INTERNATIONAL PACIFIC HALIBUT COMMISSION

Annual Report
1987

Established by a Convention between
Canada and the United States of America

Commissioners

Linda J. Alexander — Dennis N. Brock
Richard Eliason — Robert W. McVey
George A. Wade — Gary T. Williamson

Director

Donald A. McCaughran

Seattle, Washington
1988

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 the joint management of a marine resource. The Commission's authority was expanded by several subsequent conventions, the most recent being signed in 1953 and amended by the protocol of 1979.

Three IPHC commissioners are appointed by the governor general of Canada and three by the president of the United States. Each country pays one-half of the Commission's annual expenses, as required by the Halibut Convention. The commissioners appoint the director who supervises the scientific and administrative staff. The scientific staff collects and analyzes the statistical and biological data needed to manage the halibut fishery. The IPHC headquarters and laboratory are located on the campus of the University of Washington in Seattle, Washington.

Cover: Heavy fishing aboard the Kodiak vessel *Linn J* in May, 1986. The picture was taken by David G. Gordon during fishing off Kodiak in Area 3A.

The Commission meets annually to review all regulatory proposals, including those made by the scientific staff and the Conference Board, which represents vessel owners and fishermen. Regulatory proposals are discussed with the Advisory Group composed of fishermen, vessel owners, and processors. The measures recommended by the Commission are submitted to the two governments for approval. Upon approval, the regulations are enforced by the appropriate agencies of both governments.

The International Pacific Halibut Commission publishes three serial publications: Annual Reports (U.S. ISSN 0074-7238), Scientific Reports—formerly known as Reports—(U.S. ISSN 0074-7246), and Technical Reports (U.S. ISSN 0579-3920). Until 1969, only the Report series was published; the numbering of that series has been continued with the Scientific Reports.

Unless otherwise indicated, all weights in this report are dressed weight (eviscerated, head-off). Round (live) weight may be calculated by multiplying the dressed weight by a factor of 1.33.

INTERNATIONAL PACIFIC HALIBUT COMMISSION
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Activities of the Commission

In 1987, the Commission held several meetings, including its annual meeting which was held in Vancouver, British Columbia; an interim meeting in Seattle, Washington; and several telephone conference calls throughout the summer. This section summarizes the activities of the Commission during these occasions.

ANNUAL MEETING

The 63rd Annual Meeting of the Commission was held on January 26-29, 1987, with Mr. Garnet Jones presiding as chairman and Mr. Robert McVey as vice chairman. The Commission staff reviewed the 1986 Pacific halibut fishery, summarized the results of scientific investigations, and presented its regulatory proposals for the 1987 fishery. The Conference Board, representing vessel owners and fishermen, also presented its regulatory proposals to the Commission. The Commission also conducted special hearings with Northwest treaty Indian tribes and fishermen from Bristol Bay, the Pribilof Islands, and Atka Island. The Commission reviewed all proposals and adopted regulations for the 1987 halibut fishery in the presence of the Advisory Group, consisting of fishermen, vessel owners, and processors. The regulations were then sent to the Canadian and United States governments for approval.

Also during the meeting, the Commission considered administrative and fiscal matters, approved research plans for 1987, and adopted the budget for fiscal year 1989-1990. Mr. McVey was elected chairman for 1987 and Mr. Jones was elected vice chairman. After the meeting, the Commission issued a news release summarizing the regulations that were being recommended to the governments and expressing encouragement about the condition of the resource.

Following the meeting, a letter was sent to each government, noting that the large biomass of the Gulf of Alaska stocks resulted from the Commission's past management practices, controlled incidental catches, and favorable environmental conditions. Stocks at both ends of the geographical range, those in the Bering Sea and those off British Columbia and the Pacific coast, were noted to be growing slowly and in need of further rebuilding.

The letter expressed concern for the problems created by the short, intense fishing seasons that were imposed in the United States waters because of high catch rates and uncontrolled fishing effort. Three main problems were identified: (1) increased violations of regulations; (2) wastage of halibut caught on fishing gear that is abandoned on the grounds at the closure of each fishing period; and (3) the staff's inability to collect accurate catch-per-effort data from the fishery. Various solutions were discussed, but none were adopted because of lack of support by the Conference Board or insufficient enforcement manpower.

The letter also expressed concern for the increase in incidental catches of halibut in both the domestic and joint venture fisheries. The Commission recognized that some incidental catches are unavoidable if other groundfish are to be fully harvested, but urged the governments to establish caps on the incidental catch in fisheries lacking them. The Commission also supported the added safeguard of observer programs on domestic vessels in both Canada and the United States.

Also in the letter was a recommendation to the United States government regarding allocations of halibut to treaty Indian tribes off the northwest coast of Washington, including Puget Sound. The recommendation allocated 100,000 pounds to treaty tribes, and an additional 50,000 pounds if the original 100,000 pounds were landed prior to October 31. Limitations also were placed on the fishing gear, seasons, and size of halibut landed by the treaty tribes.

Further, the letter explained the Commission's decision to place additional restrictions on the recreational fishery in Area 2A, establish trip limits in Area 4C, and survey the Bristol Bay nursery area.

Regulatory Proposals for 1987

The Commission received regulatory proposals for the 1987 halibut fishery from fishermen, vessel owners, processors, government agencies, treaty Indian tribes of Washington State, and the Commission's scientific staff. A summary of all proposals and their sources was distributed to all interested groups prior to the annual meeting.

At the annual meeting, the Commission's staff recommended a total catch limit of 58.4 to 73.1 million pounds for 1987; the total catch limit in 1986 was 66.4 million pounds with total landings of 69.6 million pounds. The staff recommendations by regulatory area were as follows: Area 2A - 0.45 to 0.55 million pounds (assuming that the sport fishery would take less than 0.2 million pounds); Area 2B - 9.0 to 11.0 million pounds; Area 2C - 9.0 to 11.0 million pounds; Area 3A - 28.0 to 34.0 million pounds; Area 3B - 8.0 to 11.0 million pounds; Area 4A - 1.5 to 2.0 million pounds; Area 4B - 1.5 to 2.0 million pounds; Area 4C - 0.5 to 0.7 million pounds; Area 4D - 0.4 to 0.8 million pounds; and Area 4E - 0.04 to 0.06 million pounds. The staff also proposed a limit of 50,000 pounds and 50 skates of gear per vessel during the fishing periods in Areas 2C, 3A, and 3B to reduce wastage and illegal fishing.

In addition, the staff recommended that two important biological considerations be accommodated when the 1987 fishing seasons were set. The first was that a daily catch rate must be determined in order to avoid exceeding the catch limits and so that appropriate closure dates could be announced in advance for each regulatory area. The second suggestion was that fishing should be distributed over time so that all segments of the stock will be fished as uniformly as possible. Industry groups prefer that fishing periods be set to avoid fishing on large tides and to avoid outfitting and landing on weekends and holidays.

The Conference Board, made up of representatives of fishermen's and vessel owner's organizations, met during the first two days of the annual meeting. It proposed that all regulatory areas remain the same as in 1986, except that a new area be created within Area 4B to provide additional fishing opportunity for the area around Atka Island. The new area, 4F, would include the part of Area 4B east of 174°40'W. longitude and west of 174°30'W. longitude. The Board also proposed the following catch limits: Area 2A, 0.75 million pounds for all removals including recreational and treaty Indians; Area 2B, 12.5 million pounds; Area 2C, 14 million pounds; Area 3A, 34 million pounds; Area 3B, 10 million pounds; Area 4A, 1.9 million pounds; Area 4B, 1.8 million pounds; Area 4C, 0.8 million pounds; Area 4D, 0.8 million pounds; Area 4E, 0.075 million pounds; and Area 4F, 0.15 million pounds.

The Conference Board proposed 12-day fishing periods in Area 2A, with opening dates of July 10, August 2, September 24, and October 1. In Area 2B, two eight-day fishing periods were recommended with closing dates of May 10 and June 21. In addition, a four-day experimental fishery, with a closing date of

August 25, was proposed. Simultaneous one-day fishing periods were recommended for Areas 2C, 3A, and 3B, beginning on May 4, June 1, and September 2. The Conference Board also recommended that the June period be considered only if enough of the catch limit remained to allow for the September period. The Conference Board recommended that Areas 4A and 4B open August 1 for two days and four days, respectively, and that Area 4D open July 30 for seven days. Area 4C would open June 21 for a series of one-day periods followed by one-day closures. Area 4E would open June 21 for a series of two-day periods followed by one-day closures.

The Conference Board also made recommendations regarding research and other activities conducted by the Commission, and commented on the proposals made by the U.S. National Marine Fisheries Service that were designed to improve enforcement of the Commission's regulations. In addition, the Conference Board recommended that automated hook extractors, commonly known as *crucifiers*, be banned from use in the halibut fishery.

After discussing all proposals with the staff and other advisors, the Commission adopted the regulations which were recommended to the Canadian and United States governments. The regulations were approved by the United States secretary of state and the governor general of Canada by Order in Council, and are summarized in the later sections of this annual report.

INTERIM MEETING

The Commission met on November 24, 1987, in Seattle, Washington, with Robert McVey presiding as chairman. Linda Alexander of Parksville, British Columbia, replaced Donald McLeod as a Canadian commissioner. The staff reviewed both the 1987 fishery and the two management actions taken during 1987. The first action was to change the regulations to limit the catch per vessel. The second one allowed a 12-hour fishing period which enabled additional fishing time in Areas 3A and 3B, without exceeding the catch limit.

The Commission reviewed letters from the United States government regarding regulations that primarily allocate catch among groups of fishermen. The U.S. National Marine Fisheries Service determined that all allocative regulations should be made by the U.S. fishery management councils and that the primary goal of Commission regulations should be directed to the conservation of the resource and the management of the fishery.

The Commission also discussed options for managing the 1988 fishery. This included a review of financial reports and proposals for research in 1988.

OTHER ACTIVITIES

A list of reports published by the Commission staff during 1987 is appended to this annual report. The Commission staff also prepared various documents at the request of the governments. The staff also was involved directly in the development of fishery management plans for the United States fishery management councils.

Expenditures during the 1986-1987 fiscal year (April 1986 through March 1987) were $1,536,451. The Commission expenses were shared equally by both Canada and the United States as required by the Halibut Convention.

Retired Commissioners

Garnet Jones
Canadian Commissioner
1986 - 1987

Garnet Jones was appointed to the Commission in 1986. During his two years as a commissioner, he was Regional Director for Fisheries Operations with the Canadian Department of Fisheries and Oceans in Vancouver, B.C. Mr. Jones was elected chairman of the Commission for 1987 at the Commission's annual meeting held in Vancouver that year. In late 1987, he retired from federal service. He currently is the vice president of production for British Columbia Packers in Vancouver.

Donald McLeod
Canadian Commissioner
1981 - 1987

Donald McLeod was appointed to the Commission by the Canadian Government in 1981 and served one of the longest tenures in recent years. As a commissioner, he represented the Canadian processing industry. Mr. McLeod has been working with the Canadian Fish Company for a number of years and is currently vice president of operations for the Canadian Fish Company in Vancouver.

DIRECTOR'S REPORT

Donald A. McCaughran
Director

The 1987 harvest of Pacific halibut was the fifth largest in the history of the fishery. Nearly 69.5 million pounds were landed with an ex-vessel value of approximately $109 million. One might believe that the halibut resource was being utilized to produce maximum benefits since the total ex-vessel value was the highest in history. However, if the U.S. fishery had been conducted in an optimal fashion, the ex-vessel value may well have been in excess of $200 million.

The short, intense "olympic"-style fishery, which produces 15 million pounds per day, results in large quantities of frozen halibut. When high quality fresh halibut are brought in over an extended period of time, the ex-vessel price can increase. For example, the northwest Washington treaty Indian tribes begin fishing each March and produce small quantities of high quality fresh halibut; they receive over $3.00 per pound ex-vessel price. The Atlantic halibut fishery in eastern Canada produces approximately seven million pounds annually. The product is of high quality and is mostly sold fresh throughout Boston and New York; the ex-vessel price is between $3.00 and $7.00 per pound.

We do not believe that the Pacific halibut ex-vessel price would average those values because of the large quantity produced. But we do believe that the ex-vessel price would be between $2.00 and $3.00 per pound — nearly double the present value — if the fishery were conducted over a nine-month period with production of small quantities of high quality product. In order to do this with the highly overcapitalized U.S. fleet, implementation of an individual transferable quota (ITQ) system would seem necessary. By resisting such a system, fishermen only hurt themselves economically in the long run. The ITQ system would enable fishermen, if they chose, to use their quota as bycatch when salmon trolling or longlining for sablefish and Pacific cod. Fishermen could contract with fish buyers to deliver at preset times specific quantities of fish. The ex-vessel price would rise and the consumer would enjoy a constant supply of fresh and frozen high quality product.

Whereas such a system would benefit fishermen and consumers alike, there is opposition on the philosophical grounds that the competition of the "olympic"-style fishery is free enterprise. I believe the competition generated by the free enterprise system should be at the production level, not in obtaining the resource. Competition to produce the highest quality product at the lowest cost of operation should be the goal of the vessel owner. In a similar manner to farming, forestry, or mining, the resource harvester should lease or buy the natural resource from the owners (the U.S. citizenry through their elected government), and then attempt to make a profit by the efficient production of a desirable product.

The question remains of who initiates the changes and how they should be implemented. The Commission has no authority in this area; only the management councils can regulate the U.S. fishery. However, the final decisions will be made at the national level.

