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 30

REGULATION AND INVESTIGATION OF THE PACIFIC HALIBUT FISHERY IN 1960

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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, formerly designated the International Fisheries Commission, shall publish a report of its activities and investigations from time to time.

The present report, the thirtieth published by the Commission, is the fourteenth in a series of annual reports that was begun in 1947 to provide a summary of the Commission's activities and the more significant results of its investigations during the year. Those desiring additional background information are referred to earlier reports.

REGULATION AND INVESTIGATION OF THE PACIFIC HALIBUT FISHERY IN 1960

by

INTERNATIONAL PACIFIC HALIBUT COMMISSION

CONTENTS

INTRODUCTION

The halibut fishery of Canada and the United States in the eastern Pacific Ocean and Bering Sea has been subject to investigation for thirty-five years and to management for thirty years under four successive treaties, signed in 1923, 1930, 1937 and 1953. The investigative and management functions have been performed by the International Pacific Halibut Commission and its predecessor the International Fisheries Commission, which were established and given appropriate authority by the two countries.

Under the most recent treaty, the Commission is responsible for developing the stocks of Pacific halibut to levels which will permit maximum sustained yield and for maintaining the stocks at those levels. It is authorized to apply specified types of regulation and is required to support its regulatory actions by scientific investigations.

The responsibilities of the Commission are augmented indirectly by the International Convention for the High Seas Fisheries of the North Pacific Ocean, signed in 1953 by Canada, Japan and the United States. Provisions of this treaty, under which Japan now abstains from halibut fishing off the coast of North America, require Canada and the United States not only to develop the stocks of halibut and maintain them at levels of maximum productivity but also to demonstrate that they are being fully utilized at each stage of this development.

Under regulation, the fishery which had declined to an unprofitable state has been restored to a highly profitable condition. The size of the commercial stocks has about trebled and the justifiable annual yield has been greatly increased. The total catch in 1960 was 71.9 million pounds, the highest ever taken in one year and well above the 44.2 million of 1931, the year immediately prior to regulation.

Without regulation the Pacific halibut catch would probably have now declined to an annual level of about 30 million pounds, judging by what has happened to the halibut in the northeastern Atlantic where the nature of the fishery virtually precludes any type of effective management. Over the past three decades this would have entailed a cumulative loss of yield in the Pacific halibut fishery of more than 500 million pounds, a loss of at least $99,000,000 to the fishermen at the dockside prices received during the period. This large economic gain to the fishermen would be more than trebled if computed in terms of its contribution to the combined gross national products of the two countries.

To carry out the investigation and management of the fishery the two Governments have jointly appropriated to the Commission less than $3,000,000 during the past thirty-five years. This modest investment thus has already been returned 100-fold to the people and to the economies of the two countries.

The wisdom and foresight manifested thirty-seven years ago by Canada and the United States when they first contracted for the joint scientific management of the Pacific halibut fishery have been abundantly demonstrated.

ACTIVITIES OF THE COMMISSION

In 1960 the Commission carried forward the management of the fishery and the comprehensive program of statistical and biological research which measure the effects of regulation and indicate regulatory needs as required by the Halibut Convention of 1953.

The members of the Commission from the United States in 1960 were: Mr. Andrew W. Anderson, Washington, D.C., Chairman; Mr. Mattias Madsen, Seattle, Washington; and Mr. William A. Bates, Ketchikan, Alaska. Canadian members were: Dr. William M. Sprules, Ottawa, Ontario, Vice Chairman; Mr. Harold S. Helland, Prince Rupert, British Columbia; and Mr. Richard Nelson, Vancouver, British Columbia.

The Commission held its regular annual meeting at its office and laboratory headquarters in Seattle, Washington, from February 23 to 26 inclusive. During the meeting it examined the results of regulations and investigations in 1959, considered and approved the research program for 1960, dealt with administrative and budgetary matters, conferred with industry representatives regarding the regulation of the fishery, and adopted regulations for 1960.

On February 23, a joint open meeting was held with all branches of the fishing industry to review events in the fishery and the results of investigations in 1959, and to discuss these and suggestions that had been received regarding the regulation of the fishery in 1960. On February 25 the Commission met with the Industry Advisory Group consisting of representatives of the fishermen, vessel owners and dealers in Washington, British Columbia and Alaska. On February 24 it conferred with the dealers, and on February 25 it held a meeting with the representatives of the vessel owners' and fishermen's organizations.

At the ninth and last session of the annual meeting on February 26 the Commission considered all regulatory proposals in the light of conditions within the stocks and in the industry and adopted regulations for 1960. A summary of the regulations which were being recommended to the two Governments was released the same day for the information of the industry and the public.

During the fishing season the Commission determined the dates upon which it deemed the area catch limits would be attained, announced these dates in advance and closed the areas accordingly.

Two reports were published during the year. These were a general report upon the investigation and regulation of the Pacific halibut fishery in 1959, and a technical report relative to the utilization of the stocks of halibut. Several technical memoranda were also prepared for the information of the two Governments.

THE REGULATIONS IN 1960

The Pacific Halibut Fishery Regulations, adopted by the Commission for 1960, were approved by the Governor General of Canada on March 17 and by the President of the United States on March 24 and became effective on the latter date.

There were only two significant changes in the regulations from those of 1959. The fishing grounds in the Cape Scott-Goose Islands region and in the channels of southeastern Alaska, which had been closed to halibut fishing during the second fishing season in Area 2 during 1959 to reduce the fishing intensity in them, were reopened during the second season in 1960.

The five regulatory areas in 1960, shown in Figure 1, were the same as in 1959: Area 1A, the waters off northern California and southern Oregon, south of Heceta Head, Oregon; Area 1B, the waters off Oregon and Washington between Area 1A and Willapa Bay, Washington; Area 2, the waters off Washington,

