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The Commercial Fish Catch of California for the Year 1947 With an Historical Review 1916–1947

By
the Staff of the
BUREAU OF MARINE FISHERIES
1949

FIGURE 1. Purse seiners at San Pedro. Photograph by Vernon M. Haden, 1947

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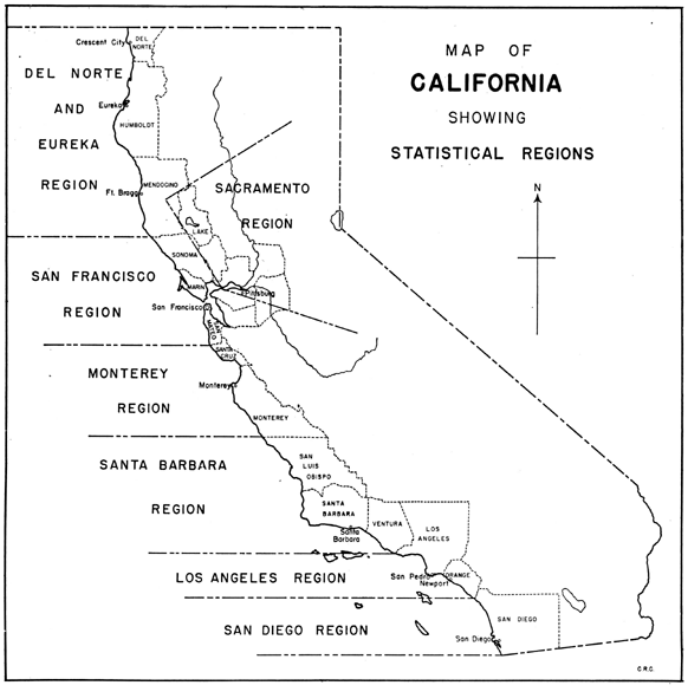

FIGURE 2. Map of California showing statistical regions

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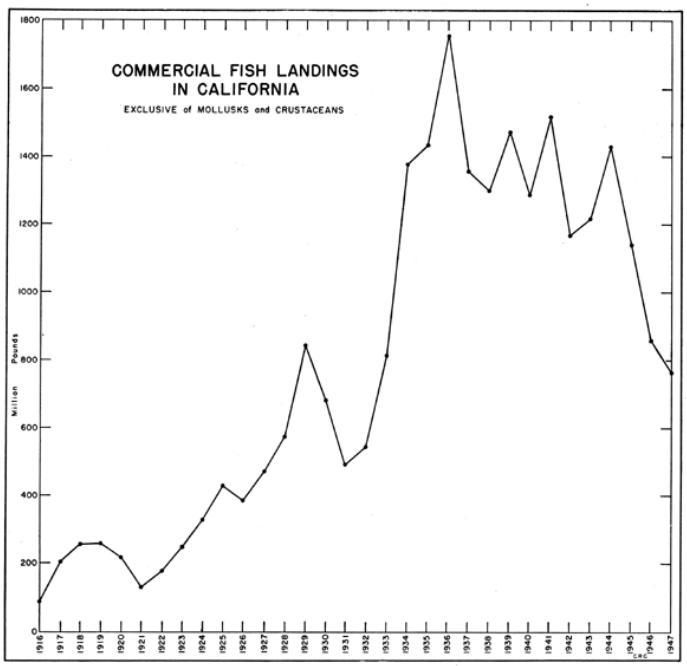

FIGURE 3. Includes sardine deliveries to reduction ships and tuna importations. See Table 37

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1. INTRODUCTION

This bulletin is the eleventh in a series begun in 1929, designed to present the detailed records of the commercial fish catch of the State. Continuing the practice of the former issues in this series, the statistical records for 1947 are here presented in considerable detail.

The current records are of interest but occasionally a review of the statistics is necessary to show the over-all picture and the trends in the minor fisheries for which no intensive program of study has been inaugurated. In 1937, Fish Bulletin No. 49 was published and gave such a review covering the period from 1916, when the record was begun, through 1935. The information gathered for that bulletin has proven of great value to the administrators, the patrol officers, the research workers in the field and the people in the industry.

During World War II the staff of the Bureau of Marine Fisheries was limited and although the statistical program was maintained it was only possible to follow the trends in the major fisheries. During 1948, in conjunction with their major projects, the field workers gathered information concerning minor species with a view toward outlining the history and explaining the reasons for the trends which appeared in the graphs drawn from the yearly totals for the individual species. These observations are set forth in the text which accompanies the graphs and cover the period from 1916 through 1947. To add to the value of the record there has been prepared a set of tables which appear in the back of the bulletin and give the yearly totals for each species. Most yearly totals include only the catch of the California fishing fleet, others include the record of fish imported for canning in the California plants or for sale in the fresh fish markets in competition with the local catch.

The statistical tables are prepared from fish receipts which are made by the markets and canneries at the time of first delivery of the fish. One copy of this original record goes to the fisherman, one is retained by the purchaser and the third copy is collected by the State. Each year since 1926 the Bureau of Marine Fisheries has published a statistical report in the form of a circular which gives a record of the catch and the canned fishery products. Since this circular is printed within a few months after the close of the calendar year, the catch figures therein are preliminary records, subject to revision. A year or two later the Catch Bulletin, similar to this one, is published and includes all supplemental items and corrections; therefore the two sets of published tables may be at variance. In preparing the yearly totals for the long term review in this issue, further discrepancies in the records have come to light and adjustments have been made accordingly.

Marine sport catch records and the live bait totals do not enter the commercial catch tables but they represent an important part of the yield of the marine fisheries. Such records as are available for these fisheries have been included in separate tables accompanying the discussions. A different phase of the industry is represented in the record of the Alaska cod caught by California vessels. The California plant merely

completed the processing of fish caught, cleaned and salted in Alaska. Seaweed and kelp cutting is under the jurisdiction of the Division of Fish and Game but detailed records are withheld to avoid divulging the volume of business of the few concerns involved. The only whaling station in operation in the United States is in California and the by-products of this plant compete with the by-products of the State's fishing industry. The whaling industry is regulated by federal agencies. The record presented is published with the permission of the company officials.

The cooperation of the Bureau of Patrol and Law Enforcement in the collection of the fish receipts is acknowledged, with special appreciation for the articles contributed by Patrol Captains Ralph F. Classic and Leslie E. Lahr. Thanks are extended to the Bureau of Fish Conservation for photographs and supplemental records on the inland fisheries. All graphs were drawn by Mr. Charles R. Clothier. To be commended is the effort of the clerks in the field offices and the women of the statistical unit whose constant vigilance has contributed to the accuracy of interpretation of the original records and to the intelligent compilation of the tables.—*Geraldine Conner, April, 1949.*

2. FISHES

2.1. THE TUNAS

Each major fishery has had its rise to a peak of popularity and importance. This is the epoch of the tunas. Obscured by enormous landings of sardines over a period of years, the tuna industry has nevertheless developed steadily, building upon a solid foundation of quality and expanding demand. Now, because of curtailed sardine catches and higher prices, tuna today is California's richest fishery, netting the fisherman a total of $37,492,284 in 1947, or 62 percent of the total value of all species. Furthermore, in volume the tunas have ranked second since 1935, with a total catch exceeded only by that of sardines.

There are five species included in the tuna catch of California. Four of these, albacore, bluefin, yellowfin and skipjack, are packed and marketed as tuna, but the fifth cannot be so labeled and appears on the grocer's shelf as "bonito." For these reasons the bonito is discussed in a separate article and statements in this introductory section apply only to the four remaining species.

The growth of the tuna industry is shown graphically in Figure 4, which gives the total annual landings plus importations. Tables 1 and 2 show of what this catch is basically composed. The annual catch of each of the constituent species is given in Table 2 both in pounds and percentage of the total; and this table reveals some significant facts.

The rise in the total catch, portrayed in Figure 4, is due predominantly to an increased catch of two species, the yellowfin tuna and the skipjack. These two species produced together 82.9 percent of the total tuna catch over the period 1927–1947, with the yellowfin contributing 58.5 percent and the skipjack 24.4. These percentages are taken from Table 2. Moreover, these average percentages are fairly consistent throughout the years, fluctuating within relatively narrow limits, whereas that of the two remaining species is erratic, reaching a minimum of zero in occasional years. The explanation is that the yellowfin tuna and the skipjack are tropical in habitat and are fished consistently throughout the year in some portion of their distributional area by a fleet of highly specialized vessels, whereas the albacore and the bluefin tuna are distinctly temperate in their distribution and are found within our fishing areas only in the summer season. The catch of the latter two species in any one year depends therefore upon the extent to which they enter our fishing area, and the duration of their stay therein.

2.1.1. Yellowfin Tuna and Skipjack

These two tunas are caught simultaneously by the same boats in the same area, and actually there is but a single fishery for the two species. They can therefore be conveniently and properly discussed together.

The yellowfin tuna, Neothunnus macropterus, and the skipjack, Katsuwonus pelamis, are similar in habits and distribution. Both are tropical, ranging into temperate waters only in the warmer months. One important difference however, is that the yellowfin appears to be confined

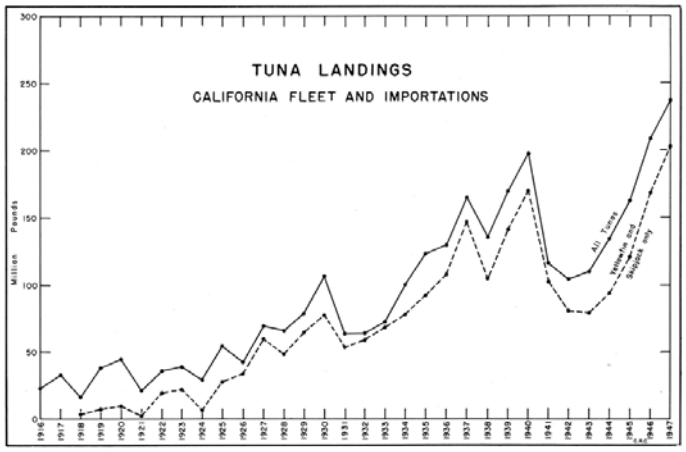

FIGURE 4. Combined landings of all tuna compared with combined landings of yellowfin tuna and skipjack. California fleet and importations. See Tables 1 and 38

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TABLE 1
TUNA LANDINGS—CALIFORNIA FLEET AND IMPORTATIONS
Pounds

Year	Yellowfin	Skipjack	Albacore	Bluefin	Oriental	Unclassified	Totals
1916			22,899,309				22,899,309
1917			30,556,242				30,556,242
1918		3,022,964	7,263,422			6,280,971	16,620,357
1919	348,081	6,892,427	13,630,899	14,990,980		2,461,311	38,323,878
1920	1,965,924	7,957,277	18,876,647	10,330,272		5,482,574	44,811,794
1921	1,297,451	1,134,993	15,276,727	1,971,813		1,552,815	21,233,829
1922	7,403,279	11,857,833	13,231,823	2,811,283		692,352	33,998,570
1923	10,836,923	11,482,522	12,514,833	3,218,090		662,370	38,694,740
1924	3,063,398	3,771,058	17,693,302	3,241,110		546,538	28,320,406
1925	13,237,898	14,222,453	22,206,923	3,803,677		426,853	53,897,804
1926	12,564,966	20,951,348	2,469,921	6,826,533		260,855	42,773,643
1927	25,933,966	33,805,960	4,656,850	4,898,465			69,295,350
1928	32,253,306	15,948,096	4,055,729	13,700,870			65,957,901
1929	37,414,924	27,066,588	6,110,330	7,536,857			78,148,699
1930	56,657,768	20,485,587	7,288,685	21,921,282			106,353,322
1931	36,581,376	16,505,761	6,576,491	3,534,030			63,596,658
1932	36,023,110	21,630,577	3,087,215	1,071,206	1,053,765		63,772,203
1933	51,075,630	17,093,041	2,794,452	560,492	899,336		72,422,951
1934	61,137,102	16,409,439	4,287,296	18,357,879			100,191,665
1935	72,294,127	19,803,554	5,678,783	25,173,083	146,531		123,096,488
1936	78,361,272	29,271,630	2,456,004	18,924,883	743,032	20,370	129,778,511
1937	92,406,606	54,698,995	4,743,706	12,604,332	523,632		165,097,294
1938	78,363,005	26,152,974	13,571,635	17,728,031	4,328		133,822,973
1939	110,417,801	31,186,959	16,423,234	11,855,715			169,883,709
1940	113,898,209	26,910,822	7,078,334	19,970,268			167,857,633
1941	76,701,820	25,707,004	4,314,508	9,519,012			116,242,404
1942	41,466,614	28,235,228	11,091,866	12,844,364			104,138,272
1943	49,261,328	28,893,781	21,384,864	10,178,768			109,718,744
1944	63,143,891	30,037,236	20,969,121	20,243,350			134,493,598
1945	87,321,440	33,347,896	21,336,201	20,594,306			162,609,845
1946	127,246,675	41,087,904	18,069,274	22,631,791			208,435,734
1947	150,459,384	52,462,104	13,427,281	20,837,634			237,186,403
Totals	1,330,078,506	718,323,055	376,438,999	341,340,628	3,372,674	18,347,039	2,988,101,891

TABLE 1
TUNA LANDINGS—CALIFORNIA FLEET AND IMPORTATIONS
Pounds

TABLE 2
TUNA LANDINGS—CALIFORNIA FLEET

Year	Yellowfin		Skipjack		Bluefin		Albacore		Totals
	Pounds	Percent	Pounds	Percent	Pounds	Percent	Pounds	Percent	Pounds
1927	23,933,966	37.5	33,805,960	48.8	4,888,465	7.1	4,579,367	6.6	69,217,758
1928	32,233,206	51.9	15,948,096	25.6	13,700,870	22.0	282,321	0.5	62,164,493
1929	37,444,924	51.8	27,097,013	37.4	7,526,857	10.4	269,101	0.4	72,247,895
1930	56,654,181	57.0	20,483,587	20.6	21,921,282	22.1	283,117	0.3	99,344,167
1931	36,579,480	64.6	16,305,761	29.1	3,514,030	6.2	37,322	0.1	56,437,593
1932	36,925,410	61.3	21,636,377	35.9	1,071,206	1.8	619,094	1.0	60,250,887
1933	51,075,630	74.8	16,657,208	24.4	560,192	0.8	487	0.0	68,333,917
1934	66,913,160	64.7	14,830,194	15.7	18,357,828	19.5	93,929	0.1	94,193,111
1935	72,294,127	61.7	17,197,186	14.7	25,173,083	21.5	2,447,328	2.1	117,111,924
1936	78,332,644	62.6	27,096,105	21.6	18,924,883	15.1	943,395	0.7	125,229,227
1937	91,522,438	59.7	47,194,092	30.7	12,660,922	8.3	2,020,016	1.3	153,249,468
1938	78,388,144	62.4	22,833,631	18.1	17,728,031	14.1	6,514,900	5.4	125,484,706
1939	110,417,801	68.0	30,120,891	18.6	11,835,715	7.3	10,000,362	6.1	162,374,769
1940	113,759,900	58.5	56,650,155	29.2	19,970,268	10.3	3,940,638	2.0	194,320,961
1941	76,964,531	66.6	25,585,468	22.2	9,519,012	8.3	3,341,209	2.9	115,110,220
1942	41,466,614	40.0	38,735,228	37.4	12,844,564	12.4	10,621,360	10.2	103,667,766
1943	49,261,328	44.9	28,893,784	26.3	10,178,768	9.3	21,384,864	19.5	109,718,744
1944	63,143,801	47.8	30,037,236	22.8	20,343,580	15.4	18,432,574	14.0	131,938,231
1945	87,321,440	53.7	33,347,896	20.5	20,504,300	12.7	21,275,300	13.1	162,548,945
1946	137,346,675	61.6	41,087,994	19.7	22,031,791	10.6	18,069,274	8.7	208,535,734
1947	150,388,754	63.5	52,462,194	22.1	20,857,634	8.8	13,171,751	5.6	236,880,343
Totals	1,477,916,264	58.5	617,780,266	24.4	294,246,560	11.6	138,632,709	5.5	2,528,584,799

TABLE 2
TUNA LANDINGS—CALIFORNIA FLEET

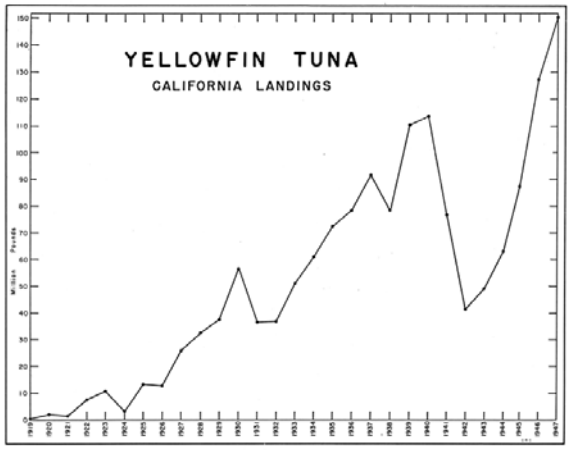

FIGURE 5. Catch of California fleet. See Tables 2, 3 and 38

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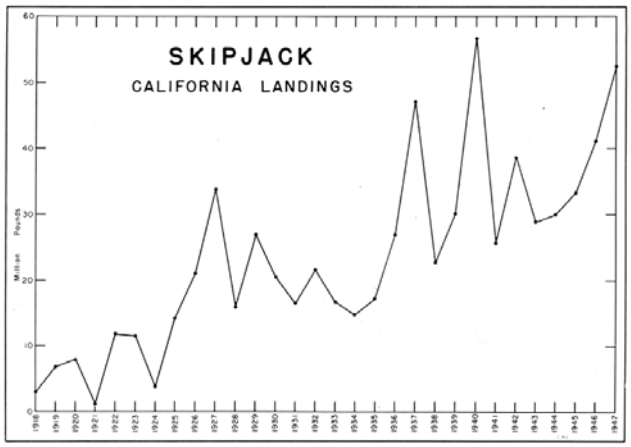

FIGURE 6. Catch of California fleet. See Tables 2, 3 and 38

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to the coastal shelf and outlying banks and islands, whereas the skipjack is not infrequently taken at considerable distances from any shore or bank.

The catch is made by a variety of gear, principally hook and line with live bait, purse seines and trolling gear. The relative importance of

TABLE 3

YELLOWFIN TUNA AND SKIPJACK [1]

Year	Tuna bait boats		Purse seiners		Miscellaneous		Yearly totals	
	Number of boats	Pounds	Number of boats	Pounds	Number of boats	Pounds	Number of boats	Pounds
1931	75	39,085,863	59	5,973,905	198	8,026,473	332	53,086,241
1932	75	48,291,370	45	9,506,121	105	762,496	225	58,559,987
1933	67	62,687,004	34	5,000,846	19	69,976	120	67,757,826
1934	63	74,121,171	8	1,112,641	32	509,542	103	75,743,354
1935	64	83,545,379	18	2,043,762	306	3,902,161	388	89,491,302
1936	73	90,080,102	90	7,135,099	384	8,143,476	547	105,358,677
1937	90	121,312,977	62	14,436,886	219	2,876,471	371	138,626,334
1938	91	97,190,919	34	3,598,349	58	152,507	183	100,941,775
1939	95	113,245,938	76	23,167,657	276	4,125,053	447	140,538,648
1940	98	137,629,522	91	27,668,411	255	5,111,823	444	170,409,756
1941	96	89,608,036	59	7,353,639	194	5,288,264	349	102,249,939
1942	79	67,950,198	31	6,826,915	380	5,105,485	490	79,882,598
1943	67	66,980,853	45	10,282,643	179	891,616	291	78,155,112
1944	78	76,583,903	41	15,853,612	92	892,692	211	93,330,207
1945	103	95,264,097	55	23,142,673	312	2,114,006	470	120,520,776
1946	136	129,317,442	87	36,489,661	399	2,527,566	622	168,334,669
1947	151	164,973,039	118	34,600,922	213	6,667,815	482	206,241,776 [2]

[1] The catch of yellowfin tuna and skipjack, combined, made by the California fleet of boats, broken down into: (1) tuna bait boats, those that fished throughout the year or a greater part of it; (2) regular purse-seiners, and (3) miscellaneous smaller boats which fished only at the northern range of the tuna, with any type of gear, nets, or live bait.

[2] 1947 total includes 3,322,224 pounds of yellowfin tuna and skipjack landed at Astoria, Oregon, but caught by vessels delivering to California plants.

TABLE 3
YELLOWFIN TUNA AND SKIPJACK

TABLE 4

Year	Tuna bait boats		Purse seiners		Miscellaneous	
	Average length	Percent of catch	Average length	Percent of catch	Average length	Percent of catch
1931	94.8 ft.	73.63	66.4 ft.	11.25	41.9 ft.	15.12
1932	94.3	82.47	69.4	16.23	42.4	1.30
1933	94.6	92.52	70.9	7.38	39.6	0.10
1934	95.7	97.86	76.5	1.47	41.2	0.67
1935	97.8	93.36	71.0	2.28	34.1	4.36
1936	93.7	85.50	66.3	6.77	35.8	7.73
1937	91.1	87.51	71.8	10.41	38.3	2.08
1938	93.3	96.28	74.2	3.57	36.8	0.15
1939	92.7	80.58	72.8	16.48	36.5	2.94
1940	92.0	80.76	73.4	16.24	37.4	3.00
1941	93.4	87.64	76.4	7.19	40.0	5.17
1942	88.4	85.06	74.1	8.55	35.1	6.39
1943	78.5	85.70	73.1	13.16	39.9	1.14
1944	76.5	82.06	73.0	16.99	42.8	0.96
1945	80.6	79.04	75.1	19.20	39.4	1.75
1946	89.5	76.82	75.3	21.68	37.8	1.50
1947	96.5	79.99	76.9	16.78	44.0	3.23
Average percent		85.10		11.51		3.39

TABLE 4

the three types is revealed in Tables 3 and 4. Actually, these tables are not a breakdown of the catch by gear, but rather a breakdown of the catch by three categories of vessel. The first category comprises all those large vessels using hook and line and live bait, and fishing tuna throughout the year, or a greater part of it. This fleet on the average accounted for 85.1 percent of the total catch during the period 1931–1947.

The second group comprises a fleet of relatively large vessels using purse seine nets exclusively. These vessels were built primarily for the sardine fishery, and in normal times they fish sardines for the canneries from about October to March. With the close of the sardine season, they turn to other fisheries and many of them find profitable occupation throughout the spring and summer fishing yellowfin and skipjack when these species are most accessible to vessels of limited cruising range. This fleet of purse seiners accounted for roughly 11.5 percent of the annual catch over the same period of years. With the decline of the sardine fishery the purse seiners are being forced increasingly to depend on tuna for a livelihood, and the purse seine tuna season is gradually lengthening. Some of the largest vessels of this fleet are now fishing tuna throughout the year.

The remainder of the catch is made by a miscellaneous fleet of smaller vessels that fish for tuna when it comes within their cruising range. The majority of such vessels fish off Southern California and the coast of Lower California through the months of July to October. Their contribution to the catch consists mainly of skipjack, and is negligible except in years when a heavy run occurs in local waters and in those of northern Lower California. This fleet of boats uses various types of gear, either live bait like the regular tuna fleet, or modified purse seines, or trolling lines. The majority of these boats change their gear throughout the season, depending upon what local fishery proves most lucrative. In consequence it is not possible to classify the catch of these craft by gear.

It follows from the above that the backbone of the tuna industry has been the live bait fleet fishing yellowfin and skipjack. These vessels range in size from about 80 feet to 150 feet in length, with carrying capacities as high as 400 tons of fish. They are distinctive and picturesque, with a raking stem and raised deck forward extending two-thirds the length of the hull to the large bait tanks aft. The majority have the hold divided into watertight compartments, in which bait is carried in some, on the outward voyage, and their catch in brine when loaded.

From two to six bait wells (or compartments of the hold) and the customary three deck tanks are piped for running sea water, and into these compartments live sardines or anchovettas are loaded when bait is caught by the small power launch and skiff from which the bait net is operated. A large stream of sea water flows constantly through these tanks and wells, and the contained bait swims slowly but endlessly around the tank in a circle. The bait is fed twice a day with raw, ground tuna, and the wells and tanks are kept clean at all times by skimming off the dead and weak fish from the surface, and by siphoning with a rubber hose the dead fish and sediment from the bottom of the tank. At night a light is kept above or in the aperture, or coaming, of the tank because this seems to quiet the bait and keep it milling easily.

When tuna are sighted a course is set to intercept the school, and as the vessel comes up with the school a stream of bait, dipped up in a 6-inch

dipnet, is thrown overboard to attract the tuna. As soon as they start to take the bait, the vessel is stopped and the fishermen clamber into steel racks which are hinged to the guard rail just above the water level, and lowered as outboard platforms upon which to stand during fishing operations.

The entire catch is taken with hook and line, attached to a seven or eight foot bamboo pole. A three-foot length of heavy cotton line is secured to a linen or cotton strap at the small end of the pole. The free end of the line is attached through a heavy swivel to a two-piece, three-foot wire leader supporting the hook.

As long as fishing is in progress one or two men stand atop the bait tanks and continually toss out bait to hold the school of tuna around the ship. Fishing continues as long as the school can be held alongside, or exceptionally, until the decks are full, with fish piled to rail height. As soon as actual fishing stops, the tuna are passed forward, and after a preliminary hosing to remove blood and slime, are dropped into chilled brine contained within compartments of the hold. Here the fish are held until the well is full and until all fish are frozen down to storage temperature. Then the brine is pumped out, and for the balance of the trip the fish are held dry in storage, with the storage temperature maintained by ammonia coils attached to the walls of the compartments. All tuna are stored in the round, i.e., they are not cleaned or dressed.

The tuna grounds of today (1948) are essentially the same as they were fifteen years ago. Up to 1930 or thereabouts the fleet fished an area from California to approximately latitude 16 degrees north, fishing along the coast of Mexico, the outlying islands and the banks along the coast of Lower California. About 1930 the larger boats began to explore farther afield, and by 1934 the entire fleet of larger vessels had extended operations to the Gulf of Panama and the Galapagos Islands on the equator. Since then there has been no material change, and the Central American grounds have sustained the fishery. Today we are on the threshhold of further expansion, and the immediate future promises a new epoch in the story of the tunas.

Although the fishing area has not changed in recent years, the fishery itself has changed in some respects. Competition for fish by boats and plants has definitely become keener. The fleet has increased tremendously in size, and with the growth in numbers, secrecy of operations, characterizing the early 'thirties, is waning. The maximum length of tuna boats has steadily increased, and today the largest is 165 feet, over all.

Although planes were tried and abandoned many years ago as an aid in finding bait and fish, a number of tuna boats are once more carrying scouting planes experimentally. of those using them, all agree that they are invaluable and contribute materially to shortened trips and better loads. However, the difficulties involved in carrying, launching and retrieving them has discouraged their use and the majority of vessels carrying planes have discontinued the attempt after one or more trips.

Perhaps the most significant development of the period is the introduction of mother ships, and the expansion of the tuna packing industry to the Pacific Northwest. In the early days of the tuna fishery, tenders, storing fish in ice, were used along the coast of Lower California to receive tuna from a fleet of small vessels fishing nearby. With the growth

in the size of tuna vessels in the late 'twenties, tenders were no longer needed, and were used only sporadically in the 'thirties. With the expansion of the fishing area to the equator, a cold storage plant for fish was erected in Puntarenas, Costa Rica, about 1935, and the larger boats used these facilities to unload small tonnages taken early in a trip. Such fish was stored, and subsequently shipped to the canneries by refrigerated freight. Shortly after this, a local canner sent small vessels to base and fish from Puntarenas, and to a limited extent this practice continues to the present.

The development in the late 'thirties of an albacore fishery off the Columbia River led ultimately to the modification of existing canneries at Astoria, Oregon, to enable them to process tuna. With this investment, and the plants adapted, the owners naturally sought a greater volume and a more regular supply of fish than could be obtained from the purely seasonal and unpredictable run of albacore. The end result was a large refrigerated mother ship, which in 1946 anchored in Costa Rican waters, purchased approximately 2,200 tons of tuna there, mainly from our California fleet, and delivered this load to Astoria for processing. The initiative was soon followed by other canners, and, in 1947, several mother ships were either planned or contracted for by various California packers.

This development resulted primarily in an increase in the potential tuna fleet. Certain Central American governments were induced to relax their restrictions on purse seine operations, and a large fleet of purse seine vessels was enabled to fish successfully the more distant and prolific waters, hitherto beyond their cruising range, obtaining provisions and supplies from the mother ship.

The total landings of this fishery, yellowfin and skipjack combined, are shown in Figure 4. The totals are taken from Table 1. This gives a general picture of the growth of this fishery, and shows the various stages through which it has passed.

Up to 1926 approximately, the fishery was in its infancy. About that year the first large and specialized boats were built, and the catch went up as more such boats were added to the fleet. The adolescence of the fishery began about 1930. With a steadily growing fleet of larger vessels expanding progressively over the entire distributional area of the species, the catch rose fairly regularly to a peak in 1940, when 85,000 tons of yellowfin tuna and skipjack were delivered. At this time the fishery can be considered as having reached maturity, and one would normally expect a levelling off. However in 1941 there was a sharp drop in total catch, and the subsequent intervention of the war caused a distortion of the picture. In 1942 the majority of the larger vessels in the tuna fleet were taken by the navy, and extensive restrictions were imposed upon the remaining fleet, which explains the low catches of 1942–1944. As the war progressed, entailing an abnormal demand for tuna, fishermen strove to replace their confiscated vessels. Gradually the fleet grew in tonnage, until by 1946 the gross tonnage of the tuna fleet far exceeded that of 1941. Furthermore, with the ending of the war the building impetus gained momentum, and through 1947, continuing into 1948, a steady stream of large tuna boats slid down the ways, from points as far removed as Oregon and Louisiana, to join the tuna fleet. Meanwhile the navy released and sold to our industry approximately 25 additional vessels (YPs) built during the war on the lines of a typical tuna boat, and used in wartime to transport

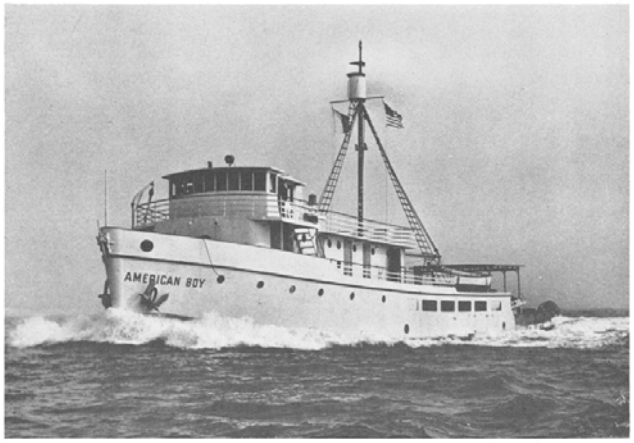

FIGURE 7. A typical modern tuna boat, able to cruise to the equator and back. The entire load of tuna is frozen in chilled brine. Photograph by Kent Hitchcock, Balboa, California, 1947

FIGURE 7. A typical modern tuna boat, able to cruise to the equator and back. The entire load of tuna is frozen in chilled brine. Photograph by Kent Hitchcock, Balboa, California, 1947

refrigerated foodstuffs to the island bases. The size of this fleet alone is almost equal to the tonnage of the tuna fleet in 1941.

The relationship between the size of the tuna fleet and the corresponding catch suggests that an annual catch in excess, roughly, of 125,000,000 pounds will result in a decreased yield per gross ton of participating vessel. In the pre-war record year of 1940, 19,124 gross tons of the live bait tuna fleet produced 85,000 tons of fish; whereas it took 36,280 gross tons of tuna vessels to produce in 1947 a catch of 101,000 tons of tuna. This is obviously a case of diminishing returns for an ever increasing effort, and carried to a logical conclusion, it means that vessels cannot operate at a profit beyond a certain limit. This should constitute a warning that it is time to take stock of the situation and plan intelligently for the continued well being of the entire industry.

2.1.2. Albacore

The albacore, Thunnus germo, is the most erratic and the most exotic of our local tunas. As though playing "hard to get," it commands the highest price, and casts its seductive spell upon the entire industry. Steady fishermen who work diligently for a modest livelihood throughout the year will stake their season's earnings in pursuit of this elusive fish. Staid and level headed business men will bid recklessly for catches of it, in apparent disregard of what the catch will yield. It is a fascinating fishery, and its fascination is enhanced by the mystery that surrounds it.

Little is known of the biology of the species. It appears within our local waters in the summer months. The first fish are sometimes caught in June, but more often in July. A fishery develops rapidly, and through August and September the bulk of the season's catch is landed. By November in an average year the fishery is over, and except for sporadic catches in exceptional years the albacore are gone until the following summer. Where they go is not known though attempts are now being made to explore their habitat.

About 1936 albacore were rediscovered (or perhaps it would be more accurate to say, commercially discovered) off the coast of Oregon. It had long been known, but overlooked, that albacore had frequently and fairly regularly been taken by the sailing vessels of the Alaska Packers Association fleet, returning southward in the fall. In 1936, a few tons of albacore were caught commercially by vessels operating from the Columbia River, and each year the extent of this catch increased. It was taken simultaneously with catches made off California, contradicting a prevalent belief that the albacore migrated northward as the season progressed.

Two types of gear are employed in our west coast fishery, namely, live bait fishing and trolling gear. Albacore have never been successfully fished with purse seines. The bait fishery is essentially similar to that described in the fishery for yellowfin. The trolling method involves catching fish upon lures trolled astern by lines of varying length. The smaller boats catch their fish by trolling; the larger ones carry one or more live bait tanks.

A typical trolling vessel has a 20- to 30-foot pole rigged on each side. These trolling poles in California are usually of eucalyptus. Each is hinged at the heel to the deck or house, or some convenient point, and is

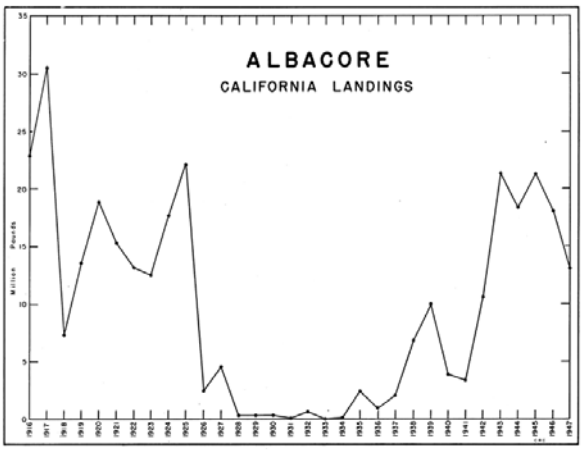

FIGURE 8. Catch of the California fleet only. See Tables 2, 5 and 38

FIGURE 8. Catch of the California fleet only. See Tables 2, 5 and 38

lowered from the vertical by a line rove through blocks. When not in use it is carried vertical, against the mast or stays. When fishing the poles are lowered to a suitable height from the water. To each pole are attached three or four trolling lines, with a steel or rubber spring in each to absorb the initial shock of a striking fish. The lines are graduated in length and so rigged that each can be pulled inboard without fouling the remaining lines on that side. Typically the lure is attached to the line by a wire leader of varying length. However the details of the gear construction are as divergent as the fishermen, and all manner of variations can be found.

In fishing, the vessels cruise in likely areas at a speed of six to eight or more knots. When a fish is caught the respective line is pulled in immediately while the vessel continues under way. The course may be changed, or a vessel may circle widely, depending upon the whims or judgment of the fisherman. In areas heavily fished, the sea adjacent may be covered with a vast fleet of boats going in all directions and weaving in and out with barely room between to clear the poles and lines.

The albacore appears to be an oceanic fish, in the sense that it is generally encountered in the warm, blue ocean water. Rarely is it found deep within the green coastal water. An optimum fishing zone is the marginal area where green and blue waters meet. The green coastal waters are characterized as a rule by lower temperatures, which fluctuate more widely. The blue ocean waters are more constant in temperature, and in Southern California it is a prevalent opinion that a temperature range of about 60 degrees to 65 degrees F. is a prerequisite for albacore. We have caught albacore, however, in temperatures as low as 56 degrees F.

The tonnage of albacore landed in a successful season is a reflection of the size of the fleet rather than the size of the vessels. As a rule the regular tuna boats do not fish for albacore. It is the smaller and more or less local boats that exploit the albacore in Southern California. Thus in 1947 there were 2,190 individual boats that delivered albacore along the California coast at some time in the season. Almost everything that will float is put to sea in Southern California in a successful season.

The most striking feature of the catch of albacore shown in Figure 8 is the failure of this fishery in the years 1928 to 1934, both inclusive. This has never been adequately explained. In the light of present knowledge, and based upon the assumptions that the albacore is an oceanic fish, the most probable explanation is that the schools failed to come inshore in those years. If the albacore move in with ocean currents that seasonally bring this water to our shores, then in years when those currents fail to approach our shores it is probable that the inshore run of albacore likewise fails. Possibly, albacore could have been found at greater distances from shore.

The catch of the northern states is added to that of California in Table 5. As the northern fishery developed, the catch rose to an unprecedented peak in 1944, due solely to the expansion of the fishing area and the fishing fleet. The northern catch however, is more vulnerable than that of California, and is in part dependent upon the prevailing summer weather. The low catch of certain years has been attributed mainly to adverse weather, which kept the fleet in port.

TABLE 5

PACIFIC COAST LANDINGS OF ALBACORE

Pounds

Year	California	Oregon	Washington	Total pounds
1936	945,595	11,176		956,771
1937	2,020,016	1,353,522	332,299	3,705,837
1938	6,814,900	8,000,000	4,112,328	18,927,228
1939	10,000,362	6,484,795	1,729,772	18,214,929
1940	3,940,638	9,286,261	1,330,266	14,557,165
1941	3,341,209	7,545,131	1,045,364	11,931,704
1942	10,621,360	10,942,956	1,841,312	23,405,628
1943	21,384,864	10,385,956	5,749,514	37,520,334
1944	18,433,574	22,418,704	11,869,555	52,721,833
1945	21,275,300	12,178,371	6,066,955	39,520,626
1946	18,069,274	3,950,804	2,172,539	24,192,617
1947	13,171,751	9,173,623		22,345,374

Oregon and Washington landings supplied by Pacific Marine Fisheries Commission.

TABLE 5
PACIFIC COAST LANDINGS OF ALBACORE
Pounds

2.1.3. Bluefin Tuna

Like the albacore, the bluefin tuna, Thunnus thynnus, is a temperate species that enters our fishing area only at certain seasons. Its known distribution is from Cape San Lucas, Lower California, to approximately the Columbia River. With all the fishing that has been done for yellowfin tuna and skipjack within the tropics in an interval of years, no authenticated records exist of bluefin tuna within this area. To the north, on the contrary, where no fishery exists for bluefin, specimens are frequently taken incidentally. Large schools have been seen, and individuals taken in the region between Point Conception and San Francisco.

Gradually our fishing season is lengthening. In an average year this extends from June to September, and the heaviest fishing occurs in July and August. The earliest catches are now invariably made off Guadalupe Island, Mexico. In May or June the bluefin begin to show in Southern California waters. These observations of bluefin to the north of Point Conception have for the most part been recorded in the late summer and in the fall. Either there is a northward movement with the advance of summer, or possibly an inshore flanking movement of the fish along the coast.

The bulk of the bluefin catch consists of small fish, weighing individually from 10 to 40 pounds. However, runs of larger fish, of 100 pounds or more, particularly in the sporadic winter catches are not uncommon. Fish of the commercial catch do not, however, attain the excessive size of the Atlantic bluefin.

Up to 1930 the fishery was strictly local, extending from Point Conception to the Mexican Border. In that year some bluefin tuna was caught in Mexican waters, in the vicinity of Guadalupe Island. In the following years we had progressively earlier deliveries from this region. Similarly, there was an extension of the season in the fall, and occasional deliveries were made in October and November. In 1946, there was at least a single delivery in every month of the year, and all the pre- and postseason catches were made at Guadalupe Island. Such catches are still sporadic, suggesting that we have as yet entered merely the fringes of the off season distributional area.

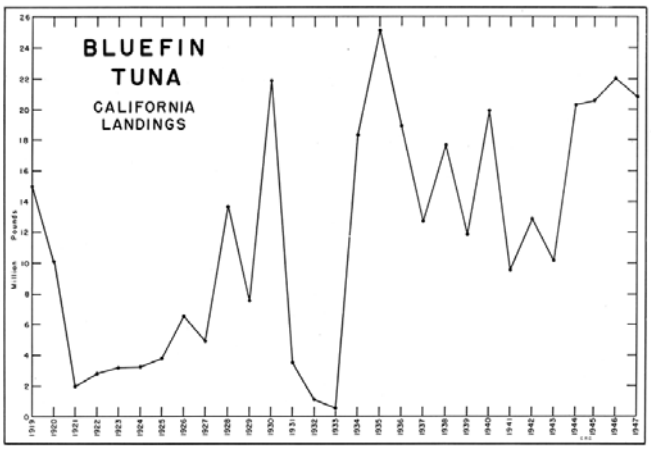

FIGURE 9. See Tables 1, 2 and 38

FIGURE 9. See Tables 1, 2 and 38

From the earliest days our bluefin fishery on this coast has been monopolized by the purse seine fleet. No other gear has been found commercially successful. Bluefin will not normally take a hook, as do the other tunas. While occasional catches are made by the live bait tuna boats, by very heavy chumming, the total catch by this means is negligible. Similarly, bluefin tuna rarely bite on a trolling lure.

Purse seining for bluefin tuna has not materially changed in recent years. Improvements have been made in gear and in operation, but essentially the method is the same. Wire purse lines have come into common use, displacing manila. Propelling motors are now installed in the majority of the large net skiffs. Vessels have grown in size, and now there is a small fleet of large purse seiners that fish tuna exclusively, either yellowfin, skipjack or bluefin, throughout the year. Such vessels have replaced their single ice hold with separate water tight compartments, in which the load is carried in chilled brine. Almost the entire fleet now carries mechanical refrigeration, adopting the system installed in the large, live bait tuna boats.

Night fishing has become more prevalent in recent years. In the early days, all local bluefin fishing was done in daylight hours. At Guadalupe Island, night fishing proved more successful, and at the present time there is as much bluefin caught at night as by daylight, in Southern California waters.

The total catch of bluefin tuna is shown in Figure 9. The trend is fairly level, or even slightly upward. No catch analysis has been made of this fishery since 1930. At that time it appeared to be healthy. The catches in the three following years were abnormally low, but this has not been correlated with any contributory cause. Since that time the catch has been relatively steady, and the average catch over the entire interval is about 6,000 tons per year—*H. C. Godsil*.

References (see page 210) : 18, 46, 66, 67, 68, 69, 88, 89, 109, 121, 133, 138.

2.2. SARDINE

For more than two decades the catch of sardine, *Sardinops caerulea*, dominated the California fishery and the tonnage exacted by the industry from this one species exceeded the combined catch of all other fisheries. These tremendous landings were possible because of an abundant supply of fish close to the fishing ports, efficient fishing gear, and large demand for canned sardines and for fish meal and oil produced by the reduction of whole sardines.

The rapid expansion of the sardine fishery began during World War I and reached over 150,000,000 pounds in 1918. At that time this was considered an outstanding growth but proved to be only a hint of the magnitude to be attained in future years.

From 1916 through 1939 the catch more than doubled every six years and reached its maximum of a billion and a half pounds in 1936. The catch could not continue to expand at such a rate and a leveling off was inevitable. This followed 1936 and continued through 1944 after which a very rapid decline began. The industry was not prepared for this failure of an over-expanded fishery and a financial crisis resulted from which the industry has not yet recovered.

The reasons for the failure are complex but stem largely from several seasons when spawn survival was poor and an intense fishery removed

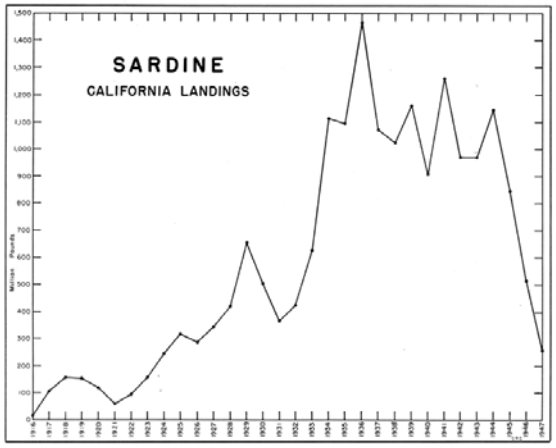

FIGURE 10. Deliveries of sardines to reduction ships included 1930 through 1938. See Table 39

FIGURE 10. Deliveries of sardines to reduction ships included 1930 through 1938. See Table 39

from the population most of the older fish on which the fishery normally relies. Thus the ratio between income and outgo was thrown out of balance.

The explanations of the early rapid expansion of the industry are much simpler. Canned sardines have usually experienced a ready sale since they constitute an inexpensive source of protein for local and for foreign markets, especially in oriental countries. Even the economic depressions of the early 'twenties and 'thirties had only a small and brief dampening effect on the sardine fishery.

In addition the demand for sardine meal and oil exceeded that for canned goods and played a more important role in the development of the sardine industry. In many years the profits derived from the reduction of sardines into meal and oil far exceeded that from canned fish. Throughout the 'twenties the California Division of Fish and Game attempted to restrain this rapidly expanding fishery by prohibiting the use of whole sardines for reduction purposes. This resulted in only a small portion of each fish being placed in the can and the remainder being reduced as offal. As a result canning practically became a by-product of the reduction process.

In 1930, state restrictions on sardine reduction were further evaded by the operation of reduction ships off San Francisco Bay, outside the three-mile limit and thus outside state jurisdiction. This phase of the industry proved very profitable, more ships were added and in 1936 over 500,000,000 pounds of sardines were so processed. This was over half of the total catch delivered to all shore plants in that year. Because of the competition from the reduction ships the State was forced to liberalize its restrictions on the use of whole sardines and for several years on and off shore processing into meal and oil was carried on simultaneously. Due to increased labor costs and the changes in California laws the reduction ship phase was terminated in 1938. The poundage delivered to the ships during the years of their operation are included in Figure 10 and Table 39.

World War II had little influence on the total catch of sardines. Although the demand for canned fish was great and the industry expended all the effort possible the total was not raised above that of the previous seven years. The need for canned fish to feed the armies and civilian populations, however, changed the trend from reduction to canning and since 1941 at least half and in most seasons more than half of the catch has been canned and not reduced to meal and oil.

The entire sardine catch is taken in round haul nets. The first nets used, termed lamparas, because they were developed from the Italian lampara, were relatively small. They consisted of a curtain of webbing stretched between a cork and lead line with a finer meshed bag in the center. A school of fish was located, the net payed off the stern of the boat, and all or part of the school surrounded. The wings and lead line were then pulled aboard and the fish confined in the bag. From the bag they were dipped onto the fishing vessel. Boats fishing with lampara nets were small, 30 to 50 feet in length, and with a carrying capacity up to 50 tons. They worked in shallow water so that the fish could not escape under the lead line before the school was confined in the bag.

Because of the small nets and small boats, until 1925 sardine fishing was confined to waters near the ports of Monterey, San Pedro and San

Diego. The purse seine was then again introduced into the fishery. It had been tried first in the '90s and was supplanted by the lampara. The second trial proved more satisfactory and the purse seine and modifications thereof, frequently called ring nets, rapidly replaced the lampara. The purse seine has rings along the lead line which permit a quick closing of the net and a lessening of the chance for the fish to escape. The bag is also at one end rather than in the middle of the net as in the lampara. Throughout the years there have been many changes and modifications in the purse seine, and the nets in the present fishery differ greatly between boats but the general principal of the round haul net has been retained.

The most important changes have been the increase in size of nets and in size of vessels. From seines approximately 200 fathoms long, operated from gasoline driven boats of 30- to 50-foot length, the sardine fleet now consists of diesel engined vessels up to 100 feet in length, operating nets of 300 fathoms or more and with a carrying capacity for the largest ships of 250 tons. These larger vessels fish over a much greater area and the sardine fishermen scour the fishing grounds along the California coast from the Farallon Islands southward to the Mexican boundary and around all the Channel Islands off Southern California. Not only the range but also the efficiency of the fleet has increased through net changes to facilitate quick closure and by the addition of radio telephones and fathometers. Radio telephones enable the fishermen to communicate while on the fishing grounds and thus to aid each other in finding fish. The fathometer helps the fishermen to locate schools too far beneath the surface to be detected by visual means.

Although the efficiency of the sardine fleet has improved greatly the number of vessels has not increased since the mid-thirties. The total number of boats fishing out of the ports of San Francisco, Monterey and San Pedro are given by season in the following table.

TABLE 6

NUMBER OF SARDINE VESSELS FISHING IN CALIFORNIA WATERS

Season	Number of boats	Season	Number of boats
1930-31	149	1939-40	335
1931-32	157	1940-41	321
1932-33	168	1941-42	297
1933-34	200	1942-43	208
1934-35	242	1943-44	206
1935-36	249	1944-45	226
1936-37	316	1945-46	224
1937-38	379	1946-47	263
1938-39	325	1947-48	270

TABLE 6
NUMBER OF SARDINE VESSELS FISHING IN CALIFORNIA WATERS

The price paid to the fisherman has varied greatly and been determined largely by general economic conditions. The price per ton for the past 23 seasons was as follows:

TABLE 7

PRICE TO THE FISHERMEN FOR SARDINES

Season	Price per ton	Season	Price per ton
1925-26	$10.00	1937-38	$13.00
1926-27	11.00	1938-39	11.00
1927-28	11.00	1939-40	11.00
1928-29	11.00	1940-41	10.50
1929-30	11.00	1941-42	17.00
1930-31	8.00	1942-43	22.00
1931-32	8.00	1943-44	22.00
1932-33	4.00- 4.25	1944-45	22.00
1933-34	6.00- 7.00	1945-46	22.00
1934-35	7.50	1946-47	30.00-40.00
1935-36	8.00	1947-48	45.00-60.00
1936-37	10.00		

—Frances N. Clark

References (see page 210) : 32, 34, 35, 36, 46, 55, 70, 71, 89, 98, 120, 136.

TABLE 7
PRICE TO THE FISHERMEN FOR SARDINES
—Frances N. Clark
References (see page 210) : 32, 34, 35, 36, 46, 55, 70, 71, 89, 98, 120, 136.

2.3. JACK MACKEREL

The jack mackerel, Trachurus symmetricus, is a newcomer among the prominent cannery fishes of California. It owes its position more to the failure of the sardine supply in the past two years and to the poor Pacific mackerel season in 1947 than to any sudden discovery of its inherent goodness or abundance. It was, until 1947, handicapped by the official common name of "horse mackerel." This was not a matter of great concern until the species began to grow in importance and it became necessary to develop a domestic market for a product formerly absorbed largely by the export trade. The word "horse" on a can holds unfortunate connotations in the mind of the American public, and it proved difficult to dispose of the pack. This led to the Division of Fish and Game instituting a survey of the industry in the summer of 1947 in an attempt to find a name more suitable for labeling purposes. The consensus favored "jack mackerel" and this name was given official sanction by the division. It was later accepted by the United States Pure Food and Drug Administration provided the scientific name as well appeared on the label.

"Jack" is appropriate as part of the name in that the fish, together with the yellowtail, belongs to the jack family, Carangidae. "Mackerel" was retained because of long-standing common usage. The jack mackerel bears a superficial resemblance to the true mackerels and is often caught with them, so the popular association of the word with this fish is not surprising. Fishermen speak of it as either "horse mackerel" or "Spanish mackerel," the latter being especially prevalent in Southern California. Neither name is applied exclusively to the jack mackerel. The large Atlantic bluefin tuna is frequently called "horse mackerel," while the members of genus Scomberomorus, (which includes our sierra) are quite generally called "Spanish mackerel."

Records of jack mackerel landings go back only to 1926. Before that, catches of jack and Pacific mackerel were not kept separate. Both species

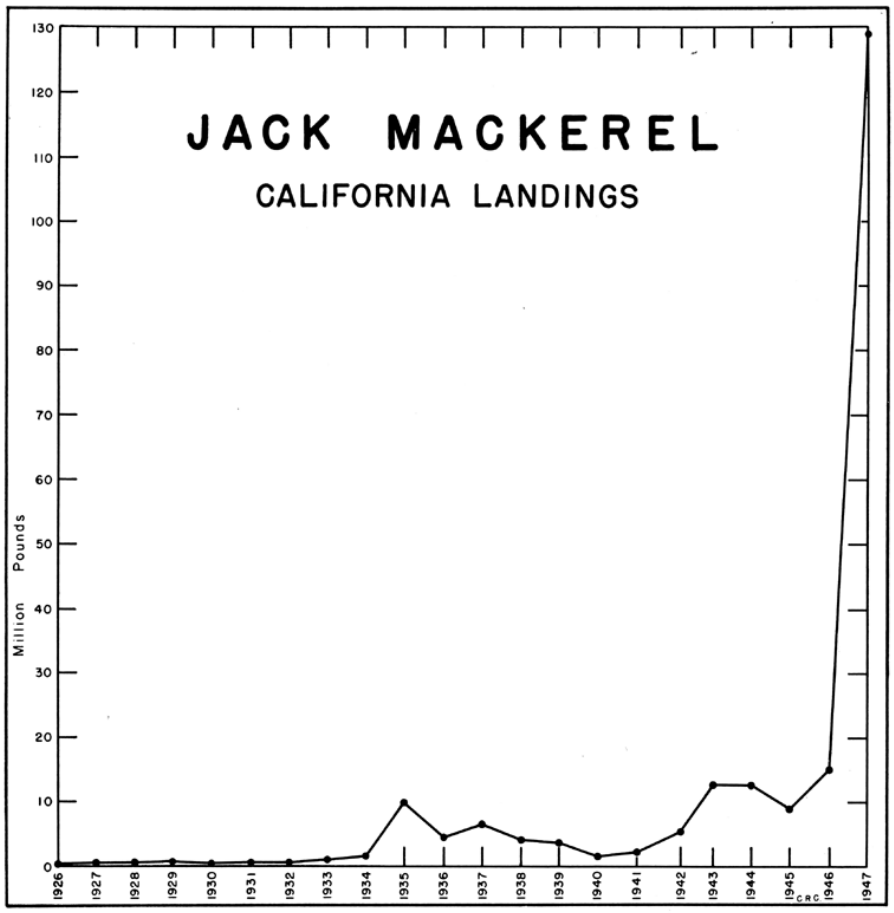

FIGURE 11. See Table 40

FIGURE 11. See Table 40

were relatively unimportant market fishes and their combined catch exceeded 4,000,000 pounds only once in the period 1916–1925. Probably most of the catch consisted of Pacifics during that decade, for annual landings of jack mackerel alone did not reach 1,000,000 pounds until 1933.