The Commission is mandated, however, to manage the stocks for production of the optimal yield, which means that it must address social and economic considerations. We do not, however, have authority to do this except through the control of catches and the setting of seasons. Trip limits, which limit the catch of each vessel in each opening, are the only option for controlling total catches. Although such restrictions will improve the social and economic aspects of the fishery, they are unpopular, because they limit the amount that many individual boats can earn. Each year since 1983 the effort in the fishery has increased approximately 10-15 percent. The stocks are now at maximum biomass, but we expect a natural downward trend to begin within the next few years. As we are forced to reduce quotas, many vessels will not earn enough to continue fishing and an economic disaster may well befall the U.S. halibut fleet. To avoid this and to optimize the yield, fishermen and managers together must begin to develop a new approach to fishing halibut. We need to let the free enterprise system bring order into the fishery if we are to maximize the value of the Pacific halibut resource. The individual transferable quota system appears to offer the only sensible solution.

Donald A. McCaughran
Director

THE FISHERY

The Pacific halibut resource is harvested by commercial and sport fisheries and is also taken incidentally in fisheries targeting on other species. The following sections present the results of the 1987 commercial and sport fisheries and provide estimates of the 1987 incidental catch.

COMMERCIAL FISHERY

A compilation of historical statistics was published in 1977 as Technical Report No. 14, "The Pacific Halibut Fishery: Catch, Effort, and CPUE, 1929-1975." The report summarized catch and effort data by statistical area, region, regulatory area, port, and country. These statistics were updated in the 1978-1986 Annual Reports. For 1987, catch statistics are reported in a new format (see Appendix I, Table 1). Studies made during 1983-1987 recommended that previously reported data on effort and catch per unit effort (CPUE) be standardized in order to be comparable to earlier statistics. Standardization procedures were developed (see Scientific Report 71 and the 1984 Annual Report) and the corrected estimates of CPUE are shown in Appendix I, Table 2. Appendix I, Table 3 shows landings for 1987 by port.

Regulatory Areas for 1987

Regulatory areas for the 1987 commercial halibut fishery are shown in Figure 1.

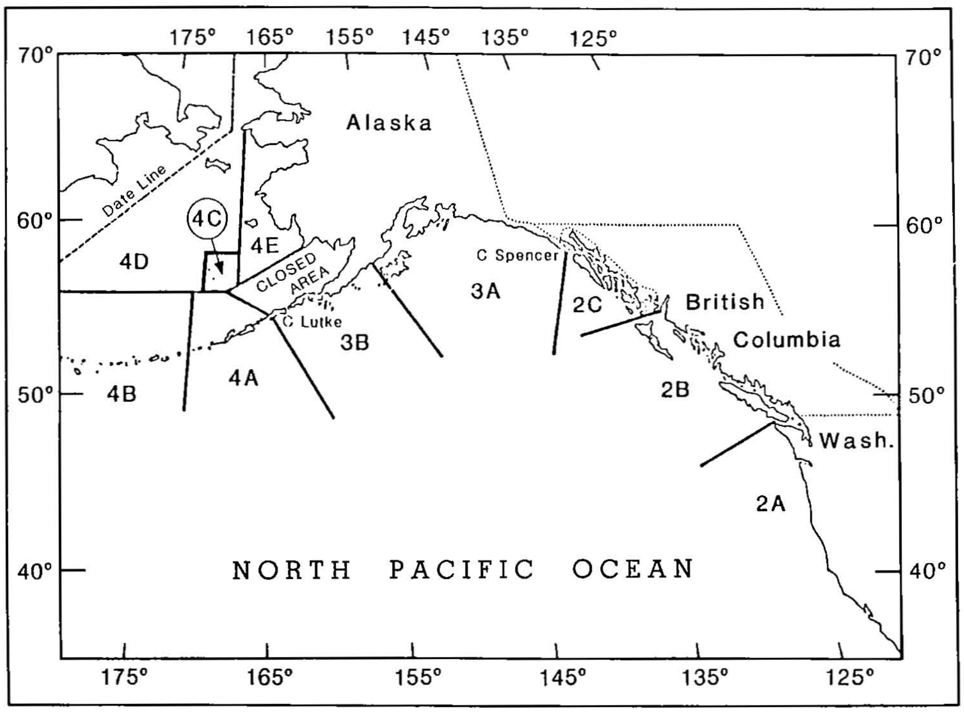

FIGURE 1.
International Pacific Halibut Commission (IPHC) regulatory areas for the commercial Pacific halibut fishery, 1987.

Boundary lines for the regulatory areas are the same as in 1986, except for a modification of the boundary line dividing Areas 4C and 4D. The closed area in the eastern Bering Sea also was closed in 1987 to all halibut fishing. A brief description of the regulatory areas for the 1987 halibut fishery is as follows:

Area 2A — all waters off the coast of California, Oregon, and Washington.

Area 2B — all waters off the coast of British Columbia.

Area 2C — all waters off the coast of Alaska, south and east of Cape Spencer.

Area 3A — all waters between Cape Spencer and Cape Trinity, Kodiak Island.

Area 3B — all waters between Cape Trinity and a line extending southeast from Cape Lutke, Unimak Island.

Area 4A — all waters west of Area 3B and of the Bering Sea closed area, south of 56°20′ N. and east of 172°00′ W.

Area 4B — all waters west of Area 4A and south of 56°20′ N.

Area 4C — all waters in the Bering Sea north of Area 4A and north of the closed area defined in section 7 which are east of longitude 171°00′ W., south of latitude 58°00′ N., and west of longitude 168°00′ W.

Area 4D — all waters in the Bering Sea north of Areas 4A and 4B, north and west of Area 4C, and west of longitude 168°00′ W.

Area 4E — all waters in the Bering Sea north of the closed area, east of Areas 4C and 4D, and south of 65°34′ N.

Other Regulations in 1987

Two new regulations in the 1987 commercial fishery are important to mention. One was a ban on the use of automated hook extractors. These devices have the potential to inflict severe injuries on sublegal halibut, decreasing their chances for survival when returned to the sea. The other regulation was established to limit fishing period catches ("trip limits") for each vessel in Area 4C and for the third fishing period in Area 3A and the third and fourth fishing periods in Area 3B. Trip limits are discussed more fully in the section on catch limits and catches. Other 1986 regulations remained the same in 1987.

Number of Vessels

For each regulatory area, the number of vessels and their catch by tonnage class are given in Table 1 for 1986 and 1987. (The 1986 data shown in this table have been updated and corrected since the figures were published in the 1986 Annual Report.) In 1987, 440 Canadian vessels reported halibut landings. The number of Canadian vessels landing halibut is close to the maximum number authorized by the Canadian government to fish for halibut under the limited entry system. In the United States, which does not restrict the number of vessels that may participate in the halibut fishery, 3,907 vessels reported halibut landings. An additional 1,986 U.S. vessels were issued an IPHC commercial license, but did not fish. Compared to 1986, the Canadian fleet reporting halibut landings was nearly five percent larger, and the United States fleet nearly 14 percent larger.

TABLE 1.
Pacific halibut catch (in pounds) by 1987 IPHC regulatory area, including the number of vessels (by net tonnage class), 1986-1987.

		1986		1987	
Regulatory Area	**Vessel Class**	**No. of Vessels**	**Catch (000's lbs.)**	**No. of Vessels**	**Catch (000's lbs.)**
2A	Unkn. Tons	182[1]	250	167[2]	198
	1- 4 Tons	23	9	44	15
	5-19 Tons	80	126	73	109
	20-39 Tons	31	128	24	164
	40-59 Tons	6	67	8	77
	60+ Tons	3	1	6	29
	Total	325	581	322	592
2B	Unkn. Tons	66	1,186	68	1,134
	1- 4 Tons	9	142	9	112
	5-19 Tons	278	6,601	298	7,871
	20-39 Tons	46	2,274	45	1,980
	40-59 Tons	10	547	12	618
	60+ Tons	6	475	8	531
	Total	415	11,225	440	12,246
2C	Unkn. Tons	115	417	133	326
	1- 4 Tons	386	1,001	389	1,045
	5-19 Tons	608	5,118	682	5,161
	20-39 Tons	194	3,173	232	3,266
	40-59 Tons	30	739	36	699
	60+ Tons	8	163	9	188
	Total	1,341	10,611	1,481	10,685
3A	Unkn. Tons	130	482	164	860
	1- 4 Tons	332	586	371	657
	5-19 Tons	624	6,442	777	8,145
	20-39 Tons	274	9,174	321	8,743
	40-59 Tons	104	6,945	121	6,016
	60+ Tons	101	9,161	121	6,895
	Total	1,565	32,790	1,875	31,316
3B	Unkn. Tons	21	203	34	323
	1- 4 Tons	22	43	19	38
	5-19 Tons	219	1,194	224	1,282
	20-39 Tons	155	2,789	161	2,474
	40-59 Tons	70	2,319	82	2,262
	60+ Tons	83	2,283	69	1,379
	Total	570	8,831	589	7,758
4	Unkn. Tons	68	87	91	201
	1- 4 Tons	31	93	61	177
	5-19 Tons	11	168	62	482
	20-39 Tons	54	1,465	52	1,512
	40-59 Tons	40	1,785	46	2,030
	60+ Tons	37	1,996	51	2,483
	Total	241	5,594	363	6,885

[1]The number of treaty Indian vessels is unknown.

[2]As many as 122 additional vessels may have participated in the treaty Indian fishery, based on fish ticket reports.

Catch Limits, Commercial Catches, and Seasons

The commercial catch by regulatory area for 1983 through 1987 is shown in Table 2. The catches for all years are shown by 1987 regulatory area, enabling a comparison of the same geographic regions over time. A more detailed summary of the 1987 seasons and catches for each regulatory area is provided in Table 3.

TABLE 2.
Commercial catch of Pacific halibut by regulatory area[1] (in thousands of pounds), 1983-1987.

Regulatory Area	1983	1984	1985	1986	1987
2A	265	431	493	581	592
2B	5,436	9,054	10,389	11,225	12,246
2C	6,398	5,847	9,207	10,611	10,685
3A	14,112	19,971	20,852	32,790	31,316
3B	7,751	6,503	10,888	8,831	7,758
4A	2,509	1,053	1,711	3,381	3,713
4B	1,335	1,104	1,236	261	1,501
4C	415	580	620	686	878
4D	148	392	681	1,223	703
4E	15	35	36	43	90
Total	38,384	44,970	56,113	69,632	69,482

[1]Regulatory areas defined in the 1987 Pacific Halibut Fishery Regulations.

In 1987, fishing seasons in all areas consisted of a series of fishing periods, each of specific lenght. When further fishing would surpass the catch limit for each area, it was closed to commercial halibut fishing and subsequent fishing periods were cancelled. Fishing periods in Areas 2A and 2B began and ended at 1200 hours local time in each Pacific time zone. Fishing periods in Areas 3C, 3 and 4 began and ended at 1200 hours local time in the Alaskan time zone; an exception was the third fishing period in Area 3B which began at 1800 hours ADT on September 2 and ended at 0600 hours ADT on September 3.

The total 1987 commercial catch was 69.5 million pounds, just slightly over the 68.8 million pound catch limit and only 200,000 pounds less than was taken in 1986. The fishery was characterized by a continued increase in the number of vessels fishing in all areas. The only reasons that the Commission was able to allow as many fishing days as it did were the imposition of fishing period limits during some fishing periods and marginal weather conditions.

TABLE 3.
Summary of the 1987 commercial fishery catch of Pacific halibut in each regulatory area[1] by fishing period.

Area	Catch limit (millions)	Opening Date	Closing Date	Fishing Days	Catch (000's lbs)
2A	0.55	July 10	July 22	12	548
	*	Apr. 1	Oct. 31	214	44
2B	11.5	May 2	May 10	8	5,945
		June 16	June 21	5	3,763
		Aug. 22	Aug. 25	3	2,538
				16	12,246
2C	11.5	May 4	May 5	1	3,366
		June 1	June 3	2	7,319
				3	10,685
3A	31.0	May 4	May 5	1	12,526
		June 1	June 2	1	14,683
		Sept. 30	Oct. 1	1	4,107
				3	31,316
3B	9.5	May 4	May 5	1	1,658
		June 1	June 2	1	3,186
		Sept. 2	Sept. 3	0.5	2,666
		Sept. 30	Oct. 1	1	248
				3.5	7,758
4A	1.75	May 4	May 5	1	57
		June 1	June 2	1	70
		Aug. 15	Aug. 17	2	3,586
				4	3,713
4B	1.75	May 4	May 5	1	1
		June 1	June 2	1	2
		Aug. 15	Aug. 19	4	1,498
				6	1,501
4C	0.6	June 21	July 2	6[2]	878
4D	0.6	Aug. 13	Aug. 20	7	703
4E	0.075	June 1	July 15	30[3]	90
Total	68.825				69,482

*100,000 pounds (plus 50,000 pounds reserve) of the Area 2A catch limit was suballocated to 11 Northwest Indian treaty tribes by the United States Government.
[1]Regulatory areas defined in the 1987 Pacific Halibut Fishery Regulations.
[2]6 one-day openings
[3]15 two-day openings

Area 2A had a catch limit of 550,000 pounds, 150,000 pounds of which were allocated to 11 northwest Washington Indian treaty tribes by the United States government. The actual catch for the area was 592,000 pounds, 42,000 pounds more than the catch limit. The non-Indian commercial catch was 548,000 pounds taken during a single 12-day fishing period, compared to 564,000 pounds taken in 1986 during two fishing periods totaling 19 days. Eleven treaty tribes caught 44,000 pounds during a 214-day season in 1987, whereas four treaty tribes caught 17,000 pounds during 184 days the previous year.

In Area 2B, the catch was slightly over 12.2 million pounds, 740,000 pounds above the 11.5 million pound catch limit. The catch was taken during three fishing periods totaling 16 days, with the best catch rate occurring during the final three-day fishing period in late August. During 1986, 11.2 million pounds were taken during two fishing periods totaling 15 days. The number of vessels reporting landings increased from 415 in 1986, to 440 in 1987, as a larger number of authorized vessels participated in the fishery.

