INTERNATIONAL PACIFIC HALIBUT COMMISSION

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

ANNUAL REPORT
1976

SEATTLE, WASHINGTON
1977

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 Conventions of 1930 and 1937 extended the Commission's authority and the 1953 Treaty specified that the halibut stocks be developed and maintained at levels that permit the maximum sustained yield.

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

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

The International Pacific Halibut Commission has three publications: Annual Reports, Scientific Reports, and Technical Reports. Until 1969, only one series was published. The numbering of the original series has been continued with the Scientific Reports.

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Contents

Activities of the Commission

The Fifty-Second Annual Meeting of the Commission was held in Seattle, Washington, January 20-23, 1976. Mr. Robert W. Schoning presided as Chairman, and Mr. Clifford R. Levelton was Vice Chairman. The Commission staff summarized results of the 1975 fishery, reviewed results of scientific investigations, and recommended regulations for the halibut fishery in 1976. The staff also presented results of a questionnaire distributed to vessel captains to obtain their recommendations for halibut regulations during 1976. Recommendations for regulations also were received from the Conference Board, halibut industry, and the Makah Indian Tribe. The Commission reviewed all proposals with its Advisory Group before adopting regulations for the 1976 halibut season. The new regulations were sent to the Canadian and United States Governments for approval. The Commission considered administrative and fiscal matters, approved research plans for 1976, and adopted the Commission's budget for fiscal year 1978-1979. Mr. Levelton was elected Chairman for 1976 and Mr. Schoning was elected Vice Chairman. A news release expressing cautious optimism for the future of the halibut resource and listing the regulations recommended to the governments for the 1976 season was issued at the close of the meeting.

Letters were sent to the governments expressing satisfaction with progress in fishery negotiations with foreign nations, urging continuation of the restrictions on trawlers, and proposing that similar restrictions be imposed on new nations entering the trawl fisheries in the Bering Sea and the North Pacific Ocean. The Commission also requested the assistance of the governments in securing information regarding the source and method of capture of imported halibut. The Commission notified the Alaska Department of Fish and Game of its concern regarding the incidental catch of halibut in king crab pots and urged adoption of legislation requiring crab pots to be constructed with self-destruct panels.

The Commission met in Seattle, Washington on September 23, 1976 to review the 1976 halibut fishery in the Bering Sea and to consider regulatory proposals for that fishery in 1977. In its report to the governments, the Commission stressed the continuing critical condition of the Bering Sea halibut resource and recommended, as a minimum, that trawl restrictions in effect in 1975-1976 be continued another year. The Commission urged extension of time-area closures, consideration of the use of off-bottom trawls instead of on-bottom trawls, and attention to the effects of the foreign longline fishery. The Commission also recommended continuation of research on ways to reduce the incidental catch of halibut by trawl gear.

Publications by the Commission during 1976 are listed at the end of this report. In addition, several documents were prepared for the International North Pacific Fisheries Commission (INPFC) annual meeting at the request of the Canadian and United States National Sections.

Expenditures during the 1975-1976 fiscal year (April-March) were $695,000. Commission expenses were shared equally by both governments.

JACK PRINCE

Canadian Commissioner, 1974-1976

Director's Report

Canada and the United States passed legislation in 1976 to extend their jurisdiction of fisheries resources to 200 miles in 1977. Assuming that the "total allowable catch" for foreign fleets will not change materially and that time-area closures will be basically the same as in 1976, the direct benefits to the halibut resource in 1977 will be minimal. However, the expected increase in enforcement and improved control of foreign fishing effort could stop reported instances of directed fishing for halibut as well as reduce the incidental catch. The expanded observer program and improved catch statistics will provide valuable information needed for stock assessment and appraisal of the impact of foreign fisheries on the resource. In fact, the very pronouncement of intent to extend jurisdiction may have contributed, along with other factors such as time-area closures, to a reduction of the foreign catch of halibut. This reduction is evidenced by the decline in Japanese exports of halibut to the United States over the past several years. These imports peaked in 1972 at 20.8 million pounds (equivalent round weight) and declined steadily to 5.3 million in 1976, the lowest amount since 1971. Further, Japanese markets recently have been seeking halibut from North American sources.

The United States Fishery Conservation and Management Act of 1976 calls for renegotiation of a fisheries treaty which is inconsistent with the Act and for the U.S. withdrawal from any such treaty if it is not renegotiated within a reasonable period of time. For example, the Act specifies optimum yield as a management objective, whereas the Halibut Convention stipulates maximum sustained yield and must be changed accordingly.* As discussed in last year's Annual Report, there are other reasons to consider a revision of the Treaty and certainly both countries will want to examine all options for managing the halibut fishery in light of the new legislation. Any decision regarding the Halibut Treaty will, of course, be in concert with decisions regarding other fisheries.

The present Treaty does not specify an allocation of the halibut catch by country and this aspect may be considered in its revision. Both governments have examined the past distribution of the catch between countries. United States fishermen landed over 80% of the catch in the 1920's, but the Canadian catch has increased gradually and exceeded 50% from 1963 to 1966 and from 1968 to 1972. Details of these data are included in the Biostatistics section of this Annual Report.

Because there are so many complex problems associated with extended jurisdiction and based on the time necessary to revise past Treaties, the renegotiation of new arrangements for the management of the halibut fishery are likely to be lengthy and involved. Any change in the Treaty requires ratification by both countries and is a slow process. Further, if changes are substantial or if the Treaty is terminated, additional time may be required to implement new legislation, to adjust the regulatory process, or to arrange for an orderly transition.

* On April 1, 1977, the U.S. State Department notified Canada that the Treaty would be terminated if not renegotiated by April 1, 1979; the 2-year notice is specified in the Halibut Convention.

The Fishery

REGULATIONS FOR 1976

Regulatory proposals for 1976 were submitted by fishermen, vessel owners, processors, government agencies, and the Commission's scientific staff. Prior to the Annual Meeting, a summary of all proposals was distributed to interested groups. The staff recommended a catch limit (quota) of 13 and 12 million pounds for Areas 2 and 3 respectively, the same as in 1974 and 1975. The staff also recommended that Areas 2 and 3 open May 15 and close September 15, if the catch limits are not taken earlier, and that the size limit, sport fishery regulations, and gear restrictions remain the same as in 1975. The staff proposed a system of determining opening dates designed to attain 50% of the season's catch prior to July 1 and 50% after that date. The staff also proposed a procedure for speeding annual approval of specified changes in the regulations.

The Conference Board proposed a catch limit of 15 million pounds in Area 2 and agreed with the staff's recommendation of 12 million pounds for Area 3. The Conference Board recommended that Areas 2 and 3 open on May 8 and close when their respective catch limits were taken, i.e., no statutory closing dates. The Conference Board requested that Area 3 west of Unimak Pass be opened in the fall at the same time as the Bering Sea areas and that the Bering Sea fall season open 7 days after the closure of Area 3. The Board reiterated proposals made in previous years that all vessels landing halibut be licensed and that all pots designed for taking fish and shellfish be constructed with escape mechanisms. The Conference Board opposed the staff proposal for setting opening dates, but supported the proposal designed to speed approval of regulations providing 30 days be allowed for possible industry appeal to the governments. The Conference Board also opposed any form of limited entry in the halibut fishery at present.

IPHC traditionally has obtained regulatory proposals from fishermen's unions and vessel owner groups who are represented on the Conference Board, but fishermen in some areas are not organized and have no representation on the Board. To obtain recommendations from these groups and to supplement the recommendations of the Conference Board, the Commission sent out 550 questionnaires to individual captains. A total of 163 or 30% of the questionnaires were completed and returned. The results indicated a wide range of opinions. Proposed opening dates ranged from April 1 to June 1, with an average at May 8. Closing dates ranged from August 1 to October 31, with an average at September 18. Catch limit proposals for Areas 2 and 3 ranged from 10 million to 25 million pounds, with an average of 13.6 and 13.1, respectively.

All regulatory alternatives were discussed with the Advisory Group which was established in 1974 and consists of representatives of fishermen, vessel owners, and processors. Members of the Advisory Group were Jerry Anderson, Rodger Davies, James Ferguson, Harold Lokken, and David Roy (Seattle, Wa.); Joseph Antonelli, Steinar Antonsen, Norman Christensen, George Dodman, and Glenn McEachern

(Vancouver, B.C.); Sid Dickens (Prince Rupert, B.C.); Albert Davis (Kake, Ak.); and Chris Christensen (Petersburg, Ak.).

Regulatory proposals for the Bering Sea fishery were considered at the Commission's September 1975 meeting. The staff proposed that Areas 4A, 4B, 4C, and 4D-East open on April 1 and close on April 19 and that the same areas reopen on September 15 and close on September 30. The staff proposal provided for Area 4D-West to open on April 1 and close on November 15, while Area 4E, a nursery area, would remain closed to halibut fishing at all times. These proposed regulations were the same as those adopted for the 1975 fishery. In addition, the staff proposed that time-area closures of foreign trawl fisheries in the eastern Bering Sea be continued to control the incidental halibut catch and that the Canadian and United States Governments continue trawl studies to determine whether modifications of gear or fishing techniques can reduce the incidental catch of halibut. Halibut fishermen concurred with the staff's proposal, but preferred a single Bering Sea fishing season from April 1 to November 1 in all areas except Area 4E.

The regulations recommended by the Commission are described in the following sections and were approved by the United States Secretary of State on March 16 and by the Governor General of Canada on March 30. As in previous years, approval of the regulations also implemented the conservation measures adopted by INPFC.

Regulatory Areas

The regulatory areas in 1976 were the same as in 1975 and are shown in Figure 1:

Area 2 — South and east of Cape Spencer, Alaska.

Area 3 — North and west of Area 2, excluding the Bering Sea.

