassessed) species in the Sebastes complex. In 1996, the GMT reviewed a stock assessment of selected species from the remaining Sebastes complex which utilized that methodology. The assessment was predicated on two assumptions, i.e., that fishing mortality (F) = natural mortality (M) is a reasonable harvest policy for rockfish, and that NMFS triennial shelf survey for groundfish provides a valid relative index of abundance for the most important rockfish species. Conversion of relative survey statistics to absolute estimates of biomass was conducted by specifying reasonable constraints on the catchability coefficient (Q) for each species. These constraints on Q were based on a variety of considerations, including each species' (1) depth range, (2) latitudinal range, (3) habitat, (4) size, (5) reproductive maturity schedule, and (5) prior assessment work. The assessment partially validated the approach by comparing results with a stock synthesis analysis of darkblotched rockfish. The GMT recognizes that the application of the F = M harvest policy to triennial survey statistics while invoking reasonable constraints on Q involves many untested assumptions, but that at the present time this represents the best available scientific information concerning the potential yields of species in this complex.

The assessment summarized the selected species by northern (Columbia and U.S.-Vancouver areas combined) and southern regions (Conception, Monterey, and Eureka areas combined). Estimates of species ABCs are presented for each region.

In the final Sebastes complex assessment document, the "other rockfish" category was defined as all species which were not specifically assessed. Based on that assessment, the Council adopted a single ABC for those species in 1997, set at the 1994 landed catch of those species (including those previously in the "unspecified rockfish" category). The new single category reduced the northern area ABC for these species from 1,884 mt to 1,842 mt, and in the southern area from 4,762 mt to 3,968 mt. This category is referred to as "other rockfish" in the following tables.

In 1996, the GMT calculated the northern region total 1997 Sebastes complex ABC by adding the ABCs for canary rockfish (Vancouver and Columbia areas), yellowtail rockfish (ranges for the three northern assessment areas), and the northern area ABCs for rockfish species identified in the Sebastes complex assessment, including "other rockfish." For the southern region Sebastes ABC, the GMT added the ABCs for bocaccio, chilipepper, the apportionment of yellowtail rockfish from assessed area (74 mt), and the ABCs for rockfish species in the southern areas identified in the Sebastes complex assessment, including "other rockfish."

The 1997 Sebastes complex harvest guidelines were calculated by adding the lesser of the ABC or recent catch for each species covered in the assessment, combined with the harvest guidelines for the other Sebastes species. The same approach is used for 1998; changes to the bocaccio, canary, chilipepper, and yellowtail values result in changes to the overall totals as well. The following tables demonstrate the calculations.

Calculation table to develop the total 1998 GMT recommendation for the northern Sebastes region.

NORTHERN AREA				
Species	ABC (mt)	recent catch (mt)	HG (mt)	
			total catch	landed catch
Darkblotched Rockfish	**209**	392		
Splitnose Rockfish	274	**103**		
Yellowmouth Rockfish	132	**116**		
Redstripe Rockfish	768	**224**		
Sharpchin Rockfish	398	**154**		
Silvergray Rockfish	**51**	93		
Yelloweye Rockfish	**39**	156		
Bocaccio	424	**156**		
Subtotal of assessed species	2,295		1,052 [a/]	1,052
Other rockfish	1,842		1,842	1,842
Sebastes assessment ABC total	4,137		2,894	2,894
add canary rockfish	1,045		1,045	878
add yellowtail rockfish (U.S.Van/Col)	3,465		3,118-3,465	2,619-2,911
Northern Sebastes total	8,647		7,057 - 7,404	6,391-6,683

a/ The harvest guideline is calculated using the lower value of either the ABC or recent catch, shown in bold.

Calculation table to develop the total 1997 GMT recommendation for the southern Sebastes region.

SOUTHERN AREA			
Species	ABC (mt)	recent catch (mt)	HG (mt)
Bank Rockfish	**81**	347	
Darkblotched Rockfish	**47**	309	
Splitnose Rockfish	868	**319**	
Pacific Ocean Perch	20	**9**	
Sharpchin Rockfish	**71**	179	
Canary Rockfish	**85**[a/]	346	
Yellowtail Rockfish	**155**	229	
Subtotal of assessed species	1,327		767[b/]
Other rockfish	3,968		3,968
Sebastes assessment ABC total	5,295		4,735
add bocaccio	230		230
add chilipepper	3,400		3,400
add Eureka yellowtail rockfish	74		74
Southern Sebastes total	8,999		8,439

a/ Monterey/Conception areas only.

b/ The harvest guideline is calculated using the lower value of either the ABC or recent catch, shown in bold.

Black Rockfish

An assessment of black rockfish off northern Oregon was conducted in 1993 using age composition and CPUE data from the recreational fishery during 1984 to 1991. The data were examined with cohort analysis, and catch at age analysis (CAGEAN) and synthesis models. The results indicated that the 1991 fishing mortality rate was half the $F_{35\%}$ level (cohort and synthesis) to near this level (CAGEAN). Although the results cannot be extrapolated to other areas to develop an ABC estimate, the assessment concluded that the fishery is impacting the stock in the northern Oregon area. Controls on fishing effort could reduce future declines in recreational CPUE in this area.

An assessment of black rockfish off Washington was conducted in 1994 using age composition data from the recreational, jig, and trawl fishery during 1980 to 1993 and CPUE data from the sport fishery (1984 to 1993) and from a nearshore jigging survey (1987 to 1990). Recent catch is dominated by the sport fishery (307 mt per year in 1991 to 1993) followed by the handline jig (80 mt), trawl (54 mt) and salmon troll (47 mt). The synthesis model fit to available data indicates that the biomass in 1994 is 7,460-9,283 mt and that the female potential egg production in 1994 is about 43% of its unfished level. The assessment indicates that expected long-term yield under a $F_{45\%}$ strategy would produce about 500 mt per year while a $F_{35\%}$ strategy would produce about 600 mt per year but result in lower biomass and, potentially, lower CPUE for the recreational fishery. The GMT did not recommend establishment of an ABC in the past because catches were slightly below the levels of potential yield calculated in the assessment. A black rockfish assessment is underway and is expected to be completed in 1999.

FLATFISH

Arrowtooth Flounder

A stock assessment conducted in 1993 resulted in maintaining the ABC in U.S. waters at 5,800 mt (equal to peak catch in 1990). The assessment author recommended conservative management, especially until new data and models can estimate absolute biomass and exploitation rates. However, the GMT recommended no change in ABC because there was no decline in fishery CPUE during 1987 to 1992 and no trend in triennial bottom trawl survey CPUE during 1977 to 1992, although survey CPUE fluctuated over a three-fold range. Future work on this assessment probably should include the Canadian zone. Fishery logbook data indicate that most of the U.S. catch occurs near the U.S.-Canada border. The survey indicates that the biomass is about two times higher in the surveyed portion of the Canadian zone than in U.S. waters. Catch in Canada increased greatly in 1990 and was nearly 50% of the U.S. catch in 1992.

Dover Sole

The 1997 Dover sole stock assessment treated the entire population from the Monterey area through the U.S.-Vancouver area as a single stock, based on recent research on the genetic structure of the population. The previous assessment addressed stocks in the various areas separately. The Dover sole population in the Conception area was not included in the assessment.

The assessment author generated projections of spawning biomass and expecting landings for 1998 to 2000 under a variety of harvest policies and three recruitment scenarios. The hypothetical harvest policies ranged from an immediate reduction to the $F_{45\%}$ harvest rate to an increase up to the $F_{20\%}$ harvest rate. In all cases, for each of the low, medium, and high projected recruitments, the expected spawning biomass increased from the estimated year-end level in 1997 through the year 2000 due to growth of the exceptionally large 1991 year-class and to the lower catches observed in the fishery since 1991.

The 1998 to 2000 landed catch each year for the assessment area, assuming $F_{35\%}$ and medium recruitment (equal to the average recruitment estimated for the period 1983-1996) is 7,954 mt. The GMT added a discard factor to reflect an assumed discard rate of five percent to obtain the total catch ABC of 8,373 mt in the area, and summed it with the 1,053 mt ABC for the Conception area to obtain the coastwide total catch ABC of 9,426 mt. (The previous Conception area ABC of 1,000 mt was also inflated to reflect an assumed five percent discard rate). The GMT deducted 472 mt for estimated discard to obtain the coastwide landed catch harvest guideline recommendation of 8,955 mt.

English Sole

The GMT recommends continuation of the coastwide ABC of 1,100 mt set in 1994 for the Eureka through Conception areas, and 2,000 mt for the Columbia and Vancouver areas. The coastwide landed catch during 1992 to 1996 averaged 1,330 mt.

The age-structured version of the stock synthesis program was used to assess the status of the stock of female English sole occurring off Oregon and Washington (Columbia and U.S.-Vancouver management areas). The analysis used age-composition data from the Oregon and Washington trawl fisheries, and estimates of relative abundance and length composition from the 1977 to 1992 triennial bottom trawl surveys. The survey CPUE increased ten-fold over this period. The assessment indicated a large and steady increase in the biomass to about 133,000 mt of age-four and older females in 1992. The increase is attributed to high recruitment during the period examined. A specific ABC was not estimated, but the early age-at-maturity, which allows a high exploitation rate, and the large biomass suggests that a ten-fold increase in short-term yield may be possible in the Columbia and Vancouver areas. The 2,000 mt ABC is equal to a doubling of the average catch (1,145 mt) during 1985-1994.

The Monterey and Conception areas contributed 52% of the total catch during 1983 to 1991, but there has been no recent assessment for these areas. The survey CPUE in the Monterey and Eureka areas has been without trend during 1983 to 1992. The ABC for these areas was set equal to the 1983 to 1991 average yield of 1,100 mt.

Petrale Sole

Based on the 1993 stock assessment for the Vancouver and Columbia areas, the combined ABC for these areas was reduced from 1,700 mt to 1,200 mt. The GMT recommends continuation of this ABC and the ABCs in the southern areas: Eureka - 500 mt; Monterey - 800 mt; and Conception - 200 mt. However, recent catch in the southern areas has been only about 800 mt per year and these ABC levels should be reviewed.

The 1993 assessment in the Columbia and U.S.-Vancouver areas used the size-structured version of stock synthesis to analyze fishery size and age composition and CPUE since 1966, ODFW flatfish trawl surveys conducted in the mid 1970s, and NMFS triennial multispecies bottom trawl surveys conducted during 1977 to 1992. The assessment tracks a two-fold decline in fishery CPUE from the mid-1970s to the mid-1980s, and also tracks a gradual increase in biomass during 1980 to 1992 as indicated by the triennial survey. The assessment indicated that the stock in this area is essentially at the expected long-term average level of abundance and recent yields are slightly below the potential. The projected average available yield for 1994 to 1996 is 1,230 mt under the higher biomass scenario and 1,100 mt under the lower biomass scenario. The long-term expected yield is 1,070 mt to 1,390 mt under the higher biomass scenario, and 980 mt to 1,280 mt under the lower biomass scenario. The current ABC of 1,200 mt is based on the higher biomass scenario, which achieves a much better fit to the fishery size-composition data, although the lower biomass scenario achieved a better fit to all the trend indicators. An assessment for petrale sole is expected in 1999.

Other Flatfish

Arrowtooth flounder was removed from this group of species in 1991 and there was no change in the ABC for the remaining species: Vancouver - 700 mt; Columbia - 3,000 mt; Eureka - 1,700 mt; Monterey - 1,800 mt; and Conception - 500 mt. These ABC levels were originally set on the basis of historical catch levels prior to the development of the arrowtooth flounder fishery, and current catch levels remain well below the level of ABC.

OTHER GROUNDFISH

The GMT recommends no change in the coastwide ABC of 14,700 mt.

TABLE 1. Estimated commercial groundfish landings (mt) for all management areas, 1982-1997.[a/] (Excludes joint venture, foreign and domestic at-sea catches).

Species		1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
Roundfish																	
	Lingcod	3,810	4,156	4,051	3,878	1,894	2,553	2,628	3,569	2,932	3,166	1,883	2,194	1,905	1,467	1,557	1,562
	Pacific Cod	908	597	585	409	331	2,280	3,343	2,188	1,064	1,795	1,778	1,369	866	504	445	595
	Pacific Whiting[b/]	1,027	1,051	2,721	3,894	3,463	4,795	6,867	7,414	8,115	21,040	56,128	42,108	73,607	74,968	76,797	91,530
	Sablefish	18,626	14,698	14,074	14,315	13,288	12,786	10,876	10,440	9,179	9,496	9,360	8,145	7,578	7,901	8,317	7,844
Total Roundfish		24,419	20,517	21,466	22,543	19,022	22,453	23,755	23,653	21,312	35,527	69,185	53,843	84,002	84,921	94,714	95,255
Rockfish																	
	Pacific Ocean Perch	1,042	1,860	1,644	1,495	1,382	1,154	1,398	1,442	1,017	1,394	1,072	1,266	970	814	733	646
	Shortbelly	9	4	3	39	22	0	0	3	9	4	3	8	53	34	34	50
	Widow	25,718	10,354	9,657	9,085	9,394	13,856	11,066	13,333	10,567	6,924	6,689	8,795	6,365	6,700	6,077	6,454
	Thornyheads	2,323	2,664	3,174	4,114	3,648	4,487	6,050	9,233	11,729	8,038	11,587	11,183	8,045	7,550	6,529	5,462
Other Rockfish																	
	Bocaccio	5,387	5,792	4,304	2,485	2,114	3,906	3,147	3,667	2,988	2,600	2,503	2,187	1,180	950	607	457
	Canary	5,137	4,667	2,191	2,470	1,952	3,105	2,863	3,016	2,597	3,174	2,901	2,116	1,287	897	1,146	1,104
	Chilipepper	2,102	2,162	2,179	2,286	1,755	3,075	3,283	3,417	3,410	4,481	3,446	3,415	1,862	1,980	1,711	1,850
	Yellowtail	9,330	8,902	5,147	3,445	4,398	4,410	5,885	5,177	4,467	3,956	6,208	5,223	5,415	4,858	5,197	2,082
	Remaining Rockfish[c/]	7,443	7,581	7,731	8,960	8,119	10,990	10,387	8,589	7,777	7,854	7,385	7,123	5,719	4,817	4,868	4,575
	Unspecified Rockfish	3,016	4,164	3,983	2,969	4,252	4,012	2,920	2,685	2,952	3,038	2,559	2,740	674	936	1,263	980
Total Rockfish		61,507	48,151	40,013	37,347	37,035	48,995	47,002	50,563	47,511	41,462	44,354	44,056	31,570	29,535	28,165	23,660
Flatfish																	
	Arrowtooth Flounder	2,351	2,077	2,379	2,679	2,231	2,830	1,946	3,552	5,824	4,945	3,576	2,713	3,251	2,321	4,391	4,696
	Dove Sole	20,919	19,993	19,205	20,537	17,354	18,440	18,116	18,815	15,697	18,223	16,035	14,339	9,359	10,544	12,152	10,094
	English Sole	2,791	2,355	1,721	1,929	2,036	2,481	2,102	2,412	1,912	2,185	1,626	1,603	1,124	1,133	1,153	1,502
	Petrale Sole	2,630	2,214	1,739	1,839	1,748	2,205	2,149	2,153	1,765	1,927	1,554	1,503	1,375	1,659	1,828	1,942
	Other Flatfish	3,922	2,994	2,655	3,455	2,758	2,913	2,729	2,966	2,502	3,235	2,015	1,937	2,437	2,558	1,998	2,308
Total Flatfish		32,614	29,633	27,700	30,439	26,128	28,868	27,042	29,898	27,699	30,515	24,805	22,094	17,545	18,216	21,522	20,542
Other Fish																	
	Jack Mackerel	282	1,302	3,234	136	55	142	1	0	109	45	408	491	359	249	344	521
	Other	372	357	514	536	333	351	424	490	730	1,160	1,449	2,087	2,390	1,374	3,832	2,939
Total Other Fish		654	1,659	3,749	672	388	493	425	491	839	1,205	1,857	2,578	2,749	1,623	4,176	3,460
Grand Total		119,193	99,960	92,928	91,002	82,572	100,808	98,224	104,604	97,361	108,709	140,201	122,571	135,866	134,295	148,576	142,917

Data Source: Data for 1982-1997 were extracted from PacFIN July 15th, 1998.

a/ The data in Tables 1 through 18 are preliminary.
b/ Whiting landings in 1991 and later do not include catches by the U.S. at-sea whiting fleet.
c/ Remaining rockfish are all species of rockfish not specifically listed on this page.

TABLE 2. Estimated commercial groundfish landings (in thousands of dollars) for all management areas, 1982-1997. (Excludes joint venture, foreign, and domestic at-sea catches).

Species		1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
Roundfish																	
	Lingcod	$2,088	$2,281	$2,183	$2,237	$1,322	$2,125	$2,116	$2,759	$2,291	$2,457	$1,617	$1,840	$1,738	$1,486	$1,605	$1,655
	Pacific Cod	$444	$311	$300	$221	$200	$1,653	$1,949	$1,249	$634	$1,188	$1,276	$974	$636	$432	$388	$510
	Pacific Whiting[a/]	$182	$194	$406	$583	$448	$663	$1,136	$1,071	$1,049	$2,395	$5,885	$2,843	$4,907	$7,821	$5,107	$8,119
	Sablefish	$10,571	$7,688	$6,806	$10,522	$10,965	$13,425	$12,499	$10,797	$9,661	$14,330	$13,634	$10,009	$13,766	$23,440	$25,875	$27,518
Total Roundfish		$13,304	$10,489	$9,711	$13,591	$12,953	$17,884	$17,721	$15,901	$13,652	$20,412	$22,482	$15,809	$21,336	$33,743	$33,843	$38,796
Rockfish																	
	Pacific Ocean Perch	$445	$888	$818	$830	$849	$832	$885	$865	$603	$920	$715	$837	$713	$638	$521	$456
	Shortbelly	$3	$1	$1	$8	$15	$0	$0	$2	$5	$3	$2	$4	$25	$15	$10	$23
	Widow	$9,010	$4,459	$4,811	$5,026	$5,760	$9,883	$7,083	$7,759	$6,311	$4,327	$4,270	$5,589	$4,431	$4,962	$4,170	$4,528
	Thornyheads	$1,140	$1,326	$1,681	$2,272	$2,245	$3,211	$4,697	$7,523	$9,941	$8,050	$11,895	$11,771	$12,864	$16,774	$12,563	$9,425
Other Rockfish																	
	Bocaccio	$2,617	$2,928	$2,400	$1,561	$1,508	$3,138	$2,311	$2,713	$2,241	$1,916	$1,962	$1,763	$1,068	$888	$553	$413
	Canary	$2,139	$2,046	$1,115	$1,410	$1,216	$2,302	$1,785	$1,834	$1,660	$2,200	$2,138	$1,584	$1,133	$999	$1,166	$1,245
	Chilipepper	$995	$1,061	$1,194	$1,441	$1,200	$2,368	$2,339	$2,340	$2,481	$3,227	$2,664	$2,880	$1,693	$1,854	$1,544	$1,626
	Yellowtail	$3,728	$4,015	$2,572	$1,941	$2,785	$3,185	$3,698	$3,142	$2,778	$2,777	$4,479	$3,624	$4,094	$3,977	$3,952	$1,735
	Remaining Rockfish	$3,910	$4,303	$4,984	$6,346	$6,581	$9,396	$8,494	$7,327	$6,825	$7,291	$7,315	$6,657	$6,388	$6,234	$5,988	$5,409
	Unspecified Rockfish	$2,508	$2,740	$2,560	$2,376	$3,540	$3,570	$2,466	$2,539	$2,938	$3,180	$2,791	$3,078	$829	$1,085	$1,463	$1,272
Total Rockfish		$26,496	$23,768	$22,137	$23,212	$25,700	$37,886	$33,759	$36,043	$35,784	$33,891	$38,232	$37,788	$33,239	$37,426	$31,930	$26,131
Flatfish																	
	Arrowtooth Flounder	$567	$456	$503	$578	$500	$913	$507	$775	$1,343	$1,250	$836	$584	$699	$569	$989	$1,010
	Dover Sole	$10,665	$9,862	$9,771	$10,861	$9,829	$12,383	$12,138	$11,394	$9,242	$12,085	$9,957	$8,615	$6,078	$7,578	$8,287	$6,537
	English Sole	$1,952	$1,670	$1,217	$1,407	$1,603	$2,194	$1,817	$1,941	$1,380	$1,656	$1,182	$1,122	$844	$922	$912	$1,076
	Petrale Sole	$3,516	$3,334	$2,714	$2,977	$2,985	$3,960	$3,862	$3,874	$3,209	$3,508	$2,760	$2,600	$2,536	$3,479	$3,691	$3,851
	Other Flatfish	$3,034	$2,410	$2,159	$2,829	$2,510	$2,828	$2,470	$2,550	$2,077	$2,748	$1,723	$1,746	$2,063	$2,088	$1,685	$1,800
Total Flatfish		$19,734	$17,731	$16,365	$18,652	$17,428	$22,278	$20,795	$20,535	$17,252	$21,247	$16,458	$14,667	$12,220	$14,636	$15,564	$14,274
Other Fish																	
	Jack Mackerel	$56	$184	$353	$34	$20	$16	$0	$0	$16	$11	$15	$57	$74	$76	$22	$100
	Other	$260	$241	$346	$346	$284	$289	$276	$308	$332	$441	$494	$656	$784	$498	$2,042	$1,821
Total Other Fish		$316	$425	$699	$380	$303	$305	$276	$308	$348	$453	$509	$713	$858	$574	$2,064	$1,921
Grand Total		$59,849	$52,413	$48,911	$55,835	$56,384	$78,353	$72,551	$72,787	$67,036	$76,002	$77,680	$68,977	$67,653	$86,379	$83,400	$81,123

Data Source: Data for 1982-1997 were extracted from PacFIN July 15th, 1998.

a/ Whiting landings in 1991 and later do not include catches by the U.S. at-sea whiting fleet.

TABLE 3. Estimated commercial groundfish landings (mt) for the U.S. portion of the Vancouver management area, 1982-1997. (Excludes joint venture, foreign, and domestic at-sea catches).

Species		1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
Roundfish																	
	Lingcod	596	1,178	1,746	1,852	569	728	621	999	987	1,452	556	651	611	367	360	363
	Pacific Cod	750	528	493	374	291	1,386	1,981	1,270	825	1,366	1,470	958	731	451	375	554
	Pacific Whiting[a/]	0	6	2	0	1	0	0	0	12	92	2	0	192	130	5,249	2,190
	Sablefish	2,375	2,665	3,723	3,066	1,718	1,772	1,862	1,836	1,519	1,705	1,546	1,490	1,369	1,903	1,610	1,485
Total Roundfish		3,736	4,381	5,979	5,296	2,601	3,910	4,486	4,128	3,347	4,622	3,583	3,099	2,903	2,852	7,594	4,592
Rockfish																	
	Pacific Ocean Perch	221	337	607	567	644	375	585	486	429	656	626	599	528	449	256	326
	Shortbelly	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Widow	3,690	1,528	461	462	584	578	341	694	1,370	813	827	1,736	1,364	1,237	714	1,276
	Thornyheads	51	105	218	91	64	77	108	240	230	252	598	1,009	1,400	1,272	603	771
Other Rockfish																	
	Bocaccio	31	157	147	129	82	116	99	284	303	394	216	140	76	87	35	117
	Canary	288	636	590	944	857	980	852	1,292	1,141	916	838	340	356	222	194	264
	Chilipepper	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Yellowtail	2,887	2,736	1,013	943	1,544	1,193	1,709	1,522	1,461	958	1,242	1,658	2,033	1,849	1,358	573
	Remaining Rockfish[b/]	255	793	801	599	657	546	478	722	680	806	602	524	533	493	366	388
	Unspecified Rockfish	239	732	470	673	536	425	471	234	166	730	575	674	295	306	353	207
Total Rockfish		7,663	7,024	4,307	4,409	4,967	4,289	4,642	5,475	5,780	5,525	5,524	6,680	6,587	5,915	3,879	3,921
Flatfish																	
	Arrowtooth Flounder	1,315	1,466	1,828	1,696	1,436	2,004	1,298	2,429	4,182	3,288	2,782	1,965	2,667	1,705	3,094	3,480
	Dover Sole	2,007	3,098	3,184	2,683	1,540	1,339	2,272	2,551	2,264	2,396	1,771	1,691	1,358	1,399	1,435	1,316
	English Sole	255	244	314	310	284	408	428	647	512	496	318	398	304	328	182	284
	Petrale Sole	166	423	373	278	239	351	357	393	285	291	247	357	234	320	309	371
	Other Flatfish	166	278	188	408	133	109	285	469	146	396	139	87	60	68	80	101
Total Flatfish		3,910	5,509	5,886	5,374	3,633	4,211	4,640	6,488	7,388	6,868	5,257	4,497	4,624	3,820	5,100	5,551
Other Fish																	
	Jack Mackerel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Other	78	28	272	298	105	136	187	280	472	876	1,044	1,225	1,315	406	480	889
Total Other Fish		78	28	272	298	105	136	187	280	472	876	1,044	1,225	1,315	406	480	889
Grand Total		15,386	16,943	16,444	15,377	11,306	12,546	13,955	16,371	16,986	17,891	15,407	15,501	15,429	12,992	17,053	14,954

Data Source: Data for 1982-1997 were extracted from PacFIN July 15th, 1998.

a/ Whiting landings in 1991 and later do not include catches by the U.S. at-sea whiting fleet.
b/ Remaining rockfish are all species of rockfish not specifically listed on this page.

TABLE 4. Estimated commercial groundfish landings (in thousands of dollars) for the Vancouver area, 1982-1997. (Excludes joint venture, foreign, and domestic at-sea catches).

Species		1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
Roundfish																	
	Lingcod	$352	$630	$904	$1,032	$380	$594	$474	$713	$703	$1,060	$456	$498	$498	$342	$346	$332
	Pacific Cod	$361	$273	$253	$201	$176	$1,006	$1,142	$734	$499	$904	$1,049	$679	$535	$387	$326	$475
	Pacific Whiting[a/]	$0	$0	$0	$0	$0	$0	$0	$0	$2	$13	$0	$0	$10	$14	$329	$239
	Sablefish	$1,502	$1,512	$1,966	$3,506	$1,834	$2,397	$2,883	$2,543	$2,219	$3,802	$3,039	$2,490	$2,875	$6,714	$5,678	$5,578
Total Roundfish		$2,218	$2,417	$3,127	$4,741	$2,397	$4,008	$4,507	$3,998	$3,425	$5,782	$4,548	$3,667	$3,918	$7,457	$6,680	$6,624
Rockfish																	
	Pacific Ocean Perch	$95	$159	$301	$315	$396	$268	$371	$295	$255	$432	$420	$402	$392	$356	$186	$237
	Shortbelly	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Widow	$1,336	$685	$219	$252	$359	$411	$228	$407	$809	$521	$557	$1,083	$930	$903	$496	$898
	Thornyheads	$20	$52	$104	$50	$39	$55	$81	$184	$193	$251	$535	$942	$2,140	$2,703	$1,099	$1,241
Other Rockfish																	
	Bocaccio	$12	$69	$69	$71	$51	$85	$65	$170	$180	$258	$147	$93	$57	$67	$24	$91
	Canary	$110	$291	$282	$519	$528	$711	$541	$772	$683	$598	$575	$231	$268	$198	$146	$210
	Chilipepper	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Yellowtail	$1,104	$1,237	$491	$519	$960	$857	$1,086	$908	$870	$632	$851	$1,121	$1,496	$1,479	$1,023	$440
	Remaining Rockfish	$102	$361	$382	$332	$404	$390	$314	$437	$424	$537	$419	$380	$418	$372	$268	$275
	Unspecified Rockfish	$101	$293	$226	$437	$374	$343	$324	$204	$161	$511	$401	$492	$299	$292	$320	$203
Total Rockfish		$2,881	$3,146	$2,073	$2,496	$3,112	$3,120	$3,008	$3,376	$3,575	$3,741	$3,905	$4,743	$5,999	$6,370	$3,561	$3,595
Flatfish																	
	Arrowtooth Flounder	$335	$320	$381	$363	$322	$644	$321	$533	$966	$837	$654	$425	$564	$416	$696	$738
	Dover Sole	$994	$1,586	$1,600	$1,439	$880	$881	$1,555	$1,563	$1,347	$1,573	$1,140	$1,085	$884	$1,046	$1,053	$888
	English Sole	$155	$160	$209	$204	$207	$331	$348	$497	$351	$352	$221	$272	$216	$257	$140	$195
	Petrale Sole	$207	$618	$587	$448	$399	$639	$668	$725	$529	$544	$452	$614	$433	$701	$594	$727
	Other Flatfish	$108	$190	$137	$276	$116	$92	$208	$332	$107	$280	$111	$67	$43	$56	$61	$67
Total Flatfish		$1,799	$2,873	$2,915	$2,730	$1,925	$2,587	$3,099	$3,649	$3,300	$3,585	$2,579	$2,463	$2,141	$2,476	$2,544	$2,614
Other Fish																	
	Jack Mackerel	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$1	$0	$0
	Other	$18	$6	$52	$57	$22	$33	$54	$86	$142	$274	$329	$357	$415	$122	$134	$292
Total Other Fish		$18	$6	$52	$57	$22	$33	$54	$86	$142	$274	$329	$357	$415	$123	$134	$292
Grand Total		$6,916	$8,442	$8,167	$10,024	$7,455	$9,748	$10,668	$11,109	$10,443	$13,382	$11,361	$11,231	$12,473	$16,426	$12,920	$13,125

Data Source: Data for 1982-1997 were extracted from PacFIN July 15th, 1998.

a/ Whiting landings in 1991 and later do not include catches by the U.S. at-sea whiting fleet.

TABLE 5. Estimated commercial groundfish landings (mt) for the Columbia management area, 1982-1997. (Excludes jont venture, foreign, and domestic at-sea catches).

Species		1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
Roundfish																	
	Lingcod	1,644	1,873	1,259	1,273	736	890	1,029	1,230	758	867	651	778	620	494	638	572
	Pacific Cod	158	69	90	34	40	803	1,346	918	239	429	307	406	135	53	70	41
	Pacific Whiting[a/]	3	65	383	882	480	240	249	88	2,570	13,768	51,148	39,003	69,803	70,747	68,480	82,747
	Sablefish	6,308	4,294	4,700	5,185	4,944	6,108	4,950	4,090	3,363	3,867	3,459	3,594	3,362	2,815	2,953	2,926
Total Roundfish		8,115	6,300	6,433	7,374	6,201	8,049	7,584	6,333	6,935	18,939	55,571	43,782	73,921	74,111	79,619	80,146
Rockfish																	
	Pacific Ocean Perch	655	1,422	971	814	703	615	733	915	570	718	399	635	431	354	458	300
	Shortbelly	3	1	1	11	2	0	0	2	0	2	3	6	49	24	4	17
	Widow	11,108	4,632	5,887	5,128	6,122	9,295	7,895	9,490	6,251	4,061	3,633	5,102	3,760	3,450	3,757	3,476
	Thornyheads	230	701	705	884	521	579	706	1,778	3,490	2,956	3,322	3,582	2,868	2,132	2,050	1,575
Other Rockfish																	
	Bocaccio	634	763	249	477	272	240	189	217	144	185	143	145	107	84	86	54
	Canary	3,843	3,154	1,128	1,069	892	1,598	1,661	1,393	932	1,772	1,450	1,429	666	395	674	535
	Chilipepper	22	10	2	2	1	0	0	3	2	5	13	6	19	11	9	9
	Yellowtail	5,408	5,216	3,432	1,910	2,340	2,566	3,734	2,637	2,215	2,164	3,930	3,123	2,980	2,650	3,521	1,091
	Remaining Rockfish[b/]	3,461	2,854	1,783	3,021	2,314	2,358	2,941	2,941	2,160	2,510	1,966	2,757	1,994	1,331	1,416	1,193
	Unspecified Rockfish	804	1,025	716	824	1,234	1,432	993	911	677	452	446	852	123	445	359	224
Total Rockfish		26,169	19,776	14,874	14,141	14,401	18,682	18,853	20,288	16,442	14,824	15,304	17,637	12,998	10,876	12,335	8,474
Flatfish																	
	Arrowtooth Flounder	979	569	502	932	770	774	602	1,091	1,571	1,467	660	665	490	488	1,141	1,065
	Dover Sole	8,452	6,778	5,279	4,837	4,031	5,534	6,817	7,651	6,156	7,153	4,848	5,030	3,058	2,692	3,508	2,993
	English Sole	941	691	360	518	648	703	560	690	488	860	702	681	339	293	353	540
	Petrale Sole	1,613	997	702	633	720	900	885	828	690	777	671	568	474	689	581	598
	Other Flatfish	2,124	1,334	1,146	1,203	899	1,056	723	784	933	1,468	937	860	985	992	444	642
Total Flatfish		14,108	10,369	7,989	8,123	7,068	8,967	9,588	11,044	9,839	11,725	7,818	7,804	5,345	5,154	6,027	5,837
Other Fish																	
	Jack Mackerel	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	194
	Other	87	78	31	15	26	14	14	30	58	116	146	356	414	413	753	508
Total Other Fish		87	78	31	15	26	14	14	30	58	116	146	356	414	415	754	702
Grand Total		48,478	36,523	29,327	29,653	27,696	35,712	36,039	37,694	33,274	45,604	78,840	69,580	92,677	90,556	98,735	95,158

Data Source: Data for 1982-1997 were extracted from PacFIN July 15, 1998.

a/ Whiting landings in 1991 and later do not include catches by the U.S. at-sea whiting fleet.

b/ Remaining rockfish are all species of rockfish not specifically listed on this page.

TABLE 6. Estimated commercial groundfish landings (in thousands of dollars) for the Columbia area, 1982-1997. (Excludes joint venture, foreign, and domestic at-sea catches).

Species		1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
Roundfish																	
	Lingcod	$871	$1,026	$672	$714	$473	$709	$781	$883	$549	$633	$519	$618	$550	$463	$596	$558
	Pacific Cod	$83	$38	$46	$19	$24	$580	$797	$515	$135	$284	$225	$291	$102	$45	$61	$35
	Pacific Whiting[a/]	$0	$32	$64	$183	$64	$46	$47	$15	$260	$1,466	$5,282	$2,499	$4,543	$7,351	$4,529	$7,297
	Sablefish	$3,438	$2,090	$2,270	$3,526	$4,193	$6,697	$6,022	$4,226	$3,389	$6,059	$5,315	$4,565	$6,352	$8,434	$9,793	$11,168
Total Roundfish		$4,392	$3,185	$3,053	$4,441	$4,754	$8,035	$7,653	$5,642	$4,337	$8,451	$11,348	$7,974	$11,548	$16,294	$14,981	$19,065
Rockfish																	
	Pacific Ocean Perch	$282	$683	$484	$453	$432	$448	$463	$545	$337	$475	$264	$415	$314	$272	$321	$205
	Shortbelly	$1	$0	$0	$5	$1	$0	$0	$1	$0	$1	$1	$3	$24	$11	$2	$9
	Widow	$4,064	$1,939	$2,967	$2,814	$3,713	$6,573	$4,967	$5,392	$3,587	$2,469	$2,255	$3,189	$2,579	$2,465	$2,492	$2,399
	Thornyheads	$95	$327	$359	$484	$324	$417	$540	$1,431	$2,950	$2,922	$3,168	$3,521	$4,429	$4,664	$3,871	$2,601
Other Rockfish																	
	Bocaccio	$266	$336	$126	$267	$168	$176	$118	$128	$88	$122	$96	$99	$88	$70	$70	$46
	Canary	$1,597	$1,366	$577	$597	$557	$1,202	$1,003	$827	$573	$1,185	$1,020	$996	$520	$373	$612	$563
	Chilipepper	$10	$4	$1	$1	$1	$0	$0	$2	$1	$3	$8	$4	$13	$7	$6	$6
	Yellowtail	$2,176	$2,287	$1,700	$1,062	$1,452	$1,826	$2,287	$1,538	$1,324	$1,433	$2,688	$2,120	$2,218	$2,141	$2,632	$858
	Remaining Rockfish	$1,420	$1,299	$891	$1,652	$1,448	$1,737	$1,849	$1,694	$1,256	$1,687	$1,376	$1,751	$1,339	$1,041	$1,040	$845
	Unspecified Rockfish	$363	$504	$361	$501	$808	$1,086	$635	$622	$530	$383	$329	$681	$124	$456	$379	$274
Total Rockfish		$10,275	$8,744	$7,467	$7,836	$8,904	$13,466	$11,862	$12,180	$10,646	$10,679	$11,205	$12,779	$11,648	$11,498	$11,425	$7,805
Flatfish																	
	Arrowtooth Flounder	$218	$127	$111	$202	$172	$252	$171	$232	$360	$363	$150	$141	$108	$119	$254	$232
	Dover Sole	$4,325	$3,337	$2,695	$2,656	$2,352	$3,832	$4,577	$4,676	$3,697	$4,815	$2,944	$2,975	$1,991	$1,981	$2,455	$1,989
	English Sole	$660	$488	$253	$375	$508	$619	$479	$542	$333	$628	$476	$446	$236	$228	$264	$370
	Petrale Sole	$2,199	$1,529	$1,113	$1,022	$1,209	$1,635	$1,638	$1,529	$1,267	$1,418	$1,188	$973	$885	$1,479	$1,247	$1,228
	Other Flatfish	$1,624	$1,105	$959	$1,001	$877	$1,146	$727	$779	$833	$1,301	$799	$751	$830	$728	$375	$493
Total Flatfish		$9,027	$6,586	$5,132	$5,256	$5,118	$7,484	$7,593	$7,760	$6,491	$8,524	$5,558	$5,286	$4,050	$4,535	$4,594	$4,312
Other Fish																	
	Jack Mackerel	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$1
	Other	$30	$39	$15	$13	$18	$18	$6	$12	$18	$26	$22	$84	$108	$129	$182	$118
Total Other Fish		$30	$39	$15	$13	$18	$18	$6	$12	$18	$26	$22	$84	$108	$129	$182	$118
Grand Total		$23,723	$18,555	$15,667	$17,546	$18,794	$29,004	$27,115	$25,594	$21,491	$27,681	$28,133	$26,124	$27,355	$32,457	$31,182	$31,301

Data Source: Data for 1982-1997 were extracted from PacFIN July 15th, 1998.

a/ Whiting landings in 1991 and later do not include catches by the U.S. at-sea whiting fleet.

TABLE 7. Estimated commercial groundfish landings (mt) for the Eureka management area, 1982-1997. (Excludes joint venture, foreign, and domestic at-sea catches).

Species		1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
Roundfish																	
	Lingcod	555	410	288	238	207	322	312	389	422	213	170	197	212	229	203	262
	Pacific Cod	0	0	0	0	0	79	14	0	0	0	0	1	0	0	0	0
	Pacific Whiting[a/]	1,016	977	2,312	3,009	2,978	4,508	6,527	7,292	5,516	6,889	4,970	3,099	3,610	4,089	2,991	6,593
	Sablefish	3,850	2,861	2,358	2,552	2,557	1,931	1,554	1,659	1,966	1,848	2,229	1,630	1,625	1,364	1,596	1,681
Total Roundfish		5,423	4,247	4,969	5,832	5,756	6,842	8,408	9,340	7,904	8,951	7,374	4,929	5,453	5,689	4,796	8,270
Rockfish																	
	Pacific Ocean Perch	165	94	59	100	32	162	79	40	13	11	40	26	8	10	19	14
	Shortbelly	2	0	0	0	0	0	0	0	2	1	0	2	1	2	1	1
	Widow	3,737	2,556	2,243	2,325	1,678	2,111	1,701	1,665	1,388	722	1,059	1,413	888	993	801	848
	Thornyheads	1,138	1,003	1,070	1,506	1,673	2,100	4,200	5,206	4,970	3,182	4,155	4,175	2,039	1,944	1,957	1,532
Other Rockfish																	
	Bocaccio	642	469	239	261	87	207	159	133	193	88	64	176	44	61	38	10
	Canary	542	616	243	171	131	264	151	174	208	200	469	190	144	163	174	172
	Chilipepper	136	166	84	106	87	170	204	125	220	338	38	598	93	104	93	65
	Yellowtail	442	413	416	167	105	304	99	274	382	485	398	230	162	185	187	152
	Remaining Rockfish[b/]	968	742	794	1,099	449	3,396	1,970	1,026	974	905	1,043	910	896	791	860	681
	Unspecified Rockfish	380	518	284	325	437	412	410	394	630	539	268	202	64	67	76	137
Total Rockfish		8,151	6,576	5,433	6,061	4,680	9,126	8,973	9,037	8,982	6,471	7,533	7,922	4,338	4,321	4,205	3,613
Flatfish																	
	Arrowtooth Flounder	55	39	47	47	23	52	43	32	71	191	127	82	89	126	150	148
	Dover Sole	5,830	5,562	5,109	5,924	5,144	5,095	4,762	4,131	3,887	3,914	3,978	3,505	1,850	2,126	2,648	1,944
	English Sole	590	780	518	407	341	612	409	307	199	135	115	127	110	103	183	215
	Petrale Sole	263	389	317	386	243	396	383	369	283	343	260	264	354	287	487	490
	Other Flatfish	664	574	579	743	572	754	567	504	368	287	190	275	408	400	448	513
Total Flatfish		7,402	7,344	6,570	7,508	6,324	6,909	6,164	5,343	4,808	4,871	4,669	4,254	2,811	3,043	3,916	3,310
Other Fish																	
	Jack Mackerel	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	2
	Other	27	35	26	51	59	50	129	81	97	77	167	317	324	149	366	306
Total Other Fish		27	35	26	51	59	50	129	81	97	77	168	317	324	149	366	309
Grand Total		21,003	18,203	16,998	19,452	16,818	22,927	23,674	23,800	21,791	20,370	19,744	17,422	12,926	13,202	13,283	15,502

Data Source: Data for 1982-1997 were extracted from PacFIN July 15th, 1997.

a/ Whiting landings in 1991 and later do not include catches by the U.S. at-sea whiting fleet.

b/ Remaining rockfish are all species of rockfish not specifically listed on this page.

