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

Appointed by

The Second Conference on Coordination of Fisheries

Regulations Between Canada and the United States

Twenty-Fifth Annual Meeting

June 20-22, 1984

Nanaimo, British Columbia

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I. CALL TO ORDER

Chairman Rigby (ADFG) called to order the 25th Annual Meeting of the Technical Subcommittee at 0900 h on June 20, 1984, in Nanaimo, B.C.

II. APPOINTMENT OF SECRETARY

Mr. S. J. Westrheim (DFO) was appointed to serve as Secretary.

III. INTRODUCTIONS

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

Canada -- Department of Fisheries and Oceans (DFO)

Fisheries Research Branch
- Mr. A. Cass
- Mrs. D. Chilton
- Mr. J. Fargo
- Mr. R. Foucher
- Mr. B. Leaman
- Ms. S. MacLellan
- Mr. G. McFarlane
- Dr. L. Richards
- Mr. M. Saunders
- Mr. W. Shaw
- Mr. R. Stanley
- *Dr. A. Tyler
- Mr. J. Westrheim

Field Services Branch
- Mrs. K. Lorette
- Mr. R. Mylchreest (Economist)
- Mr. E. Zyblut (Canadian Member, Parent Committee)

United States

National Marine Fisheries Service (NMFS)

a. Northwest and Alaska Fisheries Center, (NWAFC)
- Dr. J. Balsiger
- Dr. J. Terry (Economist)
- *Mr. M. Wilkins

b. Southwest Region, Los Angeles
- Dr. W. Silverthorne (Economist)

Alaska Department of Fish and Game (ADFG)
Mr. B. Bracken
*Mr. P. Rigby, Chairman

Washington Department of Fisheries, (WDF)
*Mr. J. Tagart

Oregon Department of Fish and Wildlife, (ODFW)
Mr. R. Demory
*Mr. J. Robinson

California Department of Fish and Game, (CDFG)
*Mr. T. Jow

Pacific Marine Fisheries Commission, (PMFC)
Mr. W. Daspit (PACFIN)
Mr. L. Six (U.S. Member, Parent Committee)
Dr. C. Woelke (Contract)

Pacific Fisheries Management Council, (PFMC)
Mr. H. Wendler

North Pacific Fisheries Management Council, (NPFMC)
Mr. J. Povolny

International Pacific Halibut Commission, (IPHC)
Mr. S. Hoag

IV. APPROVAL OF THE 1983 REPORT AND 1984 AGENDA

The 1983 Report of the Technical Subcommittee was approved, with a minor amendment. The preliminary agenda was reviewed, and a number of modifications were adopted. The approved agenda is included as Appendix A.

V. TERMS OF REFERENCE

No changes in terms of reference have occurred since 1981. Following are the Terms of Reference for 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 stocks 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 those recommendations.

VI - REVIEW OF AGENCY GROUNDFISH PROGRAMS

A list of reports pending or published, by agency, is contained in Appendix B.

A. Canada

1. DFO

The Groundfish Program at the Pacific Biological Station is responsible for all groundfish resource analysis on Canada's Pacific Coast. Much of the activities of this group therefore involve regular conduct of stock assessments and recommendation of management strategies for implementation by the Field Services Branch of the Department of Fisheries and Oceans. However, during 1983 a major stock assessment document was not produced and only interim assessments were provided to managers. This allowed more effort to be put into reporting of previous projects and additional analyses, along the broad lines of investigation listed below.

Administrative changes in the Groundfish Program concerned the termination of the domestic fishery observer program; the departure of the Analytical Methods scientist; the arrival of a scientist to head a Recreational Fisheries Unit, which will concentrate efforts in Area 4B; and the generation of a major project to examine Hecate Strait (Areas 5C-5D) as a multispecies production and management system. The latter project is slated to begin in 1984 and involves Groundfish, Salmon, Shellfish, Herring and Oceanography programs.

Pacific cod. Field research during 1983 was limited to a survey of cod distribution and abundance in Area 5C and 5D. Results indicate below-average recruitment for the 1982 and 1983 cohorts and that abundance of the total stock will continue to be low over the next two years. Examination of coastal temperature records for the 1978-1983 period suggests abnormal water temperatures as one causative agent for the reduced recruitment.

Analytical studies employed time series of standarized landing statistics for all major stock units to investigate the fishery effects on recruitment. A detailed report of stock delineation based on

historical tagging studies was completed. Additional biological studies concerning the importance of sandlance in the dynamics of cod were completed.

The use of fin rays as suitable structures for age determination of Pacific cod is currently being examined, using improved methods of mounting and sectioning the fins. If successful, this method will be used to complement the present method of length-frequency analysis for ageing.

Flatfishes. The major activities concern English and rock soles in Areas 5C and 5D. The fourth annual trawl survey of juvenile sole stocks in Hecate Strait was completed and a report of results produced. In addition, a report of the time series of abundance estimates from these surveys is also in preparation. This unit also completed an English sole tagging experiment to investigate stock delineation, abundance and movement in the Areas 5C and 5D.

Processing of recovered otoliths from rock and English soles tagged and injected with OTC continued during 1983. Results of previous rock sole taggings were incorporated into a report on stock delineation for the Hecate Strait-Queen Charlotte Sound region. Tagging and OTC-injection studies are also being used to determine whether the break/burn procedure is appropriate for flatfish of all ages.

Analytical studies continued to employ new research results in revised virtual population and surplus production analyses. These analyses were used to derive alternate harvest strategies for Hecate Strait soles during 1983.

Sablefish. Reporting of recent research results constituted the majority of the effort by the sablefish unit. Six papers on the biology of adult and juvenile sablefish, early life history, age validation, stock delineation and movements, and implications for management were presented at the Lowell Wakefield Symposium. Recoveries of sablefish from Alaska which were tagged as juveniles at inshore locations in Canada suggest much greater transboundary movement than previously believed on the basis of tagging adults in Canadian offshore areas. Such movement, if a common feature of juveniles, will have major implications for the management of this species. Also completed in 1983 was an analysis of Canadian stocks using cohort and yield-per-recruit models, which concentrated on the strong 1977 cohort.

Pacific hake. Research emphasis shifted from the inside waters of Area 4B to the offshore, migratory stock, which is found off southwest Vancouver Island. A cooperative hydroacoustic-trawl survey involving U.S. and Canadian research/charter vessels examined the abundance, distribution, and biology of that component of the stock venturing into Canadian waters. In addition, U.S. and Canadian scientists cooperated in the development of a management plan for this stock, which used an age-structured model with a stochastic recruitment function. Two papers on the biology of inshore and offshore hake were presented at the 1983 INPFC Groundfish Symposium.

A benthic core sampling project was completed in Area 4B during 1983. Analysis of the cores is underway, with the objective of determining whether the history of hake dynamics in the Strait of Georgia can be interpreted from the sediment record.

Lingcod. Tagging of lingcod in Area 4B to assess exploitation effects of commercial and recreational fisheries was continued in 1983. Also in Area 4B, the project examining variability in cohort strength of pelagic and benthic juvenile lingcod was completed; a report is in preparation. A preliminary analysis of age validation using dorsal spines of OTC-injected fish was completed and the results published.

Spiny dogfish. The major emphasis of research effort on dogfish during 1983 was on reporting of previous and current studies. The tagging program in Area 4B was continued. An analysis of the abundance, movement and diet of dogfish in Areas 5C and 5D was completed. It indicates that dogfish have returned to the level of abundance that is believed to have existed prior to the intensive liver fishery of the 1940s.

Rockfishes. Field work in 1983 consisted of three survey cruises. The first was a research and charter vessel survey of S. alutus distribution and abundance in the Dixon Entrance-southeastern Alaska area. Results indicated the majority of the biomass on trawlable bottom in the 54°-55°N area to be concentrated in the immediate boundary area (54°15;-54°25'). Two cruises to the deeper waters off Queen Charlotte Sound (Areas 5A/B) were made to determine if separate stocks of S. alutus exist outside the normal range of bathymetric movement of the Goose Island and Mitchell's gullies stocks. No such stocks were found.

The reproductive biology and age-correction matrix studies were continued but were delayed due to economic and priority constraints on ageing of rockfishes. Results from the former show higher fecundities than previously recorded for this species. Reports concerning stock analyses, assemblage management and implications of longevity were published.

Statistics/Sampling. A project examining the level of interview coverage necessary for LPUE analysis was completed. This analysis employed a log-linear fishing power model to examine multivariate effects in LPUE and the ability to correctly interpret LPUE changes when interview coverage was reduced by 50%, 75%, and 90%. Results vary with the stability of the fishery but time trends in LPUE are reflected reasonably well. However, it becomes impossible to interpret seasonal, locality or boat effects, or to test hypotheses when information content is reduced by even moderate amounts, for many important fisheries.

The results of the domestic fishery discard project were used to examine the impact of English sole discards on catch-at-age analysis. Additional reports of halibut, sablefish, and English sole discards by domestic trawlers were produced.

This unit continued to provide the program with catch/effort information and biological samples from the groundfish fishery. Percent of landed weight for which interview coverage (thus effort) was obtained was 64% in total and by gear was as follows: trawl - 66%, trap - 79%, longline - 21%. The number of biological samples collected by the sampling unit totalled 151.

Recreational fisheries. The Sports Groundfish group was organized in 1983 with the overall objectives of providing biological basis for multi-species management of the inshore rockfish and lingcod stocks. Field work this summer will begin to identify species assemblages associated with different habitats and exploitation levels in the Strait of Georgia. Survey techniques will include automated jig, SCUBA and manned submersible.

Improvements have been made to the catch-effort data bases for inshore rockfish and lingcod. Creel samplers now record rockfish catch by species and collect fin rays from lingcod for age determination. We have begun to collect samples from the growing commercial inshore rockfish fishery for species composition and age determination.

Two questionnaire-type surveys were conducted on the recreational use of groundfish. The first examined collection habits and preferences of SCUBA divers in the Strait of Georgia. Of the divers surveyed, 60% collected lingcod and 35% collected rockfish. Overall catch rates were 69% and 49% per dive for lingcod and rockfish, respectively.

Visitors to the 1984 Vancouver Boat Show were interviewed in a study of angler motivation patterns. It was found that 3% of the sample group fished exclusively for groundfish, 50% fished for both salmon and groundfish, and the remainder fished exclusively for salmon. Of the mixed group, 73% indicated that they switch to groundfish when salmon fishing is poor.

B. United States

1. NMFS

Groundfish resource assessment at the Northwest and Alaska Fisheries Center is conducted within two divisions: the Resource Assessment and Conservation Engineering (RACE) Division directed by Dr. Murray Hayes, and the Resource Ecology and Fisheries Management (REFM) Division directed by Dr. Richard Marasco. These divisions are organized into a number of tasks and subtasks on regional or scientific discipline bases. A review of pertinent work by these tasks and subtasks during the past year is presented below.

RACE Division

MARMAP II: Multispecies Groundfish Assessment Task (Bering Sea, and N.E. Pacific)

This task is composed of three subtasks with regional responsibility (Bering Sea, Gulf of Alaska, and Pacific Coast) for fishery-independent assessments of groundfish resources. A fourth subtask, Ecological Processes, was disbanded in November 1983 and its personnel and their expertise in early life history, recruitment dynamics, and ecology of groundfish and shellfish communities were absorbed by the three regional subtasks. This work will be incorporated into the regular activities of these subtasks.

Major activities of this task in 1983 included the third in a triennial series of west coast (California-British Columbia) hake/rockfish echo integration and trawl surveys; a U.S.-Japan cooperative survey of Aleutian Islands groundfish resources; a survey of the western Gulf of Alaska Pacific cod stocks; and the annual eastern Bering Sea crab-groundfish survey. Survey activities for 1983 are summarized in Table 1. The task's survey plans for the 1984 field season include a major survey effort in the Gulf of Alaska on the continental shelf and slope, a pilot project to address the feasibility of trawl surveys on the upper continental slope off Oregon and Washington, and the annual eastern Bering Sea crab-groundfish survey. Table 2 summarizes the planned survey activities in the next year.

Pelagic Resource Assessment Task

This Task's work includes three principal acoustic-midwater trawl survey programs designed to monitor the size and condition of walleye pollock and Pacific whiting (hake) stocks. The surveys involve: (1) eastern Bering Sea pollock (triennial, summer); (2) Gulf of Alaska/Shelikof Strait spawning pollock (annual, winter); and (3) Pacific whiting (triennial, summer). Research and development studies which complement the survey/assessment efforts are focused on improving the accuracy of pollock and whiting biomass estimates through the collection and analysis of size- and behavior-specific *in situ* target strength measurements using a multi-beam acoustic system. Also, the task has a significant responsibility with respect to standardizing and improving the efficiency of computer/software systems used for acoustic data collection and analysis.

Recruitment Processes Task

This task is active in research on the distribution and abundance of the early life history stages (eggs and larvae) of groundfish stocks in the Bering Sea, Gulf of Alaska, and Washington-northern California region. Through the description and understanding of factors affecting the early survival of fishes and its

Table 1. Groundfish surveys conducted by the NWAFC in the northeast Pacific Ocean and Bering Sea, June 1983-May 1984.

Survey	Primary purpose	Area	Vessels	Survey period	Total hauls
		BERING SEA/ALEUTIAN ISLANDS			
Eastern Bering Sea winter crab-groundfish survey	Special study of distribution and biology of crab-groundfish populations in winter	Outer Bristol Bay, Pribilof Island, and Unimak Pass area	Miller Freeman*	Feb. 10-28	62
Eastern Bering Sea crab-groundfish survey	Continuing annual survey to assess condition of crab-groundfish for scientific and management purposes	Eastern Bering Sea continental shelf waters from Unimak Pass to St. Matthew Island	Chapman* Alaska**	June 3-Aug. 13 June 3-Aug. 13	380
Aleutian Islands crab-groundfish survey	Second survey since 1980 to assess current condition of fisheries resources	Along Aleutian Islands chain from 170°E to 165°W	Miller Freeman* Chapman*	July 18-Aug. 16 Aug. 16-Sept. 15	162
		GULF OF ALASKA			
Project SeaSub	To observe fishing gear characteristics and collect biological specimens	Sitka	Mermaid II** Aloha**	July 24-Aug. 16	52 dives
Comparative studies of bottom trawls	Special study to compare efficiencies of standard sampling trawls	Gulf of Alaska east of Kodiak Island	Miller Freeman*	Sept. 26-Oct. 7	127
Icthyoplankton survey of larval pollock	Collect data on pollock egg and larval distribution and abundance	Shelikof Strait	Chapman*	March 20-April 1, 1984	562 (281 Bongo) (281 Neuston)
Western Gulf of Alaska Pacific Cod	Assess the abundance and stock condition of Pacific cod	Kodiak and Shumagin Islands	Miller Freeman*	Feb. 8-29, 1984	81
Gulf of Alaska-Shelikof Strait spawning pollock echo integrator-midwater trawl	Estimate the biomass of the pollock spawning aggregations hydroacoustically	Shelikof Strait and western Gulf of Alaska	Miller Freeman*	Mar. 3-Apr. 7	48
		Pacific Coast			
West coast survey	Triennial survey to assess current condition of ground-fish resources	Coastal waters from British Columbia-California	Nordfjord** Warrior II**	July 7-Oct. 30	596
Echo integrator-midwater trawl survey	Pelagic survey of Pacific whiting and shortbelly rockfish in conjunction with West Coast survey	Washington-California	Gold'N Sun**	Aug. 4-Sept. 22	38
Sablefish index survey	Continuing survey to obtain indices of sablefish abundance	Washington-Oregon	John N. Cobb*	Oct. 12-Nov. 22	400 trap lifts
Ichthyoplankton-hydrography survey	Special survey to determine geographic distribution of eggs and larvae	Washington-northern California	Miller Freeman*	Nov. 10-Dec. 3	113

* NOAA vessel
** Chartered vessel

Table 2. NWAFC resource assessment surveys scheduled for June 1984-May 1985.