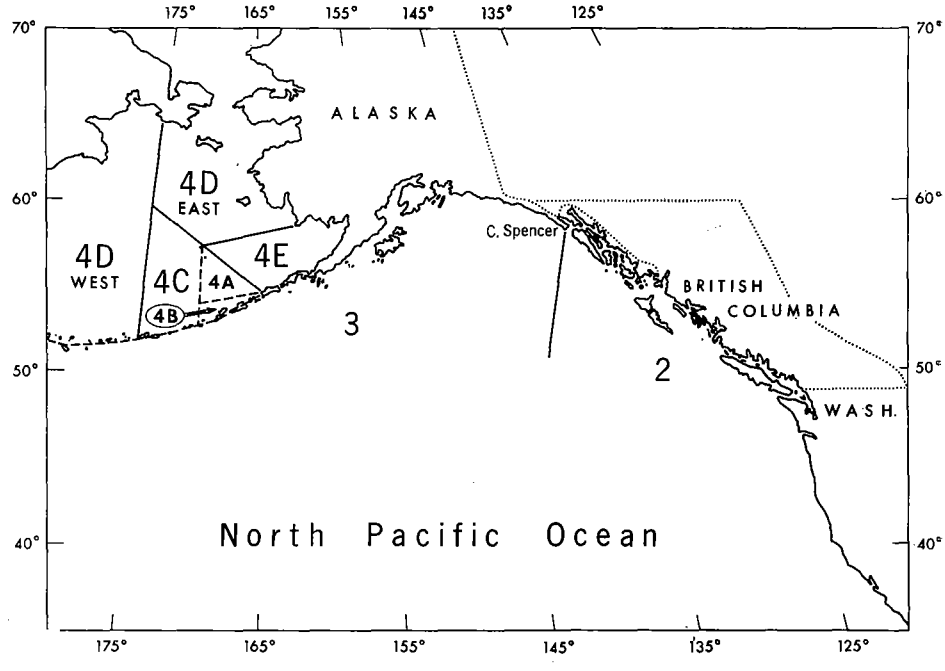


Figure 1. Regulatory areas for the Pacific halibut fishery, 1976.

Area 4 — The Bering Sea:
4A, 4B, 4C, and 4D-East: East of 175° W except Area 4E.
4D-West: West of 175°W.
4E: The southeastern flats.

Catch Limits and Length of Seasons

The 1976 catch limits of 13 million pounds in Area 2 and 12 million pounds in Area 3 were the same as 1975. Area 4 was managed by limiting the length of the fishing seasons without assigning catch limits. Area 4E was designated as a halibut nursery area and has been closed to all halibut fishing since 1967. The opening and closing dates and the length of fishing seasons for 1975 and 1976 are given in Table 1. The fishing seasons began at 1500 hours in Areas 2 and 3 and 1800 hours in Area 4 and closed at 0600 hours in all areas, the hours were Pacific Standard Time.

Table 1. Opening and closing dates by area, 1975 and 1976.

Area	1975			1976		
	Opening	Closing	Fishing Days	Opening	Closing	Fishing Days
2	May 1	Sept. 6	128	May 8	Sept. 8	123
3	May 1	Sept. 6	128	May 8	Aug. 12	96
4A, B, C, D-East	Apr. 1	Apr. 19	17	Apr. 1	Apr. 19	17
	Sept. 15	Sept. 30	14	Sept. 15	Sept. 30	14
4D-West	Apr. 1	Nov. 15	227	Apr. 1	Nov. 15	227

Other Regulations

The minimum commercial size limit of 32 inches with head-on or 24 inches with head-off was continued in 1976. The wording of the regulation was modified to specifically make possession of halibut below the minimum size limit illegal.

The vessel license requirements were modified so that vessels that transport halibut, but do not engage in any fishing activity, no longer require a license.

All other regulations pertaining to licensing, gear restriction, and the sport fishery were unchanged from 1975.

STATISTICS OF THE FISHERY

A compilation of historical statistics was completed this year and will be published in 1977 as Technical Report No. 14, "The Pacific Halibut Fishery: Catch, Effort and CPUE, 1929-1975". The report summarizes catch and effort data by statistical area, region, regulatory area, and country; data on landings also are given by port and country. Appendix Tables 1-5 of this Annual Report are in the same format and update these statistics to 1976.

Catch by Regulatory Area

The total commercial catch in 1976 was 27.5 million pounds, 0.1 million less than in 1975. The Canadian catch increased 0.6 million pounds in 1976, and the United States catch declined by 0.7 million pounds. Catches are shown by country and regulatory area for 1972 through 1976 in Table 2.

Table 2. Catch by regulatory area, 1972-1976.

Regulatory Area	1972	1973	1974	1975	1976
	Catch in Thousands of Pounds				
Area 2					
Canada	10,517	7,364	4,973	7,369	7,400
United States	5,766	5,565	5,771	6,461	5,648
Total	16,283	12,929	10,744	13,830	13,048
Area 3					
Canada	11,757	6,990	2,227	3,819	4,534
United States	14,112	11,535	7,898	9,442	9,430
Total	25,869	18,525	10,125	13,261	13,964
Bering Sea					
Canada	247	96	168	169	62
United States	485	190	269	356	461
Total	732	286	437	525	523
All Areas					
Canada	22,521	14,450	7,368	11,357	11,996
United States	20,363	17,290	13,938	16,259	15,539
Total	42,884	31,740	21,306	27,616	27,535

In Area 2, the catch was 13.0 million pounds, the same as the catch limit and 0.8 million pounds less than the 1975 catch. Most of the reduction in catch occurred in southeastern Alaska waters where the 1976 catch was nearly 0.9 million pounds less than the 1975 catch and off Vancouver Island where the catch decreased 0.4 million pounds. Conversely, the catch from north British Columbia increased nearly 0.5 million pounds.

In Area 3, the catch was nearly 14 million pounds, 2 million pounds over the catch limit and 0.7 million pounds greater than in 1975. The excess catch occurred because of an unanticipated increase in CPUE during the latter part of the fishing season and because more vessels participated in the late season than expected. Also, landings from some of the smaller ports in central Alaska were not reported promptly. Because the closure date is announced three weeks in advance, these factors caused IPHC to underestimate the catch rate and misjudge the date on which the quota would be caught.

In Area 4 (the Bering Sea), the total catch was 523,000 pounds, only 2,000 pounds less than in 1975. Eleven United States vessels fished in Area 4 during 1976; six vessels landed 153,000 pounds during the spring fishery and ten vessels landed 308,000 pounds during the summer and fall. One Canadian vessel landed 62,000 pounds during the summer and fall. Most of the catch in 1976 and in recent years was taken near the Aleutian Islands.

The landed value of the 1976 catch set a record of over $34 million, up $10 million over the 1975 value. Prices were relatively constant throughout the year and averaged $1.25 per pound to the fishermen. The price for large halibut was about 3 cents per pound higher than for medium halibut. In previous years, the percentage difference in price between size categories was much higher. Similarly, the difference in price between northern and southern ports has diminished.

Landings by Ports

Six ports had landings in excess of 1 million pounds and accounted for 73% of all Pacific Coast landings in 1976. Prince Rupert, British Columbia maintained its status as the leading port with landings of 6.1 million pounds, an increase of nearly 900,000 pounds over 1975. Landings in Seward and Petersburg, Alaska were down 500,000 and 1 million pounds respectively, whereas Kodiak and Pelican, Alaska and Vancouver, British Columbia landings were approximately the same as 1975. Landings at Washington ports continued to decline and accounted for only 4% of the total. Details of the landings by port for 1976 are given in Appendix Table 5.

Number of Vessels

Table 3 shows the number of licensed vessels (5 net tons or larger that fish with setline gear) and unlicensed vessels (setliners less than 5 net tons and all trollers and handliners) that landed halibut during 1976. The number of licensed vessels increased from 497 in 1975 to 743 in 1976, a 49% increase. Most of the increase represents vessels new to the halibut fishery, but many had fished halibut in past years without being licensed as required.

The number of unlicensed setliners increased 29% in 1976. Many fishermen were attracted to the halibut fishery because limited entry laws in Alaska and British Columbia prevented them from obtaining a license to fish salmon. The number of trollers that caught halibut in 1976 was about 2% less than in 1975.

Sport Fishery

Sport fishermen in the State of Washington caught 720 halibut in 1976 according to preliminary figures supplied by the Washington Department of

Table 3. Number of licensed and unlicensed vessels by area and nationality, 1976.

	Number of Vessels						
	Area 2		Area 3*		Total		Grand
Vessel Category	Canada	U.S.	Canada	U.S.	Canada	U.S.	Total
Unlicensed Vessels							
Troll**	1,114	1,297	0	69	1,114	1,366	2,480
Setline	256	517	1	343	257	860	1,117
Total	1,370	1,814	1	412	1,371	2,226	3,597
Licensed Vessels							
5-19 Tons***	269	135	6	127	275	262	537
20-39 Tons	34	35	19	68	53	103	156
40-59 Tons	2	3	8	15	10	18	28
60+ Tons	0	1	16	5	16	6	22
Total	305	174	49	215	354	389	743
Grand Total	1,675	1,988	50	627	1,725	2,615	4,340

* Includes vessels that fished in both areas.

** Includes handline vessels.

*** Includes small vessels of unknown tonnage.

Fisheries. Nearly three-quarters of these fish were caught in the Strait of Juan de Fuca. The weight of the halibut ranged from 15 to 135 pounds and averaged 35 pounds.

Canadian fishery officers reported 945 halibut, with an average weight of 23 pounds, caught by sport fishermen. Most of these fish were taken from the west coast of Vancouver Island from Victoria to Queen Charlotte Sound.

The Alaska Department of Fish and Game reported that sport fishermen caught 19,200 halibut in 1976. This catch was more than double the amount reported in 1975, primarily because of the marked increase in Cook Inlet where 8,000 halibut were caught. The Inlet now has five charter vessels that specialize in halibut fishing. The catch in southeastern Alaska was 7,700.

Eight halibut were over 100 pounds and qualified for Alaska's trophy program; the largest was 183 pounds and was taken in Kachemak Bay. The average weight of sport-caught halibut in Alaska is 10 pounds.

ASSESSMENT OF STOCKS

The assessment of halibut stocks in 1976, as in the past, relied heavily on trends in catch, effort, and catch per unit effort (CPUE). Data from age composition and tagging studies, as well as results from juvenile halibut surveys, also were examined. In addition, another method of analyzing catch and age data was employed in 1976. The new approach, known as cohort analysis, provides estimates of mortality and the abundance of young halibut, independent of CPUE and effort data. The analyses confirm our previous conclusion of low stock abundance and indicate that the chief reason for the low stock size is a long-term reduction in the number of young halibut entering the fishery.

Catch and Effort Data

In previous reports, IPHC pooled data from fishermen's log books to estimate CPUE and effort by regulatory areas. Hence, these estimates were solely dependent on the geographic distribution of log records and did not necessarily reflect the actual distribution of catch and fishing effort. To more nearly approximate the actual distribution, we are now pooling log data by regions within each regulatory area and calculating CPUE and total effort by region. CPUE by regulatory area is estimated by dividing the total catch by the total effort. This is equivalent to weighting CPUE by fishing effort at the regional level. The detailed steps used in compiling the data are described in Technical Report No. 14. Because the method of calculation has changed, the new CPUE values usually will differ from those reported in previous publications; however, there is no change in the long-term trends.