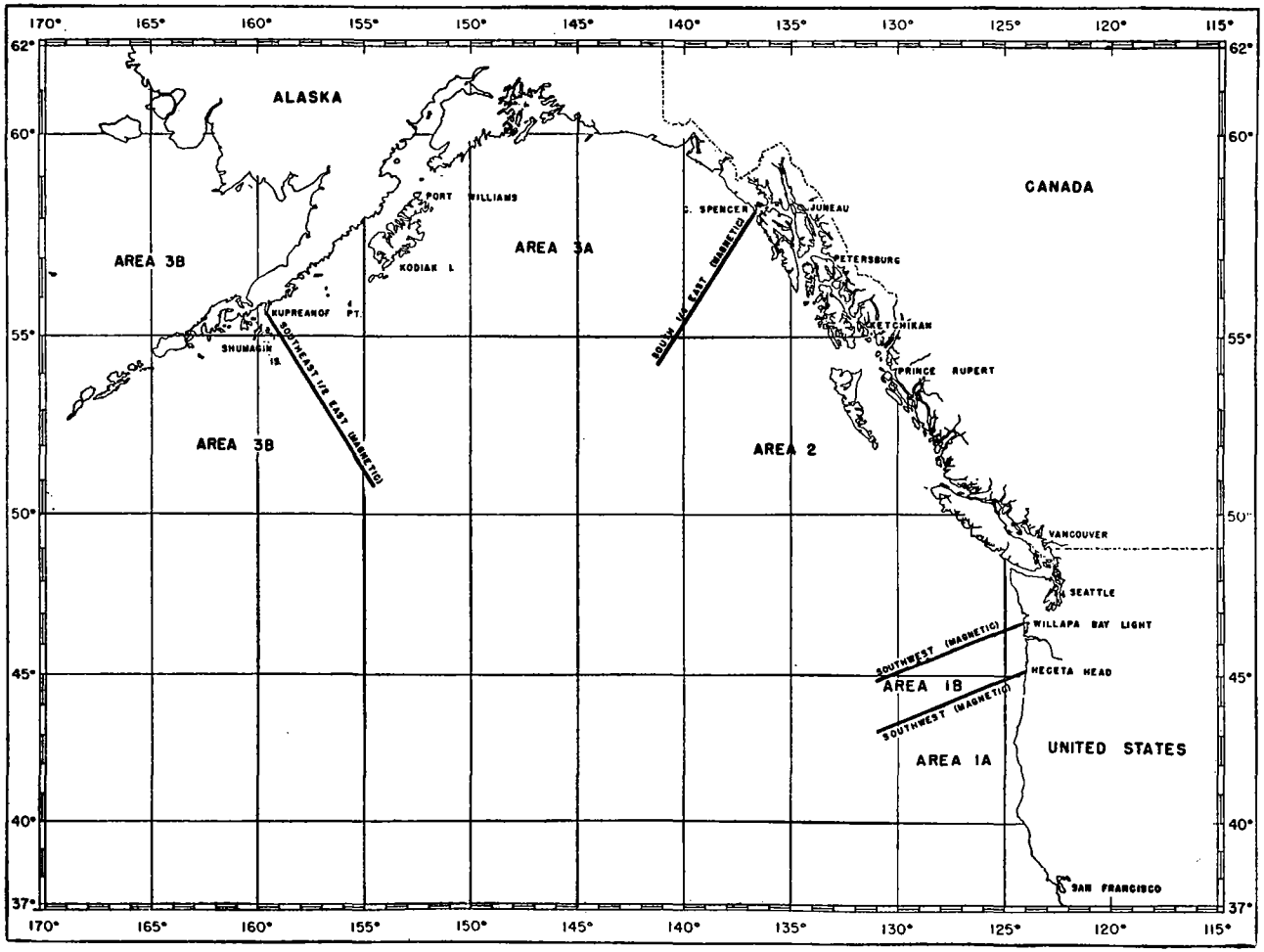

Figure 1. Pacific Coast of North America showing regulatory areas defined by the International Pacific Halibut Commission in 1960.

British Columbia and southeastern Alaska between Area 1B and Cape Spencer, Alaska; Area 3A, the waters off Alaska between Cape Spencer and Kupreanof Point, near the Shumagin Islands, Alaska; Area 3B, all convention waters west of Area 3A including those of the Bering Sea.

Catch limits of 26,500,000 pounds during the first season in Area 2 and 30,000,000 pounds during the single season in Area 3A were the same as in 1959. Fishing in other areas and other seasons was again controlled by length of season.

The following other regulatory provisions were also continued: the minimum size limit of 26 inches heads-on or five pounds heads-off for halibut; the prohibition of the use of dory gear and nets of any kind in fishing for halibut; the termination after November 15 of permits for the retention and possession of halibut caught incidentally by setline gear during fishing for other species in Areas 1A, 1B, 2, 3A and 3B; and, the beginning of the statutory closed season after November 30 in any area that might still be open by reason of the non-attainment of the catch limit which otherwise determined its closure.

The fishing season in Area 3B was opened on April 1. All other areas were opened on May 1. The first seasons in Areas 1B and 2 were terminated on July 31, following announcement of the closure date on July 22 to give the customary 8-days notice of closure. The single season in Area 3A terminated on July 25 with announcement on July 5, the customary 18 days before closure. The second season of seven days in Areas 1B and 2 commenced on September 11, and Areas 1A and 3B were closed to fishing on October 16, on the dates set in the regulations.

STATISTICS OF THE FISHERY

Landings by Regulatory Areas

Landings of halibut in thousands of pounds during 1960 are shown for groups of regulatory areas in the following table, with comparable landings for 1958 and 1959 and for 1931, the year immediately preceding the commencement of regulation by the Commission.

United States and Canadian Catches by Regulatory Areas, in Thousands of Pounds

	Areas 1A and 1B	Area 2			Areas 3A and 3B			All Areas		
Year	U.S.	U.S.	Canada	Total	U.S.	Canada	Total	U.S.	Canada	Total
1931	923	14,609	7,018	21,627	20,907	765	21,672	36,439	7,783	44,222
1958	357	15,505	15,053	30,558	20,433	13,865	34,298	36,295	28,918	65,213
1959	236	16,575	14,229	30,804	24,010	16,665	40,675	40,821	30,894	71,715
1960	309	16,723	15,086	31,809	21,318	18,527	39,845	38,350	33,613	71,963

In Areas 1A and 1B, lying south of Willapa Bay off the coasts of Oregon and northern California, the total catch has been relatively low in recent years in spite of the fact that Area 1A, south of Heceta Head, Oregon, has remained open from May to mid-October. Most of the halibut taken at this southern extreme of the range of the species are now caught incidentally during fishing for other species. Also, there has been a decline in the amount of halibut caught in the region in contravention of the regulations, conservative estimates of which are included in the catch statistics for all areas.

In Area 2 the season was further extended, and for the first time since regulation began in 1931 the closure of Area 2 occurred after that of Area 3A. In

1960 the length of the first fishing season was 91 days compared to 68 days in 1959, 59 days in 1958 and 44 days in 1957.

The extension of the season in 1960 resulted from a variety of factors. Among these were a continuation of the 8-day voluntary between-trip lay-in program of fleets which was instituted in 1956, a continuing reduction in the number of vessels in the fleet, and an increasing number of large vessels not following their customary practice of fishing in Area 2 for one or two trips before beginning operations in Area 3A. There was also some reduction in camp operations in northern British Columbia. These and other factors extended the season beyond the first week of July, by which time the vessels with a primary interest in salmon fishing terminated their activity in the halibut fishery. With only a small fleet remaining, the season was greatly extended even though a relatively small proportion of the catch limit remained to be taken.

The total catch from Area 2 in 1960 was 31.8 million pounds, about 1.1 million pounds above the average of the preceding two years.

During the first fishing season in Area 2, which commenced on May 1 and terminated July 31, the catch totaled 28,134,000 pounds, 1,634,000 pounds over the catch limit of 26.5 million pounds. In 1959 the first season catch was 1,193,000 pounds above an identical catch limit.

