

**REPORT OF THE
INTERNATIONAL PACIFIC HALIBUT COMMISSION**

APPOINTED UNDER THE CONVENTION BETWEEN CANADA AND THE
UNITED STATES OF AMERICA FOR THE PRESERVATION OF THE
NORTHERN PACIFIC HALIBUT FISHERY

NUMBER 44

**REGULATION AND INVESTIGATION
OF THE PACIFIC HALIBUT FISHERY
IN 1966**

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FOREWORD

The terms of the 1953 Convention between the United States and Canada for the Preservation of the Halibut Fishery of the Northern Pacific Ocean and Bering Sea provide that the International Pacific Halibut Commission shall publish a report of its activities and investigations from time to time.

The present report, the forty-fourth published by the Commission, is the twentieth of a series of annual reports that was begun in 1947 to provide a summary of the Commission's activities and results of its investigations during the year.

Those desiring additional background information on the Commission's activities are referred to earlier reports.

REGULATION AND INVESTIGATION OF THE PACIFIC
HALIBUT FISHERY IN 1966

By
INTERNATIONAL PACIFIC HALIBUT COMMISSION

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INTRODUCTION

The Canadian and United States halibut fishery in the Northern Pacific Ocean and Bering Sea has been subject to scientific study and regulation for 42 years. These activities have been carried out by the International Pacific Halibut Commission under authority of the 1953 Convention and by the precedent International Fisheries Commission under Conventions signed by Canada and United States in 1923, 1930 and 1937.

The first convention, which was signed March 2, 1923 and ratified October 21, 1924, required the Commission to investigate the conditions of the fishery for the purpose of recommending measures for its rehabilitation. This convention also provided for a winter closed season directed at reducing fishing intensity on spawning concentrations of halibut.

Successive Conventions of 1930, 1937 and 1953 provided broader and more effective regulatory powers including division of the coast into areas; control of the amount of fishing by the setting of an annual catch limit or by adjusting the length of a closed season in any area; and the placing of limits on the size of fish to be retained by the fishery. The current 1953 Convention also specifically requires the Commission to develop the stocks of Pacific halibut to levels which will permit maximum sustainable yield and to maintain the stocks at those levels.

CONDITION OF THE RESOURCE, 1966

In Area 2 off the coasts of Southeastern Alaska and British Columbia, the 1966 catch was 23.5 million pounds which continues the low removal level of recent years in this region. The earlier decline in catch per unit effort has terminated as a result of the reduction in fishing and in part to an increase in growth. However, improvement in the stocks has not been uniform throughout the area.

Off British Columbia the catch per unit effort has not improved as much as would be expected from the low level of removals. However, the modal year classes have been well sustained compared to earlier years.

Off Southeastern Alaska a disproportionate share of the total Area 2 catch has been taken on those grounds during the past few years. This has resulted in a sharper decline in the modal year classes than has occurred off British Columbia.

The fishing season in Area 2 in 1966 was 29 days shorter than in 1965 due to the improvement in the catch per unit effort and the increased entry of vessels from the salmon fleet.

West of Cape Spencer in Areas 3A and 3B, the 1966 catch was approximately 37.5 million pounds, 34.5 million from Area 3A and 3.0 million from Area 3B. These catches continued at the level of the past five years. The catch per unit effort increased slightly in 1966 due mainly to the sustained contribution of the 1951 through 1955 year classes. The slow but steady decline in the catch per unit effort that occurred from 1959 to 1965 in both Areas 3A and 3B indicated that the combined 38-million-pound removal level was probably too high under present environmental conditions. Also, development of the fishery in Bering Sea could reduce the emigration of adults to Areas 3A and 3B.

The lengths of the fishing season in Areas 3A and 3B in 1966 were 19 and 40 days respectively shorter than in 1965. In Area 3A the reduction was due primarily to the improvement in the catch per unit effort. In Area 3B the shortening was due

to a reduction in catch, an increase in catch per unit effort, and an unpredictable withdrawal of vessels from the fishery following announcement of the closing date.

In Bering Sea the 1966 catch of 219,000 pounds for Area 4A (the Triangle grounds) was lower than anticipated due in part to the tie-up of the United States fleet caused by owner-fisherman share negotiations. In 1966 there was a further increase in the catch per unit effort and it is estimated that the stocks are capable now of sustaining a moderate removal.

On the Fox Islands grounds, Area 4B, the catch of 237,000 pounds and the yield per unit effort were not far removed from expected levels.

On the edge grounds west of the Pribilof Islands, Area 4C, the 1966 catch of 301,000 pounds was lower than anticipated for the same reasons as in Area 4A. The catch per unit effort was considerably higher than in 1965 due mainly to the low removals from the area in 1964 and 1965.

In northeastern Bering Sea, Area 4D, four North American vessels engaged in exploratory commercial fishing in the late fall around Nunivak and St. Matthew Islands and encountered commercial concentrations of halibut.

The 1966 Pacific Coast halibut catch was 62.4 million pounds. This is about 1 million pounds less than was expected due to the lack of participation by the United States fleet in Bering Sea in the early spring. Production over the near term can be expected to hold at about a 65-million-pound level until the stocks have been raised to a size capable under current conditions of supporting approximately 70 million pounds annually on a sustained basis. The rebuilding process is being carried out at an orderly rate, and with few exceptions the stocks are exhibiting the expected reactions to the controlled fishery.

With the generally favorable economic conditions Pacific Coast halibut prices reached a record high of 33 cents (U.S.) per pound with the catch at a near record total value of about \$20,500,000 to the Canadian and United States fleets.

ACTIVITIES OF THE COMMISSION

During 1966 the Commission continued its program of statistical and biological observations which provide the basis for the regulation of the fishery according to scientific principles as required by the 1953 Convention.

United States members in 1966 were: Mr. Haakon M. Selvar, Bainbridge Island, Washington, Chairman; Mr. Harold E. Crowther, Washington, D.C.; and Mr. L. Adolph Mathisen, Petersburg, Alaska. Canadian members were: Dr. William M. Sprules, Ottawa, Ontario, Vice Chairman; Mr. Martin K. Eriksen, Prince Rupert, British Columbia; and Mr. Francis W. Millerd, Vancouver, British Columbia. Under the Rules of the Commission, the Chairmanship and Vice Chairmanship alternate between the two countries in successive years.

The Commission held its Forty-second Annual Meeting in Seattle, Washington from February 1 to 4, 1966. It examined the results of investigations and the effects of regulation on the fishery during 1965, dealt with administrative and budgetary matters, conferred with industry representatives regarding the management of the resource and adopted regulations for 1966.

On the morning of February 1, the Commission met in closed session to approve the provisional agenda and discuss the program for the public session to follow. During the afternoon the Commission met in joint session with representatives of

all segments of the halibut industry and other interested persons. The staff of the Commission presented results of scientific investigations in 1965 and reviewed the status of the stocks and of the fishery. Proposals of the staff for regulations of the fishery in 1966 were presented to the joint session of the Commission and representatives of the industry.

The Commission met with the staff on February 2 to consider various administrative and fiscal matters and to approve research plans for 1966 and a budget for the fiscal year 1967-68. A joint session of the Commission with the representatives of the dealers and the Conference Board consisting of delegates from vessel owners and union organizations was held the morning of February 3 for discussion of regulatory and other proposals of the industry.

The regulatory proposals recommended by the staff and industry were further examined during the fifth and sixth sessions held in the afternoon of February 3 and the morning of February 4, respectively. Regulations for 1966 were adopted at the sixth and final session. A press release listing the important features of the regulations being recommended to the two governments for the 1966 fishing season was released immediately for the information of the industry and public.

During the fishing season the Commission determined the dates on which it deemed the catch limits of various regulatory areas would be attained, announced those dates in advance and the areas were closed accordingly.