Figure 2 shows trends in catch, effort, and CPUE in the North American halibut fishery in Regulatory Areas 2 and 3 since 1960. In Area 2, the catch declined from about 32 million pounds in 1960 to a low of 11 million pounds in 1974. Fishing effort also has declined since 1960, but has increased about 55% since the low in 1974. CPUE is the average catch per standard skate and is used as an indicator of stock abundance. CPUE is estimated from catch and effort data recorded in fishermen's log books. The trend in CPUE in Area 2 indicates a general decline in abundance since the early 1960's. The decline appeared to be halted in 1975, but CPUE fell sharply in 1976. The 1976 CPUE was only 48 pounds, a decline of 12 pounds from that in 1975 and lower than at any time since 1932.

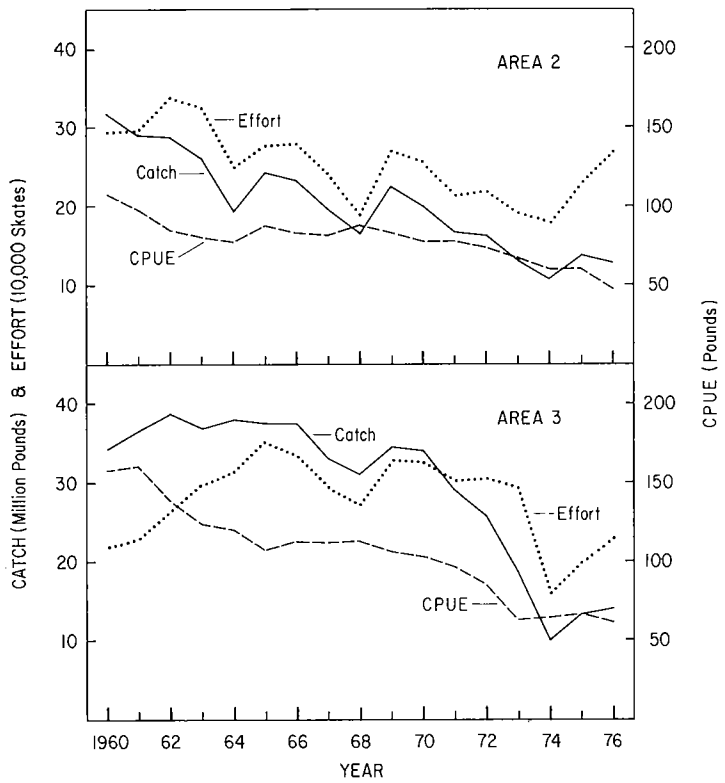


Figure 2. Catch, effort, and CPUE in Regulatory Areas 2 and 3.

In Area 3, the catch exceeded 30 million pounds until 1971, but dropped to 10 million in 1974 when the catch limit was sharply reduced (Figure 2). The 1976 catch was 14 million pounds. Effort increased during the early 1960's, remained high through 1973, and then dropped sharply in 1974. Effort has since increased about 45% and is now similar to that in 1960. The trend in CPUE indicates a major decline in abundance since 1960. CPUE has been relatively stable since 1973, but a similar stable period was observed in the late 1960's and was followed by a subsequent period of decline. CPUE in 1976 was 61 pounds, down 5 pounds from that in 1975. CPUE trends in Area 3 usually lag a few years behind those in Area 2, and the sharp decline observed this year in Area 2 may be indicative of an upcoming decline in Area 3.

Age Composition

Halibut landings are sampled routinely to estimate the age of fish in the catch. The age composition is used along with CPUE to estimate the abundance of fish at each age. CPUE generally declined for all ages in 1976. A major exception occurred in the inshore waters of the Charlotte Region (Hecate Strait and Queen Charlotte Sound) where the CPUE of fish less than 10 years old increased. The halibut in this region traditionally are younger than elsewhere, and the increase may indicate that the larger minimum size limit introduced in 1973 has reduced mortality on younger halibut. However, age composition data sometimes exhibit fluctuations that are not related to actual changes in stock, and data from additional years are necessary to determine whether the abundance of young halibut has actually increased.

Fishing Mortality

Fishing mortality can be estimated from catch and age data. Recent analyses included the incidental catch from the foreign and domestic trawl fishery as well as the catch data from the setline fishery. Trends in fishing mortality were examined for two age groups: 4-year-olds, the modal age group in the trawl catch, which have not been recruited into the setline fishery and 15-year-olds, which seldom are caught by trawls, but are fully recruited in the setline fishery.

Fishing mortality on 4-year-olds was insignificant before 1960, but increased during the 1960's with the development and expansion of the trawl fisheries. Mortality is greatest in Area 3 and generally has been over 0.1 since 1964. In Area 2, fishing mortality on 4-year-olds has been less than 0.05. Although not the only cause, the mortality of juvenile halibut by trawls has reduced recruitment to the setline fishery.

Fishing mortality on 15-year-olds has declined in Area 2 from about 0.3 in the late 1930's to about 0.15 in the 1970's. In Area 3, mortality on 15-year-olds increased from about 0.2 in the 1940's and 1950's to about 0.4 in the late 1960's and early 1970's, but then decreased to 0.25 in 1974. Mortality increased in both areas since 1974 and is considered excessive relative to the present level of recruitment.

Abundance of Young Halibut

Analysis of catch and age data indicates a severe decline in the abundance of young halibut since the 1940's. IPHC surveys in the Gulf of Alaska also provide evidence of reduced abundance. The decline in number of young halibut, the resultant reduction of recruitment, and effect on CPUE in the setline fishery in Areas 2 and 3 is illustrated in Figure 3. The figure should not be construed to mean that only the abundance of young affects the setline fishery; other factors such as natural mortality, growth, incidental catch by other fisheries, and catch by the setline fishery itself also are important. Further, estimates of abundance are preliminary and are intended only to show the relative magnitude of the decline. A more comprehensive study of the abundance of young halibut is planned for the coming year.

The number of 3-year-old halibut, estimated from cohort analysis, indicates the abundance of young halibut before they enter either the trawl or setline fisheries. Incidental capture by trawls generally occurs between 3 and 7 years of age, and young halibut are recruited to the setline fishery at about 8 years of age; the mean age of setline-caught halibut is usually 11 to 12 years. Hence, the abundance of 3-year-olds caught in a given year affects recruitment 5 years later and CPUE about 10 years later.

The 18 million 3-year-olds in 1945 provided 9 million recruits to the setline fishery in later years and led to a CPUE of 120 pounds per skate in 1955. The abundance of 3-year-olds has declined steadily since 1945 and was estimated at only 4 million in 1975. This reduction largely explains the decline in recruitment and CPUE. The estimate for 3-year-olds in 1975 indicates that CPUE may decline to 40 pounds per skate by 1985. This decline, however, need not take place. CPUE could be stabilized at the present level or even improved slightly if the setline fishery were curtailed sufficiently to compensate for the reduced recruitment. Further, a reduction in the incidental catch by trawlers could improve the survival of young halibut. In any case, the downward trend in the abundance of young halibut must be reversed before a significant improvement can be expected.

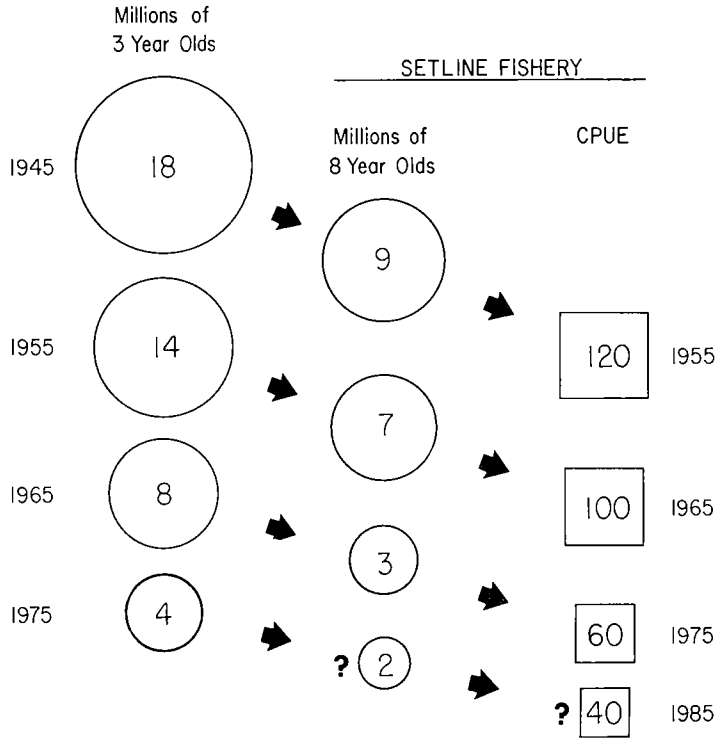


Figure 3. Effect of reduced abundance of young halibut on recruitment and CPUE in the setline fishery in the Gulf of Alaska.

The cause of the reduced abundance of 3-year-olds is not known with certainty. The trawl fisheries were not intensive until the 1960's and their incidental catch consisted primarily of halibut over 3 years old. This indicates that trawling was not responsible for the decline at this age, although it did reduce the abundance of recruits, 8-year-olds, in the 1960's and 1970's. The production of young halibut apparently has declined, although a possible increase in natural mortality cannot be dismissed. Reduced production might be due to adverse environmental conditions or to reduced spawning stocks. The abundance of spawners, however, was relatively high until the mid-1960's, and we have no evidence of a long-term change in the environment. Until more is known about environmental factors and spawning stocks, the cause of the reduced abundance of young halibut will remain in doubt.

SNAP-ON GEAR

Snap-on gear was introduced into the halibut fishery about 20 years ago; it differs from traditional setline gear in that the branch lines (gangions) are attached to the groundline with metal snaps rather than being tied to the groundline with twine. Further, the groundline used for snap-on gear is one continuous line that is simply stored on a drum after the gangions are removed; whereas the groundline of traditional gear is coiled in lengths of 1,500 to 1,800 feet with the gangions attached. The method of attaching the hooks to the gangions is the same for both types of gear.