The catch in Area 2C was 10.7 million pounds. The first fishing period of one day produced almost 3.4 million pounds because bad weather — particularly on the offshore grounds — hampered the fishing fleet. The second fishing period of two days in early June resulted in a catch of 7.3 million pounds. This left the season's total catch at 0.8 million pounds below the 11.5-million-pound catch limit. As this amount was too small for even a half day fishing period. Area 2C was closed for the remainder of the year. The number of vessels reporting landings from Area 2C increased over 10 percent from the previous year.

Catch limits in Areas 3A and 3B were 31.0 and 9.5 million pounds espectively, with the stipulation that both areas would close if the combined catch limit of 40.5 million pounds were attained. The total catch in 1987 was 31.3 million pounds in Area 3A and 7.8 million pounds in Area 3B. At the end of two one-day fishing periods in May and June, The Area 3A and 3B catches totalled 27.2 and 4.8 million pounds, respectively, leaving 3.8 and 4.7 million pounds of the two catch limits remaining. With the extremely high daily catch rates, the Commission felt it could not allow a full day's fishery because of the high probability of substantially exceeding both the separate and combined catch limits for the two areas. In order to allow the halibut fleet the opportunity to take, but not exceed, the 8.5 million pounds remaining of the Areea 3 catch limit, the regulations were amended to allow for a fishing period of less than 24 hours; a limit was placed on the maximum amount of halibut that could be retained and sold by a single vessel. As a result, Area 3B subsequently was opened in early September for a 12-hour fishing period; vessels were restricted to catching no more than 25,000 pounds of halibut. Unfortunately, severe weather occurred during the fishing period and only 2.7 million pounds were caught, leaving a deficit of 2.0 million pounds uncaught in Area 3B. Thus, the total Area 3 catch was still 5.8 million pounds below the allowable catch limit. In order to harvest this remaining poundage, The Commission decided to allow a one-day fishery from September 30 to October 1 in both areas, with the restriction that no vessel could land more than 20,000 pounds of halibut. An early fall storm again severely hampered the fishing fleet, particularly in Area 3B, which had very little fishing pressure, so the catch for the two areas totalled a little less than 4.4 million pounds. The Final Area 3A catch was 0.3 million pounds over the catch limit whereas the Area 3B catch was a 1.7 million pounds below the catch limit. The number of vessels reporting catches from Areas 3A and 3B increased 20 percent and three percent, respectively, from 1986.

In Area 4A, two one-day fishing periods in May and June produced only 127,000 pounds because most vessels fished in open areas to the east. However, a two-day fishing period in August yielded 3.6 million pounds by 172 vessels; this exceeded the 1.75 million pound catch limit for the area by over 1.9 million pounds. In a comparable three-day fishing period in late June and early July 1986, 134 vessels caught 3.3 million pounds.

Area 4B also had a catch limit of 1.75 million pounds. Only 3,000 pounds were caught by local fishermen in two one-day fishing periods in May and June. In August, 42 large non-resident vessels and 18 local vessels caught 1.5 million pounds, just 250,000 pounds below the catch limit. In 1986, the total catch from this area was only 261,000 pounds, taken by five non-resident and 16 local vessels.

In Area 4C, a total catch of 878,000 pounds was taken during six one-day fishing periods, exceeding the catch limit by 278,000 pounds. For the initial fishing periods, all vessels were limited to a maximum catch of 10,000 pounds per fishing period until 25 percent (150,000 pounds) of the catch limit had been taken. The 25 percent restriction was exceeded by the end of the second fishing period, but could not be rescinded until after the fourth fishing period in fairness to vessels fishing under the 10,000 pound restriction during period three. A total of 563,000 pounds were caught by the combined resident and non-resident fleets during fishing period five, and an additional 50,000 pounds were taken during period six by resident fishermen only. For the total six-day season, 20 non-resident fishermen caught 615,000 pounds during 33 one-day fishing operations and resident fishermen caught 263,000 pounds. In 1986, 13 non-resident fishermen caught 565,000 pounds during 26 one-day fishing operations; resident fishermen caught 121,000 pounds.

In Area 4D, twelve vessels caught 0.7 million pounds during a seven-day fishery in August, exceeding the catch limit by 100,000 pounds. In 1986, 44 vessels caught 1.2 million pounds in two fishing periods totaling eight days.

Area 4E had a total catch of 90,000 pounds, slightly over the 75,000 pound catch limit, which was taken during 15 two-day fishing periods. Residents of Nelson and Nunivak Islands caught 77,000 pounds, and 13,000 pounds were taken by three vessels from outside of the area. In 1986, 43,000 pounds were caught during 24 two-day fishing periods.

Landings by Port

Landings in British Columbia totalled 10.8 million pounds, an increase of over 1.7 million pounds from 1986. Five million pounds, slightly less than one-half of this total, were landed in the greater Vancouver area alone, and 3.7 million pounds were landed in Prince Rupert.

Landings in Washington, Oregon, and California declined 18 percent, from just under nine million pounds in 1986 to 7.6 million pounds in 1987. In contrast, landings in Alaskan ports, at 51 million pounds, were nearly the same as the previous year. The leading United States halibut port was Kodiak, with landings of 17 million pounds, followed by Homer (7.5 million pounds), Seward (4.2 million pounds), and Sitka (3.3 million pounds). Table 3 in Appendix I lists the landings at other Canadian and U.S. ports in 1987.

Waste from Lost or Abandoned Gear

Since 1984, some fishermen maximize their fishing opportunities by setting more gear during a fishing period than they can retrieve before the period closes. Other fishermen inadvertently lose gear during the period. The fish which remain hooked on the abandoned or lost gear die, so this wastage must be included in the accounting of total removals from the population.

In 1987, fishing periods in the largest areas off Alaska were 24 hours or less in length. Data collected during logbook interviews indicate that about 2.7 million pounds of halibut were wasted, probably due to the fishermen's desire to make the most of the short fishing period.

1987 IPHC Regulatory Area

	2A	2B	2C	3A	3B	4	Total
Waste (000's lbs.)	3	173	368	1,580	341	257	2,722

Most of this waste (84 percent) occurred in the Gulf of Alaska regulatory areas and over half of this occurred in Area 3A. Although these figures are lower than those estimated for 1986 (3.2 million pounds), the 1986 estimates were based on data collected during a fall opening in Area 3B which took place under severe weather conditions. The loss reported during this weather may have contributed to an over-estimation of 1986 loss for all regulatory areas.

Value of the Commercial Catch

In 1986, the coast-wide ex-vessel price was $1.44 with a catch valued at $100 million. In 1987, the coast-wide ex-vessel price (U.S.) averaged $1.58 per pound, resulting in a total catch value of $110 million, the highest value recorded in the history of the fishery.

SPORT FISHERY

Regulations

Sport fishing regulations in Alaska and British Columbia were the same in 1986 and 1987. The fishery opened on February 1 in these areas and closed on December 31, with a daily bag and possession limit of two fish per person and no size limit. Off California, Oregon, and Washington, the season opened on February 1, but closed on September 30. The earlier closure, along with a minimum size of 30 inches, was an attempt to limit the catch in this area to 200,000 pounds. The daily bag and possession limits remained at two fish per person. In all areas, an IPHC license was required for sport charter boats that intended to pursue halibut.

Catch Estimates

The recreational harvest of halibut totalled approximately four million pounds in 1987. Catches are summarized by regulatory area for 1983-1987 in Table 4. The most dramatic increase for this period occurred in Washington and Oregon where the catch increased from 50,000 pounds in 1983, to 461,000 in 1987, far exceeding the 1987 management goal of 200,000 pounds. Major increases in the sport catch also occurred in southcentral Alaska, particularly in the fishery off the Kenai Peninsula.

The catch figures shown in Table 4 reflect revisions of the catch estimates made for Alaska in previous years. The changes are based on average weight data obtained from the Alaska Department of Fish and Game creel census program. These data are recognized as being representative of sport-caught halibut throughout Alaska.

TABLE 4.
Estimated sport catch of Pacific halibut by regulatory area[1] (in thousands of pounds), 1983-1987.

Area	1983	1984	1985	1986	1987
2A	50	98	181	264	461
2B	103	124	525	560	600
2C	553	621	682	730	775
3A	957	1,042	1,227	1,924	2,175
3B	—	—	—	—	—
4	—	—	10	13	15
Total	1,663	1,885	2,625	3,438	4,026

[1]Regulatory areas defined in the 1987 Pacific Halibut Fishery Regulations.

Voluntary Logbook Program

IPHC initiated a voluntary sport charter-boat logbook program in 1983 in response to a growing halibut charter-boat fishery in Alaska. The program has been accepted gradually by the industry and a record 65 boats participated coast-wide in 1985. Participation declined in 1986 and 1987 because similar logbook programs offered by state agencies caused some charter operators to choose one program over another. This duplication of effort has been eliminated and participation in the IPHC program is expected to increase in 1988.

Participation is the greatest in Alaska, particularly Homer, where a dedicated halibut fleet resides. Other major sport charter halibut ports include Kodiak, Seward, Juneau, Sitka, and Ketchikan. Participation in the program by Oregon and Washington sport charter-boats is moderate, but expected to increase in 1988. Oregon and Washington charter-boat associations expressed a willingness to cooperate in the program in order to facilitate the reporting of data and improve estimates of the recreational catch off Newport, Oregon, and Washington. Major fishing grounds off the Pacific coast include the Hecata and Stonewall Banks off Oregon, and Swiftsure Bank and the Strait of Juan de Fuca off Washington.

Catch rates of 1.3 to 1.7 halibut per angler are common in Alaska. They are slightly less in Oregon and Washington but may increase as charter operators learn more about locating halibut concentrations. The number of anglers per vessel and the average time spent fishing have remained constant since 1984. The average weight of fish caught generally is between 15 to 20 pounds (net weight). Participants in the logbook program have accounted for approximately 10 to 20 percent of the total recreational harvest.

INCIDENTAL CATCH AND MORTALITY

Pacific halibut are caught inadvertently by fisheries that target various groundfish and shellfish species. Estimates of this incidental catch indicate that the removals are substantial. Incidental catch rates are generally highest in fisheries utilizing trawls for bottomfish, such as flounders, or for those fishing setlines in waters shallower than 200 meters e.g., the Pacific cod *(Gadus macrocephalus)* fishery. Midwater trawl fisheries, such as those targeting pollock *(Theragra chalcogramma)* or Pacific whiting *(Merluccius productus)* have very low halibut bycatch rates.

Existing knowledge of halibut bycatch in foreign and joint venture fisheries is based on information collected by on-board observers. Fishery observers monitor the catch of halibut and other prohibited species, e.g., salmon and crab. Originally, these observer programs were conducted intermittently in the early 1970s by IPHC and governmental agencies of the U.S. and Canada. In the U.S. they were substantially expanded in 1976 following the passage of extended jurisdiction (the Magnuson Fisheries Conservation and Management Act). Since 1977, the U.S. National Marine Fisheries Service (NMFS) has conducted a formal observer program for the foreign and joint venture fisheries operating off Alaska and the U.S. west coast. Off Canada, observer programs have been conducted by the Canadian Department of Fisheries and Oceans (DFO) in foreign, joint venture, and less often in domestic fisheries. During 1987, Commission summer staff took part in several field operations designed to assist state or federal agencies in collecting information on halibut incidence in fully-domestic groundfish fisheries.

Information on incidental catch in U.S. fisheries which deliver to shore-based or at-sea U.S. processors is based on data obtained from research surveys. When such data are not available, incidental catch rates in these fisheries are assumed to be the same as those of similar foreign and joint venture fisheries. Although an observer program was initiated in 1978 by the Alaska Department of Fish and Game (ADF&G) and in 1987 by the Alaska Sea Grant Program, data are inadequate for estimating incidental catch. The existing data used for such estimates have been collected from resource assessment surveys of crab and shrimp off Alaska. The resulting estimates of incidental halibut catch are considered less reliable than those based on actual fishery observations and are used mainly as an indication of the relative magnitude of the incidental catch.

Estimates of Incidental Catch

Incidental catches of halibut were relatively small until the 1960s, but increased rapidly due to the sudden influx of foreign fishing vessels off the North American west coast. The total incidental catch peaked in 1965 at about 30 million pounds. Catches fluctuated slightly below that level throughout the late 1960s and early 1970s, and then dropped to a 15-million-pound level during the late 1970s and early 1980s. Incidental catches declined further in the mid-1980s and totalled approximately 9.7 million pounds in 1986. For 1987, incidental catches were projected to be about 8.5 million pounds.

Estimates of incidental catch from 1978 through 1987 are shown in Table 5. Since 1980, incidental catch has significantly declined. Most of this decrease has occurred in Area 3, where foreign trawl and setline fisheries were being gradually phased out over the years and then eliminated in 1987. Foreign fishing also has been curtailed in the Bering Sea and Aleutian Islands (Area 4), but incidental catches have not declined due to the rapid growth of the joint venture fisheries. Domestic and joint venture fisheries have grown significantly since 1985. Incidental catch, or bycatch, in the fully-domestic fisheries is currently not

TABLE 5.
Estimated incidental catch and mortality of Pacific halibut by regulatory area[1] [in thousands of pounds (net weight)[2]], 1978-1987.

