

REPORT OF THE
TECHNICAL SUBCOMMITTEE OF THE
INTERNATIONAL GROUND FISH COMMITTEE

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

Twentieth Annual Meeting

June 20-21, 1979

Parksville, B.C., Canada

Report of the Technical Subcommittee of the International Groundfish
Committee, Appointed by the Second Conference on Coordination of Fisheries
Regulations Between Canada and the United States

Date: June 20-21, 1979.

Place: Parksville, B.C., Canada

Participants:

Canada

Fisheries and Oceans Canada

Dr. R. Beamish
Mr. A. Cass
Dr. D. Fournier
Mr. L. Lapi
Mr. B. Leaman
Dr. J. Mason
Dr. M. Stocker
Dr. F. Taylor
Mr. J. Westrheim
Mr. K. Pitre (Observer)

United States

California Department of Fish and Game

Mr. T. Jow

Oregon Department of Fish and Wildlife

Mr. R. Demory

Washington Department of Fisheries

Mr. M. Pedersen

Alaska Department of Fish and Game

Mr. P. Rigby

National Marine Fisheries Service

Mr. T. Dark (Chairman)

Pacific Marine Fisheries Commission

Dr. J. Harville (Observer)

International Pacific Halibut
Commission

Mr. S. Hoag (Observer)

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I. Call to Order

The 20th annual meeting of the Technical Subcommittee was called to order at 08:15, June 20, 1979 by Chairman Mr. T. Dark under instructions set forth by the Parent Committee in 1959.

II. Appointment of Secretary

Mr. B. Leaman, Fisheries and Oceans Canada, was appointed recording secretary.

III. Approval of Agenda

The tentative agenda circulated by Chairman Dark prior to the meeting was modified through suggestions from both national sections. These modifications were primarily additions or elaborations to previously listed items; the revised agenda adopted for the meeting is included as Appendix A of this report.

IV. Terms of Reference of the Subcommittee

At its November, 1978 meeting, the Parent Committee reviewed its own terms of reference as well as those of its Subcommittee. The inadequacies of the present terms of reference were noted and the Parent Committee recommended new terms of reference which involve an amalgamation of the two bodies to form one committee. These changes have yet to be approved by the two governments and in the interim, the Subcommittee is operating under its existing terms of reference as outlined below:

(i) To review proposed changes in groundfish regulations affecting fisheries of common interest before they are implemented;

(ii) To review the effectiveness of existing regulations;

(iii) to exchange information on the status of groundfish stocks of mutual concern and to coordinate, wherever possible, programs of research; and

(iv) to recommend the continuance and further development of research programs in order to provide a basis for future management of the groundfish fishery.

V. Review of Agency Groundfish Programs

A. Recent and Anticipated Studies

1. Canada

The Groundfish Program of the Marine Fisheries Division increased its research activities in 1978, primarily in response to the need for stock assessments of all major stocks of Groundfish in British Columbia waters. Decreases in the biomass of traditionally exploited species and the subsequent shift in fishing effort to other species accentuated the need for a comprehensive review of all stocks. A total of 17 research cruises were conducted to estimate stock biomass, tag fish or obtain biological information fundamental to stock management. Two additional Sub-Programs were created in early 1979 in recognition of the distinct nature of some activities within the Program. One other Sub-Program was created to accommodate a scientist temporarily seconded from the Fisheries Oceanography Program to undertake ichthyoplankton studies of the stock recruitment process.

The comprehensive document on assessment of groundfish stocks in B.C. waters and recommended allowable catches for them was completed in December, 1978. The recommendations of the document provided the basis for management of groundfish stocks in 1979. While this document provides information on all stocks of concern, it is sometimes of a very limited nature due to the paucity of either biological data or commercial catch statistics. It is anticipated that this report will be updated and improved on an annual basis as further research material is obtained. All Sub-Programs contributed extensively to this document.

Research projects conducted by Program investigations were many and varied and are outlined below.

More than 10,000 trap-caught sablefish were tagged off the west coasts of Vancouver Island and the Queen Charlotte Islands, approximately the same number as were tagged in 1977. Approximately 3,000 trawl-caught lingcod were tagged off the west coast of Vancouver Island and in the Strait of Georgia. Both of these tagging studies were designed to study migration patterns, delineate stocks and determine growth rates. Almost all fish were injected with oxytetracycline to validate age determination techniques; about 10% of the fish were double tagged to evaluate the effectiveness of the standard anchor tag design.

In a limited, deep-water (to 3,700 m) trapping experiment sablefish were found as deep as 2,700 m off the west coast of the Queen Charlotte Islands. Investigations into methods for age determination of sablefish were continued with favourable results. Maturity states of sablefish were examined throughout the year in an attempt to determine the spawning period.

A study of the nesting behaviour of lingcod was conducted from December 1977-June 1978 to re-evaluate the most suitable period for a fishing closure in the Strait of Georgia. A second study of lingcod nests was conducted on the west coast of Vancouver Island in early 1979 to determine what factors regulate spawning and the location and concentration of nests.

Spawning stocks of walleye pollock were located in Hecate Strait, Dixon Entrance, Georgia Strait and associated inlets. An ichthyoplankton study was initiated in the Strait of Georgia during the 1979 pollock spawning season to document spawning and early life history. Fecundity studies were also conducted during the spawning season.

Age determination studies of hake using otoliths were continued. Otolith surface readings were found to be unsuitable for ageing Strait of Georgia hake. Young-of-the-year hake were discovered during trawl surveys off the west coast of Vancouver Island.

More than 1,900 longline-caught dogfish were tagged in the Strait of Georgia. The purpose of the tagging study is to determine movement and annual growth. Almost all fish were double-tagged with a Petersen disc tag to test the effectiveness of the standard nylon anchor tag. An age-structure model incorporating recent information on growth and reproduction was developed to investigate the population dynamics of dogfish in B.C. waters. The hydroacoustics unit carried out surveys of the distribution and abundance of fish stocks in Queen Charlotte Sound and Dixon Entrance, using digital echo integration. The stocks surveyed in Queen Charlotte Sound during January-February and October consisted primarily of rockfish complexes and herring.

The July survey in Dixon Entrance was directed toward walleye pollock. In the summer pollock were found to be widely distributed in midwater throughout the area. Two centres of abundance were located, one off Cape Chacon and the other on the Two Peaks-Dundas Island grounds.

Pacific cod studies included: (a) tagging juvenile fish in Swanson Channel (Area 4B) during January and on Amphitrite/Lafertouse banks in February-March; (b) monitoring the abundance of adult cod in Area 3C during the February-March closure; (c) investigating the interrelationships of Pacific cod, rock sole and English sole on the Two Peaks-Butterworth ground (Area 5D); (d) attempting to resolve age determination problems; and (e) continuing analysis of the 1954-1969 tagging experiments.

Pacific ocean perch studies included: (a) participation in a Canada-USA rockfish project surveying the Dixon Entrance-Cape Ommaney region during July-August; (b) a biomass assessment cruise to Moresby Gully (Area 5C) in September; (c) assisting in the update, through 1977, of a stock assessment of Pacific ocean perch in the B.C.-Oregon region.

The commercial fishery sampling unit continued to provide the Program with catch and effort information from the domestic fishery as well as biological samples from landed catches. Percent of landed weight for which interviews were obtained (and thus fishing effort) remained relatively high, averaging 93% of landed weight for the coast as a whole (up 1% from 1977). Percentage of landed weight interviewed, by area, was: 4B-62%, 3C-83%, 3D-85%, 5A-92% 5B-100%, 5C-98%, 5D-100% and 5E-99%. The lower percentage interview coverage in the 4B-3D areas is due to the large number of small, alternate ports of landing in these areas where port samplers are not maintained.

The total number of samples obtained by this unit again increased over the previous year, yielding a total of 419 samples. Despite the overall increase there were reductions in the number of samples for some species and areas. In general these decreases were reflective of lowered landings of the species involved - in particular, the decrease in the number of Pacific cod samples in Area 3C was largely a result of the winter closure of the fishery. In addition to regular activities the unit also initiated a program of observer trips aboard domestic vessels, primarily to obtain ungraded samples of catches but also to document discards within the fishery and enhance liaison between the Program and the industry.

Foreign fisheries off the Pacific coast of Canada in 1978 were limited to those for sablefish and hake plus that by the United States under the provisions of a reciprocal fishing agreement. Twenty-one Japanese longliners fished a total of 310 vessel days; observers were aboard for 110 vessel days yielding a 33% coverage. Thirty percent of the landed catch was monitored by observers. The 1978 hake fishery was prosecuted by three foreign nations (Japan, Poland and USSR) and a cooperative venture between Canada and Poland. Observers monitored 26.7% of the 141 vessel-days in the former and 49.2% of those in the latter. Percent coverages of landed catches were 48.5% and 62.3%, respectively.

Rockfish investigations during 1978 were primarily concerned with stock assessment cruises aboard chartered commercial vessels to the west coast of the Queen Charlotte Islands (Area 5E) and the northwest coast of Vancouver Island (Area 3D). For many of the rockfish species in these areas the cruises served the dual purpose of obtaining biological samples necessary to estimate age composition of their populations. Biomass estimates for the 5E area point to the same conclusion as CPUE analysis with regard to optimal yields, i.e. that catches of rockfishes from the area should be held to approximately 2,500 m.t. at most. Inadequate coverage of the 3D area was obtained due to inclement weather during the cruise. Efforts are still being directed at properly estimating the confidence limits of biomass estimates. Biological samples are being processed to yield information necessary for yield-per-recruit analysis since analyses based on cohorts is precluded by the paucity of long-term data.

A new scientist was recruited in the fall of 1978 to concentrate on flatfish stocks. After a brief period of familiarization the investigation assumed responsibility for stock assessments and research. Other 1978 activities concerning flatfish included exploratory fishing for Dover sole off the west coast of Graham Island in January and July-August.

One investigation concentrated primarily upon a review of halibut considerations in relations between the USA and Canada and participation in the negotiations of the reciprocal fishing agreement between the two countries. A major review of the Strait of Georgia historical fishery was also prepared to evaluate the effects of changing effort within the fishery. The investigation also reviewed the Canadian tuna fishery and represented Canada at the annual meeting of the IATTC.

Another investigation was primarily responsible for developing accurate mathematical procedures for various aspects of groundfish investigations. Included in these activities were: developing a method of combining age and length data to accurately estimate age composition with minimum ageing activity; refining cohort analysis to make it more generally applicable; and working with the hydroacoustic investigation to improve the mathematical basis of fish density calculation. This scientist also collaborated with the Herring Program to develop a procedure for estimating age composition of a stock based on samples with both "ageable" and "unageable" fish included.