Type of survey or study	Nations participating	Area	Period	Objectives
		Bering Sea Subtask		
Crab-groundfish trawl survey	U.S.	Eastern Bering Sea	7 June-30 August, 1984	Distribution, abundance, stock condition
		Gulf of Alaska Subtask		
Triennial groundfish trawl survey	U.S., Japan, U.S.S.R., R.O.K.	Western Gulf of Alaska	12 June-12 Sept., 1984	Distribution, abundance, stock condition
Young-of-year and juvenile survey	U.S.	Western Gulf of Alaska	Sept. 1984	Distribution, relative abundance, biological characteristics
Winter Pacific cod trawl survey	U.S.	Unimak Pass-southeastern Bering Sea	Winter 1985	Distribution, biological characteristics, abundance
		Pacific Coast Subtask		
Continental slope trawl survey	U.S.	Oregon and southern Washington coast	5 Sept.-20 Oct., 1984	Distribution, abundance, biological features
Sablefish pot index survey	U.S.	California	10 Sept.-30 Oct. 1984	Distribution, abundance, stock condition
		Pelagic Resource Assessment Task		
Age-0 pollock qualitative hydro-acoustic-midwater trawl survey	U.S.	Eastern Bering Sea	23 July-14 Sept. 1984	Distribution
Spawning pollock echo integrator-midwater trawl	U.S.	Shelikof Strait	March-April 1985	Abundance, stock condition

relationship to the resultant exploitable stock size, this type of research includes identifying and describing eggs and larvae by species, developing effective sampling methods and survey designs, describing regional drift patterns as they relate to spawning and nursery areas, and studying factors affecting their growth and survival (food, predators, and the environment).

Although it is possible to use the abundance of eggs and larvae to estimate the size of the parent stock, this has not been done in the northeast Pacific. The proper utilization of this technique requires further research into the distribution of the young stages, stock structure, accuracy of egg and larval identification, and the relative costs and benefits of these types of estimates. This work is being addressed and the presence of a large concentrated spawning of walleye pollock in Shelikof Strait is being surveyed for these studies. An initial attempt to estimate the population size through estimates of plantkonic egg abundance was made in 1981, and in 1984 the group plans to repeat this work and test some refinements in their methods. These results will allow them to determine whether this is a reasonable way to assess the population size.

Other RACE Division Activities

Rob Wolotira was transferred to Seattle from the Kodiak Laboratory and is leading an effort to compile and produce an atlas of distribution, biological characteristics, and relative abundance for several groundfish species in the North Pacific Ocean based on the survey data base at NWAFC, interviews with members of the fishing industry, and other accessory sources.

Scientists at NWAFC often participate in joint international research efforts with the USSR, Japan, and the Republic of Korea. Coordination of international research plans is done by Bill High. This entails, in some cases, staffing these vessels with participating scientists, coordinating research plans, and handling the logistics of vessel port calls, personnel transfers, and the like.

The RACE Division has added hydrographic data collection capability to our surveys in the form of portable conductivity-temperature-depth (CTD) instruments. The system was used during the 1983 crab-groundfish survey to gather the first broad-scale collection of hydrographic data in the Bering Sea. Analyses of these data will provide insight into the dynamics of ocean fronts on the Bering Sea shelf and their effects upon fish and shellfish populations.

The RACE data-management group has developed a suite of programs to automate the cataloging, editing, analysis, and reporting of tag release and recovery data. The system was designed to be useable with most forms of tagging data and has resulted in a significant time savings in processing such data.

In response to interest in the location and movement patterns of juvenile sablefish, the biologists participating in the 1983 west coast groundfish survey tagged 2189 sablefish, 1175 of which were 40 cm fork length or smaller. To date 25 of these tags have been returned but no analyses have been performed on the release/recovery data. A report by Frank Shaw is nearing completion which analyzes all release/recovery data from sablefish tagged during the Division's annual sablefish pot abundance indexing surveys conducted in 1979-83. This analysis shows that there is generally little movement of sablefish off the west coast. To support age validation efforts, the possibility of including oxytetracycline (OTC) injections with future tagging efforts is being looked into.

REFM DIVISION

Foreign Fisheries Observer Program

The foreign fisheries observer program, besides being designed to monitor the progress of foreign and joint-venture catches, is also run as a sampling program of the demersal fish and shellfish resources. Data collected to determine age composition, sexual maturity, diet composition, and for other purposes as the need arises. The data collected reside in data files at the NWAFC Burroughs B7800 computer. The foreign fisheries observer data files are used for monitoring the progress of the foreign and joint-venture fisheries toward completion of catch quotas and for assessing the status of stocks. Of importance this year is the program's attempt to provide full observer coverage of all foreign and joint-venture fisheries in the US FCZ off Alaska and the Washington-California coast.

Age and Growth Studies Program. The Division includes the age and growth studies unit at the NWAFC. In recent years, there have been questions over the proper method and age results of many species. The questions generated have led the Division to focus some of its research efforts on age determination methodology. In this regard, a study has been initiated to age four age structures from the same fish: otoliths, scales, opercula, and fin rays. Four species have been selected for study: pollock, sablefish, Pacific cod, and yellowfin sole.

Preliminary results show that opercula do not present enumerable zones in the four species. For pollock, otolith ages either by surface reading or by break-and-burn reading give a higher percent agreement and smaller discrepancy than other structures in between- and within-reader tests. Scale ages underestimate the age of pollock. For Pacific cod, ages assigned by dorsal fin ray sections have the highest percent agreements and less discrepancy than other structures in within-reader tests. Objectively, annuli of dorsal fin-ray sections are also easier to interpret than the other structures. For sablefish, fin rays and opercula are not useful because they lack enumerable zones. Scales ages do not provide consistent readings and enumerated annuli are less than otolith ages. By otolith surface readings and break-and-burn

readings, a low percent agreement and a great discrepancy are found in between- and within-reader tests. Using otolith characteristics and discriminant analysis, otoliths of Age 6 (1977-year-class) in 1983 collections can be discriminated from those of Age 4, 5, and 7. The otoliths of Age 6 are characterized by a wide and enlarged anterior part and with well defined annuli. For yellowfin sole, otolith surface reading and break-and-burn reading gave higher percent agreements in within-reader tests. Scale ages and pectoral fin ray ages give less consistency and lesser age. They are difficult to interpret for the older fish.

In production reading, the Division has adopted systematic within-reader and between-reader tests of all samples read. In general, 20% of the samples are routinely re-aged to obtain a measure of reading consistency. Also, each reader performs replicate ageing of otoliths by both the break-and-burn method and the external-surface method on the same 20% subsamples. To date, over 2000 comparisons of these methods have been made.

Resource Ecology and Ecosystem Simulation

Numerical investigations have been conducted with PROBUB simulation on the effects of temperature anomalies on the stocks in the eastern Bering Sea and Gulf of Alaska. The temperature anomalies in these areas were found to be caused by surface wind anomalies. The monthly surface wind anomalies (from 1946 to present) are also used for the study of migration anomalies of pelagic fish and possible anomlies in transport of pelagic larvae.

The temperature anomalies were found to have considerable effect on the stocks, which varies from species to species and is comparable in magnitude to the effect of considerable change of fishing (mortality). Furthermore, the effects of cyclic anomalies were different in respect to the sequence of the cycles. DYNUMES simulation was used for the study of the effects of seasonal anomalies of bottom temperature on the seasonal migrations of yellowfin sole and halibut.

SKEBUB model has been modified and adapted to the Norwegian Sea for quantitative study of the seasonal dynamics of the fishery resources in this data-rich area.

The ecosystem simulations have been adapted for the study of the effects of oil developments in the eastern Bering Sea on the fisheries resources in the area. The effects of dissolved and emulsified oil in the water were found to be small. However, the effects of oil which sedimentizes to the bottom will have long-lasting effects.

Fishery Economics Program

The Division includes a fishery economics unit at the NWAFC. The research, data collection, and reporting activities of this unit are

intended to increase our ability to evaluate both the current economic status of commercial fisheries and the implications of alternative fishery management measures. Activities that are either ongoing or that were completed in the last 12 months are described below.

In a world characterized by the availability of complete information and costless adjustments, any correctly designed regulatory instrument (quota, tax, effort control, etc.) will perform a well as any other. That is, any instrument can be set at the level which elicits the optimal rate of harvesting, if it is known with certainty. However, both uncertainty about the optimal harvest rate and inability to continually adjust the level of any instrument as stock size changes create differences in the relative performance of alternative instruments. A research project intended to develop a method for setting whatever instrument is chosen at its optimal fixed level in each period, and for determining which instrument produces the highest net benefit nears completion.

A bioeconomic simulation model of the Gulf of Alaska sablefish, Anoplopoma fimbria, fishery, which had been developed to analyze fishery management strategies, was used to evaluate alternative measures of the status of stocks. The model is an age-structured population model to which economic functions were added. The usefulness of two traditional biological measures, maximum sustainable yield (MSY) and equilibrium yield (EY), were compared to corresponding economic measures; and both were compared to alternative measure which reflect the biological and economic potential of stock over time. The implications of the evaluation are: (1) the latter measures of the status of stocks are more useful than the traditional measures for fishery managers dealing with dynamic rather than steady-state situations and (2) a strictly biological measure of the status of stocks does not provide adequate information if the objectives of fishery management are not strictly biological.

A bioeconomic simulation model was also developed to examine the economic linkages between two stocks which cohabit the Shelikof Strait region in the Gulf of Alaska: walleye pollock and pandalid shrimp. Since pollock prey on shrimp, the sustainable yield and revenue curves for shrimp are dependent on the level of effort distributed among the fisheries in question. The objective function required maximizing the sum of the discounted net revenues derived from the independent exploitation of pollock and shrimp subject to both biological (the resource) and ecomonic (labor and capital) constraints. The model was used to provide insight into how a system operates, to predict general trends in response to system perturbations, and to analyze the relative socioeconomic feasibilities of alternative management policies. The results indicate that a multispecies approach to management results in greater profits to the harvesting sector, and as such is considered superior to the treatment of each species as if it were in isolation. In addition, economic optimization of both species under the combined management approach is attained at lower levels of effort, requiring less capital investment.

A qualitative evaluation of alternative management measures to control the by-catch of prohibited species in Gulf of Alaska groundfish fisheries was conducted. The evaluation criteria used were: (1) enforceability, (2) effectiveness, (3) efficiency, and (4) equity. The management measures considered included traditional measures such as transferable by-catch quotas and economic disincentives. The evaluation suggests that for fisheries with adquate observer coverage, the latter measures may prove to be preferable.

A fleet-performance system, consisting of a database and report generator, is being developed. To date, the system includes vessel activity and landings data by fishery and vessel class but no cost data. The system will be used to prepare periodic reports on the performance of commercial fishing fleets operating in the U.S. FCZ off Alaska.

An ongoing research project has used both fish ticket and log book data to characterize the operating and catch characteristics of the Oregon groundfish trawl fleets. The general objective of the next stage of this research is to understand responses of fishermen to a stochastic, rather than an assumed deterministic environment. An attempt will be made to determine if the uncertainity in a fisherman's environment translates into differences in modes of operation, and therefore differences in response to fishery management measures. By focusing on different categories of operation modes the research will help to determine if we can define fleets in a manner more consistent with the way vessels aggregate catches than the current definitions of fleets by home port or vessel type.

Research intended to provide a better understanding of the causes of fluctuations in ex-vessel and wholesale groundfish prices has just begun. This project will include a literature survey, data collecting, the development of a data base with both historical and timely data, and the development of price models.

Other projects include the development of bioeconomic models that will be used to evaluate alternative management measures to: (1) rebuild Pacific ocean perch stocks off Alaska, (2) allocate west coast rockfish quotas over a season, and (3) allocate Gulf of Alaska sablefish quotas among competing user groups.

Bering Sea Research

A study of Pacific ocean perch population dynamics from the eastern Bering Sea to southeast Alaska is nearing completion. The research examines the history of exploitation of the resource and estimates population parameters for the three subareas identified as the eastern Bering Sea slope, Aleutian Islands, and the Gulf of Alaska. The current condition of the stock and productivity of the stock in each subarea is also estimated. Finally, the study projects rebuilding rates under a variety of assumptions regarding recruitment, and examines the economic trade-offs of several management alternatives.

Sablefish Pot Index Surveys

Since 1978 the National Marine Fisheries Service has been conducting pot index surveys in the northeast Pacific Ocean in an attempt to measure interannual changes in the relative abundance of sablefish. These surveys began initially off southeast Alaska, and have since been extended to the Washington-Oregon-California region. A study was completed evaluating the available data base using analysis of variance and the relatively new method of bootstrapping (i.e., a Monte Carlo form of sample reuse). Analysis of variance indicated interannual changes in relative abundance were not statistically significant. Bootstrap analyses indicated 3 or fewer sets are required for each depth stratum at a sampling location (currently 5 are being taken); and that as many as 12 sampling locations per region may be desirable (currently 4 locations are sampled off southeast Alaska and 6 locations are sampled off California-Oregon-Washington).

Gulf of Alaska Research

The Gulf of Alaska cluster is responsible for providing stock assessments and fishery evaluations on the groundfish resources of the Gulf of Alaska to the NPFMC and to INPFC. These information documents are prepared in cooperation with the Gulf of Alaska survey group in the RACE Division and the Auke Bay Laboratory. The Gulf of Alaska stocks of pollock and sablefish receive most of the attention.

In conjunction with the Council's Plan Maintenance Term (PMT) for groundfish in the Gulf, the cluster will revise the roundfish plan into a framework format to accommodate annual changes in OY eliminating the time-consuming plan amendment procedure now required. The group will attempt to develop a spread sheet analysis of target catch and by-catch of fish stocks caught by the various fishing fleets operating in the Gulf. Initially the formulation of the spread sheet will be based on the catch rates and species composition data from the U.S. observer data from the foreign and joint venture fishing operations. The by-catch spread sheet should provide a quick way to evaluate the distribution of by-catch for a number of stocks among the various fishing fleets for range of alternative OY levels for target species.

In the fall of 1983 an analysis was initiated to develop a measure of the regional production of sablefish over its habitat along the continental slope from the Bering Sea to California as a criterion for sablefish harvest guidelines. The reviews of the first draft have been encouraging. The final draft will be available this summer pending the completion of confirmation and revision of the historical catch data.

Two genetic studies were initiated in 1984 in cooperation with the RACE and REFM Divisions to examine the stock structure of pollock in the Gulf of Alaska and sablefish throughout its range. Pollock collections were made in Shelikof Strait and Prince William Sound

spawning aggregations. Sablefish collections will primarily be taken from the U.S.-Japan cooperative longline survey in the Aleutian Islands, eastern Bering Sea and the Gulf of Alaska. Samples from Oregon, Washington, and California will be collected on RACE surveys this summer and fall. Plans are being considered to collect tissue samples from spawning adults during February from Washington to the central Gulf. This work is a repeat of the earlier work reported by Dr. Garrett, University of Alaska, in which he found considerable variability among sablefish groups all along the northeast Pacific rim.

The group is also overseeing a special project in cooperation with the Northwest Regional Office, NMFS, to document the success of an experimental set-net fishery off Washington directed at sablefish and lingcod. The project will examine gill-net selectivity of the major species, and report their catch rates, species composition including prohibited species, and size composition. This project will include the 1983 and 1984 field seasons.

Washington-Oregon-California Research

West Coast Groundfish Management Analysis. This project is designed to explore ways for the PFMC community as a whole, and the Groundfish Management Team (GMT) specifically, to develop some new approaches to providing groundfish assessment and management advice to the Council. Of utmost importance to the GMT is the development of an ability to advise managers on what the likely consequences of a contemplated management decisison affecting one part of the west coast multi-species groundfish fishery.