TABLE 8. Estimated commercial groundfish landings (in thousands of dollars) for the Eureka area, 1982-1997. (Excludes joint venture, foreign, and domestic at-sea catches).

Species		1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
Roundfish																	
	Lingcod	$307	$230	$167	$153	$169	$304	$292	$336	$370	$188	$156	$176	$204	$247	$224	$322
	Pacific Cod	$0	$0	$0	$0	$0	$57	$9	$0	$0	$0	$0	$1	$0	$0	$0	$0
	Pacific Whiting[a/]	$179	$162	$337	$397	$381	$609	$1,074	$1,045	$778	$876	$600	$342	$350	$453	$243	$581
	Sablefish	$1,817	$1,374	$964	$1,483	$1,864	$1,711	$1,342	$1,478	$1,831	$2,129	$2,751	$1,630	$2,750	$3,735	$4,513	$5,345
Total Roundfish		$2,304	$1,766	$1,474	$2,053	$2,421	$2,683	$2,717	$2,859	$2,979	$3,194	$3,510	$2,149	$3,308	$4,441	$4,988	$6,300
Rockfish																	
	Pacific Ocean Perch	$68	$42	$29	$55	$19	$113	$50	$24	$8	$7	$26	$18	$6	$9	$14	$10
	Shortbelly	$0	$0	$0	$0	$0	$0	$0	$0	$1	$1	$0	$1	$1	$1	$0	$0
	Widow	$1,257	$1,087	$1,054	$1,274	$1,018	$1,505	$1,063	$954	$783	$435	$672	$917	$627	$739	$556	$596
	Thornyheads	$575	$505	$587	$841	$1,040	$1,534	$3,311	$4,281	$4,238	$3,247	$4,449	$4,712	$3,465	$4,312	$3,706	$2,612
Other Rockfish																	
	Bocaccio	$266	$206	$122	$146	$53	$149	$101	$79	$120	$59	$45	$130	$38	$54	$38	$11
	Canary	$226	$267	$126	$95	$82	$191	$96	$104	$147	$153	$362	$192	$162	$231	$219	$250
	Chilipepper	$57	$73	$43	$59	$52	$122	$126	$74	$135	$223	$25	$418	$69	$82	$63	$51
	Yellowtail	$184	$182	$217	$93	$65	$217	$60	$165	$241	$339	$286	$174	$132	$160	$156	$146
	Remaining Rockfish	$410	$349	$399	$612	$288	$2,474	$1,333	$738	$756	$707	$816	$716	$741	$824	$823	$759
	Unspecified Rockfish	$184	$254	$160	$222	$332	$374	$328	$347	$568	$489	$228	$192	$66	$81	$91	$149
Total Rockfish		$3,226	$2,965	$2,737	$3,397	$2,949	$6,680	$6,466	$6,766	$6,997	$5,661	$6,909	$7,468	$5,306	$6,492	$5,665	$4,585
Flatfish																	
	Arrowtooth Flounder	$13	$9	$11	$10	$5	$17	$13	$9	$17	$50	$31	$18	$23	$33	$35	$37
	Dover Sole	$2,994	$2,740	$2,685	$3,234	$2,973	$3,543	$3,205	$2,509	$2,290	$2,653	$2,569	$2,158	$1,240	$1,537	$1,780	$1,276
	English Sole	$426	$566	$376	$308	$282	$570	$369	$255	$147	$112	$91	$92	$89	$87	$145	$155
	Petrale Sole	$345	$587	$483	$609	$395	$685	$640	$614	$476	$583	$435	$431	$578	$543	$901	$885
	Other Flatfish	$524	$464	$457	$610	$479	$679	$500	$421	$300	$241	$163	$231	$348	$328	$372	$388
Total Flatfish		$4,302	$4,366	$4,012	$4,771	$4,134	$5,493	$4,727	$3,808	$3,230	$3,639	$3,288	$2,930	$2,278	$2,527	$3,231	$2,741
Other Fish																	
	Jack Mackerel	$0	$0	$0	$0	$0	$0	$0	$0	$0	$9	$0	$0	$0	$0	$0	$1
	Other	$9	$16	$11	$15	$25	$23	$49	$33	$32	$22	$34	$86	$99	$52	$106	$119
Total Other Fish		$9	$16	$11	$15	$25	$23	$49	$33	$32	$31	$35	$86	$99	$52	$106	$119
Grand Total		$9,842	$9,113	$8,235	$10,237	$9,530	$14,878	$13,960	$13,466	$13,237	$12,524	$13,743	$12,632	$10,991	$13,512	$13,990	$13,746

Data Source: Data for 1982-1997 were extracted from PacFIN July 15th, 1998.

a/ Whiting landings in 1991 and later do not include catches by the U.S. at-sea whiting fleet.

TABLE 9. Estimated commercial groundfish landings (mt) for the Monterey management area, 1982-1997. (Excludes joint venture, foreign, and domestic at-sea catches).

Species		1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
Roundfish																	
	Lingcod	841	647	736	489	360	581	626	893	705	559	441	489	396	318	314	332
	Pacific Cod	0	0	2	1	0	10	0	0	0	0	1	0	0	0	0	0
	Pacific Whiting[a/]	7	3	23	3	3	9	5	0	0	1	0	0	2	0	70	0
	Sablefish	5,147	2,953	2,224	3,039	3,511	2,544	2,164	2,352	1,697	1,663	1,538	1,027	932	1,487	1,818	1,491
Total Roundfish		5,995	3,603	2,985	3,531	3,874	3,144	2,796	3,246	2,402	2,223	1,983	1,517	1,334	1,811	2,219	1,858
Rockfish																	
	Pacific Ocean Perch	1	8	7	4	3	2	0	0	4	7	5	1	2	1	0	5
	Shortbelly	3	3	0	28	19	0	0	1	7	1	0	0	3	8	30	32
	Widow	7,077	1,592	990	1,126	965	1,807	925	1,382	1,454	1,124	897	510	311	953	701	819
	Thornyheads	878	742	867	1,013	1,073	1,067	577	788	772	802	1,494	1,319	1,266	1,543	1,365	1,171
Other Rockfish																	
	Bocaccio	2,925	3,415	3,116	1,235	1,133	2,260	2,127	2,342	1,551	1,518	1,334	1,063	429	425	286	216
	Canary	463	255	222	263	68	257	191	147	314	272	142	152	114	102	103	132
	Chilipepper	1,484	1,777	1,821	1,860	1,443	2,464	2,339	2,693	2,744	3,584	3,026	2,419	1,447	1,633	1,459	1,614
	Yellowtail	556	489	276	415	378	338	309	682	399	320	626	204	227	160	124	252
	Remaining Rockfish[b/]	1,164	1,876	2,928	2,560	2,212	2,185	2,583	2,097	2,629	2,377	2,265	1,883	1,226	1,196	1,347	1,700
	Unspecified Rockfish	218	1,187	2,082	731	1,478	1,332	717	755	1,176	695	662	491	90	37	322	292
Total Rockfish		14,769	11,344	12,310	9,233	8,771	11,712	9,768	10,885	11,050	10,698	10,452	8,042	5,114	6,059	5,736	6,234
Flatfish																	
	Arrowtooth Flounder	1	1	2	3	1	0	2	1	0	0	0	0	6	1	5	4
	Dover Sole	4,520	4,185	4,347	4,261	5,398	3,994	2,609	2,869	2,011	3,285	3,599	2,894	2,124	3,226	3,239	2,741
	English Sole	857	584	497	639	711	674	621	703	667	653	467	378	359	399	423	451
	Petrale Sole	418	332	298	403	326	432	449	465	424	451	337	280	259	311	393	431
	Total Flatfish															855	943
Total Flatfish		6,657	5,770	5,814	6,161	7,425	5,877	4,537	4,954	3,786	5,256	5,013	4,098	3,468	4,883	4,915	4,570
Other Fish																	
	Jack Mackerel	282	1,302	3,234	136	55	142	1	0	109	26	91	214	157	100	91	327
	Other	85	136	66	59	44	36	23	18	28	36	40	140	284	366	2,059	1,073
Total Other Fish		367	1,439	3,300	195	99	178	25	19	137	62	131	354	440	466	2,150	1,400
Grand Total		27,788	22,156	24,409	19,120	20,169	20,912	17,125	19,104	17,376	18,240	17,579	14,011	10,357	13,220	15,020	14,062

Data Source: Data for 1982-1997 were extracted from PacFIN July 15th\, 1997.

a/ Whiting landings in 1991 and later do not include catches by the U.S. at-sea whiting fleet.

b/ Remaining rockfish are all species of rockfish not specifically listed on this page.

TABLE 10. Estimated commercial groundfish landings (in thousands of dollars) for the Monterey area, 1982-1997. (Excludes joint venture, foreign, and domestic at-sea catches).

Species		1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
Roundfish																	
	Lingcod	$460	$365	$425	$312	$276	$486	$528	$769	$603	$497	$415	$463	$402	$357	$369	$387
	Pacific Cod	$0	$0	$1	$1	$0	$7	$0	$0	$0	$0	$1	$0	$0	$0	$0	$0
	Pacific Whiting[a/]	$2	$1	$4	$2	$1	$1	$1	$0	$0	$1	$0	$0	$1	$0	$4	$0
	Sablefish	$2,821	$1,288	$840	$1,789	$2,600	$2,286	$2,009	$2,135	$1,673	$1,869	$1,802	$931	$1,362	$3,907	$5,148	$4,681
Total Roundfish		$3,284	$1,653	$1,270	$2,105	$2,877	$2,780	$2,538	$2,904	$2,276	$2,366	$2,223	$1,394	$1,783	$4,292	$5,602	$5,252
Rockfish																	
	Pacific Ocean Perch	$0	$4	$4	$2	$2	$1	$0	$0	$2	$4	$4	$1	$2	$1	$0	$4
	Shortbelly	$1	$1	$0	$3	$13	$0	$0	$0	$4	$1	$0	$0	$1	$4	$8	$13
	Widow	$2,294	$722	$525	$649	$631	$1,330	$664	$927	$1,043	$742	$620	$368	$257	$794	$548	$603
	Thornyheads	$435	$376	$468	$560	$652	$755	$427	$633	$645	$793	$1,565	$1,473	$2,049	$3,599	$2,738	$2,137
Other Rockfish																	
	Bocaccio	$1,321	$1,682	$1,666	$735	$755	$1,697	$1,495	$1,705	$1,156	$1,119	$1,050	$865	$387	$406	$252	$188
	Canary	$205	$117	$120	$173	$42	$191	$132	$112	$252	$251	$177	$158	$167	$163	$182	$219
	Chilipepper	$701	$863	$977	$1,121	$957	$1,826	$1,609	$1,806	$1,996	$2,546	$2,308	$2,048	$1,301	$1,523	$1,319	$1,396
	Yellowtail	$244	$281	$156	$260	$282	$277	$242	$487	$330	$347	$642	$196	$232	$181	$135	$269
	Remaining Rockfish	$612	$1,112	$1,705	$1,646	$1,642	$1,855	$2,349	$2,064	$2,365	$2,393	$2,327	$1,859	$1,549	$1,445	$1,647	$1,929
	Unspecified Rockfish	$213	$768	$1,262	$604	$1,230	$1,163	$700	$751	$1,133	$718	$693	$580	$114	$55	$344	$318
Total Rockfish		$6,027	$5,927	$6,884	$5,752	$6,207	$9,094	$7,619	$8,485	$8,927	$8,914	$9,385	$7,547	$6,059	$8,170	$7,172	$7,076
Flatfish																	
	Arrowtooth Flounder	$0	$1	$1	$2	$0	$0	$2	$1	$0	$0	$0	$0	$3	$1	$4	$3
	Dover Sole	$2,301	$2,028	$2,194	$2,203	$2,972	$2,581	$1,724	$1,717	$1,134	$2,186	$2,285	$1,696	$1,334	$2,241	$2,076	$1,645
	English Sole	$605	$414	$355	$476	$562	$596	$544	$590	$507	$528	$373	$296	$293	$340	$352	$345
	Petrale Sole	$539	$485	$448	$635	$536	$736	$756	$798	$762	$827	$601	$506	$511	$634	$818	$898
	Other Flatfish	$692	$542	$537	$720	$885	$719	$759	$747	$542	$714	$514	$527	$602	$819	$704	$723
Total Flatfish		$4,138	$3,470	$3,534	$4,036	$4,956	$4,632	$3,785	$3,853	$2,946	$4,255	$3,773	$3,025	$2,743	$4,035	$3,954	$3,614
Other Fish																	
	Jack Mackerel	$56	$184	$353	$34	$20	$16	$0	$0	$16	$9	$14	$54	$66	$68	$13	$99
	Other	$58	$87	$60	$66	$43	$42	$26	$30	$31	$27	$28	$58	$99	$146	$733	$497
Total Other Fish		$114	$271	$414	$100	$62	$58	$27	$30	$47	$36	$42	$112	$165	$215	$746	$597
Grand Total		$13,564	$11,321	$12,102	$11,992	$14,103	$16,563	$13,968	$15,272	$14,196	$15,571	$15,423	$12,077	$10,750	$16,712	$17,475	$16,538

Data Source: Data for 1982-1997 were extracted from PacFIN July 15th, 1998.

a/ Whiting landings in 1991 and later do not include catches by the U.S. at-sea whiting fleet.

TABLE 11. Estimated commercial groundfish landings (mt) for the Conception area, 1982-1997. (Excludes joint venture, foreign, and domestic at-sea catches).

Species		1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
Roundfish																	
	Lingcod	174	48	21	25	23	30	37	56	58	72	64	79	66	58	41	32
	Pacific Cod	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Pacific Whiting[a/]	0	0	0	0	1	1	0	6	3	3	1	1	2	1	0	0
	Sablefish	946	1,926	1,070	473	558	390	346	502	621	412	585	403	290	332	341	261
Total Roundfish		1,120	1,974	1,091	498	582	421	383	564	682	487	660	500	391	456	477	379
Rockfish																	
	Pacific Ocean Perch	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
	Shortbelly	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0
	Widow	107	47	74	44	46	62	131	67	77	115	6	35	40	63	33	34
	Thornyheads	26	113	313	620	317	664	459	1,222	2,260	846	2,017	1,097	472	659	553	413
Other Rockfish																	
	Bocaccio	1,154	988	551	383	540	1,079	573	691	796	414	746	664	523	293	161	60
	Canary	1	6	7	22	4	6	9	10	2	14	2	4	7	15	2	1
	Chilipepper	459	209	270	318	225	440	741	596	443	553	370	392	304	231	150	162
	Yellowtail	37	48	10	9	31	8	5	43	8	28	3	7	13	13	6	15
	Remaining Rockfish[b/]	1,584	1,312	1,410	1,665	2,479	2,481	2,400	1,791	1,329	1,250	1,504	1,049	1,070	1,005	875	613
	Unspecified Rockfish	1,364	681	418	396	527	370	315	371	294	605	555	507	102	82	149	120
Total Rockfish		4,733	3,404	3,056	3,457	4,168	5,110	4,633	4,791	5,209	3,825	5,205	3,755	2,531	2,361	1,929	1,419
Flatfish																	
	Arrowtooth Flounder	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
	Dover Sole	109	369	1,286	2,832	1,241	2,468	1,656	1,612	1,375	1,474	1,834	1,218	968	1,101	1,322	1,099
	English Sole	148	57	32	55	52	73	83	65	45	39	21	17	12	11	11	12
	Petrale Sole	171	74	50	139	220	123	74	98	83	64	38	34	54	52	58	51
	Total Flatfish	109	140	72	247	164	210	290	284	351	209	83	156	263	153	165	110
Total Flatfish		537	640	1,440	3,272	1,678	2,873	2,104	2,059	1,854	1,786	1,976	1,425	1,297	1,317	1,556	1,273
Other Fish																	
	Jack Mackerel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Other	95	79	119	112	99	113	71	81	70	54	51	49	53	40	167	163
Total Other Fish		95	79	119	112	99	113	71	81	70	54	51	49	53	40	167	163
Grand Total		6,484	6,098	5,706	7,340	6,527	8,518	7,190	7,494	7,815	6,153	7,892	5,728	4,272	4,175	4,130	3,233

Data Source: Data for 1982-1997 were extracted from PacFIN July 15th, 1998.

a/ Whiting landings in 1991 and later do not include catches by the U.S. at-sea whiting fleet.
b/ Remaining rockfish are all species of rockfish not specifically listed on this page.

TABLE 12. Estimated commercial groundfish landings (in thousands of dollars) for the Conception area, 1982-1997. (Exludes joint venture, foreign, and domestic at-sea catches).

Species		1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
Roundfish																	
	Lingcod	$99	$29	$15	$26	$24	$31	$40	$57	$64	$76	$71	$86	$84	$79	$70	$56
	Pacific Cod	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$1	$2
	Pacific Whiting[a/]	$0	$0	$0	$0	$1	$0	$1	$6	$6	$5	$2	$1	$3	$3	$0	$0
	Sablefish	$993	$1,425	$767	$218	$474	$270	$241	$415	$537	$470	$724	$391	$426	$650	$742	$746
Total Roundfish		$1,092	$1,454	$782	$244	$499	$301	$282	$479	$606	$552	$843	$603	$771	$1,253	$1,576	$1,498
Rockfish																	
	Pacific Ocean Perch	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$1	$0	$0	$0	$0	$0
	Shortbelly	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Widow	$59	$26	$46	$37	$39	$61	$118	$58	$74	$106	$5	$33	$38	$60	$32	$31
	Thornyheads	$15	$66	$164	$337	$189	$450	$339	$994	$1,909	$837	$2,178	$1,122	$781	$1,495	$1,147	$834
Other Rockfish																	
	Bocaccio	$752	$636	$415	$342	$481	$1,028	$531	$630	$697	$356	$625	$576	$498	$292	$170	$77
	Canary	$1	$4	$10	$26	$7	$7	$14	$20	$6	$13	$5	$8	$16	$34	$6	$3
	Chilipepper	$228	$122	$173	$261	$190	$420	$604	$458	$348	$454	$322	$411	$311	$242	$156	$173
	Yellowtail	$20	$28	$7	$7	$27	$8	$5	$35	$11	$25	$6	$12	$16	$16	$6	$22
	Remaining Rockfish	$1,347	$1,175	$1,588	$2,085	$2,787	$2,917	$2,630	$2,360	$2,016	$1,956	$2,367	$1,950	$2,339	$2,552	$2,208	$1,601
	Unspecified Rockfish	$1,632	$889	$532	$583	$747	$550	$463	$584	$531	$1,046	$1,057	$1,102	$225	$201	$325	$328
Total Rockfish		$4,053	$2,945	$2,935	$3,678	$4,466	$5,442	$4,704	$5,139	$5,591	$4,793	$6,565	$5,216	$4,224	$4,891	$4,051	$3,070
Flatfish																	
	Arrowtooth Flounder	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$1	$0
	Dover Sole	$51	$171	$597	$1,329	$652	$1,540	$1,077	$929	$772	$859	$1,016	$701	$629	$773	$923	$739
	English Sole	$106	$42	$24	$44	$45	$68	$77	$57	$41	$37	$19	$14	$10	$10	$9	$11
	Petrale Sole	$226	$114	$83	$264	$447	$258	$158	$209	$176	$137	$81	$76	$129	$121	$131	$115
	Other Flatfish	$83	$108	$65	$222	$152	$187	$270	$256	$276	$202	$100	$161	$240	$158	$169	$129
Total Flatfish		$466	$436	$769	$1,858	$1,296	$2,053	$1,581	$1,452	$1,264	$1,235	$1,216	$952	$1,008	$1,063	$1,233	$994
Other Fish																	
	Jack Mackerel	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Other	$144	$93	$207	$195	$176	$173	$140	$147	$107	$91	$80	$71	$63	$49	$882	$795
Total Other Fish		$144	$93	$207	$195	$176	$173	$140	$147	$107	$91	$80	$71	$63	$49	$882	$795
Grand Total		$5,754	$4,928	$4,692	$5,974	$6,436	$7,970	$6,706	$7,217	$7,569	$6,670	$8,705	$6,842	$6,066	$7,257	$7,742	$6,357

Data Source: Data for 1982-1997 were extracted from PacFIN July 15th, 1998.

\

a/ Whiting landings in 1991 and later do not include catches by the U.S. at-sea whiting fleet.

TABLE 13. Estimated commercial groundfish landings (mt) for Washington, 1982-1997. (Excludes joint venture, foreign, and domestic at-sea catches).

Species		1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
Roundfish																	
	Lingcod	972	1,524	2,043	2,130	714	1,023	757	1,137	993	892	561	676	477	278	360	290
	Pacific Cod	790	508	503	369	300	1,548	2,304	1,408	833	1,281	1,361	878	696	424	361	542
	Pacific Whiting[a/]	1	6	47	14	61	95	88	27	302	504	2,237	3,188	4,884	4,037	10,905	7,639
	Sablefish	3,881	3,363	4,413	3,869	2,415	3,144	2,938	2,416	1,724	2,237	1,790	1,713	1,388	1,951	1,947	2,021
Total Roundfish		5,661	5,405	7,021	6,386	3,513	5,837	6,109	5,011	3,855	4,921	5,959	6,455	7,445	6,691	14,083	10,034
Rockfish																	
	Pacific Ocean Perch	328	482	840	624	684	448	584	483	435	543	432	461	349	287	232	184
	Shortbelly	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Widow	5,980	3,211	1,446	1,532	2,550	3,712	3,075	3,375	2,234	1,148	936	1,669	1,062	1,080	953	1,000
	Thornyheads	115	118	253	56	25	63	69	131	156	134	214	604	685	580	430	365
Other Rockfish																	
	Bocaccio	46	136	152	123	80	110	96	247	265	363	206	132	50	47	43	54
	Canary	430	643	605	1,025	888	1,004	967	1,194	1,086	959	815	286	148	138	162	176
	Chilipepper	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Yellowtail	5,769	5,327	2,312	1,347	1,983	1,877	2,944	1,689	1,643	1,140	1,327	2,014	1,901	1,483	1,452	476
	Remaining Rockfish[b/]	500	856	863	709	728	685	645	657	661	855	699	450	302	301	256	224
	Unspecified Rockfish	671	1,180	842	982	1,215	1,125	961	777	477	342	438	596	357	598	484	342
Total Rockfish		13,839	11,952	7,313	6,399	8,153	9,023	9,342	8,552	6,956	5,485	5,066	6,212	4,854	4,515	4,011	2,822
Flatfish																	
	Arrowtooth Flounder	1,569	1,511	1,930	1,943	1,709	2,044	1,268	2,387	3,955	2,700	1,413	997	1,457	790	2,046	2,268
	Dover Sole	2,722	2,935	3,316	2,804	1,480	1,622	2,243	2,184	1,869	1,689	1,317	1,302	1,000	935	1,063	827
	English Sole	338	260	318	398	403	564	454	666	511	527	423	411	303	321	182	303
	Petrale Sole	331	525	460	405	313	526	452	450	342	261	251	265	210	270	290	308
	Other Flatfish	630	297	260	474	273	358	287	503	368	530	264	145	90	71	60	75
Total Flatfish		5,590	5,529	6,284	6,025	4,177	5,115	4,704	6,190	7,045	5,706	3,668	3,119	3,060	2,388	3,641	3,782
Other Fish																	
	Jack Mackerel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	86
	Other	126	30	273	299	113	143	197	291	474	835	1,044	1,233	1,323	316	477	830
Total Other Fish		126	30	273	299	113	143	197	291	474	835	1,044	1,233	1,323	316	477	916
Grand Total		25,216	22,917	20,891	19,109	15,956	20,118	20,351	20,044	18,331	16,947	15,737	17,019	16,682	13,910	22,212	17,553

Data Source: Data for 1982-1997 were extracted from PacFIN July 15th, 1998.

a/ Whiting landings in 1991 and later do not include catches by the U.S. at-sea whiting fleet.
b/ Remaining rockfish are all species of rockfish not specifically listed on this page.

TABLE 14. Estimated commercial groundfish landings (in thousands of dollars) for Washington, 1982-1997. (Excludes joint venture, foreign, and domestic at-sea catches).

Species		1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
Roundfish																	
	Lingcod	$555	$821	$1,047	$1,176	$466	$819	$555	$787	$709	$666	$457	$518	$397	$264	$346	$267
	Pacific Cod	$381	$262	$253	$198	$182	$1,124	$1,321	$801	$503	$847	$968	$619	$508	$363	$314	$465
	Pacific Whiting[a/]	$0	$0	$6	$2	$8	$18	$19	$5	$46	$80	$209	$210	$253	$364	$721	$713
	Sablefish	$2,283	$1,936	$2,428	$4,229	$2,703	$4,532	$4,616	$3,327	$2,622	$5,551	$3,815	$3,053	$3,043	$7,037	$7,090	$8,458
Total Roundfish		$3,223	$3,021	$3,738	$5,606	$3,365	$6,504	$6,519	$4,928	$3,881	$7,147	$5,453	$4,400	$4,200	$8,029	$8,471	$9,903
Rockfish																	
	Pacific Ocean Perch	$142	$230	$411	$346	$422	$322	$365	$288	$258	$357	$288	$298	$257	$227	$172	$136
	Shortbelly	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Widow	$2,232	$1,404	$670	$835	$1,550	$2,629	$1,978	$1,930	$1,325	$745	$646	$1,033	$718	$782	$631	$693
	Thornyheads	$45	$57	$116	$31	$16	$44	$50	$96	$114	$126	$189	$558	$988	$1,208	$776	$584
Other Rockfish																	
	Bocaccio	$18	$60	$70	$68	$50	$80	$63	$148	$157	$238	$140	$87	$37	$36	$29	$42
	Canary	$167	$293	$286	$564	$548	$727	$610	$712	$648	$626	$559	$193	$110	$128	$122	$141
	Chilipepper	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Yellowtail	$2,264	$2,367	$1,085	$738	$1,232	$1,347	$1,840	$997	$972	$748	$908	$1,348	$1,392	$1,190	$1,070	$360
	Remaining Rockfish	$198	$393	$406	$391	$448	$490	$415	$403	$416	$572	$492	$351	$277	$230	$182	$167
	Unspecified Rockfish	$291	$499	$398	$610	$788	$877	$553	$481	$337	$255	$308	$417	$364	$598	$475	$359
Total Rockfish		$5,357	$5,303	$3,442	$3,582	$5,054	$6,517	$5,873	$5,055	$4,227	$3,667	$3,531	$4,287	$4,144	$4,398	$3,458	$2,482
Flatfish																	
	Arrowtooth Flounder	$391	$329	$404	$414	$383	$658	$310	$524	$918	$681	$331	$214	$310	$190	$461	$478
	Dover Sole	$1,342	$0	$1,613	$1,488	$834	$1,088	$1,483	$1,310	$1,079	$1,058	$808	$818	$642	$695	$775	$551
	English Sole	$211	$170	$211	$265	$295	$459	$368	$494	$349	$371	$289	$280	$215	$252	$141	$207
	Petrale Sole	$426	$773	$726	$650	$521	$959	$846	$825	$631	$488	$461	$459	$387	$586	$539	$584
	Other Flatfish	$430	$1,668	$194	$356	$252	$394	$238	$376	$271	$395	$219	$107	$73	$72	$49	$52
Total Flatfish		$2,799	$2,940	$3,147	$3,173	$2,283	$3,559	$3,244	$3,529	$3,248	$2,994	$2,108	$1,879	$1,627	$1,795	$1,965	$1,872
Other Fish																	
	Jack Mackerel	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Other	$22	$6	$53	$59	$25	$39	$57	$88	$144	$263	$329	$356	$415	$98	$133	$281
Total Other Fish		$22	$6	$53	$59	$25	$39	$57	$88	$144	$263	$329	$356	$415	$98	$133	$281
Grand Total		$11,401	$11,271	$10,380	$12,420	$10,727	$16,618	$15,693	$13,601	$11,499	$14,070	$11,421	$10,921	$10,386	$14,320	$14,027	$14,538

Data Source: Data for 1982-1997 were extracted from PacFIN July 15th, 1998.

a/ Whiting landings in 1991 and later do not include catches by the U.S. at-sea whiting fleet.

TABLE 15. Estimated commercial groundfish landings (mt) for Oregon, 1982-1997. (Excludes joint venture, foreign, and domestic at-sea catches).

Species		1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
Roundfish																	
	Lingcod	1,458	1,734	1,057	1,052	656	717	1,004	1,174	874	1,486	708	833	859	649	717	769
	Pacific Cod	118	89	80	39	31	666	1,034	780	231	514	416	491	171	80	84	52
	Pacific Whiting[a/]	2	65	338	885	420	183	246	89	2,294	13,643	48,961	35,820	65,110	66,840	62,991	77,297
	Sablefish	5,090	4,641	4,835	5,275	4,653	5,238	4,082	3,948	3,705	3,906	3,856	3,835	4,005	3,133	3,175	2,925
Total Roundfish		6,669	6,530	6,323	7,283	5,774	6,811	6,378	5,999	7,110	19,558	53,949	40,982	70,152	70,708	73,941	75,380
Rockfish																	
	Pacific Ocean Perch	549	1,278	752	797	669	549	743	925	566	838	616	788	614	517	487	448
	Shortbelly	3	1	1	11	3	0	0	2	0	2	3	6	49	24	4	17
	Widow	9,059	3,119	5,368	4,353	4,329	6,314	5,461	6,937	5,653	3,871	3,955	5,306	4,365	3,864	3,753	4,115
	Thornyheads	166	835	795	1,117	673	727	1,043	2,553	4,529	3,506	4,281	4,460	4,043	3,336	2,786	2,328
Other Rockfish																	
	Bocaccio	740	855	325	495	282	260	207	278	194	224	167	165	141	125	82	117
	Canary	3,893	3,537	1,174	1,017	906	1,634	1,556	1,553	1,035	1,783	1,535	1,611	923	546	780	705
	Chilipepper	22	17	3	3	2	0	8	4	2	5	13	9	22	11	9	10
	Yellowtail	2,801	2,713	2,197	1,570	1,918	1,935	2,606	2,574	2,108	2,051	3,942	2,894	3,193	3,087	3,495	1,256
	Remaining Rockfish[b/]	3,542	2,959	1,968	3,114	2,340	2,362	2,991	3,144	2,289	2,644	2,228	3,141	2,474	1,666	1,730	1,618
	Unspecified Rockfish	426	774	438	620	648	855	535	428	597	1,044	611	937	82	161	261	159
Total Rockfish		21,201	16,089	13,022	13,097	11,768	14,637	15,148	18,400	16,974	15,968	17,350	19,318	15,905	13,338	13,388	10,774
Flatfish																	
	Arrowtooth Flounder	734	541	417	698	503	740	641	1,137	1,815	2,089	2,063	1,659	1,721	1,413	2,237	2,324
	Dover Sole	8,143	8,478	6,108	5,713	4,822	6,057	7,676	8,908	7,508	8,813	6,075	6,483	3,871	3,535	4,688	3,966
	English Sole	992	913	451	468	552	594	581	693	509	846	628	718	358	313	390	550
	Petrale Sole	1,508	1,105	689	577	709	855	902	862	744	932	771	775	616	797	720	806
	Other Flatfish	1,738	1,420	1,166	1,171	782	828	763	782	750	1,363	881	850	997	1,017	517	713
Total Flatfish		13,114	12,456	8,830	8,628	7,368	9,074	10,564	12,381	11,326	14,042	10,418	10,485	7,562	7,074	8,553	8,358
Other Fish																	
	Jack Mackerel	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	105
	Other	39	84	34	15	21	8	23	53	96	183	198	407	470	528	884	637
Total Other Fish		39	84	34	15	21	8	23	53	96	183	198	407	470	530	885	742
Grand Total		41,023	35,158	28,209	29,023	24,931	30,530	32,114	36,833	35,506	49,751	81,915	71,192	94,088	91,650	96,766	95,255

Data Source: Data for 1982-1997 were extracted from PacFIN July 15th, 1998.

a/ Whiting landings in 1991 and later do not include catches by the U.S. at-sea whiting fleet.
b/ Remaining rockfish are all species of rockfish not specifically listed on this page.

TABLE 16. Estimated commercial groundfish landings (in thousands of dollars) for Oregon, 1982-1997. (Excludes joint venture, foreign, and domestic at-sea catches).

Species		1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
Roundfish																	
	Lingcod	$768	$950	$584	$604	$443	$599	$798	$871	$653	$1,083	$575	$669	$755	$611	$689	$788
	Pacific Cod	$62	$49	$45	$22	$18	$482	$625	$448	$131	$342	$306	$354	$129	$69	$74	$45
	Pacific Whiting[a/]	$0	$32	$59	$185	$56	$34	$41	$15	$219	$1,433	$5,078	$2,289	$4,300	$7,000	$4,147	$6,823
	Sablefish	$2,828	$2,249	$2,170	$3,408	$3,611	$5,080	$4,459	$3,847	$3,493	$5,081	$5,405	$4,479	$7,369	$9,130	$10,098	$10,208
Total Roundfish		$3,659	$3,280	$2,865	$4,239	$4,136	$6,197	$5,931	$5,186	$4,501	$7,948	$11,373	$7,793	$12,558	$16,816	$15,012	$17,901
Rockfish																	
	Pacific Ocean Perch	$236	$613	$381	$443	$410	$400	$474	$555	$335	$555	$410	$528	$451	$403	$338	$310
	Shortbelly	$1	$0	$0	$5	$2	$0	$0	$1	$0	$1	$1	$3	$24	$11	$2	$9
	Widow	$3,250	$1,291	$2,740	$2,394	$2,628	$4,465	$3,397	$3,942	$3,224	$2,333	$2,432	$3,330	$3,004	$2,781	$2,519	$2,850
	Thornyheads	$70	$393	$415	$615	$419	$524	$806	$2,068	$3,856	$3,484	$4,092	$4,379	$6,322	$7,275	$5,264	$3,832
Other Rockfish																	
	Bocaccio	$309	$374	$167	$277	$174	$191	$129	$165	$118	$148	$112	$114	$114	$103	$67	$95
	Canary	$1,617	$1,535	$605	$568	$566	$1,229	$940	$923	$637	$1,202	$1,096	$1,167	$737	$544	$748	$772
	Chilipepper	$10	$7	$2	$2	$1	$0	$4	$2	$1	$3	$8	$6	$15	$7	$6	$7
	Yellowtail	$1,127	$1,196	$1,139	$878	$1,190	$1,375	$1,598	$1,510	$1,268	$1,372	$2,704	$1,992	$2,387	$2,491	$2,644	$1,005
	Remaining Rockfish	$1,454	$1,350	$988	$1,704	$1,464	$1,739	$1,893	$1,817	$1,328	$1,798	$1,602	$2,051	$1,709	$1,362	$1,352	$1,268
	Unspecified Rockfish	$198	$392	$239	$397	$472	$678	$433	$395	$583	$855	$442	$767	$86	$171	$270	$209
Total Rockfish		$8,272	$7,152	$6,677	$7,283	$7,326	$10,601	$9,674	$11,378	$11,350	$11,752	$12,898	$14,336	$14,849	$15,146	$13,209	$10,355
	Flatfish																
	Arrowtooth Flounder	$165	$121	$92	$154	$113	$240	$185	$242	$412	$528	$481	$357	$368	$347	$499	$503
	Dover Sole	$4,192	$0	$3,196	$3,161	$2,829	$4,184	$5,216	$5,472	$4,534	$5,975	$3,738	$3,879	$2,532	$2,599	$3,273	$2,643
	English Sole	$701	$650	$320	$343	$438	$533	$501	$563	$350	$621	$429	$473	$250	$244	$292	$379
	Petrale Sole	$2,062	$1,698	$1,093	$936	$1,194	$1,552	$1,662	$1,590	$1,357	$1,689	$1,358	$1,307	$1,108	$1,701	$1,539	$1,646
	Other Flatfish	$1,370	$5,413	$976	$949	$760	$863	$737	$769	$702	$1,210	$736	$743	$831	$734	$427	$540
Total Flatfish		$8,491	$7,882	$5,676	$5,544	$5,334	$7,373	$8,300	$8,636	$7,354	$10,022	$6,742	$6,760	$5,089	$5,625	$6,031	$5,710
Other Fish																	
	Jack Mackerel	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$74	$3	$4	$1	$0	$0
	Other	$27	$45	$19	$13	$19	$12	$10	$21	$29	$43	$32	$101	$126	$163	$221	$171
Total Other Fish		$27	$45	$19	$13	$19	$12	$10	$21	$29	$44	$105	$104	$130	$164	$221	$171
Grand Total		$20,449	$18,359	$15,237	$17,079	$16,814	$24,183	$23,916	$25,221	$23,234	$29,766	$31,119	$28,992	$32,625	$37,751	$34,473	$34,138

Data Source: Data for 1982-1997 were extracted from PacFIN July 15th, 1998.

a/ Whiting landings in 1991 and later do not include catches by the U.S. at-sea whiting fleet.

TABLE 17. Estimated commercial groundfish landings (mt) for California, 1982-1997. (Excludes joint venture, foreign, and domestic at-sea catches).

Species		1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
Roundfish																	
	Lingcod	1,381	898	951	695	524	812	867	1,257	1,064	788	613	685	568	539	479	503
	Pacific Cod	0	0	2	1	0	66	5	0	0	0	1	0	0	0	0	0
	Pacific Whiting[a/]	1,024	980	2,335	2,996	2,982	4,518	6,533	7,298	5,519	6,893	4,930	3,100	3,613	4,091	2,901	6,594
	Sablefish	9,654	6,694	4,826	5,171	6,220	4,404	3,856	4,075	3,750	3,353	3,714	2,597	2,186	2,818	3,195	2,897
Total Roundfish		12,089	8,583	8,123	8,875	9,734	9,805	11,268	12,644	10,347	11,048	9,278	6,406	6,406	7,522	6,691	9,840
Rockfish																	
	Pacific Ocean Perch	164	100	52	74	29	157	72	35	16	13	24	17	7	10	14	14
	Shortbelly	5	3	2	28	19	0	0	1	9	2	0	3	4	10	30	33
	Widow	10,680	4,024	2,842	3,200	2,515	3,831	2,530	3,021	2,680	1,905	1,798	1,820	938	1,755	1,371	1,338
	Thornyheads	2,042	1,711	2,126	2,940	2,950	3,697	4,939	6,549	7,044	4,398	7,092	6,119	3,316	3,634	3,313	2,769
Other Rockfish																	
	Bocaccio	4,601	4,801	3,827	1,866	1,751	3,535	2,844	3,141	2,528	2,013	2,130	1,890	988	777	482	286
	Canary	815	488	412	428	158	466	340	269	476	432	551	219	216	213	204	223
	Chilipepper	2,079	2,144	2,175	2,283	1,753	3,075	3,276	3,413	3,407	4,476	3,433	3,406	1,841	1,969	1,701	1,840
	Yellowtail	759	862	638	527	497	599	336	914	716	765	939	315	321	288	250	350
	Remaining Rockfish[b/]	3,401	3,766	4,899	5,138	5,052	7,943	6,751	4,788	4,828	4,354	4,458	3,532	2,944	2,849	2,882	2,732
	Unspecified Rockfish	1,920	2,211	2,703	1,367	2,390	2,032	1,424	1,480	1,877	1,651	1,511	1,207	235	177	518	479
Total Rockfish		26,467	20,110	19,677	17,851	17,114	25,335	22,512	23,611	23,580	20,010	21,937	18,526	10,810	11,682	10,766	10,065
Flatfish																	
	Arrowtooth Flounder	48	25	32	38	19	45	36	28	54	157	99	57	73	118	108	104
	Dover Sole	10,054	8,579	9,781	12,020	11,052	10,761	8,197	7,724	6,320	7,721	8,643	6,554	4,488	6,075	6,401	5,301
	English Sole	1,462	1,183	952	1,062	1,082	1,322	1,067	1,053	892	812	575	474	463	499	581	649
	Petrale Sole	792	584	591	857	726	824	795	841	678	734	532	464	550	592	818	828
	Other Flatfish	1,554	1,277	1,230	1,810	1,704	1,727	1,679	1,681	1,384	1,343	870	942	1,350	1,470	1,420	1,520
Total Flatfish		13,910	11,648	12,586	15,786	14,583	14,679	11,774	11,326	9,328	10,767	10,719	8,490	6,923	8,755	9,328	8,402
Other Fish																	
	Jack Mackerel	282	1,302	3,234	136	55	142	1	0	109	45	408	491	359	246	344	329
	Other	206	242	208	221	199	200	204	147	160	141	207	447	598	531	2,470	1,472
Total Other Fish		19,824	10,072	9,356	7,097	4,976	8,220	5,271	10,892	3,382	1,853	1,540	2,192	3,384	2,272	2,814	1,802
Grand Total		72,289	50,412	49,742	49,610	46,407	58,038	50,825	58,473	46,638	43,678	43,474	35,614	27,523	30,230	29,599	30,108

Data Source: Data for 1982-1997 were extracted from PacFIN July 15th, 1998.

a/ Whiting landings in 1991 and later do not include catches by the U.S. at-sea whiting fleet.

b/ Remaining rockfish are all species of rockfish not specifically listed on this page.

TABLE 18. Estimated commercial groundfish landings (in thousands of dollars) for California, 1982-1997. (Excludes joint venture, foreign, and domestic at-sea catches).

