

INTERNATIONAL PACIFIC HALIBUT COMMISSION

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

ANNUAL REPORT

1971

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SEATTLE, WASHINGTON

1972

This report is the 25th Annual Report published by the Commission. Two other series, Scientific Reports and Technical Reports, are published periodically to present the results of scientific studies, and to summarize statistical records of the fishery.

INTERNATIONAL PACIFIC HALIBUT COMMISSION
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Preface

The International Pacific Halibut Commission was established in 1923 by the Convention between Canada and the United States for the preservation of the halibut fishery of the North Pacific Ocean and the Bering Sea. The Convention was the first international agreement providing for joint management of a marine fishery. The Conventions of 1930, 1937, and 1953 extended the Commission's authority and specified that the halibut stocks be developed and maintained at levels consistent with the maximum sustained yield.

Three Commissioners are appointed by the Governor General of Canada and three by the President of the United States. The Commissions appoint the Director of Investigations 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 at 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 consider advice from the Conference Board that represents vessel owners and fishermen, and from other interested parties. The regulatory measures are submitted to the two governments, and the fishermen of both nations are required to observe those regulations that are adopted.

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HAROLD E. CROWTHER
U.S. Commissioner 1961-1972.

Activities of the Commission

The Commission held its 47th Annual Meeting in Seattle, Washington, January 25-29, 1971. Mr. Haakon M. Selvar was the Chairman and Dr. William M. Sprules the Vice-Chairman. The staff reviewed the results of scientific investigations, the effects of the 1970 halibut regulations, and the condition of the halibut stocks at a public session attended by representatives of the Pacific Coast halibut industry and other interested parties. The Commission also met with the industry's Conference Board. Hearings were held with representatives of the International Trawlers Association and of the Makah Tribal Council. The recommendations of these organizations were thoroughly considered by the Commission. The work by the scientific staff on incidental catch of halibut by trawls was reviewed and the Commission concluded that to achieve the maximum sustained yield, halibut taken in the trawl fishery should not be retained. Proposals for the 1971 halibut season were adopted and submitted to the Canadian and United States Governments for approval. The Commission also reviewed administrative and fiscal matters and approved the research plans for 1971 and the budget for fiscal year 1973. Dr. William M. Sprules was elected Chairman and Neils M. Evens the Vice-Chairman for the coming year.

Mr. Harold E. Crowther submitted his resignation in 1971. He was the U.S. Government representative on the Commission from 1961 and served as Chairman in 1962, 1964 and 1968. Mr. Crowther retired from the U. S. Bureau of Commercial Fisheries in 1971, having served as Deputy Director and Director of that organization.

During the 1971 fishing season, the Commission periodically reported the cumulative catches from each regulatory area and announced the closing date for Area 3B. The seasons in Areas 2 and 3A continued until the statutory closing date, November 1.

The Commission met again in Seattle, Washington in September to review the 1971 halibut fishery in the Bering Sea and to consider staff and industry proposals for that area in 1972. The regulations proposed by the Commission also were proposed by the International North Pacific Fisheries Commission and approved by the Governments of Canada, Japan and the United States.

In addition to the Annual Report for 1970, the Commission published Scientific Report No. 53 and several other articles. Technical papers were prepared at the request of the Canadian and United States national sections of the International North Pacific Fisheries Commission. The publications are listed at the end of this report.

The Canadian expenditures for the 1970-71 fiscal year (April-March) were \$252,000 including costs for monetary exchange and expenses of Canadian Commissioners. The United States expenditures for the fiscal year (July-June) were \$240,000, excluding Commissioners' expenses. In compliance with the Convention, expenses of the Commission were shared equally by both governments.

The Fishery

REGULATIONS

The Pacific Halibut Fishery Regulations for 1971 were approved by the Secretary of State of the United States of America on March 15 and by the Governor General of Canada on March 23. As in previous years, these regulations also implemented the conservation measures adopted by the International North Pacific Fisheries Commission for the eastern Bering Sea on behalf of Canada and the United States.

Regulatory Areas

The regulatory areas in 1971 were (*see Figure 1*):

- Area 2 — California to Cape Spencer, Alaska.
- Area 3A — Cape Spencer to Kupreanof Point near the Shumagin Islands.
- Area 3B — South of the Alaska Peninsula and the Aleutian Islands between Kupreanof Point and the meridian of 175° W.
- Area 3C — South of the Aleutian Islands and west of 175° W.
- Area 4A — A triangle in the Bering Sea along the 100-fathom edge lying east of 170° W., south of a line between Cape Sarichef and Cape Navarin and north of a line from Cape Sarichef to a point at 54° N. on the meridian of 170° W.
- Area 4B — The Bering Sea side of the Aleutian Islands between Cape Sarichef and the meridian of 170° W., south of Area 4A.
- Area 4C — The Bering Sea between 170° W. and 175° W. and south of a line between Cape Sarichef and Cape Navarin.
- Area 4D — The Bering Sea north of Areas 3C and 4C and north of a line between the Pribilof Islands and Cape Newenham.

Catch Limits and Length of Seasons

The catch limits in 1971 were the same as in 1970: 20 million pounds in Area 2; 30 million pounds in Area 3A; and 3 million pounds in Area 3B. Area 3C and Area 4 (Bering Sea) were regulated by the length of the fishing season and catch limits were not assigned.

On opening day, the fishing season started at 1500 hours (Pacific Standard Time) in Areas 2, 3A and 3B and at 1800 hours in Areas 3C and 4; on the last day,

the fishing season ended at 0600 hours in each area. The opening and closing dates and the number of fishing days in 1970 and 1971 are compared in Table 1. In addition to the regular seasons, special permits were granted to longline vessels to fish in the southern part of Area 2 (south of Willapa Bay) from March 17 to May 7.

Table 1. Length of seasons and opening and closing dates, 1970-1971.

Area	1970			1971		
	Opening	Closing	Fishing days	Opening	Closing	Fishing days
2	April 25	Sept. 21	149	March 17*	May 7*	51*
				May 7	Nov. 1	178
3A	April 25	Sept. 21	149	May 7	Nov. 1	178
3B	April 1	April 7	6	April 4	April 9	5
	April 25	Sept. 30	158	May 7	Nov. 1	178
3C	March 17	Nov. 15	242	March 17	Nov. 15	242
4A	March 22	April 4	12	March 22	April 4	12
4B	March 22	April 4	12	March 22	April 4	12
	Sept. 1	Sept. 14	12	Sept. 1	Sept. 14	12
4C	March 17	April 11	24	March 17	April 4	17
	—	—	—	Oct. 1	Oct. 17	15
4D	March 17	Nov. 15	242	March 17	Nov. 15	242

* Special permit season south of Willapa Bay.

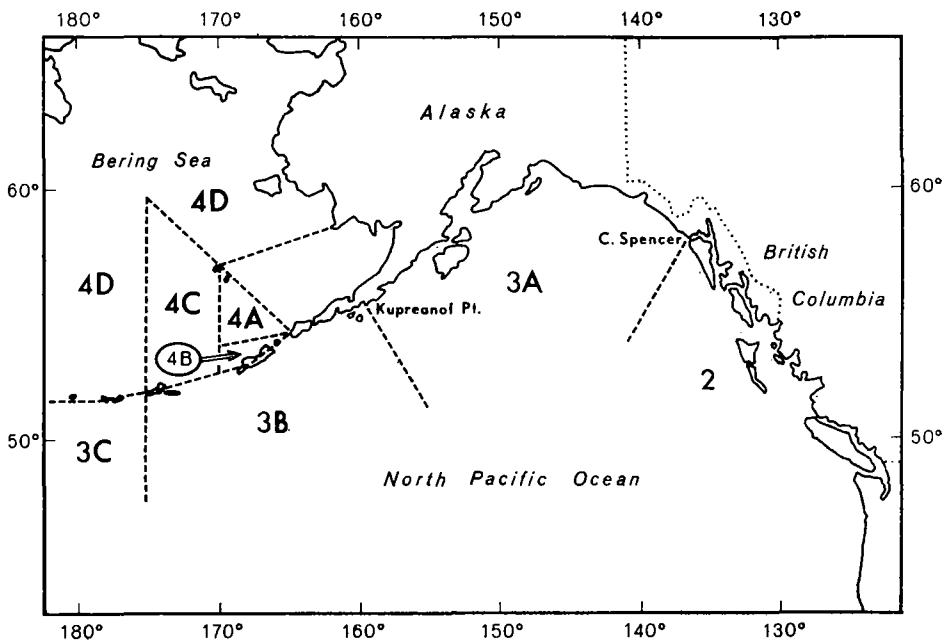


Figure 1. Regulatory Areas of the Pacific Halibut fishery.