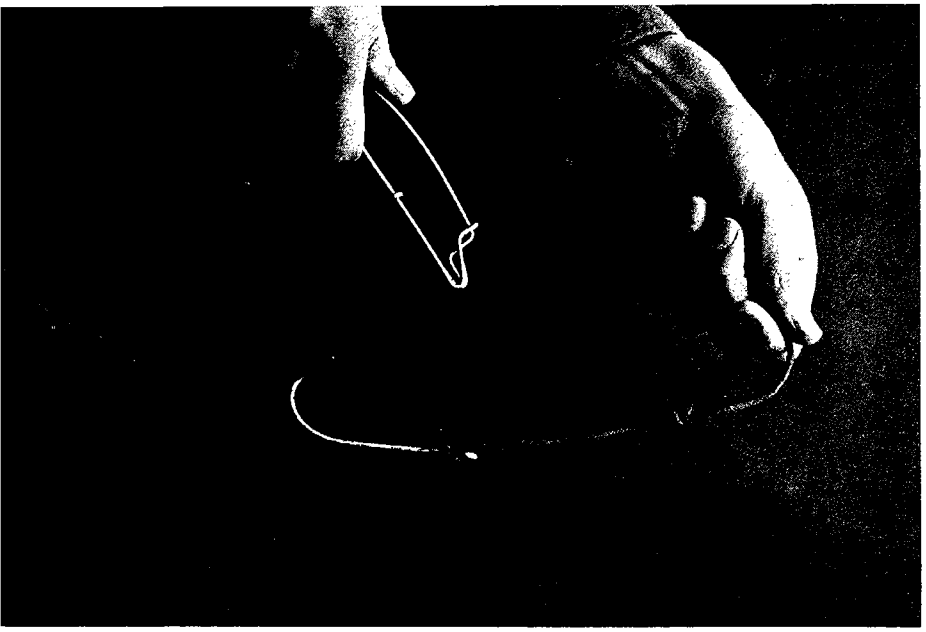
When snap-on gear is set, the hooks are baited and the gangions are attached to the groundline as it unwinds from the drum. Hook interval can be changed with

each set. When the gear is retrieved, the hooks are unsnapped and stored on racks and the groundline is rewound on the drum. The snap-on gear and one of many deck arrangements are shown on pages 18 and 19 of this report.

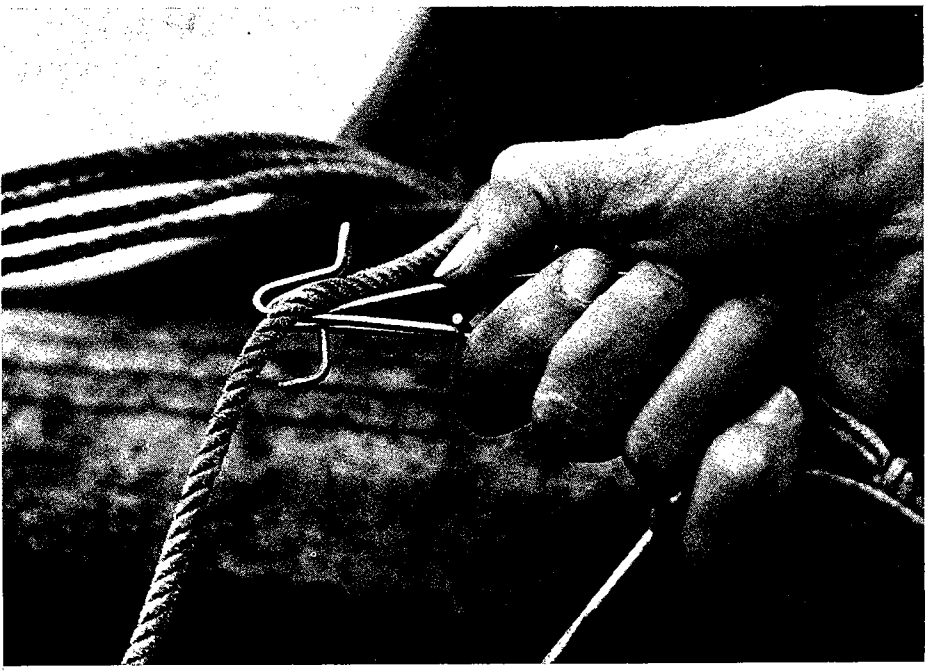
For small boats with only two or three fishermen, snap-on gear has several advantages over traditional gear. First, storing the groundline on a drum eliminates the need for a man to coil gear and reduces the amount of storage space required. The amount of gear set and the catch of snap-on vessels usually is much less than that of larger vessels using traditional gear, but two men can set and haul more gear using snap-ons than they could using the traditional coiled skates. Another advantage is that the hooks can be widely spaced when prospecting for fish and more closely spaced when a concentration of fish is located.

For these reasons and the relatively low capital investment for small boats, hundreds of new fishermen have entered the halibut fishery in recent years. Snap-on gear is particularly attractive for boats that use a gillnet drum for salmon fishing. Fishermen can readily change gear, replacing the gillnet with groundline and switching from salmon to halibut fishing.

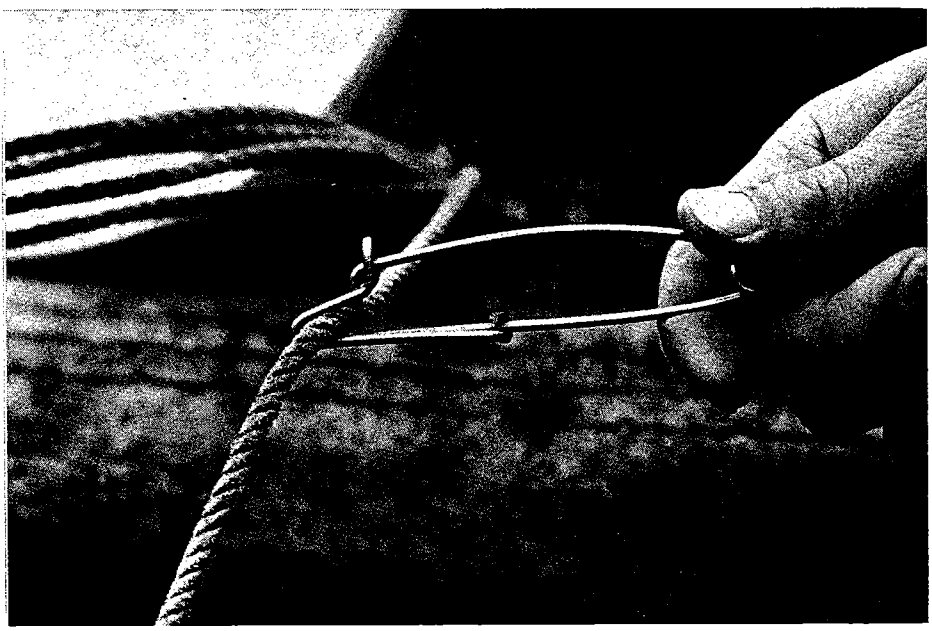
Longlining with



Snap, gangion, and hook.



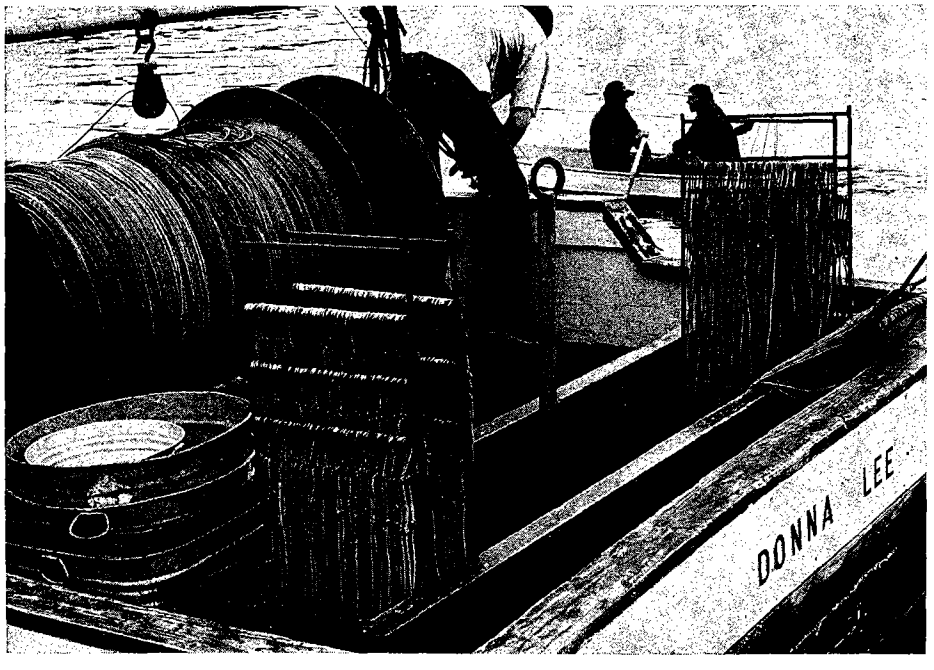
Snap ready for attachment.



Snap attached to the groundline.

Snap-on Gear

Storage of hooks.



Deck layout with groundline drum and hooks.

Setting the gear.

Scientific Investigations

STANDARDIZED STOCK ASSESSMENT

IPHC traditionally has relied on data from the commercial fishery to assess stocks of halibut and regulate the fishery. Data from log books provide estimates of CPUE, and data from landings provide estimates of size and age. Reliance on the commercial fishery, as the primary source of data for stock assessment, has many advantages but also has several limitations. The fleet does not operate randomly, but rather concentrates fishing effort in specific areas or grounds. Hence, data collected from the fishery are not necessarily representative of the entire halibut stock. Also, the fleet periodically changes its operation or develops more efficient techniques. Another limitation in sampling commercial landings is that we cannot obtain data on sex composition because halibut are dressed at sea. The lack of information on sex composition has hampered assessment of halibut stocks because mortality and growth differ between males and females. Although data from the commercial fishery has been and will continue to be useful, there is a need for an annual sampling program to provide standardized data that are independent of the fishery. This standardized stock assessment was initiated in 1976 and is considered as a supplement to the present system.

Several sampling methods were examined and it was concluded that a system comparable to the IPHC grid survey during 1963-1966 would satisfy most of the criteria for assessment with the fewest operational problems. Also, data could be compared with those collected during the early 1960's to assess changes that have occurred in the stocks. Ideally, the survey should include all of Areas 2 and 3, but operational problems require that the sampling area be restricted to Hecate Strait and Queen Charlotte Sound in Area 2 and Portlock-Albatross grounds in Area 3. These grounds produce nearly half of the total catch, and changes in the stocks on these grounds should reflect changes for Areas 2 and 3. Data from the past survey indicate that satisfactory estimates of CPUE and other parameters can be obtained from 100 stations in each area. Essentially, the survey entails fishing stations on a 6 x 24 mile grid (Figure 4). All fishing procedures are standardized to minimize variability in sampling the stocks. Data are recorded for each skate of gear and for every station.

