INTERNATIONAL PACIFIC HALIBUT COMMISSION

Established by a Convention Between

Canada and the United States of America

ANNUAL REPORT
1985

SEATTLE, WASHINGTON

1986

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: Traditionally, dressing a freshly caught halibut was a skill learned by fishermen over a period of days or weeks. Shortened openings and unprecedented catch rates have compressed this learning period to a matter of hours. As the halibut fishing fleet copes with maximizing catch in today's short fishing periods, the importance of delivering a high quality product should not be overlooked. Cleaning and bleeding the fish as soon as it is brought aboard the vessel is of prime concern. High prices for halibut will be more likely maintained by providing the market with a consistently top grade product.

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International Pacific Halibut Commission

ANNUAL REPORT 1985

Contents

Activities of the Commission

The 61st Annual Meeting of the Commission was held in Vancouver, British Columbia on January 28-31, 1985, with Mr. Robert Morley presiding as Chairman and Mr. Robert W. McVey as Vice Chairman. The Commission staff reviewed the 1984 Pacific halibut fishery, summarized the results of scientific investigations, and presented its regulatory proposals for the 1985 fishery. The Conference Board, representing vessel owners and fishermen, presented and discussed its regulatory proposals with the Commission. The Commission reviewed all proposals with the Advisory Group, consisting of fishermen, vessel owners, and processors, before adopting regulations for the 1985 halibut fishery. 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 1985, and adopted the budget for fiscal year 1987-1988. Mr. McVey was elected Chairman for 1985 and Mr. Morley 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 from evidence of continued rebuilding throughout its range, particularly in the Gulf of Alaska. The Commission noted a decrease in the incidental catch of halibut in fisheries targeting on other species, and urged that further steps be taken to reduce these losses.

Following the meeting, letters were sent to the governments, noting that stocks are expected to remain strong in the near future and that annual catches of 50 to 60 million pounds are sustainable. The division of the harvest in Area 2 continued to be an important topic, leading the Commission to adopt the following management policy for Area 2:

"WHEREAS, the Commission acknowledges the historic spirit and intent of the Protocol, specifically as it relates to the 60/40 division of the catch in Area 2; and

WHEREAS, the Commission is desirous of optimizing production from all parts of Area 2 based upon careful consideration of scientific data provided by Commission staff and other sources; and

WHEREAS, the Commission is informed by the Commission staff that the current distribution of stocks represents a departure from the long-term condition in this area;

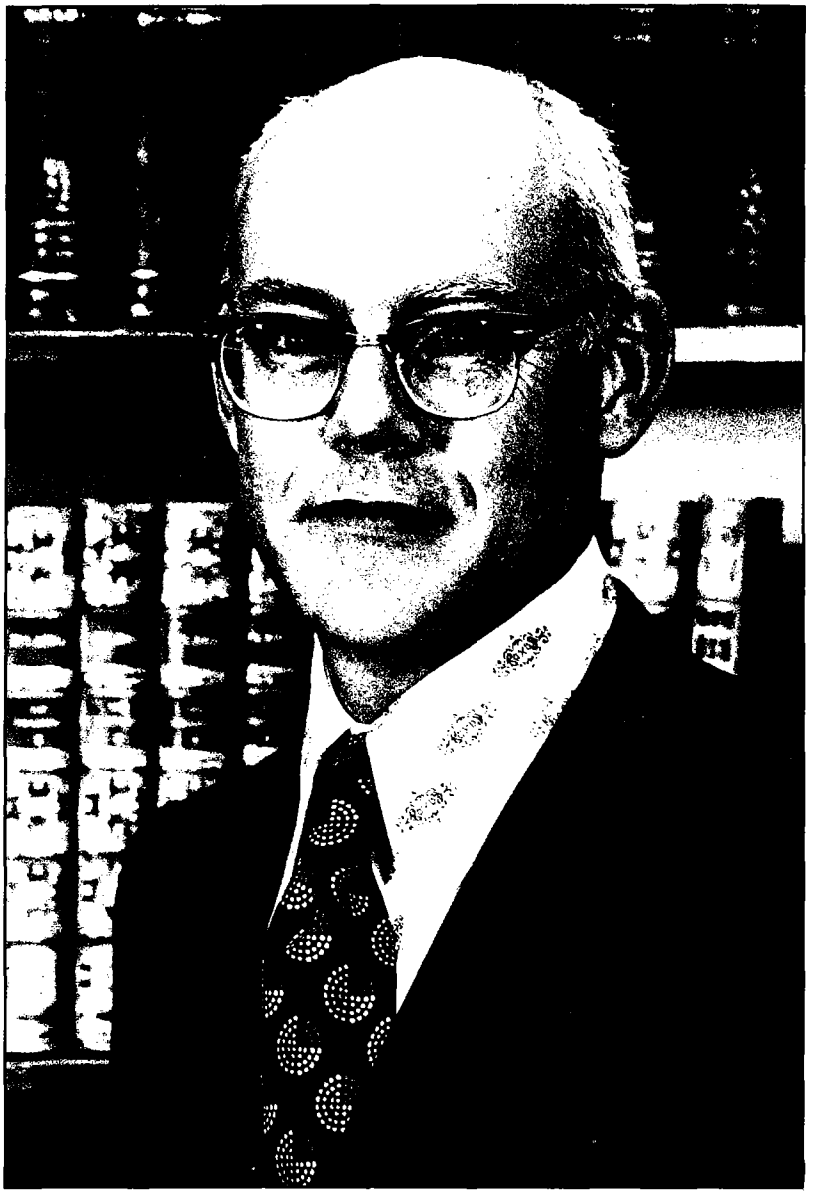
Based on these unusual conditions, the Commission recommends that a departure from the 60/40 catch division is appropriate in 1985. In future years, departures from the 60/40 catch division will be considered based on stock conditions at that time."

The letter to the governments noted the decline in the level of foreign incidental catch, but expressed concern about the incidental catch by the United States yellowfin sole fishery in the Bering Sea and flounder and cod fishery in the Kodiak area. The Commission urged the United States and Canada to continue their efforts to reduce these losses by encouraging the use of species-selective gear and fishing methods.

Also included in the letter to the governments was a recommendation that the United States and Canadian governments initiate a study to determine the legality of the respective enforcement agencies to suspend IPHC licenses for flagrant violation. Finally, the Commission acknowledged the Canadian Department of Fisheries and Oceans' staff and the United States North Pacific Fishery Management Council and National Marine Fisheries Service staffs for their help in Commission deliberations.

A list of reports published by the Commission staff during 1985 is appended to this Annual Report. Several documents were also prepared at the request of the governments.

Expenditures during the 1984-1985 fiscal year (April through March) were $1,514,000 (U.S.). The Commission expenses were shared equally by both governments as required by the Halibut Convention.



The Halibut Commission pays special recognition in this annual report to Richard J. Myhre, who retired as Assistant Director on May 31, 1985. Dick joined the Commission staff in 1949 as a junior biologist and quickly became involved in the activities of the Commission and its research program. In 1970, Dick was appointed Assistant Director by the Commission. The Commission and staff express their thanks to Dick for his many years of service and wish Dick and his wife Dorothy many happy years of retirement.

Also retiring in 1985 were William H. Hardman, Senior Biologist, after 39 years on the Commission staff, and Mary Ann Pape, Administrative Assistant, who had been on the Commission staff for 17 years.

4D — 0.6 million pounds, and Area 4E — 50,000 pounds. The Conference Board proposed 12-day openings in Area 2A, with opening dates of May 9, June 8, July 24, August 23, and September 19. In Area 2B, 9-day openings were recommended with the following closing dates: April 28, June 16, August 18, and September 29. Simultaneous openings were recommended for Areas 2C, 3A, 3B, 4A, 4B, and 4D. They were as follows: April 29-30, May 27-28, June 24-25, July 9 for four days in Areas 4A and 4B, and 10 days in Area 4D. An opening between August 7 and 14 was recommended for Areas 4A, 4B, and 4D, and openings on September 9 and 10 were proposed for Areas 2C, 3A, and 3B. The final opening for all areas would begin on September 20. The Conference Board also recommended that the June 24 opening only be considered if there were enough fishing days remaining for a season in September as well.

The Conference Board also advised the Commission to accept the request by the U.S. National Marine Fisheries Service for a special season for the Makah Indian Tribe. This proposal would allow tribal members to fish between the Area 2A seasons with handline gear in the area in which they have historic treaty fishing rights. The U.S. National Marine Fisheries Service also 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 Commission discussed all regulatory proposals with the Advisory Group. Members of the Advisory Group in 1985 were Tom Shafer, Newport, Oregon; Dale W. Johnson, Neah Bay, Washington; Jon Adams, Ray Weaver, Robert Alverson, Doug Wallick, Ralph Hoard, Mark Sandvik, Seattle, Washington; Elmer Norman, George Dodman, John Radosevic, James Tarkanen, Dave Keeling, Vancouver, British Columbia; R.H. Payne, Victoria, British Columbia; Dana Doerksen, John Newton, Sid Dickens, Prince Rupert, British Columbia; Barbara Monkiewicz, Kodiak, Alaska; Chuck Kekoni, Homer, Alaska; Ted Lekanof, St. George, Alaska; Mike Zacharof, St. Paul, Alaska; Sig Mathisen, Petersburg, Alaska; and Walt Cothran, Pelican, Alaska.

The regulations recommended by the Commission were approved by the United States Secretary of State on March 11, 1985, and by the Governor General of Canada by Order in Council on April 18, 1985, and became officially effective on the latter date.

REGULATORY AREAS

Regulatory areas for the 1985 halibut fishery are shown in Figure 1. Boundary lines for the regulatory areas are the same as in 1984. The closed area in the eastern Bering Sea was the same as in 1984, and was closed to all halibut fishing. A brief description of the regulatory areas for the 1985 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,
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., and west of 168° 00′ W.,
Area 4D — all waters north of Areas 4A and 4B, and west of Area 4C,
Area 4E — all waters in the Bering Sea north of the closed area, east of 168° 00′ W. and south of 65° 34′ N.

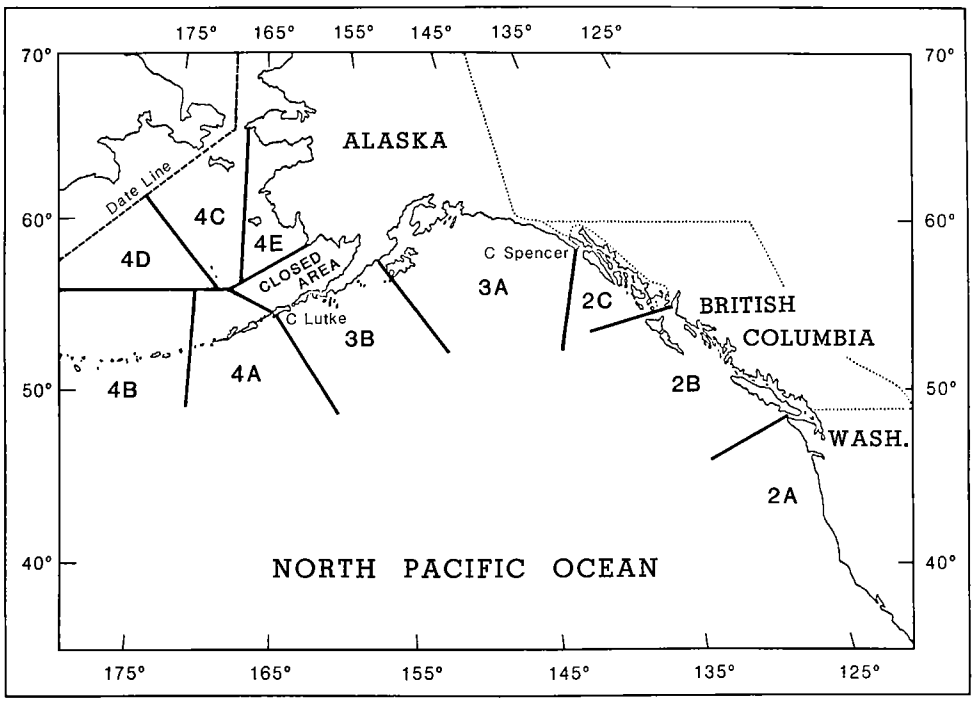


Figure 1. Regulatory areas, 1985.

CATCH LIMITS AND LENGTHS OF SEASONS

The total catch limit for all areas in 1985 was 55.75 million pounds. This was 12.7 million pounds more than the 43.05 million pound catch limit in 1984. The 1985 catch limit in Area 2 was 19.5 million pounds, 4.5 million pounds more than the catch limit in 1984. The catch limits in Regulatory Areas 2A, 2B, and 2C were 0.5, 10.0, and 9.0 million pounds, respectively. In Area 3 the catch limit was 32.0 million pounds, 7 million pounds more than the catch limit in 1984. Of this, 23 million pounds was allocated to Area 3A and 9 million pounds to Area 3B. In Area 4, the catch limit was 4.25 million pounds, 1.2 million pounds more than in 1984. Of this, 1.7 million pounds was allocated to Area 4A, 1.3 million pounds to Area 4B, 0.6 million pounds to each of Areas 4C and 4D, and 50,000 pounds to Area 4E.

The opening and closing dates and lengths of the fishing periods for 1984 and 1985 are given in Table 1. Fishing seasons in all areas in 1985 consisted of a series of fishing periods, each of specified length. When the catch limit for each area was reached 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).

OTHER REGULATIONS

Regulations pertaining to minimum size limits, gear restrictions, licensing, and closed areas were the same as in 1984. However, the sport fishing season was extended for 1985, closing on December 31, rather than on October 31, as in prior years.

Table 1. Opening and closing dates by area, 1984-1985.

	1984			1985		
Area	Opening Date	Closing Date	Fishing Days	Opening Date	Closing Date	Fishing Days
2A	May 21	June 2	12	May 9	May 21	12
	June 21	July 3	12	June 8	June 20	12
	July 22	Aug. 2	11	July 24	July 31	7
2B	Apr. 24	May 6	12	Apr. 20	Apr. 29	9
	May 23	June 2	10	June 7	June 16	9
				Aug. 14	Aug. 18	4
2C	May 22	May 25	3	Apr. 27	Apr. 29	2
				May 27	May 29	2
3A	May 21	May 25	4	Apr. 27	Apr. 29	2
	Aug. 20	Aug. 21	1	May 27	May 29	2
				Sept. 10	Sept. 11	1
3B	May 21	May 25	4	Apr. 27	Apr. 29	2
	Aug. 20	Aug. 21	1	May 27	May 29	2
	Sept. 18	Sept. 19	1	June 24	June 25	1
				Sept. 9	Sept. 11	2
4A	May 21	May 25	4	Apr. 27	Apr. 29	2
	June 18	June 21	3	May 27	May 29	2
				June 24	June 26	2
				July 9	July 12	3
4B	May 21	May 25	4	Apr. 27	Apr. 29	2
	June 18	June 21	3	May 27	May 29	2
	Aug. 2	Aug. 9	7	June 24	June 26	2
				July 9	July 13	4
				Aug. 7	Aug. 13	6
4C*	May 21	July 25	33	June 1	July 18	24
4D	May 21	May 25	4	Apr. 27	Apr. 29	2
	June 18	June 28	10	May 27	May 29	2
				June 24	June 26	2
				July 9	July 19	10
				Aug. 7	Aug. 14	7
4E**	May 21	Oct. 30	110	May 21	Oct. 29	108

*Alternating 1 day open and 1 day closed.

