International Pacific Halibut Commission

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

ANNUAL REPORT
1986

Commissioners

Sigurd Brynjolfson	Donald McLeod
Richard Eliason	Robert W. McVey
Robert Morley	George Wade

Director
Donald A. McCaughran

SEATTLE, WASHINGTON
1987

Preface

The International Pacific Halibut Commission (IPHC) was established in 1923 by a Convention between Canada and the United States for the preservation of the halibut *(Hippoglossus stenolepis)* fishery of the North Pacific Ocean and the Bering Sea. The Convention was the first international agreement providing for joint management of a marine resource. 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 commissioners are appointed by the Governor General of Canada and three by the President of the United States. The commissioners appoint the director who supervises the scientific and administrative staff. The scientific staff collects and analyzes statistical and biological data needed to manage the halibut fishery. The headquarters and laboratory are located on the campus of the University of Washington in Seattle, Washington. Each country pays one-half of the Commission's annual expenses, as required by the Halibut Convention.

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 alternatives 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 appropriate agencies of both governments.

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

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.

Cover: The U.S. vessel COMMANDER delivering a trip of halibut to a processor in Petersburg, Alaska.

International Pacific Halibut Commission
P.O. Box 95009
Seattle, Washington 98145-2009, U.S.A.

International Pacific Halibut Commission

ANNUAL REPORT 1986

Contents

Activities of the Commission

The 62nd Annual Meeting of the Commission was held in Seattle, Washington, on January 27-30, 1986, with Mr. Robert McVey presiding as chairman and Mr. Robert Morley as vice chairman. The Commission staff reviewed the 1985 Pacific halibut fishery, summarized the results of scientific investigations, and presented its regulatory proposals for the 1986 fishery. The Conference Board, representing vessel owners and fishermen, presented and discussed its regulatory proposals with the Commission. The Commission also conducted special hearings with halibut processors, northwest treaty Indian tribes, Pribilof Island fishermen, and a U.S. government representative concerned about conflicts between whales and the halibut fishery in Glacier Bay, Alaska. The Commission reviewed all proposals and adopted regulations for the 1986 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.

In other sessions, the Commission considered administrative and fiscal matters, approved research plans for 1986, and adopted the budget for fiscal year 1988-1989. Mr. Morley was elected chairman for 1986 and Mr. McVey was elected vice chairman. At the close of the meeting a news release was issued, summarizing the regulations being submitted to the governments for approval and expressing encouragement about the condition of the resource, particularly in the Gulf of Alaska.

Following the meeting, letters were sent to the governments, noting that stocks in the Gulf of Alaska are at high levels, due to the Commission's past management practices, controlled incidental catches, and favorable environmental conditions. Stocks at both ends of the range (Bering Sea, British Columbia, and the Washington-Oregon coast) are growing slowly and need further building.

The letter expressed concern for increasing incidental catches of halibut in domestic and joint venture fisheries and noted that rebuilding of the British Columbia stock relies on increased juvenile migration from the Gulf of Alaska. To reduce losses, the Commission made recommendations to the governments for implementation of specific closed areas and bycatch limitations for trawl fisheries in the Bering Sea and Gulf of Alaska. The Commission also supported observer programs on domestic vessels in both Canada and the United States.

Also included in the letter was the following recommendation to the United States Government regarding treaty rights to the Pacific halibut resource for the Makah, Quileute, Quinault, and Hoh Treaty Indian tribes:

"WHEREAS, the IPHC retains overall management authority over halibut in the Convention area, and nothing in this motion will detract from that regulatory authority; and,

WHEREAS, the following motion is based upon biological assessments provided by our staff; and,

WHEREAS, the matter of U.S. Government treaty obligations to certain northwest Indian tribes is a U.S. domestic matter, and the position of the IPHC is merely to facilitate the accommodation thereof;

THEREFORE, in 1986, the Commission recommends that the Government of the United States take regulatory action pursuant to domestic law and separate from the Commission's action to provide for any special obligations that government perceives it may have to those of its northwest Indian tribes with historic treaties containing fishery provisions, in the following manner:

1. That Area 2A-1, as defined in the 1985 Commission regulations, be expanded to include those convention waters within U.S. jurisdiction between the U.S./Canada border and Pt. Chehalis, Washington;

2. That 50,000 pounds of the total Area 2A quota of 550,000 be suballocated to the northwest treaty tribes, regardless of where those fish are taken in Area 2A convention waters;

3. That the commercial fishing season for the northwest treaty tribes in Area 2A-1 open on April 30, 1986, and close when the 50,000 pound quota is taken, or October 31, 1986, whichever occurs first;

4. That all fish taken during the special season in No. 3 above will count toward the quota of 50,000 pounds regardless of whether they are sold;

5. That no fish taken during the special season outlined above will be caught on gear other than hook and line gear;

6. That the minimum size limit for fish to be sold will be 32 inches (head on);

7. That after attainment of the quota, northwest treaty tribal fishermen will be allowed to retain up to two halibut per day for personal use only until such time as the non-treaty personal use fishery in Area 2A closes."

A list of reports published by the Commission staff during 1986 is appended to this Annual Report. Several documents were also prepared at the request of the governments. Further, the staff was directly involved in the development of fisheries management plans for the U.S. North Pacific Fishery Management Council.

Expenditures during the 1985-86 fiscal year (April through March) were $1,781,741 (U.S.). The Commission expenses were shared equally by both governments as required by the Halibut Convention.

Director's Report

The 1986 halibut catch was the fifth largest and the highest valued, approximately $100 million, in the history of the fishery. The resource is in excellent shape and is capable of maintaining a high yield for the present time. The stocks in the southern part of the range are improving, as the catch in British Columbia has increased from 5.6 million pounds in 1980 to 11.2 million pounds in 1986. Further rebuilding of these stocks is one of the Commission's goals. In general, however, the stocks and yields are excellent and the industry is benefiting from it.

It is reasonable to ask, "What problems exist in the fishery?" The answer to that question is many fold, all caused by too much fishing effort! The Commission is unable to keep the catches close to the catch limits, early and late fishing is widespread, there is wastage from gear abandoned at the end of fishing periods, the quality of the product has deteriorated, short seasons do not allow orderly processing, and the short intense fishing periods, often in poor weather, are dangerous for fishermen. The excess effort is mainly a U.S. problem, where the number of vessels fishing has increased from 2,661 in 1980 to 3,425 in 1986. In contrast, the Canadian fleet has grown from 371 active vessels in 1980 to 416 active vessels in 1986; the fleet is restricted by the Canadian government to a maximum of 433 vessels. The social and economic problems associated with the overcapitalized fleet in the U.S. do not fall within the Commission's mandate. However, when the excess effort interferes with our ability to effectively manage, the Commission must take an active role in formulating corrective measures. The Commission has asked the U.S. Government to enact a system of effort control in the fishery, but at this time nothing has been initiated and unless the political climate changes nothing is likely to be done in the near future. Therefore, the responsibility to develop alternative methods to bring order and rational harvesting back into the fishery lies with the Commission staff.

A series of very short openings was recently tried, with some success. Several short openings tend to spread the catch over a more extended season and helps in incrementally reaching the catch limits. Unfortunately, the short openings did not solve all the problems. Many fishermen still fail to properly dress fish in the race to catch as much as possible in the limited fishing time. More gear is often set than can be hauled during the legal time, and fishermen either fish illegally or cut and discard the gear at the closing time, creating wastage by leaving fish on the gear to die. The U.S. fleet is now able to catch at least 12 million pounds in a 24-hour opening, which does not allow the Commission to adjust the length of the opening and regulate the fishery harvest near the catch limit.

With no reduction in effort the Commission staff believes the only mechanism available to solve these problems is a trip limit, i.e., to limit the number of pounds caught by each vessel in each opening. The vessels could be grouped by size classes so that vessels of differing sizes would maintain their average catch proportion. The catch limits could be constructed by setting the number of openings, proportion the catch by the number of openings, and compute the trip limits to achieve the desired catch for each opening. The trip limits in the final opening could be adjusted to precisely achieve the catch limit. Each opening might be several days long, allowing a safer and less intense fishery, and providing time to properly handle the catch to insure high quality. The incentive for cheating would be removed and wastage would be all but eliminated. Some will argue that the good fishermen will be penalized, but to achieve proper management of the resource and to guarantee a superior product to the consumer, this cost may be necessary. Where there is little or no enforcement on the high seas at the present time, the enforcement activity will now more effectively take place on shore to ensure fishermen comply with their designated trip limits.

Initially, the trip limits could be put in place only on the last opening, but this only solves the catch limit problem. The Commission staff feels that the only option presently available to bring a rational regime back into the fishery is a full trip limit scenario. We believe that with the assistance of the fishing industry, this is an achievable goal.

Regulations for 1986

REGULATORY PROPOSALS

The Commission received regulatory proposals for the 1986 halibut fishery from fishermen, vessel owners, processors, government agencies, treaty Indian Tribes from Washington state, and the Commission's scientific staff. A summary of all proposals and their source was distributed to all interested groups prior to the Annual Meeting.

At the Annual Meeting, the staff recommended a total catch of 70.75 million pounds for 1986, 15.0 million pounds more than the catch limit in 1985, and 14.64 million pounds more than the catch in 1985. The staff recommended a 22.5 million pound catch limit for Area 2, 3.0 million pounds more than the catch limit in 1985. Within Area 2, the staff recommended allocating 0.5 million pounds to Area 2A, 10.0 million pounds to Area 2B, and 12.0 million pounds to Area 2C, based on estimates of stock biomass and productivity. In Area 3 the staff proposed a catch limit of 44.0 million pounds, 12.0 million pounds more than the 1985 catch limit. The catch limits recommended for Areas 3A and 3B were 33.0 and 11.0 million pounds, respectively. In Area 4, the staff proposed a catch limit of 4.25 million pounds, the same as the 1985 catch limit, with 1.7 million pounds allocated to Area 4A, 1.3 million pounds to Area 4B, 0.6 million pounds to Area 4C, 0.6 million pounds to Area 4D, and 50,000 pounds to Area 4E.

The staff recommended that 1986 fishing seasons be set to assure that two important biological considerations were accommodated. First, to avoid exceeding the catch limits the staff must be able to determine a daily catch rate, so appropriate closure dates can be announced in advance for each regulatory area. Second, 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. Based on the recommended catch limits for 1986 and the average catch per day observed in 1985, the staff estimated that the following number of fishing days would be required in each regulatory area: Area 2A — 24 days, Area 2B — 18 days, Area 2C — 4 days, Area 3A — 6 days, Area 3B — 7 days, Area 4A — 5 days, Area 4B — 9 days, Area 4C — 38 days, and Area 4D — 15 days. The number of days required to take the catch limit in any area would be highly dependent on fleet size and actual catch rates. No projection was made for Area 4E due to the intermittent fishing there. The staff also recommended two options for 1986 seasons that were intended to serve as a starting point for discussion within the industry.

The staff recommended that all area boundaries remain the same as in 1985, except those for Areas 4C and 4D. The proposed boundary was located at 58° N. latitude and was designed to allow greater fishing opportunity near St. Matthew Island. The staff also recommended setting a possession limit of four fish in the sport fishery to accommodate multiple-day fishing trips. The staff recommended that other regulations remain the same as in 1985.

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. They proposed that all boundaries remain the same as in 1985. The Conference Board proposed the following catch limits: Area 2A — 0.6 million pounds, Area 2B — 12.0 million pounds, Area 2C — 12.0 million pounds, Area 3A — 30.2 million pounds, Area 3B — 11.1 million pounds, Area 4A — 2.2 million pounds, Area 4B — 1.8 million pounds, Area 4C — 0.6 million pounds, Area 4D — 0.8 million pounds, and Area 4E — 50,000 pounds. The Conference Board proposed 12-day fishing periods in Area 2A, with opening dates of June 16, July 15, August 12, and September 10. In Area 2B, 9-day periods were recommended with the following closing dates: May 11, June 15, September 7, and September 27. Simultaneous fishing periods were recommended for Areas 2C, 3A, and 3B as follows: April 17-19, May 29-31, June 30-July 1, August 25-27, and September 23-25. The Conference Board also recommended that the June period only be considered if there were enough fishing days remaining for a season in August as well. The Conference Board proposed that if Area 3 did not open on June 30, that Areas 4A, 4B, and 4D open on June 30 for four days, with a second opening scheduled on July 29 for seven days in Areas 4A and 4B and 10 days in Area 4D. The Conference Board proposed that if Area 3 opened on June 30, that Areas 4A, 4B, and 4D open July 11 for four days, with a second opening August 3 for seven days in Areas 4A and 4B and 10 days in Area 4D. For Area 4C, the Conference Board recommended daily fishing periods from 0900 to 2300 hours from June 1 to September 24. The recommendation for Area 4E was to alternate two days open and one day closed from May 21 to October 29.

The Conference Board also recommended a 20,000 pound commercial quota for the Quileute, Hoh, Quinault, and Makah Tribes to be taken with hook and line gear, and a two fish per day subsistence fishery after the commercial fishery. The U.S. National Marine Fisheries Service made several proposals concerning the retrieval of fishing gear during closed periods, the retention of fishing logs, and the recording of IPHC license numbers on all fish tickets. The Halibut Association of North America supported the staff recommendation for catch limits, but recommended the following seasons: Area 2B — six day openings in mid-April, May 14-20, June 10-16, July 8-14, August 12-18, and September 9 to the attainment of the catch limit; Areas 2C, 3A, and 3B — two day openings from March 31 — April 2, April 28-30, May 29-31, and September 24 to the attainment of the catch limit.

The Commission discussed all regulatory proposals with the Advisory Group. Members of the Advisory Group in 1986 were Tom Shafer, Newport, Oregon; Robert Alverson, Dave Roy, Doug Wallick, Mark Sandvik, Robert Dignon, and William S. Gilbert, Seattle, Washington; Dave Keeling, Elmer Norman, Jim Tarkanen, John Radosevic, George Dodman, and Peter Wilson, Vancouver, B.C.; Dana Doerksen, Foster Husoy, and John Newton, Prince Rupert, B.C.; Sigurd Mathisen, Petersburg, Alaska; Pat Wood, Sitka, Alaska; Perry R. Buholm, Anchorage, Alaska; Marvin Bellamy, Homer, Alaska; Kathryn Kinnear, Kodiak, Alaska; and Mike Zacharof, St. Paul, Alaska.

The regulations recommended by the Commission were approved by the United States Secretary of State on March 31, 1986, and by the Governor General of Canada by Order in Council on July 4, 1986, and became officially effective on the latter date.

REGULATORY AREAS

Regulatory areas for the 1986 halibut fishery are shown in Figure 1. Boundary lines for the regulatory areas are the same as in 1985, with the exception of the line dividing Areas 4C and 4D. The closed area in the eastern Bering Sea was the same as in 1985 and was closed to all halibut fishing. A brief description of the regulatory areas for the 1986 halibut fishery are 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,

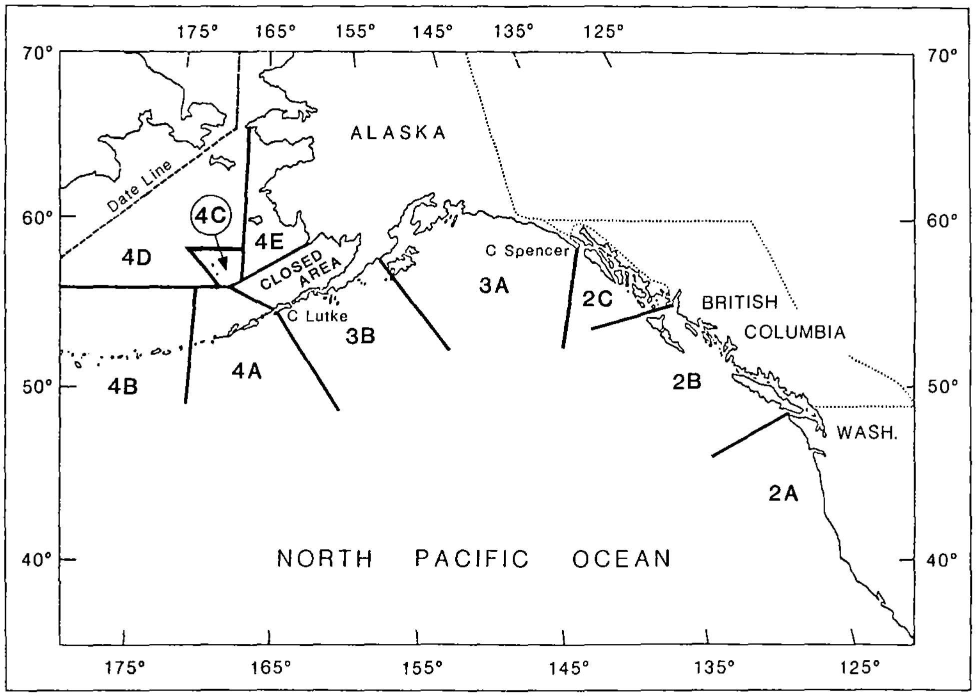

Figure 1. Regulatory areas, 1986.

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 north of the closed area and of Area 4A, east of a line extending true northwest from a point at 56°20′ N. and 170°00′ W., south of latitude 58°00′ N., and west of 168°00′ W.,
Area 4D — all waters north of Areas 4A and 4B, north and west of Area 4C, and west of 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.

CATCH LIMITS AND SEASONS

The total catch limit for all areas in 1986 was 66.4 million pounds. This was 10.65 million pounds more than the 55.75 million pound catch limit in 1985. The 1986 catch limit in Area 2 was 22.95 million pounds, 3.45 million pounds more than the catch limit in 1985. The catch limits in Regulatory Areas 2A, 2B, and 2C were 0.55, 11.2, and 11.2 million pounds, respectively. In Area 3 the catch limit was 38.4 million pounds, 6.4 million pounds more than the catch limit in 1985. Of this, 28.1 million pounds were allocated to Area 3A and 10.3 million pounds to Area 3B. In Area 4, the catch limit was 5.05 million pounds, 0.8 million pounds more than in 1985. Of this, 2.0 million pounds were allocated to Area 4A, 1.7 million pounds to Area 4B, 0.6 million pounds to Area 4C, 0.7 million pounds to Area 4D, and 50,000 pounds to Area 4E.

The opening and closing dates of the fishing periods and the catch during each period and area in 1986 are shown in Table 1. (Comparable information for 1977 through 1985 can be found in Appendix I, Table 6.) Fishing seasons in all areas in 1986 consisted of a series of fishing periods, each of specified length. When the catch limit for each area was attained or if further fishing would surpass the catch limit for an area, the area was closed to halibut fishing and subsequent fishing periods were voided. The fishing periods in all areas began and ended at 1200 hours Pacific Standard Time (PST), with the exception of the second period in Area 2C, when the fishing period began at 1800 hours PST on May 29 and closed at 0600 hours on May 31.

OTHER REGULATIONS

Regulations pertaining to minimum size limits, gear restrictions, licensing, closed areas, and sport fishing were the same as in 1985.

Table 1. Summary of the catch by the commercial fishery and the number of fishing days by fishing period and regulatory area in 1986.

Area	Catch limit (millions)	Opening Date	Closing Date	Fishing Days	Catch (000's lbs)
2A	0.55	June 16	June 28	12	336
		July 15	July 22	7	228
				19	564
*	*	Apr. 30	Oct. 31	184	17
2B	11.2	May 3	May 11	8	6,368
		June 8	June 15	7	4,857
				15	11,225
2C	11.2	Apr. 30	May 2	2	6,346
		May 29	May 31	1.5	4,265
				3.5	10,611
3A	28.1	Apr. 30	May 2	2	15,273
		May 29	May 31	2	17,517
				4	32,790
3B	10.3	Apr. 30	May 2	2	910
		May 29	May 31	2	1,802
		Aug. 25	Aug. 26	1	6,119
				5	8,831
4A	2.0	Apr. 30	May 2	2	27
		May 29	May 31	2	44
		June 30	July 3	3	3,310
				7	3,381
4B	1.7	May 29	June 1	3	—
		June 30	July 3	3	261
				6	261
4C	0.6	June 1	July 6	18**	686
4D	0.7	June 30	July 3	3	136
		July 29	Aug. 3	5	1,087
				8	1,223
4E	0.05	June 1	Aug. 11	48***	43
TOTAL	66.4				69,632

* 50,000 pounds of the Area 2A catch limit was suballocated to four Northwest Indian treaty tribes by the United States Government.

** 18 1-day openings

*** 24 2-day openings

The Fishery

COMMERCIAL FISHERY

A compilation of historical statistics published in 1977 as Technical Report No. 14, "The Pacific Halibut Fishery: Catch, Effort, and CPUE, 1929-1975" summarizes catch and effort data by statistical area, region, regulatory area, and country. Data are also given by port and country. Appendix I, Tables 1-5 in this annual report and the annual reports since 1977 are in the same format and update those statistics through 1986.

Circle hooks, which were introduced in the early 1980's, have replaced the traditional J hooks in the commercial fishery. Prior to 1983, few circle hooks were used in the halibut fishery. During 1983, many vessels switched from J to circle hooks throughout the fishing season. By 1984, the conversion to circle hooks was essentially complete. Because circle hooks improve CPUE at least two-fold (Annual Report 1984), a correction factor of 2.2 has been used to standardize circle hook CPUE to J hook CPUE for 1984 through 1986. However, these CPUE data have not been standardized for area differences in catchability (Scientific Report 71).

Catch by Regulatory Area

The total 1986 Pacific coast halibut catch was 69.6 million pounds, 3.2 million pounds greater than the catch limit and 13.5 million pounds more than was taken in 1985. In spite of a 24 percent increase in catch from the previous year, fishing seasons were shorter in all regulatory areas. A much larger fishing fleet than in 1985 and generally good stock conditions in most areas were the primary reasons for the shorter seasons and good catch. The catch by country and regulatory area for 1982 through 1986 is shown in Table 2. The catches for all years are shown by regulatory areas as defined in the 1986 Pacific Halibut Fishery Regulations to facilitate comparison of similar geographic regions.