All halibut in the catch are measured and then systematically sampled to determine age and sex composition or are tagged and released. These data will be used to estimate population parameters such as abundance, mortality, recruitment, and growth. The new estimates from the standardized stock assessment will be more representative of the entire stock within the sampling areas than the previous estimates based on sampling the commercial catch.

During 1976, preliminary sampling was conducted to test the experimental design. In Area 2, 70 stations were fished during August and September; 535 halibut were caught, of which 337 were tagged and the remainder sampled to

determine age and sex composition. CPUE was 29 pounds per skate. In Area 3, 24 stations were fished during September; 262 halibut were caught and 137 were tagged. CPUE was 51 pounds per skate. A preliminary examination of results from the 1976 operation indicates that the design is satisfactory, and a full-scale operation is planned in 1977.

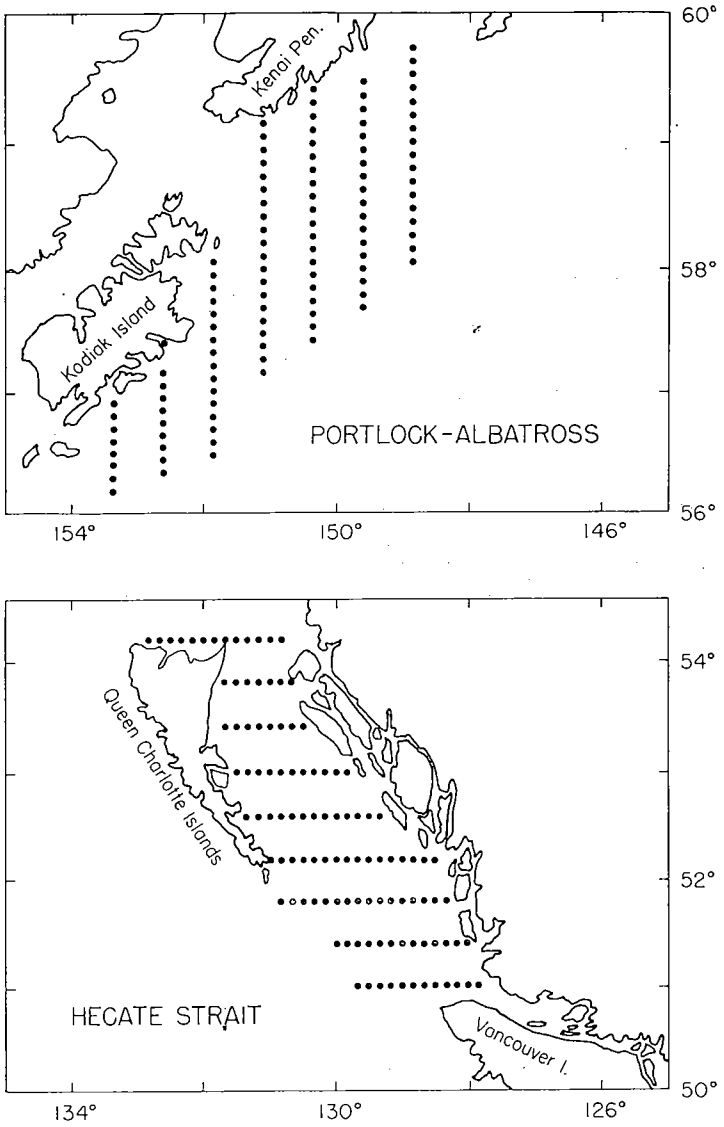


Figure 4. Fishing stations for stock assessment survey.

INCIDENTAL CATCH OF HALIBUT

Trawl Observer Programs

Observer programs to collect data on the incidental catch of halibut by Japanese and Soviet trawlers continued in 1976. These programs were coordinated by the U.S. National Marine Fisheries Service (NMFS) and arranged through the International North Pacific Fisheries Commission (INPFC) or bilateral agreements with the nations concerned. IPHC again participated in the programs and placed observers on four Japanese and one Soviet vessel in 1976. Results show a reduced incidental catch of halibut in the Bering Sea. This was expected as areas and times when the incidence was high are now closed to trawling. The incidence in 1976 was less than 0.5 halibut per metric ton of groundfish. Observers report a higher incidence in the Gulf of Alaska than in the Bering Sea, and rates of over two halibut per metric ton of groundfish were common. Halibut are widely distributed in the Gulf and area differences are not pronounced. The incidence appears to be related more to depth and season than to area. Generally, halibut are in depths less than 100 fathoms during summer (June-October) and then move to deeper waters during winter; however, some halibut remain in shallow waters during winter.

Data from observer programs are used to estimate the annual incidental catch by foreign and domestic trawlers. Estimates for the 1976 catch are still preliminary, but show that catch in the eastern Bering Sea was probably about 5 million pounds, down substantially from the 15 million pounds estimated in 1971. The reduced incidental catch is the result of the time-area closures that were initiated in 1974 (discussed in the 1973-1975 Annual Reports) as well as a reduction in the groundfish catch. The incidental catch in the Gulf of Alaska has averaged about 10 million pounds each year since 1970 and probably was about the same in 1976. These estimates exclude incidental catches from the domestic crab and shrimp fisheries and foreign blackcod fishery.

Gear Experiments

IPHC has urged its national governments to develop effective means of reducing the incidental catch of halibut and specifically proposed that an experiment be conducted to test the effects of off-bottom versus on-bottom trawls. Canada, Japan, and the United States conducted such a study in the Bering Sea during 1976 under the auspices of INPFC. NMFS coordinated the program, and scientists from Canada, the United States, and IPHC participated in the collection and analyses of the data.

Data were collected from over 500 hauls on Japanese stern trawlers from January to May. Catches were compared from two types of trawls: an on-bottom net that has been commonly used in the Japanese pollock fishery and an experimental off-bottom net that was similar in construction to the on-bottom net except that dropper chains of up to 2 m were placed between the bobbins and groundline. Although results varied among vessels, overall averages indicate that the incidence of halibut was reduced in the off-bottom net. The average incidence was 1.9 halibut per metric ton of groundfish in the on-bottom net compared to 0.7 in the off-bottom net. Although the relative magnitude of the catches by the two nets is considered representative, the incidence may be low because several observers reported that the vessels avoided areas where halibut were most abundant.

Halibut caught in the off-bottom net were slightly larger than those in the on-bottom net. The difference was small (2.0 kg versus 1.8 kg), but indicates that small halibut are more likely to escape when the groundline is raised off the bottom. Another important result is that trawlers apparently can successfully harvest pollock with the off-bottom net. In fact, the groundfish catch was actually higher with the experimental off-bottom trawl (9.5 m.t. per hour compared to 8.8 m.t. per hour). The higher catch rate, however, may have been due to the net design or the towing speed. Observers reported that dimensions of the off-bottom net were larger and the towing speed faster than the on-bottom net.

Halibut in King Crab Pots

Fishermen often reported the incidental capture of halibut in king crab pots, but the total incidental catch has not been determined. Limited data on the incidence of halibut in crab pots are available from research surveys by the Alaska Department of Fish and Game. Most of the surveys were near Kodiak Island at depths less than 100 fathoms during June-August. During 1971-1975 in the Kodiak area, 1,348 halibut were caught in 6,806 pots; the average incidence was 0.20 halibut per pot. Although data are meager, the incidence in other areas and seasons appears similar. One survey in Prince William Sound during February 1967 showed 32 halibut in 123 pots, an average of 0.26 halibut per pot. Another survey near Atka Island during September-October 1970 showed 170 halibut in 461 pots, an average of 0.37 halibut per pot. The size of halibut in the pots ranged from 30 cm (0.6 pounds, round weight) to 170 cm (155 pounds); the average was about 90 cm (20 pounds). Although the incidence in the commercial fishery may differ from that in research surveys, the above data suggest that the annual incidental catch by king crab pots may be as high as 3 million pounds.

FECUNDITY

Fecundity, the number of developing eggs in the ovary just prior to spawning, and its relation to length, weight, and age of halibut were determined during the 1920's. Since then, the growth rate of halibut has increased markedly, and a comparative study was begun in 1973 to determine whether a change in fecundity accompanied the increase in growth. Data from 60 females collected on Portlock and "W" grounds in 1927 were compared with data from 56 females collected on "W" grounds and Cape St. James in 1973.

Preliminary results from Area 3 show that the relationship between fecundity and length and fecundity and weight has not changed. However, the fecundity of fish at the same age in the 1970's is more than twice that in the 1920's (Figure 5). For example, in 1927, a 10-year-old female produced approximately 200,000 eggs, whereas a 10-year-old in 1973 produced about 460,000 eggs. The oldest fish in the early study was 26 years and had 3.4 million eggs compared with 20 years and 4 million eggs in the recent study. Apparently, age of maturity has not changed.

The increase in fecundity as well as the increase in growth apparently is in response to the decline in the abundance of halibut. However, the abundance of young has declined steadily since the 1950's, indicating that the increase in fecundity has not been sufficient to offset the decline in abundance. Other factors such as viability of eggs or the survival of larvae and juveniles may also be affecting the abundance of young.

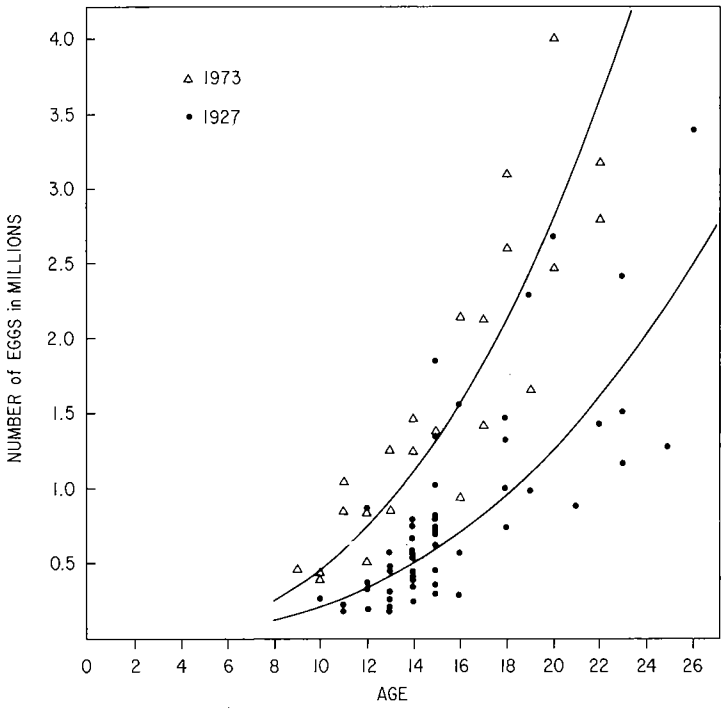


Figure 5. The fecundity-age relationship in 1927 and 1973, Area 3.