Licensing of Vessels

All setline vessels over five net tons must be licensed by the Commission. The license must be validated by Customs or Fishery Officers before each trip. Validation constitutes a declaration and clearance to fish in one or more regulatory areas. The operator of a licensed vessel must complete a statistical return for all previous trips before his license can be validated.

A new license form was introduced in 1970, incorporating the validation and clearance application, and the statistical return (*Figure 2*). The combined form simplifies the validating procedures and the new licenses will be issued to all vessels in 1972. The log book distributed by the Commission has been revised to obtain additional information on the fishery and will be issued to the halibut fleet during the 1972 season.

No.8587			
STATISTICAL RETURN RECEIVED For Previous Voyage	CLEARANCE GRANTED FOR HALIBUT FISHING IN AREA(S)		
APPLICATION FOR VALIDATION OF LICENSE No.8587 <i>(Forward to International Pacific Halibut Commission)</i>			
Clearance is requested for halibut fishing in Area(s) and will commence in Area Vessel Captain	STAMP (Port, Date, Officer)		
STATISTICAL RETURN FOR LICENSE No.8587 <i>(Forward to International Pacific Halibut Commission)</i>			
Regu- latory Area	Pounds of Halibut	Place of Landing	Date of Landing
I hereby certify that this return includes all halibut caught since last statistical return by— Vessel Captain		STAMP (Port, Date, Officer)	

Figure 2. The new halibut license incorporates the statistical return, the application for validation and the clearance.

STATISTICS OF THE FISHERY

Catches by Regulatory Areas

The total catch of halibut in 1971 was 47 million pounds, nearly eight million pounds less than in 1970. The catch declined 15 percent in Areas 2 and 3 and 24 percent in Area 4. The 53-million-pound quota was not reached, and the 47-million-pound catch was the lowest since 1933. Details of the 1971 catch by regulatory areas are listed in Table 2 and are compared with catches from 1967 to 1970.

Table 2. Catch of halibut in thousands of pounds (eviscerated, heads-off) by regulatory areas, 1967-1971.

Regulatory Area	1967	1968	1969	1970	1971
AREA 2					
Canada	9,877	10,666	13,346	11,147	10,189
United States	10,142	5,971	9,362	8,738	6,584
Total	20,019	16,637	22,708	19,885	16,773
AREA 3					
Canada	14,588	18,135	19,583	17,119	14,578
United States	18,519	12,747	15,081	16,800	14,437
Total	33,107	30,882	34,664	33,919	29,015
AREA 4					
Canada	1,108	668	668	889	729
United States	1,287	653	565	245	137
Total	2,395	1,321	1,233	1,134	866
ALL AREAS					
Canada	25,573	29,469	33,597	29,155	25,496
United States	29,948	19,371	25,008	25,783	21,158
Total	55,521	48,840	58,605	54,938	46,654

In Area 2, most of the reduction in catch occurred in Southeastern Alaska where 6.6 million pounds were landed, down 2.8 million from 1970. Catches of 9.3 million in northern British Columbia and 0.8 million off Vancouver Island and Washington were slightly less than in 1970.

In Area 3A, the catch was 26.1 million pounds, 4.3 million pounds less than in 1970. The reduction occurred throughout the area. In Area 3B, the catch was 2.9 million pounds, of this total 162,000 pounds were caught during the first fishing season, April 4 to 9. Only 2,000 pounds were caught in Area 3C.

The Bering Sea catch was 866,000 pounds: 488,000 pounds in Area 4A, 158,000 pounds in Area 4B, 29,000 pounds in Area 4C and 191,000 pounds in Area 4D. Severe weather and drifting pack-ice limited the spring fishery in Areas 4C and 4D.

The Canadian catch has increased during recent years, averaging 54 percent of the total in the past five years. This change has occurred in all areas. The U. S. catch accounted for over 70 percent of the total until 1945, but declined steadily until 1962 and has been less than 50 percent since then, except in 1967.

Landings by Ports

The distribution of landings in 1971 was similar to 1970. Landings continued to increase in Kodiak and decrease in Seattle. The reductions in 1971 landings at other ports were nearly proportional to the overall reduction in catch. Prince Rupert continued as the leading port, accounting for nearly 13 million pounds, more than 25 percent of the total landings. Kodiak was second with over nine million pounds (20 percent) of the landings. Seattle landings were as high as 40 percent of the total in the late 1930s but declined steadily to 25 percent in 1960. In 1970, Seattle landings were about four million pounds or seven percent of the total and in 1971 were less than two million pounds or only four percent. Most of this decline results from Area 3 vessels electing to land their catches in Kodiak and other northern ports, but also, fewer Seattle-based vessels are now fishing in Area 2.

Details of landings by ports for 1970 and 1971 are given in Table 3.

Table 3. Canadian and United States landings in thousands of pounds by port, 1970-1971.

Region or Port	1970			1971		
	Canada	U.S.	Total	Canada	U.S.	Total
CALIFORNIA and OREGON	—	76	76	3	69	72
WASHINGTON						
Bellingham	2,618	638	3,256	1,940	724	2,664
Seattle	256	3,687	3,943	111	1,894	2,005
Other	—	92	92	—	201	201
BRITISH COLUMBIA						
Prince Rupert	13,398	1,770	15,168	11,279	1,568	12,847
Vancouver	4,573	—	4,573	3,996	—	3,996
Vancouver Island	911	—	911	520	—	520
Other	832	—	832	438	—	438
SOUTHEASTERN ALASKA						
Petersburg	52	3,755	3,807	61	2,528	2,589
Ketchikan	32	2,843	2,875	23	2,348	2,371
Juneau	—	1,717	1,717	13	1,220	1,233
Pelican	311	1,094	1,405	581	865	1,446
Sitka	71	649	720	124	1,139	1,263
Other*	—	1,017	1,017	—	811	811
CENTRAL ALASKA						
Kodiak	3,591	5,106	8,697	4,792	4,425	9,217
Seward	1,556	2,490	4,046	1,169	2,442	3,611
Sand Point	954	810	1,764	408	276	684
Other**	—	39	39	38	648	686
TOTAL	29,155	25,783	54,938	25,496	21,158	46,654

* Craig, Hydaburg, Metlakatla, Tokeen, and Wrangell.

** Cordova, Homer, Ninilchik, Port Williams, Soldatna, Valdez, and Yakutat.

Value of Catch

The 1971 halibut catch was valued at \$15 million, compared to \$20 million in 1970. The lower value was largely due to the eight-million-pound reduction in catch but also reflected a lower average price in 1971. The average price of medium-sized halibut was 29 cents per pound in Kodiak, 36 cents in Prince Rupert and 36.5 cents in Vancouver. Seattle prices averaged 36 cents per pound compared with 40 cents per pound in 1969 and 1970.

Number of Vessels and Fishermen

Table 4 shows the number of regular setline vessels and fishermen engaged in the fishery during 1971. The total number of regular vessels and men continues to decline but gear changes and added electronic aids have made the vessels more effective.

Table 4. Number of regular setline vessels and men in each area.

Regulatory Area	Canada		United States		TOTAL	
	Vessels	Men	Vessels	Men	Vessels	Men
2	92	338	105	341	197	679
2 & 3*	12	76	21	90	33	166
3 & 4*	50	383	64	329	114	712
TOTAL	154	797	190	760	344	1,557

* Vessels fishing in more than one area.

CONDITION OF THE RESOURCE

Catch Per Unit Effort (CPUE)

During the past five years halibut fishermen have increased the interval between hooks; and much of the 18-foot gear, which was dominant in Area 3 during the late 1950s and 1960s, has been replaced with 21-foot gear. The change has been less rapid in Area 2, but most of the 13-foot gear has been replaced by 18-foot gear. Recent hook-spacing experiments and re-examination of old fishing records have shown that the catch per hook increases with the increase in space between hooks. The effect of hook-spacing was not recognized in the calculation of the former measure of effort "the standard skate", consequently the stock size in the past ten years was overestimated. The revised catch-per-unit-effort data adjust for the effect of hook-spacing and show that halibut stocks in Areas 2 and 3 are at a lower level than previously reported and that the quotas in the last 10 years were excessive relative to stock abundance. The new catch-per-unit-effort figures have been used in the following assessment of stock condition. (The hook-spacing study and its significance is discussed in the section on Scientific Investigations).

In Area 2 the catch per 18-foot skate dropped from 105 pounds in 1960 to 80 pounds in 1963. Since then the catch has varied between 80 and 89 pounds and was 80 pounds in 1971. Although removals have been reduced substantially during the past eight years and although the catch per unit effort is no longer declining as it was in the early 1960s, stock abundance has not increased. Recent catch reductions stopped the decline in stock size, but have been inadequate to rebuild the stock to higher levels. Losses of halibut through the incidental catch of foreign and domestic trawlers contributed to the decline in abundance during the 1960s and continue to be a factor in the failure of the stock to respond to stringent control on setline catches.