Area 2A had a catch limit of 550,000 pounds, of which 50,000 pounds was allocated to four northwest Washington Indian treaty tribes by the United States Government. The total catch for the area was 581,000 pounds, 31,000 pounds more than the catch limit, and 88,000 pounds more than was taken in 1985. Two fishing periods totalling 19 days were required to take a catch of 564,000 pounds, a reduction of 12 fishing days from the 31 fishing days allowed in 1985 when 493,000 pounds were landed. Halibut landings for the 12-day fishing period in June and 7-day period in July were 336,000 and 228,000 pounds, respectively. The treaty tribes had a 184-day season extending from April 30 to October 31, and landed 17,000 pounds, most of which was taken during August and September.

In Area 2B, the 1986 catch was slightly above the 11.2 million pound catch limit, and 836,000 pounds more than was taken in 1985. Two fishing periods of eight days in May and seven days in June produced catches of 6.4 and 4.8 million pounds, respectively. The 15 fishing days in 1986 was a reduction of seven days from the 22 days and three fishing periods allowed in 1985.

In Area 2C, the waters of Southeastern Alaska, the 1986 catch was 10.6 million pounds, nearly 1.4 million pounds more than was taken last year, but 0.6 million pounds below the 11.2 million pound catch limit. A catch of 6.3 million pounds was taken during two days in late April and early May, and an additional 4.3 million pounds was taken during

Table 2. Catch by country and regulatory area*, 1982-1986 (in thousands of pounds).

Regulatory Area	1982	1983	1984	1985	1986
Area 2A					
U.S.	211	265	431	493	581
Area 2B					
Canada	5,538	5,436	9,054	10,389	11,225
Area 2C					
U.S.	3,500	6,398	5,847	9,207	10,611
Area 3A					
U.S.	13,530	14,112	19,971	20,852	32,790
Area 3B					
U.S.	4,800	7,751	6,503	10,888	8,831
Area 4A					
U.S.	1,168	2,509	1,053	1,711	3,381
Area 4B					
U.S.	6	1,335	1,104	1,236	261
Area 4C					
U.S.	244	415	580	620	686
Area 4D					
U.S.	4	48	392	681	1,223
Area 4E					
U.S.	7	15	35	36	43
ALL AREAS					
U.S.	23,470	32,948	35,916	45,724	58,407
Canada	5,538	5,436	9,054	10,389	11,225
Total	29,008	38,384	44,970	56,113	69,632

*Regulatory Areas defined in 1986 Pacific Halibut Fishery Regulations.

a 36-hour fishing period in late May. The 36-hour fishing period between 1800 hours on May 29 to 0600 hours on May 31 reflected the Commission's concern that a single one-day fishing period would not allow sufficient time to reach the catch limit, whereas two full days would probably result in an over-harvest of the available resource. In 1985, 9.2 million pounds were caught during four days of fishing.

Catch limits in Areas 3A and 3B were 28.1 and 10.3 million pounds, respectively, with a provision in the regulations that both areas would be closed if the catch limit of 38.4 million pounds for the combined areas was taken. The combined catch for the two areas was 41.6 million pounds, 3.2 million pounds greater than the catch limit and 9.9 million pounds more than was taken in 1985.

In Area 3A, the 1986 catch was 32.8 million pounds, 4.7 million pounds greater than the catch limit and 11.9 million pounds more than was taken the previous year. The total catch was taken during two 2-day fishing periods compared to three fishing periods totalling five days in 1985. During the first fishing period, 15.3 million pounds were caught. In allowing a full 2-day second fishing period, the Commission expected to be close to the allowable catch limit, but did not anticipate the 2.25 million pound increase in catch from period one.

In Area 3B, the 1986 catch was 8.8 million pounds, 1.5 million pounds below the catch limit and 2.1 million pounds less than was taken in 1985. Catches of 0.9 and 1.8 million pounds were taken during two 2-day fishing periods in late April-early May and during late May. A one-day season was allowed in late August, even though it was projected that the combined Area 3 catch limit would be exceeded, and resulted in a 6.1 million pound catch. In 1985, seven fishing days spread among four fishing periods produced a 10.9 million pound catch.

Catch limits in Areas 4A and 4B were 2.0 and 1.7 million pounds, respectively, with a provision in the regulations that both areas would be closed if the catch limit of 3.7 million pounds for the combined areas was taken. This provision was enacted when the combined catch for the two areas totalled 3.64 million pounds, just 60,000 pounds below the catch limit.

In Area 4A, the catch during two 2-day fishing periods in April and May totalled only 71,000 pounds, as most vessels fished in Area 3. However, during a 3-day fishing period in late June-early July, 134 vessels caught over 3.3 million pounds, exceeding the catch limit for the area by nearly 1.4 million pounds. During a comparable 3-day fishing period in 1985, 55 vessels caught 1.45 million pounds, out of a total season catch of 1.7 million pounds.

In Area 4B, no catch was reported during a 3-day fishing period in late May-early June. During the 3-day fishing period in June and July, which coincided with Area 4A, a catch of 261,000 pounds was taken by five large vessels and 16 local vessels from Atka Island. Although 1.4 million pounds of the catch limit remained, the area was closed as a result of the combined catch limit regulation with Area 4A. In 1985, five fishing periods totalling 16 days resulted in a catch of 1.2 million pounds from this area.

Area 4C had eighteen 1-day fishing periods which resulted in a ctach of 686,000 pounds, slightly over the 0.6 million pound catch limit for the area. Pribilof Island fishermen landed 121,000 pounds, just under 18 percent of the catch. The remaining 565,000 pounds was taken by 13 non-resident fishermen during 26 one-day fishing operations. Two of the non-resident vessels accounted for nearly 60 percent of the total 1986 catch limit and over 52 percent of the actual catch. In 1985, local fishermen caught 270,000 pounds and eight non-resident fishermen caught 350,000 pounds.

Area 4D had a catch limit of 0.7 million pounds and an actual catch of over 1.2 million pounds taken in two fishing periods of three and five days, respectively. The first fishing period in late June-early July produced only 136,000 pounds, as most vessels choose to fish in Area 4A. The second fishing period in late July-early August was shortened from 10 to 5 days when it became apparent that an excessive number of vessels planned to enter the area. Even five days proved excessive, as 42 vessels caught nearly 1.1 million pounds. In 1985, eight vessels caught 681,000 pounds in 17 days of fishing.

Area 4E had a 50,000 pound catch limit and an actual catch of 43,000 pounds taken during 24 2-day fishing periods. In 1985, 36,000 pounds were taken during 54 2-day fishing periods. In both years, most of the catch was taken by local residents from villages on Nelson Island.

Number of Vessels

The number of vessels, number of landings, and catch by vessel tonnage class in 1986 are given in Table 3. IPHC regulations required that all vessels fishing commercially for halibut must have an annual license issued by the Commission, but 300 vessels, or eight percent of the vessels reporting landings did not. The number of vessels was up sharply in most areas, with an overall increase in fleet size of 645 vessels (over 20 percent) from 1985.

The number of Canadian vessels authorized to fish for halibut is limited by a fixed number of "L", or halibut longline licenses, available from the Government of Canada, and thus the fleet size does not vary greatly from year to year. However, the number of vessels actually landing halibut increased nearly six percent in 1986, as more of the "L" licensed vessels exercised their right to participate in the halibut fishery.

There are no restrictions on the numbers of United States vessels that may participate in the halibut fishery, and the result has been an overall increase in fleet size over the past several years. In 1986, 3,425 vessels reported halibut landings, an increase of 22 percent from 1985, reversing a slight downward trend in the previous two years. Increased fleet participation was prevalent in all major regulatory areas. The largest change in fleet size occurred in Area 3B which increased from 385 to 570 vessels, or nearly 48 percent, between 1985 and 1986. Increases in other areas were 40 percent in 2A, 16 percent in 2C, 24 percent in 3A, and 29 percent in the five regulatory areas within Area 4.

Landings by Port

Landings in central Alaskan ports totalled 39.9 million pounds in 1986, up a substantial 9.6 million pounds from 1985, reflecting both a 7.2 million pound increase in Areas 3 and 4 catch limits and a substantial increase in fleet size. Nearly 44 percent of that catch, 17.5 million pounds, was landed at Kodiak, the leading Pacific coast halibut port, followed successively by Homer and Seward with landings of 6.7 and 5.9 million pounds of halibut, respectively. Landings in southeastern Alaska ports totalled 11.7 million pounds, with Sitka the leading port at just over 4.0 million pounds.

Washington ports handled nearly 8.0 million pounds of halibut in 1986, which included 2.6 million pounds delivered by Canadian vessels. Leading halibut ports in Canada were the greater Vancouver area with 4.0 million pounds and Prince Rupert with 3.4 million pounds. The total for Prince Rupert includes nearly 0.5 million pounds from United States vessels.

VALUE OF THE COMMERCIAL CATCH

The preliminary ex-vessel value of the 1986 catch is estimated to be nearly $100 million (U.S.), compared to $49.9 million in 1985. Fishermen received an average price of approximately $1.38 per pound, an increase of over $0.50 per pound from 1985. Final price and value will be published in a subsequent report when available.

Table 3. Number of vessels, number of landings, and catch by vessel tonnage class by regulatory area, 1986.

Vessel Category	Canada No. of Vsls.	Canada No. of Ldgs.	Canada Catch 000's Lbs.	United States No. of Vsls.	United States No. of Ldgs.	United States Catch 000's Lbs.	Total No. of Vsls.	Total No. of Ldgs.	Total Catch 000's Lbs.
AREA 2									
Unlicensed									
Trollers	1	1	<1	16	19	1	17	20	1
Setliners	52	113	876	76	154	211	128	267	1,087
Other**	—	—	109	—	—	—	—	—	109
Total	53	114	985	92	173	212	145	287	1,197
Licensed									
Unkn. tons	66	162	1,496	552	1,113	2,398	618	1,275	3,894
1-4 tons	6	27	98	273	572	715	279	599	813
5-19 tons	235	639	5,722	528	1,135	4,003	763	1,774	9,725
20-39 tons	42	91	1,953	124	251	2,044	166	342	3,997
40-59 tons	8	16	496	11	24	277	19	40	773
60+ tons	6	12	475	1	2	32	7	14	507
Total	363	947	10,240	1,489	3,097	9,469	1,852	4,044	19,709
All Vessels	416	1,061	11,225	1,581	3,270	9,681	1,997	4,331	20,906
AREA 3*									
Unlicensed									
Trollers	—	—	—	—	—	—	—	—	—
Setliners	—	—	—	155	447	468	155	447	468
Total	—	—	—	155	447	468	155	447	468
Licensed									
Unkn. tons	—	—	—	527	1,101	8,985	527	1,101	8,985
1-4 tons	—	—	—	252	551	556	252	551	556
5-19 tons	—	—	—	494	1,110	6,212	494	1,110	6,212
20-39 tons	—	—	—	252	691	12,693	252	691	12,693
40-59 tons	—	—	—	85	279	9,192	85	279	9,192
60+ tons	—	—	—	79	275	10,620	79	275	10,620
Total	—	—	—	1,689	4,007	48,257	1,689	4,007	48,257
All Vessels	—	—	—	1,844	4,454	48,726	1,844	4,454	48,726
GRAND TOTAL	416	1,061	11,225	3,425	7,724	58,407	3,841	8,785	69,632

*Includes United States vessels that fished in both Areas 2 and 3, and those that fished in Area 4.
**Deliveries of unknown origin.

SPORT FISHERY

Until the past several years, the low level of halibut recreational fishing required little regulation. Recently the fishery has grown substantially to harvest over three million pounds in 1985. The sport fishery harvest is summarized by regulatory area for 1981-1985 in Table 4. In previous years the sport harvest was reported by state and province. This revised format provides a more meaningful comparison of removals from the sport and commercial fisheries. Substantial increases in the sport harvest have occurred since 1983 in Areas 2A, 2B, and 2C, with a moderate increase in Area 3A. Catch estimates are provided by state and provincial agencies and, although estimates for 1986 are not yet available, the sport halibut harvest in 1986 was likely higher than in 1985.

Table 4. Catch by sport fishermen (thousands of pounds), 1981-1985*

Area	1981	1982	1983	1984	1985
2A	21	40	58	117	228
2B	23	66	103	124	525
2C	318	489	553	621	1,090
3A	643	682	1,287	1,331	1,492
4	—	—	—	—	10
Total	1,005	1,277	2,001	2,193	3,345

*Estimates are subject to revision

Results of 1986 Questionnaire

Recreational fishing for halibut has grown rapidly over the past 10 years largely in response to shortened recreational salmon seasons and promotion by charter operators. As a follow-up to a 1985 questionnaire, 567 IPHC sport-charter license holders were mailed a questionnaire in 1986 seeking opinions on size, bag, and possession limits and to gather information on the frequency of multiple-day fishing trips. Results of the 208 questionnaires returned are summarized in Table 5.

From the 1985 questionnaire, it was determined that charter operators were concerned about size, bag, and possession limits. Further research may be needed before recommending changes to existing sport fishing regulations. Changes to size, bag, and possession limits should reflect the future development of the fishery and avoid the confusion and constantly changing regulations that have plagued other sport fisheries.

Bag Limit — Charter operators strongly indicated the daily bag limit should not be raised. About 75 percent felt the two fish a day limit was adequate. One concern sport charter operators expressed is local depletion. Although stocks are at historically high levels in most areas, some operators stated they are having to go further from their home base to find good fishing. An increased bag limit would require additional fishing time to fill their client's limits. A minority of charter operators suggested raising the bag limit to three or four fish.

Possession Limits — A possession limit was also strongly favored by 75 percent of the charter operators. Possession limits of two, four, and six halibut were often suggested. There may have been some confusion whether the possession limit would include the bag limit or not. The driving force behind having a possession limit on halibut is to allow

State/Province		Do you support a size limit placed on sport caught halibut? YES	NO	Do you support raising the bag limit? YES	NO	Do you support a possession limit on sport caught halibut? YES	NO	Do you offer multiple day charter trips? YES	NO
Alaska	Southeast	53	25	21	56	60	16	48	28
Alaska	Central-Western	62	24	22	64	60	26	39	45
Washington		10	5	2	13	13	2	8	7
Oregon		9	15	5	19	19	4	7	17
British Columbia		5	0	1	4	5	0	5	0
Grand Total		139	69	51	156	157	48	107	97

Table 5. Results of 1986 sport-charter boat questionnaire on size, bag, and possession limits.

fishermen on multiple-day trips to catch a daily bag limit without returning to port to land the fish each day.

Multiple-Day Trips — The requirement to land a daily bag limit of halibut before taking additional halibut in succeeding days was considered by some to be too restrictive. Results from the survey indicated that 52 percent of all charter operators responding offer multiple-day trips. In Alaska, 54 percent of charter operators offer multiple-day trips, and 66 percent of the respondents from southeast Alaska claim to offer extended trips. The range of these trips typically is from two to seven days.

INCIDENTAL CATCH AND MORTALITY

Pacific halibut are inadvertently captured by fisheries targeting on other species. These include the foreign and domestic trawl fisheries for groundfish and shrimp, foreign and domestic setline fisheries for cod and sablefish, joint venture trawl and setline fisheries for groundfish, and the post fisheries for crab. The precise amount of halibut incidentally caught by these fisheries is unknown, but can be estimated from observations made at sea during the various fishing operations. The most complete set of data has been collected from the foreign and joint venture groundfish fisheries operating in the Gulf of Alaska and Bering Sea, where an observer program is conducted under the auspices of the U.S. National Marine Fisheries Service (NMFS). Observers monitor and sample the groundfish catch as well as incidentally-caught species such as halibut, salmon, king, and Tanner crab. Observer data from the other fisheries are extremely limited, so data from research surveys are used to provide estimates of incidental catch. These estimates are considered less reliable than those from the foreign fisheries and are used mainly as an indication of the relative magnitude of the incidental catch.

Historically, incidental catches of halibut were relatively small until the early 1960's, but increased rapidly due to the sudden influx of foreign fishing vessels targeting on groundfish. The total incidental catch peaked in 1965 at about 30 million pounds. Catches fluctuated slightly below that level throughout the late 1960's and early 1970's, and then dropped to a 15 million pound level during the late 1970's and early 1980's. Incidental catches totalled approximately 9.7 million pounds in 1985 and are projected to be about 9.4 million pounds in 1986.

Estimates of incidental catches from 1977 through 1986 are shown in Table 6. The projected incidental catch in 1986 of 9.4 million pounds is less than half of the most recent peak catch of 22 million pounds, which was taken in 1980. Most of this decrease has occurred in Area 3, where foreign trawl and setline fisheries have been substantially reduced. Foreign fishing has also been curtailed in Area 4, and incidental catches have been declining over the past two years in this area as well. United States fisheries are rapidly developing and will fill the void left by the foreign operations. Observer programs have yet to be developed to monitor the U.S. domestic fisheries.

Within Area 2, most of the incidental catch is taken by the Canadian trawl fishery operating in Area 2B. Incidental catches have fluctuated between 2.0 and 2.5 million pounds over the past five years. A much-reduced king crab fishery in southeastern Alaska probably accounted for a small amount of incidental catch. For 1986, incidental catches are projected at 2.3 million pounds.

In Area 3, the only foreign operation during 1986 was a setline fishery targeting on Pacific cod during February-April; there was no foreign trawl fishery in the Gulf of Alaska. In addition, domestic king crab fishing remained closed in several major areas. The resulting projected incidental catch of 1.7 million pounds for 1986 is the lowest value since the foreign fleets started fishing in the early 1960's. Domestic groundfish fisheries in 1986 were targeting primarily on sablefish, cod, and pollock. Estimates of incidental catch in these fisheries are not available, but are believed to be less than one million pounds, based on incidence rates observed in foreign fisheries targeting on these same species.

Incidental catches in Area 4 in 1986 are projected at 5.4 million pounds, one of the lowest in many years and representing a 43 percent decrease from 1980. However, incidental catches in joint venture fisheries continue to increase and are responsible for more than half of incidental catch taken in Area 4. About half of the joint venture incidental catch occurred in the yellowfin sole/flounder fishery. Domestic fisheries for flounders, cod, and pollock

Table 6. Estimates of the incidental catch (millions of pounds) of halibut by area and fishery, 1977-1986.

	Area 2			Area 3				Area 4				
Year	Foreign Trawl	Joint Venture	Other	Foreign Trawl	Foreign Setline	Joint Venture	Other	Foreign Trawl	Foreign Setline	Joint Venture	Other	Total
1977	0.3	—	3.8	3.8	0.2	—	3.1	2.5	Trace	—	0.7	14.4
1978	0.1	—	3.1	1.9	0.1	—	3.6	4.3	0.4	—	1.1	14.6
1979	0.5	—	4.0	3.4	0.3	Trace	3.9	4.5	0.2	—	1.4	18.2
1980	0.2	—	3.1	3.2	1.9	0.1	4.1	7.0	0.1	0.5	1.8	22.0
1981	0.2	—	2.7	1.8	2.2	Trace	3.6	4.3	0.2	0.4	1.8	17.2
1982	—	—	2.0	2.0	2.5	Trace	2.5	2.5	0.1	0.9	1.3	13.8
1983	—	—	2.1	1.3	4.1	0.6	1.6	2.7	0.4	0.7	1.1	14.6
1984	—	—	2.3	0.8	1.6	1.0	1.2	2.5	1.0	1.0	0.9	11.8
1985	—	—	2.5	Trace	0.4	0.5	1.1	1.7	1.3	1.7	0.5	9.7
1986*	—	—	2.3	—	0.6	0.1	1.0	1.1	0.8	2.9	0.6	9.4

*projected

which deliver to domestic processing facilities (DAP) continued to develop and estimates of incidental catch in these fisheries are not available.

Mortality

Not all incidentally-caught halibut die as a result of injuries received during capture. To provide an estimate of mortality, 25 percent of the halibut caught on foreign and DAP setlines and 50 percent of the halibut caught in DAP trawls were assumed dead. Mortality in all other fisheries was assumed to be 100 percent. Therefore, the actual loss, or mortality, is less than the incidental catch. For 1986, incidental mortality is estimated to be 7.2 million pounds, the lowest in many years. Incidental mortality has been declining since the early 1960's, as monitoring of foreign fishing operations has increased (Figure 2). Overall, the estimated incidental mortality has dropped 64 percent since 1980.

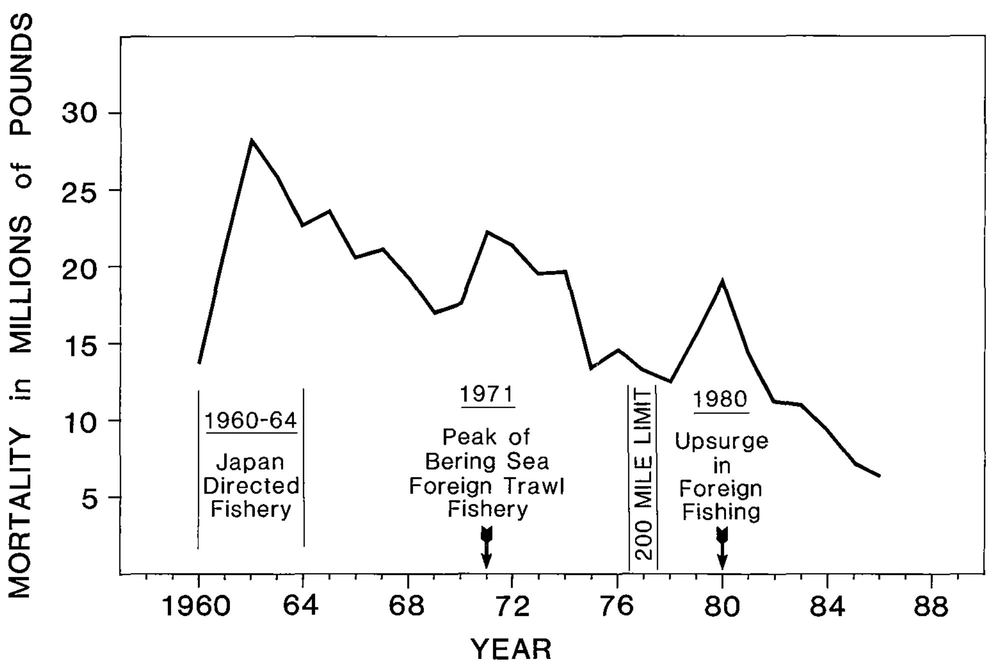

Figure 2. Trend in incidental mortality since 1960.