As a first step, we are implementing an experimental attempt to use the process of Adaptive Environmental Assessment and Management (AEAM) to quantify the response of fishing effort to management decisions and its impact to the west coast multispecies groundfish complex and its associated fishing industry. Utlimately, it is hoped that this work will be a first step in providing the Pacific Fisheries Managment Council with a multispecies multifishery management model for the west coast groundfish complex.

Groundfish Production Off the WOC Coast. This is a long term project designed to develop an understanding of processes underlying groundfish production along the West Coast. The recent work of Gary Stauffer and Sandra McDevitt on sablefish production in the northeast Pacific and eastern Bering Sea indicates that the current estimates of sustainable sablefish production used by PFMC may be high by as much as a factor of 2. Current estimates of rockfish and flatfish sustainable production used by the Council are highly questionable, meet with severe opposition from the fishing industry, and are hard to defend.

Historic Catch Data. We are currently summarizing annual groundfish catch data for the West Coast, Gulf of Alaska, and eastern Bering Sea. Ultimately we will establish a 20+year time series of annual

groundfish catch by species group and INPFC or PMFC statistical area. This data will initially be used in conjunction with estimates of physical habitat (e.g., areas of inshore waters, shelf areas from 0-100 m 100-200 m, and 200-800 m) in order to try to thoroughly characterize relative groundfish fishery production by species group and area along the West Coast and relate it to similar estimates for various areas of the Gulf of Alaska and eastern Bering Sea. The catch data will also serve as a basis for rewriting the PFMC Pacific Coast Groundfish Plan. Our preliminary work indicates that there is a good deal of uncertainty concerning historical catch data (INPFC, PMFC, state, and federal data sources). We hope to get to the bottom of it and provide as accurate a time series of annual catch as possible to both PFMC and NPFMC.

Assemblage Analysis. We are working on refining the techniques of assemblage analysis in order to gain some understanding of the dynamics of assemblage production in some key regions along the West Coast. We now have three years of comprehensive NWAFC groundfish other than hake has increased from 73,000 t in the Columbia/Vancouver areas. We will be trying to assess the impact of these removals on the underlying community structure. Rather than looking at the whole coast, we will be focusing on three areas: PMFC Statistical Areas 1C (off Eureka, California), 2C (off Newport, Oregon), and 3B (off Cape Flattery, Washington).

We are summarizing data from historical ichthyoplankton cruises conducted off the WOC coast. We feel that one factor which may have a very strong controlling influence on the groundfish production of a region is the potential juvenile habitat of that region. Therefore we will initiate a study, along the lines of the work on adults, for larvae and juveniles.

In cooperation with the IMS department of the University of Washington, we have compiled data on the population dynamics of about 30 groundfish stocks on the west coast, Canada, and Alaska. They are attempting to determine if there is any coherence between stocks in the occurrence of strong year classes and if strong year classes may be linked to oceanic conditions. Since the production of strong year classes appears to be the driving force behind groundfish production along the west coast, these results should prove valuable to management of the stocks.

2. ADFG

The Alaska Department of Fish and Game (ADF&G) presently has four groundfish biologists responsible for research and management programs in the Westward (Western Gulf and Bering Sea), Central (Cook Inlet and Prince William Sound), and Southeast (Southeastern and Yakutat) regions. They are stationed at Kodiak, Homer, and Petersburg, respectively. A coordinator position located in Juneau is responsible for interaction with other agencies and development of the Department's statewide groundfish program. A biometrician is also stationed in Juneau who provides analytical support and is taking a major role in the design of sampling programs.

The ADF&G groundfish program can be divided into six tasks: catch reporting, observer-port sampling, resource assessment, regulation development, management action, and logbook distribution and collection. In general, research and management are conducted on a regional basis. The groundfish staff is continuing the standardization of sampling methods, and the regional staffs cooperate on statewide projects.

Activities within the Southeast Region groundfish program include dockside and onboard catch sampling; skipper interview and logbook collection; sablefish tagging; information dissemination; in-season management of flounder and sablefish fisheries; and regulation development, including cooperation with the North Pacific Fisheries Management Council (NPFMC) and its Gulf of Alaska groundfish planning team. Also, annual reports and proposals for regulation changes are presented to the Alaska Board of Fisheries and its advisory committees.

Catch data (fish ticket) editing is done in Petersburg and Sitka. In-season catch logs are maintained for the sablefish and winter trawl fisheries. Dockside sampling is conducted with samplers in major ports for both the sablefish and rockfish fisheries. Species composition of the catch is determined and AWL data is collected from selected species. In addition skipper interviews are conducted to determine catch location and effort information which is used to calculate CPUE by management area. With the expansion of the nearshore rockfish fishery greater emphasis will be placed on both onboard and dockside catch sampling of this fishery during the next fiscal year. During 1983 a new longline/pot logbook was developed and is being distributed to the fleet statewide. However, funding for software development necessary for entry and analysis of the log data is not yet available. The unavailability of computer support has severely impaired the efficiency and development of this and other programs both in the Southeastern Region and statewide.

In March 1983, 2800 sablefish were tagged in the inside waters of southern Southeastern Alaska (Clarence Straits); and during the year over 900 sablefish tags from various agencies were recovered, primarily through the dockside catch sampling and skipper interview programs. Data collection for starry flounder and sablefish fecundity studies initiated in 1982 has been completed and analyses of these data are continuing.

Studies were originated to evaluate a method of tagging rockfish and lingcod *in situ*. Data analysis is ongoing. Also, a rockfish stock assessment cruise was completed in 1983 by ADF&G as a continuation of the contracted studies conducted in 1980, 1981, and 1982.

Management activities during 1983 included onboard observation of the winter trawl fisheries within Southeastern and close monitoring of fishery performance in other fisheries. Closures were made in the flounder trawl and sablefish longline fisheries.

The Central Region groundfish program has continued to focus attention on the collection of baseline data for those groundfish species

of present and potential commercial importance. Groundfish data are collected on ADF&G shellfish pot and trawl surveys in addition to spring and fall rockfish surveys in the outer and Eastern Districts of lower Cook Inlet. Commercial catch sampling has in the past been limited to the Cook Inlet Area. However, increased sablefish effort in the Central Gulf of Alaska area will necessitate catch sampling in Seward and possibly other ports in Prince William Sound and Cook Inlet.

Activities of the Westward Region groundfish program also include catch data collection; information dissemination; regulation development; resource assessment; and as a primary activity, the domestic trawl observer program. The observer program places the greatest sampling effort near Kodiak Island and Unimak Pass. Catch per unit of effort, species composition, prohibited species incidence, and other biological data are obtained. Because of the importance of assessing crab and halibut incidence within the expanding groundfish fishery and because of the program's value in obtaining biological data prior to sorting and discard on the grounds, the Department intends to continue the observer program either with State and/or Federal funds. During the fall of 1983 some additional observer funding and an additional project leader was added to the Westward Region groundfish program in order to expand fishery monitoring activities, primarily the observer program. However, observer coverage is still substantially below the level necessary to produce statistically significant results for most time and area strata.

Dockside catch sampling and logbook distribution and collection programs are expanding, and a trawl survey for Tanner crab and groundfish in waters south of the Alaska Peninsula has been conducted in July since 1981. This survey will again be conducted in 1984.

In conjunction with this region's resource assessment programs a limited age reading effort is ongoing. A seasonal age reading technician who has trained at various Pacific coast ageing labs and attended the PMFC-sponsored age-reading workshops, is hired for six months each year. The reading of Pacific cod and rockfish otoliths has received primary emphasis. Preliminary work is now being done on sablefish, several flounder species and two species of rockfish. A substantial increase in the age reading budget will be required to provide adequate groundfish age-reading services to the ADF&G program statewide.

The Westward region groundfish biologists also assist the Bering Sea groundfish plan team of the PFMC. Management action in the Westward Region has been limited to fishery observation. No closures have been needed as yet, although the fishing industry and the management agencies have expressed concern over the potential for increased catches of crab and halibut.

The headquarters groundfish section has been primarily involved in the coordination of Federal and State research and management activities. The Groundfish Research Coordinator is a member of both

NPFMC groundfish management plan teams - Gulf of Alaska and Bering Sea. Sablefish, POP, pollock, and prohibited-species management in the Gulf of Alaska and the collection of data from the domestic fleet have been issues of special concern to ADF&G and the NPFMC. The headquarters staff has worked in conjunction with the regional staff to provide the Council input on these issues.

Objectives of the groundfish program continue to center on the development of a standardized catch monitoring program with statewide and regional computerized data bases. During late 1983, with these objectives in mind, the headquarters section initiated a preliminary groundfish program review to document data and project needs for proposed program changes and upgrades.

3. WDF

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

Extended Jurisdiction Division. This Division handles all issues requiring interstate, regional, federal or international cooperation for management, conservation, or protection of groundfish resources in coastal waters. Division responsibilities include membership on the Groundfish Management Team of the Pacific Fishery Management Council and the Scientific and Statistical Committee of the North Pacific Fishery Management Council; all multi-jurisdictional issues concerning groundfish; and stock assessment and management of groundfish stocks in state coastal waters (0-3 miles) and the Fisheries Conservation Zone (3-200 miles) adjacent to Washington. Major work during the past year included management of groundfish stocks under the guidelines of the Pacific Coast Groundfish Plan; continued analysis of yellowtail rockfish stocks in the INPFC U.S.-Vancouver and Columbia areas; continuation of the black rockfish tagging program; evaluation of widow rockfish trip limits; and an experiment to determine the precision within which similar age-reading techniques were applied by different ageing laboratories.

Groundfish Management Division. The responsibilities of this Division include monitoring, research, and management of Puget Sound groundfish resources and their fisheries. The goal of the Division is to manage the Puget Sound fisheries so that the acceptable biological catch (ABC) of the key species in each management region is harvested according to the strategies outlined in the Groundfish Management Plan for Washington's Inside Waters. General monitoring work included collection of biological samples of landings from several commercial and recreational gears. Fishery data are also collected from the trawl (Trawl Interview System), setnet, troll, commercial jig, set line, beach seine, and pot fisheries, as well as the recreational anglers and charter boat fleets. The Division provides supervision for the State portion of the National Recreational Fisheries Statistical Survey.

Major accomplishments during the past year included: (1) completion of the 1982-83 study of the SCUBA fishery in state waters. Most divers indicated observation was the most important activity and less than half felt spearing was important. The most important species to spear fishermen were lingcod and rockfish; (2) completion of the analysis of the reopening of the inner Puget Sound sport fishery for lingcod, which indicated that populations had increased since the 1970s, but fishing pressure was more intense such that there would be a need to reduce fishing pressure; (3) successful management of the central Puget Sound hake fishery such that the 4672-t ABC was reached. Tagging of hake was also attempted; (4) establishment of a mandatory fishery logbook system for commercial jig and groundfish troll fishermen in Puget Sound to obtain CPUE by ground and time; and (5) finalization of 1983 ABCs for key species in each management region.

Ongoing projects of the Groundfish Management Division include: preparation of the 1984 supplement to the Groundfish Management Plan for Inside Waters, including 1984 ABCs for key species; preparation of an environmental impact statement for otter trawling in Puget Sound; evaluation of English sole fisheries and resources in Puget Sound; initiation and evaluation of a logbook program for Pacific cod setnet fisheries in Puget Sound; evaluation of lingcod fisheries and resources in Puget Sound including small-scale tagging projects to assess stock condition and choose a management strategy relative to a "trophy" sport fishery; evaluation of methods used to estimate recreational fishery catch and effort; experimental use of underwater video camera to investigate effects of otter trawls on bottom sediments and benthic communities; tagging pollock in southern Puget Sound; review of recreational angling for groundfish in Puget Sound from 1965 to 1982; and analysis of length composition of recreationally caught groundfish in Washington.

Technical Services Division. This Division is an umbrella for a variety of technical experts who perform specialized services for management divisions and carry out independent projects in their areas. At present the Division is comprised of five groups: (1) Biometrics: consulting in statistics, stock assessment and computing; (2) Acoustics: providing quantitative in-season surveys of herring and hake and assistance to research and assessment projects throughout the Department of Fisheries; (3) Fishery Information Systems: responsibilities include storage and retrieval of biological and fishery data routinely collected by other divisions and production of statistical reports; (4) Groundfish Age Determinations: tasks include production age reading and development and evaluation of new ageing methods; and (5) Artifical Reef Investigations: responsible for design, construction and evaluation of artificial rocky reefs and research on midwater fish aggregation devices.

The Division's major accomplishments in 1983, over and above ongoing service functions, were: completion of the Groundfish Biological Data System, which entailed converting accumulated age and length data to standard codes and formats, and developing programs to maintain and

access the files; acquisition of new equipment to prepare and read broken and burned, or sectioned, otoliths (until 1983, otoliths were surface read) and one week's training of the age-reading staff at the Pacific Biological Station in Nanaimo; and construction of several more artificial reefs in Puget Sound, bringing the total to twelve (nine for boat anglers and three under public fishing piers).

Research and development projects now underway include: improve estimates and reporting of trawl catches by species and area as inferred from fish tickets, logbooks and port samples; testing of a system of overflights combined with angler interviews to estimate Puget Sound recreational catches (much as the Georgia Strait sport fishery is covered); assessment of yellowtail rockfish by a variety of methods; experimental acoustic surveys of squid in Puget Sound; preparation to switch from a single-beam to a dual-beam echo sounder for quantitative surveys; modification of the trawl logbook data management system to accommodate the new interstate logbook format and meet new interstate reporting standards; analysis of age readings made by different readers and methods to determine what, if any, systematic differences there are, and what needs to be done to bring historical age data up to present standards; consulting for DFO Canada on the design and location of artificial reefs in Georgia Strait; experimenting with different construction materials and layouts in the enlargement of artificial reefs in Puget Sound; continuing surveys to document community succession on artificial reefs; and study of the effectiveness of midwater artificial fish aggregators in the open ocean and Puget Sound.

4. ODFW

The Marine Region staff and its function in 1983 were much the same as in 1982. Major emphasis of 1983 activities was on monitoring the groundfish fishery, especially the trawl fishery. The number of biological and rockfish species composition samples taken was 831, a 13% increase over samples taken in 1982. Most of the increase was due to more emphasis on rockfish species composition sampling, which accounted for 82% of all samples taken.

Our data processing system also underwent some modification. Prior to entry into the data system, logbook information is summarized by grouping individual trip-tows into State Statistical Strata. This has substantially reduced the amount of time required for data entry. Apple II computers were also placed at the Astoria and Charleston field stations.

Major analytical tasks accomplished during the past year were preparation of status-of-stock manuscript reports for canary rockfish and Dover sole. Both documents were prepared as part of Oregon's commitment to provide information to the Groundfish Management Team of the Pacific Fishery Management Council. Also prepared were segments of Stock Status reports for petrale and English sole, other flatfish, and "remaining rockfish" for the PFMC's groundfish management Teams's use in late 1983.

In 1984, a major change in rockfish reporting procedure was instituted. Buyers were asked to report rockfish purchases as Pacific ocean perch (S. alutus), widow rockfish, (Sebastolobus spp.), and other rockfish (Sebastes complex) on fish tickets.

5. CDFG

Groundfish research and management activities provide the base for management recommendations for the various fisheries. The California Department of Fish and Game's groundfish work is performed by the Marine Resources Region, Marine Resources Branch, and the Planning Branch.

The Marine Resources Region conducts fishery monitoring and assessments of commercial and recreational groundfish fisheries. A sampling program provides biological and species composition data for assessments. In 1983 at major landing ports, 1398 samples of commercial and recreational catches were obtained. Logbook data for trawl, pot, and commercial passenger fishing vessels were collected and processed.

Marine Resources Branch has projects based in southern and central California dealing with groundfish. A southern California project is studying the commercial gillnet fishery and its impact on species taken in the recreational fishery. In central California, the study of the gillnet fishery to provide biological data on target species and management alternatives to mitigate the non-target catch of sea birds and mammals has been continued. Another central California project is studying the biology, distribution, and migrations of important recreational species including rockfish and lingcod.

