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 48

THE HALIBUT FISHERY
SOUTH OF
WILLAPA BAY, WASHINGTON

BY

F. HEWARD BELL AND E. A. BEST

UNIVERSITY OF WASHINGTON
SEATTLE, WASHINGTON
1968

FOREWORD

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

The present report reviews the development, the utilization and the management of the halibut resource off the section of the Pacific Coast south of Willapa Bay, Washington.

THE HALIBUT FISHERY SOUTH OF WILLAPA BAY, WASHINGTON

By

F. HEWARD BELL and E. A. BEST

CONTENTS

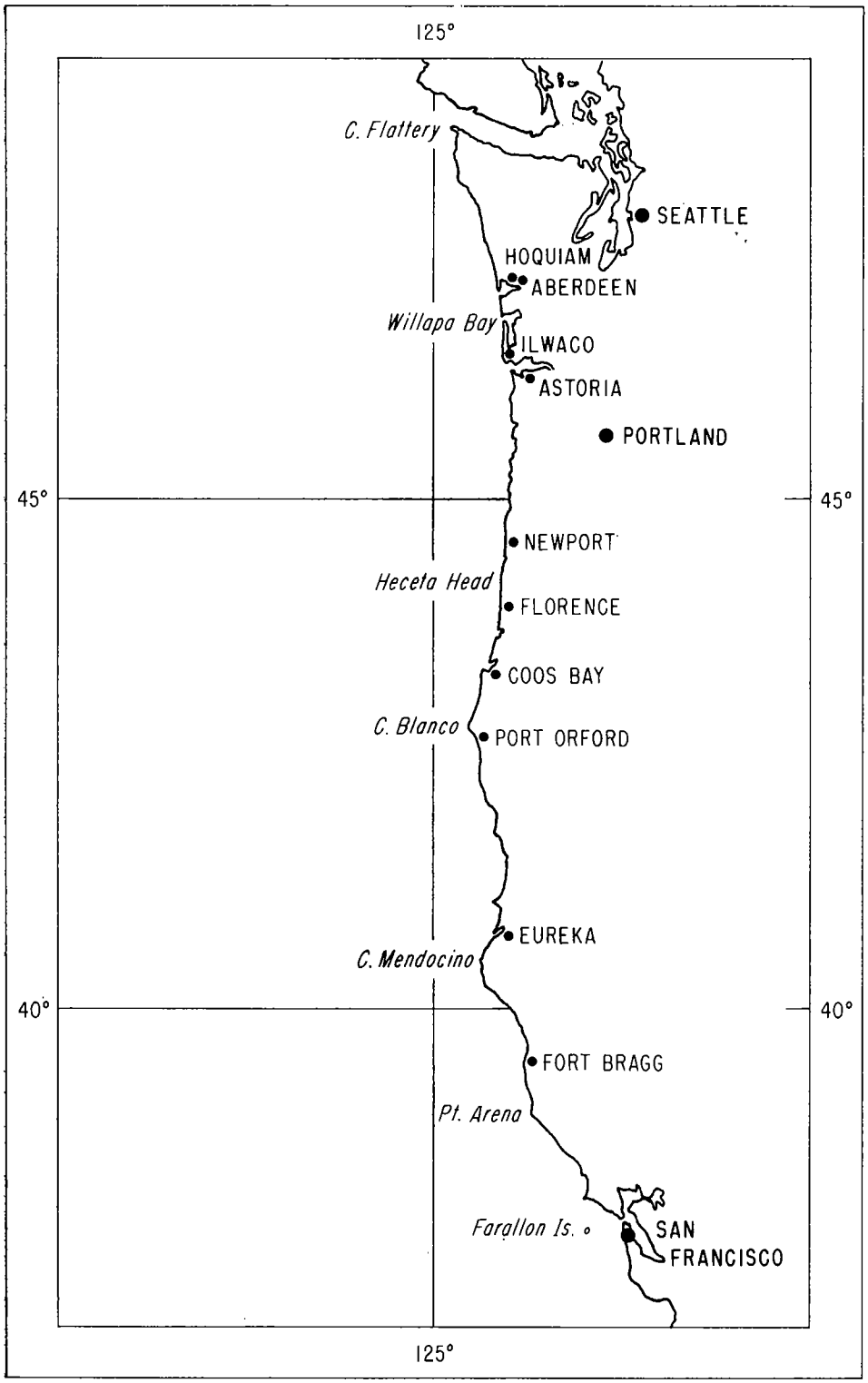

Figure 1. Map of the Pacific Coast, San Francisco to Cape Flattery.

THE HALIBUT FISHERY SOUTH OF WILLAPA BAY, WASHINGTON

by

F. HEWARD BELL and E. A. BEST

INTRODUCTION

The commercial fishery for Pacific halibut, *Hippoglossus hippoglossus stenolepis* Schmidt*, had its beginnings late in the 19th Century in waters off Cape Flattery on the northwest coast of Washington Territory and off southern British Columbia. While most of the subsequent extension of the fishery after the early 1900's was to fishing grounds off Alaska, some expansion occurred to grounds off the coasts of southwest Washington, Oregon and to a limited extent as far south as Cape Mendocino in northern California. The latter location has been the southern limit of any halibut concentrations of commercial consequence. Further south, Pacific halibut occur but infrequently.

While high initial yields were taken from a number of relatively small but dense accumulations south of Cape Flattery, such yields were not sustained. Also despite control of the fishery and a reduction in fishing intensity during the past 30 years, the halibut population in the region has not regenerated.

This report describes the conditions that have prevailed in the halibut fishery at the southern extremity of its range from Willapa Bay, Washington and south. It will review the research and conservation measures undertaken in the region during the past 43 years by the International Pacific Halibut Commission, that prior to 1953 was named the International Fisheries Commission and is hereinafter referred to as the Commission.

The region south of Willapa Bay has been included in what has been designated by the Commission as Area 1; however at times it has been divided into Areas 1A and 1B, and in 1935 it was designated as Areas 1 and 4. Geographic points referred to in this report are shown in Figure 1.

OCCURRENCE OF HALIBUT

Pacific halibut are found on the continental shelf and slope in boreal waters usually between 3° and 8° centigrade (Thompson and Van Cleve, 1936). In the North Pacific Ocean and Bering Sea it is distributed over a relatively narrow band extending about 3500 miles from California along the west coast of North America, westward along the Aleutian Chain, as far south as central Japan as well as on the continental shelf in Bering Sea, and northward to the Gulf of Anadyr on the Asiatic Coast (Moiseev 1953; Novikov 1964). The distribution of halibut in both the Pacific and Atlantic in relation to the prevailing ocean current and water temperature systems was reviewed by Thompson and Van Cleve (1936).

A number of authors have reported upon the occurrence of halibut at the southern extremity of its range in the eastern North Pacific Ocean. Ayres (1855) reported halibut from the Farallon Islands off San Francisco Bay. Starks (1919) stated that Pacific halibut was occasionally taken in Monterey Bay during the summer of 1918. Phillips (1958) recorded a single specimen caught in 80 fathoms by an otter

*In accordance with Vernidub (1936).

trawl vessel off Point Piedras Blancas (35° 35′ N. Latitude), in September 1957. Walford (1928) reported a 14-pound specimen caught in 100 fathoms of water on the southeast side of Santa Rosa Island (33° 55′ N. Latitude) in November 1927. This fish was delivered to a San Pedro market where it was stated that four such halibut had been delivered in the previous two years. A 42-pound halibut was reported (Pacific Fisherman, 1942) as having been caught by the jig boat *Albatross* off San Diego, approximately (32° 45′ N. Latitude), and was reported to be the first such fish caught in the area in ten years and the third in history. This is the southernmost record for halibut, being approximately at the United States-Mexico boundary.

EARLY INDIAN FISHERY

Halibut was not an important food source to the Indian tribes inhabiting coastal regions of California, Oregon and southwestern Washington. Farther north along the Pacific coast the natives utilized this fish to far greater extent, even developing specialized setline gear to catch halibut from the offshore waters of northwest Washington, British Columbia and Alaska (Thompson and Freeman, 1930). California Indians apparently depended upon forms available in the more accessible intertidal and estuarine areas. Chinook salmon *(Oncorhynchus tshawytscha),* steelhead trout *(Salmo gairdneri),* Pacific lampreys *(Lampetra tridentata),* surf fish *(Osmeridae),* sturgeon *(Acipenseridae),* shellfish and sea mammals were mentioned as primary food items of the Indians of the Klamath River region (Roberts, 1932).

Halibut were occasionally taken by the Coast Yuroks using hand lines 40 to 50 feet in length equipped with a gorge and thrown from shore in the vicinity of Trinidad Head, California (Kroeber and Barrett, 1960). Undoubtedly, the more abundant rockfishes *(Sebastodes* spp.) were the primary object of the Trinidad Head fishery and halibut was a welcome variation. It was also stated that the Tolowa tribe caught halibut while fishing from dugout canoes outside the breakers off Smith River in northern California. There are archaeological findings of buried fish remains that suggest that the Tolowas had the technology to fish for offshore species including halibut before white settlement of the area (Gould, 1966).

The limited interest in halibut by the Indians of northern California can be credited to a number of factors. The primary ones were the scarcity of good harbors, the possession of poor watercraft for offshore fishing, and more accessible supplies of anadromous salmon (Hewes, 1942).

EARLY COMMERCIAL FISHERY

California

As early as 1855 a few halibut were reportedly taken from the vicinity of the Farralon Islands and marketed in San Francisco. Halibut of 40 to 50 pounds were observed for sale in the San Francisco markets at 50 cents per pound (Ayres, 1855). However a schooner-load of halibut from Vancouver Island delivered in San Francisco on 12 June 1879, flooded the market (Lockington, 1879). In a later report Lockington (1880) stated that while halibut were taken at the Farallon Islands, he had seen only one such specimen in the San Francisco markets and it was selling at 50 cents per pound. Lack of an active demand prevented any systematic effort to supply San Francisco with halibut from nearby grounds except for the occasional fish brought in

by trawlers (Collins, 1892). However some shipments continued from the north, the trip from Puget Sound requiring about four days. The quality of such fish was good and the large sizes sold for 10 to 15 cents per pound. During this early period there is no indication of an active halibut fishery indigenous to northern California ports (Lockington, 1881).

It was reported that a vessel originating from some unspecified region sold 9,000 pounds of halibut at San Francisco for 30 cents per pound in 1899 but usually the small amounts brought in by the trawlers continued to be adequate to supply the local demand (Wilcox, 1902).

Oregon

In additon to the activity out of San Francisco there was some early halibut fishing from the Oregon ports of Coos Bay (Marshfield), Newport and Portland on fishing grounds off Oregon and southern Washington. It appears, however, that these operations were very spasmodic as there are no indications of any individual vessel continuing to fish more than one or two successive years.

