REPORT OF THE
TECHNICAL SUBCOMMITTEE OF THE
CANADA - UNITED STATES GROUNDFISH COMMITTEE

Appointed by
The Second Conference on Coordination
of Fisheries Regulations Between
Canada and the United States

THIRTIETH ANNUAL MEETING

June 6 - 9, 1989
Ladysmith, British Columbia

TABLE OF CONTENTS

I. CALL TO ORDER

Chairman, Mr. Tom Jagielo called to order the 30th Annual Meeting of the Technical Subcommittee at 1300 hours on June 6, 1989, in Ladysmith, B.C.

II. APPOINTMENT OF THE SECRETARY

Mr. Mark W. Saunders of the Department of Fisheries and Oceans, Nanaimo, B.C. was appointed to serve as secretary.

III. INTRODUCTIONS

Members and invited participants introduced themselves. Participants are listed below by agency, with members indicated by asterisks:

Canada - Department of Fisheries and Oceans (DFO)

Biological Sciences Branch

* Mr. Mark Saunders
* Dr. Laura Richards
Mr. Rick Stanley
Ms. Shayne MacLellan
Ms. Claudia Hand
Mr. Sandy McFarlane
Dr. Bruce Leaman
Dr. Kathleen Mathews
Dr. Al Tyler
Dr. Barry Smith
Mr. Nev Venables
Ms. Barbara Thomson

Fisheries Branch

Mr. Edward Zyblut
Mr. Barry Ackerman

United States

National Marine Fisheries Service

Alaska Fisheries Science Center (AFSC)

* Mr. Mark Wilkins
* Dr. Richard Methot

Southwest Fisheries Center (SWFC)

* Dr. Alec MacCall

Alaska Department of Fish & Game (ADFG)

* Mr. Barry Bracken

Washington Department of Fisheries (WDF)

* Mr. Tom Jagielo
* Mr. Jack Tagart
* Mr. Al Millikan

Oregon Department of Fish and Wildlife (ODFW)
* Mr. Bob Demory

California Department of Fish & Game (CDFG)
* Mr. Frank Henry

Pacific Fishery Management Council (PFMC)
Mr. Larry Six
Mr. Guy Thornburgh
Mr. Joe Easley
Mr. Bill Robinson

Pacific States Marine Fisheries Commission (PSMFC)
Mr. Guy Thornburgh

Fishermens Marketing Association
Mr. Peter Leipzig

IV. APPROVAL OF THE 1988 REPORT AND THE 1989 AGENDA

Mr. Wilkins had some concerns with the text on page 30. Mr. Henry will mail out changes in text and tables.

The 1988 report was approved as changed.

The TSC commended Mr. Henry for a job well done.

V. TERMS OF REFERENCE

No changes in the terms of reference of the Technical Subcommittee were proposed and none have occurred since 1981. Following are the Terms of Reference of the Technical Subcommittee:

1. Exchange information on the status of Groundfish stocks of mutual concern and to coordinate, whenever possible, desirable programs of research.

2. Recommend the continuance and further development of research programs having potential value as scientific basis for future management of the groundfish fishery.

3. Review the scientific and technical impacts of existing or proposed management strategies and their component regulations relevant to conservation of stock or other scientific aspects of groundfish conservation and management of mutual interest.

4. Transmit approved recommendations and appropriate documentation to appropriate sectors of Canadian and U.S. governments and encourage implementation of these recommendations.

VI. WORKING GROUP REPORTS

A. C.A.R.E

C.A.R.E. (Committee of Age Reading Experts) will not have a formal meeting in 1989. As recommended last year, they will meet every two years, the next being in 1990. Chuck Woelke submitted 1988's C.A.R.E. report to the Groundfish T.S.C. meeting the following June. Chuck is in the process of implementing some changes to the C.A.R.E. Groundfish ageing manual. Changes include updating the status of species aged list for each agency and additions of photos and the sablefish and exchange mechanism addenda. The manual is to be finished and presented for acceptance at the next C.A.R.E. meeting.

A sablefish age exchange between C.A.R.E. agencies: N.M.F.S. Seattle and Tiburon and D.F.O. Nanaimo occurred over the summer of 1988. A meeting was held 14-17 Feb. 1989 at the N.W.A.F.C., Seattle by participating age readers to discuss the results. The meeting was successful in effectively training Tiburon agers to standard criteria used by both Seattle and Nanaimo. A possible U.S. moratorium on sablefish ageing was averted.

Shayne MacLellan, as the new C.A.R.E. chairperson, has begun planning for the next meeting, tentatively scheduled for early May, 1990. A.F.S.C., Seattle has agreed to host it once again. Members will be phoned regarding possible agenda topics. Topics will further focus attention on standardization, such as training regimes, precision systems and documentation processes. C.A.R.E. would like some guidance from the T.S.C. as to topics or species they see as priorities which should be included.

C.A.R.E. has concerns, regarding member agencies support system for their fish agers. This support system consists of proper training, quality equipment, the freedom to spend time exchanging and documenting ageing methods and a fair pay scale which promotes continuity of staff. Many of the problems in fish ageing do not arise from the work itself, but rather are the result of breakdowns in the support system which surround fish agers. The breakdown sources occur through agency systems (budgets and priorities), user groups and supervisors. A common comment by members is that a part of this support system is lacking at their home agency. If we are to make recommendations. For improvement, our hope is that the T.S.C. member agencies would universally adopt them in the interests

of quality age data and standardization.

Mr. McFarlane asked for some clarification of the CARE Manual. Will it contain new sablefish criteria? Ms. MacLellan replied that the criteria are not new but the species is a new addition to the manual.

Mr. Henry asked for results of the Sablefish exchange report. Dr. Methot suggested that the report will be available from participating agencies. Mr. Bracken, noted that the ADFG sablefish ager was on leave at the time of the workshop, but attended a meeting in Seattle later to work with technicians and standardize techniques.

Mr. Jagielo asked Dr. Richards to reiterate concerns about interpreting the first annulus in lingcod ageing structures.

B. PacFIN Data Services

Mr. Henry stated that the PacFIN Data Committee meeting is scheduled for June 29, 1989. There are proposed changes to commercial input including species composition and correct area of landing. A small sub-committee will be drawn up to evaluate the proposed changes.

Mr. Tagart warned researchers that PacFIN is not a complete coastwide data set.

Mr. Bracken suggested that the technical subcommittee continue to support the development of PacFIN and its merger with the PFMC series. Mr. Tagart and Mr. Henry drafted the TSC Statement on Proposed redefinition of PacFIN. As well, a Statement on the Historical Annotated Landings Database (HAL) was prepared.

C. Stock Assessment Groups

1. Yellowtail Rockfish

Mr. Jack Tagart and Mr. Rick Stanley presented the yellowtail working group report.

At the 1988 Annual Meeting of the Canada/U.S. Groundfish Committee, the Technical Subcommittee recommended to the Parent Committee that a Yellowtail Rockfish Working Group be appointed.

They stated that this Working Group should:

1. Review the status of the yellowtail rockfish stocks;
2. Study management strategies for yellowtail rockfish;
3. Review the implications of the various management strategies on the yellowtail stocks;
4. Report to the TSC and Parent Committee on their progress.

The yellowtail rockfish fishery has recently become a significant trans-boundary concern because of increased landings by Canadian trawlers fishing off the central west coast of Vancouver Island. U.S. biologists had treated the yellowtail rockfish from northern Washington and southern B.C. as one stock (INPFC-Vancouver Area). Based exclusively on historical distribution of landings, U.S. biologists assumed that 80% of the yellowtail biomass in the Vancouver Area was in the U.S. zone, the remaining 20% in the Canadian zone. Because of the low Canadian landings, U.S. managers treated these landings as an incidental fishery and managed solely through controls on the U.S. fishery. Similarly, Canadian assessments assumed that landings from U.S. waters had no significant impact on the population of yellowtail rockfish exploited in Canadian waters.

In 1986 and 1987 however, the Canadian landings from this area increased significantly to be approximately equivalent to the U.S. estimate of sustainable yield for the whole Vancouver Area stock. The first meeting of the Working Group was attended by Jack Tagart of the Washington Department of Fisheries and Rick Stanley of the Department of Fisheries and Oceans, Canada, on July 13-15, 1988 at the Pacific Biological Station, Nanaimo. It was decided at that meeting that prior to the development of new analyses and management strategies, the first step would be to assemble, edit and standardize all the available biological and fishery information. The second step would be to examine stock delineation with the master data set and, based on these conclusions, the third step would be to conduct stock assessments and examine various management strategies.

Concurrent with these projects, the Working Group would initiate specific biological studies to improve the information base for the assessments. This report identifies the progress made on these priorities from June 1988 to June 1989.

Biological Database

Compilation of a coast-wide yellowtail rockfish biological database began in the summer of 1988 following

the TSC's establishment of the Working Group. The Washington Department of Fisheries (WDF) agreed to age approximately 3,000 yellowtail rockfish otolith held in storage by the Department of Fisheries and Oceans (DFO) and an additional 2,000 otolith held by the National Marine Fisheries Service, Alaska Fisheries Science Center (NMFS/AFSC, formerly the Northwest and Alaska Fisheries Center). By late fall, representatives of the Oregon Department of Fish and Wildlife (ODFW), WDF, DFO, NMFS/AFSC and NMFS Southwest Fisheries Center (NMFS/SWC) contributed computer files of biological data. The NMFS/SWC submitted tables of catch in number of fish at age, while all other agencies submitted raw biological data files [We have not yet requested, but plan to obtain the individual fish records from the NMFS/SWC].

Raw data files were screened for obvious errors, and by April 1989 were finally in suitable condition to be merged into a common database. The screening process was time consuming, requiring nearly four months to complete. Compilation of the coast-wide database turned out to be a more time consuming and labour intensive task than we had anticipated. We estimate that the age reading, data preparation by each agency, and screening and compilation to a common database consumed approximately one person year of labour.

The coast-wide database now contains 105,363 records (individual fish). It spans 1968 through 1987 and includes observations from Monterey to Queen Charlotte Sound. There are 23,841 records from DFO; 55,575 records from WDF; 14,450 records from ODFW and 11,497 records from NMFS/AFSC. There are 13,746 records from research cruises and 91,617 from commercial fisheries. The database includes 41,405 break-and-burn ages, 13,184 surface ages and 8,365 individual weights. Break-and-burn ages range from 1 to 60 years (surface ages from 3 to 41 years).

Stock Identification

The Working Group has initiated a number of studies to assist with stock delineation.

Comparative growth rates

As the coastwide database has just been completed, we have not fully tested for consistent differences in size-at-age among areas. A preliminary examination shows a latitudinal cline of increasing size-at-age for younger fish with increasing latitude mainly because of smaller fish in the Monterey and Eureka Areas. The differences between B.C. and northern Washington stocks appear small or non-existent. Observations of length-at-age will have

to be partitioned or standardized by month to remove growth within the year as a source of variation.

Tagging

DFO biologists tagged 14,039 yellowtail rockfish from 1980-1982 off B.C. and northern Washington. As of May 31, 1989, 30 specimens have been recaptured for which we have information on recovery location. Most of the recoveries were made in the area of tagging. Of the fish that moved significant distances, the trend was southward. However, landings in the mid-1980's were so low in central and northern B.C., that the likelihood of recovering a fish that moved northward would have been very low.

While some of the specimens moved significant distances, more were recovered in the original area of tagging. The Working Group tested the hypothesis that the population is one homogeneous stock from northern B.C. by expressing tag recoveries as a fraction of landings. If the population is fully mixed then the likelihood of catching a tagged fish from any one area in a ton of landings should be equal among areas.

We first calculated tag recoveries per ton by year over the principal area of tag recoveries. This provided us with a discount rate since ton of landings 1 year after tagging was more likely to yield a tag than a ton of landings 5 years after tagging.

If the stock were fully homogeneous, then the ratio of tag recoveries to catch where tagging was conducted should be no higher than other areas. This ratio was 77 times higher for Q.C. Sound than for the southern B.C. and Washington region. If we restrict the observations to the 1983-1987 period, to give the fish more time to disperse, the ratio was still 44 times higher.

The same ratio was calculated for fish tagged in areas 3C (Canadian and U.S.). The recovery ratios for tags recovered in this combined area of tagging to tags recovered outside the area (3A+2C+2B+2A) was only 4 times as large over the whole time period and 2.5 times as large for 1983-1987. This indicates significant mixing of the populations from the north side of Juan de Fuca canyon with populations well to the south.

Electrophoresis

Steve Phelps and Dan Klaybor of the Washington Department of Fisheries, Genetic Stock Identification Laboratory, performed an initial electrophoretic screening of the 45 yellowtail rockfish samples (15 each from Oregon,

Washington, and Canada). The purpose of the screening was to determine if we could identify sufficient genetic variation with our electrophoretic techniques to allow the examination of stock structure in yellowtail rockfish. After evaluation of this initial screening, they determined that subsequent screening will be required to identify additional variable loci and improve resolution of the variable loci already identified. The additional screening will be completed this summer, and a detailed summary of the screening and results will be provided at that time.

The initial screening consisted of eleven tissue-buffer combinations. We identified 49 loci with the first screening and found five variable loci, two of which are highly polymorphic. We also identified some loci that had isozyme patterns that appeared variable, but we need to improve resolution and/or activity before these loci could be used for population studies. Although we had hoped to find additional variation at the initial screening, there are still many enzymes left to assay.

Parasites

The Working Group coordinated the collection of samples from all the major fisheries from central B.C. to Oregon during November 1988. Each sample was composed of 20 adult specimens. Following the advice of Dr. Kabata at P.B.S., the first phase will involve conducting whole body examinations of one sample from central B.C. and one from central Washington. A summer student based at P.B.S. in Nanaimo is currently assigned to the examination. It takes her 0.5 to 2 days per specimen. The results from the 2 samples will be examined late in September to narrow the examinations to those tissues and parasites which show the most potential for serving as biological tags.

Size-at-maturity

WDF obtained length stratified samples of yellowtail rockfish females in February and March of 1989 to determine the proportion mature at age. We classified the stage of maturity of approximately 1,600 fish based on morphological characteristics of the developing gonads. The age structures from these collections are currently being processed. Preliminary examination of the data suggest a size at 50% maturity of approximately 46 cm. A complete analysis of the data is expected by the end of the summer.

Stock assessment

We are just now beginning stock assessments using the new biological database. Canadian and U.S. assessments

will both concentrate on using Rick Methot's Stock Synthesis model and will be complete by September 1989. In addition, U.S. biologists will also update the 1988 cohort analysis of yellowtail rockfish.

Critical to the issue of status of stocks is the delineation of stock boundaries. In the absence of more objective criteria, several hypothetical assemblages will be examined in an effort to determine an overall coast-wide biomass, and the distribution of biomass between the United States and Canada.

The model will have to be adapted to accommodate significant differences between sexes. Either because of higher natural mortality or dramatic decreases in vulnerability with increasing age, females represent a very small proportion of catch among fish over 20 years of age.

The assessments must also consider different selectivity between bottom and midwater fishing. Canadian samples show a older/larger composition in midwater catches. These differences appear whether comparing two commercial landings from the same season and general area of capture or comparing repeated tows during charter operations.

Management

The Working Group was instructed to examine alternative management strategies. This was not possible in 1988/89 because so much time was required to get the all available information on line. We can now start to examine this issue in conjunction with stock assessments. We anticipate using different stock scenarios but suggest that now might be an appropriate time for managers to provide some guidance as to what scenarios or strategies they would like to see examined.

Mr. Henry asked what portion of the catch was midwater trawl? Mr. Tagart responded that it was 10% historically in the U.S. and may have been as high as 90% in recent Canadian fisheries in the Vancouver INPFC area.

Mr. Stanley added that the Nootka fishery (Vancouver INPFC area) is an enigma. The working group is exploring possible scenarios to model it in a number of combinations with stocks north and south of it. Mr. Tagart said that the six stocks/aggregations will be consolidated to three concentrations for the assessment.

Mr. Bracken asked if the sampling coverage by area was adequate for the working group to be confident. Mr. Tagart responded that he was unsure and that this will

be assessed.

Mr. Millikan asked, can we get a better delineation of stocks on either side of Canada/U.S. border. Mr. Stanley responded that progress is being made. Mr. Tagart added that the working group report would be circulated to members.

2. Pacific Whiting (Hake)

Dr. Methot presented the report of the hake working group consisting of R. Methot, M. Dorn, M. Saunders, L. Richards, and A. Tyler.

The Pacific hake working group was active during the past year, with two meetings. The first was held in Nanaimo on July 12, 1988 and the second in Seattle on January 17 and 18, 1989.

The objective of the first meeting was to discuss the 1988-89 status of stock and to discuss the preliminary results of research pertaining to the development of a zone-based management model. The outcome of status of stocks work is presented in stock assessment documents produced by each agency.

The rationale for developing a zonal hake model is that it is likely that the hake fishery should be conducted at different exploitation rates in different areas of the species total range. The desired fishing rate should be adjusted with respect to the following differences by latitude: Biomass distribution, differences in zonal yield per recruit, distribution of the spawning stock biomass and joint optimization of fishing interests of Canada and the U.S. At the Fall 1987 meeting of the working group it was decided to begin collating the data necessary for the development of such a model which included summarizing of biological data by appropriate time/area cells.

Information was presented on the length frequency distribution of hake by various degrees of latitude. It was apparent from these data that a distinct break in size takes place at the Columbia River. Based on this it was decided to have data from the biomass surveys broken down finer than the INPFC areas to allow investigation at least of Can/U.S. differences and north and south of the Columbia break.

Work on the zonal model has been put on hold until the fall of 1989

The following summarizes the January 1989 meeting:

Surveys

Statistical analysis by R. Methot indicates that the oldest hake are present in lower numbers than can be explained by a constant mortality rate. Either M is higher, the fish are missing in the catches because they move north out of the survey area, or there is age determination error. It was suggested that the U.S. survey be conducted farther north into the Canadian Zone for the purpose of finding older fish outside of the main concentrations. Canadian data on northern distribution will be examined with respect to this question.

In a discussion of the biological sampling for the next survey, it was emphasized that at least some fraction of the hauls should be sampled in a comparable manner in both U.S. and Canadian surveys so that the data bases could be merged in analysis.

Catch-at-age analysis

Age determination variability has been detected for older fish. The small year classes adjacent to the very large year classes (e.g. 1980 vs. 1981) have fishing mortality rates that are anomalously high associated with older fish, as though they are being mis-assigned to the small year-class from the adjacent large year-class. Parameter estimation will be done on only the very large year-classes to avoid this bias. Discussion followed on the Stock Synthesis model.

The yield estimation model

The group agreed to continue to develop the model constructed by Francis and Hollowed, to incorporate a few modifications and to emphasize selected scenarios. The deterministic runs would be de-emphasized, or identified as being for baseline comparative purposes only, with the stochastic runs being used for short-term yield estimation.

The group discussed alternatives to the temperature-driven recruitment time series. Three approaches are being evaluated including random resampling of the recruitment values, random resampling with preservation of a 3-4 year periodicity in strong year classes and the original temperature time series.

The temperature series used for the runs with the effects of long term recruitment would be started at 1940 instead of 1930, since the twenty-year cycle peaks at about this year. The cycle is likely peaking again now, or already peaked in the early 1980s. By starting the temperature

series in 1940 two complete cycles would be incorporated into the long-term calculations. The group also noted that the hake could be facing decreasing sea temperatures over the next 10 to 15 years if the historic cycle of temperature continues.

The group agreed to emphasize the variable effort approach to developing projected catches and spawning biomasses. The constant F (instantaneous fishing mortality rate) would be used only for comparative purposes and likely not for setting future catches. Arguments for this conclusion will be written up by members of the group.

It was discussed whether age-3 fish components should be excluded from the model runs to determine the optimal effort levels. This age-class is only tentatively considered to be 50% mature and has not yet spawned. The group agreed that it was generally not a conservative policy to take fish that had not yet spawned, but it was suggested that when extra large year-classes were produced such as the 1980 year-class some exploitation of the age-3's would likely not matter to future reproduction since the high natural mortality rate would eliminate large numbers in any case. This topic will be pursued later.

Regarding short term recruitment forecasts, there is some cause for concern with the loss of the CDFG pelagic fish survey time series. No predictive measure of recruitment is available. Given the good success in predicting year-class strength from the surveys, perhaps some thought should be given to RACE conducting a short annual juvenile indexing survey.

Weight-at-age

Weight-at-age data were based on determinations for the dominant year-classes because they were sampled more completely and with less bias. Weight-at-age for year classes between the dominant ones were estimated by linear interpolation. Size-at-age of Canadian zone fish was consistently larger than U.S. zone fish. This difference was incorporated into the assessment. The decreasing size trend in both zones was accounted for in the estimation of potential yield in 1989.

Trans-boundary allocation of catch

One of the largest issues relating to assessment of this stock is the allocation of catch by nation. A two-stage allocation method, which is consistent with the current assessment and accounts for differences in the U.S. and Canadian fisheries, was proposed at the Jan. 1988

meeting. Review of this method and other alternatives is currently underway.

Given the need for cooperative research in development of assessment techniques and regular exchange of data on this short-lived, highly productive stock, it is anticipated that the working group will continue to meet at least twice per year.

Mr. McFarlane asked what the plan was for 1989 assessment regarding the split of the stocks. Dr. Methot answered, that the stocks will be separated in the analysis.

Mr. Jagielo asked if the constant effort approach is similar to the Halibut Commission approach. In response, Dr. Methot described the management-variable effort scenario.

Mr. Tagart asked when the hake working group started. Mr. McFarlane answered that the working group had been together for 8 years.

Mr. Tagart asked what was the value of a working group. Mr. McFarlane stated that the working group was very valuable, in particular in development of ancillary projects, identifying research needs, and focusing people's thinking. Dr. Tyler added that it facilitates exchange of data. Mr. McFarlane drew up the TSC recommendation regarding Pacific whiting (hake).

3. Dover Sole

The assignment to summarize Dover sole tagging studies conducted by the Oregon Department of Fish and Wildlife was completed and forwarded to the working group leader. The results are contained in Informational Report 88-2: "Results of Dover Sole Tagging Projects Conducted by the State of Oregon, 1948-75."

Mr. Demory gave a history of the group and added that the coastwide document is under review at this time. Tagging indicates that Dover sole move offshore-inshore but undergo very little longshore movement.

Mr. Tagart asked if coastwide assessments will be carried out. Mr. Demory replied that yes, coastwide assessments will be done by Richard Methot, Joe Hightower, Jim Golden, Frank Henry and himself. The stock synthesis model will be applied to age data currently being compiled. Dr. Methot added that the assessment would be done by INPFC area with Vancouver/Columbia combined into be one area.

Mr. Tagart asked, given that there is no coastal movement of the stock, is there a transboundary issue? Mr. Demory answered that there was no perceived transboundary issue at this time.

Mr. Bracken asked, how the stocks were being managed? Mr. Henry replied that management was accomplished through area specific Allowable Biological Catches (ABC's) and mesh size restrictions. Dr. Tyler noted that there could possibly be a transboundary issue in Dixon Entrance in the event of a developing U.S. fishery.

Mr. Jagielo asked what was the future of the working group. Mr. Demory replied that the working group was formed to deal specifically with tagging analysis. Mr. Saunders suggested and the members agreed that the working group dissolve given the tagging work is complete and the lack of a transboundary issue.

Dr. Richards asked that Mr. Demory produce a short statement.

Mr. Henry reminded agency members that the Status of Stocks documents should be forwarded to other agencies.

Mr. Jagielo thanked the working group for completing its tasks.

D. Other

Mr. Jagielo asked if there was a need for other working groups?

Dr. Methot asked what was the status of the INPFC working group on sablefish tagging. Mr. McFarlane replied that the INPFC working group was finished.

Mr. Bracken suggested that discussion of a sablefish working group should come up later under the recommendation session.

Dr. Methot noted that if transboundary movement is a criteria for joint assessment and formation of a working group, then the case for sablefish is a strong one. Mr. McFarlane replied that movement is primarily northward and largely juveniles. Area management is possible.

VII. REVIEW OF GROUNDFISH FISHERIES

Identified tables refer to documents submitted by the respective agency.

PacFIN tables of commercial groundfish catches for 1988 are included in Appendix J.

A. Commercial

1. Canada

Canadian landings of groundfish (excluding halibut) in 1988 were 64,896 t (Appendix E, Table 1), a decrease of 7% below the 1987 level. Trawlers landed 55,644 t, 8% less than in 1987 and 56% above the 1978-1987 mean (Appendix E, Table 2). The major species in the trawl landings were Pacific cod (20%), Pacific ocean perch (13%),Pacific hake (12%), yellowtail rockfish (9%), silvergrey rockfish (6%) and lingcod (5%). Principal areas of trawl production were 5B (20%), 4B (15%), 3C (14%), 5D (13%) and 3D (12%).

Canadian landings of groundfish caught by gear other than trawl in 1988 totalled 9,252 t (Appendix E, Table 1). Trap gear accounted for 3,795 t (99% sablefish) and longline, handline and troll gear for 5,456 t (32% dogfish, 23% sablefish and 16% lingcod).

Trawl landings by major area and species in 1988 are reported in Appendix E, Tables 3 and 4.

2. Alaska Department of Fish & Game

Commercial fisheries
Description of the area:
The Alaska Department of Fish and Game (ADF&G) has exclusive management jurisdiction over all groundfish fisheries within the internal waters of the state and to three miles from shore along the outer coast. In addition, a provision in the federal Gulf of Alaska Groundfish Fishery Management Plan (GFMP) gives the State of Alaska limited management authority for demersal shelf rockfish in the federal waters east of 137° W longitude.

Beginning in 1984 the Dixon Entrance District was formed for state management of groundfish in the Dixon Entrance area. That district includes all waters between the "AB" line at 54° 40' N latitude and the "equidistant line" which runs through the middle of Dixon Entrance and then seaward to the point where it intersects the "AB" line. The reason for the formation of the Dixon Entrance District as a separate management area is that the waters south of 54° 40' N latitude are not included in the GFMP leaving that area void of management authority.

Most of the state-managed fisheries in Alaska occur in Southeast Alaska (east of 137° W longitude) and, with the exception of sablefish, virtually all trans-boundary groundfish stocks in Alaskan waters occur in that area. For that reason the information provided in this report will be restricted to Southeast Alaska.

The Southeast Alaska is separated into five districts for groundfish management (Appendix I, Figure 1). Each of these districts represents the geographical area utilized by discrete segments of the fleet from the various ports of landing.

Species involved

State-managed groundfish fisheries in Southeast Alaska include target fisheries for sablefish, rockfish, lingcod, pacific cod, and flatfish in that order of economic importance. Rockfish are separated into three assemblages for management (Appendix I, Table 1). Demersal shelf rockfish are the most important component of the state-managed rockfish fisheries.

Gear

With the exception of the target fishery for flatfish which is conducted with trawl gear, hook and line gear is the primary means of harvest with set lines by far the most predominant gear type. Some fishing for sablefish is still conducted using pot gear in the southern southeast inside area, but that gear type is excluded from all other areas by regulation and pot catches are minimal compared to setline catches.

Harvest

The harvest by species from state-managed fisheries in Southeastern Alaska are shown in Appendix I, Table 2. The catch from the Dixon Entrance District is presented in a separate column so that the catch the U.S. fisheries conducted in that area is readily apparent. That is an important differentiation since vessels from both the U.S. and Canada fish the waters of that district. The catches from both nations need to be combined to determine the total groundfish harvest from the Dixon Entrance area.

A summary of the regulations used by the State of Alaska for management of groundfish in the Dixon Entrance District is included as Appendix C to this report. This was provided at the request of the 1988 TSC.

3. Washington Department of Fisheries

As per discussions at the 1988 meeting of the TSC, a detailed discussion of this section is omitted from this report. The reader is referred to the annual Pacific Fisheries Management Council (PFMC) Status of Stocks report for a description of groundfish fisheries, management, and regulations in 1988.

4. Oregon Department of Fish & Wildlife

Monitoring of commercial fisheries is a major part of our activity. Fish tickets, or fish receipts, form the basis of tracking landings, while logbooks form the basis for catch and effort assignments to statistical areas and depth strata. In 1988, we processed 5,741 fish tickets from all gear groups combined. The number of logbook records processed in 1988 is not yet available but will be similar to the number in 1987, which was 2,389.

The number of biological and rockfish species composition samples collected in 1988 was 848, a decline of 19% from 1987. The leading cause for decline in the sample number was, among a variety of factors, difficulty in intercepting adequate trips because of summer-long processor imposed trip limits. Rockfish species composition samples accounted for 72% of all samples taken. Biological samples, which included an age structure, sex, maturity, length, and in some cases weight, accounted for the remainder (Appendix G, Table 1).

Total landed catch of groundfish by all commercial gear types in 1988 was 32,144 mt (excluding Pacific halibut), an increase of 5% over 1987. Bottom and midwater trawl gear accounted for nearly 90% of the landed catch. Of the other gear types, pot and longline accounted for 4% and 3%, respectively, while shrimp trawl and other hook and line gear accounted for the remaining 2% and 1%, respectively.

Trawl landings in 1988 were 28,717 mt, an increase of 11% from 1987 and 9% greater than the 1978-87 mean (Appendix G, Table 2). Major species groups landed by trawl gear were flatfish, rockfish, and other groundfish which accounted for 33%, 44%, and 23%, respectively.

Landings of flatfish amounted to 10,380 mt, an increase of 15% over 1987. Dover sole composed 73% of all flatfish landed. Landings in 1988 were 7,551 mt, an increase of 25% over 1987.

Landings of rockfish in 1988 were 14,077 mt, about 8% greater than in 1987. Widow rockfish was the dominant

species and accounted for 5,444 (about 40%) of all rockfish landed. Other important species landed were yellowtail rockfish (2,283 mt) and canary rockfish (1,334 mt) (Appendix G, Tables 3 and 4). Landings of other groundfish were composed of sablefish (2,133 mt), Pacific cod (1,005 mt), lingcod (865 mt), and Pacific whiting (254 mt).

Shrimp trawl - Landings of groundfish caught incidentally in shrimp trawls were 685 mt in 1988. This was about 4% of the 18,954 mt of shrimp landed. Rockfish accounted for 586 mt or 86% of the incidental landings from shrimp trawls (Appendix G, Table 5).

Landings of groundfish caught in pots or traps in 1988 were 1,253 mt. Sablefish accounted for 1,231 mt or 98% of the pot landings (Appendix G, Table 5).

Landings by longline, or setline, in 1988 were 838 mt. Sablefish was the major species landed at 665 mt or 79% of the landings. Rockfish was the next most important species group in the landings (Appendix G, Table 5).

Other gear types, almost entirely hook and line, accounted for the remainder of groundfish landings in 1988. Combined landings were 351 mt. Rockfish and lingcod were the major components at 72% and 24%, respectively (Appendix G, Table 5).

Regulation Changes

During the year, in-season regulation changes occurred in response to action taken by the Pacific Fishery Management Council. A summary of regulation changes is contained in a report entitled "Status of the Pacific Coast Groundfish Fishery Through 1988 and Recommended Acceptable Biological Catches for 1989."

Independent regulatory action taken by ODFW was to change the landing restriction on sublegal Dover, English, and petrale sole (less than 11 inches) from 250 fish in the aggregate to five percent of fish in the aggregate when the vessel has on board a roller or pelagic trawl net. ODFW also took action to conform with federal rules in marking requirements for fixed gear.

Fleet Activity

The number of trawl vessels fishing in 1988 amounted to 142 bottom trawlers and 37 midwater trawlers, very similar to the number that fished in 1987. The number of shrimp trawlers that fished in both years only differed by one (Appendix G, Table 6).

The numbers of vessels fishing other gear types were generally lower in 1988 than in 1987. For example, the total number of other hook and line vessels was down by nearly two-thirds, while the number of pot vessels that fished in 1988 was about one-half the number that fished in 1987. The reason for the decline in these fleets is not known because all fishing activity is not accounted for; that is, we do not know how many have trolled for chinook salmon because many qualify for that fishery.

The number of longline vessels that fished in 1988 was 68 as opposed to the 49 vessels that fished in 1987. This was the only gear type that showed a significant increase in the number of vessels that fished.

5. California Department of Fish & Game

California's 1988 commercial groundfish harvest was 39,942 metric tons (t), with an ex-vessel value of $30,765,000. The 1988 catch decreased by 5%, or 960 t, from the 1987 level primarily as a result of decreased effort. Setnet effort for groundfish, in particular, decreased substantially during the year. The major share of the landings, 82.5% and 32,967 t, was harvested by trawl gear. Setnet landings comprised 8.8% (3502.2 t) of the total, followed by line gears at 6.9% (2,747 t), and other gears at 1.8% (730 t).

Rockfish (Sebastes spp.), Dover sole (Microstomus pacificus), Pacific whiting (Merluccius productus), and sablefish (Anoplopoma fimbria) were the leading trawl and all-gear species harvested in 1988 (Appendix F, Table 1). Trawl landings of Dover sole dropped by 24 %, due in part to a notable drop in demand from spring through fall of 1988. Trawl rockfish landings and value also suffered from a drop in demand due to very large Canadian rockfish exports to West Coast markets in the first two quarters of the year. Continued robust demand in Japan for sablefish fuelled an 11% increase in ex-vessel prices, which appeared to attract additional fishing effort for this species. Demand for thornyheads (Sebastolobus spp.) also remained at high levels in Asian markets, and 1988 landings increased by 53% to 4,524 t. Shore-based whiting deliveries continued their expansion in recent years to 6,541 t in 1988 (from 4,517 t in 1987).

Line catches of groundfish remained relatively unchanged. However, setnet catches dropped by 13.4% from the previous year's level. Rockfish dominated both line and setnet landings, accounting for 74% and 78% of landings, respectively.

Federal and state groundfish regulations for the Washington-Oregon-California (WOC) region 1988 fishing year affected the California harvest of sablefish and widow rockfish (Sebastes entomelas). Respective coastwide numerical optimum yield (OY) levels for sablefish and widow rockfish were 9,200-10,800 t and 12,100 t. The sablefish OY was allocated to two gear quotas: 5,200 t for trawl and 4,800 t for nontrawl gears. An additional 800 t reserve was established in the event the trawl fishery unavoidably exceeded its allocation. For the first time, trawl sablefish trip limits were imposed on January 1 with the objective of extending the fishery throughout the year. A trip limit of 6,000 pounds or 20 percent of the fish on board, whichever is greater, was employed from January 1 until August 2. Trawl landings remained high despite these restrictions, necessitating a 2,000 pound once per week trip limit effective August 3 and release of the 800 t reserve. While this trip limit regime slowed landings, sablefish discards increased significantly. Projections indicated that the 2,000 pound once per week trip limit had slowed landings to the extent that the original 5,200 t quota would not be achieved. The Pacific Fishery Management Council removed the trip frequency restriction in early October in an attempt to reduce the regulation- imposed discarding. Total 1988 trawl sablefish landings were 5,483 t, of which California landed 2,640 t. Unlike the trawl sablefish fishery, most nontrawl-caught sablefish do not supply fresh fish markets, thus no effort was made to extend the nontrawl fishery. As a result, the nontrawl fishery was closed on August 25 with a total catch of 5,295 t (California portion-1,144 t).

The 1988 widow rockfish fishery began with a trip limit of 30,000 pounds. By September, a reduction to 3,000 pounds was necessary to keep widow rockfish landings within the OY. California accounted for 1,847 t of the 12,100 t landed coastwide.

B. Recreational

1. Canada

Fisheries Branch (DFO) conduct creel surveys of the recreational angling fishery in the Strait of Georgia. Principal target species are chinook and coho salmon. Provisional estimates of 1988 catches were 65,929 fish for lingcod and 194,735 fish for all rockfish species.

2. Alaska Department of Fish & Game

Estimates of recreational groundfish harvests are not yet available for 1988. The state-wide angler survey from 1987 indicated that 42,261 rockfish were landed by recreational anglers in Southeast Alaska during that year. That is up slightly from 41,568 reported from the same area during 1986, and considerably higher than the long-term average for the region. Assuming a five pound average for rockfish, these data indicate that approximately 95 t of rockfish were taken. Creel census data in Southeast ports indicates that discard of rockfish exceeds the retained portion of the catch suggesting that the total recreational rockfish harvest may have exceeded 200 t. There is currently no species composition data available from the recreational rockfish fishery.

The survey shows that a total of 53,650 individual fish from other groundfish species were landed in Southeast Alaska during 1987 with 28,740 attributed to the marine boat fisheries and 22,522 fish attributed to the marine shoreline fishery. No species composition data are available at this time for the other groundfish category. It is assumed, however, that lingcod, Pacific cod, and flatfish are the predominant species taken. It should be noted that the discard rate on other groundfish also likely exceeds the retained portion of the total harvest.

The ADF&G is attempting to obtain better data on recreational fisheries and has requested funding to monitor the landings from the steadily increasing charter boat industry.

Recreational Fisheries

Beginning in mid-1989 bag limits will be implemented for rockfish within Southeast Alaska. The limits will more restrictive on yelloweye rockfish (Sebastes ruberrimus) than on other rockfish species. Also, there are two areas of the region, Sitka Sound and the immediate Ketchikan area where the harvest limits are more restrictive because of observed declines in the rockfish production in those areas. There are currently no other regulations for recreational groundfish fisheries.

3. Washington Department of Fisheries

As per discussions at the 1988 meeting of the TSC, a detailed discussion of this section is omitted from this report. The reader is referred to the annual Pacific Fisheries Management Council (PFMC) Status of Stocks report for a description of groundfish fisheries, management, and regulations in 1988.

4. Oregon Department of Fish and Wildlife

The number of bottomfish-directed ocean angler trips in 1988 was 32,183, an increase from the 24,442 that occurred in 1987. Charter boat anglers made 21,981 (68%) of these trips in 1988, with private boat anglers contributing the rest. Bottomfish target anglers caught an average of 6.2 fish per trip; this was up slightly from the 1987 catch, which was 5.7 fish per trip.

Oregon's 1988 recreational fishery for groundfish resulted in a catch of 260,765 fish (Appendix G, Table 7); this was a 19% increase over the 1987 catch. The sampling periods for each port are also shown in Appendix G, Table 7.

Black rockfish (Sebastes melanops) was again the most numerous species in the catch, comprising 68% of the total (Appendix G, Table 8). Combined rockfish species accounted for 88% of the catch, the same as 1987.

In 1988, Pacific halibut (Hippoglossus stenolepis) was again one of the top ten species landed, comprising only 1.6% of the total catch by numbers, but 10% of the landed weight. An intensive survey of the recreational halibut fishery in Oregon resulted in a 1988 catch estimate of 4,312 fish for the total season, with a dressed weight of 74,327 pounds (98,781 pounds, round weight). Approximately 96% of this was caught by anglers operating out of Newport. Charter boat anglers caught 87% of the statewide halibut catch, with private boat anglers contributing the remaining 13%.

PMFC area 2C produced 333 mt of recreationally caught fish, 79% of the state total (Appendix G, Table 9). This area includes the ports of Newport, Garibaldi, and Depoe Bay, whose halibut landings ranked first, second, and fourth, respectively.

5. California Department of Fish & Game

California's recreational groundfish landings from 308 commercial passenger fishing vessels in 1988 were 2,227,925 fish, including 1,852,650 rockfish, 63,393 lingcod, 18,774 flatfish, 19,387 Pacific whiting, 5,314 cabezon, 127,774 sculpin, and 142,154 fish of other species, primarily croakers. Groundfish catches from skiff, pier, jetty and skin-diving modes were unavailable as of this report.

C. Foreign

1. Canada

The USSR and Poland conducted national fisheries for Pacific hake off southwest Vancouver Island (Area 3C) in 1988. Fifteen Polish and three Soviet vessels caught 34,982 t of Pacific hake. Fifteen of the processing vessels involved in the joint-venture fishery occasionally fished directly (supplemental fishing) when domestic vessels could not supply sufficient quantities of hake. This supplemental catch of 4,733 t is added to the national catch. A summary of foreign fishery quotas and catches follows:

Nation	Species	Quota(t)	Catch(t)	Supplemental catch(t)	Total catch(t)
Poland	Hake	25,000 + 1,500[a]	23,712	2,673	26,385
	Pollock	incidental	1	tr.	1
	Rockfish	incidental	272	47	319
	Other	incidental	47	tr.	47
USSR	Hake	12,000 + 1,000[a]	11,270	2,060	13,330
	Pollock	incidental	-	-	-
	Rockfish	incidental	66	94	160
	Other	incidental	tr.	tr.	tr.
Japan	Hake	2,100[b]	-	-	-
	Pollock	incidental	-	-	-
	Rockfish	incidental	-	-	-
	Other	incidental	-	-	-
Total	Hake	39,500[b]	34,982	4,733	39,715
	Pollock	incidental	1	tr.	1
	Rockfish	incidental	338	141	479
	Other	incidental	47	tr.	47

[a] Additional quota assigned after Japan withdrew from the fishery.

[b] Japan withdrew from the fishery early and its quota is not included in the total.