In 1935, landings were nearly 10,000,000 pounds, a figure not surpassed until 1943. In the intervening years, the catch fluctuated between 1½ and 6½ million. Both the 1943 and 1944 catches were over 12,000,000 pounds, and that of 1946 exceeded 15,000,000. Then in 1947 these record years were far eclipsed with the delivery of 129,000,000 pounds.

The jack mackerel fishery is prosecuted almost exclusively by seiners and has always centered in Southern California. Through 1946, the vast majority of boats delivered to Los Angeles-Long Beach Harbor canneries. Landings in the San Diego and Santa Barbara regions were trifling, and in only one year—1946—were there heavy landings in Central California. Nearly half of that year's 15,000,000-pound catch was brought to Monterey plants, with over 6,500,000 delivered in December alone. This was the first year of the drastic sardine shortage in

Central California, and the fleet scoured the local fishing grounds. They found jack mackerel abundant inside Monterey Bay. The following season, relatively few boats fished for any length of time in Central California and the jack mackerel catch fell to about 2,000,000 pounds, still comparatively huge for the area.

Most of the 1947 catch was delivered direct to plants operating in the Los Angeles-Long Beach harbor area. However, in the last two months of the year, large tonnages were delivered at Port Hueneme and the bulk was trucked to Monterey for processing. The total catches for both November and December exceeded the best month on record (October, 1940) for Pacific mackerel. The year's total fell short of the banner Pacific year (146,000,000 pounds in 1935) but surpassed all other. The 1947 figures unquestionably include some Pacific mackerel, for mixed loads with jacks predominant were commonplace and many of them were listed simply as jack mackerel on the cannery fish receipts.

The best fishing grounds center around Anacapa and Santa Catalina islands, although many catches are made along the mainland from Santa Barbara south to San Diego and around the other Channel Islands. The season is at present limited by the extent of the fishery for sardines and Pacific mackerel. Catches are highest in the fall and winter, falling off to practically nothing in the spring. Jack mackerel may still be on the grounds but no one looks for them.

Prior to 1947, the price to the fisherman for jack mackerel usually lay between that for sardines and Pacific mackerel. In 1947, it started at $45 per ton, compared with $40 for sardines and $60 for Pacifics (Los Angeles Harbor quotations). In December, both jacks and sardines rose to $60 and Pacifics to $75.

There is as yet no way of estimating the size of the reservoir of jack mackerel. Whether it is an unexploited resource capable of further expansion which has been overlooked in the scramble for more desirable commercial species, or whether a limited, perhaps local, population is being decimated because of the lack of other fish is now an unanswerable question. Certainly the fishery warrants careful watching and study.—*Phil M. Roedel.*

Reference (see page 210) : 49.

2.4. PACIFIC MACKEREL

The Pacific mackerel, Pneumatophorus diego, is the only member of the true mackerel family, Scombridae, found in California waters. A number of closely related species are native to other parts of the world and several support important fisheries.

Pacific mackerel range from the Gulf of Alaska south to the tip of Lower California and up into the Gulf of California. They are not common north of San Francisco. South of central Lower California, we have very little knowledge of either their abundance or their habits, but there is reason to believe that fish from the southern portion of the range do not migrate as far north as California.

By and large, mackerel is a cannery fish with only an inconsequential poundage sold by the fresh fish markets. The mackerel canning industry has always been centered at Los Angeles Harbor, where it got

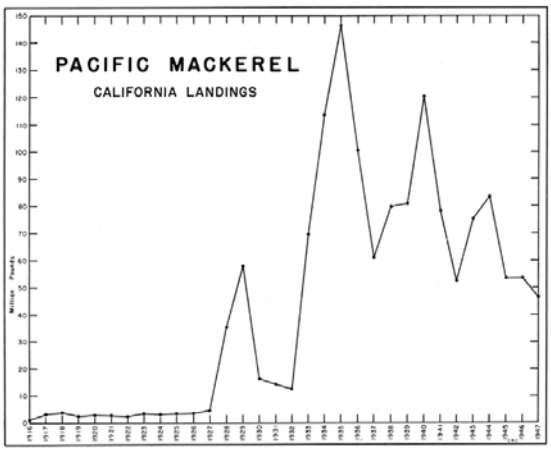

FIGURE 12. See Table 40

FIGURE 12. See Table 40

its start in the late 'twenties. There were difficulties in the first few years which stemmed both from poor quality packs and the depression, but since 1933 production has been limited chiefly by availability of the fish.

The graph (Fig. 12) shows the total landings for the State by calendar years since 1916. Through 1925, the figures include jack mackerel as well, for, in those days of a minor market fishery, records for these two quite different species were not kept apart. In all probability, Pacifics dominated the catch during that decade, because jack mackerel landings amounted to only a few hundred thousand pounds per year in the late 'twenties. The records for the following years are reasonably correct though we believe that they underestimate slightly the actual poundage caught. The reason for this is that mackerel are not infrequently caught with sardines. The tendency is to call loads containing such a mixture "sardines," particularly when sardines make up half or more of a load. Sometimes the proportion of each species is noted but rarely is such a load called "mackerel." Mackerel is relatively a high priced fish and it cannot be used for straight reduction, so the cause of the bias is apparent. Mixed fish was a particularly acute problem in 1947 and the records for this year are probably the least accurate. The complication stemmed more from loads predominantly jack mackerel than sardine but the end result was about the same.

The mackerel season does not correspond with the calendar year. (The seasonal landings, however, are reflected reasonably well by the annual figures in the graph.) There is in Southern California a definite period of scarcity centering in April. In the mid-'thirties, the season usually began sometime in May, reached a peak in the fall, and dropped off in the winter, the period of scarcity starting any time from December to March. Evidence accumulated that mackerel were becoming less abundant, and in 1938 and 1939 the canners agreed to a voluntary closed season in April and May. During the next two years, June was closed as well. Since then, though there have been no restrictions of any sort, mackerel have been too scarce in the spring and summer to warrant extensive fishing until August or September. The fishery is becoming more and more concentrated in the months of September to December, inclusive. Monterey has a similar period of scarcity, not as well defined since the fish are not pursued intensively at any time and the catches made accidentally by the sardine fleet give a disproportionate weight to mackerel taken during the sardine season.

The fishing grounds extend from Monterey Bay south to Ensenada, Mexico, but over 95 percent of the catch is taken along the Southern California coast from Santa Barbara to San Diego and offshore around the Channel Islands. Until the early 1940's, a small but steady fishery existed in Monterey Bay. A group of "Monterey type" jig boats fished out of Monterey making their catches on hand lines within a few miles of port. That fishery is now extinct and most of the mackerel delivered to the Monterey markets are caught incidentally by lampara boats. Mackerel have never been canned in any quantity at Monterey, though the pure seine fleet has at times caught appreciable poundages, often mixed with sardines and so recorded. At San Francisco, there is no mackerel fishery, though sardine seiners have delivered occasional loads containing mackerel.

San Diego has not supported a mackerel fishery of any consequence since the early 1940's. During the 'thirties a minor canning industry existed, and in 1934 the catch reached a peak of 11.5 million pounds. The San Diego operators now prefer to expend all their energies on tuna, and current landings are absorbed through fresh fish channels or are transshipped elsewhere for processing. A survey made in October, 1947, disclosed that most of the market fishermen use set or drift lines or small round haul nets in fishing mackerel. They take them accidentally in bait nets, in barracuda gill nets and on barracuda jigs.

Activities in the Santa Barbara region have been, for the most part, on a very small scale. The normal demand of the area is met by a few local market boats delivering at Santa Barbara. Late in 1941, a canning industry started at Port Hueneme but soon thereafter, the Navy took over the port and the plants were forced to move. In 1947, part of the port was reopened, and in the last two months of the year some mackerel was landed there for transshipment to canneries in both Central and Southern California. A few seiners delivered at Santa Barbara toward the end of 1947, these loads also being destined for canning elsewhere.

Ports in the Los Angeles region receive most of the state catch. The largest amount is delivered dockside to canneries at Los Angeles-Long Beach Harbor. There are as well several plants at Newport Beach to which the boats deliver direct. Redondo Beach and Santa Monica dealers have also received a good quantity of mackerel in recent years but none is processed locally. The entire catch, excepting such trifling amounts as are sold fresh, is trucked elsewhere (usually to Los Angeles Harbor) for canning.

Two entirely different fishing methods account for most of the region's catch—conventional purse seining and scooping. The latter is a specialized technique developed in Southern California and is used only in the mackerel fishery. Most of the scoop boats are small (under 40 feet) and carry crews of one to three men. The scoop itself is a long-handled dip net with a deep mesh bag hung on a spring steel hoop about 28 inches in diameter. The fish are first schooled about the boat by chumming with a soupy mixture of ground bait. The fisherman, who stands in a rack hung over the side, is then able to catch them in the scoop as they rush for the cloud of chum. Originally, scoops were made with rigid chicken wire bags, but these have long since been replaced by bags of cotton mesh. At times, the fish will not concentrate sufficiently to make scooping practicable. They can then be caught on striker poles with barbless feathered hooks. When the Newport Beach fishery first developed, striker fishing by daylight was the general practice. By the late 'thirties, night fishing with scoops alone had become the rule. Today, few of these men will trouble with strikers even when scooping is poor.

The Los Angeles Harbor industry depended upon seine-caught fish for its supply until 1939. First the lampara boats and later the purse seiners dominated the fishery. In 1939 the seiners were no longer able to meet the demand and the scoop boats invaded the harbor in force. From the 1939–40 season through 1946–47, the scoopers delivered more fish in the Los Angeles region than did the seiners. In the 1947–48 season, the seiners accounted for more than half of the very poor catch. At Newport Beach, where canneries first operated in 1935, scoop boats make almost the entire catch.

The scoop boats fish in Santa Monica Bay, along the coast south of the bay as far as Oceanside, and at Santa Catalina Island. They generally operate within a few miles of shore. Over the years since 1939, Santa Monica Bay has produced the greatest tonnage of scoop-caught fish and Santa Catalina Island the smallest. The seiners cover a much larger area. They fish the entire coast from Santa Barbara almost to San Diego and offshore around the Channel Islands, particularly Santa Cruz, Anacapa, Santa Catalina, and San Clemente. Until about 1936, they concentrated in the general area now exploited by the scoop fleet.

Small net boats have played only a minor role in the region's mackerel fishery for a number of years. Bait men and market lampara fishermen make a few deliveries, but their contribution to the total catch is very small. The amount of mackerel taken by other gear, such as set lines, hand lines and entangling nets, is negligible.

During the first 11 months of 1947, the cannery price to the fishermen in the Los Angeles region was $60 per ton. It rose to $75 in December. These prices compare with $10 in 1933, $21 in 1937, $27.50 in 1941, $40 through most of the war, and $50 to $60 in 1946.

In 1947, the scoop fishermen experienced their worst season. Through October, their total take was as high as it had been the previous year but in November the fishery collapsed. The seiners did a bit better than they had some previous years, but they, too, caught little mackerel after November. This disappearance may be a result of overexploitation, may reflect an unusually early start of the period of scarcity, or both. The total statewide catch fell to 46.5 million pounds, the lowest since 1932 which was the last year of a relatively limited demand.

The fishery has been most erratic since it completed its developmental stage. The graph of total landings shows three peaks each followed by a trough. Each peak is lower than the one before it and each succeeding trough a little deeper. The collapse of the spring and summer purse seine fishery was a danger sign, and here it should be noted that only the blossoming of the scoop fleet has kept the catch up for the past decade. The 1947 seiner catch, while about equal to the average of the past seven years, was only about a sixth as great as it was in the seiners' best year, 1935, when the area fished was smaller.

Finally, in 1947 with the great scarcity of sardines, the fishermen were expending every effort to catch any species and finding only jack mackerel in quantity sufficient to stave off disaster.—*Phil M. Roedel.*

References (see page 210): 49, 52, 61, 63, 105.

2.5. SALMON

2.5.1. Species Present

There are two species of salmon which are common in California. These are the king and silver. A third species, the pink salmon, spawns irregularly in some Northern California coastal streams. It is of no importance either as a commercial or as a game fish.

The king salmon, Oncorhynchus tshawytscha, is the more important California species. At sea its range is from Southern California northward to Alaska and south along the Asiatic side to Japan. It rarely enters streams south of San Francisco Bay. The commercial range is from Monterey northward.

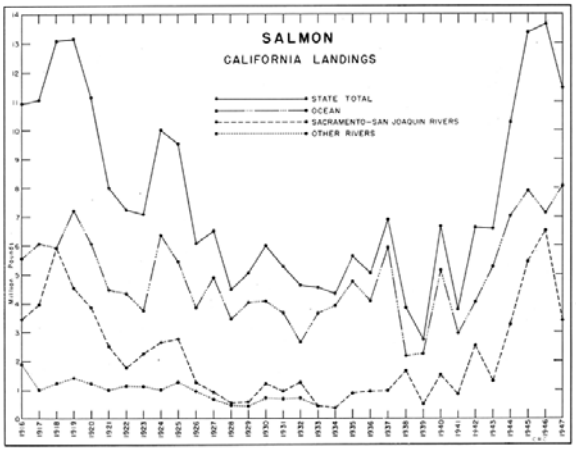

FIGURE 13. Ocean and river catch of salmon compared with yearly landing totals. See Tables 8 and 41

FIGURE 13. Ocean and river catch of salmon compared with yearly landing totals. See Tables 8 and 41

The king salmon provides all of the Sacramento-San Joaquin River catch, nearly all of the commercial ocean catch south of Pt. Arena and by rough estimate it forms on the order of 90 percent of the catch north of Pt. Arena.

This species is the largest of all salmons. The average mature fish weighs about 20 pounds. Spawning fish as large as 50 or as small as three pounds are not rare and extreme examples larger than 100 pounds or smaller than one pound have been taken. Ocean caught kings are often taken long before they have attained their growth. Five-pound fish are common in the troll catch.

The silver salmon, Oncorhynchus kisutch, forms the remainder of the California salmon catch. Like the king this species is found from Southern California north to Alaska and southward on the Asiatic side to Japan. It is rare south of Monterey. It spawns in streams from Central California northward but does not enter the Sacramento-San Joaquin River system.

A mature silver salmon will usually weigh 7 to 12 pounds. Individuals over 15 pounds are rare and 30 is about the extreme limit.

The two species of salmon have not been separated in our catch records. Dealers along the Northern California coast have habitually recorded both species as "salmon," thus making an accurate separation of past data impossible.

2.5.2. Indians

The earliest salmon fishermen were American Indians. Most people dismiss this fishery with a hastily conceived mental picture of an occasional red man catching an occasional salmon. A more accurate picture would be of thousands of Indians harvesting and drying enough salmon to last them throughout the year. Salmon was the staple food of some tribes. Even by today's standards the Indian take in some places was not small.

For example Kroeber (1939) has estimated the Indian population of the lower Klamath as 5,000 and gives salmon as the most important source of food. Indian gear was often very effective and some of the Indian weirs were often able to stop almost the entire fall spawning run of salmon. At the Hoopa Indian Reservation on the Trinity River such a weir has been used within the present decade.

2.5.3. River Fishery

By 1850 there was a commercial salmon fishery operating in the lower Sacramento and San Joaquin Rivers, in Suisun Bay and in San Pablo Bay. This fishery spread through the years and eventually included the other large coastal streams of the State, but the Sacramento-San Joaquin fishery has always been the largest and in recent decades legislation has gradually eliminated the other fisheries. The Mad River was closed in 1919, the Eel in 1922, the Smith and Klamath in 1933. Since that time a portion of the lower Sacramento-San Joaquin system is all that has remained open.

Among the earliest kinds of commercial gear were drift gill nets and beach seines. Pound nets, set nets, traps and weirs also came into use but were declared illegal by the State Legislature in 1881. Beach seines were outlawed for the taking of salmon in 1923 except in the Smith

River where this form of gear remained legal until the stream's closure 10 years later.

The drift gill net and its close relative the drift trammel net are the only commercial gear which are now legal for salmon fishing in inland waters.

In the Sacramento River above Rio Vista the nets may be as short as 50 fathoms in some of the narrower places or as long as 120 fathoms. The river nets are usually about 25 feet deep, and are suspended so that the cork line floats about 12 feet under the surface. This allows river traffic to pass over the net. Nets with a submerged cork line are called "diver nets." In the wider waters below Rio Vista there are areas where nets must be at least 300 fathoms long to fish properly. The currents will bunch up a shorter net. In most of the downstream waters 220 to 260 fathoms of net is the most popular. Such nets are usually about 35 feet deep. In the Carquinez Straits the waters are over 75 feet deep in places and nets about 50 feet deep are commonly used.

A controversial form of gear is fished by a relatively few fishermen on shallow mud flats. These "flat nets" are usually 150–175 fathoms long and about 25 feet deep. One boat may operate as many as six or eight such nets. This is possible only because the nets drag on the mud and do little or no drifting with the current. Some people contend that such nets are actually set nets and are therefore illegal. The owners claim that the nets would drift if there were a strong current. A clear-cut court ruling might help settle this point.

The gill net boats in the more open waters of the Pittsburg-Martinez area are usually 26- to 28-foot double enders with low cabins (see Figure 14). The net and catch are carried in the stern. The entire boat is low and offers little wind resistance. A boat which catches the wind will be blown out of position when drifting with its net. The boats are of a standardized design and there was no radical change for a good many years until the recent addition of two "bow pickers" to the fleet. This type of boat was developed in more northern waters and may or may not revolutionize gill netting in California. A "bow picker" is a typical Columbia River gill netter with a roller and gurdy mounted up forward for pulling the net over the bow, thus preventing it from becoming entangled as the boat drifts with the current. In the more restricted waters above Rio Vista there are some smaller gill net boats, part of which have no cabins. The size of the individual gill net boat has not changed much in recent years. In 1937 the most common length was 26 feet and over 80 percent of the boats were registered as 24, 25, 26 or 27 feet in length. In 1947 the most common length was still 26 feet, but 27-, 28- and 29-foot boats have become more common.

The number of salmon gill net boats in the Sacramento-San Joaquin River system increased from about 100 in 1872 to over 800 in 1901. By 1916 the number was down to a little over 500. The decline continued until the mid-'thirties, at which time the fleet was down to about 150 boats. Since that time there has been an increase and in 1947 there were 240 boats, each of which landed 1,000 pounds or more of salmon. There is not apt to be any large scale increase in the future unless there is an increase in the area where netting is permitted. Such is not likely. Since 1921 the trend has been in the other direction. In recent years there has been continuous heavy pressure by sportsmen's groups to close more

FIGURE 14. Salmon gill net boats. Pittsburg, California. The design is old and standard. Cabins are low to minimize the surface exposed to the wind when the boat is drifting with its net. Radical changes in design are just beginning to enter the fishery. Photo by D. H. Fry, Jr., January, 1949

FIGURE 14. Salmon gill net boats. Pittsburg, California. The design is old and standard. Cabins are low to minimize the surface exposed to the wind when the boat is drifting with its net. Radical changes in design are just beginning to enter the fishery. Photo by D. H. Fry, Jr., January, 1949

and more of the inland waters to netting. At present the gill net fleet is so confined that the open area is overcrowded. This crowding was made worse by the moving of large numbers of surplus World War II ships into some of the best salmon "drifts." The method of fishing is basically very simple, but requires a detailed knowledge of the area, every snag in it, and every whim of the tide.

The fisherman lays his net across the current and lets the tide drift him. The salmon hit the net, go part way through and become entangled. Boat, net and catch drift with the current until the end of the suitable drifting water is approached or until the tide changes. Then one fisherman keeps the boat in position with a large pair of oars while the other man hauls the net and catch on board. If there is plenty of time the fish are taken out of the net as they come aboard, but if there is a bad snag close ahead the men may hurriedly get everything on board and leave the salmon tangled in the net until later.

A somewhat different method of fishing was more common in the past. After setting out the net the fishermen would pull the net over the boat and back into the water, thus working the boat under the entire length of net, removing the catch and letting the net continue to operate behind it. Picking out individual fish as they were caught also used to be a common practice. The fishermen would watch the cork line, go to the scene of any activity and remove the fish causing it. Sometimes it was not even necessary to watch. Salmon do not peacefully die after a few

wiggles in a gill net. On a quiet night an active fish hitting the net near the surface can sometimes be heard a quarter mile away.

At present the operators of the shallow water "flat nets" are the only California salmon netters who make a regular practice of removing the catch while the net continues to fish. Because these nets are used where there is no strong current they do not drift any distance and the fishermen can leave them in position without regard for state of the tide.

2.5.4. Ocean Trolling

Ocean trolling for salmon off the California Coast started in the early 1880's in Monterey Bay. Commercially this form of fishing was of little consequence until the late 1890's. About 1898 mild curing of salmon was started and acted as a stimulus to the ocean fishery. The early trolling was done from small sail boats rigged with leg-o-mutton sails. About 1908 the Sacramento River gill netters began using power and many of these fishermen took their boats to Monterey Bay to troll for salmon in the summer. These powered gill netters were a big improvement over the boats which had previously been in use, but they would be regarded as too small for trolling as it is done today.

FIGURE 15. Salmon troller. Boats like this carry ice, are capable of long trips, and can follow schools of salmon or albacore anywhere off the coast of California, Oregon or Washington. Four trolling poles, six power operated lines and 24 hooks are most commonly used. Photo by D. H. Fry, Jr., Eureka, California, July, 1948

FIGURE 15. Salmon troller. Boats like this carry ice, are capable of long trips, and can follow schools of salmon or albacore anywhere off the coast of California, Oregon or Washington. Four trolling poles, six power operated lines and 24 hooks are most commonly used. Photo by D. H. Fry, Jr., Eureka, California, July, 1948

By 1914 the troll fishing had spread from Monterey Bay north to Pt. Reyes. Two years later some boats had tried the area off Fort Bragg and Shelter Cove and there was some trolling out of Eureka and Crescent City.

In recent years the trollers have been gradually tending toward the use of larger boats and the use of ice to preserve the catch. A large troller is shown in Figure 15. The smaller craft leave the harbor each morning and return the same afternoon or evening. If the salmon are running close to a harbor even the largest boats will make one day trips, but if the fish are 30 to 50 miles away the fishermen will put on a load of ice and may stay out a week or longer.

In 1937 the most common sizes of ocean trollers were 28 and 30 feet and about 90 percent of the boats were between 24 and 40 feet in length. In 1947 the most common sizes were still 28 and 30 feet, but boats 32 to 45 feet long were relatively more numerous than in 1937. The number of trollers has been increasing. In 1947 over 1,100 boats landed ocean caught salmon and 876 landed more than 1,000 pounds each. By comparison, Nidever (1937) states that in 1935 there were 570 trollers operating off the coast of California.

Ocean trolling used to be strictly a hand operation, except for the sail or motor which moved the boat. A typical troller of the 1920's and 1930's would use either two or four trolling poles and would fish as many as nine lines. Some of the lines might have four or even more hooks, and as much as 30 pounds of lead to keep the hooks at the proper depth. When the fish were biting fast the one or two men on a troller would have a really exhausting job. The modern salmon troller has mechanized his equipment and lets the engine do the back breaking job of lifting fish and lead to the surface, but he has to have even more dexterity than a hand puller.

The typical modern trolling boat has four poles and fishes six lines; four hooks per line is typical. This is fewer lines and hooks than some of the hand pullers used but power pulling is so much faster that no more are needed. The fishermen take less time to get the fish on board and the lines fishing again, and spend less time towing recalcitrant salmon through the ocean.

In 1947 nearly 100 percent of the trollers north of San Francisco used gurdies. At San Francisco about 80 percent were so equipped and at Monterey only about 20 percent. Probably the chief reason for this difference is that in the more southern waters salmon are often scarce and many fishermen fish salmon only a small part of the year. A secondary reason for the higher proportion of hand pullers in the south is that the gurdy is a northern development which has been working its way down the coast.

The heart of the typical power pulling mechanism is a set of six small gurdies. These are mounted three on a shaft, one shaft for each side of the boat (see Fig. 16). Each gurdy is equipped with a clutch and brake. The line is stranded stainless steel one-sixteenth of an inch thick. A single sinker is attached to the end of the line. These weights may be as heavy as 50 pounds. The heaviest leads are put on the bow lines. Lighter sinkers for shallower fishing are used on the lines from the main poles. A new type of weight for deep fishing is entering the fishery. This device has a flat surface and is so shaped that it has a diving action thus

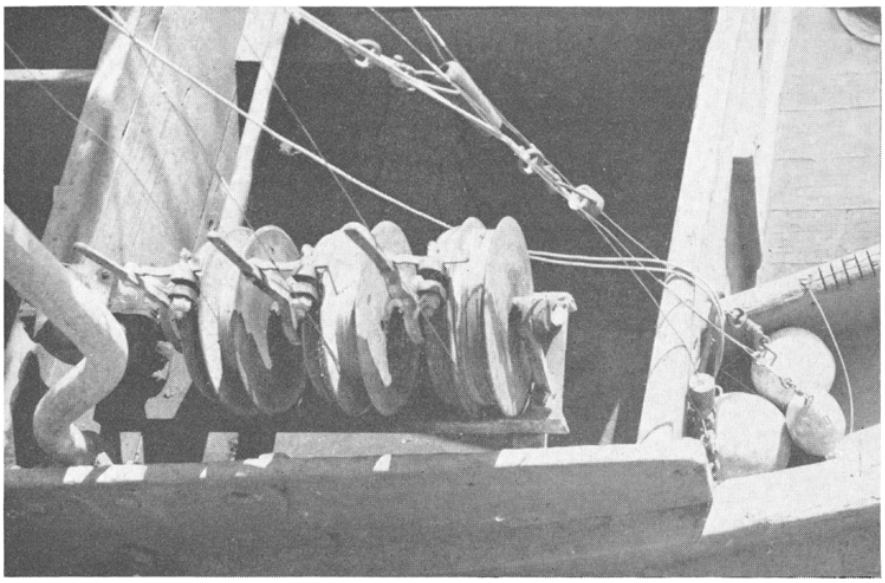

FIGURE 16. Three salmon gurdies mounted on a single shaft. There is a second set of three on the other side of the boat. The lines are stainless steel. Note the three lead weights at the right. Photo by D. H. Fry, Jr., 1949

FIGURE 16. Three salmon gurdies mounted on a single shaft. There is a second set of three on the other side of the boat. The lines are stainless steel. Note the three lead weights at the right. Photo by D. H. Fry, Jr., 1949

making it fish deeper than other sinkers of equal weight. Hooks are attached to leaders and each leader is snapped onto the line. Small "stoppers" permanently fastened to the lines keep the snaps from sliding. The lures used are spoons, wooden plugs and sardines.

When a salmon strikes, the fisherman engages the clutch of one gurdy and winds in the one line. When a hook reaches the surface he unsnaps it, unless the fish is on that hook, and lets the gurdy continue winding until the fish is at the surface. If the salmon is obviously of legal size, 25 inches (1947), the fisherman usually hits it on top of the head with a combination gaff-club, then he gaffs it in the head and lifts it aboard. Fish of doubtful size are measured and small ones are released. The methods of release are varied and are the subject of controversy. Some methods are easy on the fish, others probably kill more than they save. About the only complete agreement is that the use of a landing net is one of the worst methods. The hook catches in the webbing and unhooking a squirming salmon in the bottom of the net is a time consuming process.

The transition from hand to power pulling was slow. In 1931 a Seattle firm started selling power gurdies, not essentially different from those in use today, but more than a decade passed before such equipment reached California in any quantity. During the 1930's some California fishermen used home devised equipment to enable them to apply power to their lines but by 1941 the great majority of California fishermen were still pulling by hand. About 1943 factory made gurdies and steel lines began appearing and by 1945 the change to power was almost complete among the large boats and full time trollers. Even today there are hand pullers among the small boat operators and men who troll only a small part of the time.

Another device which has greatly increased the efficiency of the trolling fleet is the radio telephone. About 1944 some trollers started using radio and by 1946 the great majority had sets. Formerly when one fisherman located salmon there might be a lapse of days before the bulk of the fleet found out about it. Now the interval may be a matter of minutes. Not only has the radio improved communications, it has also improved the spirit of cooperation. Fishermen who used to be very secretive about the location of schools of fish now go to the other extreme.

2.5.5. Canning

The early development of the salmon fishery was greatly stimulated by the canning industry. The first salmon cannery on the Pacific Coast started operations in 1864 on the banks of the Sacramento River at Washington (now Broderick). During the next 10 years there was little growth of this new industry but in the five-year period from 1876 to 1881 the number of canneries increased from 2 to 20. These plants were located on the Sacramento and San Joaquin Rivers and on Suisun Bay. After two peak years in 1881 and 1882 the canning industry rapidly collapsed. By 1885 there were only six plants operating. From that time until 1896 the pack fell off more gradually. There was a slight revival during the next decade, followed by a gradual fading away until the last canneries closed in 1919.

On the Klamath River the canning industry never approached the maximum attained by that of the Sacramento. The peak years were 1912 and 1915. The canneries were closed by the State Legislature in 1934.

At present canning of river caught salmon is prohibited by law, except that sportsmen may have their fish packed for their own use. Ocean caught salmon may be legally canned and some small scale operations have been conducted since World War II.

2.5.6. Salmon Landings

The salmon landings from 1916 through 1947 are shown in Figure 13. During this entire period the catch has been regulated by the supply. There have been some fishermen's strikes but in general both the fishermen and the markets have taken all the salmon they could get. The period of low catches extending from the late 'twenties to the early 'forties was due to a shortage of fish, not to economic conditions. Similarly the rise which started in 1944 was due to an increase in the abundance of salmon.

Numerous logical reasons have been given for the period of poor fishing: Overfishing, dams keeping the salmon away from their spawning grounds, diversion of water for irrigation and power, pollution of streams, spearing of salmon on and near their spawning beds, loss of young into irrigation ditches, etc., etc. Probably all of the above reasons and many others played a part. Some salmon streams have had their runs exterminated by one or more of the factors mentioned and a constant struggle is necessary to keep the same thing from happening to many more streams.

The improvement in fishing which started in 1944 is harder to explain. There have been some successes in the numerous battles against the unwanted by-products of civilization, but these victories have not been enough to explain any great increase in the numbers of salmon. The most logical answer would seem to be that there has been a period of

unusually favorable conditions in the ocean and that these conditions have permitted the survival of an unusually high percentage of the young fish.

The Sacramento-San Joaquin River system has always been the backbone of California's salmon fishing. In the Nineteenth Century the fishing was nearly all in the river or the bay. Since 1916 more fish have been caught in the ocean than in the river but by tagging salmon at sea it was demonstrated that during the period of the test the majority of the ocean caught salmon were Sacramento fish. There is no reason to suspect that this is not the usual condition.

The "other rivers" shown in Figure 13 and Table 41 are the Smith, Klamath, Mad and Eel. The State Legislature felt that there were not enough fish in these streams to support both a sport and a commercial fishery and closed the commercial fishery. The last year of commercial fishing was 1918 in the Mad River, 1921 in the Eel and 1933 in the Smith and Klamath. It should be kept in mind that although closed to gill netting these streams still help supply fish to the ocean trollers. In addition their salmon are subjected to a very intense sport fishery in the rivers themselves.

The yearly catch of ocean salmon is shown by regions in Figure 17 and Table 8. Only the three most northern ocean districts produce salmon in any quantity. of these the northernmost, Eureka Region, has produced the greatest landings every year but one since 1919. Before 1919 there was relatively little ocean trolling this far north. Monterey is the

TABLE 8

SALMON

Ocean Caught

Year	Eureka	San Francisco	Monterey	All other	Total pounds
1916	98,353	262,889	5,230,839	135	5,592,216
1917	924,192	1,280,312	3,879,487	2,006	6,085,997
1918	1,110,611	1,928,794	2,892,876	1,065	5,933,346
1919	2,949,642	1,442,708	2,816,022	10	7,208,382
1920	3,115,381	1,459,932	1,490,877	----------	6,066,190
1921	2,300,259	938,886	1,243,960	----------	4,483,105
1922	2,496,841	961,317	880,129	30	4,338,317
1923	1,693,711	1,314,877	728,336	----------	3,736,924
1924	1,880,342	3,617,045	877,186	----------	6,374,573
1925	3,111,885	1,270,936	1,098,715	----------	5,481,536
1926	2,849,509	962,413	51,755	----------	3,863,677
1927	2,715,806	1,488,746	717,027	21	4,921,600
1928	2,293,832	815,815	334,654	5	3,444,306
1929	2,320,846	658,718	1,054,096	----------	4,033,660
1930	2,797,993	1,008,242	279,409	6	4,085,650
1931	3,254,846	428,298	91,471	----------	3,774,615
1932	2,656,788	124,010	80,884	16	2,861,698
1933	2,943,962	158,806	569,859	48	3,672,675
1934	2,824,743	818,852	286,230	----------	3,929,825
1935	3,790,733	337,751	219,700	15	4,348,199
1936	3,655,768	266,440	144,924	1,020	4,068,152
1937	3,895,867	1,108,402	891,083	931	5,896,283
1938	1,868,706	94,975	199,474	183	2,163,338
1939	1,821,931	285,194	125,498	----------	2,232,623
1940	3,369,492	1,177,653	613,224	34	5,160,403
1941	2,413,368	375,766	153,662	3,198	2,945,994
1942	2,255,862	1,642,051	164,931	462	4,063,306
1943	2,162,368	2,021,208	1,101,934	17	5,285,527
1944	3,792,103	2,646,714	575,579	7,452	7,021,848
1945	4,627,714	2,431,954	816,303	36,783	7,912,754
1946	4,545,299	2,017,703	569,350	2,120	7,134,472
1947	5,868,577	1,485,657	738,469	----------	8,092,703

TABLE 8
SALMON
Ocean Caught

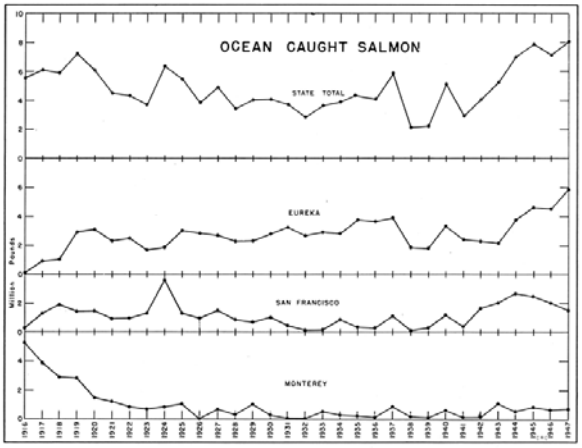

FIGURE 17. Commercial salmon landings by regions. See Tables 8 and 41

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southernmost region which produces salmon in any numbers. At one time nearly all of California's ocean caught salmon was taken in this vicinity. In 1916 the Monterey landings reached their all time high of over 5,000,000 pounds; from then on the catches fell off rapidly and since 1922 the annual landings have reached a million pounds in only three years.

The salmon landings by months are shown for the various districts in Figure 18. In the ocean regions, Monterey, San Francisco and Eureka, the season opens April 1st. At Monterey and San Francisco fishing is apt

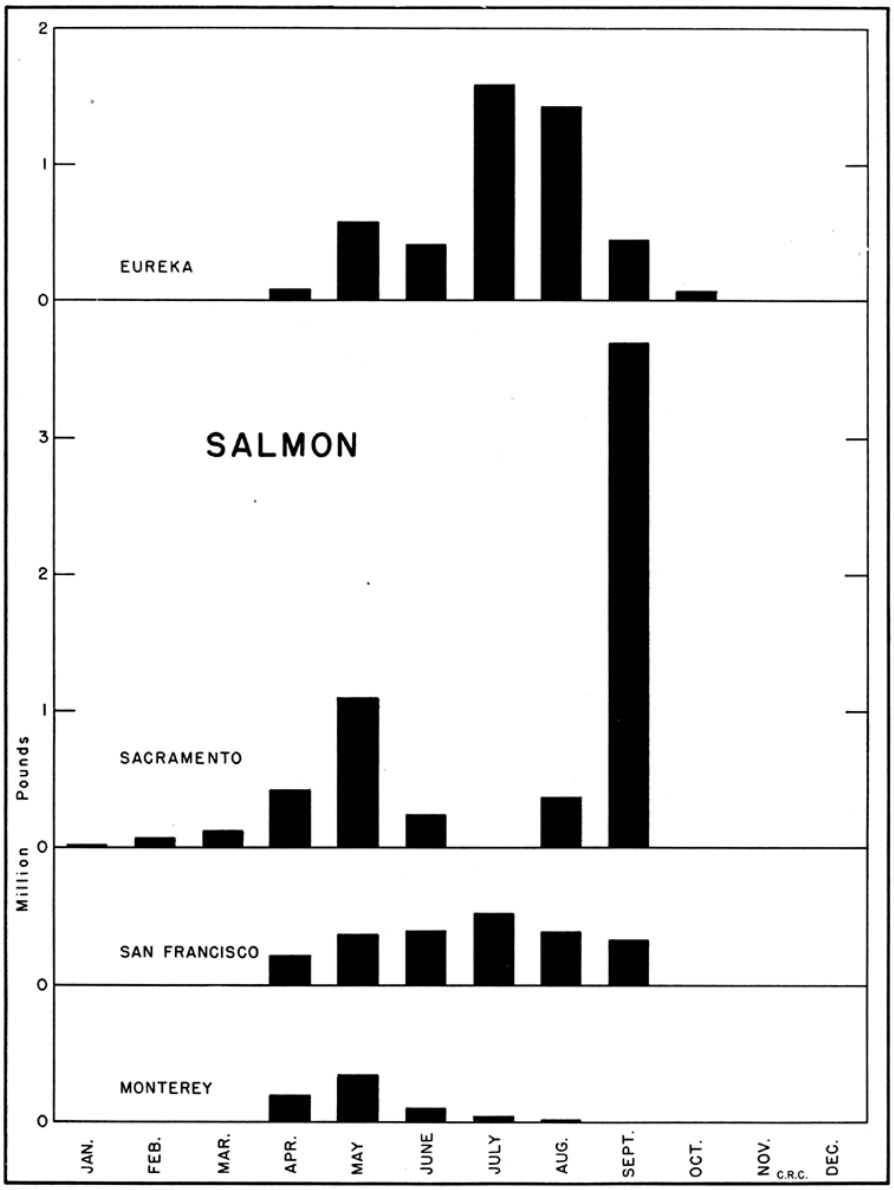

FIGURE 18. Average catches for a two-year period (1945-1946) by months for each region

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to be good right at the start of the season but at Eureka the fishing and the weather are both apt to be poor. At Monterey the salmon leave as summer advances and by August the fishing is virtually over. In the more northern areas there is good salmon fishing throughout the summer. In the fall the adult salmon start entering the streams thus leaving a population of immature fish in the ocean. To protect these young fish the season is legally closed September 15th.

In the Sacramento River fishery the salmon are taken on their upstream migration. There are some fish in the river every month of the year but by far the heaviest runs are in the fall and spring. The season is legally closed from June 16th to August 9th and again from September 27th to November 14th. The first of these closures occurs when there are very few fish in the river. The second occurs shortly after the height of the fall run and allows the escapement of tens of thousands more salmon than would otherwise have reached the spawning grounds.—*Donald H. Fry, Jr.*

References (see page 210): 38, 42, 72, 73, 75, 79, 86, 89, 113, 123, 127.

2.6. SHAD

The shad fishery centers in the San Francisco Bay, Sacramento and San Joaquin River area. A small poundage is taken in ocean waters along the entire coast from San Diego to Crescent City and individuals are generally taken each year in several of the larger Northern California streams.

Shad, Alosa sapidissima, was first introduced in California in 1871 by the California Fish Commission assisted by the U. S. Fish Commission and the New York Fish Commission. The success of this achievement in the art of fish culture was due to the energy and initiative of the first California Fish Commissioners* and the great skill of the famous fish culturist, Mr. Seth Green of the U. S. Fish Commission. As an experiment, Mr. Green left Rochester, New York, on June 20, 1871, with 15,000 shad fry just hatched, contained in eight tin cans holding 12 gallons of water each. Seven days later he arrived at Tehama, California, with 10,000 of the fry in good order and liberated them in the Sacramento River at that point. A second plant of 35,000 fry was made in the river at the same point by Mr. Livingston Stone in 1873. Later, between 1876 and 1880 several subsequent plants, totaling 574,000 shad fry, were made by the U.S. Fish Commission. The fry were brought overland in aquarium cars from streams on the Atlantic coast.

These shad fry had several natural advantages which contributed to their survival. The feeding conditions for the fry were nearly ideal because their food in freshwater was not eaten in any great amount by other fish. The Sacramento and San Joaquin Rivers and their tributaries afforded large and easily accessible spawning areas.

Under these favorable conditions, the shad increased rapidly so that in 1879 several thousand were marketed in San Francisco. They spread rapidly from California and were being taken in the Columbia River in 1880 and in Puget Sound in 1882.

* Messrs. B. B. Redding, S. R. Throckmorton and J. D. Farwell.

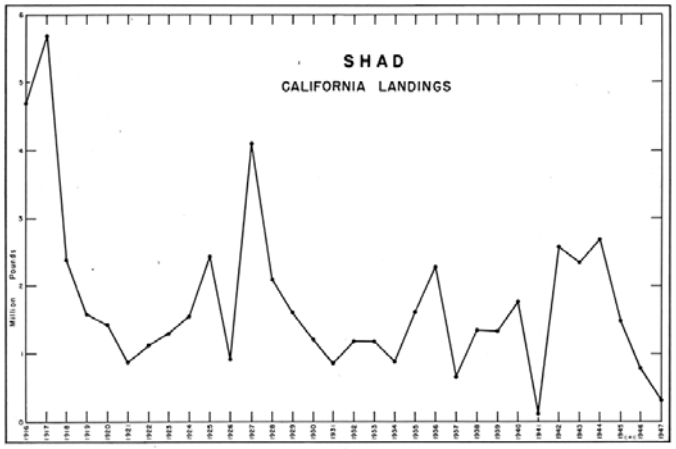

FIGURE 19. See Table 42

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Under the present fishing laws the shad are well protected. They are taken commercially, during a two and one-half month open season extending from March 15th to June 1st, by drift gill nets ranging from 150 to 300 fathoms in length with a minimum stretched mesh of 5½ inches.

The commercial fishing district is confined to Fish and Game District 12B and includes Carquinez Straits, Suisun Bay, the Sacramento River to Rio Vista and the San Joaquin River to Convict Point on Venice Island. The salmon net fishing fleet of about 225 gill net boats and their crews of one or two men, usually two, does all the commercial shad fishing. The successful shad net is of 5¾- to 6½-inch mesh, 6#-inch being the most efficient. This size will also catch salmon of smaller sizes than do the salmon nets. Shad are not taken in the ocean to any extent except incidentally with nets that are being used for other fish.

Shad take a fly readily in freshwater, and in every stream in which they spawn there is a minor sport fishery. In the Mokelumne River they are caught during the run with hand dip nets made of chicken wire.

Because the shad season comes at the time of the spring salmon run and because the same men fish for both species with different gear, it is believed that the fluctuations in the catch reflect the relative abundance and the relative price of both species rather than the abundance of shad.

In the trade, the male shad is designated as buck and the female as roe shad. Because the roe or eggs are the most valuable part of the fish, roe shad bring the highest price to the fishermen. Naturally in this case the fishermen attempt to take as much of the roe shad as possible. The roe shad is the larger of the two and gills in a larger mesh net, the larger mesh allowing a good portion of the bucks to pass through. The average weight of the roe shad when taken in the bay and river is a little better than five pounds. Buck shad average 3½ pounds in weight.

A large part of the shad and shad roe is sold fresh locally. The rest of the catch is marketed on the Atlantic coast except for those that are canned or cured in brine. Much of the roe is frozen during the season to be held for future local consumption or for eastern shipment. A fairly large proportion is canned each year. Most of the canned shad and shad roe go to eastern and foreign markets.—*Howard McCully*

References (see page 210): 20, 72, 119, 122.

2.7. STRIPED BASS

Striped bass have prospered from the time they were introduced into California waters and have not only furnished this State with an important food fish but also with a popular sport fish. Transported from New Jersey, 137 striped bass, Roccus saxatilis, were introduced into the waters of Carquinez Strait in 1879. In 1882, another plant was made of about 300 fish.

The commercial fishery started in 1880 when the first bass were brought to market. By 1889 the catch was large enough to be of importance. In 1902 the striped bass were second only to salmon in the commercial catch and were being shipped to eastern markets. The sport fishery become important about the same time.

This is probably one of the most remarkable cases of survival and acclimatization of introduced species. The 137 three- to eight-inch bass found themselves transplanted into an environment that offered them

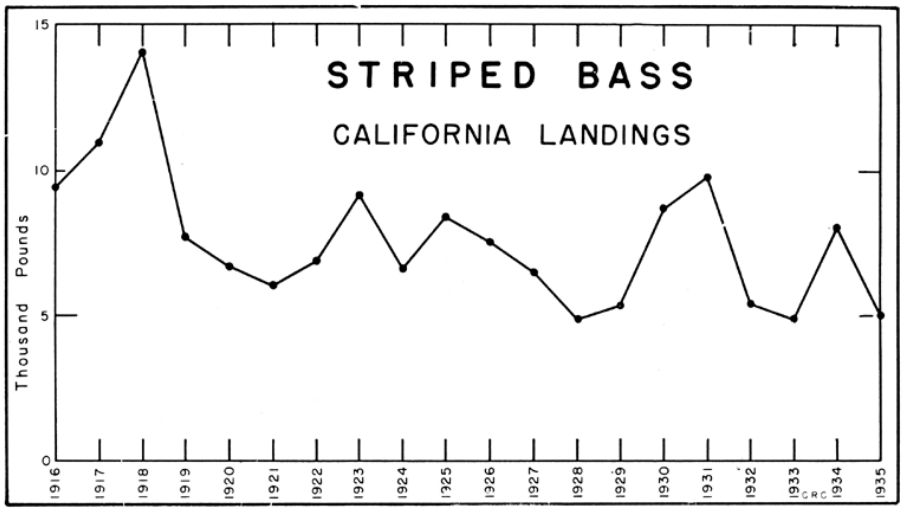

FIGURE 20. Commercial fishery ended in 1935. See Table 42

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an abundant food supply. This was shown by the extraordinary growth of two 16-pound striped bass caught in 1883 only four years after the first planting. The fish planted in 1879 had successfully reproduced before the second introduction was made in 1882.

Shortly after their introduction they found their way to Monterey Bay and to the streams, sloughs and estuaries entering it. They moved northward into the Russian River and to several bays and lagoons just north of San Francisco. In the early 1900's they were planted in the Eel River and other streams of Humboldt and Del Norte Counties. By 1906 striped bass were being taken in the Columbia River. These fish have extended their runs many miles up the Sacramento and San Joaquin Rivers and their tributaries; they inhabit all sloughs and cuts throughout the delta region, which alone consists of over 700 miles of waterways.

Investigations of the life history of the striped bass on this coast, made by the California Division of Fish and Game, have proven that the nursery grounds of most striped bass taken in California waters are within the Sacramento and San Joaquin Rivers and their delta, there being a well-defined feeding and spawning migration to and from these areas.

Sportsmen now enjoy taking this game fish the year around in San Francisco Bay and the streams and sloughs entering it. Although there never has been a record kept of the amount of striped bass taken by anglers, it has been established that the sport catch has long been much larger than the commercial catch ever was.

Fishing for striped bass was completely unrestricted for 11 years after their introduction until the San Francisco County Board of Supervisors enacted a minimum size limit of eight pounds in 1890. The first state law was a minimum size limit of three pounds enacted in 1897. Since then the laws were made progressively harsher until the commercial fishery was ended in 1935 and the sportsmen in 1948 had a bag limit of five fish or 25 pounds and one fish.

Previous to 1931, when commercial fishing for striped bass with nets was prohibited, the fishery comprised 175 to 200 small commercial fishing

boats, and 350 to 400 fishermen. The average yearly catch for the last 10 years, 1926–1935 inclusive, amounted to about 658,000 pounds, which at 11 cents per pound (the average price paid during this period) realized $72,380 per year to the fishermen.—*Howard McCully.*

References (see page 210): 119, 122.

2.8. CATFISH

Catfish were introduced into California waters from Pennsylvania in 1874, and later plants from the Mississippi Basin supplemented the original stock. These fish have thrived in most of the lakes and streams where they have been planted. They provide sport for thousands of anglers, and support an important commercial fishery in certain restricted areas. Excluding anadromous fishes, catfish lead all other fresh water species taken commercially in California both in amounts caught and in value.

of the two species originally transplanted, the fork-tail catfish, Ictalurus catus, supplies the bulk of the commercial and sport catch. This fish is also called channel catfish, blue catfish or white catfish. The square-tail catfish, Ameiurus nebulosus, is more common in lakes than in rivers and streams. It is known as the yellow catfish, bullhead, horned pout or Sacramento catfish.

Since about 1920, the spotted catfish, Ictalurus punctatus, has been taken by sportsmen in the Colorado River and a few specimens have been reported from the upper Sacramento River. This species is a native of the Mississippi drainage.

Legal restrictions prohibit commercial catfishing in a large part of the State. Commercial fishermen keep out of some areas which are legal because the fish are not sufficiently abundant. As a result of these two types of restriction most catfish netting is conducted in the Sacramento River from the City of Sacramento to the river mouth, in the San Joaquin River below Stockton, and in many of the sloughs of the Sacramento-San Joaquin delta.

In recent years there has been no commercial fishing for catfish on the Sacramento River upstream from the City of Sacramento. It is believed that cold water released from Shasta Dam has forced the fish to move downstream to areas where more moderate temperatures prevail. The disappearance of the catfish from this upstream area makes it difficult not only to predict the future of the fishery, but to assess the effects of an increase in fishing effort.

Clear Lake formerly supported a commercial hook and line fishery for catfish. However, in 1931 a law was passed prohibiting the shipping of catfish out of the district in which Clear Lake is located, and the lake fishery was virtually abandoned. In 1941 legislation was adopted which abolished all commercial catfishing in the lake.

In the commercial fishing areas protection is afforded the catfish by a closed commercial season from May 1st through August 31st. This period includes the spawning season. A minimum size limit of seven inches dressed with head off or nine inches in the round is provided by law.

Fyke nets are permitted but there is a limit fixed on the size of mesh, circumference of the funnel opening and size of the net hoops.

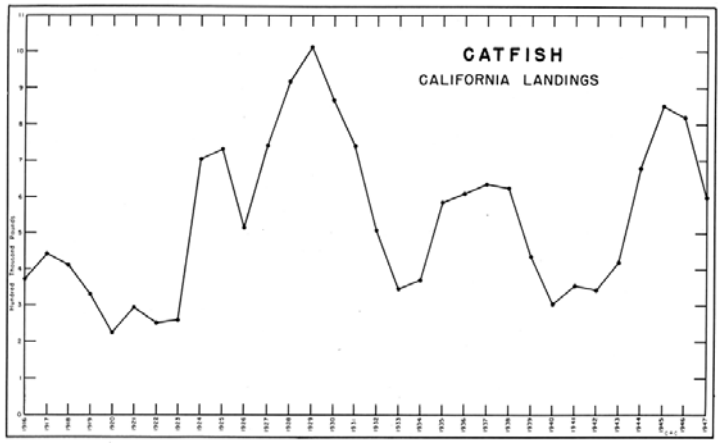

FIGURE 21. Catfish totals in round weight. Cleaned weight reported on fish receipts has been doubled. See Table 42

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The size of the net hoops permitted (22 feet in circumference) is much larger than even the largest hoops now in use. Catfish fyke nets are fished in deep water, usually close to the river bank. Lines from each end of the net are fastened to snags or overhanging trees to keep the net hoops upright on the river bottom. To prevent theft of the net or catch, some fishermen fasten their nets to a submerged mooring, and pick them up with grappling hooks. Part of the fishermen tend their nets every day, others every two days to a week.