OTOLITH WEIGHT—FISH LENGTH RELATIONSHIP

Since 1933, the Commission has sampled commercial halibut landings to obtain age and length information. Before 1962, the length was determined by measuring the fish, whereas after 1962, the fish length was estimated by measuring the radius of the otolith (ear bone). This change reduced the number of people needed to sample the commercial landings. In 1968, additional testing showed that the length of the otolith could be measured more precisely and more rapidly than the radius and the method of estimating fish length was changed accordingly. In 1972, the equation used to estimate fish length from otolith length was revised to correct a tendency to overestimate the length of large fish, and separate equations were introduced for regions of the coast.

In 1975, Martin D. Burkenroad examined IPHC data on otolith weights and noted that the weights seemed more closely related to fish length than otolith length. After confirming his observation from available otolith weight data. IPHC purchased an electronic platform scale capable of weighing to within 0.1 milligrams. A sample of over 8,000 otolith weights, with associated length and fish length, sex, age, and location was compiled. From this basic data set, an otolith length—fish length relationship and an otolith weight—fish length relationship were computed for six different regions.

Analysis of these data corroborated Burkenroad's observation that otolith weight is a better estimator for fish length than is otolith length. The analyses also showed that a single equation for the entire coast would satisfy the statistical requirements of estimating fish length at least as well as separate equations for different regions. Before adopting the otolith weight procedure, further comparison of age and length composition data based on the two procedures is necessary to

determine whether the advantages of the weight method are great enough to warrant a change.

GROWTH BY SEX

As with many other species of flatfish, female halibut are larger than males. Female halibut not only grow faster than males but also live longer. Growth was estimated by sex from age and length data collected in Areas 2 and 3 from 1963 to 1966. Over 21,000 halibut were caught on setline gear at nearly 1,000 fishing locations laid out in a grid pattern. The broad distribution of fishing locations was designed to assure that the results were representative of the halibut stocks available to setline gear. The age of the halibut in the catch ranged from 2 to 29 years. The average length of males and females at each age is shown in Figure 6. Because setlines are selective for large fish, the mean size of halibut in the catch, particularly at younger ages, is assumed to be larger than for the population as a whole.

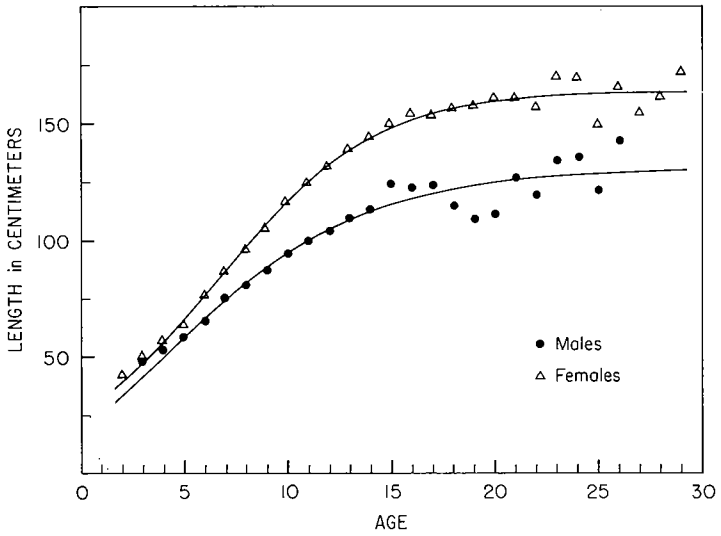


Figure 6. Lengths of male and female halibut by age.

TAGGING

In 1976, 142 tags were returned to IPHC, 10 of which were recaptured in previous years. Premium rewards of $100.00 were paid for eight returns and $2.00 was paid for each of the other returns.

In 1976, 2,186 tagged halibut were released from three chartered vessels. During the juvenile survey, 499 fish were released from the *M/V Tordenskjold* in the southeastern Bering Sea and 513 off the northern British Columbia coast. These fish were captured by trawl gear and most were below the minimum size limit. During the stock assessment survey, 337 tagged fish were released from the *M/V Seymour* in Hecate Strait and 837 were released from the *M/V Polaris* during two cruises. The first *Polaris* cruise was in the southeastern Bering Sea where 422 were released on Slime Bank and 278 near Makushin Bay. The second was near the east end of Kodiak Island where 137 were released.

One fish recaptured in 1976 was released about 15 miles northwest of Sitka, Alaska in 1966. At release, the fish was 21 inches long and 5 years old. It was recovered 10 years later in Frederick Sound, near Petersburg, Alaska. At recovery,

it was 52 inches long and had gained 48 pounds. The longest migration among 1976 recoveries was by a fish released at Atka Island in the Aleutian Islands in 1967 and recaptured in Dixon Entrance 9 years later. This fish was 29 inches long at release and 42 inches long at recovery. The release and recovery locations are approximately 1,800 miles apart.

The 1,199 releases in the Bering Sea are part of a cooperative program with the U.S.S.R. to investigate the relationship between stock in the western and eastern Bering Sea and the Gulf of Alaska. The U.S.S.R. released some tags in the western Bering Sea during 1976, but records of the number and location are not yet available. Several recoveries from the 1975 U.S.S.R.-IPHC cooperative tagging effort in the western Bering Sea have been reported, but information on the recovery site is not yet available.

During the years 1960 through 1976, IPHC tagged and released over 56,000 juvenile halibut (<65 cm long) in the eastern North Pacific Ocean and the southeastern Bering Sea. A low recovery rate was anticipated because the fish were small, i.e., release mortality may be high and the fish are exposed to several years of natural mortality and incidental capture by trawl fisheries before reaching a size large enough to be harvested by the setline fleet. To date, 1,788 or slightly over 3% have been returned. This total includes returns from IPHC charter vessels, foreign and domestic trawlers, king crab boats, sport fishermen, trollers, and setline recoveries. Additional recoveries are expected from the releases made in recent years.

The release and recovery location of the tagged juveniles is shown by region in Table 4. Most of the recoveries were made in the region of release; however, movements between regions were most often in an easterly direction. A westerly movement was noted for two fish that were released off Unimak Island and recovered in the Bering Sea 6 to 8 months later. Five fish that were tagged in British Columbia waters were recovered from the winter spawning grounds in the Gulf of Alaska.

There was a substantially higher recovery rate of juveniles tagged in the Charlotte Region (Cape Scott to Dixon Entrance) than in other areas. These juveniles generally were larger than those in regions farther west and this may account for the higher rate of recovery, i.e., the larger juveniles may be less susceptible to tagging mortality, more available to the fishery, or may have completed their early migration. The fishing intensity in each region also must be considered in assessing the rate of tag recovery.

Table 4. Release and recovery of tagged juvenile halibut by region, 1960-1976.

Releases		Recoveries by Region								
Region	Number	B. Sea	Shum.	Chir.	Kod.	Yak.	S.E.	B.C.	Unknown	Total
Bering Sea	10,758	102			1	1	1			105
Shumagin	4,621	2	7	1				1	1	12
Chirikof	11,926			43	7	3	3	6	1	63
Kodiak	10,249			6	34	4	5	13		62
Yakutat	9,278				6	81	5	8	7	107
Southeastern	2,754					6	65	38	1	110
British Columbia	7,196					5	13	1,273	38	1,329
Total	56,782	104	7	50	48	100	92	1,339	48	1,788

JUVENILE HALIBUT

IPHC annually surveys populations of juvenile halibut in the southeastern Bering Sea and in the Gulf of Alaska to measure changes in abundance. The sampling gear is a trawl net with a 3.5-inch (90 mm) codend. Juvenile halibut are defined as fish less than 65 cm (fork length) and most are less than 7 years old. A Seattle-based trawler, *M/V Tordenskjold,* was chartered from May 20 to August 18 for the 1976 survey.

At the index stations in the southeastern Bering Sea, the CPUE of juveniles (number per hour trawled) was 12.9 in 1976, up slightly from 11.8 in 1975, and up substantially from the low of 3.1 in 1972. The increase in 1976 was due entirely to the abundance of 3-year-olds (1973 year class). This year class may be the most abundant year class since 1967, but will not contribute significantly to the setline fishery for at least 5 years. Although ice was not encountered during the 1976 survey, water temperatures remained below average. The temperatures recorded near the bottom ranged from –1.1°C to 3.9°C and averaged 0.7°C.

In the Gulf of Alaska, the survey is conducted at several widely separated locations and most sampling areas show a decline in juvenile halibut since the mid-1960's. The analysis of the survey data is complicated because of differences in numbers caught, age composition, and distribution of halibut at each of the locations. It has been difficult to combine these data into a satisfactory single estimate of juvenile abundance in the Gulf of Alaska. In 1976, the catch per haul at the offshore stations increased slightly at Cape St. Elias, remained nearly the same at Unimak Island and Cape Chiniak, and declined sharply at Chirikof Island.

Halibut at the inshore locations in the Gulf of Alaska are primarily 1- to 3-year-olds and are sampled by a 15-minute haul with a net having a 1.25-inch (32 mm) codend. At these stations, the catch per haul declined from 1975 to 1976 at all areas except Shelikof Bay.

NMFS requested information on the feeding habits of juvenile halibut to provide data for an ecosystem model of the eastern Bering Sea. Data were collected during IPHC's 1976 survey in the Bering Sea and Gulf of Alaska. Species identified in the diet were recorded, but no attempt was made to quantify the amount of food. Results were similar to those reported in earlier IPHC reports (Numbers 25, 26, 27, 29, and 30). The smallest halibut contained small forms of crustacea, mainly shrimp and small crabs. As the size of halibut increased, the percentage and size of fish in the diet increased also.