In 1885 the *Carrie B. Lake,* a small vessel of 36 net tons, fished a 40-foot beam trawl off the Washington coast between Cape Disappointment and Shoalwater Bay. The catch, mostly flatfish with some halibut, was delivered to Portland, Oregon. The steam fishing schooner *George H. Chase,* also out of Portland, was reported fishing in October 1889 in the vicinity of Cape Mendocino, California taking some halibut at a depth of 40 fathoms (Rathbun, 1894).

Indicative of the slow development of the fishery, only 25,000 pounds of halibut were reported landed in Coos County, Oregon as late as 1904. By 1912 catches of halibut totaling 44,000 pounds were reported taken off Newport in September of that year.

Washington

Fishing in Area 1 out of Washington ports had an equally slow development. In 1911 the 125 ton steamer *Weiding Bros.* out of Tacoma, Washington caught about 25,000 pounds of halibut on Heceta Bank, but rough weather and lack of a suitable nearby harbor discouraged the expansion of such operations. During 1912 two small vessels, the *Red Wing* and *Zillah May* (56 net tons), respectively out of Hoquiam and Aberdeen, Washington were reported to be fishing halibut off Tillamook Bay and Newport, Oregon. In May 1913, the *Idaho,* a 7-dory halibut vessel from Seattle, prospected as far south as Heceta Bank off Newport, Oregon for a total catch of less than 6,000 pounds. In the spring of 1914 two more vessels from Puget Sound prospected the southern grounds with discouraging results.

During the summer of 1914 in response to requests of the Seattle halibut fishing fleet and coastal communities of Oregon, the United States Bureau of Fisheries vessel *Albatross* undertook a survey of the southern grounds between Grays Harbor, Washington and Coos Bay, Oregon to determine if offshore banks capable of sustaining a halibut fishery did exist. No distant offshore banks, such as exist off the Alaskan coast, were found; however, several closer-in grounds capable of limited production were surveyed.

A shore party from the *Albatross* chartered a small boat and fished southwest from the buoy on the Yaquina Bay bar. They caught from 200 to 500 pounds

dressed-weight of halibut per unit consisting of 400 fathoms of groundline bearing 250 hooks at 9-foot intervals.

Most of the grounds reported upon by the *Albatross* were already being fished commercially prior to the survey, including Heceta Bank which was the most extensive in the area. However, at that early date it was surmised from the survey that the Oregon banks "would be easily depleted by any large influx of vessels" (Schmitt et al, 1915). This was borne out by subsequent events.

LATER COMMERCIAL FISHERY

By 1914 there was considerable activity off the Oregon coast and over 850,000 pounds were landed that year in 21 trips most of which were from Heceta Bank. Fares averaged about 40,000 pounds and some were completed in a relatively few number of days with the fish averaging about 27 pounds. The best fishing was that reported by the vessel *Alaska* which took 80,000 pounds during an 8-day period in mid-August. The 4-dory schooner *Decorah* landed a total of 173,000 pounds from May to August (Schmitt et al, 1915).

The United States survey ship *Albatross* continued its exploration for possible "far offshore halibut banks" off the Oregon and Washington coasts in 1915. The survey revealed no new grounds that were not already known to the commercial fleet but it did report catching a few halibut.

In 1915 there was a sharp increase in the number of commercial vessels fishing halibut off the southwest Washington and Oregon coasts. In late April it came to be known locally in Seattle through an inebriated crew member that the Puget Sound halibut vessel *Tom & Al* had encountered extremely heavy fishing on a very small ground west of the mouth of the Columbia River. During May and June 1915 practically the entire Seattle halibut fleet fished the region. Some vessels from southern British Columbia ports were also reported fishing on the same grounds (Johnston, 1916). Two large steamers of the fleet, the *Chicago* and *Zapora,* fishing 12 and 11 two-man dories respectively, landed trips of 300,000 and 220,000 pounds in Seattle on 10 May and 14 May respectively. The *Chicago* appears to have made the 275-mile round trip, Seattle to the Columbia River Lightship grounds, in 5 days *inclusive of fishing time,* indicative of an extremely high catch per unit of fishing effort.

Fishing records of smaller gas-engined vessels carrying 5 or 6 two-man dories showed many catches of over 1,000 pounds per unit effort. One entry on 14 May 1915 showed a catch of 50,000 pounds on 25 units of gear fished. The same vessels revisited the same grounds in 1916, and experienced a catch per unit effort of slightly over 100 pounds and in 1917 considerably below 100 pounds.

Landings of over 3,000,000 pounds were recorded from the Columbia River region in May alone and the overall catch in 1915 from the small ground off the mouth of the river is estimated to have been close to 5,000,000 pounds*. Most of the landings were made at Seattle or Newport, although some deliveries were directed to Portland, Grays Harbor and to Vancouver, British Columbia due to port congestion in Seattle.

*Such catches were not separable at the time and are included in Area 2 totals in Table 2, IFC Rept. No. 17 (Bell, Dunlop and Freeman, 1952).

However, this was a very short-lived fishery. By the end of the first month of fishing in 1915, halibut were reported as being relatively scarce. In 1916 despite a strike in the fishery the area was again visited by a few vessels, some being manned by owners whose own vessels were strikebound. While a few successful catches were made off the Oregon coast that year, they were not necessarily taken on the Columbia River Lightship grounds. The large steamers failed to secure a trip on the same grounds that had produced such record catches the year previously. A few persistent vessels again returned to the same grounds in April and May 1917 but were rewarded with poor returns for their effort.

The increased interest in the halibut fishery on the Oregon coast is evidenced by the construction in 1915 of a 55-foot vessel at Florence, Oregon to be used "especially for taking fishing parties to the halibut banks which lie northwest of here" (Pac. Fish., 1915). Also at this same time moderately successful commercial fishing was reported off the Oregon coast and as far south as the mouth of the Smith River in Northern California (Rankin, 1915).

After the high yielding but short-lived fishery off the Columbia River and on some nearby locations such as off Grays Harbor, halibut fishing south of Cape Flattery continued on a very modest scale. During World War I and the immediate post-bellum period the region was fished by a number of local setline vessels in addition to a few from Puget Sound ports, and fishing was conducted at scattered locations throughout the region as far south as northern California.

Numerous but smaller concentrations were brought into production and while some provided a few very profitable catches, they, like the Columbia River Lightship grounds, all proved to lack capacity for large and sustained year-to-year yields.

THE RECENT FISHERY

The recent fishery may be regarded as commencing about the mid-1920's. The production history for the grounds south of Willapa Bay since 1932 is summarized in Table 1 by the States in which the catches were landed. Estimates of the quantities taken annually in contravention to the regulations are also included.

California

By 1923 a small halibut fishery had become established off Eureka, California. Prior to that time catches by small trollers during the off-season for salmon had been sufficient to supply the San Francisco market (Downing, 1923; Pac. Fish., 1923). Yields from this northern California area attracted the interest of some setline vessels from Puget Sound and by 1927 such vessels were fishing out of Eureka. Operations were considered somewhat hazardous due to the prevalence of fog and the necessity of fishing in the coastwise steamer lane as well as a difficult harbor-entry across an entrance bar. Notwithstanding, the fishery continued to attract halibut vessels from Oregon and Washington ports using conventional setline halibut gear. The increased fishing effort was reflected in the rising trend of halibut landings as shown in the reports of the California marine fish catch. In 1934 over three-quarter million pounds were delivered in California, mostly in the northern ports of the state.

However this increasing trend was short-lived and by 1940 the total landings of halibut in California had fallen to below 200,000 pounds. The decline occurred

in the landings by all classes of vessels as shown in Table 2. Although the shortening of the fishing season contributed to the decline in landings there was also a reduced interest in the taking of halibut as the various accumulations proved to be incapable of sustained yields. With the lengthening of the season after 1945 there was a brief period of increasing catches. The temporary increase in landings was chiefly at San Francisco where some variable treatment had been accorded the catch data for halibut particularly with respect to what was recorded as Pacific halibut during this period*. However, no corrections to the historical record have been attempted as they would not materially change the trends of halibut production either for the State of California or for Area 1 as a whole. Since 1955 however, despite prolonged seasons, the total catch has declined to the low levels of recent years.

Table 1. Landings of halibut by State from South of Willapa Bay (in thousands of pounds).

	California	Oregon	Washington	Total
1932	506	348	48	902
1933	243	481	19	743
1934	766	595	252	1,613
1935	652	629	208	1,489
1936	393	312	4	709
1937	236	459	20	715
1938	304	400	2	706
1939	283	731	59	1,073
1940	186	585	8	779
1941	158	157	17	332
1942	175	110	0	285
1943	203	217	—	420
1944	183	137	—	320
1945	175	225	—	400
1946	358	260	12	630
1947	233	146	51	430
1948	124	133	28	285
1949	167	228	31	426
1950	208	210	15	433
1951	90	227	2	319
1952	377	131	18	526
1953	226	121	35	382
1954	192	388	134	714
1955	54	193	145	612
1956	258	250	86	594
1957	151	230	65	446
1958	130	216	10	356
1959	95	115	25	235
1960	59	210	41	310
1961	40	186	44	270
1962	30	241	41	312
1963	30	136	40	206
1964	30	79	33	142
1965	41	93	22	156
1966	40	98	3	141

*See Appendix

Table 2. Halibut catch by various segments of the California fishing fleet.

	1934		1940	
	No. Boats	Pounds	No. Boats	Pounds
Paranzella trawlers (2-boat sets)	12	160,098 (21%)	7	40,385 (22%)
Setline vessels primarily interested in halibut	28	586,072 (76%)	17	142,867 (77%)
Smaller hook and line boats including trollers not primarily seeking halibut	205	20,053 (3%)	64	2,924 (1%)
Totals		766,223		186,176

A fuller discussion of the statistical reporting of halibut in California and some problems of flatfish nomenclature is appended.

By the late 1940's, about 90 percent of the landed total in California was made by less than 20 small boats fishing with halibut setline gear. The remaining 10 percent was landed by nearly 200 smaller boats, such as salmon trollers and small boats using other than regular setline gear and primarily interested in the capture of other species (Bell, 1956). There was also a sharp decrease in the number of vessels fishing for sablefish *(Anoplopoma fimbria)* in the Eureka area, declining from 55 in 1946 to 9 in 1952 (Phillips and Imamura, 1954).

During the past 15 years landings have decreased even more drastically and halibut catches in California have become largely incidental to those for other species. At the present time there are few, if any, hook-and-line vessels directing their efforts to the taking of Pacific halibut off California despite the present long open halibut fishing season in the region.