In Area 3A the catch per 18-foot skate declined from 172 pounds in 1960 to 117 pounds in 1966 and to 89 pounds in 1971. As in Area 2, reductions in catch limits stopped the sharp initial decline in the early 1960s but were not sufficient to stabilize or improve the stock. In Area 3B the catch per 18-foot skate was similar to that for Area 3A except that the initial decline in the early 1960s was not as sharp

and the stock size improved in the late 1960s. However, abundance declined after 1968 and was only 83 pounds per 18-foot skate in 1971. Clearly, recent catch limits based on the old CPUE, were higher than the stocks could sustain. Continued foreign trawling in Area 3 and a recent expansion of domestic trawling for shrimp added to the halibut losses through incidental catches.

The halibut catch and effort by setline vessels in the Bering Sea continues at a low level. In Area 4A, which includes the Polaris Ground, the abundance of halibut was low and the commercial catch was not adequate to assess stock conditions. The restricted fishing of the past years has not contributed to a rebuilding of the stocks on the Polaris Ground. The catch per unit effort on the Misty Moon Ground increased from 1970, but this small ground can support only a limited fishery. In Area 4B the catch per unit effort has been stable in the past few years. Severe ice conditions kept vessels from the grounds in Area 4C and fishing was not sufficient to provide a meaningful catch-per-unit-effort value. However, in the previous few years, catch per unit effort indicated an improving stock condition. The exploratory fishery in Area 4D continued in 1971 but fishing effort was inadequate for stock assessment.

Age Composition of the Catches

In Area 2 the age composition of the stock varies considerably from one region to another (Table 5). Southeastern Alaska and the west coasts of Vancouver Island and the Queen Charlotte Islands continue to produce older fish than Queen Charlotte Sound and Hecate Strait. Older fish were also prominent during the spring permit fishery south of Willapa Bay. Changes in age composition within regions in Area 2 are commensurate with changes in the catch. In Southeastern Alaska the mean age of halibut increased from 10.0 years in 1960 to 10.7 years in 1971. In Hecate Strait, particularly the Horseshoe Ground, the mean age increased from 7.3 years in 1960 to 9.4 years in 1965 but decreased again to 7.5 years in 1971 (Figure 3). Halibut under seven years of age constituted nearly 50 percent of the catch from this region in 1971. This reflects the difference in fishing mortality from the sections of Area 2 north and south of Dixon Entrance. In recent years, most of the reduction in catch from Area 2 has occurred in Southeastern Alaska while the catch from British Columbia has continued at a high level. Furthermore the proportion of the

Table 5. Age composition (percent) and mean age of halibut by region, 1971.

Region	Age	<6	6	7	8	9	10	11	12	13	14	15	16	17+	Mean Age
Willapa and South		4	13	12	12	8	11	5	6	6	5	5	4	9	10.3
Washington - Vancouver Is.		13	10	21	11	9	13	6	3	5	2	1	1	5	8.9
Queen Charlotte Sound		13	15	20	24	10	9	3	2	1	1	+	1	1	7.8
Central Hecate Strait		27	21	18	10	6	5	2	2	2	2	1	1	3	7.5
Northern Hecate Strait		1	18	10	21	19	11	9	2	4	2	1	1	1	8.8
West Queen Charlottes		2	10	19	24	13	18	5	2	1	2	1	1	2	9.0
Inside S.E. Alaska		1	2	8	14	13	23	8	7	7	5	4	3	5	10.7
Outside S.E. Alaska		1	1	5	8	13	11	8	9	7	8	7	7	15	12.3
Cape Spencer - St. Elias		+	3	7	8	12	16	10	8	9	9	9	4	5	11.4
Portlock - Albatross		+	1	5	11	14	24	10	8	9	6	5	3	4	11.0
Chirikof - Semedi Islands		+	1	5	11	13	21	9	9	11	8	5	3	4	11.2
Shumagins and West		+	2	3	14	12	22	6	8	11	5	6	4	7	11.3
Bering Sea — 4A		+	4	6	15	11	31	5	10	8	4	1	1	4	10.4
Bering Sea — 4B		0	1	3	10	7	21	10	10	15	8	2	4	9	11.9
Bering Sea — 4C		0	0	2	11	8	17	3	9	23	4	4	1	18	12.8

British Columbia catch taken from central and northern Hecate Strait has increased.

In contrast to Area 2 the age compositions are similar on grounds throughout Area 3 (Table 5). The 1961 year class remained dominant in 1971, and younger fish, notably seven- and eight-year-olds of the 1963 and 1964 year classes, were more available than is usual for those age groups. Since the early 1960s the mean age of halibut on Portlock Bank has decreased from 12.0 years to 11.0 years partly due to this influx of young fish but also because the abundance of older fish has declined steadily.

In the Bering Sea little fishing occurred on the once important Polaris Ground and no age data were obtained. Fishing on the Misty Moon Ground in northern Area 4A is becoming increasingly dependent on young fish. Fish over 12 years old declined from 28 percent by number in 1966 to 18 percent in 1971. One small sample obtained from fishing in Area 4C suggests that older fish continue to constitute a large percentage of the catch but at a reduced level of abundance. On Fox Islands Grounds, in Area 4B, an unusually high proportion of older fish were caught in the spring fishery. No age data were obtained from the fall fishery.

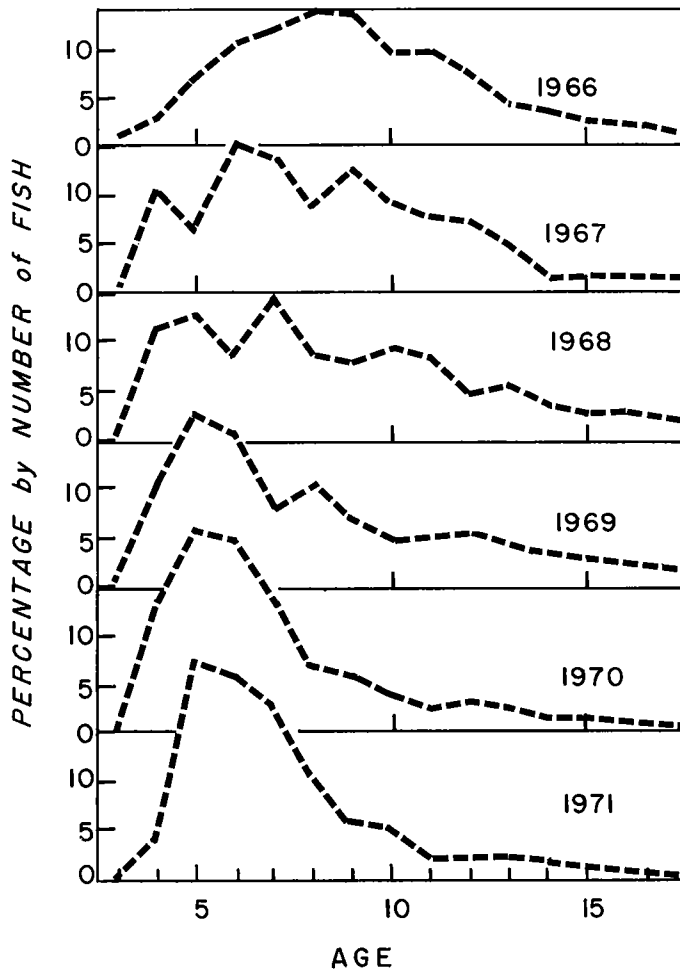


Figure 3. Age composition of halibut caught by setline gear on Hecate Strait grounds, 1966-1971.

Scientific Investigations

RE-EVALUATION OF CATCH PER UNIT EFFORT

In the early years of managing the halibut resource, a standard length of groundline was used as the basic measure of fishing effort. In the 1940s, a new measure was introduced – the 120-hook “standard skate” – which assumed that fishing effort of each hook was the same regardless of spacing, i.e. that catch per hook did not change with hook-spacing. All rigs, regardless of hook-spacing or length of groundline, were adjusted to this standard: for example, 13-foot gear with 120 hooks would be credited as 1.00 skate, 18-foot gear with 80 hooks as 0.67 skate, and 21-foot gear with 70 hooks as 0.58 skate. In the late 1960s, fishermen claimed that the “standard skate” no longer reflected the catch rates on the fishing grounds and in 1971 the Commission re-examined the calculation of CPUE. A longline vessel was chartered to study the effects of hook-spacing and the log records of the fleet from 1954 to 1971 were re-examined.