Species		1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
Roundfish																	
	Lingcod	$766	$509	$552	$458	$413	$708	$763	$1,101	$929	$707	$585	$653	$586	$611	$570	$600
	Pacific Cod	$0	$0	$1	$1	$0	$48	$3	$0	$0	$0	$2	$1	$0	$0	$0	$0
	Pacific Whiting[a/]	$181	$162	$341	$396	$384	$611	$1,076	$1,052	$784	$882	$597	$343	$354	$456	$239	$583
	Sablefish	$5,461	$3,503	$2,208	$2,885	$4,651	$3,813	$3,423	$3,622	$3,546	$3,698	$4,414	$2,477	$3,354	$7,273	$8,687	$8,852
Total Roundfish		$6,421	$4,188	$3,107	$3,746	$5,452	$5,183	$5,272	$5,788	$5,271	$5,317	$5,656	$3,616	$4,577	$8,898	$10,359	$10,992
Rockfish																	
	Pacific Ocean Perch	$68	$46	$26	$41	$17	$110	$46	$21	$10	$8	$18	$12	$5	$8	$11	$10
	Shortbelly	$2	$1	$1	$3	$13	$0	$0	$0	$5	$1	$0	$1	$2	$4	$8	$14
	Widow	$3,528	$1,764	$1,402	$1,797	$1,583	$2,789	$1,708	$1,886	$1,763	$1,249	$1,192	$1,226	$709	$1,399	$1,021	$984
	Thornyheads	$1,025	$875	$1,151	$1,626	$1,810	$2,643	$3,842	$5,360	$5,971	$4,440	$7,614	$6,833	$5,554	$8,292	$6,522	$5,010
Other Rockfish																	
	Bocaccio	$2,291	$2,495	$2,162	$1,216	$1,284	$2,866	$2,119	$2,400	$1,965	$1,530	$1,710	$1,562	$916	$750	$457	$276
	Canary	$355	$218	$224	$279	$102	$346	$235	$199	$376	$372	$483	$224	$286	$327	$296	$332
	Chilipepper	$985	$1,054	$1,192	$1,440	$1,199	$2,368	$2,335	$2,337	$2,479	$3,224	$2,656	$2,875	$1,678	$1,847	$1,538	$1,619
	Yellowtail	$337	$452	$348	$325	$363	$463	$261	$635	$538	$657	$867	$284	$315	$295	$239	$370
	Remaining Rockfish	$2,257	$2,560	$3,590	$4,251	$4,669	$7,167	$6,186	$5,107	$5,082	$4,921	$5,221	$4,254	$4,402	$4,642	$4,454	$3,974
	Unspecified Rockfish	$2,020	$1,849	$1,922	$1,369	$2,281	$2,015	$1,480	$1,663	$2,018	$2,070	$2,041	$1,895	$379	$317	$718	$704
Total Rockfish		$12,867	$11,313	$12,019	$12,346	$13,320	$20,768	$18,211	$19,609	$20,207	$18,472	$21,802	$19,166	$14,246	$17,882	$15,264	$13,294
	Flatfish																
	Arrowtooth Flounder	$11	$6	$8	$10	$4	$15	$12	$9	$13	$41	$24	$13	$21	$32	$28	$29
	Dover Sole	$5,131	$0	$4,963	$6,212	$6,166	$7,111	$5,439	$4,612	$3,630	$5,052	$5,411	$3,917	$2,904	$4,284	$4,238	$3,343
	English Sole	$1,040	$850	$686	$799	$871	$1,201	$949	$884	$681	$664	$463	$369	$379	$426	$478	$490
	Petrale Sole	$1,028	$863	$896	$1,391	$1,271	$1,449	$1,355	$1,459	$1,221	$1,331	$941	$834	$1,041	$1,192	$1,614	$1,622
	Other Flatfish	$1,233	$5,190	$989	$1,524	$1,499	$1,571	$1,495	$1,405	$1,104	$1,143	$768	$895	$1,159	$1,282	$1,209	$1,208
Total Flatfish		$8,444	$6,909	$7,542	$9,936	$9,811	$11,347	$9,250	$8,369	$6,649	$8,231	$7,608	$6,028	$5,504	$7,216	$7,567	$6,692
Other Fish																	
	Jack Mackerel	$3,984	$1,795	$1,366	$1,290	$846	$1,184	$796	$1,567	$435	$249	$237	$284	$381	$272	$0	$0
	Other	$211	$191	$274	$274	$240	$237	$208	$198	$160	$135	$134	$199	$243	$238	$1,688	$1,369
Total Other Fish		$4,195	$1,986	$1,640	$1,564	$1,086	$1,421	$1,004	$1,765	$595	$384	$371	$483	$624	$510	$1,688	$1,369
Grand Total		$31,927	$24,395	$24,307	$27,592	$29,670	$38,719	$33,737	$35,531	$32,722	$32,404	$35,437	$29,293	$24,947	$34,509	$34,879	$32,347

Data Source: Data for 1982-1997 were extracted from PacFIN July 15th, 1998.

a/ Whiting landings in 1991 and later do not include catches by the U.S. at-sea whiting fleet.

TABLE 19. Total ocean recreational harvest in metric tons, 1981-1997 (all fishing modes). No data for 1990-1992, January-February 1995, for Oregon in July-August after 1992, for Oregon January-February and November-December in 1994.

	ALL AREAS (Shaded Columns Indicate Incomplete Data)													
Species	1981	1982	1983	1984	1985	1986	1987	1988	1989	1993	1994	1995	1996	1997
Roundfish														
Lingcod	1,479	1,508	658	615	1,211	1,125	1,256	1,299	1,172	765	515	448	536	494
Pacific Cod	0	-	0	0	2	0	13	1	-	-	0	-	-	-
Pacific Whiting	10	9	1	42	71	59	8	43	32	0	1	0	1	0
Sablefish	4	2	-	9	19	24	4	71	1	2	1	-	1	7
Total Roundfish	1,493	1,519	659	666	1,303	1,209	1,281	1,414	1,205	767	517	449	538	502
Rockfish														
Pacific Ocean Perch	0	-	0	-	0	-	0	0	-	-	1	-	-	1
Shortbelly	-	-	-	-	-	2	-	0	-	-	-	-	0	-
Shortspine Thornyheads	-	1	0	23	19	2	0	3	1	-	0	-	-	-
Widow Rockfish	22	168	55	71	49	54	22	35	42	37	4	4	27	43
Total Rockfish	22	168	56	94	68	57	23	39	44	37	5	4	27	43
Other Rockfish														
Black	2,741	1,847	601	1,019	1,297	689	802	797	634	939	827	717	720	707
Blue	1,435	1,134	801	600	468	305	460	449	413	581	229	176	310	462
Bocaccio	1,075	1,320	505	211	374	566	191	151	247	122	192	33	103	112
Canary	219	300	99	128	228	245	264	252	149	120	88	125	93	141
Chilipepper	272	316	154	140	350	385	203	413	308	17	23	11	37	74
Other	1,647	2,021	1,523	1,848	1,979	1,885	1,295	1,302	1,102	916	842	666	765	528
Rockfish Genus	214	314	57	54	92	77	77	0	20	114	207	263	278	42
Yellowtail	475	1,112	557	391	426	294	268	239	350	135	88	94	143	392
Total Other Rockfish	8,079	8,366	4,296	4,390	5,214	4,447	3,560	3,604	3,222	2,942	2,495	2,085	2,450	2,459
Flatfish														
Arrowtooth Flounder	-	-	0	-	-	-	-	-	-	-	-	-	-	-
Dover Sole	0	-	0	-	-	0	-	0	-	0	-	-	-	-
English Sole	0	0	-	-	0	0	2	-	-	0	0	-	-	-
Other Flatfish	437	251	126	138	333	351	573	472	456	261	410	553	455	508
Petrale Sole	7	9	1	4	11	3	0	3	4	2	-	-	1	-
Total Flatfish	444	261	127	142	344	354	575	476	461	263	410	553	456	508
Other Fish														
Cabezon	217	174	100	116	97	160	169	116	116	111	77	85	95	91
Greenling Genus	1	1	3	-	0	1	0	-	-	0	0	-	1	-
Jack Mackerel	1	2	4	14	20	7	8	353	3	17	1	6	1	7
Kelp Greenling	62	59	42	41	34	53	71	45	42	65	35	31	35	28
Leopard Shark	9	1	6	11	32	12	52	36	2	8	20	-	3	3
Rock Greenling	10	6	7	3	7	7	7	7	5	5	5	7	9	4
Soupfin Shark	-	-	0	-	13	1	-	-	-	-	-	3	2	-
Spiny Dogfish Shark	34	44	17	17	52	63	6	49	23	10	10	20	19	4
Total Other Fish	333	288	179	202	255	305	313	606	191	216	149	152	164	137
Grand Total	10,371	10,601	5,317	5,493	7,184	6,372	5,751	6,138	5,122	4,226	3,576	3,243	3,634	3,648

Data Source: Data was extracted from RecFIN October 1, 1998.

TABLE 20. Washington ocean recreational harvest in metric tons, 1981-1997 (all fishing modes). Data not available for 1990-1992.

Species		WASHINGTON													
		1981	1982	1983	1984	1985	1986	1987	1988	1989	1993	1994	1995	1996	1997
Roundfish															
	Lingcod	137	199	43	30	66	33	142	114	38	77	110	61	54	48
	Pacific Cod	0	-	0	0	2	0	13	1	-	-	-	-	-	-
	Pacific Whiting	-	-	0	-	-	-	0	-	-	-	-	-	-	-
Total Roundfish		137	199	43	30	68	33	155	115	38	77	110	61	54	48
Rockfish		-	0	0	-	-	-	-	-	-	-	-	-	-	-
	Widow Rockfish	-	0	0	-	-	-	-	-	-	-	-	-	-	-
Total Rockfish		-	0	0	-	-	-	-	-	-	-	-	-	-	-
Other Rockfish															
	Black	1,454	1,044	282	276	428	27	238	172	-	237	319	213	231	180
	Blue	5	-	0	1	12	1	-	1	-	3	1	1	1	1
	Canary Rockfish	14	1	-	5	1	0	3	-	-	10	4	4	3	4
	Other Rockfish	15	22	9	14	14	2	81	6	-	13	5	5	5	7
	Rockfish Genus	-	-	-	-	-	5	-	-	-	-	-	-	1	0
	Yellowtail	10	2	0	12	2	-	1	-	-	22	7	5	4	6
Total Other Rockfish		1,497	1,070	292	308	456	34	323	178	-	285	336	227	245	199
Flatfish															
	Dover Sole	0	-	-	-	-	-	-	-	-	-	-	-	-	-
	English Sole	0	-	-	-	-	-	2	-	-	-	-	-	-	-
	Other Flatfish	1	0	0	4	17	1	55	2	-	-	83	54	141	147
	Petrale Sole	0	-	-	-	1	-	-	0	-	-	-	-	-	-
Total Flatfish		2	0	0	4	17	1	56	2	-	-	83	54	141	147
Other Fish															
	Cabezon	18	0	0	1	1	1	9	2	-	4	1	1	2	2
	Greenling Genus	-	-	-	-	-	1	-	-	-	-	-	-	-	-
	Kelp Greenling	4	1	3	2	0	6	12	2	-	2	1	0	1	1
	Rock Greenling	-	-	-	-	0	0	0	1	-	-	-	-	0	-
	Spiny Dogfish Shark	-	-	0	-	-	2	2	-	-	-	-	-	2	-
Total Other Fish		22	1	4	3	1	10	24	5	-	5	2	2	5	2
Grand Total		1,658	1,270	338	345	543	79	558	300	38	367	531	344	445	397

Data Source: Data was extracted from RecFIN October 1, 1998.

TABLE 21. Oregon ocean recreational harvest in metric tons, 1981-1997 (all fishing modes). Data not available for 1990-1992, January-February 1995, July-August after 1992, and for January-February and November-December 19

		OREGON (Shaded Columns Indicate Incomplete Data)													
Species		1981	1982	1983	1984	1985	1986	1987	1988	1989	1993	1994	1995	1996	1997
Roundfish															
	Lingcod	210	483	133	110	183	194	182	162	195	250	158	107	124	192
	Pacific Whiting	-	-	0	-	-	-	0	-	-	-	0	-	-	-
	Sablefish	-	-	-	-	-	0	-	-	-	2	1	-	0	7
Total Roundfish		210	483	133	110	183	194	182	162	195	252	159	107	124	199
Rockfish															
	Pacific Ocean Perch	-	-	-	-	-	-	-	0	-	-	0	-	-	-
	Shortspine Thornyheads	-	0	-	-	7	-	-	-	-	-	-	-	-	-
	Widow Rockfish	-	4	0	3	1	1	0	1	1	34	2	1	4	4
Total Rockfish		-	4	0	3	8	1	0	1	1	34	2	1	4	4
Other Rockfish															
	Black	814	337	105	331	379	253	338	336	421	422	294	338	337	438
	Blue	253	48	40	38	44	30	40	30	97	121	50	48	108	164
	Bocaccio	3	1	0	0	2	0	1	0	0	2	0	1	0	1
	Canary	47	41	4	20	60	21	30	56	25	46	33	50	26	43
	Other	145	76	4	38	48	16	32	26	52	62	33	35	19	44
	Rockfish Genus	-	-	0	-	-	-	-	-	-	-	-	-	1	-
	Yellowtail	35	14	21	32	45	12	13	8	31	42	41	63	41	26
Total Other Rockfish		1,297	518	174	459	577	333	455	457	626	694	451	535	531	716
Flatfish															
	English Sole	-	0	-	-	-	-	-	-	-	0	-	-	-	-
	Other Flatfish	1	12	0	0	3	0	14	23	58	2	52	40	25	126
	Petrale Sole	-	0	0	-	-	0	-	-	-	-	0	-	-	-
Total Flatfish		1	12	1	0	3	0	14	23	58	2	52	40	25	126
Other Fish															
	Cabezon	89	65	10	12	24	19	49	28	26	30	22	13	12	29
	Jack Mackerel	-	0	-	0	-	-	-	-	-	1	-	-	-	-
	Kelp Greenling	36	11	11	9	10	13	12	11	5	35	11	8	6	12
	Leopard Shark	-	-	-	0	-	-	-	-	-	-	-	-	-	-
	Rock Greenling	5	1	0	0	1	1	1	2	1	2	0	1	0	1
	Spiny Dogfish Shark	1	-	-	1	-	-	-	-	-	0	-	-	-	-
Total Other Fish		131	78	22	21	35	33	63	41	32	69	33	21	18	42
Grand Total		1,639	1,094	329	593	808	561	714	683	912	1,051	698	704	703	1,086

Data Source: Data was extracted from RecFIN October 1, 1998.

TABLE 22. California ocean recreational harvests in metric tons, 1981-1997 (all fishing modes). Data not available for 1990-1992 and January-February 1995.

		CALIFORNIA (Shaded Column Indicates Incomplete Data)													
Species		1981	1982	1983	1984	1985	1986	1987	1988	1989	1993	1994	1995	1996	1997
Roundfish															
	Lingcod	1,132	827	483	475	961	899	932	1,023	939	439	246	280	359	254
	Pacific Cod	-	-	-	-	-	-	-	-	-	-	0	-	-	-
	Pacific Whiting	10	9	1	42	71	59	7	43	32	0	1	0	-	0
	Sablefish	4	2	-	9	19	24	4	71	1	-	-	-	0	-
Total Roundfish		1,145	837	484	526	1,051	982	943	1,137	972	439	247	281	360	255
Rockfish															
	Pacific Ocean Perch	0	-	0	-	0	-	0	-	-	-	0	-	-	1
	Shortbelly Rockfish	-	-	-	-	-	2	-	0	-	-	-	-	-	-
	Shortspine Thornyheads	-	1	0	23	12	2	0	3	1	-	0	-	-	-
	Widow Rockfish	22	164	55	67	48	53	22	34	42	3	2	3	22	39
Total Rockfish		22	164	56	91	60	57	22	38	43	3	3	3	22	39
Other Rockfish															
	Black	473	465	214	412	491	409	226	289	213	280	214	166	152	89
	Blue	1,177	1,086	761	562	412	274	419	418	316	457	178	127	200	297
	Bocaccio	1,072	1,319	505	211	372	566	190	151	247	119	192	32	103	112
	Canary	158	258	95	103	167	224	231	196	124	65	50	72	64	95
	Chilipepper	272	316	154	140	350	385	203	413	308	17	23	11	37	74
	Other Rockfish	1,488	1,923	1,509	1,795	1,917	1,866	1,182	1,270	1,049	842	804	626	742	476
	Rockfish Genus	214	314	57	54	92	73	77	0	20	114	207	263	276	42
	Yellowtail	430	1,096	536	347	379	282	254	231	319	71	40	27	99	360
Total Other Rockfish		5,284	6,778	3,830	3,624	4,181	4,079	2,782	2,969	2,596	1,963	1,708	1,323	1,673	1,545
Flatfish															
	Arrowtooth Flounder	-	-	0	-	-	-	-	-	-	-	-	-	-	-
	Dover Sole	-	-	0	-	-	0	-	0	-	0	-	-	-	-
	English Sole	-	0	-	-	0	0	0	-	-	0	0	-	-	-
	Other Flatfish	435	239	125	134	313	349	504	447	399	259	275	459	289	234
	Petrale Sole	7	9	1	4	10	3	0	3	4	2	0	0	1	-
Total Flatfish		442	248	126	138	323	352	504	451	403	261	275	459	289	234
Other Fish															
	Cabezon	110	109	89	103	72	140	111	86	91	77	54	71	80	60
	Greenling Genus	1	1	3	-	0	-	0	-	-	0	0	-	1	-
	Jack Mackerel	1	2	4	14	20	7	8	353	3	17	1	6	1	7
	Kelp Greenling	22	46	27	31	24	34	46	31	37	28	24	23	28	15
	Leopard Shark	9	1	6	11	32	12	52	36	2	8	20	-	3	3
	Rock Greenling	5	5	7	3	6	6	5	4	4	3	5	7	8	3
	Soupfin Shark	-	-	0	-	13	1	-	-	-	-	-	3	2	-
	Spiny Dogfish Shark	33	44	17	16	52	61	4	49	23	9	10	20	18	4
Total Other Fish		181	209	153	178	218	262	227	560	159	142	114	129	140	92
Grand Total		7,075	8,237	4,650	4,555	5,834	5,732	4,479	5,155	4,172	2,808	2,348	2,195	2,486	2,165

Data Source: Data was extracted from RecFIN October 1, 1998.

TABLE 23. Washington ocean recreational harvest from private vessels in metric tons, 1981-1997. Data not available for 1989-1992.

Species		WASHINGTON - PRIVATE VESSELS												
		1981	1982	1983	1984	1985	1986	1987	1988	1993	1994	1995	1996	1997
Roundfish														
	Lingcod	8	54	32	17	31	20	94	1	18	23	19	21	22
	Pacific Cod	0	0	0	0	2	0	11	0	-	-	-	-	-
	Pacific Whiting	0	0	0	0	0	0	0	0	-	-	-	-	-
Total Roundfish		8	54	32	17	33	21	106	1	18	23	19	21	22
Rockfish														
	Widow Rockfish	0	0	0	0	0	0	0	0	-	-	-	-	-
Total Rockfish		0	0	0	0	0	0	0	0	-	-	-	-	-
Other Rockfish														
	Black	7	4	21	28	42	17	15	2	22	24	26	31	26
	Blue	0	0	0	0	12	1	0	0	1	0	0	0	0
	Canary	0	0	0	1	1	0	2	0	1	1	1	1	1
	Other Rockfish	0	12	9	8	14	2	80	1	3	2	2	2	3
	Yellowtail	0	2	0	0	2	0	0	0	1	0	0	0	0
Total Other Rockfish		8	18	31	37	70	20	96	3	29	28	29	34	30
Flatfish														
	English Sole	0	0	0	0	0	0	2	0	-	-	-	-	-
	Other Flatfish	0	0	0	4	17	1	52	0	-	22	23	70	80
	Petrale Sole	0	0	0	0	1	0	0	0	-	-	-	-	-
Total Flatfish		0	0	0	4	17	1	54	0	-	22	23	70	80
Other Fish														
	Cabezon	4	0	0	1	0	0	9	0	3	1	1	2	1
	Kelp Greenling	0	0	3	2	0	3	10	0	1	0	0	1	0
	Rock Greenling	0	0	0	0	0	0	0	0	-	-	-	-	-
	Spiny Dogfish Shark	0	0	0	0	0	0	2	0	-	-	-	-	-
Total Other Fish		4	0	3	3	1	3	21	0	4	1	1	2	2
Grand Total		20	73	66	61	120	44	277	4	51	75	72	128	134

Data Source: Data was extracted from RecFIN October 1, 1998.

TABLE 24. Washington ocean recreational harvest from charter vessels in metric tons, 1981-1997. Data not available 1990-1992.

		WASHINGTON - CHARTER VESSELS												
Species		1981	1982	1983	1984	1985	1986	1987	1988	1993	1994	1995	1996	1997
Roundfish														
	Lingcod	129	142	11	13	35	7	46	87	59	87	43	31	27
	Pacific Cod	-	-	-	-	-	-	2	-	-	-	-	-	-
Total Roundfish		129	142	11	13	35	7	48	87	59	87	43	31	27
Other Rockfish														
	Black	1,446	1,032	260	248	386	-	221	164	215	295	187	194	154
	Blue	5	-	-	1	-	-	-	-	2	1	-	1	1
	Canary	14	1	-	3	0	-	1	-	8	3	3	2	3
	Other Rockfish	14	9	0	6	0	-	1	4	9	3	3	3	4
	Yellowtail	10	-	-	12	-	-	1	-	21	7	4	4	6
Total Other Rockfish		1,489	1,042	260	270	386	-	225	168	256	308	198	204	168
Flatfish														
	Dover Sole	0	-	-	-	-	-	-	-	-	-	-	-	-
	Other Flatfish	0	-	-	-	-	-	2	2	-	60	31	71	68
	Petrale Sole	0	-	-	-	-	-	-	-	-	-	-	-	-
Total Flatfish		1	-	-	-	-	-	2	2	-	60	31	71	68
Other Fish														
	Cabezon	13	-	-	0	0	-	0	1	1	-	-	1	-
	Kelp Greenling	3	-	1	0	0	-	0	-	0	-	-	-	-
Total Other Fish		17	-	1	0	1	-	0	1	2	-	-	1	1
Total		1,635	1,183	272	284	422	7	275	258	316	456	272	307	263

Data Source: Data was extracted from RecFIN October 1, 1999.

TABLE 25. Oregon ocean recreational harvest from private vessels in metric tons, 1981-1989 and 1993-1996. Data not available for 1990-1992, January -February 1995, July-August after 1992; and for January-February and November-December 1994.

		OREGON - PRIVATE VESSELS (Shaded Columns Indicate Incomplete Data)													
Species		1981	1982	1983	1984	1985	1986	1987	1988	1989	1993	1994	1995	1996	1996
Roundfish															
	Lingcod	15	61	32	42	104	92	71	74	52	167	97	47	50	101
	Pacific Whiting	-	-	-	-	-	-	0	-	-	-	0	-	-	-
	Sablefish	-	-	-	-	-	-	-	-	-	1	0	-	-	-
Total Roundfish		15	61	32	42	104	92	71	74	52	168	97	47	50	101
Rockfish															
	Shortspine Thornyheads	-	-	-	-	7	-	-	-	-	-	-	-	-	-
	Widow Rockfish	-	-	-	-	-	0	0	0	0	2	-	0	0	0
Total Rockfish		-	-	-	-	7	0	0	0	0	2	-	0	0	0
Other Rockfish															
	Black	148	107	40	254	220	89	162	96	66	209	135	146	123	192
	Blue	12	3	2	3	43	17	9	5	9	52	24	10	9	45
	Bocaccio	1	-	0	-	1	-	-	-	-	0	-	-	-	-
	Canary	8	11	0	9	38	5	8	19	7	22	10	17	7	11
	Other Rockfish	5	7	0	14	30	4	8	10	5	24	11	15	5	18
	Rockfish Genus	-	-	-	-	-	-	-	-	-	-	-	-	0	-
	Yellowtail	3	3	6	1	9	3	3	1	1	6	3	3	1	3
Total Other Rockfish		177	131	48	281	341	118	189	132	88	314	183	192	145	269
Flatfish															
	English Sole	-	-	-	-	-	-	-	-	-	0	-	-	-	-
	Other Flatfish	-	2	0	-	2	0	0	0	27	0	26	12	3	8
	Petrale Sole	-	-	0	-	-	-	-	-	-	-	0	-	-	-
Total Flatfish		-	2	0	-	2	0	0	0	27	0	26	12	3	8
Other Fish															
	Cabezon	3	12	4	4	12	4	21	12	4	19	10	8	6	15
	Kelp Greenling	2	4	1	4	5	2	3	2	1	16	6	4	3	5
	Rock Greenling	0	0	-	-	-	-	0	-	-	1	0	-	-	-
	Spiny Dogfish Shark	-	-	-	-	-	-	-	-	-	0	-	-	-	-
Total Other Fish		5	17	5	8	17	6	23	14	5	36	16	12	8	20
Grand Total		197	211	85	332	470	217	284	221	172	520	323	262	205	399

Data Source: Data was extracted from RecFIN October 1, 1998.

TABLE 26. Oregon ocean recreational harvest from charter vessels in metric tons, 1981-1990 and 1993-1997. Data not available for 1990-1992, January-February 1995, July-August after 1992; and for January-February and November-December 1994.

		OREGON - CHARTER VESSELS (Shaded Columns Indicate Incomplete Data)													
Species		1981	1982	1983	1984	1985	1986	1987	1988	1989	1993	1994	1995	1996	1997
Roundfish															
	Lingcod	194	419	92	67	77	98	100	27	143	75	59	58	73	88
	Pacific Whiting	-	-	-	-	-	-	-	-	-	-	0	-	-	-
	Sablefish	-	-	-	-	-	0	-	-	-	1	1	-	0	7
Total Roundfish		194	419	92	67	77	98	100	27	143	77	60	58	73	88
Rockfish															
	Pacific Ocean Perch	-	-	-	-	-	-	-	-	-	-	0	-	-	-
	Widow Rockfish	-	4	0	3	1	1	0	-	1	32	2	1	4	4
Total Rockfish		-	4	0	3	1	1	0	-	1	32	2	1	4	4
Other Rockfish															
	Black	664	227	62	74	155	160	169	69	354	211	157	190	212	245
	Blue	242	45	38	35	1	12	31	7	87	69	26	38	99	119
	Bocaccio	1	1	0	0	1	0	1	0	0	2	0	1	0	1
	Canary	38	30	3	11	22	16	21	17	18	24	22	33	18	31
	Other Rockfish	140	69	4	24	18	12	22	8	47	37	22	20	13	26
	Rockfish Genus	-	-	0	-	-	-	-	-	-	-	-	-	0	-
	Yellowtail	33	11	15	31	36	9	10	2	30	35	39	60	40	24
Total Other Rockfish		1,117	384	123	175	233	210	255	104	537	378	267	341	383	445
Flatfish															
	English Sole	-	0	-	-	-	-	-	-	-	-	-	-	-	-
	Other Flatfish	1	9	0	0	2	0	14	-	31	0	26	28	22	117
	Petrale Sole	-	0	0	-	-	0	-	-	-	-	0	-	-	-
Total Flatfish		1	10	0	0	2	0	14	-	31	0	26	28	22	117
Other Fish															
	Cabezon	84	52	6	7	11	12	26	7	20	8	11	4	6	13
	Jack Mackerel	-	0	-	0	-	-	-	-	-	1	-	-	-	-
	Kelp Greenling	18	3	1	1	1	3	2	1	3	4	3	1	2	4
	Rock Greenling	-	-	-	-	-	-	0	-	-	0	0	-	-	-
	Spiny Dogfish Shark	1	-	-	1	-	-	-	-	-	0	-	-	-	-
Total Other Fish		103	55	6	9	12	14	28	9	23	13	14	5	8	18
Grand Total		1,415	871	222	254	325	323	397	139	734	500	368	433	491	678

Data Source: Data was extracted from RecFIN October 1, 1998.

TABLE 27. California ocean recreational harvest from private vessels in metric tons, 1981-1989 and 1993-1997. Data not available for 1990-1992 and January-February 1995.

		CALIFORNIA - PRIVATE VESSELS (Shaded Column Indicates Incomplete Data)													
Species		1981	1982	1983	1984	1985	1986	1987	1988	1989	1993	1994	1995	1996	1997
Roundfish															
	Lingcod	520	513	287	355	778	647	719	395	663	420	233	265	240	111
	Pacific Cod	-	-	-	-	-	-	-	-	-	-	0	-	-	-
	Pacific Hake	0	4	1	3	3	10	7	2	1	0	1	0	1	-
	Sablefish	2	1	-	0	1	2	3	0	-	-	-	-	-	-
Roundfish Total		523	518	287	359	783	658	729	397	664	420	234	265	241	111
Rockfish															
	Pacific Ocean Perch	-	-	-	-	-	-	-	-	-	-	0	-	-	1
	Shortspine Thornyheads	-	-	0	23	12	-	0	-	-	-	0	-	-	-
	Widow Rockfish	2	8	6	1	5	1	9	-	3	3	1	3	0	1
Total Rockfish		2	8	6	24	17	1	9	-	3	3	2	3	0	1
Other Rockfish															
	Black	438	378	185	377	447	394	187	126	192	277	206	160	122	72
	Blue	477	494	344	287	221	194	318	141	184	448	169	112	72	78
	Bocaccio	80	133	15	30	74	44	79	42	32	86	66	10	42	15
	Canary	79	101	49	63	109	155	110	66	54	65	50	71	26	20
	Chilipepper	15	18	3	1	3	8	5	7	21	17	17	11	14	1
	Other Rockfish	741	862	613	946	1,091	952	808	522	514	751	594	537	354	166
	Rockfish Genus	39	76	34	0	92	-	19	-	5	103	186	258	97	39
	Yellowtail	34	70	57	62	61	66	92	68	71	71	40	27	11	33
Total Other Rockfish		1,904	2,133	1,301	1,766	2,097	1,814	1,617	974	1,073	1,816	1,328	1,187	738	423
Flatfish															
	Arrowtooth Flounder	-	-	0	-	-	-	-	-	-	-	-	-	-	-
	Dover Sole	-	-	0	-	-	-	-	0	-	0	-	-	-	-
	English Sole	-	0	-	-	0	0	-	-	-	0	0	-	-	-
	Other Flatfish	159	170	74	91	235	280	415	143	320	241	213	409	220	204
	Petrale Sole	4	3	0	3	5	2	-	3	1	2	0	0	0	-
Total Flatfish		163	174	74	94	240	282	415	146	322	243	214	410	221	204
Other Fish															
	Cabezon	83	74	39	74	50	85	86	31	53	48	39	45	43	14
	Greenling Genus	-	0	2	-	-	-	-	-	-	-	0	-	0	-
	Jack Mackerel	0	1	2	5	2	3	3	1	1	14	-	5	0	0
	Kelp Greenling	10	31	9	15	10	21	22	15	14	18	14	12	10	5
	Leopard Shark	8	1	1	-	32	-	42	-	-	7	18	-	2	3
	Rock Greenling	-	0	1	-	0	1	-	-	0	1	0	1	0	0
	Soupfin Shark	-	-	0	-	10	-	-	-	-	-	-	3	2	-
	Spiny Dogfish Shark	27	44	9	14	47	56	3	14	14	9	9	16	11	4
Total Other Fish		128	151	63	108	152	166	156	62	83	97	81	82	69	27
Grand Total		2,721	2,983	1,731	2,351	3,288	2,921	2,926	1,579	2,145	2,579	1,858	1,946	1,269	766

Data Source: Data was extracted from RecFIN October 1, 1998.

TABLE 28. California ocean recreational harvest from charter vessels in metric tons, 1981-1989 and 1993-1997. Data not available for 1990-1992 and January-February 1995.

Species		CALIFORNIA - CHARTER VESSELS (Shaded Column Indicates Incomplete Data)													
		1981	1982	1983	1984	1985	1986	1987	1988	1989	1993	1994	1995	1996	1997
Roundfish															
	Lingcod	598	274	172	99	167	235	194	226	199	7	7	3	108	138
	Pacific Whiting	9	5	0	38	67	49	-	24	30	-	-	-	0	-
	Sablefish	2	0	-	9	18	22	1	60	1	-	-	-	0	-
Total Roundfish		608	280	172	147	252	306	194	310	230	7	7	3	109	138
Rockfish															
	Pacific Ocean Perch	0	-	0	-	0	-	-	-	-	-	-	-	-	-
	Shortbelly Rockfish	-	-	-	-	-	2	-	0	-	-	-	-	0	-
	Shortspine Thornyheads	-	-	-	0	-	0	-	3	1	-	-	-	-	-
	Widow Rockfish	20	156	50	66	43	52	13	11	38	-	1	-	22	38
Total Rockfish		20	156	50	67	43	54	13	15	40	-	1	-	22	38
Other Rockfish															
	Black	23	60	19	14	36	14	33	16	16	-	-	-	30	17
	Blue	694	588	405	269	186	72	97	128	121	-	3	3	127	217
	Bocaccio	987	1,185	489	181	296	520	109	24	212	33	123	22	60	97
	Canary	79	156	46	38	57	69	121	32	69	-	-	0	39	74
	Chilipepper	257	298	150	139	346	377	199	155	284	-	6	-	24	73
	Other Rockfish	739	1,057	881	838	804	899	354	341	525	80	201	76	379	300
	Rockfish Genus	175	238	23	53	-	73	57	-	15	3	14	1	164	3
	Yellowtail	395	1,026	479	285	318	216	162	77	247	-	0	-	87	327
Total Other Rockfish		3,349	4,607	2,492	1,818	2,043	2,239	1,132	772	1,490	115	348	103	910	1,109
Flatfish															
	Dover Sole	-	-	0	-	-	0	-	-	-	-	-	-	-	-
	English Sole	-	0	-	-	-	-	-	-	-	-	-	-	-	-
	Other Flatfish	75	55	32	33	58	51	70	36	67	15	49	30	52	27
	Petrale Sole	3	5	1	1	6	1	0	0	3	-	-	-	0	-
Total Flatfish		78	60	33	34	63	52	70	36	70	15	49	30	52	27
Other Fish															
	Cabezon	7	7	11	2	6	17	9	8	6	1	2	1	8	3
	Greenling Genus	-	-	-	-	-	-	-	-	-	-	-	-	0	-
	Jack Mackerel	0	1	1	5	16	3	4	347	1	1	1	0	1	7
	Kelp Greenling	1	1	1	4	1	2	1	0	3	-	-	-	1	2
	Leopard Shark	-	-	-	0	-	3	-	-	-	-	-	-	-	-
	Rock Greenling	-	-	-	-	-	-	-	-	-	-	-	-	0	-
	Soupfin Shark	-	-	-	-	3	1	-	-	-	-	-	-	-	-
	Spiny Dogfish Shark	4	-	7	2	5	5	1	14	8	-	1	2	6	-
Total Other Fish		13	8	21	14	30	32	15	370	18	2	3	4	17	12
Grand Total		4,068	5,112	2,769	2,080	2,431	2,683	1,426	1,503	1,848	138	409	139	1,109	1,324

Data Source: Data was extracted from RecFIN October 1, 1998.

TABLE 29. Council groundfish management/regulatory actions, 1997-1998 (Page 1 of 6)

Effective January 1, 1997

Adopted the following management measures for the limited entry fishery in 1997:

- For the limited entry fishery, cumulative vessel limits for specified two-month periods, with the target harvest level per month being 50% of the two-month limit. However, vessels could land as much as 60 % of the two-month limit during one of the two months, so long as the total would not exceed the specified limit. The specified periods were January-February, March-April, May-June, July-August, September-October, and November-December. All weights are round weight or round weight equivalents, unless otherwise specified.

- Sebastes Complex (Including Yellowtail Rockfish and Bocaccio) cumulative limit of 30,000 pounds per specified 2-month period north of Cape Mendocino, California (40°30'00" N latitude), and 150,000 pounds per two-months south of Cape Mendocino. Within the cumulative 2-month limits for the Sebastes complex, no more than 6,000 pounds may be yellowtail rockfish caught north of Cape Mendocino, and no limit south of Cape Mendocino (other than the limit on the Sebastes complex). For bocaccio, the cumulative limit is 12,000 pounds per 2-months south of Cape Mendocino, and no limit north of Cape Mendocino (other than the limit on the Sebastes complex). For canary rockfish, the limit is 14,000 pounds per two-months coastwide.

  Widow Rockfish cumulative limit of 70,000 pounds per specified two-month period.

  Pacific Ocean Perch cumulative trip limit of 8,000 pounds per two-month period.

  Dover sole, thornyheads, and trawl-caught sablefish (DTS) complex cumulative limit of 70,000 pounds per two-month period north of Cape Mendocino, California and 100,000 pounds per two-months south of Cape Mendocino; within the DTS complex limit, not more than 20,000 pounds may be thornyheads, of which not more than 4,000 pounds per two-months may be shortspine thornyhead. For trawl-caught sablefish, the cumulative limit is 12,000 pounds per two-months. In any landing, no more than 500 pounds of sablefish may be smaller than 22 inches. For Dover sole north of Cape Mendocino, the cumulative limit will be 38,000 pounds per two months.

  Lingcod cumulative limit of 40,000 pounds per two-month period. No lingcod may be smaller than 22 inches (56 cm) (total length) or 18 inches (46 cm) for lingcod that are "heads off, " except for lingcod caught with trawl gear. (There is a 100 pound (45 kg) trip limit for lingcod smaller than 22 inches (56 cm) taken by trawl gear. This 100 pound trip limit corresponds to 91 pounds (41 kg) of lingcod smaller than 22 inches that are gutted (with head on) and 67 pounds (30 kg) of lingcod smaller than 22 inches that are headed and gutted). The 40,000 pounds cumulative limit corresponds to 26,666 pounds for headed and gutted lingcod, and 36,364 pounds for lingcod that are only gutted. Headed and gutted lingcod are measured from the front of the dorsal fin, where it meets the dorsal surface of the body closest to the head, to the tip of the upper lobe of the tail; the dorsal fin and tail must be intact.

  Pacific Whiting trip limit of 10,000 pounds taken before or after the regular season or inside the 100 fathom contour in the Eureka area.

  Nontrawl sablefish in 1997 the derby north of 36°N latitude will be replaced by a 3-week cumulative limit that will open sometime between August 1 and September 30. A sablefish endorsement will be required for participation in the cumulative fishery, and vessels without endorsements may not fish for or land sablefish during the 3-week season or subsequent mop-up season, if any. There will be a 48-hour closure before and after the three-week season. Outside the 3-week cumulative season, the mop-up season and associated closures, there will be a daily-trip-limit of 300 pounds (round weight), and only one landing of sablefish caught with nontrawl gear may be made per day. South of 36° N latitude there will be no cumulative or mop-up seasons; there will be a daily-trip-limit of 350 pounds (round weight), and only one landing of sablefish caught with nontrawl gear may be made per day. During the 3-week cumulative and mop-up seasons north of 36° N latitude, there is a per trip limit on the amount of sablefish that may be smaller than 22 inches total length (or 15.5 inches heads off): the amount of small sablefish may not exceed 1,500 pounds round weight or three percent of the sablefish larger than 22 inches, whichever is greater. The product recovery ratio (PRR) established by the state where the fish is or will be landed will be used to convert the processed weight to round weight for the purposes of applying the trip limit; the PRR currently is 1.6 in Washington, Oregon, and California.

- Adopted the following management measures for open access gear except trawls (may not exceed 50% of any two-month cumulative limit or any other limit for the limited entry fishery for any groundfish species or complex that applies to the same area or gear).

  Rockfish for rockfish, a cumulative limit of 40,000 pounds per month coastwide, including a trip limit for hook-and-line and pot gear of 10,000 pounds per of rockfish per trip, which includes, south of Cape Mendocino, a trip limit of 300 pounds bocaccio not to exceed 2,000 pounds cumulative per month. Setnets, which are legal gear only south of 38°N latitude, will be subject to the 40,000 pound monthly cumulative limit but not the per trip limit, and will have a cumulative limit of 4,000 pounds of bocaccio per month.

  Thornyheads north of Point Conception, no retention of thornyheads. South of Point Conception, daily limit of 50 pounds. Limit of one landing of thornyheads per vessel per day, and daily-trip-limits may not be accumulated.

Sablefish daily limit of 300 pounds north of 36°N latitude and 350 pounds south of 36° N latitude. Limit of one landing of sablefish per vessel per day, and daily-trip-limits may not be accumulated. North of 36° N latitude, there will also be a cumulative limit of 1,500 pounds per month.

- Adopted the following management measures for open access (non-groundfish) trawls in 1997, in addition to the limits for any groundfish species or complex in the limited entry fishery

  Pink Shrimp cumulative trip limit of 500 pounds (multiplied by the number of days of the trip) of groundfish species for any vessel engaged in fishing for pink shrimp. In addition, not more than 300 pounds per trip may be sablefish and not more than one landing per day may include sablefish. NOTE: vessels using shrimp gear may not exceed half the limited entry two-month cumulative limits in a month, and thus are limited to 3,000 pounds of yellowtail rockfish and 6,000 pounds of sablefish per month.

  Spot and Ridgeback Prawns limit of 500 pounds of groundfish species per trip for any vessel engaged in fishing for spot and ridgeback prawns, including not more than 300 pounds of sablefish per trip, and not more than one landing of sablefish per day.

  California Halibut and Sea Cucumber limit of 500 pounds of groundfish species per trip for vessels engaged in fishing for California halibut or sea cucumbers south of Point Arena, California (38°57'30" N latitude). All fishing during the trip must occur south of Point Arena. Landings must contain California halibut of a size required at California Department of Fish and Game Code Section 8392(a), or sea cucumbers taken in accordance with California Department of Fish and Game Code Section 8396 which requires a state permit. Not more than 300 pounds per trip per day may be sablefish.