Oregon

A moderately successful fishery developed out of the Oregon ports of Marshfield (Coos Bay), Newport, Astoria and Portland after World War I. In 1925 a plant opened in Astoria to receive halibut and enjoyed a more favorable position over Portland with its greater proximity to the fishing grounds (Pac. Fish., 1925). A curiosity of the fishery at the time was the reported use of carrier pigeons by the vessel *Martha* to notify a Portland market of the size of its fares and expected time of arrival (Pac. Fish.,1930). A Seattle fish processing firm opened a plant at Kalama, Washington, and paid Seattle prices in an effort to obtain fish from the Oregon banks during the 1932 season (Pac. Fish., 1932).

In Oregon after World War II most of the Coos Bay and Newport landings were accounted for by several small setline halibut boats. Astoria became the home port and landing center for about a dozen four- to six-man vessels using standard setline halibut gear. However, most of their production did not originate from grounds south of Willapa Bay but was taken off the British Columbia coast (Area 2) with an occasional fare from waters west of Cape Spencer, Alaska (Area 3). In Table 1 only the catches taken in Area 1 are included in the Oregon landings.

The declining trend of total catch from the region during the past 30 years (Table 1, Figure 2) can only to a very limited extent be attributed to the shortening of the legal halibut fishing season. There have been other factors. The small fleet

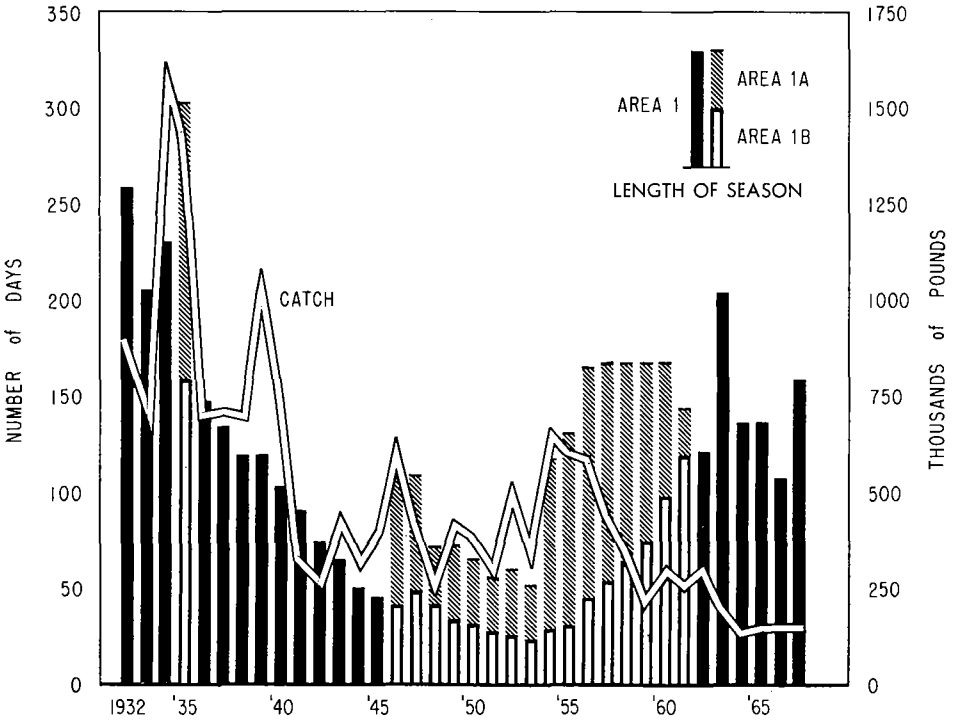

Figure 2. Length of season and catch from grounds south of Willapa Bay, 1932 to 1967.

that operated in Area 1 during the 1930's found the small localized supplies of halibut in the region inadequate. The process of attrition was accelerated by a number of the former halibut vessels directing their efforts to other more profitable pursuits such as salmon and albacore *(Thunnus alalunga)* trolling or bottom trawling for other demersal species. Also some of the decline in the setline fishing effort can be attributed to obsolescence or loss of some of the erstwhile halibut boats, or the aging of the operator/owners who had pioneered the fishery in the late 1920's. Entry of setline vessels from Puget Sound ports into the area to fish primarily for halibut also declined.

That the length of season was only a secondary factor in the decline of the total catch is further evidenced by the fact that with subsequent lengthening of the fishing season in the region after the early 1950's (Table 3, Figure 2) the catch of halibut continued to decline.

Furthermore notwithstanding the reduction in the fishing effort, the halibut supply on the grounds south of Willapa Bay did not rebuild as was the case on the grounds to the north in Area 2 and west of Cape Spencer. This is indicated by the size of the catches taken, by the few vessels continuing to fish halibut commercially in the area and by test fishing by a chartered setline vessel (Table 5).

Out of Oregon ports in recent years there has been only one boat that could be regarded as fishing halibut on grounds south of Willapa Bay. The remainder of the production landed from Area 1 in Oregon and California is caught incidentally to fishing for other species. There are, however, a few boats which fish on grounds

off British Columbia and land their fares in Oregon and account for most of the Oregon halibut landings in recent years. Through 1965 vessels from Washington ports largely restricted their setlining activities in Area 1 to fishing in the fall months for sablefish with halibut an incidental item.

INCIDENTAL CAPTURE OF HALIBUT IN OTHER FISHERIES

As indicated above the sparse and scattered occurrence of the halibut toward the southern extreme of its range resulted in a large proportion of the catch being taken incidentally to fishing for other species including salmon trolling, setlining for sablefish, and illegally while otter trawl fishing for other demersal species. A small quantity is taken by the developing ocean sport fishery.

Demersal Trawl Fishing

Bottom net trawling on the Pacific Coast commenced out of San Francisco about 1876 with the introduction of the paranzella trawl net by fishermen of Mediterranean origins. The net was a large bottom trawl, the mouth of which was spread and held open by two vessels. This gear was largely replaced by the modern otter trawl towed by a single vessel with the net spread and held by the kiting effect of a pair of otter boards, one attached to each wing (Scofield, 1948).

The initial paranzella fishing was carried out with lateen-rigged sailboats which were soon replaced by steam tugs, a more dependable and safer source of power. Steam power was supplanted as internal combustion engines became available, first using gasoline and latterly diesel oil.

Despite the uneconomic use of manpower and capital equipment in the two-boat paranzella operation there was little need for change. The vessels were owned by a few fish companies and crews were on wages. Fish were plentiful and, prior to World War II, manpower could be secured at moderate costs. Also, control of the fish receiving plants and markets by the established companies which also owned the vessels, precluded competition from any independent and probably more efficient otter trawlers. The two-boat paranzella, like the Spanish paréja or pair trawler, is in itself an effective fishing technique, and well adapted to situations where labor costs are not high.

During World War II manpower shortages and escalating wage scales forced the fish companies to convert to otter trawling and the conversion was complete by 1942. Also with increasing markets, independently-owned otter trawl vessels entered the fishery.

Trawling in California was first conducted on the close-in grounds out of San Francisco, exending west to the Farallon Islands and as far north as Point Reyes. As the productivity declined the fishery gradually expanded northward beyond Point Reyes to the more distant northerly grounds, and by 1930 some trawlers were fishing during the summer months out of the northern California ports of Fort Bragg and Eureka. The same pattern of expansion followed here with fishing first carried out close to Eureka and gradually expanding northerly until some California boats were fishing southern Oregon waters by 1934. This expansion was aided by the development of rail and highway transportation between the producing regions and markets of the San Francisco Bay region. As the trawl fishery expanded to northern

Table 3. Length of season for grounds south of Willapa Bay, Washington, Area 1.

Year	Opening Date	Description	Closing Date	Closing Date Concomitant with that of Area Indicated			Length of Season (Days)	Remarks
				Area 1A or 4	Area 1	Area 1B		
1932	February 16	Area 1 — South of Willapa Bay	October 31		Statutory*		259	*Stated in Convention
1933	February 1	Area 1 — South of Willapa Bay	August 25		Area 2		206	
1934	March 1	Area 1 — South of Willapa Bay	October 27		Later of 2 or 3*		241	*or attainment of 1,400,000 pound limit
1935	March 1	Area 4 South of Cape Blanco / Close December 26 / Area 1 Willapa Bay—Cape Blanco	September 6	Later of 2 or 3		Area 2	301-159	
1936	March 16	Area 1 — South of Willapa Bay	August 10		Area 2		148	
1937	March 16	Area 1 — South of Willapa Bay	July 28		Area 2		135	
1938	April 1	Area 1 — South of Willapa Bay	July 29		Area 2		120	
1939	April 1	Area 1 — South of Willapa Bay	July 29		Area 2		120	
1940	April 1	Area 1 — South of Willapa Bay	July 13		Area 2		104	
1941	April 1	Area 1 — South of Willapa Bay	June 30		Area 2		91	
1942	April 16	Area 1 — South of Willapa Bay	June 29		Area 2		75	
1943	April 16	Area 1 — South of Willapa Bay	June 20		Area 2		66	
1944	April 16	Area 1 — South of Willapa Bay	July 9		Area 2		51	
1945	May 1	Area 1 — South of Willapa Bay	June 15		Area 2		46	

Year	Opening Date	Description			Closing Date	Closing Date Concomitant with that of Area Indicated			Length of Season (Days)	Remarks
		Area 1A	Close	Area 1B		Area 1A or 4	Area 1	Area 1B		
1946	May 1	South of Cape Blanco	August 19	Willapa Bay—Cape Blanco	June 11	Later of 2 or 3		Area 2	111-42	
1947	May 1	South of Cape Blanco	August 17	Willapa Bay—Cape Blanco	June 8	Later of 2 or 3		Area 2	109-39	
1948	May 1	South of Cape Blanco	July 11	Willapa Bay—Cape Blanco	June 1	Later of 2 or 3		Area 2	72-32	
1949	May 1	South of Cape Blanco	July 12	Willapa Bay—Cape Blanco	June 3	Later of 2 or 3		Area 2	73-34	
1950	May 1	South of Cape Blanco	July 5	Willapa Bay—Cape Blanco	June 1	Later of 2 or 3		Area 2	66-32	
1951	May 1	South of Cape Blanco	June 25	Willapa Bay—Cape Blanco	May 28	Later of 2A or 3		Area 2A	56-28	
1952	May 14	South of Cape Blanco	July 12	Willapa Bay—Cape Blanco	June 8	Later of 2A or 3A		Area 2A	60-26	
1953	May 17	South of Cape Blanco	July 7	Willapa Bay—Cape Blanco	June 9	Later of 2A or 3A		Area 2A	52-24	
1954	May 16	South of Heceta Head	September 9	Willapa Bay—Heceta Head	June 5	Third 3B Season		Area 2*	117-29	*8 days added in August
1955	May 12	South of Heceta Head	September 21	Willapa Bay—Heceta Head	June 5	Third 3B Season		Area 2*	132-31	*7 days added in August
1956	May 12	South of Heceta Head	October 23	Willapa Bay—Heceta Head	June 27	Third 3B Season		Area 2*	164-45	*7 days added in August
1957	May 1	South of Heceta Head	October 16	Willapa Bay—Heceta Head	June 17	Area 3B†		Area 2*	168-54	*7 days added in August †Stated in Regulations
1958	May 4	South of Heceta Head	October 16	Willapa Bay—Heceta Head	July 2	Later of 3A or October 16		Area 2*	166-66	*7 days added in August
1959	May 1	South of Heceta Head	October 16	Willapa Bay—Heceta Head	July 8	Later of 3A or October 16		Area 2*	168-75	*7 days added in August
1960	May 1	South of Heceta Head	October 16	Willapa Bay—Heceta Head	July 31	Later of 3A or October 16		Area 2*	168-98	*7 days added in Sept.
1961	May 10	South of Heceta Head	October 1	Willapa Bay—Heceta Head	September 7	Later of 3A or October 1		Area 2*	144-120	*Added season abolished
1962	May 9	Area 1 — South of Willapa Bay			September 8		Area 2*		122	*Divided area abolished
1963	May 9	Area 1 — South of Willapa Bay			November 30		Area 2		205	
1964	May 1	Area 1 — South of Willapa Bay			September 15		Area 2		137	
1965	May 1	Area 1 — South of Willapa Bay			September 15		Area 2		137	
1966	May 9	Area 1 — South of Willapa Bay			August 25		Area 2		108	
1967	May 9	Area 2* — South of Cape Spencer			October 15				159	*Area 1 combined with Area 2

California, Pacific halibut became more prominent in the landings. Most of the halibut was landed at the port of Eureka from waters contiguous to the northern part of the State.