The catch of 3,161,000 pounds during the second season of seven days in Area 2, that commenced on September 11 and terminated September 18, was about equal to the average of the second seasons of the previous three years.

Included in the production total from Area 2 in 1960 are 514,000 pounds of halibut caught incidentally during other setline fishing, chiefly for blackcod.

In Area 3A and Area 3B, which includes Bering Sea, the combined catch totaled 39.8 million pounds, the second largest annual total taken from that region by the fishery, the all-time record being 40.7 million pounds in 1959.

In Area 3A during the single season from May 1 to July 25 the catch amounted to 29,940,000 pounds, 60,000 pounds below the 30-million-pound catch limit. In 1959 the catch exceeded the same catch limit by 256,000 pounds.

The length of the 1960 season in Area 3A was 85 days compared to 92 days in 1959 and 119 days in 1958 and 144 days in 1957. For the first time since regulation began, the season in Area 3A was shorter than that in Area 2. Though the fleet's voluntary between-trip lay-in program and some increase in the permitted catch limit have contributed to extending the Area 3A season in recent years much beyond the 58-day average from 1950 to 1953, recent additions to the Area 3A fleet and an increased effectiveness of fishing due to the use of octopus bait are having strong counteractive effects.

In Area 3B a total of 9.9 million pounds were taken in 1960 compared to 10.4 million pounds in 1959, and 4.6 million in 1958.

Of the 1960 Area 3B catch, 5.7 million pounds were taken in Bering Sea, an increase of 1.5 million pounds over the 1959 catch and nearly twice the total taken in 1958. About 4.4 million pounds or 78 percent of the Bering Sea catch were taken between April 1 and April 30 prior to the opening of Area 3A.

From the Area 3B grounds south of the Alaska Peninsula, 4.2 million pounds were landed in 1960 compared to 6.3 million pounds in 1959. The decline in catch

was due chiefly to poorer fishing. A concentration of fish off Sanak Islands that contributed a substantial yield in 1959 was not encountered in 1960, probably a result of the heavy removals in the previous year. About 75 percent of the catch from this section of Area 3B was taken subsequent to the end of July after the closure of Area 3A.

Total Pacific Coast catches from all areas in 1960 amounted to 71.9 million pounds, exceeding the previous all-time high total of 71.7 million pounds in 1959. The third highest catch, also exceeding 71 million pounds, was taken in 1954 when a second fishing season was instituted throughout Area 2 and produced a record high catch of 9.4 million pounds.

LANDINGS BY PORTS

The distribution of halibut landings in thousands of pounds from all areas is shown according to regions and ports or groups of ports for 1960 in the following table, with comparable data for 1958 and 1959.

United States and Canadian Landings by Regions and Ports in Thousands of Pounds

Ports	1958 U.S.	1958 Canada	1958 Total	1959 U.S.	1959 Canada	1959 Total	1960 U.S.	1960 Canada	1960 Total
California and Oregon	456	276	732	338	—	338	420	—	420
Seattle	15,478	1,825	17,303	17,471	2,925	20,396	15,849	2,444	18,293
Other Wash.	445	138	583	477	50	527	725	937	1,662
Vancouver, B.C.	—	5,610	5,610	—	5,609	5,609	—	8,495	8,495
Vancouver I.	—	1,705	1,705	—	1,887	1,887	—	2,160	2,160
Prince Rupert	579	14,322	14,901	318	14,388	14,706	1,063	14,670	15,733
Other B.C.	—	2,156	2,156	—	1,934	1,934	—	1,663	1,663
S.E. Alaska	15,854	1,255	17,109	17,717	1,900	19,617	15,851	720	16,571
Central Alaska	3,483	1,631	5,114	4,500	2,201	6,701	4,442	2,524	6,966
TOTALS	36,295	28,918	65,213	40,821	30,894	71,715	38,350	33,613	71,963

There was some decline in landings in the State of Washington from 1959 to 1960, but the total was still above that of 1958. The decline at Seattle was partly offset by increased receipts in other Washington ports.

Landings throughout British Columbia were appreciably higher in 1960 than in 1959 and 1958. The sharp rise which occurred in Vancouver was due to an increase in the number of Canadian vessels based at and operating out of that port. The increase in Prince Rupert was due chiefly to increased landings by United States vessels.

Landings in Alaska were lower than in 1959 but higher than in 1958. Receipts in the ports of southeastern Alaska were considerably lower than in 1959 due to a reduction in vessels operating out of them. The rising trend of landings in central Alaskan ports continued in 1960 as a result of a further increase in landings by Canadian vessels.

Canadian landings in United States ports totaled 6.6 million pounds, only slightly below the record high total of 7.1 million pounds in 1959.

MODIFICATION OF FISHING SEASONS

During the past decade the Commission has been modifying and testing various patterns of regulation with the object of obtaining such distribution and amounts of fishing as are required to obtain the maximum yield which present stocks in each section of the coast are capable of sustaining. Earlier management had succeeded in bringing the stocks in all regions to high levels of density and productivity. However, it had become apparent that the potentialities of some stocks could not be fully realized by increasing the catch within the fishing seasons then in effect and that changes in the geographic and seasonal distribution of fishing must be made.

The distribution of fishing was not a problem at the outset of regulation in 1932. Investigations throughout the commercial range of the halibut from 1925 to 1931 had shown that the stocks which produced 98 percent of the catch could be managed effectively on a broad basis by dividing the coast into two large regulatory areas, Areas 2 and 3, with a single fishing season in each.

The stock units within each large regulatory area were all in about the same condition. Though they were not equally available upon all banks at any one time nor on any one bank at all times, they were all subjected to some fishing directly or indirectly as a result of the relatively long fishing season and the movement of fish from one ground to another. Such movements were particularly important for southeastern Bering Sea, from which a high emigration of fish toward the heavily-fished grounds off central and southeastern Alaska and even off British Columbia had been demonstrated by recoveries from tagging in 1930.

This ideal condition came to a close in the 1940's as a result of a progressive shortening of the fishing season. Some of the built-up stocks in both areas were showing clear indications of being slightly overfished, others of being somewhat underfished. In Area 3, west of Cape Spencer, the increased density of the stocks made it no longer economically necessary for the fleet to extend operations to the most distant grounds.

It became evident that management must be modified to deal with each component stock according to its individual need. As this would necessitate further detailed investigations and more flexible treaty authority, it had to be deferred pending the termination of hostilities with Japan and the other Axis powers.

On the basis of investigations initiated immediately after World War II and under authority of the 1937 treaty which permitted only one fishing season in an area in one year, two small underfished sections of Area 2 were established as separate regulatory areas in 1951, 1952 and 1953 and opened to fishing for a short period at a propititious time of year after other parts of the area were closed. The far-western section of Area 3 and the Bering Sea were treated in a like manner in 1952 and 1953. Practical considerations prevented application of such measures to smaller areas with similar needs and made other types of measures, requiring broader treaty authority, necessary.