D. Joint Venture

1. Canada

In 1988, twenty-two Canadian catcher vessels delivered Pacific hake and incidental species to eighteen processing vessels in cooperative fishing arrangements. These fisheries take place off the southwest coast of Vancouver Island (Area 3C). A total of 50,182 t of Pacific hake was processed by 11 Polish vessels, 6 Soviet vessels and one Japanese vessel. The quotas and catches are outlined below:

Nation	Species	Quota(t)	Catch(t)
Poland	Hake	25,000 + 1,500[a]	26,314
	Pollock	incidental	177
	Rockfish	incidental	36
	Other	incidental	2
USSR	Hake	18,500 + 4,000[a]	22,818
	Pollock	incidental	50
	Rockfish	incidental	70
	Other	incidental	35
Japan	Hake	3,900[b]	1,050
	Pollock	incidental	-
	Rockfish	incidental	8
	Other	incidental	tr.
Total	Hake	49,000[b]	50,182
	Pollock	incidental	227
	Rockfish	incidental	114
	Other	incidental	37

[a] Additional quota assigned after Japan withdrew from the fishery.

[b] Japan withdrew from the fishery early and its quota is not included in the total.

2. National Marine Fisheries Service - AFSC

U.S. joint venture fisheries remain the dominant harvesters of groundfish in the Bering Sea and Gulf of Alaska, where foreign fisheries were phased out completely in 1988. After a major increase in joint venture catches in the Bering Sea between 1985 and 1986 and a smaller increase (17%) in 1987, joint venture landings showed a small decrease in the Bering Sea/Aleutians area (Appendix H, Table 1). The composition of the catches changed noticeably in 1988, reflecting the capacity of the domestic industry to more fully utilize some of the more commercially important species under DAP allocation and leaving the remainder of available harvests to JVP allocation. The result was a decrease in landings of pollock (-21%), sablefish (-88%), Atka mackerel (-35%), and herring (-25%) and substantial increases in landings of Pacific cod (+89%),

Pacific ocean perch (+184%), yellowfin sole (+19%), and other flatfish (+236%). Gulf of Alaska catches declined by 88%, going from 32,524 t to 3,771 t with catches of virtually all species falling by about 75-90%. Joint venture hake catches in the Washington-California region increased markedly again and were 136,894 t, 22.5% greater than in 1987.

Fishing effort was up again in the Bering Sea where processor-vessel days increased from 9,851 to 10,445. The decline in effort continued in the Gulf of Alaska where the number of processor-vessel days went from 2,360 in 1985, to 582 in 1986, and then to 374 days in 1987. In the Washington-California region effort continued its increase from 764 processor-vessel days in 1985, to 1695 in 1986, and to 1892 in 1987.

Joint venture allocations for 1988 and 1989 are compared in Appendix H, Table 2. Joint venture allocations in 1989 are 295,211 t (-77%) in the Bering Sea/Aleutians, 212,000 t (+28%) in the Washington-California area, and have been eliminated completely in the Gulf of Alaska. Major reductions continue in the Bering Sea/Aleutian pollock allocation, reflecting the strength of the domestic factory trawler and land based fishery (DAP). Allocations for the Washington-California joint venture fisheries in 1989 include a 25% increase in the Pacific whiting allocation and a new 5,000 t shortbelly rockfish allocation. The U.S. will be working with Poland, Peoples Republic of China, USSR, and Japan companies in the joint ventures off the Washington-California coast in 1989. The shortbelly rockfish joint ventures will be with the USSR and Japan.

Foreign groundfish catches in the U.S. FCZ were eliminated completely in 1988 except for the Washington-California area (Appendix H, Table 3). Foreign effort in the Bering Sea/Aleutian area was absent for the first time since the advent of distant water fishing in Alaskan waters. For the second year in a row, there was no directed foreign fishing in the Gulf of Alaska. Directed foreign Pacific whiting catches in the Washington-California region decreased from 49,656 t in 1987 to 18,041 t in 1988 (-64%), as joint ventures continue to take a greater share of the OY. Poland was the only country to receive a directed allocation in 1988. Final 1988 foreign groundfish allocations for the Washington-Oregon region are presented in Appendix H, Table 4. Directed foreign fishing in the Washington-California region in 1989 is again expected to be conducted only by Poland.

VIII. REVIEW OF AGENCY GROUNDFISH RESEARCH, ASSESSMENTS AND MANAGEMENT

A. AGENCY OVERVIEW

1. National Marine Fisheries Service - AFSC

a) RACE Division

i) Groundfish Assessment Task

In 1988 the primary activity of the RACE division continued to be fishery-independent stock assessments of important groundfish species of the northeast Pacific Ocean and Bering Sea. Groundfish surveys were conducted by the Bering Sea, Gulf of Alaska, and West Coast subtasks. There were two bottom trawl surveys, one trap survey, two longline surveys, three hydroacoustic surveys, and two ichthyoplankton surveys. Major emphasis was in the Bering Sea, in keeping with plans to rotate comprehensive surveys among three major geographic areas on a triennial basis. The focus will be along the west coast in 1989. A triennial survey that had been planned for the Aleutian Islands area in 1989 was cancelled because of lack of funds and because Japanese participation in cooperative trawl surveys in the North Pacific has been discontinued. A summary of tasks' activities for the past year are presented below.

- Bering Sea

  Crab and Groundfish Survey

  An expanded triennial survey was conducted in the eastern Bering Sea in 1988. This was the fourth in the series of triennial surveys which were started in 1979. In addition to sampling with bottom trawls a standard survey area on the eastern Bering Sea continental shelf (approximately 135,000 nmi^2) which is sampled annually, trawling was extended to cover the north shelf area (including Norton Sound) and the eastern Bering Sea continental slope. A hydroacoustic-midwater trawl survey was also conducted in conjunction with the bottom trawl survey to provide an overall assessment of the semi-demersal walleye pollock population. The survey was performed

aboard the chartered vessels Alaska, Ocean Hope 3, and Pelagos and the NOAA ship Miller Freeman. Two foreign vessels, the U.S.S.R. research vessel Darvin and the Japanese chartered landbased trawler Tomi Maru No. 51 also cooperated in the survey. Nearly 850 stations were sampled with bottom trawls over an area of about 200,000 nmi^2 and approximately 5,100 nmi of transect lines were surveyed hydroacoustically. In addition to the crab and groundfish assessment data collected, other studies carried out during the survey were (1) an examination of halibut and crab by-catch in inshore trawling areas, (2) side-by-side comparative fishing experiments between the U.S. and Japanese and Soviet survey vessels, (3) tagging of Pacific cod and Greenland turbot, (4) collection of stomach samples for food habit studies, (5) an evaluation of jigging equipment for catching and tagging walleye pollock, (6) the collection of specimen and tissue samples for special studies, and (7) the recording of marine debris in the trawl catches for an evaluation of the extent and magnitude of debris in the study area.

- Gulf of Alaska

Groundfish research in the Gulf of Alaska is conducted by both the RACE Division and the Auke Bay Laboratory. The role of ABL in survey activities has increased substantially in recent years and their area of responsibility includes Gulf of Alaska waters east of Cape St. Elias. Survey activity in the Gulf of Alaska and Aleutian Islands in 1988 was limited to the domestic longline survey of the Gulf, continued participation in the U.S.-Japan cooperative longline survey of the Aleutian Islands, Bering Sea and Gulf, and a survey continuing the ongoing investigation of the distribution of juvenile pollock. Subtask personnel have also assisted in the initiation of a domestic observer program for monitoring domestic fishing operations in the Gulf of Alaska during the first quarter of 1989.

Japan/U.S. Cooperative Longline Survey (RACE and ABL)

This survey was once again conducted in the Aleutian Islands, Bering Sea and Gulf of Alaska. The Japanese longline vessel Tomi Maru No. 88 sampled 107 stations, setting 7,200 hooks (8.6 nmi. of groundline) at each station. The depths sampled by each set ranged between approximately 100 and 1,000 m. Primary objectives included obtaining indices of sablefish and Pacific cod abundance, assessment of other major catch components such as halibut, arrowtooth flounder, Greenland turbot, rockfish, thornyheads, and grenadiers, tagging sablefish, and to collect biological information from sablefish. As in previous years, the cruise occurred during the period from May to September. U.S. scientists were aboard the vessel during all research operations.

U.S. Longline Survey of the Gulf of Alaska (RACE and ABL)

This was the second U.S. longline survey of the upper continental slope of the Gulf of Alaska. Sampling occurred from 6 July to 17 September. Forty-seven stations were sampled at the same pre-established sites, distributed from the Islands of Four Mountains (170°W long.) to Dixon Entrance, that have been fished annually since 1978 by the Japan/U.S. cooperative longline survey. The U.S. sampling gear was identical to that of the Japanese with respect to the number of hooks, bait, and length of each skate, but differed with regard to the hook type, gangion length and thickness, and anchoring arrangement. It differed from the U.S. gear used in 1987 with regard to bait type (squid instead of herring) and heavier gangions. Once

again additional sampling was performed in gullies to assess the abundance and size composition of the sablefish in those areas. Previously, certain assumptions were made in extrapolating CPUEs and size compositions from the upper slope stations to deep, large gullies that were not actually sampled. The results of this survey showed that catch rates were lower and average size of sablefish was smaller in the gullies than on the upper slope. Consequently, the extrapolated relative population numbers and size compositions were probably not appropriate. Comparisons between the CPUEs realized by the U.S. and Japanese longline gears are being made to relate the two data series.

Young-of-the-year survey (RACE)

A survey using qualitative echosounder evaluations and midwater trawling was conducted between Unimak Pass and the northern end of Shelikof Strait to assess the distribution and relative abundance of juvenile and young-of-the-year pollock. This was the fourth annual replication of this survey, which has found large aggregations of juveniles in past years. Findings from the 1988 survey have not yet been compiled.

- West Coast (Washington, Oregon, California Region)

Two surveys were conducted off the west coast by the AFSC in 1988. They included a trap survey to obtain indices of sablefish abundance off California and southern Oregon and a bottom trawl and plankton survey of the continental slope waters (100-700 fm) off central Oregon in cooperation with the Southwest Fisheries Center.

The National Marine Fisheries Service has reorganized somewhat since the last

meeting of this body. The four Fisheries Centers, previously separate from the five Regional Offices of the Service, have become regional Fisheries Science Centers under the administration of the Regional Offices. The former Northwest and Alaska Fisheries Center is now two entities, the Alaska Fisheries Science Center (AFSC) and the Northwest Fisheries Science Center (NWFSC). Despite this reorganization, the basic structure and organization of the groundfish research programs remain unchanged since last reported. Essentially all groundfish work is conducted within the Resource Assessment and Conservation Engineering (RACE) Division, the Resource Ecology and Fisheries Management (REFM) Division, and the Auke Bay Laboratory (ABL), which is responsible for groundfish assessment in the Gulf of Alaska east of Cape St. Elias. Changes in two key positions within the RACE Division were the retirement of Mr. Miles Alton, Groundfish Assessment Task Leader, and the appointment of Mr. Tom Dark, formerly leader of the West Coast Subtask of the Groundfish Assessment Task, to the position of Deputy Director of the RACE Division. The RACE and REFM Divisions are divided along regional or disciplinary lines into a number of tasks and subtasks. A review of pertinent work by these tasks during the past year is presented below. Recent publications produced by RACE and REFM scientists are presented in Appendix I.

Sablefish Abundance Indexing -October 18 through December 4.

The monitoring of sablefish abundance using standardized CPUE from trap sets has continued since 1979. In 1988 nine index sites off southern Oregon and California were sampled with conical traps. Except for the two northernmost sites, each site was sampled twice. In addition to catch by numbers and weight data, samples were collected for age, maturity, and individual weights by sex and length category. Catch rates for all sites

combined showed increases of 132% and 8% over those seen in 1986 and 1984, respectively. Catch rates at the four northern sites (north of 40 degrees N) were just slightly greater in 1988 than in 1986, but were sharply greater at the five southern sites. A large mode of small fish (<53 cm) suggested that increased catch rates were due to good recruitment. Over 6,000 sablefish were double-tagged during the survey and stomach samples were collected from a random sample of 20 sablefish per depth interval at the four southern California sites (approximately 560 specimens) for feeding studies being conducted by Southwest Fisheries Science Center (SWFSC) personnel at the Tiburon Laboratory. At the end of the cruise, 140 live sablefish were delivered to the SWFC in La Jolla, CA, for spawning and early life history studies.

1988 NMFS AFSC/SWFSC Cooperative Sablefish and Dover Sole Continental Slope Survey - November 25 through December 16.

This survey is part of a series begun in 1984 to examine the seasonal effects on maturity, distribution, abundance, and community structure. Objectives included descriptions of the biological characteristics of sablefish and Dover sole populations with respect to depth, assessment of the feasibility of area-swept and egg production estimates of sablefish spawning biomass, and determination of the biological characteristics for a variety of commercially important groundfish species. Fishing operations during this survey extended from 44°08' N to 45°21' N lat. and from 100 to 700 fm. Seventy trawl hauls were made at predetermined stations. Length measurements were taken for samples of all species coming aboard.

Specimen data collected for target species (sablefish, Dover sole, shortspine thornyhead, arrowtooth flounder, longspine thornyhead, darkblotched rockfish, and Pacific hake) included lengths, maturity stage, individual weight, and collections of otoliths, whole gonads for fecundity determination, pieces of ovary for histological confirmation of maturity determinations, stomachs for food habit analyses, and tissues for pathology analyses. Approximately 85 small sablefish (<40 cm) were tagged and released near the point of capture. In addition to the bottom trawls, samples of nekton and plankton were obtained with Manta and bongo nets at 27 stations.

This study continued in 1989 with a replicate of the survey in mid-February through March conducted jointly by the SWFSC and RACE Division personnel aboard the NOAA vessel David Starr Jordan, and a second replicate is planned in August or September as an auxiliary study during the 1989 west coast triennial groundfish survey. The upcoming work will complete the data collection for a year-round view of the study area and the populations.

ii) Recruitment Processes Task

- FOCI Work (Fisheries-Oceanography Coordinated Investigations)

  This task has participated annually since 1986 in studies of the distribution and abundance of eggs and larvae from pollock spawning in Shelikof Strait as part of the joint AFSC-Pacific Marine Environmental Laboratory's Fisheries-Oceanography Coordinated Investigations (FOCI). The objective of FOCI is to investigate factors affecting survival of early life history stages (eggs and larvae) of pollock and thus influencing year class success. The task's efforts have concentrated on assessing starvation, growth, predation, and tracing the drift of eggs and larvae and relating their distribution to physical processes in the area.

- West Coast Ichthyoplankton Surveys

  From 1980 through 1987, ten ichthyoplankton surveys were conducted off Washington-Oregon-northern California. Results of each of these surveys have been reported in NWAFC Processed Reports. The results from all of these surveys are now being analyzed together to establish annual patterns of occurrence of fish eggs and larvae of the region, how these relate to local oceanography, and how they vary interannually.

  A major emphasis of the task is to increase our ability to identify fish eggs and larvae collected. As a result, a major publication "A Laboratory Guide to Early Life History Stages of Northeast Pacific Fishes" is now in press. Research to establish early life history series through rearing and examination of plankton samples is continuing. Rockfishes (Sebastes) are a prime target of this research.

iii) Fisheries Resource Pathology Task

Approximately 800 juvenile walleye pollock (<110 mm) were collected during the 1988 field season. This collection represents the third and final year of studies on the diseases of juvenile walleye pollock and how these diseases may impact subsequent adult abundance or the commercial value of adults. The first two years collections indicate that diseases caused by protozoans appear to be the most important resulting in mortalities of infected juveniles or an unacceptable adult product (ie. fillets) for human consumption.

A microsporidian, Pleistophora sp., infects and proliferates in the skeletal muscle of both juveniles and adults causing replacement of large portions of body muscle. In juveniles, death and increased susceptibility to predation are certain outcomes, although rates of these processes have not been determined. Adults infected by the microsporidian yield filets with unacceptable blemishes. Infection prevalence of the microsporidian in juvenile pollock have ranged form 3.5-25%.

A second protozoan of probable importance infects the kidney. The effects of this myxozoan protozoan, Sphaerospora sp., in juvenile pollock have not been determined but because it infects a vital organ and has been reported to cause mortalities of juvenile salmon, it is considered notable. Prevalence ranged from 5-35%.

Last summer, Task members were asked to investigate the condition of extensive scale-loss in certain populations of Puget Sound quillback rockfish, Sebastes maliger. Affected rockfish were lethargic. A number of anomalies were observed but the two most important appear to be a probable protozoan infection in the peripheral blood cells of the quillback rockfish and an unidentified myxozoan infection of the mesenteries of various organs. Both require identification and/or further confirmation by transmission electron microscopy. In addition, it is not known whether the putative blood protozoan is a life history form of the unidentified myxozoan. All collected fish (N=54) appear to be infected by the blood cell protozoan while approximately

20% are infected by the unidentified myxozoan. It appears that those fish experiencing extensive scale-loss and lethargy were most infected by the putative blood cell protozoan.

The Fisheries Resource Pathology Task entered a cooperative study with the Kodiak Laboratory (NMFS) and FRED (Fisheries Rehabilitation, Enhancement & Development) of the Alaska Department of Fish & Game-Juneau to determine the distribution and prevalence of Bitter Crab disease in Chionoecetes opilio. The disease is caused by a parasitic dinoflagellate, Hematodinium sp., that is fatal to infected crab. Heavily infected crab processed for human consumption possess a "bitter" aftertaste but are not a public health concern. Preliminary results indicate that the parasite is widely distributed in opilio crab north of St. Matthew Island in the Bering Sea where station disease prevalence ranged from 7% to 48%. The data suggest that the disease may be spreading to opilio crab in the commercially important region south of St. Matthew.

iv) Conservation Engineering Task

Research on identification of the most important factors causing variability in the operating dimensions of survey trawls and analyzing the effects of this variability on area-swept abundance estimates continued. Measurements of operating width and height were made on 55% of the survey trawl hauls made during the 1988 Bering Sea survey. This allowed a comparison of the effects of different methods for estimating trawl width on survey results. Using a single (average) value for net width was found to result in underestimates of abundances in shallow water. Methods correcting for the effects of wire out (depth) on trawl width matched well with results generated from actual measurements of individual hauls.

Since trawl widths from one vessel used in the 1988 Bering Sea survey were significantly lower than those from the other vessels or those from past work on the same vessel, a set of observations was taken in February 1989 to try to find the cause of this change. It appears that use of a set of doors which was somewhat smaller and lighter was the most likely

culprit.

v) Pelagic Resources Assessment Task

Hydroacoustic/midwater trawl assessment of pelagic resources is the primary activity of this task. Associated activities include fisheries acoustic system development, target strength measurement and research into the other factors influencing accuracy and precision of acoustic surveys. The task conducts annual assessments of pelagic pollock in the Gulf of Alaska, triennial assessments of pelagic pollock in the eastern Bering Sea shelf and slope regions, and triennial assessments of pelagic Pacific whiting off the coasts of California, Oregon, and Washington. During the last two years, the task has also participated in several surveys of pelagic pollock in the Aleutian Basin; since July, 1988 these Basin surveys have been conducted in cooperation with the Far Seas Fisheries Research Laboratory (FSFRL) of the Fisheries Agency of Japan.

- Aleutian Basin Surveys

During the summer of 1988, AFSC acoustic assessment task personnel participated in a cooperative Japan-US survey of the Aleutian Basin that was conducted on board the chartered Japanese fishing vessel Seiju Maru. An echo integration/midwater trawl survey of the Basin east of the U.S.-U.S.S.R. convention line was conducted during August, September, and October. Data is currently being analyzed and preliminary results should be available later this year.

In the winter of 1989, FSFRL and the AFSC conducted a cooperative echo integration/midwater trawl survey of pollock in the Aleutian Basin (east of the US-USSR Convention Line) and on the continental shelf (outside 50 fm bottom depth). Except for the area around Bogoslof Island, very few pollock were found in the Basin. Spawning in the dense aggregations around Bogoslof Island peaked during the week of Feb 26 - March 4. Concentrations of mature fish were also encountered in shelf waters northwest of

the Pribilof Islands, near St. George Island, and north of Unimak Island.

- Eastern Bering Sea Survey

  An echo integration/midwater trawl assessment of pelagic pollock in the waters of the eastern Bering Sea shelf and slope was conducted by members of the pelagic resources assessment task on board the chartered commercial trawler Pelagos during June, July, and August 1988. The demersal component of the shelf and slope stocks was also surveyed by members of the Bering Sea Assessment subtask. The combined results of these surveys will constitute the fourth in a triennial series of comprehensive assessments of pollock in this region. Quantitative results will be available later this year. In general, it was observed that adult fish occurred in 60-100 fm water while age 0 fish were observed in shallower (50-60 fm) water. The densest distributions of pelagic pollock were observed in the northwestern portion of the survey area, especially to the west of St. Matthew Island.

- Gulf of Alaska Survey

  In March of 1989, the AFSC conducted an acoustic/midwater trawl survey of spawning pollock in selected areas of the Gulf - including Shelikof Strait, Davidson Bank, Marmot Bay, and the area south of Chirikof Island. Surveys of Shelikof Strait have been conducted annually since 1980 (with the exception of 1982). No pollock were found on Davidson Bank. Concentrations of spawning fish were found in Marmot Bay and south of Chirikof Island. The pollock in these two areas were all larger than 35 cm. In two passes of Shelikof Strait, a broad range of pollock year classes were encountered with fish sizes ranging from 10 to 65 cm.

vi) Cooperative Research with Other Nations

Cooperative research may range from approval of research within the United States FCZ to

joint field studies, analysis, and reporting of results. In 1988 the United States was involved in cooperative research with the fishery agencies of the U.S.S.R. and Japan (Appendix H, Table 5). Nineteen foreign vessels conducted research within the FCZ and some of those participated directly with U.S. vessels and AFSC personnel in major surveys of groundfish resources in the Bering Sea and Gulf of Alaska. Foreign vessels from the U.S.S.R., Japan, and Poland scheduled to work cooperatively in U.S. waters during 1989 are listed in Appendix H, Table 6.

b) REFM Division

The research and activities of the Resource Ecology and Fisheries Management Division (REFM) are designed to respond to the needs of the National Marine Fisheries Service regarding the conservation and management of fishery resources within the U.S. 200-mile Exclusive Economic Zone (EEZ) of the northeast Pacific Ocean and Bering Sea. Specifically, REFM's activities are organized under the Foreign Fisheries Observer Program and the following tasks: Age and Growth Studies, Socioeconomic Assessments, Resource Ecology and Ecosystems Modelling, and Status of Stocks and Multispecies Assessments. The work of these tasks culminates as technical reports and advice to the appropriate fishery management councils and international fisheries commissions.

i) Foreign Fisheries Observer Program

The Foreign Fisheries Observer Program is responsible for placing U.S. observers on board foreign and joint venture (JV) boats operating inside the U.S. EEZ. In 1988, the program deployed 308 observers. Observers were placed on foreign vessels which were either fishing on the basis of groundfish quotas allocated by the U.S. State Department, or receiving fish from U.S. vessels as part of JV apportionments. Vessels from Japan, the Republic of Korea (South Korea), the U.S.S.R., Poland, and the People's Republic of China were involved. The all-region observer effort was 14,892 days. Coverage was 93.5% in the Bering Sea/Aleutian (BSA) region, 91.9% in the Gulf of Alaska (GOA) region, and 95.8% off the Washington-Oregon-California (WOC) region.

In the first four months of 1989, observer

coverage of vessels involved in JV fisheries off Alaska was 93.3%. There is no foreign allocation for 1989.

ii) Age and Growth Studies Task

The Age and Growth Task of the REFM Division is the Alaska Fisheries Science Center's ageing unit for groundfish species. The task consists of a biometrician, technician, and nine age readers. Ages are usually determined from otolith, scales or fin rays.

Data provided by the task are used in stock assessment work which contributes to the estimation of the allowable catch of many commercially important groundfish species. These include species such as walleye pollock, Pacific whiting, Pacific ocean perch, Atka mackerel, yellowfin sole, and rock sole. Recently, preliminary ages have been released for northern and dusky rockfish.

Research continues to focus on two very difficult species: Pacific cod and sablefish. The ageing of Pacific cod has been a problem of classic difficulty in the northeast Pacific. Tentatively, we feel that otolith with scales as backups for younger fish is the most practical approach to the production ageing of Pacific cod. Sablefish has also proved to be an extremely difficult species. A sablefish otolith exchange in 1988, followed by a workshop in February 1989, helped greatly to standardize criteria between the Alaska Fisheries Science Center, the Pacific Biological Station and the Southwest Fisheries Science Center's Tiburon Laboratory. The task is also working with the Auke Bay Lab in a joint sablefish OTC-tagging project, and an edge growth study, in trying to validate ageing criteria. In addition we are considering the use of radioisotope validation methods for sablefish and other groundfish species.

iii) Socioeconomic Task

The primary function of the Socioeconomic Task is to provide economic information that will assist NMFS and both the Pacific and North Pacific Fishery Management Councils in making well informed fishery management decisions. However, the Task is also responsible for responding to other requests to the AFSC and

NWFSC for economic information. As a result, the Socioeconomic Task is actively involved in providing economic information for the Pacific and North Pacific Fishery Management Councils, industry, NMFS, and other agencies. This includes preparing reports and publications, participating on Council plan teams, preparing and reviewing research proposals and programs, preparing analyses of proposed management measures, and providing extracts from databases. Many of these are cooperative activities conducted with economists at other NMFS sites, the regional fishery management councils, Oregon State University, Washington State University, the University of Alaska, and the University of Idaho.

Recent reports and publications presented the results of research concerning the development of bioeconomic models for pollock in the Gulf of Alaska, economic and biological developments in a variety of fisheries, fishery product exports from the Pacific Northwest and Alaska, catch and revenue characteristics of vessels harvesting sablefish off the Pacific Coast, the economics of bycatch, price models and market analysis for sablefish and Pacific halibut, the economic implications of the bycatch of salmon in groundfish fisheries, the interdependence of international trade and fishery management issues for the Alaska groundfish fisheries, the economics of mesh size regulations for the Pacific Coast groundfish trawl fishery, the empirical implications of specific dual model assumptions, and the use of new time series methods of analysis.

iv) Resource Ecology and Ecosystems Modelling Task

The Resource Ecology and Ecosystems Modelling Task has continued analysis of the effects of fishing on the size and age composition of fished populations. The Trophic Interactions Subtask continued regular monthly collection of food habits information on key fish predators in the eastern Bering Sea. Assistance and training in food habits collection and analysis methods were furnished to other Center personnel who collected stomach scan information in the Gulf of Alaska. Food habits information was used to provide parameters for two population models: a VPA

model which includes cannibalism for eastern Bering Sea walleye pollock and an eastern Bering Sea crab/groundfish model. Current research emphasis is on interannual changes in predation which might provide insight into changes in year class strength.

v) Status of Stocks and Multispecies Assessments Task

The Status of Stocks and Multispecies Assessments Tasks are responsible for conducting studies which will enhance fishery manager's abilities to manage marine fishery resources properly. Scientists involved in these tasks assist in preparation of stock assessment documents for groundfish in the three management regions (BSA, GOA, and WOC), and they frequently provide management support in an official capacity through membership in regional groundfish management teams.

vi) Bering Sea and Gulf of Alaska Stock Assessment Task

During the past year, Task scientists analyzed a number of proposed changes to the Groundfish Fishery Management Plans for Alaska. Amendment proposals analyzed included: 1) The allocation of sablefish quotas by gear type in the Aleutian Island area; 2) The establishment of a framework mechanism for setting fishing seasons; 3) The establishment of an area closed to fishing around the Walrus Island and Cape Pierce in the Bering Sea; 4) A modification of the halibut bycatch management regime in the Gulf of Alaska; 5) An extension of the cod trawl exemption zone in the Bering Sea; and 6) The establishment of a comprehensive data gathering system for fisheries information.

The Status of Stocks Task is also coordinating research designed to identify the stock structure of pollock found in the Bering Sea donut hole. This involves 1) inquiries in the areas of genetic structure, morphometrics, meristics, and the chemical composition of otolith, 2) tagging studies, and 3) studies of egg and larval drift.

vii) West Coast Stock Assessment Task

The West Coast Stock Assessment Task is concerned with assessment of the abundance and productivity of groundfish stocks along the

coasts of Washington, Oregon and California. Annual assessments are critically important for those species managed with annual quotas by the Pacific Fishery Management Council. The task is also involved with evaluation of alternative management schemes, and with investigations into long-term productivity of these resources.

A major project during 1988 was an assessment of the status of the sablefish stock along the west coast. This assessment used a multi-dimensional approach enabled by the newly developed synthesis model. The task also has responsibility for stock assessment of Pacific whiting and Pacific ocean perch. The geographic distribution of the whiting resource was reviewed, and the pattern of yellowtail rockfish bycatch in the whiting fishery was described. Task scientists are involved in cooperative research activities between the U.S. and Canada on the Pacific whiting resource, particularly with regard to geographic distributions and trends in growth. A new management model is being developed which offers improved biological information by accounting for the latitudinal age stratification of the stock along the coast. Also in 1989, the task is conducting an analysis of the Dover sole resource in collaboration with State fishery biologists.

2. National Marine Fisheries Service - SWFC

Groundfish-related research is conducted by three major components of the Southwest Fisheries Center (SWFC): the Coastal Division (La Jolla), directed by Dr. John Hunter; the Pacific Fisheries Environmental Group (Monterey), directed by Dr. Andrew Bakun; and the Tiburon Laboratory (Tiburon), directed by Dr. Alec MacCall.

Coastal Division (La Jolla)

The Coastal Fisheries Resources Division has been involved in three areas of groundfish research to support the management needs of the Pacific Fishery Management Council and to establish a firm basis for future research and more accurate management.

Documentation of the distribution of groundfish spawning is being accomplished by analysis of fish eggs and larvae in historical CalCOFI plankton samples. This effort will aid future attempts to measure species abundance by egg and larvae surveys. Studies of environmental effects on recruitment also

depend upon an accurate assessment of the spawning distribution in time and space.
A manuscript on a method for estimating biomass of Dover sole in central California using the Daily Egg Production Method will be completed by July 6, 1989. The work is based on ichthyoplankton and trawling surveys taken in 1987 and 1988. It documents new methods, and indicates that Dover sole biomass can be estimated using these new methods. Costs relative to precision and bias are discussed. Manuscripts were also completed in the water content of Dover sole and how it changes with depth, fish size and age; and on the reproduction and fecundity of sablefish from cooperative sablefish trawl and plankton survey with the NW centre 12-88 to 4-89. The data will be used to assist in the estimation of sablefish biomass.

Coastal Division economists regularly develop and analyze information regarding the commercial and recreational groundfish fisheries off the Pacific coast, emphasizing the California region. Regular data collection activities include the periodic updating of cost and earnings data for groundfish trawlers, fuel prices, and economic indices of trawl fishery productivity. The relevant multispecies/multifactor productivity theory is published in Dale Squire's NOAA Technical Report NMFS 67 ("Index numbers and productivity measurement in multispecies fisheries: An application to the Pacific coast trawl fleet", July 1988). Pacific coast trawl fleet harvest capacity was examined in SWFC Admin. Report LJ-88-24 (D. Squires and D. Huppert, October 1988, "Measuring harvest capacity in the Pacific Coast groundfish fleet"). Currently underway are modelling efforts which (1) examine the economical consequences of alternative allocations of sablefish between trawl and fixed gear fleets; and (2) a coastwide quadratic programming model which will evaluate short-term economic effects of fishery regulations.

NMFS' Marine Recreational Fisheries Statistics Survey is supplemented by special economic surveys organized by CFRD economists. The Bay Area Sportfish Economic Study, documented in Thomson and Huppert's Technical Memorandum NOAA-TM-NMFS-SWFC-78 (August 1987, "Results of the Bay Area sportfish economic study, BASES"), provides substantial information on central California fishing effort, travel costs, species targeting, catches and angler expenditures for groundfish and other fishing trips during 1985-1986. A similar economic survey of southern California marine anglers is currently underway.

Pacific Fisheries Environmental Group (Monterey)
Pacific Fisheries Environmental Group (PFEG) develops methods to address the linkages between natural environmental variability and fish populations dynamics. Data series

developed within the PFEG research program are made available to scientific collaborators. Co-location with the U.S. Navy's Fleet Numerical Oceanography Center provides access to ocean and atmospheric data on a global scale. The development of the NOAA Center for Ocean Analysis and Prediction (COAP) in Monterey is expected to enhance this data resource. Major categories of scientific activity at PFEG include: (1) Development of environmental index time series, (2) Ocean anomaly diagnostic studies, (3) identification of environmental-biological causal linkages through interregional comparative studies, exploratory data analysis, empirical modelling etc., (4) development of appropriate environment-dependent fishery modelling methodologies, (5) development of biological time series for calibration, verification and parameter estimation. A major new research thrust now being initiated addresses the effect of bottom-trapped hydrodynamic structures in patterning the feeding and reproductive habitats of west coast groundfish.

Tiburon Laboratory (Tiburon)

The groundfish program at the Tiburon Laboratory consists of four interrelated investigations: Groundfish Analysis, Groundfish Communities, Groundfish Physiological Ecology and Underutilized Groundfish Resources. The last investigation is now directed from the Southwest Regional Office.

The Groundfish Analysis Investigation conducts studies aimed at improving management of groundfish fisheries. The work includes stock assessments, development of new management models, development of methods for predicting rockfish recruitment, sampling rockfish landings and aging rockfish, conducting economic studies of alternate management policies, and conducting life history studies of rockfish. In addition, staff participation on the Pacific Fishery Management Council's Groundfish Management Team principally involves work on stock assessments and development of management alternatives.

The Recruitment Project's goal is to detect differences in year-class strength of important species of rockfish prior to entry of the year class into the fishery. Annual midwater trawl surveys for juvenile rockfish are carried out to determine abundance and distribution off the coast of central California. Information is also being gathered on factors that affect year-class strength.

Landings of rockfish have been sampled cooperatively with California Department of Fish and Game (CDFG) since 1977. Several important species are aged and the data are being compiled with software developed by project members.

These data are routinely used in stock assessments.

Members of the staff have also been monitoring the timing of parturition in mature Sebastes females in northern and central California since 1981. Data on prenatal larval development are collected through the cooperative CDFG and NMFS rockfish sampling program.

Work on groundfish economics is also carried on under the Groundfish Analysis Investigation, in cooperation with other SWFC and Southwest Region economists, industry representatives, and management biologists. This work includes studies of alternate management methods for groundfish.

Two projects are underway to develop improved stock assessment methods. The first is a model that simulates both the fishery and the management process. The model is being used to evaluate the accuracy and precision of management recommendations based on cohort analysis. Estimates of abundance and fishing mortality made by the simulated fishery manager are compared to the actual levels for the known underlying population. The second project is an analysis of historical trends in length distribution of commercially important California rockfish species. The analyses will supplement analyses of age data for chilipepper, bocaccio, widow and yellowtail rockfish. For other species such as shortspine thornyheads, age data are not available, so the changes in length composition will be the only information about the current status of these species.

The main objective of the Groundfish Communities Investigation is to determine how changes in the marine environment affect the distributions, abundances, and related year-class strengths of groundfish species. Changes being considered include regular seasonal transformations of the habitat, as well as changes associated with irregular environmental events such as El Niños. Emphasis is on how these changes affect interspecific relationships, particularly those between predators and prey. Because prey populations fluctuate widely in response to habitat transformations, the ability of specific predators to accept alternate prey in the absence of preferred prey is a major topic of study. Information from these studies should help managers anticipate not only the effects of environmental change on the relative availability of prey, but also the impact of fisheries for such important prey as shortbelly rockfish and anchovies. In addition, recruitment success is thought to correlate with certain elements of environmental changes, and this is another major topic

of study.

The Groundfish Physiological Ecology Investigation is designed to determine the inherent and environmental factors most affecting condition and reproduction of several rockfish species. Research emphasis is on factors affecting the ability of individual populations to grow, reproduce and survive in their environment. Geographical comparisons are made between fish sampled at Cordell Bank off California and more northerly populations off Oregon, Washington and British Columbia. Information is integrated with that from other Investigations to elucidate factors affecting recruitment.

Species studied include yellowtail, bocaccio, widow and chilipepper rockfish. Most research is currently on yellowtail rockfish. Work includes examination and analysis of adult and juvenile specimens collected from commercial and sport groundfish fleets, and from cruises aboard the David Starr Jordan. Results of analyses and supportive laboratory experiments are used to determine which important characteristics of condition and reproduction will be used to form measures of health and effective fecundity.

Studies are performed on different levels of biological organization and include bioenergetic patterns, examinations for diseases, parasites and malformations, proximate analysis of tissues, determination of serum nutrient dynamics and estimates of viable fecundity and egg resorption. Results are combined with oceanographic and other data to determine environmental factors relating to condition and reproductive variability and to place species populations in the context of their habitats.

The objective of the Underutilized Groundfish Resources Investigation is to expand the resource base of the groundfish fishery. As maximum sustainable yield is approached for the traditional species, the groundfish fishery will have to turn to other species, as well as to fish that are now being discarded. This study contributes to increased use of such species and to adding information about little-known species that the industry can use when appropriate. Methods are to obtain fish and information from fishermen or from research at sea, test flesh characteristics and market acceptability of underutilized species, and then publish reports of results in appropriate journals or disseminate information in other ways to the industry. Current fishes under study are the grenadiers, small flatfishes

that are presently discarded by the fishery, and shortbelly rockfish.

3. Alaska Department of Fish and Game

During 1988 the Southeast Region commercial fisheries Groundfish Project was staffed with the project leader, an on-board observer, and a port sampler in Petersburg, an assistant project leader and a port sampler in Sitka, a full-time port sampler in Ketchikan, and part-time samplers in Craig and Yakutat.

The Southeast Region's groundfish project has responsibility for research and management of all commercial groundfish resources in state waters of the Eastern Gulf of Alaska. The project also cooperates with the federal government for management of the waters of the adjacent EEZ and the project leader participates as a member of the Gulf of Alaska Groundfish Plan Team.

Project activities centre around fisheries monitoring and in-season management of the groundfish resources based on data collected from the fisheries and from resource assessment surveys. Primary tasks include fish ticket collection, editing, and data entry for both state and federal managed fisheries; dockside sampling of sablefish and rockfish; skipper interview and logbook collection and data entry; and biological studies of important commercial species. Three resource assessment surveys were completed during the year which will be described in more detail later in this report. Regulation development and review and information dissemination also require considerable staff time.

Groundfish Management

State groundfish fisheries are managed by the Department of Fish and Game under regulations set biennially by the Board of Fisheries. In addition to announcing open and closed fishing periods consistent with the established regulations, the department has authority to close fisheries for conservation reasons if resource problems are detected. The department also cooperates with the National Marine Fisheries Service (NMFS) for opening and closing fisheries which are under joint jurisdiction.

Fish tickets are required by regulation for each commercial landing from state-managed fisheries. The catch data from the fish tickets is used as the primary means of tracking the in-season harvest levels. Fish tickets are collected from as many as fifteen ports which accept groundfish within the region. The fish tickets are edited, batched, and entered on microcomputers in Petersburg and Sitka. Because of the intensity of many of the region's groundfish fisheries, a

"soft data" accounting system using processor contacts is also utilized when necessary to track landings. State entry of fish tickets from the Exclusive Economic Zone (EEZ) off Alaska was continued through 1988 as the result of a renewed contract with NMFS to accomplish that task.

There is no specific independent management plan established for groundfish fisheries in the Dixon entrance District at this time. The portion of the area east of the longitude of the Cape Muzon Light is managed in conjunction with fisheries in the Southern Southeast Inside (SSEI) management area. The portion of the area west of that line is managed in conjunction with the Southern Southeast Outside (SSEO) management area. Vessels from both nations fish the waters of this district and increased coordination and cooperation should be considered to minimize conflicts on the fishing grounds between the fleets and to assure that the stocks in this area are not over-utilized because of the combined fishing effort.

Groundfish Research

State of Alaska groundfish research is currently divided into two major components in Southeast Alaska. These are port sampling/skipper interviews and resource assessment. A third component, on-board observers was largely eliminated in 1988 because of funding cuts. One special observer

component remains in conjunction with a lingcod life history study.

Port sampling provides biological information from the landed catch and in recent years has been restricted to landings of rockfish and lingcod only. This component provides information on species composition and length frequency of the landed catch by management area. It also provides an opportunity to collect age structures and sex and reproductive state from round deliveries of rockfish. During 1988 port sampling was conducted in Sitka, Ketchikan, and Petersburg, and Craig.

Skipper interviews are conducted for landings of the key groundfish species only. Interview effort concentrated on the state managed sablefish and rockfish fisheries during 1988. This program is designed to provide detailed location and effort information which, when coupled with the fish ticket data, provides an estimate of CPUE by management area for the landed catch.

Besides the port sampling program, research efforts during 1988 included sablefish stock assessment surveys in each of the two inside management areas and a second-year rockfish survey along the outer coast off Sitka. These surveys are designed to provide information on relative abundance of the target species and to furnish unbiased biological samples from the sablefish and rockfish populations in the southeastern area. Age structures taken during these surveys are sent to the ADF&G aging lab in Kodiak for age determination.

Data from these surveys is still being analyzed and will be used to redesign subsequent surveys in those areas. All three of these surveys are five-year study projects and no conclusive results are expected for several years. A summary of the methods used and cruise reports are available from the author of this report.