The catch of halibut by trawl gear in California during the period 1930 to 1943 represented 18 percent of the total California halibut catch for that period. The proportion varied from 1.5 percent in 1930 to 44.3 percent in 1938.

The proportion of halibut in the total California trawl landings for the period from 1930 to 1943 averaged 2.3 percent annually. With the replacement of paranzella gear by the otter trawler there was some indication of a decline in the proportion in the later years of the period. However the decrease was probably not only due to differences in the selectivity of the two types of gear but to the change in emphasis placed upon the different species. During World War II there was a growing demand for dogfish *(Squalus acanthias)* livers and on grounds usually frequented by dogfish the amounts of incidentally caught halibut were lower than on those where flatfish were more abundant.

The proportion of inadvertently-caught halibut in otter trawl catches cannot be determined from the commercial landings after 1943 as the retention of such halibut was prohibited after that year by regulations* of the Commission. However, some trawl-caught halibut are retained and landed in contravention to such regulations, and estimates of such landings are included in the catch statistics of this report.

In 1952 and 1953 the California Department of Fish and Game conducted a detailed sampling at sea of the catch of commercial trawlers out of Eureka. Pacific halibut constituted 1.1 percent of the total foodfish catch which consisted of about 75 percent other flatfish species.

Observations by Commission personnel during the summer of 1964 on a number of otter trawlers fishing out of Eureka indicated that the halibut content was 2.3 percent of the marketable catch which also consisted predominantly of flatfish.

While the foregoing observations on commercial otter trawlers are limited in scope, the continuing low proportion of halibut in the trawl catches suggests that there has been no significant accumulation of halibut in the region despite the prohibition placed upon retention of halibut by trawlers as well as the greatly reduced amount of setline halibut fishing in the region in recent years. However, on infrequent occasions a trawler may encounter a localized concentration of halibut and catch as much as several thousand pounds in a single haul.

Though domestic trawlers are not permitted to retain inadvertently caught halibut, their mortality upon rejection or their illegal retention places a continuing drain upon the marginal supplies of halibut in the region. Also, large Russian and Japanese trawlers have fished on these grounds since 1966 and undoubtedly impose a further drain of varying degree upon the already sparse supplies of halibut in the area.

Setlining for Species Other Than Halibut

On many grounds in Area 1, almost from the outset of the setline fishery, catches of halibut were frequently augmented by sablefish and rockfish caught concurrently with the halibut. Many of the setline catches at times consisted of as much as one-half or more of sablefish. When vessels from northern Oregon and Washington ports

*Pacific Halibut Fishery Regulations 1944.

entered the Eureka halibut fishery in the mid-1920's they tended to use the regular halibut setline gear and the catches were predominantly halibut. However, the sablefish component led to the local development of lighter-weight gear which was more effective in the taking of sablefish. The basket-type setline gear, which had been in use in central California at least since 1880, was introduced into northern California by the mid-1920's. This gear continued to be used in preference to the regular halibut setline gear. By 1935 a distinctive type of wooden tub in which to coil the gear was being used rather than the original basket.

The evolution of California setline gear is described by Scofield (1947) and Phillips (1954). Tub gear was usually constructed of 3/16-inch manila or cotton rope groundline with gangings of 36- to 48-thread cotton twine 1½ feet long and spaced 3 to 4 feet apart. Each tub held 150 to 220 size 7/0 or 8/0 hooks. Conventional halibut gear has gangings 13 feet apart and recently as much as 18 or even 21 feet (Pac. Fish. 1963).

With the progressive withdrawal of the typical halibut setliner from the fishery off the California-Oregon coast the largest proportion of the reported catch of halibut came to be made by the lighter sablefish gear. There are a few setliners from the Puget Sound ports that continue to fish on grounds south of Willapa Bay primarily for sablefish in the fall, usually after the closure of the area to halibut fishing. Until 1966 setline vessels could retain one pound of the incidentally caught halibut for each seven pounds of other species. Such post-season landings of incidental halibut were permitted until 15 November*.

Troll-caught Halibut

On most sections of the Pacific Coast large quantities of halibut may be landed by boats fishing primarily for salmon with hook-and-line gear, a method of fishing usually described as trolling.

Trolling is conducted by towing several lures on multiple lines with barbed hooks at speeds up to three knots usually in the upper water levels. Herring, metal spoons and plugs are the chief lures in use. A recent description of the gear as used in California is given by Scofield (1956). Trolling boats may fish close to port and land daily, or ice the fish and land at intervals of up to two weeks.

From time to time there may be as many as two thousand trolling boats that fish salmon south of Willapa Bay off the coasts of California, Oregon and Washington. Some will occasionally dispose of individual halibut with their primary catch of salmon or may retain the inadvertently caught halibut for personal use.

The amount of halibut caught incidentally by troll gear off Oregon and California is much less than what is taken by such gear on grounds off British Columbia or Southeastern Alaska. From 1932 to 1944 the recorded landings of troll-caught halibut in California averaged about 3,900 pounds annually (Table 4). During that period it annually represented about 1.1 percent of the total reported catch of halibut in the State. Since that date troll catches of halibut have not been separately indicated but are known to have declined sharply along with that by all other gear (Table 4).

Reported landings of troll-caught halibut in Oregon from Area 1 averaged about 12,700 pounds annually from 1932 to 1965 and that gear accounted for about 6.6

*Pacific Halibut Fishery Regulations, 1965.

Table 4. Average annual landings of troll-caught halibut in coastal sections of Washington, Oregon and Northern California by 5-year intervals since 1932 (in pounds).

	Washington Coastal	Oregon Coastal	California Northern
1932-1935	3,000	5,000	9,000
1936-1940	11,000	5,000	5,000
1941-1945	52,000	8,000	1,000
1946-1950	5,000	6,000	
1951-1955	15,000	20,000	
1956-1960	55,000	35,000	
1961-1965	34,000	10,000	

percent of the halibut catch taken off the Oregon coast. Landings of troll-caught halibut at Washington coast ports averaged about 25,700 pounds annually from 1932 to 1965 and represent about 51 percent of the total halibut landed in Washington from Area 1* during this period.

Sport Fishery

The development of tourist and sport fishing centers off the coastal areas of the three states, California, Oregon and Washington, has encouraged a small boat or skiff fishery for halibut during the summer vacation period and especially on weekends. These noncommercial operations are limited to moderately close inshore grounds but can be successful in taking halibut particularly off Oregon and Washington.

The Northern Pacific Halibut Convention makes no special provision for the sport or subsistence taking and retention of halibut. Under the Pacific Halibut Fishery Regulations, which apply to all nationals and inhabitants of United States and Canada, it is legal to catch and possess halibut for such sport or subsistence purposes only during the established season in a given area. The regulatory agencies of the coastal states may impose restrictions in addition to the closed season provided by the Pacific Halibut Fishery Regulations. Washington for example has set a two-fish-per-day bag limit for halibut caught by sport fishermen. Oregon and California as yet have no added restrictions.

In most cases the halibut caught by anglers in the three states are taken incidentally while sport fishing for other species. A recent survey of northern California ocean sport fishing estimated an average annual catch of 311 halibut from the Oregon border south to about Fort Bragg during the period 1958 to 1960. Average size of these fish was five pounds (Miller and Gotshall, 1965).

In 1959 halibut in the sport catches off the mouth of the Columbia River and Westport were estimated to be about the ratio of 1 halibut for every 100 sport-caught salmon. Creel checks by the Washington State Department of Fisheries at the mouth of the Columbia River reported 1,132 halibut caught in 514,304 angler trips during the period 1960 through 1964. During the same period an estimated 2,910 halibut were landed at Westport, Washington (Buckley, 1966).

It is not improbable that in the years to come the sport catch of halibut will increase in relative importance in this marginal area of productivity with respect to the species.

*The existing system of statistical returns records incidental catches of halibut by port of landing. A large, but unknown, percentage of these catches were undoubtedly made north of Area 1.

SCIENTIFIC INVESTIGATIONS

Scientific investigations of the halibut south of Willapa Bay, Washington have been conducted at levels more than commensurate to the importance of the area with respect to halibut.

Catch Statistics

The individual landings of halibut by vessels and types of gear have been compiled covering the period of the past 50 years. While fishing records have been collected from vessels frequenting the region, the marginal character of the fishery provides neither an adequate nor consistent series of catch per unit effort values. Also due to the limited availability of halibut in the region, some vessels fish concurrently for other species which tends to invalidate the use of such catch per unit effort data as a measure of the relative abundance of halibut.

That it required 15 trips upon commercial trawlers in the area by a Commission observer in 1964 to collect age and length data from 202 inadvertently-caught halibut is indicative of the relative scarcity of halibut in the region. A commercial setline vessel chartered by the Commission fished and tagged during September 1966 at a number of locations where concentrations had been encountered and fished commercially the past 50 years between Eureka and Willapa Bay. During this research cruise a total of 7,263 pounds was caught on 260 units of fishing effort or skates for an average catch per skate of only 28 pounds (Table 5). The best fishing encountered was off Port Orford, Oregon when 2,131 pounds were taken on 28 skates for a catch per skate of 76 pounds. Off the Columbia River where extremely heavy fishing was encountered in 1915, only 82 pounds were taken on 22 skates fished. These fishing results were consistent with those of small commercial boats setline fishing in the area in recent years and are also indicative of the low abundance of halibut in the region. Similarly during an earlier research cruise of the Commission to the same region in 1926 only 276 halibut were caught on 140 skates of gear.