Planning Branch processes groundfish data, provides system analyses and design, and provides biometrical assistance.

Biological sampling programs are continuing on flatfish (age, size, and sex), rockfish (age and species composition in commercial and recreational fisheries), and lingcod (age, size, and sex in commercial and recreational fisheries). Preliminary sampling studies have begun for sablefish.

Principal analytical projects underway deal with stock assessment of bocaccio (S. paucispinis) and organizing biological data on important species for use on mini-computers.

Recently completed analyses dealt with rockfish species-associations near Monterey (mid-1970s) and trawl discards-at-sea (1982), also in the Monterey area.

6. IPHC

Mr. Hoag reviewed the IPHC program which included continuing monitoring of the halibut fishery and developing improved mathematical models for management. Special projects currently underway include: (1) relative advantage of the new circle hooks over the conventional "J" hooks; (2) OTC-injected tagged halibut for age-determination validation; (3) differential catchability between British Columbia and southeastern

Alaska; (4) in situ studies on reactions of halibut to setline gear; and (5) abiotic factors affecting halibut year-class abundance.

VII. REVIEW OF NORTHEAST PACIFIC GROUNDFISH FISHERIES

A. Canada-United States

1. Commercial Fisheries

a. Total

Canada-U.S. landings of groundfish, exclusive of Pacific halibut, totalled 196,118 t, 0.3% less than in 1982 (196,788 t) (Table 3). Landings by gear were not available from one agency. Trawlers landed 174,366 t, 89% of the total. Principal species in the trawl landings were rockfish (56,426 t[a]), Pacific cod (51,621 t), Dover sole (20,670 t), sablefish (10,529 t[a]), and Pacific hake (whiting) (10,347 t) (Table 4). Notable changes, over 1982, occurred in Pacific cod (+56%), Pacific hake (+45%), and rockfish (-13%). Principal rockfish species were probably Sebastes flavidus (8952+ t), S. entomelas (8919+ t), S. alutus (6901 t), and S. pinniger (5068+ t) (Table 5).

b. Canada

The general picture of groundfish landings during 1983 was one of maintaining the status quo for most fisheries (Tables 3, 4, 5). While such maintentance might be noteworthy for the current economic climate, it was only achieved at the expense of substantial quota overruns for some species and stocks. In particular, quotas for Pacific ocean perch, canary rockfish, silvergrey rockfish and sablefish were exceeded, some by over 100%. In large measure these excesses resulted from an absence of specific trawl regulations and limited surveillance/enforcement. Areas with major quota violations were 5A/B (Pacific ocean perch), 3D (canary and silvergrey rockfishes), 5E (Pacific ocean perch) as well as the coastwide quota for sablefish.

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[a]Contains an unknown quantity landed in California by non-trawl gear.

Table 3. Canada-U.S. all-species groundfish landings (t), by gear type and landing location, in 1982 and 1983. (Excluding halibut and joint-venture catches.)

Gear	Location[a]					
	AK	BC	WA	OR	CA	Total
			1982			
Trawl	19,845	27,721	41,507	37,375	43,323	169,771
Pot	-	3,507	1,621	1,463	3,440	10,031
Longline	3,200	1,186	3,002	846	3,062	11,296
Shrimp trawl	-	T[b]	379	866	158	1,403
Other	-	-	1,226	348	2,713	4,287
Total	23,045	32,414	47,735	40,898	52,696	196,788
			1983			
Trawl	40,980	27,949	39,659	32,064	33,804	174,366
Pot	28	3,219	1,474	1,337	UNK[c]	6,058+
Longline	3,088	765	1,073	887	UNK	5,799+
Shrimp trawl	-	-	631	584	UNK	1,215+
Other	291	1,044	1,287	1,266	UNK	3,902
Unknown	-	-	-	-	4,688	4,688
Total	44,387	32,977	44,124	36,138	38,492	196,118

[a]AK = Alaska; BC = British Columbia; CA = California; OR = Oregon; WA = Washington.

[b]T = Trace = ~.5 t.

[c]UNK = not reported.

Table 4. Trawl landings (t) from the Northeast Pacific Ocean by Canadian and U.S. vessels in 1982 and 1983. (Excluding joint-venture catches.)

Species	AK[a]	BC	WA	OR	CA[b]	Total	1982
Arrowtooth flounder	-	323	1,486	534	UNK	2,343+	2,968
Dover sole	2	859	2,948	8,459	8,402	20,670	21,641
English sole	-	526	750	914	1,161	3,351	3,853
Petrale sole	-	438	526	1,106	562	2,631	2,745
Rex sole	2	49	175	645	626	1,497	1,797
Rock sole	11	668	93	4	4	780	895
Starry flounder	265	66	512	196	46	1,085	1,234
Other flatfish	31	199	130	574	1,030	1,964	1,879
Lingcod	-	2,987	1,151	1,621	830	6,589	6,128
Pacific cod	36,522	4,487	10,531	81	-	51,621	33,159
Pacific hake (whiting)	-	3,099	6,210	58	980	10,347	7,160
Sablefish	27	274	1,367	2,771	6,090	10,529	10,471
Walleye pollock	722	1,070	527	-	-	2,319	3,368
Rockfish	24	11,742	11,207	15,003	18,450	56,426	65,160
Spiny dogfish	-	591	876	1	T	1,468	2,920
Miscellaneous species	3,374	155	152	98	311	4,090	667
Animal food	-	94	326	-	UNK	420+	1,094
Reduction	-	322	692	-	UNK	1,014+	2,632
Total	40,980	27,949	39,659	32,064	38,492	179,144+	169,770

[a]Preliminary data.

[b]All gear.

Table 5. Trawl landings (t) of important rockfish species during 1983. (Alaska data not available now.)

Species	Landing area[a]				
	BC	WA	OR	CA	Total
Sebastes:					
aleutianus	214	11	42	UNK	267+
alutus	5,302	409	1,138	52	6,901
brevispinis	1,718	393	240	UNK	2,351+
crameri	47	22	466	UNK	535+
diploproa	91	8	143	UNK	242+
entomelas	61	3,315	3,121	2,422	8,919
flavidus	446	5,480	3,026	UNK	8,952+
melanops	-	179	109	UNK	288+
paucispinis	137	142	895	UNK	1,174+
pinniger	1,322	650	3,096	UNK	5,068+
proriger	234	187	360	UNK	781
reedi	1,485	3	579	UNK	2,067+
ruberrimus	1	6	109	UNK	116+
zacentrus	60	2	147	UNK	209+
other	119	91	299	UNK	509+
Sebastolobus:					
alascanus	49	106	676	UNK	831+
altivelis	-	-	165	UNK	165+
Unidentified	456	262	392	15,976	17,086
Total	11,742	11,266[b]	15,003	18,450	56,461

[a]B.C. = British Columbia; CA = California; OR = Oregon; WA = Washington.

[b]Includes 61 t landed for animal food and/or reduction.

Quota excesses were recorded in the trawl fishery despite an 8% decline in effort to 31,850 h and were concomitant with the highest coastwide CPUE (0.859 t/h) of the previous ten years. Two areas accounted for the majority of this effort. In Area 5B a winter fishery on spawning aggregations of Pacific ocean perch at the mouth of Goose Island Gully yielded a qualified CPUE (2.929 t/h) 89% above that of 1982. This fishery caught the equivalent of 250% of the quota for females that would have been taken in the traditional inside, summer fishery. Quota restrictions on Pacific ocean perch in other areas and an absence of regulations also resulted in over-harvest of canary and silvergrey rockfishes in Area 3D. The Canadian fleet has not traditionally expended much trawl effort in this area but participation by several larger rockfish trawlers raised effort to over 3300 h during 1983.

Flatfish production remained approximately the same in 1983 as in 1982, although it was well below (40%) the 10-yr mean. Some of this decline is accounted for by catch restrictions (e.g. rock sole) but most reflects low stock abundances. Pacific cod landings continued to be extremely low; at 4487 t they were only 6% of the 10-yr average. Abundance is low in all offshore areas--West Vancouver Island, Queen Charlotte Sound, and Hecate Strait. No improvement is expected for at least two years.

Most of the larger trawlers participated in the joint-venture fishery for hake in Area 3C during 1983. This fishery has the dichotomous effects of relieving exploitation of traditional stocks during the summer months but maintaining a trawl fleet with much greater catching capacity than the set traditional stocks can support. This dual effect exacerbates management problems during those periods when these vessels are not occupied in the hake fishery.

c. Alaska

Groundfish landings in Alaska were 44,387 t in 1983, representing a 98% increase over the 1982 landings of 22,402 t (Table 3).

Total Alaska catches including landings in the State of Washington totalled 53,648 t for 1983, 167% of the 32,190 t caught off Alaska during 1982. Approximately 17% of the domestic catch was landed outside of Alaska during 1983. These landings were primarily Pacific cod.

Trawl landings increased by 126% between 1982 and 1983 rising from 18,119 t to 40,980 t (Table 3). The trawl fishery accounted for approximately 91% of the total Alaskan groundfish landings in 1983. The principal species landed was Pacific cod, the majority of which came from the developing fishery in the Bering Sea and Aleutian Islands.

Alaskan non-trawl landings totalled 3407 t in 1983, 110% of the 3100 t landed in 1982 (Table 3). The longline fishery was the primary non-trawl gear with sablefish the principal target species. The total sablefish catch, in dressed weight, in 1983 was 2623 t, a 305% gain over the 1982 catch of 2016 t. The sablefish fishery is expected to continue

its rapid expansion during 1984 into the central Gulf of Alaska. Approximately 110 t (dressed weight) of sablefish were landed outside of Alaska in 1983.

The 1983 fishery for rockfish other than POP increased by 54% from a 1982 catch of 262 t to 404 t in 1983 (Table 4). This small but rapidly growing fishery primarily uses longline gear in southeastern Alaska targetting on Sebastes ruberrimus. Only 23 t of POP were landed in Alaska during 1983.

d. Washington

Washington's commercial groundfish landings (excluding halibut), 45,980 t in 1982, dropped 4% in 1983 to 44,124 t (Table 3). Trawl landings, representing 90% of the total groundfish landings, declined from 41,507 t in 1982 to 39,659 t in 1983, a 4% decline. Trawl effort showed a modest 1% decline from 70,147 hours in 1982 to 69,615 hours in 1983. Landings in 1984 by other gear were: 1474 t by pot; 1073 t by longline; 631 t by shrimp trawl; and 1287 t by "other".

Trawl-caught landings of flatfish were relatively unchanged over the last year with 6717 t landed in 1982 and 6620 t landed in 1983 (Table 4). Principal species in 1983 were Dover sole (2948 t), arrowtooth flounder (1486 t), and English sole (750 t). Together these species comprise 78% of the total flatfish landings.

Trawl landings of roundfish (Pacific cod, lingcod, sablefish, Pacific hake, and walleye pollock) increased 16% from 17,011 t in 1982 to 19,786 t in 1983 (Table 4). Principal species were Pacific cod (10,531 t) and Pacific hake (6210 t). The bulk of the Pacific cod landings (89%) were from Alaskan fishing grounds (PMFC Areas 7C, 8A, and 8C). Pacific hake landings were entirely from Puget Sound (PMFC Area 4A). Over the past four years the market for hake has changed from reduction to food fish and in 1983, 92% of the hake were purchased as food fish.

Trawl landings of rockfish declined 15% from 13,297 t in 1982 to 11,207 t in 1983 (Table 4). Declines were primarily the result of regulatory action by the Pacific Fisheries Management Council. In terms of total weight landed principal species were yellowtail rockfish (49%), widow rockfish (29%), and canary rockfish (6%) (Table 5).

Washington's non-trawl landings totalled 4465 t in 1983 compared with 4471 t in 1982 (Table 3). Principal species landed by gears other than trawl were: sablefish (49%), dogfish (18%), rockfish (17%), and lingcod (11%).

e. Oregon

Total landed catch in 1983 by all commercial gear types was 36,138 t, which includes Pacific halibut landed by hook and line gear (Table 3). This represents a decline of 14% from the 1982 record landing of 40,897 t.

The trawl fishery accounted for 32,064 t, or 89% of the total landed commercial catch (Table 3). Trawl effort in 1983 was at the highest level ever recorded at about 101,500 h. This was 7% greater than in 1982 but more than twice as great as the 10-yr mean of nearly 45,000 h. This increase reflects the additional units of effort participating in the fishery, particularly since 1977. In 1983, 194 vessels made at least one trawl landing compared to 186 in 1982. Most of the increase can be attributed to a poor shrimp season in 1983 since nearly all, if not all shrimp vessels can readily convert to groundfish trawling.

Major species groups in the trawl fishery in 1983 were rockfish (15,003 t) and flatfish (12,431 t) which comprised 46% and 39%, respectively, of the total trawl landings (Table 4). Principal rockfish species were widow (3121 t), canary (3096 t), yellowtail (3026 t), and Pacific ocean perch (1138 t) (Table 5). Principal flatfish species were Dover sole (8459 t), petrale sole (1105 t), and English sole (914 t).

Landed catch by other commercial gear types was 4074 t (Table 3). Pot gear was most important at 1337 t, followed by longline, jig and shrimp trawl. Jig-gear catch showed a marked increase, from 193 t in 1982 to 490 t in 1983. This was due entirely to directed fishing on nearshore reefs by dory-type vessels most of which converted to this fishery during the closed ocean salmon troll season. Landed catch by jig boats was primarily black rockfish.

f. California

In 1983, commercial groundfish fishermen landed 38,492 t of groundfish, a 26% decline from the peak landings of 52,152 t in 1982 (Table 3). Declines in landings occurred for every major species. The largest part of the 1983 landings were made by trawlers, 33,804 t or 88%.

Dover sole. Total landings were 8402 t in 1983, a 16% decline from 1982 landings of 9907 t (Table 4). Landings from Areas 1B and 1C were almost the same at 4021 and 4012 t, respectively. English sole. A decline of 91% occurred for English sole landings in 1983 when 1161 t were landed compared to the 1442 t of 1982. Petrale sole. Landings of petrale sole continued to decline as 562 t were landed in 1983 compared to 781 t of 1982. Rock sole. Only 4 t of rock sole were landed in 1983. The majority of the catch was from Area 1B. Lingcod. In 1983, lingcod landings declined to 830 t from the 1192 t 1982 landings. The major area of catch was 1B. Pacific cod. None were landed by California fishermen in 1983. Pacific ocean perch. Catches of this species are minor off California. The 1983 landings totalled 52 t; all were landed from Area 1C. Other rockfish. Total 1983 rockfish landings at California ports were 18,450 t which included 52 t of Pacific ocean perch and 2422 t of widow rockfish. The leading areas of rockfish landings in order of weight were 1B, 1C, and 1A. Sablefish. In 1983, 6090 t of sablefish were landed compared to 9494 t landed in 1982; a 36% decline between years. Demand declined in 1983 from the favorable situation of 1982. Dogfish. Landings were minor in 1983. Pacific hake. Landings in 1983 declined only 21 t to 1000 t from 1021 t of 1982. In 1983, the leading area of catch was 1C.

2. Recreational Fisheries

a. Canada

Lingcod and quillback rockfish are the major species in the Canadian recreational fishery for groundfish. No catch information is available at present.

b. Oregon

Sampling of the 1983 recreational ocean boat fishery began May 23 and June 13 at ports south and north of Cape Blanco, respectively. Sampling continued until September 11 at Astoria; November 6 at Brookings; and until September 18 at all others. The total 1983 catch was estimated to be 405,374 fish. This was about a 1% decline from the 1982 record catch. However, this small decrease may have been due to slightly different sampling periods between the two years.

Directed bottomfish effort in 1983 was estimated to be 35,434 angling trips, a 29 percent decrease from 1982. This is attributed to the fact that the recreational salmon angling season lasted a month longer in 1983 than in 1982, affording more opportunity for directed salmon trips. Anglers on directed bottomfish trips landed 264,298 fish, for a catch per trip of 7.5 fish. This was an increase from the 1982 figure of 6.3 fish per trip.