Hook-Spacing Experiment

The chartered vessel, *Chelsea*, carried ten skates each of 12-, 18-, 21-, and 24-foot gear all of the same length (250 fathoms). Fishing was conducted near Kodiak Island as a regular commercial operation and all skates were baited similarly with herring and cod. Approximately 100,000 pounds of halibut were caught in 32 days. The catch per skate decreased as hook-spacing increased; however, the decrease was not proportional to the number of hooks, as had been assumed in the standardization of fishing effort. THE CATCH PER HOOK INCREASED WITH HOOK-SPACING, INDICATING THAT THE EFFECTIVE EFFORT OF HOOKS IMPROVED ON THE WIDER-SPACED RIGS (*Table 6*).

Examination of Log Records

Since 1950 the fleet has shifted from predominately 13-foot gear to 18-foot and 21-foot gear (*Figure 4*). The log records show that the average catch per hook increased with hook-spacing. During the past 18 years in Area 3, the average catch per hook was 1.07 pounds for 13-foot gear and 1.28 pounds for 18-foot gear. During the last five years, when all rigs were being fished, the average catch per hook was

Table 6. Hook-spacing experiment aboard the “Chelsea” in Area 3.

Hook-Spacing in feet	Average No. of hooks per skate	No. of skates fished	Catch in pounds		
			Total	Per skate	Per hook
12	121.1	385	27,942	73	0.60
18	81.9	382	26,492	69	0.85
21	72.1	372	23,505	63	0.88
24	60.8	387	23,262	60	0.99

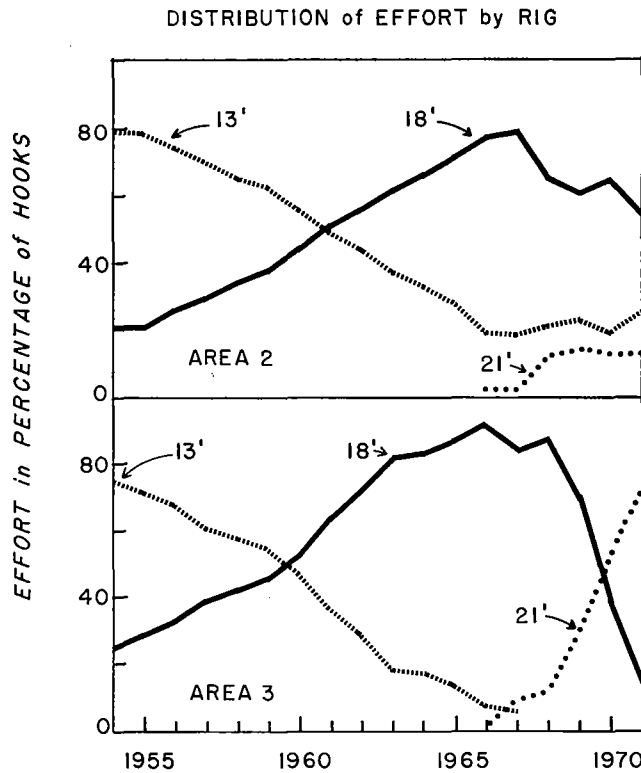


Figure 4. Changes in hook-spacing: percentage of effort by type of gear.

0.80 pounds for 13-foot gear; 1.05 for 18-foot gear; 1.18 for 21-foot gear; 1.41 for 24-foot gear; and 1.49 for 26-foot gear.

Log records from Area 2 also indicated that catch per hook increased with hook-spacing, but the difference among rigs was less pronounced than in Area 3. There are several plausible reasons for the difference; the fish in Area 2 are smaller and more abundant and fishing often is conducted on "spots" inhabited by dense concentrations of halibut. A fishing experiment is planned in 1972 to obtain more information on the relationship of catch to hook-spacing in Area 2.

Significance of Catch per Hook Study

When effort was assumed to be proportional to the number of hooks and all rigs were adjusted to the 120-hook standard, the effective effort of wider-spaced gear was underestimated and the catch per skate was overestimated indicating a higher abundance of halibut than actually existed. This error increased as wider-spaced gear was added to the fishery in the late 1960s (Figure 5). The discovery that catch per hook changes with hook-spacing has confirmed the reports of fishermen concerning the inadequacy of the "standard skate".

Changes in hook-spacing are expected to continue and must be followed closely to maintain a valid assessment of stock condition. With the excellent data-base maintained by the Halibut Commission, the new measure of effort can be used to review past estimates of stock abundance and to interpret changes that occur in the years ahead. More extensive analyses of log records and more fishing experiments



Credit: Lloyd Larsen

Icing aboard the *Chelsea* in the Bering Sea.



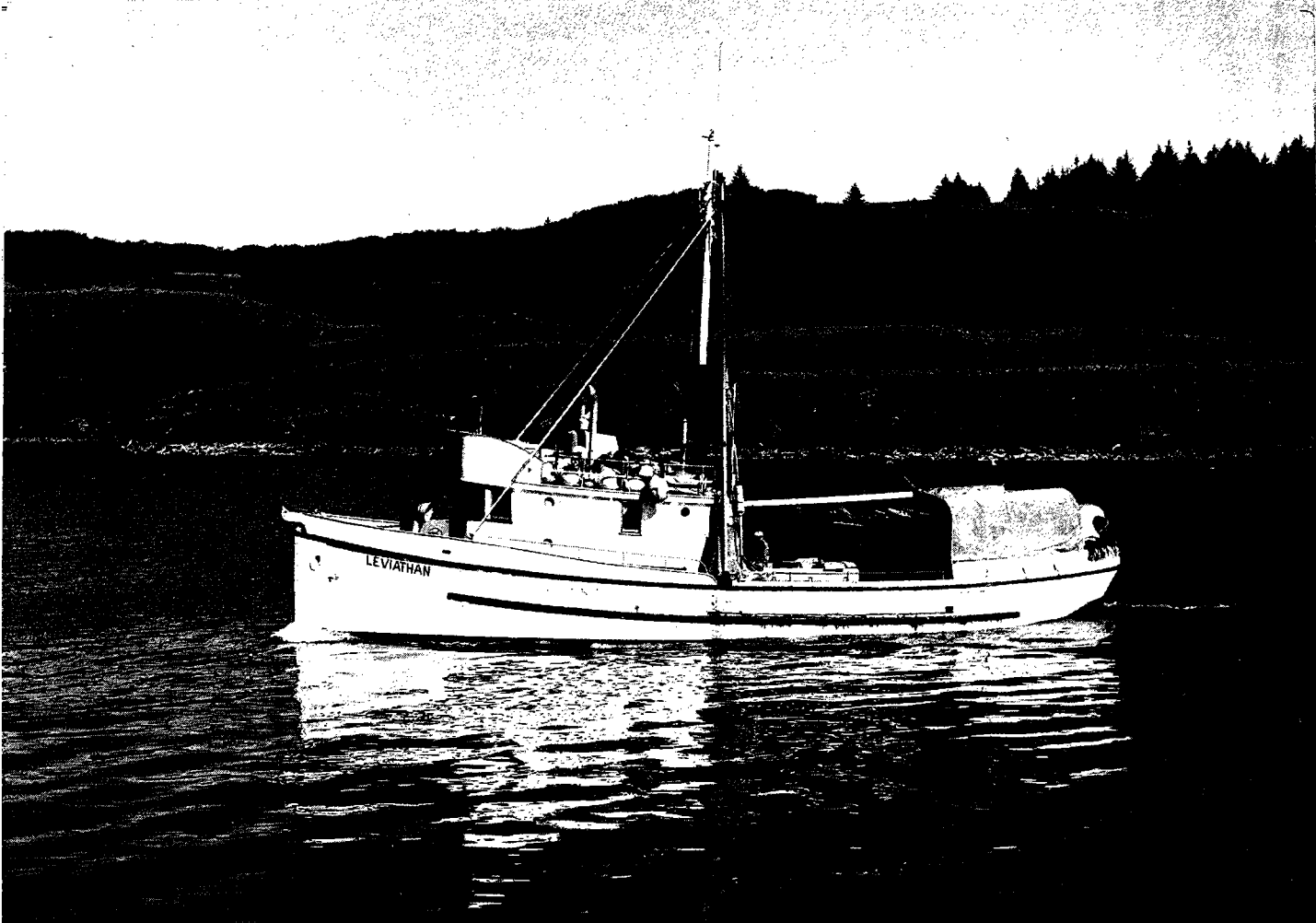
Credit: IPHC

Halibut on the rail.

The *B.C. Producer* unloading in Vancouver.

Credit: Dept. of Fish., Can.





Credit: Nat. Mar. Fish. Ser., U.S.

Halibut vessel entering Kodiak Harbor.

The "Halibut Room", Juneau Cold Storage.