- Adopted the following management measures for the recreational fishery in 1997

  California bag limit of five lingcod, no smaller than 22 inches, and 15 rockfish per person per day. Multi-day limits are authorized by a valid permit issued by the State of California and must not exceed the daily limit multiplied by the number of days in the trip.

  Oregon bag limit of three lingcod, no smaller than 22 inches, and 15 rockfish per person per day, of which no more than ten may be black rockfish.

  Washington bag limit of three lingcod, no smaller than 22 inches, and ten rockfish per person per day.

Effective May 1, 1997

- Sebastes Complex (Including Yellowtail Rockfish and Bocaccio) reduced the two-month cumulative limit on bocaccio to 10,000 pounds south of Cape Mendocino.
- Widow Rockfish cumulative limit reduced to 60,000 pounds per specified two-month period.
- Non-trawl sablefish daily-trip-limit fishery limited to 5,100 pounds per month north of 36° N latitude.
- Dover sole, thornyheads, and trawl-caught sablefish (DTS) complex cumulative two-month limit for Dover Sole north of Cape Mendocino reduced to 30,000 pounds. Reduction in overall limit for thornyheads to 15,000 pounds, reduction in two-month cumulative limit on shortspines to 3,000 pounds. The cumulative limits for the whole complex will also be reduced to 57,000 pounds per two months north of Cape Mendocino.
- Open Access south of Cape Mendocino, trip limit reduction for hook-and-line and trap gear for Bocaccio from 300 pounds to 250 pounds with no change to the monthly trip limit (2000 pounds).

Effective May 14, 1997

- Set allocation of the commercial whiting harvest guideline among the nontribal sectors at: 42% shoreside, 24% for mothership sector, and 34% for catcher/processor, Set framework for setting whiting primary season opening dates (For 1997: Catcher/processor, May 15, 1997; mothership, May 15, 1997; and shore-based, June 15, 1997), and allows for processing fish waster at sea by a "waste processing vessel."

Effective May 27, 1997

- Temporary closure of the unrestricted primary season for whiting south of 42° N latitude, and reimposition of 10,000 pound trip limit until June 15, 1997 at 0001 hours.

Effective June 1, 1997

- Closed mothership fishery for whiting at 3 p.m.

Effective June 11, 1997

- Closed at-sea (catcher-processor) fishery for Pacific whiting at noon.

Effective July 1, 1997

- Reduced the 2-month cumulative limit for lingcod from 40,000 pounds to 30,000 pounds.
- Reduced monthly cumulative limit for fixed gear sablefish daily-trip-limit fishery North of 36°N latitude from 5,100 pounds to 600 pounds.
- Reduced the cumulative limit for fixed gear sablefish open-access north of 36°N latitude from 1,500 pounds to 600 pounds.

Effective July 28, 1997

- Requirement for a sablefish endorsement on limited entry permits for permit holders to participate in the regular and mop-up limited entry fixed gear sablefish fishery north of 36°N latitude

Effective August 21, 1997

- Set dates for the 1997 fixed gear limited entry sablefish season for August 25 at noon through September 3 at noon, with an equal cumulative limit of 34,100 pounds and a pre-and post season 48 hour closure. For 1998 and beyond, a framework is established that allows the start date of the regular, north of 36°N latitude limited entry fixed gear sablefish season to be set for any day from August 1 through September 30.

Effective August 22, 1997

- Closed the shore-based fishery for Pacific whiting, and reimposed the 10,000 pound trip limit (shore-based allocation met).

Effective September 1, 1997

- Change from 2-month cumulative limits to 1-month cumulative limits for Dover Sole, thornyheads, and trawl-caught sablefish.
- Authorized fixed gear sablefish fishers in the daily-trip-limit fishery South of 36°N latitude to make one landing per week above the 350 pound daily-trip-limit but not more than 1,050 pounds (this was designed to help vessels making longer trips reduce their discard). A fisher may not make a landing larger than 350 pounds and then continue to land sablefish under the daily-trip-limit for the rest of the week.

Effective October 1, 1997

- Fixed gear limited entry sablefish mop-up season begins October 1 at noon through October 15 at noon. Vessels may land one cumulative limit of 8,500 pounds. Following the mop-up fishery, fixed-gear limited entry daily-trip-limits will be 300 pounds per day, with an increased 1,500 pound monthly limit.

- Sebastes Complex (Including Yellowtail Rockfish and Bocaccio) changed from two-month limits to one-month limits for Sebastes. Increase Sebastes one month limits to 20,000 pounds north of Cape Mendocino and 75,000 pounds south of Cape Mendocino, no more than 5,000 pounds of which may be yellowtail rockfish north of Cape Mendocino, no more than 5,000 pounds of which may be bocaccio south of Cape Mendocino, and no more than 10,000 pounds of which may be canary rockfish coastwide.

- Dover sole, thornyheads, and trawl-caught sablefish (DTS) complex reduced monthly limit for the DTS complex to 11,000 pounds north of Cape Mendocino and 39,500 pounds south of Cape Mendocino. Within these limits, no more than 1,500 pounds may be dover sole north of Cape Mendocino, and 30,000 pounds south of Cape Mendocino; no more than 2,000 pounds coastwide may be may be trawl-caught sablefish; and no more than 7,500 pounds coastwide may be thornyheads. No more than 1,500 pounds of the thornyheads may be shortspines.

- Open-Access Sablefish increased the open-access monthly cumulative limit to 1,500 pounds.

Effective January 1, 1998

Adopted the following management measures for the limited entry fishery in 1998:

- For the limited entry fishery, cumulative vessel limits for specified two-month periods, with the target harvest level per month being 50% of the two-month limit. However, vessels may land as much as 60% of the two-month limit during one of the two months, so long as the total does not exceed the specified limit. The specified periods are January-February, March-April, May-June, July-August, September-October, and November-December. All weights are round weight or round weight equivalents, unless otherwise specified. The Council may revert to one-month limits later in the year.

- Sebastes Complex (Including yellowtail, canary and bocaccio rockfish): Cumulative limit of 40,000 pounds per specified two-month period north of Cape Mendocino, California (40° 30'00" N latitude), and 150,000 pounds per two-months south of Cape Mendocino. Within the cumulative two-month limits for the Sebastes complex, no more than 11,000 pounds may be yellowtail rockfish caught north of Cape Mendocino, and no limit south of Cape Mendocino (other than the limit on the Sebastes complex). For bocaccio, the cumulative limit is 2,000 pounds per two-months south of Cape Mendocino, and no limit north of Cape Mendocino (other than the limit on the Sebastes complex). For canary rockfish, the limit is 15,000 pounds per two-

months coastwide.

Widow Rockfish: Cumulative limit of 25,000 pounds per two-month period.

Pacific Ocean Perch: Cumulative trip limit of 8,000 pounds per two-month period.

Dover sole, thornyheads, and trawl-caught sablefish (DTS) complex: Coastwide cumulative limit of 40,000 pounds of Dover sole in the January-February period and 18,000 pounds per two-month period thereafter; not more than 5,000 pounds of sablefish, not more than 10,000 pounds of longspine thornyheads, and not more than 4,000 pounds of shortspine thornyhead. (The shortspine limit is separate from the longspine limit). In any landing, no more than 500 pounds of sablefish may be smaller than 22 inches total length.

Lingcod: Cumulative limit of 1,000 pounds per two-month period. No lingcod may be smaller than 24 inches (total length), except for lingcod caught with trawl gear. A length conversion for lingcod landed "heads off" will be established. Headed and gutted lingcod are measured from the front of the dorsal fin, where it meets the dorsal surface of the body closest to the head, to the tip of the upper lobe of the tail; the dorsal fin and tail must be intact. There is a 100-pound (45 kg) trip limit for lingcod smaller that 24 inches taken by trawl gear. Vessel operators landing gutted (with head off) or headed and gutted lingcod should contact state fishery officials in the state where the fish will be landed to determine that state's official weight conversion factors.

Pacific Whiting: Trip limit of 10,000 pounds taken before or after the regular season or year-round inside the 100-fathom contour in the Eureka area .

Nontrawl sablefish: North of 36° N latitude, a daily-trip-limit of 300 pounds (round weight) and a cumulative limit of 1,500 pounds per two-month period. Only one landing of sablefish caught with nontrawl gear may be made per day. South of 36° N latitude there will be no cumulative or mop-up seasons; there is a daily-trip-limit of 350 pounds (round weight), and only one landing of sablefish caught with nontrawl gear may be made per day.

- Adopted the following management measures for open access gear except trawls: Open access landings may not exceed 50% of any two-month cumulative limit or any other limit for the limited entry fishery for any groundfish species or complex that applies to the same area, unless specifically authorized (as for bocaccio caught with setnets and lingcod).

  Rockfish: For rockfish, a cumulative limit of 40,000 pounds per month coastwide, including a trip limit for hook-and-line and pot gear of 10,000 pounds of rockfish per trip, which includes, south of Cape Mendocino, a trip limit of 250 pounds bocaccio not to exceed 1,000 pounds cumulative per month. Setnets, which are legal gear only south of 38° N latitude, are subject to the 40,000-pound monthly cumulative limit, but not the per-trip limit, and have a cumulative limit of 2,000 pounds of bocaccio per month.

  Thornyheads: North of Point Conception, no retention of thornyheads. South of Point Conception, daily limit of 50 pounds. Limit of one landing of thornyheads per vessel per day, and daily-trip-limits may not be accumulated.

  Sablefish: Daily limit of 300 pounds north of 36° 00' N latitude and 350 pounds south of 36° 00' N latitude. Limit of one landing of sablefish per vessel per day, and daily-trip-limits may not be accumulated. North of 36° N latitude, there is a cumulative limit of 600 pounds per two-month period.

  Lingcod: Coastwide, a cumulative limit of 1,000 pounds per two-month period, with no monthly sublimit. A minimum size limit of 24 inches (total length) applies coastwide.

- Adopted the following management measures for the open access (nongroundfish) trawls: May not exceed 50% of any two-month cumulative limit or any other limit for the limited entry fishery for any groundfish species or complex that applies to the same area or gear, unless specifically authorized.

  Thornyheads and sablefish: North of Point Conception, no retention of thornyheads. South of Point Conception, daily limit of 50 pounds. Limit of one landing of thornyheads per vessel per day, and daily-trip-limits may not be accumulated. For sablefish, no more than 300 pounds per day, and not more than one landing per day may include sablefish.

  Pink Shrimp: Per trip limit of 500 pounds of all groundfish species (multiplied by the number of days of the trip) for any vessel engaged in fishing for pink shrimp.

  Spot and Ridgeback Prawns: Limit of 500 pounds of all groundfish species per trip for any vessel engaged in fishing for spot and ridgeback prawns.

  California Halibut and Sea Cucumber: Limit of 500 pounds of all groundfish species per trip for vessels engaged in fishing for California halibut or sea cucumbers south of Point Arena, California (38° 57'30" N latitude). All fishing during the trip must occur south of Point Arena. Landings must contain California halibut of a size required at California Department of Fish and Game Code Section 8392(a), or sea cucumbers taken in accordance with California Department of Fish and Game Code Section 8396 which requires a state permit.

- Adopted the following management measures for the recreational fishery in 1998:

California: Bag limit of three lingcod, no smaller than 24 inches, and 15 rockfish per person per day, including not more than three bocaccio. Multi-day limits are authorized by a valid permit issued by the State of California and must not exceed the daily limit multiplied by the number of days in the trip.

Oregon: Bag limit of three lingcod, no smaller than 24 inches, 15 rockfish per person per day, of which no more than ten may be black rockfish.

Washington: Bag limit of three lingcod, no smaller than 24 inches, and ten rockfish per person per day.

Effective May 1, 1998

- Limited Entry:
  Widow Rockfish: increased cumulative limit to 30,000 pounds per specified two-month period
  Sebastes Complex: increased cumulative limit for yellowtail to 13,000 pounds per specified two-month period north of Cape Mendocino.
  Dover sole, thornyheads, and trawl-caught sablefish (DTS) complex: increased the 2-month cumulative limit for dover sole to 22,000 pounds, for longspine thornyheads to 12,000 pounds, for shortspine thornyheads to 5,000 pounds, and trawl-caught sablefish, 6,000 pounds. The overall DTS complex cumulative limit is removed.
  Fixed Gear Sablefish: North of 36° N. lat., increased the cumulative limit to 1,800 pounds per 2-month period, but retained the 300 pound daily limit. South of 36° N. lat., gave fishers the option to choose each week to make daily landings of sablefish of up to 350 pounds, per day, or make a single landing above 350 pounds, but not exceeding 1,050 pounds (effective May 3).

- Open Access :
  Fixed gear sablefish, north of 36°N. Lat: increased the 2-month cumulative limit to 700 pounds.
  Bocaccio, South of Cape Mendocino: increase the per-trip limit to 500 pounds, retaining the one-month cumulative limit of 1,000 pounds.
  Shortspine Thornyheads in Pink Shrimp Trawl Fisheries: set a limit of 100 pounds of shortspine thornyheads per trip for vessels engaged in fishing for pink shrimp.

Effective July 1, 1998

- Limited Entry Sebastes Complex: south of Cape Mendocino, decreased the 2-month cumulative limit to 40,000 pounds.
- Open Access Widow Rockfish: decreased monthly cumulative trip limit to 3,000 pounds.
- Open Access Canary Rockfish: decreased monthly cumulative trip limit to 200 pounds.
- Open Access Rockfish: removed overall rockfish monthly limit and replaced it with limits for component rockfish species: for Sebastes complex, monthly cumulative limit is 33,000 pounds, for widow rockfish, monthly cumulative trip limit is 3,000 pounds, for Pacific Ocean Perch, monthly cumulative trip limit is 4,000 pounds.
- Open Access Lingcod: reduced the monthly cumulative limit to 250 pounds for the month of July. After August 1, no lingcod may be landed by any vessel participating in the open access fisheries.
- Open Access Fixed Gear Sablefish: increased the 2-month cumulative north of 36° N. lat. To 1,800 pounds.

Effective August 1, 1998

- Open Access Lingcod: No lingcod may be landed by any vessel participating in the open access fisheries.

Effective September 1, 1998

- All limited entry cumulative limits become monthly limits

Effective October 1, 1998

For Limited Entry:
- Widow Rockfish: increased monthly limit to 19,000 pounds.
- Sebastes South(of Cape Mendocino): decreased monthly limit to 15,000 pounds.
- Canary: decreased monthly limit to 500 pounds.
- Dover Sole: increased monthly limit to 18,000 pounds.
- Longspine Thornyhead: increased monthly limit to 7,500 pounds.
- Shortspine Thornyhead: decreased monthly limit to 1,500 pounds.
- Trawl-caught Sablefish: increased monthly limit to 5,000 pounds.
- Fixed-Gear Sablefish: increased the 2 month cumulative limit to 2,700 pounds; on November 1, instituted 1,500 pound monthly limit.

For Open Access:
- All rockfish north of Cape Blanco: prohibited all landings
- Canary Rockfish, Widow Rockfish (coastwide): prohibited all landings
- Thornyheads (between Pt. Conception and Cape Blanco): prohibited all landings except for 100 pound per trip limit for shrimp trawl.
- Dover Sole (coastwide): increased monthly limit to 18,000 pounds.
- Exempted Trawl-caught sablefish: increased monthly limit to 5,000 pounds.

TABLE 29. Council groundfish management/regulatory actions, 1997-1998 (Page 6 of 6)

Effective November 1, 1998

- Fixed-Gear Sablefish: changed to monthly limit, instituted 1,500 pound monthly limit.

Effective December 1, 1998

- Limited Entry Dover Sole: increased monthly limit to 36,000 pounds.

TABLE 30. Council ABCs and harvest guidelines for 1997 for the Washington, Oregon, and California region by management area (in thousands of metric tons). Page 1 of 2

ROUNDFISH

	ABC					Total	HARVEST GUIDELINE	
	Vancouver[a/]	Columbia	Eureka	Monterey	Concep	ABC	HG	HG area
Lingcod[b/]	1.3		0.3	0.7	0.1	2.4	2.4	WOC
Pacific cod	3.2		[c/]			3.2	none	--
Whiting	290.0[d/]					290.0	232.0[e/]	US
Sablefish[f/]	8.7				0.425	9.125	7.8[f/]	VCEM
Jack mackerel[g/]	52.6					52.6	52.6	WOC +

ROCKFISH OTHER THAN SEBASTES COMPLEX

	Vancouver[a/]	Columbia	Eureka	Monterey	Concep	ABC	HG	HG area
POP	0.00	0.00				0.00	0.75[h/]	VC
Shortbelly	23.5					23.5	23.5	WOC
Widow	7.7					7.7	6.5[i/]	WOC
Thornyheads	8[i/]					8	--	--
Shortspine	1[i/]					1[j/]	1.38[k/]	n of Pt Conc
Longspine	7[i/]					7[j/]	6.0[l/]	n of Pt Conc

SEBASTES COMPLEX

	Vancouver[a/]	Col - N	Col - S	Eureka	Monterey	Concep	ABC	HG[m/]	HG area
Sebastes-N[n/]	7.130						7.130	6.656[o/]	VC
Sebastes-S[n/]				9.664			9.664	9.284[p/]	EMC
bocaccio				0.265			0.265	.387	EMC
canary	1.22						1.220	1.00	VC
chilipepper	[c/]			4.0			4.00	none	
yellowtail	.454	.984[q/]	.335[r/]				1.773[r/]	2.762	VC
remaining rockfish	2.295[s/]			1.431[s/]					
bank	[c/]			0.081			0.08	none	
bocaccio	0.424							none	
canary				0.085			0.085	none	
darkblotched	0.209			0.047			0.26	none	
POP				0.02[t/]			0.020	none	
redstripe	0.768			[c/]			0.77	none	
sharpchin	0.398			0.071			0.47	none	
silvergrey	0.051			[c/]			0.05	none	
splitnose	0.274			0.868			1.14	none	
yelloweye	0.039			[c/]			0.04	none	
yellowmouth	0.132			[c/]			0.13	none	
yellowtail				0.104[r/]	0.155		0.259	none	
Other rockfish[u/]	1.842			3.968				none	

TABLE 30. Council ABCs and harvest guidelines for 1997 for the Washington, Oregon, and California region by management area (in thousands of metric tons). Page 2 of 2

FLATFISH

	Vancouver[a/]	Columbia	Eureka	Monterey	Concep	ABC	HG	HG area
Dover	.82- 1.57[v/]	3	2.9	3.16-4.36[w/]	1	10.88-12.83[x/]	11.05	WOC
							2.85	COL only
English sole	2		1.1			3.1	none	
Petrale sole	1.2		0.5	0.8	0.2	2.7	none	
Arrowtooth flounder	5.8					5.8	none	
Other flatfish	0.7	3	1.7	1.8	0.5	7.7	none	

OTHER FISH[y/]

Vancouver	Columbia	Eureka	Monterey	Concep	ABC	HG
2.5	7	1.2	2	2	14.7	none

a/ U.S. portion, except as noted.

b/ Lingcod - same as 1996. The 1995 assessment addressed the entire Vancouver area, including Canada, and the Columbia area north of Cape Falcon. The 1997 ABC recommendation is the same as for 1996, and is based on 50% of the ABC for the assessment area, plus 400 mt for the Columbia area south of Cape Falcon. The harvest guideline recommendation is also the same as 1996, and equals the sum of the ABCs, including estimated recreational harvest of 900 mt. The remaining 1,500 mt is for commercial harvest.

c/ These species are not common nor important in the areas footnoted. Accordingly, for convenience, Pacific cod is included in the "other fish" category for the areas footnoted, and rockfish species are included in the "other rockfish" category for the areas footnoted only.

d/ Whiting - the ABC range is coastwide, including Canada, and is based on the hybrid F moderate exploitation rate policy, using the average of the 50th and 75th percentile recruitment levels.

e/ Whiting harvest guideline - the harvest guideline, which applies to U.S. waters, is 80% of the ABC range. Any allocation to tribal fisheries will be deducted prior to allocating among non-Indian sectors.

f/ Sablefish - Same as 1996; ABC includes 900 mt of estimated trawl discard. Harvest guideline (7,800 mt) applies only north of the Conception area (i.e., north of 36°N latitude), calculated by subtracting the 900 mt from the 8,700 mt ABC. The treaty tribes will be allocated 780 mt, and the remaining 7,020 mt is divided between the limited entry (6,557 mt) and open access (463 mt) fisheries. Allocation harvest guidelines are established: 58% (3,803 mt) to the trawl fishery and 42% (2,754 mt) to the nontrawl fishery.

g/ Jack mackerel - same as 1996. The FMP manages fishing only north of 39°N latitude; however, landings outside the EEZ and south of 39°N latitude are counted towards the ABC and harvest guideline. The DAP is equal to the harvest guideline.

h/ Pacific ocean perch - same as 1996. ABCs for Vancouver and Columbia remain at zero; the harvest guideline applies to the Vancouver and Columbia areas combined, and is set at the level of anticipated incidental catch. It applies to landed catch and assumes additional fish will be discarded.

i/ Widow rockfish - same as 1996. The 6,500 mt harvest guideline is derived by subtracting 16% (1,200 mt) of the ABC for estimated discards.

j/ Thornyheads - the ABCs and harvest guidelines for the two species are the same as 1996 and apply north of Pt. Conception.

k/ Shortspine thornyhead - the harvest guideline (1,380 mt) is for landed catch, equivalent to 1996. The total catch level of 1,500 mt is 50% above the ABC, but below the overfishing level, in order to allow greater harvest of longspine thornyhead. Eight percent is deducted for discard.

l/ Longspine thornyhead - harvest guideline same as 1996, which is 1,000 mt below the ABC to help prevent overharvest of shortspine thornyhead.

m/ Harvest guidelines for Sebastes complex (north and south), bocaccio, canary rockfish, and yellowtail rockfish are for total catch. Discard and bycatch adjustments will be made inseason based on best available data as it becomes available.

n/ The Sebastes complex (north) ABC includes all rockfish species listed below in the Vancouver and Columbia areas combined, including other rockfish and 335 mt of the ABC for yellowtail rockfish in the South Columbia/Eureka area. Likewise, Sebastes south includes all rockfish in the Eureka, Monterey and Conception areas combined, including 104 mt of the South Columbia/Eureka area yellowtail rockfish ABC.

o/ The Sebastes complex north harvest guideline is the sum of the harvest guidelines for canary and yellowtail rockfish, plus the sum of the ABC or recent catch, whichever is less, for all Vancouver/Columbia area rockfish species below, including "other rockfish." It includes 162 mt of the yellowtail rockfish harvest guideline for the Eureka area. Within the Sebastes north, harvest guidelines for commercial harvest of black rockfish by the Makah, Quileute, Hoh, and Quinault Indian tribes remain at 20,000 pounds north of Cape Alava (48°09"30"N) and 10,000 pounds between Destruction Island (47°40"00"N) and Leadbetter Point (46°38"10"N).

p/ The Southern Sebastes complex harvest guideline includes the bocaccio harvest guideline plus the sum of the lesser of the ABC or recent catch for all Eureka/Monterey/Conception area rockfish below in this table. It includes 162 mt of the yellowtail rockfish harvest guideline.

q/ Yellowtail rockfish ABC (N. Columbia area) - applies to the Columbia area north of Cape Falcon.

r/ Yellowtail rockfish (S. Columbia) - applies to the Columbia area south of Cape Falcon. The assessment combines the S. Columbia and Eureka areas; 104 mt of the ABC has been apportioned to the Eureka area ABC.

s/ Remaining rockfish includes the species below in the table, but not the "Other rockfish" catch.

t/ Pacific ocean perch - the new Sebastes complex assessment proposes a new ABC (20 mt) for the Eureka, Monterey and Conception area.

u/ Other rockfish includes offshore Sebastes species not identified above in this table. It is based on the Sebastes complex assessment of commercial landings and includes an estimate of recreation landings.

v/ Dover sole ABC - (Vancouver area) same as 1996, which is a range from the ABC recommended in the 1995 assessment (818 mt) up to the 1990-1994 average landing level (1,565 mt).

w/ Dover sole (Monterey) - same as 1996; the lower end of the ABC range (3,164 mt) is the 1990-1994 average landing level, and the upper end of the range is the level proposed in the 1995 assessment.

x/ Dover sole (coastwide) - same as 1996; the ABC is the sum of the area ABCs, which is a range of 10,882 - 12,828 mt; it includes a 5 percent discard inflation.

y/ Includes sharks, skates, rays, ratfish, morids, grenadiers, and other groundfish species noted above in c/.

TABLE 31. Open access and limited entry allocations for 1997 (in thousands of mt).

Species	1997 ABC	1997 Harvest Guideline	Tribes	1997 Allocations: Limited Entry 1,000 mt	Limited Entry Percent	Open Access 1,000 mt	Open Access Percent
Roundfish							
Lingcod	2.4	2.4[a/]		1.21	80.9	0.29	19.1
Sablefish	9.125	7.8	0.78	6.557[b/]	93.4	0.463	6.6
Rockfish							
Widow	7.7	6.5		6.26	96.3	0.24	3.7
Shortspine thornyhead	1.0	1.38		1.38	>99.0	0.004	<1.0
Sebastes Complex							
Northern area	7.130	6.656[c/]		6.02	90.4	.64	9.6
Southern area	9.664	9.284[d/]		6.26	67.4	3.03	32.6
Bocaccio	.265	.387[e/]		.224	67.4	0.108	32.6
Canary	1.22	1.0		.912	91.2	0.09	8.8
Yellowtail	1.773	2.762		2.5	90.4	0.27	9.6

a/ The open access and limited entry allocations for lingcod are applied only to the commercial portion of the harvest guideline, which is 1,500 mt in 1997 (900 mt is deducted for anticipated recreational harvest).

b/ The limited entry sablefish allocation is further allocated 58% (3,803 mt) to the trawl fishery and 42 percent (2,754 mt) to the nontrawl fishery.

c/ Within the Sebastes complex north, harvest guidelines for commercial harvest of black rockfish by the Makah, Quileute, Hoh, and Quinault Indian tribes remain at 20,000 pounds north of Cape Alava (48°09"30"N) and 10,000 pounds between Destruction Island (47°40"00"N) and Leadbetter Point (46°38"10"N).

d/ The Sebastes south harvest guideline includes the bocaccio harvest guideline. The open access and limited entry allocations are applied only to the commercial portion of the bocaccio harvest guideline. Therefore, 55 mt is deducted prior to calculating the allocations.

e/ The open access and limited entry allocations for bocaccio are applied only to the commercial portion of the harvest guideline, which is 387 mt in 1997 (55 mt is deducted for anticipated recreational harvest).

TABLE 32. Landings and quotas/harvest guidelines for Pacific whiting (includes discards in the foreign and joint venture fisheries).

Year	Foreign Fishery (mt)	Joint Venture (mt)	U.S.-Processed (mt)[a/]	Total Landings (mt)[b/]	Quota or Harvest Guideline (mt)	Quota Landed (percent)
1978	96,827	856	689	98,372	130,000	76
1979	114,910	8,834	937	124,681	198,900	63
1980	44,023	27,537	793	72,353	175,000	41
1981	70,366	43,557	838	114,761	175,000	66
1982	7,089	67,465	1,024	75,578	175,500	43
1983	0	72,100	1,051	73,151	175,500	42
1984	14,772	78,889	2,721	96,382	175,500	55
1985	49,853	31,692	3,894	85,439	175,000	49
1986	69,861	81,639	3,463	154,963	295,800	52
1987	49,656	105,997	4,795	160,448	195,000	82
1988	18,041	135,781	6,876	160,698	232,000	69
1989	0	203,578	7,418	210,996	225,000	94
1990	0	170,972	12,828	183,800	196,000	94
1991	0	0	217,505	217,505	228,000	95
1992	0	0	208,575	208,575	208,800	100
1993[b/]	0	0	141,222	141,222	142,000	99
1994[b/]	0	0	252,729	252,729	260,000	97
1995[b/]			176,571	176,571	178,400	99
1996[b/]	0	0	211,776	211,776	212,000	100
1997[b/]	0	0	233,511	233,511	232,000	100
1998[b/]	0	0	232,509	232,509	232,000	100

a/ U.S. processing was entirely shorebased through 1989. Since 1990, domestic at-sea processing vessels have operated in the whiting fishery.

b/ Preliminary.

TABLE 33. Final GMT recommendations for 1998 ABCs and harvest guidelines for the Washington, Oregon, and California region by management area (in thousands of metric tons). Page 1 of 3

ROUNDFISH

	GMT Final ABC Recommendation					GMT Final Harvest Guideline Recommendation	
	Vancouver a/	Columbia	Eureka	Monterey	Concep	U.S. Total (except as noted)	Total Catch	Landed Catch
Lingcod b/	1.021		.139	.325	.046	1.532 b/	.838	c/
Pacific cod	3.2		d/			3.2	none	
Whiting e/	290.0					290.0 e/	232.0	232.0
Sablefish f/	3.0				0.425	3.0, 425 f/	3.0, .425	2.7, .425
Jack mackerel	52.6					52.6 g/	52.6	52.6

ROCKFISH OTHER THAN SEBASTES COMPLEX

	Vancouver	Columbia	Eureka	Monterey	Concep	Coastwide Total (except as noted)	Total Catch	Landed Catch
POP	0.00	0.00				0.00	0.75 h/	
Shortbelly	23.5					23.5	23.5	23.5
Widow	5.75 i/					5.75 i/	4.960	4.276
Thornyheads								
Shortspine j/	.884 j/				.203	.884, .203 j/	.884, .203 j/	.557, .142
Longspine k/	4.102 k/				.509	4.102,.509 k/	4.102, .509 k/	3.733, .463

SEBASTES COMPLEX

	Vancouver a/	Columbia	Eureka	Monterey	Concep	Total for areas noted	Total Catch	Landed catch
Sebastes-N l/	8.300					8.300 l/	7.057-7.404	6.391-6.683
Sebastes-S m/			8.999			8.999 m/	8.999	8.999
bocaccio n/			0.230			0.230 n/	.230	
canary o/	1.045					1.045 o/	1.045	.878
chilipepper	c/		3.4 p/			3.4 p/	none	
yellowtail q/	4.657					4.657 q/	3.118- 3.465	2.619- 2.911
remaining rockfish	2.295 r/		1.431 r/					
bank	c/		0.081			0.08	none	
bocaccio	0.424						none	
canary			0.085				none	
darkblotched	0.209		0.047			0.26	none	
POP			0.02 s/			0.020	none	
redstripe	0.768		c/			0.77	none	
sharpchin	0.398		0.071			0.47	none	
silvergrey	0.051		c/			0.05	none	
splitnose	0.274		0.868			1.14	none	
yelloweye	0.039		c/			0.04	none	
yellowmouth	0.132		c/			0.13	none	
yellowtail			0.074 m/	0.155		0.229	none	
Other rockfish t/	1.842		3.968				none	

TABLE 33. Final GMT recommendations for 1998 ABCs and harvest guidelines for the Washington, Oregon, and California region by management area (in thousands of metric tons). Page 2 of 3

FLATFISH	GMT Final ABC recommendation						GMT Final Harvest Guideline Recommendation	
	Vancouver	Columbia	Eureka	Monterey	Concep	**Coastwide ABC**	**Total Catch**	**Landed Catch**
Dover sole u/	8.373				1.053	9.426	9.426	8.955 u/
English sole	2		1.1			3.1	none	
Petrale sole	1.2		0.5	0.8	0.2	2.7	none	
Arrowtooth flounder	5.8					5.8	none	
Other flatfish	0.7	3	1.7	1.8	0.5	7.7	none	
OTHER FISH v/	2.5	7	1.2	2	2	14.7	none	

a/ U.S. portion, except as noted.

b/ Lingcod - the 1997 assessment addresses the entire Vancouver area, including Canada, and the Columbia area. The 1998 GMT's final ABC recommendation of 1,021 mt is the F35% level and includes the Canadian portion of the Vancouver area; it is approximately 40% of the 2,230 mt ABC estimated for this area in the previous assessment. The southern area ABCs are reduced from the 1997 levels in proportion to the reduction in the northern area. The Vancouver area ABC is apportioned between the U.S. and Canada in proportion of biomass distribution determined by the surveys (44% in U.S. waters). The coastwide harvest guideline recommendation (838 mt) applies to U.S. waters only and is the sum of the individual F40% values for each area. Anticipated 1998 recreational catch, which is a range from 420 to 560 mt, must be deducted prior to establishing the commercial harvest guideline.

c/ Lingcod - the commercial total catch harvest guideline will be calculated after recreational catch is estimated.

d/ These species are not common nor important in the areas footnoted. Accordingly, for convenience, Pacific cod is included in the "other fish" category for the areas footnoted, and rockfish species are included in the "other rockfish" category for the areas footnoted only.

e/ The whiting ABC is coastwide including Canada. The 1997 STAR panel suggested a harvest range of 174,000 - 309,000 mt; the GMT's final ABC is the same as 1997; the harvest guideline is based on 80% taken in the U.S. The Council anticipates that NMFS will allocate 25,000 mt to the Makah Indian fishery; the remainder will be allocated 42% to the shore-based sector, 34% to the factory trawler fishery, and 24% to the mothership processor sector.

f/ Sablefish - the 3,000 mt ABC and 2,700 mt harvest guideline apply north of the Conception area (i.e., north of 36°N latitude). The harvest guideline reflects a 10% reduction for anticipated discard. The Conception area ABC, which is based on historical landings, remains the same as 1997. As in previous years, the northern harvest guideline will be reduced by 10% for the treaty tribes; the remainder will be divided between the limited entry and open access fisheries; and the limited entry portion will be allocated 58% to the trawl fishery and 42% to the nontrawl fishery. The GMT recommends establishment of a separate harvest guideline for the Conception area equal to the ABC (425 mt); limited entry and open access allocations will not be established unless landings approach the harvest guideline.

g/ Jack mackerel - the FMP manages fishing only north of 39°N latitude; however, landings outside the EEZ and south of 39°N are counted towards the ABC and harvest guideline. The preliminary DAP is equal to the harvest guideline.

h/ Pacific ocean perch - ABCs for Vancouver and Columbia remain at zero; the harvest guideline is unchanged from 1997, applies to the Vancouver and Columbia areas combined, and is set at the level of anticipated incidental catch. It applies to landed catch and assumes additional fish will be discarded.

i/ Widow rockfish - the ABC is based on the F40% harvest rate, which is the current MSY proxy for rockfish species. The landed catch harvest guideline (4,276 mt) is based on the F45% harvest rate; a 16% discard adjustment factor is added to obtain the total catch harvest guideline.

j/ Shortspine thornyhead - the ABC (884 mt) is calculated based on the biomass estimated directly by the slope survey assuming q=1, F=M and M=0.06/yr. The 884 mt total catch harvest guideline would apply north of the Conception area; the landed catch harvest guideline reflects a 30% reduction for discard, and an additional 10% as a precautionary adjustment. The GMT recommends the Council consider a separate harvest guideline for the Conception area equivalent to the average 1995-1996 catch (142 mt for landed catch or 203 mt for total catch, which has been inflated to reflect the 30% assumed discard rate).

k/ Longspine thornyhead - the ABC (4,102 mt) north of the Conception area is the average of the 3 year individual ABCs. The harvest guideline represents a 5% reduction from ABC to account for market discard. The GMT recommends the Council consider a separate harvest guideline for the Conception area equivalent to the average 1995-1996 catch (463 mt for landed catch or 509 mt for total catch, which was inflated to reflect 5% assumed discard).

l/ Sebastes complex (north) includes all rockfish species listed below in the U.S. Vancouver and Columbia areas combined, including other rockfish. The **total catch** harvest guideline range is equal the sum of either the ABC or recent catch (whichever is less) or the total catch harvest guideline for each species. The **landed catch** harvest guideline is the sum of the landed catch harvest guidelines, where established, and either the ABC or recent catch for each species.

m/ Sebastes complex (south) includes all rockfish listed below in the Eureka, Monterey and Conception areas combined, including 74 mt for the Eureka yellowtail rockfish ABC. The ABC is lower than in 1997 due to reduction in the ABCs for yellowtail rockfish in the Eureka area, bocaccio, and chilipepper, which are based on F40%. The harvest guideline is the sum of either the ABCs or recent catch levels, whichever is less (except the chilipepper ABC is used instead of the recent catch level to calculate the southern harvest guideline).

n/ For bocaccio, the ABC and harvest guideline range are based on the estimated F40% value. Anticipated 1998 recreational catch is 55 mt.

o/ The canary rockfish ABC is based on the F40% level; the landed catch harvest guideline reflects a 16% discard adjustment.

p/ Chilipepper rockfish - the ABC has been reduced to approximate the F40% level.

q/ Yellowtail rockfish - the GMT's final ABC (4,657 mt) applies to the Vancouver area (including the Canadian portion) and the Columbia area. Approximately 76% of the survey biomass estimate in the assessment area is in U.S. waters, so 3,539 mt is the U.S. portion of the ABC. 74 mt is transferred to the Eureka area, leaving 3,465 mt as the upper end of the total catch harvest guideline range. The lower end of the harvest guideline range is 90% (3,118 mt) of the U.S. ABC. The landed catch harvest guideline range reflects a 16% discard reduction factor.

r/ Remaining rockfish includes all rockfish species below in the table except the "Other rockfish" category.

s/ Pacific ocean perch - the ABC (20 mt) for the Eureka, Monterey and Conception area is based on the 1996 Sebastes complex assessment .

t/ Other rockfish includes offshore Sebastes species not identified above in this table. It is based on the 1996 Sebastes complex assessment of commercial landings and includes an estimate of recreation landings.

u/ Dover sole - the 1997 assessment evaluates the resource north of the Conception area as a unit. The ABC is for landed catch based on the F35% harvest rate. The Conception area ABC is inflated to reflect 5% assumed discard. The coastwide total catch harvest guideline (9,452 mt) and the landed catch harvest guideline would be 8,955 mt. The Council may wish to establish a separate harvest guideline for the Conception area in conjunction with sablefish and thornyheads.

v/ Includes sharks, skates, rays, ratfish, morids, grenadiers, and other groundfish species noted above in c/.

TABLE 34. Open access and limited entry allocations for 1998 (in thousands of mt).

Species	1998 ABC	1998 Landed Catch Harvest Guideline	Tribes	1998 Allocations			
				Limited Entry		Open Access	
				1,000 mt	Percent	1,000 mt	Percent
Roundfish							
Lingcod	0.96	0.838[a/]		0.324	80.9	0.076	19.1
Sablefish	5.2	4.68	0.468	3.934[b/]	93.4	0.278	6.6
Rockfish							
Widow	5.75	4.276		4.118	96.3	0.158	3.7
Shortspine thornyhead	1.0	1.082[c/]		1.082	>99.0	0.004	<1.0
Sebastes Complex							
Northern area	7.057[d/]			6.127	90.4	.651	9.6
Southern area	8.999	8.439[e/]		5.6	67.4	2.738	32.6
Bocaccio	.230	.230[f/]		.128	67.4	0.062	32.6
Canary	1.045	.878		.801	91.2	.077	8.8
Yellowtail	3.465	2.911		2.631	90.4	0.279	9.6

a/ The open access and limited entry allocations for lingcod are applied only to the commercial portion of the harvest guideline, which is 400 mt in 1998 (438 mt is deducted for anticipated recreational harvest).

b/ The limited entry sablefish allocation is further allocated 58% (2,282 mt) to the trawl fishery and 42 percent (1,652 mt) to the nontrawl fishery.

c/ The shortspine harvest guideline of 1,082 mt applies north of the Conception area. There is a separate ABC of 113 mt for the portion of the Conception area north of Pt. Conception.

d/ Within the Sebastes complex north, harvest guidelines for commercial harvest of black rockfish by the Makah, Quileute, Hoh, and Quinault Indian tribes remain at 20,000 pounds north of Cape Alava (48°09"30"N) and 10,000 pounds between Destruction Island (47°40"00"N) and Leadbetter Point (46°38"10"N).

e/ The Sebastes south harvest guideline includes the bocaccio harvest guideline. The open access and limited entry allocations are applied only to the commercial portion of the bocaccio harvest guideline. Therefore, 40 mt of anticipated recreational catch is deducted prior to calculating the allocations.

f/ The open access and limited entry allocations for bocaccio are applied only to the commercial portion of the harvest guideline, which is 190 mt in 1998 (40 mt is deducted for anticipated recreational harvest).