Tagging Investigations

Halibut were tagged off northern California and southern Oregon in 1964 by Commission observers on board commercial otter trawlers. Due to the small catches

Table 5. Daily summary of operations in Area 1 by the setline vessel Chelsea chartered by the International Pacific Halibut Commission, September 1966.

Date (Sept.)	Standard Skates Fished	Tagged		Otolithed		Total		Catch per Skate (pounds)
		No.	Wt.	No.	Wt.	No.	Wt.	
6	22	—	—	14	392	14	392	18
7	22	9	450	9	197	18	647	29
8	22	3	97	1	22	4	119	5
9	28	46	1,486	14	645	60	2,131	76
10	28	20	755	17	415	37	1,170	42
11	22	25	497	5	143	30	640	29
12	22	3	48	1	23	4	71	3
13	22	11	80	4	24	15	104	5
14	22	12	261	5	183	17	444	20
15	28	34	1,130	16	333	50	1,463	52
16	22	3	67	1	15	4	82	4
Totals	260	166	4,871	87	2,392	253	7,263	28

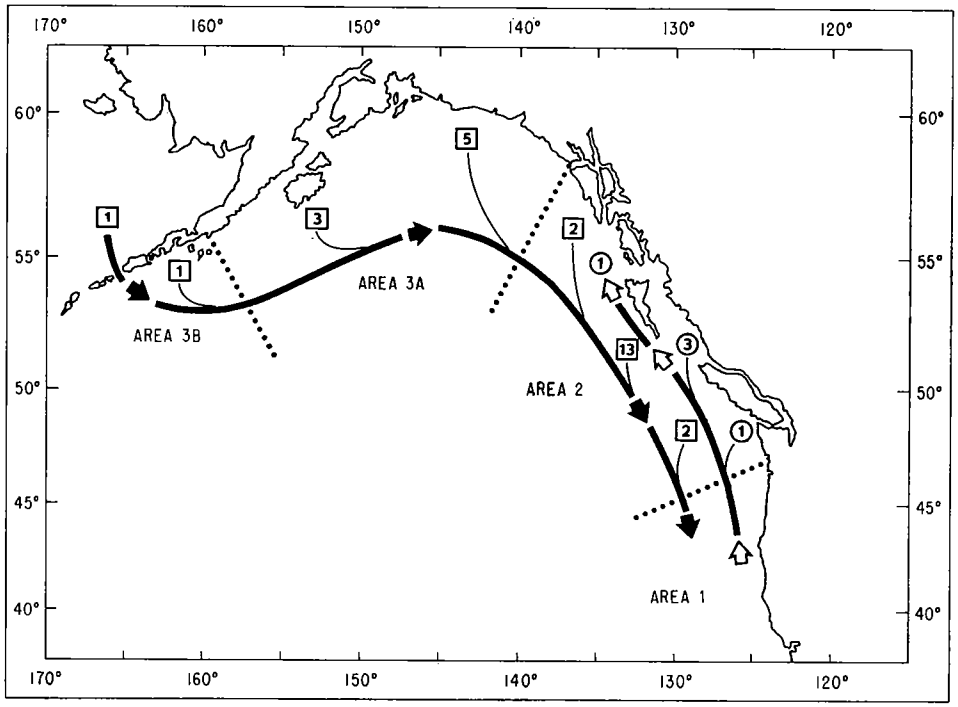

Figure 3. Release locations of 27 tagged halibut immigrating into Area 1 and recovery locations of 5 tagged halibut emigrating from Area 1.

of halibut in the region only 148 halibut were tagged but 25 have been recovered through December 1967. Of the total, 20 have been recovered from the inadvertent catches of halibut* by commercial otter trawlers fishing south of Willapa Bay, Washington and 5 have been taken by setline fishing vessels on grounds in Area 2. This movement to Area 2 from Area 1 coupled with repeated instances of migration to Area 1 from Area 2, Area 3 and even from Bering Sea (Figure 3) demonstrates the interrelationship of the halibut in Area 1 with those elsewhere.

Size and Age Composition

Despite the limited amount of data available for studies of the size and age composition, the samples portray patterns similar to those observed in larger samples taken off the Goose Islands grounds in Area 2. That the same age groups are contributing to the catches in Area 1 as in Area 2 but at a much reduced relative abundance, is shown in Figure 4. It should be noted that in Figure 4 the ordinate scale for Area 1 data is six times that used for Area 2.

The difference between the weights at each age of halibut caught by trawl and setline gear in Area 1 is also similar to what has been observed in Area 2 (Figure 5).

Changes between 1926 and 1966 in size of fish caught in Area 1 are shown by an increase in the indicated rate of growth (Figure 6), which parallels similar changes recorded in Area 2 (Southward, 1967).

*While halibut caught by such vessels normally may not be retained, the Pacific Halibut Fishery Regulations provide for the retention of tagged halibut caught by any type of gear at any time.

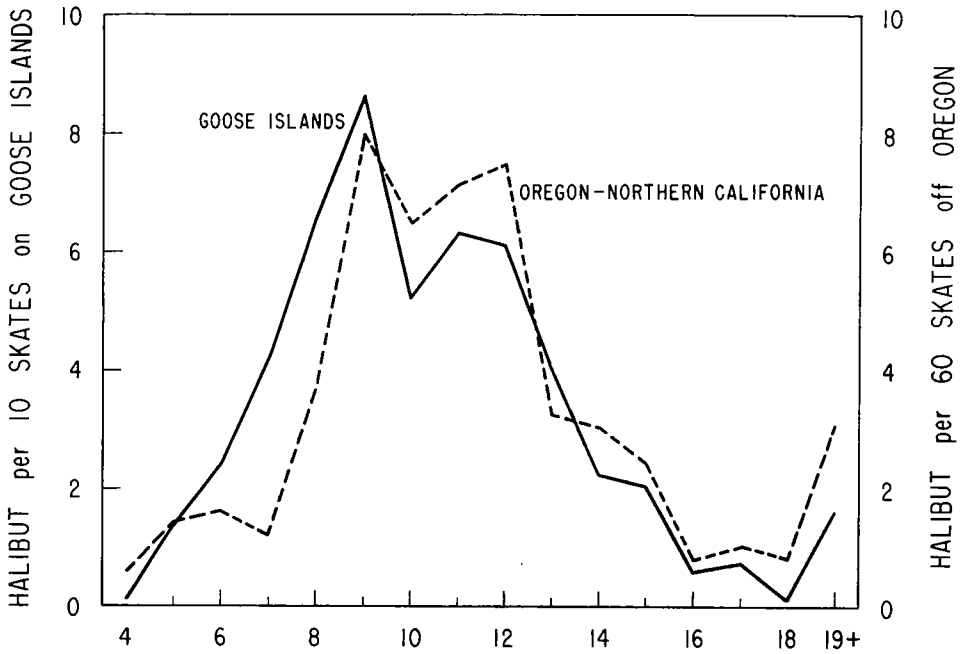

Figure 4. Number of halibut at each age caught per 10 skates of standard gear on Goose Islands grounds and per 60 skates of standard gear on Area 1 grounds in 1966.

Morphometric Studies

Morphometric studies using the counts of meristic characters showed no difference between the halibut on the Goose Islands grounds and those taken in Area 1. For example, anal fin-ray counts from 288 specimens taken in Area 1 and 146 fish from Goose Islands grounds in Area 2 were 74.67 and 74.56 respectively with standard deviations of 2.32 and 2.12 each. Vertebral counts of 77 halibut from Area 1 and

Figure 5. Average weight in pounds (dressed weight with heads on) by age for trawl and setline caught halibut from Areas 1 and 2.

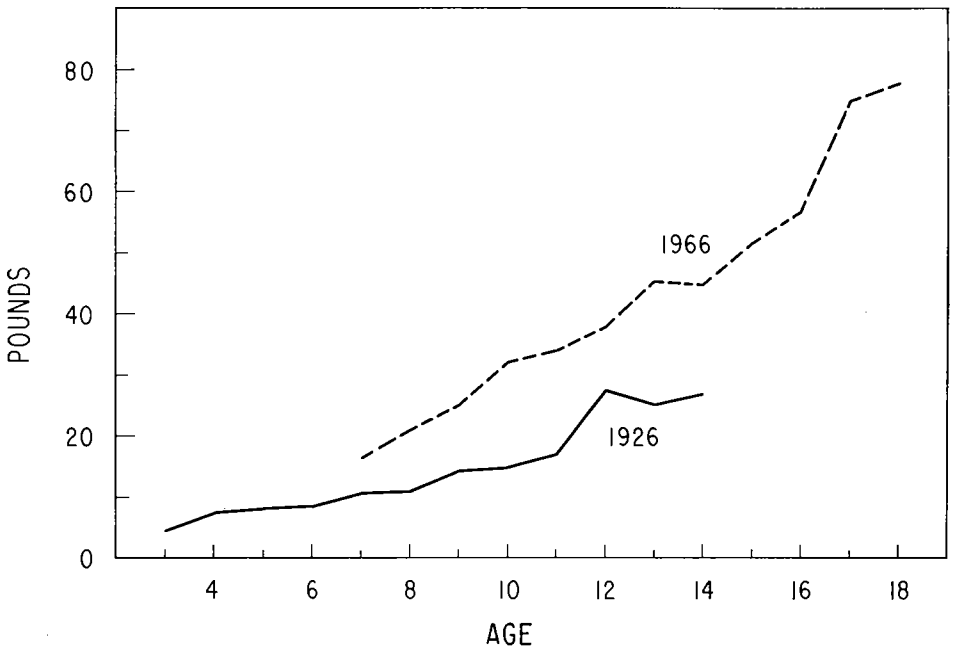

Figure 6. Average weight in pounds (dressed weight with heads on) by age for Area 1 halibut.

138 from Goose Islands were 50.26 and 50.17 respectively with standard deviations of 0.52 and 0.52 each.

Early Life History

Early life history studies of the Pacific halibut have indicated that spawning occurs on the continental slopes at depths usually from 175 to 225 fathoms. The fertilized, developing eggs and early-stage larvae rise to midwater levels and are transported considerable distances by the ocean currents. After about 6 to 7 months the postlarvae, having risen into the surface inshore drift, commence their demersal or bottom existence close to shore.

To provide a logical basis for the southern limit of the species it has been suggested that any pelagic eggs and young produced on grounds in Area 1 are swept offshore by the prevailing currents and that the population is being maintained by the "dribble of fish southward from Area 2" (INPFC, 1962, p. 27). This theory does not appear to be applicable to other Pleuronectidae in the same region. Petrale sole *(Eopsetta jordani)* and Dover sole *(Microstomus pacificus)* are known to spawn off northern California and southern Oregon at depths of 150 to 200 fathoms and greater and those species are maintaining themselves in the area and support a substantial fishery. It should be borne in mind, however, that both petrale and Dover sole are more southrely forms than halibut.