A preliminary study was begun during the winter of 1988 to determine lingcod nesting locations, spawn timing, and the timing and duration of lingcod nest-guarding in Southeast Alaska. This study is being accomplished using a two-stage approach. An on-board observer participated with cooperating local fishermen to obtain sex and size and maturity samples from the directed lingcod dinglebar fishery. In addition, dive transects were completed in diver depths in areas adjacent to known harvest locations to observe lingcod nesting areas. This project is in a very preliminary stage and will be reported on more fully in future documents.

4. Washington Department of Fisheries

The Washington Department of Fisheries Marine Fish Program is responsible for research, management and enhancement of non-anadromous finfish resources. There are three divisions actively engaged in groundfish management.

a. Coastal Marine Fish Management

The coastal Marine Fish Management Division is responsible for management and research of groundfish in all coastal waters and in the outer Strait of Juan de Fuca. The Division also handles all issues requiring interstate, regional, federal, or international cooperation. Division responsibilities include membership on the Groundfish Management Team (GMT) of the Pacific Fishery Management Council (PFMC), membership on the Gulf of Alaska Plan Team of the North Pacific Fishery Management Council, multi-jurisdiction management and stock assessment of groundfish stocks in state waters (0-3 miles) and in the Fisheries Conservation Zone (3-200 miles) adjacent to Washington, and joint research with other agencies or institutions on the question of mutual interest.

The central focus of the Division is effective management of the coastal groundfish stocks. This is primarily accomplished through membership on the GMT which develops annual estimates of "Acceptable Biological Catch" for major species/species groups and proposes management strategies to the PFMC. Division personnel implement Council decisions by drafting state regulations and coordinating state enforcement regarding groundfish management. Division personnel are stationed in major ports of landing to collect catch and biological data and other fishery related information.

b. Puget Sound Marine Fish Management

The Marine Fish Program of the Department of Fisheries defines Puget Sound as those waters east of the Sekiu River including the Strait of Juan de Fuca. The Puget Sound Marine Fish Division is responsible for the management of the marine fish resource in this area. The Division is organized into three units: Baitfish, Marine Fish Assessment, and Marine Fish Monitoring and Operations.

The Baitfish Unit is responsible for all research and management of the baitfish resource; chiefly Pacific herring (Clupea harengus pallasi) and several species of smelt (family Osmeridae). The goal of this unit is to maintain sustainable yields of baitfish harvested by

commercial and recreational fishermen. To achieve this goal the unit conducts extensive field sampling programs to determine annual spawning escapement, biological characteristics such as age, size and maturity of fish, and biomass estimates of the commercial catch. From analysis of the data collected, a management plan is formulated and the regulations are implemented to all for an efficient harvest and conservation of the species while minimizing conflict between user groups. In addition, this unit is responsible for the definition and resolution of environmental issues affecting the spawning habitats of baitfishes.

The Marine Fish Assessment Unit is partially supported by a Wallop-Breaux Project. The goal of this unit is to evaluate specific groundfish stocks in order to manage at the stock level. This unit performs analysis of fishery and biological data from regional field surveys and historical data bases to evaluate stock trends, and resource conservation problems. With consideration of these trends, a management plan is developed, implemented, and evaluated.

The goal of the Marine Fish Monitoring and Operations Unit is to maintain sustainable yields of groundfish species to the various user groups while providing for the conservation of harvested fishes and minimize conflict between user groups. The unit is subdivided in regional management units which are responsible for the management and operations in their region. These Units perform extensive field sampling and analysis of fishery and biological characteristics in order to ensure orderly harvest. This section is responsible for the development and evaluation of management strategies, usually gear and time/area restrictions.

c. Technical Services

The Technical Services Division performs specialized work in support of stock assessment and harvest management activities of the other Marine Fish Divisions. Areas of work covered by Technical Services include: hydroacoustics, age determination, and computer data processing.

The Hydroacoustics Unit conducts biomass surveys for marine fish stock assessment from out 37-foot boat, M/V Pasquale, with specialized on-board hydroacoustic equipment. Species and areas surveyed on an ongoing basis include: black rockfish coastwide; true cod in Agate Pass; herring in Bellingham Bay, Hood Canal, Gulf of Georgia, and South Puget Sound; whiting in Port Susan;

and sockeye salmon presmolts in Lake Washington. Other activities include bottom mapping coastwide and testing of new dual-beam hydroacoustic gear that will potentially provide greater accuracy in correlating target strength with actual biomass.

The Age Determination Unit conducts microscopic examinations of otoliths, spines, and other bony structures from marine fish samples to determine the age of specimens in support of marine fish stock assessment.

The Data Management Unit provides a variety of data processing services to the Marine Fish Program including; operating and maintaining our shared computer resources; user training and support; maintaining the WDF Fish Ticket, Otter Trawl Logbook, and Biological Sample Databases; and designing and implementing new computer applications.

5. California Department of Fish & Game

The California Department of Fish and Game's (CDFG) groundfish management and research activities are conducted by the Marine Resources Division (MRD) with data processing assistance from the Technical Services Branch. A considerable amount of groundfish monitoring work is conducted by MRD port biologists with assistance from federally-funded technicians.

Systematic commercial groundfish fishery sampling programs were conducted at most major California ports during the year for biological and species composition data on sablefish, rockfishes, Dover sole and English sole. Primary emphasis was given to the trawl fishery in northern California and to the set net fishery in central and southern California. The loss of PacFIN monitoring monies in mid-year severely hampered the Department's efforts to estimate commercial removals of rockfishes by species, and to gather the biological and fisheries data necessary for proper management of our groundfish fisheries. In 1988, 539 rockfish samples, 104 flatfish samples, and 112 sablefish samples were obtained from landed catches for species, age, and size composition. Due to personnel shortages, 1988 rockfish and sablefish sampling, in numbers of samples, decreased to only 24 % of the previous year's level.

B. By Species

1. Pacific Cod

a) Canada

Dr. Tyler, presented the Canadian report on Pacific Cod.

Research
The study of reproductive biology of Pacific cod continued in 1988-89. Histological samples were collected in Hecate Strait during an observer trip in October 1988 and off the west coast of Vancouver Island from port samples in August and October, 1988. Histological preparations were completed and oocyte measurements were continued during September -December 1988. Samples for fecundity, collected during a February 1989 research cruise, were processed. An investigation of inter-annual historical data on the timing of spawning showed an 18-day range in the day at which 50% of the females had spawned. Much of the variability was among regions.

An investigation of factors affecting year-class strength of Pacific cod from the west coast of Vancouver Island was initiated. Early results suggest a February temperature optimum for recruitment of 6.5 -7.0 ^{0}C, and enhancement of recruitment from abundant herring or high levels of convergence.

A reanalysis was conducted of the 24-y data series for Hecate Strait Pacific cod for factors influencing year-class strength. A previous analysis had found strong transport to the north following spawning to be important. The hypothesis tested was that larval fish are carried out of the Strait and lost to the stock. The reexamination was prompted because a better index of northward transport was developed than the Bakun wind index used in the first analysis. The results still supported the transport hypothesis, and the density-dependent effect of stock size was even more evident, with a critical stock size below which recruitment was reduced. In addition, the importance of herring and sandlance as forage species was supported. Forage species results were checked with historic stomach content data. Finally, recruitment data for 1982-85 were excluded for statistical model fitting, and the model with

only stock size and transport could successfully predict the large 1985 year-class.

Stock Assessment

During 1988 and early 1989 landings of cod were high in most areas, although the now-decreasing contributions from the strong 1985 year class have lowered landings in some areas. Due to an apparently healthy stock condition in Area 3C, no winter closure was imposed in early 1989. Landings in February 1989 were greater than for all of 1988. Landings in Queen Charlotte Sound in 1988 decreased from the record levels of 1987 but were still well above average. An investigation was conducted of the sampling program that has been in effect for Hecate Strait landings to examine sample representativeness. It was found that the within area/ season variability is very high. The effect is that there is less certainty in estimates involving port samples and therefore, cause for a conservative view of stock conditions. CPUE has declined from the very high levels of 1987.

Mr. Henry asked whether it was appropriate to apply age-structured models when ageing error appears to be a large problem. Dr. Tyler replied, that when a strong year class is recruiting, error from both sources in the modal analysis is minimized and good estimates of vital parameters can be made.

Mr. Demory asked if the Canadian catches were longline or trawl and if there was a multispecies approach? Dr. Tyler responded that there was separate management for each gear type.

Mr. Tagart asked about sampling analysis. What was the main result? Dr. Tyler responded, when poor to moderate levels of recruitment enter the stock, the number of samples should be increased by 2-3 times in order to determine a representative length-frequency. Since age structure is worked out by modal analysis, errors in length frequency translate into errors in age-class structure since more intensive sampling is likely not possible. The alternative is to treat inferences from age-structure analysis conservatively for years of low recruitment.

Management and regulations

There are no restrictions on Pacific cod landings. The spawning closure previously in place off the southwest coast of Vancouver Island was removed in

1989.

b) National Marine Fisheries Service - AFSC

Abundance of Pacific cod (Gadus macrocephalus) in the eastern Bering Sea and Aleutian Islands remained high during 1988, when a record catch of 197,892 t was taken. The 1988 survey provided continuing support for the hypothesis that the 1982-85 year classes are strong, though not as strong as the 1977-78 year classes that sustained the fishery during the early-to-mid 1980s. Although the survey biomass estimate initially reported for 1988 (970,300 t) was down slightly from the historic high recorded in 1987 (1,142,400 t), recent studies concerning the width of trawl gear used in the survey may cause the 1988 estimate to be revised upward.

The age-structured model used to assess this stock was completely recalibrated in 1988. The new model estimated maximum sustainable yield (MSY) at 275,500 t for the EBS portion of the stock, or 323,300 t for the EBS and Aleutians combined. Other model output included the following bench mark fishing mortality and exploitation (U) rates: $F_{0.1}$ = 0.1625 (U = 0.1306), F_{msy} = 0.1824 (U = 0.1453), F_{max} = 0.2299 (U = 0.1793) and M = 0.2907 (U = 0.2205). The acceptable biological catch (ABC) resulting from application of an F_{msy} harvest strategy was 370,644 t for the EBS and Aleutians combined.

For the Gulf of Alaska stock, the 1987 survey biomass estimate was revised upward to 571,188 t in 1988. Another trawl survey is scheduled for the summer of 1990. The Gulf stock continues to appear healthy, with total allowable catch exceeding actual harvests by significant amounts during each of the last few years. Total catch was 31,000 t in 1988 and is expected to increase in 1989, with total landings of 20,000 t already reported by May 8.

A new estimate of MSY was obtained for the Gulf stock by the method of stock reduction analysis (SRA). The MSY exploitation rate arrived at by this analysis (0.143) was nearly identical to the MSY exploitation rate described above for the eastern Bering Sea stock (0.145). Other model output included the following: pristine biomass = 729,501 t, pristine recruitment = 19,769 t, MSY = 34,190 t, B_{msy} = 239,283, F_{msy} = 0.179, and ABC (0.143 x projected biomass) = 71,220 t.

Mr. Bracken asked about tagging results. Mr. Wilkins mentioned that they had received many tags back but had no results on hand.

Mr. Wilkins commented that there were record catches in the Eastern Bering Sea and that the Gulf of Alaska was in good shape with a 70,000 t ABC.

Mr. Saunders asked if there was any other research on Pacific cod underway at the AFSC. Dr. Methot replied that there were ageing structure studies underway in Seattle.

Mr. Bracken stated there is a cap on flatfish and Pacific cod in Alaska because of incidental catches of halibut.

c) Alaska Department of Fish and Game

Approximately 190 t of Pacific cod was harvested in State managed fisheries during 1988. There is currently no research or management of this species.

d) Washington Department of Fisheries

The population in central and southern Puget Sound is at a low level. Commercial set net fisheries for cod in Port Townsend Bay and Port Gamble remain closed. The department is proposing a reduction in the recreational daily bag limit to 10 fish.

Mr. Tagart mentioned that a technical report may be available on hydroacoustic assessment of Pacific cod -Lemberg, 1988.

e) Oregon Department of Fish and Game

Mr. Demory stated, there is nothing from Oregon.

f) California Department of Fish and Game

Mr. Henry stated that Pacific cod landings peaked in 1987 at 67 t consequently no work is currently underway on Pacific cod.

2. Rockfish (primarily yellowtail, Pacific ocean perch, canary, nearshore spp).

a) Canada

Research

Dr. Leaman presented the report on Canadian rockfish.

The first triennial sampling survey of shelf rockfish was conducted in November 1988. Length, sex, maturity information, and ageing structures were collected for silvergrey (Sebastes brevispinis), canary (Sebastes pinniger) and yellowtail rockfish (Sebastes flavidus) from traditional fishing grounds. Comparative samples from the survey and previously collected samples of commercial landings indicated that midwater trawl fishing produced larger and older yellowtail rockfish than bottom trawling. Whole yellowtail rockfish were also collected for parasite analysis. These samples will be examined in conjunction with samples collected by U.S. biologists, as part of a stock delineation study.

Results of a 1985 Pacific ocean perch fecundity sampling cruise were also published (Leaman and Nagtegaal 1988). This cruise replicated a similar cruise in 1982 and collected data for the examination of inter-annual variability in fecundity and oocyte characteristics. Results demonstrate that oocyte weight and size are conservative, while weight-specific fecundity is variable among years.

Biological studies conducted or planned for 1989 include: samples for a study of age and size-specific fecundity of silvergrey rockfish were collected in April; a similar triennial sampling cruise, concentrating on Pacific ocean perch (S. alutus) and other slope rockfish, scheduled for July; a study of three-dimensional, diel school structure of slope rockfish and its response to trawling is scheduled for August.

In 1989, a study was initiated to examine the species composition of rockfish stocks on hard-bottom (untrawlable) areas, using hydroacoustics techniques combined with sunken gill nets. During the first cruise in March, four distinct types of rockfish aggregations were detected hydroacoustically, associated with different habitat types. There were also some differences in species caught by gillnets in these different habitats. These observations will be further quantified during cruises in August and March.

Stock assessment

A simulator, which produces expected length frequencies for exploited fish populations, was enhanced to account for variable rates of historical mortality and partial vulnerability of recruiting age groups (Rasmusson and Stanley 1988). The simulator has proven useful in the assessment of stocks for which there is no catch-at-age information.

An examination of yearly catch rates was included in the 1988 assessments of shelf rockfish. The catch rates show considerable variation among years, which indicates poor correlation with abundance. However, it is hoped that annual indices will still capture major trends.

Canadian and U.S. biologists cooperated on the preparation of a joint biological database for yellowtail rockfish. The database represents over 100,000 individual fish records collected by four different agencies from 1968-1987.

A report of the Canadian portion of the 1985 joint Canada-U.S. survey of the Pacific ocean perch stock in the southern Vancouver Area was published (Leaman et al. 1988). This survey repeated a similar 1979 survey and documented the continued decline of this stock. Estimated biomass declined by 51% from 1979-1985, in response to both inadvertent and designed over-exploitation in the Canadian and U.S. zones.

Slope rockfish assessments showed little change in stocks during 1988, although lower yields for Pacific ocean perch on the west coast of the Queen Charlotte Islands were recommended, as a result of consistently declining catch rates. The assessments noted the management and enforcement problems created by the complex stock structure of rockfishes. Some alternative management approaches were suggested and included: broader groupings of species/areas/time quotas; longer duration (3-5 y) quotas; individual transferrable quotas (ITQs); and, management for maximum data quality upon which to base assessments (e.g. unrestricted fishing to quotas).

The 1976 cohort of Pacific ocean perch appears to be stronger than any cohort since 1952. It is relatively strong in all stocks in B.C. waters but much stronger in absolute magnitude in the less exploited stocks of Moresby Gully and west Queen Charlotte Islands. This implies a global influence

on a local stock-recruitment process, rather than a global recruitment process which is independent of local stock size. The experimental open-fishery area in Dixon Entrance is now based almost exclusively on this single cohort.

A review of the impact of the extension of Canada's fisheries jurisdiction zone on conservation and management of selected marine fish was completed (Stocker and Leaman 1989). The review concluded that most aspects of management were enhanced but the requirement for annual assessments of longer-lived species, such as sablefish and rockfishes, was not appropriate to their biology.

Management and regulations

The majority of commercially harvested rockfish are managed using a combination of quotas and trip limits. The management goals are to provide an orderly harvest, to stay within assigned quotas and, to extend the fishing season for at least a 10 month period.

In 1989, POP, Yellowmouth, Canary and Silvergrey are being managed by coastwide quota. Individual area quotas have been assigned to each of the four quarters of the calendar year. As well, within quarters, trip limits are in effect. Vessels are entitled to only two rockfish landings in excess of 4.5 tonnes during any consecutive thirty day period.

In order to provide sufficient protection of the Goose Island Gully POP stock, a 4.5 t trip limit will be implemented upon attainment of the area quota.

Yellowtail rockfish are managed by coastwide quota with a trip limit of 45.4 t in effect until 60% of the quota is taken, at which time the trip limit is reduced to 22.7 t.

Rougheye rockfish are managed by trip limit.

Inshore Rockfish - Research programs

A general model for the analysis of maturity and survivorship data was developed and applied to quillback rockfish maturity. Length at 50% maturity was estimated to be 29 cm. A second model was developed to describe fecundity-size relationships. Although this model includes four parameters, four parameters were necessary to adequately account for the fecundity data. Significant differences were

found in fecundity-length relationships for quillback rockfish from two areas. One of these relationships could not be distinguished from a similar relationship for copper rockfish.

Inshore Rockfish - Stock assessment

Field angling studies to monitor rockfish abundance and size composition were continued in 1988 in the northern Strait of Georgia and Johnstone Strait. Rockfish CPUE was higher in 1988 than in 1986-87 for both areas, in spite of continued heavy commercial fishing in one of the areas. In the other area, closed to commercial fishing in 1988, research CPUE in 1988 was twice that in 1987. These results suggest substantial movements, particularly of quillback rockfish, rather than increases in stock abundance.

In 1988, the nearshore rockfish assessment was extended to include stocks along the entire B.C. coast. With declining stocks and a winter fishing closure in the Strait of Georgia, fishing pressure has shifted to other areas of the coast. There have been dramatic increases in catch since 1986 in the north coast and along the west coast of Vancouver Island. Management plans for nearshore rockfish outside of the Strait of Georgia are still in the formulation stage.

Inshore Rockfish - Management and regulations

Inshore rockfish fishing in the Strait of Georgia was closed from January 1, 1989 through April 30, 1989. The aim of the closure is to reduce fishing effort. No quotas are in effect.

There are no restrictions on inshore rockfish fishing outside of the Strait of Georgia.

Mr. McFarlane asked if Dr. Leaman was suggesting that there is a stock/recruit relationship for Pacific ocean perch. Dr. Leaman replied, yes and added that some local stock/recruit relationships appear to be influenced by broader scale environmental processes.

Mr. Tagart asked, how effort is measured for inshore rockfish. Dr. Richards replied, days fished as recorded on sales slips.

Mr. Tagart asked if there is a recreational fishery. Dr. Richards stated that there was an extensive recreational fishery in the Strait of Georgia

b) National Marine Fisheries Service - AFSC

A compilation of information on west coast (Washington-California) Sebastes species in the 'other rockfish' category is being prepared by the West Coast groundfish subtask of the RACE Division. Assemblage and recurrent group analysis are being used to characterize ecological relationships. Distribution and relative abundance with respect to depth and latitude are being described. Biological characteristics including size composition, food habits, and maturity are being summarized for each species to the extent that data is available. Data from the entire west coast survey data base is being utilized, but the majority of the information comes from the four triennial trawl surveys. The report is in the review process and should be available by December 1989.

Previous assessments of Pacific ocean perch (POP) (Sebastes alutus) stocks in waters of the WOC region indicate that the resource continues at depressed levels of abundance. Stock recovery is likely to be a slow process unless one or more strong year classes recruit to these stocks. An analysis conducted in 1987 did not detect an incoming strong year class.

The POP resource of the eastern Bering Sea and Aleutian Islands region continues to remain at a low level of abundance compared to levels during the early 1960s. Results from recent stock assessments, however, indicate that recruitment has improved somewhat. In both regions, Pacific ocean perch is currently managed as complex of five species (S. alutus; northern rockfish, S. polyspinus; rougheye rockfish, S. aleutianus; shortraker rockfish, S. borealis; and sharpchin rockfish, S. zacentrus). For the POP complex, biomass is estimated to be about 101,100 t in the eastern Bering Sea and about 276,500 t in the Aleutian region. Applying the $F_{0.1}$ exploitation rate to these biomass estimates results in potential yields of 6,000 t for the eastern Bering Sea and 16,600 t for the Aleutian region.

The GOA slope rockfish assemblage of which POP comprises 45% of the biomass, is determined to be in a depressed condition. The recommended ABC for POP is based on an evaluation of a series of catch levels imposed in 1988 and continuing for several

years. The value of 7,500 t produced relatively constant biomass beginning in 1988 for POP. The associated exploitation rate for this catch level was then applied to the biomass of the entire slope assemblage resulting in an ABC of 16,800 t for slope rockfish.

c) National Marine Fisheries Service - SWFC

Dr. MacCall presented the SWFC report on rockfish Cohort analysis and catch-at-age analysis were used to estimate fishing mortality rates and population size for widow rockfish (Sebastes entomelas), using 1980-1987 catch-at-age data. Fishing mortality was moderately higher in 1987 than in 1986, due to an increase in the harvest. Projected stock biomass in 1988 and 1989 should be lower than the estimated levels in 1986 and 1987. Average estimates of MSY were 10,700 and 8,400 mt for cohort and catch-at-age analysis, respectively. The recommended fishing mortality rate for fully recruited fish was 0.30 at M=0.20 and 0.25 at M=0.15. At these levels of fishing effort, average yield in 1989 and 1990 (an estimate of ABC) would be 17,200 mt based on cohort analysis results and 7,600 t based on catch-at-age analysis results. The difference in results from the two assessment methods was due to differences in the estimated strength of the 1980 and 1981 year classes.

Mr. Bracken asked if there was a recruitment failure for all rockfish species? Dr. MacCall answered yes, but we don't know beyond the area of northern California where the juvenile surveys have been conducted.

Dr. Richards asked the purpose of the diving survey. Dr. MacCall responded that counts of blues, blacks and widows were made. It is a good index which tracks with other surveys.

Mr. McFarlane wanted to know what kind of contrast there was in the 6 years of data. Dr. MacCall said, 4 years were similar with the exception of the El Nino year. Mr. Henry asked how far up the coast does the survey go? Dr. MacCall answered, the pelagic survey extends from Monterey Bay to Point Reyes. The inshore surveys are conducted at two locations, one near the Russian River, and the other near the town of Mendocino.

Dr. Methot said that Cagean, VPA (Virtual Population

Analysis) and stock synthesis models had been applied to widow rockfish and not all had overlapping ranges in results with no model fitting the data better than another.

Dr. Methot asked, how far south is there sign of the 1976 POP year class? Dr. Leaman responded that they were also seen in the Gulf of Alaska and off Canada but he has no knowledge of southern U.S. area. It is reasonable to assume it is in Washington.

d) Alaska Department of Fish & Game

The only component of the rockfish complex actively managed by the state at this time is the demersal shelf rockfish assemblage. Rockfish management for this group is based upon a combination of seasons and guideline harvest ranges. The state has management authority for demersal shelf rockfish in both state and federal waters of Southeast Alaska.

Separate harvest ranges have been established for each of the five southeast management areas based upon the best available information on the condition of rockfish stocks in each area. The seasons open concurrently and the landings are tracked for each area. The closure of a particular area is announced when it appears that the harvest objective for that area will be reached.

The state recognizes that bycatch of rockfish occurs routinely in fisheries for other species and has provided for this by allowing for retention of rockfish after the closure of the directed fishery. This practice serves two purposes. Because survival of rockfish is minimal after capture, retention of rockfish minimizes waste of an otherwise valuable product. In addition, allowing retention of rockfish provides the managers with a better understanding of actual bycatch rates.

Mr. Bracken mentioned they were doing research using ROV's (Remote Operated Vehicles) to investigate their applicability as an assessment tool.

Mr. Henry asked if there was a party boat fishery. Mr. Bracken responded yes, but rockfish is more of an incidental catch. Mr. Henry stated that he was surprised at the low bag limit.

Dr. Richards asked if much yelloweye is caught.

Mr. Bracken answered that it was a major component.

Mr. Millikan asked if they foresaw any allocation by user type. Mr. Bracken answered in the negative. Closures will be in place with no fishing for either directed sport or commercial effort within an approximately 10 mile range around two major communities in Southeast Alaska.

e) Washington Department of Fisheries

Mr. Jagielo presented the WDF rockfish report.

Black Rockfish.
Objectives of the ongoing black rockfish stock assessment project are to conduct a multi-stage tagging experiment to estimate survival rates, exploitation rates, and abundance of the population adjacent to the Washington coast. A secondary objective is to obtain further information on growth and migration of black rockfish. The coast has been stratified into subareas from Tillamook Head to Neah Bay with equal tagging effort expended in each subarea. The experimental design calls for annual tag releases through 1990.

In addition to tagging, acoustic surveys were conducted again in 1988 to estimate black rockfish population size along the Washington coast. The surveys began in 1986. The target area is stratified by bottom type.

Yellowtail Rockfish.
A stock assessment was completed in 1988 for the Vancouver and Columbia INPFC areas. A cooperative assessment is currently underway with Canada and will be reported by the TSC yellowtail rockfish working group.

Mr. Henry asked if Washington was expecting expansion of the hook and line fishery in the future. Mr. Millikan responded yes.

f) Oregon Department of Fish & Wildlife

Mr. Demory presented the ODFW report on rockfish.

Canary rockfish
Age distributions of canary rockfish have shifted from older to younger fish since 1980. From 1980 through 1983, average coastwide landed catch exceeded recommended acceptable biological catch

(ABC). Since 1984, landed catch of canary rockfish has been below ABC.

Catch-at-age analysis was conducted on INPFC Columbia area canary rockfish catch-at-age data from 1980 through 1986. Preliminary estimates of spawning biomass ranged from 15,000 to 30,000 mt. Equilibrium yield estimates ranged from 400 to 3,800 mt over a range of assumed recruitments, natural and fishing mortalities. Average landed catch for the Columbia area over the time series analyzed was 2,112 mt.

Additional age determinations were made to build a data series that includes the INPFC Vancouver area. Catch and length information from the INPFC Eureka area was summarized as well. Future analysis will incorporate the INPFC Vancouver, Columbia and Eureka areas in the stock synthesis model.

Black rockfish

Of black rockfish tagged in 1985, recoveries through 1988 totalled 147 for the fish tagged off Garibaldi and 95 for those tagged off Newport. The overall recovery rate was 3.1%. Most of the tagged fish recovered showed little or no movement from the tagging area. For example, 97% and 95% of the recaptured fish from the Garibaldi and Newport studies, respectively, were taken from or within 10 nautical miles (nm) of the release site. The nine fish recaptured more than 10 nm from the release site moved significant distances, from 32 to 160 nm. Eight of these fish moved north, of which seven were recaptured off Washington.

During May 1988, we tagged and released 2,743 black rockfish at Three Arch Rock out of Garibaldi, Tillamook bay. To date, we have recovered 19 of them. Twelve recoveries (63%) have come from charter boat anglers. Six tagged fish (32%) have been recaptured by private boat anglers; the commercial jig fishery has returned one tag (5%). Only one tag recovery has shown detectable movement; this fish was recaptured eight nm south of the tagging site.

Rockfish maturity

Some scorpionfishes from the genera Sebastes and Sebastolobus were sampled to determine length-at-maturity, reproductive cycle, and composition of samples with regard to maturity and length. We examined 5,967 fish from 35 species in 1985-86.

Most of the fish were obtained from trawl catches. Gonad condition criteria was described for species of the genus Sebastolobus which, unlike the live bearing genus Sebastes, extrudes unfertilized eggs within a gelatinous mass. Principal months for mating, fertilization, and parturition or ova extrusion were reported. Sebastes brevispinis was the only species spawning primarily in the summer. While most species were observed to spawn throughout a two to four month period, Sebastes diploproa had the longest spawning period (seven months). Sebastes jordani was the only multiple spawner observed, apparently spawning twice a year. Spawning appeared to occur earlier in the southern range of many species. Length at 50% maturity was often greater for fish taken off Oregon when compared to the same species sampled off California. Geographic trends for spawning were most evident for Sebastes alutus, S. crameri, and S. entomelas. A report of this work will be completed in 1989.

Mr. Stanley asked if maturity was by time of year and size. Mr. Demory replied, both.

Mr. Jagielo asked if there was a seasonal drop in the exploitation rate? Mr. Demory said, it may be so but we have no information to back it up.

g) California Department of Fish & Game

Mr. Henry presented the CDFG report on rockfish.

Mr. Bracken asked if recreational and commercial fishermen were targeting on the same species. Mr. Henry answered, yes.

Dr. Leaman asked if Mr. Henry could outline the status of S. rufus ageing. Mr. Henry stated that not much time had been devoted to it. There had been 6,000 structures collected since 1987. Fin sections/break & burn otolith are being aged by Greg Caillet at Moss Landing. They were attempting to collect young fish from Fort Bragg to Morrow Bay. Lou Botsford at U.C. - Davis is working with computer imagery.

3. Sablefish

a) Canada

Research programs

For the sixth year, a survey determining the relative abundance and distribution of pelagic sablefish larvae was conducted in April off the southwest coast of Vancouver Island. This is the final year of the sampling and correlation of abundance of larvae with strength of the year-classes at recruitment will be carried out over the next five years.

In addition, a species interaction trawl survey was conducted in August to assess the impact of sablefish and Pacific hake on the herring stocks in the La Perouse region. Biological monitoring of the sablefish fishery was also continued, using observers aboard commercial vessels as well as a stock monitoring trap survey conducted in November.

Laboratory studies included: (1) rearing of sablefish larvae. Both gametes collected at sea and those from hormone-induced captive brood stock were used successfully.; (2) examination of biotic and abiotic factors controlling year-class success; (3) an examination of the factors affecting recovery rates of tagged sablefish; (4) examination of resident and dispersal behaviour from tagging data; and (5) the potential for trematoda of sablefish to be used a biological tags. Based on the prevalence

and intensity of trematodes, it was concluded that the sablefish found on the seamounts are distinct from those on the continental slope, and that trematoda show potential for use as a biological tag.

Stock assessment

Nominal CPUE was standardized to account for variation due to trap type, and records from vessels with skippers having one or more years of experience were selected. In Queen Charlotte Sound, standardized CPUE in 1987 increased to 22.1 kg/trap from 20.3 kg/trap in 1986. Off Vancouver Island, CPUE increased to 17.4 kg/trap in 1987 from 15.0 kg/trap in 1986, while CPUE of the west coast of the Queen Charlotte Islands decreased to 15.0 kg/trap in 1987 from 16.8 kg/trap in 1986.

As in previous assessments yield options were determined using forward simulations of a deterministic age-structured model. Numbers-at-age, used as the starting vector in the model, were calculated using Virtual Population Analysis (VPA).

Management and regulations

Sablefish are managed by quota with a 4400 mt coastwide quota in effect for 1989. The quota is split between trawl (8.75%) and longline/trap (91.25%) vessels. Both trawl and longline licences are limited entry.

Longline licence holders may choose from one of seven openings of fifteen days duration. The first opening is in February with one opening each of the succeeding seven months.

Trawl vessels are permitted to retain an incidental limit of 11.3 t per boat trip. Upon attainment of 80% of the quota, the trip limit is reduced to 4.5 t.

Mr. Tagart asked about the classification of tagging studies. Did you see seasonal migrations? Mr. McFarlane mentioned that they did not look at the difference in short term movements.

Dr. Methot asked about the trematode samples. Were there any outside? Mr. McFarlane replied no.

Mr. Bracken asked if the fish were moving out as juveniles or as larvae? Mr. McFarlane replied that there were no fish younger than 2 years on the

seamount indicating that the fish are moving out as juveniles.

Mr. Tagart asked if there are trawl fishermen targeting on sablefish and if highgrading is occurring? Mr. Zyblut answered in the negative.

Mr. Millikan asked if they had any idea of what the actual discard rates are for sablefish. Mr. Stanley replied that they had some data from 1980 and 1981.

Dr. Methot asked for an update on the trap/escape mechanism work. Mr. McFarlane stated that the escape panel works and is currently required by law. There is however, no regulation for rings.

Mr. Millikan asked about the extent of trap loss. Mr. Ackerman mentioned that with spreading out of effort there was reduced loss. Mr. McFarlane felt that while gear conflicts were minimized, there was still a high number of traps lost.

Mr. Zyblut asked if there was any work done on mortality of sablefish released from hook and line? Mr. Bracken stated that analysis of limited observer data concluded that there was not enough data to determine any biological benefit from a 22" limit.

b) National Marine Fisheries Service - AFSC

Mr. Wilkins and Dr. Methot presented the National Marine Fisheries Service - AFSC report on sablefish.

West Coast

The status of the California-Oregon-Washington sablefish stock was estimated by a synthesis model simultaneously fit to the time series of catch biomass by trawl and fixed gear, the size and age composition of these fisheries components in 1986 and 1987, the time series of relative abundance of middle aged sablefish as measured by the northern and southern pot indexes, the recruitment information in the triennial trawl surveys, and the exploitation rate information in the tag return data. The mean total biomass during 1988 was estimated to be 94,700 mt and the age 3+ biomass was 78,600 mt.

Stock productivity at equilibrium and short-term yield forecasts were made with a dynamic pool model and output of the synthesis model. The dynamic pool model is driven by a Beverton-Holt stock-recruitment

function. If a 52:48 trawl:fixed gear allocation is maintained in the future, then the MSY for this stock is 8,200 mt at a mean age 3+ biomass of 67,800 mt and a F_{MSY} equal to 0.13. An ABC in 1989 of 9,000 mt is indicated by applying the F_{MSY} to the current stock structure.

Bering Sea and Gulf of Alaska

The sablefish (Anoplopoma fimbria) stocks in the BSA region have rebuilt from low levels of abundance during the 1970s. Increases in abundance during the early 1980s were attributed to the strong 1977 year class. Relative indices of abundance from Japan-U.S. cooperative longline surveys have indicated decreases in the eastern Bering Sea in 1986 and 1987. There have been no indications of significant recruitment in the eastern Bering Sea since the appearance of the strong 1977 year class. The current estimate of exploitable biomass for the BSA region is 93,300 t. Applying the annual surplus production exploitation rate to the current estimate of biomass results in potential yields of 2,800 t for the eastern Bering Sea and 3,400 t for the Aleutian region.

Sablefish of the GOA region have been determined to be in good condition due to good recruitment from the 1977 and the 1980 or 1981 year classes. The current biomass is estimated at 426,000 t based on the NMFS trawl survey. The recommended ABC is 30,900 t. This catch level, if applied for three years under pessimistic recruitment and biomass assumptions, would allow the population to remain above the 1977 estimated level which produced a strong year class.

Mr. McFarlane asked how they account for the increase in Alaskan waters? Is it the 1980 year class? Dr. Methot and Mr. Wilkins both replied that it was unclear.

A discussion on the high biomass estimates in the Gulf of Alaska ensued. Dr. Methot stated that they had no knowledge but that the situation would be reviewed in the next year. One possibility is

that it is an artifact of changes in survey design and fishing at different depths.

Mr. McFarlane asked about egg production estimates. Were there lots of eggs in the tows? Mr. Wilkins didn't know.

c) National Marine Fisheries Service - SWFC

Dr. MacCall reported that the SWFC is working with AFSC on sablefish monitoring and assessment.

d) Alaska Department of Fish & Game

Mr. Bracken presented the ADFG report on sablefish.

Sablefish fisheries in internal waters of the state are managed by season and guideline harvest ranges. The seasons are set by the Board of Fisheries based upon industry recommendations. In recent years the season framework allows for some flexibility to avoid conflicts with other fisheries and with periods of big tides which tend to concentrate the effort.

There are two separate internal water areas, the Northern Southeast Inside and Southern Southeast Inside areas, which each have separate seasons and guideline harvest ranges. An annual harvest objective is selected within the guideline harvest range for each area based upon the best available information on current stock condition. The season length is set according to the estimated time required by the existing fleet to capture the harvest objective. The seasons have been very short in recent years with five days allowed in the southern area and only one day (24 hours) allowed in the northern area the past three seasons.

Although both of these fisheries are under limited entry, the number of vessels participating in both areas exceeds the optimum level. This factor is compounded because there no control on vessel size or gear and the individual fishing power of the vessels has increased dramatically in recent years.

The offshore fishery (0-3 miles) is managed in conjunction with the federal-managed fishery in the EEZ. The state issues emergency orders to open and close the fishery consistent with field orders issued by NMFS.

e) Oregon Department of Fish & Wildlife

Mr. Demory presented the ODFW report on sablefish.

As part of a joint study between Oregon State University Sea Grant Program and Oregon Department of Fish and Wildlife, first-time estimates of age and length-specific utilization of sablefish were obtained. Sablefish were fully utilized at age 4 years. Length at 50% utilization was about 41 cm.

Utilization of sablefish was difficult to determine because discarding occurs in response to changes in landing restrictions (trip limits) imposed on trawlers, such as occurred in 1986 and 1987. Because the ex-vessel price of sablefish increases with increased length of fish, "high grading" occurs.

f) California Department of Fish & Game

Mr. Henry reported that trap vessel log data is being updated to include trap time. The trap fleet has declined to 6 from 60 vessels. Final editing of the State's sablefish trap log database for the years 1979-1987 was completed. We attempted to identify as many trap sets as possible by the type of trap employed: rectangular (Seattle type) or conical (Korean type). Voluntary trap information from annual permit applications was used to distinguish the vessel's fishing gear type, when available. Revised effort summaries will be produced in 1989 for use by sablefish scientists and managers.

Several sablefish analyses were conducted at the request of the Pacific Fishery Management Council (PFMC) during 1988, including impact analysis of in-season trawl trip limit changes, calculation of probable fishing effort levels in the 1989 season, and a study on the abundance of sablefish in trawl catches in various fishing strategies, areas and depths. The latter work was extremely valuable to our under-standing and management of the coastwide trawl sablefish fishery. Reports on these studies are available as Groundfish Management Team documents from the PFMC office.

Mr. McFarlane asked why the reduction in trap effort. Mr. Henry stated that the market collapsed so that it is not economically viable any more. Mr. McFarlane asked if the Mexicans were doing anything. Mr. Henry replied, nothing other than a California processor who fished off Baja with poor success.

4. Flatfish

a) Canada

Dr. Richards presented the DFO report on flatfish.

Research programs
A study of reproductive biology of English sole in Hecate Strait continued with the collection of samples for histological preparation in June, August and October 1988 and February 1989. Determination of oocyte diameter frequencies continued in September -December 1988. This work will help to establish the annual cycle of ovarian development. Determination of fecundity was completed for samples collected in November 1987. Comparisons will be made to factors that have historically influenced spawning timing off Oregon.

Stock assessment
Stock assessments were completed for the major stocks of commercial flatfish species. For English sole, in Hecate Strait, a positive correlation was found between Ekman transport and year-class production, while the stock-recruit relationship was determined to have a flat-topped Ricker form. For rock sole from Hecate Strait, an update of the Virtual Population Analysis confirmed the presence of a current strong recruitment mode. Maximum sustainable yield for Dover sole in the Charlotte Area was re-estimated to be 1000 t. The significant changes in landing patterns are: rock sole landings in northern Hecate Strait for 1988 were about four times the level for 1987; and Dover sole landings off southwest Vancouver Island continue to increase with the landings for early 1989 being approximately two times that for the same period in 1988.

Management
Flatfish are managed using a combination of area specific quotas and/or trip limits.

Petrale sole are subject to a 20 t trip limit from January 1 to March 31, 1989, After March 31, no trip limit will be in effect.

Rock sole are subject to a 13.6 t trip limit coastwide.

In Hecate Strait/Dixon Entrance an 800 t Dover sole quota is in place. When the quota is attained, a 9.1 t trip limit will be imposed.

A 700 t quota is in effect for English sole in Hecate Strait.

Mr. Tagart asked what age structure is used to age English sole? If interopercals, are they useful? Mr. McFarlane answered, Mr. Fargo is using otoliths.

b) National Marine Fisheries Service - AFSC

The abundance of most of the species of flatfish in the eastern Bering Sea have shown substantial increases during the 1970s and 1980s and many are currently at observed peak levels of abundance. Yellowfin sole (Limanda aspera), which suffered a severe decline in abundance from overfishing in the early 1960s, is the second most abundant species in this region after walleye pollock. This stock has undergone a long-term sustained recovery due to a series of stronger than average year classes originating in 1968-77. The current biomass is believed to be at least 2.4 million t which may be higher than the biomass when exploitation of this species started. The abundance of yellowfin sole is expected to decline because of recent lower levels of recruitment but the decline is anticipated to be slow. Virtual population analysis projections, however, indicate a possibility that these biomass estimates may be high. Because of this and the recent poor recruitment, a harvest strategy aimed at imposing a fishing mortality of 0.1 has been adopted for conservative management. The $F_{0.1}$ fishing strategy suggests that this resource can be exploited at about 290,000 t in 1989, but the catch will be limited to about 182,000 t because of other management considerations (bycatch considerations and total multispecies harvest limit of 2 million t).