**Alternating 2 days open and 1 day closed (includes one 8-day open period from August 2 to August 10 in 1984 only).

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 1985.

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 and 1985.

Catch by Regulatory Area

The total 1985 Pacific coast halibut catch was 56.1 million pounds, 11.15 million pounds more than was taken in 1984, but only 0.35 million pounds greater than the catch limit. In spite of a 25 percent increase in catch from the previous year and a 15 percent decrease in the number of vessels reporting landings, there was almost no change in the number of days required to take the catch. The catch by country and major regulatory area for 1981 through 1985 is shown in Table 2. The catches for all years are shown by regulatory area as defined in the 1985 Pacific Halibut Fishery regulations to facilitate comparison of similar geographic regions.

In Area 2A, the waters off California, Oregon, and Washington, the 1985 catch was 493,000 pounds, nearly the same as the 0.5 million pound catch limit and 62,000 pounds more than was taken in 1984. Three fishing periods totalling 31 days were required to take the catch, a reduction of four fishing days from the 35 days fished in 1984. Halibut landings for the first 12-day period were 145,000 pounds, for the second 12-day period 229,000 pounds, and for the final 7-day period 119,000 pounds.

In Area 2B, the waters off British Columbia, the 1985 catch was nearly 10.4 million pounds, 1.3 million pounds more than was taken in 1984 and 0.4 million pounds greater than the catch limit. The 22 fishing days allowed in 1985 were the same as in 1984, but was divided into three fishing periods instead of the two allowed the previous year, thus allowing fishing in late summer. Catches of 3.8 and 5.6 million pounds were taken during the 9-day periods April and June, and an additional 1.0 million pounds was taken during 4 days in August.

In Area 2C, the waters off Southeastern Alaska, the 1985 catch was 9.2 million pounds, just slightly over the 9.0 million pound catch limit and nearly 3.4 million pounds more than the 1984 catch. Catches of 4.0 and 5.2 million pounds were taken in two 2-day fishing periods, whereas the total 1984 catch had been taken in a single 3-day period.

Catch limits in Areas 3A and 3B were 23.0 and 9.0 million pounds, respectively. However, a provision in the 1985 halibut fishery regulations stipulated that both areas

Table 2. Catch by country and regulatory area*, 1981-1985 (in thousands of pounds).

Regulatory Area	1981	1982	1983	1984	1985
Area 2A					
U.S.	202	211	265	431	493
Area 2B					
Canada	5,654	5,538	5,436	9,054	10,389
Area 2C					
U.S.	4,010	3,500	6,398	5,847	9,207
Area 3A					
U.S.	14,225	13,530	14,112	19,971	20,852
Area 3B					
U.S.	451	4,800	7,751	6,503	10,888
Area 4					
U.S.	1,190	1,429	4,422	3,164	4,284
ALL AREAS					
U.S.	20,078	23,470	32,948	35,916	45,724
Canada	5,654	5,538	5,436	9,054	10,389
Total	25,732	29,008	38,384	44,970	56,113

*Regulatory Areas defined in 1985 Pacific Halibut Fishery Regulations.

would be closed to halibut fishing if the catch limit of 32.0 million pounds for the combined areas was taken. Both areas were closed under this provision when the combined catch reached 31.75 million pounds, just 250,000 pounds below the catch limit.

In Area 3A, the waters between Cape Spencer and the western end of Kodiak Island, the 1985 catch was 20.8 million pounds, 2.2 million pounds below the catch limit, and 0.8 million pounds more than the 1984 catch. The catch was taken during two 2-day fishing periods in April and May and a 1-day fishing period in early September. Catches were 7.5, 10.5, and 2.8 million pounds in each period, respectively. Catches during the last period were low because many vessels chose to fish in Area 3B, which had a concurrent 2-day fishery, instead of the single day scheduled in Area 3A. In 1984, 20.0 million pounds were caught in two fishing periods totalling five days. The number of vessels reporting catches from Area 3A in 1985 was 1,254, down 26 percent from the 1,697 reporting landings in 1984.

In Area 3B, the waters between Kodiak Island and Unimak Pass, the 1985 catch was 10.9 million pounds, 1.9 million pounds over the catch limit. The catch was taken during three 2-day fishing periods in April, May, and September and a 1-day fishing period in June. Landings during the April and May fishing periods were only 0.5 and 0.9 million pounds, respectively, as most of the Area 3 fleet concentrated their fishing in Area 3A. During the 1-day June fishing period, when Area 3A was closed, catches increased to 3.2 million

pounds, and an additional 6.3 million pounds was taken during September. In 1984, 6.5 million pounds was caught during one 4-day and two 1-day fishing periods. A total of 385 vessels reported halibut landings in 1985, an increase of 15 percent from 334 vessels in 1984.

In Area 4A, which includes all Pacific and Bering Sea waters surrounding the Fox Islands, and waters along the 100 fathom edge in the Bering Sea south of 56° 20'N., the 1985 halibut catch was 1.7 million pounds, the same as the catch limit and 0.6 million pounds more than was taken in 1984. The catch for three 2-day fishing periods in April, May, and June totalled only 260,000 pounds, as most vessels fished in Area 3. The majority of the catch, nearly 1.5 million pounds, was taken during a 3-day fishing period in July. In 1984, two fishing periods totalling seven days resulted in a catch of 1.1 million pounds, with most of the catch being taken during the final period of three days. A total of 46 large vessels fished in Area 4A in 1985, up sharply from 28 large vessels in 1984.

In Area 4B, which includes all waters surrounding the Aleutian Islands west of the meridian of 172° W., the catch limit was 1.3 million pounds, with the actual catch only 65,000 pounds below this limit. All but 78,000 pounds of the actual catch was taken during a 6-day fishing period in August. The remainder was caught during three 2-day periods and one 4-day period in earlier months. Local fishermen caught 72,000 pounds and 30 large vessels based outside the area took the balance. In 1984, 1.1 million pounds were taken, with most of the catch being taken during the last of the three allowable fishing periods.

Area 4C includes all the shallow grounds in the Bering Sea north of 56° 20'N. and west of the meridian of 168° W., but all of the fishing was concentrated near the Pribilof Islands. Twenty-four 1-day fishing periods resulted in a catch of 620,000 pounds, just slightly over the 0.6 million pound catch limit. Pribilof Island fishermen caught 270,000 pounds and eight non-resident vessels caught 350,000 pounds. This compares with a 1984 catch of 250,000 pounds by local fishermen and 330,000 pounds by non-resident vessels during 33 1-day fishing periods.

In Area 4D, the 100 fathom edge north of 56° 20'N. in the Bering Sea, the catch was 681,000 pounds, 81,000 pounds greater than the 0.6 million pound catch limit. The total catch was taken by eight vessels during one 10-day fishing period in July and one 7-day fishing period in August. Nine vessels caught 392,000 pounds from this area in 1984.

Area 4E, the Bering Sea flats north of the closed area and east of the meridian of 168° W., was established in 1984 to assist Nelson Island native fishermen in developing a local fishery for halibut. The catch limit in 1984 and 1985 was 50,000 pounds, and actual catches were 35,000 and 36,000 pounds, respectively. Most of the landings occurred during late June and early July.

Number of Vessels

The number of vessels, number of landings, and catch by vessel tonnage class in 1985 are given in Table 3. IPHC regulations require that all vessels fishing for halibut must have an annual license issued by the Commission, but 315 vessels, or 10 percent of the vessels reporting landings, did not. Although the number of unlicensed vessels in 1985 is reduced from the 1984 level of 501 vessels, the rate of noncompliance with the licensing requirement remains unreasonably high.

The number of Canadian vessels landing halibut in 1985 was almost identical to the previous year, whereas the number of United States vessels declined by 575, or over 17 percent. This represents the second successive year of a gradual reduction in the number of active participants in the United States halibut fishery. Most of the reduction occurred

among the small boat portion of the Area 3A fleet, where fishing was hampered by poor weather during several of the fishing periods.

Table 3. Number of vessels, number of landings, and catch by vessel tonnage class by regulatory area, 1985.

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	—	—	—	31	52	2	31	52	2
Setliners	58	124	802	73	132	180	131	256	982
Total	58	124	802	104	184	182	162	308	984
Licensed									
Unkn. tons	10	26	109	68	131	217	78	157	326
1-4 tons	8	25	77	381	776	806	389	801	883
5-19 tons	258	798	6,153	569	1,222	3,736	827	2,020	9,889
20-39 tons	43	108	2,225	156	299	2,250	199	407	4,475
40-59 tons	9	24	581	21	36	556	30	60	1,137
60+ tons	6	12	442	4	10	202	10	22	644
Total	334	993	9,587	1,199	2,474	7,767	1,533	3,467	17,354
All Vessels	392	1,117	10,389	1,303	2,658	7,949	1,695	3,775	18,338
AREA 3*									
Unlicensed									
Trollers	—	—	—	—	—	—	—	—	—
Setliners	—	—	—	153	442	417	153	442	417
Other**	—	—	—	—	—	4	—	—	4
Total	—	—	—	153	442	421	153	442	421
Licensed									
Unkn. tons	—	—	—	41	99	189	41	99	189
1-4 tons	—	—	—	392	1,173	724	392	1,173	724
5-19 tons	—	—	—	529	1,165	5,864	529	1,165	5,864
20-39 tons	—	—	—	235	678	11,760	235	678	11,760
40-59 tons	—	—	—	73	270	9,007	73	270	9,007
60+ tons	—	—	—	78	249	9,810	78	249	9,810
Total	—	—	—	1,348	3,634	37,354	1,348	3,634	37,354
All Vessels	—	—	—	1,501	4,076	37,775	1,501	4,076	37,775
GRAND TOTAL	392	1,117	10,389	2,804	6,734	45,724	3,196	7,851	56,113

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

Landings by Port

Landings in central Alaskan ports increased from 23.0 million pounds in 1984 to over 30.2 million pounds in 1985, reflecting the 8.2 million pound increase in catch limits for Areas 3 and 4 in 1985. Nearly 16 million pounds were landed at Kodiak, the leading halibut port on the coast. The ports of Seward and Sitka in Alaska and Prince Rupert, the leading Canadian port, all reported landings of nearly 4.1 million pounds. Twenty-six percent of the Canadian halibut catch (2.7 million pounds) was delivered directly to ports in Washington state. The remaining Canadian catch was equally divided between northern and southern British Columbia ports.

VALUE OF THE COMMERCIAL CATCH

The total ex-vessel value of the 1985 catch was $49.9 million (U.S.) compared to $34.1 million for 1984. Fishermen received an average price of $0.889 per pound, an overall increase of $0.131 per pound over the price received in 1984. The 1985 ex-vessel value was the highest ever, surpassing the 1979 level of $48.1 million, and ninth in price per pound. The average price per pound in U.S. dollars received by fishermen in various regions of the coast for 1981 through 1985 is shown in Table 4. Annual landings, ex-vessel prices, and value of the catch from 1929-1985 are given in Appendix II.

In 1985, the Canadian catch totalled 10.4 million pounds with a landed value of $10.4 million (U.S.). This included 2.7 million pounds landed in Washington state ports at an average price of $1.126 per pound. In comparison, the Canadian catch in 1984 totalled 9.1 million pounds with a landed value of $7.5 million. The 1985 U.S. catch was 45.7 million pounds with a landed value of $39.5 million, compared to 35.9 million pounds with a landed value of $26.6 million in 1984.

Average ex-vessel prices in 1985 started low and increased as the fishing season progressed. The low price received during the first period of landings was probably due to market uncertainties created by the large increase in the catch quota. Such a large increase in the catch quota suggests that cold storage holdings of frozen halibut would be significantly

Table 4. Price per pound (U.S. dollars) by region, 1981-1985.

	Price per Pound				
Region	1981	1982	1983	1984	1985
Washington-Oregon	1.166	1.265	1.402	1.012	1.186
So. British Columbia	1.155	1.117	1.392	0.825	1.008
No. British Columbia	1.043	0.979	1.199	0.770	0.884
Southeastern Alaska	0.957	1.054	1.045	0.666	0.725
Central Alaska	0.968	1.060	1.088	0.709	0.857
Coast Wide Average	1.019	1.088	1.134	0.758	0.889
Average Received by:					
Canadian Fishermen	1.108	1.105	1.317	0.823	1.001
United States Fishermen	0.994	1.084	1.104	0.741	0.864

increased, which could translate into a glut in the market and lower prices. However, adequate spacing of landing periods, lower consumer prices, and aggressive marketing techniques enabled buyers to move a larger proportion of the catch into the fresh fish market than in past years. As a large part of the production was absorbed by the fresh fish market, which usually commands a higher price, ex-vessel prices increased steadily throughout the season for each period of landings. Ex-vessel prices paid in the port of Kodiak, where 35 percent of the U.S. catch was landed in 1985, reflect this fact. There were six landing periods in Kodiak and the average ex-vessel price increased each period: Period 1 — $0.589; Period 2 — $0.764; Period 3 — $0.815; Period 4 — $0.866; Period 5 — $1.062; and $1.266 for Period 6. Halibut landed in the southern ports continued to receive a higher price than those landed in Alaskan ports.

SPORT FISHERY

Sport halibut harvest estimates will likely be as high or higher in 1985 than in previous years. Communications with sport charter boat operators indicated they enjoyed excellent fishing in 1985. Several charter services in Homer, Alaska, reported that 1985 was one of the best for catching fish 100 pounds or greater in size. Charter fishing for halibut is growing each year and several operators are offering multiple day fishing trips and venturing further from port.

The Kenai Peninsula and Southeastern Alaska areas remain the top producers for sport-caught halibut. All other regions posted significant harvest increases in 1984 with the exception of Kodiak. Washington anglers nearly doubled their harvest between 1983 and 1984 as bottom fishing, particularly in the Strait of Juan de Fuca, continues to grow in popularity. Table 5 summarizes catches by sport fishermen from 1980 through 1984. Harvest estimates for 1985 will not be available from state and provincial agencies until 1986.

Table 5. Catch by sport fishermen (thousands of pounds), 1980-1984.