2. United States

(a) National Marine Fisheries Service

Most of the groundfish research at the Northwest and Alaska Fisheries Center is conducted by the Resource Assessment and Conservation Engineering (RACE) Division. The Division leader is Dr. Murray Hayes who directs the work of 25 fishery scientists. All of the groundfish assessment studies are under the direction of Mr. Miles Alton.

Bering Sea Groundfish Assessment

Annual trawl surveys conducted since 1971 in the southeastern Bering Sea to assess the condition of groundfish resources were continued in 1978-79. The 1978 survey was expanded to 60°N lat. and to the upper continental slope down to 250 fm to provide more complete assessment of pollock, sablefish, Pacific ocean perch, Greenland turbot, and arrowtooth flounder stocks. The ongoing 1979 survey is similar in design but has been extended northward (to St. Lawrence Island) to more fully assess pollock and Tanner crab (*G. opilio*) stocks. Additionally, for the first time the slope to 1000 m will be systematically sampled. Two Japanese vessels will participate in this year's work.

Gulf of Alaska Groundfish Assessment

A bottom trawl survey of the rockfish resources in the eastern and

central Gulf of Alaska was successfully completed in 1978. The U.S. and

Canada worked cooperatively to assess rockfish stocks in the region from

Dixon Entrance to Cape Ommaney. Research to determine age composition,

growth, food habits, fecundity and length-weight relationships of Atka

mackerel was again conducted in the vicinity of Kodiak Island during the

winter of 1979.

The coastwide rockfish survey initiated in 1977 will continue, with

the area between Kodiak Island and Unalaska Island of primary study during the

summer of 1979.

West Coast Groundfish Assessment

A bottom trawl survey of the Pacific ocean perch resource off

Washington and Oregon was conducted cooperatively with the states of

Washington and Oregon during March and April 1979. Primary objectives were

to determine distribution and abundance and evaluate the relative strength of

the 1970 year class.

The program which began in 1978 to index the relative abundance of

sablefish at three sites off southeastern Alaska with trap gear, will be

repeated in 1979 and will be expanded to include three sites off Washington

and Oregon.

Future studies include a major trawl/hydroacoustic survey of the

important groundfish resources off Washington, Oregon, and California during

the summer of 1980 and possibly a tagging study in Monterey Bay and off

southern California to examine the discreteness of those stocks and to

estimate population sizes.

Other Activities

NMFS devoted considerable effort to the modification of existing preliminary management plans and the development of fishery management plans during 1978.

Scientific meetings were held with Japan, USSR, Poland and the Republic of Korea.

NMFS placed scientific observers on Soviet and Polish vessels operating off Washington, Oregon, and California and on Soviet, Japanese, and Korean vessels in the Gulf of Alaska. Thirty-seven percent of the Soviet and Polish vessel days in the Washington-California region were covered by U.S. observers. Coverage was not as complete in the Gulf of Alaska where 7 to 20 percent of the vessel days for various fleets were monitored.

(b) Alaska

Personnel

As of July 1979 two new groundfish positions were created. The Department of Fish and Game now has one groundfish biologist for the Southeastern Region and one for the Westward Region (Kodiak, west), plus a groundfish research coordinator headquartered in Juneau. However, as fate would have it, the FY 80 budget has been reduced leaving the program without attached operating funds. Outside funding sources are being investigated.

Region and area management personnel continue to assume groundfish management responsibilities as necessary, especially with regard to interacting fisheries, e.g. crab and shrimp.

Projects

A domestic observer program funded by the North Pacific Fishery Management Council, now in its second and final year, is collecting effort and biological information from the U.S. trawl fleet. The final report is due December 1979.

Three years of field investigations on nearshore and demersal resources of Cook Inlet and Kodiak Island have been completed. Funded by the Bureau of Land Management, the project is designed to acquire base line data prior to oil exploration. The results will be reported by this fall. Presently ongoing is a juvenile sablefish tagging project near Ketchikan. If additional State bottomfish development funds are available the program will be extended for two years, sampling within other inside areas of Southeastern Alaska. The National Marine Fisheries Service is providing additional assistance.

Fishery monitoring through logbooks, fish tickets and dockside sampling, though limited, is continuing. Within Southeastern, monitoring activities, especially for pollock, starry flounder, and sablefish, are being expanded. Analysis of the resulting data for Southeastern Alaska has resulted in the closure of several bays during the traditional winter flounder fishery. Presently, an initial logbook program is being maintained for this minor fishery. It is a goal of the groundfish program to initiate a statewide trawl logbook program as soon as practical.

The Computer Services Section during 1978 installed minicomputers within two regional offices in an effort to upgrade the catch reporting system. However, these machines are not as yet operational within the statewide system because funding cuts have reduced the Section's programming capability. The final 1978 catch data will not be available until August at the earliest.

(c) Washington

Stock Assessment Unit Activities

Highlights of the groundfish activities of the Stock Assessment Unit during the past year include: Concluded participation in the 1977 Rockfish-Hake survey; participated in the joint NMFS/WDF/ODFW survey of Pacific ocean perch off Washington and Oregon during 1979; finalized reports on biological statistics of yellowtail rockfish, and a study comparing methods of estimating recreational statistics in a selected area of Puget Sound. The Hydroacoustic project was involved in a joint Canadian-WDF survey of walleye pollock in the Strait of Georgia. Biometric studies were carried out on aspects of fitting the von Bertalanffy growth curve; adjustment of historical CPUE data for Pacific ocean perch; and determination of appropriate levels of sampling for estimation of age distribution from trawl landings.

Groundfish Management Unit Activities

Major tasks of the unit during the past year included participation in the development of the Pacific Regional Council Groundfish Management Plan and methodology of the National Recreational Fisheries Survey; and management of the commercial and recreational fisheries for groundfish via the public hearing process. Field activities were concerned mainly with monitoring of the trawl fisheries, set net fisheries for Pacific cod and spiny dogfish, line fisheries for lingcod, and the recreational fisheries. Biological samples collected from trawl catches during 1978 totalled 92 compared to 115 taken during 1977. In addition, rockfish species composition samples were obtained from 81 landings.

Marine Fish Enhancement Unit

This unit has been involved with implementing capital budget funds for the construction of artificial reefs, fishing piers, and acquisition of property to improve access to fishing areas. A new project has been implemented

dealing with enhancement of Puget Sound lingcod populations. The feasibility of several strategies are being examined. These include capture and transfer of prespawning adults from healthy areas to depleted areas; artificial rearing of young from eggs; and collection, pen rearing, and planting of juvenile lingcod.

(d) Oregon

There were no personnel changes in the groundfish project during the report period. The number of personnel remained at nine in 1978 plus a variable number of seasonal employees. One staff member transferred to a Portland staff position in March 1979; his position has not been refilled to date.

The major activity during the last year was the completion of

lingcod tagging on offshore reefs off Yaquina Bay.

The proposed PL 88-309 project for FY 1980 will be more rockfish

assessment, especially assessment of survey methodology. Exact approach will

be determined after consultation with other west coast fishery agencies.

Work continued on a series of computer programs to handle routine

data processing needs.

On going projects of fishery monitoring through logbooks, fish

tickets and sampling of landings continued.

(e) California

Programs in progress include the groundfish work by the Marine

Resources Region and the Operations Research Branch of the Department. The

Planning Branch performs data processing of groundfish data.

Monitoring, surveillance, and assessments of commercial and

recreational fisheries were accomplished by Regional personnel. Samples in

1978 included age, sex, size, and species composition from landings at

California ports.

Studies on the commercial passenger fishing vessel (CPFV) fishery and the biology of important rockfish in southern California were carried out by Operations Research Branch. A study of the biology of central California rockfish is underway at Monterey by Operations Research Branch.

Logbook data were collected from trawl, pot, and CPFV activities. Timely data compilation is a problem and final data for 1977 and 1978 are not available. The NORFISH system is currently in the debugging process using 1977 groundfish data. A major step forward is the acquisition of a mini-computer by the Department.

Considerable effort by the staff was devoted to the preparation of the groundfish fishery management plan of the Pacific Fishery Management Council.

(f) IPHC

Research activity by IPHC in 1978 was similar to that of 1977. A survey of juvenile halibut utilizing trawl gear was conducted at index stations in the Gulf of Alaska and the Bering Sea. A survey of adult halibut with setline gear was conducted at index stations in Hecate Strait and off Kodiak Island. IPHC continued to monitor the commercial fishery and assess the condition of the halibut resource. Other research activities include the study of transboundary movements. Evidence indicates that eggs and larvae from spawning off British Columbia drift west into the Gulf of Alaska. Juvenile halibut, and to a lesser extent adult halibut, move east in compensation for egg and larval drift. Anticipated studies in 1979 and 1980 include an expanded tagging program on juveniles, a winter spawning ground survey, and a quantitative determination of egg and larval drift.

B. List of Publications

A list of publications by agency is included in Appendix C.

VI.

Review of Northeastern Pacific Groundfish Fisheries

A. Canada-United States Commercial Fisheries in 1978

1. Total Landings

Canadian and United States trawl landings on the Pacific coast in 1978 were 27,234 m.t. and 71,049 m.t. respectively for a total of 98,283 m.t. This 1978 catch represents a 14% increase over the total 1977 trawl catch. Total trawl effort cannot be estimated at the present time but is believed to be up from the 201,163 hr expended in 1977 (Table 1).

The 1978 Canadian trawl landings were up 10% from the 1977 landings

and 45% above the 1968-77 mean. Canadian trawl effort in 1978 was down 4%

from 1977. Non-trawl landings were 4,550 m.t. which represents a 57% increase

from those of 1977. Longline accounts for 2,528 m.t.; handline/trawl, 1,059 m.t.;

trap, 639 m.t.; and shrimp trawl, 325 m.t.

The United States trawl landings in 1978 were up 15% from landings

in 1977. Total trawl effort cannot be estimated but effort was up 15% in

Washington and 44% in Oregon. Non-trawl landings were about 14,830 m.t. and

were 31% greater than 1977 non-trawl landings.

2. Dover sole

The 1978 trawl catch of Dover sole was 16,154 m.t., a 17% increase

over the 1977 catch of 13,864 m.t. Incidental catch by other gears was 53 m.t.

a. Canada

The 1978 catch was 732 m.t., a slight increase over 1977 but 18%

less than the 1968-77 mean. The major catch area was Area 5D which accounted

¹Includes 856 m.t. of Pacific hake taken by U.S. vessels involved in a

U.S.-U.S.S.R. joint fishing venture. Does not include Alaska landings as

they are not separated by gear.

Table 1. Trawl landings (metric tons) from the northeastern Pacific by Canadian and United States vessels in 1977 and 1978 and means for 1968-77.