The Commission held a Special Meeting in Seattle, Washington on September 29 to review the results of the 1966 spring halibut fishery in Bering Sea and to develop proposals for the regulation of that fishery in 1967. The condition of the halibut stocks in the area, as indicated by the Commission's investigations, were reviewed with representatives of all segments of the United States and Canadian halibut industry concerned with the halibut fishery in Bering Sea.

The proposals recommended by the staff and the industry were examined and the Commission took under consideration regulations to be proposed for Bering Sea in 1967.

Prior to the Special Meeting the staff held a two-day seminar on the condition of the resource in Bering Sea with scientists of the Canadian and United States national sections of the International North Pacific Fisheries Commission.

During 1966 in addition to the Annual Report, several manuscript reports dealing with analyses of scientific data were prepared, one of which was published. Also, various technical papers were provided the Governments of Canada and the United States including background information chiefly with respect to matters under consideration by the International North Pacific Fisheries Commission. A list of reports and technical papers prepared in 1966 is given at the end of this report.

REGULATORY PROPOSALS FOR BERING SEA IN 1967

Subsequent to the aforementioned Special Meeting the Commission advised the Governments of Canada and the United States of the proposals that it had under consideration for regulation of the halibut fishery in Bering Sea in 1967. The proposals and their objectives are given below, phrased in the terms used by the International North Pacific Fisheries Commission in its definition of halibut conservation measures for eastern Bering Sea.

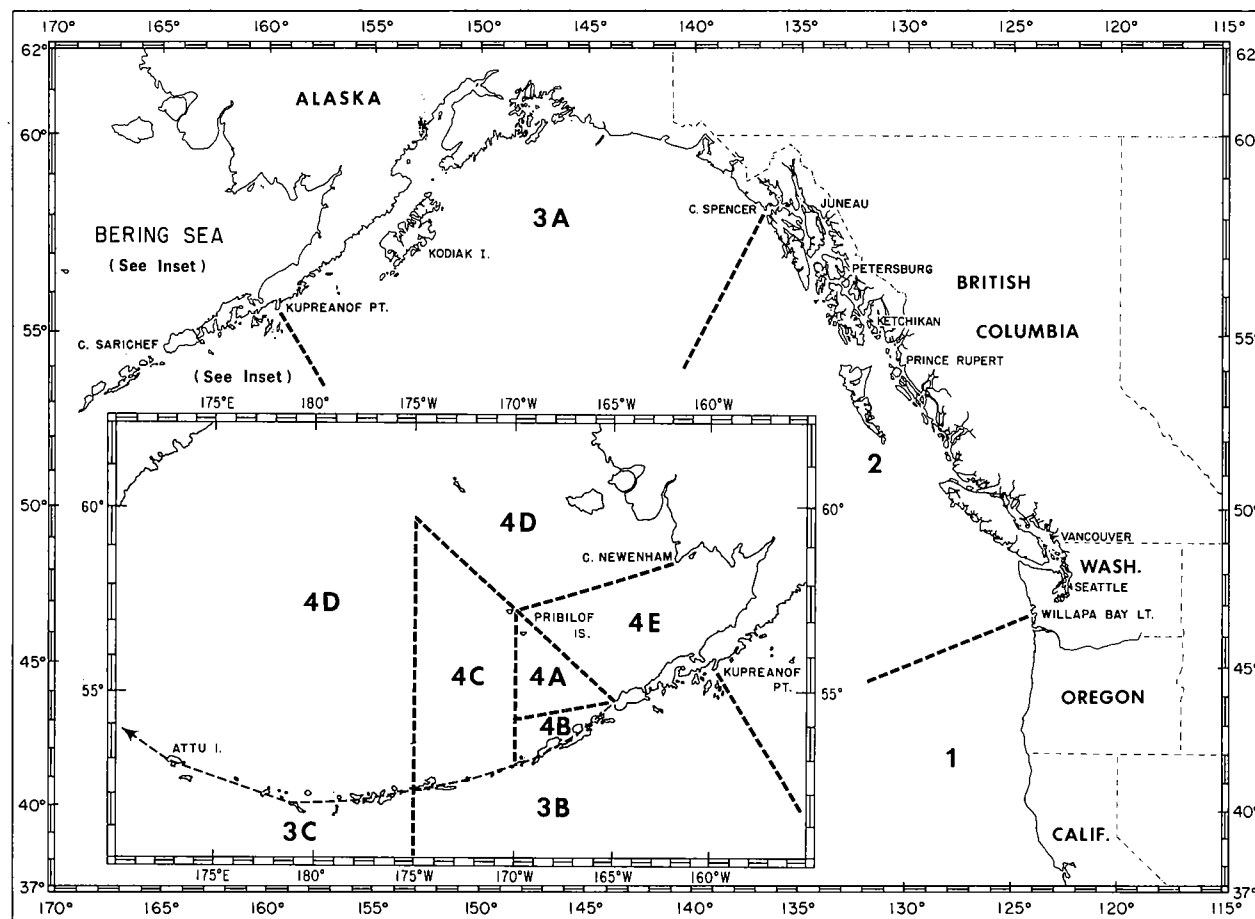


Figure 1. Pacific Coast of North America showing regulatory areas defined by the International Pacific Halibut Commission in 1966.

1. That all vessels employing any type of net gear shall return to the sea immediately any halibut captured by that gear in Bering Sea.
2. That no halibut of length less than 66 centimeters (26 inches) as measured from the tip of the lower jaw to the extreme end of the middle of the tail, or halibut which, with the head off and entrails removed, are less than 2.25 kilograms (5 pounds) in weight may be retained in Bering Sea at any time by any fishing vessel.
3. That Bering Sea be divided into the following conservation areas. The period of retention of halibut taken by longline gear is also indicated. All times mentioned in the proposals herein shall be local standard time.
 - A. Within the area designated as Area A and bounded by a line connecting Cape Navarin and the northern tip of Cape Sarichef on Unimak Island; the meridian of 170° W.; and a line connecting said northern tip of Cape Sarichef with a point on the meridian of 170° W. at 54° N.; the retention of halibut by vessels fishing with longline gear shall be permitted during a period beginning at 1500 hours on April 3, 1967 and terminating at 1800 hours on April 17, 1967.
 - B. An area designated as Area B bounded by the Aleutian Islands; the meridian of 170° W.; and a line connecting the northern tip of Cape Sarichef on Unimak Island and a point on the meridian of 170° W. at 54° N.; retention of halibut by vessels fishing with longline gear shall be permitted therein during a period beginning at 1500 hours on August 28, 1967 and terminating at 1800 hours on September 9, 1967.
 - C. An area designated as Area C bounded by the Aleutian Islands; the meridians of 175° W. and 170° W.; and a line connecting a point on the meridian of 170° W. at approximately $57^{\circ} 15'$ N. and a point on the meridian of 175° W. at approximately $59^{\circ} 42'$ N. (which line is a segment of that line connecting Cape Sarichef and Cape Navarin); retention of halibut by vessels fishing with longline gear shall be permitted therein during the period beginning at 1500 hours on March 29, 1967 and terminating at 1800 hours on April 22, 1967.
 - D. All other waters in Bering Sea, not included in Areas A, B, C or E shall be designated as Area D and shall be open for the retention of halibut by vessels fishing with longline gear during the period from 1500 hours on March 29, 1967 until 1800 hours on November 15, 1967.
 - E. An area designated as Area E, bounded on the north by a line from Cape Newenham to a point at $57^{\circ} 15'$ N., 170° W.; on the west by the eastern boundary of Area A and on the south and east by the Aleutian Islands and the Alaska Peninsula shall be closed to halibut fishing at all times.