The above regulatory changes over the three years 1951 to 1953 increased production about 8.8 million pounds, 7.0 million pounds from grounds south of Cape Spencer and 1.8 million pounds from grounds west of Cape Spencer. The Bering Sea contributed nearly one-half million pounds of the latter increase.

A new convention, recommended to the two Governments by the Commission in 1946, was signed and ratified in 1953. This contained important changes from the regulatory standpoint, including authority to establish one or more open or closed seasons within a year in any area.

Since 1954 under the new convention, provision has been made from time to time and in some areas for multiple open seasons. In Area 2, the regular fishing season with catch limit has been supplemented by a short second season without catch limit to obtain fishing on grounds and segments of the stocks not utilized during the regular season.

The second-season catch in Area 2 during 1954 was large, approximately 9.4 million pounds, due to fishing on some grounds which had not been fished to any significant extent for a number of years and a high availability of fish on all grounds in Area 2 in that year. It declined in subsequent years as the accumulated stocks were reduced and the amount of fishing declined, reaching a low of 2.6 million pounds in 1959. However, the second season in Area 2 during the 1954 to 1960 period added approximately 35.8 million pounds to the catch taken under catch limits during the regular season. A considerable part of this additional poundage came from grounds and stock components which were underfished during the regular season.

Short second seasons without catch limits were also instituted in 1954 on grounds west of Cape Spencer, contained in regulatory Areas 3A and 3B, in late summer after the regular catch limit in Area 3A was taken. A third and still later season was provided in Area 3B to obtain additional fishing there after the final closure of Area 3A. These supplementary seasons were continued through 1956, in which year a voluntary between-trip lay-in program adopted by the fleets and other factors extended the first season in Area 3A over a long enough period to warrant discontinuation of second seasons in that area.

Catches taken during the second seasons in Area 3A from 1954 to 1956 totaled 6.4 million pounds. They not only increased utilization generally but also resulted in better utilization of some sections of the stocks not adequately fished during the first season.

The Area 3B catches during the second and third seasons from 1954 to 1956 totaled 2.0 million pounds and no more than maintained the level of yield obtained in 1952 and 1953 when this area was opened separately after fishing was concluded in Area 3A. It was evident from earlier experience that the stocks were capable of sustaining greater yields than were being obtained and that other measures would be required to attain the Commission's objective of full utilization of those stocks.

The second season in Area 3A was discontinued in 1957 and the annual catch limit was increased 2.0 million pounds, the average of the second-season catches during the prior three years. This maintained removals at the level which the stocks had been sustaining satisfactorily under the multiple-season method. It further increased the length of the regular season with catch limit and improved the distribution of fishing throughout the stocks accordingly. However, as was mentioned earlier, part of the gain in length of the single fishing season has since been lost due to changes in the fishery, and if continued, may necessitate re-establishment of the less desirable second season in late summer to maintain utilization of all sections of the stocks in Area 3A.

The multiple-season method of management in Area 3B, which was necessary for enforcement purposes as long as Area 3A was regulated by the same method, was also discontinued in 1957. One continuous season was provided there from May 1, when all regulatory areas were opened, until October 16. This increased the period available for fishing after more accessible Area 3A was closed and attracted some additional fishing into the area. It added about one-half million pounds to the year's catch but did not increase the yield to even near the level which the stocks seemed capable of sustaining.

Being unable to obtain sufficient fishing to fully utilize the stocks in Area 3B during the period from late spring to autumn when weather conditions are most favorable in that remote region, the Commission decided in 1958 to try the less favorable early-spring period. It opened Area 3B to fishing one month earlier than the other areas and left it open continuously until mid-October, well after the closure of Area 3A. The earlier month of fishing increased fishing significantly and was continued in 1959 and 1960. The total catch during the first month of fishing from 1958 to 1960 amounted to 9.9 million pounds.

In addition to the use of multiple seasons and differential opening dates for some areas, changes have been made in the boundary lines between some areas and the opening dates of the fishing seasons in all areas have been varied. These measures have also been effective in distributing fishing throughout the range of the species at various seasons of the year. They have contributed substantially to the balanced utilization of the various stock components and to the realization of their present productive capacities.

It is impossible to state with precision the net increase in yield that has accrued from modifications in the method of management during the past decade. However, it seems safe to say that the gain has been between 40 to 50 million pounds. Even more important is the fact that present permitted annual yields are now from 10 to 12 million pounds higher than 10 years ago and close to their sustainable maxima.

With stocks of fish at or near their levels of maximum sustainable yield, temporary local conditions of underfishing and overfishing are unavoidable. This is particularly true in the case of the halibut fishery where the longevity of the species and the nature of the fishery cause time lags in the detection of changes in the stocks and in the adjustment of utilization. Such imperfections in management are inevitable and cannot be regarded as failures to fully or properly utilize the stocks. However, they must be minimized by continuous scientific study of the stocks and the maintenance of a flexible system of regulation.

CATCH PER UNIT FISHING EFFORT

All halibut vessels of five net tons or over are required to keep records showing the date, the fishing location, the amount of gear fished and the estimated catch of halibut in pounds for each fishing operation. These records are collected and analyzed to determine the average catch per standardized unit of fishing effort in the various areas and subsections thereof and in the different seasons. The resultant returns per unit of effort are then compared with those of earlier years to ascertain whether changes in relative abundance have occurred and to measure the magnitude of such changes.

The efficiency of the gear has been increased since 1958 by octopus bait the use of which has been widespread but variable on different grounds. Corrections, subject to further adjustment as current studies of the relative efficiency of various types and combinations of bait progress, have been made in the catch per unit effort for the years and grounds affected thereby to render comparisons valid.

In Area 2 as a whole the catch per unit effort in 1960 was slightly higher than in 1959, and maintained the long-term upward trend. However, due to present higher annual catches, the trend is now only slightly upward compared to the sharp rise that occurred during the first two decades of regulation.

The catch per unit effort on the Cape Scott and Goose Islands grounds in 1960 was higher than in 1959. A sharp decline from abnormally high levels in 1953 and 1954 to a relatively low point in 1957 was clearly ended. Much of the improvement since 1957, and particularly in 1960, was contributed by young fish. For the same reason there was a similar improvement in Hecate Strait, particularly in the southern and middle portions. The inside and outside grounds of southeastern Alaska showed some decline in the catch per unit effort in 1960 but were still in line with their long-term trends.

The Area 3A catch per unit effort of the 1958, 1959 and 1960 seasons continued the stable level of the prior five years when due allowances were made for the increasing use of octopus bait.

In Area 3B, on both the Pacific side of the Alaska Peninsula and in Bering Sea, the catch per unit effort declined. Indications are that current regulations have been effective in providing sufficient fishing in this area to fully utilize present stocks.