Species	1977						1978				Mean 1968-77	
	B.C.	Wash.	Ore. Calif.	Ak. ^a	Total	B.C.	Wash.	Ore.	Calif.	Ak. ^a		Total
English sole	1,469	1,172	1,001	1,950	5,592	807	1,598	1,041	1,825		5,271	4,824
Rock sole	1,249	191	10	5	1,455	1,309	168	12	3		1,492	2,082
Petrale sole	285	603	822	1,275	2,985	226	907	1,000	1,275		3,408	3,679
Dover sole	695	1,051	1,818	10,300	13,864	732	1,478	3,374	10,570		16,154	12,248
Rex sole	99	166	425	945	1,635	102	239	642	945		1,928	1,509
Starry flounder	89	577	283	505	1,454 ^b	73	437	489	505		1,506 ^b	1,057
Arrowtooth flounder	1,591	116	b	b	1,707 ^b	2,318	246	b	b		2,564 ^b	b
Other flatfish	16	211	435	900	1,562 ^b	25	308	564	835		1,732 ^b	b
Pacific cod	7,627	4,032	364	-	12,023	6,668	4,029	398	-		11,095	10,822
Lingcod	1,175	1,223	381	1,180	3,959	908	705	445	1,200		3,258	4,504
Sablefish	787	479	326	2,530	4,122	131	675	958	2,340		4,104	2,654
Pacific ocean perch	2,716	2,027	424	50	5,217	3,861	1,958	486	60		6,365	5,547
Other rockfish	4,866	8,718	2,398	9,000	24,982	6,147	9,547	4,388	9,000		29,082	15,008
Misc. species	262	155	153	515	1,085 ^c	165	41	185	170		561 ^c	c
Dogfish	724	586	122	2	1,434	941	699	56	-		1,696 ^c	551
Hake	-	20	450	c	470 ^c	c	7	383	c		390 ^c	c
Pollock	890	-	c	c	890 ^c	2,407	605	c	305		3,317 ^c	c
Animal food	49	842	85	-	976	112	1,050	3	-		1,165	2,968
Reduction	181	932	-	-	1,113	302	2,039	-	-		2,341	2,622
Total	24,770	23,101	9,497	29,157	86,525	27,234	26,736	14,424	29,033		97,427	72,603
Percent of total	28.6	26.7	11.0	33.7		28.0	27.4	14.8	29.8			
Total hours	34,407	52,073	26,683	88,000	201,163	33,198	60,049	38,447	d			
Catch/effort (excludes dog- fish, m.t./hr)	0.699	0.432	0.351	0.331		0.792	0.421	0.374	d			

^aTrawl landings from Alaska are not available.

^bSome Arrowtooth flounder landings included with other flatfish landings

^cSome hake and pollock landings included with miscellaneous species landings.

^dEffort data for California not available yet.

For 43% of the landings.

b. United States

The total trawl catch of Dover sole by U.S. vessels was 15,405 m.t.,

a 17% increase over the 1977 catch.

Washington - Trawl landings of Dover sole were 1,478 m.t. in 1978,

a 41% increase over 1977 and 41% greater than the 1968-77 mean. Area 3A

accounted for nearly one half the total catch and was 239% greater than in

1977.

Oregon - Trawl landings of Dover sole were 3,374 m.t., an increase

of 86% over the 1977 catch and 47% greater than the 1968-77 mean. Areas 2B

and 3A accounted for the major part of the catch.

California - The 1978 trawl catch of Dover sole was 10,570 m.t.,

about 3% greater than the 1977 catch. Areas 1B and 1C accounted for 99%

of the catch with Area 1C accounting for over one half the catch.

Alaska - Trawl landings of Dover sole were negligible.

3. English sole

Canadian and U.S. trawlers in 1978 landed 5,271 m.t. of English

sole, a catch that was 6% less than the 5,592 m.t. catch of 1977. Areas 1B,

3A, 4A, and 5D were the leading catch areas.

a. Canada

Canadian landings of English sole in 1978 were 807 m.t., a

decrease of 45% from 1977 and 15% from the previous 10 year mean. Northern

Hecate Strait (5D) continued to be the primary area of production although the

1978 5D catch was half that taken in 1977 and 29% below the 1968-77 mean.

CPUE of 0.242 m.t./hr was 33% below the 10 year mean.

b. United States

Washington - The 1978 Washington trawl catch of 1,598 m.t. of

English sole was a 36% increase over the 1977 catch and also 36% above the

10 year mean. Nearly all of the catch was utilized as human food. Area 4A was the most productive area, where the catch was 912 m.t.

Oregon - Trawl landings of English sole in 1978 were 1,041 m.t., a 4% increase over 1977 and equal to the 1968-77 mean catch. Area 3A was the major catch area where 606 m.t. were taken. CPUE in 1978 was substantially less than the 10 year means for area 1C-3A.

California - The English sole catch by California trawlers in 1978 was 1,825 m.t., 6% less than in 1977. The majority of the catch came from Area 1B.

4. Petrale sole

Canada and U.S. petrale sole landings in 1978 were 3,408 m.t., a 14% increase over the 1977 catch but below the past 10 year average. Declines occurred in Canada and California while Oregon and Washington catches increased in 1978.

a. Canada

Landings of petrale sole (226 m.t.) continued to decline and were 44% less than the 1968-77 mean. The majority of the catch, 48%, was caught in Area 3C. In 1978, CPUE in Area 3C was the same as that of 1977 but was 38% below the 1968-77 mean. The landings in 1978 from the northern stock (Areas 3D-5D) were 78 m.t., equal to the 1977 catch but 33% below the past 10 year mean.

b. United States

Washington - The 1978 trawl catch of petrale sole was 907 m.t., an increase of 50% over the 1977 catch and slightly above the 10 year average of 869 m.t.

Oregon - Trawl landings of petrale sole in 1978 were 1,000 m.t., a 22% increase over 1977 and a 4% increase over the 1968-77 mean. Area 3A was the leading catch area followed by catches from Area 2B. CPUE in 1978

was slightly below 1977 CPUE and was down substantially from the 10 year mean, CPUE in Areas 2B and 2C was down 71 and 72%, respectively. It was down 63% in Area 3A.

California - The 1978 petrale sole catch is estimated at 1,275 m.t. This catch is below the long term average catch of 1,360 m.t.

5. Rock sole

Total rock sole landings in 1978 were 1,492 m.t. about the same as in 1977, but 28% below the 1968-77 mean.

a. Canada

Rock sole landings in 1978 increased only slightly from the previous year to 1,309 m.t. Areas 5C and 5D accounted for 67% (874 m.t.) of these landings. CPUE in these areas increased 33% to 0.443 m.t./hr.

b. United States

Washington - The 1978 trawl landings of rock sole were 168 m.t., 12% below 1977 and 42% below the ten year average. Rock sole is mainly an incidental species in the Washington coastal trawl catch.

Oregon - Trawl landings of rock sole in 1978 were only 12 m.t.

This reflects the incidental nature of this species in Oregon landings.

California - The 1978 estimated catch of this minor species is

3 m.t.

6. Lingcod

Total landings of lingcod in 1978 were 5,037 m.t. Trawl landings decreased 18% from 1977 to 3,258 m.t. Landings by other gears totalled

1,783 m.t.

a. Canada

Total landings of lingcod during 1978 were 2,004 m.t., a decrease of 11% from 1977 landings. Forty-five percent (908 m.t.) of the lingcod

was landed by trawl gear of which 39% came from Area 3C. CPUE for Area 3C was slightly less than in 1977 and 15% less than the 1968-77 mean. Non-trawl landings totalled 1,096 m.t.

b. United States

Washington - In 1978 Washington trawl landings of lingcod were down 43% from 1977 to 705 m.t. and were the lowest since 1972. Landings by other commercial gears totalled 542 m.t.

Oregon - Trawl landings of lingcod in 1978 amounted to 445 m.t. an increase of 17% over 1977 but 37% less than the 1968-77 mean. Area 3A accounted for over one half the trawl catch. Catch of lingcod by other gear totalled 171 m.t. of which 60% was taken in the recreational fishery.

California - Trawlers landed an estimated 1,200 m.t. in 1978 of which 73% came from Area 1B. Other commercial gear vessels caught about 225 m.t. and recreational fishermen caught 275 m.t.

Alaska - Presently a small component of the commercial longline catch (16 m.t. in 1978), lingcod landings will become increasingly important as the small boat fleet increases its groundfish effort.

7. Pacific cod

In 1978, Canadian and United States trawlers landed approximately 11,095 m.t., a decrease of 8% from 1977.

a. Canada

Pacific cod continued to be the major species (24%) in the trawl landings even though the catch of 6,668 m.t. declined 13% from the previous year. Principal areas of production were Areas 5C-5D (2,100 mt.), Area 4B (1,372 m.t.) and Area 3C (1,345 m.t.). Landings from Hecate Strait (Areas 5C-5D) fell 40% and CPUE increased slightly from 1977 levels. Area 3C landings decrease 34% while the CPUE remained the same as in 1977.

Washington - Pacific cod continued to be the most important single species in trawl landings. Landings in 1978 were 4,029 m.t. about the same as last year but still 18% above the 10-year mean. The most productive areas were 3C, 4A and 3B. Other commercial gear took 169 m.t., while the recreational fishery harvested 215 m.t.

Oregon - Trawl landings in 1978 were 398 m.t., a 9% increase over 1977. Catch of Pacific cod by other gears amounted to 20 m.t.

Alaska - Total landings in 1978 were 760 m.t. more than double those for the previous year. This species is the prime target of the developing trawl fishery in western Alaska. Incidental landings within the halibut fishery accounted for approximately 30% of these landings.

8. Pacific ocean perch

Canadian and United States landings of Pacific ocean perch in 1978 were 6,365 m.t., up 22% from 1977 and 13% from the 1968-77 mean. Primary catch areas were 5E, 5A, 5B, 3C and 2C.

a. Canada

Landings of Pacific ocean perch in 1978 were 3,861 m.t., a 42% increase from 1977, and more than double the 1968-77 mean. The increased production was due mainly to the increased fishery in Area 5E, which accounted for 63% of the landings.

b. United States

Washington - The 1978 trawl landings were 1,958 m.t. This was 3% less than 1977 and 43% below the 10-year mean. The main areas of production were 3C, 3A and 3B. Trip limits imposed after Sept. 1, 1978 contributed significantly to the low levels of catch.

Oregon - Trawl landings of Pacific ocean perch in 1978 were 486 m.t., a 15% increase of 1977, and a 45% increase over the 10-year mean. Most of

the catch occurred in Area 3A. Emergency restrictions late in 1978 held landings under what might have been delivered.

California - The 1978 catch was estimated at 60 m.t.