Survey data has indicated that the other three principal species of small shelf flatfish were also at observed high levels of abundance in 1988. The estimates were 1.9 million t for rock sole (Lepidopsetta bilineata), 560,000 t for flathead

sole (Hippoglossoides elassodon), and 954,000 t for Alaska plaice (Pleuronectes quadrituberculatus). Unreasonably sharp increases over the 1987 survey estimates suggest that the biomasses for rock sole and Alaska plaice may have been overestimated in 1988. Nevertheless, the abundance of these species remains high, particularly for rock sole and flathead sole, and recruitment remains strong for rock sole. The estimated combined catches that these three species would be able to support in 1989 was about 327,000 t, but other management considerations, including bycatch and total harvest limits, will limit harvests to about 166,000 t.

The condition of the two principal species of large flatfish in the eastern Bering Sea, arrowtooth flounder (Atheresthes stomias) and Greenland turbot (Reinhardtius hippoglossoides), differ. Based on survey estimates, the abundance of arrowtooth flounder has increased from less than 100,000 t in 1982 to 290,000 t in 1987. The 1988 estimate of 309,000 t suggests that abundance may be reaching a peak. Over this same period, recruitment of Greenland turbot has been very low and the area of the shelf formerly occupied by juvenile Greenland turbot has been dramatically reduced. Assessments of the adult population, which occupy continental slope waters, is limited to triennial surveys such as 1988 and even these surveys incompletely sample this portion of the population. Because of the poor recruitment that has been observed since the early 1980s, exploitation of the adult population has been restricted. The 1988 triennial survey data indicates that the abundance of adults has not changed significantly since 1985. Thus, management restrictions appear to be protecting the adult spawning population.

c) Alaska Department of Fish & Game

Trawl fisheries for flatfish are allowed in the internal waters of Southeast Alaska only under the terms of a special permit issued by the department. The permits are generally issued for a month at a time and specify area and gear configuration. Mandatory logbooks are required and some areas cannot be fished without a department observer on board. This restrictive management is necessary because of reduced flatfish stocks and because of a history of very high bycatch rates of prohibited

species, particularly crab and halibut, in internal waters.
Beginning in the 1989-90 season the flatfish trawl fishery will be restricted to four areas with a guideline harvest range established for each area. As with the other fisheries, the department will set a harvest objective within the ranges annually for each area and will track the landings with information from fish tickets and logbooks.

d) Oregon Department of Fish & Wildlife

A Dover sole stock assessment working group was established in 1987 to develop a coastwide stock assessment of this species. The working group is composed of Mr. Frank Henry (CDFG), Dr. Richard Methot (NWAFC), Dr. Joe Hightower (SWFC) and Mr. Robert Demory (ODFW). Catch-at-age summaries have been prepared as well as weight at age, length-at-maturity, and a time series of CPUE by depth. A draft document is scheduled for completion in August 1989.

Age determinations were made from English sole interopercles and sample age composition data, corrected for discard, was expanded to estimates of total catch in 1987. These data were added to a data series beginning in 1971. Catch-at-age analysis will be conducted on the data series after the addition of 1988 sample data. Cursory examination of 1988 age data suggests that the El Nino period 1983 and 1984 year classes are stronger than adjacent year classes.

Utilization Studies
An investigation of age-specific and length-specific utilization of Dover, English, and petrale sole was undertaken as a segment of a study by Oregon State University Sea Grant and Oregon Department of Fish and Wildlife.

Dover sole were fully utilized at age 12 years for both males and females, while English sole females were fully utilized at age 9. Age samples of English sole males and petrale sole were too small to adequately determine age-specific utilization. Results from the 1985-87 sampling period were compared to results of a 1974 study of utilization of Dover, English, and petrale sole. Significant changes in length utilization have occurred. For example, length at 50% utilization of female Dover sole in 1974 was about 33.3 cm, but in 1985-87 was

about 30.5 cm. For English sole females and petrale sole females the corresponding changes were 30.5 cm to 27.5 cm and 31.2 cm to 27.5 cm, respectively. Utilization length of males of each of the three species showed similar declines.

Without exception, both discarded and utilized fish were of smaller size in 1985-87 than in 1974. In the case of utilized fish, the most obvious reason for smaller fish is acceptance by the processor for smaller fish. The reason for smaller-sized discard is less obvious, but the use of smaller mesh codends is suspected.

e) California Department of Fish and Game

Dover Sole
During the year, expanded estimates of Dover sole removals by age and size from the INPFC Eureka area were produced for 1981 through 1987 from samples aged with the "break-and-burn" technique. These estimates employed catch estimates from both PMFC areas 1C and 2A (the Oregon portion of the Eureka area).

Over 7,000 Dover sole specimens now have been aged from the Eureka area using this technique. Eureka area trawl log analyses were initiated to produce an effort time series for use in a stock synthesis model as part of the 1989 coastwide Dover sole stock assessment.

5. Pacific Whiting (Hake)

a) Canada

Mr. Saunders presented the DFO report on Pacific whiting (hake).

Research programs
Monitoring and biological sampling of offshore Pacific hake was continued through an extensive offshore observer program. In August, a species interaction trawl survey was conducted to assess the impact of Pacific hake and other predators on herring survival and recruitment.

In the Strait of Georgia during March, hydroacoustic and swept-volume trawl surveys, were conducted to determine distribution and abundance.
An electrophoretic study was initiated to look for genetic differences between proposed stocks of hake

in the Strait of Georgia, Puget Sound, west coast Vancouver Island and Barkley Sound. Sampling has been completed and analysis is currently underway.

Stock assessment

In the Strait of Georgia, a swept volume survey produced biomass estimates of 112,545 t (95% CL=45,326 t) which compares favourably with the 1981 estimate of 125,600 t (95% CL=36,200 t). An assessment conducted using VPA and a forward simulation model, indicates that yields up to 14,000 t may be sustainable.

A discussion of offshore hake stock status is presented in the progress report of the Can/U.S. working group on Pacific hake.

Management and regulations

Pacific hake in the Strait of Georgia are managed by annual quota. In 1989 trawlers will be limited to 11,000 t.

Hake off the west coast of Vancouver Island are managed by annual quota. A proportion of the quota is retained for domestic fisheries and the remainder is allocated to foreign and joint-venture fisheries.

Mr. McFarlane drafted a resolution regarding hake management.

Mr. Ackerman asked if the early fishery in the U.S. zone this year had an impact on the numbers. Dr. Methot replied, this has not been looked at yet.

b) National Marine Fisheries Service - AFSC

Dr. Methot presented the AFSC report on Pacific whiting (hake).

The status of the Pacific whiting (Merluccius productus) resource in 1988 was evaluated by conducting a cohort analysis of fishery catch-at-age data and tuning this analysis to the catch-at-age in the four bottom trawl and hydroacoustic surveys conducted by the Alaska Fisheries Science Center. The estimated total biomass of Pacific whiting in 1986 was 2.1 million t. The stock is currently supported by the strong 1980 and 1984 year classes. Preliminary data indicate that the 1985 and 1986 year classes are not strong.

Estimates of long-term potential productivity for Pacific whiting were made using an age-structured management model. The management policy imposed on the modeled stock constrained the spawner stock biomass to be greater than 319,000 t in 90% of the years. Estimates of long term production (MSY) from the U.S. and Canadian fisheries combined, ranged from 224,000 to 266,000 t. The recommended level of acceptable biological catch (ABC) in 1989, for the United States and Canada combined, was 300,000 t. The U.S. portion of the ABC was 225,000 t.

One of the goals of scientists from the Alaska Fisheries Science Center (Seattle, Washington) and the Department of Fisheries and Oceans (Nanaimo, British Columbia) is development of an improved management model that incorporates differences in the size and age composition of the stock from 3 to 4 production zones. The geographic patterns of age composition was analyzed in 1988-89 to provide data for this new assessment.

Mr. Bracken asked about differences in weight-at-age and added that a similar decrease in weight-at-age and a lack of older fish was being seen in pollock in portions of the Gulf of Alaska.

c) Washington Department of Fisheries

Since 1984 the Port Susan-Possession Sound-Saratoga Pass area (PPSA) biomass of Pacific whiting as determined by acoustic survey has declined. In the 1986-87 fishing season a management strategy was adopted which would determine the allowable harvest rate via a variable exploitation rate. For the fall

fishery of 1986, a 454 mt (1 million pounds) quota was established, down from the previous quota of 1361 mt (3 million pounds). Under the management plan, no additional fishing would be allowed if the estimated biomass is less than 5443 mt (12 million pounds) of adult whiting; a 15% exploitation rate would be allowed if the biomass is between 5443 and 6804 mt (12 and 15 million pounds); a 26% exploitation rate would be allowed if the biomass is between 11,340 and 15,876 mt (25 and 35 million pounds); and a 33% exploitation rate would be allowed if the biomass exceeds 15,876 mt.

In 1988, the population continued at a low level of abundance despite a reduced harvest rate. The peak biomass observed in 1988 was 5806 mt (12.8 million pounds), nearly identical to the 1987 level of 5579 mt (12.3 million pounds). This compares to a biomass of approximate 8165 mt (18 million pounds) observed in 1985 and 1986. The reason for this decline is unclear, but there is evidence of an increase in the natural mortality due to large numbers of marine mammals.

6. Dogfish

a) Canada

Mr. Saunders presented the Canadian report on dogfish.

Research programs

Approximately 3000 spiny dogfish were tagged in the Strait of Georgia to assess long-term movements, in particular, the rate of exchange among Strait of Georgia, Puget Sound and offshore areas. A study of differences in growth rates between Atlantic and Pacific stocks of dogfish is currently being conducted. As well analysis of the age-at-maturity is underway.

Stock assessment

An age-structured deterministic model developed by Wood et. al. (1979) continues to be used to evaluate the condition of the stocks in the Strait of Georgia and offshore. At current levels of harvest both offshore and in the Strait of Georgia, the stock is predicted to increase steadily over the next 5-10 years.

In recent years landings from the developing trawl fishery off the southwest coast of Vancouver Island

have been primarily females. The effect of this bias on long term yield was examined and as expected for a fish with slow growth and low fecundity, reduced reproductive potential resulted in lower sustainable yield over the long term.

Management and regulations
Dogfish are managed by annual quota with separate quotas in place for the Strait of Georgia (3000 mt) and for the remainder of the coast (15,000 mt).

7. Pollock

a) Canada

Research programs
During March 1988, swept-volume trawl and hydroacoustic surveys were conducted to determine the distribution and abundance of pollock in the Strait of Georgia. Other work was conducted to summarize evidence for delineation of stocks in Canadian waters.

Stock assessment
An assessment of pollock stocks was conducted in the Strait of Georgia. The biomass of pollock ranged from 14,300 to 22,500 t based on swept volume trawl methods, and from 9,069 to 10,435 t based on hydroacoustic methods.

Management and regulations
Pollock are managed by annual quota in the Strait of Georgia (3,400 t). Given extreme variation in availability and uncertainty regarding stock discreteness, fishing is not restricted in other areas of the coast.

b) National Marine Fisheries Service - AFSC

Estimates of the total biomass of the Gulf of Alaska walleye pollock (Theragra chalcogramma) stock are derived from Gulf-wide triennial bottom trawl surveys and annual hydroacoustic surveys of Shelikof Strait during the spawning period (March). Biomass estimates based on both kinds of surveys show a recent decline, however the magnitude of the decline differs between the two surveys. The biomass estimate from the bottom trawl survey in the summer of 1987 was 856,821 t, whereas the hydroacoustic biomass estimate of the spawning stock in Shelikof Strait in the winter of 1988 was approximately 330,000 t.

Based on information indicating a severe decline in the biomass of the Gulf of Alaska pollock stock, the North Pacific Management Council set a 1989 quota of 6,250 t for Shelikof Strait and 60,000 t outside of Shelikof Strait. The 1989 quota was taken in the first quarter of 1989. Over 50% of the catch in 1989 was taken by floating catcher/processors while the remainder was taken by shoreside processors.

Important biological information on the status of the Gulf of Alaska pollock stock is provided from samples collected by domestic observers and port samplers. This biological data includes length frequencies, age composition, maturity schedules, and sex ratios. A considerable amount of information was collected from the shoreside operations, however, sampling of the catcher/processor catch was minimal.

New developments in the assessment of the Gulf of Alaska pollock stock include: a) an analysis of growth differences between areas, seasons, years and sexes; b) an application of catch-at-age assessment models based on bottom trawl data, as well as hydroacoustic data; c) an evaluation of optimal fishing effort based on an age-structured simulation model using different recruitment scenarios.

8. Lingcod

a) Canada

Dr. Richards presented the Canadian report on lingcod.

Research programs

A multivariate model was developed for analyzing size-at-maturity data and applied to data for three lingcod stocks (Area 3C, 5A, and 5B). Size at 50% maturity increased with latitude, from 64 cm to 66 cm for female lingcod, and from 58 cm to 62 cm for male lingcod. However, a model that included both length and age provided a better prediction of maturation than models with either length or age considered alone.

The Strait of Georgia lingcod tagging data base was analyzed to assess movement and mortality. Approximately 10,000 tagged male and female lingcod were released in the Strait of Georgia between 1982

and 1985 of which about 163 males and 149 females have been recovered to date by the sport fishery. Our results indicate that females are more mobile than males, and that both males and females move more extensively than previously thought. Females had the lower mortality rate estimate, with total annual survivorship estimated at 37% and 59% for males and females, respectively.

An analysis is currently underway to estimate von Bertalanffy growth parameters for Strait of Georgia lingcod which uses length frequency data and mark-recovery data in combination. Initial results indicate the growth rate of Strait of Georgia lingcod to be about 10% slower than that determined from a length-at-age analysis for west coast Vancouver Island lingcod.

Stock assessment

A major new analysis was completed for the lingcod stock off the west coast of Vancouver Island (Area 3C-N) for the period 1956-86. The analysis was based on Schnute's size-structured model, and emphasized estimation of parameters associated with growth and survival. The average total mortality rate for the stock was estimated to be 24%, and the upper limit to the 95% confidence interval for average fishing mortality was 17%. Fishing mortality was estimated to be much higher (near 28%) with a model based on a mark-recapture experiment on the same stock. Discrepancies in mortality estimates for CPUE and mark-recapture data led to the hypothesis that refuge areas exist for lingcod from the trawl fishery. The hypothesis will be tested in future field studies.

In contrast to the offshore stocks, lingcod stocks in the Strait of Georgia are in poor condition. The 1987 commercial catch of 98 t was the lowest on record, and less than the sport catch of at least 105 t. Various rehabilitory measures are being examined. A larval survey was carried out during May, and a nesting survey is planned. Assessments are not conducted for north coast stocks and their condition is not known.

Management and regulations

Lingcod fishing coastwide, was closed from November 15, 1988 through April 30, 1989 to protect the stock during the period when spawning and protection of the egg nests by the males was taking place.

A 1,400 t quota is in place for the southwest coast of Vancouver Island with an 11.3 t trip limit to be introduced when 60% of the quota has been taken.

b) National Marine Fisheries Service - SWFC

Dr. MacCall presented the National Marine Fisheries Service - SWFC report on lingcod.

Overall landings of lingcod are generally well below the ABC's established in the Groundfish Management Plan. The exceptions are the Vancouver and Eureka areas where the total catch exceeds the ABC of 500 mt. The increase in trawl landings in the Vancouver area is the principal concern. Catches there have doubled in the last two years, indicating a much stronger targeting on this species. This is a substantial change in the fishery and deserves closer monitoring. The ABC's in both the Vancouver and Eureka areas were set on the basis of current catch levels, so exceeding the ABC's is themselves is not a major cause for alarm. Accurate evaluation of the impact of this increased harvesting would require age-composition data. In the current Eureka area situation, lingcod catches of this level have been substantiated for a number of years and this is not the immediate problem that the Vancouver area is.

In future collection of catch statistics, individual trawl landings which include lingcod should be examined by area to determine the ability of the fishery to target on lingcod. Also, collection of data on commercial fisheries other than trawl needs to be improved, particularly in the Monterey and Conception area.

A 15 day FDA holding regulation on OTC (oxytetracycline) inspected fish may render tagging unfeasible.

c) Alaska Department of Fish & Game

Beginning in July 1989 lingcod fisheries will be managed with a 27-inch year round minimum size limit. This is the first commercial regulation for this species in the state and was in response to increased targeting on small fish by an expanding "dinglebar" fleet.

d) Washington Department of Fisheries

We are continuing a multi-stage tagging experiment to determine survival rates, exploitation rates, and population size of lingcod in the Neah Bay - Cape Flattery area. In 1989, 968 tagged fish were released bringing the total to date to 3908. A total of 166 fish were recovered in 1988, and 38 have been recovered to date in 1989 bringing the current total to 362. Additionally, on-going biological sampling stratified by gear, area, and month, will be used with catch statistics to evaluate the coastal recreational and commercial lingcod fisheries. Historical catch-at-age information has been compiled for the INPFC Vancouver and Columbia areas and an age structured population analysis is underway.

e) Oregon Department of Fish & Wildlife

The Oregon Department of Fish and Wildlife conducted tagging experiments in 1977 and 1978 to determine the inshore-offshore exchange of lingcod (Ophiodon elongatus), off the central coast of Oregon. There were 293 lingcod tagged near Johnson Rock from inshore waters off Newport in December 1977 through March 1978 and 3,818 tagged from offshore waters near Stonewall Bank off Newport in July 1978. Female lingcod comprised 16% of the fish tagged inshore and 89% of the fish tagged offshore. A total of 20 (6.8%) and 637 (16.7%) tagged fish were recovered from inshore and offshore, respectively. Most tagged fish were recovered from the respective tagging areas. Only 11% of recovered fish had moved 5 nautical miles (nm) or more from the areas of tagging. Less than 5% had moved more than 25 nm. Interchange between Johnson Rock and Stonewall Bank was not observed. Changes in depth, as measured by depth increments originating at each tagging site, were uncommon with 87% of the males and 77% of the females recovered within 10 fathoms (fm) of their tagging site. We estimated a total instantaneous mortality rate of 0.593 and an exploitation rate of

0.092 from trawl-caught fish recovered from the Stonewall Bank tagging experiment. The offshore commercial fishery did not appear to strongly affect near shore stocks of lingcod, but trawling for sole in near shore waters did catch some lingcod whose range probably included inshore reefs.

9. Other

a) Canada

Hagfish

Mr. Zyblut stated that permits are being issued for hagfish in Canada:

Number	Area
9	Barkley Sound
2	Offshore - West Coast Vancouver Island
10	Northern Inlets.

Inshore permits are restricted to 2,000 traps while offshore permits can carry 25,000 traps. Permit holders must pay for biological sampling of the fish. The traps being used are 60 cm X 12 cm and they have an escape mechanism. A total of 250 t has been landed to date. In the Barkley Sound fishery, CPUE dropped steadily over the first six months suggesting the stocks will not sustain much pressure.

Mr. Bracken suggested the need for some regulations on transport to prevent infestation of clean areas.

Ms. Thomson stated that some maturity data had been collected in Canada.

Hagfish will remain under 'Other' in the TSC agenda.

b) Alaska Department of Fish and Game

There are no regulations in effect for other species of groundfish in state waters of Southeast Alaska at this time.

c) Washington Department of Fisheries

Thresher shark.
The permit only coastal thresher shark fishery was again managed jointly with the Oregon Department of Fish and Wildlife. Effort decreased in 1988 but catch rates increased. Observers were present for 69% of the drift gillnet sets. The incidental catch of marine mammals and leatherback turtles was higher than reported in previous years. The catch rates of these species for observed sets was significantly higher than for unobserved sets reported in logbooks. The states of Oregon and Washington will not continue the fishery in 1989 because of decreased participation, the high cost of management, and the high incidental catch of marine mammals and turtles.

d) Oregon Department of Fish & Wildlife

Hagfish
A new fishery for hagfish began off Oregon in the fall of 1988. A total of about 25,000 pounds was landed. We sampled four of the five landings made by two Newport vessels fishing traps. Fishing began when the sablefish fixed gear quota was filled and while hagfish were aggressively sought by buyers for a Korean "eelskin" leather market. Fishing terminated in November when most of the hagfish traps were lost at sea and the fishermen began to prepare their gear for the approaching Dungeness crab season.

Two species of hagfish were landed in Oregon: black hagfish Eptatretus deani and Pacific hagfish E. stouti. We sampled 635 black hagfish caught off Newport and 359 Pacific hagfish caught between Newport and Eureka, California. We collected sample data on length, weight, sex, maturity, egg size, and egg number.

Mr. Demory stated that there was some work to be done on holes for traps to allow juveniles to escape.

All agencies are looking at supporting work on hagfish fisheries; ADFG, Tiburon, DFO, CDFG.

C. Other Related Studies

1. Canada

a) Hecate Strait Project

A technical report is nearing completion presenting the finalized maps of demersal fish assemblages from the three cruises. Four assemblages were identified with dominant species ranked by biomass as follows: (1) Reef Island Assemblage: spiny dogfish, rock sole, big skate, Pacific halibut, lingcod; (2) Bonilla Assemblage: Pacific cod, English sole, Pacific sanddab, arrowtooth flounder, Pacific halibut; (3) Butterworth Assemblage: arrowtooth flounder, Dover sole, ratfish, spiny dogfish, English sole; Moresby Gully Assemblage: Pacific ocean perch, arrowtooth flounder, redbanded rockfish, Dover sole, yellowtail rockfish, silvergrey rockfish. The distribution, by depth of each assemblage was also identified: Reef Island, 20-80 m; Bonilla, 60-120 m; Butterworth, 100-150 m, Moresby Gully, 150-240 m.

A technical report was published summarizing results from the first four years of the Hecate Strait Project. A repeat of the May-June 1987 cruise is to be done in May-June 1989 to provide a further comparison of summer assemblages.

b) La Perouse Program

This cooperative research project, with the Institute of Ocean Sciences, was continued in 1988. The primary objective is to measure the amount of inter-annual variation in physical and biological conditions on La Perouse Bank. The maximum anticipated life of this multi-disciplinary study is 10 years, which should encompass one (and possibly 2) ENSO events. After this period we should be able to identify the dominant physical processes affecting the circulation and water property structure, quantify the statistical variability of the seasonal cycle and begin to obtain first order estimates of the impact of inter-annual oceanic fluctuations on Pacific herring, sablefish and Pacific hake. These species have experienced strong fluctuations in recruitment success recently, that seem to be associated with long-term changes in oceanic conditions.

Considering the diversity in the life history

biology of the species being studied, the Fisheries group is developing specific hypotheses to explain recruitment variability for each case. At this point in time, a predator and food-based hypothesis is being tested to explain year-class strength variations in herring; a food based hypothesis is being tested for sablefish, and a transport-based hypothesis for Pacific cod.

c) Statistics and Sampling

The principal activity in 1988 was the maintenance of the trawl and trap catch and effort database. Vessel captains were interviewed at time of landings, and biological data on the catch (length frequency, sex, age structures, gonad condition, etc.) were collected by sampling the various species landed. Work continued on an interactive database entry system for logbooks as well as a computerized seagoing logbook system. A second computerized measuring board was developed and put into service.

2. National Marine Fisheries Service - SWFC

a) Related Studies - Economics

A study completed by the Coastal Division in La Jolla analyzes the relationships between capital, labour and fuel use in the multipurpose Pacific trawl fleet. The results from this study can be used to help plan more effective fishery management for the fleet. For example, if limitations were eventually placed on the number of vessels in the fleet, increased investment in individual vessel harvesting capability could negate the capacity-reducing effects of limiting the number of participants. This study provides information on the technological capacity for increased capitalization and it can be used in planning a limited entry program.

b) Bibliography of the Genus Sebastes

The Librarian at the Tiburon Laboratory has compiled an annotated bibliography of the genus Sebastes (Leet and Reilly, 1988). A disk version of the Sebastes bibliography is being distributed by American Fisheries Society Computer User Section, Anthony Frank, AFSCUS Librarian, 1451 Green Road, Ann Arbor, MI 48105. 313-994-3331. Paper copies of this document are available from Pacific Marine Fisheries Commission, Metro Center Suite 70, 2000 SW 1st Street, Portland, Oregon.

c) Port Sampling Model

A multispecies, multiport sampling model was constructed which estimates the variances associated with the estimated catch-at-age of rockfish and other groundfish in California. The model is implemented as a spreadsheet, and is particularly useful as a planning tool for allocating sampling effort. The model is capable of answering a variety of "what if..." questions, including levels of sampling effort, allocation of effort among various landings types, overall volume of landings by port and quarter, and average size of vessel landings. For further information contact Alec MacCall, Tiburon Laboratory, SWFC.

There was considerable interest in the sampling variance estimator based on port sampling effort distribution.

3. Washington Department of Fisheries

a) Hydroacoustic studies

The hydroacoustic unit continued to conduct routine surveys on the Washington coast and in Puget Sound, the Strait of Juan de Fuca, and the Strait of Georgia. Species of major interest included Pacific herring, black rockfish, whiting, and sockeye salmon pre-smolts. Projects in 1988 included the assessment of herring impounded in net pens (associated with the spawn on kelp fishery), in-situ target strength measurement, and habitat mapping on the coast.

b) Age determination

Current activities include the aging of pollock, arrowtooth flounder, and Puget Sound hake otolith; widow, yellowtail, and black rockfish otolith; and

lingcod spines and English sole interopercula from 1988 and 1989 samples.

Mr. Saunders requested information on shark research.

Mr. Millikan said that gillnet fisheries for sharks in Washington had a high incidental catch of marine mammals. Oregon/Washington closed the fishery because of this by-catch as well as for economic reasons.

Dr. MacCall noted that a CFG/SWFC meeting regarding Elasmobranch biology and fisheries was held recently. The soupfin fishery in California continues to increase.

4. Oregon Department of Fish & Wildlife

a) Heceta Bank Submersible Studies

In 1987 and 1988, ODFW participated in submersible studies undertaken by Oregon State University and the National Underwater Research Program. Funding was through the U.S. Mineral Management Service.

Objectives were: (1) to determine distribution and abundance of commercially important species of fishes at different depths and habitat types; (2) to correlate differences in fish assemblages with bottom type; (3) to correlate depth and bottom type to occurrence of juvenile and adult rockfishes; (4) to study behaviour, home range, and site-specific relationships of yellowtail rockfish; and (5) describe invertebrate assemblages.

Results to date show that Heceta Bank offers a wide range of habitat. Large schools of yellowtail rockfish have been observed as well as dense concentrations of small or juvenile rockfish. Acoustically tagged yellowtail rockfish were successfully tracked in 1988.

5. California Department of Fish and Game

After a 10 year hiatus, summaries of bottom trawl log data for the period 1978-1987 were produced as a result of implementation of new trawl log processing computer programs. The log data is available currently as computer files of unadjusted and fish receipt-adjusted tows, as microfiche summaries, and as summarized computer files.

Between 20,000 to 25,000 trawl tows were processed annually, thus this is a potentially valuable database for a variety of fisheries analyses. Requests for access to these data should be addressed to T. Jow or F. Henry at the CDFG Menlo Park office.

VIII. OTHER TOPICS FOR DISCUSSION

Mr. Tagart asked, can we believe in log book data? Mr. Bracken stated that observers were required in one fishery and that there were severe differences between mandatory logs and observer logs. Dr. Leaman added, the fishery management approach is killing accuracy of statistics. Only catch can be considered as accurate while effort numbers are suspect.

Mr. Wilkins asked for requests for collections during the triennial survey.

Mr. Jagielo presented several table formats generated by Mr. Daspit (PacFIN) for the catch statistics to be used in the TSC report. The PacFIN formats were approved by all members for use by the TSC. Mr. Stanley agreed that Canada could provide statistics by April/May but in preliminary form. Mr. Tagart replied that the Washington State Department of Fisheries lost funding for species composition work on rockfish in 1988 and as a result some tables may be incomplete.

Dr. MacCall asked for the status of economic analysis. TSC will not append economic reports in the future. These data are available through council reports.

IX. PROGRESS ON 1988 RECOMMENDATIONS

A. The TSC to itself

1. Dixon Entrance resolution

Mr. Bracken requested an update of the status of the Dixon Entrance disputed zone. (See Appendix C)

Canadian members said that in the zone sablefish is stable while rockfish is decreasing. The TSC resolved to add Mr. Bracken to the mailing list for the management plan on an annual basis. This improved communication will help avoid potential conflicts between fishermen from both nations in the Dixon Entrance/Hecate Strait area.

B. From the TSC to the Parent Committee

1. Yellowtail Rockfish resolution

Assessment completed and report to be appended.

2. Transboundary stock emphasis resolution

Progress - adequate representation from all councils

Mr. Bracken asked if we changed the timing of the meeting to avoid conflicts with the North Pacific Council (NPFMC)? It was felt that the Council should simply be notified with enough time to avoid scheduling problems.

Mr. Jagielo suggested that the mailing list should be turned over each year to the chairman and the host agency.

X. 1989 TECHNICAL SUBCOMMITTEE RECOMMENDATIONS

A. TSC to itself

1. Dover sole recommendation, prepared by Mr. Demory - approved.

The TSC was pleased to hear that the objective of the Dover Sole working group had been achieved, that is, a summary of west coast tagging studies. The final report is undergoing review and will be submitted to the North American Journal of Fisheries Management. The TSC commends the working group for a job well done.

B. From the TSC to the Parent Committee

1. PacFIN, prepared by Mr. Henry and Mr. Tagart - approved.

The TSC has been informed that the PacFIN Data Committee will discuss redefinition of agency data feeds to PacFIN at its June, 1989 meeting. The TSC has two primary concerns. First, we support efforts which will expedite the merger of the PMFC groundfish data series with the PacFIN management database to form a single consolidated coastwide reference of commercial catch data. This merger has been a goal of the TSC and its member agencies for some time. Second, we encourage the Data Committee to produce a standard format for submission and reporting of groundfish data that will serve this function.

2. Pacific whiting (Hake), prepared by Mr. McFarlane -approved.

The Pacific whiting (hake) working group reviewed the

status of the whiting resource and the fishery. In particular, they noted that (a) the fishery for whiting is now fully subscribed in both Canada and the United States, and (b) the Can-U.S. catch allocation must be more precisely defined.

They reported that the distribution of the stock can be described from existing survey information but that work on allocation schemes has only recently been initiated. Therefore, the working group identified the need to begin discussions between Canadian and U.S. managers to address anticipated allocation issues.

The TSC recommends that Parent Committee requests the participation of U.S. and Canadian managers to immediately begin deliberations on this issue.

3. HAL, prepared by Mr. Demory - approved.

The TSC discussed the role of PacFIN and the PMFC Data Series with regard to historic records of annual groundfish landings. It was noted that the Historic Annotated Landings database (HAL) was developed to update the PMFC Data Series and provide a complete record of groundfish landings through 1980. Unfortunately, minor discrepancies in the HAL database have not yet been resolved. Since the purpose of the HAL was to provide users with the best available groundfish catch data the TSC recommends that responsible parties establish the necessary priorities so that the HAL data base is updated and completed to become the record of coastwide groundfish landings through 1980.

XI. SCHEDULE OF FUTURE MEETINGS

Mr. Bracken stated that the next meeting would be held in Sitka on June 5, 6 and 7, 1990.

XII. ELECTION OF CHAIRPERSON

Mr. Jagielo will continue through 1990 as chairman.

XIII. ADJOURNMENT

The meeting adjourned at 1205 hours, June 8, 1989.

Mr. Jagielo toasted the Canadians for hosting the meeting.

Dr. Richards thanked Chairman Jagielo for a job well done.

APPENDIX A

AGENDA FOR THE 30TH ANNUAL MEETING OF THE TECHNICAL SUBCOMMITTEE OF THE CANADA-USA GROUNDFISH COMMITTEE
Ladysmith, British Columbia
June 6-8, 1989

I. CALL TO ORDER

II. APPOINTMENT OF SECRETARY

III. INTRODUCTIONS

IV. APPROVAL OF THE 1988 REPORT AND THE 1989 AGENDA

V. TERMS OF REFERENCE

VI. WORKING GROUP REPORTS
- A. CARE
- B. PacFIN Data Series
- C. Stock Assessment Groups

* Include discussion of current management practices*
1. Yellowtail Rockfish
2. Pacific whiting (Hake)
3. Dover Sole

- D. Other

VII. REVIEW OF GROUNDFISH FISHERIES
- A. Commercial
- B. Recreational
- C. Joint Venture
- D. Foreign

VIII. REVIEW OF AGENCY GROUNDFISH RESEARCH, ASSESSMENTS AND MANAGEMENT

Agency Overviews
- Alaska Department of Fish & Game
- National Marine Fisheries Service - SWFC
- California Department of Fish & Game
- Washington Department of Fisheries

A. By species

1. Pacific Cod
   - Canada
   - National Marine Fisheries Service - AFSC
   - Washington Department of Fisheries

2. Rockfish (primarily yellowtail, Pacific ocean perch, canary, nearshore spp).
   - National Marine Fisheries Service - AFSC

- Canada
- Alaska Department of Fish & Game
- Washington Department of Fisheries
- Oregon Department of Fish & Wildlife
- California Department of Fish & Game
- National Marine Fisheries Service - SWFC

3. Sablefish
   - National Marine Fisheries Service - AFSC
   - National Marine Fisheries Service - SWFC
   - Canada
   - Alaska Department of Fish & Game
   - Oregon Department of Fish & Wildlife
   - California Department of Fish & Game

4. Flatfish
   - Canada
   - Alaska Department of Fish & Game
   - National Marine Fisheries Service - AFSC
   - Oregon Department of Fish & Wildlife

5. Pacific Whiting (Hake)
   - National Marine Fisheries Service - AFSC
   - Canada
   - Washington Department of Fisheries

6. Dogfish
   - Canada

7. Pollock
   - National Marine Fisheries Service - AFSC
   - Canada

8. Lingcod
   - Canada
   - Alaska Department of Fish & Game
   - Washington Department of Fisheries
   - Oregon Department of Fish & Wildlife
   - National Marine Fisheries Service - SWFC

9. Other
   - Alaska Department of Fish & Game
   - Oregon Department of Fish & Wildlife
   - Canada
   - Washington Department of Fisheries

B. Other Related Studies

Omit discussion of regulation changes here. Pertinent *regulations will be covered in Working Group Reports*

- FOCI (Fisheries-Oceanography Coordinated Investigations)
- Icthyoplankton Survey
- Tiburon

IX. OTHER TOPICS FOR DISCUSSION

X. PROGRESS ON 1988 RECOMMENDATIONS

A. The TSC to itself
   1. Dixon Entrance resolution

B. From the TSC to the Parent Committee
   1. Yellowtail rockfish resolution
   2. Transboundary stock emphasis resolution

XI. 1989 TECHNICAL SUBCOMMITTEE RECOMMENDATIONS

XII. SCHEDULE OF FUTURE MEETINGS

XIII. ELECTION OF CHAIRPERSON

XIV. ADJOURNMENT

APPENDIX B

LIST OF PARTICIPANTS
30TH ANNUAL MEETING OF THE CANADA-USA
TECHNICAL SUBCOMMITTEE

NAME	AGENCY
Mark Saunders	Department of Fisheries & Oceans, Nanaimo
Laura Richards	Department of Fisheries & Oceans, Nanaimo
Tom Jagielo	Washington Department of Fisheries
Barry Bracken	Alaska Department of Fish & Game
Rick Stanley	Department of Fisheries & Oceans, Nanaimo
Jack Tagart	Washington Department of Fisheries
Al Millikan	Washington Department of Fisheries
Peter Leipzig	Fishermens Marketing Association
Larry Six	Pacific Fishery Management Council
Mark Wilkins	National Marine Fisheries Service - AFSC
Richard Methot	National Marine Fisheries Service - AFSC
Bob Demory	Oregon Department of Fish & Wildlife
Alec MacCall	National Marine Fisheries Service - SWFC
Ed Zyblut	Department of Fisheries & Oceans, Vancouver
Guy Thornburgh	Pacific Marine Fisheries Commission
Frank Henry	California Department of Fish & Game
Shayne MacLellan	Department of Fisheries & Oceans, Nanaimo
Claudia Hand	Department of Fisheries & Oceans, Nanaimo
Sandy McFarlane	Department of Fisheries & Oceans, Nanaimo
Bill Robinson	National Marine Fisheries Service, Seattle
Bruce Leaman	Department of Fisheries & Oceans, Nanaimo
Feney Mathews	Department of Fisheries & Oceans, Nanaimo
Al Tyler	Department of Fisheries & Oceans, Nanaimo
Barry Ackerman	Department of Fisheries & Oceans, Vancouver
Barry Smith	Department of Fisheries & Oceans, Nanaimo
Joe Easley	Pacific Fishery Management Council
Nev Venables	Department of Fisheries & Oceans, Nanaimo
Barbara Thomson	Department of Fisheries & Oceans, Nanaimo
Kathy Rutherford	Department of Fisheries & Oceans, Nanaimo

APPENDIX C

Alaska Groundfish Management in the Dixon Entrance District of Southeast Alaska

The Dixon Entrance District includes all waters of Dixon Entrance and the waters seaward of Cape Muzon south of the "AB" line at 57° 40' N latitude and north of the "equidistant line" which runs through Dixon Entrance half way between the shores of both nations. The State of Alaska formed the district for groundfish management in 1984 when it was determined that the waters of the area were excluded from the federal Gulf of Alaska Groundfish Management Plan and jurisdiction for groundfish management was unclear.

The waters of the area are separated longitudinally at the Cape Muzon Light. The waters west of that line are managed as part of the Southern Southeast Outside (SSEO) management area while the waters east of that line are managed as part of the Southern Southeast Inside (SSEI) management area (Figure 1). There are no separate seasons or quotas for the Dixon Entrance District per se.

The following section briefly outlines the commercial and sport fishing regulations for groundfish which are in effect for those areas.

Commercial Regulations

Sablefish - SSEO AREA

The directed fishery is restricted to longline gear only. Up to 5% of the annual total allowable catch is reserved for bycatch in trawl fisheries for other species. The directed fishery opens 12:00 noon April 1 and remains open until the combined annual allowable catch limit for the Southeast outside/East Yakutat area has been taken. If the total longline allocation has not been taken in the directed fishery, up to 4% by weight is allowed in other fisheries until the longline allocation is taken.

The fishery in this area is open access and any licensed longline vessel can participate.

Catches in the Dixon Entrance District portion of this area are quite small and only 36.5 t were reported from this area in 1987 and 1988 combined.

Sablefish - SSEI AREA

The season in this area opens during the first set of small tides after June 1 which does not conflict with an area 2-C halibut opening. The 1989 season will open from 12:00 noon June 22 through 12:00 noon June 27.

This is a limited access fishery which is restricted to longline and pot gear only. Currently there are approximately 25 longline and 3 pot vessels with permits to fish this area.

The fishery is managed with a guideline harvest range of 125,000 to 500,000 pounds (57 to 227 t) dressed weight. An annual harvest objective within that range is determined prior to each season based upon information from the previous year's fishery and an annual stock assessment survey. The average harvest from the entire SSEI area has been about 350,000 pounds (159 t). The portion reported from the Dixon Entrance District has been approximately 30% of the total and 115.5 t were reported from the Dixon Entrance portion of the area for the past two seasons combined.

No sablefish for commercial sale can be retained within this area outside of the established season.

Rockfish - Both Areas

The directed fishery for demersal shelf rockfish opens at 12:00 noon October 1. Under new regulations, the annual rockfish harvest objectives are split into three seasons. The first season, October 1 through November 30, is apportioned 43% of the annual harvest, the second, December 1 through May 15, is apportioned an additional 42%, while the remaining 15% is reserved for a summer season which

Rockfish fishing is restricted to hook and line gear and most of the harvest is with setlines. This is an open access fishery although an Individual Transferable Quota System (ITQ) is being explored for the directed demersal shelf rockfish fishery at this time.

The harvest limit for demersal shelf rockfish in the total SSEI area is currently 125 t. Approximately 43 t was reported from the Dixon Entrance Portion over the past two seasons combined. The limit for the SSEO area is currently 165 t and 62 t has been reported from the Dixon Entrance District portion over the past two seasons. The harvest objectives for both areas were reduced substantially for the 1988-89 season for conservation reasons.

In addition to the quotas, mandatory logbooks are required in the directed demersal shelf rockfish fishery and no permit holder or vessel may land more than 7,500 pounds (3.4 t) of demersal shelf rockfish during any five day interval.

The harvest of other rockfish is essentially unlimited and directed fisheries are minimal. The season is open year round and only 12 t has been reported from all of the Dixon Entrance District the past two years.

Lingcod - Both Areas

New regulations limit the minimum legal size to 27 inches (68.6 cm) overall or 22 inches (55.9 cm) from the insertion of the anterior portion of the dorsal fin to the tip of the tail. Aside from heading and eviscerating, lingcod cannot be mutilated in any way which makes these length determinations unattainable until the fish are landed.

Trawl Regulations

Trawling can be done in state waters of Southeast Alaska only under the terms of a rather restrictive permit. Most of the Trawl effort in S. E. Alaska is for flatfish and no trawl permits have been requested for the Dixon Entrance District in recent years.

Recreational Regulations

New bag limits were implemented for the recreational rockfish fishery this year. The sport bag limit for all rockfish is 5 per day and 10 in possession of which no more than 2 per day or 4 in possession may be yelloweye rockfish. This is currently the only recreational regulation for any groundfish species in Southeast Alaska. There is no information available to determine how much recreational rockfish harvest,if any, comes from the Dixon Entrance District.

