

INTERNATIONAL PACIFIC HALIBUT COMMISSION

**ESTABLISHED BY A CONVENTION BETWEEN
CANADA AND THE UNITED STATES OF AMERICA**

**ANNUAL REPORT
1979**

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Preface

The International Pacific Halibut Commission (IPHC) was established in 1923 by a Convention between Canada and the United States for the preservation of the halibut (*Hippoglossus stenolepis*) fishery of the North Pacific Ocean and the Bering Sea. The Convention was the first international agreement providing for joint management of a marine resource.

Three commissioners are appointed by the Governor General of Canada and three by the President of the United States. The commissioners appoint the director who supervises the scientific and administrative staff. The scientific staff collects and analyzes statistical and biological data needed to manage the halibut fishery. The headquarters and laboratory are located on the campus of the University of Washington in Seattle, Washington. Each country provides one half of the Commission's annual appropriation.

The commissioners meet annually to review all regulatory proposals, including those made by the scientific staff and the Conference Board which represents vessel owners and fishermen. Regulatory alternatives are discussed with the Advisory Group composed of fishermen, vessel owners, and processors. The measures recommended by the commissioners are submitted to the two governments for approval. Citizens of each nation are required to observe the regulations that are adopted.

The International Pacific Halibut Commission has three publications: Annual Reports (U.S. ISSN 0074-7238), Scientific Reports (U.S. ISSN 0074-7246), and Technical Reports (U.S. ISSN 0579-3920). Until 1969, only one series was published. The numbering of the original series has been continued with the Scientific Reports.

Cover: Our cover this year is a scene from the docks in Prince Rupert, 1979's leading processing port. Some of our readers may recognize the woman to the right as Christine Selin, a former port sampler for the IPHC.

International Pacific Halibut Commission

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International Pacific Halibut Commission

ANNUAL REPORT 1979

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Activities of the Commission

The Commission held its 55th Annual Meeting in Vancouver, British Columbia, on February 20-22, 1979, Mr. Clifford R. Levelton presiding as Chairman, with Mr. Robert W. Schoning Vice Chairman. The Commission staff reviewed the 1978 halibut fishery, summarized the results of scientific investigations, and presented regulatory proposals for 1979. Chairman Levelton described the general terms of an agreement reached by Canada and the United States during negotiations earlier in February in Juneau, Alaska. The Chairman emphasized that details of the agreement would be worked out at a later meeting between the governments, and that the Commission would be advised accordingly. In the meantime, the Commission would have to develop regulations for the 1979 fishery consistent with the spirit of the new agreement. The Conference Board, representing vessel owners and fishermen, presented and discussed its regulatory proposals with the Commission. Before deciding on regulations to recommend to Canadian and United States Governments for approval, the Commission reviewed each proposal with the Advisory Group.

In other sessions, the Commission considered administrative and fiscal matters, approved research plans for 1979, and adopted the budget for fiscal year 1981-1982. Mr. Schoning was elected Chairman for 1979, and Mr. Levelton was elected Vice Chairman. At the close of the meeting the Commission issued a bulletin summarizing its recommendations to the governments, and emphasizing the continuing poor condition of the halibut resource.

Letters to the same effect went to the governments, but these included an optimistic note about prospects for recovery of the resource. The Commission expressed concern about the level of incidental catch of halibut observed on foreign and domestic vessels fishing other species, and urged the observer program be expanded to provide insight to the problem. The Commission indicated its intention to expand research on the extent of cross-boundary movements of halibut during all stages of its life.

On March 29, 1979, the Commission held a telephone conference to reconsider the opening and closing date for the first fishing period in Areas 2 and 3, and to divide the Area 2 catch limit so the portion taken from Canadian waters would be 5.4 million pounds, the yield from U.S. waters, 3.6 million. This division was required by the new protocol amending the Halibut Convention, but was not considered by the Commission at its annual meeting in February.

The annex to the protocol stipulates Canadian vessels be allowed to take 2.0 million pounds of halibut in United States waters during the period beginning April 1, 1979, and ending March 31, 1980. The Commission advised the two governments on June 14, 1979, that Canadian vessels fishing in United States waters had taken 1.8 million pounds at the end of the first fishing period and recommended that the remaining 200,000 pounds be added to the allocation for next year. The recommendation was approved by the United States Government in a letter dated June 20, 1979, and by the Canadian Government in a letter dated July 17, 1979.

Telephone conference meetings were held on July 20, 1979, and July 25, 1979. The first was called to discuss remedies to an unanticipated overharvest in the United States part of Area 2, which had the effect of prohibiting Canadian fishermen from taking their allocation of the Area 2 yield because the total Area 2 quota of 9.0 million pounds had been taken. The Commission elected to raise the Area 2 quota to 9.6 million pounds, and give Canadian fishermen more fishing time, on advice from scientific staff that the increased catch would still fall below the equilibrium yield for the area. The second meeting was called to extend the length of the third fishing period in Canadian waters, in view of the new information on the number of vessels expected to participate in the fishery.

A special meeting of the Commission was held in Vancouver, B.C., on August 1, 1979, to consider the opinions of Canadian fishermen dissatisfied with the shortfall in their catch, and the additional fishing period set for them. The Commission decided it could not postpone the opening date of the third fishing period, but would promptly determine the amount of catch taken during the period. If the catch from Canadian waters remained below the quota, and the fish there could withstand additional fishing, the Commission would consider another fishing period.

An interim meeting in Seattle, Washington, on September 18, 1979, briefly reviewed the 1979 halibut fishing season, and considered ways of meeting the requirements of the protocol in formulating regulations for the 1980 fishing season. At its close, letters were sent to the governments explaining how the Commission intended to implement the protocol. A news release summarizing the meeting also was distributed.

A list of reports published by the Commission during 1979 is appended to this report. In addition, several documents were prepared at the request of the governments.

Expenditures during the 1978-1979 fiscal year (April through March) were \$997,870. The Commission expenses were shared equally by both governments as required by the Halibut Convention.

Director's Report

The 1979 fishing season was extraordinary in a number of respects, not all of them as pleasant as members of the government and industry might have hoped for. This was the first year governed by the new protocol to the Halibut Treaty, and, quite understandably, that new development called for some difficult adjustments to be made by commissioners, staff members, and fishermen. None of the adjustments would have been particularly troublesome had they not coincided with an equally extraordinary pattern of availability of halibut.

The problem was felt most strongly in Area 2, where the protocol specified the catch be shared between the two countries: 60% of the total catch was to come from Canadian waters, and the remainder from the United States sector. At the same time, the Commission was obliged to establish a general quota for Area 2, taking into account, as it always does, the condition of the resource and the expected fishing effort and likely catch. Unfortunately, the staff did not anticipate a rise in fishing effort of 64% in the United States portion of Area 2 between the first and second fishing periods. At the same time, catch per effort on the United States side was the highest in many years, and the Canadian CPUE the lowest since 1931. Before the Commission staff was able to perceive these factors, the general quota for Area 2 had been reached, and in due course the area was closed to fishing. When the subsequent tally was taken, 49% of the Area 2 catch had been taken in United States waters.

The Commission, at its 1980 annual meeting, recommended quotas for the two national portions of Area 2 that will make up in 1980 the imbalance in the 1979 catch. In future years the Commission will attempt to control more closely the catches to achieve the intent of the protocol, but will not adjust the catch quotas to correct minor imbalances. I have asked the Commission staff to develop a procedure to ensure catches are kept within the quotas prescribed by the Commission, and they are confident future yields can be maintained within the catch limits.

The new protocol is a workable agreement between the two countries and will not interfere with sound management practices. The increasing effort in the United States portion of Area 2 does present some difficulties, but they are not insurmountable.

The signing of the new protocol by the two governments is viewed as a commitment by the two countries to maintain a viable halibut fishery. The spirit of cooperation and concern for conservation prevalent at the 1980 annual meeting give strong support to the Commission to carry out its mandate to maintain the halibut fishery into the future.

Regulations for 1979

REGULATORY PROPOSALS

The Commission received regulatory proposals for the 1979 halibut fishery from fishermen, vessel owners, processors, government agencies, the Makah Indian Tribe, and Commission scientific staff. A summary of all proposals was distributed to all interested groups prior to the annual meeting.

The staff recommended catch limits of 9 million pounds in Area 2, and 11 million pounds in Area 3 as in 1978. It proposed a sequence of fishing periods as follows: May 25 to June 10, June 26 to July 12, July 28 to August 13, and August 29 to September 14. These dates were selected to coincide with favorable tides, and avoid landings and outfittings on weekends and holidays. Other regulatory provisions such as nursery areas, size limits, gear restrictions, opening and closing hours, and sport fishery regulations would remain the same as in 1978.

The Conference Board met during the first two days of the annual meeting and proposed a catch limit of 10 million pounds in Area 2, and 11 million pounds in Area 3. Recommended fishing periods were as follows: May 15 to May 31, June 15 to July 1, July 18 to August 3, August 19 to September 4. The Conference Board also asked that the eastern boundary of Areas 3C and 4-west be moved from 175° West longitude to 173° West longitude. Kodiak delegates submitted a minority position supporting a May 25 opening, and requested more effective monitoring of the incidental catch of halibut by net and pot fishermen. Petersburg delegates favored a May 28 opening date in Areas 2 and 3, and called for a 9 million pound catch limit in Area 2, as in 1978. The Homer/Kenai delegate requested a 7 million pound catch limit in Area 2, and fishing periods in Areas 2 and 3 as follows: May 28 to June 10, June 26 to July 9, July 26 to August 8, August 29 to September 14.

The Makah Indian Tribe requested changes in the regulations that would relax regulations on their vessels and increase their opportunity to participate in the halibut fishery.

All regulatory proposals were discussed with the Advisory Group, consisting of representatives of fishermen, vessel owners and processors. Members of the Advisory Group in 1979 were Robert Alverson, Ralph Hoard, Brian Kelly, and Neil Sandvik (Seattle, Washington); William Ahern, George Dodman, John Radosevic, and Sam Smith (Vancouver, British Columbia); George Cook, Sid Dickens, and Albert Wood (Prince Rupert, British Columbia); Jere Murray (Homer, Alaska). The Commission then decided on the regulations it would recommend to the governments for the 1979 fishery in the presence of the Advisory Group.

The regulations recommended by the Commission were approved by the United States Secretary of State on April 30, 1979, and the Governor General of Canada by Order in Council on August 20, 1979, and became officially effective on the later date. On July 20, the Commission decided

that it was necessary to increase the Area 2 catch limit to 9,600,000 pounds to allow Canadian fishermen a better opportunity to take their share of the Area 2 catch. The governments were advised of this decision by letter on July 26, 1979, and the change was accepted by the United States Department of State on August 22, 1979, and accepted by the Canadian Minister of Fisheries and Oceans in a telegram, July 23, 1979.

REGULATORY AREAS

Regulatory areas in 1979 are shown in Figure 1. Area 2 was unchanged, but the boundary at 175° West longitude, which separated Area 3C from the rest of Area 3, and divided the Bering Sea into Area 4-East and Area 4-West was shifted to 173° West longitude. The nursery area in the eastern Bering Sea was closed to halibut fishing again in 1979. Following is a description of the regulatory areas for the halibut fishery in 1979.