The existence of a northerly flowing inshore current on the surface during winter and spring has been shown by Schwartzlose (1963). This is apparently a seasonal expansion of the deep, below 100 fathoms, northward flowing Davidson Current (Reid *et al,* 1958). Thus, during the winter spawning period of halibut there exists a north-flowing current at both the deeper levels where any spawning would

take place and at the upper levels to which the halibut eggs and larvae would gradually rise. Any progeny that might be produced in Area 1 would tend to be carried northward and subsequently into shallow water by the inshore surface drift and not offshore, as previously suggested, where survival would be doubtful.

This northward water movement was estimated to be at least 50 miles wide and to have a speed of at least 0.5 to 0.9 knots. Consequently, if any spawning does take place in Area 1 the northerly currents would carry the pelagic stages into Area 2 and even further before metamorphosis occurred and the young are ready to assume a bottom living existence.

Any such northward drift of the natant eggs and larvae would be counterbalanced by a net contramovement of adults from north to south as demonstrated by the recoveries of tagged adult halibut. Also the movement of adults into the generally less favorable environment for halibut in southern waters would tend to establish the discontinuous series of small concentrations that characterized the halibut population in the region. The halibut would accumulate in small enclaves or pockets where the environment was more favorable.

The net movement southward of adults would have been greatest when the populations of Area 2 and farther north were at their primeval abundance. In their present exploited condition the net southward movement is probably low which could account for the failure of the early accumulations in Area 1 to rebuild despite the reduction in fishing that has occurred in the region.

Utilization

The question as to whether the small supplies of halibut in this region are in fact being appropriately utilized has no direct rational solution. Traditional methods of assessing stock size and rates of utilization cannot be applied as the sparse distribution of halibut has not supported any consistent fishery to produce an adequate series of catch per unit effort data.

Suggestive of the present level of utilization is the fact that the annual catches are now relatively small compared to the large removals made in the initial years of the fishery. Despite accessible markets and increasing demand for halibut in the region, production has been at a relatively low level. The primeval accumulations after being rapidly removed have shown little or no evidence of regeneration. Furthermore, tagging has demonstrated the intermingling of this fringe element with the main halibut population, which makes the question of adequate utilization at this fringe of the species distribution even more involved. As the extremes of distribution of any species are approached the question of their utilization becomes more and more academic and at some point achieves the state of *reductio ad absurdum*.

REGULATION OF THE FISHERY

The early development and expansion of the fishery south of Cape Flattery, including the initial and major exploitation of the Oregon banks in 1914 and 1915, was at a time when there were no legal restrictions on the Pacific halibut fishery.

The Pacific coast fishing industry had advocated international joint control of the halibut fishery as early as 1915, but it was not until after World War I that a Convention was consummated on 2 March 1923 between the Dominion of Canada

and the United States of America. This Convention which was ratified on 21 October 1924, established a three-month winter closed season from 16 November to 15 February, during the spawning season. It also provided for the appointment of the International Fisheries Commission to investigate the fishery and to recommend measures for its preservation.

After intensive scientific investigations had shown that the stocks of halibut were in an overfished, low-yielding state and that the statutory three-month winter closed season was not effective in stopping intensification of the fishery and further decline of the resource, the Commission recommended additional remedial measures to the two governments.

A new Convention was signed in 1930 and ratified in 1931. Amongst other measures it empowered the Commission to change or suspend the closed season and to divide the convention waters into areas and to limit the catch of halibut to be taken from each during its fishing season. Subsequently the Conventions of 1937 and 1953 provided the Commission with additional authority while the latter also changed the name to the more definitive International Pacific Halibut Commission.

Halibut fishing in the region south of Willapa Bay, Washington has been limited and closely controlled since 1932 by annually enacted regulations in conjunction with the coastwise conservation program of the Commission. In addition there has been the further objective of maintaining an appropriate level of removals in this region of marginal occurrence of halibut despite the inherent difficulties involved.

From the outset of regulation in 1932 the primary management problem on the section of the coast south of Willapa Bay has been to minimize as far as possible the retention of halibut caught in contravention to the regulations.

While the amount of halibut involved with respect to Area 1 was relatively small, the area possessed characteristics that made it difficult to manage effectively. It was also essential that conditions should be prevented from developing in Area 1 that could affect the conservation of the resource on the more important grounds to the north, particularly in the adjacent Area 2. The effectiveness of regulation in Area 2 was paramount. This overriding concern is noted in the official records of the Commission ". . . In view of the scattered fishery on this long coast any control whatever of halibut landings presents difficulties, but it is apparent that this limit will carry the season past the time of greatest danger and obviate a source of much worry in law enforcement" (20 June 1934, official Commission correspondence).

It was also stated that "Area 1, to the south of Willapa Harbor, is of little importance to the regular halibut fishery but was necessary to make the enforcement of regulations in Area 2 possible" (Dunlop, 1937, p. 1). Such considerations have been the only reasons for designating the grounds south of Willapa Bay as a separate management area. It is to be noted that such a separation was not intended to confer distinction as to stock upon the halibut found in the region.

The initial regulations which were enacted for 1932 designated the waters south of Willapa Bay, Washington as Area 1. No annual limit was placed on the catch but the removals were effectively regulated by controlling the length of season. The annual production of halibut from the region had not, for the past 15 years, exceeded in any year two percent of the Pacific coast total. It had also been evident since the initial fishing in the area that despite some very dense primeval concentrations which

were found at a number of isolated locations in the region, they were ephemeral and could not sustain any substantial fishery.

It was provided that Area 1 should close at the same time as Area 2 to facilitate enforcement of the closure of Area 2 which included those waters north of Willapa Bay to Cape Spencer, Alaska. The priorities of the situation at that early date and to very recent times had demanded that such measures be taken in Area 1 so that the effectiveness of management in the more important and productive regions on the coast such as Area 2 might not be jeopardized.

In view of the trend towards shorter seasons for the important producing region of Area 2 and the need to maintain a reasonable length of season in Area 1 to be able to assess the condition of the halibut supply in this region, it was provided in the 1934 regulations that Area 1 would close with Areas 2 or 3 whichever closed the later. In that year Area 2 closed on 19 August and during the ensuing months a number of Seattle vessels chose to continue fishing in Area 1. The latter development led to the Commission amending the 1934 Regulations to include a precautionary limit upon the removals from Area 1 in the amount of 1,400,000 pounds. This amount was deemed to have been taken about the same time as the closure of Area 3, namely, 27 October 1934 and Area 1 was closed on that date. Close control of the fishery required the imposition of a catch limit in only this one year.

A lack of law observance occurred in 1934 and a considerable proportion of the reported catch in Area 1 after 19 August was in fact taken on grounds in the then closed Area 2. In these early years enforcement patrol was either lacking or had not developed to its present state of effectiveness.

To avoid repetition of the foregoing unfavorable situation yet still provide as long an open period of fishing as possible at the extreme southern limit of the species range where halibut were taken still less frequently, Area 1 was divided at Cape Blanco, Oregon in 1935. The grounds north of that point were closed with Area 2 and the areas to the south which were designated as Area 4 were closed later with Area 3.

Provision of this buffer area between Cape Blanco and the southern boundary of Area 2 was only partially effective in protecting the integrity of the closure of Area 2. In 1936 it became necessary to revert back to the original design of 1932 of closing Area 1 as a whole with Area 2.

As the Area 2 season continued to shorten in the ensuing years many complaints were made by the few small setline boats that continued to fish the marginal supplies of halibut off the California and Oregon coasts. The halibut fishery was now chiefly incidental to catches of other species.

Adequate sea and shore enforcement in the region has been difficult and costly on account of the large number of small landing ports distributed over about 400 miles of coast. Also in most instances those small ports possess a good local market demand for small quantities of fresh halibut whether legally caught or not. The ports were also within overnight motor freighting to larger centers of population. Also the relatively inconsequential production of halibut from the area, both legal and illegal, provided little justification at the time for the expenditure of large amounts of public funds on enforcement.

In 1944 enforcement problems in the region were further compounded by the

coastwise prohibition by the Commission of the retention of any halibut inadvertently taken by trawlers and other bottom nets and the further shortening of the seasons both in Area 2 and Area 3. Coupled with a heavy post-bellum demand for halibut, the landing and sale of halibut caught in contravention to the regulations increased sharply in Area 1.

It was decided in 1946 to again divide Area 1 into Areas 1A and 1B at Cape Blanco in order to permit at least the southern portion of the region to remain open as long as practicable and to reduce the amount of illegally landed halibut in a region where such early closures were difficult to enforce from a practical standpoint. It has been the continuing objective of the Commission to regulate the fishery in the area in a manner that would minimize the task of agencies responsible under the United States Enabling Act for enforcement of the regulations of the Commission. Experience has shown that without the buffer area north of Cape Blanco vessels might fish in Area 2 after closure and declare their catches from the adjoining Area 1. With the greater remoteness of Area 1A, the latter practice was less likely.

In 1948 the illegal practice of false declaration of the origin of catches was further discouraged by requiring vessels fishing south of Cape Blanco in Area 1A after closure of Areas 1B and 2 to have their licenses validated at a port in Area 1A prior to each trip. In 1954 the boundary between Area 1A and 1B was shifted northward from Cape Blanco to Heceta Head, Oregon in an attempt to further reduce violations.

These post World War II objectives of the Commission are stated in part in International Fisheries Commission Report 14, 1949, p. 13.

> "The 1948 regulations provided for the concurrent closure of Area 1B with Area 2 and of Area 1A with Areas 3 and 4. The closure of Area 1B with Area 2, as in the case of Area 4 with Area 3, is necessary for enforcement purposes. Experience has shown that without such a provision vessels would fish in Area 2 after closure and declare their catches from the adjoining Area 1B. With the greater remoteness of Area 1A, such a practice is less likely. It is further discouraged by requiring vessels fishing in Area 1A after closure of Areas 1B and 2 to have their licenses validated at a port in Area 1A prior to each trip."

Since the early 1950's enforcement effort by the United States in the region has been very substantially increased with an attendant sharp decline in the estimated amount of halibut disposed of in contravention of the regulations. The current level of such illegal catches in this region is probably at an irreducible minimum. It is apparent by any reasonable standards that the difficult enforcement conditions that existed earlier in this area have now been satisfactorily overcome. It is also unlikely that there is any commercial fishery in which the costs of enforcement reach such a high proportion of the total economic value of the fishery as was the case with respect to halibut in Area 1. Consistent and continued improvement of enforcement conditions by 1962 permitted a recombining of Areas 1A and 1B into Area 1 in that year.