Proposals 1 and 2 were directed to maximizing the physical yield of halibut from Bering Sea, the primary objective of both the Halibut and the North Pacific Fisheries Conventions. Size limits and the prohibition of the retention of halibut caught by trawl gear tend to minimize the taking of halibut below their optimum harvesting size. Such measures on other parts of the Pacific Coast have alleviated some of the destructive effects of trawling upon the halibut stocks and have neither impaired the effectiveness nor the development of important trawl fisheries for the other demersal species.

Proposal 3 would divide Bering Sea into five sections, A, B, C, D and E. Section A encompasses the edge grounds between Unimak Pass and the Pribilof Islands,

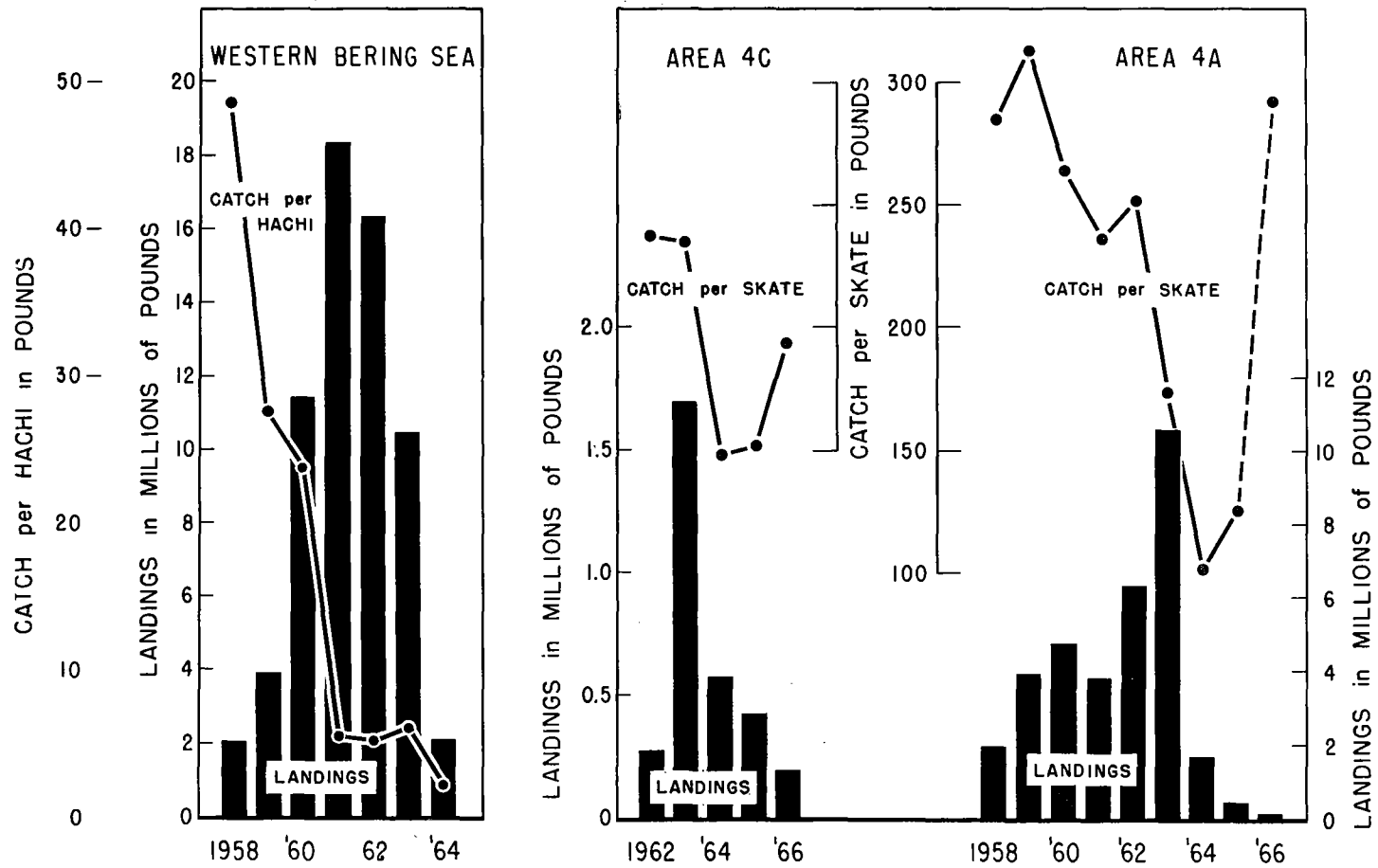


Figure 2. Total catch and catch per unit setline effort for the Japanese and North American halibut fishery by sections of Bering Sea, 1958-1966. Confidence in the level of catch per skate in Area 4A in 1966 is subject to the results of the 1967 fishery.

section B the grounds along the north shores of the Fox Islands, section C includes the grounds along the Aleutian Chain and along the 100 fathom edge in central Bering Sea lying between 170° W. and 175° W., section E is inclusive of the flats lying east of section A and south of a line between the Pribilof Islands and Cape Newenham, section D is the remainder of Bering Sea. These sections of Bering Sea are indicated in Figure 1 as Areas 4A, 4B, 4C, 4D and 4E.

Some of the foregoing proposed regulatory measures for Bering Sea in 1967 are briefly discussed below.

In section A, designated as Area 4A in Figure 1, there appears to have been some further recovery in the halibut population that had been most intensively fished from 1960 to 1962 and severely overfished in 1963. This recovery is indicated by the continued improvement in the catch per unit effort (Figure 2) and by the replenishment of older age groups (Figure 5) as a result of the reduced removals in 1964 and 1965. Several younger year classes, particularly those of 1957 and 1958, show promise of strong contribution to the available supply in the near future.

The drastically curtailed fishing periods in effect in 1965 and 1966 greatly reduced the removals and also tended to concentrate fishing upon a few grounds in the area. The slightly longer period of fishing proposed for 1967, 14 days instead of 9 in 1966 and 7 in 1965, should permit a conservative removal without jeopardizing the continuing rehabilitation of the resource, as well as providing more time for the vessels to move between adjacent grounds and assure a more adequate appraisal of the present productivity of the entire area.

In section B (Area 4B), historically the fishery was usually conducted in late summer and early fall when the availability of halibut in the area was greatest and fishing power available. The proposed increase in the period of fishing in the area from 9 days in 1966 to 12 days in 1967 would provide the fleet more latitude to fish all sections of the area and thus also produce a more representative estimate of stock conditions in the region.

In section C (Area 4C) it is proposed that the fishing period be 24 days in 1967. In 1966 the International Pacific Halibut Commission had advised the Governments of Canada and the United States that they had under consideration a 20-day fishing period for that area since the condition of the stocks and size of fleet expected in the area required a conservative approach. The 1966 conservation measures of the International North Pacific Fisheries Commission provided for a fishing period of 87 days. However, removals from this area in 1966 were not excessive primarily due to a strike which precluded entry of any United States vessels into the Area 4C fishery in 1966. In addition there was no Japanese halibut fishing in the area in 1966.

The proposed 24-day fishing period in Area 4C in 1967 is again precautionary. It anticipates normal entry of fishing effort into the region but would forestall excessive fishing by preventing North American vessels from making more than one trip into the area during the year. Restraint is required to prevent the very intensive fishing that the three countries conducted in Area 4C in 1963 or of the over-fishing that occurred in the adjoining grounds in Area 4A and in the almost exclusive Japanese fishery in western Bering Sea (Figure 2).

In section D (Area 4D) provision was made for setline halibut fishing from March 29 to November 15 in 1967 to permit some exploration of the resource in that area by North American setline gear. Despite the protracted open period, the avail-

able fishing power, economic considerations and logistics of the North American setline vessels would limit such setline fishing to very moderate levels.

Designation of the region included in section E (Area 4E) as a closed nursery ground would aid in the protection of the large population of small, immature halibut in that area.