9. Other rockfish

Total 1978 Canadian and United States trawl landings were 29,082 m.t. up 16% over 1977. Areas 1B, 3A, 5A and 5E were the major areas of production.

a. Canada

The 1978 trawl catch was 6,147 m.t., up 26% from 1977 and 346% above the 1968-77 mean. Major areas of production are Queen Charlotte Sound and Area 5E. Major species include Sebastes flavidus (35%), S. brevispinis (18%), S. reedi (18%) and S. pinniger (7%).

b. United States

Washington - 1978 trawl catches of rockfish (shelf and slope) were 9,547 m.t., the highest on record, and 10% higher than 1977. About one half of the catch occurred in Area 3A, and the increase in this area was due somewhat to displacement of effort from Canadian areas to those in the south. Principal species are S. flavidus, S. pinniger, S. brevispinis and S. paucispinis. S. entomelas is growing in importance. Other commercial gear took 816 m.t. and recreational fishermen took 348 m.t.

Oregon - The 1978 catch was 4,388 m.t., an increase of 83% over 1977 and 125% over the 1968-77 mean catch. Area 3A accounted for 60% of the landings. Major species include S. flavidus, S. pinniger and S. entomelas.

California - Trawlers landed approximately 9,000 m.t. in 1978. Area 1B was the leading catch area with 5,500 m.t. Other commercial gears landed 2,500 m.t., and recreational gear took 2,400 m.t. in 1978.

Alaska - In 1978, 60 m.t. of rockfish (including S. alutus) were taken incidental to the longline fisheries in Area 6A and 6B.

10. Sablefish

Canadian and U.S. trawl landings of sablefish in 1978 were about 4,104 m.t., almost identical to the 1977 trawl landings. Trap catches were about 5,901 m.t.¹ and line catches about 2,380 m.t. Total sablefish catches in 1978 were about 11,046¹ m.t. which is up 67% from the 1977 catch.

a. Canada

Trawl landings were at 131 m.t., a marked decrease of 83% from 1977 and 57% from the 1968-77 mean. Non-trawl landings totalled 701 m.t., 91% of which was landed by trap fishermen.

b. United States

Alaska - The 1978 sablefish landing was approximately 1,412 m.t. (dressed weight).

Washington - Trawl landings in 1978 were the highest since 1962, totalling 675 m.t. This was an increase of 41% over 1977 and 391% above the 10-year average. Traps took 473 m.t. and line gear took 637 m.t., up 121% and 34%, respectively, from 1977 levels.

Oregon - Trawl vessels landed 958 m.t. in 1978, a 194% increase over 1977, and a 350% increase over the 1968-77 mean. Catch by other gears was: trap, 290 m.t.; longline, 268 m.t.; and shrimp trawl, 70 m.t. There were 16 vessels fishing traps and 9 vessels fishing longlines. California - Trawl landings of sablefish in 1978 were 2,340 m.t. while trap catches were 4,500 m.t., a significant increase over 1977.

11. Dogfish

Total landings in 1978 were 5,858 m.t. Major areas of production were 4B (2,845 m.t.) and 4A (2,571 m.t.). Trawl landings accounted for 29% (1,676 m.t.).

¹Does not include Alaska

a. Canada

Total landings of dogfish in 1978 were 3,126 m.t., 81% greater than in 1977. This fishery was centered in Area 4B which produced 91% of the landings. Non-trawl landings accounted for 70% (2,185 m.t.), most of which were caught by longline gear (2,159 m.t.).

b. United States

Washington - During 1978 trawl landings of dogfish were 699 m.t. for foodfish. This was a 16% increase over 1977, and was five times the 10-year average production. Other gear produced 1,977 m.t. of dogfish, mostly from Area 4A.

Oregon - Trawl landings of dogfish amounted to 56 m.t. and reflects the incidental nature of this species in the trawl fishery.

12. Halibut

Total commercial catch of halibut in 1978 was approximately 9,970 m.t., slightly greater than the 1977 catch of 9,933 m.t. The division of the catch between Canada and the United States was nearly the same as in 1977 with Canadian vessels taking 3,892 m.t. (39%) and United States vessels taking 6,087 m.t. (61%). The landed value of the 1978 catch was a record \$37 million (U.S.). Fishermen received an average price of \$1.70/lb (U.S.)(\$3.75/kg).

B. Joint Fishing Ventures

1. Canada

Canada authorized one cooperative fishing agreement between Poland and a Canadian company involving hake fishing off southwest Vancouver Island. This project involved two Canadian catcher vessels delivering to two Polish factory ships. The two Canadian trawlers operated for approximately six weeks and delivered 1,836 m.t. of hake to the processing vessels.

2. United States

One joint venture operation off the Pacific coast was licensed by the United States. This operation involved two U.S. catcher vessels delivering hake via trawl codends to two Soviet factory ships. Beginning in September and fishing until October 31, 1978, the catch vessels delivered 856 m.t. hake to the Soviet ships. Incidental catches were estimated to be 21 m.t. jack mackerel, 1.3 m.t. Pacific ocean perch, 12.7 m.t. other rockfishes, 0.1 m.t., flatfish and 0.2 m.t. sablefish.

C. Other Nations' Commercial Fisheries in 1978.

In 1978, other nations conducted fisheries off the North American coast in waters subject to fisheries jurisdiction by either Canada or the United States and under conditions specified by these coastal states. These conditions included time-area, gear-vessel and species restrictions as well as catch quotas.

1. Japan

(a) Canada - Two fisheries were conducted by Japan off British Columbia during 1978. Twenty-one longliners fished throughout the year and in all of Zone 5. Some concentration of effort occurred around Cape St. James and Langara Island. Catch rates were highest in fall and winter; total catch was 2,103 m.t. of sablefish and 42.3 m.t. of mixed rockfish species. The hake fishery was conducted by three trawlers in Sub-zone 5-2 from late August until early October when catch rates began to fall; total hake catch was 3,364 m.t. with 45.9 m.t. of rockfish caught incidentally.

(b) United States - Japan licensed 42 stern trawlers and 22 longline gillnetters to fish in U.S. waters during 1978. Catches fell short of allocation due mainly to the release of reserves late in the season when they could not be fully utilized by the Japanese fleet. No fishing was conducted off the Washington-California region. Allocations and estimated catches are included in Table 2.

Table 2. Allocations and catches by foreign nations off United States in 1978.

Region	Species	Japan		USSR		Poland		ROK		Mexico		
		Allocation/Catch	Allocation/Catch	Allocation/Catch	Allocation/Catch	Allocation/Catch	Allocation/Catch	Allocation/Catch	Allocation/Catch	Allocation/Catch	Allocation/Catch	
Gulf of Alaska	Pollock	40,740	26,093	56,710	41,956	15,840	1,226	31,810	27,052	6,000	0	
	Flounders	21,370	13,809	2,030	196	100	13	350	296	100	0	
	Cod	14,722	8,846	5,518	1,140	798	14	1,662	1,369	2,400	0	
	POP	6,448	4,548	9,023	570	2,428	4	5,001	3,049	1,000	0	
	Other rockfish	1,510	1,277	2,045	1	636	9	1,485	609	224	0	
	Sablefish	8,750	6,458	100	4	50	0	1,000	665	100	0	
	Atka mackerel	2,000	1,136	21,570	18,386	1,030	0	100	63	100	0	
	Other	5,090	3,919	6,060	381	1,455	0	2,595	1,687	500	0	
	Wash-Calif	Hake	0	0	89,270	70,106	28,930	26,721	0	0	1,800	0
		Jack mackerel	0	0	1,950	673	1,950	214	0	0	100	0
Flounders		0	0	89	2	29	2	0	0	2	0	
Rockfish		0	0	714	500	231	204	0	0	15	0	
Sablefish		0	0	90	57	29	41	0	0	2	0	
Other		0	0	446	94	145	69	0	0	9	0	

Oregon, especially the Heceta Bank area. The U.S.S.R. hake allocation was not 1977 and 65-100 in previous years. Fishing effort was again concentrated off conducted from June-October. Soviet effort was down to 29 trawlers from 39 in In the California-Washington region, a Soviet fishery for hake was

eastern Alaska. Pollock and Atka mackerel were fished by 2-36 trawlers. prevalent in the Kodiak Island/Unimak Pass region with little effort off south- (b) United States - Soviet fishing in the Gulf of Alaska was

of rockfish and 13.0 m.t. of pollock caught incidentally. fleet to leave Canadian waters. Total hake catch was 700 m.t. with 8.9 m.t. reallocation of additional hake surpluses in the U.S. zone prompted the Soviet period in September. While catch rates were not exceptionally low, the

(a) Canada - Three Soviet trawlers fished hake for a short

3. U.S.S.R.

included in Table 2.

allocations due to late season reallocation. Catches and allocations are trawlers, about the same number as in 1977. Polish catches also fell short of Poland pursued its hake fishery off the west coast with seven stern was almost entirely pollock.

Albatross Banks; three more vessels than fished in November 1977. Their catch Alaska until November when five vessels were observed fishing on Portlock and (b) United States - Poland did not begin fishing in the Gulf of

incidental catch.

States waters. Total hake catch was 586 m.t. with 3.1 m.t. of rockfish as an waters following the announcement of additional hake allocations in United waters to participate in a cooperative venture, the Polish fleet left Canadian during August-September. Except for two trawlers that remained in Canadian (a) Canada - Six Polish trawlers fished hake in sub-zone 5-2

2. Polish People's Republic

completely used because the season ended before the relatively late reallocation of some unused domestic reserve and unused Mexican allocation could be harvested. Allocations to and catches by the U.S.S.R. are included in Table 2.

4. Republic of Korea (ROK)

In the Gulf of Alaska, 1-11 ROK stern trawlers fished in the Kodiak Island/Unimak Pass region, primarily for pollock and Pacific ocean perch. One to two longliners also fished for sablefish in the same general area. Catch statistics are presented in Table 2.

5. Mexico

Although granted allocations of hake, pollock and a variety of groundfish in 1978, Mexico did not initiate a fishery. Late in the year its allocation was reallocated to other nations. Mexican allocations are listed in Table 2.

D. All-Nation Commercial Catch of Major Species in 1978

1. Pacific hake

Total catch of Pacific hake off the Pacific coast in 1978 was estimated to be 106,281 m.t., down 20% from 1977. Poland caught approximately 29,143 m.t. (including 1,836 m.t. in a cooperative venture with Canada), Japan caught 3,364 m.t., the U.S.S.R. caught 70,806 m.t. (including 856 m.t. in a joint venture with the U.S.); Canada caught approximately 2 m.t. and the U.S. landed 2,966 m.t. The majority of the catch was from the Washington-California region.