The leading species in the bottomfish catch was again black rockfish, comprising 59% of the total catch. Yellowtail rockfish moved up in the total state's landings due to a significant increase in deep-water bottomfish trips out of Garibaldi and Winchester Bay. Yellowtail rockfish accounted for 33 and 70 percent of the catch, respectively, out of these two ports.

PMFC Area 2C again dominated the state's catch. This area includes Newport, Garibaldi, and Depoe Bay which ranked first, third, and fourth, respectively, in the landings.

Rockfish accounted for 83% of the total catch on a weight basis and 90 percent on a numerical basis. As usual, flatfish were approximately 1% of the landings. Sand sole and Pacific sanddab were the leading flatfish species landed.

The miscellaneous species-group catch in 1983 increased by 38% over 1982. However, the leading species were again kelp greenling (Hexagrammos decagrammus) and cabezon (Scorpaenichthys marmoratus).

A few miscellaneous species were seen in unusual numbers that were attributed to the "El Nino" phenomenon. These included Pacific mackerel (Scomber japonicus), Pacific bonito (Sarda chiliensis), albacore tuna (Thunnus alalunga) and blue shark (Prionace glauca).

B. Joint-venture fisheries

1. Canada

In 1983, eighteen Canadian catcher vessels delivered Pacific

hake (whiting) to nine processing vessels in a cooperative fishing arrangement. Five Polish vessels and four Soviet vessels participated in this fishery. A total of 27,657 t of Pacific hake was processed in the 1983 joint-venture fishery.

The quotas and catches for 1983 are outlined below:

Nation	Species	Quota (t)	Catch (t)
Poland	Hake (whiting)	12,500	13,465
	Pollock	Incidental	6
	Rockfishes	Incidental	25
USSR	Hake (whiting)	10,000	14,192
	Pollock	Incidental	-
	Rockfishes	Incidental	25
Total	Hake		27,657
	Pollock		6
	Rockfishes		50

2. United States

U.S. joint fishing ventures, with a number of foreign partners, continue to grow and successfully harvest groundfish resources in the Bering Sea and northeast Pacific Ocean (Table 6). In the Bering Sea, joint-venture catches increased 95% since 1982 due mainly to increases in the harvest of walleye pollock, yellowfin sole, and Pacific cod. Catches in the Gulf of Alaska were 92% greater than in 1982, a result of the rapidly growing fishery for pollock in Shelikof Strait and increased landings of Pacific cod, flounders, and Pacific ocean perch. In the Washington- California region Pacific hake catches were 7% greater than in 1982. In the Bering Sea and the Gulf of Alaska there were increases in harvesting and processing capability while effort dropped in the Washington- California Region. Vessel days increased from 1416 in 1982 to 1731 (+22%) in 1983 in the Bering Sea, from 742 to 1384 (+87%) in the Gulf of Alaska, and decreased from 1737 to 1461 (-17%) off the west coast. Joint-venture fishery allocations have been increased for 1984 by 75% in the Bering Sea (180,000 to 315,000 t) and by 40% in the Gulf of Alaska (150,000 to 210,000 t). They remain about the same in the Washington-California Region (100,000 t). Nations participating in 1984 joint ventures are the USSR (all three areas), Japan (BS & GOA), Republic of Korea (BS & GOA), and Taiwan (GOA).

C. Foreign fisheries

1. Canada

The Polish People's Republic conducted national fisheries for Pacific hake off southwest Vancouver Island in 1983. Five Polish vessels

caught 12,556 t of hake. Several 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 hake catch of 621 t is added to the national catch. A summary of foreign fishery catches follows:

Nation	Species	Quota (t)	Catch (t)	Supplemental catch (t)	Total catch (t)
Poland	Hake (whiting)	12,500	12,556	621	13,177
	Pollock	Incidental	10	3	13
	Ocean perch	Incidental	27	16	43
	Other rockfish	Incidental	271	6	277

2. United States

Foreign nations operated directed fisheries in areas within the U.S. Fishery Conservation Zone in the Gulf of Alaska and Bering sea in 1983 (Table 7). No directed foreign fishing was allowed in the Washington-California Region. Foreign catches declined slightly in both of the Alaska areas (-3% in the Bering Sea and -2% in the Gulf) from 1982 catches. Since 1982, Bering Sea foreign catches increased notably for Pacific cod (+47%) and yellowfin sole (+13%) while they declined markedly for Atka mackerel (-84%), Pacific ocean perch (-59%), and other rockfish (-60%). Foreign catches in the Gulf of Alaska rose for Atka mackerel (+70%), rockfish other than POP (+44%), Pacific cod (+11%), and flounders (+6%); and dropped for Pacific ocean perch (-32%), pollock (-12%), and sablefish (-12%). Foreign vessel effort decreased from 1982 levels by 4% in both areas (31,239 to 30,058 vessel days in the Bering Sea; 6884 to 6614 vessel days in the Gulf of Alaska). Foreign catches for 1983 appear in Table 7.

Foreign involvement in fisheries off Alaska and the Pacific coast can be expected to follow the trend of recent years; which has been increasing participation in joint ventures and smaller directed allocations. The final 1983 and initial 1984 foreign allocations are presented in Table 8.

D. Canada-U.S. Groundfish Management and Regulations--Significant Changes

1. Canada

Effective groundfish management during 1983 was again hampered by the absence of a legal basis for specific time/area/quota enforcement. This lack resulted in significantly greater harvests than recommended TACs, particularly for rockfishes. The B.C. general fisheries regulations have been locked in the revision/approval process for approximately three years and were only received in the spring of 1984; throughout the intervening period the only legal regulation was a coastwide closure.

Table 6. 1983 joint-venture landings (mt) in the Bering Sea, Gulf of Alaska, and Washington-California region by species and INPFC area. Values in parentheses indicate amounts discarded.

Bering Sea	Pollock	Pacific cod	Sablefish	Atka mackerel	POP	Other rockfish	Yellowfin sole	Turbot	Flounders without yellowfin sole	Squid	Herring	Other fish	Total
Area I	146,467	9,662	44	<1	126	4	22,449	37	11,546	9	1,115	1,139	192,59
Area II	0	0	0	0	0	0	62	0	2	0	0	0	6
Area IV	2,547	4,700	70	10,511	11	4	17	47	145	1	0	439	18,49
Total	149,014	14,362	114	10,511	137	8	22,528	84	11,693	10	1,115	1,578	211,15

Gulf of Alaska	Pollock	Pacific cod	Sablefish	Atka mackerel	POP	Shortspine thornyhead	Other rockfish	Flounder	Squid	Other fish	Total
Shumagin	497	469	134	789	1,934	12	271	171	1	44	4,322
Chirikof	124,540	342	11	0	7	0	1	62	3	163	125,129
Kodiak	9,094	1,615	130	1	34	1	17	2,459	<1	184	13,535
Total	134,131	2,426	275	790	1,975	13	289	2,692	4	391	142,986

Washington-California	Pacific whiting	Jack mackerel	Sablefish	POP	Other rockfish	Flounder	Other fish	Total
Vancouver	27,185	0(1)	<1(<1)	0(4)	13(356)	0(1)	<1(291)	27,198
Columbia	39,454	0(29)	6(23)	<1(3)	17(333)	0(1)	<1(37)	39,477
Eureka	2,248	0(0)	0(<1)	0(<1)	0(1)	0(<1)	0(4)	2,248
Monterey	3,213	0(<1)	0(0)	0(<1)	0(7)	0(0)	<1(17)	3,213
Total	72,100	0(30)	6(23)	<1(7)	30(697)	0(2)	<1(349)	72,136

Table 7. 1983 foreign directed groundfish catches (m) from the Bering Sea, Gulf of Alaska, and the Washington-California region by species and INPFC area. Nations participatin are listed in order of tonnage landed.

	Bering Sea					
	Area I	Area II	Area III	Area IV	Total	Nations participating
Walleye pollock	541,037	293,946	6	56,475	891,464	JPN, ROK, FRG
Pacific cod	24,108	15,127	0	2,271	41,506	" " "
Sablefish	1,392	1,212	0	574	3,178	" " "
Atka mackerel	21	95	0	1,098	1,214	ROK, JPN, FRG
POP	118	189	0	656	963	JPN, ROK, FRG
Other rockfish	66	172	0	756	994	" " "
Yellowfin sole	85,139	735	0	70	85,944	" " "
Turbot	17,760	32,450	0	6,582	56,792	" " "
Flounder (without yellowfin sole)	18,915	2,377	0	2,254	23,546	" " "
Squid	446	3,015	0	509	3,970	"
Herring	561	838	0	<1	1,399	"
Other fish	7,813	3,249	0	3,194	14,256	"
TOTAL	697,376	353,405	6	74,439	1,125,226	"

	Gulf of Alaska					
	Shumagin	Chirikof	Kodiak	Yakutat	Total	Nations participating
Pollock	39,319	35,372	6,626	41	81,358	Japan, Korea
Pacific cod	8,635	15,306	3,874	1,962	29,777	" "
Sablefish	1,363	1,294	1,227	1,082	4,966	" "
Atka mackerel	2,594	8,811	65	<1	11,470	Korea, Japan
POP	672	2,510	2,216	19	5,417	Japan, Korea
Shortspine thornyhead	158	195	307	57	717	" "
Other rockfish	474	728	486	24	1,712	" "
Flounder	2,020	4,235	3,225	51	9,531	" "
Squid	54	78	133	1	266	" "
Other fish	1,042	824	332	58	2,256	" "
TOTAL	56,331	69,353	18,491	3,295	147,470	

Washington-California

There was no directed foreign groundfish fishery in this region in 1983.

Aside from attempts to obtain voluntary compliance with harvest guidelines, significant features of the 1983 Groundfish Management Plan included the continuation of assemblage management for the shelf and slope rockfish groups and a trip limit (50,000 lb/trip) for sole (caught in Hecate Strait) throughout the year.

2. United States

a. WDF

Puget Sound. Major regulation changes for Puget Sound groundfish management during 1983 included: an increase in the minimum mesh size for Pacific whiting (hake) pelagic trawlers from 2 inches to 3 inches; restriction of the fall Pacific whiting (hake) fishery in central Puget Sound to Monday through Thursday, and the winter fishery to Monday and Wednesday until the ABC is reached; reduction of the inner Puget Sound lingcod sport bag limit to 1 fish daily; and reduction of the inner Puget Sound sport lingcod season to April 15 through May 31.

Coastal Management Zone. During 1983, regulation changes of the Department of Fisheries paralleled those of the Pacific Fisheries Management Council. They included: from January 1 to February 28 a 75,000 pounds/trip limit on widow rockfish; beginning March 1, a 40,000 pounds/trip, 1 trip/week limit for Sebastes (rockfish other than widow, Pacific ocean perch, and thornyheads) in the INPFC Vancouver-Columbia Region and reduction of the widow rockfish trip limit to 30,000 pounds/trip, no frequency limit; finally from September through December, reduction of the Vancouver-Columbia Region Sebastes limit to 3000 pounds/trip, 1 trip/week; reduction of the widow rockfish limit to 1000 pounds/trip and 1 trip/week.

b. ODFW

Extensive changes occurred in Oregon's groundfish regulations in February 1983. In essence, Oregon regulations were revised to reflect Federal regulations in the Fishery Conservation Zone (3-200 mi off-shore) including extensive revision of definitions relating to gear.

Effective in late February 1983, a trip limit of 30,000 lb was placed on widow rockfish deliveries (vs 75,000 lb to February 28). A 40,000 lb/trip limit was placed on Sebastes complex, which included all rockfish except Pacific ocean perch, widow, shortbelly, and "idiot" rockfish (Sebastolobus alascanus). A 22-inch minimum size limit was placed on sablefish landings except for a "tolerance" of 333 fish, 1000 lb, or 10% of weight of all sablefish on board. This tolerance was changed to 5000 lb effective in late June 1983. These regulations' primary purpose was to impede catch rates so the various Optimum Yields or quotas would not be met or exceeded before year's end. In late June, Sebastes trip limits (in areas north of Cape Blanco) were further restricted to one trip per calendar week not to exceed 40,000 lb, except no frequency restriction on trips of 3000 lb or less of Sebastes complex.

Table 8. Final 1983 and initial 1984 foreign groundfish allocations (mt) for the Bering Sea-Aleutians area, Gulf of Alaska, and Washington-California region.

BERING SEA-ALEUTIANS

	Pollock	Pacific cod	Yellowfin sole	Flounders	POP	Other rockfish	Sablefish	Atka mackerel	Turbot	Other fish	Total
FINAL 1983											
Japan	738,313	33,163	68,433	37,469	1,620	4,378	3,972	5,726	69,849	50,922	1,023,302
ROK	182,257	10,333	24,739	8,950	470	1,430	607	7,293	11,266	15,142	265,174
Taiwan	4,830	102	300	209	12	35	23	30	981	413	7,013
W. Germany	24,600	622	128	410	98	100	62	120	1,080	1,470	29,144
TOTAL	950,000	44,220	93,600	47,038	2,200	5,943	4,664	13,169	83,176	67,947	1,324,633
INITIAL 1984											
Japan	298,072	13,110	59,391	27,267	1,028	1,300	1,055	347	18,919	10,275	433,026
ROK	52,439	2,118	9,231	3,235	102	137	131	66	2,318	1,823	72,267
W. Germany	7,293	310	111	292	13	15	2	13	282	250	8,731
TOTAL	357,804	15,538	68,733	30,794	1,143	1,452	1,188	426	21,519	12,348	514,024

GULF OF ALASKA

	Pollock	Pacific cod	Flounders	POP	Shortspine thornyhead	Other rockfish	Sablefish	Atka mackerel	Other fish	Total
FINAL 1983										
Japan	58,992	40,604	8,593	6,442	2,850	3,534	4,724	4,469	9,171	139,379
ROK	32,602	5,955	3,138	1,297	644	2,762	700	8,656	4,561	60,315
TOTAL	91,594	46,559	11,731	7,739	3,494	6,296	5,424	13,125	13,732	199,694
INITIAL 1984										
Japan	13,435	13,367	6,162	3,169	992	1,109	856	2,287	6,872	49,606
ROK	8,654	550	1,550	295	223	1,141	100	6,376	2,904	22,124
TOTAL	22,089	13,917	7,712	3,464	1,215	2,250	956	8,663	9,776	71,730

WASHINGTON-CALIFORNIA REGION

No foreign allocations granted in 1983 or 1984.

Effective in early September, both widow rockfish and Sebastes complex directed fishing was reduced to 1000 lb per trip for widow rockfish and 3000 lb per trip for Sebastes complex. These measures were designed to allow retention and sale of incidental catches without exceeding the quotas of 18,500 t of Sebastes complex (in the combined INPFC U.S.-Vancouver and Columbia Areas) and 10,500 t of widow rockfish (coastwide).

In November 1983, retention or sale of Pacific ocean perch (S. alutus) caught in the INPFC Columbia Area was prohibited as the Optimum Yield (quota) there was reached.

c. CDFG

Increases in gillnetting for groundfish has occurred in recent years in Area 1B. A significant by-catch of seabirds and some mammals has occurred in some months and areas. As a result regulations are pending to close areas, limit gear, and limit participants.

d. NPFMC

Mr. Jeff Povolny and Mr. Steve Davis provided an overview of regulations in the Gulf of Alaska and the Bering Sea. The Gulf of Alaska Groundfish Fishery Management Plan was adopted in 1978, and 13 amendments have since been adopted or approved. Amendment B was approved by the Council in February 1984 and is currently undergoing Secretarial review with expected implementation in August 1984. This amendment combined the western and central regulatory areas for pollock management and increased the pollock OY for the combined area to 400,000 t from 200,000 t. This action was considered appropriate given the results of recent NMFS groundfish surveys that showed a major increase in pollock abundance.