Year	Area 2 Bycatch	Area 2 Mortality	Area 3 Bycatch	Area 3 Mortality	Area 4 Bycatch	Area 4 Mortality	TOTAL Bycatch	TOTAL Mortality
1978	3,320	1,850	4,995	4,895	5,309	5,023	13,624	11,767
1979	4,525	2,674	7,012	6,715	5,588	5,419	17,125	14,807
1980	3,265	1,893	8,510	7,099	9,342	9,235	21,117	18,227
1981	2,890	1,694	7,949	6,282	6,669	6,408	17,508	14,384
1982	2,036	1,169	7,866	5,972	4,882	4,756	14,784	11,898
1983	2,190	1,248	7,954	4,892	4,588	3,543	14,732	9,682
1984	2,450	1,376	4,936	3,647	5,740	4,692	13,126	9,714
1985	2,579	1,440	1,847	1,578	5,162	4,207	9,588	7,225
1986	2,625	1,465	1,724	1,246	5,317	4,472	9,666	7,183
1987	2,603	1,453	1,860	1,860	4,051	3,528	8,514	6,841

[1]Regulatory areas defined in the 1987 Pacific Halibut Fishery Regulations.
[2]No information is available for U.S. groundfish fisheries that deliver to shore-based processors.

monitored, but domestic groundfish harvests in Area 3 (the Gulf of Alaska) are constrained to prevent large halibut bycatches.

Most of the incidental catch within Area 2 was taken by the Canadian trawl fishery operating in Area 2B. Incidental catches in this fishery have remained relatively stable at 2.5 million pounds since about 1980. Bycatch also occurred in the pot fisheries for king and Tanner crab in the Southeast (Area 2C) region, but is believed to be relatively minor.

In Area 3, halibut bycatch has been declining steadily since the early 1980s and dropped to 1.8 million pounds in 1986. Only a Japanese setline fishery for Pacific cod in Area 3B was allowed in 1986. Foreign fishing was totally eliminated in the Gulf of Alaska for 1987, removing this fishery as a source of halibut bycatch. Most of the bycatch in Area 3 during 1987 occurred in a joint venture fishery for flounders.

Incidental catch in Area 4 has ranged from 4.0 to 9.8 million pounds since 1980 and was estimated at 5.3 million pounds in 1986. Although foreign trawling in this area has been reduced in recent years, there has been an increase in foreign setline and joint venture fishing for cod, pollock, and flounders. Of major concern is the Bering Sea joint venture fishery for yellowfin sole *(Limanda aspera)* which incurs large bycatches of halibut when operating in the Commission's nursery area in Bristol Bay. Only limited restrictions have been placed on this fishery to reduce the bycatch of halibut.

Incidental Mortality or Loss to the Population

Most halibut that are incidentally caught are injured to some degree during the capture process. Those fish must be returned to the sea and many survive their injuries, thus the incidental mortality, or loss, is less than the actual catch. It is believed that about 25 percent of the halibut caught on foreign and domestic setlines, and 50 percent of the halibut caught in domestic trawls, die. The mortality rate in all other fisheries (i.e., foreign trawl, joint venture, crab pot, and shrimp trawl fisheries) is believed to be 100 percent. These mortality rates are based on experiments conducted by the Commission (IPHC Scientific Report 57, Technical Report 19), observations from the fishery, and knowledge of the effects of various types of fishing gear.

Estimates of the incidental mortality are shown in Table 5. For 1986, the loss is estimated to be 7.2 million pounds and is projected to be 6.9 million pounds in 1987. Incidental mortality has been declining since 1980, mirroring the overall trend in incidental catch. Mortality in 1987 was lowest in Area 2 at 1.4 million pounds and was highest at 3.5 million pounds in Area 4.

Halibut killed when taken and released as bycatch are generally sublegal in size. To incorporate the estimates of incidental mortality into the population assessment models used for halibut, the mortality must be converted to "adult equivalents", i.e., the number of pounds of adult halibut that are represented by the estimated mortality of sublegal (juvenile) fish. This process requires adjusting the estimates of mortality for fish growth and natural mortality. The weight increase from growth is greater than the weight loss due to natural mortality, thereby resulting in a net loss to the exploitable biomass and a loss to the setline fishery. The conversion factor used to estimate adult equivalents is 1.58 (i.e., one pound of bycatch equals 1.58 pounds of adult halibut killed).

Summary of North Pacific Fishery Management Council (NPFMC) Actions in 1987

Gulf of Alaska. To control halibut bycatches in domestic fisheries in the Gulf, since 1986 the NPFMC has adopted a management goal of 3.3 million pounds [2,000 metric tons (mt)] of annual halibut mortality for all bycatch fisheries. For management purposes, the mortality limit is converted to a bycatch, or Prohibited Species Catch (PSC) limit based on known mortality rates. PSC limits are then set for the fully-domestic, joint venture, and foreign fisheries. Once a PSC limit is reached, the NPFMC intends to prohibit on-bottom trawling in that fishery for the remainder of the year, unless new information becomes available indicating that bycatch rates are lower than those originally used. For 1987, the NPFMC set a PSC limit of 5.0 million pounds (3,000 mt) for domestic fisheries and 0.08 million pounds (47 mt) for joint venture fisheries. Historical halibut mortality rates from the respective groundfish fisheries were studied to develop a PSC limit. These rates were used to establish the 1987 PSC limit of a maximum of 2.2 million pounds (1,340 mt), well below the pre-established goal of the NPFMC.

In September 1987, the NPFMC raised the 1987 halibut PSC for joint venture fisheries in the Gulf to allow for the increase in halibut bycatch anticipated in a proposed flounder fishery in the Kodiak area. At the same time, the PSC limit for domestic fisheries was reduced to reflect the less-than-anticipated harvests by that fishery. The resulting PSC limits were 0.3 million pounds (200 mt) for domestic fisheries and 4.7 million pounds (2,821 mt) for joint venture fisheries. The anticipated mortality was estimated at 2.3 million pounds (1,430 mt).

Bycatch rates used by the NPFMC's Gulf of Alaska Groundfish Plan Team to establish the PSC were averages of those recorded in the foreign and joint venture fisheries during the early 1980s. The Team believed that the rates might not reflect current conditions nor be appropriate for the domestic fishery, yet the recently collected data were limited and inadequate for estimating bycatches for the entire Gulf.

Bering Sea. In 1986, the NPFMC set both area and zone regulations to control the bycatch of king and Tanner crab in the joint venture yellowfin sole fishery. These same regulations were in effect for 1987. The NPFMC also has set an upper limit on halibut and crab bycatch for the Bering Sea/Aleutian region. But the maximum allowable number of 828,000 fish is very high and serves no conservation goal. Halibut bycatch is controlled more directly as a result of restrictions to the Tanner crab bycatch; when crab bycatch is limited, halibut bycatch will decline.

In 1987, the NPFMC formed a Bycatch Committee to develop a long-term plan for the management of bycatch in the fisheries off Alaska. The Committee has recommended to the NPFMC an annual halibut mortality limit of 6.5 million pounds (3,900 mt) for the Bering Sea/Aleutian Islands groundfish fisheries, which would take effect in 1989.

Population Assessment

Assessment of the Pacific halibut stock is conducted using catch-age analysis methods described in the 1984 Annual Report. The 1987 assessment required logbook catch and effort data, port samples of otolith length frequency with a subsample of age estimates, commercial landings, and habitat size estimates. In addition, the results of several years of IPHC research cruises were used to standardize the data that were used in the analysis.

1987 ASSESSMENT

A summary of 1987 stock assessment results is given in Table 6. The ranges given for each item correspond to the minimum and maximum of the estimates from the three catch-age analyses: (1) catch-age analysis with CPUE partitioning; (2) closed subarea analysis without migration; and (3) migratory catch-age analysis. Stock productivity is measured by annual surplus production (ASP), which is defined as the excess biomass above what is needed to replenish the population each year. The range of total ASP for the stock as a whole was 82 to 88 million pounds in 1987. Total removals in 1987 (including recreational catch, bycatch, and waste) were about 86 million pounds which is close to the ASP of the stock. The closeness of catch size to ASP indicates that the halibut stock is currently fully utilized.

TABLE 6.
Results of the 1987 population assessment conducted by the International Pacific Halibut Commission (IPHC) using three methods of catch-age analysis.

	IPHC Regulatory Area						
	2A	**2B**	**2C**	**3A**	**3B**	**4**	**Coast-wide***
Exploitable Biomass							
Range: Upper	0.91	39.3	49.4	134.5	41.1	13.8	269.4
Lower	0.64	27.9	41.9	122.8	30.0	10.1	234.8
Maximum Sustainable Yield (MSY) — a long-term reference point							
All gear	0.80	18.6	11.3	29.2	10.0	11.0	80.9
Setline Only	0.47	16.3	8.2	20.5	8.1	10.2	63.8
Total Annual Surplus Production (ASP)							
Range: Upper	0.57	14.7	11.5	51.1	11.0	6.5	87.7
Lower	0.54	12.3	6.0	46.2	7.3	4.5	82.1
Setline ASP — subtract other catches from Total ASP							
Range: Upper	0.24	12.5	8.4	42.3	9.4	5.4	70.7
Lower	0.21	10.1	2.9	37.4	5.7	3.4	65.1
Setline Constant Exploitation Yield (CEY) — proportional allocation, sums to combined CEY							
Range: Upper	0.0	12.2	11.8	39.0	8.7	5.5	77.2
Lower	0.0	10.3	10.0	32.9	7.4	4.6	65.1

*Note that range of values for the "Coast-wide" category is more precise than the sum of ranges from the individual regulatory areas, with the exception of Setline CEY.

Constant exploitation yield (CEY) estimates have been the basis for setting catch limits since 1985. CEY is calculated by multiplying an exploitation fraction (0.35) by estimates of exploitable biomass of halibut for the stock as a whole. In 1987, the total CEY for the halibut stock as a whole ranged from 82 to 94 million pounds. Regulatory area estimates of CEY are obtained by partitioning the total CEY among regulatory areas. Setline CEY (Table 6) was calculated by subtracting other removals during 1987 from the total CEY in a regulatory area; note that the amount of bycatch subtracted from each regulatory area is the estimated impact of incidental catch losses on future recruitment of fish into that regulatory area.

The combined area setline CEY estimates ranged from 65 to 77 million pounds with about half the CEY occurring in Area 3A. The 1987 setline catch limits fell within the range of CEY estimates for Areas 2B, 2C, and 4. In Area 2A and 3B, the 1987 catches exceeded the CEY ranges, and in Area 3A the 1987 catch was below the CEY range. The setline CEY estimate for Area 2A is zero because other removals (sports harvest, bycatch, and waste) exceeded the estimated total CEY for that area. CEY estimates for Area 2A were developed cautiously since very little 1987 setline logbook data from this area were usable for stock assessment.

Maximum sustainable yield (MSY) is estimated at 80.9 million pounds for the entire resource, but after subtracting current levels of other removals, only 63.8 million pounds would be available for the directed setline fishery. Table 6 shows MSY for each regulatory area. MSY is a useful long-term reference point, but it should not be used to set current catch quotas since it does not reflect the current stock conditions.

HISTORICAL TRENDS IN THE HALIBUT FISHERY

Coast-wide Changes

The population of Pacific halibut has undergone large variations in biomass and exploitation rate since the 1930s (Figure 2). The pattern of abundance has been driven by changes in recruitment and in exploitation.

Exploitation rates (total removals divided by exploitable biomass) are directly related to: (1) directed catch by the setline fleet; (2) bycatch in fisheries targeted at other species; (3) waste in the setline fishery caused by lost or abandoned gear, or from mortality of undersized halibut returned to the sea; and (4) catch by recreational fishermen. Bycatch mortality equalled or exceeded the directed catch during the 1960s and early 1970s, and has decreased since the early 1970s (Table 7). Recreational catch and waste became important removals in 1984, but are still much less than the directed catch.

Figure 3 shows estimates of the biomass of eight-year-olds since 1943, adjusted upward to account for halibut removed in bycatches prior to the age of eight years. The adjusted estimates give a clearer picture of natural fluctuations in year-class abundance. As indicated in the figure, year-class abundance exhibits an approximate 20-year cycle.

The increasing exploitable biomass through the late 1930s and 1940s is associated with increasing recruitment and decreasing exploitation rates. The low cycle of recruitment in the 1950s was mitigated by low exploitation rates,

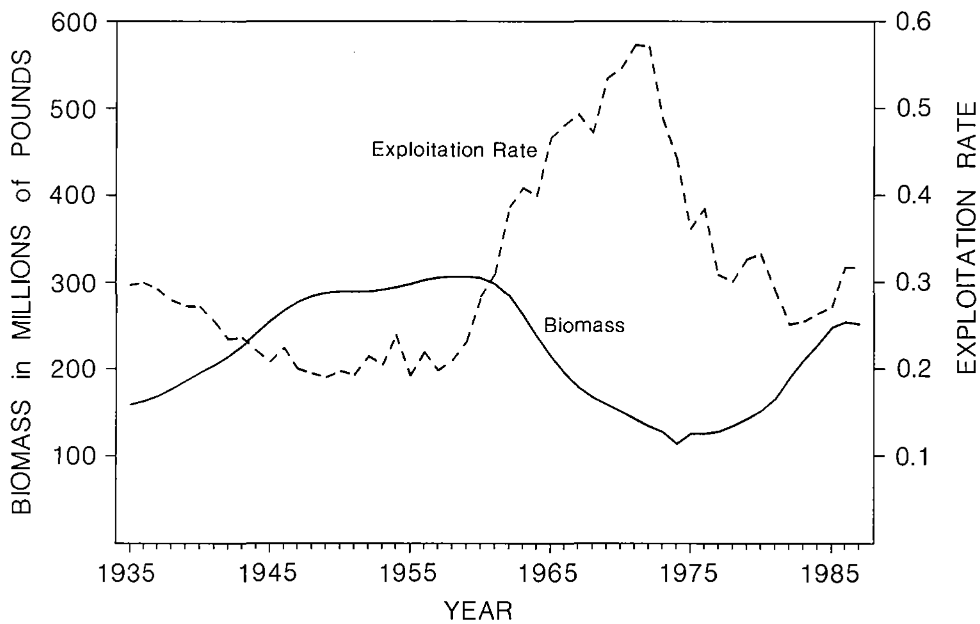

FIGURE 2.
Historical trends in exploitable biomass and exploitation rate for Pacific halibut, 1935-1987.