2. Rockfish

Total all-nation landings of rockfish were approximately 51,048 m.t., down 13% from those in 1977. The only directed fishing for rockfishes by foreign vessels in Canadian waters was that by U.S. vessels under provisions

In California a major effort is being launched to cover the commercial passenger fishing vessel (PFV) fleet which numbers more than 200 vessels. number of ways.

Importance of the recreational fishery and have approached its analysis in a recreational landings of groundfish. Member agencies have recognized the well as increasing numbers of anglers have contributed to the steady rise in acceptance and recognition of available groundfish species by sportsmen as role in the composite picture of Pacific coast groundfish resources. Wider Recreational fisheries continue to play an increasingly important

E. Canada-U.S. Recreational Fisheries

centres of production. although the Gulf of Alaska and the California region continued to be The Catch was distributed more evenly along the coast than in previous years 8,759 m.t., the U.S.S.R. 61 m.t., Poland 41 m.t. and Republic of Korea 65 m.t. The United States caught approximately 11,638 m.t., Canada 831 m.t., Japan North American vessels landed the majority of the catch, 57% (12,469 m.t.). a decrease of 17% from the 26,656 m.t. landed in 1977. For the first time The all-nation catch of sablefish in 1978 was approximately 21,995

3. Sablefish

Washington region were 719 m.t. and were incidental to the hake fishery. and the Republic of Korea (3,658 m.t.). Rockfish landings in the California-Gulf of Alaska and was conducted by Japan (5,825 m.t.), the U.S.S.R. (571 m.t.) Directed fishing for rockfishes in the U.S. zone was confined to the fisheries.

the Canadian zone (57.9 m.t.) were incidental to the hake and sablefish of a reciprocal fishing agreement. Additional landings by foreign vessels in

A logbook system for these vessels to concentrate on area, species and quantities caught is being expanded; initial results indicate up to 25% overestimation of catches although data quality is highly variable. Efforts are also being directed toward obtaining better port and shipboard sampling of this fleet. Estimated landings of groundfish by recreational fishermen in 1978 were 3,000 m.t., the majority of which were rockfish from CPFVs.

The recreational groundfish fishery in Oregon was conducted primarily from nine ports although 80% of the catch is landed at four of these. A minimum estimate of groundfish catch (332 m.t.) was obtained through monitoring of these four ports in the active fishing season. Approximately 70% of the catch was rockfish, with lingcod contributing 8% and miscellaneous species completing the total. Oregon is beginning a program to estimate effort expended on groundfish by the recreational fishery. Current information is limited although it was estimated that the 237 CPFVs completed 97,472 angler trips during 1978.

Washington currently has the most developed system of coverage for recreational fisheries and it is an expansion of the procedures used to cover the recreational salmon fishery. Creel censuses are carried out throughout the year in Puget Sound and for the duration of the fishing season on the coastal areas. The recreational catch of groundfish during 1978 was estimated to be at least 1,300 m.t. with walleye pollock, Pacific cod, rockfishes, lingcod and starry flounder being the major species in the catch. The primary fishing mode was boat angling which is estimated to account for 90% of the catch.

At present, Alaska estimates the recreational catch (smelt, halibut, rockfish, and other groundfish) through an annual mail survey. Although 1978 data are not yet available the number of fish taken in 1977 was 23,244 halibut, 31,054 rockfish, and 54,123 other groundfish. The majority of the marine recreational fishing effort in Alaska is directed toward halibut and salmon

is impractical. The 1978 FMP for the Gulf of Alaska Groundfish Fishery was some flexibility into the plan because optimum yield as defined in the legislation Washington-California region. The drafting team is presently trying to build Mr. Demory outlined the current state of the FMP draft for the

(b) Fishery Management Plans

closures for sensitive Pacific ocean perch grounds. sablefish, flounders, jack mackerel and other species as well as time/area in 1978, 198,900 m.t. in 1979) as well as incidental quotas for rockfishes, The FMP for the trawl fishery specifies a TAC for hake (130,000 m.t. allocation.

species a 7,000 m.t. TAC off Washington-California with no surplus for foreign Fishery Management Plan (FMP) for the Gulf of Alaska. The sablefish FMP in effect for the Washington-California region but has been superseded by the the trawl fisheries off Washington, Oregon and California. The former remains ies zone for most of 1978; one concerning sablefish and the other concerning Two preliminary management plans governed fishing in the U.S. fisher-

(a) Preliminary Management Plans (PMP)

1. United States

F. Groundfish Management and Regulations

with the majority of the fishery occurring in Area 4B. groundfish catch in 1978 is unknown but is estimated to be at least 300 m.t. improve until a saltwater angling licence program is initiated. Recreational quantity and highly variable in quality. This situation is not expected to Officers or Guardians at docks or launching ramps; it is therefore limited in groundfish fishery. Such data as is collected is obtained through Fisheries Canada also has no program to estimate the catch of the recreational substantially.

although effort for lingcod and rockfishes in the Seward area has increased

amended for 1979 and is highlighted by halibut-saving regulations and fishery development measures aimed at enhancing the domestic industry.

The Subcommittee held an extensive discussion on the general management of fisheries by quotas and in particular, the desirability of single species vs. grouped species management. Dr. Harville further outlined the extensive procedures which precede the adoption of a FMP in the U.S. Dr. Beamish briefly outlined the steps which must be followed in Canada to adopt management regulations. The Canadian procedures are somewhat less involved and involve voluntary rather than compulsory public hearings.

(c) State regulation changes

California had no major regulation changes in 1978 and is awaiting the FMP before considering other changes. Oregon enacted an emergency 20,000 lb trip limit for Sebastes alutus in the Columbia and Vancouver areas in 1978, and made this a permanent regulation in early 1979. There were also some changes in the recreational bag limits for groundfish. Oregon is also contemplating regulations requiring some type of escape port or destruct panel in sablefish traps.

Washington enacted several permanent changes including: a 10,000 lb or 25% of total weight trip limit for S. alutus; provision for landing of groundfish by shrimp trawlers; several re-definitions and clarification of gear and area restrictions; and the removal of Pacific halibut from the definition of bottomfish. A number of emergency measures were enacted to protect individual species or area.

Alaska enacted several regulations concerning gear and catch reporting procedures as well as one area (Prince William Sound) closure. In addition the State adopted the Federal regulations implementing the FMP for the Gulf of Alaska. The 1,000,000 lb sablefish quota for inside waters in the northern portion of southeastern Alaska was reduced to 850,000 lb.

2. Canada

(a) Regulation changes

Canada enacted a number of temporary measures during 1978, primarily dealing with single species problems. Among these were: a winter closure of the Pacific cod fishery in Area 3C; closure of the 3D/3C (Can.) area to directed rockfish fishing in June 1978 and the provision of an incidental limit for rockfishes in these areas. Dr. Beamish explained that all groundfish fisheries in B.C. will be operating under TACs during 1979. While these TACs are assigned to all major commercial species and stocks, management would have to consider the multispecies nature of the fishery when enacting any regulation. He also outlined the procedure whereby management of the resource occurs in Canada, i.e. research staff generate stock assessments and TACs which are then used by management staff to produce a management plan for the fishery.

G. International Fisheries Agreements

1. Canada-U.S. agreement

A reciprocal fishing arrangement between the two countries was negotiated in March, 1979. This arrangement provides for Canadian fishing for halibut in U.S. waters over two years (907 m.t. in 1979, 454 m.t. in 1980) in exchange for U.S. fishing of groundfish (3,250 m.t. in each of 1979 and 1980) in Canadian waters. Further details of areas and species allocations in the groundfish package were left to the direction of a Canada-U.S. consultative committee. Although the agreement has not been formally ratified, reciprocal fishing is presently being conducted under its provisions.

2. Other Canadian agreements

Canada has only one other bilateral agreement concerning the Pacific coast, that being with Japan. This agreement provides for a Japanese sablefish fishery in Canadian waters subject to availability of surpluses.

3. Other U.S. agreements

Mr. Dark reported that the U.S. is no longer dealing with fisheries matters on a bilateral agreement basis but rather that foreign nations fishing off the U.S. must enter into a Governing International Fishing Agreement (GIFA). These agreements provide recognition of U.S. fisheries jurisdiction as well as species allocations.

The chairman agreed to review the need for this agenda item prior to the next meeting, since it is largely unnecessary after the changes in the fisheries jurisdictions.

VII. Groundfish Research

A. Stock Assessments

1. Report from the working group on Pacific ocean perch

In the absence of Mr. Fraidenburg, Mr. Pedersen provided a written and oral report on the progress of this group. They had successfully completed a review and updating of the historical fishery data and reported on this at the November 1977 interim meeting of the TSC. The group has been unable to reach agreement on alternative management strategies for the rebuilding of this resource, largely because it could reach no consensus with respect to the quality of the basic fisheries data upon which all analyses must be based. In particular, no agreement could be reached on acceptable catch and age composition data for Queen Charlotte Sound and an acceptable determination of stock units. The group considered that resolution of these problems may not be possible due to the inherent deficiencies of foreign fisheries data, which represent a substantial segment of the total information base.

The TSC reviewed the progress of the group and commended it for the efforts it had made to resolve these major problems. After an extensive discussion on the details of these problems with the group members it was agreed that the work of this group should be terminated. Any future work

the area south of Point Roberts. Dr. Beamish reported that an examination of the 1979 biomass estimate was approximately one half of the 1978 estimate for acoustic surveys were carried out in 1979 using both bottom and midwater gear. Gulf of Georgia during the winter pollock fishery in 1979. Two trawl/hydro-Mr. Pedersen and Dr. Beamish reported on work in the Strait and

3. Gulf of Georgia pollock

working on an integrated design of this type. re-examine this topic at the next meeting since two agencies were actively this with the basic necessity for adequate area coverage. It was agreed to highly beneficial there was no consensus on the best method for integrating the need for input from fishermen. While the latter was acknowledged as being The TSC entered into a wide-ranging discussion on survey design and effort to increase the precision of biomass estimates.

on these grounds with 90% of the available trawl hauls allocated there in a data to identify S. alutus fishing grounds. The survey concentrated heavily Washington and Oregon and NMFS. It utilized input from fishermen and fishery The survey was a cooperative effort between the state agencies of size of the stock.

of a relatively large year-class (1970) may have substantially increased the the 1977 rockfish survey were under criticism and because the recent recruitment ocean perch resource because the precision of biomass estimates generated by 1979. The survey was prompted by the need to take a second look at the Pacific Mr. Demory reported on this survey which took place in March-April

2. Washington-Oregon Pacific ocean perch survey

areas are in varying states of depletion. that quotas for INPFC areas are not appropriate because substocks within those will be directed toward transboundary populations only. The Subcommittee felt

of maturity data indicated that the pollock which were immediately to the south of Pt. Roberts ('Apex') in 1978 may not have moved south to this area in 1979. These data indicated the possibility that the Strait of Georgia fish and those seen in the Apex region were from the same stock. Mr. Pedersen agreed to report on this topic at the next annual meeting.