Other Council action in the Gulf of Alaska included the approval of emergency regulations which increased the halibut by-catch ceilings for the domestic trawl fishery. These by-catch ceilings are applied against the domestic fishery during the period of December 1-May 31, a period when bottom trawls are especially efficient in catching halibut in the western and central regulatory areas. The old halibut ceilings, based on a one per cent of the expected trawl harvest with bottom gear, was 29 t in the western area and 52 t in the central area. The new ceilings for the western and central areas were set at 270 t and 754 t, respectively. This adjustment was considered necessary with the increase in halibut abundance and the dramatic growth of the domestic groundfish fishery in the Gulf of Alaska. Without the emergency action, the domestic groundfish fishery would have been closed in early 1984 once the old halibut by-catch ceilings had been reached. This closure would have prevented the opening of the productive Shelikof Strait pollock fishery. The closure would have remained until June 1 when the by-catch ceilings are customarily removed. A plan amendment which will address the by-catch problem with halibut and other prohibited species by the trawl fishery is being developed by the plan team.

The Council also is working toward solving its "cul-de-sac" management problem, which involves pockets, or intrusions, of federal

waters located within the Southeast Alaska archipelago. These cul-de-sacs (i.e. waters outside the territorial sea) create problems when attempting to manage the sablefish fishery in this area. Traditionally, waters within the archilpelago have been considered as "inside" waters and therefore have been managed by the State of Alaska. These "inside" waters have different sablefish seasons and harvest guidelines than those of "outside" waters. In 1983 fishermen discovered a regulatory loophole by locating these cul-de-sacs and fishing these areas when the traditional state seasons were closed. The Council has instructed their plan team to develop an amendment which will solve this problem. In the interim, the Council used its emergency powers to close these cul-de-sac areas until the traditional opening dates.

The groundfish resource in the Bering Sea/Aleutian Islands Region is now managed by the ecosystem approach in Amendment 1, rather than the individual-species approach. The optimum yield (OY) for the groundfish complex is set as a range of 1.4-2.0 million tonnes. TACs for individual species, or species groups, are set annually by the Council, and implemented administratively by the National Marine Fisheries Service.

Eighty-five percent of the TACs are apportioned to domestic fishermen for domestic processing and joint-venture processing. Any remainder is available for foreign fishing. The remaining fifteen percent is set aside as a reserve for unanticipated increases in domestic fishing, allocations, and as a conservation buffer for in-season changes in stock conditions. In 1984 the sum of the TACs equalled 2.0 million tonnes.

Amounts of groundfish for the domestic fishery are now set annually and implemented administratively by the NMFS. This is an improvement over the former system whereby each allocation of each groundfish species had to be approved by the Secretary of Commerce.

e. PFMC

PFMC established the 1984 OY for coastwide (Washington-California) widow rockfish at 9300 t, down from 10,300 t in 1983. The 1984 widow rockfish fishery was placed on a 50,000 lb, once-per-week-trip limit. The trip limit was reduced to 40,000 lb once-per-week beginning in early May. As of May 31, approximately 60-65% of OY has been landed. Additional action expected at July Council meeting.

PFMC established a harvest guideline (HG) of 10,100 t for the (U.S.) Vancouver-Columbia Region Sebastes complex (rockfish other than widow, shortbelly, and Pacific ocean perch). The Sebastes fishery in the Vancouver-Columbia Region was placed on a 30,000 lb, once-per-week trip limit. This was reduced to 15,000 lb once-per-week in early May. This regulation included a caveat that fishermen could land 30,000 lb once-every-two-weeks if intention to do so is declared in writing to the state management agency. As of May 31, approximately 50% of HG has been landed. HG is not a quota (as is OY).

PFMC maintained 600 t and 950 t OYs on POP in the Vancouver and Columbia areas, respectively. About 65% of Columbia Area and 50% of (U.S.) Vancouver Area OYs were landed as of May 31. Management action is expected at the July Council meeting to avoid exceeding OY in either area.

Coastwide sablefish OY was established at 17,400 t (ABC=13,400 t). As of May 31, only 9% of OY has been landed.

VIII. GROUNDFISH RESEARCH

A. Stock Assessments

1. Pacific cod

a. DFO

Pacific cod abundance continues to decline throughout British Columbia waters. Similar quasi-cyclic nadirs occurred during 1960-63 and 1968-70. Cause(s) of the substantial fluctuations in cod abundance is (are) unknown. There is no evidence currently available which would suggest that the fishery was an important factor in past oscillations. There is evidence to suggest that abnormal water temperature during the spawning season is a negative factor.

For this reason, we recommend a very conservative management strategy until the implications of the new biological information have been assessed and the responses of the stocks to the fishery are more clearly understood. Also, we are completing an analysis of Canadian stocks using cohort and yield-per-recruit models. This will be completed, hopefully within a few months.

b. NMFS

The stocks of Pacific cod in the Bering Sea and Gulf of Alaska remain large and relatively stable. Survey results indicated the biomass in the Bering Sea was up slightly over 1982 (+11%) at 1,126,400 t. The 1977 year-class remained a major component of the stock in 1983. No unusually large year classes appear to follow the 1977 class, so as these fish are harvested the stocks are expected to decline to more normal historical levels. This decline is expected to take place in 1984-86. The 1984 EY was set for about 290,000 t in the Bering Sea.

In the Gulf of Alaska, the Pacific cod stock is also faced with an expected decline over the next two years or so due to the 1977 year-class passing through the fishery. No recent surveys for cod have been conducted in the Gulf and the estimate of EY for 1984 remains at 95,000-190,000 t. The OY for 1984 has been reduced to 88,000 t to reduce the incidental catch of Pacific halibut.

Results of a 1983 cooperative U.S.-Japan trawl survey in the Aleutian Islands Region indicate a major increase in Pacific cod abundance from 1980 when a similar survey was conducted.

2. Rockfish

a. DFO

There was limited activity concerning assessment of slope rockfishes during 1983. Field activity was confined to a trawl survey of the Canada-U.S. northern boundary area and two smaller-scale surveys of the deeper waters off the mouth of Queen Charlotte Sound. The former survey reinforced results of a 1979 survey showing limited biomass of slope rockfishes, with major concentrations on fishable bottom being located in the immediate boundary area. The latter involved two commercial trawlers and examined the postulated existence of a separate deep-water stock of S. alutus outside Goose Island Gully. No concentrations of fish deeper than 160 fath were encountered and the 150-170 fath depth range consistently produced the highest CPUE in the traditional Goose Island Gully biomass surveys. Those fish captured on the 1983 cruises exhibited the same characteristics of high exploitation as those fish found on the traditional fishing grounds inside the gully.

No new analytical studies were initiated during 1983, although major updates of all stock assessments are underway for 1984. In particular, the sensitivity of sequential population analysis to M and the stochastic error component of the stock-recruit relationship are being investigated. These results are being fed into the simulator used to predict future stock behaviour under various harvest strategies.

No major new developments were observed in the shelf rockfish fisheries in 1983. Stock assessment for these species continues to be hampered by the multi-species nature of the fishery and the lack of age composition data. To provide some insight, we have begun comparing length frequency observations from port samples with theoretical distribution generated by a simulator (Breen and Fournier 1984). This simulator uses estimates of growth and estimates of the variance about growth to generate theoretical length frequency samples for a given "Z" and known partial recruitment coefficients. By comparing the two sets of length frequencies we can get some insights into the exploitation history of each stock.

b. NMFS

Pacific ocean perch stocks remain low in all areas following the severe overharvesting of the 1960s. The Bering Sea and Aleutian stocks appear to remain stable at a low level with an estimated biomass of 121,400 t in both areas. The 1984 EY has been set at 1400 t for the Bering Sea and 10,800 t for the Aleutians, which is at the low end of the range of the MSY estimate.

Gulf of Alaska Pacific ocean perch stocks have not been surveyed recently. Efforts at rebuilding the stock by setting relatively low OY's have not yet shown significant results because recruitment to the stock has been sporadic. The OY for 1984 remains at 11,475 t.

The 1983 west coast groundfish survey emphasized the assessment of shelf rockfish, particularly canary and yellowtail in the INPFC

Vancouver and Columbia areas. Results suggest there may be some increases in biomass for these species over estimates made from the 1980 survey, but their abundance is still much less than what was estimated from 1977 survey results. A rigorous review of trawl survey effectiveness for rockfish stock assessment will be made before the next west coast triennial survey is conducted in 1986.

c. WDF

Black Rockfish. A black rockfish tagging project was initiated in 1981 to determine distribution of the catch among various fisheries, assess trends in movement and to assist in validation of ageing criteria. To date 9539 tagged fish have been released: 4739 in 1981; 2544 in 1982; 2033 in 1983; and 223 thus far in 1984. In 1981-82, tagging effort was concentrated along the central Washington coast, in 1983 effort was split between the northern Oregon and northern Washington coast, and in 1984 we are concentrating on the northern Washington coast.

We have recovered 205 tags or 1.15% of the releases. Twenty tags were recovered from OTC-injected fish, but we have only 13 sets of otoliths from these fish. Five of the OTC-marked otoliths were examined by the age reading staff at the Pacific Biological Station in Nanaimo. Time at liberty for these fish ranged from 6 to 18 months. All otoliths showed the OTC mark and an annulus was visible on samples at liberty more than 12 months.

Distribution of the recovered tags by fishery breaks down as follows: 50% from the trawl fishery; 36% from the recreational fisheries (including charter); 13% from the troll and jig fisheries; and 2% from WDF research. Among recovered tags, 46% showed movement of 0-9 nm; 27% travelled 10-39 nm; 23% moved 40-59 nm; and 3% were recovered more than 60 nm from the point of release.

Yellowtail Rockfish. WDF's 1982 stock assessment of yellowtail rockfish has been criticized for: (1) inadequate accounting of landings by foreign fisheries; (2) inaccurate ageing; and (3) a firm conviction by industry that the estimate of current biomass (1980) was too low considering landings from the fishery. During 1983 we attempted unsuccessfully to update the assessment using a non age-structured model. We are currently preparing to re-age stored yellowtail rockfish otoliths and then using updated age and catch data to try the age-structured model again.

An analysis of variance of yellowtail rockfish catch rates (kg/km) from NMFS's triennial groundfish surveys (1977, 1980, and 1983) was conducted to determine if there were differences in catch rates among years. Before answering this question the data had to be examined for differences due to depth, vessel or latitude. Because most of the tows and the great bulk of the yellowtail were north of 43°00' and because areas north of 48°30' were not sampled in all years, data examined was restricted to tows taken between these latitudes.

There was no effect of vessel or depth on catch rates, so data from all vessels and all depths could be pooled for further analysis. Catch rates did vary by latitude, but because of the large variance between areas and the unbalanced design the usual F-tests do not have their normal significance. Using a standard analysis but relying only on P-values that were either very large of very small, it was concluded that year and latitude have no effect south of 46° but both had a marginally significant effect north of there (P-values of .02).

Representing each year's relative abundance as the unweighted sum of the mean catch rates, the trend for the area north of 46° since 1977 has been of declining abundance. The catch rates and their standard deviations are as follows: 1977, 45.4±18.8; 1980, 17.7±11.4; and 1983, 12.6±5.8. These data are not significantly different at the .05 level, but the difference between 1977 and 1973 is significant at the .10 level.

d. ODFW

A status-of-stock report for canary rockfish in the INPFC Columbia and Vancouver areas was drafted. Cohort analysis attempted by usable age data was limited to 1980-82. Age determinations prior to 1980 were based on surface readings and were therefore not usable. Results of the analysis suggested that allowable biological catch in 1984 was about 2450 t in the INPFC Columbia Area and 830 mt in the INPFC U.S.-Vancouver Area. A later draft concluded age data were inadequate for modelling and used an average catch method as a basis for interim sustainable yield estimation. This resulted in ABC as 800 t and 2100 t, respectively in the U.S. section of Vancouver Area and the Columbia free which were later adopted by the PFMC's Groundfish Management Team as its recommended 1985 ABCs. All-nations catch in 1983 was 2790 and 622 t, respectively (preliminary data). The canary rockfish report is being revised because some assumptions on which the analysis was based are highly questionable.

In May 1983, ODFW conducted a pilot tagging study of black rockfish out of Garibaldi, Oregon. A total of 1900 fish were tagged and released in the vicinity of Three-Arch Rocks near Tillamook Bay. Vessels and operator time were donated by various members of the Garibaldi charter boat fleet. As of April 1984, 16 tagged fish had been recovered, mostly from the area of tagging. Two fish showed significant movement. One fish was recaptured 17 nm to the south off Cape Kiwanda while the second fish was recaptured 60 nm to the north, just north of the Columbia River.

A second tagging study was conducted in cooperation with the Washington Department of Fisheries. About 1200 black rockfish were tagged off Tillamook Head. The fish were also captured for tagging by sport tackle. As of April 1984, 17 of these fish had been recaptured. Nine were caught at the tagging site and eight were caught at the sunken "wheatship" just north of the Columbia River. The "wheatship" recoveries were taken by trawl.

3. Sablefish

a. DFO

The sablefish stock off Canada is monitored aboard commercial and research vessels. Allowable catch remains at 3500 t. CPUE has been stable over the duration of the domestic fishery (1977-83).

It is evident that strong year classes are an important component of the stock and that the fishery is supported by these year classes. The strategy for exploiting strong year classes is now being studied using yield-per-recruit analysis. Abundance is increasing due to recruitment of strong 1977 year class.

In addition, tagging studies have shown that juvenile fish rearing in the inside waters (Queen Charlotte Sound, Hecate Strait, and mainland inlets) move northward into the United States zone off Alaska (Beamish and McFarlane 1983). If this northward movement is a coastwide phenomenon in the northeast Pacific Ocean, as evidenced by Bracken (1982) and Sasaki (1982), then a Canadian fishery for juveniles in these inside waters would impact on the U.S. fishery off Alaska. However, the intensive fishery for juveniles being conducted off the coasts of Washington, Oregon, and California clearly indicates that the management strategy in these areas is to exploit strong year classes when they occur. This fishery may be seriously affecting recruitment to the Canadian zone, making it difficult to justify conservation of migratory juveniles rearing in the Canadian zone but recruiting to the U.S. fishery.

These tagging studies (Beamish and McFarlane 1983) have identified discrete stocks of adult sablefish in areas such as the northwest coast of Vancouver Island, Queen Charlotte Sound, the west coast of the Queen Charlotte Islands, as well as major inlets. The major recruitment to these stocks is from outside the particular area (Beamish and McFarlane 1983) and excessive effort in these areas without compensating recruitment may result in a localized depletion. If monitoring programs indicate excessive effort and reduction in CPUE in an area, it will be necessary to set quotas by discrete areas as a precautionary measure.

For this reason, we recommend a very conservative management strategy until the implications of the new biological information have been assessed and the responses of the stocks to the fishery are more clearly understood.

b. NMFS

Abundance indexing. The data obtained from the Center's abundance indexing surveys was subjected to statistical analyses by REFM scientists to determine the program's ability to track annual changes in abundance. Interannual abundance indices were judged to be statistically insignificant. The survey design recommended to improve these surveys entails surveying more sites (8-9 in each area) with fewer replicates at each site.

Catch rates observed during the 1983 survey off Washington and Oregon suggest that sablefish abundance, which had been decreasing between 1979 and 1981, rebounded sharply between the 1981 and 1983 surveys. The 1983 catches, although nearly equal in numbers to baseline year 1979 levels, were composed of a much higher percentage of submarketable-sized sablefish and a lower percentage of medium and large sablefish than in any of the previous surveys. Apparently increased fishing pressure and higher landings beginning in 1979 have reduced the number of larger sablefish off Oregon and Washington, while at the same time recruitment of primarily 3-year-old sablefish into the fishery, from a strong 1980 year class, has greatly increased the proportion of smaller sablefish.

