

**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 45

**THE HALIBUT FISHERY, SHUMAGIN ISLANDS
AND WESTWARD NOT INCLUDING
BERING SEA**

BY

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FOREWORD

The 1953 Convention between Canada and the United States for the Preservation of the Halibut Fishery of the Northern Pacific Ocean requires that the Pacific halibut stocks be developed to those levels which will permit maximum sustainable yields and that they be maintained at those levels.

The present report reviews the development, the utilization and the management of the halibut resource on the far western sections of the grounds west of Cape Spencer not including Bering Sea.

ACKNOWLEDGMENTS

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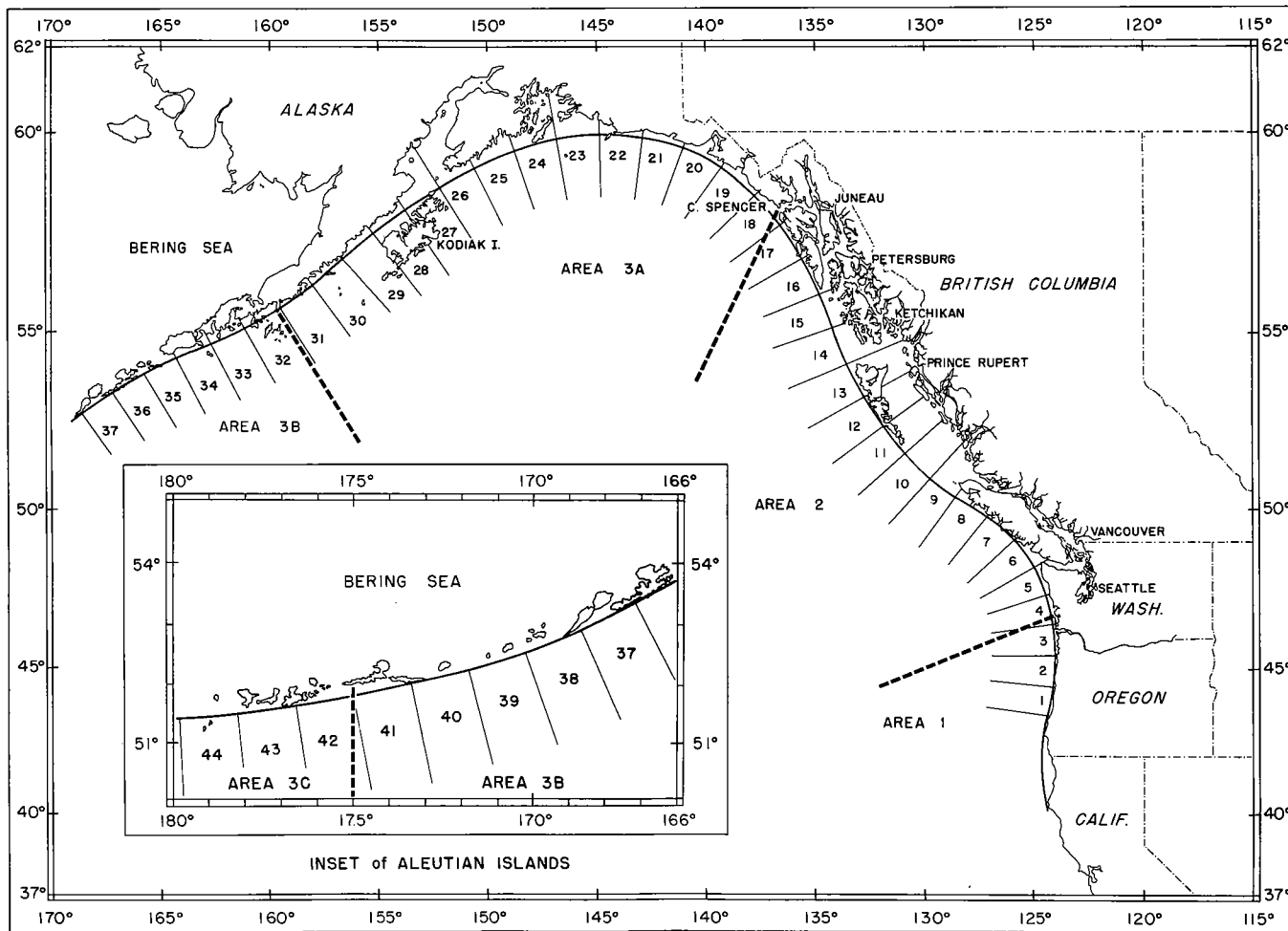
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Map of the Pacific Coast showing 60-mile statistical areas and regulatory areas for 1966 exclusive of those in Bering Sea

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INTRODUCTION

The halibut fishery described in this report includes that conducted by United States and Canadian vessels west of a line running southeast one-half east from Kupreanof Point near the Shumagin Islands and south of the Alaska Peninsula and Aleutian Islands. The region will be referred to as the far western grounds. Also various sections of the region have been referred to from time to time as Area 3B South or Area 3B in the Pacific Halibut Fishery Regulations.

This fishery, which first became of consequence in the mid-1920's, lies at the western extremity of the North American halibut fishery. The continuing decline in the stocks in the vicinity of Kodiak Island and eastward in the Gulf of Alaska and the increasing installation of the more economical diesel-powered engines in the fleet made the distant grounds near Unimak Pass and beyond relatively more attractive economically. However, even at the outset the far western region was less productive than grounds to the eastward at the same stage of their exploitation.

The scientific investigation and utilization of the halibut resource in this region and the effect of geographical location upon the regulation of the fishery in that area are reviewed in this report.

DEVELOPMENT OF THE FISHERY

Within two years after the first commercial exploitation of the halibut west of Cape Spencer in 1913, Canadian and United States vessels had extended their operations to grounds off Kodiak Island. In 1916 the United States vessel "STARR" prospected as far west as Shumagin Islands. After World War I several vessels fished the Shumagin Islands grounds and by the mid-1920's the fishery on that section of the coast had attained a production of consequence. In the late 1920's a few United States vessels also fished in Bering Sea.

Annual Canadian and United States catches from the waters off the Shumagin Islands and west not including Bering Sea since 1925 are shown in Table 1. Canadian participation in the fishery, which was of little consequence until 1956, accounted for 53 percent of the total production during the decade from 1956 to 1966.

The increase in annual yields in the region from 1925 to 1931 was part of the general westward expansion of the Pacific halibut fishery. The sharp decline in 1932 resulted from the depressed condition of the economy with low prices providing little inducement for vessels to undergo the higher financial risks of fishing on the far western grounds. Also by 1932 the catch per unit effort was not much higher than on the longer-fished grounds to the eastward.

Table 1. Landings in thousands of pounds by United States and Canadian vessels, catch per unit effort in pounds and calculated units of effort fished from grounds off Shumagin Islands and westward not including Bering Sea, 1925 - 1966.

Year	Landings			Catch Per Unit Effort	Calculated Units of Effort
	United States	Canadian	Total		
1925	261	—	261	82	3200
1926	596	—	596	91	6500
1927	1813	—	1813	100	18100
1928	1244	—	1244	79	15700
1929	2076	—	2076	74	28200
1930	2475	—	2475	82	30100
1931	2594	—	2594	77	33800
1932	976	—	976	84	11600
1933	410	—	410	78	5300
1934	198	—	198	90	2200
1935	143	—	143	104	1400
1936	147	—	147	109	1400
1937	317	—	317	147	2200
1938	321	—	321	149	2200
1939	278	—	278	157	1800
1940	569	—	569	160	3600
1941	519	—	519	201	2600
1942	47	—	47	242	200
1943	1615	—	1615	211	7700
1944	2227	—	2227	163	13700
1945	3188	11	3199	152	21000
1946	3491	65	3556	152	23400
1947	1609	148	1757	149	11800
1948	2877	166	3043	139	21900
1949	2191	55	2246	115	19500
1950	2128	83	2211	126	17500
1951	1016	—	1016	107	9500
1952	1224	69	1293	102	12600
1953	1038	270	1308	155	8500
1954	792	125	917	147	6200
1955	1614	157	1771	154	11500
1956	377	236	613	138	4400
1957	1113	239	1352	134	10100
1958	920	1471	2391	140	17100
1959	3645	2616	6261	152	41200
1960	1587	2651	4238	112	38000
1961	1520	1024	2544	125	20400
1962	1879	2335	4214	118	35700
1963	1823	2135	3958	111	35800
1964	1910	2843	4753	102	46800
1965	1395	2496	3891	87	44500
1966*	757	2337	3094	97	31900

*Preliminary data.

Tagging experiments in the late 1920's demonstrated that the halibut on the Shumagin Islands grounds and westward were also exploited during their winter migration to the then heavily-fished spawning grounds to the eastward (IFC Rept. No. 2, 1930).

During the subsequent decade from 1933 to 1942 annual catches averaged about 300,000 pounds annually for a combined 10-year total of only 3.0 million pounds. The decline in removals was largely due to the rebuilding of the stocks on the more accessible grounds to the eastward and to other causes reviewed later in this report.

There was a rapid buildup of the stocks of halibut as indicated by the rise in the catch per unit effort (Figure 1). This was due to the greatly reduced fishery within the far western region, coupled with the reduction and cessation of

the late fall, winter and early spring fishery in the eastern section of the grounds west of Cape Spencer. This fishery had previously drawn upon the far western fish during their sojourn on the spawning grounds to the eastward. Tagging experiments have shown that summer fishing in the eastern sector did not draw upon the far western population to the same degree.

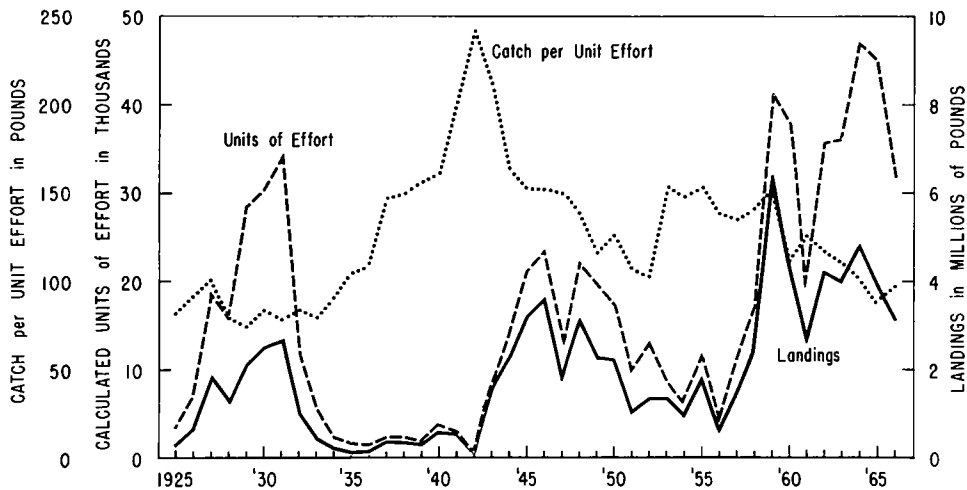


Figure 1. Catch, units of fishing effort and catch per unit effort Shumagin Islands and westward not including Bering Sea, 1925 to 1966.