Credit: Nat. Mar. Fish. Ser., U.S.



Unloading a "man-sized" halibut.

Credit: Dept. of Fish., Can.



are necessary to determine the relationship between fish abundance and the catch per hook of difference rigs. Changes in stock abundance, gear and techniques of fishing may require periodic adjustments in the new measure of effort once it is established.

The new findings on catch per hook also have economic implications which may be of interest and use to the fishermen. During the test-fishing experiment, the time required to bait and haul each rig was measured. The average time to bait a skate of 12-foot gear was 21.2 minutes and of 24-foot gear only 13 minutes. The average time for hauling was 14.6 minutes for a skate of 12-foot gear and 13.5 minutes for 24-foot gear. However, the advantages of wider-spaced gear—fewer hooks, less bait, higher catch per hook, and faster baiting and hauling time per skate—will vary with the operation of each vessel and the particular grounds being fished.

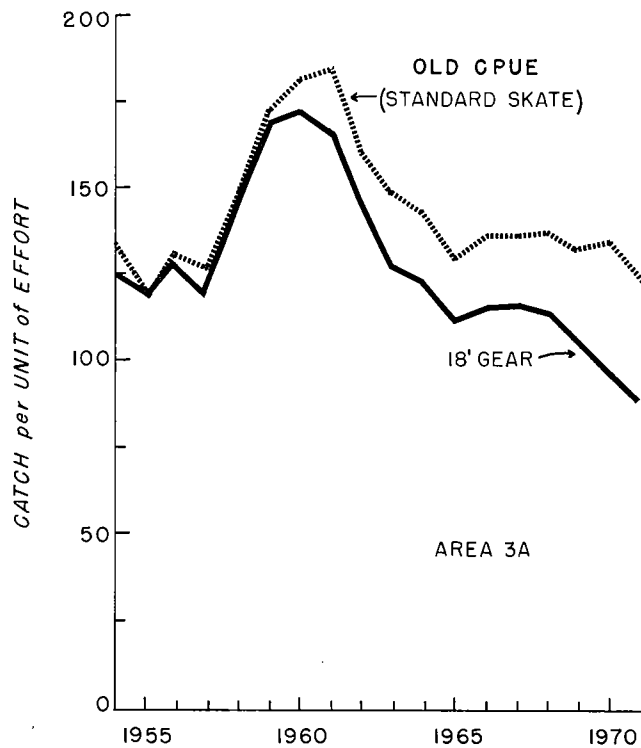


Figure 5. Comparison of CPUE based on the standard skate with CPUE of 18-foot gear.

BIOSTATISTICS

Catch Sampling

Catches from 164 trips were sampled at Newport, Seattle, Bellingham, Vancouver, Prince Rupert, Petersburg and Kodiak. Almost 40,000 fish were measured and 26,000 otoliths (ear bones) collected for age and growth studies. In addition 23,000 fish were measured and 5,000 otoliths were collected at sea aboard commercial vessels and chartered research vessels. In all, over 65,000 fish were measured. The distribution of samples by regulatory area is summarized in Table 7.

Table 7. Number of vessels sampled and number of halibut measured in 1971.

Source	Number of Vessels Sampled			Number of Halibut Measured		
	Port Samples	Sea Samples	Total	Commercial Vessels	Charter Vessels	Total
AREA 2	79	19	98	25,346	3,130	28,476
AREA 3	77	1	78	17,540	11,542	29,082
AREA 4	8	—	8	2,440	5,918	8,358
TOTAL	164	20	184	45,326	20,590	65,916

Length and age data are obtained by sampling halibut landings. Otoliths are removed for age determination and the fish are measured or the otolith lengths are used to estimate fish lengths. Port samplers are instructed to select "representative" samples of 400 fish from each vessel sampled. Studies were initiated in 1971 to test the randomness of the present method of sample selection and to evaluate alternative methods. Halibut are unloaded with a large-mesh sling which holds several hundred pounds of fish. All halibut in systematically selected slings were measured to compare with the results from the existing method of measuring a few fish from each sling. Though certain advantages are apparent, further study of the sling method sampling is necessary to determine whether sampling can be improved without undue interference during the unloading operation. In addition studies will be undertaken in 1972 to determine the required sample size and to design a stratified sampling plan utilizing time, area, and gear as criteria. The sampling scheme will also provide the data necessary to assess the fishing power of the fleet.

Processing Statistical Data

Catch and effort statistics are obtained by interviewing fishing captains and dealers during the season. The catch data were tabulated manually during the season to provide monthly reports of the landings; the keypunching and machine tabulation was done after the close of the season. These procedures were examined during the past year to determine if a greater use of automatic data processing would result in a more efficient processing of the statistical data. The review indicated that the entire procedure should be automated.

A computer programmer was employed and a statistical processing and data retrieval system was written and will be used during the 1972 season. Fishermen and dealers' records will be keypunched and entered into the system as they are received from the field rather than being held until the end of the fishing season. The data are entered in random order, but can be sorted for the required analyses. The fishing and dealers' records are merged by the computer and printed in the standard format of the Commission's statistical series. A general purpose search-reporting program will provide data for special requests. Additional programming is underway to further simplify and improve the data processing system.

Several large fishing companies and government agencies already utilize automatic data processing systems in their accounting and reporting procedures. Arrangements are being made to receive data on the halibut landings from these sources in punch card form, minimizing the duplication of records as well as increasing the efficiency of the Commission's operations.

HALIBUT SOUTH OF WILLAPA BAY

The annual catch of halibut south of Willapa Bay has declined from over five million pounds in the early 1900s to about one million pounds in the 1930s, then to only 47,000 pounds in 1970. Recently, most catches of halibut have been incidental to blackcod and salmon fishing and have not provided sufficient information to evaluate the condition of the stock. The Commission attempted to stimulate fishing in this area by granting special permits to fish halibut with setlines from March 17 to the May 7 opening of the regular 1971 season. The Commission also investigated the trawl catch of halibut in this region by placing observers on commercial trawlers from May to July.

During the permit fishery, four setline vessels fished between Astoria Canyon and Cape Blanco and caught approximately 40,000 pounds of halibut. Daily catches averaged 1,200 pounds compared to 2,200 pounds in the northern part of Area 2 during the regular season. Although less abundant, halibut south of Willapa Bay were older than those north of Willapa Bay: average ages were 10 and 8 years respectively (Figure 6). The higher average age of fish south of Willapa Bay may reflect a lower rate of exploitation. Recoveries of tagged halibut also indicate a lower rate of exploitation by setliners south of Willapa Bay (trawl-caught halibut cannot be retained). To date, 15 percent of the halibut tagged in that area in 1964 and 1966 have been recovered—12 percent by trawlers, mostly in the same area, and three percent by setliners, mostly off British Columbia (Table 8). The percentage returned by trawlers is similar to the average nine percent that are returned by trawlers in Northern British Columbia (Hecate Strait), but the percentage of tags

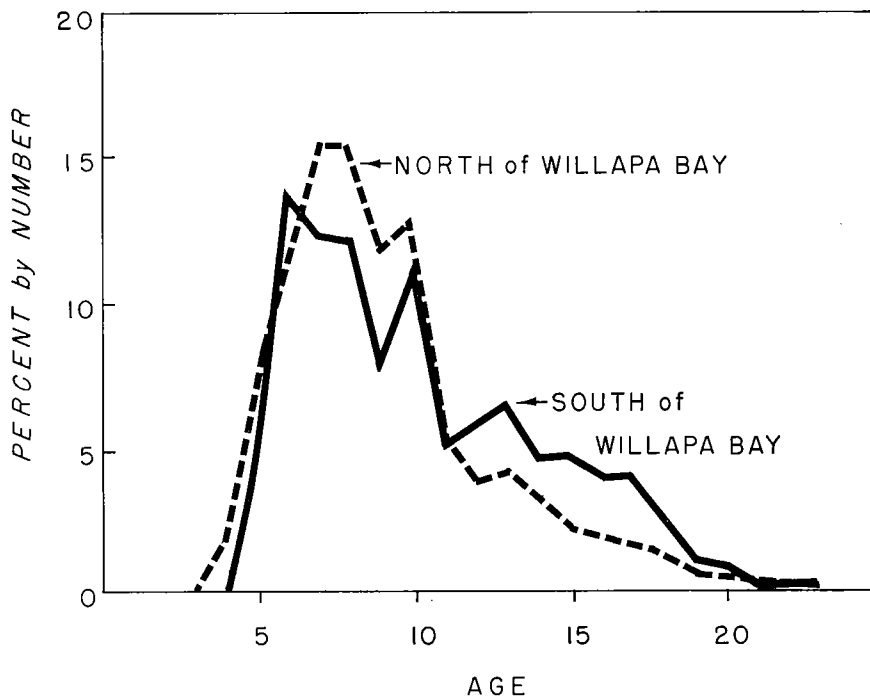


Figure 6. Age distribution of halibut caught by setline to the south (March-April) and to the north (May-October) of Willapa Bay in Area 2.

returned by setliners south of Willapa Bay is much less than the 15-25 percent recovered from halibut tagged in Hecate Strait and is indicative of a lower exploitation rate.