TABLE 7.
Summary of Pacific halibut exploitation data, 1974-1987.

Year	Exploit. Biomass	Removals (Millions of Pounds) Comm. Catch	Bycatch	Sport Catch	Waste	Total	Setline Expl. Rate	Total Expl. Rate
1974	114.20	21.3	29.3	0.3	0.0	50.9	0.187	0.446
1975	126.21	27.6	18.1	0.3	0.0	46.0	0.219	0.364
1976	126.02	27.5	21.0	0.3	0.0	48.8	0.218	0.387
1977	128.43	21.9	17.8	0.3	0.0	40.0	0.171	0.311
1978	134.81	22.0	18.6	0.4	0.0	41.0	0.163	0.304
1979	142.88	22.5	24.2	0.6	0.0	47.3	0.157	0.331
1980	152.12	21.9	28.8	0.8	0.0	51.5	0.144	0.339
1981	166.03	25.7	22.7	1.1	0.0	49.5	0.155	0.298
1982	189.92	29.0	18.8	1.3	0.0	49.1	0.153	0.259
1983	210.45	38.4	15.3	1.7	0.0	55.4	0.182	0.263
1984	228.04	45.0	15.3	1.9	0.8	63.0	0.197	0.276
1985	248.07	56.1	11.4	2.6	1.6	71.7	0.226	0.289
1986	254.46	69.6	11.3	3.5	3.2	87.6	0.274	0.344
1987	252.11	69.4	10.8	4.0	2.7	86.9	0.275	0.345

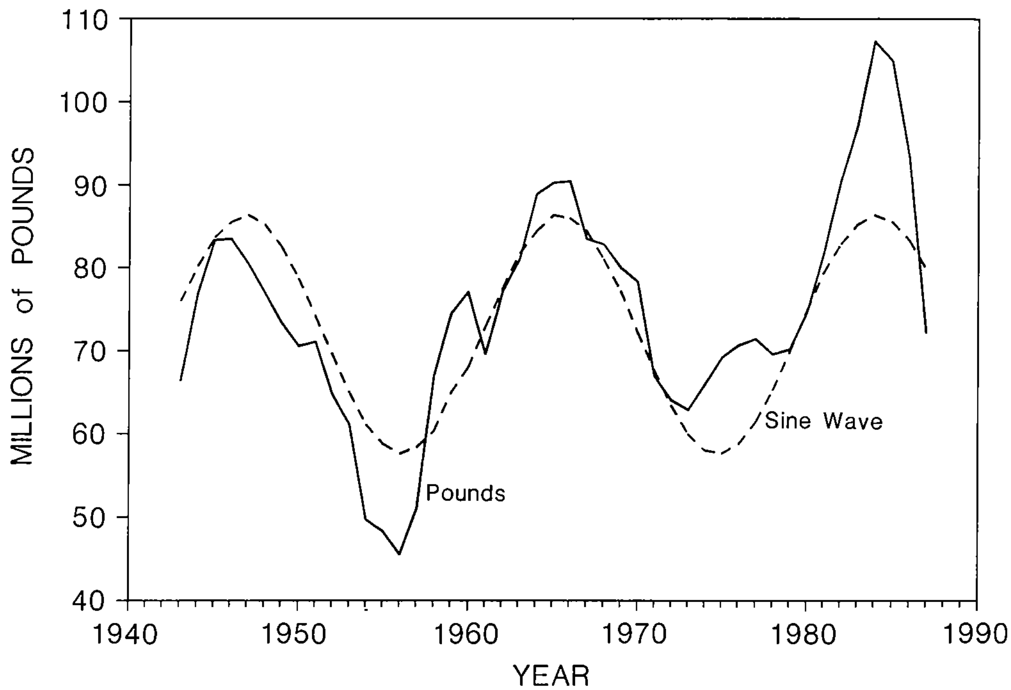

FIGURE 3.
Biomass of age-eight Pacific halibut, adjusted for bycatch and smoothed with a three year moving average, 1942-1987.

and biomass remained stable rather than declining. The declining biomass from the 1960s through about 1974 was caused by declining recruitment and increased exploitation. Bycatch during the 1960s and early 1970s greatly reduced subsequent recruitment of eight-year-olds during that period, which contributed to stock decline. The current high biomass is due to strong recruitment and moderate exploitation since the late 1970s. The most recent estimates of eight-year-old abundance suggest a cycle which is beginning another downturn. However, this cannot be confirmed because these eight-year-old fish have not been in the fishery long enough to document their abundance and confirm the downturn in the cycle.

During the last biomass increase, the philosophy and techniques for management and stock assessment changed. In the early 1980s, IPHC adopted a management philosophy of reserving a portion of the ASP to help stock rebuilding. The setline catch limit was set at 75 percent of the ASP for the directed fishery; the remaining 25 percent was reserved for rebuilding.

In 1985, when halibut stocks appeared to have rebuilt, IPHC reduced emphasis on ASP management, and shifted to CEY management which employs a constant exploitation rate. An optimal exploitation rate of 35 percent was chosen in 1986 to calculate yield from biomass. The historical pattern of exploitation rates (Figure 2) shows that exploitation higher than 35 percent occurred during the period of declining biomass, and that exploitation was well below 35 percent during rebuilding. Current exploitation is close to 35 percent.

The estimated coast-wide exploitable biomass of Pacific halibut declined from 254.5 million pounds in 1986, to 252.1 million pounds in 1987 (Figure 2). The biomass, however, remained near historical high levels, and the minor decline of the exploitable biomass of Pacific halibut was caused by a drop in abundance of young fish. It is not certain if the decline in young fish is a short-term or long-term trend. A decline in recruitment would have only minor effect on exploitable biomass over the next few years, but could cause a reduction in biomass and catch limits in the future.

Changes by Area

In spite of near-record total halibut abundance, biomass has not increased uniformly from Alaska to Oregon. The largest increase occurred in Area 3A, the center of the distribution. Increases were somewhat less than in Areas 2C, 3B, and 4, and much less in Areas 2A and 2B. Stock assessment data for Area 2A are the poorest of any area, and will not be discussed in detail. Comparison of 1974-1987 biomass and exploitation rate data from Area 3A to other areas provides insight into area-specific changes during the period of overall abundance increase (Figures 4 and 5). Recruitment and CPUE estimates for each area are not presented in this report. However, area-specific recruitment trends are similar to the pattern in Figure 3, and CPUE closely follows biomass. Area 3A is considered the standard against which to assess other areas. The halibut abun-

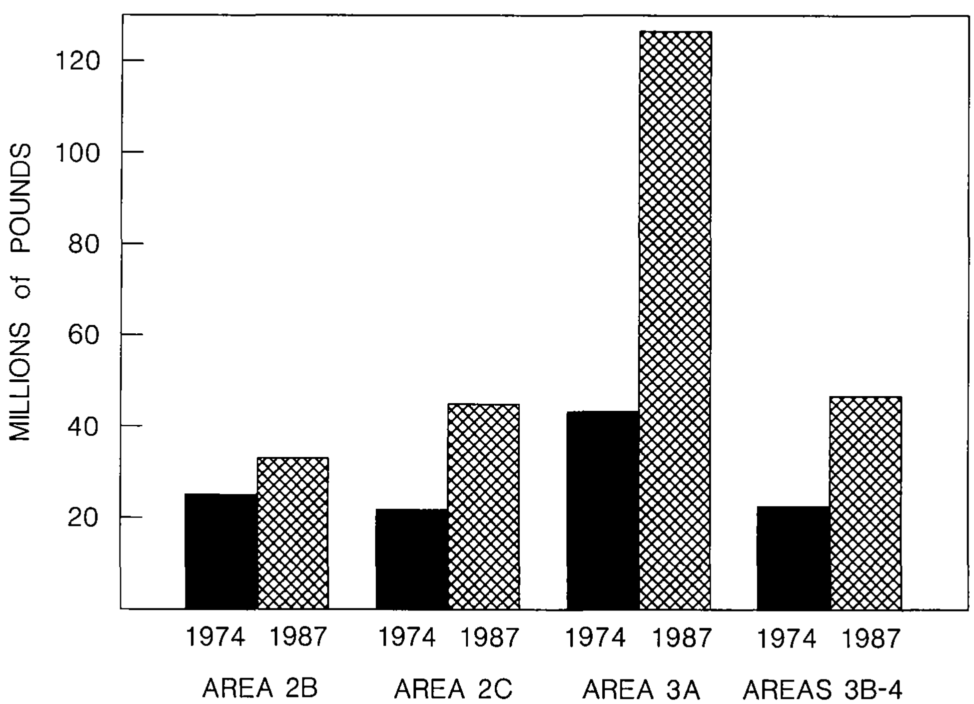

FIGURE 4.
Changes from 1974 to 1987 in the exploitable biomass (millions of pounds) of Pacific halibut in the current IPHC stock assessment areas.

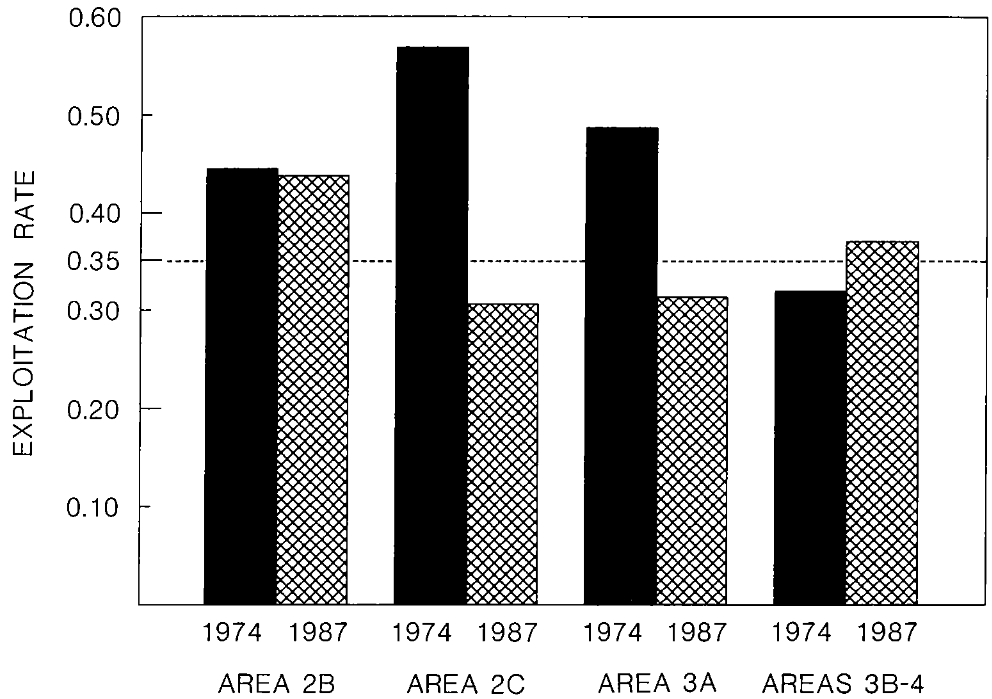

FIGURE 5.
Changes from 1974 to 1987 in the exploitation rate of Pacific halibut in the current IPHC stock assessment areas.

dance in Area 3A has grown substantially since 1974, and recruitment, CPUE, and exploitation rates are consistent with increased abundance. The abundance level is above the biomass that produces MSY (Figure 6).

Recruitment (the number of eight-year-olds coming into the population each year) approximately doubled in all areas from 1974 to 1985 (Figure 3). This increase was a major factor in the general stock rebuilding. All areas show a declining recruitment in 1986 and 1987.

Data from Area 2B present a consistent pattern of high exploitation contributing to low biomass. Biomass increased about 20 percent from 1974 to 1987; not shown in Figure 3 is a decrease in biomass from 1974-1982 and a modest increase starting in 1982. CPUE paralleled biomass. The exploitation rate in Area 2B is the highest over time of any area, and harvest generally equalled ASP. Such high exploitation may retard rebuilding. Abundance is substantially less than the biomass that produces maximum sustainable yield. Although recruitment approximately doubled from 1974 to 1985, it was far below the typical values prior to the 1970s. Recruitment now appears to be declining from levels that already are below normal.

Trends from Area 2C were similar to those of Area 3A. Biomass rebuilding occurred rapidly, and CPUE tracked the biomass trend. Exploitation rates in Area 2C have been consistently among the lowest since the biomass rebuilding began. Biomass is above the biomass of MSY.

Results in Area 3B-4 indicate that biomass more than doubled from 1974 to 1987, and estimated abundance for that area is near the biomass that produces MSY. Exploitation rates were lower in 1974 than in other areas, but are currently among the highest. If biomass estimates are correct, however, 1987 harvest and exploitation rates may not be sustainable. CPUE went up throughout the period, and 1987 CPUE values are similar to those in Areas 2C and 3A.