Between 1935 and 1945 most fishermen increased the size of their fyke nets. Fyke nets with a hoop diameter of two and one-half feet and a length of 9 or 10 feet were standard. Then some fishermen began using 16-foot nets with three and one-half foot hoops. During the 1945 fishing season a fyke net called a "bomber" was developed using hoops as large as five feet in diameter. This net had an over-all length of 25 feet. Bomber

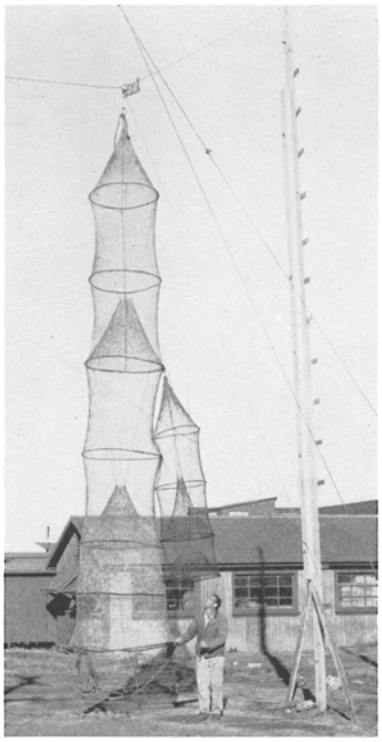

FIGURE 22. Fyke nets, the new and the old. A "bomber" net on the left and an old style catfish fyke net fastened to it. Pittsburg, California. Photograph by D. H. Fry, Jr., January, 1949

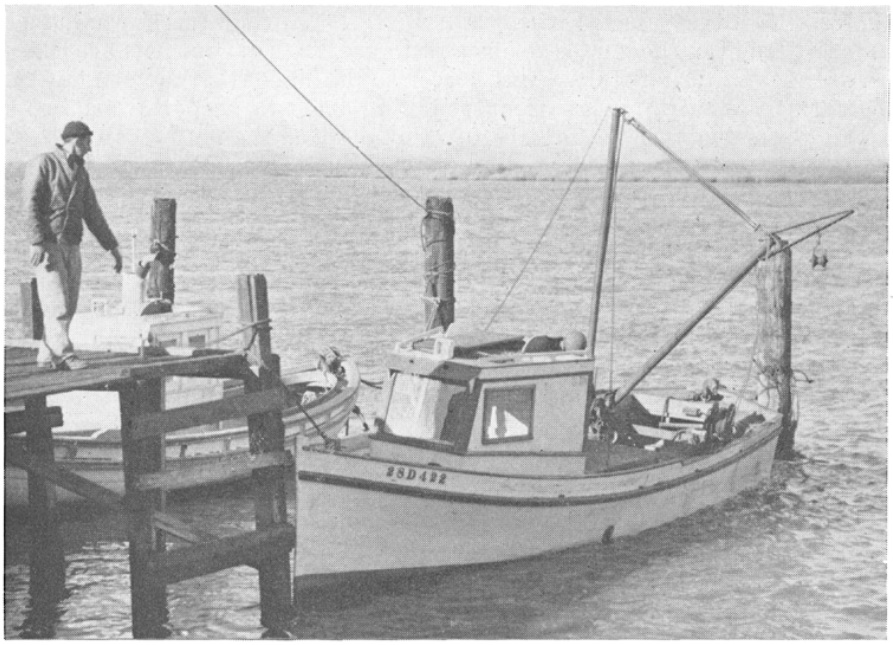

FIGURE 23. A power operated boat with a hoist for handling the large fyke net now in use. Pittsburg, California. Photograph by D. H. Fry, Jr., January, 1949

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nets are coming into more general use and are the subject of much heated controversy among the fishermen. Large power boats equipped with power hoists are used to handle these nets. As the increase in the length and diameter of the net made it possible to hold greater numbers of fish, the nets were tended only once a week. A crew of three or four men now operates as many as two hundred "bomber" nets.

Gill net fishermen who take salmon and shad often operate catfish nets as a side line. Market prices and availability of fish usually determine the type of fishing carried on by these men.

Most fishermen engaged in the catfish fishery live in houseboats or camps near the area where they set their nets. The usual equipment consists of from 50 to 100 fyke nets, tar vats for treating the nets, live cars to hold the fish and some type of boat with which to set and tend the nets. The fish are dumped into the live cars and kept alive until the fisherman is ready to market them. At that time he catches, cleans, beheads and skins the fish he is going to sell. Many fishermen deliver their catch to market by boat or truck while others sell to buyers sent out by the dealers to pick up the catch with company trucks.

All catfish are dressed by the fishermen and the fish lose 50 percent of their live weight in the cleaning process. To give an accurate picture of the catfish catch in the round (Fig. 21) the poundage reported on market receipts has been doubled.

Until 1935 the number of fishermen operating and the amount of gear used remained fairly constant. Fluctuations in take could be accounted for by weather or economic conditions. Since then the number of fishermen engaged in the fishery has doubled and the number of nets

fished per man has more than doubled. The revenue from this fishery has increased from $32,000 in 1935 to $85,000 in 1947.

Despite the greatly increased fishing intensity and more efficient gear only a moderate gain in total poundage can be noted in 1945 and 1946 (Fig. 21), and there is a marked drop in the 1947 catch.

—*George H. Warner*

References (see page 210): 50, 54, 119.

2.9. FRESH WATER ROUGH FISH

There are six species of true fresh water fishes, exclusive of the catfishes, that are caught commercially in California. All these species may be found at times in the brackish waters of the Delta area, but they are essentially fresh water fishes. They are:

Hardhead	Mylopharodon conocephalus
Greaser blackfish	Orthodon microlepidotus
Western sucker	Catostomus occidentalis
Sacramento squawfish	Ptychocheilus grandis
Split-tail	Pogonichthys macrolepidotus
Carp	Cyprinus carpio

The hardhead, greaser blackfish, western sucker, Sacramento squawfish and split-tail are all native to California waters. The greaser blackfish is sometimes called "hardhead" and is included in the hardhead catch. It is usually referred to as "blackfish," in Clear Lake and as "greaser," in the San Joaquin Valley. The Sacramento squawfish is commercially called "pike" and is so listed in the catch tables. The western sucker is sometimes referred to as "Sacramento sucker." The names used in the text are those authorized by the California Division of Fish and Game. The carp was introduced into our waters from Asia, by way of Europe. The hardhead, greaser blackfish, Sacramento squawfish, split-tail and carp are all members of the minnow family, Cyprinidae. The western sucker belongs to the sucker family, Catostomidae.

Carp were first introduced into our waters from Holstein, Germany, in 1872, when five individuals were placed in private ponds in the Sonoma Valley. The forefathers of these carp were introduced into Europe in 1227. With the eventful introduction into California waters another step in the series of involuntary migrations was completed. In 1872 the carp was one of the most popular of fishes; they were recommended as being valuable food fishes that would thrive in all of the warmer ponds, lakes and streams of California. Shortly after the first introductions of carp, many pond owners in California were engaged in carp culture, especially in Sonoma County and in the counties of Southern California. At that time the sales of carp were so rapid that there was no overstocking of ponds. Ten years after the introduction of carp into California the species was so plentiful that the market price had declined to 1½ cents per pound. In the early years of this century carloads of carp were shipped east. However, at present carp are being imported from other states to help meet the consumers demands.

The bulk of the production of California fresh water fish is consumed locally. An increasing poundage is also being purchased by the many people who have moved into California from the Middle West and South during recent years. Hardhead and greaser blackfish are particularly enjoyed by the Chinese, and they are sold alive at the fish markets.

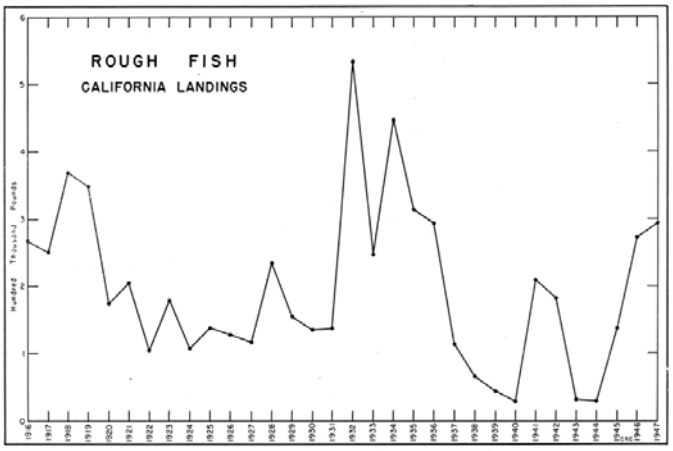

FIGURE 24. Rough fish includes fishes marketed as carp, hardhead, Sacramento pike, split-tail and sucker. Hardhead is called blackfish in Clear Lake and greaser in the San Joaquin valley. Pike is Sacramento squawfish. Table 43 shows yearly totals 1916-1947 for individual species. Graph and tables do not include an estimated 425,000 pounds taken in 1941 at Clear Lake or 1,000,000 pounds taken under permit in 1947

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The fishermen transport the live fish, in tank trucks, to the markets where they are kept alive in large containers. Many of the containers in the valley area are made of concrete. The customer picks out the live fish which he desires to purchase, and in this manner he is assured of a fresh fish. The price for live blackfish and hardhead is very good, sometimes bringing the fishermen 35 to 40 cents per pound. It is difficult to sell these same fish when they are dead. The orientals also consume many split-tails and suckers. The Jewish people prefer the squawfish and suckers, while the principal consumers of carp are Negroes.

The lower poundages of some of the rough fishes during recent years are not due to the lack of an adequate supply, but rather to restrictive legislation passed to preserve the game fishes of the State, and to the varying prices paid for rough fish from year to year. After the World War I period of high catches, landings declined markedly, and then remained fairly constant from 1922 to 1931. The Sacramento-San Joaquin River region furnishes a steady supply of rough fish from year to year, and most of the time furnishes the bulk of the catch. The heavy poundages taken between 1931 and 1936 were due mainly to the fishing operations at Clear Lake to remove rough fish. Gradually the landings at Clear Lake declined and in 1937 the Sacramento-San Joaquin River fishing area again assumed its role of principal rough fish producer. Between February 15 and December 31, 1941, an estimated 425,000 pounds of rough fish were taken from Clear Lake. The fishermen reported the total poundage landed but failed to note the poundage by species. The accompanying graphs do not include these fish.

In 1941 and 1942 a sudden increase occurred due to the landings in the Los Angeles area where 211,766 pounds of carp were caught. A steady increase in landings has occurred since 1944. During the years from 1944 to 1947 the annual landings of carp has averaged 200,000 pounds; the highest since 1919.

Hardhead and greaser blackfish are the most valuable of the rough fish, and are the object of more intensive fishing. As a result, the catch has remained fairly constant except for the period of intensive fishing operations at Clear Lake. The Sacramento squawfish has shown a slow but steady decline in poundages since 1916. Many squawfish were formerly caught by fishermen operating baited hoop lift nets from wharves near the waste outlets of the formerly active sardine canneries near Pittsburg.

Carp are regularly taken for markets in at least 35 states. The flesh of the carp is lean and firm, rather than fat. While some people may prefer to fillet carp, others will use the whole carp baked. Suckers, when caught in the waters of deep lakes or from clear running streams have a firm, sweet and flaky meat. Suckers use their rounded protruding lips almost like a vacuum cleaner and suck food into their mouths from the stream beds and lake bottoms. These fish have no teeth on their jaws, but the bones of the throat region are equipped with teeth which in certain species are strong enough to crush the shells of fresh water mussel. The main objection to suckers as food is the considerable number of small bones. Hardhead and blackfish have a sweet flavor but they are also rather bony. The split-tail and the Sacramento squawfish are comparatively unimportant although good prices are occasionally paid for small quantities of them.

Only the adult rough fish are used for food. The young of most species are used for live bait by black bass fishermen in the river region. The carp minnows are particularly sought for bait because of their golden color and their ability to stay alive for long periods of time when placed on a hook. A few commercial fishermen make additional money by catching and selling small minnows for bait. On the San Joaquin River, near Mendota, carp minnows were selling for 75 cents per dozen to fishermen in 1947.

Rough fish are taken commercially from two types of waters in California. First in importance are the slow moving waters of the lower part of the Sacramento-San Joaquin River system. Second are the still waters of the many ponds, sloughs, inland lakes and reservoirs of Central and Southern California.

FIGURE 25. A carp fisherman with a new type of carp trap, Seven Mile Slough, near the mouth of the Mokelumne River. Rolled barley is tied, in fine-mesh sacks, near the funnel-shaped entrance for bait. Fishermen sometimes fish with 50 of these traps at one time, and they have caught as much as 3,500 pounds of carp in two days of fishing. Photograph by Felix A. Miller, December, 1948

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FIGURE 26. A rough fish fisherman's equipment, Sacramento River near Broderick. The tank truck is equipped to haul live fish to the markets. The trailer holds the seine, a skiff and a live box, used to keep the fish alive during fishing operations. Photograph by Felix A. Miller, December, 1948

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Many pounds of rough fish landed in the Sacramento-San Joaquin River region are caught by fishermen in their fyke nets set to capture catfish. A few permits are issued which allow fishermen to use seines in the river districts for the purpose of catching rough fish, and these fishermen add greatly to the poundages of fresh fish in our local markets. Among the more recent developments in gear by the rough fish fishermen is a new type of carp trap in use mainly in the river region (Fig. 25). These traps are baited with rolled barley and they seem to be effective in catching only carp. Two fishermen sometimes have a string of 50 of these traps fishing at one time. The traps are usually hauled up every other day to remove the carp and to rebait the traps. In one day's haul with 50 of these traps 3,500 pounds of carp have been landed, or an average of 70 pounds per trap. It costs the fishermen $7 for material alone to construct one of these carp traps. In 1947 the price to fishermen for fresh carp varied from 5 cents per pound in the spring to 4 cents per pound in the fall in the river district. The price is less in the fall when the carp are easier to catch.

Rough fish are taken mainly by seines in the inland lakes although dip nets and hoop nets are also used. Clear Lake in Lake County and Lake Almanor in Plumas County produce quantities of rough fish each year. Southern California lakes frequently contribute to the rough fish catch. The main fish caught is the carp. Lake Elsinore in Riverside

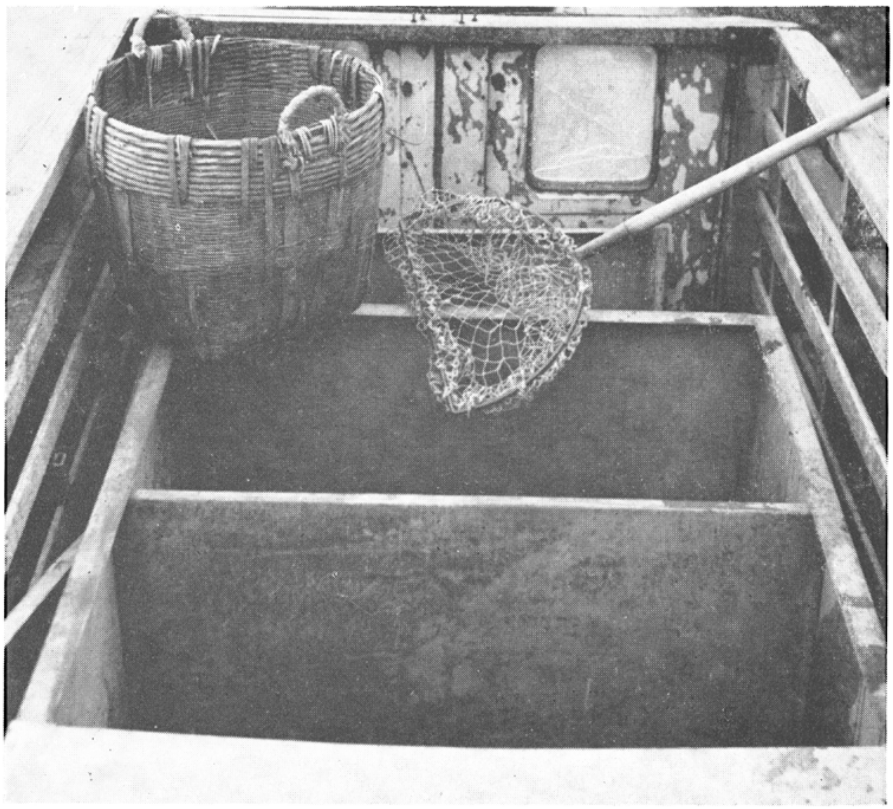

FIGURE 27. Compartments in a rough fish fisherman's tank truck, Sacramento River near Broderick. An aerator supplies oxygen to the water in these compartments when live fish are being transported to market. Note the dip net and fish basket for use in handling the fish. Photograph by Felix A. Miller, December, 1948

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County is a steady producer of carp. There were 13 permits issued to rough fish fishermen for use on Lake Elsinore during 1947.

Fishing is done on a permit basis on our inland bodies of water. Permits are issued by the Division of Fish and Game to remove fish which are competing with or preying upon more desirable food fishes, and to utilize certain food fishes which can not be taken in any numbers by ordinary angling. Some fishermen are issued permits to catch rough fish specifically for the purpose of producing fish meal, others seek permits to seine minnows to sell for bait. The permittees are required to have a commercial fishing license, and all of their operations are inspected by a representative of the Division of Fish and Game. Usually all game fish accidentally taken must be returned to the waters from which they were caught, but at times permits have required the permittees to hold all of the game fish in "live cars" for planting in other waters. During the months when black bass are spawning, permittees are required to fish in areas other than where the bass spawn. In 1947 there were 33 permits issued to take rough fish from our inland waters. Approximately 1,000,000 pounds were taken by fishermen operating under permit in 1947. Exact figures are not available and this amount is not included in the tables and graphs.

A rather recent development in methods of fishing is the use of an airplane to spot the schools of carp and to direct fishermen waiting in boats to the concentrations of fish. An airplane is used very effectively on Lake Almanor where a few fishermen depend entirely upon an airplane spotter to locate the carp. Large poundages are captured in this manner, many pounds of which are used by a dehydrating plant near the lake. Dehydrated carp was selling for $147 per ton in 1947 to meal manufacturers, who add other materials to produce the finished meal product.—*Richard J. Hallock.*

References (see page 210): 50, 84, 99, 119.

2.10. BOTTOM FISH

Trawl and bottom fish are the most important sources of fresh market fish in California, consisting of over 20 commercially important flatfish and round fish. The history of the fishery extends back to the 1870's when paranzella fishing for bottom fish was conducted in San Francisco Bay by small sailboats. As long as the grounds in the bay were productive, the fleet remained within it; but when catches declined, the area within a day's run of San Francisco was developed. Through the following years development and expansion of the fishery took place, and more efficient and larger boats and gear followed.

The fishery prior to the first World War supplied local markets within fresh fish shipping distances of San Francisco, Santa Barbara, and Los Angeles. During the first World War the industry expanded to its peak production in 1917. At the close of the war the consumption of fish dropped off and roughly stabilized at an average of about 15,000,000 pounds per year. This condition existed for a period of 10 years until the depression subsequent to 1929, when in the early '30s it slumped to about 11,000,000 pounds. Catches hovered around this point until 1940–42 when a sudden and drastic decline occurred. The causes of this almost virtual collapse were two-fold. In 1938–39 the fishing industry went "hog wild" over sharks, and the vitamin boom drew many of the former drag boat fishermen into the whirlpool of the shark fever. This influence was dominant until 1941 at which time the second factor assumed importance.

On December 7, 1941, World War II was precipitated. Regulations promulgated for the security of the United States prohibited enemy aliens from fishing in our coastal waters. These defense orders were hastily constructed and issued without consideration for the effect that they would have on the production of fish. The only concern of government, and rightly so, was the security of the west coast. A good share of the crews and skippers of the drag fleet were of Italian birth and not naturalized. The regulations meant that they could no longer fish in waters adjacent to the California coast. As a result the fishery plunged to a low in 1942. Gradually the effect of this order was mitigated with the substitution of American crews to operate the boats. The security regulations of the early war years were so strict that the limited fishing carried on was conducted under a very serious handicap. Operation under all of the imposed inefficiencies contributed to the reduction of the total catch.

As the war continued and increasing numbers of men were taken into the armed forces, it became apparent that every available source of

food must be utilized to its fullest extent to supply the Nation's requirements. Thus began the expansion of the fishery, which has continued to the present.

Before the war practically all trips made by drag boats were oneday affairs. The vessel would set out for the fishing grounds in the morning and would return to port with its fare in the afternoon. The catches were trucked to central points for distribution to the public. Almost all the fish taken by drag boats were sold fresh, and the industry operated on a fresh fish market basis.

With the gradual resumption of production as the war progressed, innovations in techniques of processing and handling were introduced. The operation of the industry was modified to such an extent that its character was drastically changed. In addition to technological revolution, certain changes were effected in actual fishing activities. Before the war the trawling was conducted by two boats dragging a net of Italian derivation, known as the paranzella. The net was kept open on the bottom by the distance maintained between the two fishing boats. During the early years of the war the otter trawl was tried in this fishery, and it proved so successful, particularly with the development of the balloon trawl, that the true paranzella fishery, or the double drag, went out of the picture about 1943. At present (1947) the fishery is carried on entirely by otter trawlers. (Fig. 57.)

In 1938 the center of production of the trawl fishery shifted from San Francisco to Eureka. Here new grounds were explored and expanded, and new processes were developed in an industry that was over 70 years old. The fishery before 1940 consisted of roughly 10 sets of double drag boats. Subsequent to this time the fleet increased to as many as 80 boats. The increased production that followed 1943 is not indicated by Figure 28, as this figure deals only with flatfish. Although flatfish, up to 1943, represented a sizable proportion of the trawler catch, a shift to other species changed the complexion of the fishery.

The unsatiated demand by the government and civilian market during the war was unprecedented. The market men and fishermen were eager, however, and adapted gear to meet the changing conditions. The

TABLE 9

FLATFISH COMBINED

Exclusive of Pacific Halibut

Year	Pounds	Year	Pounds
1916	13,144,617	1932	11,073,115
1917	16,892,806	1933	10,371,351
1918	14,226,093	1934	11,381,348
1919	11,374,392	1935	12,144,123
1920	9,305,582	1936	11,267,051
1921	9,602,617	1937	11,076,412
1922	12,009,574	1938	10,083,912
1923	11,189,299	1939	12,401,513
1924	13,493,703	1940	9,981,753
1925	13,766,279	1941	6,403,506
1926	11,811,912	1942	4,636,532
1927	13,270,056	1943	6,943,161
1928	12,987,248	1944	7,176,451
1929	14,443,277	1945	10,591,140
1930	13,036,635	1946	14,261,310
1931	11,043,550	1947	15,451,737

TABLE 9
FLATFISH COMBINED
Exclusive of Pacific Halibut

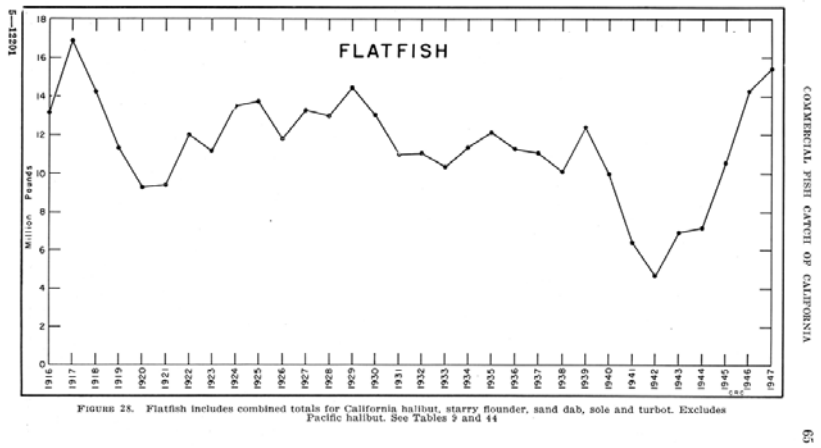

FIGURE 28. Flatfish includes combined totals for California halibut, starry flounder, sand dab, sole and turbot. Excludes Pacific halibut. See Tables 9 and 44

FIGURE 28. Flatfish includes combined totals for California halibut, starry flounder, sand dab, sole and turbot. Excludes Pacific halibut. See Tables 9 and 44

balloon trawl was improved. This net, a modification of the otter trawl, fished higher in the water and captured species that normally were not taken with the old type paranzella net. The paranzella gear fished relatively close to the bottom of the ocean.

As a result, huge stocks of rockfish were found in the northern areas and the landings of this species shot from a prewar average of less than 4,000,000 pounds to over 13,000,000 pounds. This increase was also due in part to the development of the fillet line.

The army contracts could not be met with fresh fish and new methods of handling, packaging, and refrigeration were required that would assure a product of good quality and palatability. Whereas formerly a relatively minor amount of fish had been processed into fillets, practically every species that could be obtained in volume was now filleted, packaged, and frozen for the government contracts.

To meet this demand, processing lines, which are similar to cannery lines, were developed. Individuals adept in filleting fish stand before a moving conveyor belt carrying round fish. The fish are filleted with a few deft movements of the knife; the fillets placed in a basket; and the carcassed remains are carried off by another belt to a pit to await reduction. Some filleters become so skilled that they can produce many hundreds of pounds of fillets per day. This semimechanical method removed the bottleneck from the industry and left the ability of the fishermen, the abundance of fish available, and the weather as the main factors limiting production. The lines not only operated upon rockfish and flatfish but upon many other species including sablefish of small sizes that had formerly been rejected by the markets. Government contracts did not specify size of sablefish fillets and the catches of this species climbed from less than a million pounds to over 6,000,000 pounds to help fill this need. With the cessation of hostilities, government contracts were canceled. The collapse of this market had only a temporary effect, however, since many new customers had been conditioned during the war to eating fish, and merchandising opportunities were better than normal.

of the many species taken by the trawl fishery in 1947 the soles were by far the most important, indicating a return to a state comparable to that of the late 1930's. Best catches by the trawl fleet are made during the summer and fall months, the period from June to September producing greatest yields.

2.10.1. Sole

In the restaurants of San Francisco and to a lesser extent throughout the State, fillet of sole is one of the best known of our sea foods; and it should be, as the species which make up the general category of sole accounted for over 55 percent of the total trawler caught fish in 1947.

Almost all of the soles landed in California are taken by trawls. Very few are taken by hook and line or by other gear. The Eureka area has produced the greatest percentage of the sole catch since 1938. San Francisco, although the original port from which the trawler fleet developed, has diminished in importance until at present (1947) it contributes slightly less than 30 percent of the State's total sole catch.

The various species of fish comprising sole are listed below in their general order of importance. The species called soles in California are

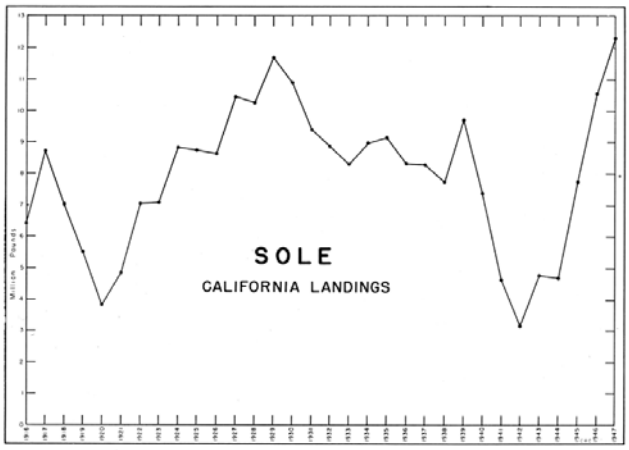

FIGURE 29. See Table 44

FIGURE 29. See Table 44

not true soles. They are nevertheless related to the soles of other domestic and foreign fisheries.

English sole, Parophrys vetulus, amounts to about 70 percent of the catch. It is widely distributed along the coast and is taken in nearly all the trawling waters of the State.

Petrale sole, Eopsetta jordani, ranks next with approximately 20 percent of the catch consisting of this species. Although not as abundant as the English sole, it is a premium fish on the sole market.

Rex sole, Glyptocephalus zachirus, is a weak third, representing slightly over 5 percent of the 1947 trawler catch.

Recent development of new techniques in handling and catching Dover sole, Microstomus pacificus, have been instrumental in increasing the take of this species. Sand sole, Psettichthys melanosticus, is considered a desired species, although it is not nearly as abundant as some of the other sole. Locally abundant in the San Francisco region, the broadfin or rock sole, Lepidopsetta bilineata, is not considered as desirable as the sand sole. A small amount of arrowtooth, Atheresthes stomias, scaly fin, Isopsetta isolepis, and slender, Lyopsetta exilis, soles are included in the landings. The quantity is so small, however, that very few records are obtained of these species; in most cases their poundage is listed as sole or included in that of the dominant species.

In the southern part of the State at Avila and Santa Barbara, the fantail sole, Xystreurys liolepis, sometimes known as the long fin sole or true petrale, forms a small but popular portion of the flatfish catch of this section.

Following the decline from 1917 to 1920 sole catches again rose from slightly under 4,000,000 pounds to over 11,500,000 in 1929. As a result of the depression of 1929–33, sole catches fell to an average of 8,500,000 pounds. After 1939–40 the landings descended further to a low in 1942 as the effect of fishing competition for soupfin shark made itself felt and the early wartime restrictions decreased the efficiency of the trawler fleet. Following 1942, catches immediately shot upwards again to 12,300,000 pounds in 1947, a height never before reached.

The starry flounder is sometimes recorded as sole and not flounder. This has caused a small error in the sole records; however, the quantity so recorded is a fraction of 1 percent. Nearly all of the sole catch is marketed in the form of fillets. Very few other than rex are consumed whole. Rex sole is usually prepared for the table or restaurant trade by beheading and eviscerating. Its name means king, and king of the soles it is as the rex is considered by connoisseurs of sea food to possess a delicate savor not found in the other soles. The records of rex sole landed are not necessarily indicative of the catches of the species made at sea. Generally it is only the last day's catch of rex that is retained for the market. Specimens taken in hauls made prior to the day the vessel makes port are usually not saved, as the flesh of this species is tender and cannot withstand handling as well as some of the other flatfish.

Flatfish are one of the most widely recognized and appreciated products of the sea. They are limited to a narrow band of ocean bottom of not too great depths surrounding the land masses of the world, and contribute significantly to the earth's food basket. Although the trawl fishery lacks the picturesque and glamorous features of many other types of fishing, the drag boats that sweep the continental shelves make

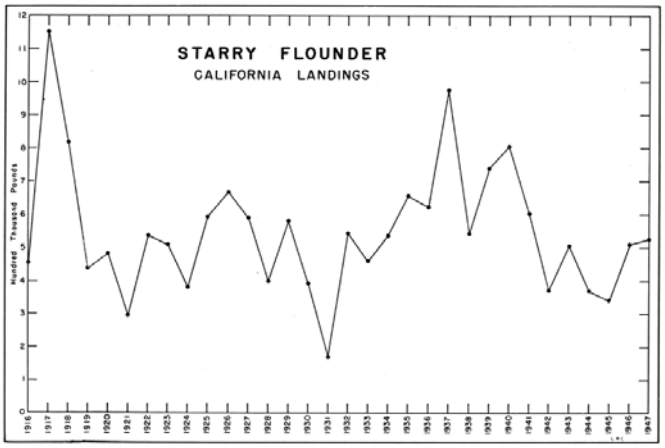

FIGURE 30. See Table 44

FIGURE 30. See Table 44

possible the harvesting and utilization of the many species of sole that dwell on the ocean floor.

2.10.2. Starry Flounder

Landings of starry flounder, Platichthys stellatus, since 1935 have averaged better than one-half million pounds. Small amounts in addition are landed and recorded as sole. At the retail level it is sold as fillet of sole. Before 1938 San Francisco produced nearly all the flounder of the State. Following this year the landings were more equally distributed between the north and central parts of the State, with Eureka and San

TABLE 10

REGIONAL LANDINGS

Flounder

Year	Eureka	San Francisco	Monterey	All other	Total pounds
1938	275,743	251,683	15,092	294	542,812
1939	242,197	478,092	16,295	2,727	739,311
1940	197,290	582,027	24,476	296	804,089
1941	281,421	302,632	16,058	1,466	601,577
1942	265,750	89,101	15,168	106	370,125
1943	311,135	160,003	14,279	19,982*	505,399
1944	197,334	130,767	34,775	3,644	366,520
1945	115,943	189,784	32,234	1,352	339,313
1946	247,526	210,887	49,391	1,644	509,448
1947	255,015	205,150	64,654	2,253	527,072

* 1943 Santa Barbara Region 18,043 pounds.

Sand Dab

Year	Eureka	San Francisco	Monterey	All other	Total pounds
1938	229,205	358,466	45,469	6,188	639,328
1939	219,305	512,689	84,025	5,185	821,204
1940	307,276	420,038	42,842	8,922	779,078
1941	170,694	228,200	36,361	7,229	442,484
1942	162,671	112,555	67,309	11,005	353,540
1943	280,395	143,862	75,023	6,058	505,338
1944	202,366	275,552	66,496	6,855	551,269
1945	145,104	325,038	111,577	6,637	588,356
1946	374,237	252,660	37,997	14,178	679,072
1947	364,293	261,357	51,003	24,750	701,403

TABLE 10
REGIONAL LANDINGS

Francisco each averaging 47 percent of the landings and Monterey 5 percent. The yearly poundages for these ports have fluctuated widely, however. Very little flounder is landed elsewhere in California.

of the smaller flatfish the starry flounder is one of the more important in the catches of the sportsmen. Many an angler's day has been saved by a catch of flounder. In the bays of the central and northern portion of the State, it affords incidental sport to a large number of anglers whose efforts may be directed toward other species. It is taken from all the harbors and piers in Northern California as well as from boats.

In 1947 this species made up almost 2 percent of the trawler caught fish. It is more abundant in comparatively shallow water, and it is captured there with other bottom fish. A relatively minor amount of effort is expended directly for catching this species.

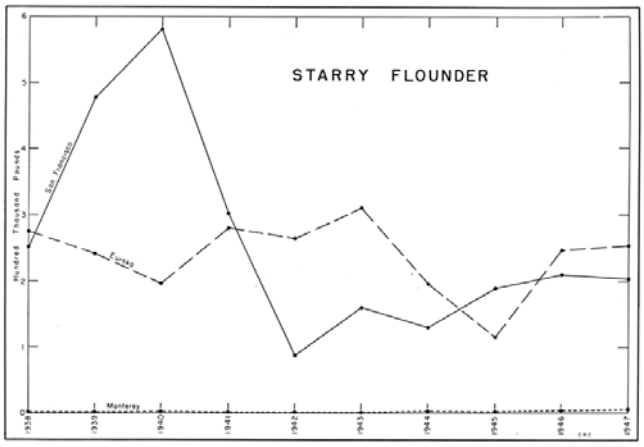

FIGURE 31. Comparison of regional landings at Eureka, San Francisco and Monterey. See Table 10

FIGURE 31. Comparison of regional landings at Eureka, San Francisco and Monterey. See Table 10

The landings for the starry flounder fluctuated around a rising trend from 1919 to 1940. In 1941 the catches of this species, as did those of other flatfish, reacted inversely to the shark fishery and in 1942 with the war. The decrease in the landings of the flounder was not nearly as marked as was that of the sole or turbot.

2.10.3. Sand Dab

Two species of sand dab, Citharichthys sordidus and C. stigmaeus, make up the commercial catch. Nearly all of the landings consist of the more abundant species, C. sordidus, taken chiefly in Northern California. Almost all of the poundage is caught in trawl nets. However, there are small quantities taken by hook and line boats off Monterey to supply local markets. Prior to 1938 the landings in San Francisco amounted to over 95 percent of the State's sand dab catches. From 1938 to the present the San Francisco region produced an average of 47 percent of the total catch. Likewise during this period of time, 40 percent of the production was taken in the Eureka area. The remaining percentage comes from Monterey with a small amount dribbling into Santa Barbara and Los Angeles. The Los Angeles fishery is conducted with hook and line, and is dependent upon the species C. stigmaeus, known locally as the Catalina sand dab.

One type of gear used in southern waters for taking this species is unique. It consists of an iron hoop about 6 feet in diameter to which short gangions are fastened around the rim. The hooks attached to the gangions are baited, and the entire device is lowered by a rope to sandy bottoms around Santa Catalina Island. After a short "soak" the hoop is lifted, the dabs removed, the gear rebaited and then reset.

Sand dabs do not account for a very great proportion of trawler loads. In 1947 under 2 percent of the drag boat catch consisted of these species. However, because they are available throughout the year and because a restaurateur may print sand dabs on his menu with reasonable assurance of obtaining them, a steady demand has been cultivated for this item.

The total landings have followed the landings for flatfish in general. The production from about 1930 to 1940 indicated a rising trend with a resultant fall in 1940–42, due to the competition from fishing activity for other species. The trend from 1942 has been upward.

2.10.4. Turbot

Considered by some epicureans to be the most delectable of the larger flatfish, the turbots do not make up a very large proportion of the trawler caught flatfish in California. A considerable part of the turbot catches, particularly in the southern part of the State, is marketed as sole.

Three species make up the bulk of the catch. The curlfin turbot, Pleuronichthys decurrens, is of major importance followed by the diamond, Hypsopsetta guttulata, and the sharpridge, Pleuronichthys verticalis. The C-O turbot, P. coenosus, and the spotted turbot, P. ritteri, are also taken. These occur rather infrequently in the catch and do not constitute a significant proportion of the drag fleet landings either in Santa Barbara or in the northern part of the State. In the Santa Barbara area turbots are estimated at more than 10 percent of the trawler loads. The turbots in Northern California contribute a very small portion to

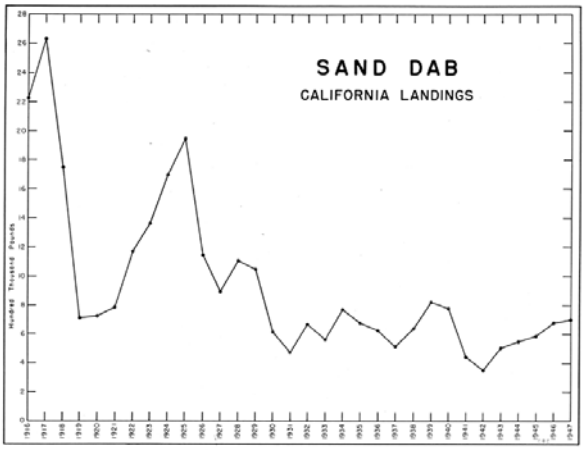

FIGURE 32. See Table 44

FIGURE 32. See Table 44

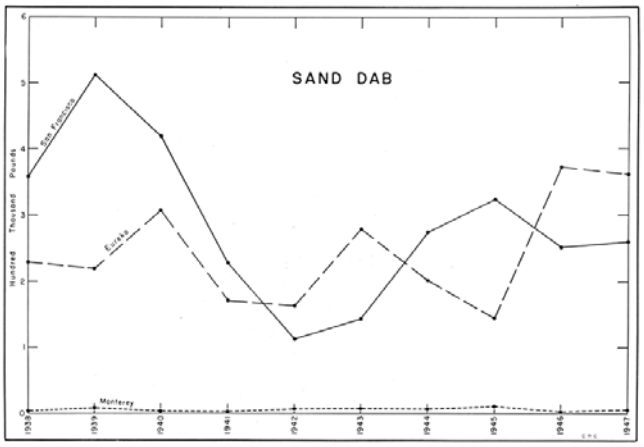

FIGURE 33. Comparison of regional landings Eureka, San Francisco and Monterey. See Table 10

FIGURE 33. Comparison of regional landings Eureka, San Francisco and Monterey. See Table 10

the catch, in 1947 amounting to one-half of 1 percent of the trawler taken fish. The curlfin turbot is most desired by the market and consequently is better known to the trade. It is marketed filleted or whole. In restaurants devoted more exclusively to serving fish, turbots are prepared whole, with only the heads and the intestines removed.

The landings prior to 1931 are very low, but this condition resulted from confusing the turbots with the soles in the landing records. From that time on, the course of landings of these species has been erratic, marked by great increases and by a tremendous decrease at the start of the war in 1941. The fishery recovered very rapidly, however, and from a low of a little more than 6,000 pounds in 1942 skyrocketed to 160,000 pounds in 1945. This phenomenal increase was brought on by the unlimited market and war time contracts offered by the Federal Government.—*Wm. Ellis Ripley.*

References (see page 210) : 40, 41, 76, 81, 87, 89, 116, 118.

2.11. CALIFORNIA HALIBUT

Landings of California halibut, Paralichthys californicus, have never since equaled the 4,600,000-pound catch of 1919. It is a market fish of considerable importance especially in Southern California and compared with all other species taken commercially in 1947 it ranked twentieth in poundage and eighteenth in value.

This fish ranges from Pt. Reyes south into Mexico and is taken commercially throughout most of its range. Two principal methods of fishing are employed, with trammel net and with otter trawl. The trammel net fishery extends from Monterey south into Mexico and the otter trawl fishery from Pt. Reyes to Santa Barbara. About 96 percent of the total catch is taken south of Pt. Conception. Prior to 1935 the landings were made principally at Los Angeles and San Diego with a large percentage coming from Mexican waters. The period 1936–1047 shows a northern shift in the landings with over 30 percent being made at Santa Barbara and only 28 percent coming from Mexican waters.

It could be debated whether the total landings of California halibut reflect the condition of the fishery or the economy of the country. The rise in poundage from 1933 to 1936 could have been caused by a fluctuation in the abundance of halibut, or it could have resulted from an increased fishing effort as the demand for the fish rose during the depression years. During and following World War II there was a large demand for protein food and all fisheries were exploited heavily and the catch of halibut increased. The rapid decline in 1947 may indicate an effect on the abundance of halibut imposed by this heavy exploitation. We can safely say from observations that the demand for halibut keeps the fishing intensity at a high level which in turn prevents the fish from attaining their former abundance.

There are some points that should be brought to the attention of anyone wishing to use the total catch figures as presented. In San Francisco the market receipts from which the records are taken are simply made out as halibut or California halibut meaning halibut from California waters. In this region the ranges of the Pacific halibut, Hippoglossus stenolepsis, and the California halibut overlap. Researchers in the field have observed a 9 to 1 ratio of Pacific to California halibut at different

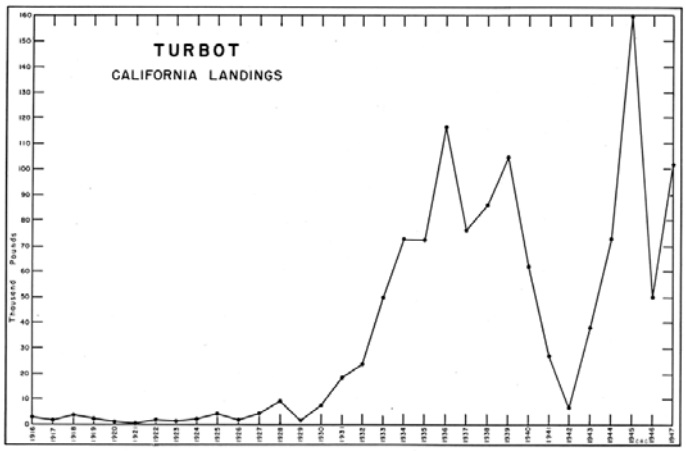

FIGURE 34. See Table 44

FIGURE 34. See Table 44

times on this market, and all the data since 1936 has been adjusted to fit this ratio. Another point is a factor in the Santa Barbara receipts, where many halibut are recorded as sole to cover the fact that they are under the 21-inch minimum legal size. Finally there is an estimated one half million pounds of California halibut taken annually by anglers and their catch does not enter the commercial records.—*Edwin K. Holmberg*.

References (see page 210) : 1, 39, 40, 41, 76, 81, 87, 116, 118.

2.12. PACIFIC HALIBUT

The Pacific halibut, Hippoglossus stenolepis, supports fisheries in the north Pacific, centering in northern Washington, British Columbia, and Alaska. The fishery is regulated along the entire coast by the International Fisheries Commission, which divides the coast into four geographical areas and sets poundage quotas for the two central areas. The open season has started on or about May 1st in recent years and has closed when the pre-established quota of fish has been taken. The season in adjoining areas closes automatically with the two central areas.

Only hook and line boats are allowed to take Pacific halibut. The otter trawl boats are required to return the halibut to the water, and this requirement is rigidly enforced in the main halibut fishing areas, but enforcement, which is in the hands of the federal agents, has been lax in California. Hook and line boats may market the halibut caught incidental to other fishing throughout the year, if they have obtained a permit to do so. About 50 percent of all Pacific halibut taken in California is marketed fresh, the balance is frozen.

California contributes about 1 percent to the total Pacific coast catch, and the fishery for Pacific halibut is one of minor importance in the State. In former state publications Pacific halibut was listed as northern halibut, a name which is frequently used to designate this species. It is a highly desired food fish, and the price of all bottom fish is affected by the abundance of this halibut on the market. It is felt that the fishery could produce more if protection were enforced in California.

The majority of the landings in the State are made at Eureka with about 15 to 20 percent of the catch landed at Ft. Bragg and San Francisco. The erratic increase in the catch from 1926 to 1934 was attributed to an increase in the number of fishermen pursuing halibut and to the discovery of new halibut banks. In the next five years the catch declined to approximately one-third of the 1934 catch. This decline was due primarily to overfishing. The halibut fishermen blame the otter trawl boats for the decrease, but in the declining years the otter trawlers accounted for 9 percent of the total catch. The take of halibut by drag boats in recent years undoubtedly prevents the halibut from increasing in abundance, and as a result there are only a few long line boats plying Northern California waters. The small catch during the war years, 1941 to 1945, was partially a result of the decrease in fishing effort but the abundance of halibut may have been low during these years since the catches contined at a low level in the years following the war.

Pt. Arena is considered the southern limit in the commercial range of the Pacific halibut, and most of the fish brought into San Francisco are caught north of this point. Fishermen land both Pacific and California halibut, Paralichthys californicus, in San Francisco. The market

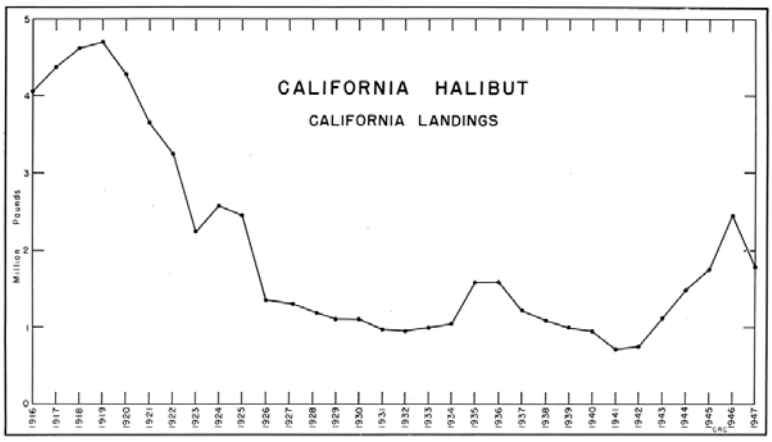

FIGURE 35. See Table 44

FIGURE 35. See Table 44

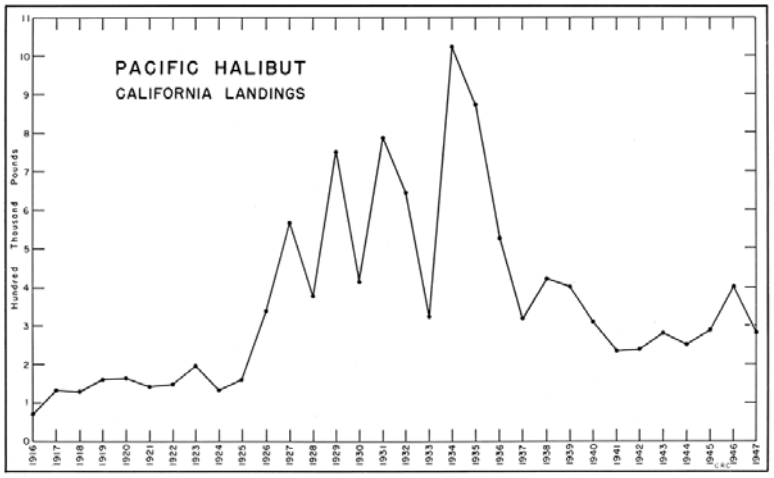

FIGURE 36. See Table 44

FIGURE 36. See Table 44

receipts do not show the species separately; both are simply recorded as halibut or California halibut, meaning halibut from California waters. This has created statistical confusion in the recording of San Francisco halibut catches. Personal observations by several fisheries biologists have indicated that about 90 percent of the landings at San Francisco is Pacific halibut. This percentage has been used to correct all San Francisco catch figures but the yearly state-wide totals for the two species have not been greatly changed by this procedure.

Trawler caught halibut at Eureka are often recorded as petrale sold which causes a slight error in the latter figures, 75,000 pounds estimated for 1947.—*Edwin K. Holmberg*.

References (see page 210): 1, 40, 41, 76, 78, 81, 87, 89, 116, 117, 118.

2.13. CABRILLA AND GROUPER

For all practical purposes the taking of cabrilla and grouper is a single fishery. The main fishery as it exists today is located between Turtle Bay and Magdalena Bay, Lower California, usually close to shore where the bottom is rocky and broken. One boat anchored on one of the fishing banks where these species are taken will usually catch a mixture of cabrilla, grouper and black sea bass. The fishery is conducted almost entirely in the winter when local California species are scarce and most of the landings are made at Los Angeles and San Diego.

Nearly all of these sea bass are taken by either hand lines or set lines, although occasional catches are made by gill nets, trammel nets and purse seines. Fishing is carried on principally by two types of boats: small live bait boats and Seattle halibut vessels. These northern boats come south at the close of the Pacific halibut season in the fall and fish in Mexican waters until spring. Fishing is usually carried on in certain definite spots along the coast of Lower California; however, in recent years schools of these fish have been located with the aid of a fathometer and fished with hand lines, using cut sierra for bait, until the boat is loaded or the school is depleted. Other boats have successfully located schools of these fish by trolling oversized handmade plugs which are readily taken by cabrilla and grouper.

All of these fish are delivered cleaned and beheaded; consequently, the actual poundages of fish caught is probably 30 or 40 percent greater than the landings recorded here. Grouper, cabrilla and black sea bass are sold as fancy fillets by the fresh fish dealers.

2.13.1. Cabrilla

Several species of true sea bass, family Serranidae, are called cabrilla or pintos by the fishermen who catch them. Probably the most important cabrilla from a commercial standpoint is Epinephelus analogus which makes up nearly 90 percent of the total landings for this species. They are usually smaller than either grouper or black sea bass, ranging in size between 20 and 35 pounds and are brown in color, the body being covered with small round, dark spots; the sides have five or six faint dark cross-bars.

Cabrilla have been important in the fish trade of Mexican seaport towns for many years; however, it was not until 1928 that any landings were recorded in California. At that time some 6,500 pounds were

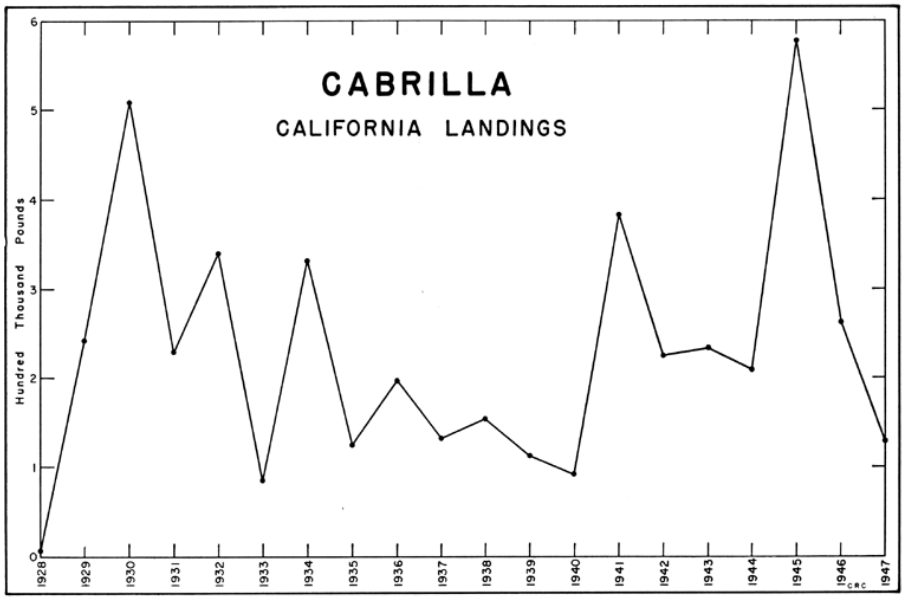

FIGURE 37. Catch of California fleet only. Importations from Gulf of California not included. See Table 45

FIGURE 37. Catch of California fleet only. Importations from Gulf of California not included. See Table 45

brought in and were sold in the form of fancy fillets by the fresh fish markets and met the immediate approval of the American consumer. The desirability of this species is attested by the fact that nearly one-quarter million pounds were landed in 1929, the second year of their sale in California and in 1930 this figure was more than doubled when one-half million pounds were reported. Since 1930 the total landings have fluctuated from year to year with a yearly average of slightly over 100,000 pounds.

The cabrilla are considered of better eating quality than the grouper and for this reason have been the most sought after of the two. The Mexican government has become alarmed at the signs of depletion as a result of the increased fishing pressure exerted on this species and placed a high tariff on any cabrilla taken out of Mexican waters. Due to this high tariff it is no longer profitable for California fishing boats to take this species.

Small amounts of cabrilla are taken in the Gulf of California by Mexican fishermen engaged in the totuava fishery and are brought to California markets by truck or rail. These truck and rail shipments are not included in this report which is concerned primarily with landings by California boats.

2.13.2. Grouper

Probably the most important grouper entering the commercial catch is Mycteroperca jordani; however, several different species of Mycteroperca enter into the grouper landings. These fish generally average between 50 and 150 pounds each. Grouper are seldom taken north of Turtle Bay, Lower California; however in May, 1947, Dr. Carl L. Hubbs of Scripps Institution of Oceanography at La Jolla, identified nine fish

taken near Encinitas, California, as grouper, Mycteroperca xenarcha. These fish weighed between 68 and 97 pounds each and were taken on a set line strung over the kelp. This is the first commercial record of this species from California. They have been taken on numerous occasions by skin divers working in the vicinity of La Jolla.