Species prominent in the diet were: Tanner crab, *Chionoecetes bairdi;* hermit crab, family *Paguridae;* sand lance, *Ammodytes hexapterus;* sand fish, *Trichodon trichodon;* pollock, *Theragra chalcogramma;* and eelpouts, family *Zoarcidae.* Marked differences in the diet were noted at different sampling locations, indicating that halibut are opportunistic feeders utilizing whatever food is available. Samples were taken in June in the Bering Sea and near Unimak Island and 35% of the stomachs were empty, whereas in the Gulf of Alaska, which was sampled in July and August when water temperatures were higher, only 9% of the stomachs were empty.

BIOSTATISTICS

Catch Sampling

During the 1976 fishing season, catch samplers were stationed at Seattle, Vancouver, Prince Rupert, Petersburg, Sitka, Juneau, Pelican, Seward, and Kodiak. Landings were sampled to obtain data on age and size composition, and catch and effort data were recorded from the vessel log books. Samplers also obtained details of halibut purchases by fish processors, relayed data to IPHC headquarters, and informed fishermen about the status of landings by regulatory areas.

Samplers attempted to sample every third landing over 5,000 pounds and every tenth landing between 1,000 and 5,000 pounds. To unload the catch, cargo slings holding about 1,000 pounds of halibut are lifted from the vessel. The samples consisted of otoliths from all fish in systematically selected slings. The objective was to collect 200 otoliths from each landing that was sampled. The number and frequency of slings depended on the size of the catch and size of the fish. In Area 2, every sling usually was selected from landings less than 12,000 pounds, every second sling from landings between 12,000 and 18,000 pounds, and every third sling from landings over 18,000 pounds. The average size of fish in Area 3 is larger than in Area 2, and every sling usually was selected from landings less than 20,000 pounds, every second sling from landings between 20,000 and 30,000 pounds, and every third sling from landings over 30,000 pounds.

The catch from 550 commercial landings was sampled in 1976. Nearly 47,000 otoliths were measured, 14,100 of which were used for age determination. Of these, over 3,000 were from landings by trollers. IPHC also measured over 72,000 halibut and collected 2,000 otoliths on its chartered vessels *Polaris, Seymour,* and *Tordenskjold.* In addition, observers on Japanese vessels measured the length and collected otoliths from 385 halibut. An otolith length—fish length relationship was used to estimate the length of each fish in the sample. Length samples from the commercial setline catch were combined by month and section of the coast. Subsamples of otoliths were randomly selected from monthly samples to determine the age structure for the setline fishery in each region.

The age composition of halibut in 1976 landings and mean age since 1972 are summarized by region in Table 5. The mean age in the setline catch increased in most regions in 1973, as expected from the increase in minimum legal size that year. Mean age changed little in 1974 and 1975 except in the inshore portion of the Charlotte Region, where mean age continued to increase as fishermen apparently adjusted their fishing locations to avoid small halibut which are particularly common in that section of Area 2. However, all regions except southeastern Alaska and Cape Spencer-St. Elias had higher proportions of young fish (under age 12) in 1976 than in 1975 and mean age declined, particularly in the inshore or Charlotte Region in Area 2. Although the increased catch of young halibut may be evidence of benefit from the larger size limit, it also could be attributed to a change in availability of fish, selectivity by fishermen, or year class strength. The increase also may be indicative of benefits from time-area closures imposed on foreign trawlers. If the increase in CPUE of these younger classes truly reflects an increase in their relative abundance, it should persist in subsequent years.

In 1976, a sample of the age composition in Area 4A in the Bering Sea was collected. Area 4A was a productive area in the 1960's, but little fishing has occurred in the area in recent years, and no estimate of the age composition has been available since 1972. The 1976 sample showed reduced abundance at all ages

Table 5. Age composition in 1976 and mean age by region, 1972-1976.

Region	Age (1976)				Year				
	<9	9-11	12-14	>14	1972	1973	1974	1975	1976
	Percent				Mean Age				
Willapa Bay and South	—	—	—	—	10.6	—	—	—	—
Washington-Vancouver Is.	9.6	36.7	31.4	22.3	9.7	13.5	—	13.6	12.3
Charlotte (Inshore)	36.2	38.6	18.1	7.1	8.6	9.9	10.8	11.0	9.9
Charlotte (Offshore)	19.3	36.0	25.6	19.1	10.6	13.6	12.1	11.4	11.6
S.E. Alaska (Inside)	15.0	42.1	26.3	16.6	10.3	11.4	11.6	11.5	11.5
S.E. Alaska (Outside)	10.2	31.6	28.2	30.0	11.3	12.9	12.7	12.5	12.6
Cape Spencer-St. Elias	8.0	35.2	36.8	20.0	12.3	12.3	12.3	12.1	12.2
Portlock-Albatross Banks	18.4	44.8	25.3	11.5	10.8	11.5	11.6	11.1	11.0
Chirikof-Semedi Islands	22.8	49.3	18.0	9.9	9.9	10.5	11.1	10.9	10.4
Shumagin Is.-Davidson Bank	16.3	45.8	28.3	9.6	11.1	11.5	12.1	11.4	11.0
Aleutian Islands	0.5	12.2	15.1	72.2	—	—	16.7	—	17.8
Bering Sea - 4A	7.5	52.2	21.8	18.5	11.0	—	—	—	11.7
Bering Sea - 4B	6.1	38.2	22.3	33.4	11.2	10.8	11.3	13.6	13.0
Bering Sea - 4C	—	—	—	—	—	—	—	—	16.7
Bering Sea - 4D-West	—	—	—	—	13.8	—	—	14.6	17.9

but particularly among those fish less than 12 years of age; the mean age was 11.7 in 1976 compared to 10.9 in 1972. The fish also were slightly larger at each age. The 1965 year class, which was prominent in the juvenile halibut survey as 2- and 3-year-olds and in the setline catch as 7-year-olds in 1972, was the dominant age group in 1976 as 11-year-olds.

Large differences in the age composition continue to be apparent between troll-caught and setline-caught halibut. Troll landings from Hecate Strait and southeastern Alaska in 1975 and 1976 contained a much higher proportion of small and young fish than setline landings. Many troll-caught halibut were close to the size limit, suggesting that many smaller halibut are caught and released. A comparison of the mean age of halibut landed by troll and setline gear during May 1976 illustrates the difference in age of fish landed by the two types of gear:

	Charlotte (Inshore)	Charlotte (Offshore)	Southeastern Alaska	Yakutat
Troll	8.30	9.95	10.69	11.85
Setline	10.20	10.92	11.31	12.54

Catch and Effort Statistics

All vessels 5 net tons or larger that fish for halibut with setline gear must be licensed by IPHC. Part of the licensing requirement is that the captain of each vessel must maintain a log book of his fishing operations to show daily fishing location, amount of gear fished, and estimated catch. These records, along with specific construction details of his fishing gear, must be made available to representatives of IPHC upon request. These records are used to calculate catch, effort,

and CPUE for each statistical area. All records are used in assigning the location of the catch, but only fixed-hook setline gear is used for computing CPUE and effort. In 1976, CPUE was based on data representing 41% of the total landed catch (25% in Area 2 and 55% in Area 3).

The catch by vessel category shows that licensed vessels produced 82% of the total catch (Table 6). In Area 2, their share was 73% and in Areas 3 and 4 was 93%. Most of the Area 2 catch by unlicensed vessels was taken by setliners (76%), and the remainder was taken by trollers. Nearly all of the Area 3 catch by unlicensed vessels was taken by setliners. For the entire coast, trollers accounted for 57% of the vessels that landed halibut but only 3% of the total catch. Most of the troll-caught halibut are taken in Area 2, largely as an incidental catch, but some of the catch credited to trollers is actually taken on setline gear.

As discussed in the Director's Report, allocation of the catch may be an aspect considered in the proposed revision of the Halibut Treaty. Tables 7 and 8 give the catch and percent of the catch by country for British Columbia and Alaska from 1930 to 1976. As a supplement to Technical Report No. 14, catch, CPUE, and effort data for 1976 are presented in the Appendix in the same format as that report.

Table 6. Comparison of total catch and catch per trip by licensed and unlicensed vessels, 1976.

Vessel Category	Number of Vessels	Number of Trips	Catch in Thousands of Pounds	
			Total	Per Trip
Unlicensed Vessels				
Trollers	2,480	7,657	850	0.1
Setliners	1,117	4,546	3,747	0.8
Other*	—	—	423	—
Licensed Vessels				
5-19 Tons**	537	2,440	7,754	3.2
20-39 Tons	156	599	8,537	14.3
40-59 Tons	28	91	3,329	35.6
60+ Tons	22	68	2,895	42.6
Total	4,340	15,401	27,535	

* Includes miscellaneous vessels such as handliners and deliveries of unknown origin.

** Includes small vessels of unknown tonnage.

Table 7. Halibut catch from British Columbia, 1930-1976.

Year	Thousands of Pounds			Percent	
	Canada	United States	Total	Canada	United States
1930	6,631	5,882	12,513	53	47
1931	6,795	7,085	13,880	49	51
1932	5,741	8,125	13,866	41	59
1933	7,366	6,636	14,002	53	47
1934	8,606	5,752	14,358	60	40
1935	8,602	5,609	14,211	61	39
1936	8,403	5,262	13,665	61	39
1937	9,601	5,685	15,286	63	37
1938	9,419	6,585	16,004	59	41
1939	10,715	6,956	17,671	61	39
1940	10,952	6,854	17,806	62	38
1941	10,495	6,032	16,527	64	36
1942	8,786	5,582	14,368	61	39
1943	10,896	5,075	15,971	68	32
1944	10,843	4,229	15,072	72	28
1945	11,078	3,501	14,579	76	24
1946	14,218	4,155	18,373	77	23
1947	16,733	935	17,668	95	5
1948	13,786	3,881	17,667	78	22
1949	13,047	3,296	16,343	80	20
1950	13,962	3,497	17,459	80	20
1951	15,603	4,439	20,042	78	22
1952	16,515	4,119	20,634	80	20
1953	17,783	6,016	23,799	75	25
1954	17,179	7,723	24,902	69	31
1955	12,538	6,113	18,651	67	33
1956	14,645	5,413	20,058	73	27
1957	13,946	3,741	17,687	79	21
1958	14,596	3,893	18,489	79	21
1959	13,175	3,655	16,830	78	22
1960	14,220	3,938	18,158	78	22
1961	12,393	3,684	16,077	77	23
1962	12,874	2,156	15,030	86	14
1963	13,185	2,333	15,518	85	15
1964	10,251	1,604	11,855	86	14
1965	10,084	1,885	11,969	84	16
1966	9,449	1,588	11,037	86	14
1967	8,823	1,288	10,111	87	13
1968	9,166	979	10,145	90	10
1969	11,980	841	12,821	93	7
1970	9,869	490	10,359	95	5
1971	9,185	662	9,847	93	7
1972	9,665	469	10,134	95	5
1973	6,420	308	6,728	95	5
1974	4,024	269	4,293	94	6
1975	6,397	428	6,825	94	6
1976	6,655	474	7,129	93	7
1930-1976	517,295	179,122	696,417	74	26

Table 8. Halibut catch from Alaska, 1930-1976.