Area	1980	1981	1982	1983	1984
Alaska:					
Southeastern	333	319	489	562	628
Prince William Sound	42	36	36	47	59
Kenai Peninsula	404	517	521	1,067	1,096
Kodiak	45	84	122	145	139
Alaska Total	824	956	1,168	1,821	1,942
British Columbia	11	23	66	103	124
Washington	20	18	43	49	93
TOTAL	855	997	1,277	1,973	2,159

Sport Charterboat Questionnaire

A questionnaire was sent to 594 IPHC sport charter license holders in 1985 to gather sport harvest data, solicit comments from the charter fleet on how the sport fishery may be improved, and inform license holders of the voluntary IPHC sport charterboat logbook program. The Commission was also interested in determining the number of license holders who did not offer charter services in 1984. Information in varying degrees of completeness was provided by 211 respondents. Alaskan charter operators contributed most of the data, followed by Oregon, Washington, and British Columbia.

Suggestions received from the fleet were wide and varied, but generally fell into five categories, listed in order of frequency: (1) restrict commercial fishing/establish exclusive sport fishing areas; (2) institute a minimum size limit/weight limit; (3) increase the bag limit; (4) distribute promotional or educational material on halibut; and (5) increase enforcement of regulations.

Almost one third of the respondents offered comments on how the sport fishery could be improved. Although commercial seasons have been reduced in length in recent years, some operators felt the increased catches would impact them in the future. Others contended small commercial vessels created gear conflicts with the sport fishery, as they do not venture far from their home port during the short seasons.

Charter operators were also concerned that too many small halibut are being harvested in the sport fishery. Size limits were suggested to curtail this catch, and recommendations fell between 24 and 32 inches. In comparison, the minimum size limit in the commercial fishery is 32 inches.

Since bottom fishing is enjoying a resurgence in popularity due to cutbacks in sport salmon fishing in certain areas, an educational pamphlet on halibut was suggested. IPHC Technical Report No. 16, which presents a generalized discussion of the biology, fishery, and management of Pacific halibut, is being revised to reflect changes occurring within the commercial and sport fisheries and answers many of the questions usually raised by non-fishermen.

Few operators thought the bag limit should be raised. Personal communication with other charter operators seems to indicate the two-fish bag limit is adequate.

The category of least concern was the need for increasing enforcement. Abuse of certain regulations undoubtedly occurs, but apparently is not a major problem.

Catch and effort data for 1984 received through the questionnaire is summarized in Table 6. Catch per angler information may vary slightly as no attempt was made to adjust for time spent targetting on salmon. Directed effort for halibut occurs in Oregon near Hecata and Stonewall Banks, in Washington near Swiftsure Bank, and in numerous locations in Alaska. Average weight information is similar to data collected in previous years. However, the average weight of halibut caught in British Columbia is likely lower than that shown in the table as the sample size for that area was small. Approximately 23 percent of the operators did not offer charter services in 1984.

Voluntary Logbook Program

Participation in the sport charterboat logbook program was increased considerably as a result of the questionnaire. Nearly 160 charter operators contacted expressed a willingness to cooperate in the logbook program. Thus far, 58 boats have returned completed logs for

1985. This represents a substantial increase over the 16 boats participating in 1983 and 21 boats in 1984.

Table 6. Catch and effort by sport charterboats in 1984.

State	Catch per Angler (No. of fish)	Average Weight (lbs)	Average Fishing Day (hours)	Charter Season Length (days)
Alaska	1.35	15.0	6.3	30
British Columbia	0.06	40.8	7.7	96
Washington	0.29	12.6	6.6	42
Oregon	0.01	23.5	6.4	91
Overall	0.45	15.0	6.4	42

INCIDENTAL CATCH AND MORTALITY

Pacific halibut are inadvertently captured by other gear types in fisheries targeting on other species. These include the foreign trawl, and setline fisheries, the joint-venture fisheries, and the domestic crab pot, trawl, and setline fisheries. 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 fisheries, where an observer program is conducted under the auspices of the U.S. National Marine Fisheries Service. 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 usually 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. In summation, estimates of incidental catch in the foreign and joint-venture fisheries are considered quite reliable, whereas estimates of the incidental catch in other fisheries are less reliable.

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 28 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 12 million pounds in 1984 and are projected to be about 10.5 million pounds in 1985.

Estimates of incidental catches from 1978 through 1985 are shown in Table 7. The level of incidental catch in 1985 is less than half of the catch of 22.0 million pounds only six years ago. Most of this decrease has occurred in Area 3, where foreign trawl and setline fisheries have been reduced and are gradually being replaced by domestic fisheries. In Area 4, incidental catches have increased slightly since 1982 and averaged 5.5 million pounds annually over the past five years. Incidental catches in Area 2 have been relatively stable over the past five years, averaging slightly more than 2.0 million pounds annually.

Table 7. Estimates of the incidental catch (millions of pounds) of Pacific halibut, 1978-1985. "Other" includes domestic shrimp trawl and crab pot.

	Foreign		Joint	Domestic		
	Trawl	Setline	Venture	Fish Trawl[1]	Other	Total
Area 2						
1978	<0.1	—	—	2.9	0.2	3.2
1979	0.5	—	—	3.7	0.3	4.5
1980	0.2	—	—	2.7	0.4	3.3
1981	0.2	—	—	2.4	0.3	2.9
1982	—	—	—	1.7	0.3	2.0
1983	—	—	—	1.9	0.2	2.1
1984	—	—	—	2.1	0.2	2.3
1985[2]	—	—	—	2.0	0.2	2.2
Area 3						
1978	1.9	0.1	—	<0.1	3.3	5.3
1979	3.4	0.3	<0.1	0.1	3.7	7.5
1980	3.2	1.9	0.1	<0.1	4.0	9.2
1981	1.8	2.2	<0.1	0.1	3.5	7.6
1982	1.9	2.5	<0.1	NA	2.5	6.9
1983	1.3	4.1	0.6	NA	1.6	7.6
1984	0.9	1.6	1.0	NA	1.2	4.7
1985[2]	- 0.6 -		0.7	NA	1.1	2.4
Area 4						
1978	4.3	0.4	—	—	1.0	5.7
1979	4.5	0.2	—	—	1.3	6.0
1980	7.0	0.1	0.5	<0.1	1.8	9.4
1981	4.3	0.2	0.4	0.2	1.6	6.7
1982	2.5	0.1	0.9	NA	1.2	4.7
1983	2.7	0.4	0.7	NA	1.1	4.9
1984	2.5	1.0	0.6	NA	0.8	4.9
1985[2]	- 3.2 -		1.9	NA	0.8	5.9

[1]Includes both British Columbia and Washington-Oregon-California for Area 2.
[2]Preliminary data.

Within Area 2, almost 90 percent of the incidental catch is taken in the Canadian trawl fishery for groundfish. Other fisheries in Area 2 incurring minor incidental halibut catches are the domestic shrimp trawl fishery and king and Tanner crab fisheries in Southeastern Alaska. Incidental catches also occur in fisheries off Washington, Oregon, and California, but these are extremely low, usually less than 100 halibut annually.

Incidental catches in Area 3 have decreased in recent years, largely due to reduced fishing by foreign nations in the Gulf of Alaska. In 1985, incidental catches in this area totalled 2.4 million pounds, with approximately 25 percent attributed to foreign trawl and setline operations. The remainder occurred in joint-venture groundfish fisheries and in domestic fisheries for shrimp and crab. An additional, unknown amount was taken in domestic trawl fisheries for groundfish and in the domestic setline fishery for sablefish. Domestic fleets will likely replace the foreign fleets in the groundfish fishery over the next few years, as the latter is gradually phased out. However, the lack of an observer program for the domestic groundfish fisheries will result in less reliable estimates and control over incidental catch.

In Area 4, incidental catches have steadily increased in recent years, from 4.8 million pounds in 1982 to 5.9 million pounds in 1985. This is a result of increases in the incidental catch by the joint-venture and foreign setline fisheries. In particular, incidental catches in the joint-venture fisheries tripled from 1984 to 1985, largely due to sizeable bycatches in the yellowfin sole fishery occurring off the north side of the Alaska Peninsula. Incidental catch from other sources has declined considerably.

Mortality

Not all halibut that are incidentally captured die from the injuries received. Past studies conducted by IPHC indicate that approximately half of the fish caught in setline fisheries and in the domestic trawl fisheries survive, whereas fish caught in all other fisheries probably die. As a result, the actual loss, or incidental mortality, is less than the incidental catch. More recent studies have indicated that mortality may not be as high as previously believed. However, in order not to underestimate the potential loss, the former assumptions about mortality are used. The total incidental loss dropped below 10 million pounds in 1984 for the first time in many years and declined even further in 1985. The incidental loss has been traditionally the lowest in Area 2, with Areas 3 and 4 each accounting for about half of the remainder. This pattern changed somewhat in 1985, as estimates indicate the loss to be 1.2 million pounds in Area 2, 2.2 million pounds in Area 3, and approximately 5.0 million pounds in Area 4.

Regulations to control and minimize the incidental catch of halibut in foreign, joint-venture, and domestic fisheries off Alaska are developed and adopted by the U.S. North Pacific Fishery Management Council (NPFMC). Over the years, the NPFMC has used various combinations of time and area closures, bycatch ceilings, bycatch rate caps, and gear restrictions to minimize the incidental catch of halibut. IPHC has worked closely with the NPFMC in developing these regulations, making sure that critical halibut areas and seasons are protected.

During 1985, the NPFMC enacted new guidelines designed to control the bycatch of halibut in the domestic bottom trawl fisheries. The new Groundfish Management Plan for the Gulf of Alaska contains framework for setting an annual prohibited species catch (PSC) limit. This provides flexibility within the plan and will not hamper the growth of domestic fisheries. Input from the IPHC staff and other industry advisors led to the adoption of a

PSC of 1,265 mt (2.1 million pounds) of incidental mortality. This PSC was based on an average of the incidental catch by the foreign fleets over the past few years and should prevent incidental catches from increasing.

Still to be resolved in 1986 is the issue of large bycatches of prohibited species within the Bering Sea. The yellowfin sole joint-venture fishery has experienced large bycatches of crab and halibut, especially in the eastern Bering Sea, since its inception in 1980. Through industry agreements, reductions in the bycatch rate have been achieved during the past three years. Unfortunately, the number of vessels fishing for sole outpaced the bycatch rate reduction, and the total incidental catch has continued to climb. A combination of time/area closures and bycatch caps may be necessary in order to reduce incidental catches in this area.

Population Assessment

Overall, the Pacific halibut resource continued to grow in 1985, increasing in coastwide abundance by eight percent from 1984. Abundance increases occurred principally in Areas 2C and 3A, with only a minor increase in other areas. 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.

Annual surplus production (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. The estimated total surplus in 1985 is 75 million pounds with a range of 56 to 93 million pounds.

Estimates of available yield are even higher with a preferred method of setting quotas, which is the constant exploitation yield (CEY) concept described in the 1984 Annual Report. That approach is based on taking a fixed percentage of the adult stock each year. A 28 percent exploitation rate appears reasonable for the fishable halibut stock for a number of reasons, including (1) this is the $F_{0.1}$ fishing mortality rate for halibut (a technical method for getting high yield per recruit), (2) it is within the range of MSY exploitation rates, and (3) it is 90 percent of the best MSY exploitation estimate for the setline fishery which allows for 10 million pounds of incidental catch. A range of estimates of CEY is shown in Figure 2 for each regulatory area, along with median estimates for each area. The estimated total setline CEY is 73 million pounds and ranges from 66 to 80 million pounds.

In Figure 3, the current estimates of commercial ASP are placed in historical perspective. Commercial catch and annual surplus production are given in millions of pounds for the years 1935 through 1985. The current ASP estimate of 75 million pounds is

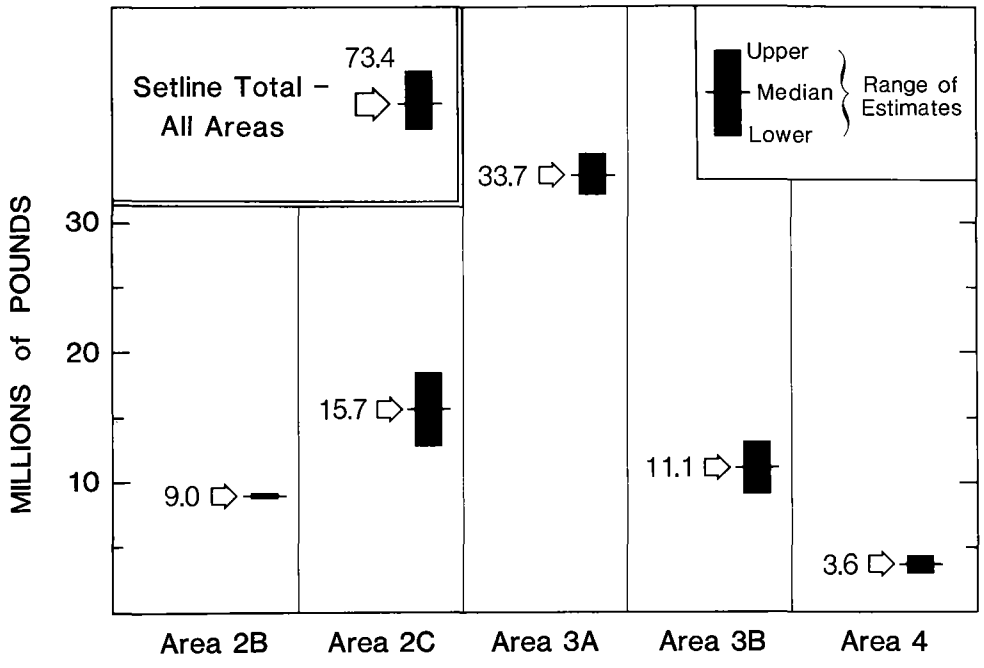


Figure 2. Constant exploitation yield estimates for 1985 by regulatory area.