4. Halibut

Mr. Hoag reported on results of IPHC research in 1978. Stock assessments show that the resource has stabilized at a low level of abundance. Adult (> 8 yr) biomass was estimated at slightly below 104,000 m.t. as compared with an estimated biomass of 227,000 m.t. in the 1950s. The major problem in stock rebuilding continues to be a scarcity of juveniles; while the 1978 survey showed a slight increase, their numbers are still insufficient to begin any substantial rebuilding of the resource.

Present EY of the stock is estimated to be 11,340 m.t., which, at present catch levels, should result in a continued, modest increase in the stocks.

B. Special Studies

1. Pacific hake population modelling studies and analysis of 1977-78 observer data

The NMFS has contracted with Dr. Al Tyler of Oregon State University to model the Pacific hake population with regard to environmental and fishery variables, their effect on recruitment and subsequent fishing strategy. Observer data is being analyzed to determine optimization of yield with regard to biological characteristics of the population (length, weight, sex ratio, growth, etc.) and the distribution of these characteristics in time and space, within the fishing season.

Mr. Dark described the establishment of four index stations off southeastern Alaska, which will be used to estimate relative abundance of blackcod over subsequent years. The four sites are Cape Addington, Cape Ommaney, Cross Sound and Icy Bay; the highest catch rate in 1978 was recorded at the Cross Sound site. Fish are also being tagged at these sites to study the exchange of fish, if any, among them. An additional three index sites off Washington and Oregon will be added in 1979.

As an adjunct to this report, Dr. Beamish discussed the Canadian sablefish tagging program. Approximately 35,000 fish have been tagged to date; of those recovered, 85% show movement of less than 50 km. Double-tagging indicates approximately 6% loss of the standard anchor tag. Highest recovery rates (14%) are for fish which were not injected with oxytetracycline; recovery of injected fish is approximately 1.4% although the interpretation of the uninjected fish data is difficult and studies are underway to resolve the additional mortality factor.

Mr. Rigby mentioned that a juvenile sablefish tagging program was initiated this year in the inside waters of southeastern Alaska.

Mr. Dark reported on a survey of Gulf of Alaska seamounts presently underway wherein some large sablefish have been found.

3. Pacific cod tagging

Mr. Leaman updated a report of a juvenile Pacific cod tagging project conducted in 1978 and summarized at the last annual meeting. Recoveries to date are approximately 20% with no evidence of primary tag loss. Recoveries of fish tagged at age 1 are expected this fall, when they will have attained commercial size. Copies of Manuscript Report No. 1516 describing this project were distributed. Mr. Westrheim gave a brief report on the February-March 1979 tagging of Pacific cod in Area 3C which used the techniques developed in the

2. Sablefish indexing and tagging studies

earlier study. Unfortunately, very few juvenile fish were located during the 1979 work.

Mr. Pedersen reported on the Washington Pacific cod tagging projects, designed to study behaviour and exploitation rates. Fish were tagged during the winter in the Port Townsend area. Approximately 85% of the recoveries from this area were made in the first 10 days after tagging, following which recoveries declined very rapidly. The study implies that there is major movement away from this area as the year progresses; there was also evidence of some shedding of primary tags.

4. Lingcod tagging

Mr. Demory reported on a lingcod tagging project in Oregon that is designed to study the movements of lingcod between an inshore and an offshore reef (approximately 24 km apart). Recoveries to date show almost no interchange between the two sites. There have been two taggings, November 1977 and June 1978; the offshore tagging resulted in approximately 85% female fish whereas the inshore tagging resulted in only 15% females.

Mr. Cass described the Canadian lingcod tagging in Area 3C during 1978. Approximately 3,000 fish were tagged. Little effort has been applied in the fishery to date and results are too limited for conclusions. He did note the strong sex segregation which is often evident in catches.

5. Dogfish tagging

Dr. Beamish outlined the Canadian dogfish tagging program. This project initially began with a Campbell River High school and had been ongoing for three years before the Department became involved. Initially, Floy anchor tags were used but they were abraded very quickly; now using titanium wire and Petersen disc tags. Approximately 3,000 fish were tagged in 1978 and 2,000 in 1979. Recoveries to date are very low and efforts are still being directed to tag design.

The investigation of rockfish otoliths has produced dramatic results. Using the current understanding of otolith structure and comparing surface and section ages over comparable intervals, it is evident that rockfishes are difficult. Surface readings of otoliths were found to be unacceptable. Broken, polished and treated with cedar oil, although interpretation is sometimes made but no totally acceptable method has been developed. Otoliths are currently ability of otoliths are continuing. Much progress on sablefish ageing has been interpretation of virgin stocks is difficult. Investigations into the sut- structures have been investigated and pectoral fins are currently used although Age determination of pollock has not been totally resolved. Many

preference in technique has been expressed. superior and either dorsal fins or scales yield similar results. No consistent most reliable readings. For Pacific cod, no one method has been shown to be (4th-8th rays of 2nd dorsal, 0.5 cm above base) have been found to produce the into the ageing structures of various species. The dorsal rays of lingcod Dr. Beamish gave a brief synopsis of the results of investigations

rockfish

7. Age studies of lingcod, Pacific cod, pollock, sablefish and recoveries reflect a northward movement of the stock. Since the fleet effort has been applied throughout the area it is believed that farthest north, with some fish being recovered from as far north as Area 5A. of the Columbia River, with the fish being at large longest being recovered ging of English sole by Oregon around Heceta Bank. The majority were from north Mr. Demory reported briefly on the December 1977 and March 1978 tag-

6. English sole tagging

though losses were unknown. Mr. Pedersen commented that the knotted spaghetti tags used in Wash- ington dogfish taggings (1969-71) were still readable on recovery in 1979, al-

considerably older than previously believed. S. alutus may live up to 85 yr. Dr. Beamish showed photographs of a S. flavidus believed to be 55-57 years old based on otolith sections. In general these old fish are a small component of the total stock.

The TSC held an extensive discussion on the implications of older fish in a population and how it may affect the stock reproduction process. It was acknowledged that our understanding of this process is very poor and that much more research on it is required.

8. Rockfish tagging in the recreational fishery

Mr. Jow reported on a project to tag rockfish through the California recreational fishery. Effort has been directed primarily in kelp beds at depths less than 90 m. The project is designed to study biology and movement of major species. Not all species have proved amenable to tagging and S. mystinus and S. serranoides have been tagged most successfully. Small numbers of fish have been tagged (approximately 2,000 in the first year) and initial returns indicate no large-scale movement.

C. Cooperative Research with Other Nations

1. U.S.-Japan Pacific cod-Sablefish survey

A study of Pacific cod and sablefish in the Gulf of Alaska was conducted by Japan (with the participation of a U.S. scientist) during July-August, 1978. The study employed trap and longline gear at stations from 100-1,200 m. and investigated fish density, efficacy of gear and bait, incidental catches and sablefish movement through tagging. A similar study is planned for 1979.

2. U.S.-U.S.S.R. hake egg and larvae survey

The NMFS conducted a cooperative egg and larvae survey for hake with the U.S.S.R. in southern California during 1978 and 1979. The U.S. employs the data as a relative index of spawning stock while the Soviets use the data to

emphasis.

restructure the agenda for the next annual meeting to reflect this change in research and assessment reports. The subcommittee requested that the Chairman in the annual meeting format but that it should be de-emphasized in favour of that the exchange of fisheries statistical information should be maintained to do justice to the topics concerned. After some discussion it was agreed TSC agreed that the scientific discussions were stimulating but often too short 2. After review of the activities of the present meeting the

and apologized for an oversight in one instance. Dr. Beamish acknowledged that this should be, and normally is, done results be relayed to officials and scientists as soon as possible after such helping to prepare channels of approval. It was also requested that cruise providing notice of opportunity for participation to the scientific agency and formal notification between governments and would serve the dual purpose of counterpart of the coastal state. This notification should be exclusive of the research cruises in U.S. waters should be made to the appropriate scientific 1. Mr. Rigby requested that any notification of Canadian

D. Other

Committee.

other work on transboundary stocks and agreed to recommend action to the Parent commitments prevented its occurrence. The TSC discussed the need for this and in 1978 that such work be expedited budgetary restraints and personnel com- had yet been done. Although the TSC had recommended to the Parent Committee Mr. Westheim presented a brief report indicating that no joint work

3. U.S.-Canada Pacific cod tagging study

derive absolute spawning biomass. Soviet scientists estimated spawning biomass to be 3.1 million m.t. in 1978 while U.S. scientists concluded that biomass was similar in 1977-1979 and substantially higher than in 1976.

VIII. Progress on 1978 Recommendations

A. The Technical Subcommittee

1. Inclusion of Pacific hake in Groundfish Data Series and in Status Reports

The TSC noted that Pacific hake had been added to the agency status reports and the PMFC Data Series. Mr. Pedersen solicited comments on the method of inclusion in the data series and the new format of the series.

2. Other rockfish stock assessment and management in Area 3C

The TSC noted that the report by Messrs. Fraidenburg and Leaman had been presented at the November 1978 interim meeting of the Subcommittee and concurred that the objectives of the recommendation had been met by the report.

3. Recreational groundfish fishery workshop (1978 TSC interim meeting)

Dr. Harville reported that this workshop was not held in 1979, primarily due to existing commitments and the deferral of the U.S. recreational fisheries statistics program until 1980. The TSC continues to support such a workshop and requested that it be rescheduled for 1980. Dr. Harville summarized the implementation of the National Recreational Statistics Survey.

B. Parent Committee

1. Coordinated rockfish survey

Dr. Harville reported that the Parent Committee had advised appropriate agencies of the need and value of such surveys. Work of this nature did proceed in the Dixon Entrance-southeast Alaska region in 1978 and the TSC expressed its thanks to the Parent Committee for facilitating this activity.