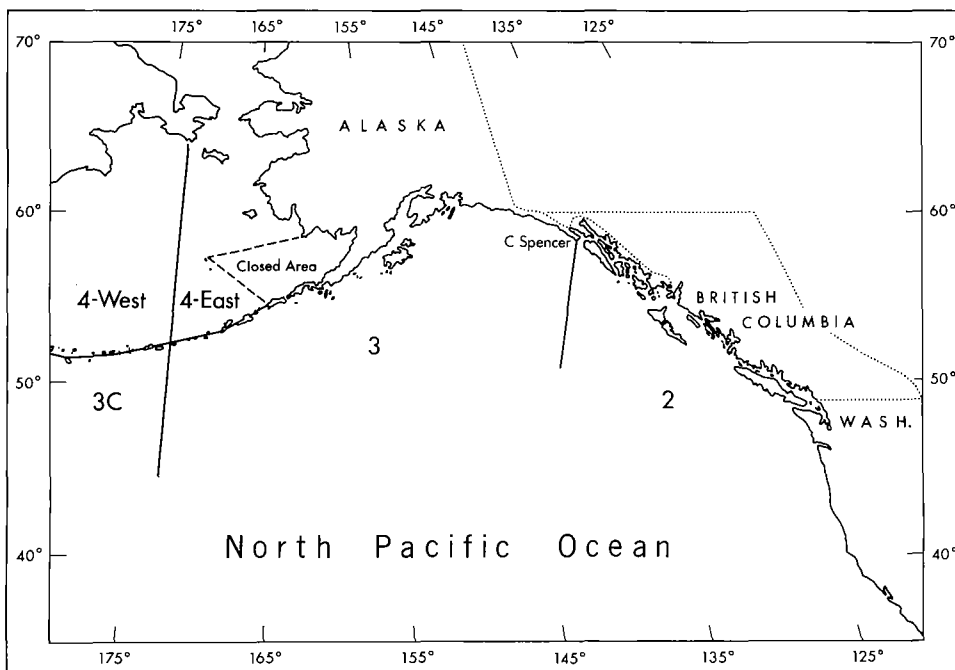


Figure 1. Regulatory areas for the Pacific halibut fishery, 1979.

- Area 2 - South and east of Cape Spencer, Alaska.
- Area 3 - North and west of Area 2, excluding the Bering Sea.
 - 3C: West of 173° West longitude.
- Area 4 - The Bering Sea
 - 4-East: East of 173° W. longitude, excluding the closed area.
 - 4-West: West of 173° W. longitude.
 - Closed area: The southeastern flats.

CATCH LIMITS AND LENGTH OF SEASONS

The revised 1979 catch limit in Area 2 was 9.6 million pounds, 600,000 pounds more than the catch limit in 1978. In Area 3, the catch limit was 11 million pounds, as in 1978. Area 3C, 4-East and 4-West were regulated by fishing seasons and catch limits were not assigned.

Opening and closing dates and lengths of fishing periods for 1978 and 1979 are given in Table 1. Fishing seasons in Areas 2 and 3, excluding Area 3C, consisted of a series of periods, each of specified length except the last which was closed on the date the catch limit was taken. The fishing periods in all areas began at 1500 hours, and ended at 0600 hours, Pacific Standard Time.

Table 1. Opening and closing dates by area, 1978-1979.

Area	1979			1978		
	Opening	Closing	Fishing Days	Opening	Closing	Fishing Days
2	May 25	June 10	16	May 15	May 31	16
	June 26*	July 3	7	June 19	July 6	17
	June 26**	July 12	16	July 25	Aug. 10	16
	July 28**	Aug. 5	8	Aug. 26	Sept. 8	13
3	May 25	June 10	16	May 15	May 31	16
	June 26	July 12	16	June 19	July 6	17
				July 25	Aug. 4	10
3C	Apr. 10	Nov. 15	218	Apr. 8	Nov. 15	220
4-East	Apr. 10	Apr. 30	19	Apr. 8	Apr. 28	19
	July 24	Aug. 11	17	Aug. 16	Sept. 3	17
4-West	Apr. 10	Nov. 15	218	Apr. 8	Nov. 15	220

*United States waters

**Canadian waters

OTHER REGULATIONS

The minimum size limit for halibut was the same as 1978: a head-on limit of 32 inches, and a head-off limit of 24 inches.

Sport fishery regulations for halibut remained the same as in 1978. The catch and possession limit for sport fishermen was two fish of any size, caught with a hook attached to a handline, or rod, or by spear. The sport fishing season was from March 1 to October 31, 1979.

All other regulations pertaining to licensing and gear restrictions remain unchanged.

The Fishery

COMMERCIAL FISHERY

A compilation of historical statistics, published in 1977 as *Technical Report* Number 14, "The Pacific Halibut Fishery: Catch, Effort and CPUE, 1929-1975," summarizes catch and effort data by statistical area, region, regulatory area, and country. Data on landings also are given by port and country. Appendix tables in this Annual Report and the Annual Report for 1977 are in the same format and update those statistics to 1979.

Catch by Regulatory Area

The total commercial catch in 1979 was 22.5 million pounds, 0.5 million pounds more than the 1978 catch of 22.0 million pounds. Canadian vessels took 30% of the catch in 1979 (39% in 1978) and United States vessels took 70% (61% in 1978). This shift in the distribution of the catch resulted from agreements reached in Juneau, Alaska, between the governments of Canada and the United States, restricting the Canadian catch from waters in which the United States claims exclusive fisheries jurisdiction, to not more than 2 million pounds in 1979. The actual catch was 1.8 million pounds.

Catch by country and regulatory area is shown for 1975 through 1979 in Table 2. The catches for Area 2 are further separated into waters in which Canada and the United States each claim exclusive fisheries jurisdiction. It should be noted that halibut caught by Canadian vessels in Dixon Entrance are considered as having been caught in Canadian waters, and halibut caught by United States vessels in the same area are considered as having been caught in United States waters. This anomaly in the division of the catch is necessary because of an unresolved boundary dispute between the two countries in this region.

The Area 2 catch was 9.4 million pounds, 0.2 million pounds lower than the prescribed catch limit. The protocol to the Convention required 60% of the Area 2 catch be taken from Canadian waters and 40% from United States waters. Due to an unexpectedly high CPUE in Southeastern Alaska and an increase in fleet size during the second fishing period, the prescribed division of the catch was not achieved. The actual division of the catch was 49% from United States waters, and 51% from Canadian waters, in spite of extended fishing allowed in the latter area in an attempt to achieve the negotiated distribution of catch. A reduced CPUE in Canadian waters from 1978, and a tie-up of part of the Canadian fleet during the extended fishing period in Canadian waters, contributed to the failure in achieving the desired distribution of catch.

In Areas 3 and 3C, the catch during the regular season of 11.9 million pounds exceeded the catch limit by 0.9 million pounds. Following the closure of the quota season on July 12, Area 3C, the western portion of Area 3, remained open to fishing without catch limit until November 15. An

Table 2. Catch by country and regulatory area, 1975-1979 (in thousands of lbs.).

Regulatory Area	1975	1976	1977	1978	1979
Area 2					
Canadian waters					
U.S.	428	474	254	243	—
Canada	<u>6,699</u>	<u>6,807</u>	<u>5,174</u>	<u>4,364</u>	<u>4,857</u>
Total	7,127	7,281	5,428	4,607	4,857
Area 2					
United States waters					
U.S.	6,033	5,174	2,859	3,503	4,412
Canada	<u>670</u>	<u>593</u>	<u>533</u>	<u>910</u>	<u>164</u>
Total	6,703	5,767	3,392	4,413	4,576
Area 2 - all waters					
U.S.	6,461	5,648	3,113	3,746	4,412
Canada	<u>7,369</u>	<u>7,400</u>	<u>5,707</u>	<u>5,274</u>	<u>5,021</u>
Total	13,830	13,048	8,820	9,020	9,433
Area 3					
U.S.	9,442	9,430	9,446	9,013	10,504
Canada	<u>3,819</u>	<u>4,534</u>	<u>2,921</u>	<u>3,297</u>	<u>1,638</u>
Total	13,261	13,964	12,367	12,310	12,142
Area 4					
U.S.	356	461	542	624	952
Canada	<u>169</u>	<u>62</u>	<u>139</u>	<u>34</u>	<u>—</u>
Total	525	523	681	658	952
All Areas					
U.S.	16,259	15,539	13,101	13,383	15,868
Canada	<u>11,357</u>	<u>11,996</u>	<u>8,767</u>	<u>8,605</u>	<u>6,659</u>
Total	27,616	27,535	21,868	21,988	22,527

additional 0.3 million pounds was caught, bringing the final Area 3 catch to 12.1 million pounds. Both catch and CPUE were sharply higher in the Yakutat region: the 1979 catch was 4.8 million pounds, compared to 3.1 million in 1978; CPUE was up nearly 33%. In the Kodiak region, the catch was 6.6 million pounds, down 0.6 million from the 7.2 million caught in 1978, and there was no change in CPUE. In the Chirikof and Shumagin regions, the catch in 1979 was 0.4 million pounds, 0.9 million less than the 1978 catch of 1.3 million pounds, and CPUE in these regions fell 29% to the lowest level on record.

In the Bering Sea (Area 4) the total catch was 952,000 pounds, up sharply from 658,000 in 1978. All the catch was taken by United States vessels, since Canadian vessels were excluded from fishing in the area in 1979. The spring fishery produced 119,000 pounds, with the remaining catch of 833,000 pounds taken in the summer and fall seasons.

Number of Vessels

Table 3 shows the number of vessels, the number of trips, and the catch by vessel category in 1979. Vessels five net tons or larger fishing with setline gear must have a license issued by IPHC, though setline vessels less than five net tons, or vessels of any size not using setline gear, do not.

Table 3. Number of vessels, number of trips, and catch by licensed and unlicensed vessels in Areas 2 and 3, 1979.

Vessel Category	Canada			United States			Total		
	No. of Vsls.	No. of Trips	Catch of 000's Lbs.	No. of Vsls.	No. of Trips	Catch of 000's Lbs.	No. of Vsls.	No. of Trips	Catch of 000's Lbs.
AREA 2									
Unlicensed									
Trollers	5	5	<1	828	1,756	143	833	1,761	143
Setliners	22	56	39	649	2,195	965	671	2,251	1,004
Other**	—	—	—	—	—	1	—	—	1
Total	27	61	39	1,477	3,951	1,109	1,504	4,012	1,148
Licensed									
5-19 tons***	292	946	3,220	215	679	1,197	507	1,625	4,417
20-39 tons	32	72	1,008	47	107	750	79	179	1,758
40-59 tons	8	18	222	8	15	189	16	33	411
60+ tons	3	6	160	1	1	<1	4	7	160
Total	335	1,042	4,610	271	802	2,136	606	1,844	6,746
All Vessels	362	1,103	4,649	1,748	4,753	3,245	2,110	5,856	7,894
AREA 3*									
Unlicensed									
Trollers	—	—	—	98	241	44	98	241	44
Setliners	—	—	—	726	2,270	1,337	726	2,270	1,337
Total	—	—	—	824	2,511	1,381	824	2,511	1,381
Licensed									
5-19 tons***	1	1	30	300	951	2,535	301	952	2,565
20-39 tons	12	22	784	120	325	5,007	132	347	5,791
40-59 tons	5	8	356	34	107	3,101	39	115	3,457
60+ tons	9	16	840	6	15	599	15	31	1,439
Total	27	47	2,010	460	1,398	11,242	487	1,445	13,252
All Vessels	27	47	2,010	1,284	3,909	12,623	1,311	3,956	14,633
Grand Total	389	1,150	6,659	3,032	8,662	15,868	3,421	9,812	22,527

*Includes vessels that fished in both Areas 2 and 3, and those that fished in Area 4.