APPENDIX D

REPORTS PUBLISHED BY THE MEMBER AGENCIES DURING THE PERIOD MAY 1, 1988 TO APRIL 30, 1989 ARE LISTED BELOW.

CANADA

Cass, Alan J., Laura J. Richards, and Jon T. Schnute. 1988. A summary of fishery and biological data for lingcod off the southwest coast of Vancouver Island. Can. Tech. Rep. Fish. Aquat. Sci. 1618: 33 p.

Fargo, J., M. W. Saunders and A. V. Tyler (Editors). 1988. Groundfish stock assessments for the west coast of Canada in 1987 and recommended yield options for 1988. Can. Tech. Rep. Fish. Aquat. Sci. 1617: 304 p.

Fargo, J., R. P. Foucher, M. W. Saunders, A. V. Tyler, and P. L. Summers. 1988. F/V EASTWARD HO assemblage survey of Hecate Strait, May 27-June 16, 1987. Can. Data Rep. Fish. Aquat. Sci. 699: 17 pages + microfiche tables.

Foucher, R. P., A. V. Tyler, M. W. Saunders, and D. H. Janusson. 1988. FRV G.B. REED assemblage survey of Hecate Strait, January 27-February 18, 1986. Can. Data Rep. Fish. Aquat. Sci. 708: 31 p. + microfiche tables.

Hand, C. M. and L. J. Richards. 1988. Results of the 1986 rockfish harvest log program. Can. MS Rep. Fish. Aquat. Sci. 1986: 23 p.

Leaman, B. M., G. E. Gillespie, D. A. Nagtegaal and R. D. Stanley. 1988. Biomass survey of rockfish stocks off the southwest coast of Vancouver Island, September 8-22, 1985 (M/V HOWE BAY). Can. Tech. Rep. Fish. Aquat. Sci. 1611: 99 p.

Leaman, B. M. and D. A. Nagtegaal. 1988. Rockfish reproductive biology cruise (GBR-R85-1) October 21-November 9, 1985. Can. Data Rep. Fish. Aquat. Sci. 716: 23 p. + microfiche table.

McFarlane, G. A. 1988. Preliminary results of sablefish mariculture experiments in British Columbia. In Proceedings of the Aquaculture International Congress and Exposition, Vancouver, Canada. p. 497-500.

McFarlane, Gordon A. and Warren D. Nagata. 1988. Overview of sablefish mariculture and its potential for industry. In Proceedings of the Fourth Alaska Aquaculture Conference, Nov. 1987, Sitka, Alaska. p. 105-120.

Rasmussen, M. C. and R. D. Stanley. 1988. A user's guide to a length frequency simulator for exploited fish populations.

Can. Tech. Rep. Fish. Aquat. Sci. 1642: 121 p.

Richards, L. J. and B. Emmet. 1988. Methods used for fecundity estimation of rockfish and lingcod ovaries. Can. Data Rep. Fish. Aquat. Sci. 707: 4 + microfiche tables.

Richards, L. J., C. M. Hand and J. R. Candy. 1988. 1988 Research catch and effort data on nearshore reef-fishes in British Columbia Statistical Areas 12 and 13. Can. MS Rep. Fish. Aquat. Sci. 2000: 89 p.

Richards, L. J. and S. Jergen Westrheim. 1988. Southern range extension of the dusky rockfish, Sebastes ciliatus, in British Columbia. Canadian Field-Naturalist 102(2): 251-253.

Rutherford, K. L. 1988. Catch and effort statistics of the Canadian groundfish fishery on the Pacific coast in 1987. Can. Tech. Rep. Fish. Aquat. Sci. 1656: 86 p.

Scarsbrook, J. R., G. A. McFarlane and W. Shaw. 1988. Effectiveness of experimental escape mechanisms in sablefish traps. N. Am. J. Fish. Manage. 8: 158-161.

Shaw, W., G. A. McFarlane and D. Davenport. 1988. Distribution and abundance of larval sablefish (Anoplopoma fimbria) off the west coast of Vancouver Island, April 2-18, and May 10-18, 1986. Can. MS Rep. Fish. Aquat. Sci. 1970: 130 p.

Shaw, W. 1988. Canadian regulations on non-domestic fisheries, 1977-1988. 4 p. (Document submitted to the Annual Meeting of the International North Pacific Fisheries Commission, Tokyo, Japan, November 1988.).

Shaw, W., R. Tanasichuk, D. M. Ware and G. A. McFarlane. 1989. Biological and species interaction survey of Pacific hake, sablefish, spiny dogfish and Pacific herring off the southwest coast of Vancouver Island. F/V CALEDONIAN, August 12-25, 1986. Can. MS Rep. Fish. Aquat. Sci. 2012.

Stanley, R. D. 1988. Cruise details and biological observations from rockfish charters to the west coast of Vancouver Island aboard the F/V HOWE BAY, July 24-31 and August 24-29, 1985 and the F/V ARCTIC OCEAN, July 28-August 5, 1986. Can. MS Rep. Fish. Aquat. Sci. 1981: 77 p.

Tyler, A. V. 1988. Biological basis for management of groundfish resources of the west coast of Canada. In W. S. Wooster, ed., Fishery science and management: objectives and limitations. Springer-Verlag. pp. 217-232.

Tyler, A. V., J. Fargo, and R. P. Foucher. 1988. Cruise of the FRV W. E. RICKER, November 2-13, 1987 to Hecate Strait to

study reproductive biology of Pacific cod and English sole. Can. MS Rep. Fish. Aquat. Sci. 1979: 72 p.

Tyler, A. V. (Ed.) 1989. Hecate Strait Project: Results from four years of multispecies fisheries research. Can. Tech. Rep. Fish. Aquat. Sci. 1675: 60 p.

UNITED STATES

NATIONAL MARINE FISHERIES SERVICE - AFSC

Alton, M. S., R. G. Bakkala, G. E. Walters, and P. T. Munro. 1988. Greenland turbot, Reinhardtius hippoglossoides, of the eastern Bering Sea and Aleutian Islands region. U.S. Dept. Commer., NOAA Tech. Rep. NMFS 71, 31 p.

Bakkala, R. G. 1988. Structure and historical changes in the groundfish complex of the eastern Bering Sea. Ph.D. Diss., Hokkaido Univ. Hakodate, Japan. 187 p.

Bakkala, R. G. (editor) and D. H. Ito, G. G. Thompson, V. G. Wespestad, S. A. McDevitt, D. K. Kimura, G. E. Walters, J. J. Traynor, L. L. Ronholt, K. L. Halliday, A. M. Shimada, and M. S. Alton. 1988. Condition of groundfish resources of the eastern Bering Sea and Aleutian Islands region in 1987. U.S. Dept. Commer., NOAA Tech. Memo. NMFS F/NWC-139,192 p.

Baldwin, R. T., and B. A. Megrey. 1988. Bioeconomic simulation model of the walleye pollock fishery in the Gulf of Alaska. U.S. Dept. Commerce, NOAA Tech. Memo. NMFS F/NWC-145. 29 p.

Clark, J. B., and D. S. Savage. 1988. Ichthyoplankton off Washington, Oregon, and Northern California March-April 1984. NWAFC Proc. Rep. 88-09, 57 p.

Coleman, B. A. 1988. The 1986 Pacific west coast bottom trawl survey of groundfish resources: estimates of distribution, abundance, length, and age composition. NOAA Tech. Memo. NMFS F/NWC-152. 136 p. plus appendices.

Dunn, J. R. 1989. A provisional phylogeny of gadid fishes based on adult and early life-history characters, p. 209-235, In: D. M. Cohen (Ed.), Papers on the systematics of gadiform fishes. Nat. Hist. Museum Los Angeles Cty., Sci. Ser. No. 32, 262 p.

Dunn, J. R., and W. C. Rugen. 1989. A catalog of Northwest and Alaska Fisheries Center ichthyoplankton cruises 1965-1988. NWAFC Proc. Rep. 89-04. 87 p. + tables & figures.

Fujioka, J. T., F. R. Shaw, G. A. McFarlane, T. Sasaki, and B. E. Bracken. 1988. Description and summary of the Canadian, Japanese, and U.S. joint data base of sablefish tag releases and recoveries during 1977-83. NOAA Tech. Memo. NMFS F/NWC-137, 34 p.

Halliday, K. L. and J. A. Sassano. 1989. Data report: 1987 bottom trawl survey of the eastern Bering Sea continental shelf. U.S. Dept. Commer., NOAA Tech. Memo. F/NWC-162, 143 p.

Halliday, K. L., and J. A. Sassano. 1988. Data report: 1986 bottom trawl survey of the eastern Bering Sea continental shelf. U.S. Dept. Commer., NOAA Tech. Memo. NMFS F/NWC-147, 159 p.

Hoff, R. Z. Spatial distribution and abundance trends for two species of flatfish in the eastern Bering Sea. Thesis submitted in partial fulfillment of the requirements for the degree of Master of Science, Univ. of Washington, 1989.

Kihara, K. and A. M. Shimada. 1988. Pre-predator interactions of Pacific cod, Gadus macrocephalus, and water temperature. Nippon Suisan Gakkaishi 54(12):2085-2088.

Kihara, K. and A. M. Shimada. 1988. Prey-predator interactions of walleye pollock, Theragra chalcogramma, and water temperature. Nippon Suisan Gakkaishi 54(7):1131-1135.

Kihara, K. and A. M. Shimada. 1989. Effects of water temperature on prey-predator interactions of yellowfin sole, Limanda aspera. Nippon Suisan Gakkaishi 55(2):301-304.

Kimura, D. K. and L. L. Ronholt. 1989. Atka mackerel. In: R. Bakkala (editor). Condition of Groundfish Resources of the Eastern Bering Sea and Aleutian Islands Region in 1988. U.S. Dep Commer. NOAA Tech. Memo. F/NWC.

Matarese, A. C., and W. C. Rugen. 1988. Spatial and temporal distribution and relative abundance of Pacific cod, Gadus macrocephalus, larvae in the western Gulf of Alaska. NWAFC Proc. Rep. 88-18, 53 p.

Megrey, B. A., and V. G. Wespestad. 1988. A review of biological assumptions underlying fishery assessment models. pp. 31-69. In: W. S. Wooster (editor), Fisheries Science and Management. Springer Verlag. 339 p.

Megrey, B. A. 1989. Population dynamics of walleye pollock, Theragra chalcogramma, in the Gulf of Alaska. Ph.D. Dissertation, University of Washington, 385 p.

Megrey, B.A. 1988. An assessment of the condition of the Gulf of Alaska walleye pollock resource as estimated in 1987. pp. 25-72. In: R.L. Major and T.K. Wilderbuer (eds.), Condition of groundfish resources of the Gulf of Alaska region as assessed in 1987. U.S. Dept. Commerce, NOAA Tech. Memo. NMFS F/NWC-149. 249 p.

Parks, N. B., and F. R. Shaw. 1988. Changes in relative abundance and size composition of sablefish in coastal waters of Washington and Oregon, 1979-87. NOAA Tech. Memo. NMFS F/NWC-141, 33 p.

Raymore, P.A., Jr. 1988. Winter distribution of groundfish in the eastern Bering Sea based on U.S.S.R. cooperative survey data. NWAFC Proc. Rep. 88-17, 117 p.

Savage, D. S. 1989. Ichthyoplankton off Washington, Oregon, and northern California April-May 1985. NWAFC Proc. Rep. 89-06, 55 p.

Sigler, M. F. and H. H. Zenger. 1989. Results of the 1988 domestic longline survey in the Gulf of Alaska. Processed Report (final draft being edited).

Walters, G.E., K. Teshima, J.J. Traynor, R.G. Bakkala, J.A. Sassano, K.L. Halliday, W.A. Karp, K. Mito, N.J. Williamson, and D.M. Smith, 1988. Distribution, abundance, and biological characteristics of groundfish in the eastern Bering Sea based on results of the U.S.-Japan triennial bottom trawl and hydroacoustic surveys during May-September, 1985. U.S. Dept. Commer., NOAA Tech. Memo. NMFS F/NWC-154, 401 p.

Wilderbuer, T. K. and E. S. Brown. 1989. Flatfish. In: T. Wilderbuer (editor). Condition of the groundfish resource of the Gulf of Alaska in 1988. U.S. Dep Commer. NOAA Tech. Memo. F/NWC-149.

Wolotira, R. S., Sr., M. S. Allen, T. M. Sample, C. R. Iten, S. F. Noel, and R. L. Henry. 1989. Life history and harvest summaries for selected invertebrate species occurring off the west coast of North America. Vol. I: Shelled molluscs. U.S. Dept. Commer., NOAA Tech. Memo. NMFS F/NWC-160, 177 p.

Zenger, H. H. and G. S. Thompson. 1989. Pacific cod. In: T. Wilderbuer (editor). Condition of the groundfish resource of the Gulf of Alaska in 1988. U.S. Dep Commer. NOAA Tech. Memo. F/NWC-149.

NATIONAL MARINE FISHERIES SERVICE - AFSC

ALTON, M. S., R.G. BAKKALA, G.E. WALTERS, and P.T. MUNRO. 1988. Greenland turbot, Reinhardtius hippoglossoides, of the eastern Bering Sea and Aleutian Islands region. U.S. Dept. Commer., NOAA Tech. Rep. NMFS 71, 31 p.

BAGLIN, R.E., R.K. KINOSHITA, and L.E. QUEIROLO. 1988. Status report on the Alaska king and Tanner Crab fisheries. U.S. Dep. Commer., NOAA Tech. Memo. NMFS F/NWC-135, 50 p.

BAKKALA, R.G. 1988. Structure and historical changes in the groundfish complex of the eastern Bering Sea. Ph.D. Diss., Hokkaido Univer. Hakodate, Japan. 187 p.

BAKKALA, R.G., and G.G. THOMPSON. 1988. Arrowtooth flounder. In R.G. Bakkala (editor), Condition of groundfish resources of the eastern Bering Sea and Aleutian Islands region in 1987, p. 79-85. U.S. Dep. Commer., NOAA Tech. Memo. NMFS F/NWC-139.

BAKKALA, R.G. (editor) and D.H. ITO, G.G. THOMPSON, V.G. WESPESTAD, S.A. MCDEVITT, D.K. KIMURA, G.E. WALTERS, J.J. TRAYNOR, L.L. RONHOLT, K.L. HALLIDAY, A.M. SHIMADA, and M.S. ALTON. 1988. Condition of groundfish resources of the eastern Bering Sea and Aleutian Islands region in 1987. U.S. Dept. Commer., NOAA Tech. Memo. NMFS F/NWC-139, 192 p.

BAKKALA, R.G., G.G. THOMPSON, and M.S. ALTON. 1988. Greenland turbot. In R.G. Bakkala (editor), Condition of groundfish resources of the eastern Bering Sea and Aleutian Islands region in 1987, p. 65-77. U.S. Dep. Commer., NOAA Tech. Memo. NMFS F/NWC-139.

BAKKALA, R.G., and V.G. WESPESTAD. 1988. Yellowfin sole. In R.G. Bakkala (editor), Condition of groundfish resources of the eastern Bering Sea and Aleutian Islands region in 1987, p. 51-63. U.S. Dep. Commer., NOAA Tech. Memo. NMFS F/NWC-139.

BALDWIN, R.T., and B.A. MEGREY. 1988. Bioeconomic simulation model of the walleye pollock fishery in the Gulf of Alaska. U.S. Dep. Commer., NOAA Tech. Memo. NMFS F/NWC-145, 31 p.

BAX, N., and T. LAEVASTU. 1987. Recruitment of Bering Sea Pacific cod and walleye pollock to the fisheries of different nations and processors from 1983 to 1986 and implications for management. Cons. int. explor. Mer., C.M., 1987, G:8, Demersal Fish Committee.

BERGER, J.D. 1988. By-catch rates in the Bering Sea and Aleutian Islands joint venture groundfish fishery, 1986-88. U.S. Dep. Commer., NOAA Tech. Memo. NMFS F/NWC-155, 137 p.

BERGER, J.D., and S.R. HARE. 1988. Product recovery rates obtained aboard foreign fishing vessels operating in the northeast Pacific Ocean and eastern Bering Sea, 1983-85, U.S. Dep. Commer., NOAA Tech. Memo. NMFS F/NWC-129, 81 p.

BERGER, J., R. NELSON, Jr., J. WALL, H. WEIKART, and B. MAIER. 1988. Summary of U.S. observer sampling of foreign and joint venture fisheries in the northeast Pacific Ocean and eastern Bering Sea, 1986. U.S. Dep. Commer., NOAA Tech. Memo. NMFS F/NWC-128, 167 p.

BERGER, J.D., and H. WEIKART. 1988. Summary of U.S. observer sampling of foreign and joint venture fisheries in the northeast Pacific Ocean and eastern Bering Sea, 1987. U.S. Dep. Commer., NOAA Tech. Memo. NMFS F/NWC-148, 141 p.

BERGER, J.D., H. WEIKART, and S. MURAI. 1988. Summaries of foreign and joint venture groundfish catches (metric tons) in the northeast Pacific Ocean and eastern Bering Sea. NWAFC Processed Rep. 88-08, 114 p. Northwest and Alaska Fish. Cent., Natl. Mar. Fish. Serv., NOAA, 7600 Sand Point Way NE, Seattle, WA 98115.

BRODEUR, R.D., and P.A. LIVINGSTON. 1988. Food habits and diet overlap of various eastern Bering Sea fishes. U.S. Dep. Commer., NOAA Tech. Memo. NMFS F/NWC-127, 76 p.

CLANCY, T.J., and R.E. NELSON, Jr. 1988. Provisional summary of U.S. observer activities and foreign and joint venture fisheries in the northeast Pacific Ocean and eastern Bering Sea, 1987. NWAFC Processed Rep. 88-07, 43 p. Northwest and Alaska Fish. Cent., Natl. Mar. Fish. Serv., NOAA, 7600 Sand Point Way NE, Seattle, WA 98115.

CLARK, J.B., and D.S. SAVAGE. 1988. Ichthyoplankton off Washington, Oregon, and Northern California March-April 1984. NWAFC Proc. Rep. 88-09, 57 p.

COLEMAN, B.A. 1988. The 1986 Pacific west coast bottom trawl survey of groundfish resources: estimates of distribution, abundance, length, and age composition. NOAA Tech. Memo. NMFS F/NWC-152. 136 p. plus appendices.

DAWSON, P.K., and H.H. SHIPPEN. 1988. Thornyheads. In Richard L. Major and Thomas K. Wilderbuer (editors). Condition of groundfish resources of the Gulf of Alaska region as assessed in 1987, p. 205-219. U.S. Dep. Commer., NOAA Tech. Memo. NMFS F/NWC-149.

DUNN, J.R. 1989. A provisional phylogeny of gadid fishes based on adult and early life-history characters, p. 209-235, In: D.M. Cohen (Ed.), Papers on the systematics of gadiform fishes. Nat. Hist. Museum Los Angeles Cty., Sci. Ser. No. 32, 262 p.

DUNN, J.R., and W.C. RUGEN. 1989. A catalog of Northwest and Alaska Fisheries Center ichthyoplankton cruises 1965-1988. NWAFC Proc. Rep. 89-04. 87 p. + tables & figures.

DWYER, D.A., K.M. BAILEY, and P.A. LIVINGSTON. 1987. Feeding habits and daily ration of walleye pollock (Theragra chalcogramma) in the eastern Bering Sea, with special reference to cannibalism. Can. J. Fish. Aquat. Sci. 44(11):1972-1984.

FUJIOKA, J.T., F.R. SHAW, G.A. MCFARLANE, T. SASAKI, and B.E. BRACKEN. 1988. Description and summary of the Canadian, Japanese, and U.S. joint data base of sablefish tag releases and recoveries during 1977-83. NOAA Tech. Memo. NMFS F/NWC-137, 34 p.

HALLIDAY, K.L., and J.A. SASSANO. 1988. Data report: 1986 bottom trawl survey of the eastern Bering Sea continental shelf. U.S. Dept. Commer., NOAA Tech. Memo. NMFS F/NWC-147, 159 p.

HALLIDAY, K.L. and J.A. SASSANO. 1989. Data report: 1987 bottom trawl survey of the eastern Bering Sea continental shelf. U.S. Dept. Commer., NOAA Tech. Memo. F/NWC-162, 143 p.

HANNA, S. 1988. Attitudes toward risk and resource use among vessel captains in a multi-species fishery. Presented at the Fourth Biennial Conference of the International Institute of Fisheries Economics and Trade, Esbjerg, Denmark, August 7-12, 1988. In conference proceedings.

HANNA, S. 1988. Economic considerations of mesh size regulation in the west coast groundfish fishery. Northwest and Alaska Fisheries Center, NOAA Technical Memorandum, NMFS F/NWC-151, 64 p.

HANNA, S. and J. GOLDEN. 1988. Occurrence of sablefish in Oregon bottom trawl tows, 1981-1987. Report to the Pacific Fishery Management Council, 163 p.

HANNA, S. and J. GOLDEN. 1988. Report Summary: occurrence of sablefish in Oregon bottom trawl tows, 1981-1987. Report to the Pacific Fishery Management Council, 22 p.

HANNA, S. 1988. Fisheries economics issues related to oil and gas development in Oregon and Washington. Invited presentation at the Conference on Recommendations for Studies in Washington and Oregon Relative to Offshore Oil and Gas Development sponsored by the U.S. Department of the Interior, May 23-25, 1988. In conference proceedings.

HANNA, S. The costs of intraseason fishery management. Presented at the Fourth Biennial Conference of the International Institute of Fisheries Economics and Trade, Esbjerg, Denmark, August 7-12, 1988. In conference proceedings.

HARE, S.R. 1988. Report on the Port Moller Pacific cod trawl fishery, summer 1988. NWAFC Processed Rep. 88-25, 22 p. Northwest and Alaska Fish. Cent., Natl. Mar. Fish. Serv., NOAA, 7600 Sand Point Way NE, Seattle, WA 98115.

HARE, S.R., and J.M. WALL. 1988. Provisional data summaries for the NPFMC pilot domestic observer program, Winter 1988. NWAFC Processed Rep. 88-10, 30 p. Northwest and Alaska Fish. Cent., Natl. Mar. Fish. Serv., NOAA, 7600 Sand Point Way NE, Seattle, WA 98115.

HASTIE, J.D. 1988. Catch and revenue characteristics of vessels harvesting sablefish off the West Coast of the United States. U.S. Dep. Commer., NOAA Tech. Memo. NMFS F/NWC-144, 38 p.

HOFF, R.Z. Spatial distribution and abundance trends for two species of flatfish in the eastern Bering Sea. Thesis submitted in partial fulfillment of the requirements for the degree of Master of Science, University of Washington, 1989.

HOLLOWED, A., S.A. ALDERSTEIN, R.C. FRANCIS, M. SAUNDERS, N.J. WILLIAMSON, and T.A. DARK. 1988. Status of the Pacific whiting resource in 1987 and recommendation to management in 1988. U.S. Dep. Commer., NOAA Tech. Memo. NMFS F/NWC-138, 54 p.

HOLLOWED, A.B., R. METHOT, and M. DORN. 1988. Status of the Pacific whiting resource in 1988 and recommendations to management in 1989. In Status of the Pacific coast groundfish fishery through 1988 and recommended acceptable biological catches for 1989. Pacific Fishery Management Council, Metro Center Suite 420, 2000 SW First Ave., Portland, OR 97201.

INGRAHAM, W.J., Jr., and R.K. MIYAHARA. 1988. Ocean surface current simulations in the North Pacific Ocean and Bering Sea (OSCURS--numerical model). U.S. Dep. Commer., NOAA Tech.

Memo. NMFS F/NWC-130, 155 p.

ITO, D.H. 1988. Other rockfish. In R.G. Bakkala (editor), Condition of groundfish resources of the eastern Bering Sea and Aleutian Islands region in 1987, p. 139-146. U.S. Dep. Commer., NOAA Tech. Memo. NMFS F/NWC-139.

ITO, D.H. 1988. Pacific ocean perch. In R.G. Bakkala (editor), Condition of groundfish resources of the eastern Bering Sea and Aleutian Islands region in 1987, p. 117-138. U.S. Dep. Commer., NOAA Tech. Memo. NMFS F/NWC-139.

KAPPENMAN, R.F. 1988. Robust symmetric distribution location estimation and regression. J. Stat. Plann. Inference 19:55-72.

KIHARA, K. and A.M. SHIMADA. 1988. Prey-predator interactions of walleye pollock, Theragra chalcogramma, and water temperature. Nippon Suisan Gakkaishi 54(7):1131-1135.

KIHARA, K. and A.M. SHIMADA. 1988. Pre-predator interactions of Pacific cod, Gadus macrocephalus, and water temperature. Nippon Suisan Gakkaishi 54(12):2085-2088.

KIHARA, K. and A.M. SHIMADA. 1989. Effects of water temperature on prey-predator interactions of yellowfin sole, Limanda aspera. Nippon Suisan Gakkaishi 55(2):301-304.

KIMURA, D.K. 1988. Analyzing relative abundance indices with log-linear models. N. Am. J. Fish. Manage. 8:175-180.

KIMURA, D.K. 1988. Stock-recruitment curves as used in the stock reduction analysis model. J. du Conseil 44:253-258.

KIMURA, D.K. and L.L. RONHOLT. 1988. Atka mackerel. In R.G. Bakkala (editor), Condition of groundfish resources of the eastern Bering sea and Aleutian Islands region in 1987, p. 147-171. U.S. Dep. Commer., NOAA Tech. Memo. NMFS F/NWC-139.

KINOSHITA, R.K. 1988. Pacific Northwest exports of edible fishery products, 1987. U.S. Dep. Commer., NOAA Tech. Memo. NMFS F/NWC-142, 33 p.

KINOSHITA, R.K. 1988. Pacific Coast Groundfish Fisheries, In Fishery Market News, National Marine Fisheries Service, Northwest Region, Seattle, WA, SF-154, December 27, 1988, 4 p.; SF-155, December 28, 1988, 4p.; and SF-156, December 30, 1988, 6 p.

LAEVASTU, T., and F. FAVORITE. 1988. Fishing and stock fluctuations. Fishing News Books Ltd., Farnham, Surrey, England, 239 p.

LAEVASTU, T., J. INGRAHAM, and F. FAVORITE. 1988. Surface wind anomalies and their possible effects on fluctuations of fish stocks via recruitment variations. Int. Symp. Long Term Changes. Mar. Fish Pop., Vigo 1986, p. 393-414.

LAI, H.-L., D.R. GUNDERSON, and L.-L. LOW. 1987. Age determination of Pacific cod, Gadus macrocephalus, using five ageing methods. Fish. Bull., U.S. 85(4):713-723.

LIN, B.-H., H.S. RICHARDS, and J.M. TERRY. 1988. An Analysis of the Exvessel Demand for Pacific Halibut. Marine Resource Economics, Vol. 4, p. 305-314.

LIVINGSTON, P.A. 1988. Interannual trends in Pacific cod (Gadus macrocephalus) predation on three commercially important crab species in the eastern Bering Sea. NWAFC Processed Rep., 88-12, 51 p. Northwest and Alaska Fish. Cent., Natl. Mar. Fish. Serv., NOAA, 7600 Sand Point Way NE, Seattle, WA 98115.

MAJOR, R.L. 1988. Other species. In Richard L. Major and T.K. Wilderbuer (editors), Condition of groundfish resources of the Gulf of Alaska region as assessed in 1987, p. 241-243. U.S. Dep. Commer., NOAA Tech. Memo. NMFS F/NWC-149.

MAJOR, R.L., and T.K. WILDERBUER. 1988. Condition of groundfish resources of the Gulf of Alaska region as assessed in 1987. U.S. Dep. Commer., NOAA Tech. Memo. NMFS F/NWC-149, 249 p.

MATARESE, A.C., and W.C. RUGEN. 1988. Spatial and temporal distribution and relative abundance of Pacific cod (Gadus macrocephalus) larvae in the western Gulf of Alaska. NWAFC Proc. Rep. 88-18, 53 p.

MATULICH, S.C., J.E. HANSON, and R.C. MITTELHAMMER. 1988. A Market Model of the Alaskan King Crab Industry. U.S. Dep. Commer., NOAA Tech. Memo. NMFS F/NWC-157.

MATULICH, S.C., J.E. HANSON, and R.C. MITTELHAMMER. 1988. A Bioeconomic Simulation of the Alaskan King Crab Industry. U.S. Dep. Commer., NOAA Tech. Memo. NMFS F/NWC-158.

MATULICH, S.C., J.E. HANSON, and R.C. MITTELHAMMER. 1988. A

Recursive Age-Structured Model of Alaskan Red King Crab. Alaska Departmenrt of Fish and Game, Fishery Research Bulletin 88-06.

MCDEVITT, S.A. 1988. Sablefish. In R.G. Bakkala (editor), Condition of groundfish resources of the eastern Bering Sea and Aleutian Islands region in 1987, p. 105-115. U.S. Dep. Commer., NOAA Tech. Memo. NMFS F/NWC-139.

MEGREY, B.A. 1988. An assessment of the condition of the Gulf of Alaska walleye pollock resource as estimated in 1987. pp. 25-72. In: R.L. Major and T.K. Wilderbuer (editors), Condition of groundfish resources of the Gulf of Alaska region as assessed in 1987. U.S. Dept. Commerce, NOAA Tech. Memo. NMFS F/NWC-149. 249 p.

MEGREY, B.A. 1989. Population dynamics of walleye pollock (Theragra chalcogramma) in the Gulf of Alaska. Ph.D. Dissertation, University of Washington, 385 p.

MEGREY, B.A., and V.G. WESPESTAD. 1988. A review of biological assumptions underlying fishery assessment models. In W. S. Wooster (editor), Fishery Science and Management, p. 31-69. Springer-Verlag, New York, 339 p.

METHOT, R. and J. HIGHTOWER. 1988. Status of the Washington-Oregon-California sablefish stock in 1988. In Status of the Pacific coast groundfish fishery through 1988 and recommended acceptable biological catches for 1989. Pacific Fishery Management Council, Metro Center Suite 420, 2000 SW First Ave., Portland, OR 97201.

NARITA, R.E., and K.T. BLACK. 1988. PacFIN joint venture logbook data: 1985 statistical reports by INPFC area, with annual reports for all areas combined, 1983-1987. NWAFC Processed Rep. 88-04, 17 p. Northwest and Alaska Fish. Cent., Natl. Mar. Fish. Serv., NOAA, 7600 Sand Point Way NE, Seattle, WA 98115.

PARKS, N.B., and F.R. SHAW. 1988. Changes in relative abundance and size composition of sablefish in coastal waters of Washington and Oregon, 1979-87. NOAA Tech. Memo. NMFS F/NWC-141, 33 p.

QUEIROLO, L.E. 1988. Measuring the economic implications of prohibited species by-catch mortality, including loss of reproductive potential in nonselective multispecies fisheries. U.S. Dep. Commer., NOAA Tech. Memo. F/NWC-142, 97 p.

QUEIROLO, L.E., R.K. KINOSHITA, and J.E. SMOKER. 1988. Status report on the North Pacific groundfish fishery, 1986. U.S. Dep. Commer., NOAA Tech. Memo. NMFS F/NWC-140, 24 p.

QUEIROLO, L.E., T.P. SMITH, and J.M. TERRY. 1988. The role of economics in bycatch valuation. In A Symposium on the Value of Commercial Fisheries to Alaska. Presented at the 15th Annual Meeting of the American Fisheries Society, Juneau, Alaska, Nov. 14-17, 1988. ADF&G Spec. Pub. No. 1., Feb. 1989., p. 61.

RAYMORE, P.A., Jr. 1988. Winter distribution of groundfish in the eastern Bering Sea based on U.S.S.R. cooperative survey data. NWAFC Proc. Rep. 88-17, 117 p.

REEVES, J.E. 1988. A biological assessment of the minimum size limit for Bristol Bay red king crab. U.S. Dep. Commer., NOAA Tech. Memo. NMFS F/NWC-133, 64 p.

ROSE, C.S., and T.K. WILDERBUER. 1988. Flatfish. In Richard L. Major and Thomas K. Wilderbuer (editors), Condition of groundfish resources of the Gulf of Alaska region as assessed in 1987, p. 153-203. U.S. Dep. Commer., NOAA Tech. Memo. NMFS F/MWC-149.

SAVAGE, D.S. 1989. Ichthyoplankton off Washington, Oregon, and northern California April-May 1985. NWAFC Proc. Rep. 89-06, 55 p.

SIGLER, M.F. and H.H. ZENGER. 1989. Results of the 1988 domestic longline survey in the Gulf of Alaska. Processed Report (final draft being edited).

TERRY, J.M., and L.E. QUEIROLO. 1988. Alaska groundfish: A fishery in which international trade and management are closely linked. NWAFC Processed Rep. 88-02, 16 p. Northwest and Alaska Fish. Cent., Natl. Mar. Fish. Serv., NOAA, 7600 Sand Point Way NE, Seattle, WA 98115.

THOMPSON, G.G., and A.M. SHIMADA. 1988. Pacific cod. In R.G. Bakkala (editor), Condition of groundfish resources of the eastern Bering Sea and Aleutian Islands region in 1987, p. 33-49. U.S. Dep. Commer., NOAA Tech. Memo. NMFS F/NWC-139.

WAKABAYASHI, K., T. WILDERBUER, K. TESHIMA, and L.L. RONHOLT. 1988. Groundfish resources of the Aleutian Islands: Cooperative 1983 U.S.-Japan bottom trawl survey. U.S. Dep. Commer., NOAA Tech. Memo. NMFS F/NWC-132, 151 p.

WALTERS, G.E., K. TESHIMA, J.J. TRAYNOR, R.G. BAKKALA, J.A. SASSANO, K.L. HALLIDAY, W.A. KARP, K. MITO, N.J. WILLIAMSON, and D.M. SMITH, 1988. Distribution, abundance, and biological characteristics of groundfish in the eastern Bering Sea based on results of the U.S.-Japan triennial bottom trawl and hydroacoustic surveys during May - September, 1985. U.S. Dept. Commer., NOAA Tech. Memo. NMFS F/NWC-154, 401 p.

WESPESTAD, V.G., and J.J. TRAYNOR. 1988. Walleye pollock. In R.G. Bakkala (editor), Condition of groundfish resources of the eastern Bering Sea and Aleutian Islands region in 1987, p. 11-32. U.S. Dep. Commer., NOAA Tech. Memo. NMFS F/NWC-139.

WILDERBUER, T.K. 1988. Fishing power standardization in multi-vessel, multi-gear, resource assessment surveys. MS Thesis. University of Washington, Seattle, WA 98195. 171 p.

WILDERBUER, T.K. 1988. Squid. In Richard L. Major and Thomas K. Wilderbuer (editors), Condition of groundfish resources of the Gulf of Alaska region as assessed in 1987, p. 237-239. U.S. Dep. Commer., NOAA Tech. Memo. NMFS F/NWC-149.

WILDERBUER, T.K. and E.S. BROWN. 1989. Flatfish. In: T. Wilderbuer (editor). Condition of the groundfish resource of the Gulf of Alaska in 1988. U.S. Dep Commer. NOAA Tech. Memo. F/NWC-149.

WOLOTIRA, R.S., Sr., M.S. ALLEN, T.M. SAMPLE, C.R. ITEN, S.F. NOEL, and R.L. HENRY. 1989. Life history and harvest summaries for selected invertebrate species occurring off the west coast of North America. Vol. I:Shelled molluscs. U.S. Dept. Commer., NOAA Tech. Memo. NMFS F/NWC-160, 177 p.

ZENGER, H.H. and G.S. THOMPSON. 1989. Pacific cod. In: T. Wilderbuer (editor). Condition of the groundfish resource of the Gulf of Alaska in 1988. U.S. Dep Commer. NOAA Tech. Memo. F/NWC-149.

NATIONAL MARINE FISHERIES SERVICE - SWFC

Adams, P. B. 1987. Diet of widow rockfish Sebastes entomelas in northern California. In W. H. Lenarz and D. R. Gunderson (editors), Widow rockfish, p. 37-41. U.S. Dep. Commer., NOAA Tech. Rep. NMFS 48.

Barss, W.H., and T.W. Echeverria. 1987. Maturity of widow rockfish Sebastes entomelas from the northeastern Pacific. In W.H. Lenarz and D.R. Gunderson (eds.), Widow rockfish, p. 13-18. U.S. Dep. Commer., NOAA Tech. Rep. NMFS 48.

Cooperrider, C.L. 1987. Commercial passenger fishing vessel landings of widow rockfish Sebastes entomelas in central

California. In W. H. Lenarz and D. R. Gunderson (editors), Widow rockfish, p. 49-52. U.S. Dep. Commer., NOAA Tech. Rep. NMFS 48.

Epperly, S. P., W. H. Lenarz, L. L. Massey, and W. R. Nelson. 1986. A generalized computer program for yield per recruit analysis of a migrating population with area specific growth and mortality rates. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-SWFC-180, 26 p.

Hightower, J. E. 1986. Sampling strategies for the Washington-Oregon-California sablefish fishery. U.S. Dep. Commer. NOAA Tech. Memo. NMFS, NOAA-TM-SWFC-63, 43 p.

Hightower, J. E. and G. D. Grossman. 1987. Optimal harvesting policies for rehabilitation of overexploited fish stocks using a deterministic model. Can. J. Fish. Aquat. Sci. 44(4):803-810.

Hightower, J. E. and W. H. Lenarz. 1987. Status of the widow rockfish fishery. Appendix C in Status of the Pacific Coast groundfish fishery through 1987 and recommended acceptable biological catches for 1988. Pacific. Fishery Management Council, Portland, Oregon.

Hightower, J. E. and W. H. Lenarz. 1987. Optimal harvesting policies for the widow rockfish fishery, In Mathematical Analysis of Fish Stock Dynamics. Reviews and Current Applications. AFS Symposium Series.

Hobson, E. S. 1986. Predation on the Pacific sand lance, Ammodytes hexapterus (Pisces: Ammodytidae), during the transition between day and night in southeastern Alaska. Copeia 1986(1):223-226.

Hobson, E.S. 1989. Predation on ocean krill. Science 243:237.

Hobson, E. S., and J. R. Chess. 1986. Relationships among fishes and their prey in a nearshore sand community off southern California. Environ. Biol. Fishes 17(3):210-226.

Kato, S. 1988. "Bone softening", a practical means of utilizing small fish. Mar. Fish. Rev 50(3):1-7.

Kendall, A. W., Jr., and W. H. Lenarz. 1987. Status of early life history studies of Northeast Pacific rockfishes. In Proc. Int. Rockfish Symposium October 1986 Anchorage, Alaska. p. 35-41. Univ. Alaska, Sea Grant Rep. 87-2.

Leet, M. H. and C. A. Reilly. 1988. Annotated Bibliography of the Genus Sebastes (Family Scorpaenidae). Pacific Marine Fisheries Commission. Portland, Oregon. 249 p.

Lenarz, W. H. 1987. A history of California rockfish fisheries. In Proc. Int. Rockfish Symposium October 1986, Anchorage, Alaska, p. 35-41. Univ. Alaska. Sea Grant Rep.. 87-2.

Lenarz, W. H. 1987. Ageing and growth of widow rockfish. In W. H. Lenarz and D. R. Gunderson (editors), Widow rockfish, p. 31-35. U.S. Dep. Commer., NOAA Tech. Rep. NMFS 48.

Lenarz, W. H., and D. R. Gunderson (editors). 1987. Widow rockfish. Proceedings of a workshop, Tiburon, California, December 11-12, 1980. U.S. Dep. Commer., NOAA Tech. Rep. NMFS 48.

Lenarz, W. H. and J. E. Hightower. 1988. Status of the Washington-Oregon-California sablefish stock in 1988. In Status of the Pacific Coast groundfish fishery through 1988 and recommended acceptable biological catches for 1989. Appendix B. Pacific Fishery Management Council, Portland, Oregon.

Lenarz, W. H., and T. Wyllie Echeverria. 1986. Comparison of visceral fat and gonadal fat volumes of Sebastes flavidus during a normal year and a year of El Nin˜o conditions. Fish. Bull., U.S. 84(3):743-745.

Reed, R. J. and A. D. MacCall. 1988. Changing the size limit: How it could affect California halibut fisheries. CalCOFI Rep. 29:158-166.

Sen, A. R. 1986. Methodological problems in sampling commercial fish landings. Fish. Bull., U.S. 84(2):409-421.

Ueber, E. 1986. Fillet yields of Dover sole versus depth of capture and length. N. Amer. J. Fish. Manage. 6(2):282-284.

Ueber, E. 1987. Widow rockfish fishery. In W. H. Lenarz and D. R. Gunderson (eds.), Widow rockfish, p. 53-56. U.S. Dep. Commer., NOAA Tech. Rep. NMFS 48.

Ueber, E. 1989. Xanthic gigantic china rockfish. Calif. Fish Game. 75:47-48.

Ueber, E. 1989. The traditional central California setnet fishery. Mar. Fish. Rev. 50(2):40-48.

Wyllie Echeverria, T. 1987. Thirty-four species of California rockfishes: Maturity and seasonality of reproduction. Fish. Bull., U.S. 85(2).