2. Joint Canada-U.S. Pacific cod tagging in Areas 3B-3C

Dr. Harville reported that the Parent Committee had acted on this recommendation and he had sent a letter to the appropriate U.S. agencies on 27/6/78 endorsing the TSC recommendation and requested review and implementation.

report, in subsequent agency status reports.

rockfish catch by species and area, similar to that in the British Columbia

were noted. Agreement was reached to recommend inclusion of a table of

information during which the ambiguities of the 'slope' and 'shelf' designations

TSC engaged in an intensive discussion of the value of species-specific catch

'slope' and 'shelf' categories to simplify both management and reporting. The

other slope rockfish. He suggested that rockfish should be combined into

reports have been corrected for contamination of "Pacific ocean perch" with

S. alutus from the other rockfishes in data reporting. In recent years status

Mr. Demory reviewed the historical background of the segregation of

B. Slope and Shelf Rockfish as Management and Reporting Units

might be candidates for joint management.

function unless the objects of the surveys were stocks in boundary areas, which

after some discussion it was agreed that the TSC should not undertake this

surveys along the Pacific coast. The Subcommittee considered this request and

IGC, with regard to the desirability of having the TSC coordinate groundfish

Mr. Dark presented a letter of 14/7/78 from Dr. Don Gunderson to the

A. TSC Coordination of Groundfish Surveys

IX. Other Business

TSC noted that all agencies have acted on these recommendations.

The Parent Committee acted on this recommendation as requested. The

4. Sablefish workshop recommendations

issue the minutes as soon as possible.

10/10/78. The Parent Committee agreed to amalgamate comments received and

Mr. Pitre replied that a draft of minutes was mailed for comment

3. IGC 1977 meeting minutes

participate during the 1979 winter tagging.

Unfortunately, U.S. agencies while supporting the project, were unable to

C. Recommendations for Boundary Changes of the Monterey-Conception Region

Mr. Jow presented a recommendation concerning a request for a change in the PMFC 1A/1B and the INPFC Conception/Monterey boundaries. The proposed change (to 36°00'N) is based on the segregation of both stocks and fisheries which is not achieved by present boundaries. The TSC endorsed this change and agreed to seek the achievement of this end through the Parent Committee.

X. 1979 Technical Subcommittee Recommendations

A. Technical Subcommittee

1. The TSC reaffirmed its support for an improvement of the quality and quantity of data from the recreational groundfish fishery. To further this end the Subcommittee recommends that the recreational groundfish statistics workshop which was not held in 1979 be rescheduled in 1980.

Dr. Harville and Mr. Jow will act to coordinate this workshop, to be held in San Diego in February.

2. The Subcommittee agreed on the current deficiencies in the reporting of rockfish catch statistics; it therefore recommends that all agencies provide an additional table of rockfish catches, by species and area, in subsequent status reports.

B. Parent Committee

1. The need for cooperative research relating to management of transboundary stocks was identified. The Subcommittee concurred that this is an important issue and recommends it be given high priority by the governments of Canada and the United States in planning of the operations of appropriate agencies. More emphasis should be placed at the program level on cooperative research on specific stocks of commercial importance, such as Pacific cod, sablefish, walleye pollock, spiny dogfish and the rockfish complex in the boundary areas. The Subcommittee offers its services in the planning of such

research.

2. The TSC recommends that the boundary between International

Statistical Area 1A and 1B, now at 35°40'N, be changed to 36°00'N and that the boundary between the INPFC Monterey and Conception Areas, now at 35°30'N, also be changed to 36°00'N.

The basis for this recommendation is that with recent developments in groundfish fisheries, the proposed new boundary will separate distinct

fisheries and stocks.

XI.

Schedule of Future Meetings

A. TSC: It was agreed that no interim meeting of the TSC was

necessary but TSC members are requested to attend the IGC annual meeting. The

next annual meeting of the TSC will be the third week in June, 1980 in Alaska.

The Chairman will communicate the exact time and site to member agencies.

B. IGC: The Parent Committee will hold its annual meeting on

Wednesday, October 3, 1979 in Sitka, Alaska.

XII.

Election of Chairman

Mr. T. Dark was reconfirmed as Chairman for 1980.

XIII.

Adjournment

The meeting was adjourned at 16:30 on 21/6/79.

Appendix A

AGENDA

for the

20th Annual Meeting

of the

Technical Subcommittee of the International Groundfish Committee
Parksville, British Columbia
June 20-21, 1979

- I. CALL TO ORDER
- II. APPOINTMENT OF SECRETARY
- III. APPROVAL OF AGENDA
- IV. TERMS OF REFERENCE OF THE SUBCOMMITTEE
- V. REVIEW OF AGENCY GROUND FISH PROGRAMS
 - A. Recent and anticipated studies
 - B. List of publications
- VI. REVIEW OF NORTHEAST PACIFIC GROUND FISH FISHERIES
 - A. Canada-U.S. Commercial Fisheries in 1978
 1. Total Landings (Chairman)
 2. Dover sole (ODFW)
 3. English sole (CDFG)
 4. Petrale sole (CDFG)
 5. Rock sole (FOC)
 6. Lingcod (FOC)
 7. Pacific cod (FOC)
 8. Pacific ocean perch (WDF)
 9. Other rockfish (WDF)
 10. Sablefish (NMFS)
 11. Dogfish (FOC)
 12. Halibut (IPHC)
 - B. Joint fishing ventures (NMFS & FOC)
 - C. Other Nation's Commercial Fisheries in 1978 (NMFS & FOC)
 - D. All-Nation Commercial Catch of Major Species in 1978
 1. Pacific hake (NMFS)
 2. Rockfish (FOC)
 3. Sablefish (NMFS)

- E. Canada-U.S. Recreational Fisheries (States & FOC)
- F. Canada-U.S. Groundfish Management and Regulations
- 1. United States
 - (a) Preliminary management plans (Dark)
 - (b) Fishery management plans (Demory & Rigby)
 - (c) State regulation changes in 1978 and changes under consideration
- 2. Canada
 - (a) Regulation changes in 1978 and changes under consideration
- G. International Fisheries Agreements
 - 1. Canada-U.S. Agreement
 - 2. Other Canadian Agreements
 - 3. Other U.S. Agreements
- VII. GROUNDFISH RESEARCH
 - A. Stock Assessments
 - 1. Report from working group on Pacific ocean perch (Pedersen & Westrheim)
 - 2. Washington-Oregon Pacific ocean perch survey (Demory)
 - 3. Gulf of Georgia pollock (Pedersen)
 - 4. Halibut (Hoag)
 - B. Special Studies
 - 1. Pacific hake population modeling studies and analysis of 1977-78 observer data (Dark)
 - 2. Sablefish indexing and tagging studies (Dark)
 - 3. Pacific cod tagging (Leaman & Pedersen)
 - 4. Lingcod tagging (Demory & Cass)
 - 5. Dogfish tagging (Beamish)
 - 6. English sole tagging (Demory)
 - 7. Age studies of lingcod, Pacific cod, pollock, sablefish and rockfish (Beamish)
 - 8. Rockfish tagging in the recreational fishery (Jow)
 - C. Cooperative Research with Other Nations
 - 1. U.S.-Japan Pacific cod-sablefish survey (Dark)
 - 2. U.S.-U.S.R. hake egg and larvae survey (Dark)
 - 3. U.S.-Canada Pacific cod tagging study (Westrheim)
 - D. Other

Agenda (cont'd)

VIII. PROGRESS ON 1978 RECOMMENDATIONS

A. The Technical Subcommittee

1. Inclusion of Pacific hake in Groundfish Data Series and in Status Reports
2. Other rockfish stock assessment and management in Area 3C
3. Recreational groundfish fishery workshop (1978 TSC interim meeting)

B. Parent Committee

1. Coordinated Rockfish Survey
2. Joint Canada-U.S. Pacific cod tagging in areas 3B-3C
3. IGC 1977 meeting minutes
4. Sablefish workshop recommendations

IX. OTHER BUSINESS

- A. Technical Subcommittee coordination of Groundfish Surveys (Dark)
- B. Slope and Shelf rockfish as management and reporting units (Demory)
- C. Recommendations for boundary changes in the Monterey-Conception Region (Jow)

X. 1979 TECHNICAL SUBCOMMITTEE RECOMMENDATIONS

- A. Technical Subcommittee
- B. Parent Committee

XI. SCHEDULE OF FUTURE MEETINGS

XII. ELECTION OF CHAIRMAN

XIII. ADJOURNMENT

Appendix B

Distribution of the Report of the Technical Subcommittee

Technical Subcommittee

Canada:	R. Beamish, A. Cass, D. Fournier, L. Lapi, B. Leaman, J. Mason, M. Stocker, F. Taylor, J. Westrheim	9
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United States:	NMFS California Oregon Washington Alaska	
	T. Dark T. Jow R. Demory M. Pedersen P. Rigby	3 2 2 2 2

International Groundfish Committee

Canada	K. Pitre	4
United States	J. Harville	4

Advisors and Others

Canada	K. Ketchen	4
United States	C. Fullerton, J. Baxter - California J. Donaldson, W. Hublou - Oregon G. Sandison, A. Millikan - Washington	3 2 2

International Pacific Halibut Commission		1
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Appendix C

List of Reports published by Technical Subcommittee Member Agencies
for the period
May 1, 1978-April 30, 1979

Canada - Department of Fisheries and Oceans

- Barner, L. W., J. Selsby, and F. Mottle. 1978. Rockfish survey off the west coast of the Queen Charlotte Islands made on ARCTIC HARVESTER Hydroacoustic cruise 78-2, May 11-June 2, 1978. Fish. Mar. Serv. Data Rep. No. 110: 86 p.
- Barner, L. W., and F. H. C. Taylor. 1978. Midwater trawl tows and catches made on ARCTIC HARVESTER 76-2, 77-1 and G. B. REED 77-1, 77-2 off the southwest coast of Vancouver Island. Fish. Mar. Serv. Data Rep. No. 88: 91 p.
- Barner, L. W., F. H. C. Taylor, and A. Bennett. 1978. Midwater trawl tows and catches made on ARCTIC HARVESTER cruise 78-1 and G. B. REED cruise 78-1 (January 24-February 10, 1978) Queen Charlotte Sound. Fish. Mar. Serv. Data Rep. No. 106: 37 p.
- Barner, L. W., F. H. C. Taylor, D. M. A. Bennett and J. M. Thompson. 1979. Midwater and bottom trawl tows and catches made by M/V NEMESIS No. 78-1 July 5-23, 1978 in Dixon Entrance. Fish. Mar. Serv. Data Rep. No. 135: 105 p.
- Beamish, R. J. 1979. Differences in the age of Pacific hake (Merluccius productus) using whole otoliths and sections of otoliths. J. Fish. Res. Board Can. 36: 141-151.
- Beamish, R. J. 1979. The use of sections of fin rays to determine the age of pollock (Theragra chalcogramma), Pacific cod (Gadus macrocephalus), albacore tuna (Thunnus alalunga), and comments on the importance of the fin ray method for the determination of age of fishes. Trans. Am. Fish. Soc. (In press).
- Beamish, R. J. 1979. New information on the longevity of Pacific ocean perch (Sebastes alutus). J. Fish. Res. Board Can. (In press).
- Beamish, R. J., and J. R. Scarsbrook. 1979. The distribution and feeding habits of lampreys in the surface waters of the Gulf Islands and in the vicinity of the Fraser River, British Columbia. Fish. Mar. Serv. MS Rep. (In press).
- Beamish, R. J., and J. R. Scarsbrook. 1979. The distribution and feeding habits of lampreys in the surface waters of the Gulf Islands and in the vicinity of the Fraser River, British Columbia. Fish. Mar. Serv. Data Rep. (In press).
- Beamish, R. J., K. R. Weir, J. R. Scarsbrook, and M. S. Smith. 1979. Growth of young Pacific hake, walleye pollock, Pacific cod and lingcod in Stuart Channel, British Columbia in 1976. Fish. Mar. Serv. MS Rep. (In press).