The harvesting of the accumulation was impeded and delayed by World War II. For a time during the war the area was closed to fishing for national defence reasons. It was not until 1943 that any significant number of vessels returned to the far western grounds. Operations in the area were further enhanced by the opening in 1948 of a cold storage and supply base in the region and a generally improved price level for halibut. From 1943 to 1950 catches averaged 2.5 million pounds annually, and in 1945 and 1946 reached 3.5 million pounds.

However, with the reduction in the accumulation by the late 1940's the fleet again concentrated its activity on the grounds to the eastward. Although some of the factors that had occasioned the same shift in the early 1930's were no longer operative, the process was now furthered by a shortening of the legal fishing season west of Cape Spencer. The regulatory area west of Cape Spencer (Area 3A) was being closed to fishing prior to the period of the year when halibut were most available on the far western grounds and when most of the fishery was normally conducted thereon.

Control measures permitted under the 1937 Halibut Convention were put into effect in 1952 but failed to secure the desired result. The removal objective for the region was about 3.5 to 4.0 million pounds based upon what had been taken in the region in the past and in view of a higher growth rate. Under the 1953 Halibut Convention more effective measures were possible, but the results were also less than desired and production between 1951 and 1957 remained at an average of about 1.2 million pounds annually.

With the availability of improved sea and air enforcement systems the use of different opening or closing dates than in the remainder of the region west of Cape Spencer became feasible. In 1958, by adjusting the opening date and the length of the fishing periods in the region, annual yields were increased. From 1958 to 1963 inclusive the catch averaged 3.9 million pounds annually. While such a catch level was slightly higher than the maximum taken in the mid-1940's, it was justified by the higher growth rate. In 1964 and 1965 catch limits were used for reasons indicated under the section in this report on Management in the Region.

During the 8-year period 1958 to 1965 inclusive, the annual removals were held at an average of about 4 million pounds which, when combined with the catch from the remainder of the Gulf of Alaska, provided a total removal of about 38.0 million pounds, the best estimate at that time of the maximum sustainable yield for the halibut population west of Cape Spencer not including Bering Sea (IPHC Rept. No. 31, 1962).

However, the continuing decline in the catch per unit effort suggested that 38.0 million pounds was slightly higher than what could be sustained under present environmental conditions. It was decided to reduce the total removal west of Cape Spencer in 1966 by 1.5 million pounds, of which 1.0 million pounds was to be removed from production of the grounds between Cape Spencer and the Shumagin Islands, currently described as Area 3A, and 0.5 million from the production from Shumagin Islands grounds and west, presently identified as Area 3B. The 12 percent reduction in catch limit on the far western section was higher than the 3 percent provided for the area between Cape Spencer and the Shumagin Islands because the rate of decline in the catch per unit effort in the former section was greater.

Accordingly, in 1966 the catch limit in Area 3B was reduced from 4.0 to 3.5 million pounds, part of which was to be taken during a stated fishing period of ten days in the spring and the remainder in a second season commencing with the opening of grounds to the eastward, Areas 3A and 2, and terminating upon attainment of the 3.5 million pound catch limit.

LENGTHS OF THE FISHING SEASONS

The effective lengths and the effective opening and closing dates of the fishing season or seasons on the far western grounds from 1929 to 1966 are shown in Table 2. The years are indicated during which there was some circumstance that resulted in fishing not commencing on the legal opening date. Also, due to boundary changes the opening and closing dates do not apply to exactly the same geographical area throughout the period.

It will be noted that multiple seasons have been applied in the area at various times. However, in 1952 and 1953 prior to the conclusion of the 1953 Convention which provided for multiple fishing seasons in an area in any one year, the far western grounds were closed during the regular season and were opened for a short season in the late summer after the closure of the remainder of the area west of Cape Spencer.

Table 2. Effective opening and closing dates and effective length of fishing seasons in days on the far western grounds as included within the regions shown, 1929 - 1966.

Year	Opening Date Month Day	Closing Date Month Day	Length in Days	Region Included
1929	2-16	11-15	273	Coastwise winter closed season.
1930	3-1*	11-15	260	
1931	3-2*	10-31	244	
1932	2-16	10-30	257	Included in the region west of Cape Spencer to Cape Sagak, Umnak Island (Area 3).
1933	2-1	10-26	268	
1934	3-1	10-27	241	
1935	4-1*	12-26	270	
1936	3-16	11-3	233	
1937	3-16	10-19	218	
1938	4-1	10-29	212	
1939	4-1	10-28	211	
1940	4-1	9-26	179	
1941	4-1	9-14	167	
1942	4-16	9-25	163	
1943	4-16	9-8	146	
1944	5-20*	11-30	195	
1945	5-1	9-24	147	
1946	5-1	8-19	111	
1947	5-1	8-17	109	Included in the region west of Cape Spencer including Bering Sea south of Cape Sarichef (Area 3).
1948	5-1	7-11	72	
1949	5-1	7-12	73	
1950	5-1	7-5	66	
1951	5-1	6-25	56	
1952	8-2	8-18	17	Sanak Is. and west including Bering Sea south of Cape Sarichef.
1953	8-5	8-29	25	
1954	5-16	7-12	58	Sanak Is. and west including all of Bering Sea.
	8-1	8-10	10	
	8-15	9-9	26	
1955	5-12	8-4	84	Shumagin Islands and west including all of Bering Sea.
	8-14	8-23	9	
	8-29	9-21	23	
1956	5-20*	8-24	96	
	9-9	9-18	9	
	9-30	10-23	23	
1957	5-1	10-16	168	
1958	4-1	10-16	198	
1959	4-1	10-16	198	
1960	4-1	10-16	198	
1961	4-25	10-1	159	
1962	4-19	9-30	164	
1963	4-19	10-15	179	Shumagin Is. and west not including Bering Sea (after June 1963).
1964	4-6	10-15	192	
1965	4-12	9-30	171	
1966	4-18	4-28	10	Shumagin Is. to 175° E. not including Bering Sea (Area 3B).
	5-9	9-17	131	

*1930 legal opening February 16 — voluntary delay by fleets.
 1931 legal opening February 16 — strike tie-up.
 1935 legal opening March 1 — voluntary delay by fleets.
 1944 legal opening April 16 — wartime prices dispute delay.
 1956 legal opening May 12 — voluntary delay by fleets.

SEASONAL DISTRIBUTION OF THE FISHERY

When the region was a part of the large regulatory area west of Cape Spencer and the open fishing season extended into the later months of the year, most of the fishing on the far western grounds not including Bering Sea was conducted in the late summer and early fall months (Table 3).

Table 3. Landings of halibut in thousands of pounds by Canadian and United States vessels for each 60-mile statistical area from the Shumagin Islands, statistical area 32, and westward not including Bering Sea by months, 1958 to 1965 inclusive, and from all grounds Shumagin Islands and westward not including Bering Sea in 1929 to 1931 combined.

Area of Origin	Year	April	May	June	July	Aug.	Sept.	Oct.	Year	April	May	June	July	Aug.	Sept.	Oct.	
All 60-mile Areas Combined	1929-1931	353	744	1023	1161	1677	887	569									
60-mile Areas									60-mile Areas								
32	1958	448	170	23	220	265	634	479	33	1958	75	—	—	—	12	—	49
	1959	542	17	5	482	769	1277	687		1959	61	—	—	72	585	281	109
	1960	749	52	63	152	429	830	398		1960	—	—	—	—	166	327	67
	1961	36	537	—	24	85	505	295		1961	—	—	34	—	108	393	147
	1962	—	537	79	38	626	262	90		1962	—	35	—	7	451	218	16
	1963	15	837	18	118	445	177	169		1963	1	484	30	83	137	410	171
	1964	666	140	154	358	126	447	253		1964	283	31	19	115	224	549	594
	1965	617	30	87	197	45	457	271		1965	392	—	2	133	211	176	380
34	1958	13	—	—	—	—	—	—	35	1958	—	—	—	—	—	—	—
	1959	—	—	—	131	491	527	74		1959	—	—	—	79	—	37	24
	1960	45	—	—	14	187	476	30		1960	—	—	—	—	—	41	—
	1961	—	—	—	—	43	128	107		1961	—	—	—	—	—	13	—
	1962	—	102	10	36	93	148	172		1962	—	28	—	49	—	112	90
	1963	1	43	—	—	25	64	93		1963	—	25	—	—	38	17	129
	1964	174	—	3	95	74	85	68		1964	—	—	—	—	12	—	—
	1965	8	—	—	46	104	89	101		1965	2	—	—	4	11	4	—
36	1958	2	—	—	—	—	—	—	37	1958	—	—	—	—	—	—	—
	1959	—	—	—	—	11	—	—		1959	—	—	—	—	—	—	—
	1960	33	—	—	—	—	106	—		1960	—	—	—	—	—	57	—
	1961	—	—	—	—	—	63	—		1961	—	—	—	—	3	23	—
	1962	—	—	—	—	20	375	128		1962	—	—	—	—	—	96	162
	1963	7	76	—	—	8	181	54		1963	—	—	—	—	—	20	—
	1964	24	—	7	19	6	13	40		1964	10	—	9	15	—	—	—
	1965	1	—	—	3	—	133	102		1965	19	—	—	4	89	138	34
38	1958	—	—	—	—	—	—	—	39	1963	—	—	—	—	—	—	63
	1959	—	—	—	—	—	—	—		1959	—	—	—	—	—	—	—
	1960	—	—	—	—	—	—	—	40	1960	—	—	—	—	—	—	7
	1961	—	—	—	—	—	—	—		1961	—	—	—	—	—	—	—
	1962	—	—	—	—	—	187	27	41	1960	—	—	—	—	—	—	10
	1963	—	11	—	—	8	—	—		1962	—	—	—	—	—	—	20
	1964	—	—	—	70	69	—	—		1964	—	—	—	—	—	—	—
	1965	—	—	—	1	—	—	—	42	1964	—	—	—	—	—	—	1

This was a propitious season of the year as the weather was usually favorable and on the average it was the period of better availability of halibut in the region. Also by late summer the annual accumulations on the grounds to the eastward had been removed by the fleet which increased the relative attractiveness of fishing on the far western grounds.

During recent years the seasonal distribution of fishing in the region has in large measure been controlled by maintaining an appropriate sequence of fishing periods in various regulatory areas to attract and maintain the desired amount of fishing effort in each at the most desirable time of year. On the far western grounds efforts have been made to maintain the seasonal pattern of the early fishery and most of the yield has been taken during the late summer and early fall period (Table 3).