**Deliveries of unknown origin.

***Includes small vessels of unknown tonnage.

The number of Canadian vessels landing halibut diminished by over two-thirds from 1978 as a result of Canadian domestic regulations limiting participation in the halibut fishery. Only vessels which landed 3,000 pounds of halibut in 1977 and/or 1978 were allowed to fish for halibut, and all troll retention of halibut was prohibited except for the few vessels that qualified under the 3,000 pound catch guideline.

United States vessels landing halibut increased by over 25% from the previous year, attracted by the high price for halibut, and the fact that other fisheries, particularly salmon, currently limit the number of vessels that may participate. The number of vessels larger than 5 tons landing halibut rose by 38%, while the number of small setliners increased by 66%. The number of trollers declined, probably due to the short length of the fishing season in Southeastern Alaska.

Landings by Port

The leading halibut port in 1979 was Prince Rupert, British Columbia, with landings of 3.3 million pounds. Kodiak, Alaska, slipped to second place with landings of 2.7 million pounds, followed by Seward, Alaska, with 2.6 million pounds. Landings were substantially higher than last year in Southeastern Alaska, slightly higher in British Columbia ports, and lower in Central Alaska and Washington ports.

SPORT FISHERY

Observations of the charter-boat fishery in Kachemak Bay, Alaska, continued in 1979. Two additional charter companies began operation this year, making a total of four companies fishing exclusively for halibut, and four fishing for halibut in addition to other species. Based on daily records of the number and weight of halibut caught supplied by one company, it was possible to project a total charter catch in Kachemak Bay of 17,800 fish weighing 188,000 pounds eviscerated, heads off. These figures are double those reported last year.

Estimates for the catch from Alaska, British Columbia, and Washington sport fishermen are provided by the state and federal agencies. According to estimates made by the Alaska Department of Fish and Game, 47,705 halibut were caught by sport fishermen in 1979. The catch in the Cook Inlet area was 29,899 fish, followed by Southeastern Alaska with 13,102 fish, Kodiak area with 3,013 fish and Prince William Sound with 1,691. The catch in the Cook Inlet area remained about the same in 1979, while the catch in the other areas showed an 80% increase over 1978.

Canadian sport fishermen caught 611 halibut, with an average weight of about 30 pounds, according to a preliminary tally of fishery officer reports. The 1979 catch is about 30% greater than that of 1978, but is still lower than

catches prior to 1978. Most of the 1979 catch was from the Prince Rupert area and Queen Charlotte Sound.

Estimates are not yet available from the Washington Department of Fisheries. Based on previous catches, it is estimated sport fishermen caught 675 halibut in Washington.

INCIDENTAL CATCH OF HALIBUT

Halibut are caught inadvertently by fishermen seeking other species. Although regulations prohibit the retention of incidentally caught halibut in these fisheries, many of the released fish die from injuries received during capture. The mortality resulting from such incidental capture varies with condition, but approaches 100% for foreign trawls and domestic pot gear, and 50% for domestic trawls and foreign setline. Consequently, the extent of the incidental catch carries some significance in the assessment of the halibut resource.

The magnitude of incidental catch is not precisely known, but is estimated from data collected by observers who sample the catch at sea. Some estimates are based on meager data or on data that may not be entirely representative, and all of the estimates may change as additional information becomes available. The majority of the incidental catch consists of fish smaller than the size caught in the commercial fishery. The estimates exclude any deliberate catch of halibut by other fisheries. In 1978, the most recent year for which data are available, the total incidental catch was estimated at 12.2 million pounds—5.2 million pounds coming from the eastern Bering Sea, and 7.0 million pounds from the northeast Pacific Ocean. The incidental catch by gear type is given in Table 4.

Table 4. Estimated incidental catch of halibut in eastern Bering Sea and northeast Pacific, 1978 (in millions of pounds).

	Foreign Trawl	Foreign Setline	Domestic Trawl	Domestic Pot Gear	Totals
Eastern Bering Sea	4.3	0.4	—	0.5	5.2
Northeast Pacific Ocean	2.0	0.1	3.9	1.0	7.0

The incidental catch in recent years has declined from the 15 to 20 million pound level of the mid-1960's and early 1970's. The decline can be attributed to several factors, including reduced foreign trawling and the closure of certain grounds to trawling when halibut are most vulnerable. Though the incidental catch in the eastern Bering Sea actually increased about 2 million pounds in 1978, the increase was offset by a sharp decline in the catch from the northeast Pacific Ocean.

Recent reports from fishermen suggest the incidental halibut catch in pots (primarily used in the crab fishery) may be much higher than

estimated. A review of the incidental catch by pot gear is proceeding and some results should be available for the 1980 Annual Report.

VALUE OF THE 1979 CATCH

The calculated landed value of the 1979 catch was \$48 million (U.S.) and the fishermen received an average price of \$2.13 per pound. The previous

Table 5. Average prices by ports and fishing periods, 1979 (U.S. dollars).

Port	Fishing Periods					Average	Trade Categories
	Bering Sea Spring	#1	#2	#3	Bering Sea Fall		
Seattle	—	2.21	2.33	—	—	2.33	
Ketchikan	—	2.12	2.12	2.12	—	2.12	
Petersburg	—	2.12	2.15	2.15	2.15	2.14	
Kodiak	1.89	2.07	2.07	1.99	1.99	2.03	Medium
Unalaska	1.65	1.70	1.98	1.86	1.86	1.81	
Vancouver	—	2.19	2.37	2.40	—	2.30	
Prince Rupert	—	2.15	2.36	2.38	—	2.25	
Seattle	—	2.21	2.33	—	—	2.33	
Ketchikan	—	2.12	2.12	2.12	—	2.12	
Petersburg	—	2.12	2.15	2.15	2.15	2.14	
Kodiak	1.89	2.07	2.07	1.90	1.90	2.01	Large
Unalaska	1.65	1.70	1.97	1.95	1.95	1.92	
Vancouver	—	2.19	2.37	2.39	—	2.30	
Prince Rupert	—	2.14	2.37	2.38	—	2.25	
Seattle	—	—	2.30	—	—	2.30	
Ketchikan	—	2.02	2.02	2.02	—	2.02	
Petersburg	—	2.02	2.05	2.05	2.05	2.04	
Kodiak	1.79	1.97	1.97	1.76	1.76	1.88	#2 Medium
Unalaska	1.61	1.60	1.88	1.76	1.60	1.61	
Vancouver	—	2.10	2.28	2.29	—	2.19	
Prince Rupert	—	2.07	2.28	2.29	—	2.17	
Seattle	—	—	2.30	—	—	2.30	
Ketchikan	—	2.02	2.02	2.02	—	2.02	
Petersburg	—	2.02	2.05	2.05	—	2.03	
Kodiak	1.85	1.97	1.97	—	1.79	1.93	#2 Large
Unalaska	1.61	1.60	1.87	1.85	1.60	1.60	
Vancouver	—	2.10	2.29	2.29	—	2.25	
Prince Rupert	—	2.14	2.29	2.29	—	2.22	

record value was in 1978, when the catch was worth \$37 million at an average price of \$1.70 per pound. Halibut prices continued to increase in the first half of 1979 to a reported high of \$2.46 (U.S.) in Vancouver, B.C. However, the prices stabilized during the second half and then dropped to \$1.80 per pound in Kodiak for the last Bering Sea opening.

The Canadian catch totalled 6.7 million pounds with a landed value of \$15.1 million (U.S.) for an average price of \$2.26 per pound. Of this, 1.8 million pounds with a landed value of \$3.9 million (U.S.) for an average price of \$2.18 per pound was taken in U.S. waters off Alaska. The U.S. catch amounted to 15.9 million pounds with a landed value of \$33.0 million for an average price of \$2.08 per pound. As in past years, fishermen continued to receive higher prices when landing their catches in southern ports.

Table 5 shows the average prices (U.S. dollars) paid each opening for selected ports, by trade categories.

Population Assessment

Population assessment indicators provided conflicting interpretations of population levels in 1979. In the past, catch and age data (cohort analysis) and CPUE data from the fishery generally showed similar trends for the resource. However, in 1979, cohort analysis indicated poorer conditions than did CPUE data, although both showed that the stock is not in good condition. At this time, explanations for these conflicting results are not available, and, because neither indicator is considered superior, both interpretations are discussed.

Although CPUE data in 1979 suggested a general increase in the stock of halibut, that conclusion was complicated by a sharp reduction in CPUE in the western Gulf of Alaska and off British Columbia. Cohort analysis indicated a slight increase in Area 2, but a major decline in Area 3. Cohort analysis also indicated a continuing decline in juvenile abundance in both areas, whereas CPUE, and IPHC survey data suggested stable or slightly increased juvenile abundance in recent years.

Similarly, estimates of equilibrium yield varied substantially, depending on the source of data used. All of the estimates showed that recent catches in Area 2 were at or below equilibrium values. Some estimates in Area 3, however, indicated the catch was above the equilibrium, and that the population will decline unless catches are reduced.

ABUNDANCE OF ADULT HALIBUT

Cohort analysis shows that the 1979 biomass of adults was about 144 million pounds in Area 2, and 135 million pounds in Area 3 (Figure 2). Adult biomass in Area 2 has increased slightly since the early 1970's, but remains below the 200 million pound peak level of the 1950's and early 1960's. In Area 3 adult biomass has declined slightly since 1977 and is well below the 300 million pound level of the 1950's and early 1960's.

CPUE data show similar trends to cohort estimates over the long term, but provide different trends since the mid-1970's. As previously mentioned, CPUE in 1979 contained some unusual patterns (Figure 3). In Area 2, an increase in Southeastern Alaska was nearly offset by a decline in the Charlotte region. Likewise, CPUE in the Yakutat region of Area 3 increased sharply while CPUE in the regions west of Kodiak declined. The decline in the western part of Area 3 began in the early 1970's but has accelerated in recent years: CPUE presently is at a historical low point in the Shumagin and Chirikof regions.