REGULATION IN 1966

The Pacific Halibut Fishery Regulations adopted by the Commission for 1966 were approved by the President of the United States of America on March 21 and by the Governor General of Canada in Council on March 23, at which time they became effective. As in the previous three years these regulations also implemented on behalf of Canada and the United States the conservation measures recommended by the International North Pacific Fisheries Commission for eastern Bering Sea.

Significant changes in the regulations in 1966 included the designation of the Fox Islands and adjacent grounds of the Triangle area in southeastern Bering Sea as a separate regulatory area, Area 4B, to be open to fishing for a period of 9 fishing days commencing September 1; the division of Area 3B South into Areas 3B and 3C with Area 3B to be administered by a first season of 10 days of fishing commencing on April 18 and a second season commencing on May 9 with a catch limit for the combined two seasons, and with Area 3C to be open to fishing from March 25 to November 15; the provision for exploratory commercial setline fishing in Area 4D in northeastern Bering Sea east of 175° W. after June 20; and the termination of the provision for the retention of halibut taken incidentally to setline fishing for other species in areas closed to halibut fishing.

Regulation in Bering Sea east of 175°W. longitude implemented the conservation measures recommended by the International North Pacific Fisheries Commission in November 1965. They also followed the proposed regulations considered at the Special Meeting of the International Pacific Halibut Commission in October 1965 except with reference to the length of the season in Area 4C and the prohibition of the retention of trawl caught halibut in Bering Sea as a whole.

Regulatory Areas

The regulatory areas in 1966, shown in Figure 1, were as follows: Area 1 — the convention waters south of Willapa Bay, Washington; Area 2 — the waters off northern Washington, British Columbia and Southeastern Alaska between Willapa Bay and Cape Spencer, Alaska; Area 3A — the waters off Alaska between Cape Spencer and Kupreanof Point near the Shumagin Islands; Area 3B — the waters south of the Alaska Peninsula and the Aleutian Islands between Kupreanof Point and the meridian of 175° W.; Area 3C — the waters south of the Aleutian Islands and west of 175°W.; Area 4A — the waters encompassing the 100 fathom edge lying east of 170°W. and south of a line between Cape Sarichef and Cape Navarin; Area 4B — the waters along the Bering Sea side of the Aleutian Islands east of the meridian of 170°W.; Area 4C — the waters in the region south of a line between Cape Sarichef and Cape Navarin between 170°W. and 175°W.; Area 4D — all of the waters lying north of the Aleutian Islands and west of 175°W. and those waters lying east of 175°W. and north of a line between the Pribilof Islands and Cape Newenham; Area 4E — the waters in southeastern Bering Sea east of Area 4A and south of Area 4D.

The above divisions of the convention waters are defined to provide practical regulatory or management units and do not necessarily define biologically separate populations. Such management units may be opened or closed to fishing at different times to provide for an amount of fishing appropriate to the productivity of the various grounds and in recognition of the seasonal differences in availability of halibut on various sections of the coast.

Catch Limits

The catch limits in 1966 were 23,000,000, 33,000,000 and 3,500,000 pounds for Areas 2, 3A and 3B respectively. Removals from Area 1, Area 3C and the five regulatory areas in Bering Sea were controlled by providing stated time periods of fishing for each area.

Lengths of Seasons

Areas 1 and 2, which opened on May 9, were closed on August 25 by reason of attainment of the catch limit in Area 2. The fishing season of 108 days was 29 days shorter than in 1965. The shortening of the season was due to the improvement in the catch per unit effort and the increased entry of vessels from the salmon fleet.

The Area 3A season also commenced May 9 and was terminated on August 15 on attainment of the catch limit for a total fishing period of 98 days, 19 days shorter than in 1965. The shortening in this case was attributable chiefly to the increase in catch per unit effort in conjunction with a small increase in fleet size.

Area 3B opened on April 18 for 10 days' fishing, closing on April 28 as provided by the regulations. The area was reopened on May 9 and was closed on September 17 upon attainment of the catch limit which included 354,000 pounds taken during the 10-day first season. The two fishing seasons provided a 131-day total fishing period, 40 days shorter than in 1965. The shortening of the season in this area was due to first, a 500,000-pound reduction in the catch limit and an increase in catch per unit effort; and secondly, to an unpredictable withdrawal of vessels from the fishery after announcement of the closing date. Area 3C opened March 25 and closed November 15 providing a 235-day fishing season.

Area 4A, the edge portion of the former Triangle area, was opened to halibut fishing for a 9-day period without catch limit commencing on April 6 and terminating on April 15, providing two more fishing days than in 1965. This moderate relaxation was designed to provide the fleets more time to fish over a wider area and permit better evaluation of the condition of the resource without endangering the continuation of the rehabilitation process.

The newly-established Area 4B was opened to fishing during the first 10 days in September without catch limit. The grounds in this area have been most productive historically during late summer and early fall.

Areas 4C and 4E were opened for an 87-day period from March 25 to June 20 without catch limit as recommended by the International North Pacific Fisheries Commission. This period was longer than the 20-day fishing period proposed for Area 4C by the Halibut Commission in October 1965.

Area 4D was open for halibut fishing from March 25 to November 15 without catch limit. However, the portion of Area 4D lying east of 175°W. was open for an 87-day period from March 25 to June 20 without catch limit; after June 20 this region was opened until November 15 only for exploratory commercial setline fishing.

STATISTICS OF THE FISHERY

Catches by Sections of the Coast and Regulatory Areas

The landed catches of halibut in thousands of pounds for the years 1962 to 1966 are shown in Table 1. The regulatory areas indicated are those in effect during 1966 with the catches for 1962 to 1965 distributed accordingly. Estimates of the poundage taken in contravention of the regulations are included in the totals for each section of the coast. All 1966 figures in the report are preliminary.

South of Cape Spencer

In Area 1, south of Willapa Bay, the total 1966 catch was only 127,000 pounds. This area encompasses the southern limit of the halibut range, where the population of halibut is sparse.

Table 1. United States and Canadian Catches by Regulatory Areas, 1962-1966*
in Thousands of Pounds

		1962	1963	1964	1965	1966
Area 1	U.S.	312	205	142	156	127
	Canada	—	—	—	—	—
	Total	312	205	142	156	127
Area 2	U.S.	14,480	11,689	8,173	12,044	12,005
	Canada	14,183	14,462	11,437	12,350	11,520
	Total	28,663	26,151	19,610	24,394	23,525
Area 3A	U.S.	19,956	17,221	15,082	16,146	16,848
	Canada	14,652	15,752	18,052	17,551	17,622
	Total	34,608	32,973	33,134	33,697	34,470
Area 3B	U.S.	1,879	1,823	1,909	1,395	757
	Canada	2,335	2,135	2,843	2,496	2,289
	Total	4,214	3,958	4,752	3,891	3,046
Area 3C	U.S.	—	—	1	—	—
	Canada	—	—	—	—	48
	Total	—	—	1	—	48
Area 3 Total	U.S.	21,835	19,044	16,992	17,541	17,605
	Canada	16,987	17,887	20,895	20,047	19,959
	Total	38,822	36,931	37,887	37,588	37,564
BERING SEA**						
Area 4A	U.S.	3,188	3,014	875	331	—
	Canada	3,169	3,990	643	178	219
	Total	6,357	7,004	1,518	509	219
Area 4B	U.S.	246	228	24	—	141
	Canada	200	34	343	42	96
	Total	446	262	367	42	237
Area 4C	U.S.	169	21	141	258	—
	Canada	109	653	219	163	301
	Total	278	674	360	421	301
Area 4D	U.S.	119	88	29	154	419
	Canada	23	—	51	207	2
	Total	142	88	80	361	421
Area 4E	U.S.	97	1	3	2	—
	Canada	2	107	—	—	—
	Total	99	108	3	2	—
Bering Sea Total	U.S.	3,819	3,352	1,072	745	560
	Canada	3,503	4,784	1,256	590	618
	Total	7,322	8,136	2,328	1,335	1,178
Total All Areas	U.S.	40,446	34,290	26,379	30,486	30,297
	Canada	34,673	37,133	33,588	32,987	32,097
	Total	75,119	71,423	59,967	63,473	62,394

* 1966 figures are preliminary

**Not including catches by Japan

In Area 2, between Willapa Bay and Cape Spencer, the total 1966 catch was 23.5 million pounds, slightly above the 23.0-million-pound catch limit. Announcement of closure of the season in this area was made on August 15, ten days prior to the actual closure on August 25. Since the trip is the operational unit of the North American fleet it is necessary to determine and announce the date of attainment of catch limits considerably in advance of the event.