Since 1958 with the development of a spring fishery in eastern Bering Sea and the need to provide a sequence of operations to secure the optimum level and timing of fishing in each regulatory area, the far western grounds were opened in the spring and provision was made to take part of the desired annual removal at that time. The spring fishery has accounted for about 23 percent of the total catch from 1958 to 1965 inclusive. In 1966 the spring fishery was restricted to 10 days to assure that an appropriate proportion of a desired reduction in the annual removal from the region would be borne by the spring fishery.

STOCK RELATIONSHIPS

The halibut on the grounds off Shumagin Islands and westward have always been regarded as an integral portion of the population complex west of Cape Spencer. During the 40 years that the Pacific halibut has been under intensive study by Canada and United States, it has been the consistent view of the Commission that the halibut on the far western grounds are no more segregated from the remainder of the main population west of Cape Spencer than is the case with the halibut on any other section of that region. There has been no evidence to indicate otherwise.

Thirty-five years ago it was stated that—

“The western banks from areas 19 to 36 show a distinct similarity in their decline. This indicates unmistakably the correctness of the results from marking experiments, which have proved that the stock of mature fish on these grounds migrates freely along the long coast line. It will also be noted that although areas 29 to 36 are the most recently exploited, the level of abundance at the time the record begins was practically the same as that of the areas east, 19 to 28. This would indicate that the stock on the far western grounds was actually being utilized whenever areas 19 to 23 were fished. The stock on areas 19 to 36 is therefore practically a unit as far as the commercial sizes are concerned.” (Report No. 6, IFC 1931, pg. 63).

The marking experiments referred to in the above quotation were those conducted in 1926 and 1927 in the winter on the spawning grounds between Cape Spencer and Cape St. Elias. Recoveries from such winter tagging were

made from grounds as far west as Unimak Pass (Table 4, Figure 2), and it was concluded—

“that an extensive free interchange of mature stock occurs from the eastern side of the Gulf of Alaska as far as Unimak Pass and perhaps beyond.” (Report No. 2, IFC 1930, pg. 108).

The hypotheses expressed in the foregoing excerpts from early reports of the Commission have been without exception sustained by repeated tagging and other studies during the subsequent 35 years, and during that period the halibut population west of Cape Spencer has been managed with such findings as a basis.

Further winter tagging was conducted in 1927 on Portlock Bank off Kodiak Island and the dominant direction of migration was again to the westward with individuals being taken as far westward as Unalaska Island (Table 5, Figure 3).

In contrast to the westward movement from the winter spawning grounds, dispersion in the opposite direction was first illustrated by returns from 928 halibut tagged off Shumagin Islands in April-May of 1929 (Table 6, Figure 4). The predominant movement was easterly and extended as far as the north end of Vancouver Island, British Columbia.

A similar experiment was repeated in 1956 when 1,394 halibut were tagged in the vicinity of Shumagin Islands in the months of May, July and September. The distribution of recoveries is given in Table 7 and Figure 5. The same pronounced easterly dispersion was observed similar to what was shown in the 1929 experiment, and extended as far as the coast of Washington State.

Between December 1963 and February 1964 tagging was conducted on grounds in the western section of Area 3A and in the eastern portion of Area 3B. Although the recovery period is only in its third year the results to date, as shown in the following table, indicate a similarity of interchange in the two experiments.

Recoveries to September 1966 of halibut tagged in the winter of 1963-1964 according to the area of tagging

Regulatory Area of Tagging	Number Tagged	Recoveries by Regulatory Area of Recovery			Total Recovered	
		3B	3A	2	Number	Percentage
3B	386	21	8	2	31	8
3A	428	10	14	2	26	6

The recovery rates for the first two full recovery years are relatively high for winter tagging in both areas. Also, both experiments exhibit the same tendency for some recoveries to be taken in Area 2 as in the case of non-winter experiments.

Further tagging experiments were conducted in the region in 1965 when 1,689 halibut were tagged from May to August between the Shumagin Islands and 170° W. longitude. The first full year of recoveries (Table 10) shows the same wide easterly dispersion as did the 1929 and 1956 summer experiments.

Table 4. Distribution of recoveries from 1748 halibut tagged off Yakutat (areas 20 and 21) in November and December 1926.

Year	Regulatory and Statistical Area of Recovery																	Unknown	Total				
	Bering Sea			Area 3B			Area 3A						Area 2							Area 1			
	36 37	34 35	32 33	36 37	34 35	32 33	30 31	28 29	26 27	24 25	22 23	20 21	18 _w 19	17 18 _s	15 16	13 14	11 12			9 10	7 8	5 6	<5
1927						6	7	11	13	20	21	24	13	1	4	1	2	1		1	1	11	137
1928					1	2	3	12	9	13	6	18	12	2	1		2					5	86
1929						2	3	9	14	14	6	9	4	1								1	63
1930						2	2	5	2	9	2	3	8					1				3	37
1931				1	3	1	6	3		4	1	2	4	1	1							2	29
1932							3	1	1		2												7
1933						1	1		1	1		3	1										8
1934							2	1													1		4
1935							1		1														2
1936							3					1											4
1937							1																1
1938																							0
1939																							0
1940										1													1
Total				1	4	14	23	49	42	63	36	62	42	1	8	3	2	4		1	1	23	379

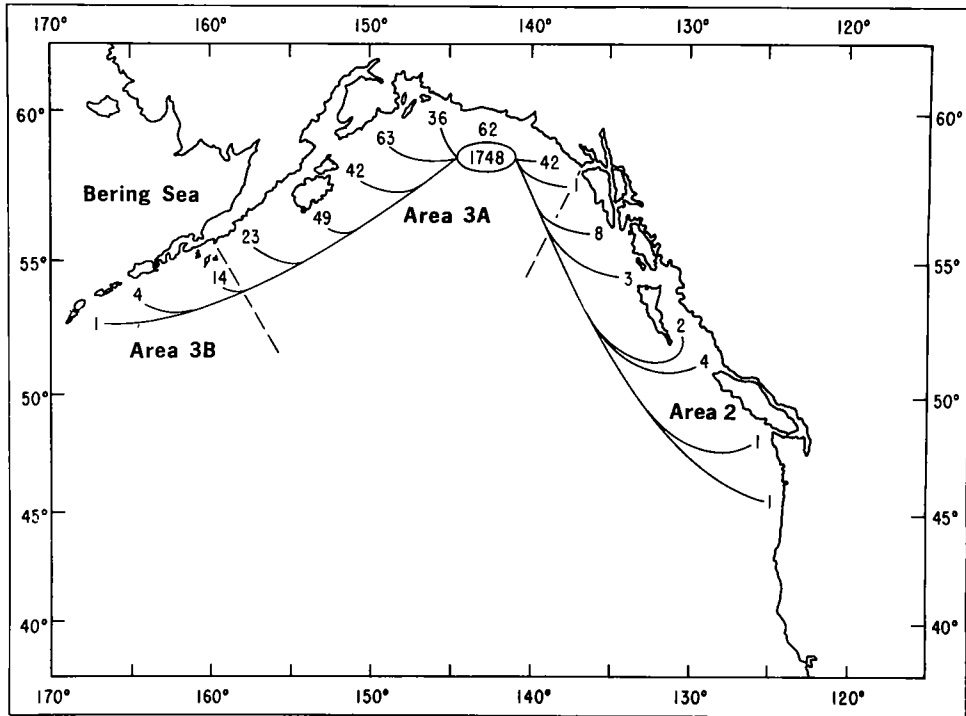


Figure 2. Distribution of recoveries from 1748 halibut tagged off Yakutat in November and December 1926.

Table 5. Distribution of recoveries from 1165 halibut tagged on Portlock Bank (Area 25) in November 1927.

Year	Regulatory and Statistical Area of Recovery																Unknown	Total				
	Bering Sea			Area 3B			Area 3A						Area 2									
	36 37	34 35	32 33	36 37	34 35	32 33	30 31	28 29	26 27	24 25	22 23	20 21	18 _w 19	17 18 _s	15 16	13 14			11 12	9 10	7 8	5 6
1928				1	3		3	10	30	42	1	1		1		1					3	96
1929						3	5	13	22	26	3	1		1	1			1			3	79
1930				2	1		6	3	6	9	1	1						2			3	34
1931					2		1	4	3	3											1	14
1932								3	1	3												7
1933								3	4	3					1					1	1	13
1934									2	2												4
1935							1	1	1	1												4
1936								1		1												2
1937								1														1
1939																					1	1
1942												1										1
Total				2	4	6	16	39	70	90	5	3		2	1	2		3	1		12	256
Unknown																					1*	1
Grand Total				2	4	6	16	39	70	90	5	3		2	1	2		3	1		13	257

*1930 - 32 Recovery

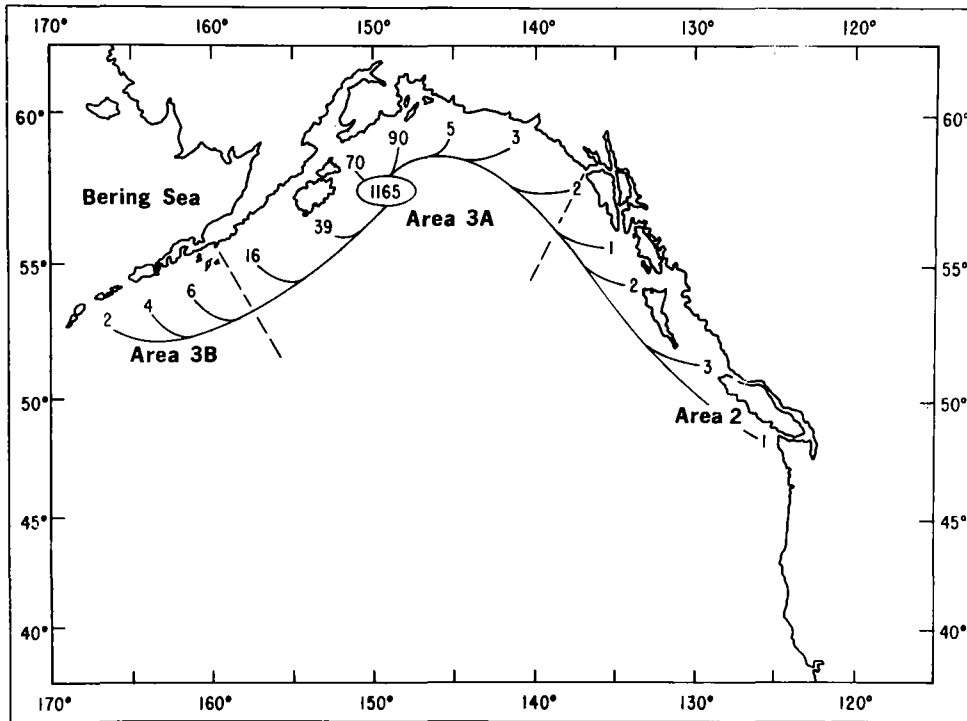


Figure 3. Distribution of recoveries from 1165 halibut tagged on Portlock Bank in November 1927.