TABLE 35. Final Council recommendations for 1999 ABCs and Optimum Yields (harvest guidelines) for the Washington, Oregon, and California region by management area (metric tons), **except for whiting**. Page 1 of 3

ROUNDFISH	**Final ABC Recommendation**						**Final OY**	Expected Landed Catch a/
	Vancouver b/	Columbia	Eureka	Monterey	Conception	U.S. Total	Total Catch	
Lingcod c/	450		139	325	46	960 c/	730 c/	666
Pacific cod	3,200		d/			3,200	NA d/	
Whiting e/	**178,000 - 232,000** e/					**178,000 - 232,000** e/	**178,000 - 232,000**	
Sablefish f/	9,692 f/					9,692 f/	7,919 f/	7,128
Conception area					472	472	472	425
(Jack mackerel) g/	(52,600)					(52,600)	(52,600)	

ROCKFISH OTHER THAN SEBASTES COMPLEX						**Final OY**		
	Vancouver	Columbia	Eureka	Monterey	Conception	Total for areas noted	Total Catch	Expected Landed Catch
POP	695 h/					695 h/	595 h/	500 h/
Shortbelly			23,500			23,500	23,500	
Widow			5,750 i/			5,750 i/	5,023 i/	3,962 i/
Chilipepper	c/			3,724 j/		3,724 j/	3,724 j/	3,724 j/
Splitnose k/				868		868	868 k/	729 k/
Thornyheads								
Shortspine l/	1,261 l/					1,261 l/	1,150 l/	805 l/
Conception area					175	175	175	123
Longspine m/	4,102 m/					4,102 m/	4,102	3,733
Conception area					429	429	429	390

SEBASTES COMPLEX						**Final OY**		
	Vancouver b/	Columbia	Eureka	Monterey	Conception	Total for areas noted	Total Catch	Expected Landed Catch
Sebastes-N n/	8,647					8,647 n/	6,617 n/	5,421 n/
Sebastes-S o/				4,731		4,731 o/	2,705 p/	2,705
bocaccio q/	420			230 q/		230 q/	230 q/	230 q/
canary r/	1,045					1,045 r/	857 r/	689 r/
yellowtail s/	3,465					3,465 s/	3,435 s/	2,407 s/
remaining rockfish	1,871 t/			1,766 t/				
bank	c/			81		81	NA	
blackgill u/	c/				365	365 u/		
bocaccio	0					0	NA	
canary				85		85	NA	
darkblotched	209			47		260	NA	
POP				20 v/		20	NA	
redstripe	768			d/		770	NA	
sharpchin	398			71		470	NA	
silvergrey	51			d/		51	NA	
splitnose	274					274	NA	
yelloweye	39			d/		39	NA	
yellowmouth	132			d/		130	NA	
yellowtail			74 o/		155	229	NA	
Other rockfish w/	1,842 w/			3,603 w/			NA	

TABLE 35. Final Council recommendations for 1999 ABCs and Optimum Yields (harvest guidelines) for the Washington, Oregon, and California region by management area (metric tons), **except for whiting**.. Page 2 of 3

FLATFISH	**Final ABC Recommendation**						**Final OY**	
	Vancouver	Columbia	Eureka	Monterey	Conception	Coastwide ABC	Total Catch	Expected Landed Catch
Dover sole x/	8,373				1,053	9,426	9,426 x/	8,955
English sole	2,000		1,100			3,100	NA	
Petrale sole	1,200		500	800	200	2,700	NA	
Arrowtooth flounder	5,800					5,800	NA	
Other flatfish	700	3,000	1,700	1,800	500	7,700	NA	
OTHER FISH y/	2,500	7,000	1,200	2,000	2,000	14,700	NA	

a/ In this table, expected landed catch usually refers to the target for the commercial fishery. However, in some cases (such as lingcod and chilipepper) it applies to the total expected catch by all sectors.

b/ ABC applies to the U.S. portion of the Vancouver area, except as noted.

c/ Lingcod - the 1997 assessment addressed the entire Vancouver area, including Canada, and the Columbia area. The GMT's final 1999 ABC recommendation of 960 mt is the F35% level and applies only to the U.S. portion of the stock (44% of the Vancouver area total) and is equivalent to the 1998 value. The Council applied the 60% reduction observed in the northern areas to the southern area ABCs based on scientific advice that stock conditions were at least as bad in the southern region. Under the default harvest policy adopted in September 1998, OY would be zero for this overfished stock (current egg production potential is estimated to be 8.8% of pristine); however, the Council chose a final total catch OY of 730 mt to address unavoidable bycatch, rebuilding needs, and competing use by several fishing sectors. The recreational sector is expected to take 310 mt. The expected landed catch of 666 mt for all fisheries reflects 64 mt of anticipated discard in the limited entry fishery.

d/ These species are neither common nor important in the areas footnoted. Accordingly, for convenience, Pacific cod is included in a non-numerical OY for the "other fish" category for the areas footnoted, and rockfish species are included in the "other rockfish" category for the areas footnoted only.

e/ The preliminary whiting ABC and OY **(178,000 to 232,000 mt)** are ranges based on the amount projected in the assessment for 1999 (222,000 mt) up to the current level (290,000 mt) times 80%, and would apply to U.S. waters. The new stock assessment is expected in early 1999 and the Council delayed its final whiting ABC and OY decisions until the March 1999 meeting. Action on the Treaty Tribes' allocation for 1999 was also delayed until that time. Any tribal allocation will be subtracted and the remainder will be allocated 42% to the shore-based sector, 34% to the factory trawler fishery, and 24% to the mothership processor sector.

f/ Sablefish - the 9,692 mt final Council ABC and 7,919 mt final OY apply north of 36°N latitude. The stock is estimated to be at 37% of its pristine level, but there is substantial uncertainty in the biomass estimate. The ABC is based on F35%, while the total catch OY is based on F40%. The 7,128 mt landed catch OY for the northern area is the total catch OY (7,919 mt) reduced by 10% (791 mt) for anticipated discard. Ten percent (713 mt) of the northern harvest guideline is set aside for the treaty tribes; the remainder (6,415 mt) is divided between the limited entry (5,992 mt) and open access (423 mt) fisheries. The limited entry portion will be allocated 58% (3,475 mt) to the trawl fishery and 42% (2,516 mt) to the nontrawl fishery. The ABC and OY for the Conception area (south of 36°N latitude), which are based on historical landings, remain the same as 1998. There are no limited entry and open access allocations for the Conception area at this time.

g/ Jack mackerel - the Council has taken action to transfer management of this species to the Coastal Pelagic Species FMP.

h/ Pacific ocean perch - the 695 mt final ABC for the combined Vancouver and Columbia areas is based on the 1998 stock assessment and application of the F40% harvest rate. The Council deviated from the default OY policy and set OY near the expected 1998 harvest level because incidental capture of this species is considered unavoidable under current management of other groundfish species. The landed catch OY is 500 mt.

i/ Widow rockfish - the 5,750 mt ABC, based on the F40% harvest rate, is unchanged from 1998. The stock is estimated to be at 29% of its pristine reproductive potential. The total catch OY (5,023 mt) will be reduced to account for an expected recreational catch of 42 mt and an assumed limited entry fishery discard rate of 16%. The commercial landed catch equivalent will also be reduced to account for anticipated bycatch in the at-sea fisheries for Pacific whiting.

j/ Chilipepper rockfish - the ABC (3,724 mt) is based on the 1998 assessment and application of the F40% harvest rate. The stock is estimated to be above the 40% precautionary threshold. The Council recommended removal of this species from the southern Sebastes complex and establishment of a separate ABC and OY. In accordance with the default harvest policy, OY is equal to the ABC. An open access allocation will be established for 1999.

k/ Splitnose rockfish (often called "rosefish") has been removed from the southern Sebastes complex, and a separate OY (868 mt) has been established. The landed catch OY (729 mt) reflects a 16% assumed discard.

l/ Shortspine thornyhead - the Council's final ABC recommendation (1,261 mt) is calculated based on a synthesis of two stock assessments prepared in 1998 and application of the F35% harvest rate. The assessment addressed the area north of 36°N latitude, which is the northern boundary of the Conception area. Therefore this ABC and OY apply only to that area. The GMT estimates the current stock size is 32% of the pristine (unfished) abundance. The final OY, which is based on the F35% harvest rate and application of the default harvest policy, is 1,150 mt. The landed catch equivalent (805 mt) reflects a 30% reduction for discard. A separate ABC and OY (based on historical catch) are established for the part of the Conception area north of Point Conception. There is no ABC or OY for the southern Conception area.

m/ Longspine thornyhead - the final ABC (4,102 mt) north of the Conception area is the same as in 1998, based on the average of the 3 year individual ABCs. The stock is estimated to be above the 40% precautionary threshold so the preliminary total catch OY is also 4,102 mt. The landed catch equivalent (3,733 mt) represents a 5% reduction to account for market discard. The ABC and OY for the Conception area apply north of Point Conception. The southern Conception area has neither an ABC or OY.

n/ Sebastes complex (north) includes all rockfish species listed below in the U.S. Vancouver and Columbia areas combined, including other rockfish and bocaccio in the north (420 mt). The total catch OY is the sum of 75% of the "remaining rockfish" total plus 50% of the "other rockfish" total, plus the final OYs for canary and yellowtail, and zero for bocaccio. The reduction in the contribution of remaining and other rockfish is intended to address uncertainty in stock status due to limited information. The expected commercial landed catch target reflects expected recreational harvest of 818 mt and a 16% discard adjustment for the limited entry fishery.

o/ Sebastes complex (south) includes all rockfish listed below in the Eureka, Monterey and Conception areas combined, except chilipepper and splitnose. The final ABC is the sum of all those individual species ABCs in the three areas.

p/ Sebastes South OY - the total catch OY is the sum of the final OY for bocaccio rockfish plus 75% of the "remaining rockfish" (except splitnose) ABC plus 50% of the "other rockfish" ABC. The recommendation to reduce the amounts contributed to OY by the other species is based on the extremely limited information on most rockfish species.

q/ For bocaccio in the south, the final ABC (230 mt) is based on the estimated F40% value. This stock in this area is estimated to be at only 7% of its unfished level and is considered to be overfished. Under the default harvest policy adopted in September 1998, OY would be zero; however, the Council chose a final OY of 230 mt to account for unavoidable bycatch expected to occur in the commercial and recreational fisheries under existing management of other rockfish species. The recreational sector in California is expected to take 80 mt.

r/ The canary rockfish final ABC is based on the F40% level; the GMT revised its estimate of stock size relative to pristine from 30% to 26%. This reduced the total catch OY recommendation to 857 mt; after subtracting expected recreational harvest (32 mt) the landed catch target for commercial fishers would be 689 mt, reflecting a 16% discard adjustment for the limited entry sector.

s/ Yellowtail rockfish - the final ABC recommendation (3,465 mt) applies to the Columbia area and the U.S. portion of the Vancouver area; it reflects a transfer of 74 mt to the Eureka area. The stock is estimated to be at 39% of its pristine level. The Council based its final OY recommendation (3,435 mt) on the F40% yield and the default OY policy. The landed catch equivalent for commercial fishers reflects a 16% discard reduction factor for the limited entry fishery and 600 mt of anticipated discard in the at-sea fisheries for Pacific whiting.

t/ Remaining rockfish includes all rockfish species below in the table except the "Other rockfish" category.

u/ Blackgill rockfish - the 1998 stock assessment estimates the Conception area stock to be at about 51% of pristine levels. The 365 mt ABC is based on F40%. This stock was previously included in the "other rockfish" category; the ABC for that group was reduced by 365 mt and the ABC for "remaining rockfish" increased by that amount. The GMT will monitor landings, and if they reach 300 mt, the GMT will alert the Council to the possible need for management action or a stock assessment.

v/ Pacific ocean perch - the ABC (20 mt) for the Eureka, Monterey and Conception area is based on the 1996 Sebastes complex assessment .

w/ Other rockfish includes offshore Sebastes species not identified above in this table. The final ABC recommendation is based on the 1996 Sebastes complex assessment of commercial landings and includes an estimate of recreational landings which has been revised from the 1998 estimate.

x/ Dover sole - The 1997 assessment evaluated the resource north of 36° N. lat. as a unit, and provided an ABC for landed catch based on the F35% harvest rate. The Conception area ABC is at the level established in the original FMP. The ABCs represent total catch, and were converted by estimating that 5% of the total catch is discarded. Therefore, the coastwide ABC and OY of 9,426 mt are for total catch, with a landed catch equivalent of 8,955 mt.

y/ Includes sharks, skates, rays, ratfish, morids, grenadiers, and other groundfish species noted above in d/.

TABLE 36. Expected Limited Entry and Open Access Allocations in 1999.

All Amounts in Metric Tons	OY	Tribal	Rec	Open Access			Limited Entry					Total	Commercial
ROUNDFISH				Percent	Total Catch	Landed Catch	Total Catch	At-Sea Bycatch	Landed	Trawl	Fixed Gear	Commercial Catch	Landed Catch
Lingcod	730	1	310	19.1%	80	80	339		275			419	355
Sablefish	7,919	713		6.6%	423	423	5,991		5,991	3,475	2,516	6,414	6,414
Pacific Ocean Perch	595						595		500			595	500
Widow	5,023		42	3.7%	184	184	4,797	300	3,777			4,981	3,962
Chilipepper	3,724		73	32.6%	1,190	1,190	2,461		2,461			3,651	3,651
Splitnose	868						868		729			868	729
Thornyheads													
Shortspine	1,150			0.25%	3	3	1,147		803			1,150	806
Longspine	4,102						4,102		3,733			4,102	3,733
Sebastes-North	6,617	14	818	9.6%	555	555	5,229	600	4,033			5,784	4,588
Yellowtail	3,435		32	9.6%	327	327	3,077	600	2,080			3,404	2,407
Canary	857		50	8.8%	71	71	736		618			807	689
Sebastes-South	2,705		1,309	32.6%	455	455	941		941			1,396	1,396
Bocaccio	230		80	32.6%	49	49	101					150	150

The open access and limited entry shares (except for sablefish) are calculated as follows. Subtract any expected tribal and recreational catch from the optimum yield (OY), and then multiply by the open access percent share to get the open access allocation. If discard is anticipated in the open access fishery, an appropriate amount is subtracted from the open access share, and the remainder is the open access landed catch. After subtracting the open access allocation from OY, any expected bycatch in the at-sea whiting fishery is subtracted. Next, the assumed discard rate in the limited entry fisheries is applied to the remaining limited entry allocation. The total commercial landed catch is the sum of the open access landed catch plus the limited entry landed catch.

For sablefish, an assumed discard rate of ten percent is applied to the OY, which leaves 7,127 mt, followed by deducting ten percent for tribal fisheries. Next, the open access percent is applied to get the open access allocation (423 mt). The remainder is allocated 42% (2,516 mt) to fixed gear fishers and 58% (3,475 mt) to the trawl sector.

TABLE 37. Comparisons of ABC (mt), domestic shore-based landings (mt), stock condition, and abundance trends for major Pacific coast groundfish stocks coastwide, 1995-1998.

Species	Assessment Year	Assessment Status	1996 ABC	1996 Landings	1997 ABC	1997 Landings	1998 ABC	1999 Proposed ABC	% of Virgin Biomass	Abundance Trend
Flatfish										
Arrowtooth flounder	1993		5,800	2,192	5,800	4,696	5,800	5,800	Unknown	Stable
Dover sole	1997		10,880-12,830	12,128	10,880-12,830	10,094	9,426	9,426	Above $B_{40\%}$	Increasing
English sole	1993		3,100	1,157	3,100	1,502	3,100	3,100	Above $B_{35\%}$	Unknown
Petrale sole	1993	Expected 1999	2,700	1,827	2,700	1,942	2,700	2,700	Above $B_{40\%}$	Unknown
Other flatfish[a/]			7,700	2,002	7,700	2,308	7,700	7,700	Unknown	Unknown
Rockfish										
Bocaccio [i/]	1996	Expected 1999	1,700	598	270	457 [j/]	230	230	7%	Declining
Canary rockfish	1996	Expected 1999	1,250	1,140	1,220	1,104	1,045	1,045	26%	Declining
Chilipepper	1998		4,000	1,737	4,000	1,850	3,400	3,724	Above $B_{40\%}$	Unknown
Yellowtail rockfish[c/]	1997		6,740	5,216	825-1,877	2,082	4,657	3,465	39%	Stable
Remaining Rockfish[b/]	1996		11,500	4,945	11,200	4,575	9,510	9,082	Unknown	Unknown/Declining
North	1996		4,500		2,582		2,295	1,871	Unknown	Unknown
North - Unspecified					1,842		1,842	1,842	Unknown	Unknown
South	1996		7,000		2,802		1,401	1,766	Unknown	Unknown
South - Unspecified					3,968		3,968	3,603	Unknown	Unknown
Unspecified rockfish	1996			1,120		980			N/A	
Other Rockfish										
Pacific Ocean perch	1998		0	798	0	646	0	695	13%	Stable
Shortbelly rockfish	1989		23,500	35	23,500	50	23,500	23,500	Above $B_{40\%}$	Unknown
Widow rockfish [i/]	1997		7,700	6,072	7,700	6,454	5,750	5,750	29%	Stable
Thornyheads	1997			6,518		5,462				
Shortspine[e/]	1998		1,000		1,000		1,000	1,436	34%	Declining
Longspine[e/]	1997		7,000		7,000		4,611	4,531	Above $B_{40\%}$	Declining
Black rockfish	1994	in progress							Above $B_{40\%}$	Unknown
Blackgill rockfish [k/]	1998			259		153		365	Above $B_{40\%}$	Declining
Other Species										
Jack mackerel[f/]			52,600	N/A	52,600	521	52,600	52,600	Above $B_{40\%}$	Unknown
Lingcod	1997	Expected 1999	2,400	1,554	2,400	1,562	1532[l/]	1,532[l/]	9%	Declining
Pacific cod[d/]			3,200	445	3,200	595	3,200	3,200	Unknown	Unknown
Pacific whiting[g/]	1997	Annual	265,000	212,000	290,000	91,530	290,000	[m/]	Near $B_{40\%}$	Unknown
Sablefish[i/]	1998		8,700	8,294	8,700	7,844	3,000	9,692	37%	Declining
Others[h/]				1,881		2,939	14,700	14,700	Unknown	Unknown

Data Source: PacFIN data extracted September 12, 1994, March 15, 1995, and September 23, 1997, and July 15th, 1998.

a/ Other flatfish consists of all flatfish except arrowtooth flounder, Dover sole, English sole, and petrale sole.
b/ Landing estimates do not include substantial landings of this species which are included under "Unspecified rockfish".
c/ The 1996 ABC is for Eureka, Columbia, and Vancouver areas; 1997 excludes Eureka; 1998 and 1999 exclude Eureka and include Canada.
d/ ABC based upon historical landings.
e/ 1996, and 1997 ABCs are coastwide north of Pt. Conception; 1998 and 1999 are coastwide.
f/ In 1998, the Council moved jack mackerel to the Coastal Pelagic Species Fishery Management Plan
g/ ABC and MSY include Canada.
h/ Includes sharks, skates, rays, morids, and grenadiers.
i/ ABC prior to 1995 did not include discard.
j/ Bocaccio landings are coastwide; the ABC only applies in Eureka, Monterey, and Conception.
k/ Blackgill landings and ABC apply to Conception area only.
l/ Lingcod ABC is coastwide. The U.S. portion is 960 mt.
m/ The whiting ABC and OY will be set in March 1999.

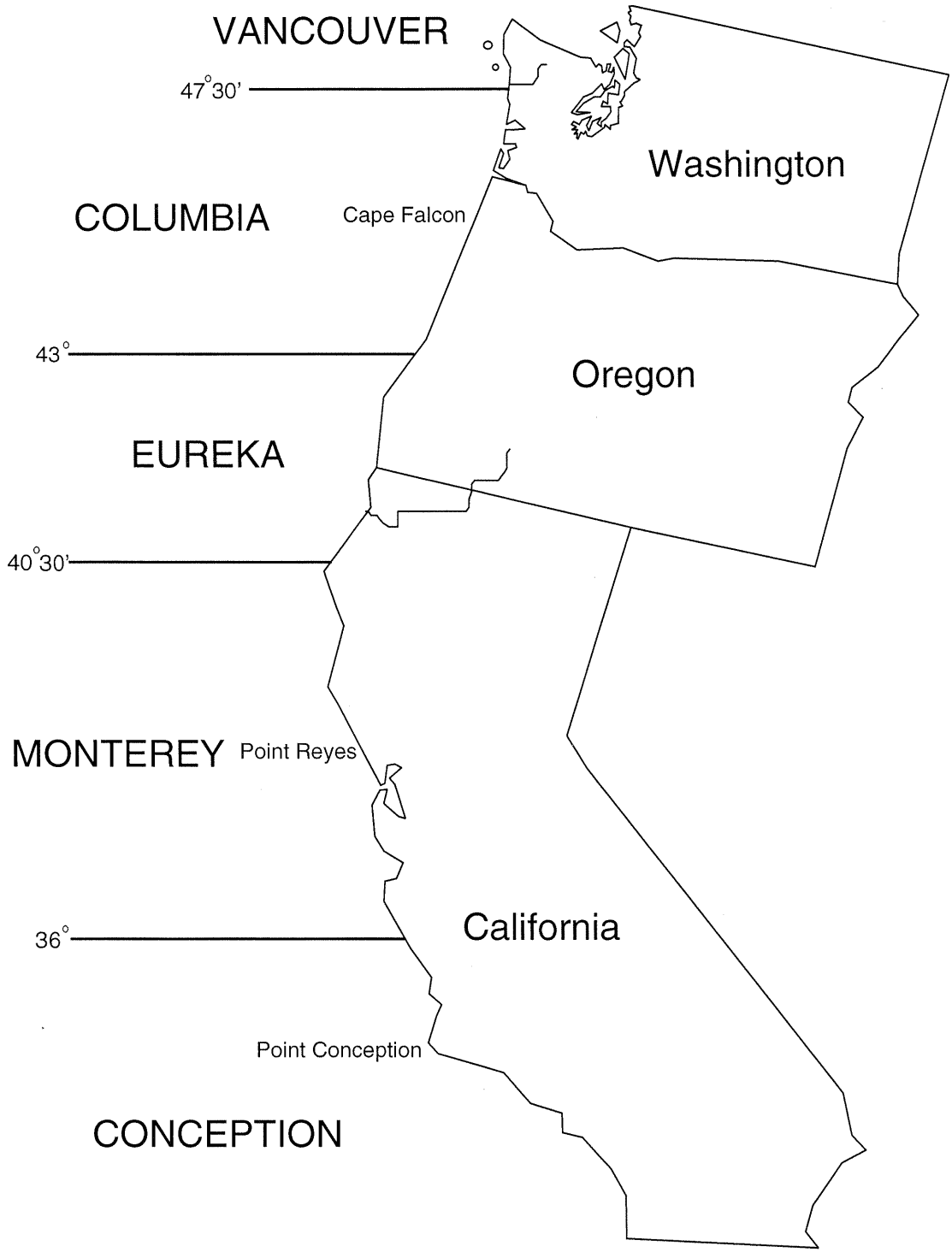

FIGURE 1. Management statistical areas in the U.S. exclusive economic zone seaward of Washington, Oregon, and California.

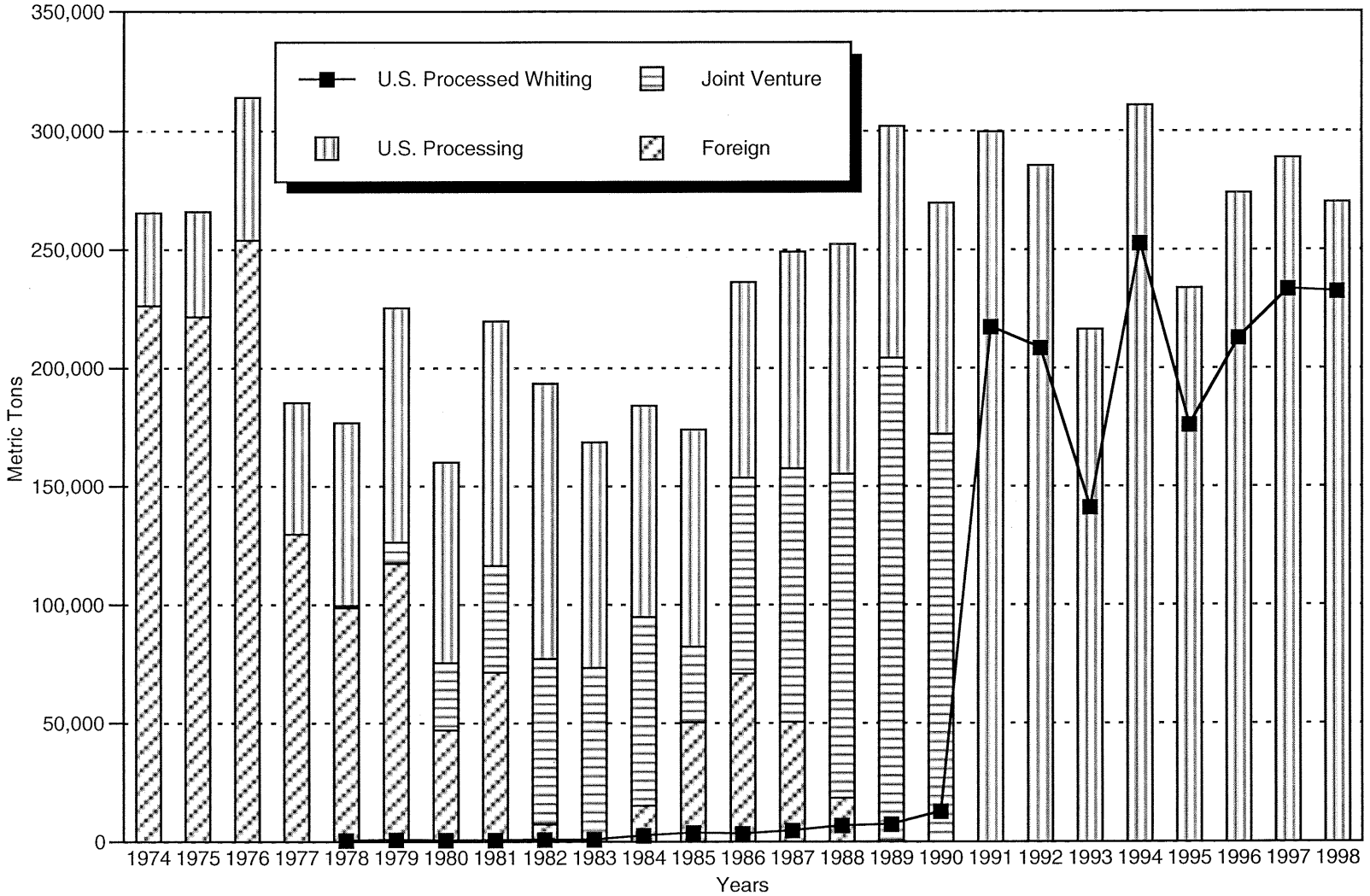

FIGURE 2. Catch of all Pacific coast groundfish in thousands of metric tons, includes discards from foreign, joint venture and U.S. at-sea processors. Source NMFS, NWR, December 1998.

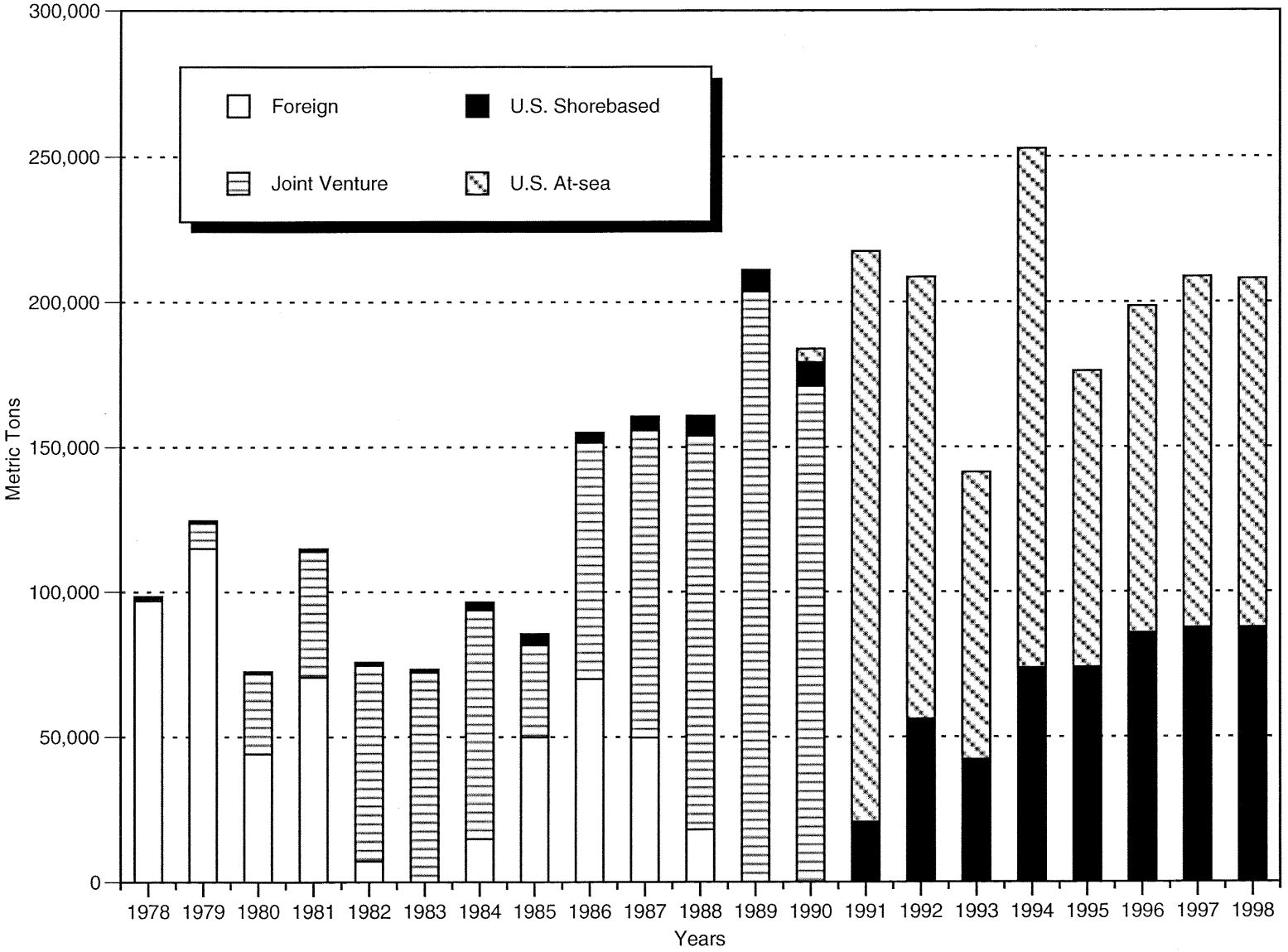

FIGURE 3. Catch of Pacific whiting. Includes discards by foreign, joint venture and U.S. at-sea processors. Source: NMFS, NWR, December 1998. 1995, 1996, 1997, and 1998 U.S. Shorebased and U.S. at-sea are preliminary.

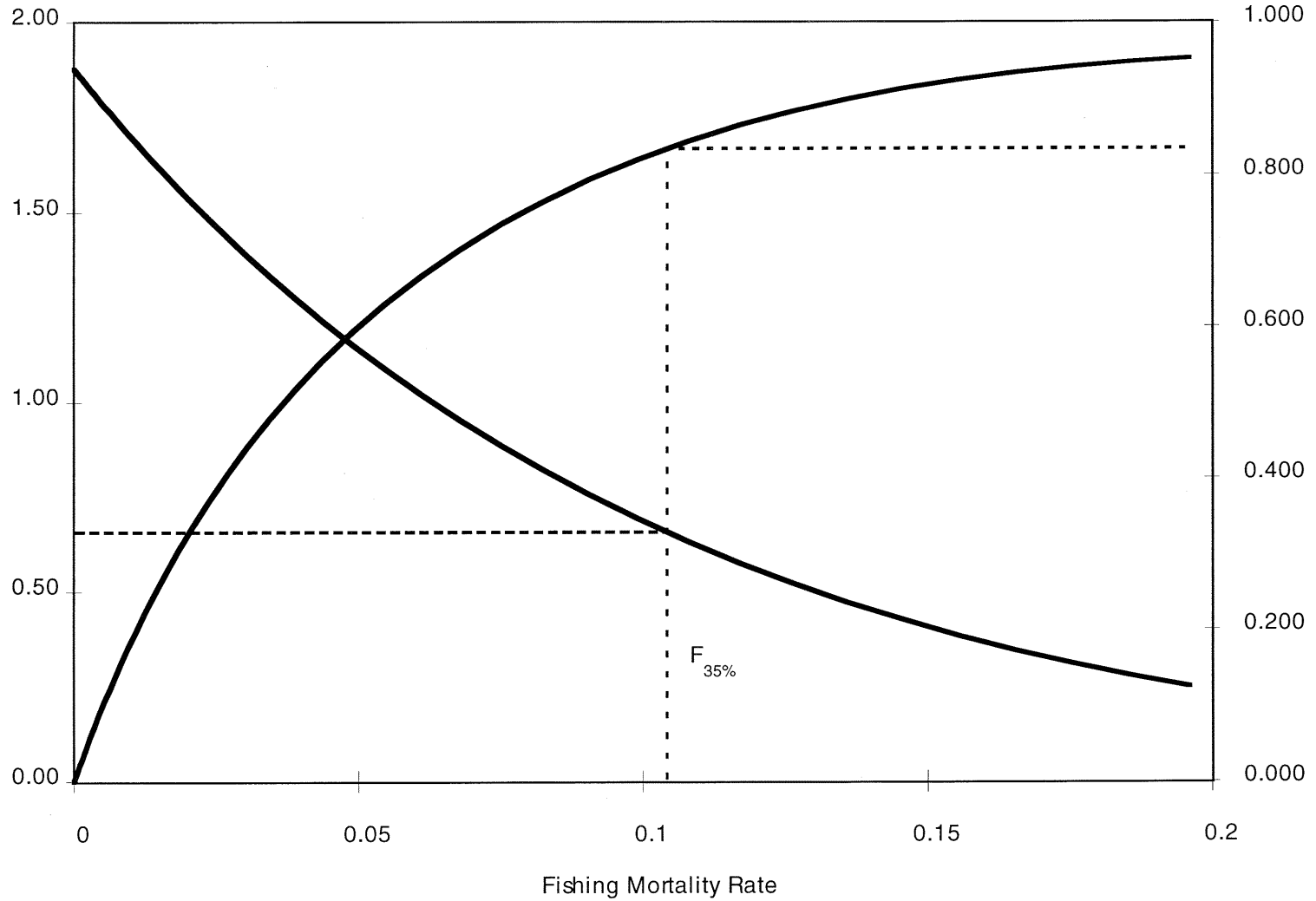

FIGURE 4. Expected relative yield per recruit and spawning biomass per recruit as a function of the rate of fishing mortality. Spawning biomass per recruit is equivalent to the expected lifetime egg production by a female entering the population. The level of fishing mortality indicated by $F_{35\%}$ will reduce spawning biomass per recruit to 35% of its unfished level.

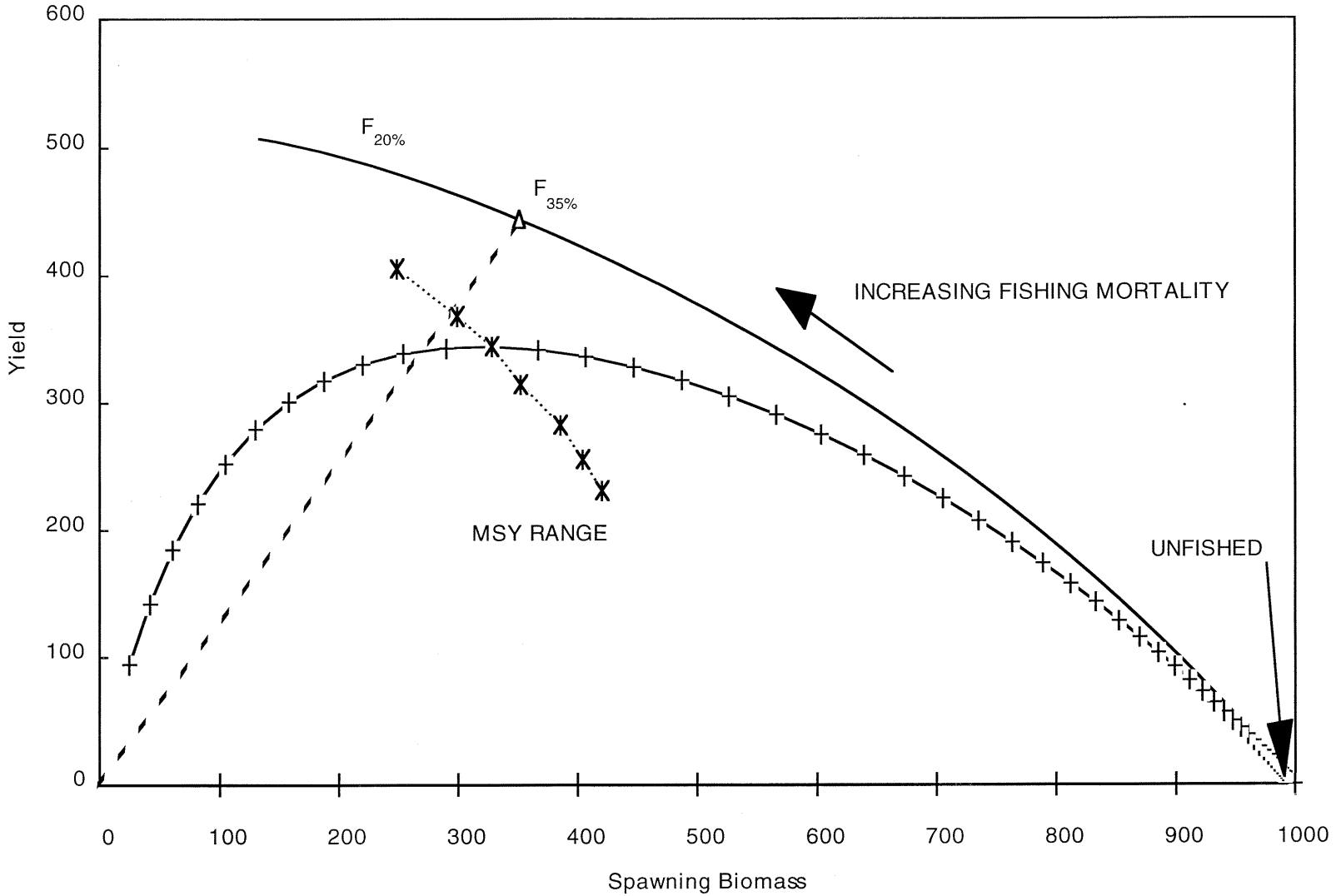

FIGURE 5. Relationship between equilibrium yield and female spawning biomass is displayed by the two curves, with tic marks indicating levels of fishing mortality at which these curves were evaluated.

ECONOMIC STATUS OF THE WASHINGTON, OREGON, AND CALIFORNIA GROUNDFISH FISHERIES

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December 1998

TABLE EC-1. Quantity and ex-vessel value of groundfish landings in Washington, Oregon, and California, including fish delivered to domestic floating processors in waters off these states, 1981 - 1997.[1] The WOC landings totals may not equal the sum of the line items due to rounding.

	Shoreside		Domestic At Sea Processors		Total	
Year	Landings (mt)	Real[2] Exvessel Revenues (1997 $)	Landings (mt)	Real Exvessel Revenues (1997 $)	Landings (mt)	Real Exvessel Revenues (1997 $)
1981	102,796	$76,189,014	0	$0	$102,796	$76,189,014
1982	118,910	$95,075,519	0	$0	118,910	$95,075,519
1983	98,657	$79,654,773	0	$0	98,657	$79,654,773
1984	89,693	$71,356,327	0	$0	89,693	$71,356,327
1985	90,868	$79,275,719	0	$0	90,868	$79,275,719
1986	82,517	$78,045,849	0	$0	82,517	$78,045,849
1987	100,667	$105,223,232	0	$0	100,667	$105,223,232
1988	98,224	$94,028,135	0	$0	98,224	$94,028,135
1989	104,604	$90,508,324	0	$0	104,604	$90,508,324
1990	97,251	$79,889,773	4,735	$939,518	101,987	$80,829,291
1991	108,667	$87,121,204	184,150	$24,858,915	292,817	$111,980,119
1992	139,792	$86,650,856	142,866	$19,489,813	282,658	$106,140,669
1993	122,079	$74,913,822	95,826	$8,016,092	217,906	$82,929,914
1994	135,512	$71,746,441	175,204	$14,950,661	310,717	$86,697,102
1995	134,039	$89,566,810	99,803	$10,337,808	233,841	$100,295,128
1996	144,961	$83,000,203	106,226	$11,834,970	251,187	$94,835,174
1997	140,884	$79,290,428	143,057	$19,258,255	283,937	$98,548,683

Source: PacFIN data extracted October, 1998.

[1] Does not include landings of fish caught in Puget Sound, Alaska, Canada, Mexico, or other waters not in the exclusive economic zone (EEZ) off Washington, Oregon, or California.

[2] Real values are current values adjusted to eliminate the effects of inflation. This adjustment has been made by dividing current values by the current year GDP implicit price deflator, with a base year of 1997. The GDP deflator is 0.9817 for 1996.

TABLE EC-2. Average annual real [1] ex-vessel prices ($/lb, 1997) paid for certain commercially important species, 1981 - 1997.[2]

Year	Arrowtooth Flounder	Dover Sole	English Sole	Lingcod	Pacific Whiting	Petrale Sole	Sablefish	Thornyheads	Widow Rockfish	All Rockfish
1981	$0.16	$0.37	$0.50	$0.39	$0.13	$0.87	$0.36	$0.38	$0.23	$0.29
1982	$0.17	$0.37	$0.50	$0.40	$0.13	$0.96	$0.41	$0.36	$0.25	$0.31
1983	$0.15	$0.34	$0.49	$0.38	$0.13	$1.04	$0.36	$0.35	$0.30	$0.34
1984	$0.14	$0.34	$0.47	$0.36	$0.10	$1.04	$0.32	$0.36	$0.33	$0.37
1985	$0.14	$0.34	$0.47	$0.37	$0.10	$1.04	$0.47	$0.36	$0.36	$0.40
1986	$0.14	$0.36	$0.50	$0.44	$0.08	$1.07	$0.52	$0.39	$0.39	$0.44
1987	$0.20	$0.41	$0.54	$0.51	$0.08	$1.09	$0.64	$0.44	$0.44	$0.47
1988	$0.15	$0.39	$0.51	$0.47	$0.10	$1.06	$0.68	$0.46	$0.38	$0.42
1989	$0.12	$0.34	$0.45	$0.44	$0.08	$1.02	$0.58	$0.46	$0.33	$0.40
1990	$0.13	$0.32	$0.39	$0.42	$0.08	$0.98	$0.57	$0.46	$0.32	$0.41
1991	$0.13	$0.35	$0.39	$0.40	$0.06	$0.95	$0.78	$0.52	$0.33	$0.42
1992	$0.12	$0.31	$0.37	$0.44	$0.06	$0.90	$0.74	$0.52	$0.32	$0.44
1993	$0.11	$0.30	$0.35	$0.41	$0.04	$0.85	$0.61	$0.42	$0.31	$0.42
1994	$0.10	$0.31	$0.36	$0.44	$0.04	$0.89	$0.88	$0.77	$0.34	$0.51
1995	$0.12	$0.34	$0.38	$0.48	$0.05	$0.99	$1.40	$1.05	$0.35	$0.60
1996	$0.10	$0.32	$0.37	$0.48	$0.04	$0.93	$1.43	$0.89	$0.32	$0.53
1997	$0.10	$0.29	$0.33	$0.48	$0.04	$0.90	$1.59	$0.78	$0.32	$0.50

1 Real values are current values adjusted to eliminate the effects of inflation. This adjustment has been made by dividing current values by the current year GDP implicit price deflator, with a base year of 1997.