Other surveys. Japanese trawl and longline surveys in the Bering Sea, Aleutians, and Gulf of Alaska show a decrease in abundance between 1982 and 1983, but good recruitment of the 1977 year class has resulted in an increase in estimates of abundance by weight between 1979-83 of 27% and 58% in the Aleutians and Gulf of Alaska, respectively. Good recruitment of the 1980 year class in the Gulf of Alaska suggests that this may also be a relatively strong year class.

Interest in sablefish stock structure has prompted requests that the Japanese provide tissue samples for biochemical genetic structures from their survey activities.

4. Flatfish

a. DFO

Principal flatfish species under analysis are Dover sole, English sole, petrale sole, and rock sole.

Dover sole: Principal regions of exploitation are 3C + 3D and 5C + 5D + 5E. In Areas 3C + 3D, exploitation of deep-water stocks began in earnest about 5 years ago. Recently, a swept-area biomass estimate was 5000 t, ±80%, but this estimate was deemed minimal. Current production appears to be appreciably below MSY. In Area 5C + 5D + 5E, standardized landing statistics for the complete history of the fishery (1970-date), indicate a modest initial decline, followed by stabilization of abundance. Surplus-production analysis suggests that current production is close to MSY, but processor-imposed trip limits, due to weak markets, confound the analysis.

English sole: Principal stock exploited is in Area 5D. Analysis is based on a 24-yr time series of standardized landing statistics, and size and age composition. Stock appears to be in satisfactory condition. Yield/recruit analysis suggests that production could be increased appreciably, without increasing effort, by reducing the catch of undersized specimens.

Petrale sole: Principal region of exploitation is Area 3C + 3D. Recent "warm" ocean years have increased recruitment, but no

quantification is possible yet. Current abundance of petrale sole is low, but is expected to increase because of the "warm" period 1978-84. Both Canadian and U.S. scientists agree that petrale stocks off Washington State and British Columbia are more vulnerable to oceanic conditions than to the fishery.

Rock sole: Principal regions of exploitation are Queen Charlotte Sound Area (5A + 5B) and Hecate Strait (Areas 5C + 5D). In Queen Charlotte Sound, standardized LPUEs for 1960-83 exhibit no trend. Fluctuations are caused by variable recruitment. Recent echo-sounder surveys by the G.B. REED indicate that for both major banks, substantial portions are "untrawlable" and may serve as refuges for rock sole and other shelf species such as Pacific cod and lingcod. Thus, these stocks may well be underexploited. In Hecate Strait, two stocks are recognized -- one in 5C and the other in 5D. Analyses are based on a 24-yr time series of standardized landing statistics, as well as size and age compositions. A Beverton-Holt stock-recruitment relationship has been demonstrated, and recruitment appears to be related to two factors -- water temperature during spawning season, and stock biomass. Stock condition appears to be satisfactory, although recruitment has been relatively low during the last decade.

b. NMFS

Principal species exploited in Alaska is yellowfin sole, primarily important in Bering Sea. Biomass is increasing. Little effort is expended on stock assessment of flatfishes in the Gulf of Alaska.

c. ADFG

Analysis is underway on the modest trawl fishery of Southeast Alaska. Search time is a major factor in analysis of landing statistics.

d. WDF

Analysis is scheduled for the long-term landing statistics for English sole in Puget Sound.

e. ODFW

Stock assessment of Dover sole, in manuscript form, is nearing completion. M is probably overestimated, based on the scale method of age determination. Yield could be increased with a larger mesh size, if M is not overestimated too much. A recent discovery is the long-term decline in mean length of fish landed, and mean length of age-10 females. Stock/recruitment analysis of English sole suggests that long-term landings are less than OSY.

f. CDFG

No comment.

5. Pacific hake (whiting)

a. DFO

Strait of Georgia. The Pacific hake fishery in the Strait of Georgia was not initiated until 1979, therefore no historical data base is available with which to study possible effects of the fishery on the stocks. Catches during 1979 and 1980 were small, 516 t and 508 t, respectively. However, 2400 t were landed in 1981, 2824 t in 1982, and 3111 t in 1983. The initial management approach was to utilize estimates of unexploited biomass (B_0) from hydroacoustic and swept-volume surveys during the mid-1970s, and estimates of instantaneous natural mortality rates (M) (0.45-0.63) to calculate theoretical maximum sustainable yields.

Using the Gulland (1970) formula, MSY $0.5(M)(B_0)$, gave estimates ranging from 11,000 t to 38,000 t. As these were preliminary parameter estimates, it was recommended that the total allowable catch not exceed 10,000 t until a re-assessment of abundance estimates and other biological parameters was undertaken (Ketchen 1980; Westrheim 1980).

Using recent estimates of abundance (60,000-130,000 t) and natural mortality rate (0.19-0.29) the range in MSY is 6000-19,000 t. Assuming abundance is near the mid-point of the estimates (100,000 t) obtained from the recent swept-volume midwater trawl, hydroacoustic and ichthyoplankton surveys, and that natural mortality is in the range of estimates taken using changes in relative abundance of good year-classes (0.19-0.29), then MSY is 10,000-15,000 t.

Monitoring of the stock to assess reproduction response to exploitation is continuing.

Offshore. Pacific hake off the west coast of Vancouver Island are generally older than those in areas to the south. Strong year classes support the fishery. Currently the 1977 year class dominates, however the 1973 and 1970 year classes contributed 5.3% and 9% (by number), respectively, during 1983. Females make up approximately 70% of the catch. Currently, U.S. and Canadian scientists are examining the applicability of an age-structured, stochastic, recruitment model as a tool in developing a cooperative management strategy. This assessment will form the basis of U.S.-Canada management policy in the future.

b. NMFS

The 1983 west coast bottom trawl and echo integration-midwater trawl surveys resulted in a Pacific hake (whiting) biomass estimate of 1,330,000 t, similar to estimates made in 1977 and 1980. A major change in the latitudinal distribution of the population was observed. The population was dominated by the 1980 and 1977 year classes. The abundance of 3-year-old fish in the Monterey area in 1980 was not seen in 1983 although 3-year-olds were by far the most abundant year class in the survey area. These young fish were distributed throughout the survey area.

6. Spiny dogfish

a. DFO

Commercial catches of spiny dogfish continue to be below the recommended TACs of 3000 t assigned to the Strait of Georgia, and 6000 t assigned to cover all other areas of the Canadian zone. The current assessment is based on a discrete-time, deterministic "age structure" model developed by Wood et al. (1979). This model is currently being adapted to the present computer system and updated to include recent work regarding age at maturity and historic catch records.

Anecdotal evidence from fishermen involved in the current longline fishery in the Strait of Georgia indicates that dogfish abundance in this area appears to have dropped. This decrease is predicted by the model as the result of an oscillation in abundance set into motion by the intensive liver fishery of the 1940s.

Current catch and effort data show no sign of decreasing CPUE, however landings indicate that the fleet is now more dispersed and fishing further from traditional grounds.

Maturity work for dogfish from the Strait of Georgia completed this year shows that age at 50% maturity of females is 35 years.

Tagging continued in the Strait of Georgia with analysis of 1983 returns currently under way. A total of 2000 fish were tagged and released on the west coast of Vancouver Island.

7. Walleye Pollock

a. DFO

The pollock fishery off British Columbia remains small. Total landings peaked in 1979, due to the roe fishery, at 3385 t, then decreased annually to 929 t in 1982; and increased slightly to 1030 t in 1983. As of 1982, the pollock roe fishery has remained small due to both low availability of fish and market conditions. Presently, the majority of the total landings are from Dixon Entrance-northern Hecate Strait during the fourth quarter as a result of the demand for pollock fillets. Off the west coast of Vancouver Island, pollock remains an incidental catch by the foreign fleet during the offshore hake fishery.

Prior to 1978 no historical data base for the fishery was available, therefore, we had utilized biomass estimates from hydroacoustic and trawl-swept-volume surveys with natural mortality rates to estimate MSY. Presently we are trying to update our backlog of age samples and to continue building the data base and monitor the fishery. Recommended MSY for pollock in the Strait of Georgia was 3100 t (plus 300 t in Juan de Fuca Strait); and 1000 t for Dixon Entrance-northern Hecate Strait.

b. NMFS

Both U.S. and Japanese survey data indicated an increase in pollock abundance in 1983. The abundance level is still believed to be somewhat lower than the 1976-83 average due to poor recruitment of the 1979-81 year-classes. The 1984 EY was estimated to be 80% of MSY or 1,200,000 t.

The biomass of pelagic pollock in the Aleutian Basin was hydroacoustically estimated in January-March 1983. Fifty-five percent of the Basin was surveyed, yielding an estimate of 1,141,500 t.

Survey efforts on pollock in the Gulf of Alaska have centered around the spawning concentration in Shelikof Strait. Echo intragration-midwater trawl surveys in 1983 estimated the off-bottom biomass as 2.4 million t. Estimates from the 1984 survey are not yet available, but preliminary findings suggest that the size of the spawning stock was comparable to that in 1983. Pollock were not concentrated as densely as in previous years, but significant densities of fish were found over larger areas.

An updated cohort analysis which included 1982 catch-at-age data provided revised estimates of exploitable biomass and annual surplus production for Gulf of Alaska pollock. As a result, the EY for 1984 was raised to 408,000 t and the OY was established at 400,000 t.

Samples collected during a major effort in Shelikof Strait in 1981 are being used to evaluate the use of pollock eggs and larvae as assessment tools in the Gulf of Alaska. In 1983 we studied the distribution, growth, and feeding of post-larvae resulting from the Shelikof Strait pollock spawning. We are planning studies for 1984 in Shelikof Strait which will allow us to improve out methods of estimating total numbers of eggs spawned.

8. Pacific Halibut

a. IPHC

Pacific halibut stocks continue to increase under the rehabilitation strategy, particularly in the central portion of its range. Current strategy involves limiting landings to 75% of ASP (Annual Surplus Production). Some sectors are now managed at 90% of ASP. The stock may be nearing optimal size. Concern continues over the condition of stocks in Bering Sea and off British Columbia. Analyses are largely based on catch-at-age data due to increasing problems with landing statistics. Of interest was the recapture in the B.C.-Oregon region of halibut tagged off Kodiak Island as juveniles (age 2-4) four years earlier.

9. Lingcod

a. DFO

In 1982-83, the offshore fisheries, particularly off Vancouver Island and in Queen Charlotte Sound, experienced a surge in production.

This is believed to be due to a recent surge in recruitment. While the assessment of stocks in British Columbia has not been particularly well developed, the offshore stocks have undergone marked fluctuations in abundance independent of fishing pressure.

In the Strait of Georgia, commercial catches have declined by 70% since the early 1960s. This decline is believed to reflect a long-term decline in stock levels. In the absence of a suitable historical data base of fisheries and biological statistics, mark-recapture experiments were initiated in 1982 to assess the impact of commercial and sports fisheries on stocks in the Strait of Georgia. Approximately 4000 tagged lingcod were released in 1982 and 2600 were released in 1983.

b. ODFW

Assessment studies on lingcod were limited to preparing a report on the 1978 tagging. The purpose of this study was to determine if exchange of tagged fish occurred between an off-shore trawl ground and a popular in-shore sport fishing area. Fish were tagged in both areas but not simultaneously. Of the 621 tags recovered, no in-shore/offshore exchange was noted between the two tagging areas even though a few fish tagged off-shore did move in a landward direction. The great majority of tagged fish were recovered at their respective tagging sites.

B. Related Studies

1. Age Analysis

a. Review of April/August 1983 Age-reading Workshops

Dr. Woelke, workshop chairman, reviewed the two-phase workshop which was convened to develop a coastwide concensus on rockfish age determination. Phase-1 was the April 1983 meeting reviewing all methods employed -- surface, sections, and break/burn. Phase-2 was in August 1983, and involved demonstrations and comparative readings. Break/burn was deemed "good" for rockfish, and evaluation for sablefish is underway. The Working Group Report was submitted to the Parent Committee at their November 1983 meeting, and was distributed to participants in February 1984.

Dr. Woelke noted that the "preferred" break/burn method was not unanimously acceptable, nor has it been validated. NMFS was concerned about the relatively low rate of reading consistency for sablefish otoliths from the Gulf of Alaska and the Bering Sea.

Discussion turned to dissemination of the CARE[a] Report

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[a]Committee of Age Reading Experts.

describing methods of age determination for individual species. TSC members agreed to "publish" the report in a loose-leaf format to facilitate the inevitable updating of methods and inclusion of other species. Mr. Six (PMFC) committed his agency to finance "publication" and dissemination of the CARE report, and TSC accepted.

Further discussion of CARE led to the appointment of a Working Group (Jow, Chilton, Tagart) to draft a recommendation to TSC.

b. Otolith Exchange

A pilot exchange has been initiated for a small sample of break/burn otoliths of S. alutus. Each otolith is to be read three times, at weekly intervals. Entire exchange will take 3-4 months to complete. One serious problem encountered is the degradation, over time, of otolith readability. No satisfactory method has been developed to inhibit the degradation.

c. Age Validation Studies

Three agencies reported that age-validation studies were underway. DFO reported studies underway on seven species -- English sole, lingcod, Pacific hake (whiting), rock sole, sablefish, spiny dogfish, and yellowtail rockfish. NMFS reported studies underway on four species -- Pacific cod, Pacific whiting (hake), walleye pollock and yellowfin sole. WDF has a study underway on the black rockfish.

2. Sablefish

a. Review of Sablefish Tagging-Coordination Working Group Report

Chairman McFarlane reviewed the report, which is attached as Appendix C. The group (McFarlane, Bracken, and Dark) was appointed in 1983 by TSC to "review all available sablefish tagging data and recommend joint tagging programs to resolve specific areas of concern including movement of juveniles and trans-boundary rates of exchange, and to submit a report to the 1983 Meeting of the Parent Committee.

Five recommendations were included in the report, and, briefly stated, are: (1) coastwide tagging of juvenile (35-50 cm FL) sablefish to investigate recruitment patterns for year classes of varying size; (2) development of a common file of all past tagging experiments for comprehensive studies of migration and stock delineation, and to identify gaps in knowledge thereof; (3) postpone further tagging of adult sablefish until the comprehensive study is complete. A single exception is tagging during the spawning season in the Queen Charlotte Islands-Dixon Entrance (Canada) and Cape Ommaney (S.E. Alaska) areas to study trans-boundary migrations; (4) validate all age-determination methods employed, with priority on California and the Gulf of Alaska, west of 140°E long; and (5) rejected biomass estimations, via tagging -- not feasible at this time. The report was accepted by TSC.

DFO reported that some 17,000 juvenile (<55 cm FL) sablefish have been tagged (OTC injected) and another 10,000 will be tagged by

fall. NMFS tagged juvenile sablefish proportionately from pot-survey catches, and plan OTC injections during fall studies. To date, 2000 have been tagged (1200<40 cm).

b. Suggestions for Joint Research

No suggestions were submitted.

3. Rockfish tagging

ODFW recommended that TSC return to informal reports on results of tagging experiments, with special emphasis on rockfish. TSC members agreed to forward to Mr. Demory information on all rockfish tagging experiments. Recapture locations were to be reported at the highest possible resolution. Results of this compilation will be reported at the 1985 TSC Meeting.

4. Research Vessel

Mr. Stanley described the new DFO research vessel (W.E. RICKER) which will replace the G.B. REED, probably in 1985. The new vessel was originally a factory trawler (190' long; 1040 GT) built in Japan for Canadian fishermen. The conversion to a research vessel is scheduled to begin in late 1984.

C. Cooperative Research with other nations

1. Canada

a. Pacific hake

A joint Canada-U.S. survey for Pacific hake was carried out during August and September 1983 off the west coast of Vancouver Island and the State of Washington between 48° and 49° North latitude. The survey employed two vessels, the Canadian vessel G.B. REED and the chartered U.S. vessel GOLD-'N-SUN. Each vessel was equipped with a calibrated echo integration system that measured the average acoustic backscattering strength. This quantity represents a good relative measurement of fish density from which an absolute biomass density estimate can be derived if the mean acoustic target strength of the insonified fish is known and if the fish do not avoid the survey vessel.