COMPOSITION OF THE CATCHES

Continuous studies of the composition of the stocks on different grounds are required to secure information regarding the numbers of spawners and recruits and the rates of growth and mortality. Detailed knowledge of these factors and of the changes in them is essential in managing the fishery to secure the maximum justifiable yield from present stocks and to develop the stocks to the levels which will provide maximum sustainable yield in the future.

This research is based upon representative samples of length and corresponding samples of otoliths obtained from the commercial catches at the time of landing. These market samples were supplemented as frequently as possible in 1960 by samples taken at sea where data regarding sex and maturity can also be obtained before the fish are eviscerated.

The number of trips sampled in 1960 and the numbers of measurements, otoliths and sex determinations secured from the various regions by sampling in the ports of Seattle, Vancouver, Prince Rupert and Petersburg and on commercial vessels at sea are shown in the following table. An additional 13,400 measurements, including more than 4,000 with otoliths and sex data, were secured during tagging operations.

The sampling of commercial catches at sea to obtain supplementary sex and maturity data was initiated in 1960. Excellent cooperation was secured from all captains and crews who could be contacted and whose vessels possessed accommodations for an additional man. A total of 27 trips were made upon 20 different Canadian and United States halibut vessels. The volume of data secured was

Summary of Catch Sampling in 1960 showing Measurements, Otoliths and Sex Data obtained according to Area of Origin

Fishing Areas	Number of Trips						Number of Fish				
	Seattle	Van-couver	Prince Rupert	Peters-burg	Sea Sampling	Total	Measurements Only		Meas. & Otoliths	Meas. Oto's & Sex	
							Ashore	At Sea	Ashore	At Sea	Totals
Area 2											
Washington-Vancouver I.	5	—	—	—	—	5	1,192	—	595	—	1,787
Cape Scott-Goose Is.	22	—	—	—	1	23	7,737	1,008	2,738	266	11,749
Dixon Entrance	—	—	—	—	—	—	—	—	—	—	—
Hecate Strait	3	—	27	—	2	32	11,008	887	3,985	604	16,484
Southeastern Alaska	3	—	5	53	3	64	18,118	2,205	5,569	1,329	27,221
Total Area 2	33	—	32	53	6	124	38,055	4,100	12,887	2,199	57,241
Areas 3A and 3B											
Cape Spencer-Cape Cleare	1	—	4	2	—	7	2,458	—	903	—	3,361
Cook Inlet-Shelikof St.	1	—	—	—	1	2	212	367	125	276	980
Portlock-Albatross Banks	14	—	3	3	—	20	5,387	—	2,601	—	7,988
Trinity Is.-Chirikof I.	9	—	2	—	8	19	3,980	4,153	1,541	3,732	13,406
Shumagin Is. & West	15	3	—	—	12	30	4,866	5,240	2,375	3,790	16,271
Total Areas 3A & 3B	40	3	9	5	21	78	16,903	9,760	7,545	7,798	42,006
Total Areas 2, 3A & 3B	73	3	41	58	27	202	54,958	13,860	20,432	9,997	99,247

fully up to expectations for the first year. However, securing an adequate pool of vessels with necessary extra accommodations proved to be a problem, particularly for Area 2 where the vessels are generally smaller.

Despite the relative success of the sampling program, the possibility of developing some more efficient method of securing samples in which the sex of individual fish is identified, was explored. Also, a new method of obtaining measurement samples on shore, using otolith measurements in lieu of fish-length measurements, was tried with some success. If the latter proves to be effective it will permit both increased and more widespread sampling of commercial catches with little, if any, increase in field and laboratory personnel.

In the laboratory age determinations were made on 35,000 otoliths, 23,000 from the current year's samples and 12,000 from earlier years. This was the largest number of otoliths read in a single year. These and readings made in previous years were combined in studies of current and long-term changes in composition of the stocks and in associated studies of recruitment, mortality and growth.

Analysis of the compositions of the samples from the various important grounds in Area 2 continued to show the same stronger year classes in 1960 as in 1959. The availability of young fish, particularly of the 1951 and 1954 year classes, was again high throughout the 1960 season and sustained the fishery on grounds in Hecate Strait. The proportion of older fish in the catches from Hecate Strait and Goose Islands grounds was low throughout the season.

Should the high availability of the above strongly-entering year classes be sustained in subsequent years, improvement in the Area 2 fishery can be expected. However, because of the high degree of dependence on these classes by the fishery on some grounds, notably middle Hecate Strait and Goose Islands, close observation must be maintained to assure that these classes are not overexploited. The possibility of overexploitation was indicated on the Horseshoe grounds where in midsummer the 6-year-olds of the 1954 year class alone constituted 38 percent of the number of fish in the catch. Also, on the intensively-fished Two Peaks ground, which has tended to show a higher proportion of older fish than the remainder of Hecate Strait in recent years, the fishery in 1960 was dependent mainly upon young fish, with the 1951 year class alone accounting for as much as 30 percent of the weight in the early season catches.

Samples from the Masset and Timbered Islet grounds, which were formerly closed as nurseries, were very limited in 1960. None were obtained from the commercial fishery in the Masset area where 1958 and 1959 samples indicated a considerable utilization of accumulated old and large fish. Samples obtained during tagging-vessel operations in the area in 1960 indicate little difference in composition from adjacent heavily-fished grounds. Large and old fish were still being taken in some quantity from the Timbered Islet area in 1960.

On southeastern Alaska grounds, young fish also contributed a greater share of the catch than in 1958 and 1959. A previously-observed difference in the age compositions on inside and outside grounds was unchanged, the outside grounds still producing a greater proportion of older fish. In both sections the younger fish, particularly of the 1951 year class, were predominant in numbers. However, the 1954 year class, very prominent for the past three years in Hecate Strait, was still not making any substantial contribution to the catches from either the

inside or outside grounds. There is evidence that young usually appear at an older age in the commercial catches of southeastern Alaska than they do in those of Hecate Strait.

Samples from Portlock and Albatross Banks in Area 3A continued to contain good proportions of older fish. Also, the abundance of the younger age groups, which were notably strong in 1959, was continued in 1960. The 1951 year class, a major contributor to the Area 2 fishery in recent years, began to assume an increasing importance on these western grounds. No other year class has entered the Area 3A fishery as strongly at such a young age during the past two decades.

In Shelikof Strait, where young fish are usually more available than in most other sections of Area 3A, the 1951 year class was especially important, contributing more than 30 percent by number to the catches throughout the season.

The Shumagin Islands-Davidson Bank region of Area 3B also began to show a good entry of young of the strong year classes observed on Portlock and Albatross Banks. The proportion of older fish was high in early April and, after an initial reduction, appeared to change little as the season progressed until early fall when the young fish predominated. It is not yet clear whether this change was caused by a seasonal movement of older fish or was the result of a reduction in abundance due to the intensive fishery operating in the area.