ALASKA DEPARTMENT OF FISH AND GAME

Bracken, B. E. 1988. Southeast-Yakutat groundfish fisheries report to the Board of Fisheries. In Paul Larson editor, Report to the Board of Fisheries, 1987 Region 1 finfish fisheries. AK. Dept. of Fish and Game Regional Info. Rpt. 1J88-05 ADF&G, Juneau, AK. 99833. pp 6.1-6.31.

Bracken, B. E. 1988. Southeast Alaska and Yakutat area groundfish investigations, July 1987 through June 1988. AK. Dept. of Fish and Game Regional Info. Rpt. 1J88-41 ADF&G, Box 667, Petersburg, AK. 99833. 40p.

Bracken, B. E. 1988. Commercial fisheries for demersal shelf rockfish in Southeast Alaska, a review of management options. AK. Dept. of Fish and Game Regional Info. Rpt. 1J88-49 ADF&G, Box 667, Petersburg, AK. 99833. 19p.

O'Connell, V. M. 1988. Southeast Alaska Rockfish, an interim report to the Pacific Marine Fisheries Commission. AK. Dept. of Fish and Game Regional Info. Rpt. 1J88-31 ADF&G, Box 667, Petersburg, AK. 99833. 5p.

O'Connell, V. M. and B. E. Bracken. 1988. Condition of demersal shelf rockfish stocks in the Eastern Gulf of Alaska as assessed in 1988. AK. Dept. of Fish and Game Regional Info. Rpt. 1J88-47 ADF&G, Box 667, Petersburg, AK. 99833. 15p.

WASHINGTON DEPARTMENT OF FISHERIES

Ayres, D.L. 1988. Black Rockfish Investigations: A Summary of 1986 and 1987 Black Rockfish Tagging Studies. Wash. Dept. Fish. Prog. Rept. No. 263. 25 p.

Day, Dwane E. 1987. Changes in the natural mortality rate of the S.E. Strait of Georgia sac roe herring spawning stock, 1976-1985. Wash. Dept. Fish. Tech. Rept. No. 98.

Jagielo, T.H. 1988. The Coastal Groundfish Landings Softdata System Documentation and Users Guide. Wash. Dept. Fish. Prog. Rept. No. 270. 82 p.

Jagielo, T.H. 1988. The Spatial, Temporal, and Bathymetric Distribution of Coastal Lingcod Trawl Landings and Effort in 1986. Wash. Dept. Fish. Prog. Rept. No. 268. 46 p.

Lemberg, N.A., S.F. Burton, and W. Palsson. 1988. Hydroacoustic results for Puget Sound Herring, Whiting, and Pacific Cod Surveys 1986-1987. Wash. St. Dept. Fish. Prog. Rept. No. 274 46 p.

Stick, K.C. and L.H. Hreha. 1988. Summary of the 1986 and 1987 Washington/Oregon Experimental Thresher Shark Gill Net Fishery. Wash. Dept. Fish. Prog. Rept. No. 275. 57 p.

Stick, K.C. and L.H. Hreha. 1989. Summary of the 1988 Washington/Oregon Experimental Thresher Shark Gill Net Fishery. Wash. Dept. Fish. Prog. Rept. No. 275. 40 p.

Tagart, J.V. 1988. Status of the Yellowtail Rockfish Stocks in the International North Pacific Fishery Commission Vancouver and Columbia Areas. Wash. Dept. Fish. Tech. Rept. No. 104. 118 p.

Tagart, J.V. and B.E. Short 1988. Grays Harbor Lingcod Study. Wash. Dept. Fish. Tech. Rept. No. 105. 68 p.

OREGON DEPARTMENT OF FISH AND WILDLIFE

Nil report.

CALIFORNIA DEPARTMENT OF FISH AND GAME

Ebert, T.B., and E.E. Ebert. 1988. An innovative technique for seeding abalone and preliminary results of laboratory and field trials. Calif. Fish and Game 74(2): 68-81.

Haaker, P.L., J.M. Duffy, K.C. Henderson, and D.O. Parker. 1988. The speckled scallop, Argopecten circularis, in Aqua Hedionda Lagoon, San Diego County, California. Calif. Dept. Fish and Game, Mar. Res. Tech. Rep. No. 57, 32 p.

Henderson, K.C., D.O. Parker, and P.L. Haaker. 1988. The survival and growth of transplanted adult pink abalone, Haliotis corrugata, at Santa Catalina Island. Calif. Fish and Game 74(2): 82-86.

Lea, R.N. 1988. Family Himantolophidae added to the ichthyofauna of the temperate eastern North Pacific. Calif. Fish and Game 74(2): 180-182.

Parker, D.O., P.L. Haaker, and K.C. Henderson. 1988. Densities and size compositions of red abalone, Haliotis rufescens, at five locations on the Mendocino and Sonoma County coasts, September 1986. Calif. Fish and Game Admin. Report 88-5.

Reilly, P.N. and T.O. Moore. 1988. Pacific herring, Clupea harengus pallasi, studies in San Francisco and Tomales Bays, April 1987 to March 1988. Calif. Fish and Game Admin. Report 88-20.

Spratt, J.D. 1988. Biological characteristics of the gill net catch from the 1987-88 Pacific herring, Clupea harengus pallasi, roe fishery in California. Calif. Fish and Game Admin. Report 88-6.

Spratt, J.D. 1988. Biomass estimates of Pacific herring, Clupea harengus pallasi, in California from the 1987-88 spawning ground surveys. Calif. Fish and Game Admin. Report 88-7.

Appendix E

Canadian Department of Fisheries and Oceans

Tables

Table 1. British Columbia landings (t) of groundfish in 1988[a] by species and gear type (excluding dumped and discarded).

Species	Bottom trawl	Midwater trawl	Line[b]	Trap	Total
English sole	873.54	2.16	.07	-	875.77
Rock sole	1,958.56	.05	.07	-	1,958.68
Petrale sole	788.35	.78	.05	-	789.18
Dover sole	1,280.46	.01	-	-	1,280.47
Rex sole	145.16	.08	-	-	145.24
Starry flounder	109.79	-	.01	-	109.80
Turbot	375.14	-	-	-	375.14
Other flatfish	174.03	-	3.00	-	177.03
Pacific cod	10,991.33	8.60	15.43	-	11,015.36
Lingcod	2,508.16	7.37	888.84	-	3,404.37
Sablefish	635.36	-	1,267.74	3,781.95	5,685.05
Pollock	17.52	663.90	-	-	681.42
Hake	.04	6,488.39	-	-	6,488.43
Ocean perch	6,893.39	26.23	.71	-	6,920.33
Other rockfish	15,000.48	3,863.56	1,520.77	13.34	20,398.15
Misc. species	230.66	.82	26.84	-	258.32
Dogfish	1,839.23	72.68	1,728.09	.11	3,640.11
Animal food	125.00	.25	4.84	-	130.09
Reduction	453.51	109.85	-	-	563.36
Total	44,399.71	11,244.73	5,456.44	3,795.40	64,896.28

[a]Preliminary data.
[b]Includes longline, handline, and troll.

Table 2. British Columbia trawl landings (t) of groundfish species, 1978-88 (excluding dumped and discarded).

Species	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1978-87	1988*
English sole	807	1,070	1,244	1,500	559	532	812	692	452	755	842	876
Rock sole	1,309	1,875	1,843	1,060	745	668	525	430	454	887	980	1,959
Petrale sole	226	203	223	291	367	439	417	336	416	445	336	789
Dover sole	732	861	1,274	1,246	914	871	1,148	963	1,167	633	981	1,280
Rex sole	102	204	145	190	74	49	219	205	87	83	136	145
Starry flounder	73	296	118	198	168	66	170	66	54	65	127	110
Turbot	2,318	1,823	1,448	946	525	324	369	764	895	1,193	1,061	375
Other flatfish	25	53	51	180	220	199	141	157	214	226	147	174
Total flatfish	5,592	6,385	6,346	5,611	3,572	3,148	3,801	3,613	3,739	4,288	4,609	5,708
Pacific cod	6,668	9,501	8,667	6,677	4,794	4,496	3,460	2,328	3,637	13,896	6,412	11,000
Lingcod	908	1,160	1,311	1,729	2,879	2,988	2,971	4,853	2,924	2,401	2,412	2,516
Sablefish	131	277	334	234	248	274	187	233	543	407	287	635
Pollock	2,407	3,384	2,201	1,252	924	1,070	800	1,895	577	1,270	1,578	681
Hake	2	818	606	5,692	2,826	3,122	4,600	6,055	6,802	13,275	4,380	6,488
Ocean perch	3,861	2,819	5,290	5,104	5,983	5,655	6,698	6,069	5,914	6,334	5,373	6,920
Other rockfish	6,147	5,574	4,154	4,488	4,645	6,559	7,905	10,854	17,571	16,515	8,441	18,864
Misc. species	163	191	292	264	139	155	169	154	209	315	205	231
Total foodfish	25,879	30,109	29,201	31,051	26,010	27,467	30,591	36,054	41,916	58,700	33,698	53,044
Dogfish	941	1,275	2,871	638	1,719	967	899	1,915	2,342	1,423	1,499	1,912
Animal food	112	214	191	42	65	94	161	309	255	186	163	125
Reduction	302	241	528	303	450	321	244	214	175	210	299	563
Total	27,234	31,839	32,791	32,034	28,244	28,849	31,895	38,492	44,688	60,519	35,658	55,644

*Preliminary data

Table 3. British Columbia trawl landings (t) by main species and major area in 1988* (excluding dumped and discarded fish).

Species	Major areas								
	3C	3D	4B	5A	5B	5C	5D	5E	Total
English sole	60.8	20.0	32.5	15.8	54.8	85.7	601.6	4.5	875.6
Rock sole	117.9	34.9	5.8	127.0	272.1	189.3	1,210.7	.9	1,958.7
Petrale sole	178.3	276.3	3.5	66.0	101.4	92.3	40.9	30.4	789.1
Dover sole	370.0	142.5	10.6	33.0	81.0	11.4	515.2	116.9	1,280.5
Rex sole	8.2	2.4	.1	1.5	3.1	4.6	117.9	7.4	145.2
Starry flounder	4.4	1.0	54.4	.9	-	.5	48.7	-	109.8
Turbot	31.4	35.1	4.6	115.6	49.1	2.4	118.6	18.3	375.2
Other flatfish	45.4	11.4	66.1	9.5	6.2	.2	4.0	2.7	145.5
Pacific cod	1,644.0	144.4	1,217.6	805.7	1,054.5	2,315.7	3,800.9	17.0	10,999.7
Lingcod	561.9	281.9	12.0	554.5	736.6	166.6	182.4	19.6	2,515.5
Sablefish	370.7	84.7	1.4	7.3	38.3	9.6	12.9	110.6	635.4
Pollock	2.9	.1	664.9	1.6	2.1	.5	9.3	tr.	681.4
Hake	593.5	-	5,894.9	-	-	-	-	-	6,488.4
Ocean perch	184.3	615.0	-	552.4	3,021.1	714.1	6.0	1,826.8	6,919.6
Other rockfish	1,978.3	5,067.4	9.7	2,387.6	5,759.6	914.5	135.5	2,611.0	18,863.7
Misc. species	12.5	1.3	17.2	12.8	20.9	21.7	172.6	.9	259.9
Dogfish	1,589.2	17.2	220.2	83.8	-	1.5	tr.	-	1,911.9
Animal food	-	-	-	-	4.3	25.6	50.3	44.9	125.1
Reduction	77.7	60.0	1.1	12.6	195.6	32.9	78.0	105.4	563.3
Total	7,831.4	6,795.6	8,216.5	4,787.4	11,400.8	4,589.0	7,105.7	4;917.2	55,643.6

*Preliminary data

Table 4. Other rockfish landings (t) from Canadian trawlers by International Areas in 1988* (including animal food and reduction).

Species	Major areas								
	3C	3D	4B	5A	5B	5C	5D	5E	Total
Sebastes aleutianus	28.2	42.8	-	36.1	150.0	12.5	1.7	820.4	1,091.6
S. babcocki	26.9	25.1	-	34.6	181.0	10.4	2.0	33.8	313.9
S. borealis	6.1	1.4	-	2.0	30.6	.4	-	17.9	58.4
S. brevispinis	395.7	793.3	.2	612.2	765.3	556.6	9.7	385.9	3,518.9
S. caurinus	-	-	-	-	-	.5	8.0	-	8.4
S. crameri	12.5	26.0	-	15.1	6.8	2.8	-	19.8	83.1
S. diploproa	34.1	12.4	-	8.3	75.1	1.2	-	18.6	149.7
S. elongatus	.3	3.0	-	6.5	2.4	1.7	-	.4	14.3
S. entomelas	27.8	643.7	-	48.0	1,296.3	7.9	24.4	26.7	2,074.8
S. flavidus	277.7	2,036.3	6.7	425.5	1,957.9	39.2	52.1	17.0	4,812.5
S. helvomaculatus	-	-	-	.2	1.1	.2	-	-	1.5
S. maliger	.3	-	.5	.3	.1	tr.	1.1	-	2.2
S. melanops	-	.5	-	-	.2	5.3	-	-	6.0
S. nebulosus	-	-	.1	.5	-	tr.	.2	-	.8
S. nigrocinctus	-	-	-	-	-	-	.3	-	.3
S. paucispinis	289.2	302.3	-	232.3	389.0	35.8	18.3	47.6	1,314.5
S. pinniger	486.4	589.3	tr.	194.2	405.5	81.0	3.8	84.3	1,844.6
S. proriger	328.3	350.0	-	295.9	125.8	94.6	1.1	630.7	1,826.4
S. reedi	6.6	168.7	-	359.3	361.7	16.7	.5	396.6	1,309.9
S. ruberrimus	1.2	.8	tr.	1.8	1.0	-	.4	10.6	15.8
S. zacentrus	28.2	12.2	-	79.3	60.7	25.0	-	38.9	244.2
Sebastolubus alascanus	8.7	8.8	-	1.3	12.4	4.7	4.3	84.6	124.8
unspecified	21.5	51.1	2.2	34.4	25.1	18.1	8.1	8.9	169.3
Total	1,979.7	5,067.7	9.7	2,387.6	5,847.9	914.4	135.9	2,642.7	18,985.6

*Preliminary data

Appendix F

California Department of Fish and Game

Tables

TABLE 1. CALIFORNIA GROUNDFISH LANDINGS (METRIC TONS)

SPECIES	1987	1988	PERCENT CHANGE
Dover sole	10,759	8,176	-24.0%
English sole	1,322	1,059	-19.9%
Petrale sole	824	780	-5.3%
Rex sole	825	839	1.7%
Thornyheads	2,955	4,524	53.1%
Widow rockfish	2,274	1,847	-18.8%
Other rockfish	11,419	9,776	-14.4%
Lingcod	841	863	2.6%
Sablefish	4,345	3,782	-13.0%
Pacific whiting	4,518	6,541	44.8%
Calif. halibut	539	515	-4.5%
Other groundfish	1,322	1,244	-5.9%
TOTALS	41,943	39,946	-4.8%

Appendix G

Oregon Department of Fish and Wildlife

Tables

Table 1. Number of biological samples collected by PMFC Area in 1988.

Species	1C	2A	2B	2C	3A	3B	Total
Dover Sole	--	3	20	1	25	1	50
English sole	--	1	4	--	9	--	14
Petrale sole	--	2	5	--	9	1	17
Rockfish							
S. alutus	--	--	--	--	5	--	5
S. entomelas	--	--	13	31	28	--	72
S. flavidus	--	--	8	5	15	--	28
S. diniger	--	--	8	3	12	--	23
Species comp.	3	16	149	246	182	17	613
Sablefish	--	--	--	--	--	--	26[a]
TOTAL	3	22	207	286	285	19	848

[a] INPFC Columbia area, n=26

Table 2. Annual Oregon groundfish trawl landings (mt), total effort (hr) and catch per unit effort (mt/hr), 1978-88. Landings include bottom and midwater trawl but excludes shrimp trawl.

Species	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1978-87 mean
Arrowtooth flounder	170	319	188	588	721	534	416	688	478	725	610	483
Dover sole	3,374	5,066	4,008	5,228	8,083	8,459	6,103	5,695	4,770	6,017	7,551	5,680
English sole	1,041	1,084	718	724	990	914	450	468	551	594	576	753
Petrale sole	1,000	1,040	850	880	1,504	1,105	688	577	707	852	893	920
Rex sole	642	734	524	606	841	645	549	397	285	286	326	551
Rock sole	12	6	13	9	30	4	2	1	6	1	5	8
Starry flounder	489	284	193	400	218	196	107	358	97	91	141	243
Other flatfish	394	569	427	483	642	574	507	415	392	448	278	485
--ALL FLATFISH	7,122	9,102	6,921	8,918	13,029	12,431	8,822	8,599	7,286	9,014	10,380	9,124
Rockfish (all species)	4,874	9,298	16,482	23,558	20,130	15,003	12,465	12,473	10,487	13,020	14,077	13,780
Lingcod	445	686	652	904	1,345	1,621	978	946	489	559	865	863
Pacific cod	398	401	156	44	116	81	78	38	26	641	1,005	198
Pacific whiting	383	129	257	162	1	58	338	884	419	176	246	281
Sablefish	958	1,493	1,026	1,304	2,951	2,771	2,775	2,843	2,125	2,520	2,133	2,007
Misc.	185	187	92	197	45	98	58	7	9	21	3	90
Dogfish	56	40	23	5	1	1	<1	<1	<1	0	<1	13
Minkfood	3	0	0	0	0	0	0	0	0	0	0	<1
Reduction	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL LANDINGS	14,424	21,336	25,609	35,092	37,618	32,064	25,514	25,790	20,841	25,951	28,717	26,424
Hours, bottom trawl	38,447	56,444	46,606	68,297	94,997	101,517	80,859	74,726	52,785	60,808	NA	67,549
Hours, pelagic trawl	--	--	--	--	--	--	1,780	2,268	2,324	3,103	NA	NA
mt/hr, bottom trawl	0.375	0.366	0.362	0.303	0.302	0.298	0.261	0.345	0.324	0.336	NA	0.391
mt/hr, pelagic trawl	--	--	--	--	--	--	2.459	1.889	1.604	1.786	NA	NA

Table 3. Preliminary Oregon landings (mt) of groundfish caught by bottom trawl in 1988 by international statistical area.

Species	3C-S	3B	3A	2C	2B	2A	1C	Total
Arrowtooth flounder	-	83	332	126	62	7	<1	610
Dover sole	7	596	2,072	1,038	3,211	589	21	7,534
English sole	-	21	216	160	141	35	2	575
Petrale sole	-	39	320	210	273	50	<1	892
Rex sole	-	9	195	56	40	26	<1	326
Rock sole	-	-	<1	5	<1	-	-	5
Starry flounder	-	16	112	8	5	<1	<1	141
Other flatfish	-	9	168	52	41	7	1	278
--ALL FLATFISH	7	773	3,415	1,655	3,773	714	24	10,361
Black rockfish	-	-	122	-	-	-	10	132
Bocaccio	-	8	62	70	58	16	-	214
Canary rockfish	-	36	453	519	318	7	<1	1,333
Chilipepper	-	-	-	-	-	<1	4	4
Darkblotched rockfish	-	25	120	312	215	53	2	727
Redstripe rockfish	-	1	94	134	101	2	-	332
Sharpchin rockfish	<1	3	145	114	29	1	-	292
Silvergrey rockfish	-	12	103	102	14	3	-	234
Solitnose rockfish	-	11	19	90	41	19	-	180
Yelloweye rockfish	-	1	23	59	28	3	-	114
Yellowmouth rockfish	-	14	74	311	5	4	-	408
Yellowtail rockfish	-	118	1,322	376	293	73	-	2,182
Other rockfish	-	38	150	153	55	30	<1	426
--Sebastes complex	<1	267	2,687	2,240	1,157	211	16	6,578
Pacific ocean perch	2	84	360	230	42	5	-	723
Shortbelly rockfish	-	-	-	-	-	-	-	-
Thornyheads	2	46	204	159	331	276	11	1,029
Widow rockfish	-	9	438	385	330	26	4	1,192
Unsp. rockfish	11	1	<1	43	18	3	3	79
--ALL ROCKFISH	15	407	3,689	3,057	1,878	521	34	9,601
Lingcod	-	62	353	238	130	78	2	863
Pacific cod	-	65	565	291	64	10	-	995
Pacific whiting	-	-	8	39	10	-	8	65
Sablefish	5	115	730	476	629	172	-	2,127
Misc.	-	-	1	1	1	<1	-	3
ALL GROUNDFISH	27	1,422	8,761	5,757	6,485	1,495	68	24,015

Table 4. Preliminary landings (mt) of groundfish caught by midwater trawl in 1988 by international statistical area.

Species	3C-S	3B	3A	2C	2B	2A	1C	Total
Arrowtooth flounder	-	-	-	-	-	-	-	-
Dover sole	-	-	14	2	-	1	-	17
English sole	-	-	<1	1	-	-	-	1
Petrale sole	-	-	1	<1	-	-	-	1
Rex sole	-	-	<1	-	-	<1	-	<1
Rock sole	-	-	-	-	-	-	-	-
Starry flounder	-	-	-	-	-	-	-	-
Other flatfish	-	-	-	<1	-	-	-	<1
--ALL FLATFISH	-	-	15	3	-	1	-	19
Black rockfish	-	-	-	-	-	-	-	-
Bocaccio	-	-	-	<1	-	-	-	<1
Canary rockfish	-	-	-	1	-	-	-	1
Chilipepper	-	-	-	-	-	-	-	-
Darkblotched rockfish	-	-	-	-	-	-	-	-
Redstripe rockfish	-	-	3	1	-	-	-	4
Sharpchin rockfish	-	-	-	-	-	-	-	-
Silvergrey rockfish	-	-	-	-	-	-	-	-
Splitnose rockfish	-	-	-	-	-	-	-	-
Yelloweye rockfish	-	-	-	-	-	-	-	-
Yellowmouth rockfish	-	-	-	-	-	-	-	-
Yellowtail rockfish	-	-	61	33	7	<1	-	101
Other rockfish	-	-	3	<1	-	-	-	3
--Sebastes complex	-	-	67	35	7	<1	-	109
Pacific ocean perch	-	-	<1	3	-	-	-	3
Shortbelly rockfish	-	-	<1	-	-	-	-	<1
Thornyheads	-	-	1	<1	-	1	-	2
Widow rockfish	-	-	1,210	2,370	593	56	23	4,252
Unsp. rockfish	-	-	39	69	2	-	-	110
--ALL ROCKFISH	-	-	1,317	2,477	602	57	23	4,476
Lingcod	-	-	<1	2	<1	-	-	2
Pacific cod	-	-	8	2	-	-	-	10
Pacific whiting	-	-	-	189	-	-	-	189
Sablefish	-	-	1	3	-	2	-	6
Misc.	-	-	-	-	-	-	-	-
ALL GROUNDFISH	-	-	1,341	2,676	602	60	23	4,702

Table 5. Oregon Landed catch (mt) of groundfish by gear types other than trawl in 1988

Species	Shrimp trawl	Pot	Long-Line	Jig	Troll	Other hook-& line	Other gear[a]	Total
Arrowtooth flounder	4	-	1	-	<1	-	-	5
Dover sole	29	4	<1	-	-	-	-	33
English sole	1	1	-	-	-	-	-	2
Petrale sole	1	<1	<1	-	<1	-	-	1
Rex sole	<1	1	-	-	-	-	-	1
Rock sole	-	-	-	-	-	-	-	-
Starry flounder	<1	-	-	<1	<1	-	-	-
Other flatfish	1	<1	<1	<1	<1	-	-	1
--ALL FLATFISH	36	6	1	<1	<1	-	-	43
Rockfish (all species)	586	11	141	82	74	98	-	992
Lingcod	22	2	25	20	19	46	-	134
Pacific cod	13	3	1	-	<1	-	-	17
Pacific whiting	-	-	<1	-	1	-	-	1
Sablefish	27	1,231	665	1	<1	3	-	1,927
Misc.	1	-	5	5	<1	2	-	13
ALL GROUNDFISH	685	1,253	838	108	94	149	<1	3,127
Pacific halibut	-	-	247	<1	2	-	-	249

[a] *Includes scallop dredge and crab pots.*

Table 6. Number of vessels, by gear type, fishing for groundfish and shrimp and number of deliveries made into Oregon in 1987 and 1988.

Gear Type	1987		1988	
	Vessels	Deliveries	Vessels	Deliveries
Other Hook and Line[a]	311	1,871	132	1,545
Longline[b]	49	369	68	459
Trawl[c]				
Bottom	136	2,786	142	3,081
Midwater	33	456	37	462
Total	141	3,251	157	3,543
Pot	21	326	12	194
Shrimp trawl	181	2,923	182	2,560

[a] Includes jig, longbar, and vertical longline
[b] Excludes Pacific halibut
[c] Most midwater trawl vessels also make bottom trawl landings, thus vessel classes are not additive.

Table 7. Estimated 1988 Oregon recreational catch, by species, the ocean boat fishery[a].

Port	Rockfish	Flatfish	Lingcod	Misc. fish	Total
Astoria[b]	180	11	66	82	339
Garibaldi[c]	56,443	115	3,325	1,170	61,053
Pacific City[d]	3,612	127	817	152	4,708
Depoe Bay[c]	33,019	176	3,148	2,601	38,944
Newport[c]	80,999	4,857	4,748	3,151	93,755
Florence[e]	210	40	5	9	264
Winchester Bay[c]	880	186	5	97	1,168
Coos Bay[c]	11,326	19	610	400	12,355
Gold Beach[f]	2,735	0	264	159	3,158
Brookings[g]	40,835	425	2,060	1,701	45,021
TOTAL	230,239	5,956	15,048	9,522	260,765

a Catch in numbers of fish
b Sampling period: July 4 through July 28
c Sampling period: May 1 through September 11
d Sampling period: June 13 through September 11
e Sampling period: June 10 through September 11
f Sampling period: June, July, and August, on an intermittent basis
g Sampling period: May 28 through September 11

Table 8. Species composition of the 1988 Oregon recreational bottomfish ocean boat fishery.

Species	Percent of catch	Number of fish	Total Weight(mt)
Sebastes melanops	67.6	175,885	232.3
S. pinniger	6.1	16,019	22.4
S. flavidus	5.9	15,482	21.4
Ophiodon elongatus	5.8	15,048	60.9
S. mystinus	3.6	9,300	7.2
Sebastes spp	2.6	6,851	6.4
Scorpaenichthys marmoratus	2.1	5,354	9.9
Hippoglossus stenolepis	1.6	4,296	44.6
S. ruberrimus	1.6	4,282	9.4
Hexagrammos decagrammus	1.0	2,712	2.7
S. nebulosus	0.9	2,420	1.2
Other fish	1.2	3,116	4.2
TOTAL	100.0	260,765	422.6

Table 9. Estimated 1988 Oregon recreational bottomfish catch (mt) by PMFC area.

	PMFC Area				
	2A	2B	2C	3A	Total
Lingcod	9.4	2.5	48.7	0.3	60.9
Rockfish	56.8	16.2	227.1	0.2	300.3
Flatfish	0.2	0.2	45.0	Tr	45.4[a]
Other fish	3.1	0.9	11.9	0.1	16.0
TOTAL	69.5	19.8	332.7	0.6	422.6

[a] Includes Pacific halibut

Appendix H

National Marine Fisheries Service - AFSC

Tables

Table 1.--1988 joint venture landings (mt) in the Bering Sea/Aleutians, Gulf of Alaska, and Washington-California region by species and INPFC area. 1987 catches are shown in parentheses.

	Bering Sea/Aleutians				
	Bering I	Bering II	Bering IV	Total	
Walleye pollock	531,121	254,090	41,202	826,413	(1,044,467)
Pacific cod	103,121	2,991	3,300	109,891	(58,157)
Sablefish	9	0	6	14	(123)
Atka mackerel	42	1	19,577	19,619	(30,061)
Pacific ocean perch	32	15	1,512	1,559	(549)
Other rockfish	9	7	513	529	(321)
Arrowtooth flounder	2,306	245	22	2,574	(1,675)
Yellowfin sole	212,889	433	0	213,322	(179,614)
Greenland turbot	70	12	6	88	(58)
Other flatfish	110,419	4,538	86	115,043	(34,247)
Squid	168	1	3	171	(35)
Herring	338	13	0	351	(469)
Other fish	10,627	932	281	11,840	(6,121)
Total	971,149	263,278	66,509	301,416	(1,355,897)

	Gulf of Alaska				
	Shumagin	Chirikof	Kodiak	Total	
Walleye pollock	0	8	144	152	(22822)
Pacific cod	0	348	1,313	1,661	(1,978)
Sablefish	0	1	35	37	(180)
Atka mackerel	0	0	0	0	(1)
Pacific ocean perch	0	0	4	4	(112)
Shortspine thornyhead	0	0	0	0	(20)
Demersal rockfish	2	0	0	2	(22)
Slope rockfish	4	0	1	4	
Pelagic rockfish	0	1	0	1	
All flounders	0	733	1,048	1,781	(7,207)
Herring	0	0	0	0	
Other fish	0	45	84	129	(178)
Total	7	1,136	2,628	3,771	(32,524)

Table 1.--1988 joint venture landings (mt) in the Bering Sea/Aleutians, Gulf of Alaska, and Washington-California region by species and INPFC area. 1987 catches are shown in parentheses. (Continued)

	Washington-California					
	Vancouver	Columbia	Eureka	Monterey	Total	
Pacific whiting	12,483	97,455	25,122	722	135,781	(105,996)
Jack mackerel	0	15	26	1	43	(16)
Sablefish	0	8	2	0	10	(2)
Pacific ocean perch	0	0	0	0	0	(0)
Other rockfish	37	76	5	4	122	(76)
All flounders	0	1	0	0	1	(0)
Other fish	9	12	2	0	23	(4)
POP Discards	0	1	1	0	2	
Rock Discards	90	396	39	13	537	
Sablefish Discards	0	46	16	0	62	
Jack Discards	5	104	30	0	139	
Flounder Discards	0	35	0	0	35	
Other Discards	18	108	13	0	139	
Total	12,642	98,256	25,255	740	136,894	(106,094)

Table 2.--Joint venture allocations in 1988 and 1989 in the Bering Sea/ Aleutians, Gulf of Alaska, and Washington-California region.

Bering Sea/Aleutians

	1988	1989
Pollock	836,678	93,415
Yellowfin sole	212,394	110,000
Arrowtooth flounder	1,893	700
Greenland turbot	81	0
Rock sole	--	9,605
Other flounders	116,761	40,000
Pacific cod	112,584	37,466
Sablefish	84	0
POP complex	1,469	0
Other rockfish	395	0
Atka mackerel	17,770	0
Herring	--	
Other fish	11,500	4,000
Squid	25	25
Total	1,311,634	295,211

Gulf of Alaska

	1988	1989
Pollock	500	0
Flounders	7,050	0
Pacific cod	11,050	0
Atka mackerel	0	0
Thornyheads	50	0
Other fish	1,500	0
Total	20,150	0

Washington - California

	1988	1989
Pacific whiting	165,000	207,000
Jack mackerel	3.0%	3.0%
POP	0.062%	0.062%
Other rockfish	0.738%	0.738%
Sablefish	0.173%	0.173%
Flounders	0.1%	0.1%
Other fish	0.5%	0.5%
Shortbelly rockfish	--	12,000
Total	165,000	219,000

Table 3.--Foreign groundfish catches in 1988 by species and INPFC area. (1987 catches are presented in parentheses).

Bering Sea/Aleutians - none

Gulf of Alaska - none

Washington - California

	Columbia	Eureka	Total	
Pacific whiting	16,862	1,179	18,041	(49,656)
Jack mackerel	33	15	49	(321)
Sablefish	27	Tr	27	(30)
POP	2	0	2	(3)
Other rockfish	149	Tr	149	(219)
Flounder	3	0	3	(2)
Other fish	66	1	68	(163)
Total	17,142	1,195	18,339	(50,394)

Table 4.--Final 1988 foreign groundfish allocations (t) for the Washington - California region.

	1988
	Poland
Pacific whiting	36,500
Jack mackerel	3.0%
POP	0.062%
Other rockfish	0.738%
Sablefish	0.173%
Flounders	0.1%
Other fish	0.5%

Table 5.--Completed U.S. Cooperative Research with Foreign Governments-1988
Alaska Fisheries Science Center, NOAA, Seattle, WA.

Vessel	Nation	Operating Area	Dates	Research Program	U.S. Scientists	Ports of Call	
DARWIN	(UBKN) USSR	B. Sea	3/16-8/1	Groundfish	Clark, Leopold	Kodiak	3/16-18
GISSAR	(UNCQ) USSR	Gulf B. Sea	May	Plankton	None	None	
NEMIROV	(EWYC) USSR	N. Pacific	4/6 -5/20	Salmon (Seine)	Dan Grosee Robert Walker	Kodiak	6/3-5
TINRO	(UYVO) USSR	N. Pacific	4/28-5/15	Salmon (Trawl)	Robert Walker	Kodiak Dutch Harbor	3/28-30 5/4-5
OSHORO MARU	(JDVA) JAPAN	N. Pacific B. Sea	6/6 -8/18	Gill net, Longline	Kate Meyer	Dutch Harbor Ketchikan	6/23, 7/2-5 7/22-27
ETSUZAN* MARU	( ) JAPAN	N. Pacific	6/1 -7/22	Longline	None	None	
SHIN RIASU* MARU	(7JHC) JAPAN	N. Pacific	6/1 -7/22	Longline	Jeff Light	None	
HOKUHO MARU	(JDVN) JAPAN	N. Pacific	6/6 -8/4	Gill net, Longline	None	None	
KANKI* MARU #3	( ) JAPAN	N. Pacific	6/3 -7/7	Longline	David Welsh	None	
HOKUSHIN* MARU	( ) JAPAN	N. Pacific	6/1 -7/4	Gill net	None	None	
IWAKI MARU	( ) JAPAN	N. Pacific	6/1 -7/15	Gill net	None	None	
KAIUN	(JRWN) JAPAN	N. Pacific	6/2 -7/20	Gill net	None	None	
HOKKO MARU	( ) JAPAN	N. Pacific	6/25-7/19	Gill net	None	None	
WAKATAKE MARU	(JDVE) JAPAN	N. Pacific B. Sea	6/7 -7/28	Gill net, Longline	None	None	
HOKUSEI* MARU	( ) JAPAN	N. Pacific	6/1 -8/11	Gill net	None	None	
HOYO* MARU	(JMKI) JAPAN	N. Pacific	8/3 -9/28	Harpoon	None	None	
TOMI MARU #88	(JLKO) JAPAN	B. Sea N. Pacific	5/17-9/21	Sablefish Longline	Jim Long	Dutch Harbor Kodiak Seattle	6/28-30, 7/28-30 8/23-25 9/22
SEIJU MARU #28	( ) JAPAN	B. Sea	7/30- 10/20	Pollock	TBN	Dutch Kodiak	8/15-17 9/29-10/1 9/7-10
SHUNYO MARU	(8JIF) JAPAN	B. Sea	7/1-8/24	Entanglement	TBN	Dutch Kodiak St. Paul	7/19-22 8/6-10 7/24, 8/3

*Cooperative research proposed, status pending.

Table 6.--Scheduled U.S. Cooperative Research with Foreign Governments - 1989
Alaska Fisheries Science Center, NOAA, Seattle, WA

Vessel	Nation	Operating Area	Dates	Research Program	U.S. Scientists	Ports of Call
MYS BABUSHKINA	(UWFH) USSR	B. Sea Gulf	10-7/3	Groundfish	Benjamin Miller Kessler	Kodiak 4/10-12 Dutch Harbor 5/17-18
*POSEYDON	(EWGF) USSR	WA, OR	Aug.	Groundfish	TBN	Vanc., B.C. Aug.
NEMIROV	(EWYC) USSR	N. Pacific	April-July	Salmon (Seine)	Haaga Nenth	Dutch Harbor 4/26-27 Kodiak 6/29
NOVOKOTOVSK	(UGZG) USSR	N. Pacific	4/28-5/15	Salmon (Trawl)	Leopold	Astoria April 4/5
RUBEZJNOYE	( ) USSR	Aleutians Kuriles	6/1-7/20	Marine Mammals	Merrick Baker	Dutch Harbor 6/4, 7/20
OSHORO MARU	(JDVA) JAPAN	N. Pacific B. Sea	6/3 -8/11	Gill net, Longline	Meyers Rogers	Dutch Harbor 6/26-30 Vanc., B.C. 7/21-26
*ETSUZAN MARU	( ) JAPAN	N. Pacific	6/1 -7/22	Longline	None	None
SHIN RIASU MARU	(7JHC) JAPAN	N. Pacific	6/1 -7/22	Gill net Longline	Davis	None
HOKUHO MARU	(JDXL) JAPAN	N. Pacific	6/6 -7/28	Gill net, Longline	None	None
HOKUSHIN MARU	(7LQV) JAPAN	N. Pacific	6/1-30	Gill net	None	None
*KAIUN MARU	(JRWN) JAPAN	N. Pacific	6/2 -7/11	Gill net	None	None
*HOKKO MARU	( ) JAPAN	N. Pacific	6/20-7/14	Gill net Longline	None	None
*WAKATAKE MARU	(JDVE) JAPAN	N. Pacific B. Sea	6/1 -7/23	Gill net, Longline	None	None
*HOKUSEI MARU	( ) JAPAN	N. Pacific	7/11-8/11	Gill net	None	None
*HOYO MARU #12	(JMKI) JAPAN	N. Pacific	8/2 -9/29	Harpoon	None	None
*RIASU MARU #1	( ) JAPAN	N. Pacific	6/5-7/19	Longine	None	None
IWAKI MARU	(8LXK) JAPAN	N. Pacific	6/1-7/10	Gill net	None	None
KAIYO MARU	(JNVF) JAPAN	Aleutian Basin	12/88-3/20/89	Trawl	Traynor Benjamin Nunnallee	Dutch Harbor 2/8-11 3/5-8
*PROFESOR SIEDLECKI	( ) POLAND	Aleutian Basin	Mar.-May	Trawl	TBN	Seattle 9/16 ?

*Cooperative research proposed, status pending.

Appendix I

Alaska Department of Fish and Game

Figure and Tables

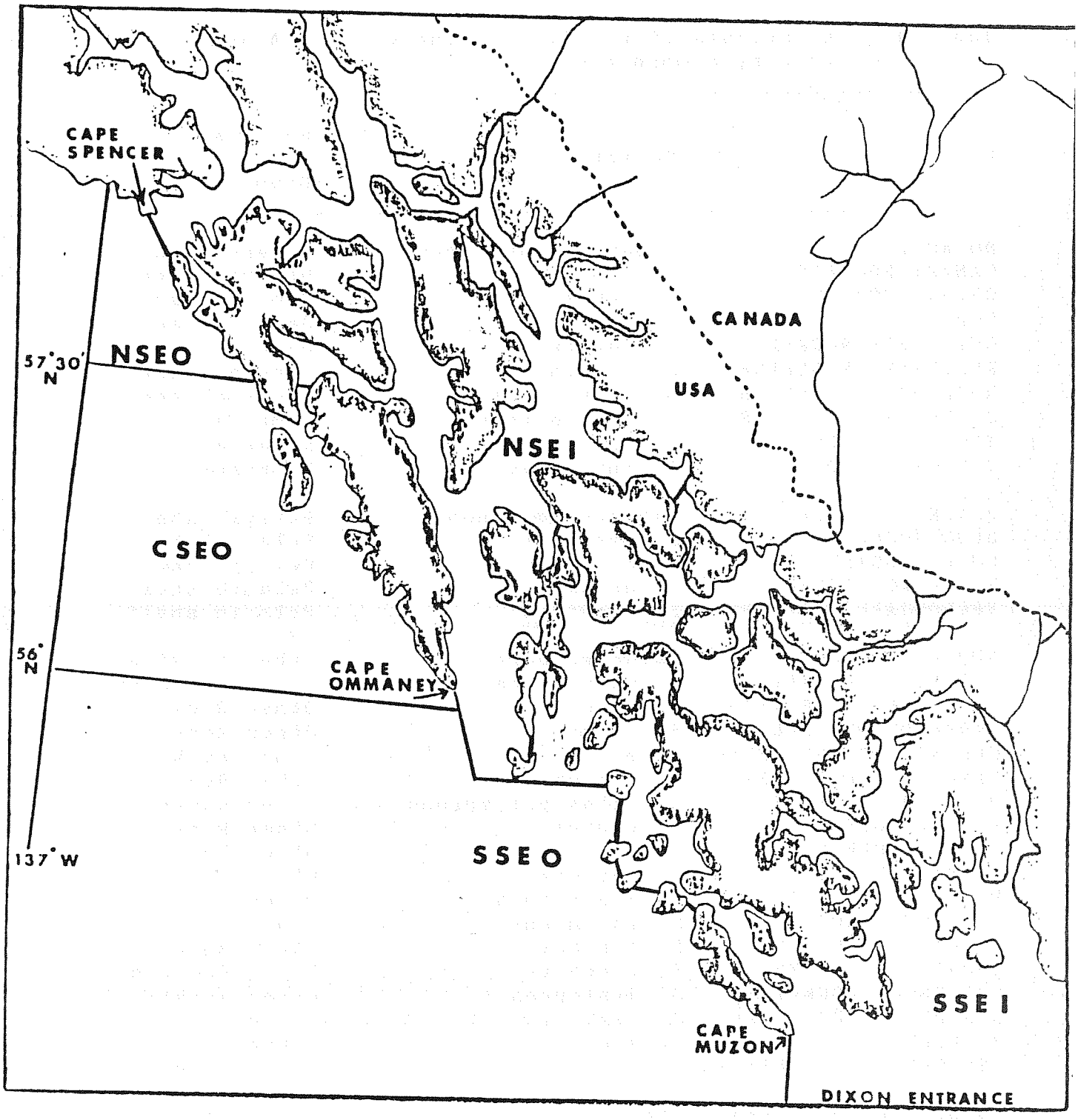

Figure 1. The Southeast Alaska coastline showing Alaska Department of Fish and Game groundfish management areas.