Year	Thousands of Pounds			Percent	
	Canada	United States	Total	Canada	United States
1930	994	34,818	35,812	3	97
1931	988	28,073	29,061	3	97
1932	671	28,663	29,334	2	98
1933	920	30,757	31,677	3	97
1934	1,112	30,092	31,204	4	96
1935	1,604	29,758	31,362	5	95
1936	2,188	32,169	34,357	6	94
1937	2,166	31,170	33,336	6	94
1938	2,781	29,817	32,598	9	91
1939	2,773	29,096	31,869	9	91
1940	1,748	32,846	34,594	5	95
1941	2,464	32,731	35,195	7	93
1942	2,382	32,920	35,302	7	93
1943	2,019	34,472	36,491	6	94
1944	2,453	35,013	37,466	7	93
1945	3,695	34,392	38,087	10	90
1946	4,314	36,679	40,993	11	89
1947	7,347	30,113	37,460	20	80
1948	4,872	32,618	37,490	13	87
1949	5,698	32,366	38,064	15	85
1950	4,962	34,110	39,072	13	87
1951	5,407	30,011	35,418	15	85
1952	8,204	32,807	41,011	20	80
1953	7,955	27,581	35,536	22	78
1954	10,257	34,571	44,828	23	77
1955	9,380	28,878	38,258	25	75
1956	10,819	35,182	46,001	24	76
1957	10,752	31,819	42,571	25	75
1958	14,231	31,265	45,496	31	69
1959	17,648	36,057	53,705	33	67
1960	19,327	33,235	52,562	37	63
1961	17,018	35,682	52,700	32	68
1962	21,749	37,634	59,383	37	63
1963	23,913	31,394	55,307	43	57
1964	23,297	24,352	47,649	49	51
1965	22,838	28,155	50,993	45	55
1966	22,453	28,343	50,796	44	56
1967	16,680	28,232	44,912	37	63
1968	20,247	18,064	38,311	53	47
1969	21,472	23,752	45,224	47	53
1970	19,285	25,135	44,420	43	57
1971	16,288	20,201	36,489	45	55
1972	12,820	19,561	32,381	40	60
1973	8,021	16,766	24,787	32	68
1974	3,343	13,155	16,498	20	80
1975	4,960	15,371	20,331	24	76
1976	5,336	14,832	20,168	26	74
1930-1976	431,851	1,374,708	1,806,559	24	76

APPENDIX

The following tables for 1976 are provided as a supplement to Technical Report No. 14, "The Pacific Halibut Fishery: Catch, Effort and CPUE, 1929-1975". A detailed explanation of the tables, the methods of compilation, and definitions of the statistical subdivisions are included in the report which is available on request. The poundage in these tables is dressed weight (head-off, eviscerated). Copies of the tables in metric units and round (live) weight are available on request.

Table 1. Catch, CPUE and effort by statistical area and country, 1976.

Table 2. Catch, CPUE and effort by region and country, 1976.

Table 3. Catch, CPUE and effort by regulatory area, 1976.

Table 4. Catch in thousands of pounds by regulatory area and country, 1976.

Table 5. Landings in thousands of pounds by port and country, 1976.

TABLE 1. CATCH, CPUE AND EFFORT BY STATISTICAL AREA AND COUNTRY, 1976.

1976	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	-	-	-	48	28.9*	17	48	28.9	17	-
04	-	-	-	5	28.9*	2	5	28.9	2	-
05	5	26.5*	2	180	26.5	68	185	10.2	182	6
06	222	32.9*	67	20	32.9	6	242	27.8	87	3
07	57	17.4*	33	17	17.4	10	74	14.8	50	-
08	101	162.4*	6	31	162.3	2	132	35.7	37	2
09 -O	35	55.3*	6	4	55.6*	1	39	39.0	10	-
09 -I	392	45.4	86	57	70.0	8	449	31.4	143	22
10 -O	-	-	-	-	-	-	-	-	-	-
10 -I	1002	50.3	199	331	102.4	32	1333	25.2	530	19
11 -O	106	64.8	16	-	-	-	106	64.8	16	27
11 -I	1086	56.0	194	10	111.1	1	1096	53.7	204	38
12 -O	90	54.2	17	-	-	-	90	54.2	17	23
12 -I	1082	56.2	192	-	-	-	1082	56.2	192	44
13 -O	436	53.5	81	-	-	-	436	53.5	81	26
13 -I	2046	55.7	367	4	55.6*	1	2050	55.3	371	25
14 -O	80	38.4	21	199	31.9	62	279	12.7	220	12
14 -I	144	55.5	26	552	29.5	187	696	12.0	578	18
15 -O	240	49.1	49	585	44.5	132	825	13.0	634	32
15 -I	-	-	-	328	41.5	79	328	41.5	79	14
16 -O	222	47.3	47	368	40.0	92	590	14.2	415	38
16 -I	-	-	-	1156	41.4	279	1156	41.4	279	37
17 -O	38	28.3	13	446	28.9	154	484	10.5	459	5
17 -I	-	-	-	169	36.6	46	169	36.6	46	53
18S-O	16	16.9	9	80	38.9	21	96	10.8	89	11
18S-I	-	-	-	1058	60.5	175	1058	60.5	175	7
18W	67	62.1	11	404	56.1	72	471	11.3	415	33
19	282	50.7	56	443	57.5	77	725	14.5	499	66
20	559	68.1	82	654	46.8	140	1213	16.5	736	53
21	276	61.0	45	152	43.6	35	428	21.7	197	56
22	496	80.5	62	248	71.3	35	744	24.0	310	68
23	284	67.0	42	407	46.5	88	691	15.4	449	49
24	236	67.9	35	604	50.8	119	840	13.1	639	55
25	393	82.0	48	1344	58.4	230	1737	12.5	1392	61
26	90	42.3	21	1722	62.1	277	1812	10.4	1743	41
27	90	51.8	17	1157	49.9	232	1247	10.6	1174	25
28	423	66.4	64	713	80.2	89	1136	14.6	777	56
29	515	73.9	70	634	64.6	98	1149	16.3	704	76
30	233	63.8	37	421	56.0	75	654	14.3	458	63
31	186	68.9	27	149	48.8	31	335	19.0	176	73
32	190	78.4	24	218	68.3	32	408	16.9	242	68
33	26	51.7	5	48	46.9	10	74	14.0	53	69
34	70	64.8	11	37	56.6	7	107	22.3	48	73
35	26	28.3	9	2	41.7	0	28	25.5	11	11
36	-	-	-	36	63.4*	6	36	63.4	6	-
37	-	-	-	18	101.1	2	18	101.1	2	83
38	-	-	-	-	-	-	-	-	-	-
39	-	-	-	-	-	-	-	-	-	-
40	-	-	-	-	-	-	-	-	-	-
41	-	-	-	-	-	-	-	-	-	-
42+	92	122.3	8	19	118.0	2	111	41.1	27	100
4A	-	-	-	34	136.5	2	34	136.5	2	94
4B	-	-	-	189	79.1	24	189	79.1	24	72
4C	2	44.4	0	41	89.3	5	43	10.5	41	95
4DE	-	-	-	-	-	-	-	-	-	-
4DW	60	84.0	7	191	70.6	27	251	12.7	198	94
4E	-	-	-	6	60.6	1	6	60.6	1	100

* NO LOG DATA, CPUE INTERPOLATED.

TABLE 2. CATCH, CPUE AND EFFORT BY REGION AND COUNTRY, 1976.

1976	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	-	-	-	48	32.0*	15	48	32.0	15	-
VANCOUVER	385	32.6*	118	253	32.4	78	638	32.6	196	4
CHARLOTTE	6275	55.0	1141	406	94.4	43	6681	56.4	1184	29
CHAR-O	667	55.6	120	4	40.0*	1	671	55.5	121	25
CHAR-I	5608	54.9	1021	402	95.7	42	6010	56.5	1063	29
SE ALASKA	740	47.1	157	4941	41.5	1190	5681	42.2	1347	23
SE AK-O	596	45.5	131	1678	40.4	415	2274	41.6	546	25
SE AK-I	144	55.4	26	3263	42.1	775	3407	42.5	801	23
YAKUTAT	1964	65.9	298	2308	53.3	433	4272	58.4	731	55
KODIAK	1232	66.6	185	5540	59.4	933	6772	60.6	1118	47
CHIRIKOF	934	70.2	133	1204	59.9	201	2138	64.0	334	72
SHUMAGIN	312	70.9	44	359	64.1	56	671	67.1	100	63
ALEUTIAN	92	115.0	8	19	95.0	2	111	111.0	10	100
BERING SEA	62	77.5	8	461	78.1	59	523	78.1	67	88
TOTAL	11996	57.3	2092	15539	51.6	3010	27535	54.0	5102	51

* NO LOG DATA, CPUE INTERPOLATED.

TABLE 3. CATCH, CPUE AND EFFORT BY REGULATORY AREA, 1976.

	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 %
1976	13048	47.6	2742	25	13964	60.9	2293	55	523	78.1	67	88

TABLE 4. CATCH IN THOUSANDS OF POUNDS BY REGULATORY AREA AND COUNTRY, 1976.

	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
1976	7400	5648	13048	4534	9430	13964	62	461	523	11996	15539	27535

TABLE 5. LANDINGS IN THOUSANDS OF POUNDS BY PORT AND COUNTRY, 1976.

PORT	1976 CAN.	U.S.	TOTAL
CAL AND ORE	-	48	48
SEATTLE	-	381	381
BELLINGHAM	137	251	388
MISC WASH	-	278	278
VANCOUVER	2157	-	2157
MISC SO BC	277	-	277
NAMU	577	-	577
PR RUPERT	6120	6	6126
MISC NO BC	377	-	377
KETCHIKAN	18	326	344
WRANGELL	21	518	539
PETERSBURG	84	2090	2174
JUNEAU	-	674	674
SITKA	-	590	590
PELICAN	630	1064	1694
MISC SE AK	30	1492	1522
KODIAK	992	3422	4414
P WILLIAMS	-	330	330
SEWARD	573	2845	3418
MISC CEN AK	3	1224	1227

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