On the Bering Sea edge, where there has been a substantial fishery for several years, the stock has been progressively altered to one of younger age. In April 1960, when this ground was intensively fished prior to the opening of Area 3A, nearly 84 percent of the fish were under 12 years of age. During the same month in 1959 and 1958 fish under 12 years constituted 78 and 62 percent respectively of the catches on the same ground. The stock, particularly of older fish, appears to have been substantially reduced by the current fishery.

A marked reduction in the availability of fish under 12 years and changes in the composition of the catches as the season progresses have been observed on the Bering Sea edge in 1958, 1959 and 1960. They suggest a considerable dispersion of fish from the concentrations found there in early spring. A return movement, or a replacement, of these younger fish is also indicated by a recurrence of the high level of availability of such fish in the springs of 1959 and 1960.

Observations of the sex composition of catches taken by the Commission's tagging vessel on the Bering Sea edge during 1959 showed a one-third reduction in the proportion of immature females in the catches from April to July, coinciding with an almost complete disappearance of the younger age groups from the commercial catches. Supporting the idea of a return migration of these age groups is the fact that the proportion of immature females recorded by Commission observers on commercial vessels in April 1960, was again at the same high level as in April 1959.

GROWTH STUDIES

Study of the growth of halibut, utilizing measurements of the widths of the annual zones in the otoliths to determine lengths at different ages, was carried forward intensively during the year. Data for the current year and from additional past years were added to previous accumulations. The effect of observed changes

in growth upon the stocks and upon the yields from them were studied. Exploratory work was also done upon methods of sampling the commercial catches and of determining the sex of eviscerated fish with the object of improving the quantity and quality of materials collected for growth and age-composition studies.

During 1960 the growth zones in approximately 5,000 otoliths were measured, 2,800 from Area 2 and 2,200 from Areas 3A and 3B, and the year-to-year growth of each individual was calculated. The materials used were derived from commercial landings, from commercial catches at sea and from catches by the chartered vessels engaged in tagging and in the study of pre-commercial life of the halibut.

In general, the growth studies show that the growth rates of fish on the major grounds both south and west of Cape Spencer, in Areas 2, 3A and 3B, have been similar during the past few years. The growth rate of halibut in the important Portlock-Albatross section of Area 3A, where it was low in the early 1930's, has increased and is now approximately the same as on the Goose Islands grounds in Area 2 where growth has been high for many years.

There is evidence that the year classes of fish currently entering the fishery on Goose Islands grounds may be growing faster than those which entered previously. This is suggested by the catching of an increased number of halibut less than 6 years old and is supported by direct observations of the size of the fish of each year class and by calculations of growth by the otolith-measurement method. However, due to a noticeable lack of older and larger fish in current catches and the known selectivity of halibut gear against small fish when large fish are present, acceptance of this apparent growth change must be deferred until additional years' data are available.

The possibility of using otolith samples, without corresponding length measurements, to determine the age composition and to compute the size and growth of individual fish in the commercial landings was examined extensively during the year. The agreement between the age compositions obtained by combined measurement and otolith samples and by otolith samples alone was excellent, as expected. The agreement between measured lengths and lengths computed from the otoliths was good but must be checked further to make sure that the agreement was not accidental. If samples of otoliths alone prove to be satisfactory for both growth and age-composition studies, substitution of otolith sampling for the present method, which requires both measurements and otoliths, will permit more widespread and more representative sampling of the commercial catches.

Because of the importance of being able to identify the sex of individual fish in the landed catches, which are eviscerated at sea, studies were initiated in 1958 to ascertain whether statistical relationships between various measurements of the fish and the otolith could be used in conjunction with the age of the fish to identify the sex. These were resumed in 1960 and promising results were obtained.

In one analysis of materials where sex was known and from which very large fish which are always females were excluded, 82 percent of the males and 65 percent of the females were correctly identified. In spite of the apparently low percentage of correct individual identifications, these determinations when combined showed a good agreement with the known length-sex distribution. The main region of error was with fish less than 75 centimeters in length which contribute relatively little to the total weight of the catch, but are important numerically.

TAGGING EXPERIMENTS

Tagging is conducted each year to obtain information required for the management of the halibut fishery. It is used to determine the migrations, availability, and relative utilization of the stocks on different banks in the various regions of the fishery. Experiments also provide measures of fishing and natural mortality which in conjunction with recruitment and growth determine the size and productivity of the stocks.

The halibut vessel SUNNFJORD was chartered for a period of 140 days from mid-April to early September. Eight trips were made in Area 2 and a total of 9,362 halibut, weighing 159,030 pounds, were tagged. The number tagged in 1960 was exceeded in only one prior operation. Further information regarding the operations is given below.

Summary of 1960 Tagging Experiments

Trip	Locality	Month	Skates Fished	Total Catch	No. Tagged	Pounds Tagged
1	Goose Is.	April	384	62,910	2,289	27,820
2	Masset-Freeman Pass	May	384	34,810	655	8,740
3	Hazy I.-Timbered I.	May-June	355	43,600	732	15,780
4	Cape Ommaney	June	374	58,410	464	15,490
5	Point Amelia	July	412	93,330	1,235	35,710
6	Timbered I.	July	421	77,700	1,936	31,940
7	Bowie Seamount and north end Graham I.	August	221	33,740	1,023	12,870
8	Goose Is.	August	317	27,300	1,028	10,680
	TOTALS		2,868	431,800	9,362	159,030

A total of 2,446 halibut were released with double tags to check on the loss of tags and to test the efficiency of new types of tags. Most of these were marked with a conspicuous dart-spaghetti tag of plastic in addition to the long-used strap tag of monel metal. One group of about 700 fish was marked with a conspicuous wire-spaghetti tag that should be particularly well retained. The spaghetti tags were attached either to the cheek or to the lower jaw on the white side; the strap tags, in the usual manner to the gill cover on the dark side.

Exploratory fishing was conducted on Bowie Seamount, a rocky submarine ridge which rises to within 35 fathoms of the surface at one point, approximately 105 miles southwest by south from Langara Island. A catch of 67 halibut weighing 6,660 pounds was taken on 17 skates which covered the fishable area. Viable halibut were tagged and biological data and materials were collected from those remaining.

Tagging on the Masset and Timbered Islet grounds, which were closed as nursery grounds from 1932 to 1957 inclusive, also provided information regarding the current nature of their stocks. The sizes of fish caught were not significantly different from those taken in many places in Hecate Strait and on Goose Islands grounds, indicating that the grounds cannot now be regarded as nurseries.

During three of the almost five months of vessel operations a shore station was maintained in a bay on Stephen Island, near Prince Rupert, to extend a study of the viability of tagged halibut which was conducted in 1958. Additional information was sought regarding possible injurious effects of handling and tagging, also an estimate of any short-term mortalities that might be attributable to the tagging operation. Live fish were furnished by the tagging vessel at the beginning of each trip. The fish were tagged and held in 20-foot-square live-boxes on the bottom and were observed daily for periods ranging from 14 to 78 days.