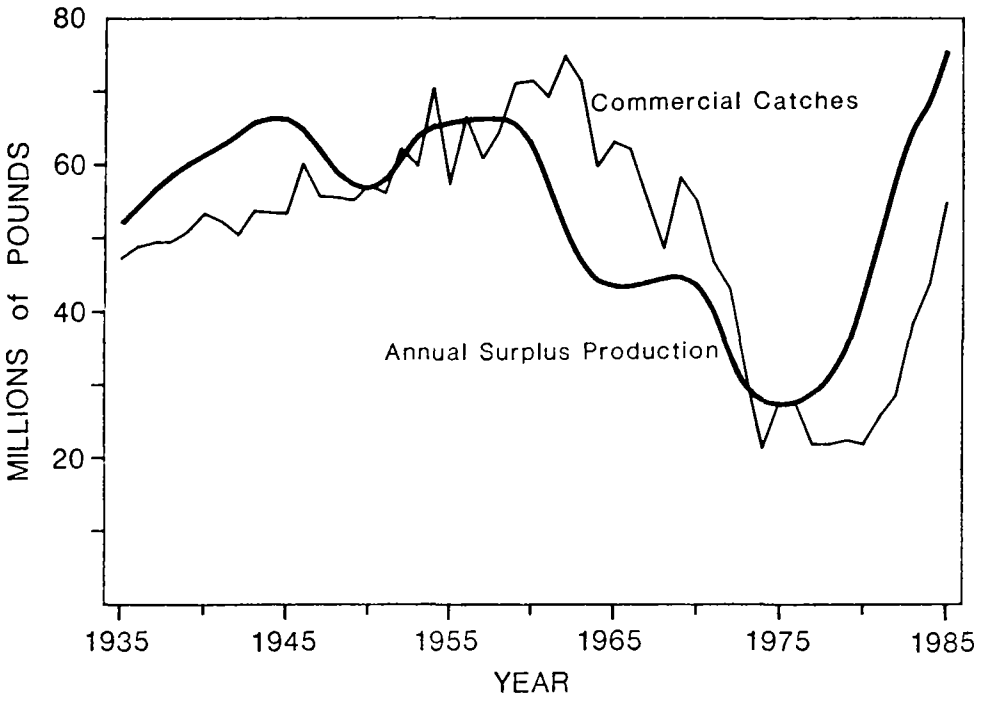


Figure 3. Annual surplus production and commercial catches of halibut for all regulatory areas combined.

the highest value for the last fifty years and exceeds the previous cyclical high point of 66 million pounds occurring in 1958. The current up cycle began around 1978 when ASP was 31 million pounds. This upward trend has lasted seven years, although there are preliminary signs that it is now leveling off at the current high level. The previous plateau of above 60 million pounds ASP lasted for 22 years (from 1939 to 1960), and we believe another long period of sustainable high yields is possible.

The driving force behind the recovery of the Pacific halibut resource is the recent high rate of production of juvenile halibut by the spawning adults. Figure 4 illustrates the historical trends in juvenile survival, juvenile production rate, and an index of spawning (mature stock biomass). Each of those trends is given by year of spawning. The latest spawn year given is 1976, since a reliable quantitative estimate of current juveniles (those less than eight years of age) is not available. The production rate of juvenile halibut during the last fifty years exhibits a periodic pattern with high points occurring around 1937 and again in 1976, and a low point occurring around 1956. This pattern of juvenile production rate is essentially opposite to the time trend for adult spawning biomass. For example, the current high recruitment of young adult halibut in the fishable stock was produced in the early 1970's by the lowest spawning stocks in our fifty-year data series, whereas the dismal natural survival of juveniles in the late 1950's occurred when spawning biomass was very high.

One hypothesis for the observed cyclic pattern in juvenile production rate is that high densities of adults reduce the juveniles' survival and growth through some type of density-

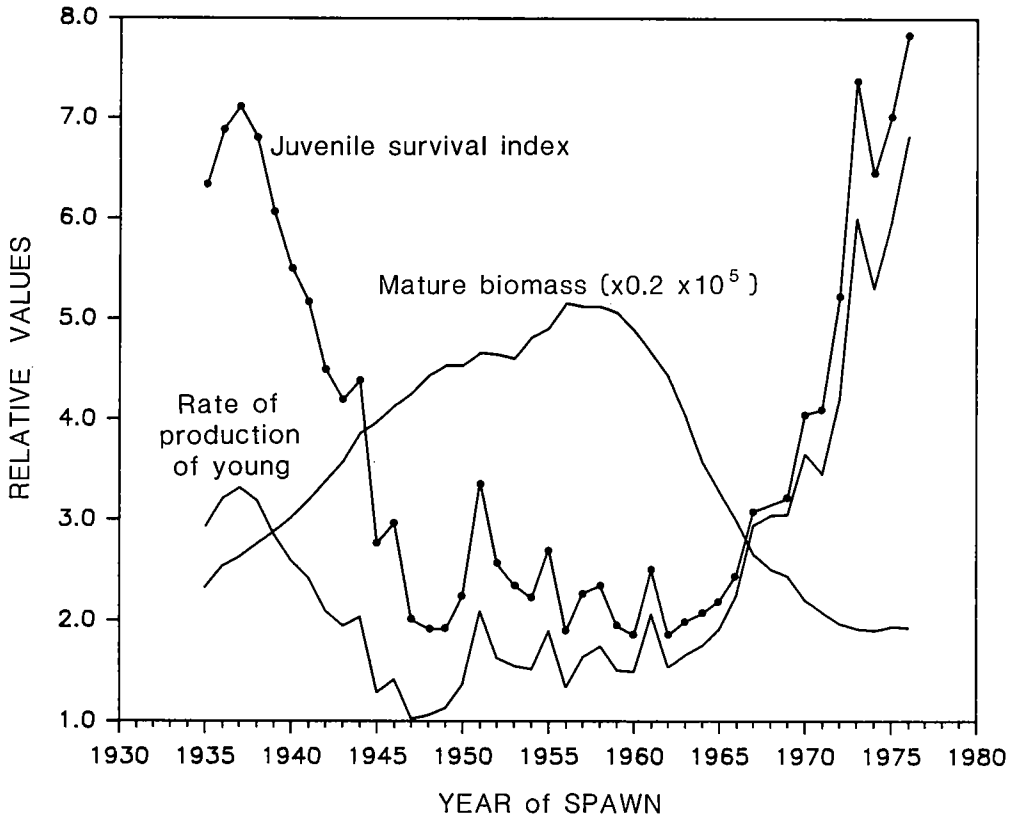


Figure 4. Juvenile survival index and rate of production of young are given by year of birth for each year class. Mature biomass is an index of spawning for each year class. Units are metric tons for mature biomass, number of eight-year-olds per 100 pounds of mature biomass for juvenile survival index, and 2.2x biomass of eight-year-olds per unit mature biomass for the rate of production of young.

dependent population regulatory mechanism (such as competition for food and space). Thus, a major concern about allowing the adult stock to continue to increase (through setting catch quotas appreciably below ASP) is that the large adult stock could suppress current juvenile production and cause fewer young adults in future years.

Weighing against the first hypothesis is the equally plausible explanation that the cycle of juvenile production is due to cyclical environmental or ecological factors wholly independent of adult halibut biomass. Under this scenario, a long-term cycle in juvenile production is natural and unavoidable. This is an important reason why a major reduction in adult biomass, through very high catch quotas, is not part of the current management philosophy. Banking some of the high adult biomass for future years can help support the fishery should a recruitment bust occur.

Under either of our two hypotheses, current record rates of recruitment are not sustainable. Recruitment is expected to decline in the future due either to density-dependent causes or natural environmental factors. The hope is that through prudent management, high and stable catch quotas can be maintained despite recruitment fluctuations.

Scientific Investigations

JUVENILE HALIBUT SURVEY

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. However, the survey in the Bering Sea region has been deferred since 1983 to permit use of the chartered trawler for various gear comparison experiments, replicate sampling studies, and tagging operations. To compensate for the lack of data in the region historically sampled in the Bering Sea, the results of groundfish surveys conducted by the U.S. National Marine Fisheries Service (NMFS) 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-feet 400 Eastern trawl, 90 mm mesh with an unlined codend; NMFS used a 83/112-feet Eastern trawl, 90 mm mesh codend with a 32 mm liner).

Bering Sea Index

IPHC's survey in the Bering Sea consisted of 34 stations fished with the 90 mm net on the flats in Bristol Bay and along the Alaska Peninsula to Unimak Pass. Five inshore stations were fished with a smaller 32 mm net.

The mean CPUE in the Bering Sea has been increasing from a low level (3.1-6.1 fish per one hour tow) in the early 1970's. In 1982, the CPUE was 32.8 fish per hour, the highest recorded since sampling began in the 1960's. Unfortunately, no comparable data are available since 1982.

Sampling by NMFS on stations within the IPHC index region in 1983 and 1984 showed a decline in the percentage number of smaller juveniles (less than 36 cm), a decline which had been observed earlier by IPHC sampling in 1981 and 1982 (Figure 5). A large recruitment of smaller juveniles occurred in 1985, although larger fish have continued to dominate the catches since 1981. The CPUE data derived from IPHC surveys since 1966 and NMFS surveys since 1980 for the Bering Sea are shown in Table 8. The CPUE in this region appears to be in a downward trend at present, being supported mainly by older juveniles with no indication in the data from 1982 to 1984 of the strong 1980 year class. This downward trend is not observed in the Gulf of Alaska. The 1980 year class was well represented as 5-year-olds in the catch data from a tagging operation along the Aleutian Islands in 1985, but the first indication of the 1980 year class in the Bering Sea index area occurred in 1985 and could be the result of immigration from nearby regions.

The last year for which age data are available for the Bering Sea index region is 1984. The length-at-age data from 1984 show that halibut had an average length of 23 cm at age two, 30 cm at age three, 43 cm at age four, 50 cm at age five, and 57 cm at age six.

Gulf of Alaska Index

A Canadian trawler, the PACIFIC HARVESTER, was chartered for 77 days in 1985. Juvenile studies in 1985 included three study projects in addition to the regular juvenile

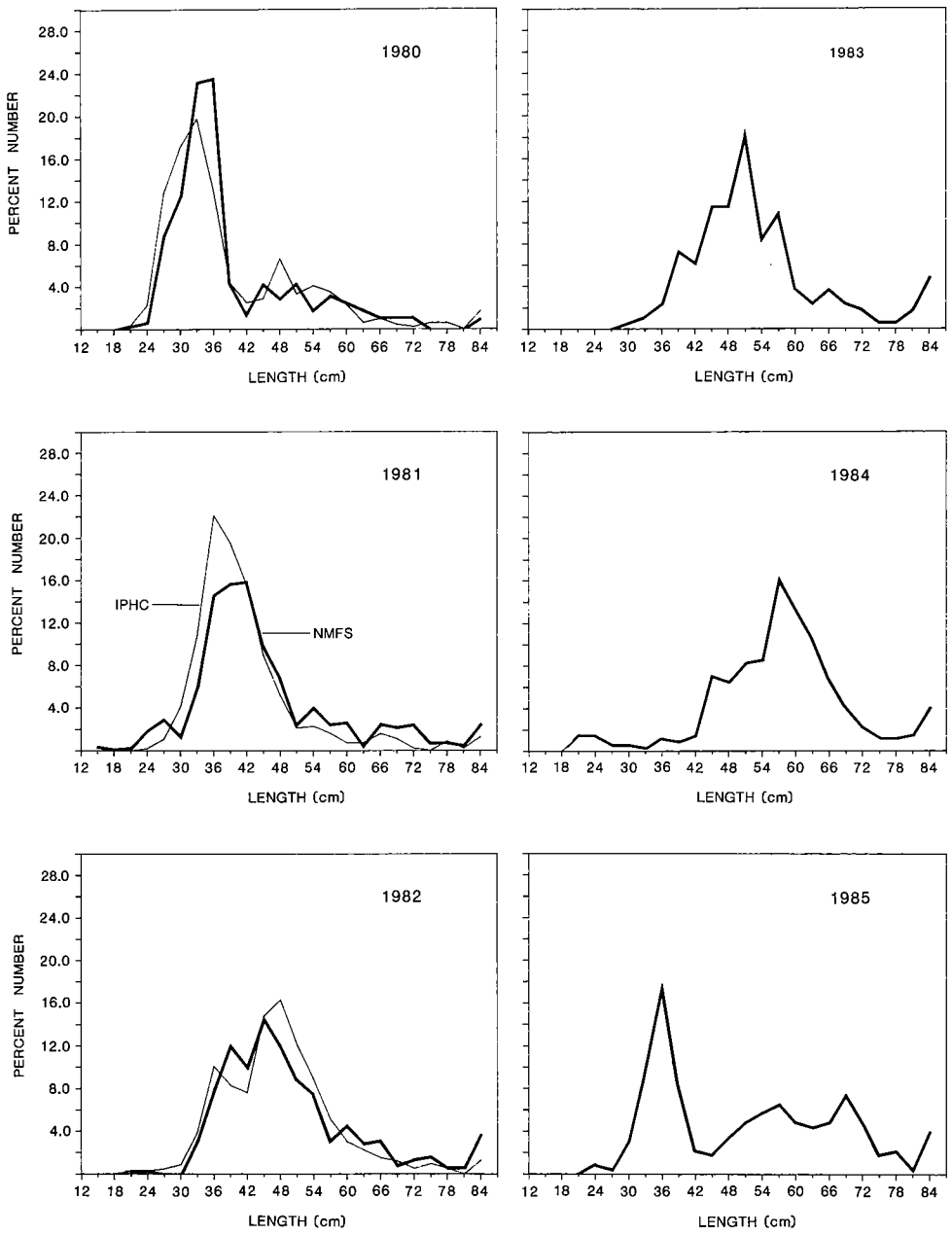


Figure 5. Length distributions of halibut caught within IPHC Bering Sea index area from NMFS and IPHC surveys during 1980-1985.

Table 8. Number of juvenile halibut (less than 65 cm) per 60-minute haul at Gulf of Alaska and Bering Sea index regions, 1966-1985.

	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	34.3	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	37.3	70.1	32.8	38.3	—	5.7

assessment survey in the Gulf of Alaska. These additional projects are reported in other sections of this report.

The assessment index in the Gulf of Alaska is based on 110 offshore stations in four regions: 25 off Unimak Island, 23 near Chirikof Island, 26 off Cape Chiniak, and 36 near Cape St. Elias. Inshore stations in the Gulf of Alaska were not sampled in 1985 because the grounds were preempted by Dungeness crab gear. Although the results of these stations were used only as indicators of potential strength of upcoming one- and two-year-old classes, their reliability as juvenile indices indicators was poor, as the results were often affected by weather conditions at these shallower inshore stations.

Halibut lengths are recorded from all hauls, and most viable halibut are tagged after sex and age data have been collected from subsamples of the catches. An otolith series is taken from each region sampled. Five otoliths were taken for each one cm size group

(through 64 cm) for each series collected, and one thereafter for each additional five individuals in that size group. In addition, one otolith was collected from fish in each one 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, and the carapace lengths of all male king crab are measured.

The CPUE at the offshore stations is given for each region from 1966 to 1985 in Table 8. Data shown in this table represent only the catch of halibut under 65 cm in length, whereas similar tables in past annual reports have included fish of all sizes. The weighted mean CPUE in 1985 was 38.3 fish per hour, lower than in 1984 (42.1) and considerably less than the high of 54.9 recorded in 1981. The catch of juveniles in the Gulf of Alaska varies greatly from region to region. There was little change in CPUE in 1985 in the Chiniak, Chirikof, and Unimak index regions from 1984, but a 36 percent decrease from an all time high in the Cape St. Elias index region. The highest CPUE of juveniles continues to be taken from the Chirikof Island index region where 70 juveniles per one-hour haul were caught in 1985.