Table 6. Distribution of recoveries from 928 halibut tagged near Shumagin Islands (Area 32) in April and May 1929.

Year	Regulatory and Statistical Area of Recovery																	Unknown	Total			
	Bering Sea			Area 3B			Area 3A						Area 2									
	36 37	34 35	32 33	36 37	34 35	32 33	30 31	28 29	26 27	24 25	22 23	20 21	18 _w 19	17 18 _s	15 16	13 14	11 12			9 10	7 8	5 6
1929				1	32		3	2	2	1		1										42
1930					2	12	9	2				1	2								2	30
1931				1	1	6	9	4		1	1										1	25
1932						3	3	2	3					1	2	1		1			2*	19
1933						1	1	3						1				2				9
1934						2	1	1	1				1	1	1	1						9
1935						1				1	2										2	6
1936							2	1		1												4
1937										1												1
1938						1	1															2
1939																						
1940						1																1
Total				1	4	59	29	15	8	5	2	4	4	2	3	2		3			7	148
Unknown										3												3
Grand Total				1	4	59	32	15	8	5	2	4	4	2	3	2		3			7	151

*West of Cape Spencer

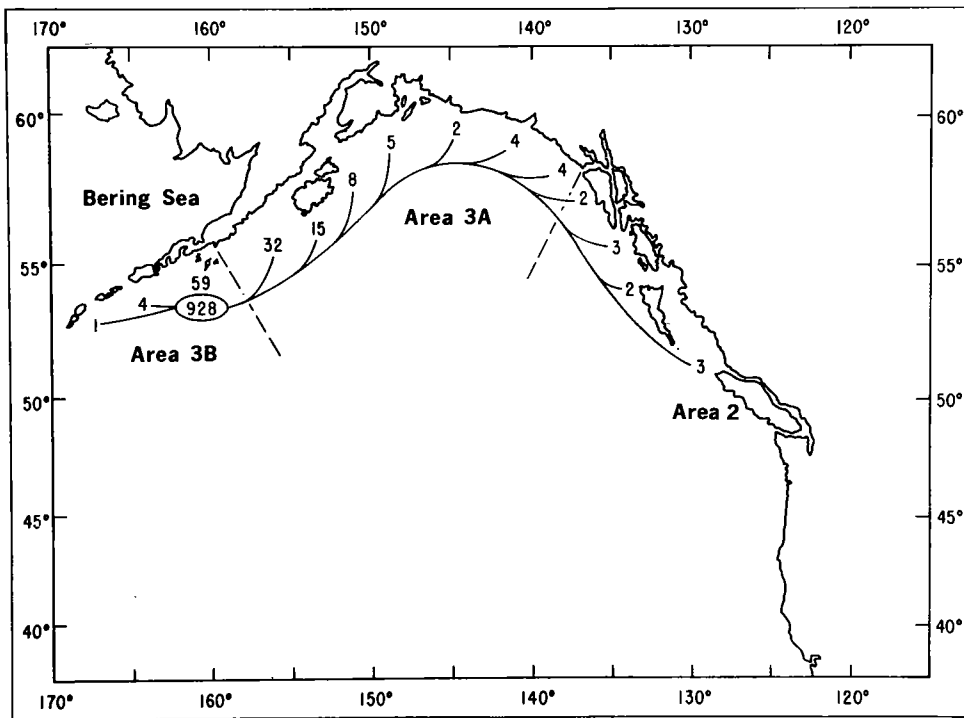


Figure 4. Distribution of recoveries from 928 halibut tagged off Shumagin Islands in April and May 1929.

Table 7. Distribution of recoveries from 1394 halibut tagged in the vicinity of Shumagin Islands (Areas 31 and 32) in May, July and September 1956.

Year	Regulatory and Statistical Area of Recovery																		Unknown	Total		
	Bering Sea			Area 3B			Area 3A						Area 2									
	36	34	32	36	34	32	30	28	26	24	22	20	18 _w	17	15	13	11	9			7	5
1956	37	35	33	37	35	33	31	29	27	25	23	21	19	18 _s	16	14	12	10	8	6	1	85
1957																						
1958																						
1959																						
1960																						
1961																						
1962																						
1963																						
1964																						
1965																						
Total																						

*Area 2

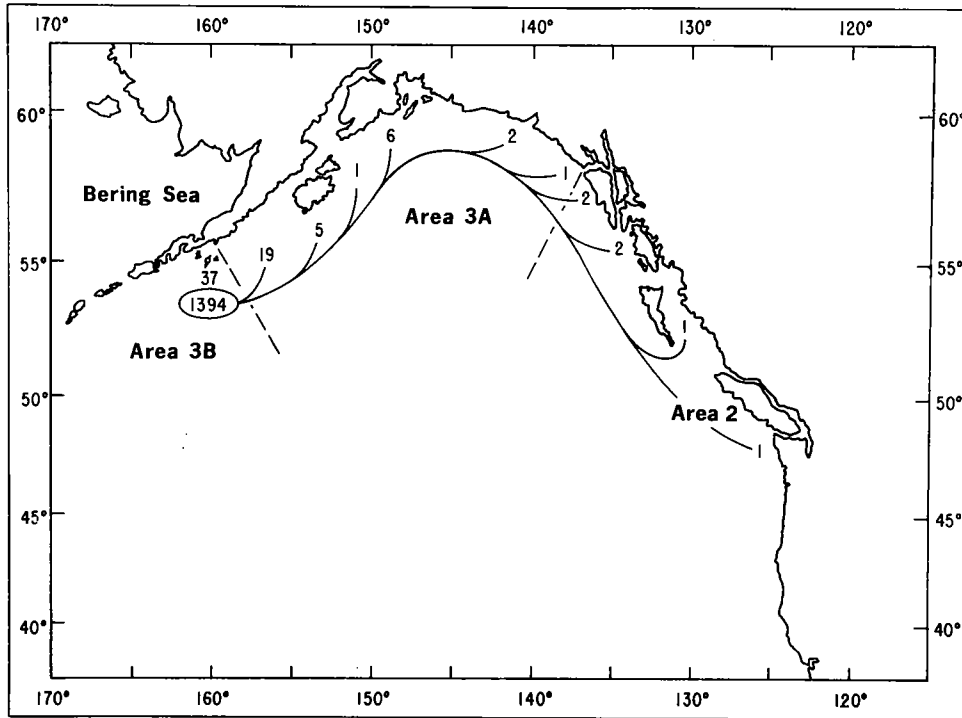


Figure 5. Distribution of recoveries from 1394 halibut tagged off Shumagin Islands in May, July and September 1956.

Some quantitative estimates may be made of the magnitude of the eastward movement out of the far western grounds by computing the number of tagged individuals that must have been present in the recovery areas to have produced the number of observed recoveries.

The results of tagging experiments conducted between the north end of Vancouver Island and Shumagin Islands in the years 1954 to 1958 have provided a measure of the recovery ratio at various points along the Pacific Coast (IPHC Rept. No. 35, 1964). The number of fish recovered at the same points from the 867 fish tagged in the 1956 experiment in the far western region provide an estimate of the probable number of migrants from this experiment. The data for this computation and the estimated number of migrants in each group of statistical areas are given in the following table. The 185 fish estimated to have emigrated to eastern grounds represent 21 percent of the number originally tagged, further illustrating the close relationship between the fish in the far western region and those on grounds to the eastward, even as distant as the coast of southern British Columbia.

Groups of Statistical Areas	Recovery Ratio	Number Recovered	Estimated No. of Migrants
9-12	0.335	1	3
13-18s	0.286	4	14
18w-23	0.236	3	13
24-27	0.126	4	32
28-31	0.073	9	123
		Total	185

The foregoing results from tagging demonstrate that the halibut encountered on grounds in the Shumagin Islands and westward are as much a part of the population west of Cape Spencer as are those on any other section of the area. Tagging also gives confirmation to the hypothesis that the intensive late fall, winter and early spring fishery on Yakutat between Cape Spencer and Cape St. Elias on such spawning grounds as Yakutat Spit, the "W", and Icy Bay as well as on such grounds off Kodiak Island including the southeast corner of Portlock Bank, Trinity Spit and Chiniak Gully had drawn heavily upon the migrants to those grounds from the distant Shumagin Islands and westward even before the development of a fishery in the far western region.

Spawning migrations of the adult halibut and the rate of development of the eggs and larvae are adapted to the direction and rate of water transport in the region. The eastward movement of the adult fish to fall and winter spawning grounds in the Gulf of Alaska counterbalances the reverse drift of the developing eggs and larvae in the Alaska Current moving in a south-westerly direction along the Alaska Peninsula and the Aleutian Islands.

The rate of water transport is such that the natant eggs and larvae originating from spawning as far eastward as Kodiak Island in the Gulf of Alaska would be transported to the far western grounds as well as into Bering Sea by the time metamorphosis is completed and the young fish settle to the bottom on the shallow sections of the continental shelf.

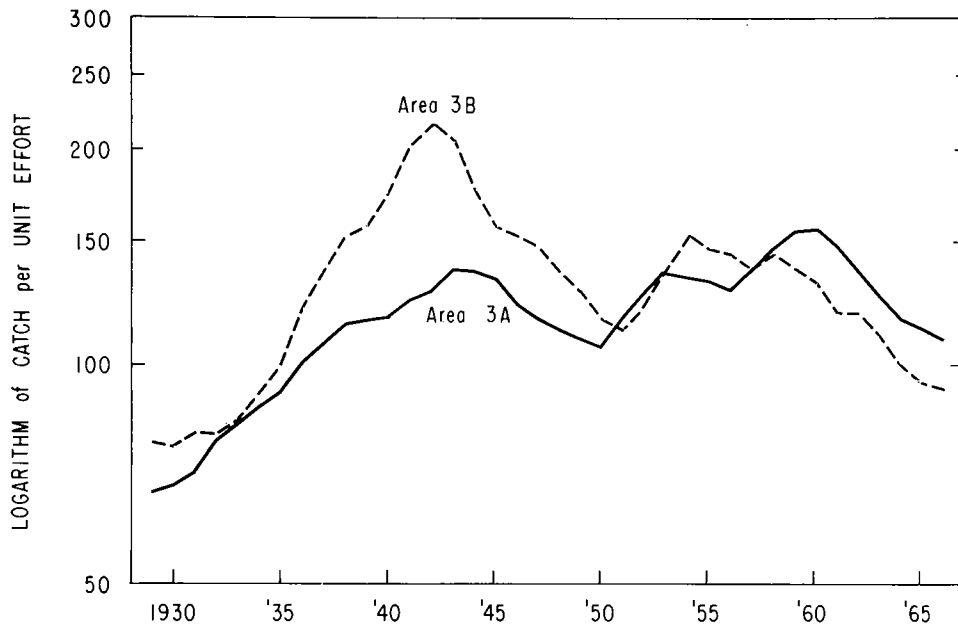


Figure 6. Logarithms of the catch in pounds per standard unit of effort Shumagin Islands and west (Area 3B) not including Bering Sea and on the remainder of the grounds west of Cape Spencer (Area 3A) 1929 to 1966 (smoothed by moving threes).