Summary of North Pacific Council Actions in 1986

For the 1986 foreign and domestic fisheries operating off Alaska, the U.S. North Pacific Fishery Management Council (NPFMC) adopted several regulatory measures for the purpose of controlling halibut incidental catches, or bycatch. The most important measure was the adoption of a bycatch limit for the Gulf of Alaska.

Gulf of Alaska — To control halibut bycatch in the 1986 DAP bottom trawl fishery, the NPFMC adopted a Prohibited Species Catch (PSC) limit of 3.1 million pounds (1,885 mt). Together with a PSC of 0.5 million pounds (322 mt) for joint ventures, the total halibut incidental *mortality* would be significantly below the accepted maximum mortality of 3.3 million pounds (2,000 mt) established by the Council. The PSC's were calculated from established quotas for groundfish and previously established bycatch rates from foreign and joint venture fishing in the 1980's. Using these rates and actual groundfish catches in 1986, bycatch mortality in 1986 has been estimated at 0.8 million pounds (480 mt) in the domestic and joint venture fisheries. Groundfish quotas for 1987 set by the Council could result in 2.2 million pounds (1,340 mt) of halibut mortality, based on pre-established bycatch rates. Actual incidental mortality in 1987 should be less, as not all quotas will be attained.

Concern over high mortality of king crab by domestic trawlers led to the emergency closure of several areas around Kodiak Island to bottom trawling. The closure period was February 15 through June 15, which is the crab molting period, and was in effect only for 1986. The NPFMC amended the Gulf of Alaska Groundfish Fishery Management Plan to incorporate a combination of seasonal and year-round closures at Kodiak Island in these areas for the future. The area closures have little benefit for halibut, as closing these areas will likely force bottom trawlers into areas with higher halibut density.

Bering Sea — At the January, 1986 meeting of the NPFMC, an Emergency Rule was passed placing limits on the bycatch of prohibited species by the yellowfin sole/flounder joint venture trawlers in various zones of the Bering Sea. Although the Council's proposed Rule included limits for halibut bycatch, NMFS could not justify the recommended caps as a conservation measure to the current high population level of the halibut resource. The subsequent Rule enacted for 1986 included only king and Tanner crab. More recently, the NPFMC amended the Bering Sea Groundfish Fishery Management Plan to include halibut bycatch limits. Unfortunately, the amendment provides little protection for halibut as the bycatch caps are very high, apply only to the joint venture yellowfin sole fishery, and only to a portion of the eastern Bering Sea.

Summary of Actions Taken by the State of Alaska

Concurrent with the Council's decision to close areas to bottom trawling around Kodiak Island, the State Board of Fisheries closed the corresponding state waters in these areas.

The State also began an observer program for the domestic groundfish fishery. Beginning in the fall of 1986, observers have been placed on vessels longlining for cod and bottom trawling for cod and pollock in the Kodiak area. Thus far, the observations are limited and data on halibut bycatches have not been summarized.

Population Assessment

Assessment of the Pacific halibut stock is based primarily on methods of catch-age analysis described in the 1984 Annual Report. Information used in 1986 for the assessment includes logbook catch and effort data, length frequencies obtained from port samples of otoliths and age distributions from a subsample of the otoliths, commercial landings, habitat size estimates, bottom area estimates, tag return information, and standard stock assessment surveys.

Halibut are at or near record total exploitable biomass levels, but the abundance is not uniform along the coast. Exploitable biomass is the portion of the population fully vulnerable to the fishery, and this is approximately 50 percent of the biomass of the adult age groups (age 8 and older). Comparison of current exploitable biomass with the exploitable biomass calculated to provide maximum sustainable yield (MSY) is a useful way to show area differences in stock condition (Table 7).

Biomass is greatest in the center of the range (Areas 2C, 3A, and 3B) and is significantly above MSY biomass. The extremes of the range, Areas 2A, 2B, and 4, are substantially below the biomass that produces MSY. Stocks in the Gulf of Alaska rebuilt rapidly from low levels of the late 1970's, whereas the Bering Sea and southern components have rebuilt only gradually (Table 8).

Management strategies during the 1970's and 1980's substantially restricted the commercial harvest and called for catching approximately 75 percent of the estimated annual surplus production (see below) so that the remaining production could contribute to biomass increase. As the population increased, the proportion of production to be harvested has increased. For example, the proportion of exploitable biomass allowed for commercial harvest (exploitation rate) increased from 17 percent in 1979 to 29 percent in 1986. In most areas, commercial catch and bycatch are the large majority of total removals. Area 2A, however, experienced a 40 percent removal by other sources in 1986, primarily the sport fishery. Exploitation rates using exploitable biomass are much higher than rates

Table 7. Biomass (millions of pounds) and exploitation summaries for Pacific halibut, 1986.

Area	Biomass 86	Biomass That Produces MSY[1]	Total Removals	Exploitation Rate
2A	0.9- 1.1	2.2	0.9	0.90
2B	28.5- 36.0	44.7	13.1	0.41
2C	38.2- 50.9	34.6	14.6	0.33
3A	110.1-143.4	87.4	40.9	0.32
3B	23.4- 40.0	30.5	10.7	0.34
4	8.0- 13.7	15.9	6.0	0.38

[1]Technical note: Biomass that produces MSY is calculated as Biomass 86 divided by the ratio of CEY to MSY. Biomass 86 and CEY are the midpoints of the calculated ranges for 1986. These values are preliminary.

circulated using all fish aged 8-years and older, because many of these fish have not recruited to the longline fishery.

Exploitation rates are currently highest in the areas with biomass below MSY levels (Table 7). The 0.9 exploitation rate in Area 2A seems unrealistically high in light of the sustained high commercial catches and increasing success of the sport fishery, and suggests that biomass is underestimated. However, the exploitation may be too high to allow for continued rebuilding. Estimates for Areas 2B and 4 indicates that exploitation rates are higher than in other areas, and may not allow for stock rebuilding.

The rapid abundance increases of the early and mid-1980's have apparently stopped. Exploitable biomass grew slightly (3.5 percent) in 1986 according to migratory catch-age analysis (Table 8), one of the stock assessment methods used. Only Area 3A showed a significant increase in exploitable biomass from 1985. Stable to slightly decreasing biomass estimates were obtained for other areas, suggesting that current exploitation rates may not permit further rebuilding.

A range of harvest levels is obtained from abundance estimates by using two methods: annual surplus production (ASP) and constant exploitation yield (CEY).

The ASP is a basic measure of stock productivity and is defined as the excess of biomass above what is needed to replenish the population each year due to removals from all sources of fishing mortality. If factors affecting the population and the fishery remain constant, then biomass increases when catch is held below ASP, and vice versa. The estimated total surplus in 1986 is 82 to 85 million pounds. The ASP is broken down into its four principal components in Figure 3. The sport catch is estimated from data provided by Alaska, British Columbia, Washington, and Oregon. Incidental catch of halibut occurs in many fisheries, and is estimated most accurately by the U.S. National Marine Fisheries

Table 8. Exploitable biomass estimates (millions of pounds) based on migratory catch-age analysis. Areas 3B and 4 are areas defined in 1977 regulations.

Year	Area 2A	Area 2B	Area 2C	Area 3A	Area 3B	Area 4	Total
1974	1.306	23.910	24.693	46.492	10.359	7.461	114.221
1975	1.337	24.675	23.581	50.073	11.033	7.202	117.901
1976	1.182	23.541	22.733	52.487	11.126	6.445	117.514
1977	1.007	23.166	22.931	55.922	11.352	5.834	120.212
1978	0.964	22.809	25.293	60.693	11.128	4.946	125.833
1979	0.943	22.879	27.497	64.539	13.907	5.393	135.158
1980	0.884	22.608	29.933	67.894	17.224	5.376	143.919
1981	0.769	22.164	33.690	71.885	20.848	5.088	154.444
1982	0.801	22.436	38.059	77.741	29.808	6.375	175.220
1983	0.761	24.362	43.531	87.706	31.177	6.630	194.167
1984	0.913	26.846	46.545	101.562	28.500	6.754	211.120
1985	1.040	28.069	50.129	113.927	28.134	8.131	229.430
1986	0.895	28.400	50.909	125.736	23.353	8.011	237.304

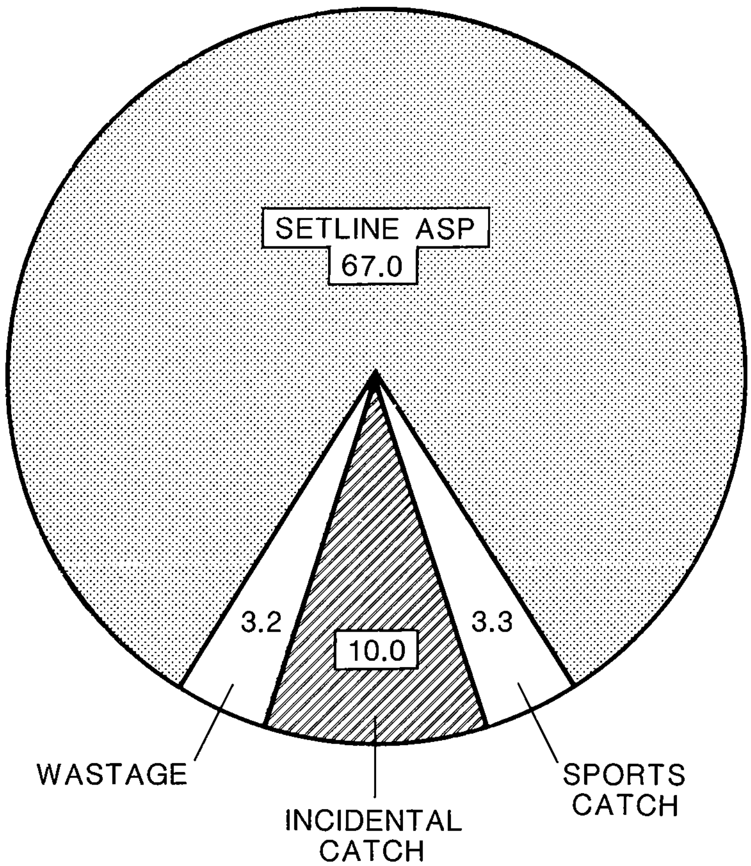

Figure 3. Pie diagram showing the breakdown of total 1986 ASP (all areas combined) into sports catch, a portion of setline wastage, incidental catch, and setline ASP. All values are in millions of pounds.

Service for joint venture and foreign fishing in U.S. waters. IPHC estimates incidental catch for other fisheries. Wastage occurs from mortality caused by lost or abandoned gear and poor handling of sublegal halibut. Estimates of wastage are imprecise, but are calculated as 6.15 percent of the catch, based on adjusted observations collected from the September, 1986 fishery in Area 3B that occurred during a severe storm. The amount of production available to the commercial fishery, labeled setline ASP on Figure 3, is calculated by subtracting these other sources of mortality from the total ASP. In principle, the entire 67 million pounds could be taken by the commercial fishery without causing stocks to decline.

The CEY is the amount of yield obtained by taking catches proportional to the estimated exploitable biomass. This concept is described in the 1984 Annual Report. Harvesting at CEY tends to move stock abundance toward MSY, and provides for more stable catches than does ASP harvest strategies. Estimates of available yield in 1986 are higher with CEY than with ASP. As with ASP, estimates of other fishing mortalities are subtracted from the total CEY value to calculate CEY for the setline fishery. A range of estimates of setline CEY is shown in Figure 4 for each regulatory area, along with median estimates for each area. The estimated total setline CEY is 70.3 million pounds and ranges from 66.8 to 75.8 million pounds.

Table 9 provides a summary of the 1986 population assessment results for the major regulatory areas. Several estimates of setline CEY and ASP were made for each subarea, and the range of estimates is presented in the table.

Abundance of adult Pacific halibut is a function of the number of young halibut that reach adulthood. Age classes of 8- and 9-year-old halibut are in high abundance, which should add support to the exploitable adult stock over the next three years as they become fully recruited into the fishery. Figure 5 illustrates the recent time trend in abundance of 8-year-old halibut for two regulatory areas since 1974. The trends show that halibut are recruiting to the Gulf of Alaska (Area 3A) in higher abundance than to British Columbia (Area 2B). Recruitment estimates for recent years are less certain than for years in the past, as indicated by the increasing standard deviations around the estimate. Estimates are most uncertain for 1986. In spite of the uncertainty, however, the trend in recruitment strongly suggests that halibut abundance will not change dramatically over the next several years. Roughly, 8-12 different ages (ages 8-18) of halibut make up the exploitable population. Future abundance will depend not only on recruitment but also on rates of fishing and natural mortality. Higher exploitation rates in recent years will tend to reduce the

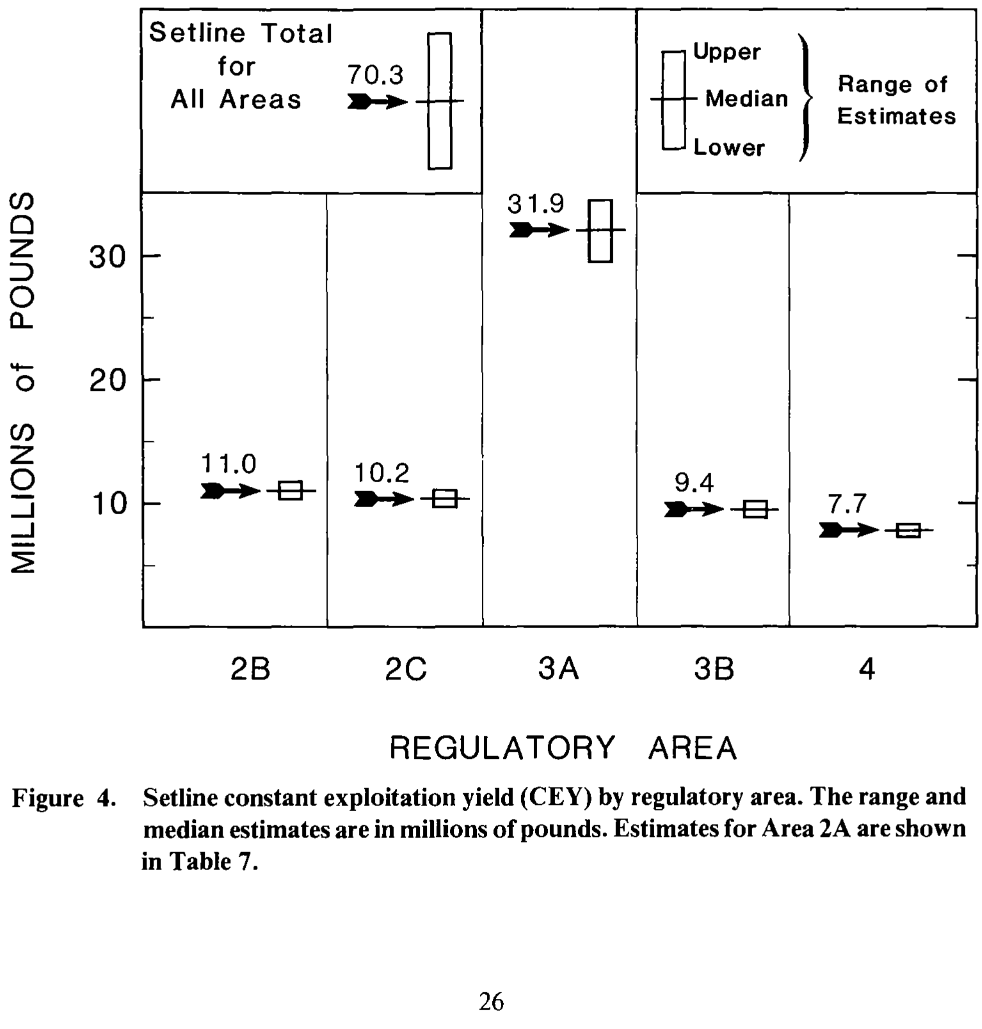

Figure 4. Setline constant exploitation yield (CEY) by regulatory area. The range and median estimates are in millions of pounds. Estimates for Area 2A are shown in Table 7.

abundance of older fish, but the outlook for the halibut resource appears good for the next several years.

Table 9. Summary of 1986 population assessment results. The estimates shown are in millions of pounds and the range of estimates corresponds to the maximum and minimum of results from three methods of catch-age analysis. Note that range for Combined is more precise than the sum of ranges from individual regulatory areas, with the exception of preferred setline CEY.

	Regulatory Area						
	2A	2B	2C	3A	3B	4	Combined
1986 Quota	0.55	11.2	11.2	28.1	10.3	5.05	66.4
1986 Catch	0.58	11.2	10.6	32.8	8.8	5.59	69.6
ASP-total annual surplus production							
Range							
Upper	0.59	14.5	14.1	46.3	13.0	9.5	84.9
Lower	0.52	11.3	13.1	35.1	6.2	4.2	82.1
Setline ASP — subtract other catches from total ASP							
Range							
Upper	0.31	12.5	10.1	38.1	11.6	8.7	68.4
Lower	0.25	9.3	9.1	26.9	4.8	3.5	65.6
Preferred Setline CEY-proportional allocation, sums to combined CEY							
Range							
Upper	0.12	11.9	11.0	34.4	10.1	8.3	75.9
Lower	0.10	10.2	9.4	29.4	8.6	7.1	64.8
Other catches							
1985 Sports	0.228	0.525	1.090	1.492	0.0	0.010	3.345
1986 Wastage	0.0	0.0	0.650	1.997	0.536	0.0	3.183
1986 Incidental	0.047	1.422	2.237	4.704	1.180	0.409	10.000
Total	0.275	1.947	3.977	8.193	1.716	0.419	16.527

Note: Wastage is half of the 12.3 percent lost or abandoned gear estimate for August in Area 3B. Incidental is approtioned into areas proportional to biomass estimates from migratory catch-age analysis.

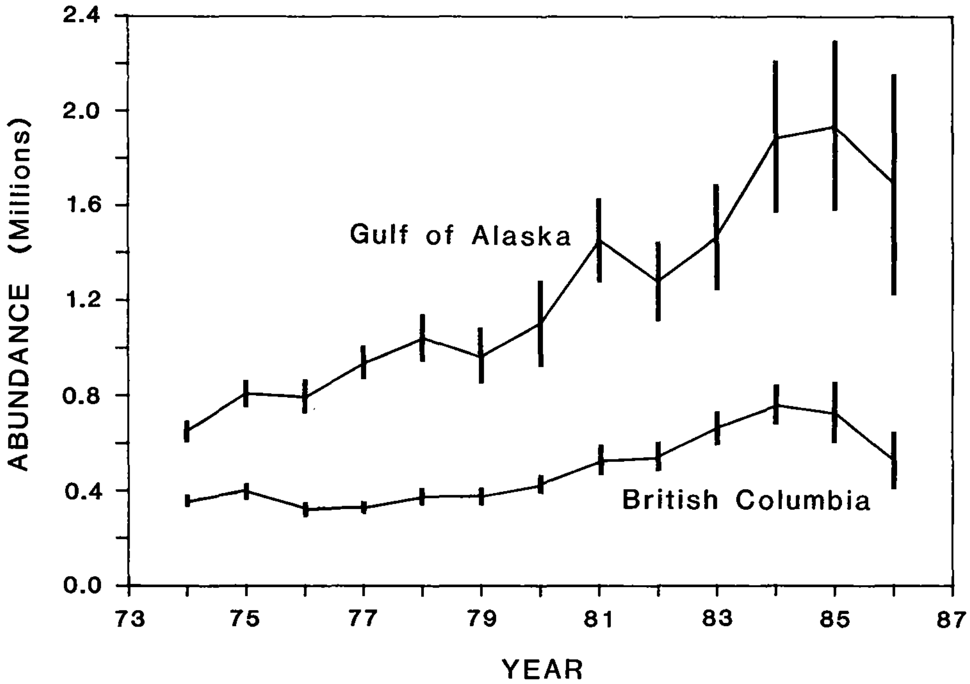

Figure 5. Estimated abundance of eight-year-old Pacific halibut for years 1974 through 1986. Standard deviation estimates are shown on vertical bars (± one SD) around mean abundance estimates.

Scientific Investigations

JUVENILE HALIBUT SURVEY

A Canadian trawler, the PACIFIC HARVESTER, was chartered for a period of 73 days for field investigations on juvenile halibut in 1986. A trawl survey has been conducted annually since the 1960's to assess changes in abundance of juvenile halibut (less than 65 cm) in the southeastern Bering Sea and in the Gulf of Alaska. Although the survey in the Bering Sea was deferred from 1983 through 1985 to permit use of the chartered trawler for other investigations, the Bering Sea survey was conducted in 1986. To compensate for the lack of data in the region historically sampled in the Bering Sea, the results of a groundfish survey conducted by NMFS in the same region have been used as a trend indicator of relative abundance of juvenile halibut. NMFS results are not directly comparable to those obtained by IPHC and must be interpreted with caution because of slight differences in the timing of the surveys and stations sampled, as well as differences in the gear used (IPHC's primary net is a 71/94 400 Eastern trawl, 90 mm mesh with an unlined codend; NMFS used a 82/112 Eastern trawl, 90 mm mesh codend with a 32 mm liner).