The length-at-age from the 1985 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 53 cm at age six. A strong recruitment of two-year-old halibut occurred in the Gulf of Alaska in 1982. Present indications suggest that the 1983 year class, which appeared as two-year-olds in 1985, may also represent the arrival of another strong year class. The increasing catch of large halibut (greater than 84 cm) in the Gulf of Alaska index regions, from 3.4 percent in 1980 to 8.2 percent in 1985, is another indication of the increasing number of halibut available to the setline fishery. Juvenile halibut CPUE and average length (cm) by age and by sampling area in 1985 is shown in Appendix III, Table 1.

LARVAL HALIBUT SURVEY

A search for larval halibut in the western Gulf of Alaska was conducted in early June from the chartered trawler PACIFIC HARVESTER. The operation was concentrated in the area studied by FOX (Fishery Oceanography Experiment) in April 1985, with an additional location sampled in Unimak Pass. The objective of this project was to obtain information on the distribution of larval halibut and to collect scientific specimens for the study of daily growth rings in the otoliths of larval halibut.

On June 6 and 7, seven tows with a Tucker trawl net were made across Shelikof Strait from Low Cape, at the west end of Kodiak Island, to Cape Providence, off the Alaska Peninsula. The nine square meter trawl net was towed for a cumulative lateral distance of 17.1 nautical miles and resulted in the capture of 80 larval halibut, mostly in Stage 10 of development. Six of these tows, covering a lateral distance of 15.9 miles, were made from surface to bottom to surface and netted 43 larval halibut.

One comparative tow covering 1.2 miles was made in only the top 26 fathoms of the water column for the capture of 37 larval halibut. Results of the comparison between a surface-bottom-surface tow and a tow covering only the first 26 fathoms suggest that the larval halibut were in the upper section of the water column. The latter tow averaged 30.8 larval halibut per nautical mile versus 3.8 for the former.

On June 9, a surface-bottom-surface tow was made off Akun Island in Unimak Pass, some five miles north of Billings Head. The trawl was towed for a lateral distance of 2.5 miles and resulted in the capture of 126 larval halibut in younger stages (5 through 9) of development for an average of 50.4 larval halibut per nautical mile.

Sampling was concentrated in locations where the color video sounder showed large concentrations of "feed" in the water column. Over 80 kg of plankton was caught in eight tows, and a sample of each catch was preserved for use by other fishery agencies.

ZERO-AGE HALIBUT SURVEY

A survey investigating the distribution of zero-age halibut in the eastern Gulf of Alaska was undertaken July 25 through August 6 from the chartered trawler PACIFIC HARVESTER. The purpose was to establish if larval halibut tend to settle uniformly along the coast or if oceanographic conditions cause less uniform settling spatially in any given year.

The areas studied include Patton Bay and Kayak Island, where zero-age halibut are known to occur, and the area east of Cape St. Elias, from which little data are available. Figure 6 shows the locations fished in the eastern Gulf of Alaska and catches at each

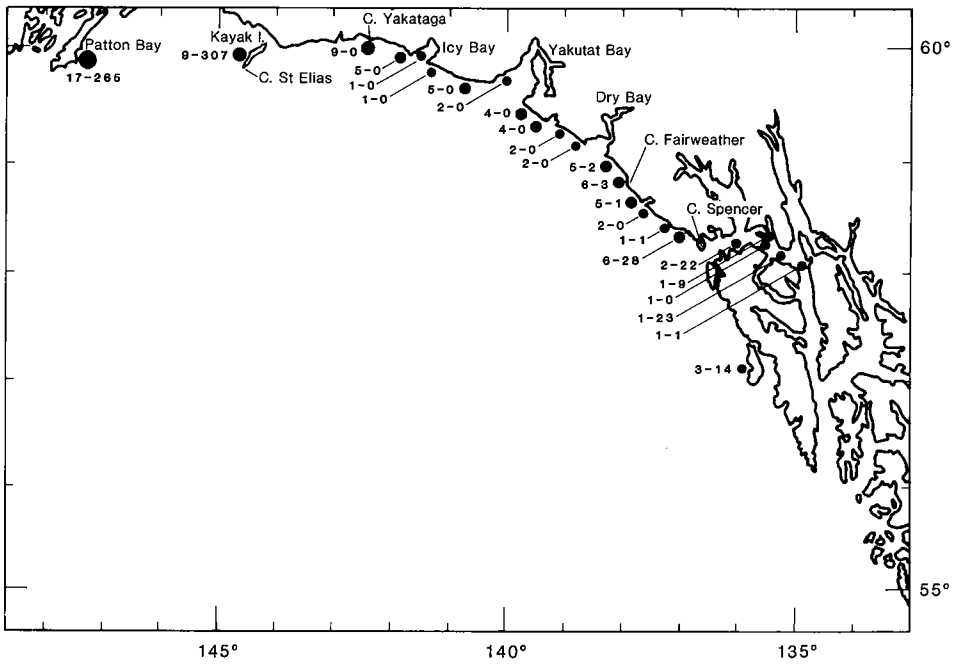


Figure 6. Locations fished in the Gulf of Alaska with the number of tows made and the number of zero-age halibut captured at each location.

location. The sampling gears used were a 32 mm inshore station sampling net (57-foot footrope) fitted with a 1/2-inch liner and a 16-foot Try net pulled by a powered skiff for shallower water. The weather was favorable at all locations and tows were made in depths from 1.5 to 46 fathoms.

The catch of zero-age halibut was very high at Kayak Island and in Patton Bay. In comparison, no zero-age halibut could be found in 35 tows conducted between Cape Yakataga and Dry Bay. Between Dry Bay and Cape Spencer 35 zero-age halibut were captured in 25 tows. Unexpectedly, 55 zero-age halibut were captured in six tows made in the inside waters of southeastern Alaska.

The capture of one-year-old halibut was very high at Kayak Island and in Patton Bay, but non-existent between Cape Yakataga and Yakutat Bay. In fact, the smallest halibut caught in the Yakataga-Yakutat area was a 36 cm individual. One-year-olds were captured in small, but increasing numbers from Ocean Cape eastward toward Cape Spencer. The highest catches of one-year-olds occurred in the inside and outside waters of southeastern Alaska.

These results suggest that very few larval halibut settle down in the Cape Spencer-Cape St. Elias region, and that any larval halibut which are a result of spawning in the Yakutat region are carried westward past Cape St. Elias by the offshore currents. The zero-age halibut in this region probably are a result of spawning off southeastern Alaska and British Columbia. Likewise, the zero-age halibut found in the inside and outside waters of southeastern Alaska likely originate from spawning to the south and are carried inside the straits and channels by the surface currents during their larval stages. Spawning by resident fish in inside southeastern waters may also account for the presence of larvae in this area.

ADULT HALIBUT SURVEY

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

In 1985, 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. Also during 1985, a preliminary assessment was made off the Oregon coast (Area 2A).

To standardize operations and make results more comparable between years, the same grid of stations is fished each year, setting and hauling times follow a pre-determined schedule, baiting practices are the same in all areas, and gear is not soaked overnight. In most areas, six skates are fished at each station and the stations are generally located on a 6-by-24 mile grid. In the Charlotte region, eight skates are fished at each station. On the survey of the inside waters of southeastern Alaska, stations are grouped on selected grounds rather than in a grid pattern. All halibut are measured and the catch is sampled for age and sex information. All other halibut are tagged and released. The catch of other species is also enumerated and, when practical, surface and bottom temperatures are recorded.

Circle hooks were first used in these surveys in 1984. Both circle and J hooks were fished in the Charlotte and Kodiak regions in a hook comparison study that year and ratio estimators were determined for comparison of effort between the two gear types. During

1985, only circle hooks were used and, where appropriate, J hook catches have been estimated to facilitate comparisons with results from earlier surveys. In interpreting changes between 1984 and 1985 and earlier years, care must be taken when examining average weight, median age, and sex composition of the catches. As can be seen in Table 9, these

Table 9. Historic results from the adult halibut surveys.

	Sublegals (<81 cm)					Adults (>81 cm)				
Region/ Year	Lbs. Per Skate	No. Per Skate	Avg. Wgt.	Median Age	Percent Female	Lbs. Per Skate	No. Per Skate	Avg. Wgt.	Median Age	Percent Female
Charlotte										
1965-1966	3.0	0.4	7.1	7.2	27	43.6	1.2	37.3	11.4	71
1976	2.1	0.3	7.8	8.0	11	26.8	0.8	34.7	10.3	79
1977	1.7	0.2	7.6	7.6	31	14.7	0.5	31.4	10.4	60
1978	1.7	0.2	7.3	6.7	29	20.7	0.6	35.0	11.3	53
1980	2.5	0.3	7.6	7.5	35	29.0	1.0	28.2	10.3	63
1981	1.8	0.3	7.3	7.1	30	18.2	0.6	30.1	10.5	67
1982	2.5	0.3	7.3	7.5	36	23.2	0.8	28.6	10.4	66
1983	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-J*	4.6	0.7	—	—	—	19.8	0.8	—	—	—
1985-O	15.1	2.3	6.7	7.8	35	47.5	2.0	23.7	10.1	69
Southeast										
1982	4.4	0.6	6.9	7.7	34	114.8	3.0	38.2	11.6	63
1983	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-J*	4.2	0.6	—	—	—	118.5	2.8	—	—	—
1985-O	16.2	2.3	6.9	8.2	35	260.6	7.1	36.6	12.0	65
Kodiak										
1963	3.9	0.6	6.3	7.5	30	86.3	2.2	38.6	10.5	72
1977	5.5	1.0	5.7	7.0	30	73.0	1.5	47.3	10.2	70
1978	4.3	0.8	5.5	6.1	40	33.1	0.8	39.8	9.7	65
1979	6.0	1.0	6.0	6.7	36	52.0	1.4	36.8	9.9	65
1980	5.2	0.8	6.4	7.4	40	93.7	2.3	41.2	10.8	75
1981	6.8	1.1	6.2	6.9	37	160.4	3.5	45.4	11.3	71
1982	2.5	1.0	7.3	7.2	39	160.7	3.7	43.4	10.4	70
1983	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-J*	6.6	1.0	—	—	—	222.7	4.8	—	—	—
1985-O	22.6	3.3	7.0	7.7	41	461.6	11.4	40.3	11.3	68

*J hook values have been estimated from 1984 ratios determined for each area. Ratios for Southeastern were determined using ratios for Charlotte and Kodiak combined.

stock indicators have varied between gear types when both gears have been fished in the same year and area.

The 1985 surveys caught 14,316 halibut, of which 6,130 were used to estimate the sex and age composition of the catches, 140 were measured and released, and the remaining 8,046 halibut were tagged and released. In the following discussion, CPUE is expressed in pounds per skate for legal-sized, or adult, halibut (greater than 81 cm) and in number per skate for sublegal halibut. Results for each region are described in the following sections.

Central Oregon Coast

During August last year, twenty-three sets for a total of 40 skates were fished off the Oregon coast. Circle hooks and snap gear were used, with salmon as the primary bait. A total of 236 halibut weighing 3,459 pounds was caught. Fishing was on and around several banks located southwest of Newport, Oregon, and, although a grid pattern was not used, an attempt was made to sample equally the "bank" and "between-bank" areas. Generally, CPUE decreased with increasing depth, from a high of 144 pounds per skate in 26 to 40 fathoms to 60 pounds per skate in depths greater than 60 fathoms. The shallow depths were typically found near to or on top of the offshore banks, areas locally known to be more productive.

Overall, CPUE for legal-sized fish was 85.8 pounds per skate (3.4 fish per standard skate), with an average weight of 25.1 pounds. Females comprised 74 percent of the legal-sized catch. Sublegal halibut averaged 2.4 fish per skate (16.9 pounds per skate), with an average weight of 6.9 pounds. Females comprised 59 percent of the sublegal catch.

Charlotte

Fishing was successfully completed at 91 grid stations on the Charlotte survey. A total of 2,277 fish weighing 33,510 pounds was caught during the survey. Of these, 1,106 were sampled for sex and age data.

The CPUE of adult fish in 1985 was 47.5 pounds per skate, down 27 percent from the historical high of 65.2 pounds per skate seen in 1984. The percentage of females in the adult catch increased slightly from 1984, from 59 percent to 69 percent (circle hook data).

The estimated J hook CPUE of adult fish was 19.8 pounds per skate, the lowest value seen since 1981. Sublegal CPUE decreased almost 12 percent to 2.3 fish per skate in 1985 from the 1984 value of 2.6 fish per skate. The estimated J hook CPUE for sublegals was 0.7 fish per skate, still over twice the average seen prior to 1984.

The average weight for both adult and sublegal fish has continued the decline which started in the mid-1970's, in both cases reaching historic lows for this area. A popular interpretation of this decline would be an increased recruitment of the younger year classes. This interpretation is supported by catch-at-age data from the survey.

Notable during the 1985 survey was the increased CPUE of dogfish at 23.4 fish per standard skate, comprising 71 percent of the total catch by number. This was the highest dogfish CPUE seen since the start of the Charlotte surveys and may account for some or all of the decreased halibut catch.

Southeastern

During the Southeastern survey, 4,614 halibut weighing 135,047 pounds were caught. Of these, 2,375 fish were sampled for age and sex information. Fishing was conducted at 95 stations using 488 standard skates.

Overall survey CPUE for legal-sized fish was 260.6 pounds per skate, down slightly from the 265.9 pounds per skate seen in 1984. The estimated J hook CPUE of 118.5 pounds per skate was down two percent from the high seen in 1984. Females comprised 65 percent of the total catch by number, up from 57 percent in 1984 (circle hook data). Mean weight of adult fish was 36.6 pounds, not significantly different from earlier years.

Sublegal CPUE at 2.3 fish per skate was down 31 percent from the high value seen in 1984. The estimated J hook CPUE for sublegal fish of 0.6 fish per skate, while lower than the 1984 value, was the same as that seen in the first two years of the survey. The average weight of sublegal fish was 6.9 pounds, with 35.4 percent of the catch by number female.

Significant differences exist between the inside and outside stations. Although year-to-year trends in CPUE are similar, the outside stations consistently have had higher values for CPUE of both adult and sublegal-sized fish.

Kodiak

On the Kodiak survey, 7,189 halibut weighing 236,792 pounds were caught, with 2,503 sampled for sex and age information. Fishing occurred on 100 grid stations, for a total effort of 489 standard skates.

Overall survey CPUE for adult fish was 461.6 pounds per skate, up five percent from the 1984 level and a historic high for this survey. Females comprised 68 percent of the adult catch. The mean weight of the catch of adults was 40.3 pounds, down from 1984, but, due to the change from J to circle hooks, it is not evident whether this is a significant drop over earlier years.

The CPUE of sublegal fish was 3.3 fish per skate, which was no change from 1984. The estimated J hook CPUE of 1.0 fish per skate was also not significantly different from previous years. It is possible that larger halibut compete more effectively for hooks than smaller halibut. If this is the case, then the relatively steady CPUE of sublegal fish over the last few years in light of the greatly increased catch of adult fish could indicate strong recruitment potential into the fishery. Catch-at-age analysis supports this assumption.