2 This report includes only data for PFMC Areas: Vancouver, Columbia, Eureka, Monterey, and Conception.

TABLE EC-3. Washington, Oregon, and California shoreside commercial groundfish landings[1] (metric tons) and real[2] exvessel value (thousands of 1997 dollars), 1981 - 1997.

	California		Oregon		Washington	
Year	mt	$	mt	$	mt	$
1981	42,394	$35,918	37,502	$24,880	23,080	$15,386
1982	52,672	$44,429	41,023	$32,514	25,216	$18,128
1983	40,583	$34,465	35,158	$27,998	22,916	$17,188
1984	40,593	$33,715	28,209	$22,392	20,891	$15,254
1985	42,734	$37,368	29,023	$24,265	19,112	$17,647
1986	41,629	$39,909	24,931	$23,280	15,957	$14,852
1987	50,017	$50,419	30,530	$32,484	20,120	$22,325
1988	45,757	$42,691	32,114	$30,994	20,353	$20,340
1989	47,727	$42,235	36,832	$31,363	20,044	$16,913
1990	43,415	$38,486	35,505	$27,695	18,331	$13,707
1991	41,965	$36,863	49,751	$34,124	16,951	$16,136
1992	42,140	$39,273	81,915	$34,637	15,737	$12,742
1993	33,869	$31,534	71,191	$31,512	17,019	$11,871
1994	24,736	$26,082	94,097	$34,636	16,682	$11,026
1995	28,489	$35,526	91,645	$39,187	13,905	$14,854
1996	27,455	$34,324	95,816	$34,689	21,189	$13,986
1997	29,007	$31,300	95,879	$33,775	15,994	$14,216

Source: PacFIN data extracted September, 1998.

1 This report includes only data for PFMC Areas: Vancouver, Columbia, Eureka, Monterey, and Conception.

2 Real values are current values adjusted to eliminate the effects of inflation. This adjustment has been made by dividing current values by the current year GDP implicit price deflator, with a base year of 1997.

TABLE EC-4. Commercial shoreside landings[1] (mt) of individual groundfish species by state, 1996 - 1997.

	California			Oregon			Washington		
Species	1996	1997	% CHG	1996	1997	% CHG	1996	1997	% CHG
Arrowtooth Flounder	50	48	-4%	1,118	1,162	4%	1,023	1,134	11%
Dover Sole	6,401	5,301	-21%	4,688	3,965	-15%	1,063	827	-22%
English Sole	581	649	12%	390	551	41%	182	303	66%
Petrale Sole	818	828	1%	717	806	12%	290	308	6%
Other Flatfish	1,418	1,514	26%	521	711	36%	60	76	27%
Pacific Ocean Perch	14	14	0%	619	490	-21%	232	184	-21%
Thornyheads	3,313	2,769	-16%	2,786	2,326	-17%	430	365	-15%
Widow Rockfish	1,371	1,338	-2%	3,753	4,105	9%	953	1,000	5%
Unspecified Rockfish	481	435	-10%	255	278	9%	484	342	-29%
Other Rockfish	5,610	5,536	-1%	5,973	3,573	-40%	1,912	931	-51%
Lingcod	479	503	5%	717	767	7%	360	290	-19%
Pacific Cod	0	0	0%	84	52	-38%	361	542	50%
Pacific Whiting	2,901	6,332	118%	70,574	73,837	5%	11,653	7,241	-38%
Sablefish	3,195	2,897	-9%	3,175	2,924	-8%	1,947	2,036	5%
Other Groundfish	1,323	843	-36%	446	332	-26%	239	415	74%

Source: PacFIN data extracted September, 1998.

[1] Does not include landings of fish caught in Puget Sound, Alaska, Canada, Mexico, or other waters not in the EEZ off Washington, Oregon, or California.

TABLE EC-5. Shoreside landings and real exvessel value [1] (thousands of dollars) of individual groundfish species landed in Washington, Oregon, and California, 1996 - 1997.[2]

	1996		1997		% Change	
Species	mt	1997 $	mt	1997 $	mt	1997 $
Arrowtooth Flounder	2,192	$501	2,343	$502	7%	0%
Dover Sole	12,151	$8,441	10,092	$6,536	-17%	-23%
English Sole	1,153	$929	1,503	$1,076	30%	16%
Petrale Sole	1,828	$3,760	1,942	$3,851	6%	2%
Other Flatfish	1,997	$1,711	2,303	$1,791	15%	5%
Pacific Ocean Perch	866	$633	688	$479	-21%	-24%
Widow Rockfish	6,076	$4,248	6,444	$4,520	6%	6%
Thornyheads	6,529	$12,797	5,460	$9,421	-16%	-26%
Unspecified Rockfish	1,219	$1,368	1,055	$1,218	-13%	-11%
Other Rockfish	13,496	$13,573	10,039	$10,568	-26%	-22%
Lingcod	1,557	$1,635	1,560	$1,653	0%	1%
Pacific Cod	445	$395	595	$510	34%	29%
Pacific Whiting	85,127	$5,202	87,410	$8,119	3%	56%
Sablefish	8,317	$26,300	7,858	$27,573	-6%	5%
Other Groundfish	2,008	$1,506	1,588	$1,473	-21%	-2%

Source: PacFIN data extracted September, 1998.

1 Real values are current values adjusted to eliminate the effects of inflation. This adjustment has been made by dividing current values by the current year GDP implicit price deflator, with a base year of 1997.

2 Does not include landings of fish caught in Puget Sound, Alaska, Canada, Mexico, or other waters not in the EEZ off Washington, Oregon, or California.

TABLE EC-6. Percentage contribution of Pacific coast landings to the total ex-vessel value (thousands of dollars) of all Pacific coast commercial fish landings, 1981-97.[1]

	Fishery							
Year	Groundfish	Salmon	Tuna	Crab	Coastal Pelagics[2]	Shrimp	Other	Total Value
1981	12%	17%	45%	5%	7%	5%	9%	$428,941
1982	18%	23%	33%	5%	8%	4%	9%	$381,286
1983	20%	10%	37%	9%	9%	4%	11%	$296,021
1984	22%	17%	29%	9%	5%	3%	15%	$281,714
1985	24%	26%	10%	11%	7%	4%	18%	$270,464
1986	20%	26%	9%	8%	6%	10%	20%	$328,252
1987	19%	29%	8%	7%	5%	11%	21%	$454,543
1988	17%	34%	10%	10%	6%	7%	16%	$460,548
1989	21%	22%	7%	12%	6%	8%	23%	$377,977
1990	21%	21%	5%	14%	7%	8%	24%	$354,709
1991	35%	15%	3%	8%	8%	9%	22%	$308,169
1992	34%	10%	6%	14%	6%	10%	21%	$314,800
1993	28%	11%	7%	15%	6%	6%	27%	$312,725
1994	26%	10%	8%	17%	7%	7%	25%	$349,508
1995	28%	7%	6%	20%	10%	6%	23%	$369,232
1996	25%	5%	10%	21%	13%	6%	20%	$397,299
1997	24%	6%	9%	18%	13%	7%	23%	$361,758

Source: PacFIN data extracted September, 1998.

1 This value exceeds that reported for groundfish in Table 1, because they include fish caught in Puget Sound, outside the U.S. EEZ, and in waters off Alaska.

2 Coastal Pelagics include chub mackerel, jack mackerel, Pacific sardine, northern anchovy, market squid, herring and Pacific Bonito.

TABLE EC-7. Washington, Oregon, and California combined landings and real [1] ex-vessel value (thousands of 1997 dollars) of sablefish by gear, and percentages each gear contributed to the total sablefish landed catch and exvessel value, 1996 and 1997.

	1996				1997			
Gear	mt	% Tot mt	1997 $	% Tot $	mt	% Tot mt	1997 $	% Tot $
Hook and Line	3,356	40%	$12,489	47%	3,502	45%	$14,950	54%
Groundfish Trawl	4,134	50%	$10,466	41%	3,738	48%	$10,156	37%
Fish Pot	749	9%	$2,861	11%	579	7%	$2,369	9%
Other Net	68	1%	$155	<1%	27	<1%	$65	<1%
Other	10	<1%	$29	<1%	12	<1%	$33	<1%
Total	8,317		$26,300		7,858		$27,573	

Source: PacFIN data extraction September, 1998.

1 Real values are current values adjusted to eliminate the effects of inflation. This adjustment has been made by dividing current values by the current year GDP implicit price deflator, with a base year of 1997.

TABLE EC-8. Washington, Oregon, and California groundfish shoreside landings (metric tons) by gear group, 1981 - 1997.[1]

Year	Trawl	Fish Pot	Hook and Line	Gill/Set Net[2]	Other/Misc.
1981	90,571	2,029	4,689	1,631	4,056
1982	103,154	4,264	5,376	2,098	4,017
1983	83,662	2,965	3,374	2,315	6,341
1984	76,650	2,851	2,725	2,206	5,261
1985	74,906	2,796	5,393	3,916	3,853
1986	61,615	1,472	6,570	4,164	8,695
1987	80,768	1,711	7,748	6,140	4,300
1988	78,565	1,386	6,561	3,995	7,718
1989	88,228	1,078	6,842	4,325	4,130
1990	82,548	884	6,800	3,048	3,973
1991	94,708	711	8,545	2,269	2,435
1992	124,269	406	9,900	2,448	2,770
1993	109,703	652	7,982	1,748	1,993
1994	125,484	1,374	6,720	724	1,211
1995	124,735	1,108	6,563	768	864
1996	135,184	856	7,677	313	932
1997	132,185	651	7,324	283	437

Source: PacFIN data extraction September, 1998.

[1] Does not include landings of fish caught in Puget Sound, Alaska, Canada, Mexico, or other waters not in the EEZ off Washington, Oregon, or California.

[2] Includes gill net, set net, and trammel net, but not dip, seine, or miscellaneous nets.

TABLE EC-9. Real[1] ex-vessel value (thousands of 1997 dollars) of Washington, Oregon, and California groundfish shoreside landings by gear group, 1981 - 1997.[2]

Year	Trawl	Fish Pot	Hook and Line	Gill/Set Net[3]	Other/Misc.
1981	$61,941	$1,852	$6,859	$2,485	$3,046
1982	$74,514	$4,436	$8,161	$2,773	$5,187
1983	$63,546	$2,762	$4,374	$2,682	$6,288
1984	$57,252	$2,329	$3,731	$2,902	$5,145
1985	$58,332	$3,472	$8,395	$4,781	$4,298
1986	$51,533	$1,775	$10,281	$4,913	$9,540
1987	$76,073	$2,622	$13,866	$7,623	$5,041
1988	$68,172	$2,370	$12,325	$4,851	$6,306
1989	$68,753	$1,602	$11,219	$4,932	$4,008
1990	$60,051	$1,235	$11,269	$3,650	$3,681
1991	$63,703	$1,497	$17,188	$2,433	$2,297
1992	$63,627	$831	$16,876	$2,542	$2,776
1993	$57,341	$1,095	$12,983	$1,944	$1,554
1994	$54,086	$3,061	$12,472	$837	$1,301
1995	$66,330	$2,769	$17,535	$905	$1,259
1996	$58,321	$3,240	$20,104	$403	$930
1997	$53,423	$2,802	$22,213	$342	$511

Source: PacFIN data extraction September, 1998.

[1] Real values are current values adjusted to eliminate the effects of inflation. This adjustment has been made by dividing current values by the current year GDP implicit price deflator, with a base year of 1997.

[2] Does not include landings of fish caught in Puget Sound, Alaska, Canada, Mexico, or other waters not in the EEZ off Washington, Oregon, or California.

[3] Includes gill net, set net, and trammel net, but not dip, seine, or miscellaneous nets.

Figure 1. Pacific coast shoreside groundfish landings and real exvessel revenues (1997 dollars), 1981-97

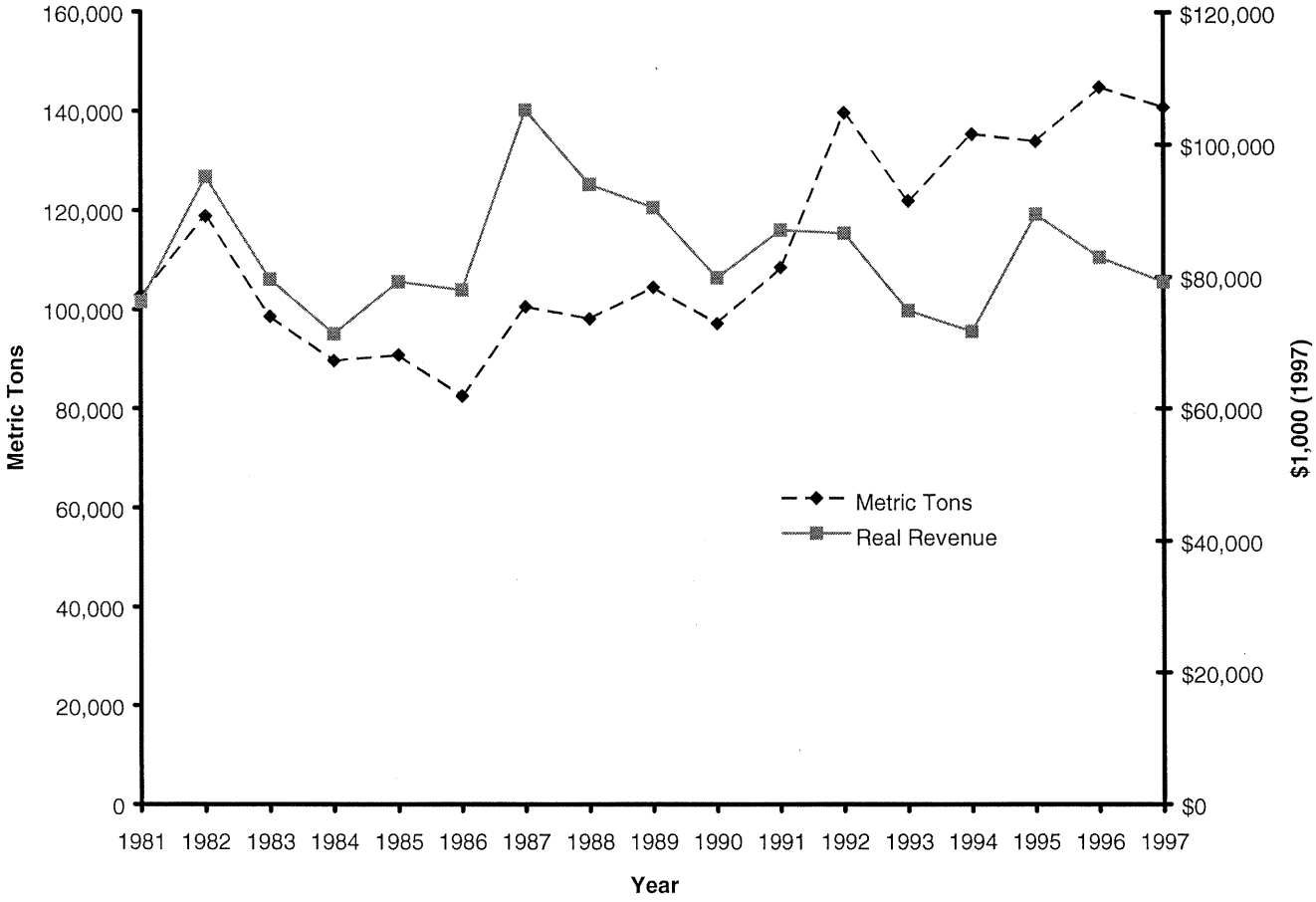


Figure 2. Washington, Oregon and California groundfish landings as a proportion of coastwide groundfish landings, 1981-97.

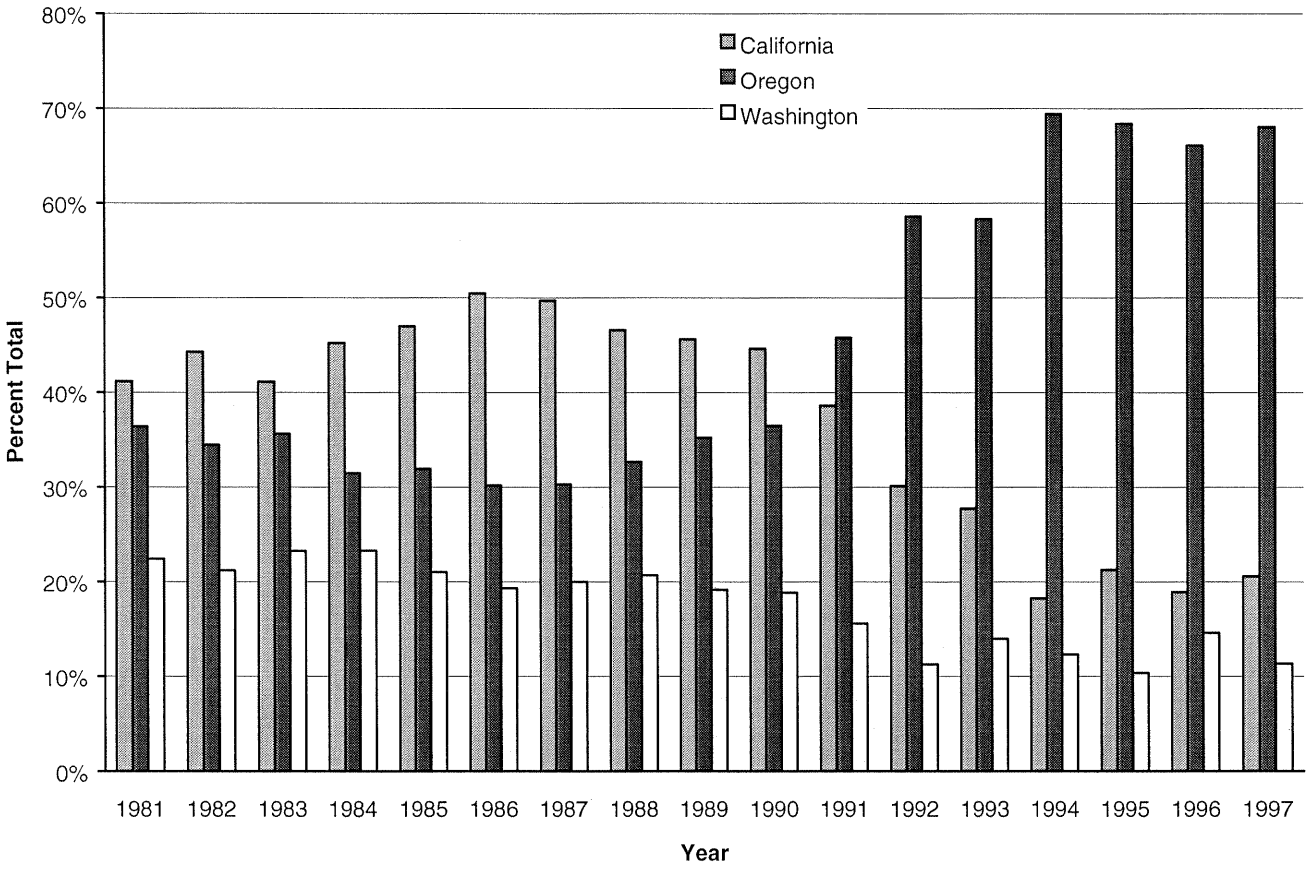
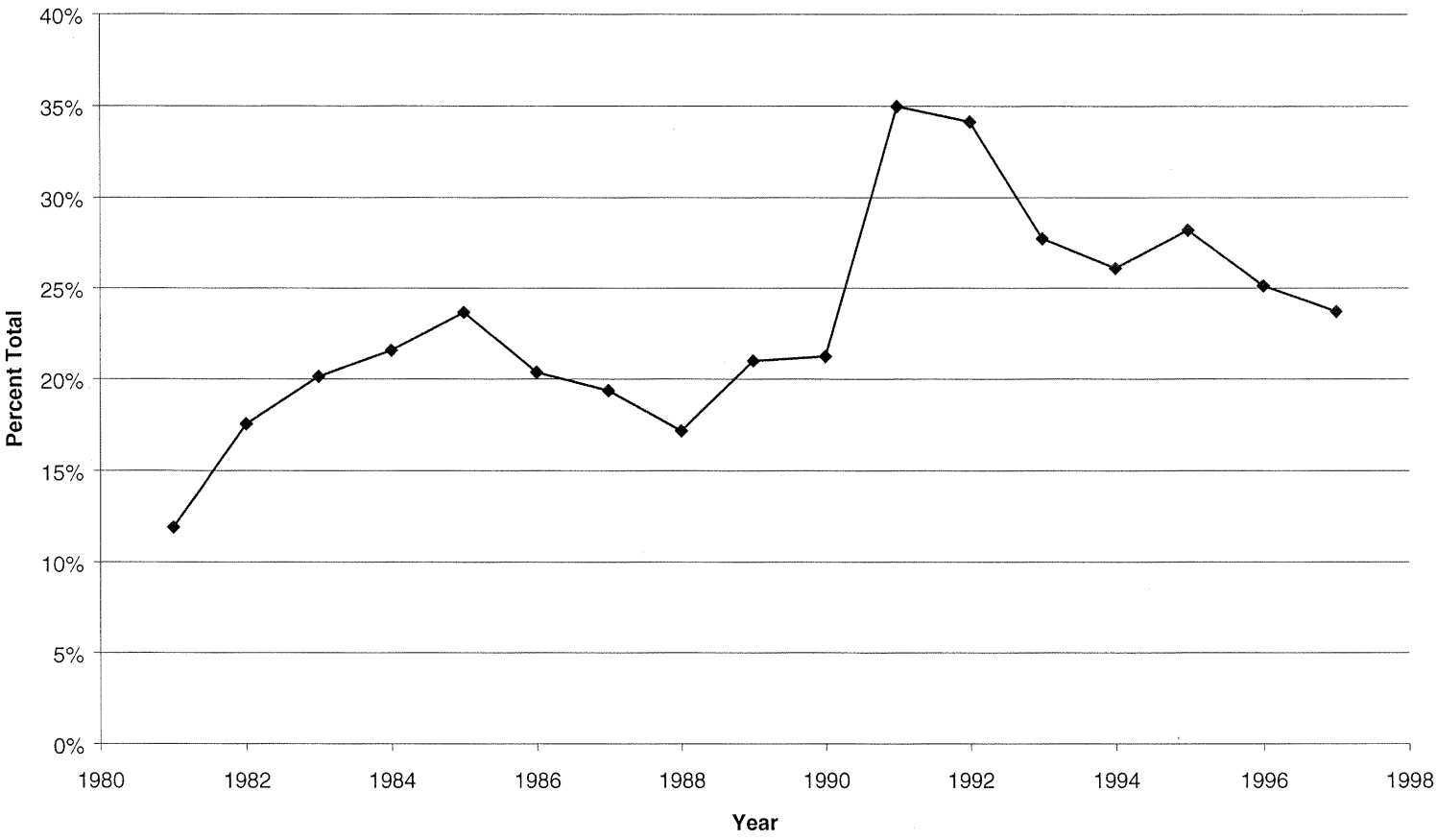


Figure 3. Pacific coast groundfish exvessel revenues as a percentage of exvessel revenues from all species, 1981-97.



GROUNDFISH STOCK ASSESSMENT AND REVIEW PROCESS DURING 1998

Goals and Objectives

The goals and objectives for the 1998 groundfish assessment and review process* are:

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

b) Satisfy the MSFCMA and other legal requirements.

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

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

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

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

g) Use assessment and review resources effectively and efficiently.

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

Shared Responsibilities

The purpose of this discussion document is to help planners and the Council family understand responsibilities for the groundfish stock assessment review process during 1998. Parties involved are the National Marine Fisheries Service (NMFS), state agencies, the Council and its advisors which include the Scientific and Statistical Committee (SSC), GMT, Groundfish Advisory Panel (GAP), Council staff and interested persons. Background information and a strawman proposal are given below.

Leadership, in the context of the stock assessment review process for groundfish, means consulting with all interested parties to plan, prepare terms of reference, and develop a calendar of events and a list of deliverables. Coordination means organizing and carrying out review meetings, distributing documents in a timely fashion, and making sure that assessments and reviews are completed according to plan. Leadership and coordination both involve costs, both monetary and time, which have not been calculated but are likely substantial.

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

History

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

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

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

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

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

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

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

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

At the end of 1997, a post-mortem review meeting was convened to discuss events and to make recommendations for 1998.[4] Discussants concluded that objectives were, to varying degrees, achieved during 1997. Least progress was made in the area of "increasing acceptance and understanding by all members of the Council family." The most significant issues seemed to be the nature of the STAR Panels' responsibilities, communicating uncertainty to decision makers, workload and inexperience in conducting the review process.

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

FACA

Sponsorship of the review process will remain with the Council in 1998 because the Federal Advisory Committee Act (FACA) controls NMFS' ability to set up new advisory committees. FACA specifies a process and constraints for setting up advisory committees, particularly when the committee will provide *consensus* recommendations to the federal government. Under FACA, advisory committees must be chartered by the Department of Commerce through a process which is difficult and slow. The intent of FACA was to limit the number of advisory committees, ensure that advisory committees fairly represent affected parties, and insure that advisory committee meetings, discussions and reports are carried out and prepared in full public view.

Under the Magnuson-Stevens Act the Council is exempt from FACA, however the Act provides protections similar to those under FACA in its requirements for public notice and open meetings.

Strawman

All parties share responsibilities in the stock assessment and review process for 1998. The Council will continue to sponsor the process and involve its standing advisory committees, but it has little additional resources to contribute to coordination or costs. Funding will be shared by NMFS and the Council. The following strawman was prepared based on these facts and constraints.

Draft Statement of Shared Responsibilities

The Council has responsibility to make decisions and make policy choices about groundfish management based on the Fishery Management Plan for Pacific Coast Groundfish, the Magnuson-Stevens Act and other applicable law.

The Pacific Fishery Management Council will sponsor a review of groundfish stock assessments prepared in 1998 according to the interim protocols identified below. Sponsorship will involve consulting with all interested parties to plan, prepare terms of reference, and develop a calendar of events and a list of deliverables. NMFS and the Council will share fiscal and logistical responsibilities.

NMFS will work with the Council, other agencies, groups or interested persons that carry out assessment work to organize STAT Teams and STAR Panels, and make sure that work is carried out in a timely fashion according to the calendar and terms of reference. NMFS will provide a senior scientist to coordinate these tasks with assistance from the PFMC staff. NMFS will convene a pre-assessment meeting where STAT Teams, GAP representatives, and interested parties meet to discuss upcoming stock assessments, external reviews, and data.

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[4]Jacobson, L.D. (ed.). 1997. Comments, issues and suggestions arising from the groundfish stock assessment and review process during 1997. Report to the Pacific Fishery Management Council (Revised Supplemental Attachment B.9.b, November 1997).

The SA coordinator, in consultation with the SSC, will select STAR Panel chairs, and will coordinate the selection of external reviewers with panel chairs following criteria for reviewer qualifications, nomination and selection. The public is welcome to nominate qualified reviewers.

NMFS, state agencies or others that carry out assessments or technical work in connection with groundfish assessments have the responsibility to ensure that they are technically sound and complete. The Council's review process is the principal means for review of complete stock assessments, although additional in-depth technical review of methods and data is desirable.

Council staff will publish and distribute meeting notices, stock assessment documents, stock summaries, meeting minutes and other appropriate documents. Council staff will help NMFS and agencies coordinate meetings and events.

The Council's Statistical and Scientific Committee (SSC) will participate in the stock assessment review process and provide the Council with technical advice related to the stock assessments and the review process.

The Council's Groundfish Management Team (GMT) will appoint representatives to track each stock assessment, who will attend STAR Panel meetings, and participate in review discussions. The GMT will provide the Council with advice on management of groundfish stocks based on stock assessments and other available information.

The Council's Groundfish Advisory Subpanel (GAP) will appoint representatives to track each stock assessment, who will attend STAR Panel meetings and participate in review discussions

Stock Assessment Priorities

Periodic stock assessments for west coast groundfish are conducted to determine appropriate harvest levels. Assessments rely upon a combination of NMFS survey data and state fishery monitoring data. To the extent possible, other fishery dependent data are also used.

Under the new stock assessment process begun in 1997, the time involved in soliciting data and preparing and reviewing stock assessments has increased substantially. Using STAT Teams and STAR Panels has also required participation by a larger number of people. In order to provide more thorough assessments and more complete reviews, the Council needs to establish priorities for conducting stock assessments. These priorities should be discussed at the Council's June meeting in order to allow sufficient time to begin data gathering for the species to be assessed. The following general principles will be used in setting priorities each year:

1) No more than 2 assessments will be reviewed by a STAR Panel;
2) Until more fiscal and personnel support is obtained, assessments (except for Pacific whiting) normally will be conducted only once every three years;
3) Assessments will be scheduled to take advantage of new data, including especially survey data;
4) Assessments may be conducted more frequently than once every three years if --
   A) new data, including fishery dependent and anecdotal data, which indicate unforseen increases or decreases in stock size, are brought to the attention of the Council,
   B) the Council believes that the results of a stock assessment are sufficiently in dispute to warrant a re-assessment the following year, or
   C) A fishery for a species, stock, or stock complex has rapidly developed and that species, stock, or stock complex has not been assessed recently;
5) An update or report that falls short of a full assessment may be prepared for a species, stock, or stock complex to provide information helpful to the Council in making management decisions.
6) Any stock assessment submitted by the public should be submitted through the normal Council channels and reviewed at Stock Assessment Review (STAR) Panel meetings.

Based on these general principles, and taking into account testimony presented at the November, 1997 Council meeting, the following list of stock assessments for 1998 and the preliminary list for 1999 are recommended for adoption by the Council:

1998 Stock Assessments
Sablefish
Shortspine thornyhead
Chilipepper rockfish
Blackgill rockfish
Pacific Ocean perch
Black rockfish

In addition, Pacific whiting will be assessed, but the timing will be offset (late 1998 - early 1999) in order to take advantage of the 1998 hydro-acoustic survey data. Along with the full assessments, a preview report will be prepared for grenadier and some California rockfish species for which new data is available.

1999 Stock Assessments (Preliminary)
Ling cod (may be limited to southern area only)
Petrale sole
Grenadier
Bocaccio
Canary rockfish
English sole
Near shore rockfish (with emphasis on California species)
Pacific whiting
Sablefish

Because the 1999 preliminary list is likely to exceed the time, money, and personnel resources available, this list will be further refined in 1998, based on the priorities adopted by the Council.

Terms of Reference for Groundfish STAR Panels and Review Meetings

Composition: STAR Panels normally include a chair, at least one "external" member (outside the Council family and not involved in management or assessment of west coast groundfish), and one SSC member. The total number of STAR members should be at least "n+2" where n is the number of stock assessments and "2" counts the chair and external reviewer. In addition to official members, STAR meetings will include GMT and GAP advisory with responsibilities laid out in their terms of reference. STAR Panels normally meet for one week. The number of assessments reviewed should not exceed two.

The STAR Panel and chair's main responsibility is to carry out these terms of reference according to the calendar for groundfish assessments.

The goal of the STAR Panel meeting is to review assessments for stocks according to these terms of reference. This work (described in detail below) includes reviewing draft stock assessment documents and any other pertinent information (e.g.; external anonymous reviews of the previous assessment, STAR Panel reviews of previous assessments and previous assessments, if available), working with STAT Teams to make sure necessary revisions are made to stock assessment documents, documenting meeting discussions, and reviewing summaries of stock status (prepared by STAT Teams) for inclusion in the SAFE document.

Most groundfish stocks are assessed infrequently (every three years) and each assessment and review should result in useful advice to the Council. It is the STAR Panel's responsibility to identify assessments that cannot be reviewed or completed for any reason.

The STAR Panel's terms of reference concern technical aspects of stock assessment work. The STAR Panel should strive for a risk neutral approach in its reports and deliberations. The full range of uncertainty should be reflected in complete stock assessments and the reports prepared by STAR Panels. The STAR Panel should identify scenarios that are unlikely or have a flawed technical basis.

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

Panel members are responsible for determining if a stock assessment document is sufficiently complete according to the "Outline for Groundfish Stock Assessments."

A STAT Team and STAR Panel may disagree on technical issues. If the STAR Panel and STAT Team disagree, the STAR Panel must document the areas of disagreement in its report. The STAR Panel may request additional analysis based on alternative approaches. It is expected that the STAT Team will make a good faith effort to complete these analyses.

The STAR Panel's decision that a stock assessment is complete should be made by consensus. If panel cannot reach agreement, then the nature of the disagreement must be described in the panel's report.

Recommendations and requests to the STAT Team for additional or revised analyses must be clear, explicit and in writing. All recommendations and requests to the STAT Team should be preserved in the meeting report.

A written summary of discussion on significant technical points and a lists of all STAR Panel recommendations and requests to the STAT panel are required in the STAR Panel's report. This should be completed (at least in draft form) prior to the end of the meeting. It is the chair and panel's responsibility to carry out any follow-up review work that is required.

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

A panel representative is expected to attend meetings where stock assessments and harvest projections are discussed to explain the reviews and provide other technical information and advice.

The chair is responsible for providing Council staff with a camera ready and suitable electronic version of the panel's report for inclusion in the annual "Status of the Pacific Coast Groundfish Fishery" report.

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

Suggested Template for STAR Panel Report

Minutes of the STAR Panel meting containing:

Name and affiliation of STAR Panel members

List of analyses requested by the STAR Panel

Comments on the technical merits or deficiencies in the assessment and recommendations for remedies

Explanation of areas of disagreement regarding STAR Panel recommendations (1 among STAR Panel members (majority and minority reports), 2) between the STAR Panel and STAT Team

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

Prioritized recommendations for future research and data collection

Terms of Reference for Groundfish STAT Teams

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

Each STAT Team will appoint a representative who will attend the pre-assessment planning meeting if one is held. STAT Teams are encouraged to also organize independent meetings with industry and interested parties to discuss issues, questions and data.

Each STAT Team will appoint a representative to coordinate work with Stock Assessment Review (STAR) panel and attend the STAR Panel meeting.

Each STAT Team will appoint a representative who will attend the GMT meeting (usually in August) and Council meeting (usually in September) where preliminary ABC and HG levels are discussed. In addition, a representative of the STAT Team should attend the GMT (usually September or October) and Council meeting (usually November) where final ABC and HG levels are discussed, if requested or necessary.

The STAT Team is responsible for preparing three versions of the stock assessment document: 1) a "draft" for discussion at the stock assessment review meeting; 2) a revised "complete draft" for distribution to the GMT, SSC, GAP and Council for discussions about preliminary ABC and HG levels; 3) a "final" version published in the "Status of the Groundfish Fishery" report. Other than authorized changes, only editorial and other minor changes should be made between the "complete draft" and "final" versions. The STAT Team will distribute "draft" assessment documents to the STAR Panel, Council, GMT and GAP advisors at least one week prior to the STAR Panel meeting.

The STAT Team is responsible for bringing computerized data and working assessment models to the review meeting in a form that can be analyzed on site. STAT Teams should take the initiative in building and selecting candidate models. If possible, the STAT Team should have several complete models and be prepared to justify model recommendations.

The STAT Team is responsible for producing the complete draft by the end of the STAR Panel meeting. In the event that the complete draft is not completed, the team is responsible for completing the work as soon as possible and to the satisfaction of the STAR Panel at least one week before the GMT meeting.

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

GMT Responsibilities

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

GAP Responsibilities

The Chair of the Groundfish Advisory Subpanel (GAP) will appoint a representative to track each stock assessment. GAP representatives will be appointed at the GAP meeting in March.

The GAP representative will attend the STAR Panel meeting where the assessment of his / her species is reviewed. The GAP representative will participate in review discussions as an advisor to the STAR Panel, in the same capacity as the Groundfish Management Team (GMT) advisor.

The GAP representative will attend the August GMT meeting along with STAR, STAT, and SSC representatives and will attend subsequent GMT, Council, and other necessary meetings where the assessment of his / her species is discussed.

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

SSC and Council Staff Responsibilities

Scientific and Statistical Committee

The Council's Scientific and Statistical Committee (SSC) will participate in the stock assessment review process and provide the Groundfish Management Team (GMT) and Council with technical advice related to the stock assessments and the review process. As in 1997, the SSC may solicit anonymous external reviews of the previous stock assessments. These external anonymous reviews should be completed in time for discussion at the pre-assessment planning meetings identified in the calendar for the 1998 review process. The SSC will assign one member from its Groundfish Subcommittee to each STAR Panel. This member is expected to attend the assigned STAR Panel meeting, the August and October GMT meeting, and the September and November Council meetings when groundfish stock assessment agenda items are discussed. The SSC, during their normally scheduled meetings, will also serve as arbitrator to resolve any disagreements that may arise between the STAT Team, STAR Panel, or GMT. The SSC will provide review of any additional analytical work on any of the stock assessments required or carried out by the GMT after the stock assessments have been reviewed by the STAR Panels. In addition, the SSC will review and advise the GMT and Council on projected ABCs and Harvest Guidelines.

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

Council Staff

Council Staff will prepare meeting notices and distribute stock assessment documents, stock summaries, meeting minutes, and other appropriate documents. Council Staff will help NMFS and the State Agencies in coordinating stock assessment meetings and events. The Staff will also publish or maintain file copies of reports from each STAR Panel (containing items specified in the STAR Panel's term of reference), the outline for groundfish stock assessment documents, comments from external reviewers, SSC, GMT, and GAP, letters from the public, and any other relevant information.. At a minimum, the stock assessments (STAT Team reports, "STAR Panel reports, and stock summaries) should be published and distributed in the Council's annual "Status of the Groundfish Fishery" SAFE document. Once the Council's final ABCs, HGs, and management measures have been implemented, the Staff will publish an addendum to the SAFE documenting these final values.

Calendar[5]

Jan 12-13	Planning meeting involving representatives of Council, States, NMFS, SSC, GMT, GAP and Council staff at Council office in Portland. Stocks to be assessed in 1998 selected. Provisional list of 1999 stocks developed.
Jan 19	Planning meeting rapporteurs send revised meeting documents to members.
Jan 26	Comments on documents due to rapporteurs.
Jan 30	NMFS appoints a senior scientist as coordinator for process.
Feb 9	Rapporteurs send final documents to Council staff.
Feb 9-12	GMT meeting at Council office in Portland. GMT advisers to STAR Panels appointed.
Feb 13	NMFS/agencies appoint STAR Panel chairs and members and STAT Team members.
Feb 13	Staff compiles completed report on process to be included in March briefing book.
Feb 13	SSC may send previous stock assessments out for external anonymous review.
Mar 2-5	GAP/GMT/SSC meet in Portland. GAP advisers to STAR Panels appointed. SSC adopts outline for stock assessments and reviews process report.
Mar 9-13	Council meeting at Clarion Hotel in Millbrae. Council adopts process and calendar for 1998 (scheduled for Mar. 12).
Mar 20	SSC sends completed external anonymous reviews (if any) to STAT Teams.
Apr 6-10	Council meeting at Columbia River Doubletree.
Apr 21-22	NMFS/agency sponsored "pre-assessment" meeting where STAT Teams, GAP representatives and interested parties meet to discuss upcoming stock assessments, external reviews and data.
Jun 1-4	GMT meeting.
Jun 5	Council staff and STAR Panel members (including GMT and GAP advisers) receive draft assessments for POP and black, blackgill and chilipepper rockfish.
Jun 8-9	Staff distributes draft rockfish assessments to Council, GMT, GAP, SSC and interested persons who have requested them[6].
Jun 15-19	STAR Panel for black rockfish and POP and STAR Panel for chilipepper and blackgill rockfish meet in Olympia.

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[5] Since time between receipt of documents and STAR meetings is limited, Council staff can only fulfill distribution responsibilities if documents are received by the deadlines specified in this calendar. If documents are late, the Council staff will simply provide mailing labels to the authors so the documents may be distributed directly from the source.

[6] In June and September, Council staff will query Council family on which drafts of which stock assessment documents they wish to receive, and circulate a notice of availability for the public. These lists will determine who receives stock assessment documents throughout the process.

Jun 22-26	Council meeting at Sea-Tac Red Lion.
Jun 26	Council staff and STAR Panel members (including GMT and GAP advisers) receive draft sablefish and shortspine thornyhead assessments from STAT Teams.
Jun 29-30	Council staff distributes draft sablefish and shortspine assessments to Council, GMT, GAP, SSC and interested persons who have requested them.
Jul 6-10	STAR Panel for sablefish and shortspine thornyhead meets in Newport.
Jul 31	Complete assessments, stock summaries, STAR Panel reports, and other documents used during the STAR Panel meeting arrive at Council office.
Aug 3	Council staff distributes complete assessments and STAR Panel reports to GMT, Council, SSC, GAP and interested persons who have requested them.
Aug 10-14	GMT meeting to review stock assessment results attended by STAR Panel chairs or designees, SSC members of STAR Panels, STAT Team representatives, and GAP advisers to STAR Panels.
Sep 3	Council staff distributes briefing book for September meeting.
Sep 14-18	Council/SSC/GMT/GAP meeting at Red Lion in Sacramento. Council adopts preliminary ABCs and harvest guidelines. STAR Panel and STAT Team representatives attend.
Sep 28-Oct 2	GMT meeting attended by STAR Panel chairs or designees, SSC members of STAR Panels, STAT Team representatives, and GAP advisers to STAR Panels.
Sep 29	Final stock assessments, stock summaries, and STAR Panel reports arrive at Council office (camera-ready hard copy) for SAFE report.
Oct 13	Council staff mails SAFE report and appendices to Council family and public who have requested them.
Oct 22	Council staff distributes briefing book for November meeting.
Nov 2-6	Council/SSC/GMT/GAP meeting at Columbia River Doubletree. Final harvest levels for 1999 adopted. Post-mortem on 1998 assessment and review process.