West of Cape Spencer

In Area 3A the 1966 total catch was 34.5 million pounds. Announcement of closure of the season in this area on August 15 was made on July 28 to provide the usual 18 days advance notice. The excess above the catch limit resulted largely from the better-than-expected fishing and lower than anticipated diversion of vessels into Area 3B during the last trip following the announcement of the closure date of Area 3A. Such departures from the catch limit tend to balance one another over a period of years.

In Area 3B the 1966 total catch was 3.0 million pounds, which was 500,000 pounds below the catch limit. The deficiency was, as mentioned earlier, due to an unpredictable withdrawal of vessels from the fishery after announcement of the closing date. Announcement of closure of the season in this area was made on August 30, nineteen days in advance of actual closure on September 17, 1966.

In Area 3C the 1966 total catch was 48,000 pounds. This catch was taken in late September following the closure of Area 3B.

Bering Sea

In Area 4A the total 1966 catch was 219,000 pounds, which continued the low level of removals of the past few years. Early in 1966 it appeared that about 10 Canadian and 16 United States vessels might participate in the spring fishery. However, United States vessel owners and fishermen were preoccupied with contract negotiations on crew shares which precluded any participation by that fleet; and furthermore, due to mishaps and other causes only 5 Canadian vessels fished the area.

In Area 4B the total 1966 catch was 237,000 pounds. The catch was considerably greater than in 1965 but less than the yearly removals in the period 1962 to 1964 when there was some fishing throughout most of the summer months.

In Area 4C the total 1966 catch was 301,000 pounds. As was the case in Area 4A, the spring fishery was restricted to Canadian vessels. While this reduced the removals from Area 4C, fishing results indicate that the halibut stocks in the area had well sustained the 1965 removal of 421,000 pounds.

In Area 4D the total 1966 catch was 421,000 pounds. This catch was taken largely by United States vessels fishing in the fall after the closure of Areas 3B and 4B.

In Area 4E no catches were reported in 1966.

Catch Per Unit of Fishing Effort

The Area 2 catch per unit effort off British Columbia in 1966 was slightly above the 1965 level continuing the upward trend of the last four years, but at a rate slower than expected from the present low removal levels.

The trend north of Dixon Entrance in Southeastern Alaska, which had shown a substantial increase between 1964 and 1965, turned downward in 1966. Thus the overall Area 2 catch per unit effort showed a slight decrease in 1966.

In Areas 3A and 3B the steady decline in catch per unit effort during the past several years did not continue in 1966. On all sections of the coast within these regulatory areas the catch per unit effort was higher in 1966 than in 1965, and the increase was more noticeable on the grounds between Kodiak and Shumagin Islands where during the past two years there has been a reduction in the removals.

In view of the known emigration of adult halibut from Eastern Bering Sea into the Gulf of Alaska, the effects of the large removals from the former area since 1959 and their sharp reduction since 1964 may have contributed in part to the decline and subsequent recovery in the catch per unit effort in Areas 3A and 3B.

In Area 3B despite the improvement that occurred in 1966, the catch per unit effort in the area is still below the estimated optimum level for the region and continued restraint is required in order to restore the halibut in this region to levels of higher productivity.

In southeastern Bering Sea the catch per unit effort showed continued improvement on nearly all the grounds as a result of the sharp reduction in removals in 1964 and 1965. It is indicative of the continued rehabilitation of the halibut population in the region in response to the drastic restrictions placed upon the fishery by the Halibut Commission in 1965 and 1966.

Landings by Ports

Distribution of halibut landings from all areas is shown in Table 2 according to regions and ports or groups of ports for 1966 with comparable data for 1964 and 1965.

Reduced landings in Seattle and Vancouver in recent years continued in 1966, although declines in the latter port have been offset by some increase in Canadian landings in nearby Bellingham, Washington. However, the sharp reduction in Seattle receipts was not offset by any similar increase in United States landings in other Puget Sound ports. The decline in Seattle landings was due to the reduced size of the Seattle fleet and to relative port prices which tended to increase landings in ports closer to the major fishing grounds off Alaska.

Landings in other British Columbia ports and in Alaska in 1966 were either at the level of 1965 or showed some increase. The high level of landings in Southeastern Alaska ports including Ketchikan continued in 1966 and is in part a reflection of the further increase in the number of vessels, local to the area, entering the halibut fishery. Receipts in central Alaska continued to increase over the 1964 level due mainly to the greater buying activity in that region.

Table 2. United States and Canadian Landings by Regions and Ports 1964-1966*
in Thousands of Pounds

Region or Port	1964			1965			1966		
	U.S.	Canada	Total	U.S.	Canada	Total	U.S.	Canada	Total
California and Oregon	133	—	133	157	—	157	136	—	136
Seattle, Washington	7,938	1,226	9,164	5,995	149	6,144	3,803	466	4,269
Bellingham, Washington	982	1,588	2,570	887	1,459	2,346	1,005	2,608	3,613
Other Washington	215	—	215	149	—	149	313	—	313
Vancouver, British Columbia	—	5,739	5,739	—	4,012	4,012	—	4,083	4,083
Vancouver Island	—	833	833	—	968	968	—	1,293	1,293
Prince Rupert, British Columbia	562	18,275	18,837	566	19,835	20,401	596	17,889	18,485
Other British Columbia	—	856	856	—	864	864	—	1,260	1,260
Ketchikan, Alaska	6,123	929	7,052	8,155	594	8,749	8,123	233	8,356
Other Southeastern Alaska	7,095	498	7,593	9,749	461	10,210	10,059	595	10,654
Central Alaska	3,331	3,644	6,975	4,828	4,645	9,473	6,262	3,670	9,932
Totals	26,379	33,588	59,967	30,486	32,987	63,473	30,297	32,097	62,394

*1966 Data are preliminary.

COMPOSITION OF THE CATCHES

Sampling of the catches was continued at the five major Pacific coast halibut ports of Seattle, Vancouver, Prince Rupert, Ketchikan and Petersburg. These ports receive over 75 percent of the total North American production of Pacific halibut and also provide a proportionate representation of the catch from all major fishing grounds. In addition, some sampling was conducted at Kodiak and Sand Point particularly on landings from Area 3B. Over 62,000 halibut measurements and otoliths were collected for length and age data from 246 commercial trips, including 13 trawl and 11 setline vessels sampled by observers at sea.

In addition, three vessels under charter to the Commission for tagging and recruitment investigations contributed over 15,000 measurements, including otoliths and individual identifications by sex which were not obtainable from sampling eviscerated catches as landed.

The total number of samples obtained in 1966 compares favorably with 1965 (Table 3).

Size and Age Composition

In Area 1, despite the small size of the sample, the age composition of setline catches in 1966 was similar to those observed in samples taken in Area 2 off the British Columbia coast. The proportionate contribution of the various age groups was about the same in both areas but in Area 1 each was at a much reduced level of relative abundance (Figure 3). It is noted that the ordinate scale in Figure 3 for Area 1 data is six times that used for Area 2.