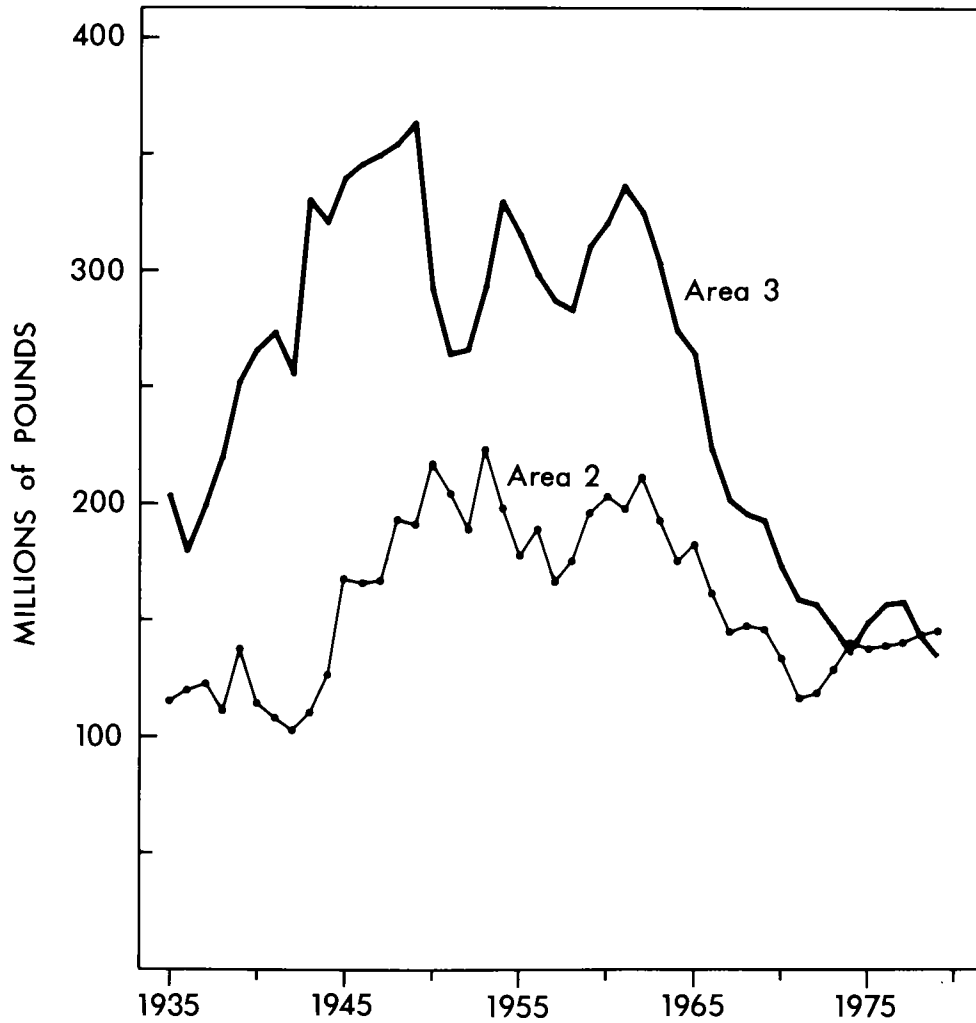


Figure 2. Biomass of adult halibut (8- to 20-year-olds), cohort analysis, 1935-1979.

JUVENILE ABUNDANCE

Results from cohort analysis show a continuing decline in the abundance of 3- to 7-year-old halibut (Figure 4). Abundance in 1979 was estimated at about 20 million fish for Areas 2 and 3 combined, compared to about 70 million fish during the early 1940's. These estimates indicate that the abundance of adult halibut and the equilibrium yield will remain low during the 1980's when these juveniles reach adult ages.

Other indicators provide a more optimistic picture of juvenile abundance. The CPUE of 9-year-olds—an index of recruitment to the fishery—was higher in 1979 than any year since 1972. Estimates from IPHC juvenile surveys are variable, but indicate that abundance has not declined since the early 1970's.

EQUILIBRIUM YIELD

Equilibrium yield is the catch that can be taken without changing population size from one year to the next. If the catch is held below the equilibrium yield, a subsequent increase in the supply of fish should occur. Estimates of equilibrium yield vary considerably, depending upon whether the results from cohort analysis or CPUE analysis were used, but are probably around 12 million pounds in each of Areas 2 and 3. Equilibrium yield in Area 4 probably is between 1 and 2 million pounds.

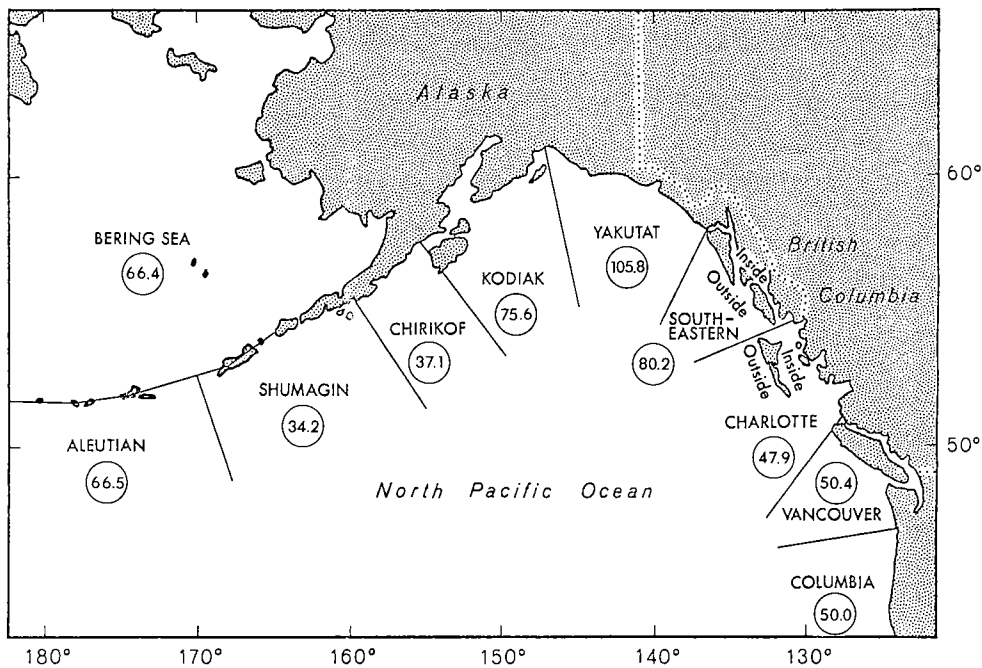


Figure 3. Setline CPUE in 1979 by regions of the coast.

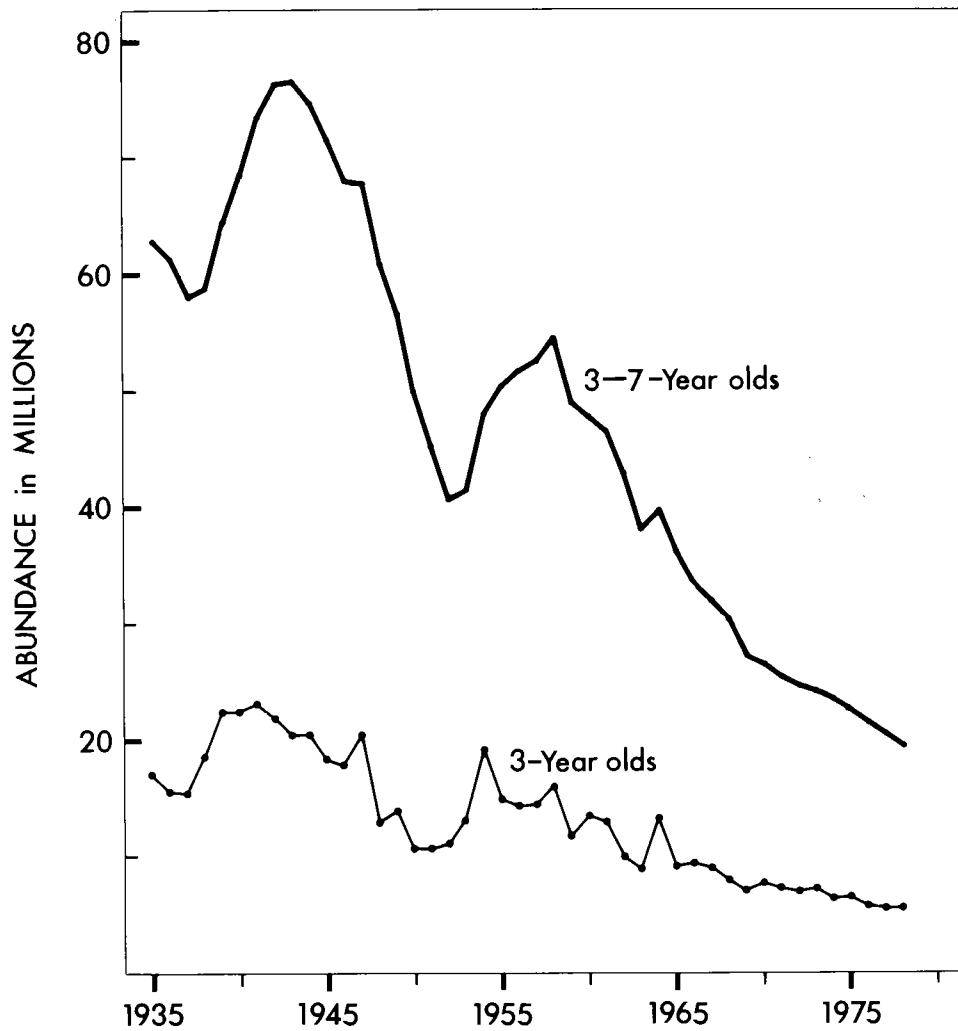
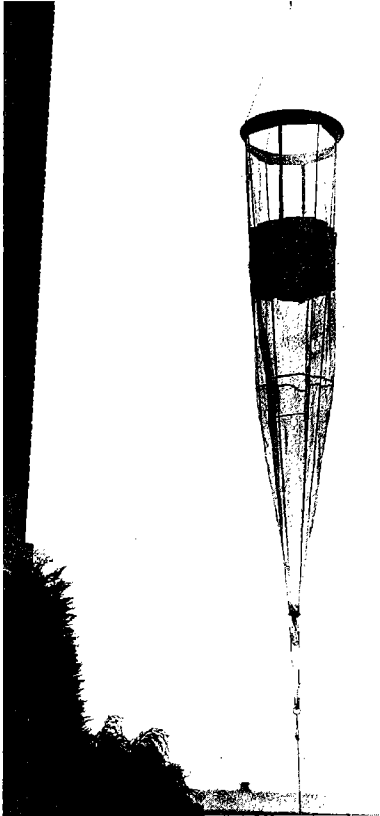


Figure 4. Estimated abundance of juvenile halibut, cohort analysis, 1935-1979.

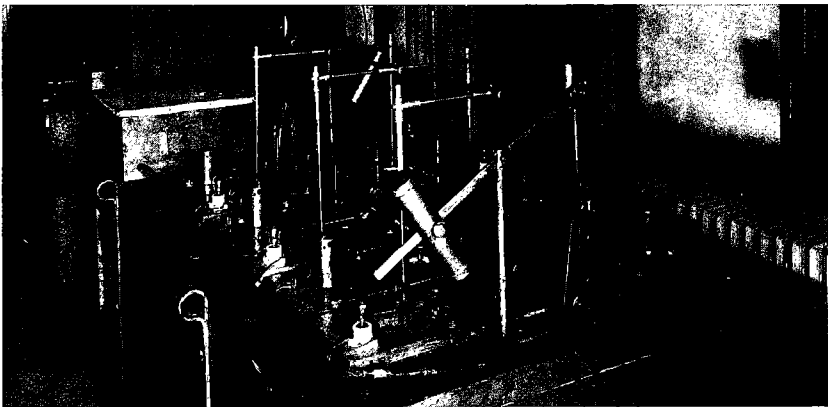
At the time the Commission was formed, little was known of the hydrography of the Alaskan Gulf, nor did any supplement seem forthcoming. Consequently, the Commission was first to rigorously accumulate such information. The man is holding one of many "drift bottles" set loose in the uncharted currents of the Gulf. It was carefully ballasted with sand to ride low in the water, and a vaned, copper plate, dangling at the end of the attached wire, acted as a drag in the current. In this manner the influence of wind currents was reduced. Each bottle, of course, contained a note advising the finder of its origin, and asking for details of recovery. Incidentally, the man in the photograph is Richard Van Cleve, now Professor Emeritus, University of Washington, whose assistance in explaining the contents of these photographs we gratefully acknowledge.