The Bering Sea grid index consists of lines of stations oriented in a northwesterly direction and approximately perpendicular to the Alaska Peninsula shore, with the stations and each line separated by 15 minutes of latitude and 15 minutes of longitude. The grid of index stations in the Gulf of Alaska is set along parallel north-south lines, 15 minutes of longitude apart. The stations are spaced 6 minutes of latitude apart along these lines which run from the beach to depths in excess of 50 fathoms.

The Bering Sea survey began in Bristol Bay on June 7 and progressed westward to Unimak Pass. The Gulf of Alaska survey started June 15 south of Unimak Island and proceeded in an easterly direction. The survey of each index area is scheduled so that the actual sampling period varies as little as possible from year to year. The juvenile survey was completed on July 17.

The duration of a haul at an index station is 30 minutes, but catch data are standardized to a 60-minute haul for analytical purposes. Air and surface temperatures were obtained at each station fished and a reversing thermometer was used to obtain bottom temperature.

All halibut are measured and the most viable are tagged after sex and age data have been collected from the catches. An otolith series is taken in each region and consists of five otoliths for each cm size group through 64 cm, and one thereafter for each additional five individuals in that size group. In addition, one otolith was collected from fish in each cm size group from 65 through 80 cm.

All other species are subsampled to determine the number and weight in each haul. The number, weight, and sex of all king crab caught are recorded by haul and the carapace lengths of all male king crab are measured.

Bering Sea

IPHC's survey in the Bering Sea consists of 34 stations fished with the 90 mm net on the flats in Bristol Bay and along the Alaska Peninsula to Unimak Pass.

The mean CPUE of juvenile halibut in the Bering Sea has been increasing from a low level in the early 1970's to a high level in the early 1980's (Table 10). In 1982, the CPUE was 32.8 fish per hour, the highest recorded since sampling began in the 1960's. CPUE trends during 1983-1985 are not available from IPHC data, as surveys were not conducted during this period. However, the CPUE on the 1986 survey was down significantly from previously observed levels, to 8.9 fish per hour. This CPUE is only slightly above the all-time low of the early 1970's. (The 1979 values may underestimate the abundance of juvenile halibut because of operational difficulties during the survey.) These results place the index CPUE at a 12-year low and lend support to trends observed in NMFS data, which have shown a steady decline in CPUE since 1980.

Sampling by NMFS on stations within the IPHC index region indicates a decline in CPUE in this Bering Sea region since 1980 (Table 10). Figure 6 shows the trend in the percentage of small (<40 cm) juveniles from the IPHC Bering Sea and Gulf of Alaska surveys and from NMFS survey data. The downward CPUE trend in this region since 1981

Table 10. Number of juvenile halibut (<65 cm) per 60-minute haul with 90 mm net at Gulf of Alaska and Bering Sea index regions, 1966-1986.

	Gulf of Alaska					Bering Sea	
Year	St. Elias	Chiniak	Chirikof	Unimak	Weighted Mean	IPHC	NMFS
1966	14.6	—	66.0	52.6	40.0	31.0	—
1967	12.0	29.8	119.6	27.5	42.2	16.6	—
1968	18.6	41.3	91.4	28.6	41.5	12.5	—
1969	14.9	20.5	86.6	30.7	34.8	12.8	—
1970	11.4	31.1	121.4	27.3	42.7	12.1	—
1971	7.6	46.5	51.4	33.8	31.9	14.2	—
1972	13.4	22.5	62.6	28.4	29.2	3.1	—
1973	13.4	25.7	58.0	37.4	31.1	6.6	—
1974	13.2	20.9	73.0	24.6	30.1	6.1	—
1975	9.2	20.0	32.4	22.3	19.6	11.8	—
1976	12.9	20.3	23.7	20.6	18.7	12.9	—
1977	17.0	24.6	34.9	23.6	24.0	18.9	—
1978	26.0	23.9	73.7	23.9	35.0	14.2	—
1979*	21.9	25.9	59.2	15.0	29.1	8.9	—
1980	26.3	29.0	102.9	52.0	48.8	27.2	15.7
1981	30.5	51.5	48.3	99.5	54.9	20.8	12.9
1982	26.2	21.6	67.0	34.0	35.4	32.8	12.8
1983	15.9	35.2	54.2	31.8	32.1	—	9.9
1984	35.1	37.6	69.7	31.4	42.1	—	8.8
1985	22.6	38.4	70.1	32.8	38.6	—	5.7
1986	19.4	42.6	54.6	27.8	34.2	8.9	5.4

*Values for 1979 are considered inaccurate for the estimation of CPUE.

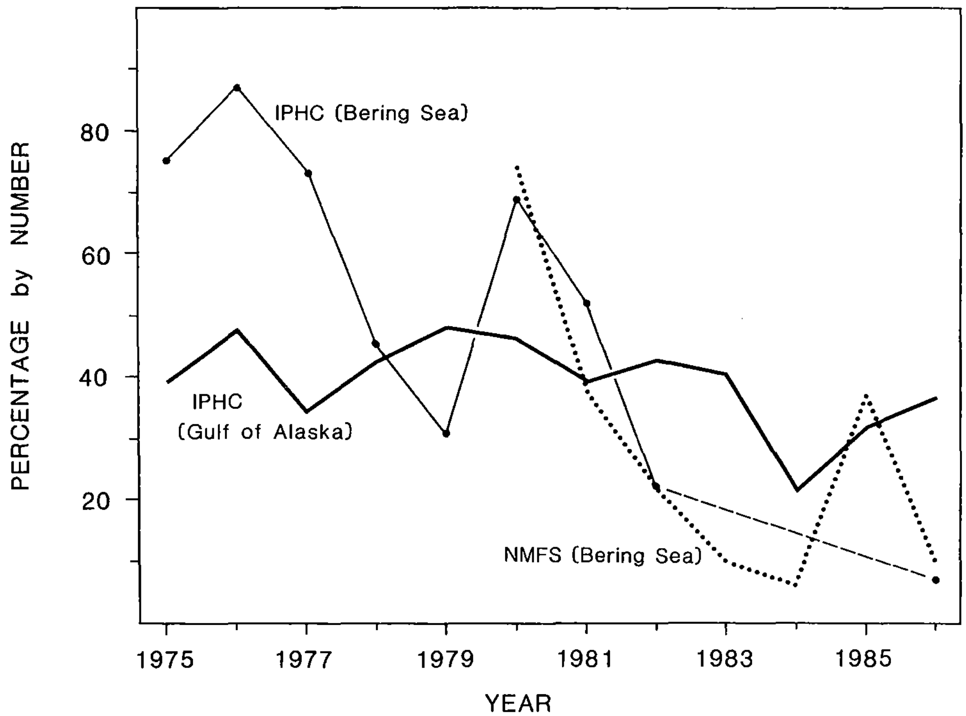

Figure 6. Proportion of the number of juvenile halibut less than 40 cm caught on IPHC trawl surveys of the Bering Sea and the Gulf of Alaska and NMFS trawl surveys of the Bering Sea.

coincides with a decline in the proportion of smaller juveniles on NMFS surveys, which had also been observed by IPHC sampling in 1981 and 1982. No such shift in the catch of small fish is apparent from the Gulf of Alaska data (Figure 6). Larger fish continued to dominate the catch in the Bering Sea since 1981 although good catches of smaller juveniles was noticed in 1985.

The severe downward trend in CPUE and the decline in the proportion of smaller fish in the Bering Sea are not observed in the Gulf of Alaska data. Perhaps it reflects the consequences of several years of poor recruitment in the Bering Sea or higher mortality inflicted by trawl fisheries operating in this region. The length-at-age data show that halibut had an average length of 35 cm at age three, 44 cm at age four, 50 cm at age five, and 58 cm at age six. (See Appendix III, Table 1.)

Gulf of Alaska

The assessment index in the Gulf of Alaska is based on 110 offshore stations in four regions: 25 stations off Unimak Island, 23 stations near Chirikof Island, 26 stations off Cape Chiniak, and 36 stations near Cape St. Elias.

The CPUE at the offshore stations is given for each region from 1966 to 1986 in Table 10. The weighted mean CPUE in 1986 was 34.2 fish per hour, lower than in 1985 and considerably less than the high recorded in 1981. The catch of juveniles in the Gulf of Alaska varies greatly from region to region and in general the region with shallow stations contributes the largest number of juveniles. Declines of 14, 15, and 22 percent, respectively, were observed in the St. Elias, Unimak, and Chirikof regions in 1986. The Chiniak region was the only one to show an increase (11 percent) in CPUE over 1985. The highest CPUE of juveniles continues to occur in the Chirikof Island index region where 55 juveniles per one-hour haul were caught in 1986.

The length-at-age information from the 1986 Gulf of Alaska index regions shows that halibut had an average length of 28 cm at age two, 36 cm at age three, 43 cm at age four, 50 cm at age five, and 56 cm at age six. Catches of two-year-old halibut were high in the Gulf of Alaska in 1985 and the data show the three-year-olds as the strongest age class in 1986. However, the catch of larger halibut (>83 cm) in the Gulf of Alaska decreased by 15 percent in 1986 but continues to be high, comprising seven percent of the catch. The catch of larger halibut increased from 3.4 percent in 1980 to 8.2 percent in 1985.

LARVAL HALIBUT SURVEY

A search for postlarval halibut in the Gulf of Alaska and Bering Sea was conducted in May and early June from the chartered trawler PACIFIC HARVESTER. The primary objectives of this project were to examine the distribution of postlarval halibut in the inside waters of southeastern Alaska, the Gulf of Alaska, and eastern Bering Sea and to collect otoliths for a study of daily growth rings of postlarval halibut from different geographic locations. Identifying the origin of the zero-age halibut found in the inside waters of southeastern Alaska and documenting the contribution of Gulf of Alaska spawning to the eastern Bering Sea stock of juveniles were secondary objectives.

The survey for postlarval halibut was divided into two cruises. The first cruise sampled the inside waters of southeastern Alaska, whereas the second cruise was conducted from Cape Spencer to the eastern Bering Sea. Between Cape Spencer and the Shumagin Islands, sampling was conducted on transects located every 70 to 100 miles, with stations extending from the shore outward. Because of the high abundance of postlarval halibut from Unimak Island westward and in the Bering Sea, the stations were picked randomly in this area. Figure 7 shows the location of each station where successful tows were made. Plankton tows were made with a single net nine square meter Tucker trawl.

Ninety-four successful plankton tows were made between May 10 and June 6, and the postlarval halibut catch by region is summarized in Table 11. Because the operation in each region was geared primarily to examine the distribution of postlarval halibut, the stations were chosen randomly and the results should be regarded as an indicator of relative differences in between regions at this time of the year. The results indicate that the abundance of postlarval halibut increases from east to west. By the beginning of June, large concentrations are found on both sides of the Alaska Peninsula and the Aleutian Islands from longitude 163°00'W. and westward, with the heaviest concentrations found in Unimak Pass. The pattern of water flow into the Bering Sea from the Gulf of Alaska through Unimak Pass, and the larval distribution observed, suggest that a large portion of the halibut population along both sides of the Aleutian Islands, and those from the Bristol Bay nursery area in the eastern Bering Sea, originate from spawning in the Gulf of Alaska. Thus, it is very likely that the Bering Sea juvenile survey which takes place from north of Unimak Island to Bristol Bay is sampling primarily juveniles spawned in the Gulf of Alaska.

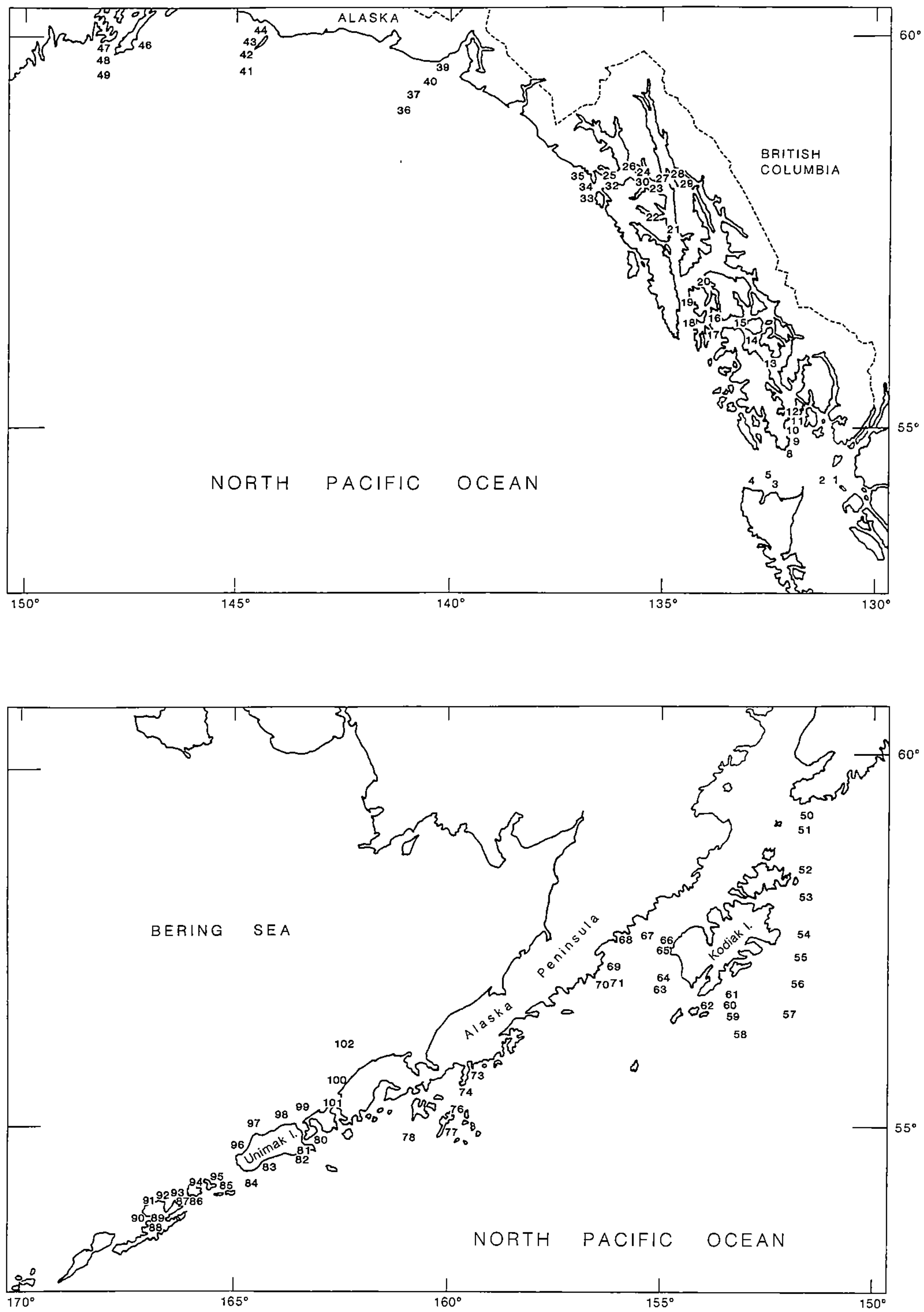

Figure 7. Station locations on the trawl survey for postlarval halibut.

Table 11. Summary of postlarval halibut catches by region sampled with the Tucker trawl net.

Location Sampled	No. of tows	No. of larvae	No. of ft. towed	No. of larvae per mile towed
Southeastern Alaska	29	4	361,810	0.07
Cape Spencer — Cape Cleare	15	13	175,940	0.45
Cape Cleare to Semidi Islands	22	170	241,613	4.28
Shumagin Islands	5	83	46,269	10.90
South of Unimak Is.-Akutan Pass	9	348	50,842	41.56
North of Unalaska Is.-Akun Is.	7	401	72,875	33.42
North of Unimak Is. and East	7	337	39,643	51.65

In general, the postlarval halibut survey in southeastern Alaska attempted to shed light on the origin of the zero-age halibut found in the inside waters of this region. Prevailing hypotheses regarding the origin of these fish are: (1) that currents transport the zero-age halibut from outside spawning grounds situated to the south; or (2) spawning actually occurs in these inside waters. Twenty-nine plankton tows were made in the inside waters of southeast Alaska and only four halibut postlarvae were captured. Twelve bottom tows for zero-age halibut were made in July, 1986 at the same time and at locations where six similar tows were made in 1985. No zero-age halibut were captured after 107 minutes of towing in 1986, compared to a catch of 55 halibut in 60 minutes of fishing in 1985. The lack of zero-age halibut in the bottom tows in 1986 is consistent with the low catch of postlarval halibut obtained in the plankton tows.

The low level of postlarval halibut and the apparent absence of zero-age halibut in this region in 1986 suggest that the currents were not favorable to the inflow of larvae from the outside spawning grounds, and that halibut spawning does not occur in the inside waters of this region. Results support Hypothesis (1) rather than Hypothesis (2) because larval halibut produced by any spawning in these inside waters should have been trapped in the numerous straits, bays, inlets and canals, thus making them susceptible to capture in the larval stage or as young-of-the-year. At this time, the origin and densities of zero-age halibut in these inside waters appears to be more closely associated with current transport rather than from local spawning. However, these conclusions may be wrong because of the difficulty in sampling the rough bottom with a trawl and the faster development of larval halibut caused by the warmer water of this region. It is possible that postlarval surveying in this region should be conducted earlier in the year.

OBSERVATIONS ON SURVIVAL OF POSTLARVAL HALIBUT

The survival study entailed holding a collection of postlarvae for a prolonged period to determine their ability to survive outside their natural environment. The object of this study was to determine the feasibility of transporting postlarval halibut to a laboratory for observation and further study. Thirty stage 10 and 11 postlarvae were held under minimal conditions in a five gallon container and their mortality rate was observed. No attempt was made to supply oxygen and keep the water at a constant temperature, nor was food made available. Conditions of the postlarvae were checked twice a day and dead halibut were removed. Half of the specimens were dead after eight hours of captivity, with the remaining halibut sustaining a 30 percent mortality every 12 hours. The experiment was terminated after 67 hours with one live halibut remaining, which was easily induced to swim around. In better conditions, these fish would likely have survived longer.

CANNIBALISM ON POSTLARVAL HALIBUT

Halibut cannibalism was observed for the first time on June 18, 1986, at two adjacent stations close to shore in the region south of Unimak Island in depths ranging from 10 to 29 fathoms. At those stations, eleven 3- and 4-year-old halibut ranging in size from 27 to 38 cm were examined for stomach contents. Twenty-eight stage 11 and 12 halibut postlarvae were found. The number of postlarvae in each stomach varied from zero to eight. Additional sampling of 15 halibut ranging in size from 40 to 79 cm at the remaining nine stations in this region and at depths ranging from 39 to 62 fathoms produced no further observation of cannibalism. No halibut predation by other species was found during a cursory examination of stomach contents of other species captured at the two stations where cannibalism had been observed. However, the cannibalism was observed within an area where an intensive seine fishery for salmon was taking place and it may be possible that salmon also prey on postlarval halibut.

ADULT HALIBUT SURVEY

Since 1976, IPHC has conducted annual setline surveys in several regions in the northeast Pacific. Fishing locations and procedures have been standardized to make results comparable between years. These surveys are used as an indicator of stock condition independent of the commercial data. Length-at-age and catch-at-age data are indicative of year-class strength and growth. The CPUE of legal-sized halibut is a measure of stock abundance and the CPUE (in numbers) of sub legal halibut may give a measure of potential recruitment into the fishery in subsequent years.

Catch rate analysis is done in terms of standard skates with 18-foot hook spacing, so the actual number of skates fished is converted to the number of standard skates using a hook-spacing conversion factor. In the following discussion, catch is expressed in pounds per standard skate (CPUE) for legal sized halibut and number per standard skate (NPUE) for sublegal halibut.

Circle hooks were first used in 1984 on the IPHC surveys. Both circle and J hooks were fished in the Charlotte and Kodiak regions during 1984 and ratio estimators were determined for comparison of effort between the two gear types. Since 1985, only circle hooks have been used on the surveys. Historic results from the adult halibut surveys are given in Appendix III, Table 5.

In 1986, surveys were conducted in the Charlotte region in Area 2B, in the southeastern Alaska region (Area 2C), and in the Kodiak region of Area 3A. These surveys caught 10,785 halibut. Sex and age composition of the catches was estimated using data frm 5,051 fish, 22 were measured and released, and the remaining 5,712 halibut without serious injuries were tagged and released. Out of 293 stations located in the three survey areas, 277 stations were successfully fished, requiring 1,543 standard skates of gear.

Circle hook catches from the 1986 surveys along with 1985 catches for comparison are summarized in Table 12. Notable changes are evident in all areas of both legal CPUE and sublegal NPUE. With the exception of southeastern Alaska, legal catch in pounds per skate dropped 15 to 18 percent. In all areas, sublegal NPUE is down 32 to 48 percent.

Table 12. Results from the 1986 adult surveys.

	CPUE (legals)			NPUE (sublegals)		
Region	1985	1986	change	1985	1986	change
Charlotte	48	41	-15%	2.3	1.1	-48%
Southeastern Alaska	261	283	+8%	2.3	1.8	-32%
Kodiak	462	380	-18%	3.3	1.9	-43%

Charlotte

During 1986, 89 stations were successfully fished. Legal halibut CPUE of 40.6 pounds per skate declined 15 percent from the 1985 catch levels. In terms of numbers of fish, the legal catch has declined 20 percent, from 2.0 to 1.6 fish per skate. The 1986 estimated J hook CPUE of 16.9 pounds per skate is the second year of decline after an eight year trend of increasing CPUE in this area, and is the lowest seen during the last eight years in this area.

Sublegal NPUE fell 48 percent from the 1985 value, continuing the decline from the record high of 1984. Accompanying this decline is an increase in average weight of sublegal fish. The estimated J hook NPUE for sublegal fish of 0.3 fish per skate is at pre-1983 levels for this area.