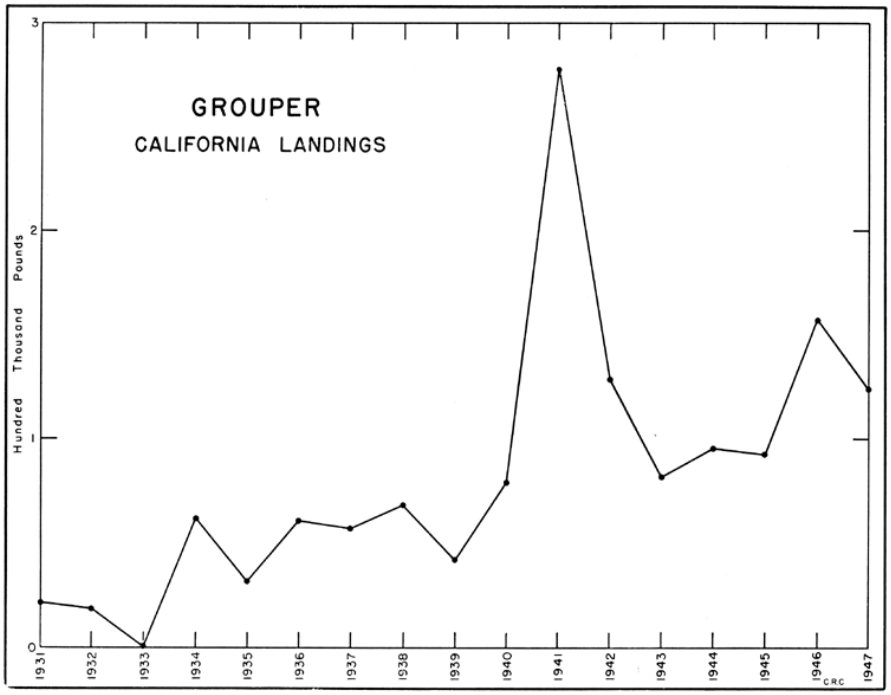

FIGURE 38. Grouper delivered cleaned and beheaded, therefore approximately 30 to 40 percent should be added to show round weight. See Table 45

FIGURE 38. Grouper delivered cleaned and beheaded, therefore approximately 30 to 40 percent should be added to show round weight. See Table 45

Here again as with the cabrilla a small percentage of the catch is made in the Gulf of California by Mexican totuava fishermen and shipped into California by rail or truck. These fish taken in the Gulf are not entered in the landings presented in the graph.

The first grouper recorded in California landings amounted to 21,600 pounds in 1931 and until 1940 the landings showed a slight upward trend. The landings in 1941 of nearly 280,000 pounds were nearly four times greater than those of the preceding year and represent the highest landings for any single year to date (through 1947). Since 1942, average yearly landings have been around 100,000 pounds. It seems reasonable to assume that with the high tax placed upon cabrilla by the Mexican government slowing down the fishery for cabrilla, the landings of grouper will show a marked rise in years to come as fishing effort is transferred from cabrilla to grouper.—*John E. Fitch*.

References (see page 210): 53, 130, 133.

2.14. MEXICAN CORBINA AND TOTUAVA

The Mexican corbina and totuava although separated in the catch records comprise a single fishery. This fishery is conducted both on the mainland and peninsular side of the Gulf of California in the area affected by the silt laden water of the Colorado River. At the fishing camps set up primarily for totuava, any member of the family Sciaenidae which is over five pounds in weight and not a totuava is considered a corbina by the fishermen and sold as such. Corbina are generally smaller than totuava, averaging less than 10 pounds and ranging in size from 3 to 40 pounds. Totuava range from 50 to 150 pounds, one specimen viewed by the author weighed 200 pounds. Both fish are delivered cleaned and beheaded to the California markets and no adjustment has been made in the record for the loss in weight resulting from cleaning. The figures presented in Table 46 are 30 to 35 percent less than the actual poundage caught.

2.14.1. Mexican Corbina

Records of landings of Mexican corbina in California by California boats have been relatively insignificant and probably quite incomplete. Mexican corbina sold in the markets as fillets consist mostly of the gulf corbina, Cynoscion orthonopterus which is taken incidentally along with totuava by Mexican fisherman and shipped in conjunction with this more important species. often the two have not been separated in the reports of shipments received by the markets thus adding further confusion to an already complicated picture.

The average yearly poundage shipped to California markets from the Gulf has been somewhat in excess of 60,000 pounds. This is compared to the greatest yearly landings by California boats of slightly over 5,000 pounds in 1944 and a yearly average of somewhere around 1,000 pounds. The Mexican corbina landed by California boats are in most cases taken accidentally or incidentally at the entrance to the Gulf of California by purse seiners and live bait boats plying these waters and sold to the markets to supplement their profits from other fishing activities.

During certain times of the year heavy runs of corbina occur in the waters around San Felipe and Santa Clara, Mexico, and all of the local population not actually engaged in totuava or shrimp fishing at the time line the shores or set forth in skiffs to fish corbina. On good days two or three men can land up to 1,000 pounds or more of these fish in an hour of fishing.

2.14.2. Totuava

Until 1924 little was known about the totuava or Mexican sea bass, Cynoscion macdonaldi, a member of the croaker family. In that year a couple of enterprising Americans who had heard of these giant fish being landed at San Felipe, Lower California, pioneered an industry trucking iced fish across the then uncharted 150 miles of desert between Calexico and San Felipe. Prior to this time, totuava were caught, the swim bladder removed for drying and shipment to the orient, where it is used as a soup stock, and the carcass left on the sands to rot. Not even the wildest estimate could approximate the millions of pounds of fish wasted in this manner in the years preceding 1924. When the trucking business was first started fish could be purchased at San Felipe for as little as 5 cents

per 100-pound carcass while the air bladders properly dried often brought as much as $5 each. In a few years, however, the carcass became the more valuable of the two and trucking became a big business between San Felipe and Calexico and between Santa Clara on the mainland and Yuma.

No record is available for the years prior to 1928 when the amount trucked to California markets is recorded as 840,000 pounds. Most of this came from the fish camps on the Gulf of California to either Calexico or Yuma and was then transshipped to San Pedro chiefly, although some was sent to San Diego. In 1929 the landings increased to over 1,000,000 pounds and have remained at that point nearly every year since that date.

In early years most of the fish was hauled to California markets; however, since about 1933 increasing amounts have been sent to many inland cities, Phoenix, Kansas City and St. Louis receiving most of the fish. After the market was expanded to include other than California shipments, it has become impossible to obtain good records from the border custom stations because the fish destined for California was mixed with fish to be shipped to markets in other parts of the United States. Because of these very poor and incomplete records, shipments of totuava have been omitted from our catch records since 1941.

Totuava comes entirely from the Gulf of California and at present (1949) none is caught or landed by boats of the California fishing fleet. Most of the fishing is done between October and May. The fishing boats are from 35 to 50 feet long and use gill and trammel nets. These net boats have replaced the skiffs and canoes which were used in the earlier hand line fishery.

The nets used in the fishery are usually from 1,000 to 1,500 feet in length with the gilling mesh between 10 to 14 inches stretched measure. They are generally fished perpendicular to the shore in shallow water, being set at high tide and left in position from one to three days depending upon the availability of fish. During the set the boat lies at anchorage just beyond the off-shore end of the net and two crew members in a skiff run the length of the net every two or three hours removing totuava, sharks and porpoises. The totuava are cleaned and beheaded soon after removal from the net and the heads, along with the sharks and porpoises, are hauled to the nearest sandy beach above the high tide mark and are left to the flies. The stench from these rotting carcasses is obnoxious on most of the beaches and flies are unbearable to one intending to camp anywhere within a mile or more of the water.—*John E. Fitch.*

References (see page 210): 22, 48, 133.

2.15. SWORDFISH

The catches of broadbill and marlin have been included under the name swordfish in our catch records. Broadbill, Xiphias gladius, is often thought of as an important sport fish. However, the numbers and pounds of broadbill landed by sportsmen are very small, and the expense and time involved make it practically impossible for the average sportsmen to even try to catch this fish. The broadbill is, however, of considerable commercial importance. The landings are not great in pounds, by comparison with other fish, but the value per pound is very high. The gear necessary is relatively inexpensive.

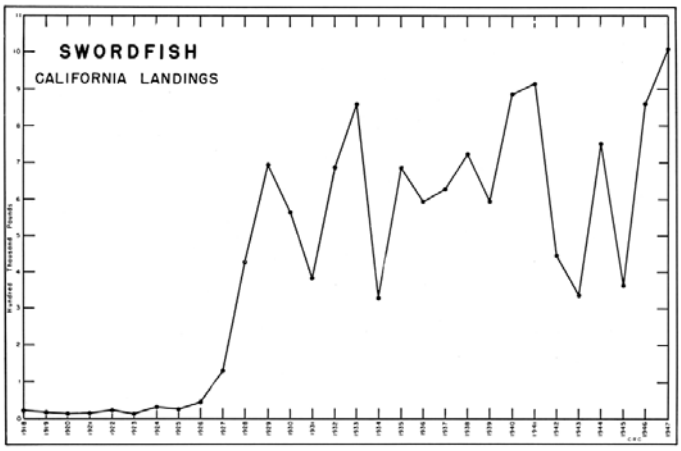

FIGURE 39. Includes broadbill and marlin. See Table 47

FIGURE 39. Includes broadbill and marlin. See Table 47

Marlin, a sport fish, is found in warm seas throughout the world. Locally it is caught off the islands of Southern California from Point Conception south into Mexico. Marlin, Makaira mitsukurii, is usually found in California waters from June to December, with the peak in September.

The average commercial swordfish boat of today is 30 to 45 feet in length and is manned by two or three men. They may stay away from port 4 to 10 days, usually trying to pick up a full load before returning. Special gear is used by vessels seeking swordfish. The boats have a long board extending forward from the bow called the plank. The plank varies from 20 to 30 feet in length. On the forward end of the plank is located the pulpit. This is a platform with a protecting rail around it. The swordfisherman in the pulpit can brace himself against the rail when throwing the harpoon, and also in moderate swells it affords safety. The shorter planks can be used by the boats with greater speed and finer lines, while the slower boats need the longer plank in order to get close enough to throw the harpoon. A few very short planks, about six feet long, are used by boats which are primarily in search of other varieties of fish, but will take swordfish when available. In order to maintain their maneuverability and seaworthiness they use the six-foot plank. In addition to the plank found on the swordfish boat many of them have a crows nest. From this height the fisherman can better spot the dorsal fin and upper part of the caudal fin which show when the swordfish is on the surface. Many boats have the engine controls extended to the crows nest. After spotting and approaching the broadbill the man on the pulpit drives the harpoon into the fish and the shaft of the harpoon is detached from the barb. Fastened to the barb is a one-quarter-inch line which is payed over the side to the end, where a keg or float is secured. While

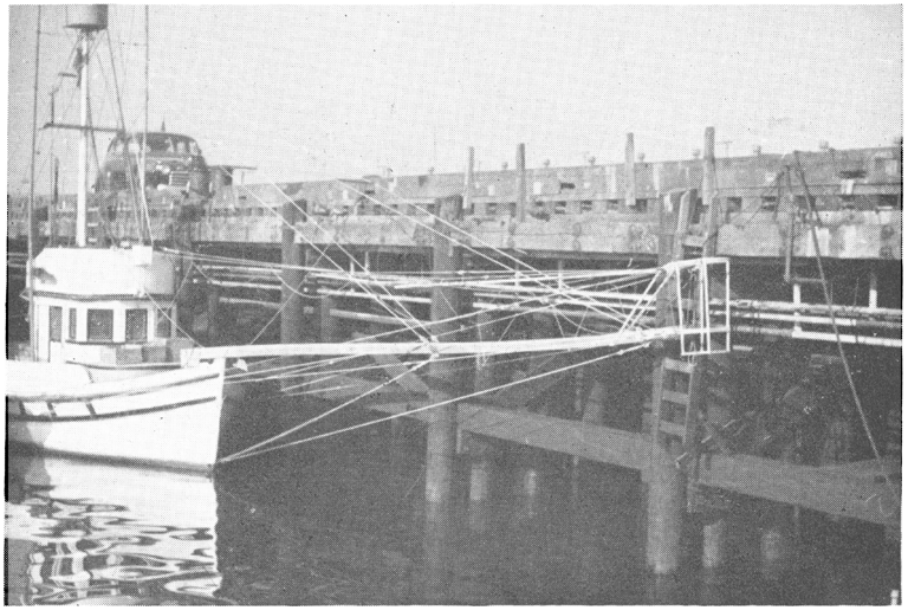

FIGURE 40. Typical swordfish boat showing plank and pulpit. The plank is almost as long as the boat. Photograph by Edward C. Greenhood, 1948

FIGURE 40. Typical swordfish boat showing plank and pulpit. The plank is almost as long as the boat. Photograph by Edward C. Greenhood, 1948

FIGURE 41. Typical swordfish boat showing plank, crows nest and trolling poles. Complete engine controls are extended to the crows nest. The trolling poles are vertical on either side of the crows nest and in trolling they are lowered to about a 30° angle above the horizontal. Photograph by Edward C. Greenhood, 1948

the fish just harpooned is playing himself out the boat goes in search of other broadbill. Until the broadbill is exhausted no attempt is made to bring it aboard. Most of the boats are equipped with a boom and a block and tackle to assist in bringing in these large fish. The head and part of the tail are then trimmed off, the fish is cleaned and the liver saved to be sold for its high vitamin A and D content. The carcass is then iced down and stowed. The boat "Bernard Pedro" took 58 broadbill swordfish on an 11-day trip in August 1942. The catch weighed over 9,500 pounds and sold to wholesale dealers for 25 cents a pound dressed. This was believed to be the largest number of fish caught on one trip along the California coast in the trade's history.

The methods of fishing for marlin are by trolling or by searching until the telltale caudal fin and sometimes the dorsal fin, as well, are sighted. When one has been spotted, the boat circles the fish, trolling cut bait until the marlin strikes. As food the flesh of the marlin is considered

poor when fresh but very good smoked. When taken commercially it did not enjoy the popularity of the broadbill.

The development of the swordfish fishery was rather slow in the early stages. Within the past 20 years it has become more rapid. In the early 1920's there was little or no market and its acceptance as a desirable, palatable fish has been very slow. The increase in our commercial catch was stimulated by importations of swordfish which helped to create eastern markets. One of the early importers on the west coast, M. N. Blumenthal, started to import swordfish from Japan as early as 1925. He said that he developed his imports to the stage where at various times 75 to 100,000 pounds a month were shipped into this country. Figures are not available to show the total quantity of swordfish imported. They have been delivered from Japan, Hawaii, and South America.

As indicated by Table 47 swordfish landings by California boats have varied greatly in poundage from a low of 12,513 pounds in 1920 to a high of 1,009,957 pounds in 1947. Figure 39 includes both marlin and broadbill landings up to 1937. In 1935 it became illegal to take marlin by harpoon in California waters and since 1937 these fish could not be bought or sold in the State. Marlin was only of minor commercial importance and these laws had little effect upon the fishery. Between 1931 and 1937 the catch of marlin never exceeded 20 percent of the total catch and usually it comprised about 3 percent. The first marlin landings were made by sportsmen who, unable to dispose of the large carcass sold a limited amount to the fish markets. In 1927 the catch commenced to increase. The continued upward trend in poundage might be attributed to the fact that markets were paying a fixed price for fish delivered, and there was a growing demand in California in addition to the east coast market. Then the previously latent fishery began to come into its own. Between 1929 and 1939 the catch seemed to remain fairly stable with an increase in 1940 and 1941. Around 1939 the swordfish association was formed, and at this time the prices and catches again increased. The average price paid per pound between 1935 and 1939 was 10 to 13 cents. In 1940 there was a slight upward trend and by 1941 the fishermen were getting around 16 cents per pound. In 1942 with the nation at war all food products rose in cost. Swordfish was no exception. The fishermen then received about 21 cents a pound for swordfish. This value was set by the office of Price Administration based on the price that was being paid in March of that year. At a later date the OPA allowed an increase of about 10 cents a pound to the fishermen. The regulation on maximum price was not affixed to livers. As a result there was a slight price increase on swordfish livers. By 1945 the fishermen were receiving for swordfish about 30 cents per pound, increasing slightly through 1946 and reaching about 32 cents per pound in 1947. In this year the fishermen received $322,252 for their catch of 1,009,957 pounds.

There are many factors which affect the landings of swordfish. The catch is no doubt affected by price, availability or abundance of the fish, the size of the fleet engaged in the fishery, and the availability of more desirable species, such as albacore. It is much easier for the fisherman to load his boat with albacore when they are running. As a result swordfish are often subordinated to the albacore when they are available—*Edward C. Greenhood and John G. Carlisle, Jr.*

Reference (see page 210) : 133.

2.16. ANCHOVY

In California, anchovies are represented in the catch by three species, Engraulis mordax, Anchoa compressa and A. delicatissima. The first of these, called the northern anchovy, is the largest, most abundant and most valuable. It is found from British Columbia to Cedros Island, Lower California. The latter are called the deep-bodied and slough anchovy, respectively. They are smaller, less abundant and are found in Southern and Lower California waters.

Anchovies have always been of importance in California as a source of both live and dead bait. Both sardines and anchovies are among the outstanding forage fishes in the diet of a number of predators in our waters.

In central California several thousand pounds of anchovies have been salted down each year for human consumption and starting with 1946, the northern anchovy has been used as a cannery fish. During the period 1916–1921 the large take was due to a demand for anchovies for reduction into oil and meal. In 1919 a state law was passed which prohibited the reduction of whole fish except under permit, but it was not until 1921 that "teeth" were put into this law and the years that followed show a reduced total catch. From 1916 through 1937 an average of 500,000 pounds were landed each year and the bulk of these fish were utilized in Central California. During the period from 1938 through 1946 the average landings increased to about 2,750,000 pounds and the bulk of these fish were utilized in Southern California. It is probable that previous to 1938 the annual take of anchovies in Southern California was also greater than that for the balance of the State and that the poundage recorded throughout is misleading. The catch of the live bait fishery in the southern area does not get into our catch records because the fish are not brought ashore.

In 1947 the landings reached 19,000,000 pounds and only 3,000,000 pounds of this total was landed in Southern California, the remaining 16,000,000 pounds was canned at Monterey. There had been some experimental canning of anchovies in California prior to 1946 but during that year, because of the scarcity of sardines, the canning of anchovies started in earnest. In 1946 about 1,500 cases of anchovies were canned at Monterey and in 1947, 180,000 cases and about 2,400 cases at San Francisco. This same year in the Los Angeles region an experimental pack of about 75 cases was made.

Part of the anchovy pack was shipped to the Philippines and the balance sold on the domestic market. Near the end of 1947, the canned anchovy market weakened noticeably and a number of plants ceased packing the fish regularly. Early in 1948, the California Division of Fish and Game issued notice of a regulation which required a high case pack per ton of fish. This served to discourage unnecessary reduction of whole fish into meal and oil.

Anchovies are caught with lampara nets and purse seines. With the development of canning on a more regular basis in 1946, the purse seines made a greater portion of the catches. The mesh size of the purse seine has been reduced in recent years to accommodate smaller sized sardines and anchovies—*Julius B. Phillips*.

References (see page 210) : 3, 53.

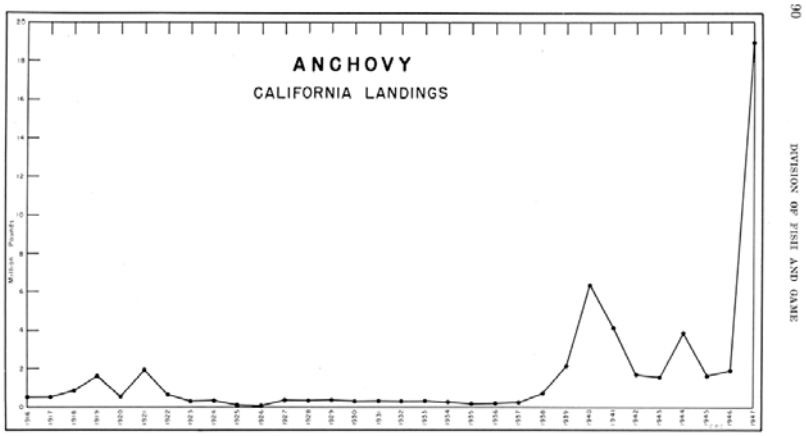

FIGURE 42. Approximately 181,000 cases of anchovies were canned in 1947. See Table 48

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2.17. BARRACUDA

The barracuda, Sphyraena argentea, ranges from Alaska to the Gulf of California, but is taken in commercial quantities only from Point Conception southward to Cape San Lucas, Lower California. Practically all the commercial catch is sold fresh; barracuda is one of the chief sources of revenue for the fresh fish markets of Southern California. At the same time, by total poundage landed, barracuda ranks first among the marine sport fishes of the State.

The catch figures exhibit a rather wide annual variation, as may be seen from Figure 43. The trend of the commercial catch in California

TABLE 11

BARRACUDA

Comparison of Commercial Catch With Catch of Sport Fishing Vessels

Year	Commercial catch			Sport catch*	Total pounds
	California waters	Mexican waters	Total	California and Mexican waters	
1936	2,247,800	730,000	2,977,800	2,399,200	5,377,000
1937	1,799,000	1,139,500	2,938,500	2,991,500	5,930,000
1938	1,260,800	1,269,000	2,529,800	1,636,500	4,166,300
1939	2,969,300	1,122,800	4,092,100	3,379,500	7,471,600
1940	2,545,600	1,169,200	3,714,800	3,609,500	7,324,300
1941	2,971,300	1,230,600	4,201,900		
1942	2,243,100	1,211,400	3,454,500		
1943	2,382,900	1,392,400	3,775,300		
1944	2,317,400	1,330,900	3,648,300		
1945	1,744,600	2,128,700	3,873,300		
1946	1,637,300	1,469,700	3,107,000	1,824,800	4,931,800
1947	1,695,800	969,900	2,665,700	3,744,700	6,410,400

* No records available for 1941-1945; 1946 record incomplete.

TABLE 11
BARRACUDA
Comparison of Commercial Catch With Catch of Sport Fishing Vessels

waters is downward since 1939. Unfortunately the record of landings by marine sport fishermen was not complete or available from 1941 through 1946. The 1947 sport catch figures, however, indicate that a larger portion of the total catch is now taken by sportsmen than before the war.

Barracuda are taken by means of artificial lures, live bait, gill nets, and round haul nets, including purse seines. It is unlawful to catch barracuda with a round haul net in the waters of the State. However, the largest part of the catch south of the international boundary is made by purse seiners. Most of the catches are sold to fresh fish markets at Los Angeles and San Diego, with a few catches sold at Santa Barbara.

The landings from California waters are greatest from April through September, with a small part landed throughout the year. Catches originating in Mexican waters are greatest from September through April.

Barracuda are caught for the most part in shallow water along the coast and nearby islands. They feed upon anchovies, young sardines, and small organisms. The spawning season is from April through September, with greatest spawning in May and June. Young fish of the year have appeared in the latter part of July (Walford 1932). Evidence of definite northward movement as the fishery progresses indicates barracuda are migratory (Walford 1929).

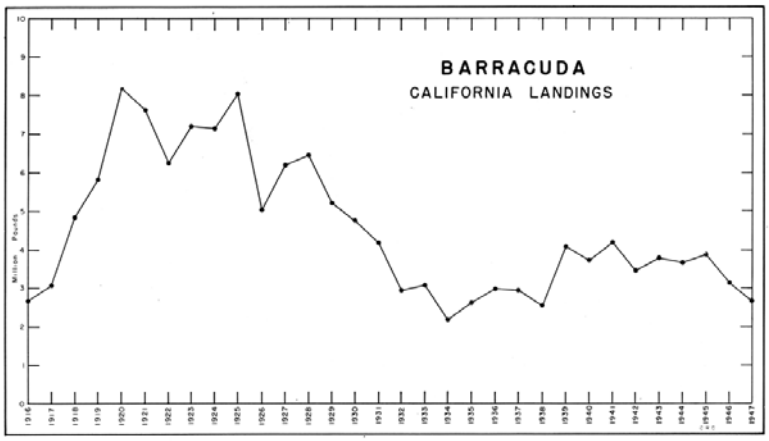

FIGURE 43. See Table 48

FIGURE 43. See Table 48

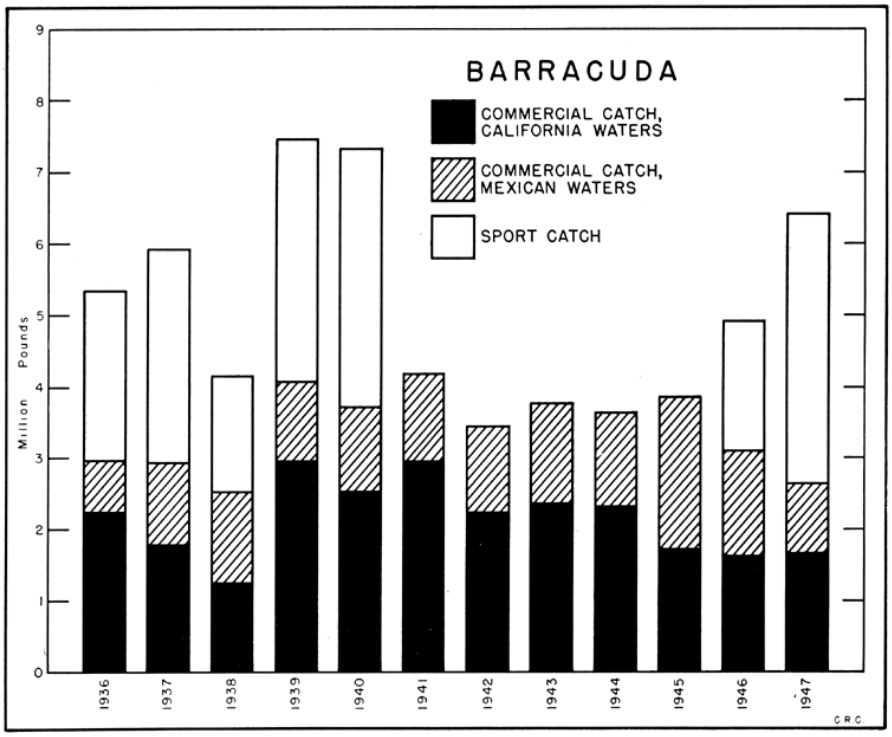

FIGURE 44. Commercial catch in California and Mexican waters compared with catch of sport fishing vessels. No sportfish records were collected from 1941 through 1945 and 1946 records are incomplete. See Tables 11, 24, 26 and 48

FIGURE 44. Commercial catch in California and Mexican waters compared with catch of sport fishing vessels. No sportfish records were collected from 1941 through 1945 and 1946 records are incomplete. See Tables 11, 24, 26 and 48

Marketing conditions are such that the price paid to the fishermen shows variation disproportionate to the rather steady consumer demand. Frequently at both San Diego and Los Angeles purse seiners fishing in Mexican waters unload many tons within a short interval of time, with a resulting temporary oversupply and depression of price. Markets commonly pay one or two cents more per pound for fish landed by jig boats that for fish landed by purse seiners. There is little apparent relationship between average annual price paid the fishermen and the commercial catch in any one year—*Robert C. Wilson.*

References (see page 210): 121, 128, 131, 133.

2.18. BONITO

The bonito, Sarda lineolata, is a fish of moderate size, as closely related to the mackerels as to the tunas. It may arbitrarily be included in either group, and heretofore it has been considered as one of the five tunas of this coast. The federal regulations, however, prescribe that it cannot be packed and labeled as "tuna," and because the market for canned bonito is distinctly limited the fishery has not experienced steady and intensive exploitation.

The bonito is a coastal fish of temperate waters, and is distributed seasonally, roughly from Magdelena Bay to British Columbia. Specimens from the latter region are scarce, and occur mostly in the late summer and fall of occasional years. The principal distributional area of the

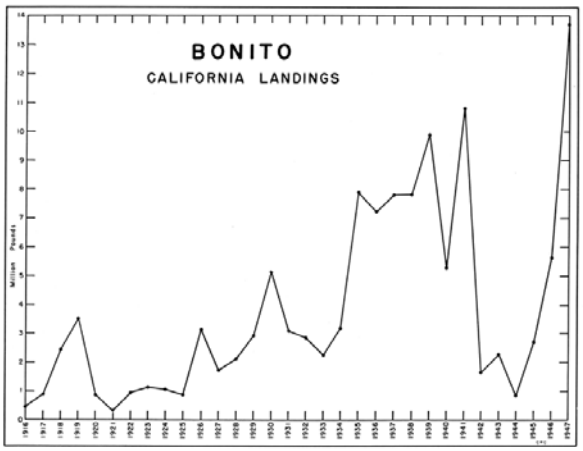

FIGURE 45. See Table 48

FIGURE 45. See Table 48

bonito is off the coast of Southern California and the northern half of Lower California. Within this area the bulk of the commercial catch is made, and the greatest tonnage is landed at San Pedro and at San Diego.

The bonito is a pelagic and a predatory fish that occurs in schools at varying distances from our coast. Casual observations indicate that it spawns in the early spring and summer. There are suggestions of a seasonal migration within this habitat, but the exact pattern of this migration is not known. Much of the winter catch comes from Mexican waters, but in the summer and early fall it appears equally abundant in both Mexican and local waters.

The bonito is a voracious fish and is caught by almost every type of gear. An appreciable tonnage is caught by the trolling fleet, both in local and in Mexican waters. A larger tonnage is caught by the smaller live bait boats that fish locally and off the coast of Lower California. Even the smaller tuna boats may occasionally complete their load with catches of bonito. In some years large catches are made by the purse seine fleet. Negligible quantities are even caught by gill nets.

The market for bonito is limited. Small quantities are sold regularly in the fresh fish trade, but the bulk of the catch goes to the canneries. Here it is processed in a manner identical with tuna. It is gutted, precooked and cooled. Then the light meat is separated in four "loins," which are cut to length and packed solid in tuna cans with a fill of salad oil. The cost of this method of processing is relatively high, and the industry has found difficulty in realizing a fair margin of profit on the pack. Furthermore, there is at best a restricted market for canned bonito. Lacking any individual selling characteristics, it cannot share the prestige that sells the tuna. Expensive to produce, it does not command a premium price, and in consequence the industry has accepted bonito more from necessity than choice. Only exceptionally has the industry sought bonito.

The catch of bonito is shown in Figure 45. In general there has been a slow but steady growth in its volume. The peacetime annual fluctuations are not excessive. The phenomenal drop in 1942, continuing into 1943, 1944 and 1945, is probably due to the restrictive measures of the war years. The sharp rise to the peak in 1947 may be attributed to the removal of ceilings set by the office of Price Administration after which every product was salable at the producer's price. To this extent the cannery demand, or acceptance, is the controlling factor in the bonito catch, and a plot of the total case pack is identical with the plot of total catch. The price to the fisherman has risen steadily (see Table 12) and is not reflected in the drop in catch in the years 1942 to 1945.

Notwithstanding the foregoing statements the primary or ultimate cause of the fluctuations is undoubtedly the fluctuating availability relative to that of more desirable and marketable fish. Some years are characterized by abnormally large local runs of bonito, and others by a scarcity; and the correlation of such runs with that of other species determines in large part the annual bonito catch.

The condition of the fishery is not apparent from this superficial analysis. However, the basic conditions underlying its present exploitation will safeguard its immediate future. It is essentially a secondary or subordinate fishery. Bonito are not primarily sought, but are taken incidentally or in lieu of more desirable species. No concerted or increasing

TABLE 12

BONITO

Average Annual Price per Ton Paid to the Fisherman

Year	Price per ton	Year	Price per ton
1931	$30	1940	$75
1932	40	1941	90
1933	40	1942	140
1934	50	1943	155
1935	50	1944	195
1936	60	1945	195
1937	75	1946	195
1938	75	1947	235
1939	65		

TABLE 12
BONITO
Average Annual Price per Ton Paid to the Fisherman

effort is being exerted to secure bonito, and as stated above, the catch is a reflection of relative availability. Under present conditions of demand and price there is no inducement to increase the effort disproportionately to maintain the catch. A decline in the fishery, even though it be due to overexploitation, resulting in a decreased return to the fisherman for any unit of effort, will in all probability cause a shift of fishing effort to other fisheries, rather than enhance the effort expended to catch bonito.—*H. C. Godsil*.

Reference (see page 210): 133.

2.19. CABEZONE

Cabezone, Scorpaenichthys marmoratus, are landed in minor amounts in California and deserve passing mention, only. Technically the cabezone belongs to the sculpin family, Cottidae, in which are classed a number of smaller species which are found on our coast but none of which are of commercial significance. Although the cabezone belongs to the sculpin family, it is not to be confused with the species commonly called sculpin, Scorpaena guttata, in Southern California. The latter species belongs to the family Scorpaenidae in which are classed the rockfishes.

The cabezone is taken along the entire California coast, wherever there are rocks, but the bulk of the annual landings are made at Monterey and San Francisco. There is not much market demand for this fish and therefore it is rather low-priced. The average annual poundage in California during the period 1930–1947 was about 6,000 pounds. This species is caught on hook and line, usually while fishermen are seeking other species such as rockfish or lingcod.

On occasions, some fishermen and marketmen in Central and Northern California refer to the cabezone and the channel rockfish as sculpin. Because of its spinous head, the channel rockfish may be referred to as scorpion, also. However, the fish known as sculpin and sometimes scorpion, Scorpaena guttata, which is common in Southern California, is rarely taken in the Central California region.—*Julius B. Phillips*.

Reference (see page 210): 6.

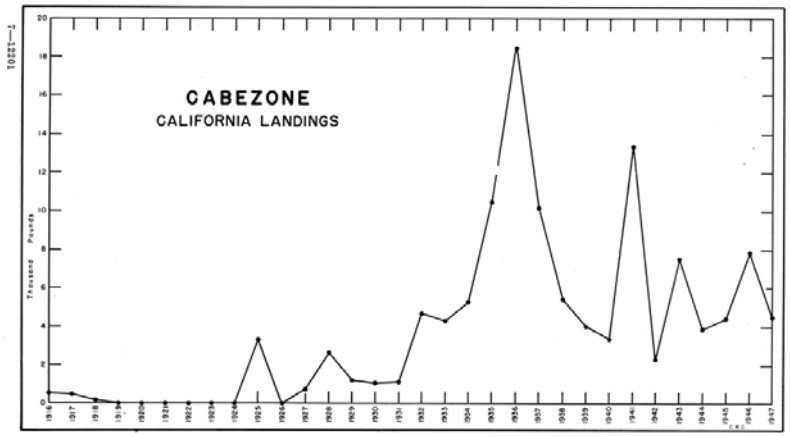

FIGURE 46. See Table 48

FIGURE 46. See Table 48

2.20. CALIFORNIA FLYING FISH

One of the chief tourist attractions at Santa Catalina Island is the boat trip at night to see the flying fish. The fish leave the water in front of the boat and sail through the air in the path of the boat's searchlight. The sight is beautiful to behold and somewhat astounding to strangers from the hinterland who previously would have laughed to scorn anyone who told them that there were fish living today that could fly through the air.

Actually, the fish does not fly; it sails, and therefore the name "flying fish" is a misnomer. The pectoral fins are extremely long and are

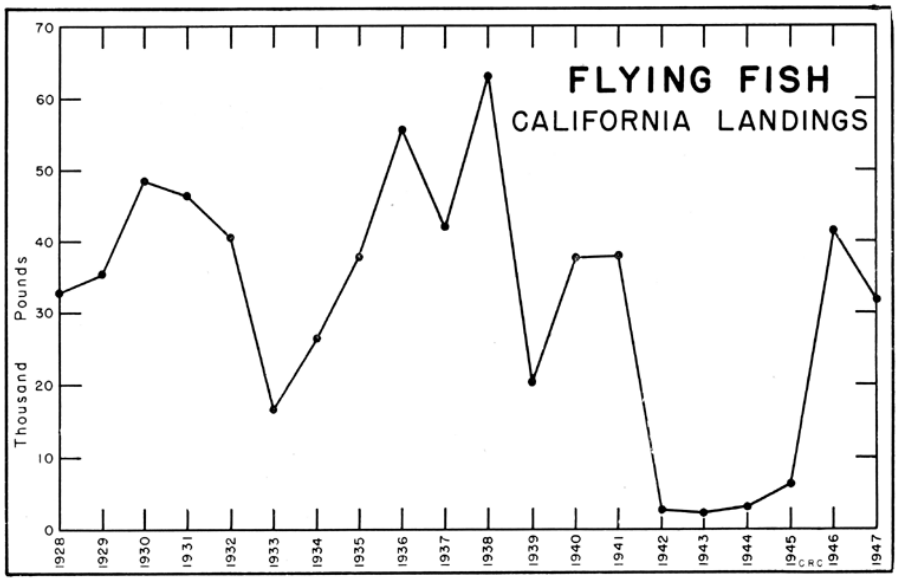

FIGURE 47. See Table 48

FIGURE 47. See Table 48

capable of great expansion till they resemble the wings of a monoplane. The fish picks up its initial speed in the water. Breaking through the surface it extends its pectoral fins into sails and adds to its speed by rapidly sculling with the lower lobe of the tail fin which has not yet left the water. When soaring speed is attained, the tail is completely withdrawn from the water and the fish can soar for 50 to 200 feet through the air. As the speed slackens the fish loses altitude and if it wishes to continue in the air it will once more lower the tail into the water and scull very rapidly, gaining a fresh burst of speed for another long soar. In this manner the fish will frequently make as many as four soaring trips before it finally plops back into the water.

The lens of the eye of a flying fish is constructed for seeing under water and therefore the fish has very poor eyesight when in the air, with the result that it will occasionally circle around and smash into the boat that startled it from the water. If the fish is soaring in an updraft of air it will frequently reach heights of 50 feet or more above the water, and not a few have landed on the decks of the Santa Catalina Island passenger steamers on their trips to and from the island.

Besides tourist attraction, the flying fish, Cypselurus californicus, also is valued commercially as bait for marlin fishing. The season extends from spring through summer to fall, these being the months when the marlin are present in greatest numbers. Other species of flying fish occur in other parts of the world, but this particular species is found only in Southern California and Lower California. It is caught in gill nets (the only kind of net which will take such agile and "air-minded" fish). The landings are made at the fresh fish markets where they are immediately iced, then shipped out to marlin fishing centers. A large share is shipped to Hawaii for the marlin fishermen there.

The records of the catches go back only to 1928. Previous to that time the landings were included with the "miscellaneous fish" category. Since the sale of this fish is almost exclusively to the marlin fishermen for bait, the records should reflect the ups and downs of that industry. Thus we observe a decline ending in 1933 which probably is indicative of the economic depression. Then again there is a prolonged low period from 1941 to 1946 which was caused by the war.—*Charles R. Clothier*.

Reference (see page 210): 77.

2.21. HAKE

Hake, Merluccius productus, is a soft flesh fish which must be marketed fresh. It has been of minor importance and more recently of no importance. With the expansion of most of our fisheries the fishermen have gone farther afield which means that it takes longer for the fish to reach the consumer. As a result it has become impossible to present this fish to the consumer in a satisfactory condition, and the market demand has fallen to nothing. This is evidenced by the fact that the greatest poundage of hake was landed in ports nearest the major markets, but when the center of the trawl fishery shifted to Eureka the hake landings declined. Hake are still taken by drag nets, hand lines, and gill nets but these fish are discarded, because they are too soft to reach the markets in edible condition and therefore the recorded catch is low. More could be brought in if there was a market demand. Technological processes may be evolved to utilize hake and it has been described by several authorities as one of the latent fisheries.

The range of this species is from the Gulf of California northward, but few commercial landings are made south of Pt. Conception. In Northern California hake is often recorded as ocean whitefish which has lead to confusion with the true ocean whitefish, Caulolatilus princeps, taken in Southern California waters. An attempt was made to correct this confusion in the tables presented in this bulletin, but it would behoove the investigator to assay the situation before using the materials in toto.—*Edwin K. Holmberg*.

References (see page 210): 21, 53.

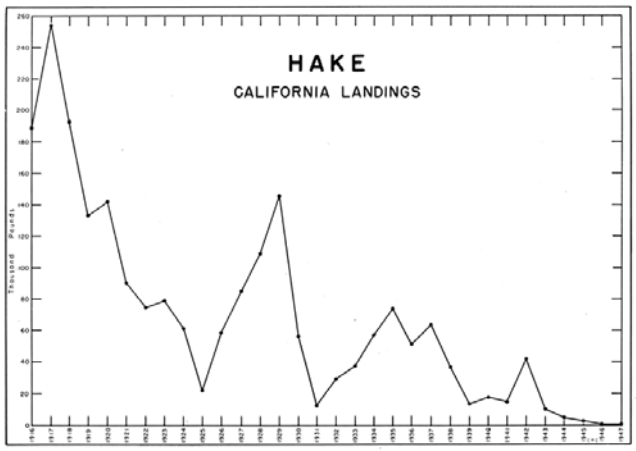

FIGURE 48. See Table 48

FIGURE 48. See Table 48

2.22. PACIFIC HERRING

Herring are found in nearly all temperate waters of the Northern Hemisphere. The Pacific herring, Clupea pallasii, ranges from San Diego Bay on the south to Nome, Alaska, on the north, and extends southward along the Asiatic coast to Japan and China. It is of major commercial importance throughout British Columbia waters and as far west as Kodiak in Alaska.

Herring are easily captured by nets because they habitually form dense schools. This makes them a cheap source of excellent and nourishing food. They have been found to be ideal for processing into meal and oil, the former to be used as food for livestock, the latter for the host of purposes to which animal fat has been found adaptable. In addition to these direct uses herring are of tremendous importance in the economy of the ocean, for they are food for a multitude of larger fishes and mammals which are valuable to man.

Important as it is elsewhere in the world, in California the herring fishery has never been large, as Figure 49 illustrates. During, and shortly after World War I comparatively large quantities of herring were landed in California. Reduction into fish meal and oil and canning for export to needy countries were the stimuli causing the increased landings. The State Reduction Act[1] which went into effect in July, 1919, and the discontinuance of canning operations after that same year combined to bring the landings down to where they have only rarely exceeded 1,000,000 pounds annually. This small quantity has been used primarily by bait dealers, although some are salted, kippered or sold fresh. It should be noted that for salting or kippering the fatter herring from Alaska and Icelandic waters are preferred to the local fish.

It will be noted that an increase in landings took place during 1947. This was caused by a few plants in the San Francisco Bay area buying herring which they canned in an attempt to fill the demand created by the recent scarcity of sardines. Unfortunately, the economics involved and the quality of the finished product failed to meet the public's buying standards. The writer was informed by some of the companies concerned that they do not plan to handle any more herring until improved packing methods are developed.

To date no method has been devised that will prevent the product from falling apart in the can. This defect greatly reduces the "eye appeal" and therefore the future demand for canned herring. However, new processing methods are being tested. It is believed that feasible methods for producing a top quality pack of herring is definitely possible, even though the economics involved in the new methods have not as yet been thoroughly studied.—*Eldon P. Hughes*.

References (see page 210): 53, 106, 112.

[1] This act prohibits the use of fish for reduction purposes without written permission from the California Division of Fish and Game.

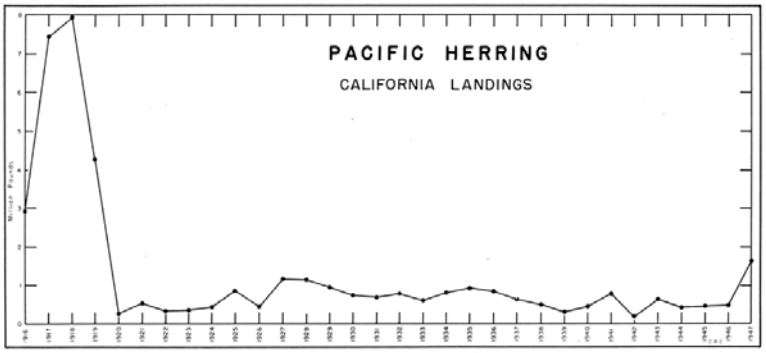

FIGURE 49. See Table 48

FIGURE 49. See Table 48

2.23. KINGFISH AND QUEENFISH

Sold under the name of "kingfish" are two species of fish: Genyonemus lineatus, the kingfish (erroneously called tomcod), and Seriphus politus, the queenfish (erroneously called herring or shiner). Both are members of the croaker family, Sciaenidae. The kingfish composes an estimated 75 to 90 percent or more of the total catch of the two species in the Los Angeles region, and possibly an even higher percentage at Monterey.

These fish are taken commercially by small round haul nets in Southern California, and a few accidentally on hook and line set for other fishes. In Central California, they are taken by round haul, gill, and drag nets, and on hook and line. They are also taken by sport fishermen on hook and line from piers and boats. They are landed throughout the year.

Most of the commercial catch is sold in the fresh fish markets. These fish are less desirable for eating than many other members of their family, but are quite popular among certain racial groups. Some are sold for bait; they comprised 5 percent of the total live bait catch in 1947, with the queenfish predominating for this use. (Table 27). The commercial demand is limited, and fluctuations in landings probably reflect this demand rather than any great changes in the abundance of these species. The value at the markets has ranged from about 3 cents a pound to a little over 6 cents in recent years.

Through 1942, about two-thirds of the catch was landed in the Los Angeles region, with almost all of the remainder landed at Monterey, and small amounts at San Francisco and other ports. In 1943, the situation changed sharply, with the Monterey catch increasing to comprise 52 to 69 percent of the total for the next four years, then dropping to 42 percent in 1947. The explanation may lie in the increased catch by round haul and drag nets as compared with gill nets, at Monterey; it may also reflect an increasing scarcity of other more desirable fishes in that region.—*Anita E. Daugherty*.

References (see page 210): 27, 53.

2.24. LINGCOD

In past statistical records for the State, lingcod, Ophiodon elongatus, was called Pacific cultus. Following the change made in official common names future statistics for this fish shall be recorded under the name lingcod which is in line with general usage, although the fish is not related to the codfish family.

Lingcod is of considerable importance on local markets where it is sold fresh. This rather highly esteemed fish is either white or green in the fresh state, but the more desirable green flesh turns white on cooking. It is taken by hand lines, set lines, troll lines, and otter trawl nets. A new method of fishing has been improvised for taking lingcod from San Francisco northward in California. A power gurdy, as normally used for trolling operations retrieves the heavily weighted line rapidly from the ocean bottom when the jig or lure is taken by the fish. Being a game fish, lingcod is of considerable importance in the sport catch which does not enter these records.

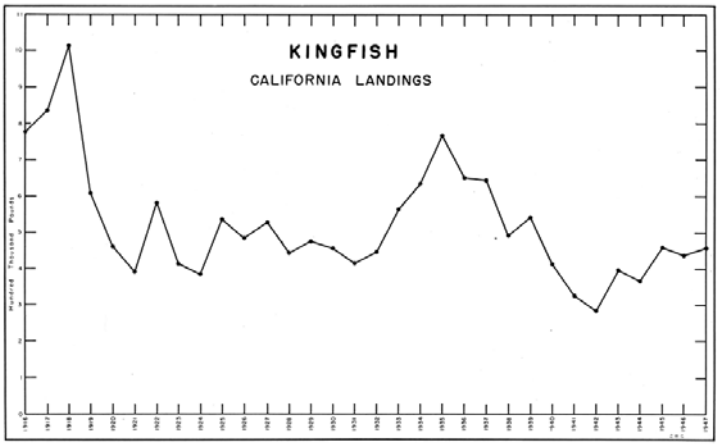

FIGURE 50. Kingfish is the trade name under which both kingfish and queenfish are sold. See Table 48

FIGURE 50. Kingfish is the trade name under which both kingfish and queenfish are sold. See Table 48

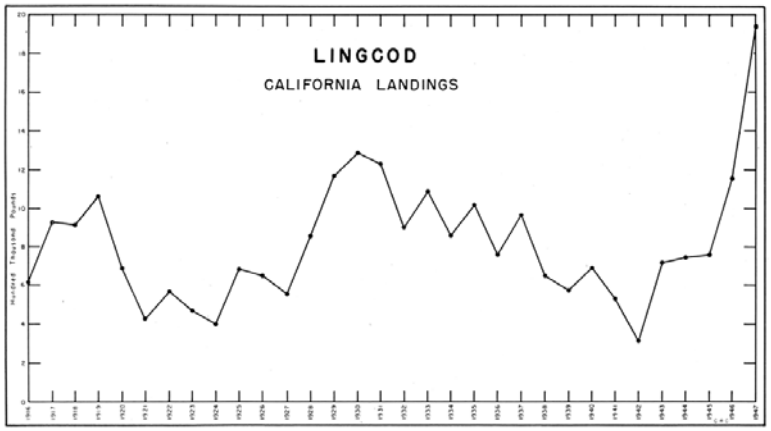

FIGURE 51. Lingcod was called Pacific cultus in former statistical records. See Tables 24, 26, and 48

FIGURE 51. Lingcod was called Pacific cultus in former statistical records. See Tables 24, 26, and 48

Ranging from Alaska south to below the Mexican border, this species occurs in the landings at all fishing ports along the California coast. The heaviest poundages are brought in at Eureka with lesser amounts delivered at San Francisco and Monterey. The heaviest catches are reported from April to October with some fish taken throughout the year.

The total catch tapered off from the depression years of 1930 and 1931 to an all time low in 1942. The demand for fish after that year caused a continued rise to an all time high of 1,940,000 pounds in 1947. It is feared that the increased pressure on this slow growing fish will prove too great and a resulting decline in its abundance will be reflected in the future catch of lingcod.—*Edwin K. Holmberg.*

Reference (see page 210): 53.

2.25. MULLET

The mullet, Mugil cephalus, has for years been one of the most under-rated fish taken in California waters and has only recently come into its own both as a sport fish to be taken with a dry fly and as a table delicacy second to none. The species ranges in the eastern Pacific from Central California to Chile as well as in the lower Colorado River and the Salton Sea. Various species of mullet are found in estuaries and shallow bays throughout the temperate and tropical areas of the world.

The fish has never been taken in commercial quantities north of Los Angeles County and seldom north of San Diego. In the years up to and including the middle 1930's most of the landings shown in the graph were taken in San Diego Bay and a few other shallow bays to the south of San Diego. They were caught in either gill nets or beach seines and were seldom taken on hook and line. In these early years much of the fish taken in San Diego Bay was peddled by the fisherman directly to the consumer so the total catch is greater than that shown.

Mullet became established in the Salton Sea in 1905 when it was flooded by the Colorado River. Catches of commercial quantity in this sea first were recorded in 1915; reached a peak of around 91,000 pounds in 1918 and ceased in 1921 when the environment became unsuitable for mullet and no more were to be found. Between 1921 and 1942 there was no commercial fishing for mullet in the Salton Sea. However, in 1942 conditions had again become favorable for this species and limited fishing was allowed under strict supervision and regulation. The figures from 1943 through 1947 are almost entirely made up of fish taken in the Salton Sea with a peak of over one-half million pounds landed in 1945.

Since the middle 1930's no commercial fishing with nets or seines has been allowed in San Diego Bay and most of the landings of mullet in California between 1936 and 1942 were of fish taken in Mexican waters. The demand was never great enough in these years for a separate fishery and those poundages landed were probably taken incidentally with other more desirable species. The great fluctuations are probably due more to this factor rather than the lack of availability of the species to the fishermen.—*John E. Fitch.*

References (see page 210): 54, 124.

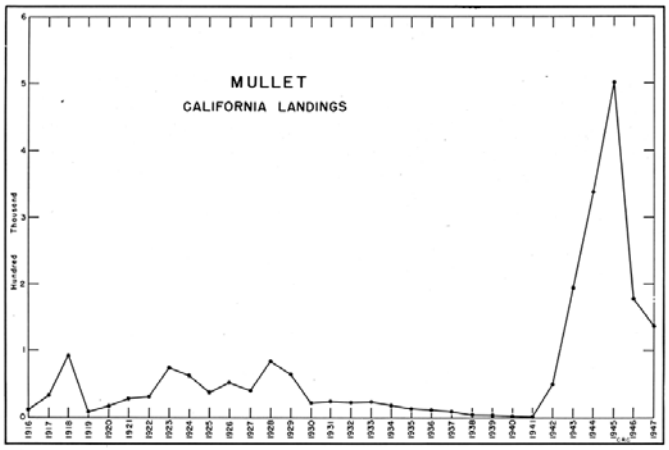

FIGURE 52. Most of the catch 1943-1947 was made in Salton Sea. See Table 48

FIGURE 52. Most of the catch 1943–1947 was made in Salton Sea. See Table 48

2.26. PERCH

No significant fluctuations took place in the perch fishery for a 21-year period (1916–1937). However, 1938 marked the beginning of a drop in production which continued into the all time low of 1941. Evidence indicates that the drop was due to a lack of fishermen rather than a lack of fish. A complete record of price fluctuations, from the Los Angeles area, indicates a slight upward trend until 1942 at which time a considerable jump in price per pound occurred. Since the initial price jump in 1942, both price and production has risen at almost exactly proportional rates. Perch was worth 6 cents a pound to fishermen in the Los Angeles area in 1931; perch is now valued at 15 cents per pound as an all year average.

The catch contribution of the numerous species of fish sold as perch can be determined from Table 13. In brief, the areas from Eureka through Monterey utilize fish from the salt-water perch family Embiotocidae. The Santa Barbara and Los Angeles areas are dependent on the salt-water perch, and to a large extent on members of three other families of fishes. The halfmoon, or blue perch as it is known in the markets, is restricted to California waters south of Point Conception and is one of the important species in the perch catch. It is the only member of family Scorpidae to be found in California waters. The opaleye, often called green perch, is far less important than the halfmoon. It is a member of family Girellidae and the only representative in California waters. The blacksmith, miscalled black perch, is a member of the demoiselle family Pomacentridae. Fish belonging to the demoiselle family are the least desirable of the perch and perchlike species in the markets. One other fish that occasionally appears and is sold as a perch is the sargo, Anisotremus davidsonii, also known as silver perch.

The above species of fish, hereinafter referred to as perch, are mainly utilized as a cheap source of fresh fish. In the Eureka region save for the redtail perch, part of the catch is frozen or set aside as cut bait material for the long line fishermen.

Examination of port landing records for a 13-year period, 1935–1947, shows that San Francisco markets rank first throughout the State of California in perch landings. Los Angeles generally ranks second, although the greatest landings for the years 1938, 1941, and 1947 were in the Los Angeles region. Monterey, for a 13-year average, ranks in third position, with Eureka following very closely. The Santa Barbara region landings are inconsistently fifth in volume, but as an over-all average well outrank San Diego, the least important major port.