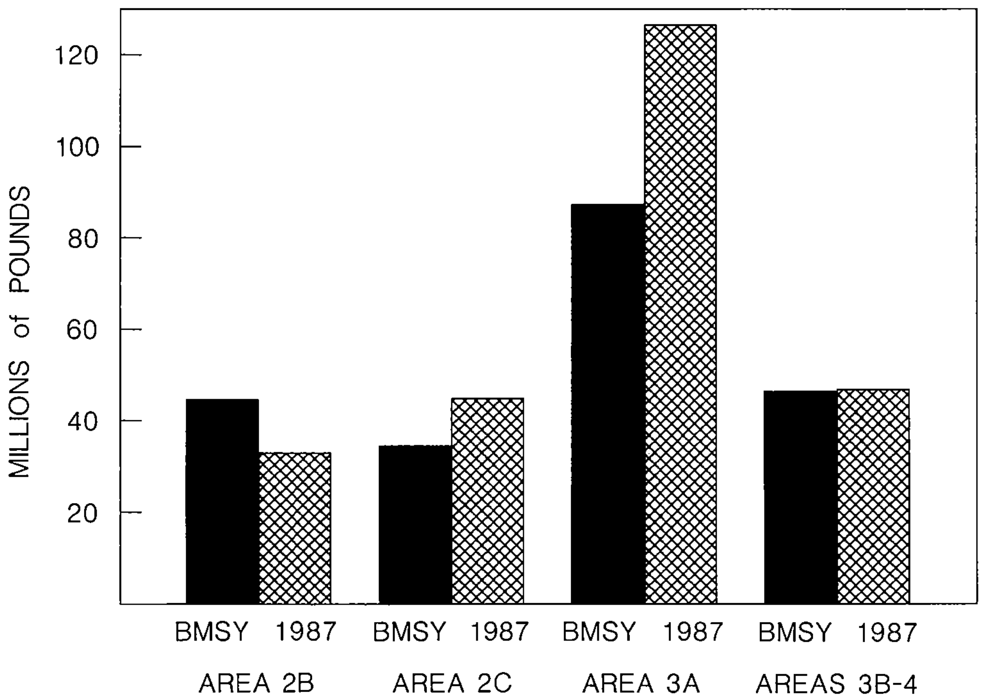

FIGURE 6.
Comparison of 1987 Pacific halibut biomass level to biomass at maximum sustainable yield (BMSY) by IPHC stock assessment area.

SCIENTIFIC INVESTIGATIONS

Each year the Commission conducts various experiments, surveys, and data collection programs designed to better understand the biology of halibut, the effects of the fishery upon the resource, and the changes taking place within the halibut population. In 1987, at-sea research was focused on assessing differences in the availability of halibut to setline gear among different regions of the coast. In addition, port sampling of the commercial fishery landings was conducted as in prior years. These activities are described in the following sections.

HALIBUT REARING PROJECT

The International Pacific Halibut Commission has been conducting experiments investigating the biology of Pacific halibut in cooperation with the University of Washington and the U.S. Fish and Wildlife Service. Since 1985, the Commission has been holding and attempting to spawn halibut at the Service's facility at Marrowstone Island in Puget Sound. During 1987, additional fish were delivered to the project site. Fish also were delivered to the Nanaimo facility of the Canadian Department of Fisheries and Oceans in preparation for a companion study. Preliminary work has been done in identifying changes in hormone levels associated with the onset of annual spawning in adult halibut. As a result, the sex and stage of maturation of halibut can be determined from adult blood samples. A successful spawning from the experiment is expected during the spring of 1988.

CATCHABILITY STUDIES

In 1987, the Commission conducted experiments in Areas 2B and 3A to investigate apparent differences in the effectiveness of setline gear in catching halibut (catchability) between those areas. One of the basic assumptions of the study was that the trawl catchability of halibut would not vary between the study areas. If that were true, differences between areas in the ratios of trawl to setline catch should have been the result of differences in the setline catchability between areas.

During mid-summer, a trawler and setliner were chartered to determine paired estimates of relative abundance and stock composition in each area. These estimates were then used to assess differences in the setline catchability between areas. A total of 52 locations were fished, including 25 in the Charlotte region and 27 in the Kodiak region. Fishing depth ranged from 16 to 104 fathoms with averages of 48 fathoms in the Charlotte region and 59 fathoms in the Kodiak region.

There was a marked difference in the selective nature of the two fishing gears used in this study. In contrast to the setliner, the trawler caught about twice as many adult halibut in the Charlotte region and substantially fewer adult halibut in the Kodiak region. The trawler caught many fish in the 50 to 80 cm size category, but caught few fish over 100 cm. On the other hand, the setliner caught few fish smaller than 70 cm. Because of this difference in size of fish caught by the two gear types, it was considered appropriate to limit the analysis to catches of fish between 82 and 99 cm. In this size range, the setliner caught almost four times as many halibut as the trawler in the Kodiak region, but about half as many as the trawler in the Charlotte region.

Very high catches of dogfish were seen in about half of the stations fished in the Charlotte region; dogfish represented about 70 percent of the total setline catch over all Charlotte stations. Recognizing the effect of hook occupancy by dogfish, an analysis was performed which compared Charlotte stations which had relatively low dogfish catches, with stations in the Kodiak region that also had low dogfish catches. This resulted in a calculated catchability difference between regions of 1.9. Even with this accounting for the high dogfish interaction, the catchability of halibut in the Kodiak regions is still twice that of the "low dogfish" stations from the Charlotte region. The confidence interval around this estimate is quite broad, from 1.1 to 3.5; data from more stations are needed in future comparisons, in order to reach more precise estimates. A similar study done in 1983 resulted in an overall catchability difference between regions of 1.5 and this was incorporated into the Commission's catch-age model. This value falls well within the confidence intervals calculated from the present experiment.

CONTINUOUS FISHING EXPERIMENTS

Catch rates on a fishing ground typically decline as fish are removed by a fishery. The rate of decline can be used to estimate the size of the populations. If successful, continuous fishing experiments can be used to verify or alter present estimates of biomass. During a preliminary investigation of this methodology, fishing was conducted on several consecutive days in survey areas in the Charlotte and Kodiak regions. The data collected provided information on change in catch rate over the fishing period, stock composition, and movement of fish into and out of the survey area. The Kodiak portion of the survey was plagued by bad weather so results from this area were not usable for these analyses. Data was usable from eight days of fishing conducted in the Charlotte region off Carpenter Bay, just inside and north of Cape St. James in Hecate Strait. A total of 28 skates of gear were fished each day in about 65 fathoms.

In the Charlotte region, 224 skates of gear caught 1,576 halibut, resulting in an unstandardized catch rate of 86 pounds per skate. Legal-sized halibut (>81.3 cm) comprised 62 percent of the catch and had a catch rate of 131 pounds per skate. There was little change in the size composition of halibut from day to day and, although showing an initial decline in catch per unit effort (CPUE), the catch rate of halibut over the eight days remained relatively stable. This indicated high rates of migration into the experimental area. Although estimates of adult and juvenile halibut had been much lower initially, high migration had effectively replenished the population in the experimental area. Analyses also showed very high initial abundance levels for dogfish but very low migration rates. As a result, dogfish were fished out by the middle of the experiment.

When halibut abundance estimates in the survey area were extrapolated to all of Area 2B, the result was that the biomass estimates for Area 2B were close to those estimated by the Commission's catch-age models. Further experiments are needed to determine whether this methodology can be useful in assessing halibut stocks.

BRISTOL BAY SURVEY

A proposal to open a commercial fishery in the Bristol Bay near-shore area was rejected by the Commission at the 1987 annual meeting. This area has been included in a nursery area since 1967 and is closed to commercial halibut fishing. In order to assess the commercial potential as well as the occurrence of sublegal halibut, an exploratory setline survey of the area was conducted. The survey area encompassed the shoreline out to 20 miles offshore, and along the coast from Cape Newenham to Cape Seniavin. One large and two small setline vessels were used in the survey. The large vessel caught 65 sublegal and 66 legal halibut on 323 skates of gear. The two small boats caught 24 sublegal and 55 legal halibut on 99 skates. The average catch per skate of legal halibut was 3.8 pounds per skate for the large boat and 13 pounds per skate for the small boats.

The results indicated that there are very few legal-sized halibut in the Bristol Bay survey area. Although the Bristol Bay area is considered a halibut nursery ground, the catch of sublegal fish also was small (less than 0.5 halibut per skate). A drawback of the survey was that small halibut probably would not have been easily caught on the large circle hooks used in this study.

TAGGING STUDIES

Table 8 summarizes the tags released during IPHC research in 1987. The total number released was the lowest in the last decade because the vessel research activities emphasized special topics for 1987 and tagging was not an important aspect of most of them. The setliner *Snowfall* was chartered to work in conjunction with the trawler *Ocean Star* on catchability studies. This work took place in northern British Columbia and off Cape Chiniak on Kodiak Island from May through July. There were 2,541 tagged halibut released from the *Snowfall*. None were released from the *Ocean Star* as the crew's workload did not allow time for tagging. In August, the setliner *Cape Flattery* released 168 tagged halibut in Chiniak Gully as part of its continuous fishing experiment. Inner Bristol Bay nearshore waters were explored in July and August by three setline vessels, the

TABLE 8.
Number of Pacific halibut tag releases identified by month, location, and type of gear, 1987.

Month	Location	Gear	No. Tagged
May	Two Peaks-Masset	Setline	616
June	Horseshoe-Goose Island	Setline	70
June	Cape Scott	Setline	219
July	Cape Chiniak	Setline	1,636
July/August	Inner Bristol Bay	Setline	166
August	Chiniak Gully	Setline	168
June/July	Bering Sea Flats	Trawl	287
May/August	Oregon	Sport	40
Total			3,202

Valorous, Erica C, and *Coral.* The primary goal of these vessels was to ascertain stock abundance and size composition on these grounds. Two trawl vessels, the *Alaska* and *Pat San Marie,* under charter to the U.S. National Marine Fisheries Service for their grid survey on the Bering Sea flats, released 287 tagged fish, mostly juveniles. Through the cooperation of the Oregon Department of Fish and Wildlife, 40 tagged juvenile halibut were released off the Oregon coast.

Tag returns in 1987 totalled approximately 1,800, about 400 fewer than in 1986, but still a relatively large number. A new record for time at liberty was established by a tagged fish recovered in 1987. A 47 cm fish that was tagged on July 3, 1966, in Shelikof Bay was recovered on June 2, 1987, off Cape Ommaney. Thus, this fish had been at liberty 20 years and 11 months. Unfortunately, no record of the length at recovery is available.

MINIMUM SIZE LIMITS IN THE SPORT FISHERY

A background paper was developed in 1987 to assess the impact of minimum size limits on the recreational fishery for halibut. A minimum size limit of 32 inches currently is used to control the age of entry into the commercial halibut fishery.

Historically, halibut landings have been dominated by the directed setline fishery and the recreational catches have been small by comparison. This began changing by the mid-1980s in Area 2A, where the catch from a rapidly developing recreational fishery, combined with commercial and treaty Indian catches exceeded acceptable catch limits. In 1987, an experimental 30-inch minimum size limit was placed on the recreational fishery in Area 2A, solely as a way to reduce the catch to about 200,000 pounds. By itself, the minimum size length was ineffective in reducing catch in terms of weight, although catch in numbers of fish probably was affected.

Primary factors considered in evaluating the impact of a minimum size limit include: (1) hooking mortality; (2) migration; (3) size composition; and (4) effect of size limit on harvest.

Hooking Mortality. Little is known about hooking mortality in the recreational fishery. However, in 1987, small-scale studies by the Oregon Department of Fish and Wildlife and the Washington Department of Fisheries suggest that average hooking mortality is between eight and 24 percent. Observations from IPHC research surveys indicate that circle hooks cause little damage to the fish, usually hooking it in the lip or jaw. Treble hooks tend not to be swallowed but probably result in more damage than circle hooks. The j-hook probably causes the most damage because it tends to be swallowed, resulting in internal injuries.

Migration. Both juvenile and adult halibut are migratory. Juvenile halibut make most of the extensive migrations between regulatory areas and tend to migrate east and south along the coast from Alaska to British Columbia, Washington, and Oregon (Areas 2A and 2B). Harvest of juvenile halibut in the recreational fishery causes a yield loss to the fisheries in areas to which migration would have occurred. Migratory yield losses to Area 2A and 2B from the present recreational harvest in Alaska are minimal, yet represent less than a one percent increase to the existing annual surplus production.

Size Composition and the Effects of Size Limits on Harvest. For 1984-86, recreationally-harvested halibut in Alaska averaged 32.8 inches and 15.7 pounds (net weight). About 58 percent of the recreational harvest is below 32 inches by number for this period. This represents 23 percent of the catch by weight. Average length and weight for recreationally-harvested halibut in Washington are 32.6 inches and 13.5 pounds (net weight) for the period 1984-1986. About 48 percent of the number of fish caught are less than 32 inches long and comprise 25 percent of the harvested weight. Size composition data are not available for Oregon and British Columbia but are believed to be similar to that of Washington.

The imposition of a size limit on recreationally-caught halibut will not necessarily result in reduced harvests for sport fishermen. The sport catch could increase in weight even if fewer fish are harvested. Preliminary estimates indicate that the recreational harvest increased by 28 percent in number and 70 percent by weight in Area 2A during 1987, despite the 30-inch minimum size limit.

At this time, placing a minimum size limit on the recreational fishery would not provide significant biological benefits to the halibut resource or increased benefit to recreational fishermen. However, a minimum size limit might be a valuable management tool in the future if the recreational fishery continues to grow.

CATCH SAMPLING

Commercial landings were sampled at ports between Newport, Oregon, and Dutch Harbor, Alaska, in 1987. Over 20,000 otoliths were collected from the landings to determine the approximate size of the fish landed. A subsample of 16,000 otoliths was selected for estimating the age composition of the landed fish. Although fewer otoliths were taken than in previous years due to a new sampling format, more otoliths were read for the age composition. Although smaller samples were taken, more boats were sampled.

Because there are so many short fishing periods, the IPHC staff cannot adequately sample the landings. Unexpected shifts of vessels from one port to another sometimes leave the field staff over-represented in one port and under-represented in another. Although sampling opportunities were expanded in 1987, only one percent of the total landings was actually sampled (Table 9). However, the revised sampling program permitted the sampling of a wider range of vessels that represented more statistical areas.

AGE VALIDATION STUDY

During 1982 and 1983, the Commission performed age studies by releasing tagged halibut which had been injected with oxytetracycline (OTC) in Areas 2B, 3A, and 3B. Fish absorb OTC during deposition of new bone, placing a time-mark on the otolith. When viewed under ultraviolet light, the otolith exhibits a yellow ring where the OTC is present. Comparison of the time at liberty to the number of annuli laid down since release gives partial verification of the age of the fish. Release and recapture data for this study are summarized in Table 10.