Growth changes in Area 1 between the early and recent years are indicated by an increase in the average weight at each age in samples of known sex composition (Figure 4). This parallels similar historical changes recorded in Area 2 and on grounds west of Cape Spencer.

Table 3. Summary of Catch Sampling Showing Number of Trips According to Area of Origin of the Catches in 1966 and Totals for 1965

Area of Origin of Catch	Number of Trips		
	Port Sampling	Sea Sampling	Total
Cape Flattery to Cape Scott	2	4	6
Queen Charlotte Sound	25	11	36
Hecate Strait	20	1	21
Dixon Entrance and West Coast Queen Charlotte Islands	9	—	9
Southeastern Alaska	44	—	44
Total South of Cape Spencer	100	16	116
(Totals 1965)	(117)	(13)	(130)
Cape Spencer to Cape Cleare	48	—	48
Cook Inlet — Shelikof Strait	5	—	5
Portlock — Albatross Banks	40	2	42
Trinity Islands — Chirikof Island	12	—	12
Shumagin Islands and West	10	4	14
Bering Sea	7	2	9
Total West of Cape Spencer	122	8	130
(Totals 1965)	(113)	(8)	(121)
Totals Pacific Coast	222	24	246
(Totals 1965)	(230)	(21)	(251)

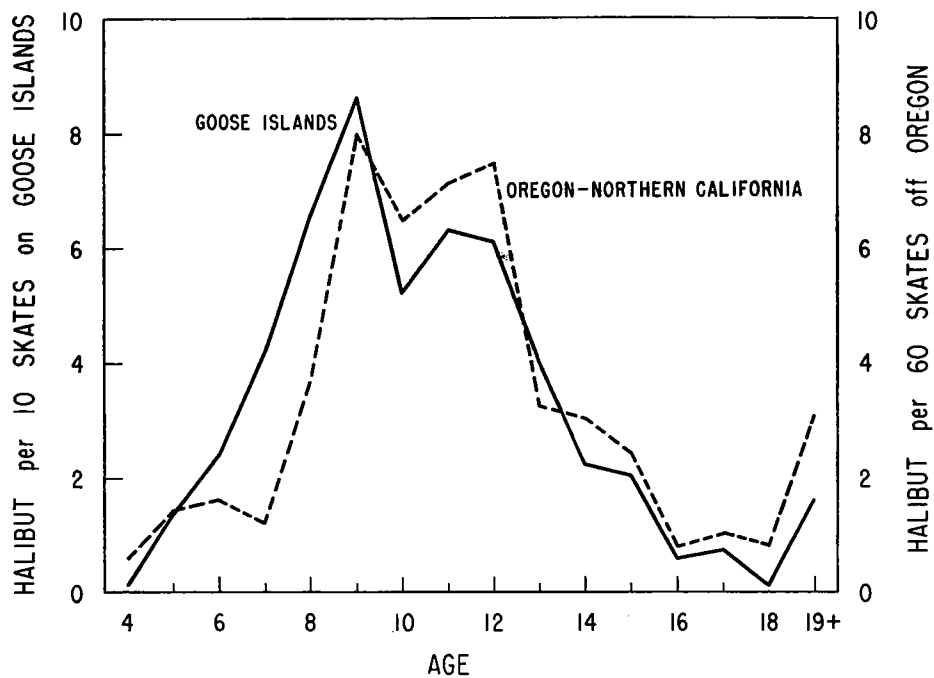


Figure 3. Number of halibut at each age caught per 10 standard units of effort on Goose Islands grounds in Area 2 and per 60 standard units off Oregon and Northern California in Area 1 in 1966.

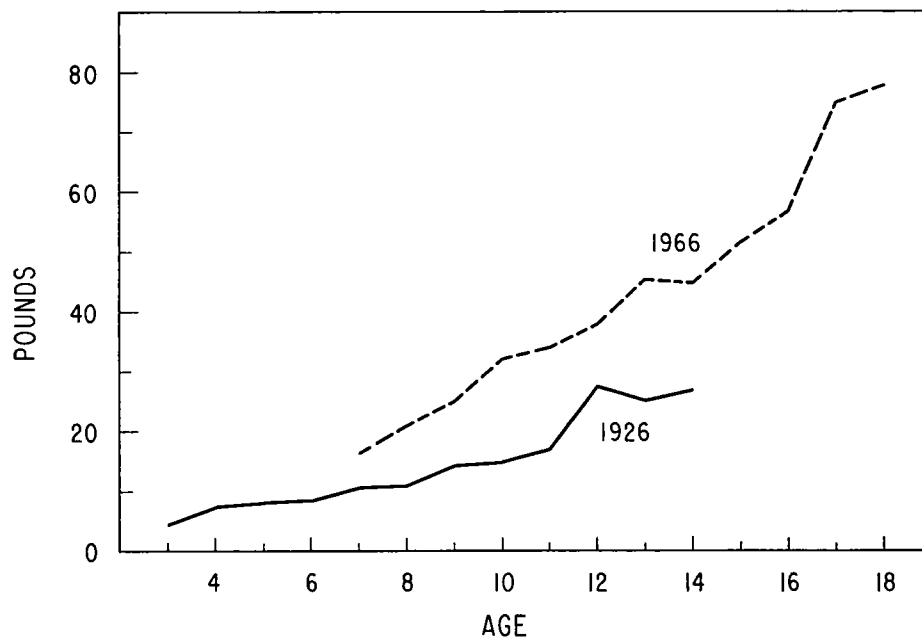


Figure 4. Average weight (pounds, heads-on eviscerated) by age for setline-caught halibut in Area 1 in 1926 and 1966.

In Area 2 the numbers of fish 14 years and older have increased significantly on the Goose Islands and Hecate Strait grounds from the low points reached in 1961 and 1962. However, the catches continued to be heavily dependent upon young fish which have also increased in abundance on all grounds since 1964, particularly the 1958 and 1961 year classes.

Seasonally in Area 2, all age groups tended to be more available in June or July than in May. The young 1961 year class, 5-year-olds in 1966, relatively unavailable on Goose Islands grounds in May, accounted for 15 percent of the weight of the catch by August although the average weight was only 10 pounds per fish.

The imbalance in the distribution of fishing between grounds off Southeastern Alaska and those in Hecate Strait appeared to be having an adverse effect upon the composition of stocks in the former region. With the continued high level of removals from Southeastern Alaska, particularly upon the inside grounds, the availability of most age groups in the catch continued to decline.

In Area 3A the improved composition noted in 1965 continued into 1966 as the decline in abundance of older fish appears to have ceased. The abundant 1955 year class was more available as 11-year-olds than was the abundant 1951 year class at the same age. It is being followed by several relatively strong classes, notably those of 1957 and 1958.

In Area 3B on the other hand, although the same classes as in Area 3A are prominent in the catches, they are leveling off prematurely. The abundance of fish over 14 years old continued to improve, primarily due to the continued numerical strength of the 1951 year class, but the 1955 year class declined prematurely in this section and the 1957 and 1958 year classes failed to show the recruitment expected at 8 and 9 years of age. The less favorable age composition in Area 3B emphasizes the continuing need for maintaining moderate removals from this area.

In southeastern Bering Sea, despite the limited data in 1966 upon which to base conclusions, improvement in stock composition noted since 1964 appeared to continue on all sections.

In Area 4A the availability of older fish, which had declined progressively from 1956 until 1964, increased in 1965 and 1966 (Figure 5). At the same time younger classes, particularly those from 1955 through 1958, continue to be important contributors to the catches. The 1958 year class appeared more abundant as 8-year-olds than any class at the same age since the 1951 year class, and alone accounted for almost 20 percent of the weight of the small catches that were taken from the Polaris ground in 1966.