The effect of the closed season (May 1st-July 15th), on the commercial taking of salt-water perch varies considerably. Eureka perch fishing is most productive in March and April, falling off to a minimum in the summer and fall months. In the San Francisco area, catches are characteristically strong in the spring months, and continue to be comparatively good for the remainder of the year following the reopening of the season. Monterey catches are strong in March and April, very weak in January and February and following the closed season. The Santa Barbara and Los Angeles areas produce catches that are fairly even throughout the months of the entire year. In the Los Angeles area, the important halfmoon catches follow the reopening of the season. Other species are not taken in appreciable quantities after July 15th.

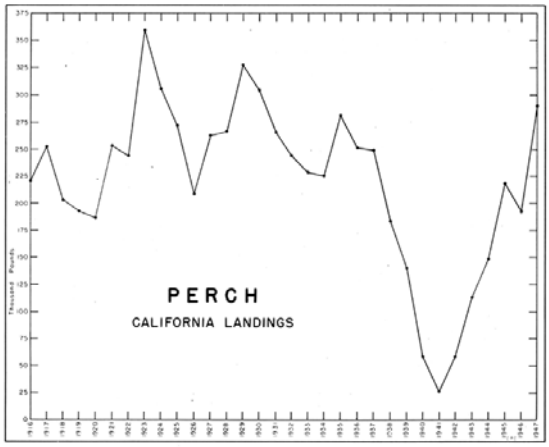

FIGURE 53. See Table 48

FIGURE 53. See Table 48

TABLE 13

DISTRIBUTION OF PERCH CATCH—1947

Region and catch in pounds	Species commonly taken [1]	Percent of catch (approx.)	Fishing methods
Eureka	Redtail perch	80	Hook and line, beach seines
	Pacific white perch		Beach seines
45,856	Striped perch	20	Beach seines
	Walleyed perch		
San Francisco	Pacific white perch	30	Beach seines
69,328	Pile perch	30–35	Beach seines; incidental to other fisheries
	Rubberlip perch		
	Rainbow perch		
	Barred perch		
	Walleyed perch	20–25	Ditto
	Striped perch		
	Black perch	10	Ditto
Monterey	Rubberlip perch	50	Part of drag net catches
	Pile perch		
49,349	Pacific white perch	40	Combination of gill nets and drag catches
	Barred perch		
	Striped perch		
	Rainbow perch		
	Black perch	10	Gill nets
Santa Barbara	Pacific white perch	90–95	Similar to Los Angeles region
	Walleyed perch		
13,010	Striped perch		
	Halfmoon		
	Opaleye	5	Ditto
Los Angeles	Halfmoon	40	Gill net designed for the purpose, also incidental to trap operations for sheepshead
113,067	Opaleye	5	Ditto
	Pacific white perch	35	Local lampara nets, incidental to bait fishing and king fish
	Walleyed perch		
	Barred perch	10	Hook and line, incidental to lampara fishing
	Rubberlip perch	10	Local lampara nets, hook and line
	Pile perch		
	Blacksmith		

[1] Barred perch, Amphistichus argenteus.
Black perch, Embiotoca jacksoni.
Pacific white perch, Phanerodon furcatus.
Pile perch, Damalichthys vacca.
Rainbow perch, Hypsurus caryi.
Redtail perch, Holconotus rhodoterus.
Rubberlip perch, Rhacochilus toxotes.
Striped perch, Taeniotoca lateralis.
Walleyed perch, Hyperprosopon argenteum.
Blacksmith, Chromis punctipinnis.
Halfmoon, Medialuna californiensis.
Opaleye, Girella nigricans.

TABLE 13
DISTRIBUTION OF PERCH CATCH—1947

If a prediction concerning the future of perch fishing is appropriate, it is probably safe to say that the increased population along the California coast plus the increased demand for a cheap source of fresh fish will combine to hold perch production at a comparatively high level. Supply, of course, will depend primarily on the sustained ability of the various perches to produce a sufficient surplus of tender young recruits every year.—*Parke H. Young*.

Reference (see page 210): 28.

2.27. POMPANO

The pompano fishery is at present dependent on the California pompano, Palometa simillima, but at times quantities of the Mexican pompano, Trachinotus kennedyi, have entered the catch records. The California pompano is not a pompano but is the only member of the butterfish family, Stromateidae, to be found in California waters. The range of this species is very wide, from British Columbia to central Lower California. The maximum length of the California pompano is around 11 inches.

In contrast, the Mexican pompano (Table 48) is a true pompano of the family Carangidae; closely related are the amberjack, yellowtail and crevally, all found on the Pacific Coast. The northern range of the Mexican pompano is approximately 300 miles south of the southern limit of the California pompano. It is found from Magdalena Bay, Lower California, to the coast of Panama. The length of a large specimen may be in excess of two feet.

Each of the Pacific coast pompanos has its Atlantic coast counterpart; however the fishery for the Atlantic species is developed to a much greater extent. The butterfish, Poronotus triacanthus, which corresponds to the California pompano produces an annual catch of 12,000,000 pounds, whereas the Atlantic pompano, Trachinotus goodei, and others, average less than 1,000,000 annually. The Atlantic butterfish and California pompano attain approximately the same maximum length, but the true pompano from the Atlantic may grow to a length of three feet and weight of 8 or 10 pounds.

Perhaps the comparatively low catch of the California pompano is due to relatively hit and miss fishing methods. They are usually taken in lampara nets in conjunction with fishing effort expended on other species. There is an exclusive commercial fishery for butterfish on the Atlantic coast where floating traps and pound nets are used. The true pompano in the southern Atlantic fishery is taken by trammel and run-around gill nets, haul seines and by hook and line.

According to the 1878 report of the California Commissioner of Fisheries, 18 years after the California pompano was first described by Ayres, "pompino" were considered to be a special delicacy bringing 25 and 50 cents per pound. In the present day with inflated prices a catch rarely brings as much as 50 cents per pound although as a fresh seafood pompano are held in high esteem. Fishermen in the early days, even as now, did not hesitate to take three- to four-inch half grown fish as the market value outweighed any conservative inhibitions of the fisherman. Special release devices permit the escape of the half grown fish on the Atlantic Coast.

The principal fishing center for California pompano was originally in San Francisco Bay, leading to the belief that the natural range of the fish was very limited. By 1916, the first year for which there are documented records, Los Angeles was by far the most important producing area. Prior to 1946 Los Angeles maintained the lead in the fishery for 29 of the 30 years. In 1946, Monterey Bay produced approximately 2,000 pounds more than did Los Angeles, and in 1947 more than double the Los Angeles catch. The fishery of Monterey Bay is conducted mainly in the northern portion where the warmer water is to be found. Several

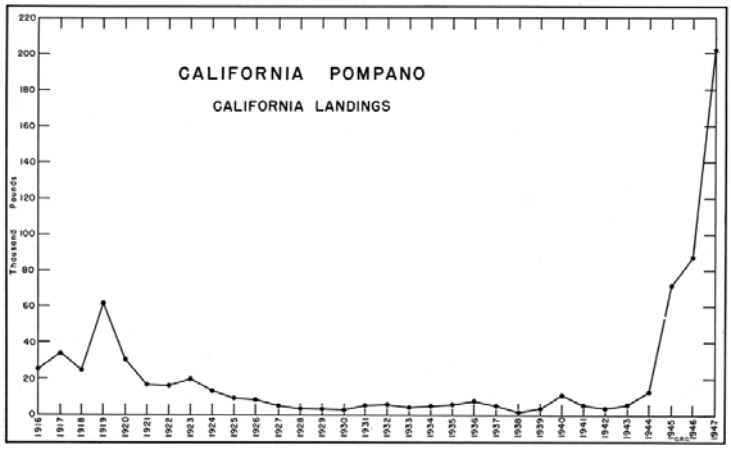

FIGURE 54. For the record of Mexican pompano, see Table 48

FIGURE 54. For the record of Mexican pompano, see Table 48

lampara boats, about 25 feet in length, are providing the great bulk of the catch. Fishing in both areas is conducted in water less than 10 fathoms deep.

There is nothing to indicate that the efficiency of the fishing methods has increased in Monterey Bay, which leads to the conclusion that there is an increase in abundance, particularly to the northward. This conclusion is substantiated by the observations of British Columbia scientists who have recent records of California pompano occurring in hundreds of pounds rather than by isolated instances as was the case prior to 1946.

California pompano taken in quantity more than satisfy a moderate local market, and as a consequence must find outlets in eastern markets. Shipments of frozen pompano to the east have become more common in the last several years. Conversely, butterfish, the Atlantic species, is shipped frozen to the markets on the West Coast. The prevailing price at this time is around 45 cents per pound. One company in the Los Angeles area has imported many thousands of pounds of butterfish for local dealers. California pompano are very popular with the Japanese and Filipino trade in the Los Angeles area. Part of the Monterey fish are consumed locally, but the great bulk is shipped to San Francisco and to the East.

Price fluctuations are no doubt dependent upon supply, and during a season of good catches, a boat captain may find it necessary to contact several buyers in order to dispose of his catch. In both the Monterey and Los Angeles markets, the average price per pound appears to vary inversely with the total deliveries. For instance, in the 1945 season, Monterey deliveries totaled slightly over 9,000 pounds but commanded an amazing average price of 58 cents per pound to the fisherman. In 1946, Monterey catches amounted to 44,000 pounds which brought 33 cents per pound as an average. In the month of April, 1947, slightly more than 37,000 pounds of California pompano were landed, mostly in Monterey. The fisherman received for his catch an average of 18 cents per pound in Monterey and approximately 16 cents in Los Angeles.

From the foregoing, it would seem that there may be possibilities of increasing the yield of the California pompano fishery. Introduction of more efficient gear, including the incorporation of release devices, and a more thorough knowledge of the habits of the fish could do much toward providing fuller utilization of the resource.—*Parke H. Young*.

Reference (see page 210): 133.

2.28. ROCK BASS

The California rock bass fishery consists chiefly of two species, the kelp bass, Paralabrax clathratus, and the sand bass, Paralabrax nebulifer, and is of minor commercial importance. To the marine sport fishermen, however, the rock bass fishery is of major importance, ranking first in number of fish taken and second in poundage. (See Tables 24 and 26.)

Rock bass are taken throughout the entire year with the largest landings made in June, July and August. Fishing grounds extend from Point Conception south into Mexican waters. Rock bass are common in Southern California, all along the coast and around the islands.

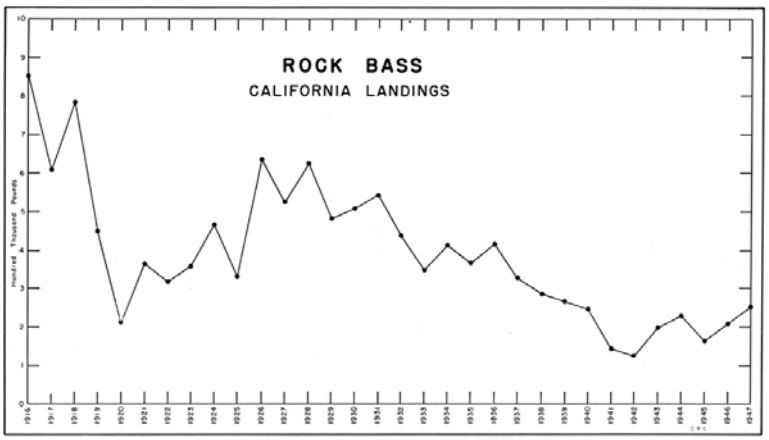

FIGURE 55. Commercial landings only. Rock bass is also an important marine sport fish. See Tables 14, 21, 6, 48

FIGURE 55. Commercial landings only. Rock bass is also an important marine sport fish. See Tables 14, 21, 6, 48

The commercial catch has varied little from year to year, and the general trend has been toward a decline in the total landings. The average catch from 1916 through 1935 was about 480,000 pounds and from 1936 through 1947 was only half that amount. This drop does not necessarily show a decline in the availability of the fish but rather a reduction of the fishing effort for local market fish, especially for those species with which the rock bass fishery is associated. Unfavorable economic conditions have caused many fishermen to pursue other, more profitable species.

Few regular commercial fishermen are engaged primarily in rock bass fishing. The demand for this fish is a limited one, existing only in the fresh fish market. Therefore, the price per pound to the fisherman is seldom high enough to attract full time fishing effort. Rock bass are caught by every conceivable fishing method and are taken incidentally by boats fishing for other species such as rockfish, sheepshead and lobster. Rod and reel, hand and set lines, gill nets, traps and trawls all contribute to the catch.

A large portion of the commercial rock bass landings have consisted of fish taken by sportsmen with sport tackle and live bait. This practice of selling the catch became more and more popular among ardent fishermen who regularly fished on the live bait sportfishing vessels, for it helped considerably to defray the cost of the day's recreation. In 1947 a law was passed to stop this practice and make sportfishing boats for sportsmen only.

TABLE 14

ROCK BASS

Pounds

	Commercial	Sportcatch		Commercial	Sportcatch
1936	416,145	705,114	1942	122,812	----------
1937	325,000	470,518	1943	198,132	----------
1938	286,087	901,488	1944	229,032	----------
1939	266,153	904,140	1945	163,846	----------
1940	245,559	926,181	1946	207,548	824,636
1941	141,977	----------	1947	251,413	1,356,241

TABLE 14
ROCK BASS
Pounds

The amount of fish reported by the numerous live bait sportfishing boats and not included in the commercial record, is shown in the Table 14. This constitutes the major part of the sportsmen's catch, but not all, since these fish are also taken by pier fishermen, skiff fishermen, and on private party boats. The abrupt rise in the sport catch of rock bass in 1947 is the result of more complete records collected by the Bureau of Marine Fisheries from the operators of the sportfishing vessels.—*Robert D. Collyer*.

References (see page 210): 30, 133.

2.29. ROCKFISH

The rockfishes, commonly called "rock cod," have been one of the mainstays of the fresh fish markets in California for a number of years. These fish are also an important item in the ocean sport catch along the California coast. The rockfishes comprise a large family with about 55 species occurring in California waters.

These fishes are caught along our entire coast, primarily where there is a rocky or gravelly bottom. Some species are found close to shore while others may be taken from 300 fathoms and occasionally from greater depths. Most of the commercial fishing is done in 40 to 110 fathoms. The smallest species may reach a length of only 8 inches, but the largest attain a length of 36 inches.[1] A half-dozen of the larger and more abundant species make up over half of the annual California commercial poundage landed, namely:

- Bocaccio, Sebastodes paucispinis
- Vermilion rockfish, S. miniatus
- Yellowtail rockfish, S. flavidus
- Chilipepper, S. goodei
- Orange rockfish, S. pinniger
- Black rockfish, S. melanops

Aside from the true rockfishes of the genus Sebastodes, there are three other species belonging to this family, Scorpaenidae, that are landed in minor amounts. These are the sculpin, Scorpaena guttata, and two so-called channel rockfish, Sebastolobus alascanus and S. altivelis. of these two channel rockfish, the latter is landed only rarely because it is taken in 300 or more fathoms of water. The catches of sculpin are listed separately in the statistical records, whereas the catches of channel rockfish are included with rockfish. Channel rockfish were not landed in appreciable quantities until 1932, and they are still of only minor importance.

To the commercial fishermen, the rockfishes are "cheap" fish and it is not profitable to fish them unless fairly large quantities are caught. This is due partially to the fact that in dressing out the fish in the most popular fillet form for the trade, there is a loss of about two-thirds in weight because of the heavy bony structure and large head. Hook and line fishermen will readily forsake rockfish for more valuable market fishes such as salmon and albacore during good "runs" in the open season.

The rockfish catch increased from about 5,000,000 pounds in 1916 to a little over 8,000,000 in 1918, as a consequence of the increased demand for food during World War I. The decline to 4,000,000 pounds in 1922 reflects a postwar slump. The landings then increased to 7½ million pounds in 1926 and remained between this figure and 6,000,000 pounds until 1931, when the yearly total declined steadily to 1½ million pounds in 1942. However, 1942 represents the first full year of this country's participation in World War II, and cannot be considered normal because of restrictions that curtailed fishing activities during a period of adjustment to war conditions. Therefore, the normal decline was from 7½ million pounds in 1931 to about 3½ million pounds in 1941. This appears to represent a gradual dimunition of the stock of rockfish on the usual fishing grounds in Southern California and in Central California, but not in Northern California, because the rockfishes in this region had been but

[1] In Fish Bulletin 49, p. 43, a reported record rockfish, caught April 19, 1933, near Pt. Sur, was 36½ inches long and weighed 32½ pounds. This was identified erroneously, as Sebastodes pinniger when it should have been S. levis.

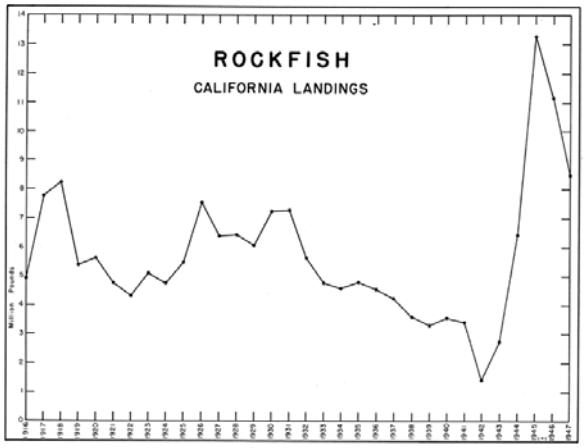

FIGURE 56. See Table 48

FIGURE 56. See Table 48

FIGURE 57. A Northern California dragger, equipped with a balloon type trawl and otter-boards or "doors." The major portion of the net has been suspended from the boom to dry. The otter-boards, of which there are two, are lashed to the rail, one on either side, near the stern of the vessel. In operation, a hauling cable is attached to each board and each board, in turn, is fastened to a wing of the net. The otter-boards are weighted so that they slide along on the bottom edge. The attachment of the hauling cable to the boards is such, that as the boat moves along the boards are pushed outward, keeping the mouth of the net open. Photograph by J. B. Phillips. Fort Bragg, November, 1947

FIGURE 57. A Northern California dragger, equipped with a balloon type trawl and otter-boards or "doors." The major portion of the net has been suspended from the boom to dry. The otter-boards, of which there are two, are lashed to the rail, one on either side, near the stern of the vessel. In operation, a hauling cable is attached to each board and each board, in turn, is fastened to a wing of the net. The otter-boards are weighted so that they slide along on the bottom edge. The attachment of the hauling cable to the boards is such, that as the boat moves along the boards are pushed outward, keeping the mouth of the net open. Photograph by J. B. Phillips. Fort Bragg, November, 1947

lightly exploited up to this time.[2] Previously, the catches in the Southern and Central California regions had been maintained by the discovery of new "rocks" or "banks," which were fished intensively until their production was poor.

Before 1933 the landings, by Southern California boats, of catches made in Mexican waters amounted to a few thousand pounds annually. During the period 1934-1943, landings from catches made in Mexican waters ranged between 100,000 and 200,000 pounds. In other words, the lack of good fishing in Southern California waters was compensated, in some measure, by trips into more productive Mexican waters. Since 1943, catches made in Mexican waters have dropped off considerably just as they have in the locally fished waters. This has not been due to poorer fishing conditions in Mexican waters so much as to the fact that the relatively unexploited Northern California region began producing large quantities of rockfish caught by the balloon drag net. The first rockfish drag boat moved down to Eureka, from Oregon, in November, 1943 and by 1944, a large number of such vessels were operating in Northern California. Later, this type of net was introduced farther south.

The year 1943 serves to mark two different phases in the history of the rockfish fishery in California. Up to, and including most of the year

[2] The major ports in Northern California are Eureka, Crescent City and Fort Bragg; in Central California, San Francisco, Monterey and Santa Cruz; in Southern California, Santa Barbara, San Pedro and San Diego.

FIGURE 58. Rockfish being hauled in from a depth of 100 fathoms, off Pt. Sur, near Monterey. In this case there was about one mile of mainline with 3,000 baited hooks set out on the bottom of the ocean. As the rockfish are brought up from such depths, the lessened pressure allows the gases in the air bladder to expand, increasing the size of the air bladder, and the fish balloon upward to the surface. Photograph by J. B. Phillips, April, 1928

FIGURE 58. Rockfish being hauled in from a depth of 100 fathoms, off Pt. Sur, near Monterey. In this case there was about one mile of mainline with 3,000 baited hooks set out on the bottom of the ocean. As the rockfish are brought up from such depths, the lessened pressure allows the gases in the air bladder to expand, increasing the size of the air bladder, and the fish balloon upward to the surface. Photograph by J. B. Phillips, April, 1928

1943, the fishery was conducted primarily in Southern and Central California, with hook and line, trawl lines, or long lines with numerous baited hooks attached. About 5 percent of the annual state poundage was landed by the old-type paranzella and otter-board draggers. Late in 1943, the balloon drag net proved so successful that, by the end of 1944, the bulk of the rockfish landings in California were caught by this type of gear. The state catch rose abruptly to 13¼ million pounds in 1945. Fish could be delivered cheaper because of the huge quantities taken, but the surplus in Northern California could not be disposed of locally. As a consequence, a frozen fillet industry developed and the product was shipped to many of the markets formerly supplied by the Southern and Central California fisheries.

There are still hook and line operations for rockfish along the entire California coast, and in Southern and Central California this is the principal gear used. The greater poundage is now taken by the balloon draggers operating in Northern California.

To illustrate the change that has taken place in this fishery: During the eight-year period, 1935–1942, the average annual catch in California was about 3,650,000 pounds, and Northern California contributed 10 percent of this total, Central California 63 percent and Southern California 27 percent. During the five-year period, 1943–1947, the average annual catch in California amounted to about 8,400,000 pounds and Northern California contributed 82 percent of the total, Central California 14 percent and Southern California 4 percent.

The first impetus was given the frozen fillet industry in Northern California by the Army during World War II. When it was demonstrated that the balloon drag net could provide large quantities of rockfish at a reasonable price, the Army placed large orders for this product for the

camps in California. With the cessation of hostilities, the large Army orders were withdrawn and this lessened demand is reflected in the decreased catch since the 1945 peak year. In the Southern and Central California fisheries in the last decade the catch experienced a downward trend in spite of a relatively constant demand. This suggests that the northern rockfish population might not have continued to furnish an annual catch of 13,000,000 pounds for very many years.

Some experiments in canning rockfish have been made in California, but this particular pack has not been developed commercially. Small amounts of rockfish are preserved by salting but the bulk of the catch continues to be sold fresh or as frozen fillets.

—*Julius B. Phillips.*

References (see page 210) : 31, 40, 41, 96, 116, 117, 118.

2.30. SABLEFISH

Sablefish, Anoplopoma fimbria, also known as black cod, coalfish, candlefish, seatrout and skilfish, ranked sixteenth in the commercial catch of 1947. It ranges from Alaska to Southern California, and is taken throughout the year by hand lines, set lines, long lines, otter and balloon trawls. In California, greatest landings are made at Eureka where 40 percent of the trawler catch consists of sablefish. Monterey, where the fishing is primarily long line, is next in importance.

Inhabiting deep water during the winter months, the fish migrate into shallower water as the season progresses. Taken at depths of from 80 to 300 fathoms, the heaviest landings are made during the summer months when calmer weather allows the fishermen more time at sea.

The sablefish is dark greenish-black in color, with a long, slender body. It reaches a length of three feet and a weight of from forty to fifty pounds. There is a report of an Alaskan specimen weighing 126 pounds with the viscera removed.

Marketed chiefly as smoked "black cod," sablefish are also valued for the liver. Recently frozen fillets have been introduced in the stores in an effort to stimulate an interest in the fresh product. Buyers for the markets accept only fish of five pounds or more because smaller fish are not suitable for filleting or smoking. During the war years four-pound fish and smaller were accepted and such large quantities of small fish were delivered that the long line fishermen became alarmed and voluntarily adopted a minimum size limit of about four pounds.

The accompanying figure shows several minor fluctuations. The catch reached a peak first in 1935, when sablefish livers brought a higher price than the fish itself. The sharp drop following this year and continuing until 1942, was caused by the fishermen abandoning the sablefish and turning to the more lucrative shark fishery. The outbreak of World War II, with the demands it placed on the fishing industry, and the introduction of the balloon trawls at Eureka late in 1943, skyrocketed the landings of sablefish to over 6,000,000 pounds in 1945. With the end of the war, the demand for fishery products lessened and sablefish landings have declined until they are now at the 1928 level.

of historical interest is the Newport Beach fishery which is protected by a city charter drawn in 1905. Here fish are sold right on the beach from the dories making up the fleet. Sablefish under the name of "seatrout" comprises a considerable portion of these sales. No other shops, stores or markets are allowed on the beach according to the provisions

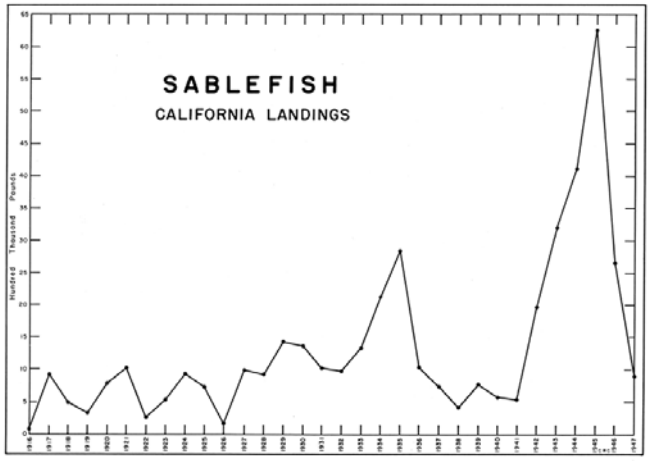

FIGURE 59. See Table 48

FIGURE 59. See Table 48

of the charter. Also of interest is the sablefish run which began July 11, 1947, in Monterey Bay. Fishermen from miles around thronged the municipal pier, pulling in fish as fast as they could throw in a line. On July 26th, the run abruptly ceased. An estimated 100 tons were taken by the sportsmen during the 15 days of the run.—*Keith W. Cox.*

References (see page 210) : 7, 47, 89, 116, 117, 118.

2.31. PACIFIC SAURY

Although known to most commercial fishermen, the Pacific saury, Cololabis saira, also called skipper, garfish, and needlefish, is seldom seen in the fish markets, having appeared in quantity only once when in 1931, 1300 pounds were delivered at Monterey. Most individuals are about 10 inches long, some reach 14 inches, and with their long, slender cigarshaped bodies and pointed jaws, they look not unlike small barracuda. Occurring in large schools, close to the surface and inhabiting the temperate seas, they range from Lower California to Japan. of considerable importance in Japan before the war, shipments of frozen saury were made to the United States for sale to the Japanese here. At the present time sauries are of negligible importance in the California commercial fisheries. The few individuals appearing in the market usually have been caught in the nets mixed with other species.

As an experiment, in September, 1947, Hovden Food Products Company, of Monterey, packed 10, half-pound oval cans of saury in oil. The product was highly satisfactory being judged superior to sardines in taste and appearance. Unfortunately, the fish moved from the area and no more have been canned. Since sauries are more plentiful off Southern California than was formerly suspected, it may be possible that further investigation will reveal a commercial fishery could be established for these fish in this region.—*Keith W. Cox.*

Reference (see page 210) : 2.

2.32. SCULPIN

This is Scorpaena guttata, the translation of which is spotted scorpion. It is a member of the rockfish family, Scorpaenidae, and should not be confused with the true sculpins, Cottidae. The common names, sculpin and scorpion, as well as the scientific name, are all derived from its poisonous dorsal spines. These can inflict a painful wound, varying considerably in degree; but they in no way affect the quality of its flesh. On the contrary, it is a much-sought-after fish and considered a great delicacy and often goes directly to the fishermen's homes. Most of it is consumed locally, sold through fresh fish markets in the ports of delivery.

Sculpin is taken chiefly with hook and line and incidentally in round haul nets. Its catch by the latter, which seldom take rockfish of the Sebastodes group, is of interest, suggesting a difference in habitat or behavior; the sculpin probably swims farther off the bottom, at least at times. It will even come to the surface to lights at night and the mackerel scoop boats occasionally get these fish when they come up for chum. It is reported to occur over both rocky and sandy bottoms, concentrating in certain areas and possibly at certain times of year, where it is sought by those fishermen who specialize in this fishery.

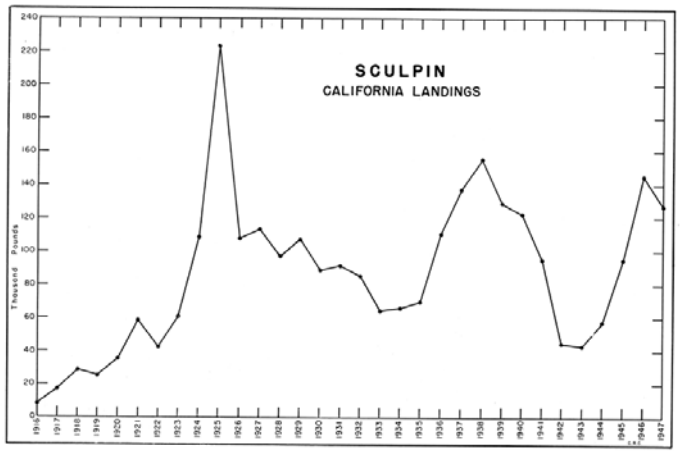

FIGURE 60. See Table 48

FIGURE 60. See Table 48

The species ranges from Monterey south into the Gulf of California and is caught the year around, with heaviest landings in the spring and summer. Most of the commercial landings reported in recent years have been made in the Los Angeles and San Diego regions, with the amount at Los Angeles ranging from 69 to 95 percent of the total. The landings have varied from year to year, apparently representing variations in fishing effort rather than in abundance of fish. Sculpin is caught mostly by a few specialists, who move from one fishery to another as the chances for greatest profit shift. Despite the claim that there is probably never enough of this fish taken to supply the potential demand, the price paid for it is not incentive enough for fishermen to go after it. Prices in recent years have risen from around 7 cents a pound to about 14 cents and in 1947 the bulk of it sold for 20 cents.—*Anita E. Daugherty.*

Reference (see page 210) : 6.

2.33. BLACK SEA BASS

The present fishery for black sea bass, Stereolepis gigas, is conducted almost entirely along the coast of Lower California, Mexico, between Cedros Island and Cape San Lucas. Most of the catch is sold fresh in the form of fillets, although in past years some was dry salted. The fish is frequently called jewfish.

Several boats fish almost exclusively for black sea bass and other closely related forms. Most of the catch, however, is brought to California markets at San Diego and Los Angeles by the numerous small boats which ply Mexican waters for any marketable species from yellowtail, bonito and skipjack to black sea bass and groupers. Certain spots or banks are more favorable than others for catching this species and sometimes a full load can be acquired in a few days time on one bank. often the fisherman must fish several of these favorite localities before a pay load is assured. Most of the fish taken range between 50 and 500 pounds each, and are caught on either hand lines or set lines usually fished on the rocky bottom and close to shore. Purse seiners also account for a small percentage of the total California landings as do the shark gill netters which operate in Mexican waters.

Until about 1922, the commercial catch of approximately 150,000 pounds per year was made up almost entirely of fish taken off the California coast. During the next 10 years or until about 1933 the average yearly landings of 350,000 to 400,000 pounds was divided nearly equally between fish taken in Mexican waters and those taken locally. Since 1933, presumably as increased fishing pressure resulted in depletion of the stock on local banks, the bulk of the catch has come from Mexican waters. During this period an all-time high of approximately 861,000 pounds was landed in 1934; generally, however, the average yearly landings have remained fairly stable at around 400,000 pounds. The 244,000 pounds in 1947 represented the lowest landings since 1925.

Up to 1922 probably most of the catch was delivered round. During the next 10 years the practice of cleaning the fish at sea increased and by 1933 all fish were delivered cleaned. This makes the record of landings misleading since it does not represent round fish. The black sea bass taken locally is eviscerated before it is landed, and the fish taken in Mexican waters are beheaded and eviscerated and no adjustment has

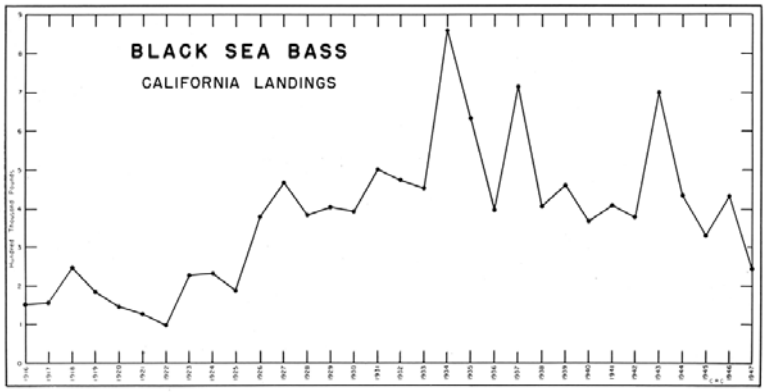

FIGURE 61. See Table 48

FIGURE 61. See Table 48

been made in the catch record for this loss of weight. A reasonably accurate approximation of the total poundage of fish caught can be reached by adding 40 percent to the recorded totals beginning with 1933 to cover the loss of weight in cleaning and beheading.—*John E. Fitch.*

Reference (see page 210): 133.

2.34. WHITE SEA BASS

The California white sea bass, Cynoscion nobilis, ranges from Alaska south to the Gulf of California. However, the commercial range of this species can be defined as lying between Tomales Bay in Northern California and Magdalena Bay, Lower California. From San Diego southward a small percentage of the catch includes a very closely related species, the shortfin sea bass, Cynoscion parvipinnis. The two species are so much alike they are seldom separated in the catch by the markets and therefore both have been treated as a single species in this report. Probably 99 percent is actually Cynoscion nobilis the true white sea bass. The young of the two species of sea bass have several dark cross bars on the body and are sometimes erroneously called seatrout.

TABLE 15

SHORTFIN SEA BASS

Pounds

1932	2,487	1938	2,259
1934	438	1939	2,600
1935	3,350	1940	2,544
1936	156	1941	2,305
1937	1,191	1945	375

TABLE 15
SHORTFIN SEA BASS
Pounds

Both of these species are members of the croaker family, which includes much sought after food fish on both coasts of North America such as the croakers, corbina and totuava on the Pacific Coast and the weakfish and drum of the Atlantic Coast.

The white sea bass, usually found in and around kelp beds, is a schooling fish and quite voracious in its feeding habits. It is a valuable market fish and rated second only to albacore in general popularity as a sport fish in Southern California. The average weight of this species ranges between 15 and 20 pounds, though it has been recorded up to 80 pounds and fish up to 60 pounds are not too uncommon.

Prior to 1925 over half the catch was made by purse seines and other round haul nets; with increasing scarcity of white sea bass the round haul netters gradually turned to other fisheries and in 1940 were declared illegal. For a couple of years after World War II a new fishery for white sea bass sprang up at Pismo Beach, California. It entailed the use of a small monoplane and surplus army DUKWs carrying beach seines. The plane would fly low over the surf until a school of white sea bass was spotted feeding in shallow water. A radio call would inform the DUKW operator who would enter the surf, set the beach seine parallel to shore beyond the school of sea bass and then return to shore. The two ends of the net would be quickly pulled ashore with winches leaving the sea bass trapped in the remaining bag, and eventually the whole school would be landed as the net was beached. This method accounted for a

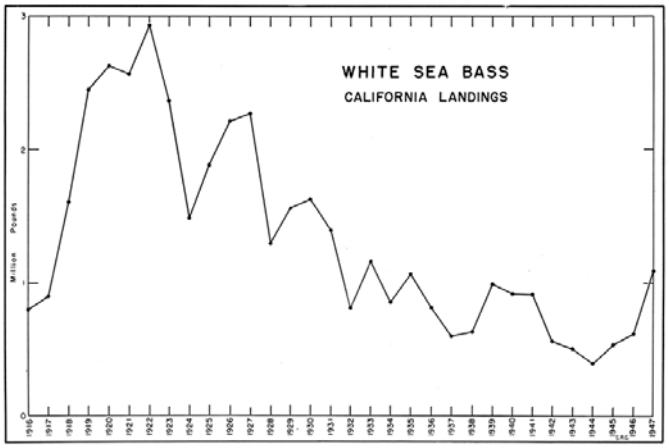

FIGURE 62. See Tables 24, 26, and 48

FIGURE 62. See Tables 24, 26, and 48

great number of fish but has been declared illegal and has not been used since 1947.

Until 1931 the average yearly commercial catch of white sea bass was well over 1,000,000 pounds reaching a peak of nearly 3,000,000 pounds in 1922. Since 1932 the catch has fluctuated widely, amounting to 1,000,000 pounds on only three occasions (1933, 1935 and 1947). Generally the catch has remained at a figure slightly over a half million pounds; the lowest landings on record were made during 1944 when only 394,000 pounds were reported.

Numerous restrictive measures have been enacted throughout the years in order to give maximum protection to this heavily fished species. These laws include such items as closed seasons, closed areas, gear prohibitions, minimum size limits, and bag limits.

Los Angeles Harbor and vicinity has usually been the center of the white sea bass fishery, although in 1946 over half of the total landings were made in the Santa Barbara region. A small portion of the catch is also made along the coast of Lower California each year and landed at either San Diego or Los Angeles. The landings recorded for white sea bass do not represent a true record of the actual pounds caught, since at present nearly all of these fish are landed eviscerated. In earlier years they were both eviscerated and beheaded before being landed. A reasonably accurate approximation of the total poundage of fish caught can be obtained by adding 15 percent to the total landings given in Figure 62 to cover loss of weight in cleaning.—*John E. Fitch.*

Reference (see page 210): 48, 121, 133, 137.

2.35. GREENLING SEATROUT

This is a fine food fish taken only in small quantities by market fishermen. Many more are taken by sportsmen. Greenling seatrout, Hexagrammos decagrammus, are found along rocky shores and reefs and around kelp beds from Alaska to Point Conception. Their food consists to a large extent of worms, crustaceans and small fishes. They are also known to eat plants such as sea lettuce. The commercial catch consists solely of fish taken incidentally with rockfish, lingcod or other varieties. Sportsmen take them almost everywhere they fish along the Northern California coast; from rocks or reefs, from skiffs and larger boats. The greenling seatrout belongs to the family Hexagrammidae. There are three similar species found in Northern California, of which it is the most common.

Seatrout seems to be a pleasing name to epicures and is, thus, confusingly used by many dealers and fishermen to indicate other species

TABLE 16

GREENLING SEATROUT

Pounds

1919	47	1936	59
1920	647	1937	57
1921	30	1938	566
1922	101	1939	24
1923	38	1941	143
1925	75	1947	115
1935	30		

TABLE 16
GREENLING SEATROUT
Pounds

of fish. In Southern California the young white sea bass and shortfin sea bass are often miscalled seatrout, as is the sablefish at Newport Beach. In Northern California the steelhead are sometimes so misnamed.—*Robbert D. Collyer.*

2.36. SHARK AND SHARK LIVER

One of the greatest bonanzas reaped from the sea was harvested along the Pacific Coast when it was discovered that the liver of the soupfin shark, Galeorhinus zyopterus, was one of the richest known sources of vitamin A.

The fishery from 1916 to 1937 was principally devoted to the capture of shark for the production of edible carcasses. These carcasses, mainly from the soupfin, the leopard shark, Triakis semifasciata, the smooth-hound sharks, Mustelus californicus and Rhinotriacis henlei, and the dogfish shark, Squalus suckleyi, were absorbed in the Southern California fresh fish markets. The demand in the northern part of the State for this product was never very great. The requirements for shark were limited to supplying this and another small market for the highly specialized soup base derived from the cartilaginous rays of the dorsal and pectoral fins of the soupfin shark. The common name of the soupfin shark was derived from the practice of making soup from the dehydrated fins. This item commanded a premium price in the oriental market. A small amount of effort was expended to supply shark skin for an eastern firm, but this attempt never met with any great success. The difficulty and care involved in removing the skin and preserving it for the market was more trouble than the average fisherman cared to undertake for the amount received.

Long lines equipped with many hooks were the principal means of capture for shark during the years before the vitamin boom. A lesser quantity was taken incidentally in gill and trammel nets. Needless to say, no great development was possible predicated upon the limited demand then prevalent.

Investigation by the F. E. Booth Company in 1937 showed that the soupfin shark had great quantities of very high potency vitamin A in its liver. This information was not generally known and for a short time the market lay dormant. Buying activity on the market stimulated the interest of others and the industry began to expand by leaps and bounds. Prices spiraled from a few dollars to $2,000 dollars a ton in a short while. The shark fever spread through the fishing industry as many fishermen and boats were attracted to shark fishing by the chance to strike it rich. Until 1938 the fishery consisted of small boats fishing with hook and line gear or set gill nets used mainly for taking other species. The sharks captured were generally those taken incidental to other fishing activities. The halibut long line tub gear and gurdy were adapted to shark fishing in 1938. This method remained popular for some time but was soon supplemented and subsequently supplanted by the diver gill net, when it developed that the diver would capture many more sharks than would the hook and line gear. The diver net is a bottom gill net equipped with sufficient weight on the leadline to keep it on the bottom and with enough floats to make it stand like a wall of web from the bottom. It is anchored at both ends. When a shark strikes the web, it attempts to turn or roll and in so doing it is entangled in the net.

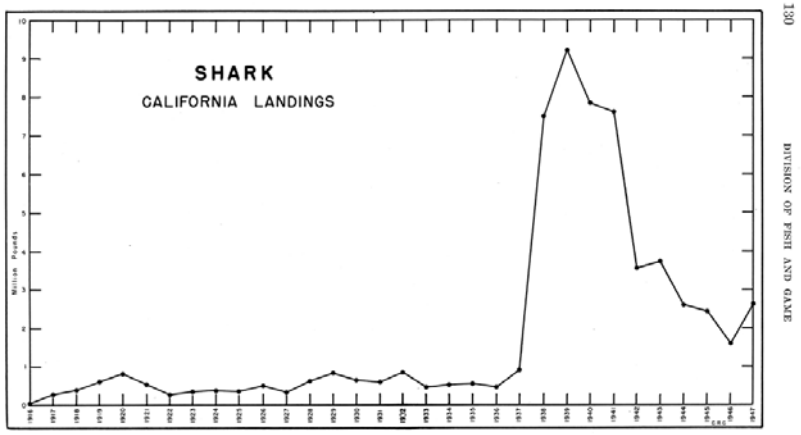

FIGURE 63. In 1937 it was discovered livers of soupfin shark had quantities of high potency vitamin A. Yearly totals incomplete due to practices of throwing carcasses overboard and landing only livers. See Table 48

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With the increased development of the fishery, there came added knowledge of the habits of the soupfin. As a result of the fact that the soupfin was pelagic and could be found far out at sea near the surface during various periods of the year, the floating gill net was developed and introduced into the fishery in 1943. The floating gill net or "floater" is about 1,500 to 1,800 fathoms long and about 10 to 15 fathoms deep of 9½ to 11-inch mesh. Individual variations in construction are not conducive to standardization of the gear. The net is set behind the boat in a line about a mile and a half long. One end is attached to the boat; the other drifts free with a buoy and a light attached. Current and wind usually keep the vessel with some leeway against the net. The drifts are made overnight, during which time the sharks, if any, are entangled in the wall of net that hangs below the surface. To prevent the capture of a great quantity of unwanted great blue sharks, Prionace glauca, the nets are sometimes suspended from buoy lines so that the corkline of the net is several fathoms below the surface of the ocean. The net is hauled into the ship by a power gurdy. The gurdy, or net puller, is constructed in the form of a free sheave placed horizontally. A power shaft extends from the bottom of the sheave through a casing which supports it to the deck of the vessel. Power is supplied to the shaft from the motor of the vessel through a clutch. The V-shaped score of the sheave is usually lined with rubber to give a better purchase on the net.

Coincident with the expansion of the soupfin shark fishery there occurred the development of the dogfish shark industry. The high prices paid for soupfin stimulated investigation of other possible sources of vitamin A. As a result, it was discovered that dogfish liver was another important source. The dogfish liver, however, did not contain oil with as great a vitamin potency as that of the soupfin. Dogfish shark are taken in the northern part of California during the winter at which times otter trawlers usually make special efforts to obtain this species.

Vitamin oils from the soupfin and dogfish sharks were the major sources of vitamin A for the United States during World War II. As a consequence the stocks were fished heavily to supply the tremendous demand that developed, as other sources of vitamin oils were cut off. Shark liver oil was used in the production of vitamin concentrates, in human and animal food fortification, and in therapeutics.

The total shark landings are misleading. The figures given for the years up to 1937 represent for the most part carcass weights as prepared for the market rather than round shark. Several species are included in these totals, and the proportion represented by soupfin and dogfish during this time is not known. The large increase in landings in 1938–39 was the result of the wild scramble for soupfin and is probably a fairly accurate total of round weights of the shark landed. During the first two years of the expanded fishery, the sharks were traded in the round at the fisherman-dealer level. The dealers removed the livers in their plants and sold them either to brokers or vitamin processors. About this time some of the fishermen found that the livers ran somewhat more than 10 percent of the round weight (10 percent liver weight to body weight was the rule of thumb upon which the price per ton of round shark was determined), and began to sell the excised shark livers rather than the shark in the round. Because of this change in marketing practice which began about in 1940–41, the statistics that indicate a

decline during these two years are inaccurate. During this period, some fishermen sold their sharks in the round; others sold the excised livers and the carcasses separately; still others sold livers only. The proportion of each of these various marketing practices represented in the total reported catch is not known; however the figures do represent a minimum record.

Trading of livers between the fishermen and dealers at this time was conducted on an established price per pound. The price was determined on the basis of the average vitamin A potency contained by the livers from a given region during a given season. It soon became apparent to the observant fisherman and dealer that some livers were good (high in vitamin A content) and others were poor (low in vitamin content).* As a result, grading became a practice; poor livers were placed in containers separate from the good ones; and female livers, which were low in vitamin potency, were maintained in a separate category. Some of the more enterprising individuals developed trading techniques based on the principle of *caveat emptor*. The higher potency livers were sold on the basis of chemical analysis of the vitamin content. The poor livers were sold on the open market at the prevailing "blind" price per pound. As the market price was based on the average run of the lot containing both good and poor livers, lots containing nothing but culled remains were not bargains. This iniquity not only depressed the "blind" price on the open market, but was instrumental in bringing about a further change in marketing technique.

Gradually the procedure has developed wherein all livers are offered for sale on the basis of vitamin content. It is now general practice for the fisherman to unload his livers into a cold storage plant. There they are frozen and core samples taken by representatives of commercial analytical firms. Upon receipt of the subsequent report of vitamin content the lot is put on the block. In many cases this procedure is so far removed from the ordinary fish handling and bookkeeping techniques that reports of these transactions are not obtained. Thus, the spread of this marketing method has resulted in more and more omission of shark poundage in our catch records. At San Francisco at present (1947), all livers are sold on potency at auction where interested firms may bid competitively for the merchandise. In other ports livers are sold to individual dealers who follow rather closely the published sale prices of the auctions. In some cases livers are shipped to San Francisco to be offered for sale at the weekly auction.

The transition in trading practices of sharks has been somewhat gradual but erratic. It is most difficult to interpret accurately its effect on the total shark landings. However, there are data at hand from reports made by liver processors that indicate our figures for 1942 to 1946 are low by the following percentages:

1942	41%
1943	22%
1944	16
1945	28%
1946	160%

The above figures should be used with discretion as they in themselves are subject to some question. Nevertheless, it is thought that the trend indicated by the differences might be some help in interpreting the

* Investigation subsequently developed that the production of vitamin A was associated with the growth of sharks, both soupfin and dogfish—the older or larger the shark the more vitamin its liver contained.

data. No attempt was made to distinguish dogfish shark from soupfin so that the relationship between these two species remains clouded. Notwithstanding its decrease in abundance the soupfin shark was by far the most important segment of the total shark catch to 1945.

In 1946 a fishery for basking shark, Cetorhinus maximus, was revived as new uses for the liver oil were developed. The fishery does not approach the soupfin or dogfish in value, there being no appreciable amount of vitamins in the liver oil. The value of this species lies in the commercial use of the liver oil and the utilization of fish meal produced from the carcass.

The fact that shark fillets are used for human consumption is unknown to the consuming public in many cases. Shark has been commonly substituted for other species of fish such as California and Pacific halibut, white sea bass, barracuda, sole, rockfish, etc., and even salmon. During the summer of 1944 the author observed soupfin shark fillets purveyed in a Long Beach restaurant as white sea bass, California halibut, barracuda and salmon. Upon questioning, the owner of the establishment admitted that the fillets sold for salmon had been treated with food coloring to simulate the color of salmon tissue. Elsewhere throughout the State shark has been misrepresented for various other species. Soupfin steaks substitute for halibut in some of the inland communities. Even in a fishery port such as Santa Barbara, entrepreneurs have been known to foist bonito, thresher, and soupfin shark as halibut, rockfish, cod, etc. This has undoubtedly extended the use of shark meat into segments of the population that would not have normally consumed it.

Shark meat is as palatable and nutritious as many other popular species, and there is no sound nutritional, esthetic, or scientific basis for the reluctance attached to the consumption of sharks. The practice of substituting shark for other species, however, is not condoned. Connoisseurs of fish flesh can detect nuances of flavor peculiar to certain kinds. Many markets for fish have been developed and cultivated because of the gastronomic characteristics peculiar to the type. Substitution of shark for other species has a depressing effect on the market for these other fish. The person with a cultivated taste for halibut, for instance, may not be able to detect that he is eating disparaged shark, but he may however perceive that the flavor of the "halibut" is off. A few such experiences and the halibut customer is lost to the trade. Therefore, if for no other reason than to maintain their integrity before the fish consuming public, the industry should attempt to restrain these perfidies.

During the war years, 1941–45, many markets carried shark under its common trade names, whitefish, grayfish, or fillet. Most people in securing this commodity knew or suspected what they were receiving, or were not particularly interested in the lineage of the product, and it was sold and purchased without subterfuge. It appeared in retail markets and in many restaurants and in places where fish products had not been consumed before, as a result of the scarcity of meat. Meatless days, accepted by many restaurants and individuals throughout the nation as a meat conservation move, increased the market and distribution of shark fillets.

The present consumption of shark has fallen materially with the decreased demand upon our fisheries resources. Other products of more well-known repute have replaced shark flesh on the market. The remaining

market for shark carcasses is prevalent only in areas where the low price of this commodity is a factor.

A few other species are taken and their carcasses are of varying degrees of commercial value. Among them are the bonito shark, Isurus glaucus, the thresher shark, Alopias vulpinus, the sevengill shark, Notorynchus maculatus, and the sixgill shark, Hexanchus corinus.—*Wm. Ellis Ripley.*

References (see page 210): 19, 58, 89, 97, 101, 102, 107, 132.

2.37. CALIFORNIA SHEEPSHEAD

The California sheepshead, Pimelometopon pulchrum, ranges from Monterey Bay to the Gulf of California with the greatest abundance south of Point Conception. It is usually found around kelp beds and rocky shores where it feeds on mollusks, crustaceans and small fishes. This species is a member of the family Labridae, as is the señorita but is not related to the sheepshead of the Atlantic coast and the Gulf of Mexico.

The scientific name of this colorful fish means "a beautiful fat forehead" and this is evidently derived from the large fleshy hump on the head of the male which becomes more prominent with age. This fish reaches a length of about 3 feet and a weight of from 20 to 25 pounds, with the depth and thickness of the front portion of the body increasing as it matures. The females and young are usually of a uniform rose color. The males have a striking coloration consisting of a broad crimson band encircling the body and extending from just behind the head to the central portion of the body; the head, dorsal, anal and caudal fins and the posterior portion of the body being purplish black. The lower jaw is white. Both sexes have large protruding teeth in heavy powerful jaws which give them a most pugnacious appearance. The striking appearance of the male makes it an object of interest both in show windows and to passengers in excursion boats around Santa Catalina Island.

Sheepshead are considered to be quite destructive to lobsters as their fondness for crustaceans often leads them into lobster traps where they are caught and used for bait. They are quite adept at detaching their favorite food, abalone, from the rocks. Nothing conclusive is known of this fish's biology except its fondness for crustaceans and mollusks. Two cases have been noted of a female and a male taken near Santa Catalina Island on June 28 and 30, 1936, respectively, wherein the 9¾-inch female contained ripe ovaries of which about one third of the ova was transparent and the 15-inch male was completely spawned.

Sheepshead are caught with hook and line, hand or set lines, incidentally in lobster traps and may be taken with lures trolled at ordinary speeds. In 1943 permits were issued to take them in fish traps in areas where commercial fishing was permitted but constant abuse of the permits resulted in their being revoked in March of 1947. There is no bag limit and the fishing season extends throughout the year with the heaviest landings made in the winter months.

This fish is of minor commercial importance but is ranked fairly high among the sport fishermen partly because of its good flavor. The flesh of the sheepshead is rather coarse but the fat forehead is an esteemed

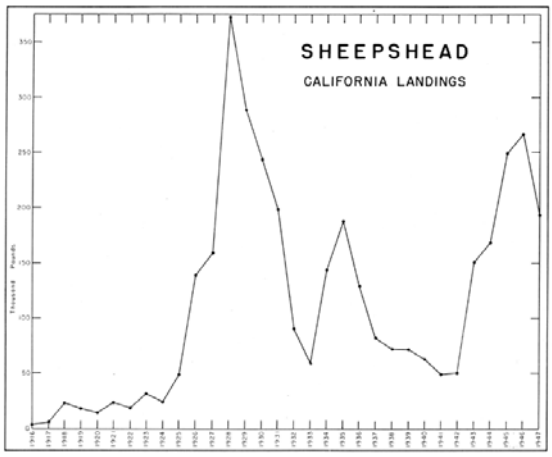

FIGURE 64. See Table 48

FIGURE 64. See Table 48

ingredient for chowder. The flesh has a flavor similar to lobster meat and it is often served as, or mixed with, lobster in salads and cocktails.