TABLE 9.
Proportion of the Pacific halibut commercial catch sampled for size and age composition by region, 1987.

Region	Catch* (000's lbs)	Percent Sampled
Columbia	252	2.0
Vancouver	1,154	0.2
Charlotte Outside	2,266	1.5
Charlotte Inside	9,138	1.2
S.E. Alaska Inside	6,536	1.1
S.E. Alaska Outside	4,183	1.9
Yakutat	2,942	0.2
Kodiak	28,124	0.8
Chirikof	4,571	2.4
Shumagin	5,653	0.5
Aleutian	846	0.9
Bering Sea	3,618	0.7
Total	69,283	1.0

*Does not include research catches.

Recovery rates have varied among experiments. The 1982 OTC-injected releases apparently had a higher mortality rate than did the control group; the control group returned at three times the rate of injected fish. The reason these releases fared poorly is not completely understood, but may be related to the volume of fluid injected into the larger fish. The body cavity noticeably swells, which is an indicator that the fish may have trouble assimilating the fluid. Return rates for OTC and control-group fish were nearly the same for the 1983 releases. Injection doses also were the same for both years. Releases from future OTC experiments will carry a proportionately smaller dosage of OTC than that of the 1982 and 1983 releases.

Recoveries of OTC releases confirm the absorption of OTC during the formation of new bone on the otolith. The longest at-large period for an OTC-injected fish is just under five years. It was tagged in May 1982 on the Masset grounds and was recovered in the same area during June, 1987. During that period, the fish grew from 67 cm to 79 cm. A surface reading of the otolith estimated its age to be 13 years old. Although the presence of OTC was weak, growth adjacent to the mark suggests that four rings are present. This is consistent with the time at large for this fish.

No recoveries from the 1982 Area 3B releases were recorded in 1987. Several 1983 Area 2B and 3A releases recovered in 1987 show excellent OTC marks and three complete growth rings following completion of OTC absorption.

Some degree of difficulty was encountered while surface aging the small, thick otoliths. Near the edge, the rings become stacked resembling split ring growth. Examination of these otoliths by the break-and-burn method may be useful in eliminating this problem.

TABLE 10.
Pacific halibut tag recoveries[1] for an age validation study, 1982-1987.

			OTC Group Recoveries						
Release Year	**Area**	**No. Tagged**	**1982**	**1983**	**1984**	**1985**	**1986**	**1987[2]**	**Totals**
1982	2A	111	2(2)	1(0)	4(2)	1(1)	3(1)	3(2)	14(8)
	3B	459	1(0)	1(1)	1(1)	2(1)	2(1)	0(0)	7(4)
1983	2B	765	—	28(19)	28(20)	24(12)	17(10)	21(17)	118(78)
	3A	456	—	2(0)	15(7)	20(7)	9(5)	2(2)	48(21)
Totals		1791	3(2)	32(20)	48(30)	47(21)	31(17)	26(21)	187(111)

			Control Group Recoveries						
Release Year	**Area**	**No. Tagged**	**1982**	**1983**	**1984**	**1985**	**1986**	**1987[2]**	**Totals**
1982	2B	69	1(1)	1(1)	11(6)	8(4)	2(0)	2(1)	25(13)
	3B	287	1(1)	3(1)	5(2)	4(0)	0(0)	0(0)	13(4)
1983	2B	627	—	29(15)	16(10)	25(12)	15(6)	5(2)	90(45)
	3A	472	—	2(1)	21(12)	24(11)	14(7)	1(1)	62(32)
Totals		1455	2(2)	35(18)	53(30)	61(27)	31(13)	8(4)	190(94)

[1]Recoveries having otoliths are in parentheses.
[2]Preliminary data

APPENDICES

The tables in Appendix I provide preliminary catch and catch-per-unit-effort (CPUE) statistics for 1987. The regulatory areas delineated in these tables are those employed for the 1987 fishery and differ from the areas used in earlier reports. Catch-per-unit-effort data have been standardized for changes in hooks and for area differences in catchability. The standardization procedures are reported in Scientific Report 71 and the 1984 Annual Report. Copies of the tables in metric units and round (live) weight are available on request. Round weight can be calculated by multiplying the dressed weight by a factor of 1.33.

The table in Appendix II provides data on ex-vessel price of halibut. The table in Appendix III shows abundance and average size at each age by region of sampling.

APPENDIX I.
Catch statistics for 1987.

Table 1. Commercial halibut fishery catch (thousands of pounds) in 1987 by country, statistical area, region, and regulatory area.

Table 2. Estimates of Pacific halibut catch per unit effort (CPUE) by IPHC regulatory subarea 1975-1987. Estimates are standardized for area differences in catchability and for the use of circle hooks.

Table 3. Commercial Pacific halibut landings by port and country (in thousands of pounds) 1987.

APPENDIX II.
Historical landings and value, 1929-1987.

Annual landings of Pacific halibut, value (U.S. dollars), and calculated ex-vessel price, 1929-1987.

APPENDIX III.
Age, size, and sex composition data, 1987.

Table 1. Commercial landings of Pacific halibut in numbers, catch per unit effort (CPUE) in number per 10,000 skates, and average weight in pounds (dressed, head-off) at age by regions, 1987.

APPENDIX I.

TABLE 1.

Commercial halibut fishery catch (thousands of pounds) in 1987 by country, statistical area, region, and regulatory area.

Country	Statistical Area	Catch	Region	Catch	Regulatory Area	Catch
United States	00-03	261	Columbia	261	2A	592
	04	74	Vancouver	1,099		
	05	257				
Canada	06	313			2B	12,246
	07	194				
	08	261				
	09-O	271	Charlotte			
	09-I	976	Outside	2,274		
	10-O	152	Inside	9,204		
	10-I	1,349	Total	11,478		
	11-O	166				
	11-I	2,141				
	12-O	175				
	12-I	1,589				
	13-O	1,510				
	13-I	3,149				
United States	14-O	197				
	14-I	377				
	15-O	1,024				
	15-I	724	Southeastern			
	16-O	1,384	Outside	4,269	2C	10,685
	16-I	2,330	Inside	6,416		
	17-O	1,070	Total	10,685		
	17-I	972				
	18S-O	594				
	18S-I	2,013				
	18W	578				
	19	292				
	20	651	Yakutat	3,062		
	21	467				
	22	316				
	23	758			3A	31,316
	24	2,097				
	25	5,058				
	26	8,694	Kodiak	28,254		
	27	6,847				
	28	5,558				
	29	2,142				
	30	1,858	Chirikof	4,537		
	31	537			3B	7,758
	32	2,297				
	33	653				
	34	271				
	35	966	Shumagin	5,627		
	36	618				
	37	316				
	38	506				
	39	-			4	6,885
	40	42	Aleutian	811		
	41	346				
	42+	423				
			Bering Sea	3,668		

APPENDIX I.

TABLE 2.
Estimates of Pacific halibut catch per unit effort (CPUE) by IPHC regulatory subarea, 1975-1987. Estimates are standardized for area differences in catchability and for the use of circle hooks.

	IPHC Regulatory Area						
Year	**2A**	**2B**	**2C**	**3A**	**3B**	**4**	**Total**
1975	130.6	148.7	146.8	145.3	149.3	210.7	147.5
1976	71.7	116.7	116.0	131.4	142.2	184.2	124.8
1977	182.2	135.3	124.3	134.6	161.3	176.2	138.5
1978	85.5	138.0	155.1	171.9	116.4	166.6	155.1
1979	110.0	105.8	220.8	189.0	80.8	146.1	159.7
1980	82.0	143.7	218.4	260.6	249.5	124.2	204.0
1981	107.6	175.7	273.6	250.8	294.6	236.8	231.5
1982	101.6	176.7	355.9	274.1	300.7	172.5	252.5
1983	102.1	180.5	342.9	349.6	335.5	112.1	273.7
1984	101.8	188.8	328.5	412.8	353.1	193.6	298.4
1985	87.5	176.5	354.1	401.2	420.1	296.4	309.6
1986	105.9	154.7	296.4	411.9	322.4	304.6	291.7
1987	50.3	157.9	244.5	437.0	329.9	276.4	275.8

APPENDIX I.

TABLE 3.
Commercial landings of Pacific halibut by port and country (in thousands of pounds), 1987.

Port	Canada	United States	Total
California & Oregon	-	736	736
Seattle	80	1,810	1,890
Bellingham	654	1,643	2,297
Misc. Washington	1,157	1,530	2,687
Vancouver	5,008	-	5,008
Misc. So. B.C.	1,819	-	1,819
Namu	95	-	95
Prince Rupert	3,131	565	3,696
Misc. No. B.C.	231	-	231
Ketchikan	71	901	972
Wrangell	-	742	742
Petersburg	-	2,516	2,516
Juneau	-	415	415
Sitka	-	3,279	3,279
Pelican	-	652	652
Misc. SE Alaska	-	2,189	2,189
Kodiak	-	17,036	17,036
Port Williams	-	-	-
Seward	-	4,201	4,201
Misc. Central Alaska	-	19,021	19,021
Total	12,246	57,236	69,482

APPENDIX II.

Annual landings of Pacific halibut, value (U.S. dollars), and calculated ex-vessel price, 1929-1987.

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				
1930	49,492	.10	4,949	1960	71,605	.16	11,457
1931	44,220	.07	3,095	1961	69,274	.21	14,548
1932	44,454	.04	1,778	1962	74,862	.30	22,459
1933	46,795	.06	2,808	1963	71,237	.21	14,960
1934	47,546	.06	2,853	1964	59,784	.23	13,750
1935	47,343	.07	3,314	1965	63,176	.32	20,216
1936	48,923	.08	3,914	1966	62,016	.34	21,085
1937	49,539	.08	3,963	1967	55,222	.23	12,701
1938	49,553	.07	3,469	1968	48,594	.23	11,177
1939	50,903	.07	3,563	1969	58,275	.38	22,144
1940	53,381	.09	4,804	1970	54,938	.37	20,327
1941	52,231	.10	5,223	1971	46,654	.32	14,929
1942	50,388	.15	7,558	1972	42,882	.64	27,446
1943	53,699	.19	10,203	1973	31,740	.74	23,488
1944	53,435	.15	8,015	1974	21,306	.70	14,914
1945	53,395	.15	8,009	1975	27,616	.89	24,577
1946	60,266	.17	10,245	1976	27,535	1.26	34,644
1947	55,700	.17	9,469	1977	21,868	1.31	28,587
1948	55,564	.17	9,446	1978	21,988	1.70	37,424
1949	55,025	.17	9,354	1979	22,527	2.13	48,064
1950	57,234	.23	13,164	1980	21,866	.99	21,668
1951	56,045	.17	9,528	1981	25,732	1.02	26,223
1952	62,262	.19	11,830	1982	29,008	1.09	31,560
1953	59,837	.15	8,976	1983	38,384	1.13	43,534
1954	70,583	.17	11,999	1984	44,970	0.75	33,698
1955	57,521	.14	8,053	1985	56,113	0.89	49,884
1956	66,588	.22	14,649	1986	69,632	1.44	100,270
1957	60,854	.17	10,345	1987	69,482	1.58	109,782
1958	64,508	.21	13,547				
1959	71,204	.19	13,529				

APPENDIX III.

TABLE 1.

Commercial landings of Pacific halibut in numbers, catch per unit effort (CPUE) in number per 10,000 skates, and average weight in pounds (dressed, head-off) at age by regions, 1987.

	Columbia			Vancouver			Charlotte Outside		
Age	Catch	CPUE	Ave Wt	Catch	CPUE	Ave Wt	Catch	CPUE	Ave Wt
1	0	0	0.0	0	0	0.0	0	0	0.0
2	0	0	0.0	0	0	0.0	0	0	0.0
3	0	0	0.0	0	0	0.0	0	0	0.0
4	0	0	0.0	0	0	0.0	0	0	0.0
5	0	0	0.0	0	0	0.0	0	0	0.0
6	104	249	8.7	298	245	10.1	559	353	9.7
7	468	1122	11.6	1468	1207	12.0	3037	1920	12.1
8	1819	4360	13.2	4283	3520	15.2	8905	5629	15.3
9	2547	6105	15.8	5307	4362	18.8	11420	7219	18.5
10	2443	5856	18.9	7582	6232	21.9	16076	10162	22.3
11	1715	4111	22.3	5807	4773	27.3	12357	7811	26.8
12	936	2244	31.2	3396	2791	32.4	7371	4659	31.6
13	468	1122	35.4	2896	2380	37.3	5808	3671	37.6
14	260	623	69.1	2213	1819	39.5	4490	2838	39.2
15	104	249	85.2	1310	1077	47.5	2894	1829	46.5
16	104	249	62.2	654	538	64.5	1443	912	60.5
17	156	374	101.0	708	582	46.4	1529	966	44.9
18	104	249	111.0	542	446	64.3	986	623	67.2
19	0	0	0.0	341	280	50.5	763	482	51.5
20	0	0	0.0	469	386	79.6	849	537	77.3
21+	0	0	0.0	499	410	110.2	1008	637	105.8
Tot	11228	26913	23.3	37774	31049	29.1	79493	50248	28.6
	Av Len 98.7, Av Age 10.1			Av Len 106.5, Av Age 11.2			Av Len 106.0, Av Age 11.2		
	#Oto's 216, #Aged 216			#Oto's 1243, #Aged 1030			#Oto's 1243, #Aged 1030		

	Charlotte Inside			SE Alaska Outside			SE Alaska Inside		
Age	Catch	CPUE	Ave Wt	Catch	CPUE	Ave Wt	Catch	CPUE	Ave Wt
1	0	0	0.0	0	0	0.0	0	0	0.0
2	0	0	0.0	0	0	0.0	0	0	0.0
3	0	0	0.0	0	0	0.0	0	0	0.0
4	263	36	1.8	0	0	0.0	0	0	0.0
5	418	57	11.7	108	70	5.5	0	0	0.0
6	4483	611	10.8	39	25	11.8	280	99	11.9
7	26027	3546	12.4	1362	885	11.9	1801	636	14.7
8	48979	6672	15.5	6490	4216	16.1	10071	3558	15.7
9	58697	7996	19.4	12058	7833	17.9	17368	6135	18.1
10	75071	10227	23.7	21710	14104	22.3	38114	13464	21.9
11	47444	6463	27.0	21422	13917	27.7	31482	11121	26.6
12	30824	4199	33.1	17033	11065	34.1	26835	9480	31.8
13	19874	2707	38.1	13248	8607	40.9	25583	9037	38.0
14	12667	1726	39.8	9973	6479	46.5	18988	6708	40.7
15	8079	1101	47.0	7792	5062	48.4	13102	4628	43.2
16	5531	753	52.2	5408	3513	60.3	8139	2875	42.0
17	5008	682	53.1	2679	1740	61.0	5080	1795	50.7
18	1880	256	81.0	2750	1787	60.8	2485	878	50.0
19	1272	173	72.4	1209	785	71.8	2048	723	56.9
20	1350	184	62.9	693	450	84.9	955	337	60.7
21+	3089	421	98.2	684	444	127.2	2591	915	68.0
Tot	351012	47817	26.1	124659	80984	34.2	204922	72390	31.3
	Av Len 103.2, Av Age 10.4			Av Len 112.5, Av Age 12.0			Av Len 110.1, Av Age 12.1		
	#Oto's 4036, #Aged 3398			#Oto's 2266, #Aged 1697			#Oto's 2290, #Aged 1717		

(continued)

APPENDIX III.