The life... was a specimen of water tagging

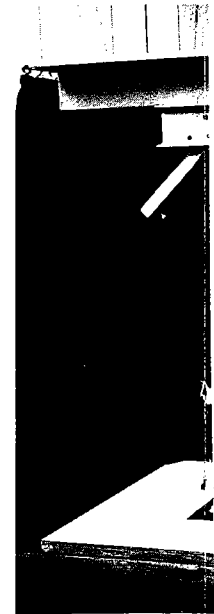
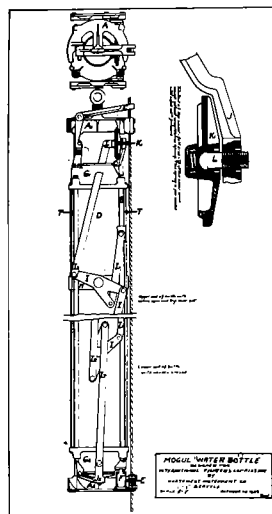


As one might expect, this net was used to capture tiny halibut larvae. At the same time, though, it also captured many other minute organisms, and when the Commission was through using the samples thus collected for its larval studies, the residue was sent to the Smithsonian Institution where the accompanying species were further analyzed. Though these original studies are of considerable value, the net is not: other oceanographic agencies have since relieved the Commission of the task of gathering this kind of information.

Sometimes it is possible to acquire an instructive picture of an organization, just by examining the things it has cast off. Pictured here is some of the equipment the IPHC has acquired over a half century, and subsequently abandoned for one reason or another. It is a history, in spare parts, of the IPHC's variegated investigations and changing role in biological research.

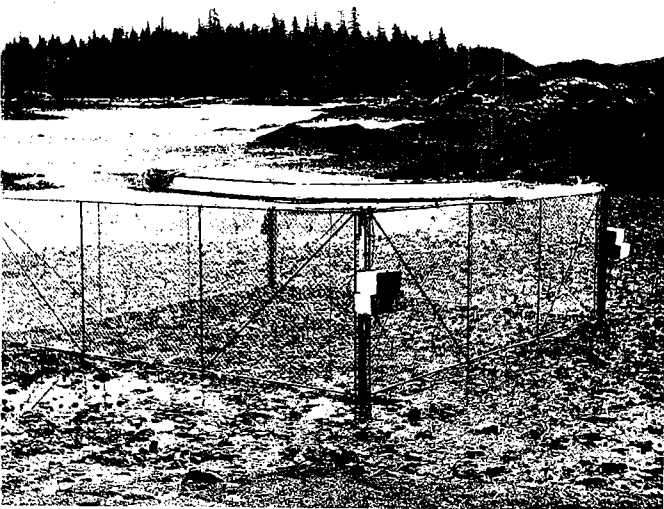


The photographs above and right really belong together since they were part of the same experiment. At the right is a Mogul water bottle designed for the Commission by a Seattle firm in 1933, and used to collect large (15 gal.) samples of water, from specified depths, for supply to the apparatus above. It had a lid at either end, open when the bottle was lowered, allowing potentially contaminating water from shallower depths to be flushed through the cylinder as it descended. The resulting pure samples from predetermined depths refreshed stale water in what was called a "Constant Temperature Machine", the holding tank above. The six cells in the device, each cooled to a slightly varying temperature, held growing halibut eggs, and were intended to replicate the environmental circumstances of embryonic halibut, during dispersal by ocean currents. The six vertical rods reaching down into the tanks are part of a rocker-arm assembly which gently stirred the water.

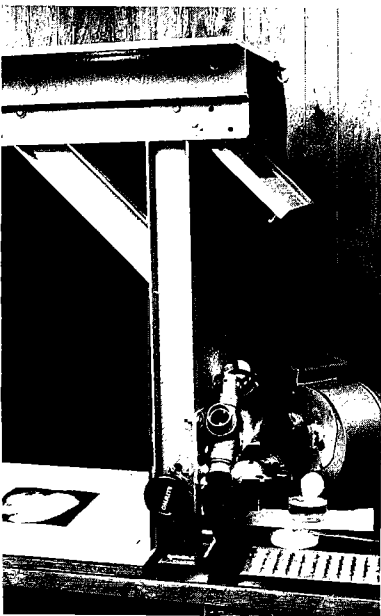


Reading an otolith mation locked in the evolving art. At the useful, biologists w otolith rings to tel rate of its donor. Ar a nuisance to measi fied the process by otolith was placed i an image of known sees the photograp simply took the mec Since then, weight, pies most studies, storage.

is a "Live Box", and, as its name suggests, is meant to contain
 In this case, however, fish inside it sometimes died. It's purpose
 to test the resilience of halibut to tagging. Divers placed tagged
 mens in the pen, which rested on the bottom in about five fathoms
 water, and then wated to see which of the specimens died due to the
 ng process.



As a professional courtesy to fellow biologists, the
 Commission sometimes collected information that was not
 directly applicable to the halibut fishery. Such was the case in
 the survey that used this Allen Plankton Sampler, named after
 the Scripps biologist for whom the survey was done.



h — extracting all the potential infor-
 is skeletal artifact — is a constantly
 e time the device pictured here was
 ere relying upon the distance between
 l them something about the growth
 otolith, being small and unwieldy, is
 ure, and the Commission staff simpli-
 designing this projector. When an
 n the circular tray at the lower right,
 magnification appeared where one
 h, at left. The lab technician then
 surements of the image with a ruler.
 rather than shape of an otolith occu-
 and the projector has gone into



Like the drift bottles shown
 opposite, this bit of hardware
 was employed, briefly, in hy-
 drographic studies. It's called
 a Green-Bigelow water bottle,
 and was a water sampler and
 thermometer in one. It is not re-
 membered as being very effec-
 tive for marine purposes, and
 was quickly replaced by an
 Ekman bottle performing the
 same functions. The man in
 the picture led a career as trans-
 boundary as the species he
 studied. The first PhD to
 graduate from the College of
 Fisheries at the University of
 Washington, J. L. Kask has
 been a senior executive with
 the U.S. Fish and Wildlife Ser-
 vice, the Fisheries Research
 Board of Canada, the Food and
 Agriculture Organization of
 the United Nations, not to men-
 tion the International Salmon,
 Tuna and Halibut Commis-
 sions.

Scientific Investigations

TAGGING STUDIES

In 1979, 152 halibut tags were returned by finders, 145 were recovered in 1979, and 7 in earlier years. Of these, 10 recoveries were premium tags and the finders received \$100.00 premium rewards, in addition to the standard \$5.00 reward for the return of an IPHC tag.

The number of tagged fish released during 1979 was 11,008, much greater than the number released in recent years. In January and February, 1,002 tags were released from the M/V SEYMOUR on the Cape Bartolome spawning grounds. During May, 202 tagged fish were released from the commercial trawler, M/V NEMESIS, in northern Hecate Strait. This small experiment was designed primarily to test a new tag which shows promise for tagging small halibut. During the stock assessment survey, 823 tagged fish were released by the M/V CHELSEA near the east end of Kodiak Island in August and September.

Finally, 8,981 tagged fish were released during the juvenile study by the M/V HOPE BAY. Past experience indicates that the percentage recovery will be small. Most of these fish were below 65 cm in length, and recoveries will indicate how juvenile halibut are recruited to the adult stock. The 1979 releases are summarized in Table 6.

Tagging on the spawning ground off Cape Bartolome, Alaska, during January and February of this year, contributed 28 returns in 1979. Of these, 6 (21%) were recovered in Southeastern Alaska, and 22 (79%) were recovered in Canadian waters. These early returns indicate a pronounced southerly, and inshore movement from winter spawning grounds in Alaska, to summer feeding grounds in British Columbia waters.

Table 6. Numbers of halibut tagged in 1979 by region of release.

Region	Vessel	Months	Number Released
Southeastern	SEYMOUR	Jan.-Feb.	1,002
Charlotte	NEMESIS	May	202
Kodiak	CHELSEA	Aug.-Sept.	823
Bering Sea	HOPE BAY	June	133
Shumagin	HOPE BAY	June	102
Chirikof	HOPE BAY	June-July	2,046
Kodiak	HOPE BAY	July-Aug.	5,310
Yakutat	HOPE BAY	August	1,184
Southeastern	HOPE BAY	Aug.-Sept.	206
Total			11,008

JUVENILE HALIBUT SURVEY

A trawl survey is conducted annually to assess changes in abundance of juvenile halibut populations in the southeastern Bering Sea and the Gulf of Alaska, and to gather information surrounding transboundary migrations of the species. Juvenile halibut are defined as fish less than 65 cm long and most are under 7 years of age.

The M/V HOPE BAY, a 22.0 meter trawler out of Vancouver, B.C., was chartered for 110 days from May 22 to September 7 to conduct the 1979 survey and tagging studies. A total of 218 hauls were made on predetermined stations during the assessment phase: 154 thirty-minute hauls at offshore locations, using a 90-mm mesh codend net, and 64 fifteen-minute hauls at inshore locations with a 32-mm mesh codend. In addition, 182 hauls were made for tagging purposes at locations selected for above-average availability of juveniles. Length, sex, and age data were collected on halibut in all regions. To assist other agencies, all king crab caught were sexed and counted, and all male crab were measured.

The relative abundance of juvenile halibut (ages 2 to 6) in the Bering Sea and the Gulf of Alaska is given in Table 7. The Bering Sea assessment index is based on the catch at 34 stations fished each year. The mean CPUE in Bering Sea has declined sharply from 18.9 per standardized 60-minute haul in 1977 to 14.6 in 1978 and 9.4 in 1979. In contrast to these figures, however, the all-station mean catch was 19.8 in 1977 (43 stations), 12.6 in 1978 (45 stations) and 12.7 in 1979 (46 stations), indicating that the overall decrease may not be as great as shown by the index area. Juveniles were more widely dispersed in 1979, being available further into the head of Bristol Bay and further north (outside the index area) than in 1970-1976. The CPUE of 3-year-olds was down sharply in 1979 to a low of 0.30 in the index area, which would appear to indicate the 1976 year class as the lowest on record. Nevertheless, this age group appears somewhat more abundant in the stations outside the index area, contributing 1.85 fish per hour to the CPUE of all stations.

Water temperatures may have affected the distribution of juveniles. The southeastern Bering Sea temperatures have been above average for several years during the sampling period, and were nearly 2°C higher in 1979 (5.4°C) than in 1978 (3.5°C). These temperature conditions represent a drastically warmer situation than the previous 10 years. As water temperature increases, juvenile halibut tend to disperse over the flats in the southeastern Bering Sea, accounting partly for the lower availability of juveniles within the index area.

The Gulf of Alaska assessment index is based on 110 offshore stations in four regions: 25 off Unimak Island, 23 near Chirikof Island, 26 off Cape Chiniak, and 36 near Cape St. Elias. In 1979, the average CPUE declined to 29.6 juveniles per 60-minute haul compared to the high of 34.1 recorded in 1978, but is still well above the low in the 1975-1976 period. CPUE changed little from 1978 to 1979 in the regions east of Kodiak (25.7 to 21.9 at St. Elias; 24.0 to 25.9 at Cape Chiniak) but declined sharply in the regions west of Kodiak (73.7 to 57.1 at Chirikof, and 23.3 to 14.2 at Unimak). These differences tend to reflect similar patterns of availability in the commercial

fishery: vessels fishing in the eastern Gulf of Alaska reported much better catches than those fishing west of Kodiak Island in 1979.