- Beamish, R. J., C. Wood, and C. Houle. 1978. A summary of sablefish tagging studies conducted during 1977 by the Pacific Biological Station. Fish. Mar. Serv. Data Rep. 77: 103 p.
- Brown, D. R., L. G. (Van) Egan, M. S. Smith, and R. J. Beamish. 1979. Results of spiny dogfish (Squalus acanthias) tagging in the Strait of Georgia in 1978. Fish. Mar. Serv. Data Rep. (In press).
- Foucher, R. P., and R. J. Beamish. 1979. The production of non-viable oocytes by Pacific hake (Merluccius productus). J. Fish. Res. Board Can. (In press).
- Harling, W. R., J. J. Fargo, J. C. Blackburn, and A. Thieffry. 1978. Trawling survey for Dover sole off northwest Queen Charlotte Islands (G. B. REED cruise No. 78-6), July 28-August 10, 1978. Fish. Mar. Serv. Data Rep. No. 113: 27 p.
- Harling, W. R., W. Shaw, R. M. Wallis, and F. W. Motil. 1979. G. B. REED Groundfish cruise No. 78-7, August 29-September 19, 1978. Fish. Mar. Serv. Data Rep. No. 120: 64 p.
- Harling, W. R., R. M. Wallis, M. R. Fretwell, and F. W. Motil. 1978. ARCTIC HARVESTER Groundfish cruise No. 78-3, (February 27-March 10, 1978). Fish. Mar. Serv. Data Rep. No. 78: 35 p.
- Harling, W. R., R. M. Wallis, and N. Sigmond. 1978. Industrial Development Program exploration for Dover sole (Microstomus pacificus) off north-western British Columbia January 1978. Fish. Mar. Serv. Ind. Rep. No. 99: 19 p.
- Leaman, B. M., D. Davenport, W. R. Harling, D. A. Nagtegaal, W. A. Ostermann, J. R. Selsby, and G. A. Thomas. 1978. Biological observer coverage of foreign fisheries off Canada's Pacific coast, 1977. Fish. Mar. Serv. Data Rep. No. 99: Part 1: 171 p.; Part 2: 187 p.; Part 3: 124 p.; Part 4: 116 p.
- Leaman, B. M., D. A. Nagtegaal, and J. E. Smith. 1979. A pilot tagging study of Pacific cod in the Strait of Georgia January 17-February 2, 1978. Fish. Mar. Serv. MS Rep. (In press).
- Low, C. J., and R. J. Beamish. 1978. A study of the nesting behaviour of Lingcod (Ophiodon elongatus) in the Strait of Georgia British Columbia. Fish. Mar. Serv. Tech. Rep. No. 843: 27 p.
- Shaw, W. R., R. M. Wallis, F. W. Motil, and S. J. Westrheim. 1978. FREEPORTR Groundfish cruise No. 78-1, July 21-August 11, 1978. Fish. Mar. Serv. Data Rep. No. 112: 34 p.
- Sigmond, N., R. J. Beamish, J. Fargo, G. Kingston, and M. Stocker. 1979. Exploratory bottom trawling for sablefish southwest of Vancouver Island, 1978. Fish. Mar. Serv. MS Rep. (In press).

Appendix C (cont'd)

Smith, J. E. 1978. Catch and effort statistics of the Canadian Groundfish fishery on the Pacific coast in 1977. Fish. Mar. Serv. Tech. Rep. 835: 85 p.

Venables, N. L. 1979. An inventory of biological samples taken in the commercial groundfish fishery in British Columbia in 1978. Fish. Mar. Serv. Data Rep. (In press).

Alaska Department of Fish and Game

Blackburn, J. E. 1979. Pelagic and Demersal Fish Assessment in the Lower Cook Inlet Estuary System. Annual Report OCSEAP Research Unit S12. NOAA, OCSEAP, Box 1808, Juneau, AK 99802.

Blackburn, J. E. 1979. Demersal and Shellfish Assessment in Selected Estuary Systems of Kodiak Island. Final Report OCSEAP Research Unit 486. NOAA, OCSEAP, Box 1808, Juneau, AK 99802

California Department of Fish and Game

Jow, Tom and James E. Hardwick. 1978 Status of the groundfish resource and a plan for its management. Department of Fish and Game, Mar. Resour. Mgt. Rept. (2): 1-98

Jow, T. 1978. Trawl mesh sizes and yields per units of recruitment in the California fishery. Unpublished Rept. 9 p.

Jow, T., and L. F. Quirollo. Production model analyses of the INPFC Eureka area Dover sole fishery. Unpublished Rept. 6 p.

National Marine Fisheries Service

Bakkala, Richard, Wendy Hirschberger, and Katherin King (In press). The Groundfish resources of the Eastern Bering Sea and Aleutian Island Region - History of commercial fishing, current condition of resources, and areas of fishing.

Bakkala, Richard G., and Gary B. Smith. 1978. Demersal fish resources of the eastern Bering Sea. (NWAFC processed report).

Grant, Stewart, Richard Bakkala, and Fred Utter. 1979. Examination of biochemical genetic variation in yellowfin sole (Limanda aspera) of the eastern Bering Sea. Unpublished manuscript, MWAFC, Seattle, WA.

Hughes, Steven B., and George Hirschhorn. 1979. Biology of walleye pollock (Theragra chalcogramma), in the west Gulf of Alaska. Fishery Bulletin 77(1).

Low, Loh-Lee, and Richard Marasco. 1979. Preliminary report on bio-economic considerations of harvesting sablefish by longline and trawl gear in the Gulf of Alaska. NWAFC processed report 79-3.

Parks, Norman B., and Harold Zenger. 1978. Trawl surveys of groundfish resources in the eastern Gulf of Alaska and southeastern Alaskan waters 1976-77. NWAFC processed report.

Ronholt, Lael. 1979. Change in flounder abundance in the Gulf of Alaska from 1961 to 1973-76. Unpublished manuscript, NMWAFG, Seattle, WA.

Ronholt, L., Herbert H. Shippen, and Eric S. Brown. 1978. Demersal fish and shellfish resources of the Gulf of Alaska from Cape Spencer to Unimak Pass (an historical review). NMWAFG processed report vol. 1-4.

Ronholt, Lael and Loh-lee Low. 1979. Trends in abundance of Pacific ocean perch and other rockfish stocks in the Gulf of Alaska as indicated by trawl surveys in 1961 and 1973-76. Unpublished manuscript, NMWAFG, Seattle, WA.

Ronholt, L., and V. G. Westestad. 1979. Status of Pacific cod in the Gulf of Alaska. Unpublished manuscript. NMWAFG, Seattle, WA.

Westestad, V. G., and L. L. Ronholt. 1979. Atka mackerel resource in the northeastern Pacific Ocean and Bering Sea. Unpublished manuscript, NMWAFG, Seattle, WA.

Westestad V. G., K. Thorson, and S. Mizroch. 1978. Movement of sablefish (*Anoplopoma fimbria*) in the northeastern Pacific Ocean as determined by tagging experiments (1971-1977). NMWAFG processed report.

Oregon Department of Fish and Wildlife

Barss, William H. and Edwin L. Niska. 1978. Pacific ocean perch (*Sebastes alutus*) and other rockfish (Scorpaenidae) trawl landings in Oregon 1963-1977. Informational Report 78-6. Oregon Department of Fish and Wildlife (processed).

Barss, William H. 1978. Report of cruise 78-2. English sole tagging. Oregon Department of Fish and Wildlife (processed).

1978. Report of cruise 78-7. Lingcod tagging. Oregon Department of Fish and Wildlife (processed).

Demory, Robert L., William H. Barss, and James T. Golden. 1978. Groundfish assessment: Pacific ocean perch (*Sebastes alutus*), English sole (*Parophrys vetulus*) and lingcod (*Ophiodon elongatus*). Annual Report October 1, 1977 to September 30, 1978. Oregon Department of Fish and Wildlife (processed).

Hosie, Michael J. 1978. Report of cruise 78-5, Shrimp. Oregon Department of Fish and Wildlife (processed).

Lukas, Jerry. 1979. 1978 Oregon shrimp fishery. Information Report 79-1 Oregon Department of Fish and Wildlife (processed).

Washington Department of Fisheries

Anonymous. 1978. 1976 Marine Fish Program. Wash. Dept. Fish. Progress Rept. No. 74. 39 p.

Appendix C (cont'd)

- Bargmann, G. G. 1979. Studies on Pacific cod in Agate Pass, Washington. Wash. Dept. Fish. Tech. Rept. In preparation.
- Beam, J. 1979. An inventory of groundfish biological samples, including rockfish species composition catch estimates, taken in Washington during 1977. Wash. Dept. Fish. Progress Rept. In press.
- Culver, B. 1978. The 1977 recreational fisheries at the Columbia River north jetty and Grays Harbor south jetty. Wash. Dept. Fish. Progress Rept. No. 63. 14 p.
- Fraidenburg, M. 1978. Washington Department of Fisheries rockfish (Sebastes sp.) cruises during 1977: Cruise 77-1 and 77-2. Wash. Dept. Fish Progress Rept. No. 68. 21 p.
- Fraidenburg, M. E., N. A. Lemberg, and D. K. Kimura. 1979. Factors influencing the availability of shelf rockfish (Sebastes sp.) to trawl and hydro-acoustic gear. Wash. Dept. Fish. Prog. Rept. No. 79. 38 p.
- Kimura, D. K., R. R. Madapat, S. L. Oxford. 1979. Method, validity, and variability in the age determination of yellowtail rockfish (Sebastes flavidus), using otoliths. J. Fish. Res. Board Can. 36: 377-383.
- Pattie, B. H. 1978. The 1977 Washington trawl landings by Pacific Marine Fisheries Commission and state bottomfish statistical areas. Wash. Dept. Fish. Progress Rept. No. 76: 44 p.
- Pedersen, M. G. 1979. Review of the set net fisheries for groundfish in Puget Sound. Washington, 1974-1976. Wash. Dept. Fish. Prog. Rept. In preparation.