Table 1. Assemblages of rockfish in the Gulf of Alaska in alphabetical order by common name.

Common Name	Scientific Name	Rockfish Management Group
BOCACCIO	Sebastes paucispinus	Demersal shelf
CANARY ROCKFISH	S. pinniger	Demersal shelf
CHINA ROCKFISH	S. nebulosus	Demersal shelf
COPPER ROCKFISH	S. caurinus	Demersal shelf
QUILLBACK ROCKFISH	S. maliger	Demersal shelf
REDSTRIPE ROCKFISH	S. proriger	Demersal shelf
ROSETHORN ROCKFISH	S. helvomaculatus	Demersal shelf
SILVERGRAY ROCKFISH	S. brevispinus	Demersal shelf
TIGER ROCKFISH	S. nigrocinctus	Demersal shelf
YELLOWEYE ROCKFISH	S. ruberrimus	Demersal shelf
BLACK ROCKFISH	Sebastes melanops	Pelagic shelf
BLUE ROCKFISH	S. mystinus	Pelagic shelf
DUSKY ROCKFISH	S. ciliatus	Pelagic shelf
WIDOW ROCKFISH	S. entomelas	Pelagic shelf
YELLOWTAIL ROCKFISH	S. flavidus	Pelagic shelf
AURORA ROCKFISH	Sebastes aurora	Other Rockfish
BLACKGILL ROCKFISH	S. melanostomus	Other Rockfish
CHILIPEPPER ROCKFISH	S. goodei	Other Rockfish
DARKBLOTCHED ROCKFISH	S. crameri	Other Rockfish
GREENSTRIPE ROCKFISH	S. elongatus	Other Rockfish
HARLEQUIN ROCKFISH	S. varigatus	Other Rockfish
NORTHERN ROCKFISH	Sebastes polyspinus	Other Rockfish
PACIFIC OCEAN PERCH	S. alutus	Other Rockfish
PYGMY ROCKFISH	S. wilsoni	Other Rockfish
REDBANDED ROCKFISH	S. babcocki	Other Rockfish
ROUGHEYE ROCKFISH	S. aleutianus	Other Rockfish
SHARPCHIN ROCKFISH	S. zacentrus	Other Rockfish
SHORTBELLY ROCKFISH	S. jordani	Other Rockfish
SHORTRAKER ROCKFISH	S. borealis	Other Rockfish
SPLITNOSE ROCKFISH	S. diploproa	Other Rockfish
STRIPETAIL ROCKFISH	S. saxicola	Other Rockfish
VERMILLION ROCKFISH	S. miniatus	Other Rockfish
YELLOWMOUTH ROCKFISH	S. reedi	Other Rockfish
LONGSPINE THORNYHEAD	Sebastolobus altivelis	Thornyheads
SHORTSPINE THORNYHEAD	S. alaskanus	Thornyheads

Table 2. Total groundfish landings (t) from State of Alaska managed fisheries in Southeast Alaska in 1988 by major species group and area.

Species	All of Southeast	Dixon Entrance District (DED)	Percent of total from DED
Sablefish	1,448	94	6.5%
Demersal shelf rockfish	927	58	6.3%
Flatfish	376	0	0%
Pacific cod	186	1	0.2%
Lingcod	177	6	3.4%
Total	3,114	159	5.0%

US-CANADA DOMESTIC GEAR GROUP REPORT: COMM. GROUNDFISH LANDED CATCH (MTONS) FOR 1988 FOR ALL AREAS

SPECIES	JIG	LONGLINE	OTH HK&LN	POLE(COM)	OTH GEARS	NETS	POTS	TROLLS	TRAWLS	SH-TRAWLS
UNSP. ROUNDFISH		TR	0.1				TR	TR	.	
___ALL ROUNDFISH	73.6	41606.7	673.3	571.4	2209.7	1650.6	8479.3	101.4	741406.3	100.7
SPINY DOGFISH	0.3	5549.0	24.9	_	_	227.0	0.7	0.3	3099.1	TR
UNSPECIFIED SQUID									205.7	
OTHER GROUNDFISH	1.0	217.1	9.4	8.5	9.4	1030.4	16.3	0.5	507.6	0.7
UNSP. GROUNDFISH		65.1	6.9	1.3	30.2	39.4	67.1	0.1	1162.9	TR
___MISC. GROUNDFISH	1.3	5831.2	41.2	9.8	39.6	1296.8	84.1	0.9	4975.3	0.7
ALL GROUNDFISH	274.9	52852.4	1600.4	2416.5	5425.8	5477.4	8715.8	229.3	902952.6	1317.2
CALIFORNIA HALIBUT		TR		40.3	69.7	251.7	0.9	0.4	158.5	
PACIFIC HALIBUT	6.8	2492.5	0.2	_	_	0.1		7.6		_
PINK SHRIMP	_	_	_	_	_	_	1.0	_	4781.1	27236.9

DATA SOURCE FOR AREAS CHARLOTTE, GEORGIA STRAIT, AND THE CANADIAN PORTION OF VANCOUVER IS DFO,CANADA
TR => LANDED CATCH LESS THAN 0.05 METRIC TONS, OR METRIC TONS PER UNIT OF EFFORT LESS THAN 0.005

US-CANADA DOMESTIC GEAR GROUP REPORT: COMM. GROUNDFISH LANDED CATCH (MTONS) FOR 1988 FOR ALL AREAS

SPECIES	ALL GEARS
ARROWTOOTH FLOUNDER	3781.3
ALASKA PLAICE	2.1
DOVER SOLE	20386.4
ENGLISH SOLE	3473.3
GREENLAND TURBOT	6586.6
PETRALE SOLE	2963.7
REX SOLE	2085.3
ROCK SOLE	25091.6
STARRY FLOUNDER	1118.4
YELLOWFIN SOLE	7391.0
OTHER FLATFISH	1931.5
UNSP. FLATFISH	4495.4
___ALL FLATFISH	79306.7
BLACK ROCKFISH	376.5
BOCACCIO	2618.6
CANARY ROCKFISH	3635.4
CHILIPEPPER	1194.0
DARKBLOTCHED ROCKFIS	1470.8
DUSKY ROCKFISH	14.1
OTHER DEMERSAL RKFSH	5.6
QUILLBACK ROCKFISH	165.3
REDBANDED ROCKFISH	8.1
REDSTRIPE ROCKFISH	2151.3
ROSETHORN ROCKFISH	3.1
ROUGHEYE ROCKFISH	1181.8
SHARPCHIN ROCKFISH	611.2
SHORTRAKER ROCKFISH	107.2
SILVERGREY ROCKFISH	3745.8
SPLITNOSE ROCKFISH	364.1
UNSP. DEMERSAL RKFSH	431.4
UNSP. PELAGIC RKFSH	625.3
UNSP. SLOPE RKFSH	12640.7
YELLOWEYE ROCKFISH	830.1
YELLOWMOUTH ROCKFISH	1734.6
YELLOWTAIL ROCKFISH	9524.5
OTHER ROCKFISH	3472.2
PACIFIC OCEAN PERCH	8638.6
UNSP. POP GROUP	2541.7
SHORTBELLY ROCKFISH	0.4
THORNYHEADS	8580.0
WIDOW ROCKFISH	12966.0
UNSP. ROCKFISH	13163.6
___ALL ROCKFISH	92801.8
ATKA MACKEREL	2014.3
LINGCOD	6754.6
PACIFIC COD	133297.8
PACIFIC WHITING	19329.4
SABLEFISH	54278.1
WALLEYE POLLOCK	579852.4
OTHER ROUNDFISH	1346.2

US-CANADA DOMESTIC GEAR GROUP REPORT: COMM. GROUNDFISH LANDED CATCH (MTONS) FOR 1988 FOR ALL AREAS

SPECIES	ALL GEARS
UNSP. ROUNDFISH	0.1
___ALL ROUNDFISH	796872.9
SPINY DOGFISH	8901.4
UNSPECIFIED SQUID	205.7
OTHER GROUNDFISH	1800.8
UNSP. GROUNDFISH	1372.9
___MISC. GROUNDFISH	12280.9
ALL GROUNDFISH	981262.3
CALIFORNIA HALIBUT	521.6
PACIFIC HALIBUT	2507.2
PINK SHRIMP	32018.9

DATA SOURCE FOR AREAS CHARLOTTE, GEORGIA STRAIT, AND THE CANADIAN PORTION OF VANCOUVER IS DFO,CANADA
TR => LANDED CATCH LESS THAN 0.05 METRIC TONS, OR METRIC TONS PER UNIT OF EFFORT LESS THAN 0.005

US-CANADA DOMESTIC GEAR GROUP REPORT: COMM. GROUNDFISH LANDED CATCH (MTONS) FOR 1988 FOR ALEUTIAN AREA

SPECIES	LONGLINE	POTS	TRAWLS	ALL GEARS
ARROWTOOTH FLOUNDER	16.0		6.4	22.4
GREENLAND TURBOT	633.2	0.2	122.2	755.6
ROCK SOLE			26.1	26.1
YELLOWFIN SOLE			0.5	0.5
UNSP. FLATFISH			2.5	2.5
___ALL FLATFISH	649.2	0.2	157.7	807.1
ROUGHEYE ROCKFISH	1.7			1.7
SHORTRAKER ROCKFISH	13.2		TR	13.2
UNSP. DEMERSAL RKFSH	25.2		2.2	27.3
UNSP. SLOPE RKFSH	7.5			7.5
YELLOWEYE ROCKFISH	6.3			6.3
PACIFIC OCEAN PERCH	0.1			0.1
UNSP. POP GROUP	5.8	0.2	653.0	659.0
THORNYHEADS	138.9	0.2	7.7	146.8
UNSP. ROCKFISH	14.7	0.8	1.2	16.8
___ALL ROCKFISH	213.5	1.2	664.1	878.8
ATKA MACKEREL			1907.5	1907.5
PACIFIC COD	137.1	30.1	1698.3	1865.5
SABLEFISH	2806.4	242.9	344.5	3393.7
WALLEYE POLLOCK	0.2		1892.0	1892.2
___ALL ROUNDFISH	2943.7	272.9	5842.2	9058.9
UNSP. GROUNDFISH	22.7	0.1	12.6	35.4
___MISC. GROUNDFISH	22.7	0.1	12.6	35.4
ALL GROUNDFISH	3829.1	274.4	6676.7	10780.1

DATA SOURCE FOR AREAS CHARLOTTE, GEORGIA STRAIT, AND THE CANADIAN PORTION OF VANCOUVER IS DFO,CANADA
TR => LANDED CATCH LESS THAN 0.05 METRIC TONS, OR METRIC TONS PER UNIT OF EFFORT LESS THAN 0.005

US-CANADA DOMESTIC GEAR GROUP REPORT: COMM. GROUNDFISH LANDED CATCH (MTONS) FOR 1988 FOR AREA 2 AREA

SPECIES	LONGLINE	TRAWLS	ALL GEARS
ARROWTOOTH FLOUNDER	3.7	7.0	10.7
GREENLAND TURBOT	1067.0	687.1	1754.1
ROCK SOLE	-	7.7	7.7
UNSP. FLATFISH	-	16.8	16.8
___ALL FLATFISH	1070.7	718.5	1789.2
UNSP. DEMERSAL RKFSH	1.7	-	1.7
UNSP. SLOPE RKFSH	-	6.2	6.2
YELLOWEYE ROCKFISH	0.6	-	0.6
UNSP. POP GROUP	4.1	386.9	391.0
THORNYHEADS	1.1	4.1	5.2
UNSP. ROCKFISH	4.3	28.1	32.4
___ALL ROCKFISH	11.8	425.2	437.1
PACIFIC COD	1419.3	1234.2	2653.6
SABLEFISH	331.3	48.6	379.9
WALLEYE POLLOCK	0.1	42067.0	42067.1
___ALL ROUNDFISH	1750.8	43349.8	45100.6
UNSP. GROUNDFISH	0.2	1.7	1.9
___MISC. GROUNDFISH	0.2	1.7	1.9
ALL GROUNDFISH	2833.5	44495.3	47328.8

DATA SOURCE FOR AREAS CHARLOTTE, GEORGIA STRAIT, AND THE CANADIAN PORTION OF VANCOUVER IS DFO,CANADA
TR => LANDED CATCH LESS THAN 0.05 METRIC TONS, OR METRIC TONS PER UNIT OF EFFORT LESS THAN 0.005

US-CANADA DOMESTIC GEAR GROUP REPORT: COMM. GROUNDFISH LANDED CATCH (MTONS) FOR 1988 FOR AREA 1 AREA

SPECIES	LONGLINE	POTS	TRAWLS	ALL GEARS
ARROWTOOTH FLOUNDER			402.9	402.9
GREENLAND TURBOT	306.3	-	3589.6	3895.8
REX SOLE		-	2.3	2.3
ROCK SOLE	1.0	-	22140.1	22141.1
YELLOWFIN SOLE		-	7356.5	7356.5
UNSP. FLATFISH	1.2	-	2079.9	2081.1
___ALL FLATFISH	308.4	-	35571.1	35879.5
ROUGHEYE ROCKFISH	0.1			0.1
UNSP. DEMERSAL RKFSH	7.1	-	15.8	22.9
UNSP. PELAGIC RKFSH		-	9.5	9.5
UNSP. SLOPE RKFSH	-	-	5.3	5.3
YELLOWEYE ROCKFISH	1.6	-		1.6
PACIFIC OCEAN PERCH		-	11.6	11.6
UNSP. POP GROUP	5.0	-	1049.3	1054.3
THORNYHEADS	8.6	0.1	166.3	175.0
UNSP. ROCKFISH	6.7	0.4	35.7	42.8
___ALL ROCKFISH	29.1	0.5	1293.5	1323.1
ATKA MACKEREL			39.0	39.0
PACIFIC COD	1007.9	299.3	81336.3	82643.5
SABLEFISH	624.1	62.3	2114.8	2801.2
WALLEYE POLLOCK	53.2		478556.5	478609.7
___ALL ROUNDFISH	1685.2	361.5	562046.7	564093.5
UNSPECIFIED SQUID		-	195.7	195.7
UNSP. GROUNDFISH	0.3	-	303.3	303.6
___MISC. GROUNDFISH	0.3	-	498.9	499.3
ALL GROUNDFISH	2023.1	362.0	599410.2	601795.3

DATA SOURCE FOR AREAS CHARLOTTE, GEORGIA STRAIT, AND THE CANADIAN PORTION OF VANCOUVER IS DFO,CANADA
TR => LANDED CATCH LESS THAN 0.05 METRIC TONS, OR METRIC TONS PER UNIT OF EFFORT LESS THAN 0.005

US-CANADA DOMESTIC GEAR GROUP REPORT: COMM. GROUNDFISH LANDED CATCH (MTONS) FOR 1988 FOR SHUMAGIN AREA

SPECIES	LONGLINE	OTH GEARS	NETS	POTS	TRAWLS	ALL GEARS
ARROWTOOTH FLOUNDER	0.4	-	-	-	3.7	4.1
GREENLAND TURBOT	70.4	-	-	-	10.9	81.2
REX SOLE		-	-	-	0.1	0.1
ROCK SOLE	TR	-	-	-	6.7	6.7
OTHER FLATFISH	-	-	-	-	0.3	0.3
UNSP. FLATFISH	70.8	-	-	-	160.7	160.7
___ALL FLATFISH		-	-	-	182.4	253.2
ROUGHEYE ROCKFISH	2.5	-	-	-	-	2.5
SHORTRAKER ROCKFISH	6.0	-	-	-	-	6.0
UNSP. DEMERSAL RKFSH	23.6	-	-	1.0	136.3	160.9
UNSP. PELAGIC RKFSH	0.8	-	-	-	197.9	198.8
UNSP. SLOPE RKFSH	15.0	-	-	-	2246.4	2261.4
YELLOWEYE ROCKFISH	5.3	-	-	-	-	5.3
PACIFIC OCEAN PERCH	2.7	-	-	-	-	2.7
UNSP. POP GROUP		-	-	-	224.0	224.0
THORNYHEADS	52.3	-	-	0.1	705.9	758.3
UNSP. ROCKFISH	11.3	-	-		11.8	23.1
___ALL ROCKFISH	119.4	-	-	1.1	3522.4	3642.9
ATKA MACKEREL					67.8	67.8
PACIFIC COD	1321.7	8.3	0.7	725.5	3505.6	5561.8
SABLEFISH	2290.0			555.5	630.8	3476.3
WALLEYE POLLOCK	TR	-	-		4572.4	4572.5
___ALL ROUNDFISH	3611.7	8.3	0.7	1281.0	8776.7	13678.4
UNSPECIFIED SQUID					4.6	4.6
OTHER GROUNDFISH	TR	-	-	-		TR
UNSP. GROUNDFISH		-	-	0.6	5.0	5.6
___MISC. GROUNDFISH	TR	-	-	0.6	9.6	10.2
ALL GROUNDFISH	3801.9	8.3	0.7	1282.7	12491.2	17584.7
PACIFIC HALIBUT	70.3	-	-	-	-	70.3

DATA SOURCE FOR AREAS CHARLOTTE, GEORGIA STRAIT, AND THE CANADIAN PORTION OF VANCOUVER IS DFO,CANADA
TR => LANDED CATCH LESS THAN 0.05 METRIC TONS, OR METRIC TONS PER UNIT OF EFFORT LESS THAN 0.005

US-CANADA DOMESTIC GEAR GROUP REPORT: COMM. GROUNDFISH LANDED CATCH (MTONS) FOR 1988 FOR CHIRIKOF AREA

SPECIES	LONGLINE	POTS	TRAWLS	ALL GEARS
ARROWTOOTH FLOUNDER		-	18.7	18.7
GREENLAND TURBOT	3.6	-	20.0	23.6
REX SOLE	-	-	0.4	0.4
ROCK SOLE	-	-	118.6	118.6
UNSP. FLATFISH		-	928.8	928.8
___ALL FLATFISH	3.6	-	1086.5	1090.1
BLACK ROCKFISH		-	0.7	0.7
ROUGHEYE ROCKFISH	1.3	-	-	1.3
SHORTRAKER ROCKFISH	4.5	-	-	4.5
UNSP. DEMERSAL RKFSH	8.7	-	63.2	71.9
UNSP. PELAGIC RKFSH		-	122.9	122.9
UNSP. SLOPE RKFSH	1.6	-	2314.0	2315.6
YELLOWEYE ROCKFISH	1.3	-	0.6	1.9
PACIFIC OCEAN PERCH	3.4	-	0.1	3.5
UNSP. POP GROUP	2.2	-	50.1	52.3
THORNYHEADS	52.6	-	391.1	443.7
UNSP. ROCKFISH	2.8	-		2.8
___ALL ROCKFISH	78.3	-	2942.6	3021.0
PACIFIC COD	24.2	2.3	2076.4	2102.8
SABLEFISH	2642.7	-	954.0	3596.6
WALLEYE POLLOCK		-	986.0	986.0
___ALL ROUNDFISH	2666.8	2.3	4016.3	6685.5
UNSPECIFIED SQUID		-	0.4	0.4
OTHER GROUNDFISH	0.4	-	-	0.4
UNSP. GROUNDFISH	0.1	-	-	0.1
___MISC. GROUNDFISH	0.5	-	0.4	0.9
ALL GROUNDFISH	2749.3	2.3	8045.9	10797.5
PACIFIC HALIBUT	292.7	-	-	292.7

DATA SOURCE FOR AREAS CHARLOTTE, GEORGIA STRAIT, AND THE CANADIAN PORTION OF VANCOUVER IS DFO,CANADA
TR => LANDED CATCH LESS THAN 0.05 METRIC TONS, OR METRIC TONS PER UNIT OF EFFORT LESS THAN 0.005

US-CANADA DOMESTIC GEAR GROUP REPORT: COMM. GROUNDFISH LANDED CATCH (MTONS) FOR 1988 FOR SHELIKOF89 AREA

SPECIES	LONGLINE	OTH GEARS	NETS	POTS	TRAWLS	ALL GEARS
ARROWTOOTH FLOUNDER	0.7	-	-	-	23.2	23.9
ALASKA PLAICE	-	-	-	-	0.6	0.6
DOVER SOLE	-	-	-	-	2.4	2.4
ENGLISH SOLE	-	-	-	-	0.6	0.6
REX SOLE	-	-	-	-	3.0	3.0
ROCK SOLE	-	-	-	-	20.8	20.8
STARRY FLOUNDER	-	-	-	-	5.7	5.7
YELLOWFIN SOLE	-	-	-	-	14.6	14.6
OTHER FLATFISH	-	-	-	-	20.3	20.3
UNSP. FLATFISH	-	-	-	-	264.9	264.9
___ALL FLATFISH	0.7	-	-	-	356.0	356.8
BLACK ROCKFISH	0.1	-	-	-	0.9	1.0
DUSKY ROCKFISH	-	-	-	-	0.6	0.6
YELLOWEYE ROCKFISH	TR	-	-	-	TR	TR
PACIFIC OCEAN PERCH	-	-	-	-	3.1	3.1
THORNYHEADS	-	-	-	-	0.9	0.9
UNSP. ROCKFISH	0.2	-	-	-	2.5	2.7
___ALL ROCKFISH	0.4	-	-	-	8.0	8.3
PACIFIC COD	704.2	2.5	4.8	230.9	2386.9	3329.3
SABLEFISH	23.9	-	-	-	7.1	31.0
WALLEYE POLLOCK	1.9	-	0.7	TR	11817.9	11820.5
___ALL ROUNDFISH	730.0	2.5	5.5	230.9	14211.9	15180.9
UNSP. GROUNDFISH	-	-	-	-	186.4	186.4
___MISC. GROUNDFISH	-	-	-	-	186.4	186.4
ALL GROUNDFISH	731.1	2.5	5.5	230.9	14762.3	15732.3

DATA SOURCE FOR AREAS CHARLOTTE, GEORGIA STRAIT, AND THE CANADIAN PORTION OF VANCOUVER IS DFO,CANADA
TR => LANDED CATCH LESS THAN 0.05 METRIC TONS, OR METRIC TONS PER UNIT OF EFFORT LESS THAN 0.005

US-CANADA DOMESTIC GEAR GROUP REPORT: COMM. GROUNDFISH LANDED CATCH (MTONS) FOR 1988 FOR KODIAK AREA

SPECIES	LONGLINE	OTH HK&LN	OTH GEARS	NETS	POTS	TRAWLS	ALL GEARS
ARROWTOOTH FLOUNDER	0.5	-	-	0.4	-	859.7	860.5
ALASKA PLAICE	-	-	-	-	-	1.5	1.5
DOVER SOLE	-	-	-	-	-	926.3	926.3
ENGLISH SOLE	-	-	-	-	-	6.4	6.4
GREENLAND TURBOT	0.3	-	-	-	-	75.0	75.3
REX SOLE	-	-	-	-	-	664.9	664.9
ROCK SOLE	0.1	-	-	0.5	-	659.5	660.0
STARRY FLOUNDER	TR	-	-	-	TR	87.9	87.9
YELLOWFIN SOLE	-	-	-	TR	-	0.9	0.9
OTHER FLATFISH	1.2	-	-	0.3	-	700.9	702.3
UNSP. FLATFISH	1.9	-	-	TR	-	946.4	948.4
___ALL FLATFISH	4.0	-	-	1.2	TR	4929.2	4934.4
BLACK ROCKFISH	39.3	31.6	-	TR	-	41.5	112.4
DARKBLOTCHED ROCKFIS	0.1	-	-	-	-	-	0.1
DUSKY ROCKFISH	-	-	-	-	-	11.1	11.1
QUILLBACK ROCKFISH	0.1	-	-	-	-	-	0.1
REDBANDED ROCKFISH	0.1	-	-	-	-	-	0.1
ROUGHEYE ROCKFISH	12.5	-	-	-	-	-	12.5
SHORTRAKER ROCKFISH	18.0	-	-	-	-	-	18.0
UNSP. DEMERSAL RKFSH	-	-	-	-	-	145.1	145.1
UNSP. PELAGIC RKFSH	-	-	-	-	-	211.9	211.9
UNSP. SLOPE RKFSH	7.8	-	-	-	-	3581.6	3589.4
YELLOWEYE ROCKFISH	38.0	0.9	-	-	-	45.1	84.0
PACIFIC OCEAN PERCH	7.8	-	-	TR	-	275.2	283.0
UNSP. POP GROUP	3.2	-	-	-	-	48.0	51.2
THORNYHEADS	115.5	-	-	-	-	516.1	631.6
UNSP. ROCKFISH	74.0	10.6	-	TR	-	149.0	233.6
___ALL ROCKFISH	316.3	43.1	-	0.1	-	5024.6	5384.0
LINGCOD	8.1	3.0					11.0
PACIFIC COD	1621.0	2.3	0.8	38.2	463.6	17482.7	19608.6
SABLEFISH	8002.7	-	-			1719.4	9722.1
WALLEYE POLLOCK	83.6	-	-	1.6	0.2	38257.4	38342.8
___ALL ROUNDFISH	9715.4	5.3	0.8	39.8	463.9	57459.5	67684.6
UNSPECIFIED SQUID		-	-	-	-	0.3	0.3
OTHER GROUNDFISH	0.5	-	-	-	-	3.4	4.0
UNSP. GROUNDFISH	6.3	-	-	-	-	86.8	93.1
___MISC. GROUNDFISH	6.8	-	-	-	-	90.5	97.3
ALL GROUNDFISH	10042.4	48.4	0.8	41.1	463.9	67503.8	78100.3
PACIFIC HALIBUT	336.4	-	-	-	-	-	336.4

DATA SOURCE FOR AREAS CHARLOTTE, GEORGIA STRAIT, AND THE CANADIAN PORTION OF VANCOUVER IS DFO,CANADA
TR => LANDED CATCH LESS THAN 0.05 METRIC TONS, OR METRIC TONS PER UNIT OF EFFORT LESS THAN 0.005

US-CANADA DOMESTIC GEAR GROUP REPORT: COMM. GROUNDFISH LANDED CATCH (MTONS) FOR 1988 FOR YAKUTAT AREA

SPECIES	LONGLINE	OTH HK&LN	TRAWLS	ALL GEARS
ARROWTOOTH FLOUNDER			9.6	9.6
REX SOLE			0.1	0.1
ROCK SOLE			4.1	4.1
UNSP. FLATFISH			31.2	31.2
___ALL FLATFISH			45.0	45.0
BLACK ROCKFISH	13.8	24.5	0.4	38.7
BOCACCIO	TR			TR
CANARY ROCKFISH	TR			TR
DARKBLOTCHED ROCKFIS	TR			TR
DUSKY ROCKFISH	TR			TR
OTHER DEMERSAL RKFSH	0.1			0.1
QUILLBACK ROCKFISH	1.0			1.0
REDBANDED ROCKFISH	2.7			2.7
ROSETHORN ROCKFISH	0.3			0.3
ROUGHEYE ROCKFISH	20.7			20.7
SHORTRAKER ROCKFISH	6.2			6.2
SILVERGREY ROCKFISH	0.3			0.3
UNSP. DEMERSAL RKFSH			TR	TR
UNSP. PELAGIC RKFSH			82.1	82.1
UNSP. SLOPE RKFSH	1.3		4019.1	4020.4
YELLOWEYE ROCKFISH	50.3	0.9	4.9	56.1
PACIFIC OCEAN PERCH	0.3		2.3	2.6
UNSP. POP GROUP			109.0	109.0
THORNYHEADS	46.7		509.8	556.5
UNSP. ROCKFISH	19.6	0.1		19.7
___ALL ROCKFISH	163.4	25.6	4727.5	4916.5
LINGCOD	24.3	8.5		32.7
PACIFIC COD	13.7		25.8	39.5
SABLEFISH	5987.9		767.1	6755.0
WALLEYE POLLOCK	0.1		0.5	0.6
___ALL ROUNDFISH	6026.0	8.5	793.4	6827.8
UNSPECIFIED SQUID			3.0	3.0
OTHER GROUNDFISH	9.5			9.5
UNSP. GROUNDFISH	TR			TR
___MISC. GROUNDFISH	9.5		3.0	12.5
ALL GROUNDFISH	6198.9	34.1	5568.9	11801.9
PACIFIC HALIBUT	485.8			485.8

DATA SOURCE FOR AREAS CHARLOTTE, GEORGIA STRAIT, AND THE CANADIAN PORTION OF VANCOUVER IS DFO,CANADA
TR => LANDED CATCH LESS THAN 0.05 METRIC TONS, OR METRIC TONS PER UNIT OF EFFORT LESS THAN 0.005

US-CANADA DOMESTIC GEAR GROUP REPORT: COMM. GROUNDFISH LANDED CATCH (MTONS) FOR 1988 FOR S. EASTERN AREA

SPECIES	LONGLINE	OTH HK&LN	NETS	POTS	TRAWLS	ALL GEARS
ARROWTOOTH FLOUNDER	0.4	-	-	TR	TR	0.4
DOVER SOLE	-	-	-	-	TR	TR
ENGLISH SOLE	-	-	-	-	5.5	5.5
REX SOLE	0.1	-	-	-	0.1	0.1
ROCK SOLE	-	-	-	-	11.8	11.8
STARRY FLOUNDER	-	-	-	-	267.8	267.8
YELLOWFIN SOLE	-	-	-	-	18.0	18.0
OTHER FLATFISH	-	-	-	-	12.4	12.4
UNSP. FLATFISH	TR	-	-	-	0.3	0.3
___ALL FLATFISH	0.5	-	-	TR	315.8	316.3
BLACK ROCKFISH	18.4	7.8	-	TR	-	26.2
BOCACCIO	TR	-	-	-	-	TR
CANARY ROCKFISH	4.1	TR	-	-	-	4.1
DUSKY ROCKFISH	1.9	0.4	-	-	-	2.3
OTHER DEMERSAL RKFSH	5.4	TR	-	-	-	5.4
QUILLBACK ROCKFISH	161.2	1.9	-	TR	-	163.1
REDBANDED ROCKFISH	5.4	-	-	-	-	5.4
REDSTRIPE ROCKFISH	TR	-	-	-	-	TR
ROSETHORN ROCKFISH	2.8	TR	-	-	-	2.8
ROUGHEYE ROCKFISH	46.3	0.1	-	-	-	46.4
SHORTRAKER ROCKFISH	0.8	TR	-	-	-	0.9
SILVERGREY ROCKFISH	1.4	TR	-	-	-	1.4
UNSP. DEMERSAL RKFSH	-	-	-	-	1.5	1.5
UNSP. PELAGIC RKFSH	-	-	-	-	0.2	0.2
UNSP. SLOPE RKFSH	TR	-	-	-	434.9	434.9
YELLOWEYE ROCKFISH	530.6	5.3	0.1	0.4	-	536.3
YELLOWMOUTH ROCKFISH	0.2	-	-	-	-	0.2
YELLOWTAIL ROCKFISH	TR	-	-	-	-	TR
PACIFIC OCEAN PERCH	0.1	-	-	-	-	0.1
UNSP. POP GROUP		-	-	-	0.9	0.9
THORNYHEADS	59.8	TR	-	TR	56.8	116.7
WIDOW ROCKFISH	TR	-	-	-	-	TR
UNSP. ROCKFISH	38.2	0.8	-	TR	TR	39.0
___ALL ROCKFISH	876.6	16.4	0.1	0.4	494.4	1387.9
LINGCOD	140.3	113.1	-	TR	TR	253.4
PACIFIC COD	244.9	0.6	-	0.3	8.0	253.8
SABLEFISH	7320.8	-	-	8.5	62.1	7391.4
WALLEYE POLLOCK		-	-	-	1.6	1.6
UNSP. ROUNDFISH	TR	-	-	-	-	TR
___ALL ROUNDFISH	7706.0	113.7	-	8.8	71.7	7900.2
SPINY DOGFISH	18.1	0.1	-	0.6	TR	18.8
OTHER GROUNDFISH	143.5	2.6	-	TR	-	146.1
UNSP. GROUNDFISH	5.2	1.0	1.6	-	0.6	8.4
___MISC. GROUNDFISH	166.8	3.7	1.6	0.6	0.6	173.4
ALL GROUNDFISH	8750.0	133.8	1.7	9.9	882.4	9777.8
PACIFIC HALIBUT	174.1	-	-	-	-	174.1

DATA SOURCE FOR AREAS CHARLOTTE, GEORGIA STRAIT, AND THE CANADIAN PORTION OF VANCOUVER IS DFO,CANADA
TR => LANDED CATCH LESS THAN 0.05 METRIC TONS, OR METRIC TONS PER UNIT OF EFFORT LESS THAN 0.005

US-CANADA DOMESTIC GEAR GROUP REPORT: COMM. GROUNDFISH LANDED CATCH (MTONS) FOR 1988 FOR UNK-ALASKA AREA

SPECIES	LONGLINE	OTH HK&LN	ALL GEARS
GREENLAND TURBOT	1.0	_	1.0
___ALL FLATFISH	1.0	_	1.0
BLACK ROCKFISH	0.2	_	0.2
CANARY ROCKFISH	TR	_	TR
OTHER DEMERSAL RKFSH	0.1	_	0.1
QUILLBACK ROCKFISH	1.1	TR	1.1
REDBANDED ROCKFISH	TR	_	TR
ROSETHORN ROCKFISH	TR	_	TR
ROUGHEYE ROCKFISH	1.1	_	1.1
YELLOWEYE ROCKFISH	2.8	TR	2.8
THORNYHEADS	1.3	_	1.3
UNSP. ROCKFISH	0.3	_	0.3
___ALL ROCKFISH	7.0	TR	7.0
LINGCOD	0.7	0.1	0.8
PACIFIC COD	3.4	_	3.4
SABLEFISH	17.7	_	17.7
___ALL ROUNDFISH	21.9	0.1	22.0
SPINY DOGFISH	0.2	_	0.2
OTHER GROUNDFISH	0.8	TR	0.8
UNSP. GROUNDFISH	0.1	_	0.1
___MISC. GROUNDFISH	1.1	TR	1.1
ALL GROUNDFISH	31.0	0.2	31.2
PACIFIC HALIBUT	144.8	_	144.8

DATA SOURCE FOR AREAS CHARLOTTE, GEORGIA STRAIT, AND THE CANADIAN PORTION OF VANCOUVER IS DFO,CANADA
TR => LANDED CATCH LESS THAN 0.05 METRIC TONS, OR METRIC TONS PER UNIT OF EFFORT LESS THAN 0.005

US-CANADA DOMESTIC GEAR GROUP REPORT: COMM. GROUNDFISH LANDED CATCH (MTONS) FOR 1988 FOR CHARLOTTE AREA

SPECIES	LONGLINE	OTH HK&LN	POTS	TRAWLS	ALL GEARS
ARROWTOOTH FLOUNDER	-	-	-	305.2	305.2
DOVER SOLE	-	-	-	763.6	763.6
ENGLISH SOLE	-	-	-	763.6	763.6
PETRALE SOLE	-	-	-	330.7	330.7
REX SOLE	-	-	-	134.6	134.6
ROCK SOLE	-	-	-	1798.1	1798.1
STARRY FLOUNDER	-	-	-	50.5	50.5
YELLOWFIN SOLE	-	-	-	0.4	0.4
OTHER FLATFISH	-	-	-	22.2	22.2
UNSP. FLATFISH	0.5	-	-	-	0.5
___ALL FLATFISH	0.5	-	-	4168.9	4169.4
BLACK ROCKFISH	-	-	-	5.5	5.5
BOCACCIO	-	-	-	724.8	724.8
CANARY ROCKFISH	-	-	-	756.3	756.3
DARKBLOTCHED ROCKFIS	-	-	-	44.6	44.6
REDSTRIPE ROCKFISH	-	-	-	1146.0	1146.0
ROUGHEYE ROCKFISH	-	-	3.4	1020.5	1023.9
SHARPCHIN ROCKFISH	-	-	-	203.8	203.8
SHORTRAKER ROCKFISH	-	-	-	50.8	50.8
SILVERGREY ROCKFISH	-	-	-	2310.7	2310.7
SPLITNOSE ROCKFISH	-	-	-	103.2	103.2
YELLOWEYE ROCKFISH	-	-	-	13.8	13.8
YELLOWMOUTH ROCKFISH	-	-	-	1132.1	1132.1
YELLOWTAIL ROCKFISH	-	-	-	2441.6	2441.6
OTHER ROCKFISH	571.0	148.7	0.7	394.8	1115.3
PACIFIC OCEAN PERCH	0.1	-	-	6157.7	6157.7
THORNYHEADS	-	-	5.4	107.3	112.7
WIDOW ROCKFISH	-	-	-	1403.5	1403.5
UNSP. ROCKFISH					
___ALL ROCKFISH	571.1	148.7	9.4	18016.9	18746.1
LINGCOD	303.4	190.1	-	1660.2	2153.6
PACIFIC COD	3.0	0.3	-	8064.8	8068.2
SABLEFISH	244.6	2.1	2728.4	180.9	3156.0
WALLEYE POLLOCK				13.6	13.6
___ALL ROUNDFISH	551.0	192.5	2728.4	9919.4	13391.4
SPINY DOGFISH	624.1	1.6	0.1	87.5	713.2
UNSPECIFIED SQUID	-	-	-	0.2	0.2
OTHER GROUNDFISH				227.4	227.4
UNSP. GROUNDFISH	9.8	1.0	-	314.9	325.7
___MISC. GROUNDFISH	633.8	2.7	0.1	630.1	1266.6
ALL GROUNDFISH	1756.5	343.9	2737.9	32735.2	37573.5
PACIFIC HALIBUT	-	-	-	-	-

DATA SOURCE FOR AREAS CHARLOTTE, GEORGIA STRAIT, AND THE CANADIAN PORTION OF VANCOUVER IS DFO,CANADA
TR => LANDED CATCH LESS THAN 0.05 METRIC TONS, OR METRIC TONS PER UNIT OF EFFORT LESS THAN 0.005

US-CANADA DOMESTIC GEAR GROUP REPORT: COMM. GROUNDFISH LANDED CATCH (MTONS) FOR 1988 FOR GRGIA STRT AREA

SPECIES	LONGLINE	OTH HK&LN	TRAWLS	SH-TRAWLS	ALL GEARS
ARROWTOOTH FLOUNDER	-	-	4.6	-	4.6
DOVER SOLE	-	-	10.6	-	10.6
ENGLISH SOLE	-	-	32.6	-	32.6
PETRALE SOLE	-	-	3.5	-	3.5
REX SOLE	-	-	0.1	-	0.1
ROCK SOLE	-	-	6.1	-	6.1
STARRY FLOUNDER	-	-	54.4	-	54.4
OTHER FLATFISH			66.8		66.8
UNSP. FLATFISH	0.2	2.5		0.1	2.8
___ALL FLATFISH	0.2	2.5	178.6	0.1	181.4
CANARY ROCKFISH	-	-	TR	-	TR
SILVERGREY ROCKFISH	-	-	0.2	-	0.2
YELLOWEYE ROCKFISH	-	-	TR	-	TR
YELLOWTAIL ROCKFISH			6.7		6.7
OTHER ROCKFISH	139.1	357.0	2.7	0.1	498.9
PACIFIC OCEAN PERCH	0.6	-	-	-	0.6
UNSP. ROCKFISH					
___ALL ROCKFISH	139.7	357.0	9.7	0.1	506.5
LINGCOD	6.6	76.3	13.0	-	96.0
PACIFIC COD	7.4	3.8	1222.8	0.1	1234.1
PACIFIC WHITING			5460.5	-	5460.5
SABLEFISH	4.7	TR	1.4	-	6.1
WALLEYE POLLOCK			1094.8	-	1094.8
___ALL ROUNDFISH	18.7	80.2	7792.4	0.1	7891.4
SPINY DOGFISH	823.6	1.7	220.6	-	1046.0
OTHER GROUNDFISH			17.3	-	17.3
UNSP. GROUNDFISH	10.8	1.2	0.1	TR	12.1
___MISC. GROUNDFISH	834.4	2.9	238.0	TR	1075.3
ALL GROUNDFISH	993.0	442.5	8218.8	0.3	9654.6
PACIFIC HALIBUT	-	-	-	-	-

DATA SOURCE FOR AREAS CHARLOTTE, GEORGIA STRAIT, AND THE CANADIAN PORTION OF VANCOUVER IS DFO,CANADA
TR => LANDED CATCH LESS THAN 0.05 METRIC TONS, OR METRIC TONS PER UNIT OF EFFORT LESS THAN 0.005