The 1976 year class (3-year-olds)—exceptionally scarce in the Bering Sea—was also scarce in the region near Unimak Island. In contrast, though, it was exceptionally abundant further east in the Chirikof region, and also very high at Cape Chiniak and Cape St. Elias, culminating in a high average CPUE of 9.3 for the Gulf as a whole.

IPHC also samples annually at shallow inshore stations in the Gulf of Alaska and the eastern Bering Sea using a 32-mm mesh trawl to obtain information on juvenile halibut younger than 3 years of age. Data from these stations are too variable to provide a reliable index of abundance, but are still useful in determining age and growth, and give an early indication of year class strength.

Table 7. The number of juvenile halibut caught per hour trawled in the Bering Sea and the Gulf of Alaska, IPHC surveys, 1963-1979.

Year	Bering Sea		Gulf of Alaska	
	2- to 6-year-olds	3-year-olds	2- to 6-year-olds	3-year-olds**
1963	(45.9)*	3.4	(46.5)	(15.2)
1964	No survey		(44.1)	(20.8)
1965	(26.3)	2.6	(38.8)	(12.9)
1966	31.0	17.2	(39.7)	(13.8)
1967	16.6	4.3	(40.4)	(35.7)
1968	12.5	6.4	(41.0)	(7.0)
1969	12.8	4.1	(35.1)	(17.6)
1970	12.1	8.8	(42.1)	(12.1)
1971	14.2	2.6	31.8	17.2
1972	3.1	2.0	28.6	9.2
1973	6.6	3.7	31.0	11.1
1974	6.1	1.2	29.6	12.9
1975	11.8	3.2	19.2	3.8
1976	12.9	6.5	18.6	5.8
1977	18.9	5.4	25.1	4.6
1978	14.6	5.1	34.1	6.1
1979	9.4	0.3	29.6	9.3

*Parenthesis indicates meager data.

**Unweighted estimate

In 1979, 27 inshore stations were fished in the Gulf of Alaska (at Unimak Bight, Trinity Island, Alitak Bay, Kayak Island, and Shelikof Bay in southeastern Alaska). Five inshore stations were also fished in the southeastern Bering Sea. The catches in 1979 were disappointingly low: 1,545 juveniles in 54 tows in the Gulf compared to 4,422 in 1978; and 177 in the Bering Sea compared to 543 in 1978. No explanation for this sharp reduction is apparent apart from the possibility the small net used at these stations may not have been fished as effectively with the heavier vessel chartered in 1979.

The 1977 year class continued to be prominent as 2-year-olds in 1979, accounting for over 50% of the catches, despite the small overall numbers taken.

ADULT HALIBUT SURVEY

Since 1976, IPHC has acquired information independent of the commercial fishery through its own setline population assessment survey. The survey entails fishing approximately 100 predetermined stations in each of two areas: Hecate Strait-Queen Charlotte Sound in Area 2, and the Portlock-Albatross grounds in Area 3. Information regarding size, age, sex, and CPUE is collected, and selected fish are tagged. Species other than halibut appearing in the catch are also noted. The 1979 survey, conducted aboard the Seattle-based M/V CHELSEA, was confined to Area 3. The Hecate Strait-Queen Charlotte Sound survey was postponed until 1980 in order to provide additional monies for more timely research needs.

Results of the survey showed CPUE was 58.0 pounds per skate—well above last year's 37.5 pounds per skate, though less than that reported by the commercial fishery. An increase in the number of fish of all sizes was also observed in 1979. The average male fish weighed 15.6 pounds, and was 8.4 years old. As expected, females were more numerous, comprising 56% of the catch, and tended to be larger and older, averaging 38.9 pounds, and 9.5 years.

Species other than halibut affect the results of the survey, because they compete for baited hooks. In 1979, for example, halibut only represented 37% of the catch, though it was the predominant species taken. The commoner competitors for bait are: Pacific cod (*Gadus macrocephalus*), black cod (*Anoplopoma fimbria*), together with significant numbers of cottids and starfish. Spiny dogfish (*Squalus acanthias*), rockfish (*Sebastes* spp.), skates (*Raja* spp.), and arrowtooth flounder (*Atheresthes stomias*) appeared in lesser amounts.

Approximately 1,700 halibut were caught during the 1979 survey, of which slightly more than 800 were tagged and released. Recoveries of these tags will provide estimates of mortality and growth as well as information on migration patterns.

POPULATION MODEL

Work continued in 1979 on the development of a mathematical model of the halibut population. In effect, this model attempts to replicate the complex relationships which govern the halibut population. The model has value in forecasting the probable effects of different approaches to the management of the fishery. To date, a fairly complete and reliable model of the halibut population in Area 2 has been constructed. The factors which affect this population have been inferred from accumulated data and

necessary assumptions. Although these assumptions may not be totally accurate, the model based upon them performs encouragingly.

The halibut model makes several assumptions which fall into two general categories: (1) mortality, the annual rate at which deaths occur, either in the population generally, or among specific age groups or sexes, and (2) rejuvenation, or the annual rate at which eggs are produced and the likelihood those eggs will survive to the benchmark age of three years. By mechanically accounting for these categories, the model predicts both short- and long-term changes in the population.

One noteworthy product of the population model's manipulation of historical data has been the discovery of a sharp drop in the number of halibut eggs surviving to the age of three. Since 1935, the number of 3-year-old survivors has fallen from between 12 and 20 for every million eggs spawned, to between 3 and 5 survivors for every million eggs.

MATURITY

Effective management of the resource demands a good understanding of the reproductive biology of halibut, and maturity studies have been an integral part of biological investigations toward that end. The age of maturity can be of primary importance to management because it may be used with other information to estimate the size of the spawning population—an index of the health of the population as a whole. Large variability in estimates of the age of maturity for female halibut has caused a problem in interpretation. For example, estimates from research cruises differed seasonally, often by as much as three years. Although several explanations for this disparity seem possible, the first one evaluated was the accuracy of the method to identify the stage of maturity.

The method routinely involves a visual examination of ovaries: an immature female has comparatively small ovaries for its size and eggs are not visible to the naked eye; ordinarily, a mature female has large ovaries with visible eggs, although shortly after the spawning season, many mature females have large, slack ovaries with few or no eggs. During the summer, the distinction between the two stages of maturity sometimes is unclear, and IPHC biologists wished to determine if they correctly identified the stage of maturity. To do this, the results of the visual examination of ovaries were compared with those from a serological technique for determining female maturity. This technique involved testing halibut blood serum for a factor present only in mature females.

During August and September 1979, blood samples were collected from 21 males, 8 mature and 46 immature females, based on a visual examination of the gonads. The results of the serological tests agreed for all but one immature female. Blood samples from 11 males, 17 mature and 36 immature females also were collected during January and February 1980, and the test

results agreed for all but two mature females. Errors in data collection and analysis may account for the few discrepancies.

The results showed good agreement between visual and serological determinations of maturity, regardless of season, and confirm the validity of both methods. Because IPHC biologists correctly identified the stage of maturity by visual means during both seasons, another explanation for the seasonal disparity in estimates of the age of maturity is now sought.

CATCH SAMPLING

Commercial halibut landings are routinely sampled to obtain data on their age and size composition. Since 1935, the sampling program has been conducted continuously at Seattle, Washington. Development of modern processing and transportation facilities in Alaska, and changing patterns of fishing have led to the subsequent expansion of the sampling program to Canadian and Alaskan ports. During the 1979 fishing season, samples were collected from landings at the following ports: Seattle, Bellingham, Vancouver, Prince Rupert, Petersburg, Sitka, Pelican, Seward, and Kodiak.

In 1979, IPHC attempted to sample one third of all landings over 5,000 pounds, and one tenth of the landings between 1,000 and 5,000. Samples were taken from setline vessels only, and a typical sample consisted of otoliths from all fish in systematically selected cargo slings used to unload the catch. The number and frequency of sampled slings were determined by the size of the catch and the capacity of the sling used.

Landings from 248 setline vessels were sampled in 1979. Nearly 38,000 otoliths were weighed to estimate fish lengths, and over 7,200 were used for age determination. IPHC also measured 11,000 halibut and aged 2,200 otoliths from research vessels conducting the annual adult and juvenile halibut surveys. About 100 otoliths from recovered tagged halibut were aged.

Catches from most major fishing regions were represented. In 1979, samples amounted to roughly 6% of the catch by weight, although the percentage varied with region, as shown in Table 8.

Table 8. Total catch and percentage sampled for age and size by region during 1979.

Region Fished	Columbia	Vancouver	Charlotte	S.E. Alaska	Yakutat	Kodiak	Chirikof	Shumagin	Aleutian	Bering Sea
Percent Sampled	0.0	0.0	8.5	5.2	4.5	5.2	5.9	0.0	11.6	8.4
Catch 000's pounds	14	277	4,210	4,932	4,751	6,584	334	56	417	952

Landings from the Columbia, Vancouver, and Shumagin regions were very small and no samples were obtained from these regions. Landings from the Aleutian and Bering Sea regions also were relatively small.

Age composition of halibut in the 1979 setline landings and the mean age since 1975 are summarized by region in Table 9. Mean age increased in all regions of Area 2 in 1979; however, all regions of Area 3 had a lower mean age. Mean age data from the Bering Sea continued the variability distinguishing recent years.

Table 9. Age composition in 1979 and mean age by region, 1975-1979.

Region	Age (1979)				Year				
	<9	9-11	12-14	>14	1975	1976	1977	1978	1979
	Percent				Mean Age				
Columbia	—	—	—	—	—	—	—	—	—
Vancouver	—	—	—	—	13.6	12.3	—	12.4	—
Charlotte (Inside)	31.3	38.7	21.1	8.9	11.0	9.9	10.4	10.1	10.3
Charlotte (Outside)	14.9	44.8	26.7	13.6	11.4	11.6	11.4	11.1	11.2
S.E. Alaska (Inside)	16.6	44.3	28.9	10.2	11.5	11.5	11.5	10.6	11.1
S.E. Alaska (Outside)	12.6	43.4	29.4	14.6	12.5	12.6	12.0	11.2	11.4
Yakutat	16.2	42.5	30.1	11.2	12.1	12.2	12.3	11.5	11.1
Kodiak	18.9	49.5	22.8	8.8	11.1	11.0	11.2	10.8	10.7
Chirikof	34.8	49.3	11.5	4.4	10.9	10.4	10.6	10.3	9.6
Shumagin	—	—	—	—	11.4	11.0	11.3	10.7	—
Aleutian	3.1	31.0	24.2	41.7	—	17.8	13.7	15.8	13.7
Bering Sea	5.8	24.2	25.2	44.8	14.0	15.4	13.8	14.3	13.5

Glossary

IPHC uses a variety of methods and data to determine the general health of Pacific halibut stocks. The scientific methods used for population assessment are continually evolving to take advantage of recent advances in the scientific literature. This section presents a brief description of some of the methods and scientific terminology used in this report.

Availability - The fraction of a fish population living in a region susceptible to fishing during a given fishing season.

Biomass - The weight of a fish stock.

Catch-per-unit-effort (CPUE) - The catch of fish in numbers or in weight taken by a defined unit of fishing effort (see following definition of "Fishing effort"). CPUE is interpreted as an indicator of density, presuming selectivity of a unit of gear and the availability of halibut do not change over area or time.