The results of this study were complicated by some unfavorable changes in environmental conditions toward the end of the experimental period. However, preliminary estimates indicate a maximum tagging mortality of not more than 10 percent, with a probable value of about 5 percent.

A total of 875 tagged fish were recovered in 1960 compared to 576 recoveries in 1959. Most of this increase was due to the recovery of 458 of the large number of tags released during 1960 in Area 2. Included in the recoveries in 1960 from the 1959 Bering Sea experiments are four made by Japanese trawlers operating in that region.

A summary of tag recoveries during 1959 and 1960 from experiments in 1957, 1958 and 1959 is given in the following table. Tags recovered during the year of tagging are omitted because they are not comparable either from experiment to experiment in that year or with recoveries in subsequent years. The "other" recoveries were made outside the fishing seasons and by trawlers throughout the year.

Tag recoveries during 1960 were generally in accord with expectations, except from experiments in Bering Sea. Only 64 of the 5,148 halibut released in Bering Sea during 1959 were recovered there in 1960 by the halibut fishery, which appears few for the first full year of fishing after tagging. Judgment regarding the significance of the low recovery must be deferred until additional years' returns are available, because the season and locations of tagging and the size of the fish caught and tagged were not the same as in previous experiments in the same region.

Normally, the number of recoveries from a tagging experiment is highest during the year following the tagging year and decreases each year thereafter due to the gradual recapture and mortality of tagged individuals. Exceptions to this rule were experiments conducted in 1930 and 1947 in Bering Sea. In the absence of a fishery in the area of tagging at the time of the 1930 and 1947 experiments, recoveries could only be made from fish that emigrated into the fishery in Areas 3A and 2. In these experiments the number of recoveries increased for four years, as long as the number of immigrants from Bering Sea exceeded the number removed by fishing and natural mortality. Subsequently, recoveries declined in the usual manner.

Assuming that the 1956 Bering Sea experiments would follow the above pattern, it was predicted that the number of recoveries would increase through the fourth year. However, the pattern of recoveries has been altered by the development of an intense fishery in Bering Sea in 1958. The numbers taken outside Bering Sea increased to the third year after tagging but declined in 1960, the fourth year. Apparently, fishing within Bering Sea reduced the number of tagged fish available for emigration to such an extent that the number of immigrants outside Bering Sea was exceeded by mortalities there one year earlier.

Recoveries within Bering Sea during the past three years from the 1956 experiments have provided first quantitative estimates of 38 percent and 40 percent annually for fishing mortality and emigration respectively. This fishing mortality rate is higher than that found in any other section of the coast and indicates a high rate of utilization of Bering Sea halibut by the present fishery in that region. The 40 percent annual rate of emigration accounts for the recovery of a high

Summary of 1959 and 1960 Tag Recoveries from 1957 to 1959 Tagging Experiments

Year and Location	Month	Number Tagged	Number of Recoveries*							
			1959				1960			
			1st**	2nd**	Other	Total	1st**	2nd**	Other	Total
SOUTH OF CAPE SPENCER										
1958 Experiments										
Frederick Sound	March-April	1,158	66	—	7	73	41	8	3	52
Chatham Strait	March-April	261	9	1	4	14	12	1	—	13
Stephens Passage	April	111	5	—	1	6	3	—	2	5
WEST OF CAPE SPENCER										
1957 Experiments										
Yakutat and "W" ground	January	504	4	—	—	4	8	—	1	9
Seward Gully	April-May	588	11	—	1	12	5	—	1	6
Cape Cleare	May	275	15	—	—	15	4	—	—	4
Cape Cleare	August-September	94	8	—	—	8	2	—	—	2
Shelikof Strait	May	1,089	23	1	2	26	22	—	—	22
Foggy Cape	June	506	2	—	—	2	19	—	—	19
Foggy Cape	July-August	539	7	—	—	7	16	—	—	16
Cook Inlet	June	748	11	—	2	13	5	—	1	6
Albatross Bank	August	328	2	—	—	2	3	—	—	3
1958 Experiments										
Marmot Bay & Kitoi Bay	May-June	222	—	—	—	—	2	—	—	2
1959 Experiments										
Bering Sea Edge	May	1,270	—	—	—	—	26	—	2	28
Bering Sea Edge	June	365	—	—	—	—	3	—	2	5
Bering Sea Edge	July	82	—	—	—	—	2	—	—	2
Makushin Bay	June	60	—	—	—	—	3	—	—	3
Makushin Bay	August	389	—	—	—	—	13	—	—	13
Slime Bank	June-July	1,907	—	—	—	—	11	—	—	11
Slime Bank	July	963	—	—	—	—	5	—	1	6

*Recoveries during the year of tagging are omitted because they are not comparable.
**Fishing seasons.

proportion of Bering Sea tags in Areas 3A and 2 and is evidence of a close relationship between the stocks in Bering Sea and those south and east of the Alaska Peninsula.

STUDIES OF HALIBUT BELOW COMMERCIAL SIZE

Scientific management of the halibut fishery requires information regarding the abundance of young and of their recruitment to the fishable stocks. Because eight to thirteen years elapse between spawning and full recruitment, a knowledge of the relationships between the number of spawners, number of young and the resultant recruits, and an understanding of the factors that affect them is also essential. To obtain such knowledge and understanding, which may provide advance information regarding the recruitment that can be expected from each spawning, investigations of the small halibut are conducted each year.

Field investigations were initiated in 1955 with exploratory fishing in Hecate Strait and Dixon Entrance off British Columbia. Exploratory fishing and systematic sampling was extended gradually to include the waters of southeastern Alaska in 1956, the Gulf of Alaska and Kodiak regions in 1957 and the Shumagin Islands in 1958. In 1959 explorations were also undertaken off the west coasts of Vancouver Island and of Graham Island.

In 1960, regions between Vancouver Island and Kodiak Island, where juvenile halibut had been found in previous years, were resampled using a chartered vessel, the COMMANDO, during a 99-day period from mid-June to late September. Sampling was intensified within the more productive of the sampling regions and was extended into deeper water. Grounds off Cape St. Elias, the Trinity Islands and the southwest coast of Kodiak Island were explored for the first time.

Otter trawls with codend meshes of 1¼ inches, identical to those used from 1957 to 1959, were the standard unit of gear. These were supplemented by trawls with codend meshes of 4¼ inches, which were employed extensively for the first time in an effort to increase the catches of larger fish below commercial size and to ascertain whether differences in mesh size affect the size composition and age composition of the catches. The larger-meshed trawls were fished in the same locations as the small-meshed ones for comparative purposes, and also in deeper waters.

Almost three times as many drags were made in 1960 as in 1959 due to a two-thirds increase in the charter period, better weather and improvements in the methods of handling gear and catches. A total of 217 drags were completed, 165 with the small-meshed trawls and 52 with those of larger mesh, in depths ranging from 5 to 64 fathoms. Ten of the drags were not usable for comparative purposes because the nets were torn and some of the catch was lost. Drags were usually 15 minutes long and covered six-tenths of a mile. However, in areas of low abundance of fish where sufficient trawlable bottom was available, the period of dragging was extended to as long as 60 minutes.