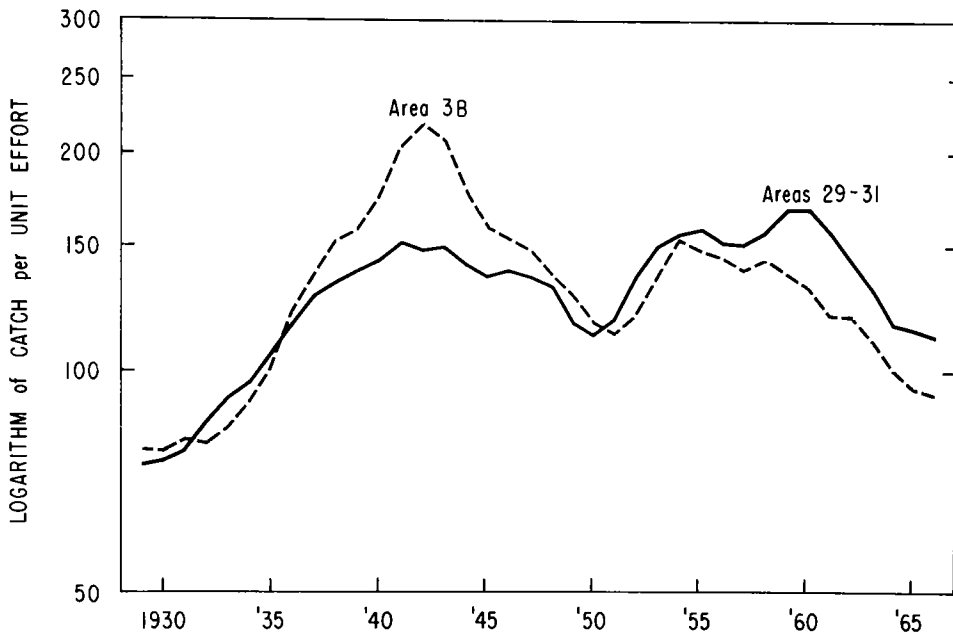


Figure 7. Logarithms of the catch in pounds per standard unit of effort Shumagin Islands and west (Area 3B) not including Bering Sea and on the adjacent grounds as far east as Trinity Islands (Statistical Areas 29-31) 1929 to 1966 (smoothed by moving threes).

The intermingling that occurs between the far western grounds and the remainder of the region west of Cape Spencer and the fact that the two sections of the coast were regulated as a unit from 1932 to 1951 is also reflected in the close parallelism that exists between the historical trends in the catch per unit effort in the two regions (Figure 6). Also, as might be expected where intermingling exists, the resemblance in such trends is greater when the catch per unit effort of immediately adjacent grounds is compared (Figure 7).

On the other hand, the differences that exist between the trends of the catch per unit effort indicate that the intermingling is not complete. Consequently, regardless of how extensive the intermingling may appear to be, it has been the continuing policy of the Commission that whenever feasible provision be made to secure fishing on all grounds at the most propitious season or seasons of the year, and in proportion to the productivity of each ground with respect to halibut.

SIZE COMPOSITION

The longest continuous series of data indicating the trends of size composition of the catches is that of the weight of the various trade categories—chickens, 5 to 10 pounds; mediums, 10 to 60 pounds; and large, over 60 pounds—covering the 37-year period 1929 to 1965. The annual catch per unit effort of each category is shown in Figures 8, 9 and 10 for the Shumagin Islands region (statistical area 32), the adjoining Lighthouse Rocks grounds (statistical area 31) and Portlock Bank (statistical area 26) off Kodiak Island.

The catches per unit effort of chickens generally paralleled one another on the above three grounds west of Cape Spencer (Figure 8). This might be expected in a situation where there tends to be common spawning groups and where the resultant recruitment is probably proportionately not dissimilar in each respective section of the general region. Each ground shows a period of slow rise in catch per unit effort of the chicken category from 1929 to the mid-1930's, a sharp fall in the later 1930's, some leveling during the decade 1940 to 1950, a further decline to the mid-1950's, and a continuation of similar low level trends during the next decade to date.

The similarity of the trends of the catch per unit effort of chickens on the three sectors of the coast west of Cape Spencer provides further confirmation of the common but complex character of the total population in the Gulf of Alaska and westward. It should be noted, however that the declining trend in the catch per unit effort of chickens is not necessarily a measure of recruitment changes. The growth rate over the period has accelerated to reduce the number of age classes and thereby individuals in the chicken category, and the selectivity that occurs in the fishery will also lead to an underestimate of the commercially-less-valuable chicken category as the availability of the more valuable mediums and large increases.

The similarity of the trends of the catch per unit effort of the chicken category from ground to ground continues to some degree into the medium category (Figure 9). In the category of large which consists predominantly of spawning-sized females there were periods when there was considerable divergence between grounds (Figure 10).

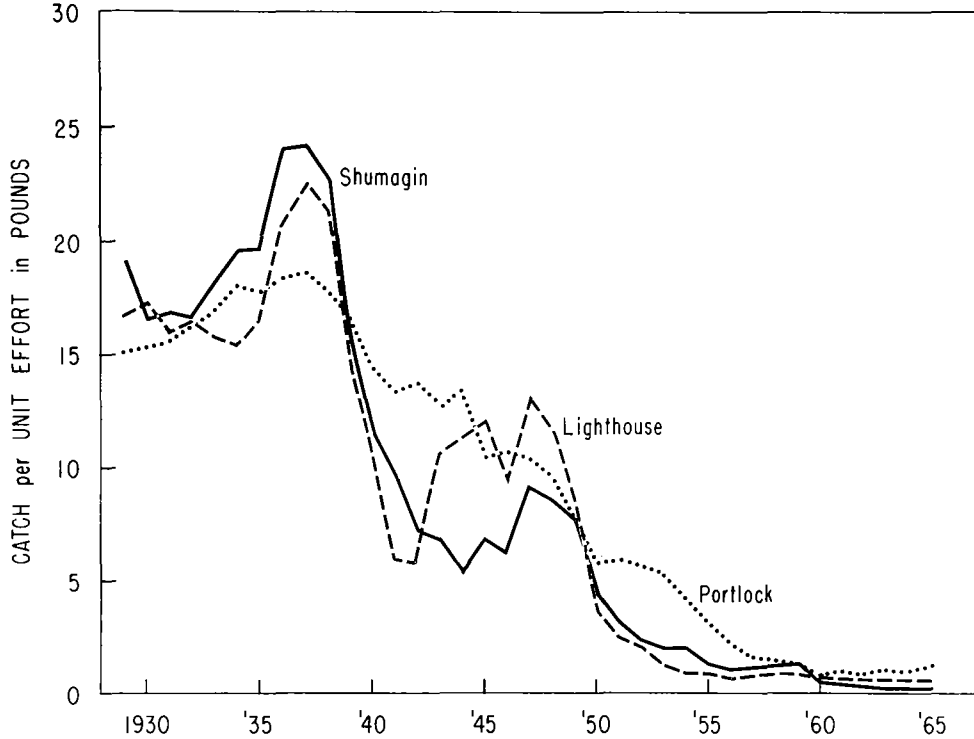


Figure 8. Catch per unit effort in pounds of Chicken halibut (5 to 10 pounds) on the Shumagin Islands and Lighthouse Rocks Grounds and Portlock Bank, 1929 to 1965.

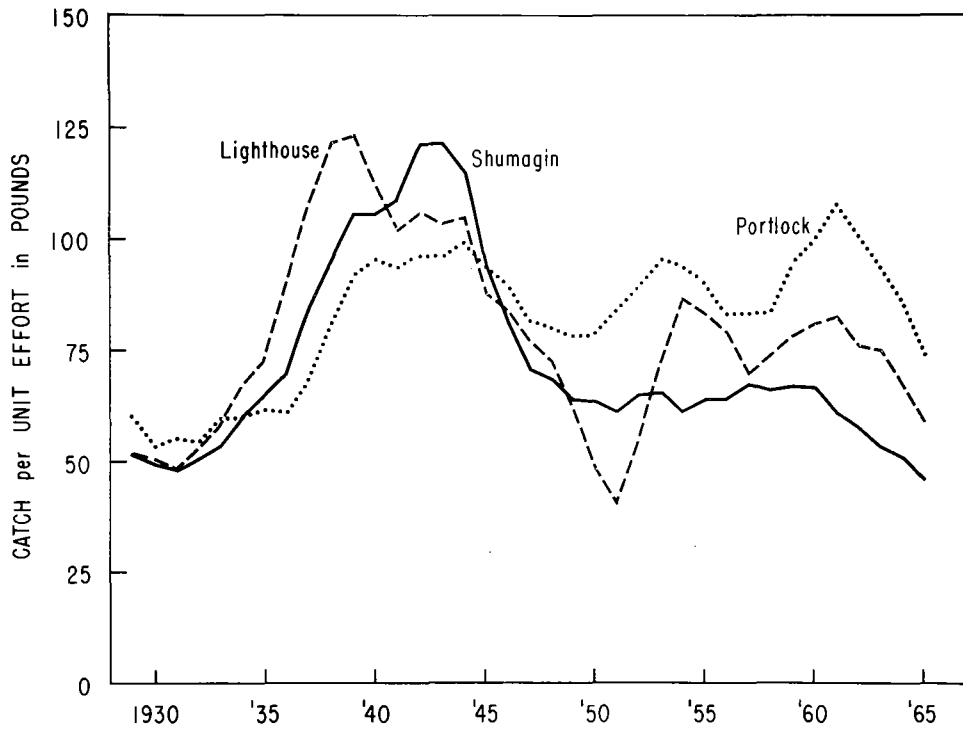


Figure 9. Catch per unit effort in pounds of Medium halibut (10 to 60 pounds) on the Shumagin Islands and Lighthouse Rocks Grounds and Portlock Bank, 1929 to 1965.