The commercial landings have varied between 50,000 and 370,000 pounds per year. The fluctuations in the catch seem to be due to the number of boats fishing rather than to the abundance of fish as this species is consistently plentiful south of Point Conception. Although it is taken incidentally with other species the largest landings are made by a few boats which specifically fish for sheepshead. In 1947 the landings from 7 percent of the boats making catches of sheepshead, constituted 62 percent of the total poundage of this species landed commercially from California waters. Other species frequently taken with sheepshead are rock bass, ocean whitefish and shark. There are considerable quantities landed by the lobster fishermen, probably due to the fact that this fish is used extensively for lobster bait, and spiny lobster and sheepshead are found in the same localities.

Around 1880 large quantities were caught by Chinese fishermen who dried and salted the meat. Between that time and 1925, when the fishery started to expand, there was little demand for the fish which is now sold entirely on the fresh fish market. In 1928 the total catch reached a peak of 370,000 pounds, probably due to the scarcity of other species and the fact that more boats were turning to set line fishing. Again in the period from 1942 to 1946 the demand for sheepshead increased resulting in larger poundages being taken in Mexican as well as in California waters. Since 1930 Los Angeles has been the leading port of landing except during 1940 through 1945 when Santa Barbara took the lead. A small portion of the catch has come from Mexico and since 1942 these poundages have increased considerably. In 1945 the landings from Mexican waters were equal to about one third of the catch from California waters. The average price per pound to the fishermen rose from 2½ cents in 1932 to 9½ cents in 1944.

In the sport catch for 1947, 51,500 pounds representing 13,100 fish were taken from the waters of California. Sheepshead ranked sixteenth in pounds per species taken during the year by party boats and sport fishermen. The larger specimens are considered to be an excellent target for the underwater spear fishermen. They are wary and powerful, putting up quite a struggle when speared.—*James W. Withycombe.*

Reference (see page 210): 133.

2.38. SIERRA

The sierra, Scomberomorus sierra, is a market fish of very minor importance. It deserves more attention, for it is excellent table fare and should make a good canned product. It appears to be abundant off Lower California and there seems no reason for its not supporting a much heavier fishery. Until 1947, it was called officially "Spanish mackerel" and is listed as such in previously published catch records. This name unquestionably accounts in part for the lack of demand, because the jack mackerel, a less desirable food fish, is frequently miscalled "Spanish mackerel" and sold under that name. In any event, the sierra has remained relatively unknown to the California housewife. A good advertising campaign could well result in far wider utilization of this resource.

Sierras are slender, mackerel-like fishes belonging to the bonito family, Cybiidae. They are distinguished by the series of finlets which

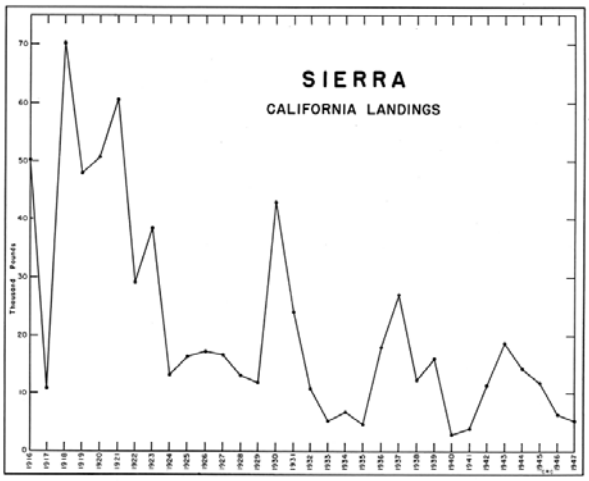

FIGURE 65. Erroneously called "Spanish mackerel." See Table 48

FIGURE 65. Erroneously called "Spanish mackerel." See Table 48

follow the dorsal and anal fins and by the golden bronze spots on their sides. They reach a length of two or three feet and a weight of four or five pounds. The genus, Scomberomorus, includes in all about 20 species which are found in tropical and subtropical coastal seas throughout the world. of these, the sierra is the only common kind found off western North America; it is a Mexican fish which seldom reaches Southern California waters. Another species, the Monterey Spanish mackerel, Scomberomorus concolor, was once found in Central California where it supported a small fishery in the 1870's and 1880's. It disappeared almost completely before 1890 and only a half dozen specimens have been caught since that time. All members of the genus are quite generally called Spanish mackerel. This was one reason for changing the name to sierra, though more fundamental was the confusion with jack mackerel in California.

The entire sierra catch since 1916 would hardly fill three modern purse seiners. The fluctuation in annual landings in no way indicates availability; it merely reflects happenstance catches of a little wanted fish. Market boats operating out of San Diego and Los Angeles occasionally bring in up to a few hundred pounds along with more salable varieties and this constitutes the fishery. The 1947 catch of 5,229 pounds represents 18 deliveries made by 17 boats, while in 1946, 17 boats caught 6,390 pounds in 19 trips.—*Phil M. Roedel.*

Reference (see page 210): 133.

2.39. SKATES AND RAYS

Skates and rays in California, unlike many of our other species, suffer from under utilization. The species that make up the volume of the recorded catch are available in much greater quantity than they are used. Although almost any type of equipment that fishes the bottom may be used to take skates and rays, the great bulk of the catch is derived from trawl boat landings in Monterey and San Francisco. Almost every drag made by trawlers produces a share of skates and rays. A very few are retained, only smaller specimens up to several pounds in weight being considered desirable—all the rest are returned to the sea. Los Angeles landings are from hook and line and from gill and trammel net boats.

The San Francisco region has consumed the greatest portion of the total catch, averaging over 66 percent for the years 1936 to 1947. During the same period Monterey averaged 10 percent; Los Angeles, 5 percent; and the remaining 19 percent was distributed among the other fish producing ports of California.

In the northern part of the State, people of Italian, Japanese, French, and Chinese descent consume most of the production. Only the trimmed wings (pectoral fins) are used from the skates. Rays are seldom, if at all, consumed. The reduction of skates and rays has been attempted several times, but because the price offered for the raw material was of necessity low, the ventures were never successful.

The ups and downs of skate and ray landings have followed roughly the trends of general economic conditions, the peaks of production falling at about the same time as periods of economic plenty. The decrease in landings following 1938 was a result of a shift to the shark fishery

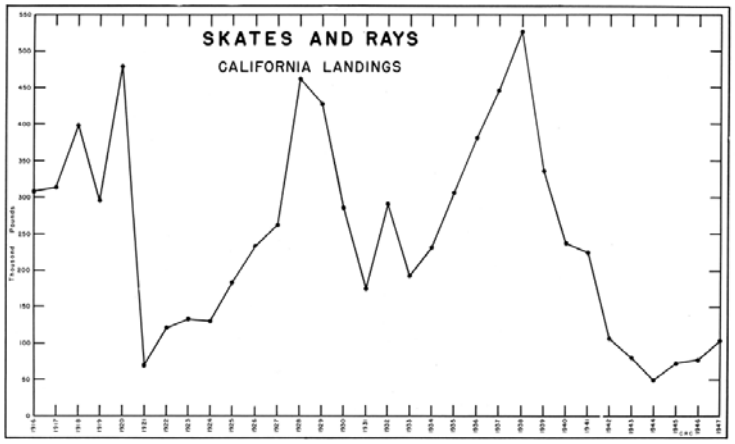

FIGURE 66. See Table 48

FIGURE 66. See Table 48

by nearly all fishermen who were able to make the change, coupled with the entry of the United States into World War II. At the start of the war unfriendly aliens were barred from fishing the offshore waters. This action removed many of the Italian crew members from the drag boats. The forced migration of people of Japanese descent from the coastal areas into relocation centers also contributed to the decrease in the demand. The Japanese market did not revive after the war, probably due to resettlement of these people in other areas and states.

Three species are of importance in the catch—the big skate, Raja binoculata, the California skate, Raja inornata, and the long nose skate, Raja rhina. The big skate and the California skate are considered more desirable.—*Wm. Ellis Ripley*.

Reference (see page 210): 132.

2.40. SMELT

There are four species of fish which comprise most of the catch marketed as smelt in California. These are jack smelt, Atherinopsis californiensis, surf smelt, Hypomesus pretiosus, grunion, Leuresthes tenuis, and top smelt, Atherinops affinis. of these, jack smelt make up most of the catch. Top smelt contribute an estimated quarter of the total and the other species each make up a small fraction. The surf smelt is a member of the true smelt family, Osmeridae, while the others belong to the silverside family, Atherinidae. As the markets often do not separate these smelt they must be treated together. The smelt catch is largely made at San Francisco and ports to the south. Although the flesh of these fish is white and of good flavor, their generally small size and large number of bones reduce their desirability. The yearly catch totals of smelt shown in Figure 67 reflect demand rather than fluctuations in abundance or availability. The high catches in the three years beginning with 1943 are the direct result of a wartime boom. The lumping together of several species in this one record would tend to mask any changes in the abundance of each kind.

Most of the commercial smelt catch is made with round haul nets. They are often taken incidentally by boats fishing primarily for other species. There is no particular fishing season as they are available throughout the year. At Monterey some smelt are taken in circle gill nets. These small nets are laid out in a circle around the school of fish. The fisherman then scares the smelt by throwing into the water a small weighted board attached to a retrieving line. The frightened fish then gill themselves in the net in their efforts to escape. Drift gill nets are also frequently used in smelt fishing. This net is laid out straight and allowed to drift for a few hours. Some smelt are also taken with beach seines at Newport Beach in Southern California. In this method the net is laid out from a skiff as it makes a half circle out through the surf and back. The net is then hauled ashore with a team of horses.

In Southern California considerable numbers of smelt are caught incidentally by boats fishing for live bait. However, smelt are so unsatisfactory as bait that they are used only when no other fish are available.

In addition to the recorded catch, smelt are taken by amateur fishermen from the shore along most of the California coast. North of San Francisco surf smelt are taken with a net similar to the one used for whitebait. Jack smelt and bay smelt may be caught either with baited

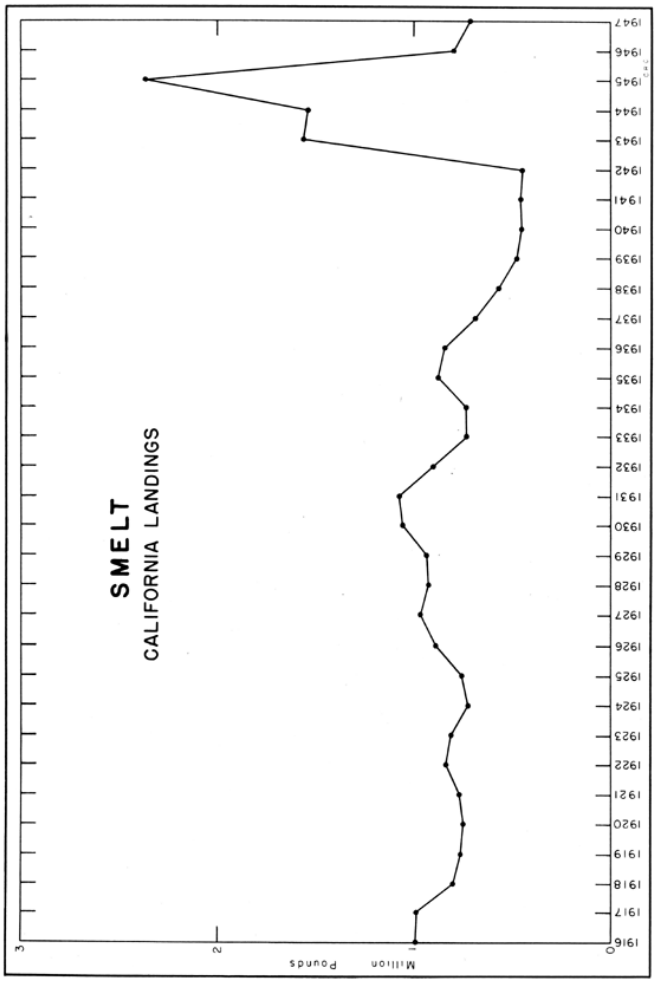

FIGURE 67. See Table 48

FIGURE 67. See Table 48

hooks or by snagging. When snagging the fisherman uses a line with many small hooks. By chumming he attracts a school of smelt around his line. A sudden upward jerk often hooks several fish at once. As smelt are one of the most abundant fishes found close inshore they make up a large part of the dilettante fisherman's catch.—*J. A. Aplin.*

References (see page 210): 24, 25, 26, 33, 53, 90, 125.

2.41. WHITEBAIT

The species of fish which make up most of the market supply sold under the name of whitebait are Spirinchus starksi and Allosmerus attenuatus. The young of several other kinds of fish are also marketed as whitebait.

The yearly catch records shown in Figure 68 reflect demand rather than abundance. At Fort Bragg the fisherman often takes an order for a definite quantity before going out to fish. This is also true at Eureka and most Northern California ports. Over the period shown in the table of landings the totals are an indication of the degree of economic prosperity. This is one of California's few fisheries where demand has not exceeded the ability to produce. The yearly totals since 1943 have shown a considerable increase as transportation from the outlying beaches in Northern California has improved and better refrigeration has helped in speedier utilization of this highly perishable product. During World War II a small proportion of the catch was dried and sold in the Chinese markets of San Francisco. However, with the return of trade with the orient this business has stopped.

FIGURE 69. Whitebait net of American Indian origin in use on the Humboldt County beaches. The most effective method of catching these fish. Photo by Wm. Ellis Ripley, 1948

FIGURE 69. Whitebait net of American Indian origin in use on the Humboldt County beaches. The most effective method of catching these fish. Photo by Wm. Ellis Ripley, 1948

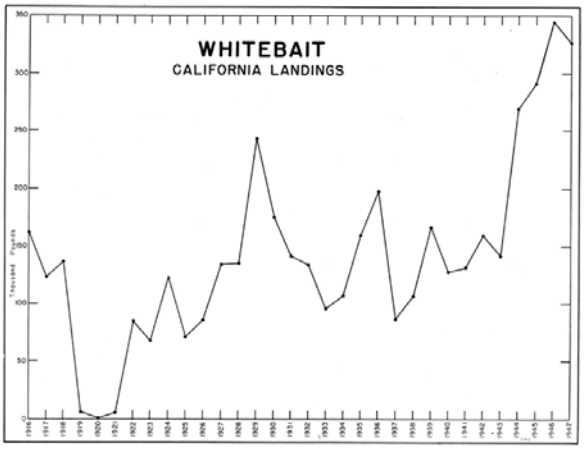

FIGURE 68. See Table 48

FIGURE 68. See Table 48

Whitebait is fished along the coast of Humboldt and Del Norte Counties with a net of the type shown in Figure 69. This net is of American Indian origin and still is the most effective method of catching these fish. Fishing begins at the turn of the high tide and lasts an hour or more. Sometimes a fisherman working at night can locate the schools of fish by feeling them strike against his legs as he stands in the wash of the surf. When a scoop of the net has caught only a few fish, they can be shaken back into the sack held by the hand at the point of the triangle. Here they can be held while other tries are being made. This makes it unnecessary for the fisherman to go up the beach to empty his net so often. During a good run of fish it is now possible to see as many as a dozen nets in operation along a stretch of a half mile of beach near Arcata. This is a considerable increase over the number of fishermen seen on the same beach before the war.

Probably the unrecorded catch of whitebait by the sport fishermen north of San Francisco has increased in proportion to that of the commercial catch. This increase has been the result of improved roads and a greater local population. So far no regulation of this fishery has been deemed necessary.—*J. A. Aplin.*

Reference (see page 210): 9.

2.42. OCEAN WHITEFISH

The ocean whitefish, Caulolatilus princeps, is found from Central California south into Lower California and has been taken at the Galapagos Islands and Peru. The largest California landings are reported from the Los Angeles area.

This fish is handled entirely in the fresh fish markets. It not only has a delightful flavor but it is also beautiful to look at with its bright hues of blue, green, yellow and brown. In Northern California the hake is often erroneously called ocean whitefish. The two fish do not resemble each other in the least, the ocean whitefish being as described above, while the hake is a dirty slate color and its flesh is soft and flabby.

Ocean whitefish is caught on set lines baited with squid, or sometimes with mackerel when squid are not available. The lines are set in various depths from 30 to 100 fathoms and are pulled up about every four hours. The catch from this type of fishing gear will be variable with rockfish predominating. Some localities will yield mostly rockfish, others mostly sculpin or ocean whitefish.

Since the ocean whitefish is taken on the same gear as rockfish the landings will reflect to a certain extent the Southern California landings of rockfish. Thus there is a period of large landings from 1924 to 1931 during the time when rockfish were plentiful and in great demand. Since 1931 the supply of rockfish has diminished in Southern California, and more and more boats have dropped out of the fishery with the result the ocean whitefish landings have fallen off proportionally. The war years created an unusually large demand for fish of all kinds, and this is shown by the increased landings from 1942 to 1945.—*Charles R. Clothier.*

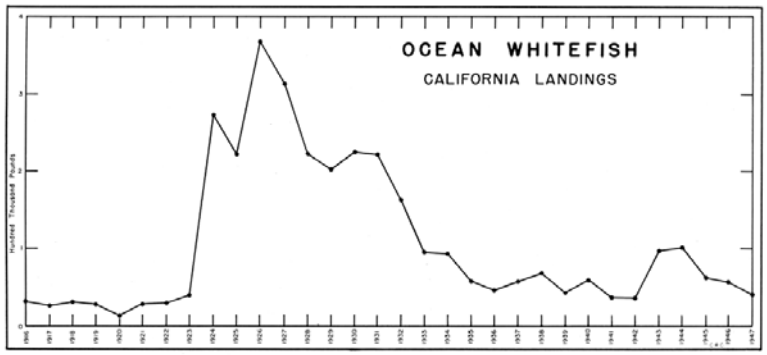

FIGURE 70. See Table 48

FIGURE 70. See Table 48

2.43. YELLOWTAIL

Yellowtail, Seriola dorsalis, is a sportfish of prime importance in Southern California. It is a fish that can be taken by anglers from boats, and occasionally from shore. Yellowtail is generally taken on live bait, but it may also be caught by trolling. It is noted for its fighting qualities, and by many sportsmen it is considered second only to the albacore in gameness.

Yellowtail is taken commercially by boats of all types, using various gear. It is taken in purse seines, and incidentally caught in gill nets. The larger bait boats rarely deliver this fish in quantity because the fresh fish demand is limited and competitive; the cannery demand for it is small, inasmuch as it is a less desirable canning species. The cost of the raw product and the cost of processing it make it difficult to market. The smaller tuna bait boats, however, frequently catch yellowtail to complete a partial load when the more desirable tuna is not available. Some of this is sold to the markets, and the surplus is delivered to the canners. Small jig boats take a good many yellowtail, and there is a fleet of small live bait boats fishing for the markets at San Diego, catching seasonally considerable quantities a short distance south of the border.

The yellowtail is not a tuna, but with the jack mackerel is in family Carangidae. Its range is from Central California south along the Mexican coast into the Gulf of California. It is taken commercially from Point Conception south to the tip of Lower California. The commercial catch is greatest between June and September. However, it may be caught the year around in Mexico.

In 1933 legislation was passed which prohibited the taking of yellowtail by seiners in California waters during certain months and after 1940 this regulation was effective throughout the entire year. Between 1933 and 1940 further protection was given yellowtail by making it illegal to take them in California waters for the purpose of canning. This legislation stimulated fishing south of the international border and the small live bait boats of San Diego then ranged along the Mexican coast as far as Cedros Island, and intensively around the Coronado Islands, delivering their catch to the canneries. Except for prohibition of canning, these laws are still in effect, and, with one or two additional ones regulating quantity per person, influence the catch of yellowtail today.

In 1918 the catch was high due to the war and the "eat less meat" campaign of that time. In 1919 and 1920 the catch fell precipitously, and then rose gradually to a relative equilibrium. It has been noted in an earlier publication that the amount of yellowtail canned parallels the catch (Fry, 1937b). Apparently the poundage caught depends a good deal on the canners demands. Hence it is likely that the quantity sold on the fresh fish market is relatively stable. Between 1921 and 1935 the canners had little desire for this species. In 1935 and 1936 the yellowtail catch was again high, and this was due apparently to a healthy market for canned fish, inasmuch as the quantities canned in these years increased strikingly. Moreover the restriction of fishing in local waters, caused a more extensive exploitation of the richer grounds along the Mexican coast. Canned yellowtail is usually packed in a solid or flake form. The flake form makes a tastier, less pungent, more desirable pack.

Between the years 1936 and 1940 there was a large sport catch of yellowtail reported. During the war years there was little if any marine

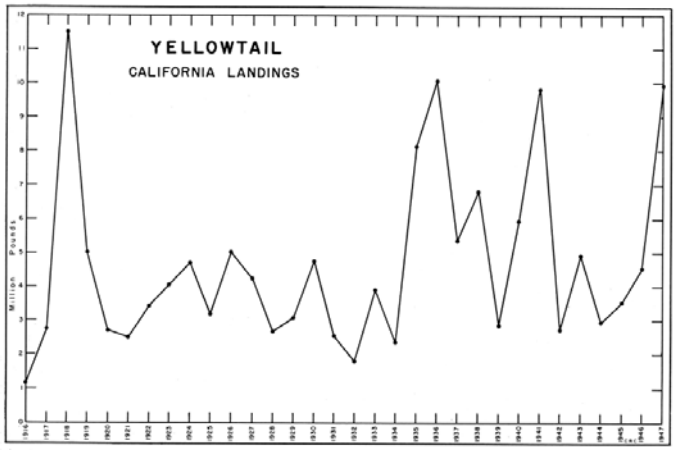

FIGURE 71. See Tables 24, 26, and 48

FIGURE 71. See Tables 24, 26, and 48

sport fishing, and in 1946 when the gathering of records was resumed, the sport catch had diminished to an exceedingly low level (see Table 26). The catch continued low in 1947, but the fact that the commercial catch in that year approached the peaks of 1981 and 1936, would belie any claims to depletion. Apparently the yellowtail were not available in those years to the local sportsman of Southern California.

During World War II the commercial catch varied. When the government took over the larger boats in 1941 and 1942, the supply of tuna delivered to the canners decreased. The smaller live bait boats that remained had a good market for their available catch of yellowtail, and the total catch in 1942 approached the 1918 record take. An increased demand from the canners and higher prices paid in 1947 resulting from the end of the office of Price Administration regulations caused the increase in poundage that year. The price has varied and it no doubt affects the catch, but to get a clear picture of the extent of its influence it would be necessary to take into consideration all economic aspects. The price paid to the fisherman reached an extremely high point of $225 per ton during the war and postwar years.—*Edward C. Greenhood.*

References (see page 210): 62, 133, 139.

2.44. ALASKA COD

No California ships have gone north to fish for Alaska cod, Gadus macrocephalus, since 1937. During that year the one California company sending ships north lost its packing plant by fire. The industry was at such a low point that it was economically unsound to revive it in California. Seattle companies continued to send a few ships north each spring until 1942 when the fishing grounds became a war theater and the fishing fleet was taken over by the government for military service. Up to and through 1947 no ships have returned to the Alaska cod fishery.

Because Alaska cod were landed in California in a prepared state, salted, the amounts brought in do not appear in California fresh fish catch figures. The accompanying graph was prepared from figures gathered by the "Pacific Fisherman" directly from the fish companies. Codfish landings are always shown in numbers of fish. Additional scales of weights have been placed on the graph to facilitate comparisons with the other figures in this bulletin. The size of the fish varies from year to year, but the average weight of the fresh fish is 12 pounds; average weight as landed is about 3¾ pounds. Shortly before Californians left the fishery the average size of the fish became smaller and smaller, and the companies had to set minimum size limits to eliminate even smaller fish from the catch.

The graph illustrates the declining success of the California fleet since 1919, the peak year of heavy wartime demand. Various reasons have been suggested for this lowered productivity. First, competition for the available fish on the fishing grounds increased as more and more Japanese trawlers either caught most of the fish or scattered the schools to such an extent that our ships' dory fishermen, restricted to the use of hook-and-line, were unable to make good catches. It finally reached the point where, in 1936, one California ship didn't even fish her fleet of dories, but returned home with a 360-ton load of cod that had been purchased from Japanese trawlers. Second, the increased competition,

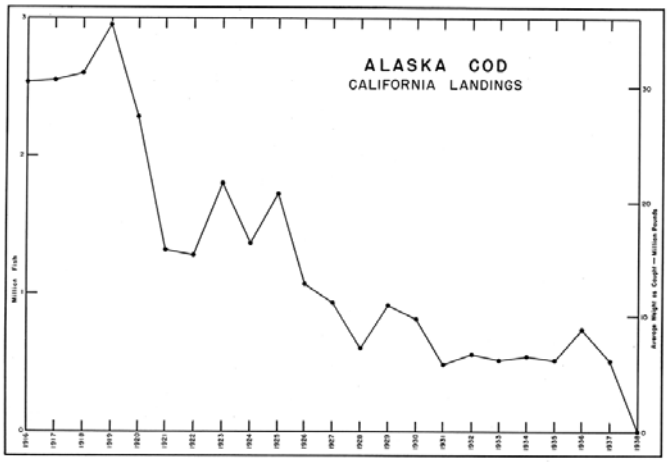

FIGURE 72. Alaska cod figures are not included in California commercial landing totals. Average weight 12 pounds per fresh fish when landed in Alaska, 3¾ pounds upon arrival in California cleaned and salted. See Table 17

FIGURE 72. Alaska cod figures are not included in California commercial landing totals. Average weight 12 pounds per fresh fish when landed in Alaska, 3¾ pounds upon arrival in California cleaned and salted. See Table 17

TABLE 17

ALASKA COD LANDED IN CALIFORNIA—1863-1937

Year	Number of fish [1]	Year	Number of fish [1]
1863	7,100 [2]	1901	1,429,000
1864	54,500	1902	2,073,000
1865	225,000	1903	2,022,300
1866	724,000	1904	2,021,200
1867	943,400	1905	2,610,133
1868	580,000	1906	2,368,632
1869	1,032,000	1907	1,858,751
1870	1,467,000	1908	1,904,403
1871	926,000	1909	1,497,361
1872	305,500	1910	1,060,600
1873	563,000	1911	1,348,000
1874	369,000	1912	1,624,984
1875	362,000	1913	1,374,847
1876	844,000 [3]	1914	2,412,202
1877	857,000	1915	2,367,900 [2]
1878	1,129,000	1916	2,537,500
1879	1,499,000	1917	2,557,000
1880	1,203,000	1918	2,606,268 [4]
1881	1,061,000	1919	2,961,500
1882	1,241,000	1920	2,284,000
1883	1,720,000	1921	1,318,000
1884	1,622,000	1922	1,277,000
1885	1,374,000	1923	1,806,377
1886	1,183,000	1924	1,371,647
1887	1,126,000	1925	1,734,000
1888	1,046,000	1926	1,074,704
1889	816,000	1927	931,000
1890	1,138,000	1928	599,402
1891	1,220,000	1929	915,000
1892	1,312,000	1930	813,000
1893	1,216,000	1931	482,660
1894	894,000	1932	556,423
1895	939,000	1933	514,000
1896	728,000	1934	541,485
1897	1,065,000	1935	512,039
1898	742,000	1936	737,731
1899	1,302,000	1937	508,974
1900	1,532,000		

[1] Average weight of fresh cod 12 pounds each.

[2] Data for 1863-1915, from Cobb, John N., Pacific cod fisheries. U. S. Comm. Fish., Rept. (for 1915) App. 7, 1917. Data for 1916-1937, from Pacific Fisherman.

[3] 1876 includes catches of shore stations which operated for the first time in 1876. Figures for following years include station fish brought to San Francisco.

[4] Includes landings by Japanese vessels from Okhotsk Sea. 1918, 728,000 fish, four vessels. 1919, 612,500 fish, three vessels. 1920, 92,000 fish, one vessel.

TABLE 17

ALASKA COD LANDED IN CALIFORNIA—1863–1937

coupled with adverse economics played an important part in curtailing California's Alaska cod fishery. The catch had to be transported thousands of miles for processing and marketing, and because handling costs increased more rapidly than retail prices, it became continually less profitable to handle Alaska cod. Finally it was more profitable to process Atlantic cod, Gadus morrhua, a close relative of the Alaska cod, shipped from eastern Canada, and this has been the condition in California since our fleet left the fishery after 1937.

A method of vacuum packing the salted cod in cans was introduced to the industry in 1936 and held promise of reviving the demand for cod by making it more accessible to the retail trade. It was believed that canning would overcome the handicaps of a perishable product, troublesome to transport and difficult to display effectively. Although this vacuum pack did facilitate handling and displaying unfortunately canning did not prevent spoilage during hot weather because no sterilization process was used. The freshly curred cod reached the market in more acceptable condition but canned cod did not gain much popularity among the discriminating buyers.

While cod is thought of principally as a dry-salt fish, some is preserved as stockfish by air drying; some is made into fillets and some sold in the fresh fish market to the north of California. Stockfish is used in making "lutfisk," a favorite Scandinavian dish for the Christmas and New Year holidays.

Alaska cod is one of the few potential fishery resources remaining and the Pacific banks are estimated to be large and capable of greater production. When plants are established near the fishing grounds and improved transportation facilities become available, this resource may be more fully utilized.—*Eldon P. Hughes.*

Reference (see page 210): 45.

2.45. CRABS

The most important crab in California is the market crab, Cancer magister, sometimes called the white crab or Dungeness crab. The range of this species is from Alaska to Magdalena Bay, Lower California, but only occasional specimens are found south of Point Conception, California. This is the meatiest and best flavored of our crabs and the only one that receives protection in this State. In Southern California, where the market crab is very scarce, three similar but less desirable species, Cancer antennarius, C. productus, and C. anthonyi, collectively termed "rock crabs," are caught locally and marketed to a limited extent. Previous to 1928, the landings of rock crabs were not important and did not appear on our statistical records. Even now the annual landings of these crabs are relatively unimportant. During the period 1932–1947, the average annual poundage of rock crabs amounted to 8,800. During the same period, the average annual poundage of market crab was 4,300,000. Quantities of the market crab, cooked and iced, are shipped into the Southern California region from Northern California and Oregon ports.

Commercial fishing for the market crab is carried on from Monterey Bay northward into Alaskan waters. South of Monterey Bay the market crab is not abundant enough for commercial exploitation. This crab is taken over a sandy bottom for the most part, but also over a clay or mud bottom on occasions. The main fishing areas along the California coast are: Crescent City to the mouth of the Eel River in the Crescent City-Eureka region; around Bodega Bay, and Point Reyes to Halfmoon Bay in the San Francisco region; off Moss Landing in Monterey Bay in the Monterey region. Fishing operations are conducted by one or two men, in power boats usually 20 to 40 feet long.

The first legislative protection given crabs was in 1897, when a law was enacted prohibiting the possession and sale of female market crabs. The next step, in 1903, was a minimum size limit of six inches breadth, for males, measured straight across the back from point to point. In 1911, the minimum size limit for males was increased to seven inches, and this limit has remained in effect since that time. This greatly eliminated the possibility of females being taken through inability to distinguish the sexes, because females seldom attain that size. It was required also that crabs brought to shore or offered for sale be whole and in the shell so that they could be measured. In 1929, the law was amended to permit the sale of crab meat not in the shell. The canning of market crabs captured in California was not permitted commercially until 1941.

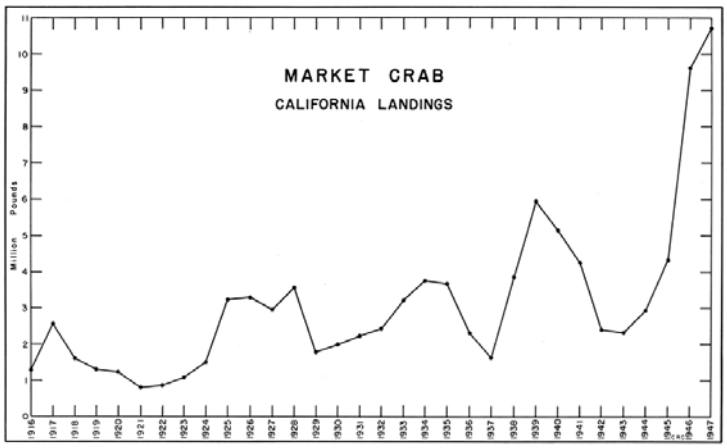

FIGURE 73. For rock crab see Table 49

FIGURE 73. For rock crab see Table 49

Added to the ban on female crabs and the size limit on male crabs, there is a closed season on market crabs which covers the main molting period. The first closed season, September 1st-November 1st, was established in 1903. Since then the dates of the closed period have been changed several times. In 1929, different closed seasons were established for the part of the State north of the Mendocino-Sonoma county line, as it was found that the crabs in the north molted a little later in the year than did crabs to the southward. For about 15 years previous to 1929, the closed season for the whole State was July 31st-November 14th. This same closed season was retained for the portion of the State south of the Mendocino-Sonoma county line until 1935, at which time the closed dates were changed to August 16th-October 31st. Since 1929, the closed season for the portion of the State north of the Mendocino-Sonoma county line has been August 31st-December 14th.

In Del Norte, Humboldt and Mendocino Counties, local county ordinances that curbed the export of crabs existed until 1917, when a state law was passed which prohibited the shipment of market crabs outside of the coastal districts between the Oregon state line and the Mendocino-Sonoma county line. In 1923, this regulation was amended to prohibit holding crabs in live boxes in this area. The purpose of this latter regulation was to prevent fishermen from accumulating large quantities of crabs at one time and to discourage smuggling, which was prevalent some years ago. However, in 1938 the courts rendered a decision that crabs caught outside the three-mile limit are not subject to the state law which prohibited the shipment of crabs from the Del Norte-Humboldt-Mendocino district. In 1941, the state law was changed so that crabs caught anywhere in this district could be shipped out of this region. In 1947, legislation prohibited possession of more than 500 pounds of crabs on a drag boat.

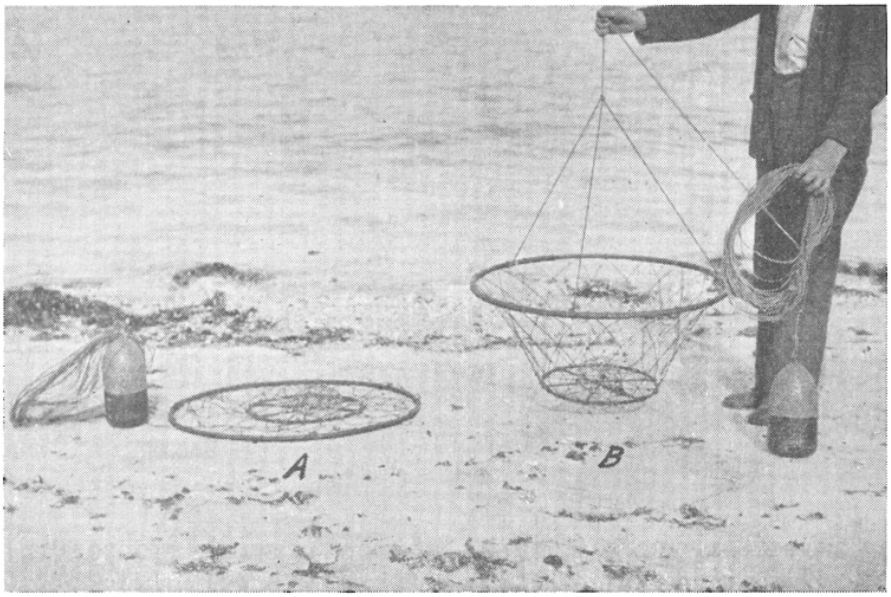

FIGURE 74. Crab hoop net. The trap on the left is collapsed, as it is when on the bottom of the ocean. That on the right is extended, as it is while being hauled quickly to the surface. When the trap is on the bottom, the crabs are attracted to the center of the net by the bait held in a small receptacle. Coarse mesh cotton webbing is attached between the larger and smaller hoops. Photograph by J. B. Phillips, May, 1934

FIGURE 74. Crab hoop net. The trap on the left is collapsed, as it is when on the bottom of the ocean. That on the right is extended, as it is while being hauled quickly to the surface. When the trap is on the bottom, the crabs are attracted to the center of the net by the bait held in a small receptacle. Coarse mesh cotton webbing is attached between the larger and smaller hoops. Photograph by J. B. Phillips, May, 1934

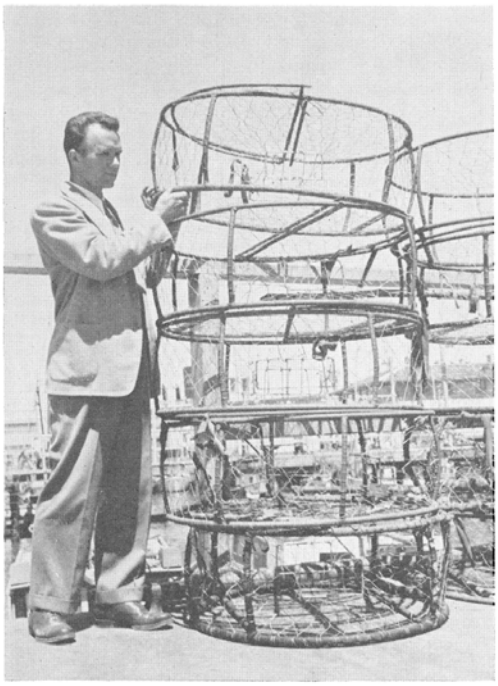

FIGURE 75. A stack of five circular crab pots. The iron framework of each trap is covered with coarsely woven wire mesh, leaving two entrance tunnels on the sides, one opposite the other, and a hinged lid covering half of the top ring. A bait box or bag is hung between the two entrance tunnels. The crab, attracted by the diffusion of juices from the bait, crawls through the entrance tunnel and falls into the trap. A retrieving line on each pot is attached to a small buoy, which floats at the surface of the water. Photograph by J. B. Phillips, August, 1948

Crab hoop nets were used in the crab fishery from San Francisco to Crescent City until about 1938, at which time the crab pot started replacing the hoop net in the Crescent City-Eureka region. (See Figs. 74 and 75). During the last few years, about 90 percent of the crabs landed in this region have been taken in crab pots, the balance in hoop nets. In 1943, several crab fishermen were using pots at San Francisco. Since that time, an increasing number of fishermen in that area have turned to crab pots, and now the bulk of the crab catch is accounted for by this type of gear. At Bodega Bay, crab pots have been used exclusively for the past several years. Gill nets have been used in Monterey Bay for catching crabs since the early days of the fishery. Although hoop nets have been tried from time to time, they have not been widely used in Monterey Bay, nor has the crab pot been given a fair trial.

The annual crab landings for California for the period 1916–1947 are plotted in Figure 73. The lowest annual landing was just under a

million pounds in 1921, while the highest annual landing was nearly 11,000,000 pounds in 1947. The annual poundage trend has been upward during the entire period. During the first half of the 32-year period, 1916–1931, the average was about 2,000,000 pounds, while during the second half, 1932–1947, the annual poundage averaged a little over 4,000,000.

Over the entire period, 1916–1947, an average of 75 percent of the state poundage was landed in the San Francisco region, 22 percent in the Eureka region and 3 percent in the Monterey region. Until 1938 90 percent of the state crab landings were made in the San Francisco region and only 6 percent in the Eureka area. Due to the court decision that crabs taken outside the three-mile limit could be shipped from the Eureka region and the passage in 1941 of a state law legalizing the shipment of crabs caught anywhere in the Eureka region the Eureka percentage rose to 36 percent for the period from 1938–1947, with 61 percent credited to San Francisco.

Although the San Francisco region percentage was lower for the 1938–1947 period, the actual poundage of crabs landed had not been reduced. The trend line for the San Francisco landings has been slightly upward since 1925, and in 1947 the total catch of 5,000,000 pounds topped any previous year. Eureka region first surpassed San Francisco in 1946 with a catch of close to 6,000,000 pounds, and it also topped San Francisco in 1947. The fishery in Monterey Bay has always remained relatively poor because of the scarcity of crabs this far south.

The greatest increase in the annual catch since 1938 has occurred in the Eureka region, a region that had been but partially exploited, previously. Shortly after 1938 an industry developed in "picked" crab meat. Crab meats are packed in five-pound cans and shipped to large cities in the west and eastward to Salt Lake City.—*Julius B. Phillips.*

References (see page 210): 23, 43, 80, 89, 94, 95.

2.46. SPINY LOBSTER

The California spiny lobster, Panulirus interruptus, is now one of the most expensive products of our marine fisheries. The lobster has enjoyed an unprecedented demand in the postwar years, and the landings, both from California waters and from Mexico, are the greatest since records were first kept in 1918.

While the spiny lobster ranges from San Luis Obispo County as far south as Magdalena Bay, Lower California, the commercial fishery is restricted to the coast and outlying islands from Point Conception southwards to central Lower California.

Spiny lobsters are protected by a closed season between March 15th and October 1st. They are further protected by a minimum size limit of 10½ inches, and a maximum size limit of 16 inches. (1948.)

Box-like traps constructed of lath or wire are the chief means of capture of spiny lobsters. They are baited with fish heads or other waste fish, and sunk into waters up to 35 fathoms in depth. Most traps are fished in less than 10 fathoms, especially toward the latter part of the season. The lobsters caught in the traps may be transferred and held alive in receivers, anchored in the kelp, until a load is secured.

Lobster are marketed either fresh or frozen and are sometimes shipped alive to points not over 24 hours from the point of landing. No

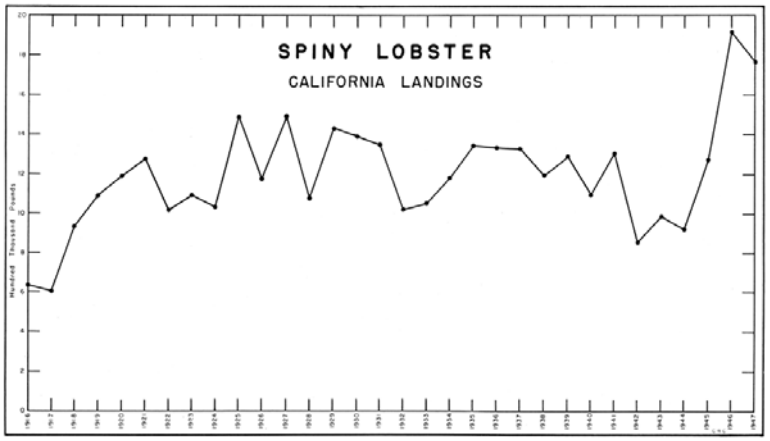

FIGURE 76. Landings from California and Mexican waters. See Table 49

FIGURE 76. Landings from California and Mexican waters. See Table 49

lobsters are canned in the State. San Diego, Los Angeles, Newport and Santa Barbara are points of landing for spiny lobsters. San Diego received twice as much as Los Angeles in 1947, chiefly because most of the Mexican imports are received there.

As may be seen from Table 49, the imports from Mexico are two to three times as large as the landings from the waters of this State. Formerly it was required that lobsters be alive when landed or delivered from Mexico, but now lobsters may be, and are, imported in the cooked condition. No lobsters may be imported into the State during the California closed season. Since the Mexican season conforms with the open season in California, there is in effect a uniformity of fishing season throughout the habitat of this species.

The 1946 and 1947 landings of lobster from waters of the State are the greatest since records have been kept. This, possibly, may be attributed to greatly increased demand, and to the fact that some areas in the Channel Islands were not fished during the war years. During this time it is possible that the local populations were able to recuperate from long continued exploitation, and yield now the reserve accumulated in the intervening years.

No direct index of effort applied to the California fishery can be readily derived from our records, but there are indications that the number of lobster fishermen has greatly increased since 1945. The reaction of the lobster population in California waters to this increased fishing pressure cannot be positively foretold, but in view of the more or less stabilized condition of the fishery prior to the war, the outlook for a future sustained high catch is doubtful.

Under the present regulations, lobsters to be held for sale during the closed season are marked with a punch. This is a much abused system, opening the way to poaching and other unlawful activities. It is doubtful if the State is getting complete records of the catch.—*Robert C. Wilson.*

Reference (see page 210): 140.

2.47. SHRIMP AND PRAWN

The shrimp fishery of California centers in the San Francisco Bay area. The San Francisco fishery started around 1869, and except for a short lived fishery in Monterey Bay, has remained California's sole source of native shrimp. Crago franciscorum and Crago nigricauda are the species taken and have no counterpart in other fisheries in the United States. Monterey Bay shrimp men fished in about 150 fathoms of water for the prawn, Pandalus platyceros, in the early 1930's, but, due to the destruction of most of their traps in a heavy storm and the difficulty of working in such deep water, this fishery was not continued. Experimental fishing (1920–1921) in Southern California found both Pandalus and Peneus but not in commercial quantities.

The gear used in California has undergone very little change since the inception of the fishery. Italian fishermen found that small-meshed seines worked for shrimping but could not compete with the Chinese shrimp net which was introduced in 1871. The Chinese nets look very much like giant old-fashioned nightcaps. These are set and must be lifted at each change of tide to keep them from becoming tangled. About forty-five years after the introduction of the Chinese net, the shrimp

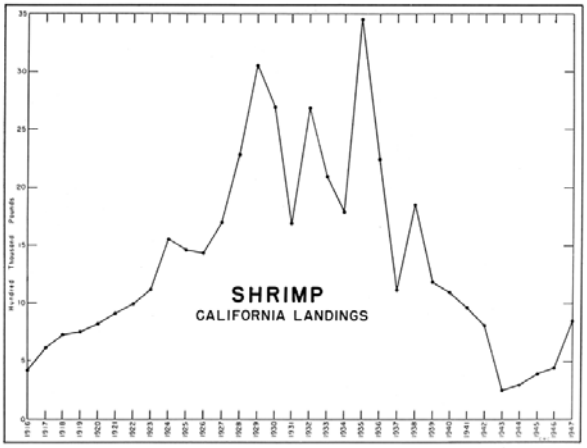

FIGURE 77. Includes prawn from California waters, excludes importations of shrimp and prawn. See Table 49

FIGURE 77. Includes prawn from California waters, excludes importations of shrimp and prawn. See Table 49

trawl, a type of beam trawl, was introduced. This trawl is drawn along the bottom to make the catch. The Chinese nets have been used in south San Francisco Bay and the shrimp trawls make their catches in the northern part of the bay. Monterey Bay fishermen found that the bamboo bottle-shaped octopus traps were quite efficient for the taking of small catches of prawns. This trap with modifications made it possible to catch prawns more successfully, with catches of up to 250 pounds per day being recorded.

Shrimping is carried on practically entirely with trawls throughout the shrimp fisheries of the United States. For the most part, otter trawls have taken the place of the older beam trawls. A very recent development in the South Atlantic fishery substitutes a special type of mesh for the bag. The foundation of the mesh is hard laid twine in conjunction with coextensive strands of soft long fibre cotton twine. The hard twine shrinks on contact with the water, whereas the soft twine stretches. The shrimp, with forward pointing spines, become entangled in the soft twine, while fish, whose spines point to the rear, are permitted to escape. The mesh measure, for the hard twine, is approximately 1¼ inches and seven-eights of an inch for the soft twine. Tests have shown that not only are small fish released but that shrimpers who have used the new type of netting are completely satisfied.

There has been some experimenting with the electronic sounding devices which have recently been tried in so many fisheries. One test in an area near the mouth of the Colorado River, Gulf of California, was quite successful. This method of detecting shrimp beds by the variation in the return of high frequency sound signals sent to the bottom of the ocean would reportedly save many hours of futile dragging operations along with the attendant costs for operation of the gear.

The San Francisco Bay shrimpers are, by law, allowed to dry up to 50 percent of a load. In 1947 slightly over 300,000 pounds of shrimp were dried and 540,000 pounds were sold fresh or frozen for shipment or for future sale. Most of the dried shrimp meat product is exported to China, although part is utilized locally. Shrimp meal, composed of ground shells and waste, is utilized in fertilizers and animal feeds.

Imported fresh and frozen shrimp find retail outlets in California. Arizona and California shrimp imports from Mexico totaled well over 11,000,000 pounds for 1947. A separation for the two states is not available. All of the Mexican imports, except 5,000 pounds of dried shrimp, arrived as fresh and frozen shipments. Since about 1941, a large shrimp has been imported into California from Guaymas, Mexico. These are shipped in the frozen state, without heads, and run 12 to 15 shrimps per pound. They are quite popular in the restaurants of the Los Angeles

TABLE 18

SHRIMP IMPORTS FROM MEXICO INTO ARIZONA AND CALIFORNIA—1947 [1]

January	994,843	July	309,386
February	1,226,217	August	126,963
March	1,517,088	September	354,319
April	1,062,913	October	1,273,141
May	344,452	November	1,723,432
June	583,973	December	1,712,605
Total pounds			11,228,432

[1] Record from U. S. Department of Interior, Fish and Wildlife Service, Market News Service, 1947.

TABLE 18
SHRIMP IMPORTS FROM MEXICO INTO ARIZONA AND CALIFORNIA—1947

and San Francisco areas. A comparison of the Mexican imports with the 1947 San Francisco total, some 800,000 pounds, indicates that a market exists in California which is far above our present ability to supply from California waters.—*Parke H. Young and James W. Withycombe.*

References (see page 210): 12, 56, 57, 60, 65.

2.48. ABALONE

The abalone is a marine snail that originally was an important item in the food supply of the Indians of the west coast of North America. Between 1850 and 1900 abalones were gathered in such quantities between tide lines by the Chinese portion of the population that legal restrictions were imposed to curb the over-exploitation. The Chinese dried the abalones and shipped them to China. They also exported the shells to that country. In the 'seventies there was such a demand for curios and jewelry made of abalone shell that the shell was worth twice as much as the meat. There is little demand, at present, for abalone shell jewelry.

Having decimated the beaches of abalone and having been effectively curbed by legal restrictions, the Chinese were practically eliminated from the fishery. The Japanese then introduced the diving suit and moved out into deep water. They controlled the fishery until about 1930 when a number of Caucasians began diving at Morro Bay. At the beginning

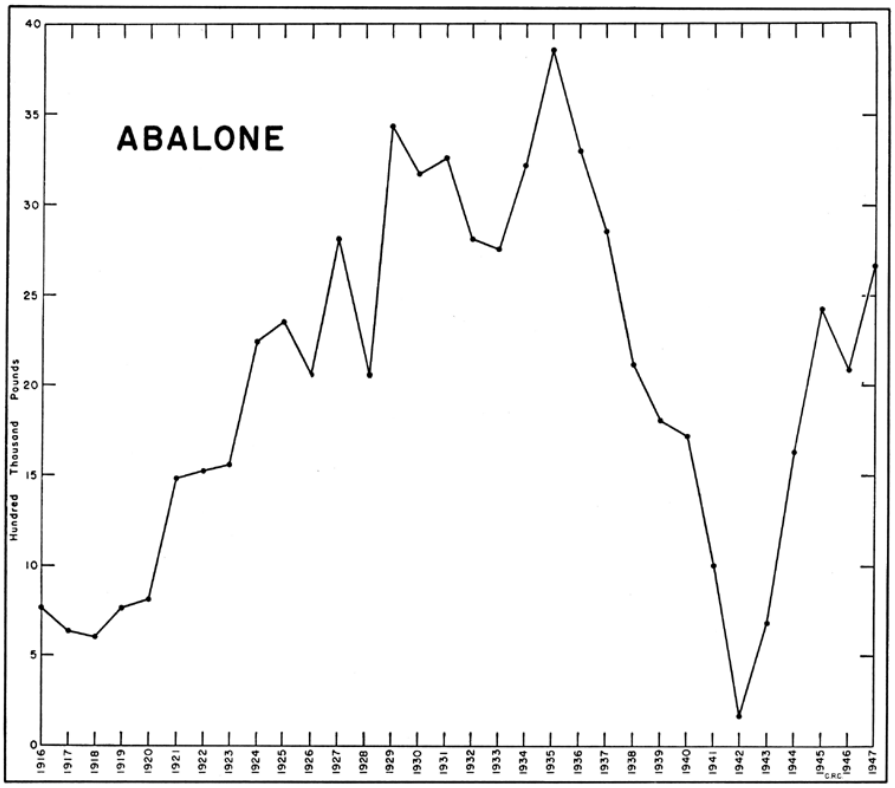

FIGURE 78. Importations not included. See Table 50

FIGURE 78. Importations not included. See Table 50

of World War II, in 1941, there were about equal numbers of white and Japanese crews. During the war the Japanese were not allowed to operate, and none of them have so far gone back into the fishery.

The Japanese divers received $1 a dozen for their abalones and this price had been increased to $2.50 by 1941. The present price to the diver is about $6 a dozen for the red and $5 for the green abalone.

The present fishery is based chiefly on the red abalone, Haliotis rufescens, and is concentrated between Point Conception and Monterey. During the war the divers went to Southern California and gathered gelidium, the marine algae from which agar is produced. The southern area was opened to abalone diving at this time so that the divers could supplement their incomes. South of Point Conception there are few red abalones. The southern green, H. fulgens, and the pink or corrugated, H. corrugata, which occur in this area are not as large or as plentiful as the reds to the north but the divers could make a good living by moving to deep water for abalones when it was too rough close to the beaches to collect gelidium, which grows in shallow water. With the end of the war, however, even this arrangement was not profitable and most of the diving crews have moved back to Morro Bay and Monterey.

Other species found along the California coast but which seldom enter the commercial catch are the black abalone. H. cracherodii; the threaded abalone, H. assimlis, which is taken in deep water and does not grow very large. The northern green abalone, H. wallalensis, and the Japanese, H. kamschatkana, are taken along the beaches by sportsmen in Northern California where there is no commercial diving.—*Paul Bonnot.*

Reference (see page 210) : 16.

2.49. CLAMS

The coastline of California is deficient in bay and estuary areas and the ocean beaches are also of limited extent. The clam population is correspondingly scarce. Some bays which are suitable for clams have been rendered unproductive by extensive dredging and increasing pollution. The ocean beaches have also been so persistently maltreated by over-digging and pollution that the annual clam harvest is a very minor affair.