Comparison among regions

Survey CPUE of adult halibut was lowest in the Charlotte region (47.5 pounds per skate), intermediate in Southeastern (260.6 pounds per skate), and highest in Kodiak (461.6 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 have been closer. A similar trend is seen in average weights of adult fish, the highest average seen in the Kodiak area (40.3 pounds), lowest in Charlotte (23.7 pounds), and Southeastern intermediate (36.6 pounds). The percentage of females in the adult catch was comparable among all regions (65 to 69 percent).

CPUE of sublegal fish was highest in Kodiak (3.3 fish per skate). The average weight of sublegal fish was highest in Kodiak (7.0 pounds), intermediate in Southeastern (6.9 pounds), and lowest in Charlotte (6.7 pounds). This trend in average weight for sublegals is atypical of previous years, when sublegals were largest in Charlotte and smallest in Kodiak, but the differences between areas is small. The percentage of females in the sublegal catch increased in the more northern areas, from 35 percent in Charlotte to 41 percent in Kodiak, typical of the historical data.

HOOK SPACING EXPERIMENTS

During the last few years, the commercial halibut fleet has entirely switched over from the traditional J hook to the circle hook. In order to more accurately estimate changes in stock composition and to compare and tally catch and effort among boats using different combinations of hook type or gear spacing, it has been necessary to determine factors for the comparison of J and circle hook effort and for the comparison of circle hook effort between gears of different hook spacings. During 1984, IPHC undertook a series of studies to determine the relative fishing power of J and circle hooks and results from these studies were reported in the 1984 Annual Report. As the second phase of these studies, during 1985 IPHC conducted a series of experiments to estimate the relative fishing power of different hook spacings of circle hook gear.

Three locations were selected in both the Charlotte and Kodiak regions which were broad enough to allow six strings of gear to be set side by side approximately 0.5 mile apart. These locations were chosen with the expectation that halibut would be abundant. Each string of gear was comprised of six skates and three hook-spacings were fished: 13-, 21-, and 26-foot gear. Each day, two strings of each hook spacing were fished for a total of six strings per day. The sequence for fishing strings of different spacing was predetermined. On the first day, the six strings were set in a specific sequence. On each of two following days the same locations were fished but in a different sequence of hook spacing. This experimental design was meant to minimize the effects of a local "hot spot" and the effect of soak time and facilitates the factoring out of effects other than hook spacing in the analysis. After three days at the first location the operation moved to the second site and the experiment repeated. On analysis of the data collected, the experimental design will also allow estimation of day to day depletion effects on catch rate in the different locations.

Catch results for the different hook spacings in the study areas are shown in Table 10.

Table 10. Catch of legal-sized halibut during hook spacing and area depletion experiments off Kodiak Island in the Kodiak region and in Hecate Strait in the Charlotte region.

		Hook Spacing			Day		
Region		13-foot	21-foot	26-foot	1	2	3
Charlotte	pounds per skate	118.5	85.4	81.3	124.4	82.1	78.7
	pounds per hook	1.03	1.20	1.40	1.57	1.05	1.01
Kodiak	pounds per skate	622.9	474.0	428.2	719.8	436.8	368.4
	pounds per hook	5.42	6.68	7.38	9.23	5.49	4.76

In both areas, the 13-foot gear, with twice as many hooks, caught about half again as many pounds of fish as the 26-foot gear. Conversely, the catch per hook on 26-foot gear was about 33 percent higher than on 13-foot gear.

Although preliminary in nature, these findings would indicate that the final conversion factors between hook spacings will be similar to those determined for J hooks.

Area Depletion

Preliminary results over all hook spacings by day of fishing are also shown in Table 10. In both areas, there was a reduction in catch of about one third from the first to the second day's fishing. Between the second and third day the reduction was less, about four percent in the Charlotte region and 12 percent in the Kodiak region. A large number of small legal fish were caught in the Charlotte experiment, which could account for the smaller difference in catches in the Charlotte region between the second and third day if movement is size-related. A more thorough investigation of both the hook spacing and depletion is currently underway.

HALIBUT REARING AND LIFE HISTORY STUDY

Since 1984, IPHC has been working with the U.S. Fish and Wildlife Service (USF&WS) and the U.S. National Marine Fisheries Service (NMFS) on a study of long-term culturing and early life history of Pacific halibut. Over the past two years, IPHC has delivered live halibut to the USF&WS laboratory at Marrowstone Island in Puget Sound, Washington, and also provided financial support for personnel and supplies in the rearing project.

During 1985, IPHC twice supplied fish to the Marrowstone Lab. Initially, two charter days at the beginning of an adult halibut survey charter were spent capturing fish in northern Area 2A, on Swiftsure Bank. Extremely poor catches at that time resulted in the delivery of only five fish, three of which died in captivity, two from capture injuries and one from accidental causes. A second trip was successfully completed in mid-November with the delivery of 13 live fish in excellent condition. The fish ranged in size from 20 to over 50 pounds and five of the fish were gravid females. When the adults spawn, fertile eggs will be collected at the holding tank outfall and rearing techniques will be evaluated.

COMPUTER AGING OF OTOLITHS

Studies have been conducted to determine if halibut can be aged with a computer, using digital image analysis of otoliths, a computer technique for analyzing pictures, or images, of otoliths. Essentially, a television camera looks through a microscope at the magnified image of an otolith. The image is recorded by the television camera and sent to the computer in a digitized form.

Once the image is stored in the computer, the following physical measurements of the otolith are taken: (1) surface area; (2) average otolith length; (3) maximum otolith length; (4) minimum otolith length; and (5) otolith perimeter length. These measurements are then used to indirectly estimate the age of the fish from which the otolith was taken.

A direct estimate of the age is also obtained from the rings, or annuli, projected on the otolith image. The indirect and direct estimates are then combined with statistical techniques to arrive at an equation that would estimate the age previously determined by visual enumeration of the otolith annuli.

Almos 1,000 otoliths from the Kodiak region have been measured using this system. Results thus far are encouraging and suggest that complete computer aging of halibut otoliths may be possible in the near future.

TAGGING STUDIES

Tagged halibut were released from five vessels in 1985 and totaled 18,902 fish (Table 11). The Commission placed one scientist aboard the MILLER FREEMAN while it was engaged in crab research with trawl gear in the southeastern Bering Sea in February. From the halibut caught during this research, 199 were tagged.

Three vessels, the STAR WARS II, CAPE FLATTERY, and CHELSEA were chartered by the Commission to conduct adult halibut surveys in Areas 2B, 2C and 3A between May and September with setline gear. Halibut not needed for age and sex data were tagged and totaled 1,199, 2,242, and 4,757 in Areas 2B, 2C, and 3A, respectively.

A hook spacing study was conducted in Hecate Strait by the STAR WARS II in June and July. This study resulted in the release of 1,176 tagged halibut, most of which were under the legal minimum size. A similar hook spacing study was conducted east of Kodiak Island by the CHELSEA in August. From this study there were 2,659 tagged halibut released, many of which were legal-sized fish.

The trawler PACIFIC HARVESTER was chartered for the juvenile halibut survey. An extensive tagging operation was conducted in June around the eastern Aleutian Islands as a part of this survey, resulting in the release of 5,056 tagged halibut, mostly juveniles. While fishing at other areas in the Gulf of Alaska in July and August an additional 1,614 tagged halibut were released, again mostly juveniles.

Table 11. Tag releases by month, activity, and gear in 1985.

Month	Activity/Area	Gear	No. Tagged
February	Crab Research-Bering Sea	Trawl	199
May-August	Adult Survey-Area 2B	Setline	1,199
May-August	Adult Survey-Area 2C	Setline	2,242
May-September	Adult Survey-Area 3A	Setline	4,757
June-July	Hook Spacing-Area 2B	Setline	1,176
August	Hook Spacing-Area 3A	Setline	2,659
June	Juvenile Survey-Aleutian Islands	Trawl	5,056
July-August	Juvenile Survey-Gulf of Alaska	Trawl	1,614
Total			18,902

Tag returns in 1985 totaled 1,517, of which 16 were caught in earlier years but not previously reported. The number of tags returned has been increasing annually over the last few years, primarily due to an increasing number of releases each year. The recovery area was reported for 1,244 of the 1985 recoveries (Table 12). Most of the recoveries (85 percent) were recaptured in the area of release, while 49 (4 percent) moved west or north and 142 (11 percent) moved east or south.

Table 12. IPHC tagged halibut recovered in 1985 by area of release and recovery.

	Recovery Area										
Release Area	Bering Sea	Shumagin	Chirikof	Kodiak	Yakutat	Southeastern	Charlotte	Vancouver	Columbia	Eureka	Total
Bering Sea	15	2	1	—	1	—	1	2	—	—	22
Shumagin	2	12	1	6	—	—	2	—	—	—	23
Chirikof	—	2	36	35	1	8	12	2	—	—	96
Kodiak	—	3	18	466	1	11	21	4	—	—	524
Yakutat	—	—	—	3	15	1	6	1	—	—	26
Southeastern	—	—	1	2	4	250	18	2	—	—	277
Charlotte	—	—	—	—	—	14	259	1	1	1	276
Total	17	19	57	512	22	284	319	12	1	1	1,244

AGE VALIDATION STUDY

In 1982 and 1983, halibut were injected with the antibiotic oxytetracyclene (OTC) during routine IPHC tagging operations off the coasts of British Columbia and Alaska to evaluate the aging techniques used by the Commission. Upon injection, the OTC is absorbed by the fish's bony structure, including the otoliths, and leaves a mark that is easily seen when viewed under an ultraviolet light. When an OTC-injected tagged fish is recovered, the otoliths are removed and examined under the ultraviolet light. By comparing the number of annuli laid since the OTC mark to the known time at liberty, the accuracy of the age readings can be determined.

The injection of tagged fish was confined to Areas 2B, 3A, and 3B during 1982 and 1983. In Area 2B, near the Masset grounds, 111 halibut were tagged and injected with OTC during September 1982. In Area 3B, primarily on the Sanak and Shumagin Islands grounds, 459 halibut were tagged, injected, and released in July of 1982. Operations conducted in May and September, 1983 on the Cape Scott, Goose Islands, Horseshoe, Shell, and Masset grounds in Area 2B resulted in 765 tagged and injected halibut released.

Also during May, 456 halibut were tagged, injected, and released near Kodiak Area 3A. Tag release/recapture data for these studies are summarized in Table 13.

Table 13. 1982-1985 age validation study tag recoveries (recoveries with otoliths in parentheses).

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

Recoveries from the experiments thus far are mixed. The 1982 OTC releases appear to have a higher mortality rate than the control groups. OTC recoveries in Area 2B and 3B represent only 7.2 percent and 1.1 percent of the releases, whereas control recoveries are 30.4 percent and 4.5 percent, respectively. However, the situation for 1983 releases is much different. OTC releases in Area 2B and Area 3A are returning at rates similar to the control group. OTC and control recoveries in Area 2B are nearly the same, 10.5 percent to 11.2 percent. In Area 3A, OTC recoveries are 8.1 percent and control group recoveries 10.0 percent. The reason 1982 OTC releases fared poorly is not completely understood, but the large volume of fluid injected in bigger fish may be involved. The body cavity noticeably swells and the fish may have trouble assimilating the fluid. For this reason, only fish under 125 centimeters were injected in 1983. In future experiments the dosage will be reduced from 50 to 25 mg/kg of body weight.

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 three years. This fish was tagged in July 1982 on the Sanak Island grounds and recovered near Davidson Bank during June 1985. During that period the fish grew from 62 cm to 77 cm. A surface reading of the otolith indicated the fish to be 11 years old. Unfortunately, there was no presence of OTC when viewed under ultraviolet light. Another recovery from the 1982 releases occurred off Massett in British Columbia during April 1985. This fish was at large two years, eight months, and grew 20 cm over that period to 93 cm. This fish was aged at 12 years old and a strong presence of OTC was observed. A comparison of the OTC mark and subsequent growth adjacent to the mark appears to be reasonable considering the time-at-large for this fish. Completion of this project is expected by early 1987.

OCEANOGRAPHIC AND METEOROLOGICAL STUDIES

Several hypotheses relating oceanic conditions during halibut spawning to subsequent spawning success are being investigated. Halibut larvae ascend the water column and are subsequently deposited in shallow shelf nursery areas. Year-class-strength can therefore be greatly affected by water transport, since onshore drift of larvae is critical for their survival. Water movement in coastal waters determines the length, intensity, and timing of the critical spring production cycle that supports larval feeding in the upper layers. These conditions vary with local wind and annual storm patterns.

One phenomenon of particular interest is the fluctuation in the Alaska Coastal Current (or Kenai Current in the Kodiak region), which could affect the transport of halibut larvae onto the continental shelf. Evidence suggests a strong correspondence between CPUE-derived indices of year-class abundance and strength of the Current. Field corroboration of such processes is being pursued through larval survey and extensive hydrographic and meteorological monitoring, as part of the NOAA-NSF Fishery Oceanography Experiment (FOX) in Shelikof Strait and west of Kodiak Island.

CATCH SAMPLING

Halibut landings in 1985 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 sub-sample of nearly 13,000 otoliths was selected for estimating the age 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. Area 3A samples were obtained in September for the first time in several years. Even with the expanded sampling opportunities, only 1.8 percent of the total landings were sampled (Table 14). The proportion of the landings sampled was generally higher in areas with small catches, such as the Columbia region.

Table 14. Commercial catch and percent sampled for size and age composition by region during 1985.

Region	Catch* (000's pounds)	Percent Sampled
Columbia	125	13.0
Vancouver	793	1.2
Charlotte-Outside	1,897	1.8
Charlotte-Inside	8,018	2.5
Southeast Alaska-Outside	3,393	1.6
Southeast Alaska-Inside	5,749	1.0
Yakutat	2,796	0.6
Kodiak	17,903	1.6
Chirikof	8,005	1.3
Shumagin	4,459	2.6
Aleutian	781	2.4
Bering Sea	1,927	4.1
Total	55,848	1.8

*Does not include research catches.

The 1973 year class was a major contributor to the landings as it has been for the past several years. This cohort, now 12 years old, was important in the large landings from Area 3. The relative strength of this year class was predicted from the catches of 3- and 4-year-olds on the juvenile survey (see 1976 and 1977 Annual Reports). In Areas 2A and 2B, 9-year-olds (1976 year class) dominated the landings, while in the Bering Sea 8-year-olds were most abundant.

Catch and CPUE in number of fish and average weight at each age of halibut in the 1985 setline landings are summarized by region in Appendix III, Table 2. The average length and age of fish in the landings and number of halibut measured and aged are also given.