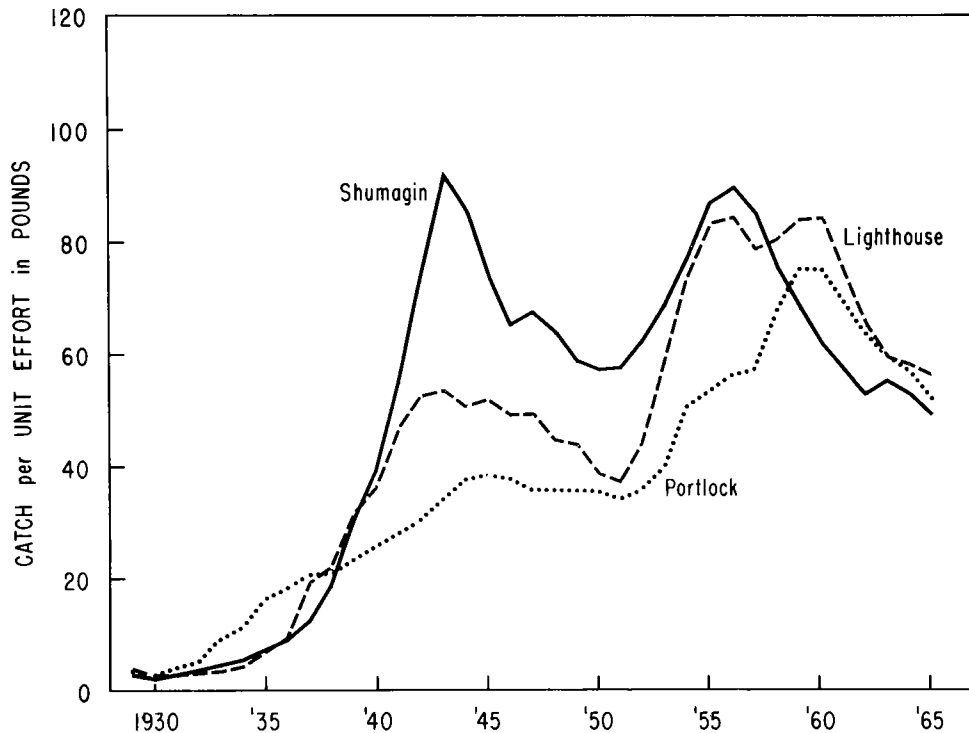


Figure 10. Catch per unit effort in pounds of Large halibut (over 60 pounds) on the Shumagin Islands and Lighthouse Rocks Grounds and Portlock Bank, 1929 to 1965.

The large category increased more sharply in the late 1930's on the far western grounds than elsewhere west of Cape Spencer in consequence of the sharper reduction in the mortality rate arising from the lower level of fishing within the region during the period. Also, with the reduction and ultimate cessation of all fall and winter fishing west of Cape Spencer, the large category, chiefly spawners, were no longer being exploited as fall and winter migrants to the eastward.

Since the mid- or late 1950's the trends of the catch per unit effort of the medium and large categories in all sections exhibit steady declines indicative of the high intensity with which the fishery is being conducted in each section.

AGE COMPOSITION

Data upon the age composition of the population on the Shumagin Islands grounds and westward are available from samples collected as early as 1926 by observers upon commercial vessels, from catches of vessels chartered by the Commission for tagging purposes beginning in 1929, and from sampling of the commercial landings initiated in 1935, the amount of the latter generally reflecting the extent of commercial fishing in the region (Hardman and Southward, IPHC Rept. No. 37, 1965, Table 1).

As seen in Figure 11, samples taken in 1926, not long after the initial fishing in the region, do not display any large proportion of older fish such as might be expected in catches from recently exploited areas. The number

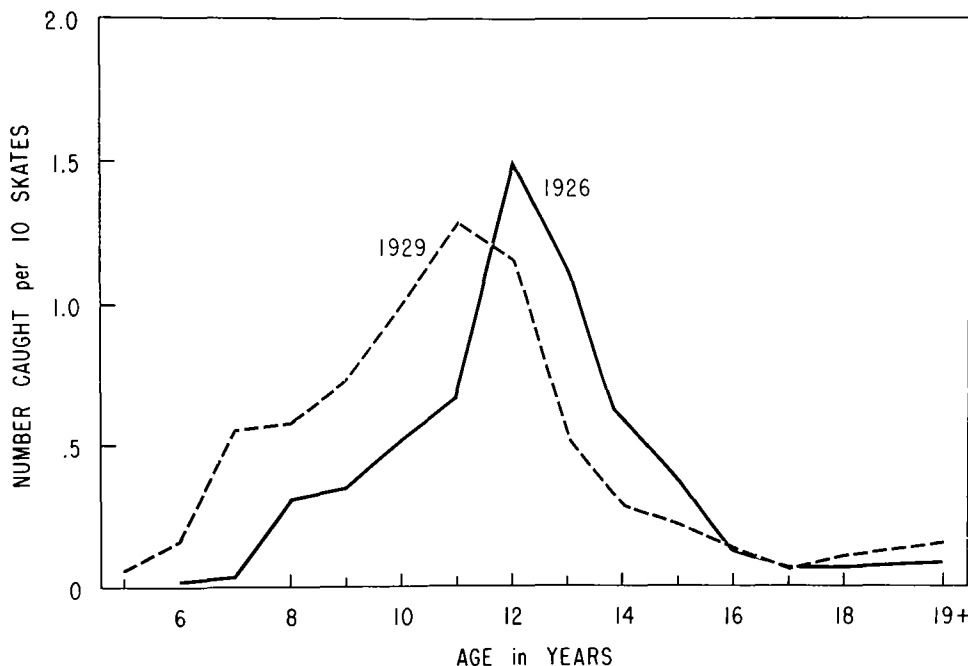


Figure 11. Number of halibut at each age caught per unit effort (10 skates) on Shumagin Islands grounds in 1926 and 1929.

of fish at ages older than 12 in the age composition decreased about 40 percent per year. Such a disappearance rate is considerably greater than the best estimate of natural mortality for Pacific halibut, and is as high as rates of fishing plus natural mortality observed upon grounds to the eastward (IPHC Rept. No. 28, 1960, and Rept. No. 35, 1964). This supports observations from catch statistics and tagging that these stocks were probably being utilized to a degree by the intensive and almost year-long fishery upon grounds eastward in the Gulf of Alaska.

Furthermore, total mortality weighted according to the relative abundance of year classes at ages 12 to 17 in 1926 and 15 to 20 in 1929 averaged 0.62 per year (46 percent). Such a high rate is indicative of heavy utilization whether by fishing directly upon the grounds or indirectly through emigration to heavily-fished grounds to the eastward.

The reduced average age between 1926 and 1929 apparent in Figure 11 may well be the result of the increased removals from directly within the region which in 1930 reached a maximum for the early period of the fishery.

The relative abundance of older fish (age 11 and older) upon the far western grounds is shown in Figure 12 for all years in which data are available. Unfortunately, few samples were obtained between 1930 and 1940 during which period fishing was at a very low level and, due to insufficient funds, no samples were obtained between 1943 and 1949 during which period removals were at a new high level.

A long-term reduction in older fish has occurred, which by 1965 reached a level only one-fourth that recorded in the late 1920's and less than one-half

that in the early 1950's. The decline reflects that observed for the trade category large (Figure 10). The leveling-off observed in the period from 1949 to 1955 is attributable to the reduced fishing in the region. The recent continuation of the decline is a reflection of the high level of utilization in all regions west of Cape Spencer.

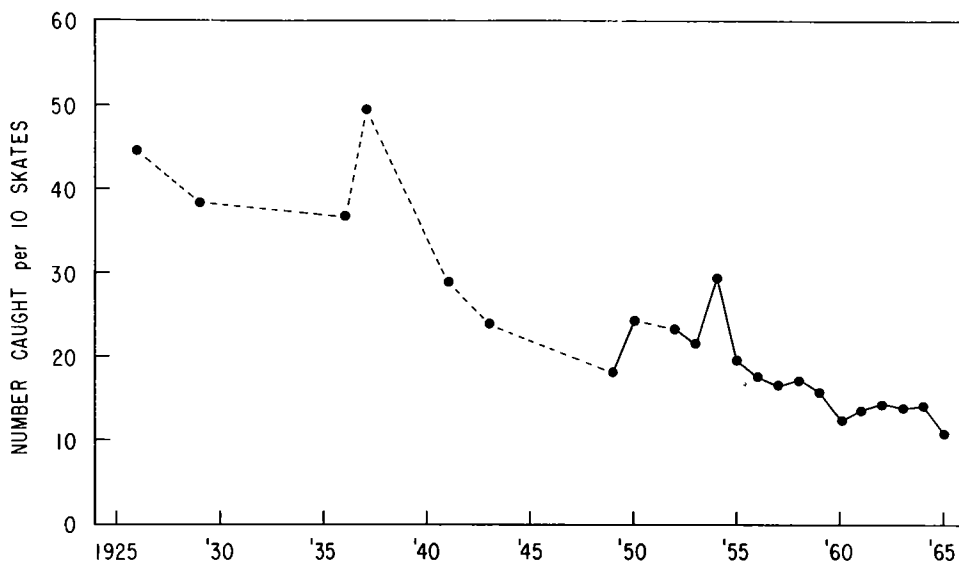


Figure 12. Number of halibut age 11 and older caught per unit effort (10 skates) on Shumagin Islands grounds by year, 1926 - 1965.

GROWTH

The average weight at each age of halibut from the Shumagin Islands grounds between 1929 and 1965 has increased sharply, as indicated in Table 8 and Figure 13.

As can be seen in Table 8 the average weight of halibut at each age has at least doubled between 1929 and 1950 for the ages from 7 to 15 years, and has tripled between 1929 and 1965.

More detailed studies (Southward, IPHC Rept. No. 43, 1966) show that the extent and timing of the increase in average weight of fish at each age from the Shumagin Islands grounds is consistent with the increases observed in halibut from other grounds west of Cape Spencer. Also the most rapid increase in growth west of Cape Spencer occurred during the early 1950's. It is also indicated that the increase in average weight coincides with a reduction in population density in combination with probable changes in the physical conditions contributing to growth.

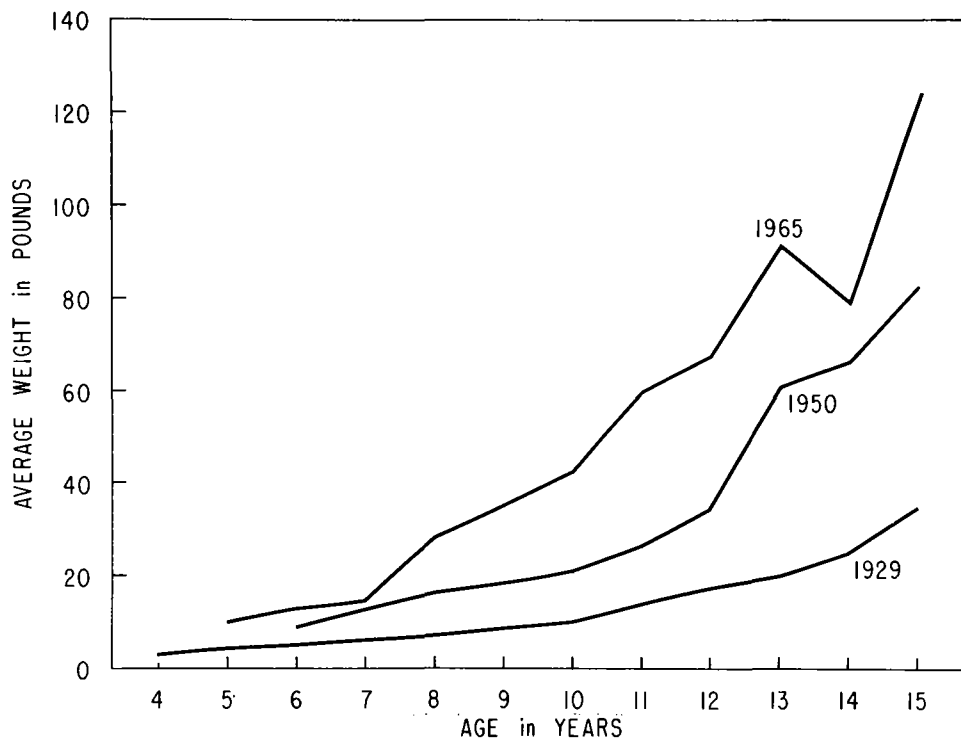


Figure 13. Average weight in pounds (dressed weight with heads on) by age for female halibut from Shumagin Islands grounds.