Outline for Groundfish Stock Assessment Documents

This is an outline of items that should be present in all stock assessment and fishery evaluation (SAFE) reports for groundfish managed by the Pacific Fishery Management Council. The outline is a working document meant to provide assessment authors with flexible guidelines about how to organize and communicate their work. All items listed in the outline may not be appropriate or available for each assessment. In the interest of clarity and uniformity of presentation, stock assessment authors and reviewers are encouraged (but not required) to use the same organization and section names as in the outline.

This outline for 1998 includes suggestions from many parties and is based on a similar outline used during the 1997 groundfish stock assessment cycle.

OUTLINE FOR GROUNDFISH STOCK ASSESSMENT DOCUMENTS

1) Title page and list of preparers-the names and affiliations of the stock assessment team (STAT) either alphabetically or as first and junior authors

2) Executive Summary (see attached template)

3) Introduction

   A) Scientific name, distribution, stock structure, management units

   B) Important features of life history that affect management (e.g.; migration, sexual dimorphism, bathymetric demography, etc.)

   C) Important features of current fishery and relevant history of fishery

   D) Management history (e.g. changes in mesh sizes, trip limits, harvest guidelines, etc.)

   E) Management performance-a table or tables comparing ABC, harvest guidelines, landings and catch (landings plus discard) for each area and year

4) Assessment

   A) Data

      i) Landings by year and fishery, discards (generally specified as a percentage of total catch in weight and in units of mt), catch-at-age, weight-at-age, survey and CPUE data, data used to estimate biological parameters such as growth rates, maturity schedules and natural mortality with CV's or variances if available.

         - Include complete tables and figures if practical

         - Sample size information for length and age composition data by area, year, gear, market category, etc.

   B) History of modeling approaches used for this stock

      i) Changes between current and previous assessment models

C) Model description

i) Assessment program with last revision date (i.e.; date the executable program file was compiled).

ii) List and description of all likelihood components in the model.

iii) Constraints on parameters, selectivity assumptions, natural mortality, assumed level of age reader agreement or assumed ageing error (if applicable), and other assumed parameters

iv) Description of stock-recruitment constraint or components

v) Critical assumptions and consequences of assumption failures

vi) Convergence criteria

vii) Treatment of discards (generally specified as a percentage of total catch in weight and in units of mt)

viii) Complete description of any new modeling approaches.

D) Model selection and evaluation

i) Evidence of search for balance between realistic (but possibly over-parameterized) and simpler (but not realistic) models

- Use hierarchical approach where possible (e.g. asymptotic vs. domed selectivities, constant vs. time varying selectivities, etc.)

ii) Residual analysis (e.g.; residual plots, time series plots of observed and predicted values, or other approach)

iii) Convergence status and convergence criteria for "base-run(s)"

-Randomization run results or other evidence of search for global best estimates

iv) Do parameter estimates make sense, are they credible?

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

E) Base-run(s) results

i) Time series of total and spawning biomass, recruitment and fishing mortality or exploitation rate estimates (table and figures)

ii) Selectivity estimates (if not included elsewhere)

iii) Stock-recruitment relationship

F) Uncertainty and sensitivity analyses

i) Sensitivity analyses (tables or figures) that show ending biomass levels or likelihood component values obtained while systematically varying emphasis factors for each type of data in the model. Likelihood profiles for parameters or biomass levels may also be used.

ii) The best approach for describing uncertainty and the range of probable biomass estimates in groundfish assessments may depend on the situation. Approaches used in the past are listed below.

- CV's for biomass estimated by bootstrap, implicit autodifferentiation, or the delta method

- Subjective appraisal of magnitude and sources of uncertainty

- Comparison of alternate models

- Comparison of alternate assumptions about recent recruitment

iii) If a range of model runs (e.g.; based on CV's or alternate assumptions about model structure or recruitment) is used to depict uncertainty, then it is important that some qualitative or quantitative information about relative probability be included. If no statements about relative probability can be made, then it is important to state that all scenarios (or all scenarios between the bounds depicted by the runs) are equally likely.

iv) If possible, ranges depicting uncertainty should include at least three runs: one judged most probable; at least one that depicts the range of uncertainty in the direction of lower current biomass levels; and one that depicts the range of uncertainty in the direction of higher current biomass levels. The entire range of uncertainty should be carried through stock projections and decision table analyses.

v) Retrospective analysis (information about retrospective bias in base model or models for each area)

vi) Historical analysis (plot showing actual estimates from current and previous assessments for each area)

vii) Simulation results (if available)

5) Target fishing mortality rates (if changes are proposed)

6) Harvest projections and decision tables

1) Harvest projections and decision tables should cover the full range of uncertainty about current biomass and the full range of candidate fishing mortality targets used for the stock or requested by the GMT

ii) Information presented should include three year biomass and yield projections

7) Management recommendations

8) Research needs (prioritized)

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

10) Literature cited

11) Tables and figures

12) Brief response to all points raised by external anonymous reviewers. Respond to each point (e.g.; "suggestion carried out", "suggestion not carried out because . . ." or "good idea for future research but I didn't do it this time because . . .").

13) Complete parameter files for base runs.

Template for Summary of Stock Status Prepared by Stat Teams

Stock: (Species/area)

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

Data and assessment: (Date of last assessment, type of assessment model, data available, new information, and information lacking.)

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

Reference points: (Management targets and definition of overfishing.)

Stock biomass: (Trends and current levels relative to virgin or historical levels, description of uncertainty-include table for last ten years and graph with long term estimates)

Recruitment: (Trends and current levels relative to virgin or historical levels-include table for last ten years and graph with long term estimates)

Exploitation status: (Exploitation rates-include table for last ten years and graph with long term estimates. Exploitation rates are total catch divided by exploitable biomass.)

Management performance: (original ABC estimates, original HG specifications, overfishing levels, actual catch including discard, and discard).

Forecasts: (normally three-year forecasts of catch and biomass)

Decision table: (if available)

Recommendations for future research and data collection:

Sources of additional information: (Cite STAR Panel report, assessment documents and other useful or non-technical sources).

1998 STAR PANEL REPORTS

- Chilipepper Rockfish
- Blackgill Rockfish
- Black Rockfish
- Pacific Ocean Perch
- Sablefish and Shortspine Thornyhead

Star Panel Report on the Chilipepper Rockfish (*Sebastes goodei*) Assessment

received by the Pacific Fishery Management Council
August 5, 1998

Chilipepper Rockfish STAR Panel Meeting
Evergreen State College
Olympia, Washington
June 16-19, 1998

STAR Panel: Jon Brodziak, Panel Leader
National Marine Fisheries Service
Northwest Fisheries Science Center

Tom Jagielo, Rapporteur
Pacific Fishery Management Council
Scientific and Statistical Committee and
Washington Department of Fish and Wildlife

Richard Parrish
National Marine Fisheries Service
Southwest Fisheries Science Center

Panel Advisors: Pete Leipzig
Pacific Fishery Management Council
Groundfish Advisory Panel and
Fishermen's Marketing Association

Dave Thomas
Pacific Fishery Management Council
Groundfish Management Team and
California Department of Fish and Game

Summary of the Chilipepper Rockfish (*Sebastes goodei*) Assessment

The STAR Panel met in Olympia, Washington, during June 16th to 19th, 1998 to review an assessment prepared by the chilipepper rockfish STAT Team comprised of Dr. S. Ralston, NMFS/Southwest Fisheries Science Center, Mr. D. Pearson, NMFS/Southwest Fisheries Science Center, and Ms. J. Reynolds, University of California. Their assessment provided an updated evaluation of the status of the chilipepper rockfish resource off the west coast which was last assessed in 1993.

The STAR Panel identified several sources of uncertainty for the 1998 chilipepper rockfish assessment. These were:

1. There was a concern that commercial fishery size-at-age data could be biased and may not be representative for younger chilipepper due to size selectivity. As a result, growth curves estimated from commercial fishery data may not reflect the average size of juvenile chilipepper. Growth curves for male and female chilipepper were estimated within the assessment model based on commercial fishery size-at-age data. The STAR Panel suggested that other sources of size-at-age data be developed and analyzed, such as research survey collections, to help determine growth curves for male and female chilipepper.

2. Natural mortality of chilipepper rockfish was a source of uncertainty for assessment modeling and interpretation of results. The natural mortality rate used in the previous assessment (M=0.15) was not likely given data used in the current assessment. As a result, the STAT Team used the assessment model to determine separate values of M for males and females that were more consistent with the current data and model configuration. These values of M were then treated as fixed constants in subsequent modeling. The STAR Panel discussed the merits of attempting to estimate M and concluded that this heuristic approach was an appropriate way to determine values that were consistent with current data and knowledge of the population dynamics of chilipepper.

3. Time-varying selectivity was assumed for the chilipepper rockfish fishery based on synchronous patterns in size-at-age observations from the fishery. The STAT Team suggested that fishery selectivity differed between years due to changes in the spatial distribution of chilipepper. Although empirical differences in size-at-age were substantial between some years, for example 1985 and 1993, it was unknown why these patterns occurred. Oceanographic changes due to El Nino conditions were considered to be a likely causal mechanism.

4. Two relative abundance indices of chilipepper rockfish biomass, the trawl logbook index and the NMFS shelf survey index, exhibited different trends. It was uncertain whether the logbook index or the survey index provided a more accurate trend for chilipepper biomass. It was noted, however, that the increase in the logbook index during 1988-89 was consistent with the recruitment of the large 1984 year class to the trawl fishery.

5. Historic landings of chilipepper rockfish were uncertain because landings statistics were reported as unspecified rockfish rather than as chilipepper.

Dr. Steven Ralston, STAT Team leader, presented the draft assessment document. He discussed the types and sources of data available for the assessment, and presented the results of additional model runs conducted since the draft assessment document was distributed. The assessment was conducted using the length-based stock synthesis model.

In the initial model runs, male and female growth curves were estimated within the stock synthesis model. The STAR Panel noted that growth curves could be estimated outside of the assessment model, if representative size-at-age data were available. It was pointed out that commercial fishery age data were the only source of data for growth analysis. Because commercial fishery size-at-age data tend to be biased toward selection of fast-growing fish, the STAR Panel recommended that alternative sources of size-at-age data, such as a research survey collections, be developed. Although some chilipepper rockfish otoliths have been collected during the NMFS shelf survey, these

samples have not been processed for age determination. Processing these otoliths was an important research recommendation that would likely improve chilipepper rockfish growth curves in future assessments.

The STAR Panel reviewed the sources of catch data used in the assessment. Chilipepper catch data was taken from the NMFS Tiburon lab TIGRBASE database. Discards of chilipepper were assumed to be negligible and total catch used in the assessment consisted of estimated landings from the INPFC Eureka, Monterey, and Conception Areas. The ratio of bocaccio to chilipepper rockfish landings was used to estimate the chilipepper catch from 1960-1979 based on landings of bocaccio during this time period. The assessment model used an historical catch level fixed at the 1960-1969 average and included year-specific catch estimates from 1970 to 1998. It was noted that landings in recent years (about 1500 mt) have been well below ABC levels (the 1998 ABC was 3400 tons). Inability to harvest the full ABC might be interpreted as a signal of a decline in chilipepper abundance. Alternatively, inability to harvest the full ABC could also be an artifact of management measures for the Sebastes Complex because chilipepper may have been included in Sebastes Complex landings.

The STAR Panel discussed whether any trends in the ratio of boccacio to chilipepper landings existed prior to 1980; such trends would affect catch estimates of chilipepper during the early years of the assessment time horizon. Based on long-term experience in the California rockfish fishery, one fishermen indicated that chilipepper was a high percentage of rockfish landings (80%) in the 1950's and early 1960's but was a low percentage (20%) in the 1970's. This anecdotal information contrasted the constant boccacio to chilipepper ratio used in the assessment. Given the uncertainty in the early catch data, the STAR panel discussed alternate time horizons for the assessment model as well as the effect of estimating the initial age composition in 1980 versus 1970. The STAR Panel recommended that the STAT Team conduct a sensitivity analysis to assumptions about the pre-1980 landings. Also, it was recommended that the STAT Team consider a model that began in 1980 versus 1970 to explore the

consequences of estimating recruitment levels based on the uncertain historic catch data.

The STAR panel discussed the utility of MRFSS recreational fishery catch-per-unit effort (CPUE) as a tuning index for chilipepper biomass. It was not clear how effort was measured in the MRFSS index and this was a substantial source of uncertainty. In particular, it was unknown whether effort was measured for all bottomfish boat trips or for all recreational fishing trips, including those targeting salmon. If recreational effort included salmon trips, it seemed unlikely that the MRFSS CPUE would be a useful tuning index. Further, it was noted that recreational fisheries have operated at different depths over time and this would also affect trends in the MRFSS CPUE. The STAR Panel expressed reservations about the MRFSS CPUE index given uncertainty in how effort was calculated. Overall, the STAR Panel recommended that the STAT Team consider omitting the MRFSS CPUE index from the assessment model.

The STAT Team applied a general linear model to compute a CPUE index of relative chilipepper abundance (kg/hectare swept) from selected NMFS triennial trawl survey tows. Survey tows within selected latitude and depth ranges where chilipepper are common were included in this analysis. The STAR Panel supported this approach to analyzing chilipepper CPUE from the NMFS shelf survey.

The STAT Team used the SWFSC midwater trawl survey to estimate an index of chilipepper recruitment (projected number of age-1 fish per tow). The coefficient of variation (CV) of the recruitment index was adjusted to have the same level of variability as estimated recruitments from a model run that excluded the index. The STAR Panel supported the use of the midwater trawl recruitment index in the assessment model.

The STAT Team derived a CPUE index from California trawl logbook data. Because rockfish catches have historically been reported in an aggregate market category containing several rockfish species, calculation of this index required estimation of the proportion of chilipepper within unspecified rockfish landings. To estimate this proportion, the STAT Team

identified CDFG trawl blocks where chilipepper rockfish were landed by linking commercial market sample data for rockfish to trawl logbook data. As a result, the STAT Team found 26 CDFG trawl blocks that had a high proportion of chilipepper. The STAR panel noted that the variance of the logbook CPUE index underestimated actual variability because it did not account for the unknown error involved in estimating the proportion of chilipepper catch. The STAR Panel recommended the STAT Team consider increasing the CV of the logbook CPUE index in the assessment model. Alternatively, it was recommended that the STAT Team consider reducing the emphasis of the logbook CPUE as a likelihood component.

The STAT Team reported a trend in mean size at age from commercial fishery samples. This suggested that selectivity was probably changing through time. Their results indicated that mean size at age of chilipepper in 1985 and 1993 decreased across fisheries and ages. Re-examination of age-reading data as well as re-ageing of some samples from 1993 did not suggest that this effect was due to a change in age-reading criteria. In addition, the STAT Team pointed out that time-varying growth was unlikely because this would have implied negative fish growth for some years. The STAT Team also showed that the proportion of the stock on the continental shelf varied between surveys. This supported the notion that chilipepper distribution changed between years and suggested that changes in spatial distribution might explain the shifts in fishery size-at-age data. To address the changes in size-at-age data, the assessment model was configured to estimate year-specific fishery selectivity functions. Model parameters to determine selectivity changes were linked across fisheries to account for the similar patterns of change. The STAR Panel supported the use of time-varying selectivity functions in the chilipepper rockfish assessment model.

The STAR panel observed that the initial assessment model which estimated growth, year-specific selectivity, and natural mortality had unstable convergence. That is, when the model solution was randomly changed by +/- 10% and model parameters were re-estimated starting at the random offset from the solution, the new solution differed from the original one. In particular, model estimates of 1998 biomass

varied by about 4500 tons (17%) when the randomization process was performed many times. This suggested that the model likelihood surface was flat near the model solution and that the model results were sensitive to the choice of initial parameter values. To alleviate this difficulty, the STAR Panel requested a methodical progression from a simpler model with fewer parameters to more complex models under the criterion that convergence be stable at each step. The STAR Panel recommended that the STAT Team present a less structured model and evaluate convergence stability in a sequential manner as more complexity was added. In particular, the STAR Panel recommended starting with a model configuration that did not use the length data and fixed growth, natural mortality, and selectivity parameters. Convergence stability was recommended to be evaluated using a randomization test with about a 25% random offset for about 40 runs.

The STAT Team made the recommended changes to the model configuration. Results of a randomization test showed much better convergence properties (estimates of 1998 biomass varied by 200 tons, <1%). The STAR Panel recommended that the STAT Team continue in a stepwise fashion, adding complexity and testing convergence stability at each step. The suggested steps of additional complexity was: 1) Estimate growth parameters and include mean length-at-age likelihood component; 2) Estimate time-varying selectivity parameters; 3) Estimate M by sex.

The STAT Team configured the assessment model to accomplish step 1) above but found that this model did not exhibit stable convergence. The STAR Panel recommended a return to the stable model and suggested that the CV of the logbook CPUE index be increased to better reflect its variability and that the MRFSS CPUE index be removed.

The STAT Team made the suggested changes but model convergence appeared to be less stable than before. To ensure convergence stability, it was suggested that the STAT Team consider the model configuration with the logbook CPUE index CV set back at the STAT teams recommended level of 0.10, with the MRFSS CPUE index removed, natural mortality and growth parameters fixed, and with constant fishery selectivity functions.

The STAT Team made the suggested model run and found improved convergence stability in comparison to the previous model. Next the STAT Team suggested altering the improved model configuration to estimate year-specific selectivity functions for all fisheries. Model parameters were estimated and the new model was subjected to 70 randomization tests using a 10% random offset and a convergence criteria of 0.001 likelihood units. Results of the randomization tests indicated that the new model had acceptable convergence stability (range of 1998 biomass was 3%). As a result, the new model was adopted as the preferred model by the STAT Team and STAR Panel. The STAR panel noted, however, that the fixed values of the natural mortality and growth parameters were not known with certainty and suggested that the final report include likelihood profiles over values of M and K to characterize this uncertainty. The STAR Panel also requested that the STAT Team examine residuals of two tuning indices (the trawl survey and the logbook index) for gross departures from model assumptions. The STAT Team found some moderate residual patterns for these indices. This was expected given the conflicting trends of the trawl survey and logbook indices. Further evaluation of trawl logbook CPUE as an index of abundance and its relation to the NMFS shelf trawl survey index was recommended as an area for future research.

The STAR Panel expressed concern that the strength of the 1993 year class, which was estimated to be larger than other recent year classes, was uncertain. Though the assessment model included a recruitment index, the amount of information supporting the strength of this year class was limited to one year of catch data from a partially-selected year class. The STAR Panel recommended a cautious interpretation of projections of future population size and allowable catch due to this uncertainty.

Analyses Requested by the STAR Panel

The STAR Panel commended the STAT Team for their diligent and timely responses to STAR Panel requests. Most requests were completed during the review meeting. Nonetheless, some items could not be completed during the meeting due to time and logistical constraints and

were requested to be in the final assessment document. These items were:

a. A Stock Summary Report.

b. Profile likelihood plots for natural mortality (M) and the Brody growth coefficient (K).

c. Sensitivity analyses for a higher and a lower level of natural mortality.

d. Harvest projections at the F40% fishing mortality rate for at least 3 years.

e. Sensitivity analysis of model results to the 1970-79 catch levels.

Prioritized Research Recommendations

1. Age chilipepper rockfish otoliths collected during NMFS triennial shelf trawl survey(s) to characterize male and female growth curves.

2. Investigate why the trawl logbook index and the shelf trawl survey index have different trends.

3. Continue the midwater trawl survey to ensure a consistent recruitment index through time.

4. Continue to monitor age and length composition of fishery catch.

5. Report logbook catches of rockfish by species, e.g. chilipepper rockfish, rather than as unspecified rockfish.

Star Panel Report on the Blackgill Rockfish (*Sebastes melanostomus*) Assessment

Blackgill Rockfish STAR Panel Meeting
Evergreen State College
Olympia, Washington
June 15-19, 1998

STAR Panel: Jon Brodziak, Panel Leader
National Marine Fisheries Service
Northwest Fisheries Science Center

Tom Jagielo
Pacific Fishery Management Council
Scientific and Statistical Committee and
Washington Department of Fish and Wildlife

Richard Parrish, Rapporteur
National Marine Fisheries Service
Southwest Fisheries Science Center

Panel Advisors: Pete Leipzig
Pacific Fishery Management Council
Groundfish Advisory Panel and
Fishermen's Marketing Association

Dave Thomas
Pacific Fishery Management Council
Groundfish Management Team and
California Department of Fish and Game

Summary of the Blackgill Rockfish (*Sebastes melanostomus*) Assessment

The STAR Panel met in Olympia, Washington, during June 15th to 19th, 1998 to review an assessment prepared by the blackgill rockfish STAT Team comprised of Dr. J. Butler, NMFS/Southwest Fisheries Science Center, Dr. L. Jacobson, NMFS/Southwest Fisheries Science Center, and Dr. T. Barnes, California Department of Fish and Game. Their assessment represents the first quantitative evaluation of the status of the blackgill rockfish resource off the west coast.

The blackgill rockfish stock assessment is somewhat unique in that it is the first full assessment of one of the minor rockfish stocks. It differs from most previous stock assessments in that it is based on considerably less information than is generally available for stock assessments made for the Pacific Fishery Management Council.

Major sources of uncertainty for analyses based on the limited data sources for blackgill rockfish, as well as other minor rockfish species, are:

1. No index of blackgill rockfish biomass is currently available. This is a severe limitation for conducting a quantitative assessment of resource status.

2. Landings are poorly known. Landings used in the assessment are based on nominal blackgill rockfish landings in California and on estimates derived from multispecies market categories used in California, Oregon, and Washington.

3. The age composition of annual landings is not available. Limited size composition data is available for landings from California.

4. The number of aged fish is minimal (n=202) for determination of mortality rates in a species with this longevity (87 years); use of an otolith weight-age relationship is a novel solution.

5. There is little information on the abundance and distribution of blackgill rockfish from the time they are pelagic larvae until they recruit to the fishery about 30 years later.

6. No index of blackgill rockfish recruitment is currently available. This led the STAT Team to assume that recruitment is constant for modeling purposes. In contrast, experience with other long-lived rockfish species suggests that recruitment is likely to be episodic.

7. Biomass estimates based on swept-area methods are of limited utility for blackgill rockfish because they do not account for differential habitat utilization and

heterogeneous bottom topography and also because research survey catchability is unknown.

8. Catch curve analyses may not produce accurate estimates of total mortality for blackgill rockfish due to their longevity and due to the spatial patterning of the fishery in relation to stock abundance. Potential bias due to the inclusion of older ages would lead to underestimation of total mortality. Potential bias due to the fishery operating on a small portion of the recruited population would lead to overestimation of total mortality. The relative magnitude of the two sources of potential bias is unknown.

During the first day of the meeting, the STAT team reviewed the sources of data. These were principally biological information and catch statistics from the INPFC Conception Area, but also included a more limited data set from the INPFC Monterey Area. The bulk of the US portion of what is presumed to be a single stock is distributed within the Conception and Monterey Areas. However, an unknown proportion of the stock resides in Mexican waters. It is not known if there is any exploitation of the stock by Mexican fishermen.

Available biological information, which is relevant to stock assessment, includes size-at-age data and growth rates derived from a limited number (n=202) of otolith-aged fish. These data were augmented by age estimates derived from an otolith weight-age relationship developed by the STAT Team. These data show that blackgill rockfish do not begin to recruit to the fishery until they are about 10-20 years of age and that they are fully-recruited at an age of between 30 and 35 years. Growth is sexually dimorphic with females achieving larger sizes than males. In comparison to other rockfishes, age at first maturity is delayed. First maturity of females occurs at about 16 years and most females are mature by age 26. The instantaneous natural mortality rate (M) was estimated, by maximum age methodology, to be about M=0.05. The average total mortality rate (Z) during 1980-97 was calculated, by regression of the back slope of the age composition data, to be Z=0.10.

There is some concern about the accuracy of the catch

statistics for blackgill rockfish. Annual estimates of catch (1980-97) were derived from the TIGRBASE database at the SWFSC. The STAT Team thought that total landings may be underestimated and they presented some sensitivity analyses using an alternative (+30%) time series where annual landings were set to be 30% above estimated values. In the Conception Area, where the majority of landing have been taken, the fishery is prosecuted primarily with hook and line and set net fishing gear. These gears are also used in the Monterey Area where trawl landings are predominant.

There is a minimal amount of information on blackgill rockfish available from the NMFS 1995 triennial shelf and the NMFS 1997 slope surveys. These surveys do not cover the portion of the stock south of Point Conception.

Data availability suggested that a quantitative assessment could be made for the Conception Area where landings have been the greatest. Information from the Monterey Area was considered to be inadequate for a quantitative assessment.

The STAR Panel and STAT Team concurred that catch curve analyses may not produce an accurate estimate of total annual mortality (Z) and that estimates of Z from the assessment may be biased low. The direction of the bias due to older ages being included in the catch curve would be towards underestimation of total Z. The STAR Panel discussed the potential bias in the catch curve analyses and emphasized a cautious interpretation of results.

This discussion also focused on the fact that the population is assumed to be in an unfished equilibrium at the beginning of 1975 within the assessment model. In each year after 1975, total mortality includes fishing mortality and this shifts the population age composition away from the initial equilibrium level through an increase in Z above natural mortality. While the population age composition would eventually become independent of the initial equilibrium, this would take many decades due to the number of recruited age classes (about 50, age-35 to age-85 fish). In effect, most of the cumulative mortality experienced by older blackgill

rockfish during the 1980's was accumulated natural mortality.

The STAT Team conducted catch curve analyses based on age composition data collected during 1985 and 1997. For the 1985 ageing data, abundance of age classes between 35 to 45 years old are determined by the recent values of Z during the 1970's and 1980's. All older age classes include some effect of the equilibrium age structure with this effect being more pronounced for older age classes. For the 1997 ageing data, the age-35 to age-57 abundances are solely determined from recent Z's and are independent of the initial condition in 1975. As a result, the STAR Panel concluded that inclusion of age classes older than roughly age-60 would tend to bias the results of the catch curve analyses.

Another feature of the catch curve analyses would have an opposite effect on the Z estimate. This is the spatial patterning of the fishery in relation to blackgill rockfish population abundance. Implicit assumptions for the catch curve analyses are that the recruited population is closed and fully-susceptible to fishing mortality and that fishing and natural mortality are not age-specific. The fishery on blackgill has apparently operated on distinct spatial components of the resource through time, as indicated by the spatial pattern of set net effort. If much of the blackgill rockfish population has not been susceptible to fishing mortality because the fishery did not cover the range of recruited biomass in the Conception Area, then a catch curve estimate of total mortality would be biased low. If an accurate estimate of Z was developed for the susceptible recruited biomass, then the total mortality on the recruited population would be a weighted average of natural mortality on the unfished component and estimated Z for the fished component. As a result, the estimate of total Z from the fished component would be biased high for total recruited biomass. The amount of bias due to spatial patterning depends on the proportion of recruited biomass that has been susceptible to fishing and this proportion is unknown for blackgill rockfish.

The STAR Panel concluded that the catch curve analyses

in the current assessment produce estimates of average Z that are probably biased low due to the cumulative effects of natural mortality on older age classes. This is in accordance with the STAT Team's preferred model of Z=.125 which presumes that the bias in Z is 25%. However, the inference that the catch curve Z's are biased low is also contingent on the assumption that recruited biomass of the Conception Area stock has been fully-susceptible to fishing mortality and this is another source of uncertainty.

The STAT Team constructed decision tables with a range of plausible natural mortality values (4-6%) for 3-year harvest projections. Results of the 3-year projections under an F40% policy (about 270-410 mt per year with M=0.05) indicated that blackgill spawning biomass would decline by 1% to 5% during 1999-2001. In contrast, spawning biomass would likely remain near current levels if status quo catches of 150-250 mt per year were taken during 1999-2001. Status quo catch levels correspond to harvest rate policies between F50% and F55% for blackgill rockfish.

In summary, the results of the blackgill assessment modeling are uncertain. The catch curve estimates of Z are probably biased low. The magnitude of the bias is not known but the STAT Team has put forward a preferred model scenario that indicates a bias of 25%. The STAR Panel considered this to be plausible but observed that the tradeoff between potential downward and upward biases on Z was not quantified. Projections based on the STAR Panel preferred scenario indicate that spawning biomass would likely decrease if catches increase beyond status quo levels of 150-250 mt per year. Overall, the STAR Panel emphasizes that the model results are contingent upon the estimated Z and assumed M and that cautious interpretation of results is warranted.

Analyses Requested by the STAR Panel

Following the discussion of the presentation by the STAT Team, the STAR Panel made a number of suggestions for additional analyses.

I. Requests that maturity at length ogives be fit

through 1% and 99% percentiles of Love et al. and Echeverria curves. The rationale for this request is that the ascending portion of these curves are too broad when translated to age and appear inconsistent with similar species of rockfish. This recalculation will affect computed values of reference points for the stock, including F40%. The STAT Team produced these analyses at the Panel meeting. They were reviewed and accepted by the Panel and the STAT Team.

II. Some sensitivity analyses of model results to catch levels from unspecified rockfish landings during 1980's should be conducted. The STAT Team conducted a sensitivity analysis to the level of reported catch of unspecified rockfish during the 1980's at the Panel meeting. An adjustment of catches upward by 30% was considered reasonable by the Panel. However, the Panel considered the model run with the nominal catch level to be preferred to adjustment of catches upward by 30%. In particular, the STAR Panel preferred model for the Conception Area was the Z=0.099; M=0.047; nominal catch model run. In comparison, the STAT Panel preferred model used Z=0.125 and catches at 30% above the nominal catch.

III. Some sensitivity analyses of model results to catch levels assumed during 1976-79 should be conducted. These sensitivity analyses were completed by the STAT Team during the Panel meeting.

IV. Provide additional information to support use of catch curve analyses to estimate average values of fishing mortality. The STAT Team provided several additional analyses that were reviewed by the Panel. Based on this review, there was consensus of the STAT Team and the STAR Panel that an age of 35 years was an appropriate value for the age of recruitment. The STAR Panel accepted the catch curve analyses for the Conception Area but had reservations about the applicability of the approach to the Monterey Area due to the limited amount of data available for this region. As a result, there was a consensus that the catch curve approach should be applied to the Conception Area but not the Monterey Area.

V. Some sensitivity analyses of model results to

estimated value of M should be reported. Use of 99 percentile of age distribution as estimate of maximum observed age (to account for sampling variability and imprecision of age determination for older fishes) with Hoenig equation or some other method to provide higher value of M. The STAT Team provided several sensitivity analyses for the value of M and these were accepted by the Panel.

VI. Provide projections of the status quo catch for 10 years under a range of management options. The STAT Team provided a wide range of 10-year projections proposed by the STAT Team and STAR panel.

VII. Perform sensitivity analyses for these choices: Effect of using nominal catch vs 130% nominal catch. Effect of using the initial model year as 1970 vs 1975. Effect of choice of harvest policy (F30% to F55%). The STAT Team provided these sensitivity analyses during the meeting.

The STAR Panel thanked the STAT Team for their timely responses to Panel requests. After conclusion of the review meeting, the STAT Team agreed to complete these items for inclusion in the final assessment report.

a. A Stock Summary Report.

b. A decision table that characterized the effects of uncertainty in natural mortality.

The STAR Panel suggested that the following information would be useful to include in the final assessment document if the STAT Team had time to prepare it:

c. Include values of yield and spawning biomass per recruit for commonly-used biological reference points.

d. Present additional price information on other rockfish to see whether blackgill prices are unusual or typical, by fishing gear.

e. Present nominal biomass estimate for Monterey Area based on expansion of trawl survey density estimates and available habitat area.

Prioritized Research Recommendations

1. Develop and apply an appropriate research survey method to track trends in the abundance of blackgill rockfish.

2. Conduct additional ageing with a high priority on a research survey in areas with a nearly virgin population structure (such as in Mexican waters) leading to a better estimate of natural mortality.

3. Monitor age and length composition of commercial landings.

4. Develop fine-scale characterization of habitat utilization to allow stratified habitat-area assessment.

5. Consider development of a logbook program for longline fishers to provide information on the spatial distribution of effort and on levels of CPUE.

1998 STAR Panel Report on Black Rockfish

STAR Panel members:
Jim Packer, WDF&W
Han-Lin Lai, NMFS
Gary Stauffer, NMFS, SSC representative
Frank Henry, CDF&G, chairperson

STAT Team members:
Farron Wallace, WDF&W
Annette Hoffmann, WDF&W
Jack Tagart, WDF&W
Thomas Jagielo, WDF&W

Brian Culver, WDF&W, GMT representative
Rod Moore, GAP representative

Overview

The STAR panel reviewed the draft black rockfish document, as submitted on June 5, 1998. The black rockfish STAT team stated that the assessment is still in the developmental stage, and population model and production model runs had not yet been conducted. The STAT team and STAR panel unanimously agreed that the document was insufficently complete to accept for the 1998 management cycle. The panel chose to discuss the introductory sections (species distribution, stock structure, fishery review, sampling regime, model data components) and provide recommendations for future modeling efforts. The STAT team anticipates an early to mid-1999 completion date for a draft comprehensive black rockfish assessment.

Comments on the technical merits and/or deficiencies of the document

The 1994 stock assessment used the stock synthesis program. The current assessment uses a likelihood-based model constructed using AD Model Builder computer software. The current model differs from the earlier black rockfish assessment in that it is built with less restrictive statistical assumptions by including more sources of variance, for example. Core data inputs are from trawl, commercial line, and recreational fisheries, and a mark/recapture study. The STAT team chose to use AD Model Builder because of its interpretive properties and its flexibility. As part of this ongoing model development, the STAR panel concurred with the STAT team's plan to conduct simulation studies with an artificial dataset with inherent sufficient variability to determine if the model could reflect these data accurately.

The STAR panel noted that future model runs may be hindered by the considerable variability in the commercial fishery data. The panel also observed that

the 14-year series of catch proportion-at-age data from the sport fishery contained little interannual variability, thus providing little information on the response or dynamics of the stock over time.

Prioritized recommendations for future research and data collection

The panel recommended that the complete assessment document provide: a more explicit description of the recreational-fishery sampling protocol for catch and effort; and a review of the fishery effects from the recreational bag limit reductions in 1992 and 1995, and a discussion of concerns about localized fish depletion and the resultant effort shifts.

Given the uncertainty about the development of a successful model for the black rockfish stock, the panel discussed whether or not to recommend continuance of the assessment effort for this species. The STAT team and the STAR panel agreed that: 1) the assessment scientists need to determine if meaningful inferences about the stock can be drawn from past and current data collection efforts; 2) considerable effort has already been invested in the stock assessment and the assessment should continue to completion; 3) the effects of commercial and recreational fishery regulation changes since the last assessment report should be reported to the fishing community and the public; and 4) the model investigation will reveal whether the recreational fishery survey is supplying the requisite types and quantities of data for assessment purposes.

The STAT team hopes to complete the model runs (with the addition of the most recent fishery data) by winter 1998. If the STAT team cannot complete the assessment document by the time a STAR panel is convened in February 1999 to review the Pacific whiting assessment, then it's the intention of the STAT team to submit the document during the regular 1999 review cycle.

1998 STAR Panel Report on Pacific Ocean Perch

STAR Panel members:
Jim Packer, WDF&W
Han-Lin Lai, NMFS
Gary Stauffer, NMFS, SSC representative
Frank Henry, CDF&G, chairperson

STAT Team members:
Jim Ianelli, NMFS
Mark Zimmermann, NMFS

Brian Culver, WDF&W, GMT representative
Rod Moore, GAP representative

Overview

The STAR panel reviewed the most recent draft Pacific ocean perch document, as submitted on June 15, 1998. An earlier, substantially similar draft was distributed to the STAR panel approximately ten days prior to the June 15 meeting. The STAT team and STAR panel unanimously agreed that the document was sufficiently complete to accept for the 1998 management cycle. The panel devoted two and one-half days of discussion to a thorough review of model data inputs, underlying model assumptions, and results of prior and requested model runs. The STAR panel commends the STAT team for producing a comprehensive and essentially complete assessment for panel review.

List of Requested Analyses

The panel evaluated the reference model and the document's five alternative models for sensitivity analyses. It's important for readers of the assessment to recognize that the five alternative sensitivity analyses models do NOT represent equally likely scenarios. They were constructed for exploratory purposes to construct optimal or most desirable reference case specifications. The following list describes the panel's recommendations regarding acceptance or modification of each alternative model. When the STAR panel directed the STAT team to modify the assessment's reference case specifications, this step necessitated re-running of all alternative models during the course of the panel meeting. The STAT team complied with all requests.

Model 1 - Reference Case. Change the selectivity pattern from variable with an apparent knife-edge selectivity during 1966-1980 to variable selectivity corrected for this knife-edge artifact. During the panel meeting a test run of this model was conducted using constant selectivity for these fishery data. This fixed selectivity run produced a very dome-shaped selectivity curve, creating an unreasonable

proportion of old individuals remaining in the population. Consequently, this alternative was rejected in favor of the above-mentioned specification. Biased fishery catch-at-age data from ages 14 and older individuals appeared to cause the knife-edge artifact, and thus were not used to tune the final reference case model.

Model 2 - Foreign and domestic fishery catch in three peak harvest years reduced by one-half. Accept as presented in document.

Model 3 - Variable survey selectivity over time. Replaced with new model examining the case of constant fishery selectivity over time. This alternative was adopted during the panel meeting. Variable survey selectivity in the original alternative produced little difference in results compared with the original reference case.

Model 4 - Broader prior distributions on survey catchability (q), natural mortality (M), and stock-recruit (S-R) steepness. After investigating the results during the STAR meeting of using uniform priors for values of M from 0.02 to 0.10, this model was accepted as presented in document.

Model 5 - Exclude fishery CPUE index. Accept as presented in document.

Model 6 - Alternative age-at-50% sexual maturity of age 7 (versus reference case of age 10). Accept as presented in document.

The panel recommended that the document include projections of future stock size and harvest at $F_{40\%}$, and a value of F more conservative than F_{msy} to evaluate a rebuilding policy. $F_{30\%}$ is approximately equivalent to current fishing levels. Additionally, projections for the next three years should include both estimates of catch quantities and female spawning biomass. The STAT team revised the decision table following critical examination of results of the Markov-Chain Monte Carlo (MCMC) analysis.

Comments on the Technical Merits and/or Deficiencies of the Document

During the STAR panel review of the reference model, the pattern of selectivity coefficients for the commercial fishery was examined. The pattern exhibited a knife-edge pattern at age 14 for years 1966 to 1980. The STAT team attributed this to aggregation of ages in a 14+ category to deal with the bias from otolith surface ages. Two alternative models were run by the team: one with constant selectivity and the other with age 14+ fish deleted from the tuning of the model, relying instead on only the data for ages 4 through 13. The independently-gathered catch-at-length data were retained in the model; as a result it was thought that little information on population performance was lost by excluding these older fish. This change eliminated the knife-edge pattern and the resulting selectivity was less domed-shaped than the constant

selectivity model. The STAR panel and the assessment author agreed that the new variable-selectivity model is preferable to the constant-selectivity model, because of the profound technological changes that have occurred in the fishery over the last 30 years. Therefore, the STAR panel recommended that the reference selectivity model be changed to the new variable-selectivity model.

The sensitivity analysis of the results from the alternative models compared to the reference model provides some insight into the applicability of the reference model results for levels of removals for 1999 through 2001. A comparison with Model 2 indicates that the accuracy of the large foreign catch is not particularly important. This model alternative was added at fishing industry request due to concerns over possible overestimation of POP catches from misidentification of other rockfish as POP. However, the panel noted that the opposite case of underestimation may also have occurred, citing Fraidenburg et al. (1978) as the basis for consideration of possible foreign under-reporting. A 50% reduction of the three highest catches did not change the harvest reference points or estimated population parameters significantly.

For Model 3 (constant selectivity) and for Model 6 (age for 50% maturity at 7 rather than 10), the 1999 harvest reference points were about 14% and 26% higher for the two models, respectively. Model 3 is believed to be relatively unlikely, as stated above. The two identified concerns about Model 6 were that visual gonad inspections (the basis of data in the 1995 assessment for age 7) may be biased, and that the histological examination-based estimate of age 10 from recent Alaska studies may not be correct for the Washington-Oregon-California POP stock in the extreme southern end of the species' range. However, an age-at-50% maturity of 10 is most appropriate until new data become available. The other estimated parameters and reference points were relatively unchanged for Models 3 and 6 compared to the reference case model (Model 1).

The results from Model 4 (broad priors for M, q, and S-R steepness) and Model 5 (deleted 1956-73 CPUE data) suggest that 1999 harvest reference points are 25% and 32% lower than results for Model 1, respectively. Broader prior distributions for M, survey q, and S-R steepness resulted in a higher point estimate for M and lower estimates of q and steepness. The parameter estimates for Model 5 are unchanged from Model 1. These results suggest the importance of re-examining the earlier analysis of CPUE time series and the need for measuring the q for the triennial bottom trawl survey for POP. Although these models provide more conservative harvest projections for 1999, Model 1 is preferred .