Table 8. Recovery of halibut tagged south of Willapa Bay.

Year of Release	Number Tagged	Number Recovered			
		South of Willapa		North of Willapa	
		Setline	Trawl	Setline	Trawl
1964	148	1	19	6	0
1966	166	3	16	0	1
TOTAL	314	4	35	6	1

Commission observers were aboard five United States trawlers during 11 trips off Washington and Oregon. A total of 158 halibut were caught in 120 hauls and the average catch was five pounds of halibut per hour trawled; the highest was 160 pounds. Halibut accounted for approximately one percent of the catch of marketable species. Halibut occurred more frequently in the trawl catch off British Columbia where catches of halibut averaged 75 pounds per hour trawled or six percent of the catch. Halibut in the trawl catch were smaller than in the setline catch; seven percent of the trawl-caught halibut were over 40 inches long compared to 45 percent of those taken by setline (Figure 7). In addition 24 percent by number of the trawl catch were below the legal size of 26 inches, and off British Columbia 32 percent were sublegal.

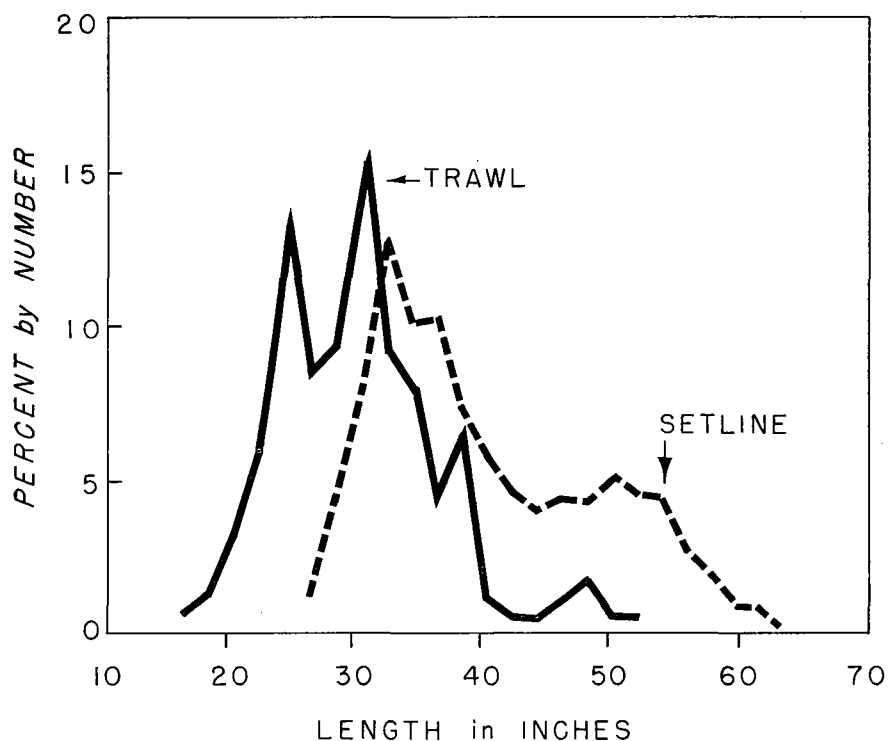


Figure 7. Length distribution of halibut caught by trawl (May-July) and setline (March-April) south of Willapa Bay.

RECRUITMENT STUDIES

Two Seattle-based otter trawlers were chartered for recruitment studies in 1971. The *Tordenskjold* sampled stations in the Gulf of Alaska; the *Don Edwards* sampled in the Bering Sea, the Pacific side of Unimak Island and in the Gulf of Alaska. In addition to routine trawling, plankton samples were collected from the Bering Sea for the National Marine Fisheries Service MARMAP program. Samples of halibut were collected from the Bering Sea and the Gulf of Alaska for mercury analysis.

Inshore Areas

Inshore stations throughout the Gulf of Alaska and in the Bering Sea are monitored annually to estimate the abundance of the young halibut. During the survey a special trawl with a 1¼-inch (32 mm) codend was used in 127 hauls of 15 minutes duration made at depth of seven to 35 fathoms (13-64 meters). Over 6,016 halibut were caught and 98 percent were less than the 26-inch minimum legal size. Catches among stations varied greatly, reflecting local differences in abundance. The catch of one-year-olds (1970 year class) was above average only in Shelikof Bay. The catch of two-year-olds (1969 year class) was above average in the Bering Sea, Kodiak Island and Trinity Islands.

Offshore Areas

In the southeastern Bering Sea 34 stations have been used to estimate the abundance of juveniles. These stations showed a slight increase in 1971, due to the above-average numbers of 1967 and 1969 year classes. The 1969 year class was more abundant as two-year-olds than the 1967 year class at the same age. The survival of these two-year classes will be important to the halibut stocks in the Bering Sea and the Gulf of Alaska in the next few years.

The survey of the Bering Sea stations began June 6 in inner Bristol Bay, a postponement of one week due to abnormally low water temperatures. No significant catches were made before sampling the westernmost stations near Unimak Pass. Apparently, the cold water delayed the normal migration to the flats in the southeastern Bering Sea. The concentration of fish near Unimak Pass provided an opportunity to tag 2,460 juvenile halibut between June 21 and July 1.

Fair weather permitted sampling in additional areas not routinely sampled in the Gulf of Alaska and Dixon Entrance. In 172 one-hour hauls made at depths of 10 to 130 fathoms (19 to 238 meters), 7,043 halibut were caught; 88 percent were sublegal. The percentage of sublegals varied from 99 percent off Unimak Island to 30 percent in Hecate Strait and off the Washington Coast. The numbers of larger juveniles were above average at Cape Chiniak, Cape Fairweather and Dixon Entrance. The abundance of the 1968 year class was above average near Chirikof Island in 1970 and east of Cape Chiniak in 1971. Juvenile halibut normally move eastward at this stage of their growth. All juveniles were below the average abundance on the commercially important grounds near Chirikof Island in 1971. In the eastern Bering Sea, 109 one-hour hauls were made at depth of 14 to 124 fathoms (26-277 meters). Of the 4,643 halibut caught only 0.5 percent were of legal size.

Table 9 summarizes the catch per unit effort of sublegal halibut by age groups on both inshore and offshore grounds in 1971 and the average annual catch.

Table 9. Catch per unit effort by age groups, 1971 and average since 1967 (bold face).

Station	Age Year Class	1	2	3	4	5	6	7
		1970	1969	1968	1967	1966	1965	1964
INSHORE		Number per 15 minute tow						
Akutan Island		62.7	11.0	2.0	0.3	—	—	—
		*	*	*	*			
Bering Sea		9.5	67.7	8.1	1.8	—	—	—
		25	40	10	2			
Unimak Island		9.0	27.2	14.2	6.5	—	—	—
		40	30	15	5			
Shumagin Islands ...		35.7	3.7	0.7	—	—	—	—
		*	*	*				
Kodiak Island		107.9	34.6	6.5	1.2	—	—	—
		140	30	7	1			
Trinity Islands		14.9	8.1	1.5	0.1	—	—	—
		50	5	1	*			
Cape St. Elias		17.9	5.0	15.4	4.9	—	—	—
		30	15	10	4			
Shelikof Bay		12.0	0.8	0.4	2.7	—	—	—
		10	2	3	1			
OFFSHORE		Number per 60 minute tow						
Bering Sea		—	3.3	2.2	6.4	0.2	0.0	—
			2	5	4	2	1	
Unimak Island		—	8.8	17.0	13.5	2.9	1.0	0.2
			7	13	10	4	2	1
Chirikof Island		—	1.9	22.9	11.7	4.0	2.4	0.9
			27	33	15	8	5	1
Cape Chiniak		—	0.2	27.9	7.1	6.4	2.5	1.3
			2	16	11	6	3	1
Cape St. Elias		—	—	1.1	1.7	2.0	1.1	0.9
				2	3	4	3	1
Cape Fairweather ...		—	—	4.3	8.6	7.2	2.8	1.7
				2	4	5	2	1
Dixon Entrance		—	1.2	5.6	39.1	48.8	55.7	45.0
		*	*	*	*	*	*	*
Cape Flattery		—	—	—	—	1.0	0.4	0.4
						*	*	*

* No average established.