Table 8. Average weight at each age for female halibut from the Shumagin Islands grounds for 1929, 1950 and 1965.

Age	1929	1950	1965
4	2.3		
5	3.6		9.8
6	4.2		12.6
7	5.2	7.2	14.3
8	6.4	12.8	27.7
9	7.9	15.8	34.8
10	9.4	17.5	42.1
11	13.1	20.4	59.9
12	16.8	25.8	67.4
13	19.9	34.2	90.7
14	24.5	60.7	78.5
15	34.4	65.7	123.7

UTILIZATION

Levels of utilization on the far western grounds can be ascertained from the percentage recovery of tags from several experiments that have been conducted on the grounds off Shumagin Islands and westward.

Table 9. Number and percentage recovery by regulatory area from three tagging experiments off Shumagin Islands.

Year of Tagging	No. Tagged	Regulatory Area of Recovery									
		Area 2		Area 3A		Area 3B South		Area Unknown		Total	
		No.	%	No.	%	No.	%	No.	%	No.	%
1929	928	10	1.1	70	7.5	64	6.9	7	.8	151	16.3
1950	693	4	.6	6	.9	3	.4			13	1.3
1956	867	5	.6	16	1.8	26	3.0	5	.6	52	5.0

The above recovery percentages reflect the distribution and magnitudes of the fishing effort during the recovery period of each experiment. During the period of the 1929 experiment the fishery was active in the far western region because the halibut in that region had not reached the same state of depletion as those on the longer-fished grounds to the eastward. By the time of the 1950 experiment fishing effort had been diverted from the far western grounds to the closer eastern grounds where regulation had restored the stocks to their former productivity.

During the 1956 experiment fishing on the far western grounds had been substantially increased by controlling the opening and closure dates of the respective fishing seasons. Not only was the utilization level increased several times off Shumagin Islands it was as high as observed in areas as far east as the heavily-fished grounds off Kodiak Island, statistical areas 26 and 27 (Figure 14).

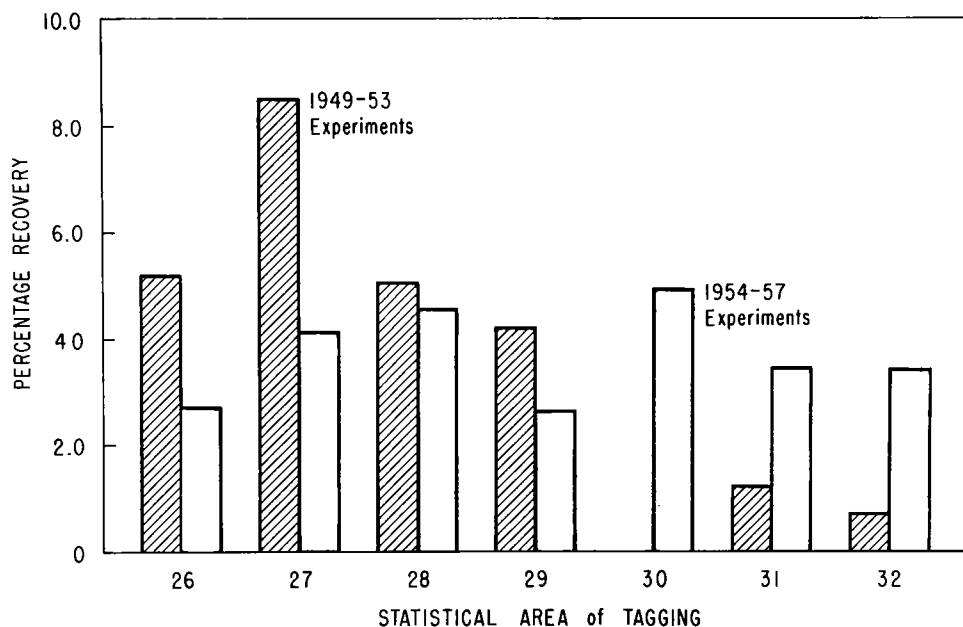


Figure 14. Percentage recovery during the first 3-full recovery years from tagging in Areas 26 to 32 in the years 1949 - 53 and 1954 - 57.

Tag recoveries in 1966 from experiments conducted in the region in 1965 (Table 10) provide indications of a still higher utilization within the area and in Area 3A than did the 1956 experiment in its first full recovery year as shown in the following data extracted from Table 7:

Percentage recovery at the end of the first full recovery year from 1394 fish tagged in 1956.

Number Tagged	Area 2	Area 3A	Area 3B	Area Unknown	Total
1394	5	10	9	1	25
Percentage of Total	.4	.7	.7	.1	1.8

The lower percentage of the recoveries made in Area 2 in 1966 could be attributed to the fact that removals from that area have been reduced 23 percent from the 1957 level of 30.6 million pounds to 23.5 million pounds in 1966, the levels in the first full recovery years of the respective experiments.

The large proportion of the recoveries that are made on grounds outside the general area of tagging is indicative of the continuing drain being placed on the halibut in the region by the fishery elsewhere on the Pacific coast. Also the percentage recovery from within the tagging area is as high as that observed within the tagging areas for current experiments on other grounds west of Cape Spencer.

Similarly, tagging off Kodiak Island in 1963 showed a recovery rate of 5.5 percent by the end of the first full recovery year. A tagging experiment between Trinity and Shumagin Islands in 1964 showed a recovery rate of 2.9 percent in the same recovery period. The 4.1 percent for the Shumagin Islands and west shown in Table 10 is of the same magnitude as in the two aforementioned Area 3A experiments.

Table 10. Distribution of recoveries* at the end of the first full recovery year 1966 from 1689 fish tagged in 1965 on various sections of the grounds, 60-mile sections 32 to 38 Shumagin Islands and westward.

60-mile Statistical Section	Number Tagged	Area 2	Area 3A	Area 3B*	Totals
32	530	1	7	24	32
33	374	1	5	10	16
34	274	1	2	6	9
35	143		1	1	2
36	175			4	4
37	158	1	1	4	6
38	35			1	1
Totals	1689	4	16	50	70
Percent of Total		.2	.9	3.0	4.1

*Exclusive of three recoveries reported by Japan taken in Area 3B while trawling in the area in 1966.

It is also evident from the recoveries of fish tagged in the summer in each 60-mile section of the far western grounds (Table 10) that the halibut in the region as a whole distribute themselves throughout the range of the fishery to the eastward.

During the winter of 1963-1964 tagging was conducted on the far western grounds and 386 fish were released between Shumagin and Sanak Islands. Recoveries by the first two full recovery years were 8 percent of the total tagged. Returns from the 1956 tagging experiment by the first two full recovery years were 3 percent of the total tagged.

The tagging experiments show that regulatory measures that have been applied in the region since 1951 were successful in restoring and maintaining to date a generally high level of utilization on the far western grounds although in the most recent years the removals may be slightly higher than

desirable. The elevated utilization rate is reflected in the decline that has occurred in the catch per unit effort in the region during the past 6 years. Measures were initiated in 1966 to reduce the removals to maintain the optimum size of population in the region.

The degree of utilization on the far western grounds, as indicated by the decline in relative abundance at ages 13 to 19 in one year to ages 14 to 20 in the next, is shown in Table 11. Estimates of the rate of total mortality have been calculated from these changes and are shown as four-year averages with similarly calculated rates for grounds off Kodiak Island.* The average values for these two sections of the area west of Cape Spencer correspond closely and reflect the high level of utilization of halibut in the Gulf of Alaska and westward.

Table 11. Number of halibut of older ages per unit effort Shumagin Islands and West from one year to the next from 1949 to 1965, and four-year average estimates of the instantaneous rates of total mortality for that region and Kodiak Island grounds.

Years	Number at Ages 13-19	Number at Ages 14-20	Four-Year Average Total Mortality	
			Shumagin Ids. and West	Kodiak Island
1949-1950	11,184	6,241		
1950-1951	9,963	—		
1951-1952	—	7,920	.32	.31
1952-1953	12,398	7,398		
1953-1954	10,489	6,583		
1954-1955	14,028	7,516		
1955-1956	12,107	8,246	.46	.38
1956-1957	10,576	7,309		
1957-1958	10,754	8,197		
1958-1959	10,071	6,158		
1959-1960	12,352	5,463	.46	.40
1960-1961	6,979	5,397		
1961-1962	7,325	4,150		
1962-1963	5,382	3,096		
1963-1964	5,106	4,232	.52	.53
1964-1965	7,918	3,723		

Examination of the trends of catch in the history of the fishery in the region and the resultant reactions observed in the catch per unit effort shows that when the number of units of effort fished increased the catch per unit effort subsequently declined. In the intervening periods when fishing effort was reduced the catch per unit effort rose. As discussed earlier the optimum removal level from the grounds has probably been somewhere in the magnitude of about 3.0 to 4.0 million pounds annually under environmental conditions of the past fifteen years.

MANAGEMENT IN THE REGION

Some of the management methods that have been used to secure maximum sustainable yield in the Pacific halibut fishery are reviewed in Report No. 30

* IPHC Rept. No. 28, Appendix Table 7, 1935 to 1958; and IPHC Unpublished MS Data, 1959 to date.

(IPHC 1960). Following are some extracts therefrom.

"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 more 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.

"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.

"With stocks of fish at or near their levels of maximum sustainable yield, temporary local conditions of underfishing and overfishing were 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."

Management procedures applied to the far western grounds have also been described in various annual reports of the International Pacific Halibut Commission since 1947.

During the 20-year period from 1932 to 1951 the far western region was managed as an integral portion of the grounds west of Cape Spencer on the basis of the results from tagging (IFC Rept. No. 6, 1931) and biometric studies (Bell MS). A single catch limit, which was gradually increased through the years, was applied to all grounds west of Cape Spencer.

In the late 1920's and until 1933 yields from the far western grounds were probably higher than what could be sustained under prevailing conditions. Growth rate was not as high as in later years and the late fall, winter and early spring fisheries which then existed in the eastward sector of the grounds west of Cape Spencer placed a continuous drain upon the migrant spawners from the far western areas.