TABLE 1.

Commercial landings of Pacific halibut in numbers, catch per unit effort (CPUE) in number per 10,000 skates, and average weight in pounds (dressed, head-off) at age by regions, 1987.

	Yakutat			Kodiak			Chirikof		
Age	Catch	CPUE	Ave Wt	Catch	CPUE	Ave Wt	Catch	CPUE	Ave Wt
1	0	0	0.0	0	0	0.0	0	0	0.0
2	0	0	0.0	0	0	0.0	0	0	0.0
3	0	0	0.0	0	0	0.0	0	0	0.0
4	0	0	0.0	0	0	0.0	0	0	0.0
5	20	23	9.9	186	35	9.9	0	0	0.0
6	89	104	16.0	816	155	16.1	0	0	0.0
7	2307	2689	16.9	21262	4047	16.9	1593	1493	18.3
8	5421	6318	20.5	49879	9495	20.5	6952	6514	20.0
9	9129	10640	26.3	83815	15954	26.3	13119	12292	23.4
10	14473	16868	32.0	132896	25297	32.0	19542	18310	28.7
11	12667	14763	38.4	116512	22178	38.4	19987	18727	36.1
12	9841	11470	46.3	90612	17248	46.3	15782	14787	46.4
13	7641	8906	52.3	70361	13393	52.3	12424	11641	45.3
14	5549	6467	57.4	51035	9715	57.3	8292	7769	54.1
15	2756	3212	67.1	25280	4812	67.1	5975	5598	61.4
16	1747	2036	71.6	16093	3063	71.6	2636	2470	71.1
17	868	1012	78.4	7977	1518	78.5	1751	1641	63.1
18	748	872	85.5	6882	1310	85.4	690	646	93.9
19	284	331	117.2	2611	497	117.2	1621	1519	55.9
20	236	275	90.4	2164	412	90.4	475	445	74.3
21+	342	399	148.6	3165	602	148.8	1545	1448	115.9
Tot	74119	86386	41.3	681547	129734	41.3	112385	105298	40.4
	Av Len 119.4, Av Age 11.3			Av Len 119.4, Av Age 11.3			Av Len 118.6, Av Age 11.7		
	#Oto's 4686, #Aged 3505			#Oto's 4686, #Aged 3505			#Oto's 2642, #Aged 2025		

	Shumagin (3B)			Aleutians			Bering Sea		
Age	Catch	CPUE	Ave Wt	Catch	CPUE	Ave Wt	Catch	CPUE	Ave Wt
1	0	0	0.0	0	0	0.0	0	0	0.0
2	0	0	0.0	0	0	0.0	0	0	0.0
3	0	0	0.0	0	0	0.0	0	0	0.0
4	0	0	0.0	0	0	0.0	0	0	0.0
5	0	0	0.0	0	0	0.0	198	165	3.8
6	0	0	0.0	0	0	0.0	51	43	9.3
7	479	341	10.4	0	0	0.0	254	212	9.8
8	4666	3323	20.5	271	607	21.3	4090	3409	17.5
9	11600	8262	21.6	1099	2462	19.4	10891	9078	21.5
10	36205	25787	31.9	3648	8174	19.2	26737	22286	25.8
11	31989	22784	34.3	5872	13157	23.6	17164	14307	26.9
12	14548	10362	44.5	2614	5857	26.0	12425	10357	37.9
13	10345	7368	54.3	2747	6155	31.3	8035	6698	40.9
14	8739	6224	66.0	2984	6686	35.9	9398	7834	50.5
15	6209	4422	74.0	1492	3343	41.7	4402	3669	53.8
16	2789	1986	51.4	1369	3067	40.3	3074	2562	43.8
17	2328	1658	78.9	982	2200	48.5	2469	2058	51.9
18	1429	1018	88.0	391	876	68.4	1109	924	76.3
19	499	355	51.4	412	923	60.0	1237	1031	70.7
20	513	365	100.5	422	946	57.8	894	745	69.8
21+	1589	1132	153.1	1109	2485	67.9	2243	1870	87.8
Tot	133927	95390	42.0	25411	56937	32.0	104669	87246	35.0
	Av Len 119.8, Av Age 11.6			Av Len 110.5, Av Age 13.0			Av Len 116.6, Av Age 11.9		
	#Oto's 653, #Aged 526			#Oto's 251, #Aged 186			#Oto's 1108, #Aged 1043		

(continued)

APPENDIX III.

TABLE 1.

Commercial landings of Pacific halibut in numbers, catch per unit effort (CPUE) in number per 10,000 skates, and average weight in pounds (dressed, head-off) at age by regions, 1987.

	Area 2A			Area 2B			Area 2C		
Age	Catch	CPUE	Ave Wt	Catch	CPUE	Ave Wt	Catch	CPUE	Ave Wt
1	0	0	0.0	0	0	0.0	0	0	0.0
2	0	0	0.0	0	0	0.0	0	0	0.0
3	0	0	0.0	0	0	0.0	0	0	0.0
4	0	0	0.0	256	26	1.8	0	0	0.0
5	0	0	0.0	407	42	11.7	108	25	5.5
6	236	261	8.7	5201	531	10.6	319	75	11.9
7	1061	1176	11.6	29735	3034	12.4	3163	740	13.5
8	4123	4569	13.2	60543	6177	15.5	16560	3876	15.9
9	5773	6398	15.8	73453	7495	19.2	29425	6886	18.0
10	5537	6136	18.9	96150	9811	23.3	59823	14001	22.0
11	3887	4308	22.3	63894	6519	27.0	52902	12381	27.1
12	2121	2351	31.2	40505	4133	32.8	43865	10266	32.7
13	1061	1176	35.4	27831	2840	37.9	38830	9087	39.0
14	589	653	69.1	18864	1925	39.6	28960	6778	42.7
15	236	261	85.2	11961	1220	46.9	20893	4890	45.1
16	236	261	62.2	7429	758	54.9	13547	3170	49.3
17	354	392	101.0	7055	720	50.7	7759	1816	54.3
18	236	261	111.0	3319	339	74.4	5235	1225	55.7
19	0	0	0.0	2314	236	62.6	3256	762	62.5
20	0	0	0.0	2599	265	70.4	1648	386	70.8
21+	0	0	0.0	4477	457	101.1	3276	767	80.4
Tot	25448	28203	23.3	456046	46532	26.8	329570	77130	32.4

Area 2A	Area 2B	Area 2C
Av Len 98.7, Av Age 10.1	Av Len 104.0, Av Age 10.6	Av Len 111.0, Av Age 12.0
#Oto's 216, #Aged 216	#Oto's 5279, #Aged 4428	#Oto's 4556, #Aged 3414

	Area 2 Total			Area 3A			Area 3B		
Age	Catch	CPUE	Ave Wt	Catch	CPUE	Ave Wt	Catch	CPUE	Ave Wt
1	0	0	0.0	0	0	0.0	0	0	0.0
2	0	0	0.0	0	0	0.0	0	0	0.0
3	0	0	0.0	0	0	0.0	0	0	0.0
4	263	18	1.8	0	0	0.0	0	0	0.0
5	527	35	10.4	206	34	9.9	0	0	0.0
6	5762	386	10.7	906	148	16.0	0	0	0.0
7	34164	2289	12.5	23569	3857	16.9	2071	838	16.5
8	80547	5396	15.5	55301	9049	20.5	11618	4701	20.2
9	107396	7195	18.8	92944	15208	26.3	24719	10002	22.6
10	160996	10786	22.8	147368	24114	32.0	55747	22558	30.8
11	120228	8055	26.9	129179	21137	38.4	51977	21032	35.0
12	86394	5788	32.7	100453	16437	46.3	30330	12273	45.5
13	67877	4547	38.5	78002	12763	52.3	22770	9214	49.4
14	48591	3255	41.6	56584	9259	57.3	17031	6892	60.2
15	33280	2230	45.9	28037	4588	67.1	12184	4930	67.8
16	21279	1426	51.4	17840	2919	71.6	5425	2195	60.9
17	15159	1016	53.0	8846	1447	78.5	4080	1651	72.1
18	8747	586	63.6	7629	1248	85.4	2119	857	89.9
19	5632	377	62.5	2896	474	117.2	2120	858	54.8
20	4316	289	70.6	2400	393	90.4	987	399	87.9
21+	7874	528	92.5	3507	574	148.7	3134	1268	134.7
Tot	809088	54204	29.0	755666	123649	41.3	246312	99669	41.3

Area 2 Total	Area 3A	Area 3B
Av Len 107.1, Av Age 11.2	Av Len 119.4, Av Age 11.3	Av Len 119.4, Av Age 11.6
#Oto's 10051, #Aged 8058	#Oto's 4686, #Aged 3505	#Oto's 3295, #Aged 2551

(continued)

APPENDIX III.

TABLE 1.

Commercial landings of Pacific halibut in numbers, catch per unit effort (CPUE) in number per 10,000 skates, and average weight in pounds (dressed, head-off) at age by regions, 1987.

	Area 3 Total			Area 4 Total			All Areas		
Age	Catch	CPUE	Ave Wt	Catch	CPUE	Ave Wt	Catch	CPUE	Ave Wt
1	0	0	0.0	0	0	0.0	0	0	0.0
2	0	0	0.0	0	0	0.0	0	0	0.0
3	0	0	0.0	0	0	0.0	0	0	0.0
4	0	0	0.0	0	0	0.0	263	10	1.8
5	206	24	9.9	198	120	3.8	930	37	8.9
6	906	106	16.0	51	31	9.3	6719	267	11.4
7	25640	2987	16.9	254	154	9.8	60058	2387	14.3
8	66918	7797	20.4	4361	2649	17.7	151826	6036	17.7
9	117663	13709	25.5	11990	7284	21.3	237049	9423	22.2
10	203115	23666	31.7	30385	18460	25.1	394496	15682	27.5
11	181156	21107	37.4	23036	13995	26.1	324419	12897	32.7
12	130782	15238	46.1	15039	9137	35.9	232214	9231	40.4
13	100771	11741	51.6	10782	6550	38.5	179430	7133	45.9
14	73615	8577	58.0	12382	7522	47.0	134588	5350	51.1
15	40221	4686	67.3	5894	3581	50.7	79395	3156	57.1
16	23265	2711	69.1	4443	2699	42.7	48987	1947	59.0
17	12926	1506	76.5	3450	2096	51.0	31535	1254	62.4
18	9748	1136	86.4	1500	911	74.3	19996	795	75.5
19	5015	584	90.8	1648	1001	68.0	12296	489	74.8
20	3387	395	89.7	1316	800	65.9	9019	359	77.1
21+	6642	774	142.1	3352	2036	81.2	17866	710	108.8
Tot	1001978	116744	41.3	130080	79028	34.4	1941146	77166	35.7
	Av Len 119.5, Av Age 11.4			Av Len 114.5, Av Age 12.1			Av Len 114.2, Av Age 11.3		
	#Oto's 7981, #Aged 6056			#Oto's 1108, #Aged 1043			#Oto's 19140, #Aged 15157		

(concluded)

PUBLICATIONS

The Commission publishes three serial publications — Annual Reports, Scientific Reports, and Technical Reports — and also prepares and distributes regulation pamphlets and information bulletins. Items produced during 1987 by the Commission and staff are shown below. A list of all Commission publications is shown on the following pages. Commission materials are available upon request free of charge.

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3. Determination of the chlorinity of ocean waters. Thomas G. Thompson and Richard Van Cleve. 14 p. (1930).
4. Hydrographic sections and calculated currents in the Gulf of Alaska, 1927 and 1928. George F. McEwen, Thomas G. Thompson, and Richard Van Cleve. 36 p. (1930).
5.* History of the Pacific halibut fishery. William F. Thompson and Norman L. Freeman. 61 p. (1930).
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43. Growth of Pacific halibut. G. Morris Southward. 40 p. (1967).
44. Regulation and investigation of the Pacific halibut fishery in 1966 (Annual Report). IPHC. 24 p. (1967).
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