Environmental Conditions

The halibut vessels encountered unusually severe icing conditions in the Bering Sea in March 1971, suggesting below normal temperatures. Long-term oceanographic observations and water temperatures for the Bering Sea are not available, however, air temperatures from St. Paul Island show that from 1930 through 1971, only 1946 was colder in March than 1971. Temperatures remained cold in the Bering Sea until mid-summer and apparently inhibited the movement of young halibut onto the flats of Bristol Bay. Long-term oceanographic data for the Gulf of Alaska will be analyzed to determine if changing environmental conditions are related to the distribution and abundance of both young and adult halibut.

OBSERVATIONS OF FOREIGN TRAWL FLEETS

Bering Sea

The trawler, *Don Edwards*, fished near Japanese and South Korean trawlers in the Bering Sea between July 25 and August 3 to observe their catches. The vessel

began fishing east of the Pribilof Islands, moved northwesterly to a position southwest of St. Matthew Island, then along the continental edge west of the Pribilof Islands towards Dutch Harbor. The cruise of halibut by the *Don Edwards* was several times greater south of latitude 57° N. (Pribilof Islands) than north of this parallel (Table 10). Near St. Matthew Island, Japanese and South Korean trawlers caught mostly walleye pollock (*Theragra chalcogrammus*), while the charter trawler caught more tanner crab (*Chionectes spp.*) than pollock. Apparently the gear of the *Don Edwards* fished the bottom and was less efficient for pollock. Halibut were taken at rate of 0.7 fish or 1.5 pounds (0.7 kg) per hour trawled. South of the Pribilof Islands, "independent" Japanese stern trawlers caught mainly pollock. The catches of halibut by the research vessel averaged 10.9 fish, or 13.4 pounds (6.1 kg), per hour trawled in this area.

Gulf of Alaska

Estimates of the removals of halibut by foreign vessels are needed to interpret the changes in abundance of halibut indicated by the catches of Canadian and U. S. longline fleets. The U. S. National Marine Fisheries Service has provided the Commission with data collected by observers aboard Japanese trawlers from 1963 to 1969. The records include observations on the incidental catch of halibut which are being analyzed for geographical and seasonal differences. Estimates of the annual

Table 10. Catch of M.V. "Don Edwards" in the Bering Sea during comparative fishing near foreign vessels, July 25-August 3, 1971.*

	South of 57° N. Lat.	North of 57° N. Lat.	Total
No. Hauls	10	10	20
PACIFIC HALIBUT			
No.	109.0	7.0	116.0
Wt. (lbs)	133.7	15.6	149.3
Wt. (kg)	60.6	7.1	67.7
MISC. FLATFISH			
Wt. (lbs)	3,949.2	1,103.4	5,052.6
Wt. (kg)	1,791.4	500.5	2,291.9
WALLEYE POLLOCK			
Wt. (lbs)	4,097.4	1,677.0	5,774.4
Wt. (kg)	1,858.6	760.7	2,619.3
PACIFIC COD			
Wt. (lbs)	2,007.6	210.5	2,218.1
Wt. (kg)	910.6	95.5	1,006.1
MISC. ROUNDFISH			
Wt. (lbs)	2,152.6	636.6	2,789.2
Wt. (kg)	976.4	288.8	1,265.2
TANNER CRAB			
Wt. (lbs)	3,491.9	4,718.3	8,210.2
Wt. (kg)	1,583.9	2,140.2	3,724.1
KING CRAB			
Wt. (lbs)	6.0	208.0	214.0
Wt. (kg)	2.7	94.3	97.1
TOTAL (lbs)	15,838.4	8,569.4	24,407.8
TOTAL (kg)	7,184.3	3,887.1	11,071.4

* Sixty minute tows with a 400-mesh eastern trawl having a 3.5 inch (90 mm) codend. The stations were between 56° and 59° N. latitude, and 168° and 174° W. longitude. The depth at stations north of 57° N. latitude ranged from 70 to 140 m; at stations south of 57° N. latitude, from 100 to 230 m.

incidental catch will be made by multiplying the annual Japanese effort by the average catch of halibut per hour trawled on the observer trips. Annual effort by Japanese trawlers increased steadily from 1963 to 1969, and the incidental catch of halibut has probably increased accordingly. A similar analysis is planned with effort data from the Soviet trawlers. These estimates will be less reliable because the analysis will depend on observations of incidental catch from Japanese vessels that have different gear than the Soviet vessels. Soviet effort, based on the number of fishing vessels, increased rapidly to 1965, but declined substantially by 1969, and their incidental catch of halibut can be assumed to have followed a similar trend.

TROLL-CAUGHT HALIBUT

During 1971 data on the size composition of troll-caught halibut were collected in British Columbia, and information was obtained on the survival of sublegal fish released at sea. Canadian salmon trollers *Gorm*, *Miss Pacific*, *Sundance II* and *Taplow* were used for these studies.

The size composition of halibut varied significantly between different sections of the coast (Figure 8). In Dixon Entrance over 81 percent of the fish were below

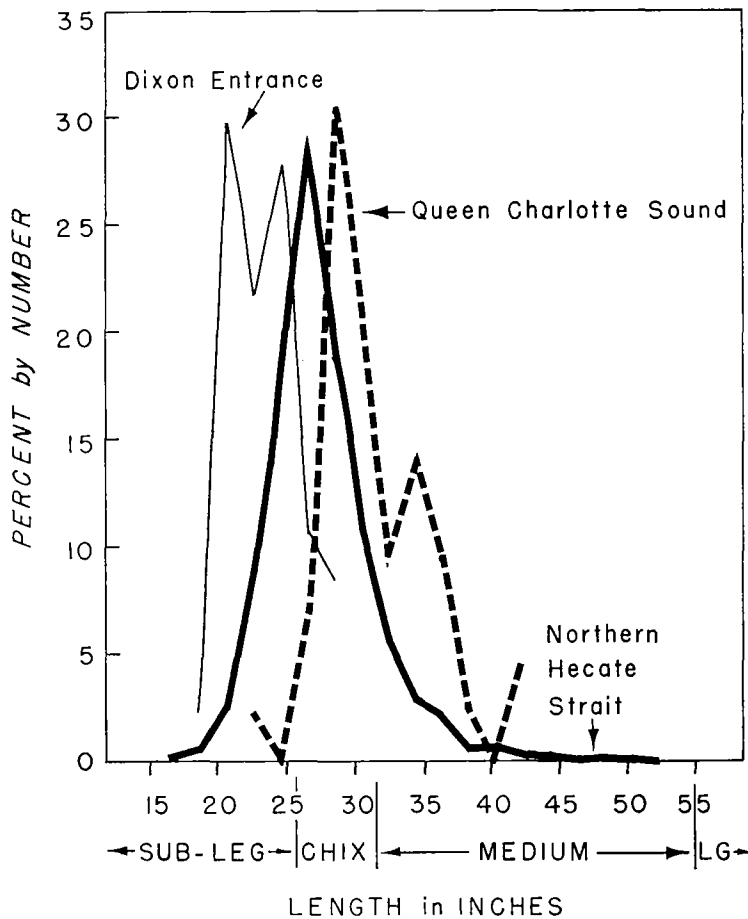


Figure 8. Size composition of troll-caught halibut, British Columbia, 1971.

legal size (26 inches) and no fish exceeded 31 inches, whereas in Queen Charlotte Sound only two percent of the fish were below legal size and 40 percent exceeded 31 inches. The mean size of fish from northern Hecate Strait was larger than from Dixon Entrance but less than from Queen Charlotte Sound.

The size compositions of troll- and trawl-caught halibut from northern Hecate Strait were similar. Halibut between 26 and 31 inches (chickens) dominated the catches. Approximately one-third of the fish caught were below legal size and only a few exceeded 31 inches (mediums). A comparison of troll and setline landings from the same region showed significant differences (Figure 9). Almost 75 percent of the troll landings were below 31 inches as compared to 35 percent of the setline landings. Landings by setliners also contained a much higher proportion of large fish.