Furthermore, surveillance in the region will probably be materially increased by the 1964 action of the State of Oregon of including in their General Orders the

significant features of the Pacific Halibut Regulations governing the taking of halibut. This will permit state enforcement agents, namely, the Oregon State Police, to actively participate in surveillance over the catching and landing of any halibut caught in contravention of the regulations.

Due to a number of circumstances the season length in Area 2 increased from the low point of 24 days in 1953 to an average of 149 days from 1963 to 1967. However, in Area 1 both the fishery and probably the supply of halibut had deteriorated to such an extent that production from the area with the greatly lengthened season not only failed to increase but has in fact declined steadily (Table 1, Figure 2). Since 1958 the total catch from the area has been less than a quarter of a million pounds annually with much of the catch being taken incidentally to fishing for other species.

Consequently, with the lengthening of the season and the effective solution of the enforcement problem, the need for the separation of grounds on this fringe of the halibut population from the main body to the north off British Columbia no longer prevailed. In 1967 the Pacific halibut fishery regulations provided for the incorporation of Area 1 into Area 2, although for all practical purposes the two areas had been managed as a unit for many decades.

It is evident from the 35-year history of regulation in this region of low halibut availability that the area has received a proportionately large amount of management attention. This, however, is an almost inevitable consequence of any conservation program of a natural resource whose socioeconomic importance usually declines at either extreme of the species' distribution.

SUMMARY

The southern limit of the commercial range of the Pacific halibut *(Hippoglossus)* is at Cape Mendocino, California. Further south the species is encountered infrequently.

The local and discontinuous concentrations of halibut at this southern extreme of the range of the species that once supported a moderate fishery have a limited capacity to sustain any substantial yields.

Indicative of the low productivity with respect to halibut of this 375-mile section of the coast between Willapa Bay, Washington and Cape Mendocino, California, the halibut catch has exceeded one million pounds in only seven years between 1926 and 1967. Despite accessible markets and increasing demand for halibut in the region, production has been at a relatively low level and the population has not rebuilt despite the reduction in the amount of fishing. At the present time most of the catch is taken incidentally while fishing for other species.

Halibut fishing in the region south of Willapa Bay, Washington has been limited and closely controlled since 1932 by annually enacted regulations in conjunction with the coastwise conservation program of the Commission. In addition there has been the further objective of maintaining an appropriate level of removals in this region of marginal occurrence of halibut despite the inherent difficulties involved.

The interrelationship of the halibut south of Willapa Bay, Washington with those to the north off British Columbia and Alaska is evident from the results of tagging and morphometric studies. Numerous halibut tagged throughout the entire range of the fishery and as distant as the Pribilof Islands in the Bering Sea have been recovered from grounds south of Willapa Bay, Washington. Also a reverse movement is demonstrated by the recovery of tags off the coast of British Columbia and Southeastern Alaska that were released off northern California. Furthermore, if there is any halibut spawning south of Willapa Bay, the effects of the prevailing currents upon the eggs and larvae are such as to establish a close relationship between the halibut in Area 1 and those in Area 2 or farther north.

The close relationship in Area 2 is also evident in the similarities in age composition, in growth rates and in changes therein and in the age-weight relationship of halibut caught by setline and by trawl gear in the two areas.

The biological inseparability of the halibut south of Willapa Bay with those to the north was evident at the outset of regulation in 1932. Enforcement and law observance considerations until 1965 required that the sparse population of halibut in the large southern area be administered in conjunction with those to the north. Also much of the catch was taken by vessels that fished from time to time both south and north of Willapa Bay. In 1967 with the improved enforcement facilities in the region, Area 1 was incorporated with Area 2.

APPENDIX

NOMENCLATURE

It is necessary to examine the names by which halibut has been described in the region under review as the landings of Pacific halibut *(Hippoglossus)* have from time to time been variably grouped in the California statistical reports along with the large flounder *Paralichthys californicus.* Frequently they were not separately identified on the dealer's invoices of purchase that formed the basis for the State's statistical system. This confusion occurred mostly in the early stages of the fishery and before the State of California had fully developed its now classic system of catch statistics. *Paralichthys* in any significant numbers overlaps the range of *Hippoglossus* only as far north as central California, and both are landed in the San Francisco Bay region.

From an examination of the published California catch statistics since 1926 it is evident that no consistent procedure has been followed in allocating the landings of halibut in the San Francisco region between *Hippoglossus* and *Paralichthys* (Appendix Table 1).

Prior to 1938, the reported landings of *Hippoglossus* into San Francisco were relatively large. However, they were probably close to the actual as the retention and landing of net-caught halibut was legal at this time and also some setline vessels were known to have delivered their halibut catches to San Francisco. There was an apparent high availability of halibut off California during this period as shown by the large landings at Eureka.

For the 9-year period from 1938 to 1946 inclusive, 4 percent of the total "halibut" catch landed in San Francisco was designated as *Hippoglossus,* the proportion varying from year to year. In light of the circumstances prevailing during World War II which is included in this period and the change-over from paranzella-net fishing to otter trawling, the proportion of true halibut as indicated above may not be unreasonable.

For the period 1947 to 1954 the total "halibut" reported as landed in San Francisco was uniformly prorated in the State's catch statistics as 10 percent *Paralichthys* and 90 percent *Hippoglossus.*

> "Halibut delivered to the San Francisco region in previous years was prorated and published as 90 percent Pacific halibut and 10 percent California halibut. Recent investigation indicates that 90 to 99 percent of the landings are California halibut, instead of Pacific halibut. Hence, all halibut landed in the San Francisco region is published as California halibut except when the variety is specifically designated as Pacific or Northern by the fish dealers." (Calif. Depart. of Fish and Game, 1958, Fish Bull. 105, p. 29).

In light of the magnitude of the reported landings of *Paralichthys* at Monterey to the south and of *Hippoglossus* at Eureka to the north, it would appear that the amounts of *Hippoglossus* indicated to have been landed at San Francisco during the period in question were too high, and conversely the *Paralichthys* component too low. At this distance it appears that it would have been more realistic to have prorated

the catches on the basis of 10 percent *Hippoglossus* and 90 percent *Paralichthys*. Landings of Pacific halibut would probably have also been somewhat discouraged after 1944 by the regulation of the Commission prohibiting the retention of Pacific halibut caught by trawlers.

From 1955 to 1965 all "halibut" landed in the San Francisco region has been published as *Paralichthys,* in accord with the above 1958 directive, except for 30 pounds indicated in 1961 as Pacific halibut. Although the size of the reported landings of *Paralichthys* in San Francisco during this period are what might be expected in view of the magnitude of the landings of that species immediately south of San Francisco, it is probable that some Pacific halibut were included in the San Francisco totals each year. However, the general decline in the landings of Pacific halibut at California ports would preclude such amounts being of any consequence and they were probably landed by trawlers in contravention of the Pacific halibut fishery regulations.

In the Eureka region there are only scattered occurrences of *Paralichthys* in the landed catches. In the decade before 1965 the recorded catches of that species did not exceed 500 pounds in any year. Further north in Oregon and Washington there is no problem of identification with respect to *Paralichthys* as the species occurs only very infrequently in these regions. Magill (1962) reported individual specimens as far north as Long Beach, Washington (46° 24′ N. Latitude).

The misidentification of *Paralichthys* in the California catch statistics was aggravated by the fact that it is usually marketed in that State as "California halibut" to take advantage of the high market value of the word halibut. *Hippoglossus* is known to possess the highest protein, lowest sodium and lowest fat content of any North American flatfish (Stansby and Hull, 1967).

Official United States publications from earliest times (Goode, 1880) with very few exceptions have restricted the use of the term HALIBUT to the genus *Hippoglossus.* The United States Tariff Commission, Report 69, second series, 1933, page 31, states regarding paragraph 717 of the Tariff Act—"Description and Uses (of halibut) . . . *The only fish recognized in United States markets as halibut is the species known scientifically as Hippoglossus hippoglossus.*" Also in the fisheries statistics and other official publications of Canada the term halibut has been restricted to species of *Hippoglossus,* either *H. hippoglossus* the Atlantic form or *H. h. stenolepis* of the Pacific.

The situation with respect to *Paralichthys californicus* and more lately with respect to *Reinhardtius hippoglossoides* has caused confusion in published national and international (FAO) catch statistics, severe dislocations in the marketing of the Pacific halibut *Hippoglossus* in North America and "deception of the consumer"*.

The very large potential supplies of *Paralichthys* and *Reinhardtius***, the former a multi-species worldwide group and the latter an abundant single-species genus distributed throughout the boreal zone, make the need for a more restricted use of the term halibut urgent.

In California the common names in general use for *Hippoglossus* and *Paralichthys*

*U.S. Dist. Court Oregon, No. 67-534, 27 March 1968.

**Several widely distributed individuals of Reinhardtius have been reported from the northeastern Pacific Ocean and one as far south as Baja California approximately 32° 30′ N., latitude (Hubbs and Wilimovsky, 1964; Westrheim and Pletcher, 1966).

have been reviewed on many occasions in reports of the California Department of Fish and Game. Quotations therefrom are given below with emphasis by the present authors.

> "In the past both the southern halibut . . . and the northern halibut were classified as one and called 'halibut'. This is incorrect, as the northern halibut is a true halibut, while the so-called SOUTHERN HALIBUT IS A FLOUNDER". (Whitehead, 1929, p. 35).

> "California halibut, the only species of the genus *Paralichthys* found in California, is one of the many varieties of flatfishes sold in fresh fish markets of the State, but IT IS NOT A TRUE HALIBUT. The species was formerly known as southern halibut, and is often erroneously termed bastard and chicken halibut" (Clark 1931, p. 7).

It is evident from the foregoing quotations from the official State of California publications as far back as 1929 that "the northern halibut is a TRUE HALIBUT" "while the so-called SOUTHERN HALIBUT IS A FLOUNDER". Notwithstanding, local market advantage continues to perpetuate consumer confusion with respect to *Paralichthys* and *Hippoglossus* even though the two belong to different taxonomic Families, namely, Bothidae and Pleuronectidae, respectively. Currently the accepted common names with respect to the State of California for *Paralichthys* is California halibut and for *Hippoglossus* Pacific halibut. The unauthorized names are Southern halibut, bastard halibut, chicken halibut, Monterey halibut and alabato for *Paralichthys* and northern halibut and alabato for *Hippoglossus* (Roedel, 1953).

Appendix Table 1. Landings of California halibut (Paralichthys) and Pacific halibut (Hippoglossus) as reported by California Department of Fish and Game (in thousands of pounds).