In Area 4C, the grounds west of Area 4A where the fishery is confined to a limited and steep edge, catches in 1966 continued to contain a relatively high proportion of older fish compared to other sections of southeastern Bering Sea. Individuals 14 years and older contributed over 30 percent of the total number caught compared to 11 percent on the Polaris ground in Area 4A. Also, whereas the abundant 1955 year class declined slightly on the Polaris ground, it showed continued and substantial recruitment in Area 4C.

In Area 4B, the 1966 catch was heavily dependent upon relatively young fish, typical of previous observations in the area. The 1955 year class alone constituted 24 percent of the catch by number and the young 1958 class (8-year-olds) constituted 13 percent.

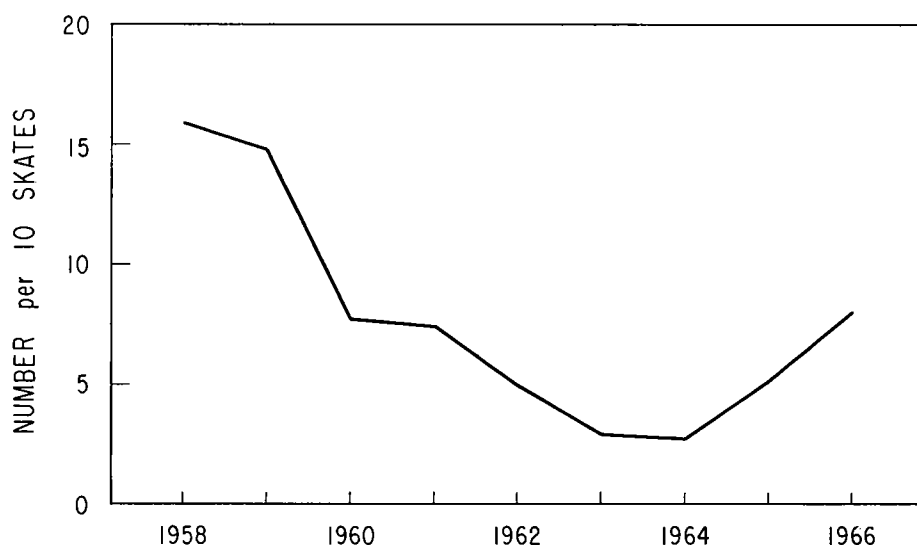


Figure 5. Number of halibut aged 14 and older caught per 10 standard skates of setline gear on the Polar ground in southeastern Bering Sea, 1958 - 1966.

TAGGING EXPERIMENTS

Tagging experiments provide information regarding the rate at which halibut on the various grounds die from natural and fishery-induced causes. In addition, they provide a means of determining the direction and extent of migration of halibut between the various regions. Such knowledge is needed to determine the degree of utilization and the inter-relationships of the various stock components.

Nearly 13,000 halibut were tagged in 1966 from three chartered vessels, the setline vessel *Chelsea*, and two trawlers, the *Don Edwards* and the *Arthur H*, which operated between Cape Mendocino in California and Nunivak Island in Bering Sea and by Commission observers on commercial trawlers. A summary of releases is shown in the following table.

Vessel	Operation	Region of Tagging	Number Tagged
CHELSEA	Summer Setline-Grid	Hecate Strait - Dixon Entrance	547
CHELSEA	Summer Setline	Hecate Strait	3,591
CHELSEA	Summer Setline	California - Oregon - Washington	182
DON EDWARDS	Trawl	Hecate Strait	772
DON EDWARDS	Recruitment Studies	Southeastern Alaska to Chirikof Island	4,418
ARTHUR H	Trawl-Grid	Bering Sea	1,624
ARTHUR H	Trawl-Grid	South of Unimak Island	349
ARTHUR H	Trawl	Chirikof Island	244
*	Commercial Trawlers	Cape Flattery to Queen Charlotte Sound	1,182
Total			12,909

* United States and Canadian commercial trawlers TORDENSKJOLD, BON ACCORD, OCEAN LEADER and SHARON M.

The setline vessel *Chelsea* was chartered for a period of 112 days and made six trips between early June and late September. During trips one, four and five severely injured halibut in the 5-to-10 pound range were tagged to ascertain the survival of fish of this size when rejected from setline gear. The first trip was on the Goose Islands grounds in Queen Charlotte Sound where fishing was conducted in conjunc-

tion with the chartered trawler *Don Edwards*. The purpose of the joint operation was to compare the size composition and the relative viability of halibut taken by setline and trawl gear.

During trips two and three a grid-tagging program, initiated in 1965 in Hecate Straits, was completed. During this second year 85 stations were fished, mainly in northern Hecate Strait and Dixon Entrance, although a few were on the west coast of Graham Island. It is expected that grid-design tagging experiments will provide mortality rates more representative of the total population than those obtained with the customary spot-tagging.

During trips four and five, halibut were tagged from catches taken on the commercial fishing grounds within the grid-tagging area, rather than on the grid of predetermined stations. The returns from these two methods of tagging will provide information required to compare the relative effectiveness of grid- and spot-tagging.

The sixth and final trip of the *Chelsea* was devoted to tagging of setline-caught halibut off Northern California, Oregon and Washington to provide information on the distribution, stock size, age composition, and mortality rates of the halibut in Area 1.

Tagging on vessels engaged in recruitment studies is described in the following section of this report.

A total of 982 recovered tags were reported during 1966, including 23 taken in previous years. This represents a substantial increase over 1965, most of which is explained by a high rate of early return of the tags released in 1966 and to some extent from the use of premium rewards. Japanese vessels reported 35 of the total 1966 recoveries. United States and Canadian vessels reported recoveries of an additional 19 tags released by Japanese research vessels which were forwarded to the Fisheries Agency of Japan.

The 1966 returns have produced some additional information on the migration of halibut tagged in Bering Sea. Three fish tagged near Nunivak Island on the northeastern flats of Bering Sea have been recovered, two on the edge grounds west of the Pribilof Islands and the third in Icy Straits in Area 2. Two tagged halibut released on the Polaris Grounds in southeastern Bering Sea were recovered by the Japanese fishery west of 180 degrees. This makes a total of three recoveries that have shown such a westward migration within Bering Sea.

Premium rewards were paid for certain preselected halibut tags returned in 1966 to test the effectiveness of present procedures for the return of recovered tags. The industry was notified that 650 tag numbers had been randomly selected for premium rewards and that \$100.00 would be paid for each of the first 12 of such tags that were turned in during 1966 by nationals of Canada or of the United States. Coincidentally, exactly 12 of such tags were reported and premium rewards paid.

A wide spectrum of the industry was represented in the recoveries. Seven of the recipients were from Washington, four from British Columbia, and one from Alaska. One premium reward tag was recovered by an otter trawler, one by a dockworker, and the remainder by setline vessels both large and small. These 12 recoveries were evenly divided between the grounds to the west and south of Cape Spencer, Alaska.

The 1966 recoveries from all past experiments exceeded the expected number based on recoveries and fishing effort in past years. While it appears that the program may have been effective in stimulating the return of recovered tags, continuation of the program is indicated in order to confirm the results.

RECRUITMENT STUDIES

Investigations of the recruitment of young halibut was expanded substantially in 1966 both in the Gulf of Alaska and in Bering Sea. The increased funds directed to this study made it possible to provide more reliable estimates of the condition of the stocks of young halibut in those two regions than has been possible heretofore. In addition, the statistical variability of the catch rates and the comparability of the fishing effectiveness of the chartered vessels was evaluated by replicate sampling on certain stations and by parallel fishing with the two vessels. In order to distinguish changes in year-class strengths due to natural conditions from those that might be caused by the expanding foreign trawl fishery in the North Pacific waters it will be necessary to conduct such recruitment investigations over a period of years. Two commercial otter trawlers were chartered in 1966 for the studies.