The clams which can still be obtained in limited quantity are:

- Bean (Donax gouldii)
- Cockle (Paphia staminea; Chione *sp.*)
- Gaper (Schizothaerus nuttalli)
- Jackknife (Tagelus californianus)
- Razor (Siliqua patula)
- Softshell (Mya arenaria)
- Washington (Saxidomus nuttalli)

The softshell clam is not a native species. It was accidentally introduced from the east coast of the United States with some of the first shipments of eastern oysters to San Francisco Bay. The clams have spread to the north and will be found in all suitable areas. Productive beds can be maintained by the simple expedient of surrounding an area of mud flat with a stake fence to exclude the stingrays, who effectively curtail the clam population. At one time there were several such staked beds

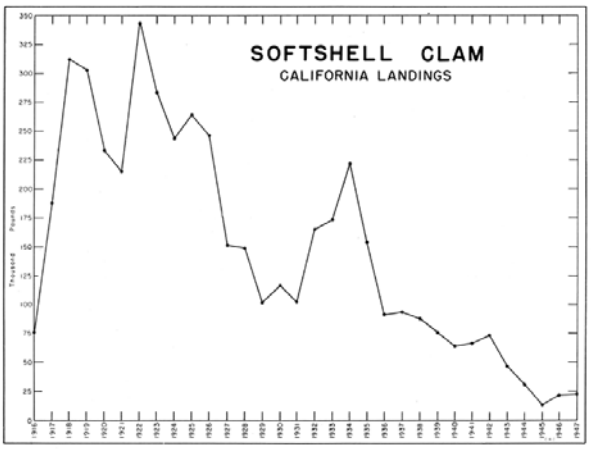

FIGURE 79. See Table 50

FIGURE 79. See Table 50

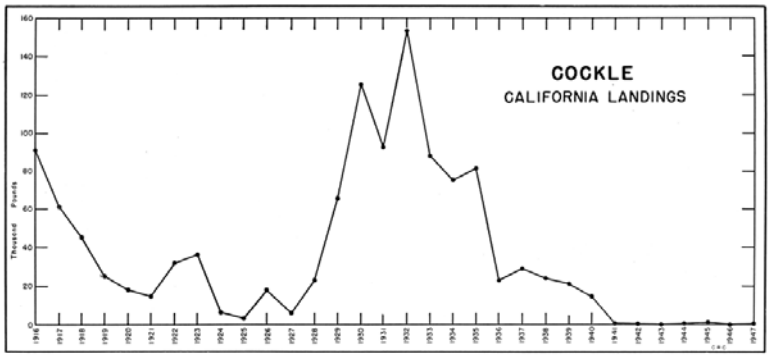

FIGURE 80. See Table 50

FIGURE 80. See Table 50

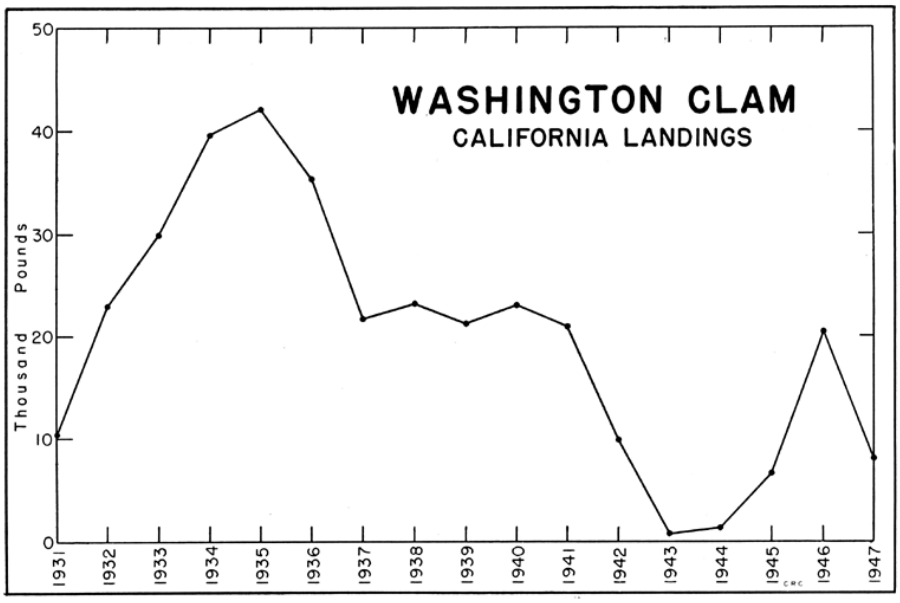

FIGURE 81. See Table 50

FIGURE 81. See Table 50

in San Francisco and Tomales Bays which supplied the local market. These beds are now all abandoned due to pollution.

Cockles are found inside the bays and also in protected places along the ocean shore. They do not ordinarily form extensive beds. Paphia is the cockle taken in the northern part of the State, while from Point Conception south there are three species of Chione. A Japanese cockle (Tapes semidescussata) has recently appeared in several places in San Francisco Bay. It undoubtedly came in with shipments of Japanese seed oysters in the 'thirties. During the depression years many individuals collected cockles as a means of enhancing their incomes. The figures and graphs of the commercial landings show the result. Most of the natural beds were over-exploited and a steady decline is demonstrated.

The gaper and Washington clams are usually found together in the mud bottoms of bays and inlets. They are highly perishable and are usually dug as required and consumed locally.

Razor clams live under the surf line on flat sand beaches in the northern part of the State. They have little commercial importance but are dug extensively by sportsmen. The jackknife clam inhabits the ocean beaches and the mud bottoms of estuaries in the southern part of the State. They are not used for food but a considerable quantity is sold to sport fishermen for bait.

The little bean clams are gathered along the ocean beaches, where they are sometimes washed up in windrows. These clams make a good chowder. Their occurrence and use is local.—*Paul Bonnot.*

References (see page 210) : 11, 15, 134.

2.50. PISMO CLAM

The Pismo clam, Tivela stultorum, is found on most of the flat sandy beaches of California south of San Francisco. At one time these clams were as abundant in California as they are now on the Mexican beaches. At present the greatest abundance occurs on the beach from which the clam gets its name. The clam population of Pismo Beach represents one of the most thoroughly measured in the State of California. In 18 of the last 24 years a systematic survey has been made of the number and age of the clams on this beach. The clams can usually be aged by counting growth rings on the shell.

In September of 1947 a law became operative which prohibited the taking of Pismo clams for commercial purposes in California. Prior to that time the law forbade the shipment of California-produced Pismo clams. The sudden decrease in the catch shown in 1942 was the result of closing the beach by the U. S. Coast Guard. The first clam population survey made after World War II, in 1946, showed a large increase of clams on the beach. However, even with the restriction on commercial digging, it is doubtful if the catch will ever increase much above its present level as the number of sport clam diggers is increasing with the growing population of the State.

In 1935 a shipment of live Pismo clams was made from Mexico to Long Beach where they were shucked and canned. As this venture was not entirely successful no more clams were imported from Mexico until 1941. This time the clams were shucked on the beach where they had been dug and the meats shipped in refrigerated five-gallon cans. At the cannery they were cooked, minced, and put into half-pound flat cans. This shipping of clam meat to canneries in California developed into an industry of considerable importance. The weights reported from 1941 through 1947 were on clam meat only. To arrive at the figures for this table in round weights, the meat weight was multiplied by eight to cover the loss in shucking. Table 50 shows this development which reached its peak in 1945. Then with even more abruptness it declined until now it appears to have about ended. This spurt was the direct result of the tremendous demand put on all fishery products by World War II.

There are many beaches along the coast of Lower California where Pismo clams are plentiful. Here a man can gather and shuck enough clams at one low tide to produce from one to two hundred pounds of meats. However, a number of factors have made it impractical to continue the canning of Mexican Pismo clams. Although the cost of digging the clams was quite low, the expense of getting them to the cannery was considerable. Carrying the cans of clam meats through the surf to a vessel anchored offshore was both difficult and dangerous. Shipment by truck was also unsatisfactory due to the poor roads. Whether the clams were transported by land or water, refrigeration was always a problem. Combined with these difficulties was a tendency to include sand with the clam meats as they were being shucked. This is the natural result of opening the clams on the beach without adequate equipment or supervision. The result was a product that did not compare favorably with canned clams of other kinds produced entirely in the United States.

Under the present regulations an angling license is required to take Pismo clams in California. The bag limit is 10 per day per person and the clams must measure at least five inches in greatest diameter. The importer

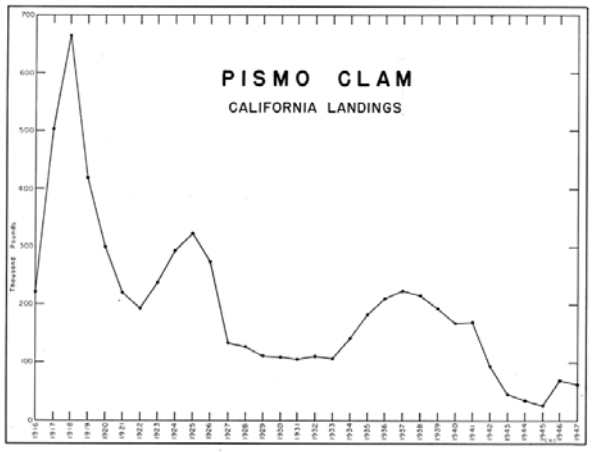

FIGURE 82. No California Pismo clams for commercial purposes after September 1947. Mexican Pismo clams imported for canning in California plants not included in graph. See Table 50

FIGURE 82. No California Pismo clams for commercial purposes after September 1947. Mexican Pismo clams imported for canning in California plants not included in graph. See Table 50

of Mexican Pismo clams must file a report with the U. S. Custom Service and obtain a permit from the Division of Fish and Game of California. All containers must be marked "Product of Mexico" and there is a limit of 24 clams in the shell or five pounds of meat to a container.—*J. A. Aplin.*

References (see page 210) : 4, 5, 29, 74, 103, 135.

2.51. OYSTERS

2.51.1. Native

An indigenous race of oysters, Ostrea lurida, is found in most of the bays of California. Considerable experimenting with this species has shown that it is feasible to produce it in quantity (catch seed), but our local environmental conditions are not conductive to the production of a commercial article. The ocean and bay waters of our coast do not attain a sufficiently low temperature in the fall to cause the oysters to "harden up." The natives, Olympias, on the local markets are shipped in from Olympia, Washington.

2.51.2. Eastern

The first eastern oysters, O. virginica, which were brought to the West Coast about 1870 were full grown shell stock. All of them could not be sold immediately so they were bedded in San Francisco Bay. As they responded favorably, experiments were conducted with seed oysters which also flourished. About 1900 the importing and growing of eastern oysters in San Francisco Bay was a million dollar a year business. After 1900 increasing population and industrial expansion gradually produced an adverse condition which was fatal to oyster culture and the industry was eliminated. Several small beds of eastern oysters were maintained in Tomales Bay for a number of years after the failure in San Francisco Bay. One Tomales Bay bed is still used to hold adult oysters, shipped in by the car load. Recently, a small holding bed for easterns has been established in Drakes Bay.

2.51.3. Pacific

Several California bays do not have beds of native oysters. Why this is so is not apparent as conditions seem ideal and Indian shell mounds demonstrate that at one time oysters were abundant. About 1931 the Division of Fish and Game encouraged experiments with Pacific seed oysters, O. gigas, imported from Japan. Extensive beds of these oysters had been established in the Puget Sound area. Test plants in California responded favorably to local conditions, and several individuals and companies started planting imported seed. These oyster beds, notably in Drakes, Tomales, and Morro bays were successful and operators were gradually enlarging their stocks and markets when World War II cut off the supply of seed. So far, this species of oyster has not reproduced locally in any quantity. An irregular set is obtained in Washington and Oregon, and some seed oysters were imported from there during the war. The demand for any form of protein food was so great at that time that the oyster companies sold practically all their stock, and at the end of hostilities their beds were practically empty. Pacific seed oysters are now coming from Japan, and a small but steadily increasing local set is developing. In a few years there will be several sizable oyster beds producing a considerable quantity of first class oysters.

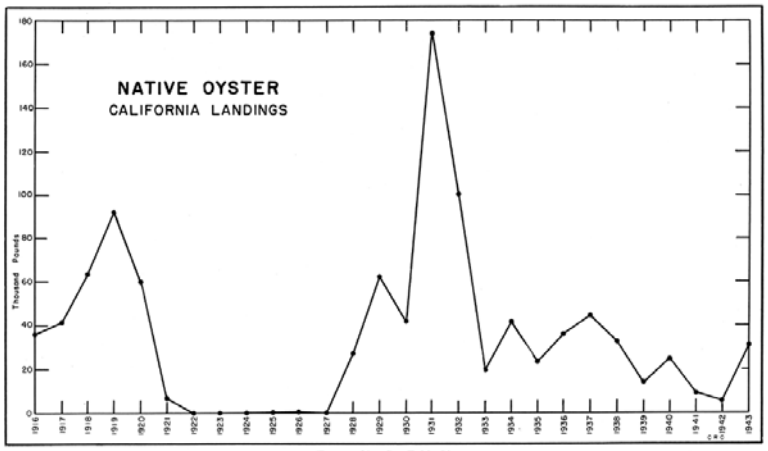

FIGURE 83. See Table 50

FIGURE 83. See Table 50

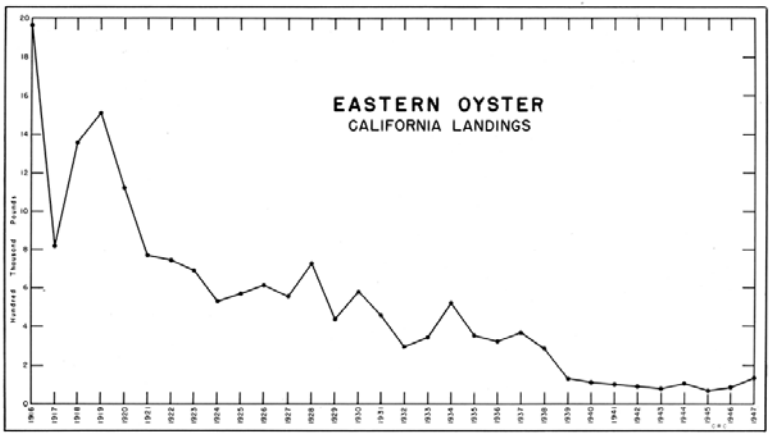

FIGURE 84. See Table 50

FIGURE 84. See Table 50

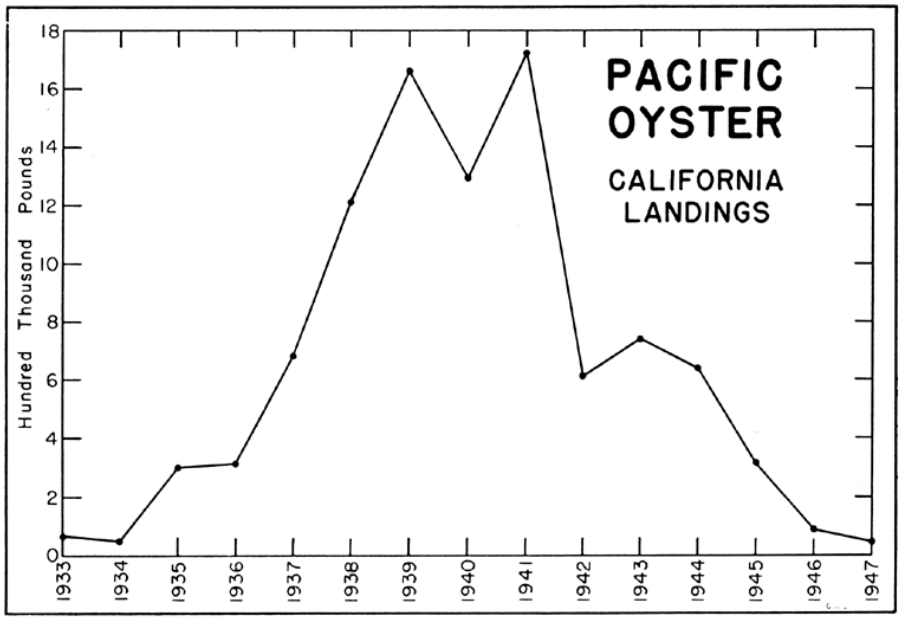

FIGURE 85. See Table 50

FIGURE 85. See Table 50

The usual task of a conservation agency is the imposition and enforcement of regulations to curb over exploitation of an existing natural resource. In this case a fishery is being created from which tons of protein food can be expected from areas which previously produced nothing. The chief problems of this growing industry are pollution, the sometimes fallacious projects of local chambers of commerce, and the predacious machinations of real estate promoters who advocate extensive dredging and so called improvements in our already curtailed inland waters.—*Paul Bonnot*.

References (see page 210) : 13, 14, 64, 82, 83.

2.52. OCTOPUS

The commercial octopus catch is of little importance compared with most other California fisheries. Not in the least among the factors influencing this fishery is the horror with which most Americans regard the much-maligned octopus. To the Chinese, Japanese, Italians and Greeks, who comprise almost the entire market, the octopus is considered a rare delicacy, and the few Americans who have summoned the courage to try it say the taste is similar to chicken. Regardless of this encouraging news, the general public has maintained a marked coolness towards accepting the octopus as a member of its bill of fare.

Despite his spectacular appearance, the octopus is actually a mollusk—a sort of second cousin to the snails, clams and abalones. Although possessed of a pair of eyes as highly developed as our own, and a large, well functioning brain, this does not, however, prevent him from being captured in a very simple trap, the "devilfish pot." These pots are similar in appearance to deep, cone-shaped wicker baskets, with a mouth in the shape of a funnel opening at the large end and tapering to a smaller opening in the center of the trap. A trap-door is located at the small end and is used in baiting and removing the catch. The pots are lowered among the rocks in from 20 to 30 fathoms of water about one-half to a mile off shore, and left down for a day or two. The octopus enters the trap for the bait, or out of curiosity, and cannot find his way out. In addition to the traps, octopi are taken also by the various nets and lines used in other fisheries, but the majority of the catch is captured in the devilfish pots.

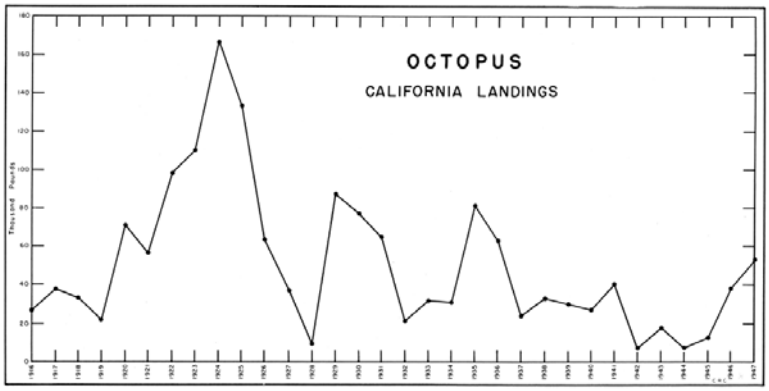

FIGURE 86. See Table 50

FIGURE 86. See Table 50

Half a dozen different species of octopi are found along the coast of California, but practically the entire commercial catch consist of the big octopus, Paroctopus apollyon, formerly referred to Polypus hongkongensis, which ranges from Alaska to San Diego and along the coast of China and Japan. It is reported to reach a spread of 16 feet and a weight of 90 pounds. The average size of those delivered to the markets is between 20 and 30 pounds. From San Pedro south to Panama, the small, two-spotted octopus, Octopus bimaculatus, is found inshore among the rocks. Many of these are captured for food by the Orientals in Southern California who take them from the tide pools. A large specimen of this species would span about 20 inches.

For over 25 years, until 1944, almost the entire catch was landed at Monterey, then for a year San Francisco became the leading port, only to lose to Eureka in 1946. Since then Eureka has maintained the lead and in two years (1946–1947), has received more octopi than had been landed there in the last 25 years. Over 50 percent of the entire commercial catch is being landed now at Eureka.

The following recipe is given for the more adventurous gourmets, and to those driven to desperation by todays high food prices: Remove the tentacles, pound them as with abalone to tenderize, and scald with hot water to loosen the skin. Cook for 30 minutes in boiling salt water flavored with tomato sauce and garlic. After boiling, remove the skin, slice into chunks and serve with vinegar sauce.

No discussion of octopi would be complete without some mention of the luckless divers, swimmers and fishermen who have been snatched to a horrible death by one of these monsters. Actually, most of these encounters are difficult to verify, and while it is doubtless true that the giant octopus said to be encountered in southern seas is a real menace, aggressive and cunning, the species found along the California coast are timid and inoffensive.—*Keith W. Cox.*

Reference (see page 210) : 93.

2.53. SQUID

The most important squid in California is the common squid, Loligo opalescens, of the Pacific Coast, which has an elongated body, with fins near the posterior end. The range of this squid is from Puget Sound to San Diego, and this species of mollusk attains an over-all length of about 12 inches. It is pelagic and migratory to some extent. Although a few squid are caught throughout the year, a large percentage of the landings are made during the period from April to July, which is considered the regular squid fishing season. At this time of the year large schools concentrate in certain inshore areas for the purpose of spawning, and seem, as the fishermen term their habits, to "ball-up" and are attracted by lights making their impounding by round haul fishermen very easy. Although there may be other areas within the range of squid along the Pacific Coast, where there may be concentrated spawnings, one of the most accessible and dependable for many years has been in the southern portion of Monterey Bay adjacent to the sardine canneries. The Los Angeles region accounts for most of the remaining small percentage of squid landings.

Several other species of squid are found in California waters but none of these are of commercial value. The jumbo squid, Doscidicus gigas,

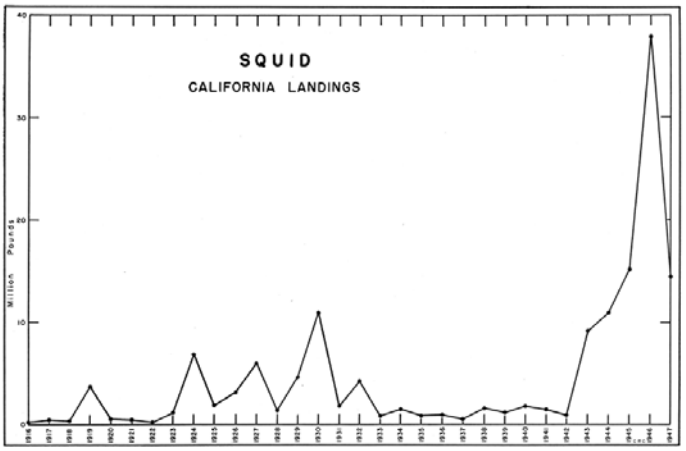

FIGURE 87. Canned chiefly for export 1943-1947. See Table 50

FIGURE 87. Canned chiefly for export 1943–1947. See Table 50

which reaches a length of four and a half feet, appears in appreciable numbers in California waters only during certain years but as yet no use has been found for it either as food or bait.

The total annual squid poundage of California was less than 1,000,000 pounds in 1916, when the first commercial landings were tabulated. For the period 1916–1942 the annual poundage fluctuated considerably, but reached a peak of about 11,000,000 pounds in 1930 and then dropped off again. In 1942 there were about 1,000,000 pounds landed, but in succeeding years the annual landings increased to an all time peak of 38,000,000 pounds in 1946. In 1947 the California poundage dropped to a little less than half of this amount. The ups and downs in the amount of squid landed in California reflect economic conditions in the fishery rather than fluctuations in the availability of the supply.

According to producers of frozen squid, there is a demand of approximately 1,000,000 pounds of fresh squid a year for domestic use. During the last 15 years a greater proportion of fresh squid has been frozen for shipment along the Pacific Coast and across the continent. In 1946 two cold storage firms, freezing squid at Monterey, shipped 30 carloads, or 1,000,000 pounds of the frozen product during the season. The frozen product brought 10 cents per pound.

All of the squid for freezing is bleached for four hours in a brine solution. The squid are then placed in 10-pound heavy oblong cartons and frozen at —20 degrees F. The finished product is white and quantities are used for human consumption, while some is used as a substitute bait in other fisheries.

Considerable amounts of squid were dried for export to the Orient during the period 1916–1932. This market was not steady because it depended upon the stability of silver, the medium of exchange in China. The drying of squid in large amounts was discontinued after 1932 because of the unstable market and also due to increased competition from dried squid shipped into China from Japan. In 1946 about 70 tons of squid was dried at Monterey by a concern using a dehydrator instead of the sun-dried method, traditional in previous years, but this was discontinued in the following year.

The canning of squid in California has been of minor importance since 1919, except for the period 1943–1947 during which there was a temporary boom in the export market. Very little domestically canned squid is eaten in this country. Previous to 1930, the normal annual pack was exported to Greece, mainly. However, near the end of World War II government orders for squid for export stimulated the activity along this line, which continued for a short period after cessation of hostilities. Eleven plants at Monterey participated in the pack after the war while but four plants canned squid in 1943, when the demand was limited. The huge total of 38,000,000 pounds in 1946 represents a large element of speculation and over-estimation of the needs of the Philippines, the main export market in recent years.

Fishermen and plant operators were glad to have this pack to turn to as a partial substitute for a period of poor sardine fishing and to fill a nonoperating gap during the closed sardine season.

No conversion of equipment is necessary in the plants because the same canning machinery used for sardines is used in canning squid. It is canned whole, with salt in one-pound tall cans with enamel linings.

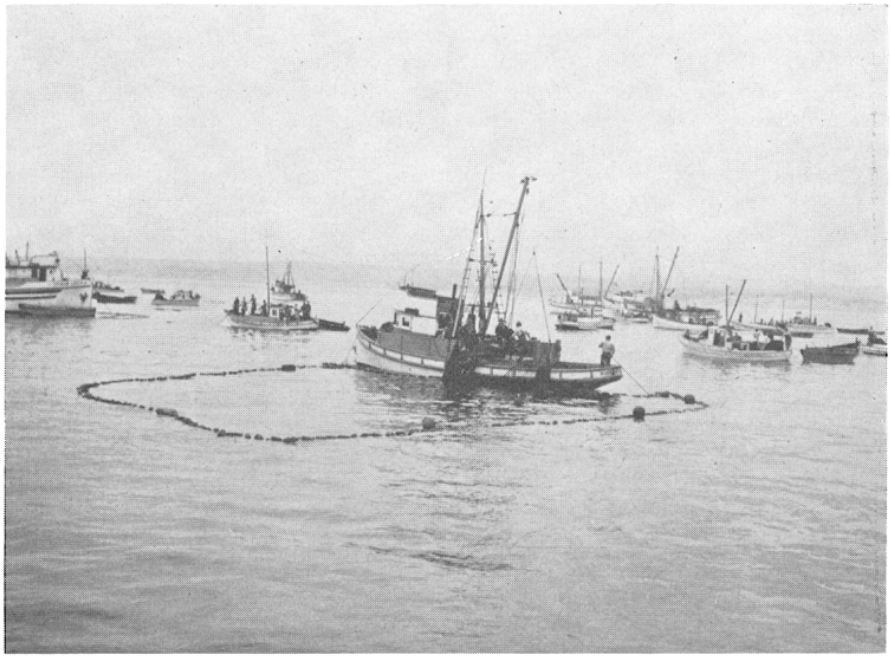

FIGURE 88. Part of the Monterey squid fleet on fishing grounds off Monterey.
Photograph by J. B. Phillips, May, 1946

FIGURE 88. Part of the Monterey squid fleet on fishing grounds off Monterey. Photograph by J. B. Phillips, May, 1946

No cleaning or eviscerating is necessary preparatory to canning. In earlier years the squid were pre-cooked before canning and various sauces and oils were added, such as tomato sauce and cottonseed oil. A minced product was also tried, and by labeling this sample pack "Calamerai," an Italian name for squid, a good reaction from the domestic market was obtained.

In recent years squid fishermen have received as much as 8 cents a pound or $160 a ton (1947) for squid used for freezing. However, this was during a short period when squid were scarce on the fishing grounds. The usual price for squid for fresh use, including freezing, has been $80 a ton in recent years. Squid for canning has been about $60 per ton. The canners have enjoyed a price differential because they take larger amounts than the fresh fish markets and freezers. In earlier years before 1935, fishermen received $8 to $15 a ton for squid to be dried and $25 a ton for squid for fresh and freezer use.

Fishermen use three types of round haul nets in catching squid. The lampara net which can be operated from either a power boat or skiff is the net most commonly used by the fishing fleet at Monterey. However, during the past few years larger type vessels have been engaged in the squid fishery, using the half-ring and small purse seine net. Most of the fishing is carried on during the earlier part of the morning and evening when the squid appear at the surface of the water.—*Ralph F. Classic.*

References (see page 210) : 37, 44, 92, 114.

2.54. MISCELLANEOUS SPECIES

At present the commercial fish catch approximates 800,000,000 pounds per year. This involves about 125,000 items recorded on fish receipts which are collected each month from the fish markets and canneries. There are a number of these items which, for various reasons, we are unable to classify by species, hence the classification "miscellaneous fish." Since 1916 we have recorded from 100,000 to 1,242,000 pounds of fish per year as miscellaneous. Much of this poundage results from illegible items on receipts and items called mixed fish, scrap, flatfish, roughfish, or bait. Occasionally, identified items too small to lend significance to the tables are relegated to miscellaneous.

In recent years, the tremendous growth of the market for fish liver as a by-product of California's fishing industry has given rise to the widespread use of the term "junk." Fish whose livers yield the most desirable medicinal oils are usually segregated by species, either by the fishermen before they sell their catch, or by the wholesale market men. The livers of other fish are all thrown together in the cans and sold as junk liver. In 1947, for example, it was impossible to classify over 28,700 pounds of junk liver reported on the fish receipts. In the case of the shark boats, all junk liver is reported in our records as unclassified shark.

Amounts of miscellaneous roe also enter the record. While this is probably barracuda or white sea bass roe, it is difficult to separate, as the two species frequently appear together on the receipts, with the roe given as one item.

A small amount of fish is reported as fillet. Several species of flatfish will appear together on a receipt with one item for fillet. This fillet may be fish of illegal size, filleted at sea to prevent identification.

Some dealers report items of bait on receipts. These may be sardines, anchovies, or a mixture of immature fish of several species.

Occasionally a significant poundage of some unusual species has appeared in the statistical record. These species are of slight commercial importance but should receive passing mention. Certain species are no longer fished because their sale has been prohibited by law, as in the case of the sturgeon and scallops. Statistical records are not required from dealers handling reptiles, such as terrapin, and frogs. The bulk of these landings are not listed on the commercial fish receipts and the small amounts reported have little significance.

2.54.1. Fishes

Crevally—In December, 1941, 563 pounds of red crevally was reported on a San Pedro fish receipt. This fish was taken on the west coast of Mexico. Crevally is not regarded as a food fish. This may have been some other species.

Croaker—In 1918 an item of 67,126 pounds of croaker appeared in the Los Angeles and San Diego receipts, and again in 1921 there were 69,929 pounds reported. While kingfish, queenfish and white sea bass all belong to the croaker family, Sciaenidae, they are not called croaker. Black croaker was legal commercially at the time but the landings of this species were always negligible—not enough for the above poundages. It has been illegal since 1915 to fish commercially for spotfin croaker, yellowfin croaker or California corbina, the remaining members of the

family. Undoubtedly these large items were improperly identified but it is impossible to determine the species to which this poundage should have been credited.

Dolphin—The name dolphin is applied to both a fish, Coryphaena hippurus, and a mammal. The catch reported on the receipts is undoubtedly the fish.

TABLE 19

DOLPHIN

Year	Pounds	Year	Pounds
1918	741	1936	92
1926	3,145	1937	1,993
1931	518	1943	168

TABLE 19
DOLPHIN

Eel—While a few pounds of eel are reported every year on the receipts, there is little commercial demand for this fish. The Indians of Northern California use them for food, but the bulk of the catch does not appear in the record. The moray, Gymnothorax mordax, always is taken in the southern part of the State. Two species of blenny, Cebidichthys violaceus, and Xiphister mucosus, which are not true eels, are taken incidentally in the trawls in Northern California. The lamprey, Entosphenus tridentatus, is taken both along the coast and inland. This is an extremely oily fish, and recently in Oregon a fish reduction plant has been processing them for low potency fish oil and fertilizer. (Table 48.)

Steelhead trout—Since 1927, it has been illegal to take steelhead trout commercially in the State. Prior to that time, steelhead taken with salmon gear in certain districts during salmon season, could be sold.

TABLE 20

STEELHEAD

Year	Pounds	Year	Pounds
1916	33	1921	3,605
1917	19,706	1922	2,490
1918	21,819	1923	3,011
1919	17,217	1924	87,088
1920	6,999	1925	222

TABLE 20
STEELHEAD

Sturgeon—The sturgeon, Acipenser transmontanus, was once abundant in California waters. Threatened with extinction, the fish has been protected by law since 1917. Very little is known about these fish. They are slow growing and reach a tremendous size. Recently an increase in abundance has been reported by observers but at present this has not been verified. The record for 1916 shows 15,178 pounds and 1917—9,822 pounds.

Tai—In January, 1931, 1,165 pounds of tai was reported on a San Diego fish receipt. In April, 1931, 160 pounds was reported on a San Pedro receipt. The fish was taken on the west coast of Mexico. This was Calamus brochysomus, which is a food fish of some importance.

Tomcod—The tomcod, Microgadus proximus, is found from Monterey to Unalaska but has practically disappeared from the commercial

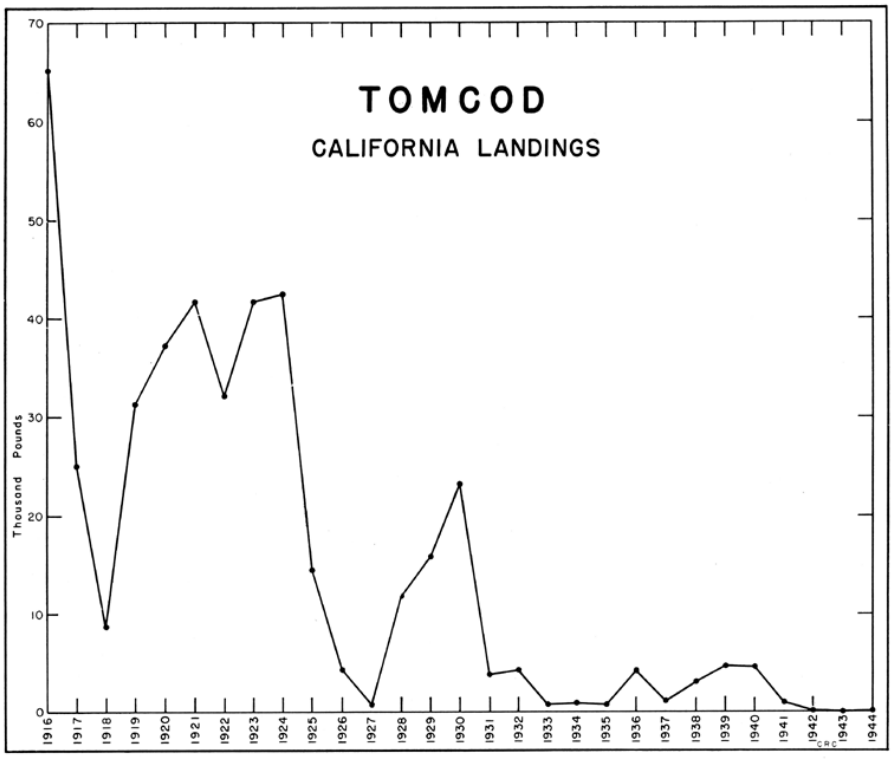

FIGURE 89. See Table 48

FIGURE 89. See Table 48

catch statistics. It has been reported that the landings of the San Francisco trawler boats included large poundages of tomcod prior to 1916, but since catch records have been kept, the catch of this fish has gradually dwindled. No appreciable landings have been made since 1930. The decline in the catch could have resulted from a lack of demand in the markets or from the tomcod being taken in mixed loads with not enough of them to make a separation worth while. The kingfish, an entirely different species, is erroneously called tomcod in Southern California. (Table 48.)

2.54.2. Crustaceans

Barnacles—Barnacles, Mitella polymerus, appear only once in our commercial records. In 1916, 175 pounds were recorded.

Crayfish—Crayfish, Astacus trowbridgei, was reported in the commercial record in 1916 and 1917. There are many of these taken in streams and reservoirs but not sold through the usual commercial channels. The record shows the following: 1916—2,478 pounds; 1917—210 pounds.

2.54.3. Mollusks

Limpets—This mollusk, somewhat like abalone, appears twice in our records, 1919—8,350 pounds; 1920—18,835 pounds.

Mussels—Mussels, Mytilus californianus and M. edulis, were of considerable commercial importance at one time, but a regulation of the California State Board of Health quarantines mussels during the summer months, allowing none to be sold for human consumption and posting warnings against their use. Such closures have been in effect since 1927 as the result of an outbreak of mussel poisoning.

The earliest record of mussel poisoning was published in 1793. Prior to the coming of the white man the California Indians had guards on the coast to warn against "red water." A plankton organism, Gonyaulax, upon which mussels and clams feed produces a toxin poisonous to man. When Gonyaulax and other planktonic forms multiply rapidly they color the ocean waters red. Mussels and clams feed on these minute animals and ingest enough of the toxin to make the mollusks fatal when eaten by man. (Table 50.)

Scallops—Scallops, Pecten circularis, were gathered commercially in 1920 and 1921 in the vicinity of Anaheim Landing, Orange County. Those reported in 1937 and 1939 were taken in the extreme northern part of the State and Southern Oregon and are probably Hinnites giganteus. The record shows the following: 1920—759 pounds; 1921—1,371 pounds; 1937—100 pounds; 1939—300 pounds.

Snails—Sea snails have little commercial value and are not widely popular. They are observed in the markets and on the docks from time to time, but the bulk of these landings do not reach our records.

TABLE 21
SNAILS

Year	Pounds	Year	Pounds
1916	80	1920	340
1917	145	1935	600
1918	1,461	1940	225
1919	653		

TABLE 21
SNAILS

Whelk—This small mollusk is also observed on the wharves and occasionally in the markets, but we do not get the records on commercial receipts. The fishermen and their families apparently consume them. They appear twice in our records, in 1935—485 pounds and in 1936—250 pounds and probably belong to the genus Kellettia.

2.54.4. Reptiles and Amphibians

Frogs—Frogs, *Rana* sp., are raised commercially on frog farms and occasionally appear on fish receipts.

Terrapin—Most of the terrapin caught, probably genus Malaclemys, was handled by dealers not in the fish business. They are found in inland waters but taking them has been illegal since 1945.

TABLE 22
TERRAPIN

Year	Pounds	Year	Pounds	Year	Pounds
1916	3,216	1920	144		
1917	9,456	1921	120	1924	312
1918	648	1922	360	1928	168
1919	4,272	1923	1,128	1930	58

TABLE 22
TERRAPIN

Turtles—Several years ago, significant poundages of turtle, Chelonia mydas, appeared in our records. The fishery was concentrated along the coast of Lower California. This fishing is now controlled by the Mexican government. Occasionally, turtles are taken in Southern California waters.—*Helen L. Nelson.*

References (see page 210): 15, 133.

TABLE 23

TURTLE

Year	Pounds	Year	Pounds	Year	Pounds
1916	1,870	1923	4,057	1932	5,728
1917	23,722	1924	51	1933	2,901
1918	30,629	1925	21	1934	3,661
1919	255,239	1928	5,594	1935	1,722
1920	76,918	1929	2,216	1936	2,638
1921	2,571	1930	580	1940	70
1922	12,521	1931	6,657	1941	33

TABLE 23
TURTLE

2.55. MARINE SPORTFISHING

The marine sport catch is a major drain on the supply of some of our choicest ocean fish. Since sportsmen and commercial fishermen are actively pursuing many of the same species of fish, statistics of the sport catch are pertinent in this bulletin.

The importance of ocean sportfishing became apparent many years ago. Preliminary work started in 1932 to determine the magnitude of the sportsman's catch. The 1935 Legislature enacted a law making it mandatory that all boats carrying fishermen for hire shall keep daily records of their operations and of all fish taken. The basic law has not changed. At the beginning of each calendar year, or prior to the sportfishing season, every boat operator must register his boat and obtain a permit from the Division of Fish and Game. There is a fee of $1 for the permit. Every vessel engaged in fishing operations must carry Fish and Game boat plates in plain sight on either side of the boat's superstructure. These plates are obtained free with the first registration and become a permanent fixture on the boat.

In 1947 a law was enacted, making it unlawful to sell any fish taken under the privileges of a sportfishing license or to sell fish taken on any vessel which carries anglers. Prior to this it was the practice of the operator of the boat to purchase a market fisherman's license and sell the excess catch of the sportsmen. There are a few other state regulations which govern the manner in which the daily records are to be kept in order that accurate reports may be obtained.

At the time the boat is registered the operator is issued a book of printed forms for keeping daily records, postage-paid envelopes for mailing records to the Division of Fish and Game at the end of each month, a chart with coastal areas blocked off and numbered so that the operator may record the areas where the fish are caught, and a copy of the regulations.

A report sheet must be completed for every trip the boat makes, showing an accurate count of the number and an estimated total weight of each species taken. These reports must be filled out between the time

TABLE 24

MARINE SPORT AND COMMERCIAL CATCH

Comparison of Catches Made in California Waters (Pounds)

Marine Sport Catch [1]

Species	1936	1937	1938	1939	1940	1946	1947	7-year average
Barracuda	2,246,916	2,840,349	1,544,372	3,062,497	3,452,557	1,796,856	3,698,195	2,661,963
Rock bass	631,882	454,176	869,509	867,731	889,610	781,100	1,323,506	831,086
California halibut	316,946	256,659	206,247	431,016	512,434	572,499	949,746	420,799
White sea bass	123,895	100,712	137,684	358,939	136,615	128,572	225,985	173,199
Yellowtail	327,688	147,881	240,166	87,517	193,422	9,074	25,088	147,548
Lingcod	26,469	55,199	55,163	76,048	71,013	92,570	194,397	81,551

Commercial Catch

Species	1936	1937	1938	1939	1940	1946	1947	7-year average
Barracuda	2,347,858	1,799,045	1,260,790	2,969,259	2,545,661	1,636,346	1,695,867	2,022,046
Rock bass	324,405	230,969	255,627	238,423	239,310	147,278	211,627	235,605
California halibut	783,159	812,081	838,566	746,509	921,331	1,718,397	1,172,638	998,083
White sea bass	564,936	263,195	269,987	806,604	809,331	471,549	692,314	553,991
Yellowtail	253,723	223,683	246,218	262,524	326,036	31,295	103,613	207,200
Lingcod	754,491	965,080	645,018	573,659	690,522	1,126,538	1,876,986	947,813

[1] No record available 1941-1945; 1946 record incomplete.

TABLE 24
MARINE SPORT AND COMMERCIAL CATCH
Comparison of Catches Made in California Waters (Pounds)

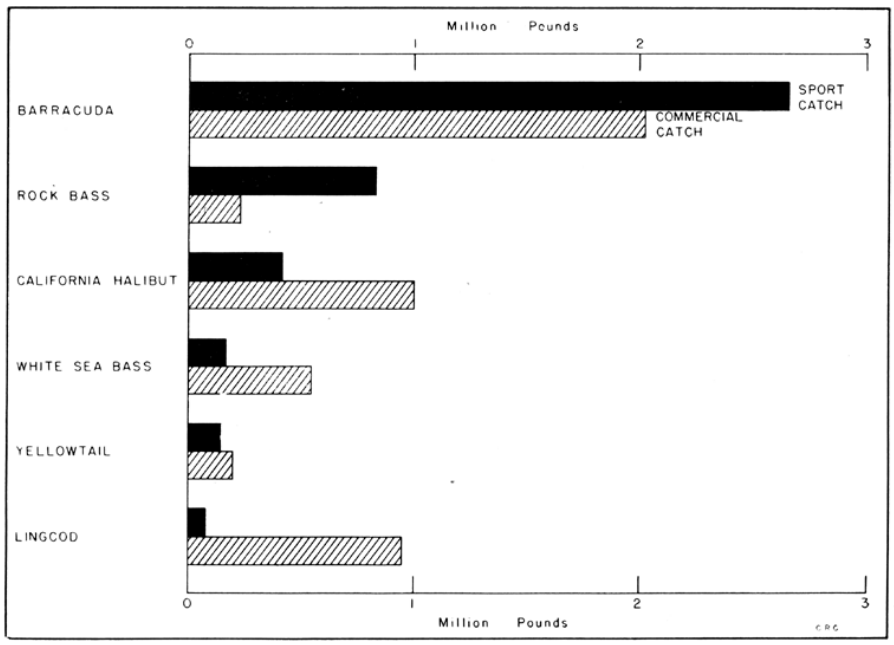

FIGURE 90. Leading species in marine sport catch compared with commercial landings. Average for 7 year period, 1936-1940, 1946, and 1947. See Tables 24, 26 and 48

FIGURE 90. Leading species in marine sport catch compared with commercial landings. Average for 7 year period, 1936–1940, 1946, and 1947. See Tables 24, 26 and 48

fishing is over and before the boat docks or lands its passengers. At least 80 percent of the sport fish landed are taken on these boats. Thus, the records give us a good picture of ocean sportfishing.

It is impractical, if not impossible, to obtain adequate records of fish caught by surf fishermen, pier fishermen, and from private boats. However, we do recognize that a great many pounds of fish are taken and much recreation is afforded to sportsmen by the above fishing methods. The corbina, other members of the croaker family and various species of perch commonly taken by surf fishermen are not recorded. Our salmon records show only those fish caught on the boats which carry fishermen for hire. Many more salmon are taken by skiff fishermen and sportsmen fishing along the river banks. Some marlin are reported every year, but most are taken by private boats for which no records are available. The striped bass, which is much prized by sportsmen in the San Francisco region, is under special investigation by the Bureau of Fish Conservation and therefore is not discussed in this article.

The sportfishing boats operate throughout most of the year from nearly every pier or harbor from Eureka to San Diego. A few run all winter. During 1947, 286 boats reported their catches. Most of these boats operate in Southern California between Santa Monica and Newport Beach. This accounts for the predominance of Southern California species in the catch. The following table shows where the sportfishing boats were located in 1947, the types of fishing done, and the varieties most commonly taken.

This system for collecting marine sport catch statistics had been in operation seven years, 1936–1940 and 1946–1947. During the war, the program of necessity was abandoned. Some surprising facts have been revealed by the records. The catches of about 350,000 fisherman days have

TABLE 25

Ports	Number of boats reporting	Species of fish most commonly taken	Types of fishing
Eureka	1	Salmon	Trolling for salmon
San Francisco Bodega Bay Princeton	52	Salmon, rockfish, lingcod, cabezone	Trolling for salmon, bottom fishing with cut bait
Monterey Santa Cruz Capitola	19	Rockfish, lingcod, cabezone, salmon	Bottom fishing with cut bait or with jigs
Morro Bay San Simeon Avila	13	Rockfish, lingcod, cabezone	Bottom fishing with cut bait or with jigs
Santa Monica Bay to San Clemente	174	Barracuda, kelp bass, California halibut, albacore, white sea bass, Pacific mackerel, yellowtail	Live bait used to take all species, some trolling for barracuda, albacore, and marlin
San Diego	27	Same as above except yellowtail most prized	Same types of fishing as in Los Angeles region

TABLE 25

been reported each year, which show that the sportsmen averaged approximately 20 pounds of fish per day. Two of the most prized fish in the sport catch, barracuda and rock bass, have consistently exceeded the commercial catch made in California waters. In number of pounds taken, barracuda holds number one position of importance in the sport catch every year. In second position are the rock basses, better known to the sportsmen as kelp bass and sand bass. In addition a large percentage of the total catch of yellowtail, California halibut and white sea bass are taken each year by sportsmen.

During 1947, the fare on the sport fishing boats ranged from $2 per person on the barges to $7.50 on the regular day boats. Prices for charter boats ranged from about $35 to at least $100 per day for the larger vessels. A million and a half dollars is a conservative estimate of the amount spent by sportsmen for boat fare alone. In addition, an enormous amount of money was spent for fishing tackle, transportation, and food. Thus marine sport fishermen take a considerable quantity of fish each year and their expenditures for recreation means a great deal to the economy of the State.—*Robert D. Collyer.*

References (see page 210): 51, 133.

2.56. LIVE BAIT FISHERY

Fishing for live bait, as it exists today, evolved from fishing methods locally introduced in 1910 by Japanese albacore fishermen. The original nets used were known as "blanket" nets. The term "blanket" is descriptive of the shape of the net. Such nets were made to agree with the length of the boat from which they were to be used. Two long poles, one at each end, were lashed securely to the net to facilitate operation. Two operators, one at each end of the boat, would lower the "blanket" into the water and hold it below and as nearly parallel to the surface as the poles would allow. Bait fish were chummed over the net and, when a sufficient school had been attracted, each operator would raise the pole at his end of the net, concentrating the fish in the bag between the two poles. This method was not able to supply the amount of bait needed by either the

TABLE 26
MARINE SPORTFISH LANDINGS IN CALIFORNIA [1]
Pounds

Ten most common species	1936 [2]	1937	1938	1939	1940	1946 [2]	1947
Barracuda	2,399,177	2,991,501	1,626,449	3,379,530	3,609,493	1,824,844	3,744,683
Rock bass	705,114	670,518	901,488	904,140	926,181	824,638	1,256,241
California halibut	322,277	354,249	207,452	433,536	513,243	575,963	652,765
Albacore	9,566	23,781	72,920	174,330	3,440	222,403	145,388
Rockfish	500,467	410,168	427,662	383,043	510,006	184,861	461,116
Pacific mackerel	480,394	565,457	543,621	990,154	586,377	143,514	379,221
White sea bass	132,550	117,767	163,131	399,087	142,827	132,542	242,480
Lingcod	26,475	55,259	56,149	76,481	71,670	92,941	199,046
Yellowtail	1,231,795	821,699	646,905	359,898	1,124,351	53,718	120,009
Salmon	2,991	16,378	34,583	53,779	109,611	48,177	81,827
All others	743,631	676,768	673,986	711,033	573,486	255,434	600,558
Totals	6,565,027	6,403,525	5,364,348	7,835,949	8,172,685	4,356,033	7,983,384
Number of fisherman days reported	240,189	328,261	263,571	347,257	362,072	209,775	447,860

[1] Catches made in California and Mexican waters.
[2] No record available 1941-1945; 1946 record incomplete.

TABLE 26
MARINE SPORTFISH LANDINGS IN CALIFORNIA
Pounds

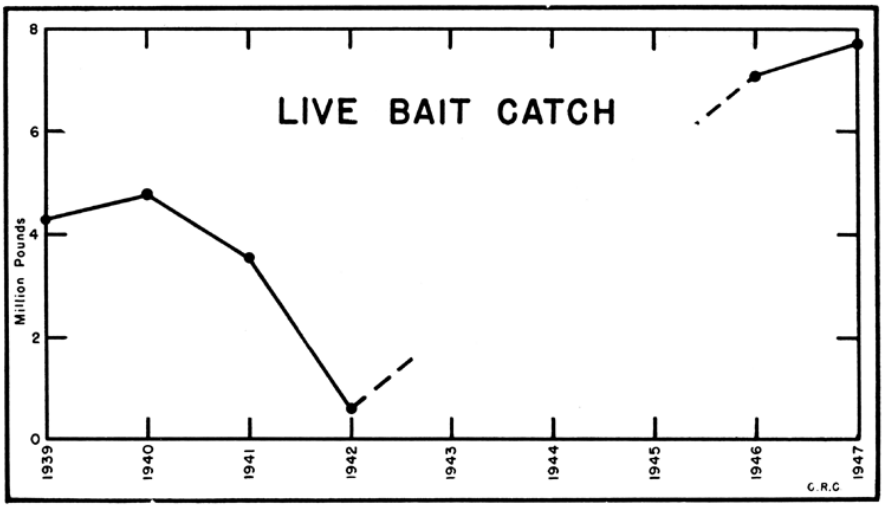

FIGURE 91. Catch of boats fishing for live bait to be used chiefly in the marine sport fishery. Bait caught and used by commercial fishing vessels not included. See Table 27

FIGURE 91. Catch of boats fishing for live bait to be used chiefly in the marine sport fishery. Bait caught and used by commercial fishing vessels not included. See Table 27

commercial or the sport fishing interests. In 1912, the present lampara or round haul net was first used for bait hauling. Alert sport fishing boat operators quickly adapted their boats to haul live bait in the early morning hours, devoting the remainder of the day to sport fishing. Modification of the lampara was found to be necessary as some fishing locations demand special shallow nets due to obstructions on the bottom, or because of shallow waters. Open coast lines require longer and deeper nets.

There has been some change in the number of boats engaged in fishing live bait. However, the years in which the greatest number of boats were operating did not necessarily produce the greatest landings of bait. The number of boats in operation ranged from a high of thirty in 1940 to a low of nine in 1942.

As sport fishing became increasingly important, the demand for live bait forced a greater degree of specialization into the bait industry. Boats came into existence that had no function other than furnishing live bait. Each year more efficient methods of hauling bait have been instituted and have recently led to the installation of fathometers for detecting subsurface bait schools. The use of fathometers makes it possible for bait to be taken in areas and at times that would have formerly been unproductive. Bait boat operators have become so skillful in the interpretation of the signals relayed by a fathometer that the species of fish may be determined, although there may be no indication of such fish on the surface.

Most of the fishing for bait is conducted during the early morning hours. At this time, scattered fish will congregate and usually will rise to the surface where "flips" reveal the presence of fish to the patrolling bait fishermen. In an area that is protected by a breakwater, floating gas or kerosene lanterns are sometimes anchored at night so that scattered fish will be attracted to the school under the lights. A haul around the floating lanterns will be successful unless the moon destroys the effectiveness of the glowing light.