	Eureka		San Francisco		Monterey	
	California Halibut	Pacific Halibut	California Halibut	Pacific Halibut	California Halibut	Pacific Halibut
1926	—	233	—	92	10	—
1927	—	509	—	13	8	—
1928	—	320	—	25	18	—
1929	—	654	—	51	23	—
1930	—	393	—	31	18	—
1931	—	719	7	55	16	—
1932	—	519	20	124	47	—
1933	—	187	24	134	22	—
1934	—	805	31	213	35	—
1935	—	756	18	104	42	—
1936	—	478	12	46	44	—
1937	—	234	9	83	19	—
1938	3	405	15	+	40	+
1939	2	378	25	+	29	+
1940	6	247	62	1	21	—
1941	+	212	22	3	15	—
1942	—	233	6	—	12	—
1943	—	270	11	1	16	—
1944	—	241	8	3	17	—
1945	—	234	62	+	34	—
1946	—	356	50	3	210	—
1947	—	230	6	52	135	—
1948	—	55	8	75	81	—
1949	—	86	9	81	98	—
1950	—	96	12	106	80	—
1951	—	28	7	59	64	—
1952	—	65	20	177	23	—
1953	—	46	6	53	29	—
1954	—	66	3	25	41	—
1955	—	52	42	—	31	—
1956	+	39	16			
1957	—	26	14	—	20	—
1958	+	8	10	—	13	—
1959	—	8	34	—	9	—
1960	+	5	22	—	4	—
1961	+	4	50	+	10	—
1962	—	4	74	—	47	—
1963	+	5	126	—	62	—
1964	+	3	184	—	43	—
1965	+	5	163	—	94	—

+ Less than 1000 pounds.

REFERENCES

Ayres, Wm. O.
1855 Report of meeting held April 2, 1855. Calif. Acad. Nat. Sci., Proc. 1: 41.

Bell, F. Heward
1956 The incidental capture of halibut by various types of fishing gear. Int. Pac. Hal. Comm. Rept. (23): 48 pp., Seattle.

Bell, F. Heward, H. A. Dunlop and N. L. Freeman
1952 Pacific coast halibut landings 1888 to 1950 and catch according to area of origin. Int. Fish. Comm. Rept. (17): 45 pp., Seattle.

Buckley, Raymond M.
1966 Status report on the marine "non-salmon" sport fishery in Washington State. Pac. Mar. Fish. Comm. 18th Ann. Rept. 1965: 23.

California Department of Fish and Game
1958 The marine fish catch of California for the years 1955 and 1956, with rockfish review. Calif. Dept. Fish and Game, Fish Bull. (105): 104 pp.

Clark, G. H.
1931 The California halibut *(Paralichthys californicus)* and an analysis of the boat catches. Calif. Div. Fish and Game, Fish Bull. (32): 52 pp.

Collins, J. W.
1892 Report on the fisheries of the Pacific Coast of the United States. Rept. of the U.S. Comm. of Fish and Fisheries for the fiscal year ending June 30, 1889. Appendix 1: 3-269.

Downing, Earle
1923 Halibut in California. Calif. Fish and Game 9(4): 173.

Dunlop, H. A.
1937 Why are there separate areas? Int. Fish. Comm. Circ. (5): 5 pp.

Ginsberg, Isaac
1952 Flounders of the genus *Paralichthys* and related genera in American waters. U.S. Fish and Wildl. Ser., Fish. Bull. 52(71): 267-351.

Goode, G. Brown
1880 Exhibit of the fisheries and fish culture of the United States of America, at the Internationale Fischereiausstellung, held at Berlin, April 20, 1880 and forming a part of the collections of the National Museum. U.S. Nat. Mus. Bull. No. 18: 263 pp.

Gould, Richard A.
1966 Archaeology of the Point St. George site and Tolowa prehistory. U. Calif., Publ. Anthropology, 4: 107 pp.

Hewes, Gordon W.
1942 Economic and geographical relations of aboriginal fishing in northern California. Calif. Fish and Game 28(2): 103-110.

Hubbs, Carl L. and Norman J. Wilimovsky
1964 Distribution and synonomy in the Pacific Ocean, and variation of the Greenland halibut, *Reinhardtius hippoglossoides* (Walbaum). Jour. Fish. Res. Bd. Canada 21 (5): 1120-1154.

International Fisheries Commission
1949 Regulation and Investigation of the Pacific Halibut Fishery in 1948. Int. Fish. Comm. Rept. (14): 30 pp., Seattle.

International North Pacific Fisheries Commission
1962 The exploitation, scientific investigation and management of halibut (*Hippoglossus stenolepis,* Schmidt) stocks on the Pacific Coast of North America in relation to the abstention provisions of the North Pacific Fisheries Convention. Int. No. Pac. Fish. Comm., Bull. No. 7: 93 pp.

Johnston, Edward C.
1916 Survey of the fishing grounds on the coasts of Washington and Oregon in 1915. Rept. of the U.S. Commissioner of Fisheries for the fiscal year 1915, Appendix 6: 20 pp.

Kroeber, A. L. and S. A. Barrett
1960 Fishing among the Indians of northwestern California. Berkeley, U. of Calif., Anthropological Records, 21(1): 1-210.

Lockington, W. N.
1879 Notes on Fishes of the Pacific Coast No. 1. Mining and Scientific Press 39(4): 70.
1880 Report upon the food fishes of San Francisco. Rept. of the Commissioner of Fisheries of the State of California for the years 1878-1879: 17-57.
1881 Report upon the edible fishes of the Pacific Coast, U.S.A. Rept. of the Commissioner of Fisheries of the State of California for the year 1880: 16-60.

Magill, Austin R.
1962 Northerly range extension of the California halibut. Copeia 1962 (4): 840-841.

Miller, Daniel J. and Daniel Gotshall
1965 Ocean sportfish catch and effort from Oregon to Point Arguello, California. Calif. Dept. Fish and Game, Fish Bull. (130): 130 pp.

Moiseev, P. A.
1953 Cod and flounders of the far-eastern seas. Izvestiia Tikhookeanskovo N.-I., Inst. Rybnovo Khoziaistva i Okeanografii, 40: 1-257. Fish. Res. Bd. Canada, Transl. No. 119.

Novikov, N. P.
1964 Basic elements of the biology of the Pacific halibut (*Hippoglossus hippoglossus stenolepis* Schmidt) in the Bering Sea. Soviet Fish. Invest. in the northeast Pacific Ocean. Proc. All-Union Research Institute of Marine Fish and Ocean (TINRO), 49(2): 167-207.

Pacific Fisherman

1915 Florence, Ore., plans halibut fishing. Pac. Fish. 13(4): 30.

1923 Halibut on California coast. Pac. Fish. 21(8): 34.

1925 Burke improvements at Astoria. Pac. Fish. 23(6): 35-36.

1930 Pigeons bring Portland news from halibut vessels on Oregon banks. Pac. Fish. 28(13): 40.

1932 Halibut buying at Kalama. Pac. Fish. 30(9): 38.

1942 True northern halibut caught at San Diego. Pac. Fish. 40(8): 70.

1963 Modern north Pacific halibut gear. Pac. Fish. 61(10): 23-25.

Phillips, J. B.

1935 A large northern halibut in Monterey. Calif. Fish and Game 21(3): 262.

1954 The sablefish fishery of California. I. History and research. Pac. Mar. Fish. Comm., Bull. (3): 5-22.

1958 Southerly occurrences of three northern species of fish during 1957. A warmwater year on the California coast. Calif. Fish and Game 44(4): 349-350.

Phillips, J. B. and Seigi Imamura

1954 The sablefish fishery of California. II. Catch analysis. Pac. Mar. Fish. Comm., Bull. (3): 23-37.

Rankin, Edward P.

1915 The halibut fishery of the Pacific Coast. Calif. Fish and Game 1(3): 116-119.

Rathbun, Richard

1894 Summary of the fishery investigations conducted in the North Pacific Ocean and Bering Sea from July 1, 1888 to July 1, 1892, by the U.S. Fish Commission steamer Albatross. U.S. Fish Comm. Bull. 12: 127-201.

Reid, Joseph L., Gunnar I. Roden, and John G. Wyllie

1958 Studies of the California current system. Calif. Coop. Ocean. Fish. Invest., Prog. Rept. 1 July 1956–1 January 1958: 27-56.

Roberts, Ruth Kellett

1932 Conservation as formerly practiced by the Indians in the Klamath River Region. Calif. Fish and Game 18(4): 283-290.

Roedel, Phil M.

1953 Common ocean fishes of the California coast. Calif. Dept. Fish and Game, Fish Bull. (91): 184 pp.

Schmitt, Waldo L., E. C. Johnston, E. P. Rankin and Edward Driscoll

1915 Survey of the fishing grounds on the coasts of Washington and Oregon in 1914. Rept. of the U.S. Comm. Fish. for fiscal year 1914, Appendix 7: 30 pp.

Schwartzlose, Richard A.
1963 Nearshore currents of the western United States and Baja California as measured by drift bottles. Calif. Coop. Ocean. Fish. Invest., Repts. 9: 15-22.

Scofield, W. L.
1947 Drift and setline fishing gear in California. Calif. Div. Fish and Game, Fish Bull. (66): 38 pp.

1948 Trawling gear in California. Calif. Div. Fish and Game, Fish Bull. (72): 60 pp.

1956 Trolling gear in California. Calif. Dept. of Fish and Game, Fish Bull. (103): 45 pp.

Southward, G. Morris
1967 Growth of halibut. Int. Pac. Halibut Comm. Rept. (43): 40 pp., Seattle.

Stansby, Maurice E. and Alice S. Hall
1967 Chemical composition of commercially important fish of the United States. Fish. Ind. Res. 3(4): 29-46.

Starks, E. C.
1919 Rare fish from Monterey Bay. Calif. Fish and Game 5(1): 43.

Thompson, William F. and Norman L. Freeman
1930 History of the Pacific halibut fishery. Int. Fish. Comm. Rept. (5): 61 pp., Vancouver, B.C.

Thompson, William F. and Richard Van Cleve
1936 Life history of the Pacific halibut (2) Distribution and early life history. Int. Fish. Comm. Rept. (9): 184 pp., Seattle.

Vernidub, M. F.
1936 Data concerning the Pacific white-skinned halibut. Trudy Leningrad Society of Naturalists, 65(2): 143-184.

Walford, L. A.
1928 Northern halibut in southern California. Calif. Fish and Game 14(1): 89.

Westrheim, S. J. and F. T. Pletcher
1966 First records of the twoline eelpout, *Bothrocara brunneum,* Greenland halibut, *Reinhardtius hippoglossoides,* and shortbelly rockfish, *Sebastodes jordani,* in British Columbia waters. Jour. Fish. Res. Bd. Canada 23 (2): 309-312.

Whitehead, S. S.
1929 Northern and southern halibut. Calif. Div. Fish and Game, Fish Bull. (15): 35-37.

Wilcox, William A.
1902 Notes on the fisheries of the Pacific Coast in 1899. Rept. of the U.S. Comm. of Fish and Fisheries for the year ending June 30, 1901: 501-574.