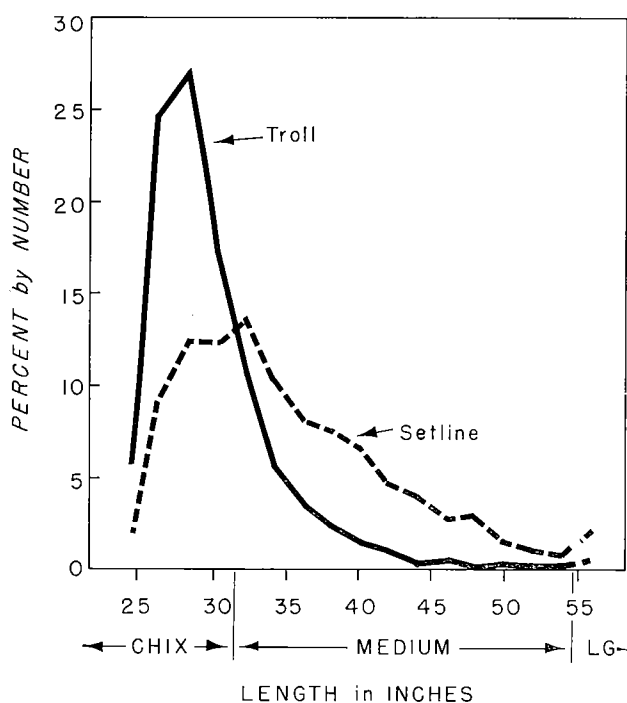


Figure 9. Size composition of halibut landed from Northern Hecate Strait, 1971.

All sublegal troll-caught fish were examined for hook injuries and their physical condition was recorded to estimate probable survival after tagging. Only six percent of the 352 halibut were rated in poor condition and no fish were landed dead. Fish captured by setline or trawl tend to be more seriously injured and approximately 30 percent are rated poor or dead. Two factors account for the better condition of troll-caught fish. Fish usually are hooked by troll lures in the forward parts of the mouth with little resulting damage; whereas fish hooked by setline often swallow the bait. Second, troll gear is retrieved when a fish strikes, minimizing the time of attachment to the gear. Halibut caught by setline or trawl usually are held captive for longer periods of time. All sublegal troll-caught halibut were tagged before being released. The recoveries during the next few years will provide further information on their survival.

TAGGING EXPERIMENTS

The Commission tagged and released halibut from the two otter trawlers that were chartered for recruitment studies in the Bering Sea and the Gulf of Alaska. Halibut were also tagged from salmon trollers in upper Hecate Strait and six commercial trawlers off the Washington and Oregon coasts to study the mortality of troll- and trawl-caught halibut. In all, over 9,000 halibut were tagged, the distribution by area of release is summarized in Table 11.

Table 11. Number of halibut tagged and area of release in 1971.

Vessel	Gear	Area of Release	No. Tagged
DON EDWARDS	Trawl	Bering Sea Flats	2,460
DON EDWARDS	Trawl	Unimak Island	1,157
TORDENSKJOLD	Trawl	Gulf of Alaska	2,526
TORDENSKJOLD	Trawl	Dixon Entrance	2,465
GORM	Troll	Upper Hecate Strait	186
Commercial*	Trawl	Washington - Oregon Coasts	104
Commercial**	Troll	Dixon Entrance	279
TOTAL			9,177

* Trawlers: WASHINGTON, CORAL SEA, WESTERN, MISS CONNIE, PACIFIC, and RASCAL.

** Trollers: TAPLOW, SUNDANCE II, and MISS PACIFIC.

There were 895 tags recovered and returned during the year. One of the tags was released in 1960 and seven were released in 1962 and 1963. An additional 23 tags recovered in earlier years were reported this year—11 of these returned by Japanese vessels and through the International North Pacific Fisheries Commission.

A program of premium rewards was initiated in 1966 to stimulate interest in the return of tags. Five of the selected tags were recovered in 1971 and a \$100.00

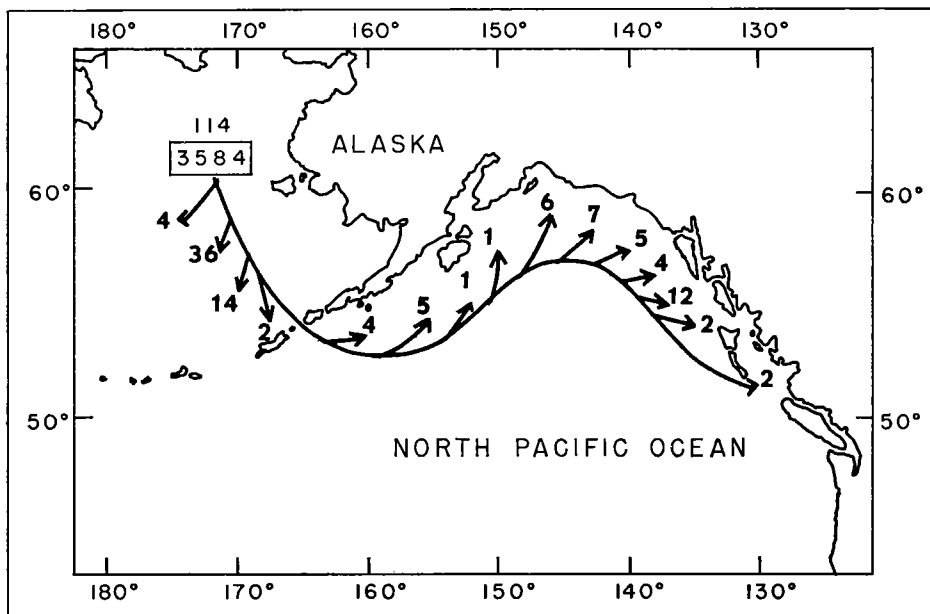


Figure 10. Recoveries (1967-1971) of halibut tagged near St. Matthew Island in the Bering Sea.

reward paid to the finders; three from Canada and two from the United States. Since the start of this program 40 rewards have been paid for premium tags.

Of the 3,584 halibut tagged at St. Matthew Island (Bering Sea) in 1967, 221 have been recovered — 170 from the Bering Sea, 38 by foreign trawlers and 132 by North American halibut vessels; and 51 from grounds from the Gulf of Alaska, all from North American vessels. The distribution of recoveries at known locations is shown in Figure 10. The longest migration was to Hecate Strait, a distance of 2,000 miles and the fish was captured within a year after tagging. Migrations of this distance in tagging experiments were also observed in the Bering Sea in 1956 and 1959. The number of returns from the Gulf of Alaska reached a maximum of 25 in 1970, the third year after tagging, and declined to 11 in 1971. Experiments in 1956 and 1959 also had the largest number of returns in the Gulf of Alaska during the third year.

In 1970, a total of 2,181 halibut were tagged and released from Canadian and United States trawlers to estimate mortality due to trawl capture. The physical condition of each fish was recorded, judged on muscle tone and ability to close the operculum. Preliminary results from tag recoveries in 1970 and 1971 show that the recovery rate declined for fish in poorer physical condition (*Table 12*). Apparently, the criteria are meaningful but not entirely accurate as 1.5 percent of the fish recorded as "dead" have been recovered.

Table 12. The physical condition of trawl-caught halibut at time of release and their percentage recovery.

	Physical Condition					Total
	Excellent	Good	Fair	Poor	Dead	
Number Released	146	572	850	288	325	2,181
Number Recovered	25	81	97	23	5	231
Percentage Recovered	17.1	14.2	11.4	8.0	1.5	10.6

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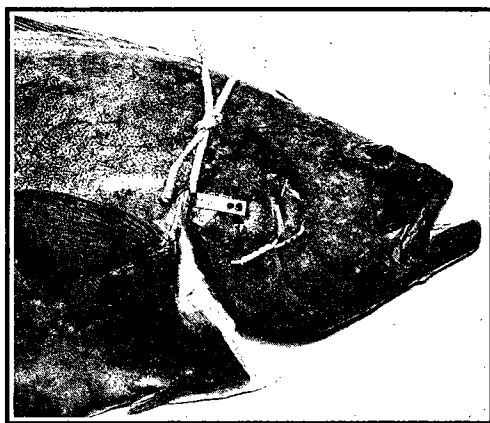
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TAGGED HALIBUT

The INTERNATIONAL PACIFIC HALIBUT COMMISSION tags halibut with plastic tags and metal strap tags attached to the cheek on the dark side of the fish. Some fish have two tags. Retain all tagged halibut regardless of size or gear used.



REWARD

\$2.00 WILL BE PAID FOR THE RETURN OF THE TAGS AND RECOVERY INFORMATION FROM EACH FISH. \$100.00 WILL BE PAID FOR SPECIAL PRESELECTED TAGS.

WHEN YOU CATCH A TAGGED HALIBUT:

1. Record Tag Numbers, Date, Location and Depth in your log book.
2. Leave Tags on the fish.
3. Mark the fish with a gangion.

WHEN YOU LAND A TAGGED HALIBUT:

1. Report fish to a Commission Representative or Government Officer
or
2. Forward tags to address below and enclose recovery information (see above), your name, address, boat name, gear, overall length of fish and, if possible, earstones from the fish.

FINDER WILL BE ADVISED OF MIGRATION AND GROWTH OF THE FISH.

International Pacific Halibut Commission

P. O. Box 9
University Station
Seattle, Washington 98105

Tag Reward Poster.