The *Arthur H* operated from May 16 through September 2 in the eastern Bering Sea and in the Pacific in the vicinity of Unimak Island. During the 110 days of charter the vessel made 148 hauls over about 100,000 square miles of the Bering Sea. The trawler *Don Edwards* was under charter during the period from June 1 to October 24 and operated in the Gulf of Alaska. During the 124 days of charter the vessel made 221 hauls on the established sampling grounds between Chirikof Island and Baranof Island. At about midpoint in the operations of each vessel charters were temporarily suspended for a rest and recreation period of about ten days.

Tagging has always been an important part of the recruitment studies, and during the 1966 survey over 5500 young halibut not required for age composition purposes were tagged as well as nearly 1100 viable legal-sized halibut. Although it takes several years for the small fish to become available to the commercial setline fishery, such recoveries will yield valuable information on stock relationships including that which may exist between the very large population of young halibut in southeastern Bering Sea and the adult population in the Gulf of Alaska and even in Area 2.

Inshore Areas—Southeastern Alaska and Gulf of Alaska

Sampling of selected inshore areas around the perimeter of the Gulf of Alaska that have proven to be good indicator areas for the zero-, one- and two-year-old halibut, was continued in 1966 using standard small-fish trawl of 1¼-inch codend mesh. Seventy hauls of 15 minutes duration were made at depths varying from 8 to 27 fathoms and 4,078 halibut less than 65 cm. in length were caught. The number of hauls and age composition of the halibut in the catch is summarized according to locality in the following table.

Number of Halibut Less than 65 Centimeters in Length Taken from Inshore Areas in 1966
According to Locality and Age

	Age:										Totals	Number Hauls
	0 1966	1 1965	2 1964	3 1963	4 1962	5 1961	6 1960	7 1959	8 1958	9 1957		
Shelikof Bay	12	70	114	27	45	69	6	—	—	—	343	25
Icy Straits	—	—	7	10	46	98	17	4	—	—	182	13
Cape St. Elias	881	378	386	68	21	13	—	—	—	—	1747	10
Kukak Bay	—	11	211	157	37	13	1	—	—	—	430	6
Kodiak Island	—	169	540	67	22	5	1	—	—	—	804	11
Unimak Island	—	255	104	159	40	13	1	—	—	—	572	5
Totals	893	883	1362	488	211	211	26	4	—	—	4078	70

The 1964 year class, which dominated the inshore catches as one-year-olds last year, continued to be dominant as two-year-olds. The 1961 year class, which has shown strength in all areas in the past several years, has grown to nearly legal size and migrated away from most of the inshore areas surveyed. Only on the small fish grounds in Icy Straits, which characteristically produces older fish, was this group of continued relative importance.

As in previous years a large proportion of the fish caught on the inshore stations was tagged and released for migration studies. In 1966 the tags released as a result of the inshore fishing numbered 812.

Offshore Areas—Gulf of Alaska

The expanded survey undertaken this year permitted coverage second only to the year-round trawl survey between 1961 and 1963. Groups of stations between Unimak Pass and Cape Spencer that the trawl survey had shown to possess some consistent concentrations of young halibut, were selected for study. These clusters of stations were located off Unimak Island, Chirikof Island, Cape Chiniak, Cape St. Elias and Cape Fairweather. Replicate sampling was done at certain groups of stations to measure variability between vessels, stations, areas, and seasons. In addition some areas that have not been visited since the trawl survey were sampled.

A 3½-inch-mesh West Coast trawl, identical to that used in the aforementioned trawl survey, was used, and 190 hauls of 60-minutes duration were made at depths varying from 25 to 120 fathoms. These produced 6,969 halibut of which 6,055 or approximately 87 percent, were less than 65 cm. in length.

The 1961 year class, now five years old and approaching legal size, was dominant in the catches made off Cape Fairweather and Cape St. Elias. The other grounds showed a predominance of younger fish, the three-year-olds being most important.

As was the case with the inshore areas, both sublegal and legal fish were tagged resulting in the liberation of 4,199 tags.

Number of Halibut Less than 65 Centimeters in Length Taken from Offshore Areas in 1966
According to Locality and Age

	Age:										Totals	Number Hauls
	0 1966	1 1965	2 1964	3 1963	4 1962	5 1961	6 1960	7 1959	8 1958	9 1957		
Cape Fairweather	—	—	13	130	284	380	106	28	13	2	956	64
Cape St. Elias	—	—	14	126	188	240	70	38	23	8	707	41
Trinity Islands	—	—	8	77	94	10	5	2	2	—	198	3
Chirikof Island	—	1	790	779	703	566	138	62	36	8	3083	56
Unimak Island	—	—	352	439	191	120	9	—	—	—	1111	26
Totals		1	1177	1551	1460	1316	328	130	74	18	6055	190

Bering Sea—Inshore and Offshore Grounds

The 1966 survey in southeastern Bering Sea expanded the grid pattern of fishing stations used in 1963 and 1965 in northerly and westerly direction to cover approximately 100,000 square miles.

Inshore areas along the Alaska Peninsula produced an abundance of three-year-olds with the 1961 year class still making a strong contribution to the catch. All fishing was done with the 3½-inch-mesh commercial trawls, with the exception of four hauls made inshore of the regular grid, in which the 1¼-inch-mesh small-fish trawl was used

to check on the occurrence of very young halibut. Commercial nets caught fish as small as those caught by small-mesh nets. Sixty-five hauls of one-hour duration were made on the regular inshore stations at depths of 7 to 43 fathoms.

Fishing on the offshore stations indicated a markedly different size distribution of halibut. The smaller sizes at the inshore stations became scarce and the predominant age group was the five-year-olds (1961 year class) which are now about 50 cm. (20 inches) in length and will probably not begin entering the commercial fishery in Bering Sea for another two years.

As the survey worked to the north a concentration of these larger sublegal fish, also predominantly from the abundant 1961 year class, was found in the vicinity of Nunivak Island.

Throughout Bering Sea 109 hauls were made at depths of 7 to 205 fathoms. These hauls resulted in the capture of 2,579 halibut of which 2,443 or approximately 95 percent were less than 65 cm. in length.

The tagging of 1,624 legal and sublegal halibut in this area will contribute information on the movements and subsequent contribution to the commercial fishery of the production of this vast nursery area.

The age composition of the small halibut from eastern Bering Sea is summarized below.

Number of Halibut Less than 65 Centimeters in Length Taken from Bering Sea in 1966 by Age

	Age: Year Class:	0 1966	1 1965	2 1964	3 1963	4 1962	5 1961	6 1960	7 1959	8 1958	9 1957	Totals	Number Hauls
Inshore		—	—	19	1049	387	485	54	12	—	—	2006	65
Offshore		—	—	3	33	32	245	64	25	24	11	437	44
Totals		—	—	22	1082	419	730	118	37	24	11	2443	109

PUBLICATIONS AND MANUSCRIPT REPORTS PREPARED DURING 1966

Published Reports:

Report No. 40: Regulation and Investigation of the Pacific Halibut Fishery in 1965.

Report No. 41: Loss of Tags from Pacific Halibut as Determined by Double-Tag Experiments — Richard J. Myhre.

Manuscript Reports:

Summary of Bering Sea Halibut Tagging and Recoveries Since September 1965.

Comparison of Selectivity and Effectiveness of Japanese and North American Longline Fishing Gear.

Observations on the Distribution, Age Composition and Size of Population of Young Halibut in Southeastern Bering Sea.

The Halibut Fishery, Shumagin Islands and Westward Not Including Bering Sea. Halibut Fishery South of Willapa Bay—Washington.

Sport and Personal Subsistence Catch of Halibut.