Beginning in 1933 however, there was a shift of fishing from the far western grounds to the eastward associated with the rebuilding of the halibut population west of Cape Spencer, certain voluntary measures on the part of fleet controlling the size of the fares, and economic conditions of the period which concentrated fishing effort on the grounds closer to port. These led to a sharp decline in removals from the far western grounds. Also, a reduction or cessation of late fall, winter and early spring fishing on grounds west of Cape Spencer due to shortening of the fishing season reduced the drain upon the migrants from the far western grounds. In consequence an accumulation built up rapidly in the far western region in the 1930's.

It has been a basic premise of the Commission that interchange between areas should not solely be depended upon to secure full utilization of the halibut on all grounds. However, differential openings of the season in such far western regions were not feasible in the 1930's due to the difficulty of surveillance without the modern air and sea patrol facilities now available.

After some delay occasioned by World War II and the national defence closure of the grounds in 1942* the accumulation was eventually harvested. With the consequent decline in the catch per unit effort by 1950 the fleet again tended to concentrate on the further rebuilt and still more productive grounds to the eastward with the resultant reoccurrence of low removals from the far western areas.

Pending final conclusion of a new convention between Canada and United States, measures were initiated in 1952 to provide a more uniform distribution of fishing within the entire region west of Cape Spencer. It was considered desirable that an appropriate share of any further increases in the catch permitted from grounds west of Cape Spencer would in fact be taken from the far western regions.

For the above purposes the grounds west of Sanak Islands were removed in 1952 from the single catch-limit area west of Cape Spencer along with the grounds south of a line running true west from Cape Sarichef. These were described as a separate management area. With the postwar developments in air surveillance it was now more feasible to patrol such areas.

The far western grounds have been variously defined during the past 14 years (Table 2) in order to adjust for developments in the fishery both within the area and in Bering Sea. In 1954 the boundary of the area was shifted to include all of Bering Sea. In 1955 the eastern boundary was moved to its present location just east of the Shumagin Islands. In 1961 the grounds south of the Alaska Peninsula were separated from those in Bering Sea and the

*One vessel fished four days close to the eastern boundary of the area in 1942.

Aleutian Islands west of Umnak Island and designated as Area 3B South. In June of 1963, Area 3B South was enlarged to include all waters on the South side of the Aleutian Islands. In 1966 the identity of the region as a management area was again changed to include only those grounds as far west as 175° West not including the waters in Bering Sea, and was renamed Area 3B.

In 1952 and 1953 single short seasons of varying lengths were used in the fall of the year in an attempt to obtain additional fishing in these special management areas. While some gains were made the attempts were generally unsuccessful in securing the desired amount of fishing in the region.

As stated earlier the catch target in this area has been about 4.0 million pounds. While this is higher than the catch taken in very early years, it was recognized that the growth rate has increased during the past 15 years and, with the cessation of fall and winter fishing on the eastern sector of the region west of Cape Spencer, the drain of such fishing upon the migrants from the far western region has been reduced.

In 1954 multiple seasons were put into effect on the far western grounds under the authority of the newly-enacted 1953 Convention. In Area 2 multiple short seasons with or without special subdivisions for management purposes proved effective in rectifying imbalances that had developed in the fishery on that section of the coast. On the far western grounds, however, they were largely ineffective in attaining the desired objectives and were abandoned after 1956.

In 1957 a long period of fishing extending well beyond the closure of other grounds west of Cape Spencer was specified in the regulations. In the first year the measure was moderately effective in increasing the removals. In 1958 the area was opened earlier than other grounds west of Cape Spencer with further increase in removals. It was not until 1959 that the full effectiveness of such differential openings was achieved. Enforcement of the differential openings of the western grounds was strengthened by using check points within the area to control the entry into and the departure of vessels from the region.

During the period 1958 to 1963, without the use of stated catch limits, the actual catch averaged 3,935,000 pounds annually, which was within 2 percent of the 4-million-pound objective. In 1964, 1965 and 1966 when stated catch limits were applied, the total catch in the three years was within 4 percent of the combined catch limits.

The largest deviation from the desired removal for the region occurred in 1959 when some concentrated accumulations of fish were encountered particularly off Sanak Island and were heavily fished in the fall resulting in unusually large fares with a high catch per unit effort. Much of the excess catch was taken after the date it would have been necessary to announce closure had a stated catch limit been in effect.

By 1960 this accumulation had been decimated. In 1961 the catch was low due in part to an unexpected prolongation of the fishing season in Area 3A which reduced fall fishing on the far western grounds and to a shorter fishing season which was designed to offset the large catch in 1959.

With the use of prescribed time periods of fishing from 1958 to 1963 inclusive the actual catch has closely approximated 4-million pounds which was regarded as the catch target for this particular region on the basis of the history of fishing in the area and simple mathematical models.

While stated catch limits have been successfully used in the control of the fishing mortality for many years in the larger management areas, it must be recognized that the same objective can be attained by the use of controlled periods of fishing when they are related to the probable amount of fishing effort available.

With the removal of halibut in eastern Bering Sea from abstention on the part of Japan in 1963, effective control of the fishery in that area with respect to Canada and the United States passed from the Halibut Commission. In consequence the magnitude and logistics of the North American fishery on the far western grounds became less predictable than heretofore. Also, since it was evident that a severe decline in the resource in eastern Bering Sea would occur in 1964 as a result of the 11.0-million-pound catch permitted by the International North Pacific Commission in 1963, United States and Canadian vessels could well be expected to attempt to offset their losses by diverting their operations to grounds opened to halibut fishing outside Bering Sea, particularly those west of the Shumagin Islands.

To provide against such possible increased entry into Area 3B in the early spring, a catch limit of 4.0 million pounds was imposed in 1964. Catch limits were continued in 1965 and 1966 because the conditions which prevailed in 1964 were compounded by the fact that rehabilitation of the resource in Bering Sea required that very drastic restrictions be placed upon the spring fishery therein.

In considering the relative merits of catch limits and time periods in controlling the fishing rate it must be recognized that in Canada and the United States the quasi-constitutional principle of free entry precludes the control of fishing intensity in an area by restricting the number of licenses or by allotting catch targets to individual vessels or any other like measures. Also in the North American halibut fishery the operations unit is the trip which may be from 12 days to 30 days in length depending upon the area fished and the ports of departure and landing. In the case of mothership operations, as conducted in the area by other nations, the operations unit is usually the daily landing.

The trip operation in the North American halibut fishery requires prediction and announcement of closure in some catch-limit areas long in advance of the date of probable attainment of a stated catch limit. Thus even with a stated catch limit in the regulations the length of the fishing season becomes in all cases the effective control element. In some situations where the season was very short, as in Area 2 in the early 1950's, closure had to be determined and announced shortly after fishing began when more than 90 percent of the production was yet to be reported.

While some management error is involved both with stated catch limits or with stated time periods, any deficits or excesses can be and have been

largely offset from year to year without significant losses as the halibut year classes are available to the fishery over several years and not for a single fishing season.

Where only a relatively small removal is desired from an area the use of the catch-limit method to control the fishing mortality rate may become impractical as well as incompatible with the logistics that have existed in the North American Pacific halibut fishery for the past 75 years. Before such vessels will commit to an operation and make the required large advance expenditures for outfitting, they must have reasonably firm indications of being able to fish halibut—their exclusive source of income—long enough for a profitable trip.

Consequently, in most instances where a small removal is desired, a fixed fishing period is a necessity. The length of such a period is determined with due regard to the size of the potential entry and of the desired removal. Experience has shown that entry can be indirectly controlled by adjusting the timing and length of the permitted period. This method has been successfully used from time to time in Areas 2 and 3 and recently in Bering Sea. Also, in some special situations it could become necessary to forego any fishing in some years if the potential entry was unmanageably large in relation to the size of the desired removal.

Whether, in view of the present utilization rate, the far western grounds require a continuation of the specific control measures that have been applied since 1951 or whether they can be managed as a unit with the rest of the grounds west of Cape Spencer as was the case for the twenty years from 1932 to 1951 is a matter of current study. It revolves around whether under such unit control the present logistics of the North American halibut fleet will permit maintenance of a level of removal that will continue to ensure a uniform utilization of the halibut population west of Cape Spencer so that the present maximum sustainable yield of about 36.5 million pounds for the region not including Bering Sea will be maintained.

SUMMARY

During the 20-year period from the beginning of regulation in 1932 until 1951 the far western grounds were managed as an integral portion of the region west of Cape Spencer. Stock reactions, tagging and other studies indicate that the halibut in the region are an intermingling component of the large population complex west of Cape Spencer and to some extent of that south of Cape Spencer.

In the early years between 1925 and 1930 migrants from the far western region were intensively fished by the late fall and winter fishing on spawning grounds in the Gulf of Alaska. By the late 1930's, with the rebuilding of the stocks and the consequent shortening of the fishing seasons, the fishery west of Cape Spencer tended to concentrate in the eastern Gulf of Alaska. This, coupled with the cessation of winter fishing on the migrant spawners, resulted in a sharp rise in the population size in the far western region.

Although it was recognized that the rehabilitation of the total population west of Cape Spencer was accelerated by a low intensity of fishing, such localized high concentrations on the far western grounds could result in some loss of yield. However, scientific investigations needed as a basis for management on the far western grounds had to be deferred until after World War II. The additional treaty authority required to implement the findings was also delayed. The continued rise in the catch per unit effort, however, did lead to a short-term fishery in the region in the immediate postwar period.

Under the new 1953 Halibut Convention a number of management measures including multiple fishing seasons and boundary line changes were designed to provide a more adequate distribution of fishing. Unlike a similar management program south of Cape Spencer, results were less than desired.

Under current conditions, empirical data and simple models have suggested that annual removals from the far western section should be about 4.0 million pounds. In earlier years with a lower growth rate and with the migrant spawners being cropped elsewhere the optimum level of removals was probably lower.

From 1958 to 1963, by continuing adjustment of the length and timing of the fishing periods in relation to the available fishing effort, annual catches averaged 3.9 million pounds, within two percent of the 4-million-pound objective.

Beginning in 1964, due to difficulties in predicting the entry of fishing effort as a consequence of the decline in the Bering Sea fishery after 1963, it was necessary to provide stated catch limits in the regulations. Actual catches have been within four percent of the combined catch limits during the three years 1964 to 1966 inclusive.

Due to the high level of utilization indicated by the decline in the catch per unit effort on all grounds west of Cape Spencer, the best estimate of maximum sustainable yield of 38 million pounds as of 1960 was reduced in 1966 to 36.5 million pounds. One million of the reduction was assigned to the region between Cape Spencer and the Shumagin Islands and one-half million in the far western region. The reduction was proportionately larger on the latter grounds where the decline in catch per unit effort was greater.

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