The panel felt it would be worthwhile to review how the domestic trawl fishery CPUE dataset was calibrated . This dataset spans a time period of 1956-73 when fishing technology was relatively stable, thus it's appropriate to use these data in the model. More recent domestic fishery CPUE data, on the other hand, would be confounded by profound technological improvements (Loran A/C, plotters, net sounders, net configurations, etc.), as well as a bycatch trip-limit regime.

The STAR panel and STAT team discussed the appropriateness of the discard rate estimate of 16% derived from the study by Pikitch et al. (1988). The group acknowledged that this value may not be accurate under recent regulations and fishery practices, but more accurate, near-term information is unavailable to supplant the value used in the assessment.

The panel discussed employing only the more recent recruitment values for yield models since the current model projections allow for a year class that was produced by very large historically-early biomass levels (~100,000 MT). The STAT team stated that the model was in fact already operating in this manner.

Areas of Disagreement

No major areas of disagreement arose during the panel meeting.

Unresolved Problems and Major Uncertainties

The differences between the expected reference points from the forward projection age-structured model and the full Bayesian integration analysis using the Markov-Chain Monte Carlo (MCMC) algorithm are somewhat troubling because they suggest quite different spawning stock levels for B_{msy} and for year 2009. The MCMC integration algorithm is a more explicit treatment of the uncertainty about the model's harvest projections than the "point estimates" traditionally used in westcoast groundfish management, and the MCMC expected value is a more accurate reflection of future stock sizes. Simulation studies to explore the characteristics of probability distributions of estimates for various reference points should be encouraged for future stock assessments for Pacific ocean perch and other species. We expect that future efforts to develop a rebuilding plan for POP should be based on the full integration analysis. The 1999 through 2001 harvest projections for harvest reference points are nearly identical for the two modeling approaches. The current harvest levels, given the Council's management objective for a bycatch only fishery, are nearly equivalent to the $F_{30\%}$ level. To provide for any rebuilding, future harvest levels will need to be reduced to exploitation rates closer to F_{msy}, which will likely be difficult to attain, given the multi-species nature of the trawl fishery.

Recommendations for future research and data collection

The Star panel recommends the following:

First Priority

Collaborate on a stock-wide assessment including the Canadian INPFC Vancouver Area data with the present U.S. Vancouver Area and Columbia Area analyses. Resulting fishery yields would then be allocated between the two countries in an operational manner similar to that employed for Pacific whiting.

Resume the collection of age structures from the fishery in areas where POP are landed.

Conduct histological studies to determine the most appropriate age at sexual maturity for the Vancouver/Columbia Area population.

Review the standardization of domestic fishery logbook data from 1956-1973 by D. Gunderson to determine how the CPUE data were calibrated. Determine if these data are retrievable to redo the CPUE analyses.

Second Priority

Investigate ways to improve the precision of the NMFS triennial survey catchability coefficient (q). NMFS staff could examine gear effects on catchability, such as herding of POP by trawl doors and escapement under the trawl footrope. In addition, analyses of survey data should continue on the implications of area-swept expansions onto untrawlable grounds.

Examine field observation data from the Oregon Trawl Commission for potential insights on the appropriateness of a 16% discard rate for POP since the discard study of Pikitch in the late 1980s.

Re-age the pre-1983 historical-fishery age structures using the break-and-burn technique.

Since extensive trawl fishery logbook collections are available and questions remain about the occurrence of targeting behavior, the STAT team and STAR panel recommend that questions about POP fishing be incorporated in the NMFS Port Interview Program (PIP) questionnaire.

Detailed investigations into the Soviet survey data from the 1960s and 1970s should be continued, particularly regarding their use as an independent historical abundance index. As mentioned in the assessment document, if rockfish species identifications were credible, these data may provide insights into changes in relative species abundance over time for a variety of rockfishes.

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Sablefish & Shortspine Thornyhead

STAR panel meeting report

Newport, Oregon
6-10 July 1998

Mike Sigler, NMFS, Alaska Fisheries Science Center, Chairman
Bob Hannah, Oregon Department of Fish and Wildlife
Larry Jacobson, NMFS, Southwest Fisheries Science Center, SSC representative
Sandra Lowe, NMFS, Alaska Fisheries Science Center
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Pete Leipzig, Groundfish Advisory Panel representative
Jim Hastie, Groundfish Management Team representative

Final, 31 July 1998

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1.0 Introduction

Two stock assessment teams (STAT) prepared assessments for sablefish. One team (STAT1) consisted of NMFS scientists, the other (STAT2) of scientists contracted by the nonprofit organization "Ocean Trust." A third team (STAT3) composed of NMFS scientists prepared an assessment for shortspine thornyhead, as did STAT2. We organized the meeting agenda to give each team's assessment equal attention.

2.0 Sablefish

The fundamental issue for the sablefish assessment is the lack of good data to track population trend and determine abundance. All data sets available for sablefish are problematic because of the lack of consistent, reliable data series. Consequently, estimates of biomass trend are imprecise regardless of the model used. We generally endorsed the range of modeling approaches used and made some suggestions that were addressed by the assessment teams at the meeting. We focused our review on two models, STAT1 age-structured model and STAT2 delay-difference model. The lack of informative data means that the only real way to improve the assessment is to begin conducting annual, coastwide abundance surveys or annual coastwide tagging, the latter requiring a known reporting rate.

2.1 Treatment of the slope survey data

Treatment of the slope survey data is a problem for the sablefish assessment because each survey, except for the 1997 survey, had limited spatial coverage. Resolution of the historical trend is uncertain and largely driven by a large abundance estimate in the Central Columbia area in 1988. The two teams dealt with these problems differently. STAT1 used an "aggregate years"[1] approach to provide a coastwide index of abundance. This approach implicitly assumes that differences between areas were more important than differences between years during 1988-1993. STAT2 fitted a trend to slope survey data for 1988-1997 and estimated variances of the abundance estimates. Both teams' analyses effectively down-weighted the large 1988 abundance estimate. We felt that both analyses were reasonable approaches to assessing sablefish given the problems in the survey data.

The 1995 external review of groundfish assessments concluded that the slope survey did not provide a reliable time series of relative abundance, particularly the 1988-1993 data, and recommended that the assessment not use the slope survey results. We accepted the use of historical data because Lauth et al. (1998) concluded that the catch rates of the deep-water

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[1]STAT1 combined data from individual surveys conducted in 1988, 1990-1993, and 1995-97, which resulted in a reduced time series of three data points, "1991", "1995", and "1997", referred to as "aggregate years" in the STAR panel report and "super years" in the STAT1 assessment.

complex were not significantly different despite the high variability found in trawl performance. The historical data were necessary to estimate the recent abundance trend and was used by both assessment teams. However our acceptance is not a stamp of approval for the long-term use of the pre-1993 data. Future assessment teams and review panels should carefully evaluate whether using the questioned pre-1993 data is necessary as additional years of survey data are collected.

Three important issues were unresolved for treating the slope survey data. 1) The sharp drop from 1988 to 1990 does not make biological sense given low natural mortality of sablefish and assuming, as the assessments did, that the stock is closed. The 1988 point covered a relatively small area where sablefish density may have been high and probably should not be extrapolated coastwide. 2) Survey catchability may vary from year to year. 3) The coefficient of variation of the "aggregate years" index is about 8%, which seems unreasonably low.

2.2 Decision not to use recent trawl logbook CPUE

We endorsed the use of trawl logbook CPUE data to 1988. STAT1 explained that management measures may have begun to affect landings data and catch rates beginning in 1989. In the future, it may be possible to use CPUE data for more recent years as well. This was discussed, and some preliminary calculations were completed by STAT1, but we lacked time to reach conclusions.

2.3 Size classes included in the pot survey data

STAT2 included all size classes in their analysis of pot survey data whereas STAT1 included only the medium and large sizes. STAT1 found that the catch rates (number of fish/pot) based on all sizes of sablefish were highly variable in both the northern and southern pot surveys. The peaks exhibited in both surveys were due to high catch rates of extra-small and small fish. However, the decline in medium and large sablefish was a consistent signal in both pot surveys. STAT2 used data from fish of all sizes despite the fact that the smaller fish introduced additional variation into the predominant trend indicated by the larger fish. STAT2 noted that the lower bound of the medium and large size categories was larger than the asymptotic body size for males and felt it more appropriate to include all size classes. The different treatments of size classes complicated comparisons between STAT1 and STAT2 models, but both approaches seemed reasonable given the high variability of the pot survey data.

2.4 Contradiction between the trawl logbook CPUE and pot survey trends

We were concerned about the contradiction between the trawl logbook CPUE data and the pot survey data, and whether the decline in pot survey indices is overstated relative to the CPUE data. Several factors may contribute to the differences in trend and rate of decline between the two indices: 1) the pot survey index treatment of medium and large fish vs. all size classes, 2) impacts of the whiting fishery discards in the pot survey area, 3) a gear change in the middle of the pot survey time series that could have artificially depressed catch rates, and 4) the pot survey

is conducted in pre-selected sites which generally are flatter and more"trawlable". We could not resolve the conflicting trends between the CPUE and pot survey data.

2.5 Discards

Both assessment teams assumed mortal discards during 1988-1996 were 20% of total trawl catch. Discards from longline and pot catch were assumed non-mortal. Discards probably vary annually, adding uncertainty to the assessment and undermining the use of logbooks as an index of abundance.

2.6 Model complexity

We endorsed STAT1's age-structured model, but were concerned about the complexity of the model given the limited data. For example, it would be better to constrain the time-varying selectivities with external variables, such as changes in regulations and market dynamics. The time-varying estimates of selectivity would be more understandable if a parameter such as the age of 50% selection were plotted versus time.

2.7 Recent recruitments

Recent recruitments (after 1991) estimated using STAT1's age-structured model were poor compared to historical levels, possibly due to environmental change or reduced spawning biomass. This pattern does not occur in estimates from STAT2's delay-difference model because it estimates recruitments from a deterministic stock-recruitment curve that does not allow for year-to-year variation in recruitment. The most likely reason that reduced recruitment was estimated in the age-structured model is a lack of small fish in the 1995 shelf survey and in the 1997 slope survey.

2.8 Abundance trend

Abundance estimated from STAT1's age-structured model (Figure 1) and STAT2's delay-difference model declined from the early 1970's until about 1990. The trend after 1990 depends on the model. Recent estimates from STAT2's model are flatter than estimates from STAT1's model. Differences in how the slope survey data was treated and how recruitment was modeled could have caused the difference.

STAT1's approach to analysis of the slope survey data resulted in a time series that was flat over a narrower range of years (1991, 1995, and 1997) than STAT2's time series which was essentially flat from 1988 to 1997. We speculated that the sparser STAT1 time series was less likely to flatten the pre-1990 decrease in abundance.

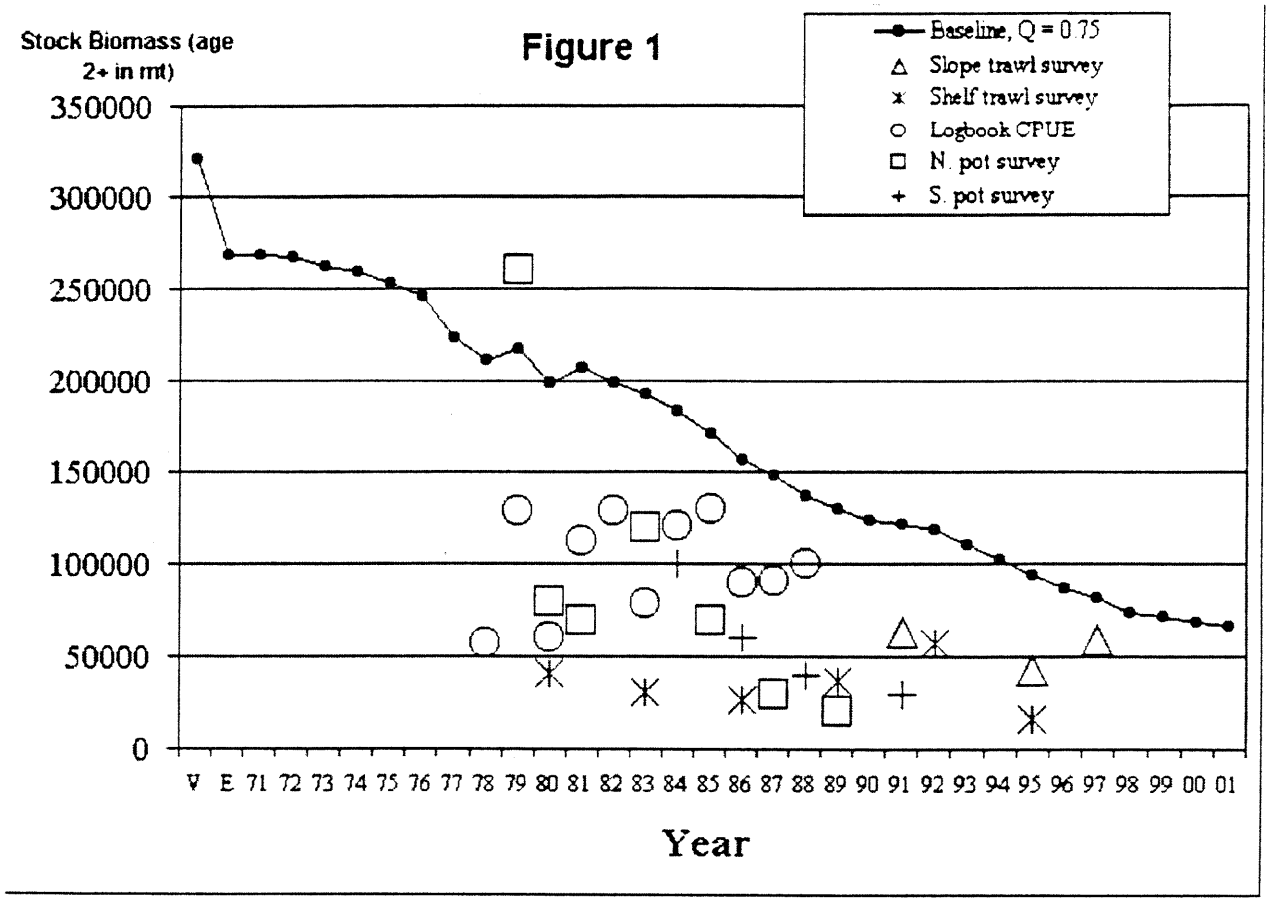


Figure 1. STAT1 model total age 2^+ biomass estimates for the baseline model at slope survey catchability, $q = 0.75$. The indices are plotted only to show trends and their plotted absolute values relative to the biomass estimates are not relevant.

The continued decrease in abundance during the 1990's may be the result of poor recent recruitment and can be depicted only by a model flexible enough to estimate year-to-year variation in recruitment, as described in section 2.7.

The hypothesis of poor recruitment and decreasing abundance in recent years is important for management, but difficult to verify with a shelf survey conducted only every third year and a lack of coastwide slope surveys prior to 1997. We checked model structures which might artificially cause the post-1991 pattern of poor recruitment and decreasing abundance and found that the result was insensitive to the range of survey catchability we considered most likely ($q = 0.5$, 0.75, 1.0), data sources included in the model, and varying selectivity during the 1990's.

Both hypotheses about flat and declining trends in sablefish abundance during the 1990's are plausible given the ambiguous nature of the available data. The panel concluded that model abundance estimates were based mainly on the assumed q, age-structure and historical catch data.

We asked STAT1 for a short-term (3 year) projection from the age-structured model that assumes recruitment equal to the average of the last 5 years estimated recruitment (1991-1994) in order to communicate to managers the consequences of the hypothesis of continued poor recruitment.

Pete Leipzig, the GAP observer, described how the estimated trends in sablefish abundance seem contradictory to the industry's perception of trends in sablefish abundance over the last decade. We were unable to reconcile differences in perceptions about abundance trends.

2.9 Treatment of slope survey catchability coefficient

The assessment models did not give reliable maximum likelihood estimates of current biomass, due to data limitations. Uncertainty about the slope survey catchability (q) and uncertainty about current biomass levels were directly linked. In the absence of credible maximum likelihood estimates of q, the Panel and STAT teams decided to base estimates of current biomass on their opinions about plausible values for q using a simple "Bayesian" approach, which we considered a reasonable way to handle uncertainties in results for sablefish. This approach does not substitute for collecting more data such as coastwide annual surveys.

Most of the uncertainty in sablefish biomass estimates was associated with q, although other important parameters in the stock asessment models, such as spawner recruit steepness in STAT2's model, were also important. We had time to investigate only uncertainty in q.

The Panel and STAT teams agreed on reasonable values for q in the form of a "prior" distribution - a range of possible values for q with an associated probability that measured how likely each q value was in their opinion. The probabilities were best guesses based on discussions about sablefish behavior, the fishery, experience with other stocks, and two published reports on other species.

Prior Distribution for Slope Survey q for Sablefish

q	Probability
0.25	0.125
0.5	0.25
0.75	0.25
1.0	0.25
1.5	0.125

The chosen values imply that q for sablefish is probably less than one, which seemed reasonable because: 1) sablefish probably occur outside the survey areas, so that the survey misses part of the stock; 2) sablefish probably escape over the top of the trawl survey gear; 3) substantial herding of sablefish by trawl doors has not been documented; 4) sablefish are strong swimmers; 5) very large sablefish are taken less frequently by trawl than longline gear; 6) sablefish densities are similar on untrawlable and trawlable ground based on longline survey data from Alaska; and 7) in published reports, estimates of other species' q are also generally less than one.

We emphasize that assumptions about q are effectively assumptions about current biomass for sablefish and that the prior distribution was an educated guess by the Panel and STAT teams.

2.10 Decision tables

Decision tables were created by the assessment teams to attempt to convey the range of uncertainty in the assessments and the consequences of management actions. The tables, presented in the assessment summaries, showed considerable uncertainty in short- and medium-term biomass projections.

We endorsed two sets of decision tables, one for the STAT2 delay-difference model, the other for the STAT1 age-structured model. Each decision table includes a range of states of nature for slope survey catchability over different catch policies and for 3- and 10-year projections. The assumed shape of the stock-recruitment curves used in both decision tables implies that sablefish are resilient to recruitment overfishing. This was an important discussion point because the best fit for the STAT1 model implied a stock either more susceptible to recruitment overfishing or with recruitment affected by environmental conditions.

If estimated current biomass is used for the allowable biological catch (ABC) recommendation, then results from either STAT1 age-structured or STAT2's delay-difference model can be used. If short-term projections are needed for the ABC recommendation, then they should be based on STAT1's age-structured model because it incorporates the possibility of poor recruitments in recent years, which is important for short-term biomass projections.

3.0 Shortspine thornyhead

The fundamental issue for the shortspine thornyhead assessment is that all the assessment models were very sensitive to small differences in model specification and parameter values. Biomass estimates changed dramatically in response to plausible changes in assumed parameter values. This problem was exacerbated by the lack of data to track trends in abundance and uncertainty about growth rate and natural mortality.

All models showed a declining trend in stock abundance. The principal differences among model results were the rate of decline and the current stock size. Choosing among the models was difficult due to the limitations of the available data. We focused our review on two models, STAT3 age-structured model and STAT2 "simple" age-structured model.

3.1 Treatment of the slope survey data

Like the sablefish assessment, treatment of the slope survey data is a problem for the shortspine thornyhead assessment because each survey, except for the 1997 survey, had limited spatial coverage. The two assessment teams treated the slope data the same for both sablefish and shortspine thornyhead, which seemed reasonable. The abundance trend estimated by STAT2 of

5% per year from the slope survey data was similar to the trend implied by the "aggregate years" approach used by STAT3.

3.2 Trawl logbook CPUE trends

We felt that trawl logbook CPUE data were more difficult to interpret for shortspine thornyhead than sablefish and supported the exclusion of the logbook data from the shortspine thornyhead models. We discussed several problems in interpreting the shortspine thornyhead CPUE data. 1) The thornyhead catch was separated into longspine and shortspine components based on the reported depth in the logbook rather than on sampling. 2) The spatial coverage of the CPUE index changed over time. The early portion is from California alone, then Oregon, then in 1995 Washington.

Trawl logbook CPUE increased in 1995-1997. Information from Gerald Gunneri supported a recent improvement in catch rates. We were unable to determine whether the increase was due to increased abundance or availability or changed fishing practices. We discussed some recent fishery changes: stricter trip limits, decreased effort, and increased mesh size.

The shelf survey shows more, smaller fish in 1995, whereas the 1997 slope survey does not support the recent increase. Small fish do not dominate the landings in recent years, but these data are difficult to interpret because the length compositions are variable and market related discards have changed over time.

3.3 New discard and landings model

STAT3 included a new method of estimating size-related discards and returned to an earlier method of estimating fishery selectivities in their age-structured model. Discarding-at-size was expressed as a linear function of minimum size acceptable to processors. Additional trip-limit induced discard was assumed to be 30% in 1995-1997. Changes in the selectivity of the larger fish, which are found in deeper water, was expressed as a linear function of the average depth of fishing as reported in the Oregon logbooks. We support the use of external information on market price and minimum size to constrain estimates of selectivity and discard. This approach makes estimates of changes in selectivity more believable and easier to understand. However modeling is not a substitute for fishery sampling and data are needed to verify the discard patterns estimated by the model (e.g., observers for at sea discards).

3.4 Parameter determination and model specification

Uncertainty in the assumed values of natural mortality (M) and the von Bertalanffy growth coefficient (k) and the estimates of the slope survey catchability coefficient (q) is a key problem for the shortspine thornyhead assessment.

There was considerable discussion about choosing a reasonable set of values for the growth parameter k and natural mortality M. For the baseline model, STAT3 initially chose $k = 0.023$, which was derived by Butler et al. (1995) and $M = 0.06$, which was inferred from an oldest age of 80 years. STAT3 tested values of M from 0.03 to 0.09; the best fit occurred at $M = 0.05$. STAT2 found that 0.03 fit much worse than 0.06. Exponential survivorship implies that with $Z = M =$ 0.06, 5% of the fish would be older than 50 and 1% older than 77. If M were 0.03, the 5% and 1% ages would be 100 and 153. A visual inspection of Butler's age data suggested that the higher value of M is more likely. A similar profile was performed for k when M was fixed at 0.06, which found a best estimate of k at 0.04.

Changing the assumed values of k and M within a biologically believable range has important impacts on the biomass estimates. Ending biomass was 34,000 mt (metric tons) for the initial baseline STAT3 model ($M = 0.06$, $k = 0.023$) and fell to 25,000 mt when M was 0.05 and to 21,000 mt when k was 0.04. The latter two ending biomass values were close to the lower biomass estimate defined by probable range of the STAT3 base case, implying that the normalized likelihood understates uncertainty in ending biomass.

The initial baseline STAT3 age-structured model was replaced with a model with two recruitment stanzas and a fitted growth parameter k. Like the initial baseline model, the revised STAT3 model also had a narrow likelihood profile but was centered at 21,000 mt ($q = 1.0$). The STAT2 revised "simple" age-structured model fit the data best at higher estimated biomass, 42,000 mt ($q = 0.5$). These results show the sensitivity of the abundance estimates to changes in model specification. Further references to the STAT3 model in this document refer to the revised model.

Differences in results between the STAT3 and STAT2 models probably resulted from differences in modeling approach. STAT2 did not dynamically model discards or fishery selectivity, was fit only to the slope survey index, and used different catch estimates. Changes in age structure due to time-varying selectivity and discards won't be captured in the STAT2 model. In future assessments, all models should use the same estimated catch histories or test the effect of using the different catch histories.

We endorse the approach of the "simple" age-structured model presented by STAT2. Having two models of different complexity, STAT3 age-structured model and STAT2 "simple" age-structured model, also improves the overall quality of the shortspine thornyhead assessment. However we do not endorse the results of the STAT2 "simple" age-structured model because the model was fit only to the slope survey index and used different catch estimates from the STAT3 model; the STAT2 assessment did not explore the consequences or sufficiently explain the rationale for these differences.

3.5 Modeling recruitment

None of STAT2 or STAT3's models incorporated the possibility of annual recruitment variation because of the lack of data to reliably estimate annual recruitment variation. However, data from several sources supported a model in which recruitment was not constant, including the trawl logbook CPUE, which indicated increased thornyhead abundance after 1994, the shelf survey biomass index which also showed a slight upward trend in recent years, and, to a lesser degree, the shelf survey length frequency data which suggested some increase in the relative frequency of smaller animals in 1995. STAT3 also provided a model run in which annual recruitments were estimated, with bounds on the allowable annual recruitment variation. Estimated age-1 recruitment during the 1980's increased, which was consistent with increases in the abundance of fully vulnerable fish in the early to mid 1990's. This model had an ending biomass of 41,500 mt.

We also discussed recent literature on recruitment variability in the northeast Pacific Ocean suggesting that decadal scale variation in recruitment is common for many stocks. To avoid over-parameterization of the model while allowing for the possibility of a recent increase in recruitment, we recommended that the STAT3 model be constructed to allow two recruitment stanzas to be estimated, with the discontinuity taking place around 1977.

3.6 Abundance trend

All models show that the biomass is falling, but the rate of decline is uncertain (Figure 2). Abundance data for shortspine thornyhead show different trends. The "aggregate years" slope survey data also show a monotonic decline. The shelf survey abundance trend was downward and followed by a recent increase, similar to the trawl logbook CPUE.

There is an internal inconsistency in the STAT3 age-structured model fit to the shelf survey data; the best fit to its size distributions is with low terminal biomass, but abundance trends show an increase since the early 1990's, which would suggest a higher ending biomass.

The difference in model fit between the two assessments, in relation to the estimated q, was attributed to differences in model structure, as described in section 3.4, and the analysis of the slope survey data. To provide a coastwide index of abundance, STAT3 used the"aggregate years" approach and STAT2 fitted a trend to slope survey data for 1988-1997. There was no consensus as to which approach gives a more realistic estimate of q.

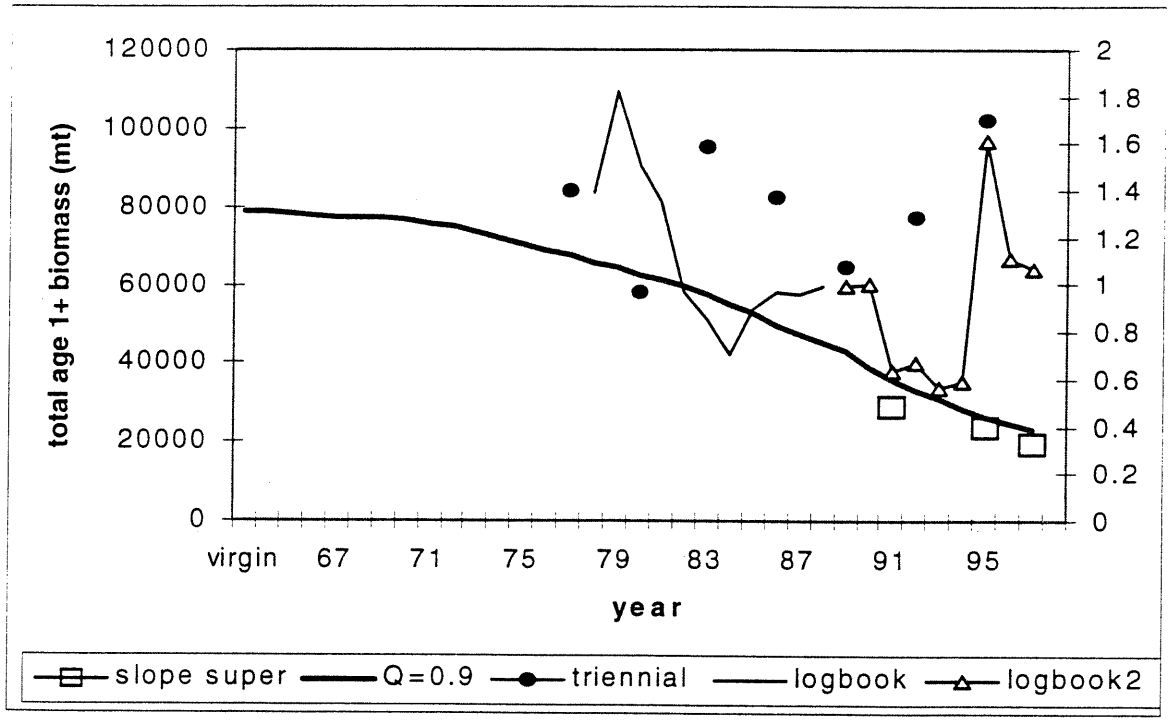


Figure 2. STAT3 model total age 1^+ biomass estimates at the slope survey catchability value providing the best fit to the data, $q = 0.9$, compared to the available relative indices of abundance. The indices are plotted only to show trends and their plotted absolute values relative to the biomass estimates are not relevant.

3.7 Treatment of slope survey catchability coefficient

We felt it was important to assign prior probabilities to slope survey catchability and, hence, ending biomass, in order to more fully express the range of uncertainty about shortspine thornyhead biomass. We discussed a probable range of q for shortspine thornyhead and agreed on a prior probability distribution. It was based on panel, assessment teams, and industry knowledge of gear performance and shortspine thornyhead biology. Like the sablefish prior for q, the shortspine thornyhead prior for q was an educated guess.

The chosen values imply that q for shortspine thornyhead probably is less than one and that "very low" values of q are unlikely. This hypothesis seemed reasonable because 1) substantial herding of shortspine thornyhead by trawl doors seems unlikely; 2) shortspine thornyhead probably occur outside the survey areas, so that the survey misses part of the stock; 3) animals appear sedentary, so that q probably is not "very low;" and 4) no net is likely to be 100% efficient even for large fish within its path.

Prior Distribution for Slope Survey q for Shortspine Thornyhead

q	Probability
0.25	0.1
0.5	0.4
0.75	0.4
1.0	0.1

The shortspine thornyhead prior for q implies that they are less catchable than sablefish. This was considered contrary to the observation that sablefish are generally considered to be less catchable, except for one factor affecting catchability, herding, which was believed to be highly unlikely for shortspine thornyhead, but could not be ruled out for sablefish. No further action was taken because the prior distributions for both species are only approximate.

3.8 Decision tables

Decision tables were created by the assessment teams to attempt to convey the range of uncertainty in the assessments and the consequences of management actions, and are presented in the assessment summaries. The tables showed considerable uncertainty in short- and medium-term projections.

We endorsed the decision tables for the STAT3 age-structured model of shortspine thornyhead. We did not endorse the results or decision tables for the STAT2 "simple" age-structured model, for the reasons described in section 3.4. We endorsed the STAT3 model that fitted k and fixed M = 0.06 for a range of values of q, because fitting k markedly improved the fit to the data. We also recommended that two recruitment stanzas be estimated as described in section 3.5. However neither model estimated annual variation in recruitment, which is important in short-term biomass projections. The decision tables include a range of states of nature for slope survey catchability over different catch policies and for 3- and 10-year projections.

We specified a prior distribution for slope survey q (a best guess) based on panel and industry knowledge of gear performance and shorspine thornyhead biology. We disagreed internally on whether to use the STAT3 model likelihood profile to generate a posterior probability distribution for q. Most panel members expressed the view that the likelihood profile from the final model runs seriously understated the uncertainty in stock status. A minority of panel members supported using the model likelihoods in calculating the posterior probability, because the model specifications for the final model runs were a reasonable choice of parameters. Because of this disagreement, we recommend that two series of expected values be presented in the final decision tables for STAT3.

4.0 Prioritized research and data needs for future assessments

Both the sablefish and shortspine thornyhead assessments suffer from the lack of consistent, coastwide abundance data collected over time. Significant improvements in the assessments (and corresponding reductions in uncertainty in the level and trajectories in stock size) will require major new efforts spanning the gamut of basic fishery sampling data. The panel, along with the assessment teams and industry people participating in the meeting, agreed on several broad categories of research necessary to upgrade these assessments. The first four items are highest priority. The first two items are methods to estimate abundance.

- *Abundance Data.* The coastwide slope survey undertaken in 1997 provides the single most important data element used in the current assessment. ***We consider it crucial to the development of long-term, credible stock assessments that annual, coastwide abundance data be collected beginning as soon as possible.*** Various survey types (slope, shelf, ichthyoplankton, pot, longline) or tagging can be employed, and directed to answer particular questions (indices of recruitment, exploitable biomass). It is beyond the scope of our mandate to evaluate the merits of various survey types. Above all, we emphasize the importance of conducting any survey in a consistent manner (gear, operational characteristics, areas covered).

  Three additional aspects of abundance surveys are important if the swept-area biomasses from the survey are to be used to measure stock size: 1) catchability and selectivity of the gear (see below), 2) relative density of sablefish on untrawlable grounds, and 3) proportion of the assumed population that occurs outside the geographic boundaries of the survey (in deeper or shallower waters or migrating latitudinally beyond the survey region). Additional field research and detailed measurements of the proportion of untrawlable grounds could be used to evaluate the effects of these considerations on assessment results.

  Additional information on the migratory patterns of sablefish, growth, and estimates of abundance could be obtained from an intensive tagging study, based on the use of cryptic tags (coded-wire or PIT tags), in combination with a program to detect tagged fish as they are processed. The reporting rate must be known to infer abundance. The scale of such a program has not been evaluated (i.e., numbers of tags necessary to derive meaningful statistics), but this could be evaluated based on current assumptions of population size, handling mortality rate of fish from various depths, and proportion of the catch available for sampling.

- *Estimates of catchability of the slope survey.* A continuing source of uncertainty in the assessment is the assumed level of catchability (q) of sablefish and shortspine thornyhead for the survey. Appropriate experimental work focusing on various elements affecting q could narrow the range of plausible values, thereby reducing uncertainty in assessments and projections. Field studies relating to the catchability of the surveys are

recommended. In the interim, more objective methods for determining priors for the slope survey catchability (including expert opinions of gear technologists, fishers, and scientists) should be sought. Meta-analyses of worldwide experiments to estimate survey q would be useful pending the results of local field studies.

- *Biological Sampling of the Catch.* Age and length sampling of the catch is sparse for some gear, state, and area combinations. We recommend that consistent, statistically-based sampling programs be instituted to provide biological sampling data with levels of bias and precision appropriate to the assessment. Furthermore, a technical problem in sampling sablefish in market categories exists because market categories are not defined consistently throughout the industry. Alternative sampling schemes (perhaps including random sampling of landings before binning into categories) may be required. Solving this problem will require a cooperative effort between scientists, fishers, and processors. Discarding of both species (primarily regulatory-induced discards) have been assumed to be a significant portion of the catch in some years. However, contemporary estimates of discards are not available. We recommend that a directed sampling program to collect discard data through at-sea observer programs, enhanced logbooks, or other suitable means be initiated, and that such sampling be conducted annually as a basic element of catch sampling.

- *Age Validation and routine ageing studies.* Stock assessment analyses and interpretation of natural mortality rates based upon longevity require more conclusive studies to validate ageing techniques and estimate growth, primarily for shortspine thornyhead. We recommend that further studies of age validation be undertaken for shortspine thornyhead as expeditiously as possible, potentially including isotopic studies (radiometric ageing, interpretation of annual marks using oxygen isotopes), tagging and marking studies, and other approaches as deemed appropriate. A study of the onset and factors relating to sexual maturity for the species is necessary for developing fishing mortality rate targets based on spawning stock biomass per recruit because relatively little is known of the reproductive biology and functional maturity of these two species.

- Meta-analysis of stock-recruitment parameters would be useful for forecasting recruitment trends and for incorporating into model abundance projections.

- Improvements in assessment and projection software would facilitate stock assessments and management-related analyses.

- Describing to the Councils and others how Bayesian analyses can be used would improve communication about assessment uncertainty between assessment teams, industry groups, and the Council.

5.0 Requested analyses

5.1 Sablefish

Analyses and data requested by the STAR Panel during the meeting (check [✓] indicates request fulfilled):

- STAT1 produce catch-at-age matrices for commercial catch (all gears combined and by gear type). ✓
- STAT1 produce catch-at-age matrix for the slope survey, a fishery-independent index. ✓
- STAT1 provide an age-structured model run with fishery selectivity parameters for all gear types held constant since 1992 to compare recent recruitment scenarios with the run that allows selectivity to vary. ✓
- STAT1 re-analyze trawl logbook CPUE data with an intervention term to allow interpretation of recent trends in abundance using the logbook data. Plot the frequency distributions of catch per trip by year to evaluate the possible impacts of regulations.✓
- List how data and assumptions vary between STAT1 and STAT2 assessments. ✓
- STAT1 produce residuals from ages and lengths from the baseline age-structured model run.✓
- STAT1, STAT2 produce decision tables with the following elements:✓

  Time Horizon: 3 and 10 years (2001; 2008)
  Policies: range of catch from about 4,000 to 8,000 mt
  Hypotheses: 5 q hypotheses
  Statistics: projected biomass, ratio of projected biomass to unfished biomass, F
  List the priors across the top of the table
- STAT1 produce age-structured model results with and without contradictory data, with each individually, and for a range of plausible q, biomass and recruitment trends.✓
- STAT2 revise projections based on delay-difference model: ✓

  Average F given Biomass in 1997, compute ABC based on $F_{35\%}$ and $F_{40\%}$
  Unfished biomass
  $F_{35\%}$ and $F_{40\%}$ from SBPR analysis
- STAT1 compute deterministic 3-year projection (1999, 2000, 2001) with the age-

structured model using the median recruitment from 1991-1996 (5 years). ✓ Check that fishery selectivity parameters for STAT2 delay-difference and STAT1 age-structured models are similar. ✓

- Plot time trends of slope and shelf surveys, pot surveys and trawl logbook CPUE along with model estimates of biomass with $q = 0.75$; plot the estimated biomass with $q = 0.75$ with various combinations of the pot survey and CPUE excluded from the model parameter estimation; plot cumulative catches removed over time. Produce these plots for both STAT1 age-structured model ✓ and STAT2 delay-difference models.

5.2 Shortspine thornyhead

Analyses and data requested by the STAR Panel (check indicates request fulfilled):

- STAT3 produce growth data used for various growth curves estimated for the species. ✓
- STAT3 produce abundance indices at length for the three "aggregate year" surveys. ✓
- STAT3 sensitivity runs to be done: ✓

  Baseline (best fit) for $M = 0.06$ and $k = 0.023$
  Fitted k for $M = 0.06$ and $k = 0.04$

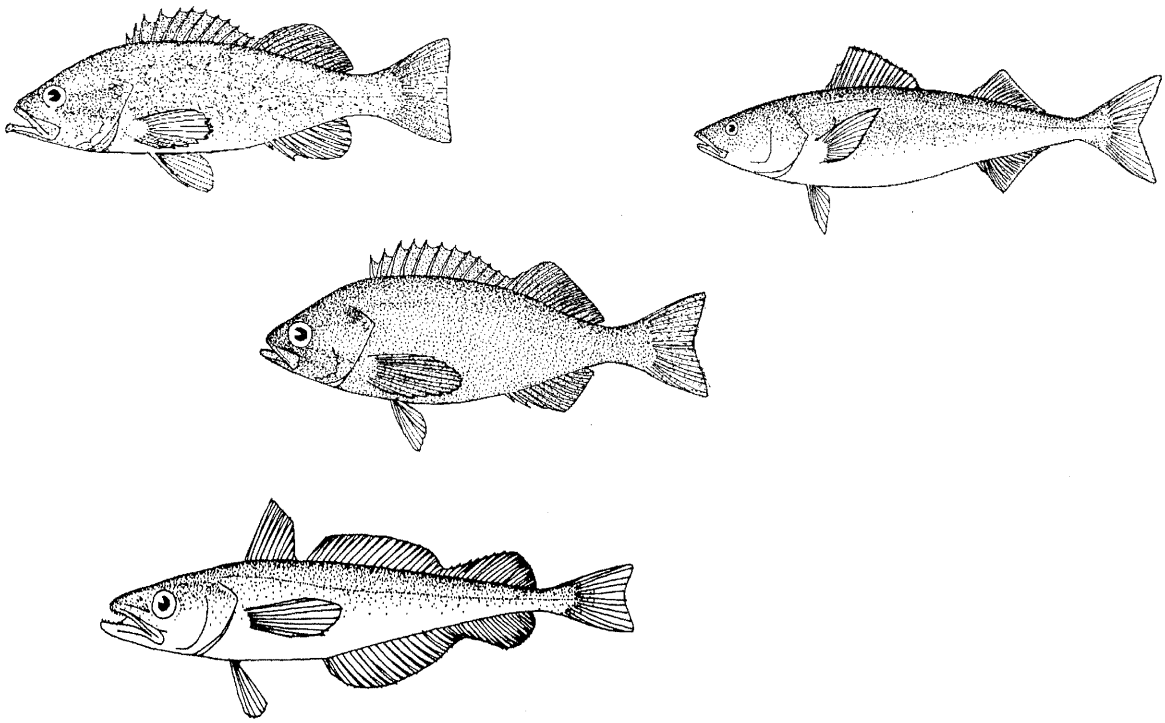
	(1) Base	(2) 1%Upper	(3) 1% Lower	Profile
M	0.06	0.06	0.06	0.05
q	0.65	0.50	0.98	0.86
k	0.023	0.023	0.04	0.023

- STAT3 profile q, fitted k, $M = 0.06$. ✓
  Two recruitment stanzas, before 1977; 1977 onward using runs (1), (2), (3).
- STAT2, STAT3 produce decision tables similar to those for sablefish using the appropriate F-reference levels and catch levels ranging over a fine-scale grid starting at about 600 mt. ✓

APPENDIX

TO THE STATUS OF THE PACIFIC COAST GROUNDFISH FISHERY THROUGH 1998 AND RECOMMENDED ACCEPTABLE BIOLOGICAL CATCHES FOR 1999

Stock Assessment and Fishery Evaluation



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APPENDIX: STOCK ASSESSMENTS
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