Appendices

The tables in Appendix I provide statistics for 1985 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 1985. 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 poundage in these tables is dressed weight (head-off, eviscerated). The CPUE values for 1985 have been adjusted by a correction factor of 2.2 to standardize circle hook CPUE to J hook CPUE. 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 region of sampling, respectively.

Appendix I.

Table 1. Catch, CPUE, and effort by statistical area and country, 1985.
Table 2. Catch, CPUE, and effort by region and country, 1985.
Table 3. Catch, CPUE, and effort by regulatory area, 1985.
Table 4. Catch in thousands of pounds by regulatory area and country, 1985.
Table 5. Landings in thousands of pounds by port and country, 1985.

Appendix II.

Annual landings, ex-vessel price, and value (U.S. dollars), 1929-1985.

Appendix III.

Table 1. Juvenile halibut CPUE and average length (cm) by age and sampling area, 1985.
Table 2. Catch in numbers, CPUE in number per 10,000 skates, and average weight in pounds (dressed, head-off) at age by regions, 1985.
Table 3. 1985 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.
Table 4. 1985 Adult Survey catch per unit effort (number of fish per skate) of males and females by 5 cm length interval and region.

APPENDIX I.

TABLE 1. CATCH, CPUE AND EFFORT BY STATISTICAL AREA AND COUNTRY, 1985.

1985	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	-	-	-	129	23.6	55	129	23.6	55	-
04	-	-	-	25	23.6*	11	25	23.6	11	-
05	-	-	-	339	23.6	144	339	23.6	144	25
06	179	23.6*	76	-	-	-	179	23.6	76	-
07	202	23.6*	86	-	-	-	202	23.6	86	-
08	48	23.6*	20	-	-	-	48	23.6	20	-
09 -O	110	71.8*	15	-	-	-	110	71.8	15	-
09 -I	439	42.9	102	-	-	-	439	42.9	102	2
10 -O	82	71.8*	11	-	-	-	82	71.8	11	-
10 -I	1028	84.2	122	-	-	-	1028	84.2	122	12
11 -O	65	71.8*	9	-	-	-	65	71.8	9	-
11 -I	1849	61.0	303	-	-	-	1849	61.0	303	24
12 -O	170	83.3	20	-	-	-	170	83.3	20	52
12 -I	1937	55.6	349	-	-	-	1937	55.6	349	31
13 -O	1471	70.7	208	-	-	-	1471	70.7	208	26
13 -I	2809	55.1	510	-	-	-	2809	55.1	510	13
14 -O	-	-	-	166	165.2	10	166	165.2	10	10
14 -I	-	-	-	315	175.4*	18	315	175.4	18	-
15 -O	-	-	-	510	142.6	36	510	142.6	36	15
15 -I	-	-	-	646	189.7	34	646	189.7	34	14
16 -O	-	-	-	956	154.8	62	956	154.8	62	21
16 -I	-	-	-	2637	168.7	156	2637	168.7	156	27
17 -O	-	-	-	1396	152.7	91	1396	152.7	91	11
17 -I	-	-	-	501	191.1	26	501	191.1	26	16
18S-O	-	-	-	391	74.1	53	391	74.1	53	1
18S-I	-	-	-	1689	176.7	96	1689	176.7	96	7
18W	-	-	-	566	116.8	48	566	116.8	48	19
19	-	-	-	515	120.1	43	515	120.1	43	19
20	-	-	-	466	179.9	26	466	179.9	26	18
21	-	-	-	440	145.4	30	440	145.4	30	9
22	-	-	-	267	193.1	14	267	193.1	14	36
23	-	-	-	542	139.7*	39	542	139.7	39	-
24	-	-	-	1199	261.6	46	1199	261.6	46	16
25	-	-	-	4496	247.5	182	4496	247.5	182	35
26	-	-	-	3605	301.8	119	3605	301.8	119	43
27	-	-	-	3938	261.9	150	3938	261.9	150	17
28	-	-	-	4818	200.8	240	4818	200.8	240	20
29	-	-	-	3763	188.4	200	3763	188.4	200	18
30	-	-	-	2969	279.3	106	2969	279.3	106	32
31	-	-	-	1273	284.5	45	1273	284.5	45	23
32	-	-	-	2149	358.3	60	2149	358.3	60	46
33	-	-	-	308	248.0	12	308	248.0	12	76
34	-	-	-	426	274.0	16	426	274.0	16	60
35	-	-	-	792	148.4	53	792	148.4	53	53
36	-	-	-	312	187.2	17	312	187.2	17	33
37	-	-	-	260	115.9	22	260	115.9	22	55
38	-	-	-	212	158.3	13	212	158.3	13	88
39	-	-	-	-	-	-	-	-	-	-
40	-	-	-	16	100.6*	2	16	100.6	2	-
41	-	-	-	437	94.3	46	437	94.3	46	59
42+	-	-	-	328	109.8	30	328	109.8	30	66
4A	-	-	-	131	224.3	6	131	224.3	6	-
4B	-	-	-	124	187.9	7	124	187.9	7	36
4C	-	-	-	1335	146.4	91	1335	146.4	91	42
4DE	-	-	-	36	148.1	2	36	148.1	2	-
4DW	-	-	-	301	93.7	32	301	93.7	32	35
4E	-	-	-	-	-	-	-	-	-	-

* NO LOG DATA, CPUE INTERPOLATED.

APPENDIX I. (continued)

TABLE 2. CATCH, CPUE AND EFFORT BY REGION AND COUNTRY, 1985.

1985	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	-	-	-	129	23.6	55	129	23.6	55	-
VANCOUVER	429	23.6*	182	364	23.6	155	793	23.5	337	11
CHARLOTTE	9960	60.8	1639	-	-	-	9960	60.8	1639	20
CHAR-O	1898	72.7	261	-	-	-	1898	72.7	261	25
CHAR-I	8062	58.5	1378	-	-	-	8062	58.5	1378	19
SE ALASKA	-	-	-	9207	163.8	562	9207	163.8	562	16
SE AK-O	-	-	-	3419	150.8	227	3419	150.8	227	13
SE AK-I	-	-	-	5788	173.0	335	5788	173.0	335	17
YAKUTAT	-	-	-	2796	143.3	195	2796	143.3	195	15
KODIAK	-	-	-	18056	252.5	715	18056	252.5	715	28
CHIRIKOF	-	-	-	8005	238.5	336	8005	238.5	336	24
SHUMAGIN	-	-	-	4459	223.3	200	4459	223.3	200	52
ALEUTIAN	-	-	-	781	100.8	77	781	100.8	77	61
BERING SEA	-	-	-	1927	139.5	138	1927	139.5	138	37
TOTAL	10389	57.1	1821	45724	187.9	2433	56113	131.9	4254	31

* NO LOG DATA, CPUE INTERPOLATED.

TABLE 3. CATCH, CPUE AND EFFORT BY REGULATORY AREA, 1985.

	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 %
1985	20089	77.5	2593	18	33316	230.4	1446	29	2708	126.0	215	44

TABLE 4. CATCH IN THOUSANDS OF POUNDS BY REGULATORY AREA AND COUNTRY, 1985.

	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
1985	10389	9700	20089		33316	33316		2708	2708	10389	45724	56113

TABLE 5. LANDINGS IN THOUSANDS OF POUNDS BY PORT AND COUNTRY, 1985.

PORT	CAN.	U.S.	TOTAL
CAL AND ORE	-	607	607
SEATTLE	781	2547	3328
BELLINGHAM	515	1066	1581
MISC WASH	1416	535	1951
VANCOUVER	3027	-	3027
MISC SO BC	841	-	841
NAMU	5	-	5
PR RUPERT	3581	526	4107
MISC NO BC	219	-	219
KETCHIKAN	-	646	646
WRANGELL	-	542	542
PETERSBURG	-	2124	2124
JUNEAU	-	488	488
SITKA	4	4068	4072
PELICAN	-	1000	1000
MISC SE AK	-	1337	1337
KODIAK	-	15991	15991
P WILLIAMS	-	-	-
SEWARD	-	4081	4081
MISC CEN AK	-	10166	10166

APPENDIX II. Annual landings, value (U.S. dollars), and calculated ex-vessel price, 1929-1985.

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				
1957	60,854	.17	10,345				
1958	64,508	.21	13,547				
1959	71,204	.19	13,529				

APPENDIX III. Table 1. Juvenile halibut CPUE and average length (cm) by age and by sampling area, 1985.

AREA		AGE 0	1	2	3	4	5	6	7	8	9	10	Total
Using 90 mm mesh for 60-minute tow													
Cape St. Elias	CPUE	—	0.18	3.69	2.56	5.44	4.83	4.12	1.13	0.52	0.07	0.07	22.61
	Av. Lgth.	—	23.4	29.7	39.8	44.6	50.2	55.1	58.5	60.0	63.2	63.2	52.6
Cape Chiniak	CPUE	—	—	10.70	4.55	7.17	8.71	4.96	0.72	0.49	—	—	37.30
	Av. Lgth.	—	—	29.4	36.2	44.6	50.5	54.3	59.2	61.2	—	—	52.2
Chirikof Island	CPUE	—	0.09	25.89	8.81	9.11	14.93	6.45	2.98	1.55	0.14	0.14	70.09
	Av. Lgth.	—	13.0	27.1	33.3	42.8	49.4	52.2	57.7	61.1	62.7	62.7	47.0
Unimak Island	CPUE	—	—	2.21	4.81	7.58	4.67	4.32	3.31	4.49	1.23	0.19	32.81
	Av. Lgth.	—	—	22.6	36.1	39.8	46.4	51.5	56.8	57.9	55.4	62.8	52.1
Gulf of Alaska	CPUE	—	0.10	9.65	4.89	7.10	7.73	4.96	1.94	1.55	0.31	0.10	38.33
	Av. Lgth.	—	21.7	27.8	35.8	42.9	49.5	53.4	57.5	58.9	56.1	63.0	50.3

APPENDIX III. (continued)

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, 1985.

	Columbia			Vancouver			Charlotte Outside		
Age	Catch	CPUE	Ave Wt	Catch	CPUE	Ave Wt	Catch	CPUE	Ave Wt
1	0	0	0.0	0	0	0.0	0	0	0.0
2	0	0	0.0	0	0	0.0	0	0	0.0
3	0	0	0.0	0	0	0.0	0	0	0.0
4	0	0	0.0	0	0	0.0	0	0	0.0
5	0	0	0.0	0	0	0.0	0	0	0.0
6	15	28	9.5	164	49	10.9	529	203	10.4
7	154	290	11.5	985	293	10.8	2145	823	11.4
8	509	959	14.3	4267	1267	12.9	9357	3589	14.3
9	748	1409	17.0	8944	2657	14.9	15194	5828	16.2
10	717	1351	21.2	7385	2193	16.2	14023	5379	19.9
11	517	974	31.5	7221	2145	20.4	11576	4440	23.8
12	339	639	38.4	5170	1536	22.2	7744	2970	29.4
13	177	334	43.1	1805	536	21.3	3455	1325	36.9
14	139	262	65.6	1067	317	34.5	4375	1678	41.5
15	77	145	64.1	903	268	45.1	2508	962	45.1
16	100	188	90.6	574	170	41.4	2342	898	52.5
17	46	87	88.8	328	97	55.4	804	308	50.6
18	77	145	88.0	164	49	36.8	577	221	56.3
19	62	117	90.0	328	97	68.6	388	149	54.6
20	39	73	81.7	82	24	60.5	185	71	103.7
21+	77	145	106.7	164	49	117.8	624	239	73.3
Tot	3794	7149	33.0	39552	11748	20.1	75826	29084	25.0
	Av Len 108.4, Av Age 11.0			Av Len 95.6, Av Age 10.6			Av Len 101.7, Av Age 10.8		
	#Oto's 492, #Aged 492			#Oto's 482, #Aged 482			#Oto's 1377, #Aged 1045		

	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	50	22	3.1	0	0	0.0
5	762	56	8.1	0	0	0.0	0	0	0.0
6	7008	511	10.6	408	181	9.2	316	95	11.3
7	28261	2062	12.8	1233	548	12.3	3220	969	13.5
8	64106	4678	15.6	8368	3719	15.7	16407	4937	15.6
9	71963	5252	18.9	10625	4722	20.0	21191	6377	20.0
10	60357	4405	22.0	11645	5176	23.5	33091	9958	23.3
11	36367	2654	28.0	16324	7255	29.4	32090	9657	27.4
12	28144	2054	30.2	16709	7426	34.5	29114	8761	31.7
13	14924	1089	38.6	12118	5386	38.8	18809	5660	36.7
14	8025	586	40.4	7661	3405	42.6	8193	2465	39.9
15	6100	445	40.8	5145	2287	49.3	7569	2278	48.3
16	5510	402	46.5	3837	1705	51.9	5174	1557	57.0
17	3362	245	48.3	2935	1304	58.5	3280	987	52.8
18	2679	196	69.7	1258	559	58.5	3185	958	62.3
19	662	48	81.8	805	358	65.5	1563	470	78.3
20	1166	85	75.1	809	360	63.9	661	199	86.6
21+	1171	85	102.9	1272	565	79.3	2704	814	81.6
Tot	340565	24854	23.5	101201	44978	33.5	186568	56143	30.8
	Av Len 100.0, Av Age 10.0			Av Len 111.8, Av Age 11.9			Av Len 109.3, Av Age 11.5		
	#Oto's 8658, #Aged 1799			#Oto's 1627, #Aged 1198			#Oto's 1872, #Aged 1201		

APPENDIX III. (continued)

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, 1985.