Non-halibut species accounted for 88 percent of the total catch by number. Notable among these are dogfish (*Squalus acanthias*, 56 percent, down from a record 71 percent in 1985), sablefish (*Anoplopoma fimbria*, 8.2 percent), skates (*Raja* spp., 8.0 percent) and redbanded rockfish (*Sebastes babcocki*, 5.9 percent). While proportions of individual species varied slightly between 1985 and 1986, non-halibut species accounted for a similar proportion (87 percent) of the total catch in numbers in 1985 in this area.

Southeastern Alaska

In 1986, 90 stations were successfully fished. CPUE for legal halibut was 282.7 pounds per skate overall, an increase of eight percent over 1985. The CPUE for inside stations rose from 211.8 to 267.7 pounds per skate, whereas CPUE on outside stations dropped from

322.7 to 303.6 pounds per skate. The percentage of legal females was higher in the outside station catches (67 percent) than those from inside stations (56 percent), a similar pattern to previous years.

The highest halibut catches in 1986 were seen in the outside waters off Chichagof Island and the inside waters of Chatham Strait, areas of traditionally high catch rates. Generally, catch rates were lowest in the southern areas of the inside waters and highest for outside or more northern areas. Increases in catch rates from 1985 to 1986 occurred at all inside locations, with the greatest increases occurring in the northern areas, including Frederick Sound and Chatham and Icy Straits. All of the southern areas of the outside waters showed decreases in halibut CPUE.

Sublegal NPUE increased from 1985 in the waters of Dixon Entrance, Clarence Strait, and Ernest and Frederick Sounds. In all other areas, sublegal catch rates were down. Overall, sublegal NPUE was down about 32 percent from 1985, from 2.3 to 1.8 fish per skate.

Species other than halibut represented 53 percent of the total catch by number. Notable among these were sablefish (16.4 percent), yelloweye rockfish *(Sebastes rubberimus,* 7.9 percent) and dogfish (6.9 percent). Although these species dominated the non-halibut species catch for the entire survey and that portion occurring in the outside waters, Pacific cod *(Gadus macrocephalus*, 7.5 percent), Arrowtooth flounder (*Atheresthes stomias,* 7.8 percent), and sablefish (19.5 percent) were predominant in the inside waters. The relative species composition, abundance, and relative distribution of other species in the catches showed little change from 1985.

Kodiak

In 1986, 98 stations were successfully fished. CPUE for legal halibut was 379.9 pounds per skate, down 18 percent from 1985 but still well above pre-1984 levels. More dramatic is the decrease in the catch rate in number of legal fish, down 32 percent from 11.4 in 1985 to 7.7 fish per skate in 1986. This is associated with a 22 percent increase in the average weight of legal fish caught in the survey. Sublegal NPUE is down 43 percent, from 3.3 fish per skate in 1985 to 1.9 in 1986. The estimated J hook NPUE of 0.6 would be the lowest sublegal catch rate seen in this area since the initial 1963 survey.

Other species accounted for 53 percent of the total catch by number, an increase from the 1985 estimate of 38 percent. Catches of the two other major species, Pacific cod (up from 23 percent in 1985 to 29 percent in 1986), and sablefish (from 3 percent to 14 percent), account for most of this increase.

Comparison Among Regions

Survey CPUE of legal-sized halibut was lowest in the Charlotte region (40.6 pounds per skate), intermediate in Southeastern (282.7 pounds per skate), and highest in Kodiak (379.9 pounds per skate). This pattern of CPUE among areas is typical of past years, although prior to 1984 the CPUE's of Kodiak and Southeastern had been similar. The highest average weight of legal fish occurred in the Kodiak area (49.0 pounds), was lowest in Charlotte (25.6 pounds), and intermediate in Southeastern (39.8 pounds). The average weight of legal halibut increased in all areas, 8 to 9 percent in Charlotte and Southeastern and 22 percent in Kodiak. The percentage of females in the legal catch was comparable among regions (61 to 75 percent). While showing significant decreases in all regions, the CPUE of sublegal fish remained highest in Kodiak (1.9 fish per skate). The average weight of sublegal fish was highest in Charlotte (7.6 pounds). The percentage of females in the sublegal catch was similar among regions (35 to 43 percent), values typical of previous surveys.

HALIBUT REARING AND LIFE HISTORY STUDY

Since 1984, IPHC has worked with the U.S. Fish and Wildlife Service (USF&WS) and NMFS in a cooperative study of long-term culturing and the early life history of halibut. Over the past three years, IPHC has delivered live halibut to the USF&WS laboratory at Marrowstone Island in Puget Sound, Washington, and has also provided financial support for personnel and supplies in the rearing project. As a result of collection efforts in late 1985, 13 halibut were being held at the Marrowstone facility.

Two fish died early in 1986 and a major wind storm during September, 1986 resulted in the loss of seven of the 11 remaining fish. Floating particulate matter from the storm partially clogged the seawater intake system and, although insufficient to set off the alarm system, the reduced water flow resulted in the reduction of the pool oxygen levels to less than three ppm. The problem has been corrected and a recurrence is highly unlikely.

In early October, 1986 a four day trip to the Swiftsure Bank area at the entrance to the Strait of Juan de Fuca resulted in the delivery of 10 additional fish to the Marrowstone facility. In early December, the new fish were measured and tagged and blood samples were taken for protein analysis. IPHC is currently working with a graduate student from the University of Washington School of Fisheries to conduct research on the fish. The program is intending to induce spawning during the winter of 1986-1987.

TAGGING STUDIES

The release of tagged halibut was continued in 1986 with an additional 9,136 fish (Table 13). By far, the majority of these releases occurred on the continuing adult halibut

Table 13. Tag releases by month, activity, and gear in 1986.

Month	Activity/Area	Gear	No. Tagged
May-August	Adult Survey-Area 2B	Setline	780
June-July	Adult Survey-Area 2C	Setline	1,967
July-August	Adult Survey-Area 3A	Setline	2,965
June	Juvenile Survey-Bering Sea	Trawl	98
June-July	Juvenile Survey-Gulf of Alaska	Trawl	1,202
May and August	Sport Fishing-Cook Inlet	Sport	25
September	Gear Research-Area 3A	Setline	2,099
Total			9,136

surveys. The Area 2B survey was conducted by the WINDWARD ISLE and SNOWFALL and resulted in the release of 780 fish between Cape Scott and Dixon Entrance. The Area 2C survey was conducted by the CAPE FLATTERY and resulted in 1,967 releases throughout southeast Alaska. The CAPE FLATTERY also did the survey in Area 3A and released 2,965 fish between Seward Gully and the Trinity Islands.

The trawler PACIFIC HARVESTER, conducting research on juvenile halibut, released 1,300 tagged fish, 98 on the Bering Sea flats with the remainder distributed from Unimak Island to Icy Strait in the north Pacific. These were primarily fish of less than legal size.

Halibut were also tagged and released on other projects. The setliner MORIAH was chartered in September to study potential halibut mortality caused by automated hook strippers. There were 2,099 fish tagged and the recoveries from this project will be useful in determining which injuries might prove fatal. A small project involving the halibut sport fishery was conducted near Homer, Alaska. Using sport gear, 25 halibut were tagged and released; two of these fish were recaptured later in the season by sports fishermen in the Homer area.

Tag recaptures in 1986 totalled 2,193 fish. The 1986 recaptures are only exceeded by the 2,400 received in 1969. An additional 59 were caught in earlier years but not reported until 1986. The recovery area was reported for 1,906 of the 1986 recoveries (Table 14). Most of the recoveries (87 percent) were recaptured in the area of release, whereas 56 (3 percent) moved west or north and 188 (10 percent) moved east or south. The amount of interchange between areas is greatly influenced by the size of the fish at time of release. The smaller fish, primarily under 80 cm, account for most of the between-region movement.

A new reward was offered in 1986 for the return of halibut tags. The finder was given the option of receiving $5.00, as in the past, or of receiving a hat with a special logo indicating that it was a tag reward hat (see inside back cover). The hats were very well received by the fleet, with over 80 percent of the finders choosing the hat.

Table 14. IPHC tagged halibut recovered in 1986 by area of release and recovery.

	Recovery Area										
Release Area	Bering Sea	Shumagin	Chirikof	Kodiak	Yakutat	Southeastern	Charlotte	Vancouver	Columbia	Eureka	Total
Bering Sea	83	8	—	5	1	2	4	1	2	—	106
Shumagin	5	13	1	8	1	—	1	—	—	—	29
Chirikof	—	1	11	34	3	11	10	—	—	—	70
Kodiak	—	1	11	914	9	8	31	4	1	2	981
Yakutat	—	—	—	11	10	6	6	—	—	—	33
Southeastern	—	—	—	3	6	315	18	2	—	—	344
Charlotte	—	—	—	1	1	16	316	6	3	—	343
Total	88	23	23	976	31	358	386	13	6	2	1,906

AGE VALIDATION STUDY

During 1982 and 1983, the Commission released tagged halibut which had been injected with oxytetracycline (OTC) for an age validation experiment in Areas 2B, 3A, and 3B. The fish absorbs OTC during deposition of new bone, placing a time-mark on the otolith. When viewed under ultraviolet light, the otolith fluoresces 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 15.

Recovery rates have varied among experiments. The 1982 OTC releases had an apparently higher mortality rate than the control groups: the control group returned at rates about three times that of injected fish. The reason these releases fared poorly is not completely understood, but the large volume of fluid injected into the bigger fish may be one reason. The body cavity noticeably swelled and the fish may have had trouble assimilating the fluid. Consequently, only fish under 125 cm in length were injected in 1983. Return rates for OTC and control group fish were nearly the same for the 1983 releases. Released fish from future OTC experiments will carry a proportionately smaller dosage of OTC for larger fish than occured in 1982.

Table 15. 1982-1986 age validation study tag recoveries (recoveries with otoliths in parentheses).

		OTC Group						Control Group					
		No.	Recoveries					No.	Recoveries				
Release Year	Area	Tagged	1982	1983	1984	1985	1986	Tagged	1982	1983	1984	1985	1986
1982	2B	111	2(2)	1(0)	4(2)	1(1)	3(1)	69	1(1)	1(1)	11(6)	8(4)	2(0)
	3B	459	1(0)	1(1)	1(1)	2(1)	2(1)	287	1(1)	3(1)	5(2)	4(0)	0(0)
1983	2B	765	—	28(19)	28(20)	24(12)	17(10)	627	—	29(15)	16(10)	25(12)	15(6)
	3A	456	—	2(0)	15(7)	20(7)	9(5)	472	—	2(1)	21(12)	24(11)	14(7)
Totals		1791	3(2)	32(20)	48(30)	47(21)	31(17)	1455	2(2)	35(18)	53(30)	61(27)	31(13)

Recoveries of OTC releases confirm the absorption of OTC during formation of new bone on the otolith. The longest at-large period for an OTC-injected fish is just under four years. This fish was tagged in July, 1982 on the Sanak Island grounds (Area 3B) and recovered near Fairweather Gully (Area 3A) during May, 1986. During that period the fish grew from 110 cm to 142 cm. A surface reading of the otolith indicated the fish was 13 years old at recovery. Although the OTC mark was weak, three growth rings plus an incomplete ring were visible beyond the OTC mark. This is the growth pattern expected, assuming growth rings of halibut occur annually. Another of the 1982 releases was recovered near Masset in British Columbia (Area 2B) during May, 1986. This fish grew 23 cm during the four years at liberty to a length of 88 cm. A strong OTC mark was observed and the otolith was aged at eight years. The subsequent growth pattern adjacent to the OTC mark is also consistent with the time at large for this fish. Recoveries from 1983 releases are yielding similar results. Analysis of this project is expected to be completed in 1987.

CATCH SAMPLING

Halibut landings in 1986 were sampled at ports between Newport, Oregon, and Dutch Harbor, Alaska. Over 30,000 otoliths were collected from the commercial landings to estimate the size of the fish landed. A subsample of 12,500 otoliths was selected for estimating the age composition of the landed fish. Research cruises for stock assessment purposes provided an additional 4,000 otoliths for aging.

Multiple fishing periods of short duration permitted repeat sampling in many regions. Even with the expanded sampling opportunities, only 1.5 percent of the total landings were sampled (Table 16). The proportion of the landings sampled was generally higher in areas with small catches such as the Columbia and Aleutian regions.

Table 16. Commercial catch and percent sampled for size and age composition by region during 1986.

Region	Catch* (000's pounds)	Percent Sampled
Columbia	282	9.3
Vancouver	1,207	2.4
Charlotte-Outside	1,815	0.9
Charlotte-Inside	8,490	1.6
Southeast Alaska-Outside	6,272	0.9
Southeast Alaska-Inside	4,266	1.1
Yakutat	4,991	1.3
Kodiak	27,689	1.3
Chirikof	5,547	1.2
Shumagin	5.657	2.3
Aleutian	100	10.6
Bering Sea	3,121	2.0
Total	69,438	1.5

*Note: Does not include research catches.

HOOK STRIPPERS

During the 1986 fishery, several vessels were noticed with closely spaced rollers between the rail and gurdy that functioned as hook strippers, allowing the groundline and hooks to pass freely while pulling the hooks from fish as they are drawn against the rollers. By their design, these hook strippers may only be used on fixed-gear boats. Overall, it was estimated that as many as 100 vessels used hook strippers during the 1986 halibut fishery. During the latter portion of the 1986 fishing season, captains from 20 boats which used hook strippers were interviewed to determine changes in the fishing power of boats rigged with hook strippers and to examine the potential effect of hook stripper use on sublegal halibut mortality.

The interviewed fishermen felt that the hook stripper allowed gear to be hauled more quickly and with a greater margin of safety to the rollerman, who is required to handle far fewer fish as they come aboard. Small legal halibut and trash fish could be removed by the hook stripper without effort by the rollerman. The gear cost is high in broken gangions and bent and broken hooks. However, the general conclusion is that with shorter fishing periods, the higher gear cost is more than compensated for by an approximate 30 percent increase in the amount of gear that can be hauled. Although respondents indicated that sublegal halibut are normally shaken over the side, most agreed that in heavy weather or when time was short, sublegals might be removed by the hook stripper.

The Kodiak-based setliner MORIAH was chartered for a four-day investigation of hook stripper efficiency and hook removal injury. Tub gear with 12-foot hook spacing was fished during the study. The hook stripper layout included a wide roller in a partially cutout rail with an aluminum chute leading to a set of closely-spaced rollers.

A site was selected immediately north of Chiniak Gully (east of Kodiak Island) based on large catches of small fish obtained on the annual setline survey of the area. Three seven-skate sets were baited with salmon and set each morning. The gear was hauled after a minimum four-hour soak and each set was hauled in about three hours, a slower hauling speed than occurs during regular commercial fishing. Fish from every other skate were manually shaken inboard whereas fish from alternate skates were removed by the hook stripper. Every fish was examined for hook location and hook removal injury and this information was recorded with the length of the fish. Most fish were then tagged and released. Returns of these fish should provide estimates of actual mortality from hook removal injuries.

During the four-day operation, 2,365 halibut were handled, including 1,240 sublegal halibut, for a catch of 16.5 halibut per standard skate. Even though the site was selected to maximize the catch of sublegal fish, 1,125 legal fish were caught for a CPUE of legal halibut of 514 pounds per shate. Over 90 percent of the fish caught were hooked in the cheek and jaw area, with the hook point usually creating a puncture through the cheek and the fish hanging on the round of the circle hook.

A range of hook removal injuries was observed and were classified into seven types. The first was "no apparent injury" when no wound was evident on the fish. This progressed in severity through a "torn cheek", defined as small puncture or tear not extending into the jaw, and a "torn lip" into a more severe "split jaw" and "torn jaw", both presumably interfering with feeding and breathing activities. More severe were "torn cheek and jaw" and "torn face" wounds, where a side of the head was missing. The distribution of hook removal injuries between fish shaken from the hook and fish removed by the hook stripper is shown in Table 17. Over 90 percent of the shaken fish displayed either no apparent injury or the torn cheek wound. Only eight percent had the more severe injuries associated with a tearing-through of the jaw.

The removal of a circle hook by the hook stripper most often resulted in the hook being torn from the cheek and out through the cheek and jaw. Of the 671 sublegals which had the hook removed by the hook stripper, 24 percent had a "torn jaw", 44 percent had a "torn cheek and jaw", and 16 percent had the most severe "torn face", where the cheek and jaw on one side was totally torn away. Only nine percent of the sublegals unhooked by the hook stripper had the less severe "torn cheek" or "torn lip" injuries.

This study was initiated to determine the differences in injuries that occur from proper releasing of sublegal fish to what occurs with a hook stripper. There is no doubt that a good deal of improper releasing (horning) occurs during the shortened fishing seasons. The added danger posed by hook strippers is that a passive response to unhooking sublegal halibut

Table 17. Number and percent of fish by hook removal injury type.

Injury	Shaken fish		Removed by stripper	
	No.	Percent	No.	Percent
None apparent	26	5	3	—
Torn lip	5	1	8	1
Torn cheek	491	87	55	8
Torn jaw	28	5	163	25
Split jaw	1	—	37	6
Torn cheek and jaw	11	2	296	44
Torn face	1	—	109	16
Total	563	100	671	100

results in mechanical removal by the hook stripper. This creates injuries which are compounded in severity by the additional time these fish are left lying on deck prior to their being thrown back into the water.

OTOLITH GROWTH AND DEVELOPMENT

The halibut population is at its highest level of abundance in fifty years. Explanations for the increased abundance are possibly found in the early life history events of halibut, yet halibut larvae have rarely been encountered. The capture of 206 larval halibut in June 1985, from two locations in the Gulf of Alaska, Shelikof Strait and Unimak Pass, is the largest collection since the capture of 576 larval halibut from the pioneering study of Thompson and Van Cleve fifty years ago (see IPHC Report 9). They described in detail twelve stages of development which covered hatching to completed metamorphosis. The 1985 specimens were used to reevaluate Thompson and Van Cleve's classification scheme and examine the otolith microstructures for additional information on the early life history.

Four stanzas of larval growth were identified by examining changes in body length and depth with advancing development. Developmental stages were good indicators of both larval size and otolith size. Comparisons between the 1985 and 1936 samples indicate the mean size at a given developmental stage of the 1985 specimens was 7.6 percent $\pm$ 3.3 percent (one standard error) larger than those larvae captured in 1936. The size difference may be due to variable shrinkage rates resulting from different capture and preservation methods, as well as normal variability attributed to difference in locations.

The otoliths from a subsample of 65 postlarvae were removed and measured along the longest axis with additional measurements made of promiment checks apparent in the microstructure. Regularly occurring patterns in halibut otolith microstructures are similar to those found recently in several other species and likely provide a record of daily age and growth. Two prominent rings, or checks, in the otoliths at 0.023 $\pm$ 0.003 mm and 0.057 $\pm$ 0.004 mm probably correspond to hatching and the end of yolk-sac absorption, respectively. Ring counts were made starting at the outer check using enlarged photographic and video camera projections.

An average growth rate of 0.13 mm per day was postulated based on the assumption of daily ring formation, although there is some slowing of growth toward the end of the larval period. Otolith growth rates were found to be greater in the Shelikof Strait samples than in the Unimak Pass samples, which might be related to the 2°C warmer surface temperatures at the first locality. With the assumption that first ring formation occurs at 70 days, examination of larval age distribution suggests that specimens from both locations are progeny of halibut spawning in the last half of the spawning season, and that the Shelikof Strait specimens were spawned earlier than Unimak Pass specimens.

ENVIRONMENTAL VARIABILITY AND RECRUITMENT

This is a brief summary of a comprehensive fishery oceanography study into the influence of ocean variability on Pacific halibut recruitment (Ph.D. Dissertation, funded by the Commission).

Studies indicate that environmental conditions during winter, the season of halibut spawning and larval drift, are related to eventual year class strength in the commercial fishery. Specifically, the transport of larvae along the Gulf of Alaska continental shelf is dependent upon wind- and buoyancy-driven coastal circulation. Fluctuations in the Alaska Coastal Current system are believed to influence cross-shelf flow of slope water onto the shelf by associated mechanisms, such as entrainment and Ekman convergence due to wind forcing. Onshore transport then critically affects survival as larvae rise to the surface layers from deep offshore slope waters to subsequent deposition in shallow shelf nursery areas. It is hypothesized that recruitment strength is enhanced or depressed by transport rates integrated over the six-month pelagic phase of halibut larval development.

The prevailing counterclockwise ("cyclonic") transport around the Gulf of Alaska may lead to interannual shifts in larval abundance patterns. Year-to-year variability in the Alaska Coastal Current system, particularly vigorous in the western Gulf, substantially influences the 5 to 7 month drift of larvae from the offshore deeper waters. Knowledge of water movements permits rough projections of likely egg and larval transport from spawning sites. Such trajectories have always been poorly understood. The most recent data have been obtained through the extensive hydrographic and meteorological monitoring being carried out by the U.S. National Oceanographic and Atmospheric Administration's Fishery Oceanography Experiment (FOX) in Shelikof Strait and west of Kodiak Island.

Oceanographic mechanisms controlling the onshelf flow of offshore waters include bathymetric steering (via deep trough features cut into the shelf), specific components of the coastal current system (e.g., Kenai and Haida Currents), eddies (e.g., the "Sitka Eddy"), and the convergent downwelling with Ekman transport. The latter condition exhibits a winter maximum and is chiefly the result of seasonal and event-scale winds that appear to conform to interannual variations in the intensity and position of the Aleutian Low atmospheric pressure system.

A time series consisting of 88 oceanographic and meteorological conditions developed for this study include wind speed and stress, sea level height, freshwater discharge, transport and current velocity, and atmospheric pressure. Two recruitment series from 1935-1977 were estimated from existing CPUE, cohort, and (migratory) catch-age analyses of the 60-year commercial fishery record. Adjustments have been incorporated to account for geographic partitioning by habitat size, migration between areas, incidental catch losses, catch biomass, and gear selectivity by age. A moving average lagged 8 to 10 years was necessary to accommodate the protracted juvenile stage which occurs prior to recruitment to the fishery.