The survey incorporated two objectives. The first was designed to provide an inter-calibration between the two survey vessels and thus provide information on a possible "boat effect" (Olsen 1980), a term that is used to describe changes in fish target strength and/or distribution in response to the survey vessel. Both survey vessels conducted a series of simultaneous measurements on typical hake aggregations under normal survey conditions. A stochastic model was developed to compare the

measured backscattering strengths. These data are currently being analysed and a jointly authored paper is in preparation.

The second objective was for each vessel to determine independently the distribution and abundance of Pacific hake in the offshore waters of the survey area. A predetermined grid of regular, parallel transects was followed by the Canadian vessel, while the chartered U.S. survey vessel conducted a zig-zag series of transects. Simultaneous fishing operations were conducted by both parties to determine species identification and to provide biological samples for the hake population.

The hake distributions of both survey vessels were very similar. A study is underway to determine the possible effects of different population expansion algorithms using these data.

b. Pacific cod

DFO and WDF are conducting a modest investigation into two anomalous fisheries for Pacific cod in Juan de Fuca Strait. A report was submitted to TSC in 1983, and a final report is now in preparation. The cod have disappeared from the Canadian ground, and gear conflicts have eliminated the trawl fishery in the U.S. grounds.

2. United States

During 1983, the United States conducted cooperative research on fish and mammals with Japan, the USSR, the Republic and Korea, and Canada. Cooperative research has taken many forms from approval of research plans and sharing of results, to joint field studies, analyses, and reporting of results. Twenty-one foreign vessels conducted research inside the U.S. FCZ, primarily in the Gulf of Alaska, Bering Sea, and Aleutian Island areas. Foreign vessels which will be working cooperatively on groundfishes during 1984 are listed in Table 9.

During the 1983 west coast groundfish survey an extensive collection of Pacific hake (whiting) was made for a cooperative study of the myxosporidian parasite which has hampered the domestic utilization of this species. Scientists from the NWAFC and the Pacific Biological Station (Nanaimo) are examining and analyzing these samples together. The principal investigators on this project are planning to meet in Seattle on 31 July to discuss their findings and to plan the reporting phase of the work.

In a further cooperative effort between these laboratories, the Pacific hake resource was hydroacoustically surveyed concurrently by each agency in order to compare and calibrate past and future hydroacoustic efforts.

Bob Francis (REFM) and Sandy McFarlane (DFO), among others, are cooperating on a project which will provide the biological rationale to lay the groundwork for joint U.S.-Canada management of the Pacific hake fishery.

Table 9. Scheduled U.S. cooperative groundfish research with foreign governments in 1984.

	Nation	Operating area	Date	Research program
NOVODRUSK*	USSR	Bering Sea	1/1, 5/20	Trawl/Plankton
POSEYDON*	USSR	Pacific coast	3/1, 6/30	Trawl/Plankton
SHANTAR*	USSR	Gulf of Alaska	4/5, 6/30	Trawl/Plankton
RYUSHO MARU#158	Japan	Bering Sea, Gulf of Alaska	5/5, 9/11	Longline-sablefish
DAIKICHI MARU#37*	Japan	Aleutians, Gulf of Alaska	7/5, 10/16	Trawl
OH DAE SAN	Republic of Korea	Gulf of Alaska	7/1, 8/19	Trawl

*Proposed.

IX. OTHER TOPICS FOR DISCUSSION

A. Fisheries Data Deficiencies

1. Canada

Dr. Tyler reported a problem with respect to obtaining information on groundfish landings in Washington State by Canadian trawlers -- Pacific hake, rockfish, and spiny dogfish. Principal problem is rockfish. Mrs. Lorette (DFO--Vancouver) reported that a reverse problem may occur because DFO granted permission for U.S. trawlers to land groundfish in Prince Rupert for processing prior to shipment on to Oregon State. Informal discussions at the meeting established coordinated data collection for both situations.

2. United States

a. ADFG

Mr. Rigby (ADFG) reported a federal-state meeting was planned to deal with needs of NPFMC.

b. PMFC

Mr. Six reported that PMFC was surveying member states to document all projects related to regional management and future project needs. The purpose is to improve long-term financing and mandates for appropriate projects.

c. NMFS

Mr. Wilkins reported that the Tiburon Meeting outlined the data needs for sablefish, but no further progress was made.

A request for on-line program inventories more frequently than annually was submitted by an economist. The request received little support.

B. PMFC Data Series/PacFIN Integration

After some discussion, TSC agreed in principle to the integration of the PMFC Data Series and PacFIN, subject to refinements of PacFIN.

C. TSC Accomplishments

In response to a recommendation of the Parent Committee, Messrs. T. Jow (CDFG) and S. J. Westrheim (DFO) accepted the task of summarizing the historical accomplishments of TSC for presentation at the next meeting of the Parent Committee.

X. PROGRESS ON 1983 RECOMMENDATIONS

A. The TSC to Itself

1. Break/burn age determination and recommended species

TSC members agreed to supply the Secretary, by August 1, lists of preferred species, together with validation evidence, for which the break/burn method is employed. NMFS reported that they have no list. CDFG applies the method to chilipepper rockfish, but no validation has taken place. (see VIII.B.1)

2. PMFC/PacFIN Data Series

Agreement in principle was achieved to combine the two series. (see IX.B)

3. Sablefish Working Group

A report was submitted, and attached as Appendix C.

B. The TSC to the Parent Committee

1. Coordinated Sablefish Program

Mr. Six (PMFC) reported that the coordinated sablefish research program is developing. A weak link is coastwide monitoring, but PMFC is actively recruiting funding.

2. Second Age-reading Workshop and Annual Meetings of CARE

Report on the age-reading workshop was submitted (see VIII.B.1.a). TSC approved annual meetings of CARE, and recommended that the 1984 meeting take place at the INPFC-sponsored workshop in Nanaimo during October.

C. The Parent Committee to TSC (December 1983)

Unfortunately, minutes of the 1983 Parent Committee were not distributed prior to, or at, the 1984 TSC Meeting.

1. Review Data Needs for Domestic and Joint-venture Fisheries

Completed. (see IX.A)

2. Review and Document Accomplishments of TSC

Working group appointed. Report due at the next meeting of the Parent Committee.

XI. 1984 TECHNICAL SUBCOMMITTEE RECOMMENDATIONS

A. To the TSC

1. CARE Report (prepared by Jow, Chilton, and Tagart)

The TSC accepted the report of the CARE Working Group for review and final approval at the 1985 TSC Meeting. Text is attached as Appendix D.

2. Data Deficiencies

The TSC recommended that discussions on data deficiencies be accorded a place on the agenda for the 1985 meeting of TSC.

3. Economists

The TSC recommended that for its 1985 meeting Agenda Item VIII (GROUNDFISH RESEARCH) contain a sub-section B.3 Economics, and that the attending economists be encouraged to contribute, as appropriate, to any other section of the agenda.

4. Endorsed Species

The TSC recommends that each Agency review its applications of various age-determination techniques, and present a list of endorsed species, by stock, age group, and data, at the 1985 meeting of TSC.

B. To the Parent Committee

No recommendations, but disappointment was expressed at the absence of minutes for the 1983 Meeting of the Parent Committee.

XII. FUTURE MEETINGS

The TSC agreed to hold its next meeting during the third week of June, in Alaska. Final arrangements will be made at a later date.

The Parent Committee has tentatively scheduled its next meeting to take place at the January 1985 Meeting of the Western Groundfish Workshop.

XIII. ELECTION OF CHAIRMAN

S. J. Westrheim (DFO) was elected chairman for the 1985 and 1986 meetings.

XIV. ADJOURNMENT

Chairman Rigby adjourned the meeting at 1128 PDT, June 22, 1984.

APPENDIX A

AGENDA FOR THE 25TH ANNUAL MEETING
OF THE TECHNICAL SUBCOMMITTEE OF THE
CANADA-UNITED STATES GROUNDFISH COMMITTEE,
NANAIMO, BRITISH COLUMBIA, JUNE 20-22, 1984

I. CALL TO ORDER

II. APPOINTMENT OF SECRETARY

III. APPROVAL OF AGENDA

IV. INTRODUCTIONS

V. TERMS OF REFERENCE OF THE SUBCOMMITTEE

VI. REVIEW OF AGENCY GROUNDFISH PROGRAMS

VII. REVIEW OF NORTHEAST PACIFIC GROUNDFISH FISHERIES
- A. Canada-U.S. Fisheries
  1. Commercial fisheries -- new fisheries, notable changes in resources, landings, markets, etc.
     a. British Columbia
     b. Alaska
     c. Washington
     d. Oregon
     e. California
  2. Recreational fisheries -- where applicable
     a. British Columbia
     b. Alaska
     c. Washington
     d. Oregon
     e. California
- B. Joint-venture Fisheries
  1. Canada
  2. United States -- including Bering Sea and Gulf of Alaska
- C. Foreign Fisheries
  1. Canada
  2. United States -- including Bering Sea and Gulf of Alaska
- D. Canada-U.S. Groundfish Management and Regulations -- Significant Changes

VIII. GROUNDFISH RESEARCH
- A. Stock Assessments
  1. Pacific cod
  2. Rockfish
  3. Sablefish
  4. Flatfish

5. Pacific whiting (hake)
6. Dogfish
7. Pollock
8. Pacific halibut
9. Lingcod
10. Other

B. Related Studies
   1. Age analysis
      a. Review of August 1983 Age Reading Workshop
      b. Otolith exchange
      c. Age validation studies
   2. Sablefish
      a. Review of Sablefish Working Group Report
      b. Suggestions for joint research
   3. Rockfish tagging
   4. Other (Canada)
      a. Hecate Strait studies
      b. Recreational fishery study
      c. New research vessel

C. Cooperative Research with Other Nations

IX. OTHER TOPICS FOR DISCUSSION
   A. The TSC to Itself
      1. Age determination by break and burn method with species recommendations (see VIII.B.1)
      2. PMFC Data Series/PacFIN (see IX.B)
   B. The TSC to the Parent Committee
      1. Coordinated sablefish program (see VIII.B.1.c; B.2.b. and IX.A.)
      2. Fisheries economists
      3. Second Age-reading Workshop
   C. The Parent Committee to the TSC (12/83)
      1. Review data needs for domestic and joint-venture fisheries (see IX.A.)
      2. Review and document accomplishments of the TSC

XI. 1984 TECHNICAL SUBCOMMITTEE RECOMMENDATIONS
   A. To the TSC
   B. To the Parent Committee

XII. SCHEDULE OF FUTURE MEETINGS

XIII. ELECTION OF CHAIRPERSON

XIV. ADJOURNMENT

APPENDIX B
REPORTS PUBLISHED (OR IN PRESS) BY MEMBER AGENCIES, MAY 1, 1983 TO APRIL 30, 1984

CANADA

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None reported.

APPENDIX C.

Report of the TSC Working Group on Sablefish Tagging Studies.

By

S. McFarlane (chairman), T. Dark and B. Bracken

The Technical Subcommittee (TSC) of the U.S.-Canada Groundfish Committee, during its 1983 annual meeting, acknowledged that a large body of sablefish tagging information exists and that a review was in order for the purpose of identifying specific research needs. The Subcommittee appointed Messrs. Barry Bracken (ADFG), Tom Dark (NMFS), and Sandy McFarlane (DFO) to a working group charged with "reviewing all tagging data and recommending joint tagging programs to resolve specific areas of concern including movement of juveniles and transboundary rates of exchange". The working group met in Seattle on December 14, 1983, and discussed a number of research activities which have the potential for filling gaps in our knowledge of sablefish biology and behavior. Proposed studies and associated rationale are presented below in order of priority for consideration by the TSC.

I. Juvenile sablefish migration and recruitment patterns

Juvenile sablefish movements have been studied for years through tagging and it is generally acknowledged that they are more likely to migrate, and migrate over long distances, than are other components of the populations. More recent studies by Canada and the State of Alaska suggest that there is a directional element to their migrations. This observation has stimulated a number of questions regarding nursery areas, recruitment patterns, and the delineation of stock units. Past studies don't adequately address all of these questions.

Therefore, the working group proposes that juvenile sablefish (35-50 cm) be tagged off Washington, Oregon, and California to determine where and when those fish recruit to a fishery and, especially, to evaluate their contribution to the Canadian fishery. Juveniles should also be tagged off W. Vancouver Island, W. Queen Charlotte Islands, Queen Charlotte Sound and Hecate Strait, Dixon Entrance, SE Alaska (with emphasis on outside waters), and in the Kodiak area to provide information on recruitment to local fisheries and to those found in other regions. Tagging should be conducted on juvenile representatives of small or moderately sized year classes as well as large year classes, in the event that migrations and recruitment characteristics vary with year-class size.

II. Comprehensive tagging data analysis

The working group concluded that development of a common file of existing tagging data is needed to determine long-term trends in movement, identify stock components and pinpoint areas where additional research is needed.

This concept has been discussed and endorsed by the INPFC and was the subject of a workshop at the International Sablefish Symposium in March, 1983. Working group members recognize the need for completion of a multi-agency comprehensive tagging report which would present results of all tagging experiments conducted to date. This report should be updated every two to three years to present new information. Once the comprehensive review is complete, an action file of new data should not be necessary.

III. Adult sablefish tagging studies

Adult sablefish have been tagged extensively in recent years from California to the Aleutian Islands and in the Bering Sea. The working group concluded that continuation of large-scale adult tagging projects should be curtailed until a comprehensive analysis of coastwide sablefish tagging data is complete. However, specific tagging needs were identified by the group and were given a relatively high priority. It was felt that these studies could provide information vital to regional managment at transboundary stocks, and determine if significant annual movement occur.

Areas identified where additonal adult tagging should be conducted include in order of priority:

1) Queen Charlotte Islands - Dixon Entrance
2) Cape Ommaney

Tagging of fish in these areas during the spawning period is of particular importance in understanding annual distribution of sablefish stocks.

IV. Age validations using tagging in conjunction with O.T.C. (oxytetracycline injections)

As age validation is critical to our understanding of population dynamics and development of management strategies for a species, the working group participants agreed that the method of age determination used by all participating agencies should be validated. Participants noted that tagging of sablefish in conjunction with

interperitoneal injections of O.T.C. had been successful in age validation studies conducted off Canada and identified this type of study as desirable for other areas. Ongoing biological studies have identified similarities in growth between some areas, i.e.; Northern Canada-Southern Alaska; Southern Canada-Washington, Oregon, which could be linked to Canadian validation. In view of these similarities, participants identified waters off California and in the Gulf of Alaska west of 140°E as being priority areas for conducting additional age-validation studies.

V. Biomass Estimation

The working group discussed the feasibility of initiating tagging studies to estimate the abundance of sablefish in specific areas. Discussion centered on identification and estimation of parameters needed for the study; specifically, rate of tag loss; tagging mortality; emigration, immigration, and on the reliability of these estimates. All participants agreed that in view of the complexities of this approach and the availability of alternative means of assessing stock condition and determining appropriate harvest levels, that population estimates through tagging be considered of relativley low priority. It is the hope of the working group that the TSC discuss the contents of this report and act soon to support those studies deemed critical to near-term management needs.

APPENDIX D

Report[a] of CARE Working Group

The TSC recognizes the importance of the efforts of CARE (Committee of Age Reading Experts) and the accomplishments of this group at their meetings and workshops. In an effort to facilitate continued progress, the TSC proposes that the primary focus of CARE is the description and application of groundfish age-reading methodology, and the development and implementation of age-reading quality-control procedures among agencies. It further recommends that CARE meet annually and provide a report of each meeting to TSC; that within the guidelines above, they (CARE) develop their own terms of reference, report these to TSC, and carry out their initiatives; and that TSC agencies seek the necessary financial support to convene the annual meeting.

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[a]Underlined sections were suggested by reviewers.