	Yakutat			Kodiak			Chirikof		
Age	Catch	CPUE	Ave Wt	Catch	CPUE	Ave Wt	Catch	CPUE	Ave Wt
1	0	0	0.0	0	0	0.0	0	0	0.0
2	0	0	0.0	0	0	0.0	0	0	0.0
3	0	0	0.0	0	0	0.0	0	0	0.0
4	0	0	0.0	111	16	1.7	0	0	0.0
5	0	0	0.0	189	27	6.2	83	25	4.7
6	427	219	11.9	911	129	15.9	528	157	11.8
7	540	277	14.4	9246	1304	15.7	4767	1420	16.6
8	3666	1879	15.6	36884	5203	21.4	21166	6307	21.0
9	4483	2297	21.2	64397	9084	25.2	32167	9585	26.3
10	10473	5367	24.0	66816	9425	31.9	36080	10751	31.6
11	11477	5881	30.9	70670	9969	38.7	29739	8861	40.6
12	12054	6177	28.9	76710	10821	46.9	31538	9397	41.0
13	9996	5122	39.3	33459	4720	56.0	13426	4000	53.4
14	7310	3746	35.1	24585	3468	66.0	9424	2808	64.6
15	6254	3205	42.8	17132	2417	72.6	8654	2579	63.4
16	4709	2413	40.9	12362	1744	71.4	4931	1469	55.9
17	1959	1004	42.1	3822	539	89.4	4080	1216	66.6
18	1758	901	56.0	2764	390	90.4	2415	720	65.0
19	1080	553	73.8	1783	252	143.7	2136	636	73.0
20	1620	830	55.7	902	127	94.1	954	284	87.4
21+	2685	1376	80.0	2789	393	111.4	1780	530	97.3
Tot	80492	41246	34.7	425532	60027	42.1	203871	60746	39.3
	Av Len 112.9, Av Age 12.8			Av Len 119.8, Av Age 11.2			Av Len 117.6, Av Age 11.2		
	#Oto's 514, #Aged 514			#Oto's 6971, #Aged 1796			#Oto's 2682, #Aged 1199		

	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	48	35	2.6
6	0	0	0.0	0	0	0.0	16	12	6.8
7	1012	507	15.7	367	473	14.8	719	520	14.4
8	14216	7119	20.8	3552	4578	19.9	15628	11311	17.3
9	13938	6979	24.6	3144	4052	22.6	6848	4956	22.1
10	20794	10413	30.8	3797	4894	29.5	13576	9826	27.5
11	18646	9337	39.0	3552	4578	39.1	7356	5324	34.9
12	22289	11161	45.6	2940	3789	42.1	7542	5458	45.3
13	8723	4368	48.3	1184	1526	45.0	3542	2564	45.1
14	3621	1813	58.5	1102	1420	56.3	1954	1414	51.1
15	4093	2050	68.6	531	684	67.3	1357	982	61.9
16	1827	915	59.3	653	842	65.3	956	692	64.9
17	998	500	102.1	122	157	64.7	353	255	54.7
18	1092	547	70.9	204	263	64.8	359	260	59.0
19	747	374	96.5	122	157	108.6	103	75	92.8
20	120	60	123.3	122	157	91.1	199	144	60.7
21+	976	489	134.9	204	263	98.8	530	384	106.9
Tot	113091	56630	39.4	21599	27837	36.2	61087	44211	31.5
	Av Len 117.5, Av Age 11.1			Av Len 114.6, Av Age 10.9			Av Len 109.9, Av Age 10.5		
	#Oto's 2902, #Aged 1528			#Oto's 529, #Aged 529			#Oto's 3032, #Aged 1733		

APPENDIX III. (continued)

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, 1985.

	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	50	9	3.1
5	0	0	0.0	736	44	8.1	0	0	0.0
6	59	28	9.5	7436	440	10.6	724	130	10.1
7	602	289	11.5	30312	1794	12.6	4453	799	13.2
8	1989	957	14.3	75058	4441	15.3	24774	4445	15.6
9	2922	1406	17.0	92797	5491	18.1	31815	5709	20.0
10	2801	1347	21.2	78956	4672	21.1	44735	8027	23.4
11	2020	972	31.5	53268	3152	26.1	48412	8687	28.1
12	1324	637	38.4	39646	2346	29.1	45821	8222	32.8
13	692	333	43.1	19490	1153	36.8	30926	5549	37.5
14	543	261	65.6	13003	769	40.3	15853	2845	41.2
15	301	145	64.1	9183	543	42.3	12713	2281	48.7
16	391	188	90.6	8136	481	47.8	9011	1617	54.8
17	180	86	88.8	4340	257	49.2	6214	1115	55.5
18	301	145	88.0	3303	195	65.8	4443	797	61.2
19	242	117	90.0	1331	79	71.0	2369	425	74.0
20	152	73	81.7	1384	82	78.0	1469	264	74.1
21+	301	145	106.7	1892	112	94.7	3976	713	80.9
Tot	14823	7130	33.0	440272	26052	23.5	287756	51633	31.8
	Av Len 108.4, Av Age 11.0			Av Len 99.9, Av Age 10.2			Av Len 110.2, Av Age 11.7		
	#Oto's 492, #Aged 492			#Oto's 10517, #Aged 3326			#Oto's 3499, #Aged 2399		

	Area 2 Total			Area 3A			Area 3B		
Age	Catch	CPUE	Ave Wt	Catch	CPUE	Ave Wt	Catch	CPUE	Ave Wt
1	0	0	0.0	0	0	0.0	0	0	0.0
2	0	0	0.0	0	0	0.0	0	0	0.0
3	0	0	0.0	0	0	0.0	0	0	0.0
4	50	2	3.1	111	12	1.7	0	0	0.0
5	762	30	8.1	189	21	6.2	83	16	4.7
6	8441	327	10.5	1338	148	14.6	528	99	11.8
7	35998	1396	12.7	9786	1082	15.6	5779	1080	16.5
8	103014	3996	15.4	40550	4485	20.9	35383	6610	20.9
9	128665	4991	18.6	68880	7619	24.9	46105	8613	25.8
10	127220	4935	21.9	77288	8549	30.8	56875	10625	31.3
11	104095	4038	27.0	82148	9087	37.6	48385	9039	39.9
12	87219	3383	31.0	88764	9818	44.5	53826	10055	42.9
13	51289	1989	37.2	43455	4807	52.1	22149	4138	51.4
14	29459	1143	40.9	31895	3528	59.0	13045	2437	62.9
15	22302	865	46.0	23386	2587	64.6	12747	2381	65.1
16	17538	680	51.6	17072	1888	63.0	6758	1262	56.8
17	10755	417	53.0	5781	639	73.4	5077	948	73.6
18	7941	308	63.4	4522	500	77.0	3508	655	66.8
19	3808	148	73.2	2863	317	117.3	2883	539	79.1
20	2940	114	76.1	2522	279	69.5	1073	200	91.4
21+	6012	233	85.7	5475	606	96.0	2757	515	110.6
Tot	747506	28995	26.7	506024	55973	40.9	316962	59211	39.3
	Av Len 104.3, Av Age 10.8			Av Len 118.7, Av Age 11.5			Av Len 117.6, Av Age 11.2		
	#Oto's 14508, #Aged 6217			#Oto's 7485, #Aged 2310			#Oto's 5584, #Aged 2727		

APPENDIX III. (continued)

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, 1985.

	Area 3 Total			Area 4 Total			All Areas		
Age	Catch	CPUE	Ave Wt	Catch	CPUE	Ave Wt	Catch	CPUE	Ave Wt
1	0	0	0.0	0	0	0.0	0	0	0.0
2	0	0	0.0	0	0	0.0	0	0	0.0
3	0	0	0.0	0	0	0.0	0	0	0.0
4	111	8	1.7	0	0	0.0	161	4	2.1
5	272	19	5.7	48	22	2.6	1082	26	7.2
6	1865	130	13.8	16	7	6.8	10322	244	11.1
7	15565	1081	15.9	1086	503	14.5	52650	1244	13.7
8	75932	5275	20.9	19180	8890	17.8	198127	4680	17.7
9	114985	7989	25.3	9992	4631	22.2	253642	5992	21.8
10	134163	9321	31.0	17373	8052	27.9	278755	6585	26.7
11	130532	9069	38.5	10908	5056	36.3	245535	5800	33.5
12	142590	9906	43.9	10482	4858	44.4	240291	5676	39.2
13	65605	4558	51.9	4726	2190	45.1	121619	2873	45.4
14	44940	3122	60.1	3057	1417	53.0	77455	1830	52.5
15	36133	2510	64.8	1888	875	63.4	60323	1425	57.8
16	23830	1656	61.3	1609	746	65.1	42977	1015	57.5
17	10858	754	73.5	476	221	57.3	22089	522	63.2
18	8029	558	72.6	564	261	61.1	16534	391	67.8
19	5746	399	98.2	226	105	101.4	9780	231	88.5
20	3595	250	76.0	322	149	72.3	6857	162	75.9
21+	8232	572	100.9	735	341	104.6	14979	354	95.0
Tot	822986	57177	40.3	82686	38323	32.8	1653178	39053	33.8
	Av Len 118.4, Av Age 11.4			Av Len 111.1, Av Age 10.6			Av Len 111.8, Av Age 11.0		
	#Oto's 13069, #Aged 5037			#Oto's 3032, #Aged 1733			#Oto's 30609, #Aged 12987		

APPENDIX III. (continued)

TABLE 3. 1985 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	CPUE	AVG. WGT.	CPUE	AVG. WGT.	CPUE	AVG. WGT.	CPUE	AVG. WGT.	CPUE	AVG. WGT.	CPUE	AVG. WGT.
2	-	-	-	-	-	-	-	-	-	-	-	-
3	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	0.006	1.9	-	-	0.009	3.8	-	-	0.002	1.2
5	0.082	4.2	0.039	3.5	0.021	3.3	0.032	4.4	0.074	5.9	0.134	3.6
6	0.156	5.1	0.157	5.0	0.076	5.1	0.103	8.6	0.135	5.5	0.354	5.8
7	0.257	6.0	0.258	8.1	0.253	6.4	0.279	9.2	0.482	7.1	0.444	8.7
8	0.553	7.2	0.453	11.4	0.585	8.7	0.646	14.0	0.915	9.3	1.397	16.3
9	0.377	8.7	0.415	14.2	0.581	10.1	0.612	16.8	0.774	13.8	1.146	20.8
10	0.246	10.8	0.288	22.0	0.400	13.5	0.669	24.1	0.790	18.2	1.091	29.4
11	0.105	14.2	0.169	26.2	0.457	17.8	0.522	32.9	0.759	21.2	0.847	40.6
12	0.146	15.0	0.119	33.3	0.437	19.7	0.582	40.1	0.852	24.7	1.112	51.0
13	0.078	20.4	0.063	44.6	0.346	22.9	0.508	47.6	0.503	25.9	0.944	59.9
14	0.035	20.7	0.033	43.8	0.280	26.2	0.461	56.1	0.202	43.8	0.542	85.8
15	0.037	18.3	0.039	54.8	0.185	29.8	0.263	63.4	0.111	38.5	0.379	97.5
16	0.022	21.3	0.020	64.6	0.138	29.1	0.201	68.1	0.084	48.9	0.145	82.5
17	0.021	30.0	0.019	89.6	0.113	30.2	0.107	78.5	0.062	52.8	0.109	94.7
18	0.011	22.7	0.016	67.3	0.058	39.7	0.088	83.5	0.026	43.0	0.028	138.9
19	0.006	32.0	0.004	32.0	0.083	40.3	0.077	76.4	0.013	95.5	0.081	97.8
20	0.008	39.3	0.007	86.1	0.035	44.8	0.044	98.8	-	-	0.053	134.1
21	0.004	37.7	0.007	83.7	0.025	44.6	0.032	115.9	-	-	0.031	183.5
22	-	-	-	-	-	-	0.038	108.3	-	-	0.004	153.4
23	0.004	42.0	0.005	145.1	0.004	71.2	0.024	125.1	-	-	0.009	193.5
24	-	-	-	-	0.007	79.8	0.012	129.1	-	-	0.016	68.1
25+	-	-	-	-	0.004	33.8	0.017	119.2	0.006	103.8	0.040	129.9
TOT	2.15		2.12		4.09		5.33		5.79		8.91	

REGION:	OREGON			
	MALES		FEMALES	
AGE	CPUE	AVG. WGT.	CPUE	AVG. WGT.
2	-	-	-	-
3	-	-	-	-
4	-	-	-	-
5	0.052	5.3	0.101	5.6
6	0.178	5.6	0.583	6.4
7	0.254	6.9	0.579	9.3
8	0.354	7.8	0.873	12.2
9	0.398	13.6	0.719	16.0
10	0.224	14.9	0.347	23.6
11	0.099	14.1	0.149	34.8
12	0.124	22.9	0.174	40.0
13	0.099	22.2	0.149	47.6
14	0.025	31.1	0.124	48.5
15	-	-	0.025	55.3
16	0.025	22.3	-	-
17	-	-	-	-
18	0.025	27.6	0.050	83.3
19	-	-	0.050	62.9
20	-	-	0.025	93.9
21	-	-	-	-
22	-	-	-	-
23	0.025	30.2	0.025	108.0
24	-	-	-	-
25+	-	-	-	-
TOT	1.88		3.97	

APPENDIX III. (continued)

TABLE 4. 1985 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		OREGON	
LENGTH INTERVAL	MALE CPUE	FEMALE CPUE	MALE CPUE	FEMALE CPUE	MALE CPUE	FEMALE CPUE	MALE CPUE	FEMALE CPUE
30-34	-	-	-	-	-	-	-	-
35-39	-	-	-	-	-	-	-	-
40-44	-	-	-	-	-	0.002	-	-
45-49	0.006	0.006	0.006	-	-	0.010	-	-
50-54	0.030	0.020	0.031	0.008	0.030	0.040	-	-
55-59	0.083	0.059	0.082	0.037	0.095	0.126	0.025	-
60-64	0.212	0.122	0.231	0.099	0.259	0.154	0.161	0.161
65-69	0.355	0.125	0.347	0.128	0.355	0.215	0.248	0.422
70-74	0.396	0.162	0.368	0.219	0.539	0.294	0.257	0.437
75-79	0.328	0.232	0.357	0.285	0.513	0.354	0.298	0.422
80-84	0.232	0.253	0.317	0.321	0.548	0.407	0.099	0.298
85-89	0.160	0.204	0.299	0.290	0.454	0.516	0.124	0.397
90-94	0.113	0.184	0.335	0.311	0.481	0.527	0.198	0.397
95-99	0.092	0.128	0.376	0.237	0.450	0.552	0.099	0.397
100-104	0.056	0.116	0.317	0.281	0.466	0.460	0.198	0.149
105-109	0.035	0.106	0.287	0.322	0.353	0.488	0.099	0.099
110-114	0.012	0.085	0.229	0.329	0.302	0.510	0.050	0.223
115-119	0.013	0.065	0.190	0.320	0.325	0.396	0.025	0.025
120-124	0.012	0.041	0.104	0.349	0.172	0.445	-	0.074
125-129	0.006	0.042	0.080	0.269	0.169	0.424	-	0.149
130-134	0.007	0.045	0.061	0.317	0.091	0.443	-	0.074
135-139	-	0.034	0.032	0.257	0.106	0.424	-	0.074
140-144	-	0.026	0.017	0.206	0.038	0.377	-	0.050
145-149	-	0.021	0.020	0.170	0.023	0.345	-	-
150-154	-	0.009	-	0.148	0.007	0.353	-	0.025
155-159	-	0.006	0.003	0.128	-	0.282	-	0.050
160-164	-	0.009	-	0.098	0.006	0.243	-	-
165-169	-	0.011	-	0.064	0.007	0.154	-	0.050
170-174	-	-	-	0.045	-	0.129	-	-
175-179	-	0.006	-	0.031	-	0.080	-	-
180-184	-	-	-	0.021	-	0.065	-	-
185-189	-	-	-	0.012	-	0.031	-	-
190-194	-	-	-	0.014	-	0.012	-	-
195-199	-	-	-	0.004	-	0.025	-	-
200+	-	0.002	-	0.006	-	0.025	-	-
TOTAL	2.15	2.12	4.09	5.33	5.79	8.91	1.88	3.97

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