Recruitment variability not explained by the effect of spawning biomass was expressed as anomalies from regressing year class abundance on exploitable biomass. Smoothing these regression results revealed a clear density-dependent relation. Studies were targeted at the extent to which this relation is driven by environmental fluctuations.

Several analyses within four adjacent geographic regions, encompassing the entire Gulf of Alaska shelf, indicate significant relationships between the environmental factors and the production of young halibut. A linearized, depth-integrated momentum balance equation for alongshore transport computes the mean and seasonal effects of gradients in wind stress and runoff on sea slope between specific stations. This shelf model was then used to relate the recruitment estimates to the dynamics of coastal flow. Wind-driven coastal current strength was of central importance, and wind stress at specific locations around the Gulf was a key indicator.

The data shown in Figure 8 reflect the paired relationship between strength of the coastal or "Kenai" current and that of year class from the Kodiak region. The winter transport intensity as indexed by coastal wind analysis appears to be associated with good and poor years of estimated larval survival.

Substantial interannual variations exist in the parameters of the regional physical environment. The analyses suggest coastal transport processes that are related to variations in Pacific halibut year class strength.

The meteorology provides the driving energy for ocean responses, and several time series were used in this study. An index of seasonally-averaged mean pressure differences provided an indication of the general frequency and intensity of storm tracks across the Gulf of Alaska, and pressure-surface patterns occurring over the region were correlated with the recruitment estimates. The incidence and duration of blocking high pressure ridge phenomena in winter and early spring can affect coastal circulation patterns by deflecting storms, accompanying winds, and precipitation. This in turn affects the biological environment through reduced or delayed regional atmospheric forcing patterns. Thus, a shift in the position of major storm tracks in some years can generate conditions of transport and/or turbulence that may lead to depressed recruitment.

Coastal water turbulence (mixing) determines the timing, intensity, and duration of the critical spring production cycle that supports larval feeding in the upper layers. These conditions will vary annually with the local wind and annual storm patterns. Little is known of seasonal ambient levels of secondary production in the Gulf of Alaska or the prey densities required by halibut larvae at various stages during the pelagic phase. The sampling carried out since 1985 by IPHC for halibut larvae in association with these studies should continue to provide needed information on larval success and distribution.

Larval mortality also varies with the duration of egg and larval stages which may be significantly influenced by unusual environmental fluctuations. The effects of vertical wind-mixing and stratification on nutrient availability and the spring plankton bloom, together with the circulatory variations discussed previously, all represent important factors that may interact to affect early life history success and, ultimately, year class strength.

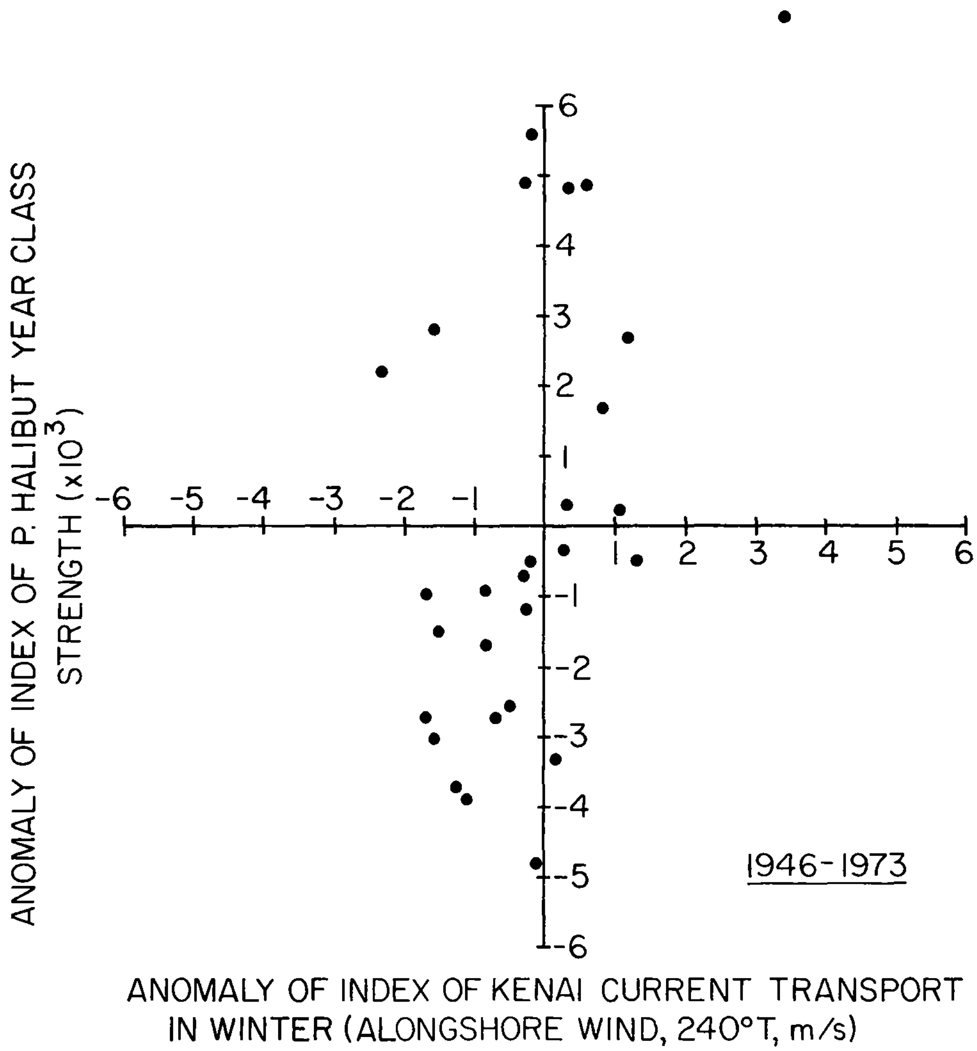

Figure 8. Relationship between the Alaska Coastal Current and year class strength in the Kodiak region.

Appendices

The tables in Appendix I provide statistics for 1986 and are a supplement to Technical Report No. 14, "The Pacific Halibut Fishery: Catch, Effort and CPUE, 1929-1975." Appendix tables in this annual report and the annual reports since 1977 are in the same format and update those statistics through 1986. A detailed explanation of the tables, the methods of compilation, and definitions of the statistical subdivisions are included in Technical Report No. 14, which is available on request. The CPUE values for 1986 have been adjusted by a correction factor of 2.2 to standardize circle hook CPUE to J hook CPUE but are not standardized for area differences in catchability. The poundage in these tables is dressed weight (head-off, eviscerated). Copies of the tables in metric units and round (live) weight are available on request. If desired, round weight may be calculated by multiplying the dressed weight by a factor of 1.33.

The tables in Appendix II and Appendix III provide data on ex-vessel price of halibut and on abundance and average size at each age by regions of sampling, respectively.

TABLE 1. CATCH, CPUE AND EFFORT BY STATISTICAL AREA AND COUNTRY, 1986.

1986	CANADA			UNITED STATES			TOTAL			
STAT. AREA	CATCH 000 LBS	CPUE LBS	EFFORT 00 SKS	CATCH 000 LBS	CPUE LBS	EFFORT 00 SKS	CATCH 000 LBS	CPUE LBS	EFFORT 00 SKS	LOGS %
00-03	-	-	-	282	14.6	193	282	14.6	193	-
04	-	-	-	41	17.3	24	41	17.3	24	29
05	-	-	-	258	14.2	181	258	14.2	181	5
06	463	28.4*	163	-	-	-	463	28.4	163	-
07	174	28.4	61	-	-	-	174	28.4	61	9
08	271	28.4*	95	-	-	-	271	28.4	95	-
09 -O	200	39.3	51	-	-	-	200	39.3	51	9
09 -I	612	28.1	218	-	-	-	612	28.1	218	-
10 -O	94	63.8*	15	-	-	-	94	63.8	15	-
10 -I	884	45.4	195	-	-	-	884	45.4	195	19
11 -O	215	42.1	51	-	-	-	215	42.1	51	41
11 -I	1954	47.4	412	-	-	-	1954	47.4	412	22
12 -O	161	60.5	27	-	-	-	161	60.5	27	37
12 -I	2060	63.8	323	-	-	-	2060	63.8	323	31
13 -O	1146	81.1	141	-	-	-	1146	81.1	141	23
13 -I	2991	54.6	548	-	-	-	2991	54.6	548	25
14 -O	-	-	-	333	95.3	35	333	95.3	35	17
14 -I	-	-	-	308	147.7*	21	308	147.7	21	-
15 -O	-	-	-	931	167.0	56	931	167.0	56	23
15 -I	-	-	-	711	179.0	40	711	179.0	40	9
16 -O	-	-	-	1293	121.4	106	1293	121.4	106	20
16 -I	-	-	-	2949	129.4	228	2949	129.4	228	23
17 -O	-	-	-	1132	184.0	62	1132	184.0	62	2
17 -I	-	-	-	1084	139.5	78	1084	139.5	78	16
18S-O	-	-	-	610	99.0	62	610	99.0	62	7
18S-I	-	-	-	1260	206.1	61	1260	206.1	61	10
18W	-	-	-	876	126.4	69	876	126.4	69	27
19	-	-	-	494	139.3	35	494	139.3	35	28
20	-	-	-	1159	122.4	95	1159	122.4	95	11
21	-	-	-	518	130.1	40	518	130.1	40	9
22	-	-	-	863	206.4	42	863	206.4	42	40
23	-	-	-	1081	243.4	44	1081	243.4	44	8
24	-	-	-	2848	221.0	129	2848	221.0	129	21
25	-	-	-	7572	256.6	295	7572	256.6	295	52
26	-	-	-	7482	235.4	318	7482	235.4	318	27
27	-	-	-	4664	224.1	208	4664	224.1	208	20
28	-	-	-	5233	262.6	199	5233	262.6	199	29
29	-	-	-	2287	188.5	121	2287	188.5	121	17
30	-	-	-	2135	220.3	97	2135	220.3	97	28
31	-	-	-	1125	189.8	59	1125	189.8	59	44
32	-	-	-	1986	238.6	83	1986	238.6	83	29
33	-	-	-	481	288.0	17	481	288.0	17	60
34	-	-	-	817	415.4	20	817	415.4	20	42
35	-	-	-	616	106.6	58	616	106.6	58	42
36	-	-	-	810	74.5	109	810	74.5	109	24
37	-	-	-	443	72.9	61	443	72.9	61	36
38	-	-	-	504	192.1	26	504	192.1	26	65
39	-	-	-	-	-	-	-	-	-	-
40	-	-	-	-	-	-	-	-	-	-
41	-	-	-	32	61.3	5	32	61.3	5	100
42+	-	-	-	68	143.8	5	68	143.8	5	100
4A	-	-	-	95	186.3	5	95	186.3	5	45
4B	-	-	-	1008	142.0	71	1008	142.0	71	47
4C	-	-	-	1311	120.9	108	1311	120.9	108	53
4DE	-	-	-	510	99.7	51	510	99.7	51	21
4DW	-	-	-	197	186.0	11	197	186.0	11	23
4E	-	-	-	-	-	-	-	-	-	-

* NO LOG DATA, CPUE INTERPOLATED.

TABLE 2. CATCH, CPUE AND EFFORT BY REGION AND COUNTRY, 1986.

1986	CANADA			UNITED STATES			TOTAL			
REGION	CATCH 000 LBS	CPUE LBS	EFFORT 00 SKS	CATCH 000 LBS	CPUE LBS	EFFORT 00 SKS	CATCH 000 LBS	CPUE LBS	EFFORT 00 SKS	LOGS %
COLUMBIA	-	-	-	282	15.6	180	282	15.6	180	-
VANCOUVER	908	28.4	320	299	15.6	191	1207	23.6	511	3
CHARLOTTE	10317	55.7	1853	-	-	-	10317	55.7	1853	23
CHAR-O	1816	63.1	288	-	-	-	1816	63.1	288	23
CHAR-I	8501	54.3	1565	-	-	-	8501	54.3	1565	23
SE ALASKA	-	-	-	10611	135.7	782	10611	135.7	782	15
SE AK-O	-	-	-	4299	130.1	331	4299	130.1	331	14
SE AK-I	-	-	-	6312	140.1	451	6312	140.1	451	17
YAKUTAT	-	-	-	4991	156.3	319	4991	156.3	319	20
KODIAK	-	-	-	27799	246.4	1128	27799	246.4	1128	32
CHIRIKOF	-	-	-	5547	200.6	277	5547	200.6	277	27
SHUMAGIN	-	-	-	5657	163.2	347	5657	163.2	347	38
ALEUTIAN	-	-	-	100	100.3	10	100	100.3	10	100
BERING SEA	-	-	-	3121	126.7	246	3121	126.7	246	50
TOTAL	11225	51.7	2173	58407	167.8	3480	69632	123.2	5653	31

* NO LOG DATA, CPUE INTERPOLATED.

TABLE 3. CATCH, CPUE AND EFFORT BY REGULATORY AREA, 1986.

	AREA 2				AREA 3				AREA 4			
YEAR	CATCH 000 LBS	CPUE LBS	EFFORT 00 SKS	LOGS %	CATCH 000 LBS	CPUE LBS	EFFORT 00 SKS	LOGS %	CATCH 000 LBS	CPUE LBS	EFFORT 00 SKS	LOGS %
1986	22417	67.4	3326	18	43994	212.4	2071	31	3221	125.8	256	52

TABLE 4. CATCH IN THOUSANDS OF POUNDS BY REGULATORY AREA AND COUNTRY, 1986.

	AREA 2			AREA 3			AREA 4			ALL AREAS		
YEAR	CAN.	U.S.	TOTAL	CAN.	U.S.	TOTAL	CAN.	U.S.	TOTAL	CAN.	U.S.	TOTAL
1986	11225	11192	22417		43994	43994		3221	3221	11225	58407	69632

TABLE 5. LANDINGS IN THOUSANDS OF POUNDS BY PORT AND COUNTRY, 1986.

PORT	CAN.	U.S.	TOTAL
CAL AND ORE	-	1014	1014
SEATTLE	360	2173	2533
BELLINGHAM	1128	2130	3258
MISC WASH	1127	1043	2170
VANCOUVER	4000	-	4000
MISC SO BC	1407	-	1407
NAMU	74	-	74
PR RUPERT	2917	487	3404
MISC NO BC	152	-	152
KETCHIKAN	6	694	700
WRANGELL	-	802	802
PETERSBURG	-	2903	2903
JUNEAU	-	329	329
SITKA	-	4020	4020
PELICAN	-	830	830
MISC SE AK	-	2102	2102
KODIAK	-	17456	17456
P WILLIAMS	-	-	-
SEWARD	-	5900	5900
MISC CEN AK	-	16524	16524

Table 6. Summary of the catch by the commercial fishery and the number of fishing days by fishing period and regulatory area in 1985.

Area	Catch limit (millions)	Opening Date	Closing Date	Fishing Days	Catch (000's lbs)
2A	0.5	May 9	May 21	12	145
		June 8	June 20	12	229
		July 24	July 31	7	119
				31	493
2B	10.0	Apr. 20	Apr. 29	9	3,756
		June 7	June 16	9	5,598
		Aug. 14	Aug. 18	4	1,035
				22	10,389
2C	9.0	Apr. 27	Apr. 29	2	4,037
		May 27	May 29	2	5,170
				4	9,207
3A	23.0	Apr. 27	Apr. 29	2	7,587
		May 27	May 29	2	10,505
		Sept. 10	Sept. 11	1	2,760
				5	20,852
3B	9.0	Apr. 27	Apr. 29	2	500
		May 27	May 29	2	937
		June 24	June 25	1	3,199
		Sept. 9	Sept. 11	2	6,252
				7	10,888
4A	1.7	Apr. 27	Apr. 29	2	—
		May 27	May 29	2	48
		June 24	June 26	2	211
		July 9	July 12	3	1,452
				9	1,711
4B	1.3	Apr. 27	Apr. 29	2	2
		May 27	May 29	2	3
		June 24	June 26	2	9
		July 9	July 13	4	64
		Aug. 7	Aug. 13	6	1,158
				16	1,236
4C	0.6	June 1	July 18	24*	620
4D	0.6	Apr. 27	Apr. 29	2	—
		May 27	May 29	2	—
		June 24	June 26	2	—
		July 9	July 19	10	295
		Aug. 7	Aug. 14	7	386
				23	681
4E	0.05	May 21	Oct. 29	108**	36
TOTAL	55.75				56,113

* 24 1-day openings
** 54 2-day openings

Table 6. (cont'd). **Summary of the catch by the commercial fishery and the number of fishing days by fishing period and regulatory area in 1984.**

Area	Catch limit (millions)	Opening Date	Closing Date	Fishing Days	Catch (000's lbs)
2A	0.3	May 21	June 2	12	61
		June 21	July 3	12	158
		July 22	Aug. 2	11	212
				35	431
2B	9.0	Apr. 24	May 6	12	5,331
		May 23	June 2	10	3,723
				22	9,054
2C	5.7	May 22	May 25	3	5,847
3A	18.0	May 21	May 25	4	15,822
		Aug. 20	Aug. 21	1	4,149
				5	19,971
3B	7.0	May 21	May 25	4	2,893
		Aug. 20	Aug. 21	1	301
		Sept. 18	Sept. 19	1	3,309
				6	6,503
4A	1.2	May 21	May 25	4	104
		June 18	June 21	3	949
				7	1,053
4B	1.1	May 21	May 25	4	<1
		June 18	June 21	3	12
		Aug. 2	Aug. 9	7	1,092
				14	1,104
4C	0.4	May 21	July 25	33*	580
4D	0.4	May 21	May 25	4	—
		June 18	June 28	10	392
				14	392
4E	0.05	May 21	Oct. 30	110**	35
TOTAL	43.05				44,970

* 33 1-day openings
** 51 2-day openings and one 8-day opening

Table 6. (cont'd). Summary of the catch by the commercial fishery and the number of fishing days by fishing period and regulatory area in 1983.

Area	Catch limit (millions)	Opening Date	Closing Date	Fishing Days	Catch (000's lbs)
2A	0.2	June 15	June 28	13	111
		July 14	July 27	13	154
				26	265
2B	5.4	May 3	May 15	12	2,750
		June 14	June 26	12	2,686
				24	5,436
2C	3.4	June 17	June 22	5	6,398
3A	14.0	June 16	June 23	7	14,112
3B	5.0	June 16	June 23	7	1,377
		Aug. 27	Aug. 30	3	6,374
				10	7,751
4A	1.2	June 16	June 23	7	19
		July 15	July 23	8	2,490
				15	2,509
4B	0.8	June 16	June 23	7	1
		July 15	July 29	14	201
		Sept. 13	Sept. 21	8	1,133
				29	1,335
4C	0.4	June 16	July 20	28*	412
		Aug. 25	Aug. 29	4	18
				32	430
4D	0.2	June 16	June 23	7	—
		July 15	July 29	14	148
				21	148
TOTAL	30.6				38,384

* 7 4-day openings

Table 6. (cont'd). Summary of the catch by the commercial fishery and the number of fishing days by fishing period and regulatory area in 1982.

Area	Catch limit (millions)	Opening Date	Closing Date	Fishing Days	Catch (000's lbs)
2A	0.2	May 12	May 24	12	45
		June 9	June 21	12	76
		July 7	July 19	12	46
		Aug. 9	Aug. 22	13	44
				49	211
2B	5.4	May 12	May 24	12	1,475
		June 19	June 21	12	1,689
		July 7	July 19	12	922
		Aug. 9	Aug. 22	13	804
		Sept. 14	Sept. 16	12	648
				61	5,538
2C	3.4	May 12	May 17	5	3,500
3A	14.0	May 11	May 19	8	10,134
		June 9	June 12	3	3,396
				11	13,530
3B	3.0	May 11	May 19	8	413
		June 9	June 12	3	175
		Aug. 20	Aug. 27	7	4,212
				18	4,800
4	1.5	May 11	May 19	8	13
		June 9	June 28	19	1,416
				27	1,429
TOTAL	27.5				29,008

Table 6. (cont'd). Summary of the catch by the commercial fishery and the number of fishing days by fishing period and regulatory area in 1981.

Area	Catch limit (millions)	Opening Date	Closing Date	Fishing Days	Catch (000's lbs)
2A	0.2	June 7	June 21	14	50
		July 7	July 21	14	85
		Aug. 6	Aug. 20	14	41
		Sept. 5	Sept. 19	14	26
				56	202
2B	5.4	May 7	May 22	15	2,030
		June 7	June 22	15	1,775
		July 7	July 22	15	1,307
		Aug. 6	Aug. 19	13	542
				58	5,654
2C	3.4	June 7	June 14	7	4,010
3A	13.0*	June 7	June 20	13	14,225
3B	2.0*	June 7	June 20	13	96
		Aug. 25	Aug. 28	3	360
				16	456
4	1.0	June 7	June 22	15	25
		July 10	Aug. 6	27	1,160
				42	1,185
TOTAL	25.0				25,732

*Original Area 3 catch limit of 13.0 million pounds (11.0-3A; 2.0-3B) increased to 15.0 million pounds to allow on August fishery in Area 3B.

Table 6. (cont'd). Summary of the catch by the commercial fishery and the number of fishing days by fishing period and regulatory area in 1980.

Area	Catch limit (millions)	Opening Date	Closing Date	Fishing Days	Catch (000's lbs)
2 (U.S. waters)	3.2	May 20	May 30	10	3,260
2 (Canadian waters)	6.1	May 20	June 3	14	1,514
		July 15	July 29	14	1,893
		Aug. 12	Aug. 26	14	1,380
		Sept. 19	Sept. 23	14	795
		Oct. 27	Nov. 5	9	68
				65	5,650
3	10.0	May 19	June 4	16	9,391
		July 15	July 19	4	2,852
				20	12,243
4	1.0	Apr. 10	Apr. 30	19	158
		July 29	Aug. 23	25	555
				44	713
TOTAL	20.3				21,866

Table 6. (cont'd). Summary of the catch by the commercial fishery and the number of fishing days by fishing period and regulatory area in 1979.