Samples of lengths and of age and growth materials were collected from the halibut, also samples of stomach contents from the halibut and other species. Temperatures at the bottom, as well as at the surface, were taken for the first time. More than 1,900 one-year-old halibut were marked by fin clipping in Alitak Bay to explore the feasibility of studying population size and migrations

by this means. Sets of comparable drags were made at a number of stations for study of the variability of samples. Seasonal variability was also explored by sampling at different times in identical locations.

A total of 11,462 small halibut from 2 to 25 inches in length and from less than one year to eight years of age were caught in 1960. Of these, 11,074 were taken in 165 drags with the small-meshed trawls and 388 in 52 drags with the larger-meshed trawls. Some commercial-sized halibut were also captured in 147 of the drags with the former and in 39 of the drags with the latter. Of the total caught 8,340 were measured, 7,630 were sexed, and 3,000 were otolithed. The number of halibut of sub-commercial size according to locality, date, depth and age are summarized in the following table.

Catches of Halibut of Sub-Commercial Size During 1960 Investigations

Location	Date	Fathoms	Age 0*	1	2	3	4	5	6	7	8	?	Total
British Columbia													
Queen Charlotte Sd.	June 18	33-47	—	—	—	—	—	1	2	2	—	—**	5
No. Hecate Strait	June 20-26	14-64	—	—	5	9	1	1	1	1	—	—	18
	Sept. 15	19-60	—	1	1	—	—	—	1	—	—	—	3
McIntyre Bay	June 26-27	6-16	—	—	—	1	1	1	2	—	—	—	5
	Sept. 14	7-36	—	—	1	—	—	—	—	1	—	—	2
Masset	Sept. 14	37-50	—	—	—	—	1	—	2	—	—	—	3
Southeastern Alaska													
Shelikof Bay	June 30-July 3	11-24	1	536	132	69	24	12	5	1	—	1	781
	Aug. 6-8	11-22	175	207	80	65	29	19	6	1	—	2	584
	Sept. 12	11-23	85	81	2	6	2	6	1	—	—	—	183
Central Alaska													
Yakutat	July 5	11-23	—	—	—	7	5	2	1	—	—	—	15
Cape St. Elias	July 6-7	16-37	—	18	16	78	29	8	11	2	2	—	164
	Aug. 3	16-21	27	5	16	233	59	26	9	1	—	1	377
	Sept. 6	16-22	12	5	15	30	—	1	1	—	—	—	64
Prince William Sd.	July 9	11-21	—	—	—	2	—	1	3	—	—	—	6
	July 31	14-21	—	—	2	21	6	1	2	—	—	—	32
Cook Inlet	July 11-13	16-30	—	468	165	72	13	11	1	—	—	—	730
	Aug. 13-14	16-21	23	282	55	12	1	1	—	—	—	—	374
Kodiak Island	July 17-26	5-43	5	2,639	461	134	22	27	5	1	—	—	3,294
	Aug. 17-Sept. 1	6-54	715	2,880	207	124	43	27	5	1	—	3	4,005
Trinity Islands	July 20	15-18	—	260	3	1	—	1	—	—	—	—	265
	Aug. 23	14-51	65	469	9	7	1	1	—	—	—	—	552
TOTAL			1,108	7,851	1,170	871	237	147	58	11	2	7	11,462

* Less than 1-year-old.
**Otoliths illegible.

The catch of fish less than one year old per standard 15-minute drag increased as the season progressed. This group was taken in depths of from 6 to 23 fathoms. In standard drags off Kodiak Island the catch of these was many times greater at stations on the northwest side than on the western end of the island some 40 miles distant. None were taken off British Columbia in 1960.

One-year-olds composed about 70 percent of the total catch as in prior years. The largest catches per standard drag were taken in the Kodiak Island area, Cook Inlet and Shelikof Bay. Fishing in Dixon Entrance and northern Hecate Strait resulted in only one capture.

Some two-year-old and older fish were taken in all regions, but only off Cape St. Elias and in Kiliuda Bay, Kodiak Island, did they constitute a significant part of the catch. The heaviest catches were made in 16 to 20 fathoms off Cape St. Elias, but in 47 to 53 fathoms in Kiliuda Bay. They seemed to be associated with heavy concentrations of food of suitable size.

The distribution of two-year-old and older sub-commercial halibut differed from that of one-year-olds and younger fish. An increase in the number of older fish and a decrease in the number of one-year-olds and younger in waters exceeding 25 fathoms in 1960 and in previous years indicate that the older groups frequent deeper water.

In the regions fished to date the older juveniles have not been sufficiently numerous to provide catches that can be used as measures of abundance, probably because of dispersion. This applies even in deeper water where the number of older juveniles is generally greater.

Attempts to increase the catches of older and larger juveniles by the use of the 4¼-inch trawls met with little success. The larger-meshed nets appeared to catch no more of the large juveniles than did the smaller-meshed nets in the few places where larger fish occurred in sufficient numbers to warrant comparisons. At the same time they caught significantly smaller numbers of the smaller juveniles when these were present. However, they had the advantage of permitting fishing in some places where debris plugged the smaller-meshed trawls and made them ineffective.

Comparisons of the relative strengths of the 1957, 1958 and 1959 year classes, as one-year-olds, in the sampling areas where one-year-olds have been found in greatest abundance show some consistency. The relative strengths of the three broods varied similarly in Cook Inlet and Alitak Bay in Area 3A. The relative strengths of the 1957 and 1959 broods in Shelikof Bay in Area 2 were not inconsistent with those in Area 3A. However, the 1958 brood was relatively stronger than the other two in Area 2 and relatively weaker in Area 3A.

Males and females occurred in the catches in about equal numbers. At ages of one, two and three years, the females were larger than the males in all regions in 1959 and in 1960. The fish of each sex and age were larger in Area 2 than in Area 3A.

The stomach contents of 2,700 small halibut, 100 adult halibut and 400 fish of other species, were examined in 1960. Analysis of stomach contents indicates that the diet of young halibut in 1960 was generally similar to that shown in other years, and that associated flatfishes feed primarily upon the same organisms as do halibut less than 6 inches long. No small halibut were found in the stomachs of older halibut and only one was found in the stomachs of other species.

Through the cooperation of the United States Fish and Wildlife Service, 1,029 length measurements and sex determinations of halibut were secured from Bering Sea. Two hundred and two were accompanied by otoliths. The halibut were caught during August in 46 of 70 one-hour otter-trawl drags between Unimak Pass and Cape Newenham in depths ranging from 17 to 69 fathoms. Of the halibut taken, 82 percent were below the minimum commercial size limit. They ranged in length from 7 to 25 inches and in age from two to eight years. Males outnumbered the females by about three to one.