Setline CPUE, the average catch per standard skate (see "Fishing effort" for definition of a standard skate), is used as an indicator of adult halibut abundance. Setline CPUE from the commercial fishery is estimated from catch and effort data recorded in the fishermen's log books. IPHC regulations require the captains of all licensed setline vessels to maintain log records showing statistical area fished each day, amount of gear fished, and estimated catch. All records are used in assigning the location of the catch, but only fixed-hook setline gear is used for computing CPUE and fishing effort.

CPUE indices are also calculated from research surveys. Setline CPUE from standardized population assessment surveys provide another indicator of adult abundance. Trawl CPUE, the number of juvenile halibut per hour trawled, provides an indicator of juvenile abundance.

Cohort analysis - A cohort, or year-class, is a group of fish spawned in the same year. Cohort analysis is a method of population estimation based on relationships between the catch, death from natural causes, and population size during the life span of a cohort. Necessary data for cohort analysis are the estimates of catch by age, obtained from catch sampling. Though cohort analysis is not subject to presumptions of constant selectivity and availability, as is CPUE (see Catch-per-unit-effort), it has other limitations (see IPHC Scientific Report Number 65).

Equilibrium Yield - The total catch of fish that can be taken from one year to the next without changing the biomass of fish in a stock. If the catch is held below the equilibrium yield, a subsequent increase in biomass should occur; a catch exceeding the equilibrium should result in a reduction of total population.

Fecundity - The number of eggs produced by a female.

Fishing effort - The total amount of fishing gear used for a specified period of time. The basic unit of setline effort is a standard skate, defined as a 1,800 foot (550 meter) groundline with 100 hooks attached at 18-foot (5.5 meter) intervals. Correction factors have been developed for non-standard skates.

Incidental Catch - The total catch of halibut by fisheries other than the commercial or sport fishery. The majority of the incidental catch is made up of young fish under the minimum size limit for the commercial fishery.

Landing - The number or weight of fish brought into port for sale from the commercial fishery.

Maturity - The stage at which fish are able to produce sex products.

Mean Age of Catch - The mean or average age of the catch can be a useful indicator of the health of the population. If, for example, the mean age of the catch increases over a period of time, then the number of young fish entering the fishery may be decreasing, implying a future reduction in the total population.

Mortality - The number of deaths that occur in the population, and is divided into two general categories, *natural* and *fishing mortality*. Natural mortality refers to the rate of deaths owing to natural causes such as disease or predation. Fishing mortality, often specified as setline or trawl mortality, refers to the death rate due to various forms of fishing, deliberate or incidental.

Region - A geographic unit larger than a statistical area, yet smaller than a Regulatory Area, useful in understanding the biology and fishery of halibut. Current regions used by IPHC are Columbia, Vancouver, Charlotte-Inside, Charlotte-Outside, Southeastern-Inside, Southeastern-Outside, Yakutat, Kodiak, Chirikof, Shumagin, Aleutian and Bering Sea. (see Figure 3, Page 20).

Regulatory Area - An arbitrarily defined area used by IPHC for management purposes. In rough terms, Area 2 comprises the regions Columbia to Southeastern; Area 3, the regions Yakutat to Aleutian; Area 4, the Bering Sea region. (see Figure 1, Page 10).

Selectivity - The relative vulnerability of fish to different types of gear.

Statistical Area - The basic reporting unit used by IPHC, established by division of the coast of North America from California to the Aleutian Islands into 60-mile intervals and inside and outside waters.

Stock - Population or resource.

Appendices

The tables in Appendices I and II provide statistics for 1978 and 1979, and supplement Technical Report Number 14, "The Pacific Halibut Fishery: Catch, Effort and CPUE, 1929-1975." Appendix tables in the 1977 Annual Report updated these statistics for 1976 and 1977. A detailed explanation of the tables, the methods of compilation, and definitions of the statistical subdivisions are included in Technical Report Number 14 which is available upon request. The poundage in these tables is dressed weight (head-off, eviscerated). Copies of the tables in metric units and round (live) weight are available upon request.

Appendix I.

- Table 1. Catch, CPUE and effort by statistical area and country, 1978.
- Table 2. Catch, CPUE and effort by region and country, 1978.
- Table 3. Catch, CPUE and effort by regulatory area, 1978.
- Table 4. Catch in thousands of pounds by regulatory area and country, 1978.
- Table 5. Landings in thousands of pounds by port and country, 1978.

Appendix II.

- Table 1. Catch, CPUE and effort by statistical area and country, 1979.
- Table 2. Catch, CPUE and effort by region and country, 1979.
- Table 3. Catch, CPUE and effort by regulatory area, 1979.
- Table 4. Catch in thousands of pounds by regulatory area and country, 1979.
- Table 5. Landings in thousands of pounds by port and country, 1979.

Appendix III.

- Annual landings, ex-vessel price, and value (U.S. dollars), 1929-1979.

Appendix I

TABLE 1. CATCH, CPUE AND EFFORT BY STATISTICAL AREA AND COUNTRY, 1978.

1978	CANADA			UNITED STATES			TOTAL			LOGS
STAT. AREA	CATCH 000 LBS	CPUE LBS	EFFORT 00 SKS	CATCH 000 LBS	CPUE LBS	EFFORT 00 SKS	CATCH 000 LBS	CPUE LBS	EFFORT 00 SKS	%
00-03	-	-	-	32	38.9*	8	32	38.9	8	-
04	-	-	-	6	39.0*	2	6	39.0	2	-
05	3	39.0*	1	56	38.9	14	59	39.3	15	7
06	76	64.8*	12	11	64.7*	2	87	62.1	14	-
07	23	64.8*	4	2	64.5*	0	25	62.5	4	-
08	76	66.5	11	3	66.7*	0	79	71.8	11	28
09 -0	23	49.7	5	7	49.6*	1	30	50.0	6	23
09 -I	175	62.1	28	1	62.5*	0	176	62.9	28	10
10 -0	-	-	-	9	49.7*	2	9	49.7	2	-
10 -I	615	52.8	116	202	81.0	25	817	57.9	141	20
11 -0	57	93.8	6	-	-	-	57	93.8	6	47
11 -I	1219	67.0	182	7	67.3*	1	1226	67.0	183	37
12 -0	94	81.1	12	-	-	-	94	81.1	12	3
12 -I	606	58.4	104	-	-	-	606	58.4	104	34
13 -0	300	71.1	42	-	-	-	300	71.1	42	30
13 -I	900	55.9	161	1	55.6*	0	901	56.0	161	24
14 -0	173	58.4	30	104	58.4*	18	277	57.7	48	4
14 -I	192	74.2	26	128	74.2*	17	320	74.4	43	25
15 -0	312	84.8	37	181	53.3	34	493	69.4	71	32
15 -I	-	-	-	262	38.0	69	262	38.0	69	3
16 -0	416	78.8	53	461	79.4	58	877	79.0	111	17
16 -I	-	-	-	680	47.0	145	680	47.0	145	56
17 -0	13	35.7	4	501	52.2	96	514	51.4	100	8
17 -I	-	-	-	98	38.9	25	98	38.9	25	16
18S-0	1	35.7*	0	117	35.2	33	118	35.8	33	5
18S-I	-	-	-	877	8.0	1096	877	8.0	1096	-
18W	62	79.8	8	265	75.1	35	327	76.0	43	47
19	404	98.6	41	295	67.2	44	699	82.2	85	46
20	333	79.5	42	321	76.4	42	654	77.9	84	51
21	220	87.2	25	138	38.8	36	358	58.7	61	37
22	512	91.4	56	230	93.8	25	742	91.6	81	50
23	49	45.8	11	278	74.3	37	327	68.1	48	39
24	235	87.3	27	612	66.4	92	847	71.2	119	37
25	282	72.4	39	1518	77.1	197	1800	76.3	236	59
26	237	92.5	26	2084	79.1	263	2321	80.3	289	54
27	12	45.5	3	949	80.3	118	961	79.4	121	58
28	461	85.6	54	798	70.4	113	1259	75.4	167	64
29	170	63.7	27	248	43.8	57	418	49.8	84	56
30	111	53.6	21	146	51.1	29	257	51.4	50	77
31	12	69.8*	2	294	69.8	42	306	69.5	44	68
32	72	22.7	32	194	68.1	28	266	44.3	60	55
33	8	32.9	2	40	42.8	9	48	43.6	11	79
34	4	81.6	0	21	69.8	3	25	83.3	3	80
35	-	-	-	2	58.8*	0	2	58.8	0	-
36	-	-	-	4	21.1	2	4	21.1	2	50
37	-	-	-	1	11.4	1	1	11.4	1	100
38	-	-	-	-	-	-	-	-	-	-
39	-	-	-	-	-	-	-	-	-	-
40	-	-	-	-	-	-	-	-	-	-
41	-	-	-	14	54.7	3	14	54.7	3	93
42+	113	128.6	9	561	109.1	51	674	112.3	60	71
4A	-	-	-	43	76.2	6	43	76.2	6	83
4B	-	-	-	207	69.6	30	207	69.6	30	64
4C	-	-	-	76	89.3	9	76	89.3	9	69
4DE	-	-	-	15	76.9	2	15	76.9	2	97
4DW	34	106.3	3	283	43.2	66	317	45.9	69	72
4E	-	-	-	-	-	-	-	-	-	-

* NO LOG DATA, CPUE INTERPOLATED.

TABLE 2. CATCH, CPUE AND EFFORT BY REGION AND COUNTRY, 1978.

1978 REGION	CANADA			UNITED STATES			TOTAL			LOGS %
	CATCH 000 LBS	CPUE LBS	EFFORT 00 SKS	CATCH 000 LBS	CPUE LBS	EFFORT 00 SKS	CATCH 000 LBS	CPUE LBS	EFFORT 00 SKS	
COLUMBIA	-	-	-	32	38.9*	8	32	38.9	8	-
VANCOUVER	178	66.6	27	78	38.9	20	256	54.5	47	10
CHARLOTTE	3989	62.5	638	227	81.1	28	4216	63.3	666	28
CHAR-O	474	73.3	65	16	73.4*	2	490	73.1	67	26
CHAR-I	3515	61.3	573	211	81.0	26	3726	62.2	599	28
SE ALASKA	1107	78.5	141	3409	51.7	660	4516	56.4	801	19
SE AK-O	915	79.7	115	1364	62.5	218	2279	68.4	333	16
SE AK-I	192	74.2	26	2045	46.3	442	2237	47.8	468	22
YAKUTAT	1580	83.3	190	1527	75.9	201	3107	79.5	391	46
KODIAK	1227	84.2	146	5961	76.3	781	7188	77.5	927	55
CHIRIKOF	293	58.4	50	688	55.2	125	981	56.1	175	65
SHUMAGIN	84	26.1	32	262	59.7	44	346	45.5	76	60
ALEUTIAN	113	128.6	9	575	105.8	54	688	109.2	63	72
BERING SEA	34	106.3	3	624	56.0	111	658	57.7	114	71
TOTAL	8605	69.6	1236	13383	65.9	2032	21988	67.3	3268	49

* NO LOG DATA, CPUE INTERPOLATED.

TABLE 3. CATCH, CPUE AND EFFORT BY REGULATORY AREA, 1978.

YEAR	AREA 2				AREA 3				AREA 4			
	CATCH 000 LBS	CPUE LBS	EFFORT 00 SKS	LOGS %	CATCH 000 LBS	CPUE LBS	EFFORT 00 SKS	LOGS %	CATCH 000 LBS	CPUE LBS	EFFORT 00 SKS	LOGS %
1978	9020	59.3	1522	23	12310	75.4	1632	55	658	57.7	114	71

TABLE 4. CATCH IN THOUSANDS OF POUNDS BY REGULATORY AREA AND COUNTRY, 1978.