Area	Catch limit (millions)	Opening Date	Closing Date	Fishing Days	Catch (000's lbs)
2	3.6	May 25	June 10	16	2,791
(U.S. waters)		June 26	July 3	7	1,785
				23	4,576
2	6.0*	May 25	June 10	16	2,068
(Canadian waters)		July 26	July 12	16	2,255
		July 28	Aug. 5	8	534
				40	4,857
3	11.0	May 25	June 10	16	5,976
		June 26	July 12	16	5,749
				32	11,725
3C	—	Apr. 10	Nov. 15	218	417
4East	—	Apr. 10	Apr. 30	19	44
		July 24	Aug. 11	17	318
				36	362
4West	—	Apr. 10	Nov. 15	218	590
TOTAL	20.6				22,527

*Original Area 2 catch limit of 9.0 million pounds (60% to Canadian waters; 40% to U.S. waters) increased to 9.6 million pounds to allow extra Canadian Area 2 fishing.

Table 6. (cont'd). Summary of the catch by the commercial fishery and the number of fishing days by fishing period and regulatory area in 1978.

Area	Catch limit (millions)	Opening Date	Closing Date	Fishing Days	Catch (000's lbs)
2	9.0	May 15	May 31	16	2,078
		June 29	July 6	17	2,399
		July 25	Aug. 10	16	2,452
		Aug. 26	Sept. 8	13	2,091
				62	9,020
3	11.0	May 15	May 31	16	4,467
		June 19	July 6	17	4,604
		July 25	Aug. 4	10	2,565
				43	11,636
3C	—	Apr. 8	Nov. 15	220	674
4East	—	Apr. 8	Apr. 28	19	131
		Aug. 16	Sept. 3	17	210
				36	341
4West	—	Apr. 8	Nov. 16	220	317
TOTAL	22.0				21,988

Table 6. (cont'd). Summary of the catch by the commercial fishery and the number of fishing days by fishing period and regulatory area in 1977.

Area	Catch limit (millions)	Opening Date	Closing Date	Fishing Days	Catch (000's lbs)
2	11.0	May 10	May 29	19	3,024
		June 16	July 4	18	2,411
		July 20	Aug. 7	18	1,823
		Aug. 23	Sept. 10	18	1,562
				73	8,820
3	11.0	May 10	May 29	19	4,759
		June 16	July 4	18	4,775
		July 20	July 30	10	1,623
				47	11,157
3B	*	Sept. 15	Oct. 3	18	821
3C	—	Apr. 1	Nov. 15	227	389
4A	—	Apr. 1	Apr. 21	19	20
		Aug. 9	Aug. 29	19	—
				38	20
4B	—	Apr. 1	Apr. 21	19	109
		Aug. 9	Aug. 29	19	161
				38	270
4C	—	Apr. 1	Apr. 21	19	35
		Aug. 9	Aug. 29	19	94
				38	129
4DEast	—	Apr. 1	Apr. 21	19	—
		Aug. 9	Aug. 29	19	5
				38	5
4DWest	—	Apr. 1	Nov. 15	227	257
TOTAL	22.0				21,868

* Additional fishing without catch limit

APPENDIX II. Annual landings, value (U.S. dollars), and calculated ex-vessel price, 1929-1986.

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	42,884	.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	1.38	96,092
1957	60,854	.17	10,345				
1958	64,508	.21	13,547				
1959	71,204	.19	13,529				

*Preliminary

APPENDIX III. Table 1. Juvenile halibut CPUE and average length (cm) by age and by sampling area, 1986.

AREA		AGE											
		0	1	2	3	4	5	6	7	8	9	10	Total
A. Using 90 mm mesh for 60-minute tow													
Cape St.	CPUE	—	0.06	0.72	4.22	4.06	4.39	4.22	1.50	0.22	—	—	19.39
Elias	Av. Lgth.	—	23.0	30.7	39.0	46.5	52.0	57.6	60.2	59.7	—	—	49.1
Cape	CPUE	—	—	5.26	29.44	3.13	2.35	1.88	0.56	—	—	—	42.62
Chiniak	Av. Lgth.	—	—	27.9	37.7	43.4	51.4	56.3	57.8	—	—	—	38.8
Chirikof	CPUE	—	—	3.59	25.01	6.97	7.75	8.30	2.09	0.55	0.35	—	54.61
Island	Av. Lgth.	—	—	25.0	34.8	40.4	49.1	55.0	58.2	60.6	62.8	—	41.3
Unimak	CPUE	—	—	—	4.72	8.64	3.68	3.92	3.12	2.64	0.72	0.32	27.76
Island	Av. Lgth.	—	—	—	33.6	42.8	47.8	54.1	57.4	60.5	61.3	60.1	47.5
Gulf of	CPUE	—	0.03	2.26	14.38	5.75	4.40	4.40	1.87	0.76	0.25	0.06	34.16
Alaska	Av. Lgth.	—	24.4	27.6	36.5	42.9	50.2	55.9	57.7	60.3	61.7	60.0	43.2
Bering	CPUE	—	—	0.12	0.24	2.65	2.53	1.06	2.06	0.12	0.12	—	8.9
Sea	Av. Lgth.	—	—	21.0	34.7	44.0	49.5	57.7	58.2	63.0	63.0	—	50.5

Note: Minor discrepancies between values of the Gulf of Alaska and its sampling areas are an artifact of the procedure used to project unaged halibut to the aged sample.

APPENDIX III

Table 2. Commercial landings in numbers, CPUE in number per 10,000 skates, and average weight in pounds (dressed, head-off) at age by regions, 1986.

	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	13	7	6.7	98	19	10.1	0	0	0.0
6	114	64	9.8	818	160	10.7	396	137	8.9
7	1003	559	10.8	4646	911	12.6	1851	643	12.7
8	2453	1367	15.1	13278	2604	13.7	6881	2389	16.0
9	3583	1997	17.3	20417	4004	15.8	11189	3884	18.2
10	3028	1687	20.8	11195	2196	19.5	13790	4787	21.3
11	1694	944	21.9	8157	1600	21.6	9657	3352	23.8
12	840	468	27.6	4222	828	26.0	8063	2799	28.2
13	317	177	40.3	1762	346	20.7	5573	1935	35.5
14	172	96	47.5	992	195	37.1	2949	1024	51.9
15	55	31	38.0	711	139	26.5	1703	591	55.3
16	125	70	53.2	85	17	42.8	1820	632	51.6
17	46	26	41.8	104	20	31.9	453	157	66.9
18	106	59	49.8	85	17	45.1	340	118	109.3
19	21	12	58.3	0	0	0.0	113	39	52.4
20	29	16	60.9	159	31	51.4	340	118	71.4
21+	76	42	94.5	244	48	62.1	792	275	109.2
Tot	13676	7621	20.6	66974	13135	18.0	65911	22879	27.5
	Av Len 96.6,	Av Age	9.8	Av Len 93.6,	Av Age	9.6	Av Len 104.2,	Av Age	10.9
	#Oto's 1266,	#Aged	883	#Oto's 1577,	#Aged	667	#Oto's 582,	#Aged	578

	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	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	3484	223	10.5	302	92	8.3	485	109	9.3
7	14501	927	13.8	3000	914	12.7	4548	1019	14.5
8	42499	2718	16.1	7634	2326	15.7	22870	5123	16.2
9	74456	4762	20.4	21330	6499	18.5	39336	8812	19.4
10	53300	3409	24.4	21624	6589	23.4	35032	7848	25.1
11	38589	2468	27.6	19709	6005	28.6	33404	7483	28.1
12	28528	1824	32.0	17552	5348	36.5	28060	6286	34.0
13	20667	1322	39.0	15355	4679	36.4	22666	5078	39.9
14	14582	933	40.2	10911	3325	45.5	9898	2217	42.7
15	6876	440	49.6	5473	1668	49.8	5716	1280	48.5
16	5687	364	49.6	4855	1479	54.0	4414	989	49.3
17	4172	267	56.0	1850	564	52.2	2639	591	52.9
18	1788	114	64.8	1778	542	63.5	1504	337	55.7
19	3037	194	64.3	1712	522	61.2	951	213	90.7
20	1497	96	75.8	700	213	75.3	588	132	96.9
21+	1213	78	79.0	561	171	76.6	1007	226	90.3
Tot	314877	20137	27.0	134346	40935	31.8	213418	47809	29.3
	Av Len 104.3,	Av Age	10.5	Av Len 110.0,	Av Age	11.6	Av Len 107.6,	Av Age	11.0
	#Oto's 5104,	#Aged	1197	#Oto's 1505,	#Aged	1142	#Oto's 1997,	#Aged	1188

APPENDIX III

Table 2. Commercial landings in numbers, CPUE in number per 10,000 skates, and average weight in pounds (dressed, head-off) at age by regions, 1986.

	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	88	32	1.1
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	132	41	15.0	199	17	7.8	734	265	14.5
7	1386	434	13.2	20442	1750	17.8	5194	1877	16.1
8	4621	1447	17.1	53325	4564	22.1	19396	7008	21.3
9	13864	4341	19.2	105370	9019	27.9	33451	12087	27.0
10	17492	5477	24.5	115618	9896	35.0	26824	9692	33.7
11	23898	7482	31.4	92624	7928	42.1	21649	7822	42.8
12	24866	7785	36.3	90413	7739	51.0	15964	5768	49.7
13	19375	6066	40.5	73546	6295	54.0	11889	4296	52.1
14	13053	4087	44.9	30599	2619	67.1	5289	1911	67.4
15	7742	2424	49.9	25793	2208	65.6	2654	959	69.7
16	6372	1995	50.2	15565	1332	81.6	2539	917	61.1
17	2112	661	54.2	7597	650	73.2	1496	541	71.9
18	2335	731	57.8	4958	424	91.0	179	65	59.8
19	1303	408	75.8	2057	176	100.2	366	132	56.7
20	881	276	92.7	542	46	115.7	117	42	153.8
21+	497	156	67.2	2706	232	151.5	205	74	166.0
Tot	140182	43891	35.6	641994	54949	43.1	148033	53488	37.5
	Av Len 114.2, Av Age 12.1			Av Len 121.1, Av Age 11.1			Av Len 116.1, Av Age 10.4		
	#Oto's 1776, #Aged 1192			#Oto's 8532, #Aged 1190			#Oto's 1788, #Aged 1029		

	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	0	0	0.0
6	445	128	11.3	0	0	0.0	0	0	0.0
7	4423	1275	16.3	28	281	17.0	1313	575	14.7
8	17623	5081	20.6	132	1323	20.6	9756	4270	19.0
9	38725	11165	25.5	481	4820	27.1	24970	10930	21.8
10	19908	5740	34.1	425	4259	30.4	11357	4971	28.8
11	21828	6293	45.7	453	4539	37.5	13439	5882	35.8
12	16826	4851	52.5	406	4068	40.2	9973	4365	44.2
13	12382	3570	60.8	236	2365	41.9	7880	3449	47.6
14	4162	1200	62.7	123	1232	44.8	3401	1489	47.3
15	2220	640	71.5	142	1423	40.0	3222	1410	47.0
16	2744	791	75.2	75	752	51.6	1844	807	56.5
17	1071	309	85.4	85	852	55.9	1458	638	58.0
18	528	152	102.0	38	381	69.6	513	225	69.4
19	643	185	117.6	28	281	68.2	709	310	79.3
20	0	0	0.0	9	90	70.5	417	183	67.5
21+	478	138	159.6	37	371	75.7	1346	589	92.7
Tot	144046	41531	39.3	2699	27044	37.2	91600	40095	34.1
	Av Len 117.1, Av Age 10.5			Av Len 117.0, Av Age 11.7			Av Len 112.9, Av Age 11.0		
	#Oto's 3306, #Aged 1194			#Oto's 286, #Aged 286			#Oto's 3312, #Aged 2166		

APPENDIX III

Table 2. Commercial landings in numbers, CPUE in number per 10,000 skates, and average weight in pounds (dressed, head-off) at age by regions, 1986.

	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	0	0	0.0	0	0	0.0
5	27	12	6.7	95	4	10.1	0	0	0.0
6	235	104	9.8	4577	211	10.4	787	102	8.9
7	2067	912	10.8	20455	942	13.4	7548	974	13.8
8	5056	2229	15.1	61035	2811	15.6	30507	3938	16.1
9	7386	3256	17.3	103317	4758	19.3	60670	7832	19.1
10	6242	2752	20.8	76259	3512	23.1	56659	7315	24.4
11	3492	1540	21.9	54943	2530	26.1	53115	6857	28.3
12	1731	763	27.6	39757	1831	30.6	45615	5889	34.9
13	653	288	40.3	27277	1256	37.2	38023	4909	38.5
14	355	156	47.5	18044	831	41.9	20811	2687	44.2
15	113	50	38.0	9051	417	48.9	11190	1445	49.1
16	258	114	53.2	7395	341	50.0	9270	1197	51.8
17	95	42	41.8	4608	212	56.5	4489	580	52.6
18	218	96	49.8	2155	99	70.9	3281	424	59.9
19	43	19	58.3	3069	141	63.9	2663	344	71.7
20	60	26	60.9	1944	90	73.1	1287	166	85.2
21+	157	69	94.5	2192	101	87.8	1568	202	85.4
Tot	28190	12430	20.6	436173	20087	25.7	347784	44899	30.2
	Av Len 96.6,	Av Age	9.8	Av Len 102.7,	Av Age	10.4	Av Len 108.6,	Av Age	11.2
	#Oto's 1266,	#Aged	883	#Oto's 7263,	#Aged	2442	#Oto's 3502,	#Aged	2330

	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	88	14	1.1
4	0	0	0.0	0	0	0.0	0	0	0.0
5	110	3	9.7	0	0	0.0	0	0	0.0
6	5599	169	10.2	331	22	10.7	1179	189	13.3
7	29549	891	13.4	21828	1467	17.5	9617	1542	16.2
8	95615	2884	15.7	57946	3895	21.7	37018	5936	21.0
9	170311	5136	19.2	119234	8014	26.9	72176	11574	26.2
10	137969	4161	23.6	133110	8947	33.6	46732	7494	33.8
11	111209	3354	27.1	116522	7832	39.9	43478	6972	44.2
12	87266	2632	32.8	115279	7749	47.8	32791	5258	51.1
13	66340	2001	38.0	92921	6246	51.2	24271	3892	56.6
14	39504	1191	43.1	43652	2934	60.4	9451	1516	65.3
15	20534	619	49.0	33535	2254	62.0	4874	782	70.5
16	16986	512	51.0	21937	1475	72.5	5284	847	68.4
17	9265	279	54.5	9709	653	69.0	2567	412	77.5
18	5599	169	64.1	7293	490	80.4	707	113	91.3
19	5835	176	67.4	3361	226	90.7	1009	162	95.4
20	3313	100	77.7	1422	96	101.4	117	19	153.8
21+	3895	117	87.0	3203	215	138.4	682	109	161.6
Tot	809202	24405	27.6	782176	52575	41.8	292079	46838	38.4
	Av Len 105.4,	Av Age	10.8	Av Len 120.0,	Av Age	11.3	Av Len 116.6,	Av Age	10.5
	#Oto's 12031,	#Aged	5655	#Oto's 10308,	#Aged	2382	#Oto's 5094,	#Aged	2223

APPENDIX III

Table 2. Commercial landings in numbers, CPUE in number per 10,000 skates, and average weight in pounds (dressed, head-off) at age by regions, 1986.

	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	88	4	1.1	0	0	0.0	88	2	1.1
4	0	0	0.0	0	0	0.0	0	0	0.0
5	0	0	0.0	0	0	0.0	110	2	9.7
6	1510	72	12.7	0	0	0.0	7109	125	10.7
7	31445	1489	17.1	1342	563	14.8	62335	1100	15.3
8	94964	4498	21.4	9888	4147	19.1	200468	3538	18.6
9	191410	9066	26.6	25451	10674	21.9	387173	6834	23.0
10	179842	8518	33.7	11782	4941	28.9	329592	5818	29.3
11	160000	7578	41.1	13892	5826	35.9	285102	5032	35.3
12	148069	7013	48.6	10379	4353	44.1	245714	4337	42.8
13	117192	5551	52.3	8116	3404	47.4	191648	3383	47.1
14	53103	2515	61.3	3524	1478	47.2	96131	1697	53.3
15	38409	1819	63.1	3364	1411	46.7	62307	1100	57.5
16	27221	1289	71.7	1920	805	56.3	46127	814	63.4
17	12276	581	70.8	1543	647	57.9	23083	407	63.4
18	8000	379	81.3	550	231	69.4	14150	250	74.0
19	4370	207	91.8	737	309	78.9	10942	193	77.9
20	1539	73	105.4	426	179	67.5	5278	93	85.0
21+	3885	184	142.5	1383	580	92.2	9165	162	111.3
Tot	1074255	50880	40.8	94299	39548	34.2	1977756	34909	35.1
	Av Len 119.2, Av Age 11.1			Av Len 112.9, Av Age 11.0			Av Len 113.3, Av Age 10.9		
	#Oto's 15402, #Aged 4605			#Oto's 3312, #Aged 2166			#Oto's 30745, #Aged 12426		

TABLE 3. 1986 ADULT SURVEY CATCH PER UNIT EFFORT (NUMBER OF FISH PER SKATE) AND AVERAGE WEIGHT (POUNDS, HEADS-OFF, EVISCERATED) OF MALES AND FEMALES BY AGE AND REGION.

REGION:	CHARLOTTE				SOUTHEASTERN				KODIAK			
	MALES		FEMALES		MALES		FEMALES		MALES		FEMALES	
AGE	NPUE	AVG. WGT.	NPUE	AVG. WGT.	NPUE	AVG. WGT.	NPUE	AVG. WGT.	NPUE	AVG. WGT.	NPUE	AVG. WGT.
2	-	-	-	-	-	-	-	-	-	-	-	-
3	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-
5	0.009	3.3	0.034	4.4	0.015	5.2	0.050	6.4	0.033	6.1	0.076	3.8
6	0.078	5.0	0.112	5.6	0.078	3.9	0.096	4.4	0.237	4.7	0.153	6.3
7	0.112	6.9	0.205	8.2	0.185	5.6	0.165	9.4	0.258	5.9	0.260	9.3
8	0.176	8.2	0.270	11.9	0.292	7.4	0.236	11.5	0.362	8.2	0.283	17.5
9	0.229	8.6	0.259	17.0	0.583	9.1	0.447	16.0	0.777	11.0	0.523	21.1
10	0.128	10.4	0.152	20.8	0.467	14.6	0.468	21.8	0.497	16.2	0.529	29.7
11	0.122	13.8	0.147	30.8	0.368	17.8	0.493	30.8	0.434	18.5	0.475	41.8
12	0.103	15.3	0.102	34.2	0.393	19.4	0.492	38.2	0.563	24.8	0.484	56.0
13	0.052	18.2	0.055	42.9	0.513	25.3	0.655	48.1	0.487	29.3	0.628	65.9
14	0.065	21.2	0.059	50.4	0.293	24.7	0.511	56.2	0.338	30.8	0.440	78.0
15	0.044	25.0	0.029	48.3	0.265	28.3	0.378	61.2	0.190	31.4	0.371	95.3
16	0.014	19.6	0.031	75.2	0.194	35.6	0.220	68.6	0.157	45.2	0.237	94.6
17	0.008	37.5	0.005	69.6	0.131	38.4	0.143	73.2	0.117	39.3	0.161	103.9
18	0.015	39.1	0.011	90.0	0.131	38.1	0.153	81.8	0.061	67.7	0.089	108.7
19	0.003	66.4	0.003	62.0	0.043	36.0	0.065	98.2	0.052	66.9	0.071	116.8
20	0.004	36.9	0.005	132.3	0.060	41.2	0.045	86.1	0.010	74.3	0.064	121.3
21	-	-	-	-	0.040	48.6	0.035	105.8	0.026	100.3	0.027	163.6
22	-	-	-	-	0.047	53.2	0.041	99.4	0.013	74.3	0.078	148.6
23	-	-	0.005	91.3	0.018	48.4	0.029	131.4	-	-	0.019	197.9
24	-	-	0.002	129.8	0.009	56.6	0.019	135.8	0.011	48.5	0.011	169.1
25+	-	-	-	-	0.007	80.4	0.021	134.2	-	-	0.045	192.4
TOT	1.161		1.486		4.130		4.763		4.622		5.026	

TABLE 4. 1986 ADULT SURVEY CATCH PER UNIT EFFORT (NUMBER OF FISH PER SKATE) OF MALES AND FEMALES BY 5 CM. LENGTH INTERVAL AND REGION.