US-CANADA DOMESTIC GEAR GROUP REPORT: COMM. GROUNDFISH LANDED CATCH (MTONS) FOR 1988 FOR PUGET SND AREA

SPECIES	JIG	LONGLINE	NETS	POTS	TROLLS	TRAWLS	ALL GEARS
ARROWTOOTH FLOUNDER	TR	0.1	TR	-	-	2.6	2.7
DOVER SOLE		0.2		-		22.1	22.3
ENGLISH SOLE	TR	TR	0.1	-	TR	453.5	453.7
PETRALE SOLE				-	-	0.1	0.1
ROCK SOLE	TR	TR	0.7	-	-	25.0	25.7
STARRY FLOUNDER	-	-	TR	-	-	253.8	253.8
OTHER FLATFISH			0.1	-		42.3	42.4
ALL FLATFISH	0.1	0.3	0.9	-	TR	799.5	800.7
YELLOWTAIL ROCKFISH	29.3	0.1		-	TR	1.0	30.4
THORNYHEADS	-	TR	-	-	-		TR
WIDOW ROCKFISH						0.1	0.1
UNSP. ROCKFISH	11.0	16.0	2.9	TR	1.6	24.5	56.2
ALL ROCKFISH	40.3	16.1	2.9	TR	1.7	25.6	86.6
LINGCOD	5.2	4.2	0.7		1.9	30.2	42.2
PACIFIC COD	0.6	23.0	3.7	TR	1.7	514.2	543.1
PACIFIC WHITING						263.5	263.5
SABLEFISH	TR	30.1	TR	-	TR	2.1	32.3
WALLEYE POLLOCK	0.1	0.1		-		9.8	10.0
OTHER ROUNDFISH			41.5	-	TR		41.5
ALL ROUNDFISH	5.8	57.4	45.9	TR	3.6	819.8	932.5
SPINY DOGFISH	0.3	802.8	226.8	-	TR	371.3	1401.2
UNSPECIFIED SQUID						1.3	1.3
OTHER GROUNDFISH	0.2	43.0	924.1	11.1	0.1	174.9	1153.3
MISC. GROUNDFISH	0.5	845.7	1150.9	11.1	0.2	547.4	2555.8
ALL GROUNDFISH	46.7	919.6	1200.6	11.1	5.4	2192.3	4375.7
PACIFIC HALIBUT	1.2	5.9	0.1		1.4		8.5
PINK SHRIMP	-	-	-	1.0	-	10.3	11.3

DATA SOURCE FOR AREAS CHARLOTTE, GEORGIA STRAIT, AND THE CANADIAN PORTION OF VANCOUVER IS DFO,CANADA
TR => LANDED CATCH LESS THAN 0.05 METRIC TONS, OR METRIC TONS PER UNIT OF EFFORT LESS THAN 0.005

US-CANADA DOMESTIC GEAR GROUP REPORT: COMM. GROUNDFISH LANDED CATCH (MTONS) FOR 1988 FOR VANCOUVER AREA

SPECIES	JIG	LONGLINE	NETS	TROLLS	TRAWLS	SH-TRAWLS	ALL GEARS
ARROWTOOTH FLOUNDER	TR	8.3	_	TR	1124.4	_	1132.8
DOVER SOLE	_	2.2	_	_	1765.7	0.3	1768.2
ENGLISH SOLE	_	TR	TR	_	369.8	_	369.8
PETRALE SOLE	TR	0.1	_	_	643.1	_	643.2
REX SOLE	_	_	_	_	21.8	_	21.8
ROCK SOLE	TR	_	_	_	160.1	_	160.1
STARRY FLOUNDER	TR	_	_	TR	75.7	_	75.7
OTHER FLATFISH	TR	_	TR	TR	69.7	_	69.7
___ALL FLATFISH	TR	10.8	TR	TR	4230.1	0.3	4241.3
BOCACCIO	_	_	_	_	636.6	_	636.6
CANARY ROCKFISH	_	_	_	_	1219.5	_	1219.5
DARKBLOTCHED ROCKFIS	_	_	_	_	61.1	_	61.1
REDSTRIPE ROCKFISH	_	_	_	_	679.4	_	679.4
SHARPCHIN ROCKFISH	_	_	_	_	42.0	_	42.0
SILVERGREY ROCKFISH	_	_	_	_	1209.4	_	1209.4
SPLITNOSE ROCKFISH	_	_	_	_	56.0	_	56.0
YELLOWEYE ROCKFISH	_	_	_	_	3.1	_	3.1
YELLOWMOUTH ROCKFISH	_	_	_	_	187.4	_	187.4
YELLOWTAIL ROCKFISH	25.9	0.3	TR	2.2	3591.5	_	3619.9
OTHER ROCKFISH	_	294.0	_	_	197.2	1.0	585.2
PACIFIC OCEAN PERCH	_	0.1	_	_	927.2	_	927.4
THORNYHEADS	_	7.8	TR	_	75.8	_	83.7
WIDOW ROCKFISH	TR	TR	_	0.2	975.2	_	975.3
UNSP. ROCKFISH	107.9	112.3	0.3	21.2	1091.5	17.9	1351.1
___ALL ROCKFISH	133.8	414.6	0.3	23.5	11031.7	18.9	11716.5
LINGCOD	57.4	169.1	0.2	74.9	1161.1	5.6	1670.3
PACIFIC COD	10.3	25.1	TR	1.0	3242.5	1.5	3280.5
SABLEFISH	TR	2263.8	_	TR	850.1	0.1	4243.3
WALLEYE POLLOCK	_	_	_	_	24.2	_	24.2
OTHER ROUNDFISH	_	_	30.8	_	_	_	30.8
___ALL ROUNDFISH	67.7	2458.0	31.0	75.9	5871.3	7.2	9842.6
SPINY DOGFISH	_	2094.8	0.2	0.1	1793.4	_	3909.9
UNSPECIFIED SQUID	_	_	_	_	0.2	_	0.2
OTHER GROUNDFISH	0.8	10.2	0.7	0.1	48.4	_	60.2
UNSP. GROUNDFISH	_	8.8	_	_	116.1	_	192.9
___MISC. GROUNDFISH	0.8	2113.8	0.9	0.2	1958.1	_	4163.2
ALL GROUNDFISH	202.3	4997.2	32.3	99.7	23091.2	26.4	29963.6
PACIFIC HALIBUT	5.6	85.1	_	4.9	_	_	95.6
PINK SHRIMP	_	_	_	_	_	412.3	412.3

DATA SOURCE FOR AREAS CHARLOTTE, GEORGIA STRAIT, AND THE CANADIAN PORTION OF VANCOUVER IS DFO,CANADA
TR => LANDED CATCH LESS THAN 0.05 METRIC TONS, OR METRIC TONS PER UNIT OF EFFORT LESS THAN 0.005

US-CANADA DOMESTIC GEAR GROUP REPORT: COMM. GROUNDFISH LANDED CATCH (MTONS) FOR 1988 FOR COLUMBIA AREA

SPECIES	JIG	LONGLINE	OTH HK&LN	NETS	POTS	TROLLS	TRAWLS	SH-TRAWLS	ALL GEARS
ARROWTOOTH FLOUNDER	-	1.8	TR	-		TR	830.4	3.9	836.1
DOVER SOLE	-	0.2	-	-	0.2		7977.9	41.0	8019.4
ENGLISH SOLE	-		-	-	-	TR	708.4	3.0	711.3
PETRALE SOLE	-	0.1	-	-	-	TR	1118.5	1.0	1119.6
REX SOLE	-	-	-	-	-	-	387.4	0.2	387.6
ROCK SOLE	-	-	-	-	-	-	7.3	0.3	7.6
STARRY FLOUNDER	-		TR	-	TR	TR	207.8	0.3	208.1
OTHER FLATFISH	-	TR		-	TR	TR	312.9	0.9	313.9
___ALL FLATFISH	-	2.2	TR	-	0.2	TR	11550.7	50.5	11603.7
BLACK ROCKFISH	-	-	-	-	-	-	137.3		137.3
BOCACCIO	-	-	-	-	-	-	189.1	0.5	189.6
CANARY ROCKFISH	-	-	104.7	-	-	-	1295.3	79.2	1479.2
DARKBLOTCHED ROCKFIS	-	0.7	-	-	-	-	697.9	0.4	699.0
REDSTRIPE ROCKFISH	-	-	-	-	-	-	323.1	0.1	323.1
SHARPCHIN ROCKFISH	-	-	-	-	-	-	266.8		266.8
SILVERGREY ROCKFISH	-	-	-	-	-	-	217.7	0.2	218.0
SPLITNOSE ROCKFISH	-	-	-	-	-	-	145.2	-	145.2
YELLOWEYE ROCKFISH	-	-	-	-	-	-	106.5	-	106.5
YELLOWMOUTH ROCKFISH	-	-	-	-	-	-	411.0	-	411.0
YELLOWTAIL ROCKFISH	0.1	2.7	3.1	-	-	0.2	3114.4	143.5	3263.8
OTHER ROCKFISH	-	46.1	-	-		-	368.4	0.5	415.0
PACIFIC OCEAN PERCH	-	0.1	-	-	0.3	-	697.3	0.8	698.5
SHORTBELLY ROCKFISH	-		-	-	-	-	0.4		0.4
THORNYHEADS	-	12.3	-	-	0.1	-	703.4	0.3	716.1
WIDOW ROCKFISH	-	0.2	0.7	-		0.1	8629.7	1.3	8631.9
UNSP. ROCKFISH	25.6	141.6	74.1	-	3.3	94.5	1357.8	910.5	2607.5
___ALL ROCKFISH	25.7	203.9	182.6	-	3.6	94.7	18661.2	1137.3	20309.0
LINGCOD	0.1	17.0	56.3	-	0.6	19.3	1071.5	33.3	1198.2
PACIFIC COD	TR	3.4	-	-	-	0.1	1831.0	25.0	1859.6
PACIFIC WHITING	-			-		0.8	334.0		334.8
SABLEFISH	-	1542.4	1.2	-	1380.7	TR	2236.7	32.0	5193.0
WALLEYE POLLOCK	-	-		-			0.2	-	0.2
UNSP. ROUNDFISH	-	-	0.1	-	TR	TR			0.1
___ALL ROUNDFISH	0.1	1562.8	57.6	-	1381.3	20.3	5473.4	90.3	8585.8
SPINY DOGFISH	-	9.3	TR		TR	0.2	0.4	TR	10.0
OTHER GROUNDFISH	-	3.3	5.8	39.6	4.4	0.2	6.8	0.6	60.8
UNSP. GROUNDFISH	-	TR	0.5		TR	0.1	2.6		3.3
___MISC. GROUNDFISH	-	12.6	6.3	39.6	4.4	0.5	9.9	0.6	74.0
ALL GROUNDFISH	25.8	1781.6	246.6	39.6	1389.6	115.6	35695.2	1278.7	40572.6
PACIFIC HALIBUT	-	143.2	0.2	-	-	1.4	-		144.8
PINK SHRIMP	-	-	-	-	-	-	-	25517.8	25517.8

DATA SOURCE FOR AREAS CHARLOTTE, GEORGIA STRAIT, AND THE CANADIAN PORTION OF VANCOUVER IS DFO,CANADA
TR => LANDED CATCH LESS THAN 0.05 METRIC TONS, OR METRIC TONS PER UNIT OF EFFORT LESS THAN 0.005

US-CANADA DOMESTIC GEAR GROUP REPORT: COMM. GROUNDFISH LANDED CATCH (MTONS) FOR 1988 FOR COL RIVER AREA

SPECIES	NETS	ALL GEARS
STARRY FLOUNDER	13.6	13.6
OTHER FLATFISH	TR	TR
___ALL FLATFISH	13.6	13.6
UNSP. ROCKFISH	0.1	0.1
___ALL ROCKFISH	0.1	0.1
OTHER ROUNDFISH	1273.8	1273.8
___ALL ROUNDFISH	1273.8	1273.8
UNSP. GROUNDFISH	26.7	26.7
___MISC. GROUNDFISH	26.7	26.7
ALL GROUNDFISH	1314.3	1314.3

DATA SOURCE FOR AREAS CHARLOTTE, GEORGIA STRAIT, AND THE CANADIAN PORTION OF VANCOUVER IS DFO,CANADA
TR => LANDED CATCH LESS THAN 0.05 METRIC TONS, OR METRIC TONS PER UNIT OF EFFORT LESS THAN 0.005

US-CANADA DOMESTIC GEAR GROUP REPORT: COMM. GROUNDFISH LANDED CATCH (MTONS) FOR 1988 FOR EUREKA AREA

SPECIES	JIG	LONGLINE	OTH HK&LN	POLE(COM)	OTH GEARS	NETS	POTS	TROLLS	TRAWLS	SH-TRAWLS
ARROWTOOTH FLOUNDER	-	TR	-	-	6.6	-	-	-	34.8	0.1
DOVER SOLE	-	-	-	4.3	609.3	-	32.1	-	3931.1	2.5
ENGLISH SOLE	-	-	-	1.4	63.0	-	1.5	-	333.8	TR
PETRALE SOLE	-	-	-	0.6	39.3	-	2.8	-	279.7	TR
REX SOLE	-	-	-	0.4	42.8	-	1.0	-	281.3	-
ROCK SOLE	-	-	-	-	0.2	-	-	-	TR	-
STARRY FLOUNDER	-	-	-	TR	5.3	-	TR	-	16.7	TR
OTHER FLATFISH	-	-	-	0.1	35.2	-	0.9	-	176.6	-
UNSP. FLATFISH	-	-	-	TR	0.2	-	0.1	-	6.4	-
___ALL FLATFISH	-	TR	-	6.7	802.0	-	38.4	-	5060.3	2.7
BLACK ROCKFISH	-	-	-	-	-	-	-	-	54.1	-
BOCACCIO	-	-	-	0.1	-	-	-	-	89.9	TR
CANARY ROCKFISH	-	-	-	-	-	-	-	-	90.9	TR
CHILIPEPPER	-	-	-	TR	-	-	-	-	81.3	TR
DARKBLOTCHED ROCKFIS	-	-	-	-	-	-	-	-	564.9	TR
REDSTRIPE ROCKFISH	-	-	-	-	-	-	-	-	2.8	-
SHARPCHIN ROCKFISH	-	-	-	-	-	-	-	-	98.6	TR
SILVERGREY ROCKFISH	-	-	-	-	-	-	-	-	3.2	-
SPLITNOSE ROCKFISH	-	-	-	-	-	-	-	-	34.4	TR
YELLOWEYE ROCKFISH	-	-	-	-	-	-	-	-	2.7	-
YELLOWMOUTH ROCKFISH	-	-	-	-	-	-	-	-	4.0	-
YELLOWTAIL ROCKFISH	-	TR	-	-	-	-	-	-	84.0	0.1
OTHER ROCKFISH	-	-	-	0.1	TR	-	-	-	194.0	TR
PACIFIC OCEAN PERCH	-	-	-	-	-	-	-	-	31.1	TR
THORNYHEADS	-	-	-	1.1	430.1	-	35.8	-	3384.3	TR
WIDOW ROCKFISH	-	-	-	0.4	583.4	-	0.3	-	730.6	TR
UNSP. ROCKFISH	0.1	23.8	20.2	335.9	193.9	-	11.9	0.8	107.3	5.8
___ALL ROCKFISH	0.1	23.9	20.2	337.4	1207.5	-	48.0	0.8	5558.0	6.0
LINGCOD	-	11.4	12.1	81.9	22.1	-	0.3	0.3	178.4	3.1
PACIFIC COD	-	-	-	-	0.8	-	-	-	13.7	-
PACIFIC WHITING	-	-	-	0.1	1833.2	-	-	-	4693.7	0.1
SABLEFISH	-	4.6	-	52.6	135.3	-	80.7	-	1266.2	-
OTHER ROUNDFISH	-	-	TR	-	-	-	-	-	-	-
___ALL ROUNDFISH	-	16.0	12.1	134.6	1991.4	-	81.0	0.3	6152.1	3.2
OTHER GROUNDFISH	-	0.8	0.9	2.1	0.3	TR	TR	0.1	20.5	TR
UNSP. GROUNDFISH	-	TR	1.4	TR	21.7	-	0.1	-	102.5	-
___MISC. GROUNDFISH	-	0.8	2.4	2.2	22.0	TR	0.1	0.1	123.0	TR
ALL GROUNDFISH	0.1	40.7	34.7	480.9	4022.9	TR	167.5	1.1	16893.4	11.8
CALIFORNIA HALIBUT	-	TR	-	-	0.1	-	-	-	0.6	-
PINK SHRIMP	-	-	-	-	-	-	-	-	4583.0	1306.8

DATA SOURCE FOR AREAS CHARLOTTE, GEORGIA STRAIT, AND THE CANADIAN PORTION OF VANCOUVER IS DFO,CANADA
TR => LANDED CATCH LESS THAN 0.05 METRIC TONS, OR METRIC TONS PER UNIT OF EFFORT LESS THAN 0.005

US-CANADA DOMESTIC GEAR GROUP REPORT: COMM. GROUNDFISH LANDED CATCH (MTONS) FOR 1988 FOR EUREKA AREA

SPECIES	ALL GEARS
ARROWTOOTH FLOUNDER	41.4
DOVER SOLE	4579.3
ENGLISH SOLE	399.7
PETRALE SOLE	322.5
REX SOLE	325.4
ROCK SOLE	0.2
STARRY FLOUNDER	22.0
OTHER FLATFISH	212.8
UNSP. FLATFISH	6.7
___ALL FLATFISH	5910.1
BLACK ROCKFISH	54.1
BOCACCIO	89.9
CANARY ROCKFISH	90.9
CHILIPEPPER	81.3
DARKBLOTCHED ROCKFIS	564.9
REDSTRIPE ROCKFISH	2.8
SHARPCHIN ROCKFISH	98.6
SILVERGREY ROCKFISH	3.2
SPLITNOSE ROCKFISH	34.4
YELLOWEYE ROCKFISH	2.7
YELLOWMOUTH ROCKFISH	4.0
YELLOWTAIL ROCKFISH	84.1
OTHER ROCKFISH	194.1
PACIFIC OCEAN PERCH	31.1
THORNYHEADS	3851.3
WIDOW ROCKFISH	1314.7
UNSP. ROCKFISH	699.9
___ALL ROCKFISH	7201.9
LINGCOD	309.6
PACIFIC COD	14.5
PACIFIC WHITING	6527.0
SABLEFISH	1539.6
OTHER ROUNDFISH	TR
___ALL ROUNDFISH	8390.7
OTHER GROUNDFISH	24.9
UNSP. GROUNDFISH	125.8
___MISC. GROUNDFISH	150.6
ALL GROUNDFISH	21653.3
CALIFORNIA HALIBUT	0.7
PINK SHRIMP	5889.8

DATA SOURCE FOR AREAS CHARLOTTE, GEORGIA STRAIT, AND THE CANADIAN PORTION OF VANCOUVER IS DFO,CANADA
TR => LANDED CATCH LESS THAN 0.05 METRIC TONS, OR METRIC TONS PER UNIT OF EFFORT LESS THAN 0.005

US-CANADA DOMESTIC GEAR GROUP REPORT: COMM. GROUNDFISH LANDED CATCH (MTONS) FOR 1988 FOR MONTEREY AREA

SPECIES	LONGLINE	POLE(COM)	OTH GEARS	NETS	POTS	TROLLS	TRAWLS	ALL GEARS
ARROWTOOTH FLOUNDER			1.9				0.1	2.0
DOVER SOLE		8.2	141.3	17.0	6.3		4066.5	4239.4
ENGLISH SOLE		8.9	107.1	14.3	2.5	TR	542.1	674.9
PETRALE SOLE		4.9	85.6	13.3	2.0		399.9	505.7
REX SOLE		1.5	36.0	3.3	1.1		496.4	538.3
ROCK SOLE		TR	1.6	TR			3.4	5.0
STARRY FLOUNDER		0.3	18.9	0.4	0.1		56.6	76.3
OTHER FLATFISH		22.0	119.2	47.0	2.9	0.1	265.9	457.0
UNSP. FLATFISH		2.6	1.8	17.0	0.3	TR	10.2	32.0
___ALL FLATFISH		48.3	513.5	112.4	15.3	0.1	5841.1	6530.7
BOCACCIO		11.4					941.7	953.1
CANARY ROCKFISH		TR					80.9	80.9
CHILIPEPPER		2.1					1093.5	1095.6
DARKBLOTCHED ROCKFIS							94.9	94.9
SILVERGREY ROCKFISH							2.4	2.4
SPLITNOSE ROCKFISH							25.1	25.1
YELLOWEYE ROCKFISH		TR					8.5	8.5
YELLOWTAIL ROCKFISH							75.1	75.1
OTHER ROCKFISH		59.3			2.1		485.6	547.0
THORNYHEADS		8.4	21.2	0.3	2.8		946.8	979.4
WIDOW ROCKFISH		7.2	37.9	120.5	0.1		468.2	634.0
UNSP. ROCKFISH	11.4	934.5	496.1	1717.5	22.2	6.1	921.1	4109.0
___ALL ROCKFISH	11.4	1023.0	555.2	1838.3	27.2	6.1	5143.7	8604.9
LINGCOD	0.1	99.5	65.3	182.6	2.8	0.8	302.8	653.8
PACIFIC COD		TR	TR				0.3	0.3
PACIFIC WHITING		0.1	0.5	0.2	8.6		4.5	13.8
SABLEFISH	2.6	332.0	139.3	56.8	524.5	0.5	1372.1	2427.7
___ALL ROUNDFISH	2.8	431.5	205.1	239.6	535.8	1.3	1679.7	3095.7
OTHER GROUNDFISH		3.4	1.9	9.9	0.3		5.0	20.6
UNSP. GROUNDFISH		1.2	7.4	6.8	0.1		30.2	45.8
___MISC. GROUNDFISH		4.6	9.3	16.7	0.5		35.3	66.4
ALL GROUNDFISH	14.2	1507.4	1283.0	2206.9	578.8	7.5	12699.8	18297.7
CALIFORNIA HALIBUT		31.6	28.4	45.1	0.3	0.4	142.7	248.6
PINK SHRIMP							155.9	155.9

DATA SOURCE FOR AREAS CHARLOTTE, GEORGIA STRAIT, AND THE CANADIAN PORTION OF VANCOUVER IS DFO,CANADA
TR => LANDED CATCH LESS THAN 0.05 METRIC TONS, OR METRIC TONS PER UNIT OF EFFORT LESS THAN 0.005

US-CANADA DOMESTIC GEAR GROUP REPORT: COMM. GROUNDFISH LANDED CATCH (MTONS) FOR 1988 FOR CONCEPTION AREA

SPECIES	LONGLINE	POLE(COM)	OTH GEARS	NETS	POTS	TRAWLS	ALL GEARS
DOVER SOLE	-	-	TR	-	-	4.2	4.2
ENGLISH SOLE	-	-	2.9	3.0	-	18.8	24.6
PETRALE SOLE	-	TR	0.6	2.3	TR	4.2	7.2
REX SOLE	-	-	-	TR	-	2.3	2.4
ROCK SOLE	-	-	-	0.1	-	-	0.1
STARRY FLOUNDER	-	-	-	TR	-	-	TR
OTHER FLATFISH	-	6.3	1.3	2.9	0.3	0.2	11.0
UNSP. FLATFISH	-	0.5	4.2	5.6	TR	8.2	18.5
___ALL FLATFISH	-	6.7	9.0	14.0	0.3	37.9	68.0
BOCACCIO	-	15.7	-	-	-	8.8	24.6
CANARY ROCKFISH	-	3.3	-	-	-	1.2	4.5
CHILIPEPPER	-	7.6	-	-	-	9.5	17.1
DARKBLOTCHED ROCKFIS	-	-	-	-	-	6.1	6.1
SILVERGREY ROCKFISH	-	-	-	-	-	0.1	0.1
SPLITNOSE ROCKFISH	-	TR	-	-	-	0.3	0.4
YELLOWEYE ROCKFISH	-	0.3	-	-	-	-	0.3
YELLOWTAIL ROCKFISH	-	2.4	-	-	-	0.4	2.9
OTHER ROCKFISH	-	96.7	1.6	3.6	0.5	9.4	111.8
PACIFIC OCEAN PERCH	-	TR	-	-	-	-	TR
THORNYHEADS	-	-	TR	-	-	0.8	0.8
WIDOW ROCKFISH	-	-	-	TR	-	6.4	6.4
UNSP. ROCKFISH	1.5	263.7	83.4	533.4	1.4	17.2	900.6
___ALL ROCKFISH	1.5	389.9	84.9	537.0	1.9	60.1	1075.5
LINGCOD	-	1.5	1.0	10.3	TR	3.2	16.0
PACIFIC WHITING	-	0.1	-	-	-	-	0.1
SABLEFISH	-	3.0	0.6	3.1	3.3	0.4	10.4
___ALL ROUNDFISH	-	4.6	1.6	13.4	3.3	3.6	26.5
OTHER GROUNDFISH	TR	2.7	7.1	49.3	0.1	0.3	59.5
UNSP. GROUNDFISH	0.7	TR	0.9	4.2	TR	0.1	5.9
___MISC. GROUNDFISH	0.7	2.7	8.0	53.5	0.1	0.4	65.4
ALL GROUNDFISH	2.3	404.0	103.5	618.0	5.7	102.1	1235.4
CALIFORNIA HALIBUT	-	8.6	41.0	204.0	0.6	15.1	269.3
PINK SHRIMP	-	-	-	-	-	18.3	18.3

DATA SOURCE FOR AREAS CHARLOTTE, GEORGIA STRAIT, AND THE CANADIAN PORTION OF VANCOUVER IS DFO,CANADA
TR => LANDED CATCH LESS THAN 0.05 METRIC TONS, OR METRIC TONS PER UNIT OF EFFORT LESS THAN 0.005

US-CANADA DOMESTIC GEAR GROUP REPORT: COMM. GROUNDFISH LANDED CATCH (MTONS) FOR 1988 FOR UNKN INPFC AREA

SPECIES	LONGLINE	POLE(COM)	OTH GEARS	NETS	POTS	TRAWLS	ALL GEARS
PETRALE SOLE	-	0.4	-	-	-	-	0.4
OTHER FLATFISH	-	0.1	-	-	-	-	0.1
UNSP. FLATFISH	-	TR	TR	0.2	TR	-	0.2
___ALL FLATFISH	-	0.5	TR	0.2	TR	-	0.7
BOCACCIO	-	TR	-	-	-	TR	TR
CANARY ROCKFISH	-	TR	-	-	-	TR	TR
CHILIPEPPER	-	-	-	-	-	TR	TR
DARKBLOTCHED ROCKFIS	-	-	-	-	-	0.1	0.1
SHARPCHIN ROCKFISH	-	-	-	-	-	TR	TR
SPLITNOSE ROCKFISH	-	-	-	-	-	TR	TR
YELLOWEYE ROCKFISH	-	TR	-	-	-	-	TR
YELLOWTAIL ROCKFISH	-	-	-	-	-	TR	TR
OTHER ROCKFISH	-	4.6	0.2	0.1	TR	TR	4.9
PACIFIC OCEAN PERCH	-	-	-	-	-	TR	TR
WIDOW ROCKFISH	-	TR	-	0.2	-	TR	0.2
UNSP. ROCKFISH	0.1	18.1	4.3	8.6	0.4	TR	31.5
___ALL ROCKFISH	0.1	22.8	4.4	8.9	0.5	0.1	36.8
LINGCOD	-	0.5	0.1	0.4	TR	-	1.0
PACIFIC WHITING	-	0.1	TR	0.1	-	-	0.2
SABLEFISH	-	TR		0.3		-	0.3
___ALL ROUNDFISH	-	0.6	0.1	0.9	TR	-	1.6
OTHER GROUNDFISH	-	0.3	0.2	6.7	0.4	TR	7.6
UNSP. GROUNDFISH	-	TR	0.1	0.1			0.2
___MISC. GROUNDFISH	-	0.3	0.2	6.8	0.4	TR	7.7
ALL GROUNDFISH	0.1	24.2	4.8	16.7	0.8	0.1	46.8
CALIFORNIA HALIBUT	-	0.1	0.3	2.6	TR		3.0
PINK SHRIMP	-	-	-	-	-	13.5	13.5

DATA SOURCE FOR AREAS CHARLOTTE, GEORGIA STRAIT, AND THE CANADIAN PORTION OF VANCOUVER IS DFO,CANADA
TR => LANDED CATCH LESS THAN 0.05 METRIC TONS, OR METRIC TONS PER UNIT OF EFFORT LESS THAN 0.005

Washington, Oregon, and California Groundfish Fisheries

by

Charles S. Korson

Prepared for the

THIRTIETH ANNUAL MEETING
of the
TECHNICAL SUBCOMMITTEE
of the
CANADA/UNITED STATES GROUNDFISH COMMITTEE

June 1989
Nanaimo, British Columbia

Southwest Region
National Marine Fisheries Service
300 South Ferry Street
Terminal Island, California 90731

Summary of the Fishery in 1988

The following tables present statistics on annual landings, exvessel values, and fishing vessel fleet size for the commercial groundfish fisheries off Washington, Oregon, and California from 1981 through 1988. During the 1988 fishing year shoreside landings decreased slightly to 92,300 mt. Joint venture Pacific whiting landings continued to increase, totaling a record high of 126,000 mt. As a result the total commercial landed catch rose 10 percent when compared to the 1987 fishing year. The exvessel value of the total commercial landed catch was $82.3 million or 1.5 percent lower than in 1987. The exvessel value of shoreside and joint venture landings decreased 6 and increased 26 percent, respectively.

Shoreside groundfish landings for individual species/species groups were somewhat lower in 1988, with lingcod, sablefish, widow rockfish, and all flatfish species declining in magnitude. Other species showed either higher (pacific cod and whiting) or stable (nominal or other rockfish) landings during 1988.

Landings declined generally for all gear groups except sablefish pot. The slight decline in groundfish trawl landings coincided with a significant increase in the size of the trawl fleet making at least one landing of groudfish in 1988. This is the second consecutive year for the groundfish trawl fleet to expand in size. The sablefish pot fleet remained constant, while the number of longline vessels landing groundfish fell for the third consecutive year. As in past years the status of the groundfish setnet fleet cannot be determined due to insufficient data.

Table 1 - Quantity and exvessel value of groundfish landings in Washington, Oregon, and California, including joint venture deliveries in waters off these states.

	1988	1987	% Change
Shoreside (mt)	91,636	92,329	-0.7
Joint Venture (mt)	125,903	106,095	+18.7
Total WOC Landings	217,539	198,424	+9.6
Shoreside Values $			
Current	67,646,000	71,881,000	-5.9
Real [1]	63,901,000	70,210,000	-8.9
Joint Venture Value			
Current	14,682,000	11,663,000	+25.9
Real	13,869,000	11,392,000	+21.7
Total WOC Groundfish Landed Value			
Current	82,328,000	83,544,000	-1.5
Real	77,771,000	81,602,000	-4.7

Source: Pacific Coast Fishery Information Network (PacFIN) Groundfish report series, preliminary data May 1989.
NMFS, Northwest Regional Office

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 GNP implicit price deflator, with a base year of 1986. The GNP deflators are 1.0238 in 1987 and 1.0586 in 1988.

Table 2 - Average annual exvessel prices paid for some commercially important groundfish species, 1979-1988.

	Sablefish		All Rockfish Combined		Widow Rockfish		Dover Sole		English Sole		Petrale Sole	
	Nominal	Real	Nominal	Real	Nominal	Real	Nominal	Real	Nominal	Real	Nominal	Real
1979	.356	.518	.199	.290	-	-	.215	.313	.286	.416	.447	.651
1980	.199	.265	.159	.212	-	-	.211	.281	.328	.437	.458	.611
1981	.215	.262	.169	.206	.135	.164	.223	.270	.297	.362	.512	.624
1982	.252	.289	.195	.224	.157	.180	.233	.267	.318	.365	.606	.696
1983	.237	.262	.223	.246	.192	.212	.224	.247	.322	.356	.682	.755
1984	.218	.232	.251	.267	.225	.240	.231	.246	.321	.343	.709	.755
1985	.334	.343	.281	.289	.250	.257	.240	.246	.333	.342	.736	.756
1986	.374	.374	.313	.313	.275	.275	.258	.258	.360	.360	.777	.777
1987	.472	.461	.350	.343	.322	.314	.305	.298	.402	.393	.816	.797
1988	.525	.496	.323	.305	.286	.270	.304	.287	.392	.370	.816	.771

Source: PacFIN, Groundfish Report Series, preliminary data, May 1989

NOTE: Real prices were adjusted for inflation using the GNP implicit price deflator, where 1986=1.00. All prices are weighted averages.

Table 3 - Commercial landings (mt) of individual groundfish species by state, 1987-1988.

Species	California		Oregon		Washington	
	1988	1987	1988	1987	1988	1987
Lingcod	873	929	999	719	756	1,023
Pacific Cod	5	66	1,022	659	2,305	1,549
Pacific Whiting	6,541	4,518	246	183	88	95
Sablefish	3,784	4,347	4,068	5,239	2,926	3,144
Pacific Ocean Perch	26	96	728	549	49	332
Widow Rockfish	1,847	2,274	5,445	6,300	3,555	4,113
Other Rockfish	14,345	14,309	8,898	7,856	5,686	4,582
Dover Sole	8,176	10,761	7,583	6,058	2,241	1,622
English Sole	1,062	1,322	577	595	454	564
Petrale Sole	785	824	894	855	452	526
Other Flatfish	1,709	1,772	1,369	1,572	1,553	2,403

Source: PacFIN, Groundfish Report Series, preliminary data, May 1989.

Table 4 - Washington, Oregon, and California shoreside commercial groundfish landings (metric tons) and exvessel value (thousands of dollars), 1979-1988.

Year	California		Oregon		Washington		Total Coast	
	mt	$	mt	$	mt	$	mt	$
1979	36,392	19,566	28,935	17,264	22,508	11,112	87,835	47,942
1980	36,862	16,551	28,515	11,425	22,514	9,119	87,891	37,095
1981	42,578	21,448	37,502	14,721	23,093	10,100	103,173	46,269
1982	52,608	27,795	41,023	20,445	25,368	11,405	118,999	59,645
1983	39,498	21,984	35,158	18,345	22,970	11,257	97,626	51,586
1984	40,570	22,914	28,209	15,234	21,080	10,474	89,859	48,622
1985	43,062	26,516	29,023	17,095	19,229	12,449	91,314	56,060
1986	41,246	28,522	24,931	16,813	16,081	10,905	82,298	56,240
1982-86 Average	43,397	25,546	31,669	17,586	20,946	11,298	96,019	54,431
1987	41,410	30,682	30,626	24,328	20,292	16,872	92,329	71,881
1988	39,420	28,213	31,845	23,748	20,371	15,686	91,635	67,646

Source: State Fishery Agencies
PacFIN, Groundfish Report Series; preliminary data, 1981-1988.

Table 5 - Landings and exvessel value of individual groundfish species landed in Washington, Oregon, and California, 1987-1988.[1]

Species	1988		1987		% Change	
	mt	$	mt	$	mt	$
Lingcod	2,629	2,122,100	2,586	2,152,800	+1.7	-1.4
Pacific Cod	3,332	1,945,700	2,273	1,644,800	+46.6	+18.3
Pacific Whiting	6,876	1,145,400	4,795	664,100	+43.4	+72.5
Sablefish	10,778	12,468,300	12,730	13,244,600	-15.3	-5.9
Pacific Ocean Perch	803	514,300	976	704,400	-17.7	-30.0
Widow Rockfish	10,847	6,827,500	12,687	9,002,300	-14.5	-24.1
Other Rockfish	28,928	21,550,800	26,747	21,477,900	+8.1	+0.3
Dover Sole	18,000	12,053,500	18,441	12,400,400	-2.4	-2.8
English Sole	2,093	1,809,800	2,481	2,198,500	-15.6	-17.7
Petrale Sole	2,131	3,835,200	2,205	3,965,400	-3.4	-3.3
Other Flatfish	4,631	2,968,000	5,747	3,763,400	-19.4	-21.1
TOTAL	91,048	67,240,600	91,659	71,218,600	-0.7	-5.6

Source: PacFIN, Groundfish Report Series, preliminary data, May 1989.

1/ Includes domestic landings from U.S. coastal waters off WOC, but not Puget Sound; A small amount of landings of miscellaneous groundfish species are not included in the totals.

Table 6 - Washington, Oregon, and California landings and exvessel value of sablefish by gear, 1987-1988.[1]

	Total WOC 1988				Total WOC 1987			
	mt		$		mt		$	
Ground. trawl	5,262.4	(48.8)	4,169.5	(33.4)	6,430.0	(50.0)	4,625.5	(34.9)
Pot	2,018.7	(18.7)	2,651.7	(21.3)	2,017.0	(15.8)	2,293.7	(17.3)
Longline/Setline[2]	3,124.2	(29.0)	5,362.9	(43.0)	4,152.0	(32.6)	6,231.6	(47.0)
Net	60.2	(0.6)	41.0	(0.3)	36.4	(0.3)	21.1	(0.2)
Other	312.3	(2.9)	243.2	(1.9)	94.7	(0.7)	72.7	(0.6)
Total	10,777.8		12,468.3		12,730.1		13,244.6	

Source: PacFIN, Groundfish Report Series, preliminary data, May 1989.

1/ Figures in parentheses are the percentages each gear group contributed to the total landed catch and exvessel value.

2/ Includes California commercial pole-and-line gear.

Table 9 - Number of shoreside vessels in Washington, Oregon, and California commercial groundfish fleets, 1981-1988.

Year	Otter Trawl	Pot/Trap[1]	Longline[1]
1981	408	66	191
1982	444	82	208
1983	436	59	185
1984	397	34	96[2]
1985	358	32	129[2]
1986	308	25	190[2]
1987	318	26	186[3]
1988	349	26	156[3]

Note: Data are preliminary, therefore, numbers are subject to change as updated information on fleets is received.

Source: State Fishery Agencies

1/ Vessels landing fish caught with this gear-type in two or more states are counted in each state for years 1982-83. These numbers therefore are an upper bound for the trus number of vessels using this gear-type.

2/ Represents number of longline vessels landing in Oregon and Washington, where double counting has been eliminated; California data unavailable for those years.

3/ Includes count for sablefish longline vessels landing in California and Oregon and all coastal longline vessels landing in Washington.

Table 10 - Washington, Oregon, and California groundfish shoreside trawl fleet characterisics, 1983-88.[1]

	1985	1986	1987	1988
Total Number Landing	358	308	318	349
Frequency by Size (length) Class				
< 30 feet	2	1	1	7
30-39	15	9	10	10
40-49	96	73	73	75
50-59	93	87	85	95
60-69	98	90	94	98
70-79	39	37	38	45
80-89	6	6	10	8
> 90	9	5	7	8
Missing	-	-	-	3
Vessel Characteristics:				
Average Length	57.6	58.2	58.8	58.4
Average Horsepower	309.7	310.8	318.9	317.8
Average Net Tonnage	45.8	47.6	49.7	48.8
Number Vessels Based in Each State				
California	157	126	121	130
Oregon	121	110	120	136
Washington	80	72	77	83
Vessels Landing in More Than One State	41	34	35	37

Source: State Fishery Agencies

1/ Preliminary data

Table 11 - West Coast commercial groundfish shoreside landings, exvessel values (thousands of dollars) and average vessel gross revenues for selected gear groups, 1981-88. (Numbers of vessels using gear types other than the three listed below are unknown).

Year	Groundfish Otter Trawl[1]			Pot/Trap			Longline		
	mt	$	$ per vessel	mt	$	$ per vessel	mt	$	$ per vessel
1981	90.800	37,900	92.9	3,956	2,080	31.5	3,997	3,700	11.3
1982	103,300	47,000	105.8	6,530	4,860	59.3	4,384	4,600	13.2
1983	81,700	40,600	93.1	5,423	3,600	61.0	2,191	2,100	7.2
1984	72,700	36,900	92.9	3,854	2,340	68.8	1,989	2,100	N/A
1985	75,400	41,300	115.4	3,703	3,154	98.6	4,603	5,300	N/A
1986	61,200	36,900	119.8	2,216	2,171	86.8	5,894	6,800	N/A
1987	74,700	52,200	164.1	2,076	2,347	90.3	6,952	9,500	51.1
1988	73,500	48,000	137.5	2,186	2,797	107.6	5,679	8,600	55.1

Source: PacFIN, Groundfish Report Series, preliminary data.

1/ Includes bottom, roller, and midwater trawls.

Table 12 - Landings and participation in Pacific Whiting joint-venture fisheries off of Washington, Oregon, and California, 1979-88.

Year	Landings (mt)	Estimated Dollar Value ($)	Number of Trawl Vessel	Average Revenue Per Vessel ($)
1979	9,054	1,162,000	11	105,600
1980	26,793	3,275,000	15	218,300
1981	43,758	6,345,000	21	302,100
1982	68,420	10,367,000	17	609,800
1983	72,140	10,217,000	19	537,700
1984	79,047	11,841,000	21	563,800
1985	31,567	3,751,000	17	220,700
1986	81,855	8,760,000	25	350,400
1987	106,095	11,663,000	30	388,800
1988	125,093	14,682,000	40	367,100

Source: PacFIN, Groundfish Report Series
NMFS, Northwest Regional Office