YEAR	AREA 2			AREA 3			AREA 4			ALL AREAS		
	CAN.	U.S.	TOTAL	CAN.	U.S.	TOTAL	CAN.	U.S.	TOTAL	CAN.	U.S.	TOTAL
1978	5274	3746	9020	3297	9013	12310	34	624	658	8605	13383	21988

TABLE 5. LANDINGS IN THOUSANDS OF POUNDS BY PORT AND COUNTRY, 1978.

PORT	1978		TOTAL
	CAN.	U.S.	
CAL AND ORE	-	62	62
SEATTLE	42	256	298
BELLINGHAM	1201	625	1826
MISC WASH	-	107	107
VANCOUVER	1567	-	1567
MISC SD BC	158	-	158
NAMU	230	-	230
PR RUPERT	2967	111	3078
MISC ND BC	220	-	220
KETCHIKAN	127	162	289
WRANGELL	123	401	524
PETERSBURG	399	1666	2065
JUNEAU	-	445	445
SITKA	24	911	935
PELICAN	541	832	1373
MISC SE AK	74	626	700
KODIAK	377	3313	3690
P WILLIAMS	-	-	-
SEWARD	555	2831	3386
MISC CEN AK	-	1035	1035

Appendix II

TABLE 1. CATCH, CPUE AND EFFORT BY STATISTICAL AREA AND COUNTRY, 1979.

1979 STAT. AREA	CANADA			UNITED STATES			TOTAL			LOGS %
	CATCH 000 LBS	CPUE LBS	EFFORT 00 SKS	CATCH 000 LBS	CPUE LBS	EFFORT 00 SKS	CATCH 000 LBS	CPUE LBS	EFFORT 00 SKS	
00-03	-	-	-	14	50.0*	3	14	50.0	3	-
04	-	-	-	10	50.0*	2	10	50.0	2	-
05	-	-	-	22	50.0*	4	22	50.0	4	-
06	63	50.0*	13	-	-	-	63	50.0	13	-
07	21	50.0*	4	-	-	-	21	50.0	4	-
08	161	50.0	32	-	-	-	161	50.0	32	1
09 -0	69	44.9	15	-	-	-	69	44.9	15	23
09 -I	379	47.0	81	-	-	-	379	47.0	81	15
10 -0	31	55.7*	6	-	-	-	31	55.7	6	-
10 -I	441	51.5	86	-	-	-	441	51.5	86	17
11 -0	145	35.4	41	-	-	-	145	35.4	41	10
11 -I	929	45.4	205	-	-	-	929	45.4	205	39
12 -0	182	104.9	17	-	-	-	182	104.9	17	32
12 -I	521	43.5	120	-	-	-	521	43.5	120	26
13 -0	509	57.2	89	-	-	-	509	57.2	89	25
13 -I	1004	43.7	230	-	-	-	1004	43.7	230	20
14 -0	79	68.9	11	107	68.9*	16	186	68.9	27	20
14 -I	354	72.1	49	259	72.0*	36	613	72.1	85	46
15 -0	93	102.5	9	393	107.0	37	486	105.7	46	38
15 -I	-	-	-	248	105.6	23	248	105.6	23	16
16 -0	40	73.3*	5	409	73.3	56	449	73.6	61	14
16 -I	-	-	-	1065	73.1	146	1065	73.1	146	49
17 -0	-	-	-	637	41.4	154	637	41.4	154	2
17 -I	-	-	-	130	60.4	22	130	60.4	22	15
18S-0	-	-	-	124	59.0*	21	124	59.0	21	-
18S-I	-	-	-	994	100.5	99	994	100.5	99	12
18W	65	95.7	7	554	73.3	76	619	74.6	83	31
19	250	163.1	15	1085	83.5	130	1335	92.1	145	34
20	383	135.5	28	627	97.2	64	1010	109.8	92	64
21	71	272.0	3	351	116.7	30	422	127.9	33	68
22	226	184.5	12	550	118.7	46	776	133.8	58	75
23	74	111.3	7	515	86.3	60	589	87.9	67	40
24	174	58.1	30	1240	79.3	156	1414	76.0	186	51
25	174	89.7	19	1947	84.2	231	2121	84.8	250	64
26	60	71.1	8	1749	74.4	235	1809	74.4	243	35
27	5	27.5	2	532	48.1	111	537	47.5	113	34
28	139	61.3	23	564	68.5	82	703	67.0	105	56
29	17	63.4	3	242	42.3	57	259	43.2	60	42
30	-	-	-	35	23.4	15	35	23.4	15	43
31	-	-	-	40	27.1	15	40	27.1	15	30
32	-	-	-	41	38.5	11	41	38.5	11	34
33	-	-	-	10	31.3	3	10	31.3	3	90
34	-	-	-	1	20.0	1	1	20.0	1	100
35	-	-	-	1	35.7*	0	1	35.7	0	-
36	-	-	-	3	36.1*	1	3	36.1	1	-
37	-	-	-	-	-	-	-	-	-	-
38	-	-	-	-	-	-	-	-	-	-
39	-	-	-	-	-	-	-	-	-	-
40	-	-	-	1	14.3	1	1	14.3	1	-
41	-	-	-	89	65.9	14	89	65.9	14	94
42+	-	-	-	327	67.0	49	327	67.0	49	98
4A	-	-	-	2	40.0	1	2	40.0	1	100
4B	-	-	-	125	37.7	33	125	37.7	33	46
4C	-	-	-	205	73.7	28	205	73.7	28	76
4DE	-	-	-	30	48.7	6	30	48.7	6	100
4DW	-	-	-	590	77.8	76	590	77.8	76	85
4E	-	-	-	-	-	-	-	-	-	-

* NO LOG DATA, CPUE INTERPOLATED.

TABLE 2. CATCH, CPUE AND EFFORT BY REGION AND COUNTRY, 1979.

1979 REGION	CANADA			UNITED STATES			TOTAL			LOGS %
	CATCH 000 LBS	CPUE LBS	EFFORT 00 SKS	CATCH 000 LBS	CPUE LBS	EFFORT 00 SKS	CATCH 000 LBS	CPUE LBS	EFFORT 00 SKS	
COLUMBIA	-	-	-	14	50.0*	3	14	50.0	3	-
VANCOUVER	245	50.0	49	32	50.0*	6	277	50.4	55	0
CHARLOTTE	4210	47.9	878	-	-	-	4210	47.9	878	25
CHAR-O	936	60.9	154	-	-	-	936	60.9	154	23
CHAR-I	3274	45.2	724	-	-	-	3274	45.2	724	25
SE ALASKA	566	77.5	73	4366	80.6	542	4932	80.2	615	26
SE AK-O	212	88.3	24	1670	85.3	194	1882	86.3	218	16
SE AK-I	354	72.1	49	2696	77.5	348	3050	76.8	397	32
YAKUTAT	1069	148.4	72	3682	97.6	377	4751	105.8	449	50
KODIAK	552	71.2	78	6032	76.1	793	6584	75.6	871	50
CHIRIKOF	17	63.4	3	317	36.4	87	334	37.1	90	40
SHUMAGIN	-	-	-	56	34.2	16	56	34.2	16	43
ALEUTIAN	-	-	-	417	66.5	63	417	66.5	63	97
BERING SEA	-	-	-	952	66.4	143	952	66.4	143	79
TOTAL	6659	57.8	1153	15868	78.2	2030	22527	70.8	3183	48

* NO LOG DATA, CPUE INTERPOLATED.

TABLE 3. CATCH, CPUE AND EFFORT BY REGULATORY AREA, 1979.

YEAR	AREA 2				AREA 3				AREA 4			
	CATCH 000 LBS	CPUE LBS	EFFORT 00 SKS	LOGS %	CATCH 000 LBS	CPUE LBS	EFFORT 00 SKS	LOGS %	CATCH 000 LBS	CPUE LBS	EFFORT 00 SKS	LOGS %
1979	9433	60.8	1551	25	12142	81.5	1489	52	952	66.6	143	79

TABLE 4. CATCH IN THOUSANDS OF POUNDS BY REGULATORY AREA AND COUNTRY, 1979.

YEAR	AREA 2			AREA 3			AREA 4			ALL AREAS		
	CAN.	U.S.	TOTAL	CAN.	U.S.	TOTAL	CAN.	U.S.	TOTAL	CAN.	U.S.	TOTAL
1979	5021	4412	9433	1638	10504	12142		952	952	6659	15868	22527

TABLE 5. LANDINGS IN THOUSANDS OF POUNDS BY PORT AND COUNTRY, 1979.

PORT	1979		
	CAN.	U.S.	TOTAL
CAL AND ORE	-	43	43
SEATTLE	-	241	241
BELLINGHAM	884	474	1358
MISC WASH	-	27	27
VANCOUVER	1371	-	1371
MISC SO BC	573	-	573
NAMU	207	-	207
PR RUPERT	3093	247	3340
MISC NO BC	255	-	255
KETCHIKAN	37	195	232
WRANGELL	77	390	467
PETERSBURG	-	2255	2255
JUNEAU	-	697	697
SITKA	-	1353	1353
PELICAN	101	1496	1597
MISC SE AK	61	1508	1569
KODIAK	-	2691	2691
P WILLIAMS	-	-	-
SEWARD	-	2638	2638
MISC CEN AK	-	1623	1623

Appendix III. Annual landings, ex-vessel price, and value (U.S. dollars), 1929 - 1979.

Year	Catch (000's pounds)	Price (dollars/ pound)	Value (000's dollars)	Year	Catch (000's pounds)	Price (dollars/ pound)	Value (000's dollars)
1929	56,928	.12	6,831	1955	57,521	.14	8,053
1930	49,492	.10	4,949	1956	66,588	.22	14,649
1931	44,220	.07	3,095	1957	60,854	.17	10,345
1932	44,454	.04	1,778	1958	64,508	.21	13,547
1933	46,795	.06	2,808	1959	71,204	.19	13,529
1934	47,546	.06	2,853	1960	71,605	.16	11,457
1935	47,343	.07	3,314	1961	69,274	.21	14,548
1936	48,923	.08	3,914	1962	74,862	.30	22,459
1937	49,539	.08	3,963	1963	71,237	.21	14,960
1938	49,553	.07	3,469	1964	59,784	.23	13,750
1939	50,903	.07	3,563	1965	63,176	.32	20,216
1940	53,381	.09	4,804	1966	62,016	.34	21,085
1941	52,231	.10	5,223	1967	55,222	.23	12,701
1942	50,388	.15	7,558	1968	48,594	.23	11,177
1943	53,699	.19	10,203	1969	58,275	.38	22,144
1944	53,435	.15	8,015	1970	54,938	.37	20,327
1945	53,395	.15	8,009	1971	46,654	.32	14,929
1946	60,266	.17	10,245	1972	42,884	.64	27,446
1947	55,700	.17	9,469	1973	31,740	.74	23,488
1948	55,564	.17	9,446	1974	21,306	.70	14,914
1949	55,025	.17	9,354	1975	27,616	.89	24,578
1950	57,234	.23	13,164	1976	27,535	1.26	34,694
1951	56,045	.17	9,528	1977	21,868	1.31	28,647
1952	62,262	.19	11,830	1978	21,988	1.70	37,380
1953	59,837	.15	8,976	1979	22,532	2.13	48,080
1954	70,583	.17	11,999				

Publications

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