REGION:	CHARLOTTE		SOUTHEASTERN		KODIAK	
LENGTH INTERVAL	MALE NPUE	FEMALE NPUE	MALE NPUE	FEMALE NPUE	MALE NPUE	FEMALE NPUE
30-34	-	-	-	-	-	-
35-39	-	-	-	-	-	-
40-44	-	-	-	-	0.000	-
45-49	0.000	-	0.000	-	0.000	-
50-54	0.000	-	0.019	0.034	0.016	0.016
55-59	0.015	0.005	0.070	0.040	0.051	0.021
60-64	0.045	0.031	0.154	0.063	0.165	0.075
65-69	0.106	0.083	0.218	0.093	0.288	0.104
70-74	0.158	0.151	0.327	0.149	0.417	0.108
75-79	0.231	0.134	0.328	0.180	0.386	0.145
80-84	0.196	0.137	0.309	0.190	0.375	0.166
85-89	0.107	0.181	0.344	0.208	0.357	0.200
90-94	0.085	0.127	0.344	0.172	0.312	0.197
95-99	0.067	0.091	0.298	0.226	0.321	0.138
100-104	0.066	0.084	0.307	0.251	0.348	0.203
105-109	0.020	0.080	0.314	0.284	0.330	0.227
110-114	0.029	0.048	0.289	0.267	0.325	0.167
115-119	0.013	0.047	0.219	0.308	0.288	0.210
120-124	0.004	0.079	0.196	0.323	0.142	0.293
125-129	0.006	0.047	0.164	0.275	0.148	0.192
130-134	0.000	-	0.117	0.260	0.045	0.295
135-139	0.008	0.023	0.050	0.293	0.099	0.247
140-144	0.006	0.023	0.018	0.227	0.072	0.227
145-149	0.000	-	0.024	0.219	0.052	0.291
150-154	0.000	-	0.005	0.172	0.040	0.282
155-159	0.000	-	0.004	0.175	0.023	0.282
160-164	0.000	-	0.005	0.081	0.000	-
165-169	0.000	-	0.000	-	0.011	0.191
170-174	0.000	-	0.003	0.072	0.000	-
175-179	0.000	-	0.003	0.046	0.008	0.096
180-184	0.000	-	0.000	-	0.000	-
185-189	0.000	-	0.000	-	0.000	-
190-194	-	-	0.000	-	0.000	-
195-199	-	-	0.000	-	0.000	-
200+	-	-	0.000	-	0.000	-
TOTAL	1.161	1.486	4.130	4.763	4.622	5.026

APPENDIX III Table 5. Catch, median age, and average weight data from the standardized adult setline surveys, 1963-1986.

	Sublegals (<81 cm)					Adults (>80 cm)				
Year/ Hook-Type	Lbs. per Skate	No. per Skate	Avg. Wgt.	Median Age	% Female	Lbs. per Skate	No. per Skate	Avg. Wgt.	Median Age	% Female
Charlotte										
1965-66 J	3.0	0.4	7.1	7.2	27	43.6	1.2	37.3	11.4	71
1976 J	2.1	0.3	7.8	8.0	11	26.8	0.8	34.7	10.3	79
1977 J	1.7	0.2	7.6	7.6	31	14.7	0.5	31.4	10.4	60
1978 J	1.7	0.2	7.3	6.7	29	20.7	0.6	35.0	11.3	53
1980 J	2.5	0.3	7.6	7.5	35	29.0	1.0	28.2	10.3	63
1981 J	1.8	0.3	7.3	7.1	30	18.2	0.6	30.1	10.5	67
1982 J	2.5	0.3	7.3	7.5	36	23.2	0.8	28.6	10.4	66
1983 J	4.3	0.6	6.8	7.3	36	20.5	0.8	26.5	10.2	70
1984 J	5.6	0.8	7.3	7.2	42	27.3	1.1	24.7	10.1	74
1984 O	18.5	2.6	7.1	7.2	37	65.2	2.7	23.9	10.1	59
1985 O	15.1	2.3	6.7	7.8	35	47.5	2.0	23.7	10.1	69
1986 O	8.0	1.1	7.6	7.6	43	40.6	1.6	25.6	10.6	66
Southeast										
1982 J	4.4	0.6	6.9	7.7	34	114.8	3.0	38.2	11.6	63
1983 J	4.4	0.6	7.1	7.9	33	139.0	3.7	37.9	11.7	63
1984 J*	6.0	0.9	—	—	—	120.9	3.2	—	—	—
1984 O	23.3	3.5	6.7	7.3	39	265.9	7.7	34.5	11.2	57
1985 O	16.2	2.3	6.9	8.2	35	260.6	7.1	36.6	12.0	65
1986 O	12.4	1.8	7.0	8.5	33	282.7	7.1	39.8	12.9	61
Kodiak										
1963 J	3.9	0.6	6.3	7.5	30	86.3	2.2	38.6	10.5	72
1977 J	5.5	1.0	5.7	7.0	30	73.0	1.5	47.3	10.2	70
1978 J	4.3	0.8	5.5	6.1	40	33.1	0.8	39.8	9.7	65
1979 J	6.0	1.0	6.0	6.7	36	52.0	1.4	36.8	9.9	65
1980 J	5.2	0.8	6.4	7.4	40	93.7	2.3	41.2	10.8	75
1981 J	6.8	1.1	6.2	6.9	37	160.4	3.5	45.4	11.3	71
1982 J	2.5	1.0	7.3	7.2	39	160.7	3.7	43.4	10.4	70
1983 J	5.7	0.9	6.3	7.0	47	143.7	3.2	45.4	11.2	72
1984 J	6.7	1.0	6.7	7.3	37	214.0	4.6	46.7	11.2	74
1984 O	22.9	3.3	6.9	7.3	43	443.6	10.9	40.8	11.2	72
1985 O	22.6	3.3	7.0	7.7	41	461.6	11.4	40.3	11.3	68
1986 O	13.4	1.9	7.0	7.6	41	379.9	7.7	49.0	12.3	75

*1984 J hook values are estimated from combined data collected in the Charlotte and Kodiak surveys in 1984.

Publications

CALENDAR YEAR 1986

Best, E.A. and Gilbert St-Pierre. 1986. Pacific halibut as predator and prey. International Pacific Halibut Commission, Technical Report 21, 27 p.

Deriso, Richard B. 1986. Factores a considerar en el manejo de una pesqueria incierta. [IN] Bases Biologicas y Marco Conceptual Para el Manejo de Los Recursos Pelagicos en el Pacifico Suroriental. Lima, Peru.

Deriso, R.B., S.H. Hoag, and D.A. McCaughran. 1986. Two hypotheses about factors controlling production of Pacific halibut. International North Pacific Fisheries Commission, Bulletin No. 47:167-174.

International Pacific Halibut Commission. 1986. Annual Report 1985. 59 p.

__________. 1986. Pacific halibut fishery regulations, 9 p.

__________. 1986. Commercial halibut regulations for 1986. Information Bulletin No. 33.

Isaki, C.T., L. Shultz, P.J. Smith, and G. Diffendal. 1986. Methods for census undercount adjustment. [IN] Small Area Statistics, R. Platek, J. Rao, C. Sarndal, and M. Singh, editors. Wiley-Interscience: New York.

Sedransk, J. and P.J. Smith. 1986. Confidence intervals for quantiles of finite populations. [IN] Handbook of Statistics, Volume 6: Sampling, P.R. Krishnaiah, editor. North Holland Publishing Company.

COMMISSION PUBLICATIONS — 1930-1986

Reports

1.* Report of the International Fisheries Commission appointed under the Northern Pacific Halibut Treaty. John Pease Babcock, William A. Found, Miller Freeman, and Henry O'Malley. 31 p. (1931).

2. Life history of the Pacific halibut (1) Marking experiments. William F. Thompson and William C. Herrington. 137 p. (1930).

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).

6.* Biological statistics of the Pacific halibut fishery (1) Changes in the yield of a standardized unit of gear. William F. Thompson, Harry A. Dunlop, and F. Heward Bell. 108 p. (1931).

7.* Investigations of the International Fisheries Commission to December 1930, and their bearing on the regulation of the Pacific halibut fishery. John Pease Babcock, William A. Found, Miller Freeman, and Henry O'Malley. 29 p. (1930).

8.* Biological statistics of the Pacific halibut fishery (2) Effects of changes in intensity upon total yield and yield per unit of gear. William F. Thompson and F. Heward Bell. 49 p. (1934).

9.* Life history of the Pacific halibut (2) Distribution and early life history. William F. Thompson and Richard Van Cleve. 184 p. (1936).

10. Hydrographic sections and calculated currents in the Gulf of Alaska. 1929. Thomas G. Thompson, George F. McEwen, and Richard Van Cleve, 32 p. (1936).

11. Variations in the meristic characters of flounders from the northeastern Pacific. Lawrence D. Townsend. 24 p. (1936).

12. Theory of the effect of fishing on the stock of halibut. William F. Townsend. 22 p. (1937).

13. Regulation and investigation of the Pacific halibut fishery in 1947 (Annual Report). IFC. 35 p. (1948).

14. Regulation and investigation of the Pacific halibut fishery in 1948 (Annual Report). IFC. 30 p. (1949).

15. Regulation and investigation of the Pacific halibut fishery in 1949 (Annual Report). IFC. 24 p. (1951).

16. Regulation and investigation of the Pacific halibut fishery in 1950 (Annual Report). IFC. 16 p. (1951).

17. Pacific Coast halibut landings 1888 to 1950 and catch according to area of origin. F. Heward Bell, Henry A. Dunlop, and Norman L. Freeman. 47 p. (1952).

18. Regulation and investigation of the Pacific halibut fishery in 1951 (Annual Report). Edward W. Allen, George R. Clark, Milton C. James, and George W. Nickerson. 29 p. (1952).

19. The production of halibut eggs on the Cape St. James spawning bank off the coast of British Columbia 1935-1946. Richard Van Cleve and Allyn H. Seymour. 44 p. (1953).

20. Regulation and investigation of the Pacific halibut fishery in 1952 (Annual Report). Edward W. Allen, George R. Clark, Milton C. James, George W. Nickerson, and Seton H. Thompson. 29 p. (1953).

21. Regulation and investigation of the Pacific halibut fishery in 1953 (Annual Report). IPHC. 22 p. (1954).

22. Regulation and investigation of the Pacific halibut fishery in 1954 (Annual Report). IPHC. 32 p. (1955).

23. The incidental capture of halibut by various types of fishing gear. F. Heward Bell. 48 p. (1956).

24. Regulation and investigation of the Pacific halibut fishery in 1955 (Annual Report). IPHC. 15 p. (1956).

*Out of print.

Reports

25. Regulation and investigation of the Pacific halibut fishery in 1956 (Annual Report). IPHC. 27 p. (1957).
26. Regulation and investigation of the Pacific halibut fishery in 1957 (Annual Report). IPHC. 16 p. (1958).
27. Regulation and investigation of the Pacific halibut fishery in 1958 (Annual Report). IPHC. 21 p. (1959).
28. Utilization of Pacific halibut stocks: Yield per recruitment. Staff. IPHC. 52 p. (1960).
29. Regulation and investigation of the Pacific halibut fishery in 1959 (Annual Report). IPHC. 17 p. (1960).
31. Regulation and investigation of the Pacific halibut fishery in 1960 (Annual Report). IPHC. 24 p. (1961).
31. Utilization of Pacific halibut stocks: Estimation of maximum sustainable yield, 1960. Douglas G. Chapman, Richard J. Myhre, and G. Morris Southward, 35 p. (1962).
32. Regulation and investigation of the Pacific halibut fishery in 1961 (Annual Report). IPHC. 23 p. (1962).
33. Regulation and investigation of the Pacific halibut fishery in 1962 (Annual Report). IPHC. 27 p. (1963).
34. Regulation and investigation of the Pacific halibut fishery in 1963 (Annual Report). IPHC. 24 p. (1964).
35. Investigation, utilization and regulation of the halibut in southeastern Bering Sea. Henry A. Dunlop, F. Heward Bell, Richard J. Myhre, William H. Hardman, and G. Morris Southward. 72 p. (1964).
36. Catch records of a trawl survey conducted by the International Pacific Halibut Commission between Unimak Pass and Cape Spencer, Alaska from May 1961 to April 1963. IPHC. 524 p. (1964).
37. Sampling the commercial catch and use of calculated lengths in stock composition studies of Pacific halibut. William H. Hardman and G. Morris Southward. 32 p. (1965).
38. Regulation and investigation of the Pacific halibut fishery in 1964 (Annual Report). IPHC. 18 p. (1965).
39. Utilization of Pacific halibut stocks: Study of Bertalanffy's growth equation. G. Morris Southward and Douglas G. Chapman. 33 p. (1965).
40. Regulation and investigation of the Pacific halibut fishery in 1965 (Annual Report). IPHC. 23 p. (1966).
41. Loss of tags from Pacific halibut as determined by double-tag experiments. Richard J. Myhre. 31 p. (1966).
42. Mortality estimates from tagging experiments on Pacific halibut. Ricahrd J. Myhre. 43 p. (1967).
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).
45. The halibut fishery, Shumagin Islands and westward not including Bering Sea. F. Heward Bell, 34 p. (1967).
46. Regulation and investigation of the Pacific halibut fishery in 1967 (Annual Report). IPHC. 23 p. (1968).
47. A simulation of management strategies in the Pacific halibut fishery. G. Morris Southward. 70 p. (1968).
48. The halibut fishery south of Willapa Bay, Washington. F. Heward Bell and E.A. Best. 36 p. (1968).
49. Regulation and investigation of the Pacific halibut fishery in 1968 (Annual Report). IPHC. 19 p. (1969).

50.* Agreements, conventions and treaties between Canada and the United States of America with respect to the Pacific halibut fishery. F. Heward Bell. 102 p. (1969).

51. Gear selection and Pacific halibut. Richard J. Myhre. 35 p. (1969).
52. Viability of tagged Pacific halibut. Gordon J. Peltonen. 25 p. (1969).

SCIENTIFIC REPORTS

53. Effects of domestic trawling on the halibut stocks of British Columbia. Stephen H. Hoag. 18 p. (1971).
54. A reassessment of effort in the halibut fishery. Bernard E. Skud. 11 p. (1972).
55. Minimum size and optimum age of entry for Pacific halibut. Richard J. Myhre. 15 p. (1974).
56. Revised estimates of halibut abundance and the Thompson-Burkenroad debate. Bernard Einar Skud. 36 p. (1975).
57. Survival of halibut released after capture by trawls. Stephen H. Hoag. 18 p. (1975).
58. Sampling of landings of halibut for age composition. G. Morris Southward. 31 p. (1976).
59. Jursidictional and administrative limitations affecting management of the halibut fishery. Bernard Einar Skud. 24 p. (1976).
60. The incidental catch of halibut by foreign trawlers. Stephen H. Hoag and Robert R. French. 24 p. (1976).
61. The effect of trawling on the setline fishery for halibut. Stephen H. Hoag. 20 p. (1976).
62. Distribution and abundance of juvenile halibut in the southeastern Bering Sea. E. A. Best. 23 p. (1977).
63. Drift, migration, and intermingling of Pacific halibut stocks. Bernard Einar Skud. 42 p. (1977).
64.* Factors affecting longline catch and effort: I. General review, Bernard E. Skud; II. Hook-spacing. John M. Hamley and Bernard E. Skud; III. Bait loss and competition. Bernard E. Skud. 66 p. (1978).
65. Abundance and fishing mortality of Pacific halibut, cohort analysis, 1935-1976. Stephen H. Hoag and Ronald J. McNaughton, 45 p. (1978).
66. Relation of fecundity to long-term changes in growth, abundance and recruitment. Cyreis C. Schmitt and Bernard E. Skud. 31 p. (1978).
67. The Pacific halibut resource and fishery in Regulatory Area 2: I. Management and biology. Stephen H. Hoag, Richard J. Myhre, Gilbert St-Pierre, and Donald A. McCaughran. II. Estimates of biomass, surplus production, and reproductive value. Richard B. Deriso and Terrance J. Quinn II. 89 p. (1983).
68. Sampling Pacific halibut *(Hippoglossus stenolepis)* landings for age composition: History, evaluation, and estimation. Terrance J. Quinn II, E.A. Best, Lia Bijsterveld, and Ian R. McGregor. 56 p. (1983).
69. Comparison of efficiency of snap gear to fixed-hook setline gear for catching Pacific halibut. Richard J. Myhre and Terrance J. Quinn II. 37 p. (1984).
70. Spawning locations and season for Pacific halibut. Gilbert St-Pierre. 46 p. (1984).
71. Recent changes in halibut CPUE: Studies on area differences in setline catchability. Stephen H. Hoag, Richard B. Deriso, and Gilbert St-Pierre. 44 p. (1984).
72. Methods of population assessment of Pacific halibut. Terrance J. Quinn II, Richard B. Deriso, and Stephen H. Hoag. 52 p. (1985).

TECHNICAL REPORTS

1. Recruitment investigations: Trawl catch records Bering Sea, 1967. E. A. Best. 23 p. (1969).
2. Recruitment investigations: Trawl catch records Gulf of Alaska, 1967. E. A. Best. 32 p. (1969).
3. Recruitment investigatons: Trawl catch records eastern Bering Sea, 1968 and 1969. E. A. Best. 24 p. (1969).
4. Relationship of halibut stocks in Bering Sea as indicated by age and size composition. William H. Hardman. 11 p. (1969).
5. Recruitment investigation: Trawl catch records Gulf of Alaska, 1968 and 1969. E. A. Best. 48 p. (1969).
6.* The Pacific halibut. F. Heward Bell and Gilbert St-Pierre. 24 p. (1970).
7. Recruitment investigation: Trawl catch records eastern Bering Sea, 1963, 1965 and 1966. E. A. Best. 52 p. (1970).
8. The size, age and sex composition of North American setline catches of halibut *(Hippoglossus hippoglossus stenolepis)* in Bering Sea, 1964-1970. William H. Hardman. 31 p. (1970).
9. Laboratory observations on early development of the Pacific halibut. C. R. Forrester and D. F. Alderdice. 13 p. (1973).
10. Otolith length and fish length of Pacific halibut. G. Morris Southward and William H. Hardman. 10 p. (1973).
11. Juvenile halibut in the eastern Bering Sea: Trawl surveys, 1970-1972. E. A. Best. 32 p. (1974).
12. Juvenile halibut in the Gulf of Alaska: Trawl surveys, 1970-1972. E. A. Best. 63 p. (1974).
13. The sport fishery for halibut: Development, recognition and regulation. Bernard Einar Skud. 19 p. (1975).
14. The Pacific halibut fishery: Catch, effort and CPUE, 1929-1975. Richard J. Myhre, Gordon J. Peltonen, Gilbert St-Pierre, Bernard E. Skud, and Raymond E. Walden. 94 p. (1977).
15. Regulations of the Pacific halibut fishery, 1924-1976. Bernard E. Skud. 47 p. (1977).
16.* The Pacific halibut: Biology, fishery, and management. International Pacific Halibut Commission. 56 p. (1978).
17. Size, age, and frequency of male and female halibut: Setline research catches, 1925-1977. Stephen H. Hoag, Cyreis C. Schmitt, and William H. Hardman. 112 p. (1979).
18. Halibut assessment data: Setline surveys in the north Pacific Ocean, 1963-1966 and 1976-1979. Stephen H. Hoag, Gregg H. Williams, Richard J. Myhre, and Ian R. McGregor. 42 p. (1980).
19. I. Reducing the incidental catch of prohibited species in the Bering Sea groundfish fishery through gear restrictions. Vidar G. Wespestad, Stephen H. Hoag, and Renold Narita. II. A comparison of Pacific halibut and Tanner crab catches in (1) side-entry and top-entry crab pots and (2) side-entry crab pots with and without Tanner boards. Gregg H. Williams, Donald A. McCaughran, Stephen H. Hoag, and Timothy M. Koeneman. 35 p. (1982).
20. Juvenile halibut surveys, 1973-1980. E.A. Best and William H. Hardman. 38 p. (1982).
21. Pacific Halibut as predator and prey. E.A. Best and Gilbert St-Pierre. 27 p. (1986).

*out of print

INFORMATION BULLETINS

1. Bait experiments. 2 p. (1972).
2. Hook-spacing. 2 p. (1972).
3. Length-weight relationship. 1 p. (1972).
4. Minimum commercial size for halibut. 1 p. (1973).
5. Information on Japanese hooks. 1 p. (1974).
6. 1974 halibut regulations. 1 p. (1974).
7. Halibut catch in 1974. 1 p. (1974).
8. $300 halibut landed in Seattle. 1 p. (1974).
9. Fisherman needed for tagging study with U.S.S.R. 1 p. (1975).
10. Soak-time and depth of fishing. 1 p. (1975).
11. Japanese hooks in halibut. 1 p. (1975).
12. Notice on 1975 halibut regulations. 1 p. (1975).
13. Cooperative halibut research with U.S.S.R. 1 p. (1975).
14. Halibut catch improves in 1975. 1 p. (1975).
15. Japanese hooks and IPHC premium tags. 1 p. (1976).
16. 1976 halibut catch. 1 p. (1976).
17. Questionnaire on 1977 regulations. 1 p. (1977).
18. Why split the halibut season? 2 p. (1977).
19. Environmental conditions-1977. 1 p. (1977).
20. Possession of halibut during closed periods. 1 p. (1977).
21. Halibut migrates from Soviet Union to Alaska. 1 p. (1977).
22. 1978 halibut regulations. 1 p. (1978).
23. Halibut tags-May 1979. 1 p. (1979).
24. Progress report on the 1979 halibut fishery. 2 p. (1979).
25. Stock assessment research program-detailed catch information. 1 p. (1979).
26. Commercial halibut regulations for 1980. 1 p. (1980).
27. Commercial halibut regulations for 1983. 2 p. (1983).
28. Circle hooks outfish traditional halibut hooks. 1 p. (1983).
29. Commercial halibut regulations for 1984, 2 p. (1984).
30. New halibut license system. 1 p. (1984).
31. Commercial halibut regulations for 1985. 2 p. (1985).
32. Research fishing off the coast of Oregon. 1 p. (1985).
33. Commercial halibut regulations for 1986. 4 p. (1986).

ANNUAL REPORTS

Annual Report 1969. 24 p. (1970).
Annual Report 1970. 20 p. (1971).
Annual Report 1971. 36 p. (1972).
Annual Report 1972. 36 p. (1973).
Annual Report 1973. 52 p. (1974).
Annual Report 1974. 32 p. (1975).
Annual Report 1975. 36 p. (1976).
Annual Report 1976. 40 p. (1977).
*Annual Report 1977. 39 p. (1978).
*Annual Report 1978. 40 p. (1979).
Annual Report 1979. 43 p. (1980).
Annual Report 1980. 49 p. (1981).
Annual Report 1981. 48 p. (1982).
Annual Report 1982. 56 p. (1983).
*Annual Report 1983. 59 p. (1984).
Annual Report 1984. 63 p. (1985).
Annual Report 1985. 59 p. (1986).

*out of print