TABLE 27
LIVE BAIT CATCH FOR SPORTFISHING [1]
Pounds

Species	1939	1940	1941	1942	1946	1947
Anchovy	3,006,500	4,011,900	3,163,300	515,100	5,496,500	5,707,900
California pompano					200	2,500
Kingfish	18,800	12,900	5,700	700	28,100	42,400
Queenfish	75,200	70,000	93,700	20,200	165,000	445,100
Sardine	1,146,900	671,800	205,300	49,200	1,337,100	1,472,500
Smelt	6,100	11,300	6,600	700	19,900	30,100
Total pounds	4,253,500	4,777,900	3,374,600	585,900	7,046,600	7,700,500

[1] No record available 1943-1945.

TABLE 27
LIVE BAIT CATCH FOR SPORTFISHING
Pounds

FIGURE 92. Fishing for bait with a lampara net. A weighted float attached to one end of the net is thrown from the boat, the boat moves continually in a circle as the net is payed out and the ends of the net are brought together at the float encircling the fish. Photograph by R. D. Collyer, August, 1948

FIGURE 92. Fishing for bait with a lampara net. A weighted float attached to one end of the net is thrown from the boat, the boat moves continually in a circle as the net is payed out and the ends of the net are brought together at the float encircling the fish. Photograph by R. D. Collyer, August, 1948

FIGURE 93. Pulling in the net. The bait is trapped between the walls of the net, and will be brailed into the opening of the bait tank (center of photograph) and held there until sold. Photograph by R. D. Collyer, August, 1948

FIGURE 93. Pulling in the net. The bait is trapped between the walls of the net, and will be brailed into the opening of the bait tank (center of photograph) and held there until sold. Photograph by R. D. Collyer, August, 1948

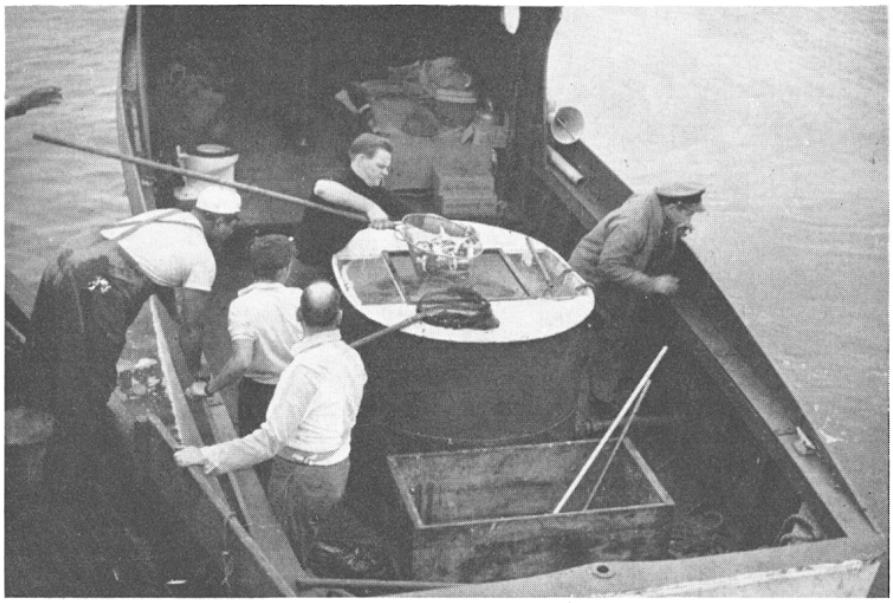

FIGURE 94. Brailing live bait from the bait boat into the tank of the sport fishing boat.
Photograph by R. D. Collyer, August, 1948

FIGURE 94. Brailing live bait from the bait boat into the tank of the sport fishing boat. Photograph by R. D. Collyer, August, 1948

Holding live bait for future use is not an easy problem. The usual method is to place bait fish in floating wooden boxes or receivers. The dimensions of these boxes vary from a 6- to a 10-foot cube and are so constructed that fresh sea water is constantly washing through the lattice walls and bottom. Cement receivers have been devised that are capable of floating without benefit of additional support. Cement has a much longer life under conditions that would destroy wooden construction. Buoyancy is achieved by utilizing extremely light aggregates instead of conventional rock and sand.

Southern California, specifically from Santa Barbara to San Diego, is the home of the live bait industry. North of Point Conception, sport fishermen are compelled to use salted bait, clams, mussels and inanimate tidbits. However the varieties of fish taken north of Point Conception are primarily bottom fish and do not require live bait. South of Point Conception, the prized fish are pelagic, swiftly swimming species and are attracted by movement and life. Dead bait is very likely to receive little or no attention.

A reliable method for keeping bait records was instituted for the first time in 1939. These records are made out daily by the skippers of the various bait boats. All catches are reported as number of scoops taken, and converted to pounds by the factor 17 pounds per scoop. This conversion factor has been used for computing catches for all years except 1947. Individual scoop weights for as many bait boats as possible were determined for this year and different factors used for different regions.

of the six species of fish commonly found in the live bait net, anchovies are by far the most important. For the few years for which bait records are available, they comprise approximately 75 percent of the total catch. Sardines represent 20 percent, and queenfish, kingfish,

smelt and pompano make up the remaining 5 percent of the landings. Bait caught in excess of the amount required by sport boats is often sold to fresh fish markets for salting or to canners to be ground into chum. Bait fish disposed of either to markets or canners is not included in the totals as shown on the accompanying graph. Such fish is included in the totals for the particular species to be found elsewhere in this bulletin.

In 1947, live bait sold from $1 to $1.50 per scoop, depending on scoop size, availability of bait, and other factors. Most of the bait men contract to supply bait for a fixed percentage of the sport boat proceeds. There is considerable competition for the good contracts that are to be had. Similarly, there is competition among the sport boat owners to secure dependable bait haulers, and a boat carrying many passengers, as a rule, has the edge in securing good haulers. Bait suppliers are busiest in the very early hours of the morning, seven days a week, and from five to nine or more months of the year. The winter months usually bring bait hauling to a complete close.—*Parke H. Young.*

Reference (see page 210) : 3

2.57. WHALES

In 1931 an international treaty, designed for world-wide regulation of whaling, was signed at Geneva by representatives of 26 maritime powers. As a result of this convention the Whaling Treaty Act of May 1, 1936, was approved by the United States Congress. This act, closely following the Norwegian law, provided protection for whales. Subsequently two conferences were held in London in 1937 and 1938 where amendments were drafted. Plans were made to collect biological and statistical data concerning whales, closed seasons and refuges were set up, protection was given females with suckling calves, and minimum sizes varying according to species were established to save the immature calves. There were regulations established whereby crews and gunners would be paid on a wage basis rather than on the number of whales killed and provision was made for license fees and fines for violations. The Secretary of Commerce, the Coast Guard and Bureau of Customs were named as record collecting and enforcement agencies.

Maritime Industries of Fields Landing in Northern California is unique in that it is the only whaling station operating in the continental United States. Weather permitting, operations begin as soon as the season opens. The opening date is optional with the company, it may open April 1st to close October 1st, or it may open May 1st but must close November 1st. Two converted naval vessels, approximately 100 and 135 feet long, put to sea in search of migrating whales. Both vessels are diesel powered and are manned by crews of from five to seven men.

Each vessel is equipped with a gun of approximately 3½-inch bore, mounted on traverse gear and trunnions in the foremost point of the bow. A four-barbed harpoon weighing 165 pounds, attached to a heavy nylon line, is the projectile. The head of the harpoon is charged with a delayed action "head bomb" which explodes after the harpoon has penetrated the body of the whale. The gun is loaded from the muzzle in the manner of early type cannon. The exact amount of the powder charge used for propelling the harpoon is a trade secret with the individual gunner but approximately 14 ounces of black powder is the usual charge. It is necessary

to experiment to determine the correct charge and maintain a margin of safety. The method of measuring the powder charge is interesting. The usual procedure is to pour the powder into a can to obtain the approximate amount. The powder is then placed in a paper bag and firmly rammed into the gun. To anyone familiar with the complications resultant from a few grains of overcharge, the system leaves much to be desired. Fortunately slight variants in charge are not as critical for black powder as for the modern smokeless types. A cork or rubber plug is next rammed home over the sacked powder charge. This plug serves the same purpose as wadding in a shotgun, sealing the powder gases to assure complete combustion and maximum power. The harpoon shaft is next inserted into the gun. The weapon is fired by a .32 caliber blank cartridge contained in a firing mechanism in the breech end of the gun. Excessive recoil from this heavy charge is absorbed by the familiar recoil cylinder used in modern artillery.

Upon sighting the whale the killer boat must approach to within 100 feet to insure a kill. Usually the distance is closed as much as possible before the gunner fires. If the wind is favorable and clears the dense cloud of powder smoke, the harpoon may be seen curving out toward the quarry and then disappearing into the body of the whale. There is a short delay and then the head bomb completes the destruction of the whale. If the range is too long, the harpoon may pay out all of the nylon line, halt abruptly and appear to head back for the ship. The muzzle velocity is so low, however, that the harpoon falls harmlessly into the sea.

If no complications arise, and the whale has been killed, the carcass is hauled alongside the ship where a pipe is driven into the animal and compressed air is pumped into the abdominal cavity to give the body buoyancy and prevent it from sinking. The sperm whales are less apt to sink since they are buoyed up by the huge oil reservoir contained in the skull cavity. Experiments with a harpoon head charged with compressed carbon dioxide gas were made in an attempt to kill and inflate the whale at the same time, thus preventing the loss of whales that would sound or dive when wounded. So far technical difficulties have prevented the success of this method.

If there is evidence of other whales in the vicinity, a careful record is made of the location of the first kill, and the dead whale is marked with a flag on a long pole which is thrust into the floating carcass, and the hunt continues. It is interesting to note that the 66 whales taken during the 1947–1948 seasons were all killed within an area 117 nautical miles long by 48 nautical miles wide.

When hunting operations are completed the whale is secured by a chain around the base of the tail, a hole is cut in the tail and a safety line secured. The whale is then towed to the shore station and pulled ashore by a power winch. Here the animal is measured from the tip of the upper jaw to the fork of the tail and the weight is estimated at a ton per foot of length. Age, condition and variety cause some variation in weight and the experienced plant manager makes allowances for these factors.

At the plant the butchering, located in the open air near the beach, is done on an asphalt base with a surface of 2 x 4 planks set on edge. A crew armed with long handled flensing knives swarm aboard the whale, cut the oil-rich blubber into strips which are peeled from the carcass and cut into blocks for processing. Care must be exercised to prevent the

TABLE 28

WHALES LANDED IN CALIFORNIA

July 12-November 1, 1947

	Number		Average	
	Male	Female	Length, feet	Weight, tons
Finback (*Balaenoptera velifera*)	7	10	63	54
Humpback (*Megaptera versabilis*)	5	8	43	42
Sei or Japanese (*Balaenoptera borealis*)		3	58	47
Sperm (*Physeter macrocephalus*)	5		45	36
May 2-November 1, 1948				
Finback	12	1	61	48
Humpback		5	44	41
Sperm	10		48	42

TABLE 28
WHALES LANDED IN CALIFORNIA

loss of the free oils which run in small streams from the blubber as it is removed from the carcass.

The process varies slightly in the case of sperm whales. A hole is cut in the top of the skull and the pure spermaceti, the finest of all oils, is bailed from a reservoir at the back of the head. Sperm whales have been landed at Fields Landing which contained as much as 200 gallons of pure spermaceti. The amount varies with the size and age of the animal. Spermaceti has a waxy consistency when taken from the whale. It becomes fluid at a low temperature. Sperm whale oil must be processed and stored separately as it does not mix with other whale oils.

After refining, whale oil is suitable for any of the purposes for which vegetable and other animal oils are used. It is manufactured into salad and cooking oils and oleomargarine. Sperm oil is noted for its fine qualities as a tenacious and anticorrosive lubricant because it does not congeal with cold or break down under heat; it leaves no gum upon evaporation. Many of the better firearm lubricants and rust preventives have a sperm oil base. In the manufacture of fine cosmetics, spermaceti is the substantial ingredient of subtle compounds alleged to bring the bloom of youth to the cheeks of women from 18 to 80.

The dark, coarse meat is next removed and stored. The meat has a strong odor when raw but is reported to be quite palatable and very tender when properly prepared for human food. It is purchased in quantities by domestic fur farmers and is used in the manufacture of dog and cat food and has had a good market in lieu of the currently higher priced feeds.

The viscera and other nonsalable parts of the meat and the huge bones of the skeleton are reduced to meal for poultry feed and fertilizer. The stomach content is sometimes reduced, but because of its extremely offensive odor this practice has been discontinued lately and this material is used in its raw state as fertilizer by the neighboring farmers.

Approaching Fields Landing the motorist is informed of attractions ahead by the odor and by signs which read "See a Real Whale." Despite the fact that ambergris, derived from whales, is an ingredient of costly perfumes, it was necessary to build a special platform for spectators on the seaward side of the plant where a brisk wind makes it tenable. For an admission fee the visitor may view the entire butchering operation while

a guide gives a suitable lecture on the biology of whales and methods of capture. As a tourist attraction the company has built up a side-line business in the sale of sperm whale teeth as souvenirs at $5 each. Baleen (whalebone) which was formerly used as a valuable aid to milady in maintaining a trim figure is sold in pieces for 25 cents and up.—*Leslie E. Lahr.*

References (see page 210) : 8, 17, 108, 110, 126.

2.58. SEAWEED AND KELP

Seaweed and kelp are common names applied to marine algae. Seaweed usually designates the smaller littoral zone species while kelp is applied to the large varieties that form great offshore beds. There are many species of potentially valuable marine algae on the California coast but few of them are used.

One littoral zone algae, Porphyra perforata, is gathered for human food. It is an annual which liberates spores before the winter storms eliminate the current year's growth. The Chinese, who collect it for export to their native country, burn extensive areas of flat rock surfaces, in suitable places, to obtain clean areas for the spores to develop. The wet weed is sun dried until rubbery (dries 5 to 1) and is shipped in 200-pound sacks. In 1929 the local price of the dry weed was 12 cents per pound. This dropped to 5 and 7 cents during the economic depression of the '30s. There was no harvesting of Porphyra during the war, but during 1947 several camps were again taking small quantities. Available records show:

1928	135,000 pounds (dry)
1929	267,500
1930	109,300

Along the Southern California coast is found a marine algae, Gelidium, from which agar is produced. Previous to World War II, practically all the agar used in this country (about 50,000 pounds annually) was imported from Japan. Agar is an indispensable component in bacteriological techniques. It supplies the only known jelly which does not break down under the heat and pressure necessary for sterilization. About 4,000 pounds of agar are used annually for scientific purposes. Agar is used as a filler and stabilizer in ice cream, candy and pastries, and as a sizing for cloth.

There is a sufficient quantity of Gelidium on the Southern California coast to supply the bacteriological needs of the country. However, it can be collected only by divers, and it is not financially profitable to harvest it under a peacetime economy. A single company now manufactures agar from "weed," most of which is from Lower California. Some agar is again being imported from Japan.

The kelp of the Southern California coast, Macrocystis, is found in great beds over rock bottoms in from 20 to 60 feet of water. During the first World War great quantities were used to obtain potash and iodine and a number of related chemical products which were in short supply. During 1917, there were 20 companies and a number of individuals harvesting kelp. Under a war economy it was profitable to work the kelp beds, but with the return of peace the industry languished. Some experimenting continued however, and with the advent of World War II a

comparatively simple process had been developed for the extraction of alginic acid from kelp. This versatile material has many industrial uses. It is a satisfactory substitute for agar in many substances, and processes requiring a colloid and several new uses for it were developed during the war. As an ingredient in camouflage paint, it provides a material which is more easily applied than ordinary oil paint, has insulating properties, and is fire resistant. Paper containers impregnated with an algin solution can be used to ship and store liquids.

There are two concerns harvesting kelp at the present time. One manufactures alginic acid and the other grinds and dries the kelp and incorporates it in a stock feed. In the 11-year period 1937–1947 about 57,000 wet tons of kelp were harvested each year.

There has been considerable opposition to kelp harvesting by individuals and societies who feared depletion of the kelp beds and a consequent undesirable unbalancing of ecological conditions. Their apprehensions are not warranted. No dire results have materialized. Our present knowledge indicates that judicious kelp harvesting is beneficial to the beds.—*Paul Bonnot.*

References (see page 210): 10, 91, 100, 115.

2.59. VALUE

The California Division of Fish and Game has since 1939 published tables showing the value of the commercial fish catch. These values are an estimate of the total amount of money received by the fishermen for the initial sale of their catches. The record system in effect in California, whereby the purchaser makes out a receipt in triplicate showing price, as well as species, pounds, and other data, is the original source of information. One copy of each receipt is sent the Division of Fish and Game, the other copies being retained by the fisherman and the purchaser. If

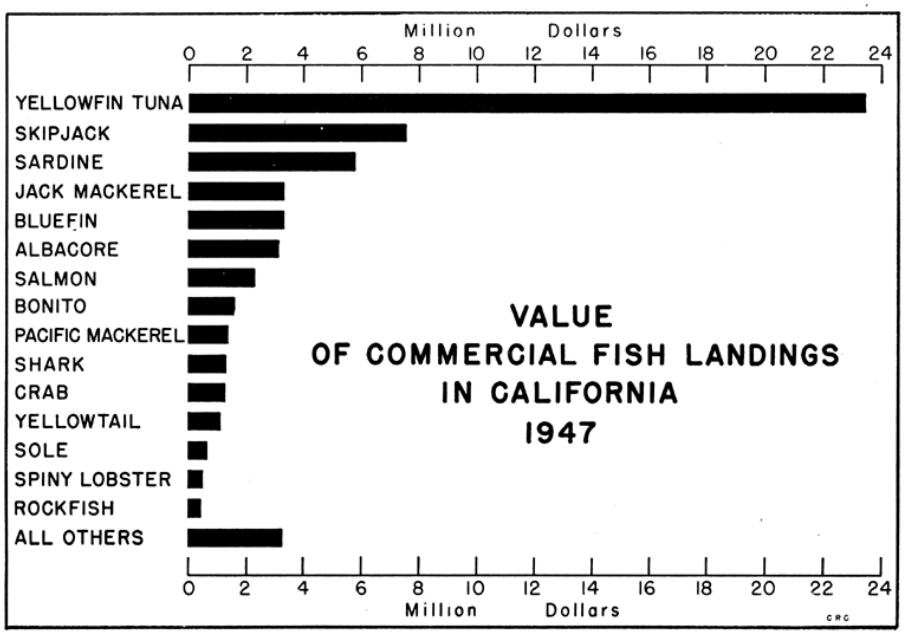

FIGURE 95. See Tables 60-68

FIGURE 95. See Tables 60–68

all receipts showed price, there would be no problem in determining total value. Unfortunately price is often omitted despite continued effort on the part of the Division to have the receipts made out in full. With cannery fish, this is not too serious because the boats operate at a price which is generally uniform throughout the State or at least within a port, and which is usually in force for a considerable length of time. Hence the value of the cannery catch can be determined with reasonable accuracy regardless of the omission of price on some receipts.

The situation is different for fresh fish market sales. The demand of the markets may fluctuate widely even in the course of a day, and it is necessary to estimate the value of unpriced deliveries on the basis of the average price reported for the species in the area during the month. If for a given species, no price is quoted in an area for a length of time, the value is estimated from prices prevailing in adjoining regions, from prices paid in the area before or after the time period in question, or from prices paid in the area during the same time interval in the preceding or following year. This latter circumstance is rare.

Almost all of our fish are caught by independent fishermen who sell to a market or cannery. Part of the trawl catch is, however, made by company-owned boats which make up a fifth to a third of the trawl fleet. These fishermen are now paid by the company on the basis of existing prices set by union contract for both independent and company-owned boats; in earlier years, the value was estimated from the prevailing price to independent fishermen in the area or, if independents did not handle the species, from estimates made by the companies as to a fair valuation. The oyster industry is completely company-owned as is most of the shrimp. Values for these varieties are obtained from firms.

Loads or parts of loads of cannery fish are occasionally condemned by the California Department of Public Health. Such fares are used by the canner for reduction but the fisherman is not paid. The poundage is included in our landing tables.

The value of the catch has increased each year since 1939. In 1947, the total reached $60,457,000, about $15,000,000 over 1946. (Fig. 96). Thus value has continued to go up even though the poundage caught has decreased considerably in the past few years. Rising prices coupled with good fishing for the high-priced tunas have far more than offset the drop in catch which reflects the poor landings of low-priced sardines.

The tunas (albacore, yellowfin, bluefin, and skipjack) accounted for 62 percent of the total 1947 value and for most of this year's increase over 1946. The value of the yellowfin catch alone rose nearly $9,000,000 to a total of over $23,000,000. Eight of the 10 most valuable species are cannery fish. Salmon, little of which is canned in California, ranks seventh, while shark, used chiefly as a source of vitamins, ranks tenth. The leading invertebrate is crab in eleventh place.

With the tunas dominating the price picture, it is to be expected that the Los Angeles and San Diego regions should outshadow those to the north. From 1939 through 1946, Los Angeles was the leader, but in 1947, San Diego surpassed it by a small margin. Within these two regions over $50,000,000 worth of fishery products were handled out of the state-wide total of $60,000,000. Their lead has not always been so pronounced, though it has always been substantial.—*Phil M. Roedel.*

Reference (see page 210): 46.

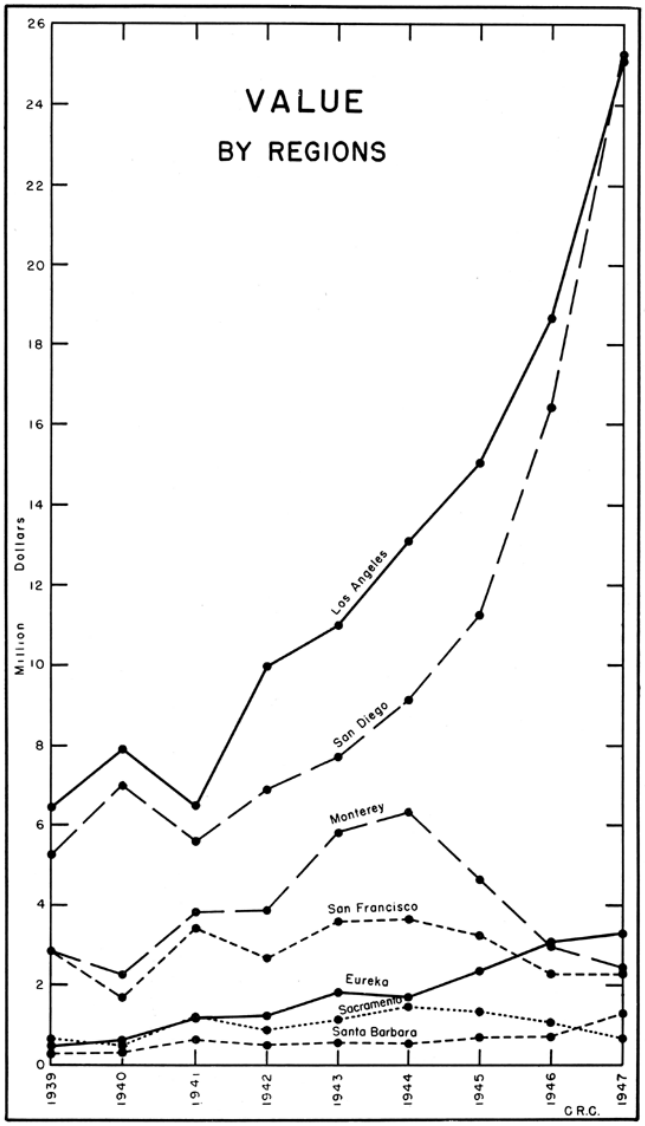

FIGURE 96. The tunas dominate the Los Angeles and San Diego regional totals. The increased fleet of trawlers in the Eureka region is responsible for the rise in pounds and value. See Tables 29 and 60-68

FIGURE 96. The tunas dominate the Los Angeles and San Diego regional totals. The increased fleet of trawlers in the Eureka region is responsible for the rise in pounds and value. See Tables 29 and 60–68

TABLE 29
VALUE OF CALIFORNIA'S COMMERCIAL FISH CATCH [1]

Region	1939	1940	1941	1942	1943	1944	1945	1946	1947
Eureka	$493,800	$633,400	$1,199,800	$1,242,200	$1,830,000	$1,779,800	$2,376,000	$3,129,100	$3,346,700
Sacramento	659,800	511,100	1,220,000	920,000	1,175,400	1,460,500	1,355,700	1,092,300	688,200
San Francisco	2,675,100	1,703,300	3,459,200	2,702,600	3,619,200	3,683,200	3,270,300	2,295,900	2,290,800
Monterey	2,889,100	2,277,300	3,853,600	3,914,000	5,836,900	6,332,100	4,630,600	3,009,500	2,435,000
Santa Barbara	360,100	318,200	625,300	524,700	391,300	549,900	705,700	734,000	1,308,000
Los Angeles	6,431,100	7,942,200	6,522,100	9,989,400	11,062,200	13,136,000	15,045,200	18,602,400	25,110,300
San Diego	5,311,100	7,014,000	5,618,500	6,917,200	7,746,400	9,167,900	11,265,800	16,433,100	23,283,400
Totals	$18,963,100	$20,399,500	$22,499,100	$26,210,100	$31,961,600	$36,129,400	$38,658,300	$45,346,300	$60,462,500

[1] Based on price paid to the fishermen.

TABLE 29
VALUE OF CALIFORNIA'S COMMERCIAL FISH CATCH

2.60. COMMERCIAL FISHING FLEET

The commercial fishing fleet has expanded over the years at about the same rate as the number of market fishermen has increased in California, and as has the population of the State. The numbers of fishing boats in the different size groups have maintained about the same proportions since 1934, except that during World War II the numbers of large boats, 85 feet in length and over, dropped off sharply as these vessels were requisitioned by the armed forces. However, the proportion is now back to what it was before the war, with a slight increase in the maximum length in the group of largest vessels.

One of the greatest changes of the last 10 or 15 years has been shown by the trawler fleet. From about 10 pairs of boats, using paranzella nets in 1940, the fleet has expanded to 80 or more boats in 1947, all using stern-set otter trawls. This includes a large influx of boats which come down from the north in the off-halibut season and change to trawl gear. The size of the boats has increased from a maximum of 50–55 feet to 60–70 feet, with a few even larger (the largest is the *Dennis Gayle*, 103 feet over-all). Manila towing lines have been replaced by steel cable. At Eureka, the development in 1943 and 1944 of the balloon trawl, a modified otter trawl which fishes a little off the bottom, has created a considerable rockfish fishery. Local industries there have built up a big business in rockfish fillets, first to fill army contracts during the war, now for shipping to various localities. Trawlers in very recent years have

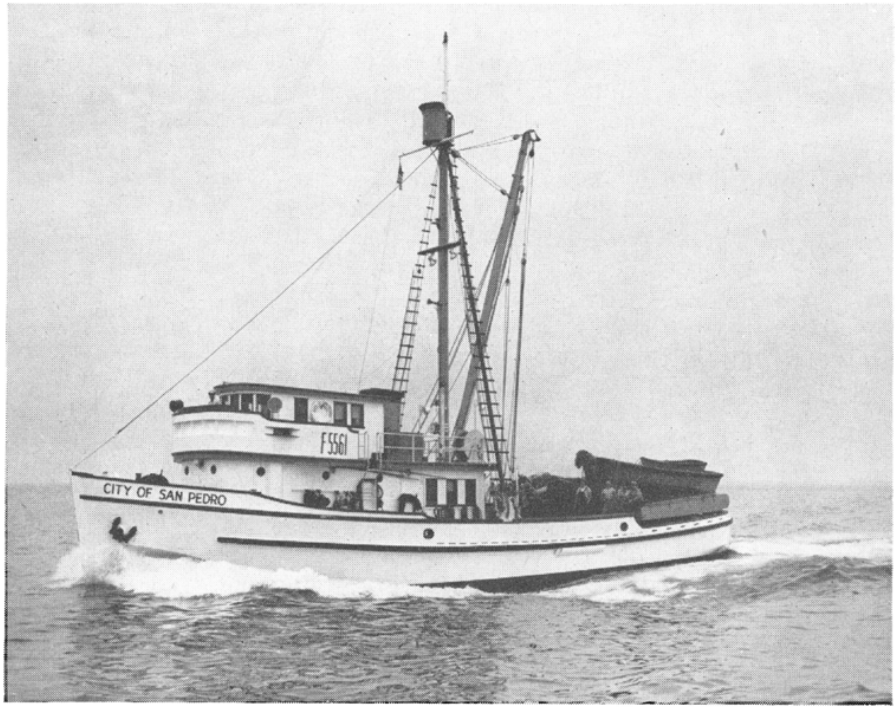

FIGURE 97. A representative of the modern purse seine fleet. These vessels fish seasonally for sardines, mackerel and tuna. The larger ones are depending increasingly on tuna and are, therefore, adapting their refrigeration plants to carry part of their load in brine. Photographed by Kent Hitchcock, Balboa, California, 1947

FIGURE 97. A representative of the modern purse seine fleet. These vessels fish seasonally for sardines, mackerel and tuna. The larger ones are depending increasingly on tuna and are, therefore, adapting their refrigeration plants to carry part of their load in brine. Photographed by Kent Hitchcock, Balboa, California, 1947

been equipping with heavier gear and longer cables, enabling them to fish in much deeper water and farther offshore than before. This has resulted in increased catches of flatfishes. From fishing at 30–95 fathoms, a number—perhaps 20 boats at Eureka—are fishing down to 300 fathoms and more, and as much as 15–20 miles offshore. Although they may stay out for several days at a time, only three are known to be refrigerated.

As sardine fishing has become poorer and as the local and southern tuna fishing has increased, boats in the seiner fleet are being built larger and equipped to go farther afield. These boats may go as far as Central America and the Galapagos Islands. Most still fish tuna only part of the year, but a small number have become year-round tuna boats. The most marked development toward this end has been the installation of brine tanks for carrying fuel and, later, refrigerated fish. These make longer trips possible, make the stowing away of the fish when caught easier and more rapid, and preserve the fish in better condition. There has been an increase in size, with the two largest vessels 128 and 136 feet over-all length. Nets also are correspondingly larger. Four boats have been built with all-steel hulls. Seine skiffs are being motorized.

Smaller boats, around 40 to 50 feet, without the turn-table but carrying more or less typical purse seines, have become fairly popular during the last 10–15 years. These boats represent a smaller investment and require a smaller crew, and so in spite of their more limited cruising range and carrying capacity may pay off as well or better than a larger boat. While mainly limited to local fishing grounds, they are well adapted to succeed under cannery restrictions on amount of daily landings or in times of scarcity of fish, and can fish both cannery and market species with a purse seine, or shift to a lampara for the market fishing, or even change to albacore fishing with hook and line during the summer.

In the tuna bait fleet, the type of boat has remained essentially the same. The raised-deck type is now universal among the larger boats. Sizes remain about the same with an average of 95–98 feet. The maximum size has increased to 156 feet over-all for the *Scarlet Queen*. The larger boats are now all brine-refrigerated, this trend having preceded that in the seiners by a number of years. Probably at least 15 or 20 of the boats have all-steel hulls.

The salmon trollers have remained about the same in average size. Hand-trolling north of San Francisco has been replaced almost 100 percent by use of mechanized gurdies. Lines are now mostly stainless steel. At San Francisco, about 80 percent have converted to gurdies. At Monterey lines are still brought in mostly by hand.

Shark gill net boats have increased in size as have the nets operated. Pulling is practically all done by means of a mechanized net gurdy. Shark boats have mostly converted from hook and line to gill nets, though at Monterey and south a few small Monterey and other type boats still use hook and line. The smaller vessels are found mostly in Southern California; larger ones fish throughout the year up and down the entire coast. The average size is about 65 feet, with 85 feet the largest. As in the trawl fishery, the fleet is augmented during part of the year with boats that come down from the north.

The albacore trolling and mackerel scoop fleets continue to be made up of a heterogeneous assortment of boats of many sizes, shapes, and origins—"anything that will float."

The war and subsequent years brought many additions to the fleet. When U. S. Coast Guard restrictions stopped pleasure boats from going outside of the harbors, and war duties of the owners prevented their giving the necessary time to keep the vessels in good repair, many were sold at relatively cheap prices and converted for use in mackerel scooping or albacore trolling. At the end of the war, a number of army and navy vessels were bought and converted into fishing boats. The 117-foot YPs, of which some 30 were built and which had been designed with this ultimate end in mind, are particularly prominent in the fishery at present; one is fishing tuna as a seiner, the rest as bait boats. Occasionally, the waterfront observers are astounded by ex-landing craft which turn up as fishing vessels. Amphibians or DUKWs were used to catch white sea bass with beach nets in the vicinity of Pismo Beach for a short time, until the practice was prohibited through legislation. They are now used to a limited extent in a harpoon fishery for basking shark.

In addition to the usual losses by accident, a small number of boats, particularly seiners, have been sold to various foreign countries, where the interest in building up the fisheries along modern lines has been growing rapidly.

Many new improvements to make running a boat easier and fishing more successful have come into usage. Radio telephones got their first extensive use on the seiners. In 1939–40, they were just beginning to be appreciated on boats in general, then during most of the war years were not allowed. Since the war, they have become very popular. Practically all the seiners have them. Bait boats have installed radio telephones in addition to their wireless, as the development of more powerful sets has made them useful for long-range broadcasting. Trawlers have added them since the war.

Airplanes have been tried on several bait boats and one seiner, but due to difficulties in handling were given up as impractical on all except one vessel.

The trawlers started putting on fathometers in about 1942, the seiners in 1944. Since then, they have become practically universal on both types of boats, where they are used for fishing as well as navigational aids. Bait boats, shark boats, and others also have fathometers, though largely or entirely for navigation. Many boats have installed automatic steering devices. The YPs came equipped with radar, and it has been installed in a few other vessels. Now there is talk of using sonar equipment for locating and identifying fish, and a recent newspaper article predicts that this and other modern devices will help take the luck out of fishing. This somehow depressing prediction will, however, probably never be realized.—*Anita E. Daugherty*.

References (see page 210): 40, 41, 58, 59, 60, 66, 85, 116, 117, 118, 121.

TABLE 30

COMMERCIAL FISHING FLEET

Season	Under 40 feet	40 feet and over	Total
1935-36	1,848	605	2,453
1936-37			2,660
1937-38			2,843
1938-39			3,057
1939-40	2,253	857	3,110
1940-41	2,510	944	3,454
1941-42	2,331	871	3,202
1942-43	2,264	701	2,965
1943-44	2,929	797	3,726
1944-45	2,852	930	3,782
1945-46	3,103	1,042	4,145
1946-47	3,558	1,299	4,857
1947-48	3,639	1,403	5,042

TABLE 30
COMMERCIAL FISHING FLEET

TABLE 31

COMMERCIAL FISHING FLEET—1947-1948

Region of home port	Number of boats, grouped by length					Total number of boats for each region
	Up to 24 feet	25 to 39 feet	40 to 64 feet	65 to 84 feet	85 feet and over	
Eureka	57	294	89	6		446
Sacramento	114	253	7			374
San Francisco	56	510	100	23	1	690
Monterey	66	227	47	42	13	395
Santa Barbara	43	113	37	1		194
Los Angeles	345	1,083	385	101	55	1,969
San Diego	100	327	137	47	113	724
Alaska, Oregon and Washington	4	47	122	55	20	248
Mexico			2			2
Total number of boats	785	2,854	926	275	202	5,042

TABLE 31
COMMERCIAL FISHING FLEET—1947–1948

TABLE 32

FISHING PARTY VESSELS—1947

Boat owners with market fishermen's licenses	368
Boat owners with party permits only	310
Total party permit or "sport" boats	678

TABLE 32
FISHING PARTY VESSELS—1947

2.61. COMMERCIAL FISHERMEN

The number of licensed commercial fishermen in the state has multiplied almost five times over the period 1916–17 through 1947–48. of these, a large percentage are foreign-born, from over 20 countries, or are first or second generation Americans of foreign-born stock. However, the number actually born outside the United States has dropped from two-thirds, in earlier years, to about one-third (1947). Over the years, natives of the United States have been the most numerous group, with Italians second, Jugoslavs third, Japanese fourth, Norwegians fifth, and Portuguese sixth. Since the beginning of World War II, foreign-born Japanese have almost dropped out of the picture—they were for a time entirely excluded from fishing—but the other groups have maintained their same relative positions.

FIGURE 98. Fishermen pulling in the bag of a purse seine. Photograph by John E. Fitch, August, 1948

FIGURE 98. Fishermen pulling in the bag of a purse seine. Photograph by John E. Fitch, August, 1948

The war brought a number of changes. No Japanese, either United States or foreign born, was permitted to fish. Other foreign nationals were required to become naturalized citizens before they were eligible for a commercial fishing license. A number of the younger fishermen were drafted as the war continued. To replace these and to help fill the increased demand for fish, many new fishermen appeared. Some were older men who had retired from fishing; some were young boys, particularly from fishermen's families, but many were men from eastern and midwestern states who had had no previous contact with fishing. Dazzled by tales of the big money to be made in fishing and tiring of their shipyard

or other defense jobs as the war progressed, they invested their savings in small boats and took to mackerel scooping or albacore fishing.

Fishermen have tended to concentrate by nationalities and subdivisions of nationalities in various localities: Sicilians in San Francisco and Monterey, Dalmatians and Neapolitans in San Pedro, Portuguese and Italians in San Diego, with other smaller colonies in various regions. This has occurred as the result of early arrivals settling, possibly by chance, in one or more places along the coast, then as they prospered sending for their relatives and friends to join them. In addition to residents of the State, a number of out-of-state fishermen, chiefly of Norwegian and United States nativity from the Pacific Northwest, take out licenses in California and fish here part of the year.

The fee for a market fisherman's license is $10, and the license year runs from April 1st of one year through March 31st of the following year.—*Anita E. Daugherty*.

TABLE 33

LICENSED COMMERCIAL FISHERMEN

License year	Number of fishermen	License year	Number of fishermen
1916-17	2,663	1932-33	4,955
1917-18	2,152	1933-34	4,991
1918-19	4,522	1934-35	5,323
1919-20	5,087	1935-36	6,007
1920-21	5,269	1936-37	6,981
1921-22	4,462	1937-38	7,665
1922-23	4,472	1938-39	7,793
1923-24	4,123	1939-40	8,724
1924-25	4,671	1940-41	9,047
1925-26	5,072	1941-42	9,344
1926-27	5,078	1942-43	9,043
1927-28	5,206	1943-44	11,804
1928-29	5,340	1944-45	10,871
1929-30	6,014	1945-46	11,747
1930-31	6,179	1946-47	12,312
1931-32	5,651	1947-48	12,894

TABLE 33
LICENSED COMMERCIAL FISHERMEN

TABLE 34

NATIVITY OF LICENSED FISHERMEN
License Year 1947-1948

	Number of fishermen		Number of fishermen
United States	9,058	Mexico	57
Italy	1,362	Spain	56
Jugoslavia	782	Greece	53
Norway	454	Germany	51
Portugal	378	Russia	38
Great Britain	172	Philippine Islands	38
Sweden	96	Austria	21
Finland	63	All others	157
Denmark	58		
Total licensed fishermen			12,894

TABLE 34
NATIVITY OF LICENSED FISHERMEN
License Year 1947–1948

TABLE 35

CITIZENSHIP

1947-1948 Licensed Commercial Fishermen

	Number of fishermen		Number of fishermen
Citizens:		Noncitizens:	
United States born	9,056	First naturalization papers	331
Foreign-born United States citizens	2	Aliens	308
Naturalized citizens	3,152	Nativity not given	26
		Citizenship not given	19
Total			12,894

TABLE 35

CITIZENSHIP

1947–1948 Licensed Commercial Fishermen

TABLE 36

CALIFORNIA COMMERCIAL FISHERMEN, LICENSE YEAR 1947-1948

Region of residence	Nativity	Number of fishermen	Total
Eureka	United States	720	
	Finland	35	
	Norway	24	
	All others	77	856
Sacramento	United States	502	
	Italy	111	
	Greece	23	
	All others	36	672
San Francisco	United States	776	
	Italy	360	
	Norway	38	
	Jugoslavia	24	
	Sweden	23	
	All others	91	1,312
Monterey	United States	876	
	Italy	381	
	Spain	37	
	Portugal	14	
	All others	64	1,372
Santa Barbara	United States	543	
	Philippine Islands	23	
	Portugal	10	
	All others	41	617
Los Angeles	United States	3,585	
	Jugoslavia	725	
	Italy	279	
	Great Britain	93	
	Norway	85	
	Russia	25	
	Sweden	24	
	Denmark	23	
	All others	131	4,970
San Diego	United States	1,702	
	Portugal	318	
	Italy	206	
	Norway	35	
	Great Britain	30	
	Mexico	25	
	Costa Rica	18	
	All others	71	2,405
Alaska, Washington and Oregon fishermen licensed in California	United States	352	
	Norway	259	
	Jugoslavia	17	
	Sweden	17	
	Finland	17	
	All others	14	676
Mexican nationals licensed in California	Mexico	14	14
Total			12,894

TABLE 36

CALIFORNIA COMMERCIAL FISHERMEN, LICENSE YEAR 1947–1948

2.62. COMMON NAMES

Many of our important fishes are called by different names in different places. Sometimes one fish has several names in one area and often one name may refer to two or more entirely different species, depending on to whom you are speaking. This confusion in names led to confusion in catch statistics when the Division of Fish and Game first began compiling records. In 1931, the Division published an official list of names for the more important fishes, crustaceans and mollusks of the State (Walford, 1931a) in the hope that these names would be used by the fishing industry. Whenever possible the names adopted were those in current uses although a number of popular names could not be accepted because they were applied to several kinds of fishes. Such a list is obviously a compromise and complete agreement could not be reached and the use of all the names could not be expected. However, there was a marked improvement in the record during the ensuing years because many of the official names came into greater use and some of the unauthorized names were forgotten. Within the past year, the list has been revised insofar as it pertains to marine bony fishes (Roedel, 1948a). There have been a number of changes and these, together with the reasons for them, are discussed in the paragraphs which follow.

Certain of the original official names met with no popular favor. The fishes to which they were applied have reasonably well established vernacular names, and we have adopted several of them to conform with usage. In a few cases, other considerations prevented our accepting a widely used name. Those which were changed:

New official name	*Old official name*	*Scientific name*
Lingcod	Pacific cultus	Ophiodon elongatus
English sole	Pointed-nosed sole	Parophrys vetulus
Petrale sole	Round-nosed sole	Eopsetta jordani
Sand sole	Fringe sole	Psettichthys melanosticus

A number of the names apply to fishes not generally separated by our fishermen or not often caught. Several of these were changed either on grounds of appropriateness or to make them conform with names used in other areas or by other agencies. These include:

New official name	*Old official name*	*Scientific name*
Bonefish	Ladyfish	Albula vulpes
Round herring	Japanese herring	Etrumeus orthonops
Scad	Mackerel scad	Decapterus hypodus
Slough anchovy	Southern anchovy	Anchoa delicatissima
Top smelt	Bay smelt	Atherinops affinis
Curlfin turbot	California turbot	Pleuronichthys decurrens
C-O turbot	Mottled turbot	Pleuronichthys coenosus

The first three are not fished in California. The others, when caught, are included in records of the anchovy, smelt and turbot catches, respectively.

The remaining changes were made for a variety of reasons: 1. Jack mackerel from horse mackerel, Trachurus symmetricus. This change was made official by the California Division of Fish and Game at the request of the canning industry in the summer of 1947. The United States Pure Food and Drug Administration gave its permission to use the name on labels in May, 1948. With the vast expansion of the fishery in 1947, need for the change for marketing purposes became apparent.

2. Sierra from Spanish mackerel, Scomberomorus sierra. "Spanish mackerel" proved confusing because it is often misapplied to the jack mackerel. Further, the name is used elsewhere in the world for other members of genus Scomberomorus. We therefore substituted sierra, a name which has been used in reference to this species.

3. Pile perch from fork-tail perch, Damalichthys vacca. This species is rarely if ever separated from other perches by commercial fishermen. The name pile perch has some standing among sportsmen, while fork-tail perch is misleading in that several close relatives have as deeply forked tails.

4. Priestfish from black rockfish, Sebastodes mystinus. We have given names to several species of rockfish not previously listed. In discussing the group, it developed that "black rockfish" should be applied to Sebastodes melanops, a species heretofore unnamed. "Priestfish" has appeared in biological literature and is the official name for the fish in Canada.

5. Greenling seatrout from California sea-trout. This new name was selected after considerable discussion and is definitely a compromise. The fish, Hexagrammos decagrammus, is known as "greenling" in the Pacific Northwest. In Central and Northern California it is universally called "seatrout," though it is not, of course, a trout. In Southern California, "seatrout" may mean any of several other species. Academically, "greenling" alone would be the better name, but because of usage in that part of the State where the species is found it was not thought practical to eliminate "seatrout."

6. Moray from moray eel, Gymnothorax mordax. This is not a true eel and the name "moray" alone has considerable usage.

7. Pacific halibut from northern halibut, Hippoglossus stenolepis. This has always been the Pacific halibut in the Pacific Northwest, where it is of major commercial importance.

8. Dover sole from slippery sole, Microstomus pacificus. This fish, also known as the slime sole and the Chinese sole, has only recently become of commercial importance. "Dover sole" is now in general use, and is, needless to say, a much better trade name.

9. Sand bass from rock bass. This fish Paralabrax nebulifer, is caught in bays or on a sandy bottom and is usually "sand bass" to sportsmen. The name "rock bass" is used collectively in the markets for the three species of this genus comprising the commercial catch and we use it in this sense in the catch records.

10. Spotted sand bass from spotted rock bass, Paralabrax maculatofasciatus. This change follows the one above on logical grounds. The fish, which is not commonly caught, is generally called "spotted bass" but that name is reserved officially for a fresh-water species.

The Bureau of Fish Conservation has changed the names of three fresh-water fishes which enter the commercial catch. These are:

New official name	*Old official name*	*Scientific name*
Greaser blackfish	Hardhead	Orthodon microlepidotus
Western sucker	Sacramento sucker	Catostomus occidentalis
Sacramento squawfish	Sacramento pike	Ptychocheilus grandis

Mr. Leo Shapovalov, of that bureau, in a letter dated August 13, 1948, writes as follows with regard to these changes: “"The name 'Greaser Blackfish' was chosen for O. microlepidotus on the basis of two common names now in wide local use for the species: 'Greaser' in the San Joaquin Valley and 'blackfish' in the vicinity of Clear Lake.” “'Western Sucker' was chosen in preference to 'Sacramento Sucker' for C. occidentalis because more than one species of sucker is present in the Sacramento River system, and also because 'Western Sucker' is more descriptive of the scientific name of the species.” “'Sacramento squawfish' was chosen in preference to 'Sacramento pike' for P. grandis because the name 'pike' leads to confusion in regard to relationships of this genus."” We are retaining "pike" as a trade name because of its universal use by commercial fishermen. The greaser blackfish is included in the "hardhead" catch.

In compiling catch records, a number of species are often grouped under one name, even though each species may have its own "official" name. This may be because the species are so alike in general appearance that little or no effort is made to separate them in the markets, because little reliance can be placed on the market identification or because only part of the total catch can be assigned accurately to the several species. The trade name, in a few cases, includes members of two or more families. For example, "smelt," includes the true smelts of family Osmeridae and the silversides (jack smelt, top smelt and grunion) of family Atherinidae, and "perch" includes not only the true saltwater perches but also a number of fishes superficially perch-like which actually belong to other families. In the list which follows, species will be found under the appropriate trade name in such circumstances.—*Phil M. Roedel.*

2.63. LIST OF COMMON AND SCIENTIFIC NAMES OF FISHES, CRUSTACEANS AND MOLLUSKS

Common name	*Scientific name*
Anchovy	
Deep-bodied	Anchoa compressa
Northern	Engraulis mordax
Slough	Anchoa delicatissima
Barracuda	Sphyraena argentea
Bass, striped	Roccus saxatilis
Bonito, California	Sarda lineolata
Cabezone	Scorpaenichthys marmoratus
Cabrilla	Epinephalus analogus
Carp	Cyprinus carpio
Catfish	
Forktail	Ictalurus catus
Squaretail	Ameiurus nebulosus
Cod, Alaska	Gadus macrocephalus
Corbina, Mexican	Cynoscion orthonopterus
Eel	
Blenny-eel	Cebidichthys violaceus
Blenny-eel	Xiphister mucosus
Moray	Gymnothorax mordax
Flounder, starry	Platichthys stellatus
Flying fish, California	Cypselurus californicus
Grouper	*Species of* Mycteroperca
Hake	Merluccius productus
Halibut, California	Paralichthys californicus
Halibut, Pacific	Hippoglossus stenolepis
Hardhead	
Greaser blackfish	Orthodon microlepidotus
Hardhead	Mylopharodon conocephalus
Herring, Pacific	Clupea pallasii
Kingfish	
Kingfish	Genyonemus lineatus
Queenfish	Seriphus politus
Lingcod	Ophiodon elongatus
Mackerel, jack	Trachurus symmetricus
mackerel, Pacific	Pneumatophorus diego
Marlin, striped	Makaira mitsukurii
Mullet	Mugil cephalus
Perch	
Blacksmith	Chromis punctipinnis
Halfmoon	Medialuna californiensis
Opaleye	Girella nigricans
Salt-water perch	Members of family Embiotocidae
Pike (Sacramento squaw-fish)	Ptychocheilus grandis
Pompano, California	Palometa simillima
Pompano, Mexican	Trachinotus kennedyi
Rock bass	
Kelp bass	Paralabrax clathratus
Sand bass	Paralabrax nebulifer
Rockfish	All species of Sebastodes and Sebastolobus
Sablefish	Anoplopoma fimbria
Salmon	
King	Oncorhynchus tshawytscha
Silver	Oncorhynchus kisutch
Sand dab	Citharichthys sordidus
	Citharichthys stigmaeus
Sardine, Pacific	Sardinops caerulea
Sculpin	Scorpaena guttata
Sea bass, black	Stereolepis gigas
Sea bass, white	Cynoscion nobilis
Seatrout, greenling	Hexagrammos decagrammus
Shad	Alosa sapidissima

Shark	
Basking shark	Cetorhinus maximus
Dogfish	Squalus suckleyi
Gray smoothhound	Mustelus californicus
Leopard shark	Triakis semifasciata
Soupfin	Galeorhinus zyopterus
Varying amounts of other species	
Sheepshead, California	Pimelometopon pulchrum
Sierra	Scomberomorus sierra
Skate	
Big	Raja binoculata
California	Raja inornata
Longnose	Raja rhina
Varying amounts of other species	
Smelt	
Grunion	Leuresthes tenuis
Jack smelt	Atherinopsis californiensis
Surf smelt	Hypomesus pretiosus
Top smelt	Atherinops affinis
Small amounts of other Osmerids	
Sole	
English	Parophrys vetulus
Dover	Microstomus pacificus
Petrale	Eopsetta jordani
Rex	Glyptocephalus zachirus
Varying amounts of other species	
Split-tail	Pogonichthys macrolepidotus
Sucker, western	Catostomus occidentalis
Swordfish, broadbill	Xiphias gladius
Tomcod	Microgadus proximus
Totuava	Cynoscion macdonaldi
Tuna	
Albacore	Thunnus germo
Bluefin tuna	Thunnus thynnus
Oriental tuna	Thunnus orientalis
Skipjack	Katsuwonus pelamis
Yellowfin tuna	Neothunnus macropterus
Turbot	
Curlfin	Pleuronichthys decurrens
Diamond	Hypsopsetta guttulata
Sharpridge	Pleuronichthys verticalis
Small amounts of other species	
Whitebait	Allosmerus attenuatus
	Spirinchus starksi
	Young of several other species
Whitefish, ocean	Caulolatilus princeps
Yellowtail	Seriola dorsalis

Crab, market	Cancer magister
Crab, rock	Cancer antennarius
	Cancer anthonyi
	Cancer productus
Lobster, spiny	Panulirus interruptus
Shrimp	Crago franciscorum
	Crago nigricauda
Abalone	
Pink	Haliotis corrugata
Red	Haliotis rufescens
Southern green	Haliotis fulgens
Clam	
Cockle	Paphia staminea
	Species of Chione
Gaper	Schizothaerus nuttalli
Pismo	Tivela stultorum
Softshell	Mya arenaria
Washington	Saxidomus nuttalli
Mussel	Mytilus californianus
	Mytilus edulis
Octopus	Paroctopus apollyon
Oyster	
Eastern	Ostrea virginica
Native	Ostrea lurida
Pacific	Ostrea gigas
Squid	Loligo opalescens

—Phil M. Roedel

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For the benefit of anyone interested in pursuing further the course of any California fishery, particularly with reference to statistics of the catch, the following list of publications has been compiled. Some of these references have been cited in the text, others are of general interest in connection with specific fisheries, and in a few will be found bibliographies for individual species. In selecting this list, special attention was given to the fishes of minor importance, about which little has been written and for which no complete bibliographies are available.

of general interest and upon which the authors have drawn heavily in preparing the historical accounts and the scientific identification of species are the publications of the Division of Fish and Game, which are identified below.

Biennial Reports of the California Fish and Game Commissioners.
California Fish and Game. (quarterly)
Circulars, Bureau of Marine Fisheries, nos. 1 through 22.
Fish and Game Code. (biennial)
Fish Bulletins, Bureau of Marine Fisheries, nos. 1 through 73.
For statistics and history, bulletins no. 15, 20, 30, 44, 49, 57, 58, 59, 63 and 67.
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3. TABLES
YEARLY LANDINGS IN POUNDS 1916–1947

TABLE 37

YEARLY LANDINGS IN POUNDS—COMMERCIAL FISH

Exclusive of Mollusks and Crustaceans [1]

Year	Pounds	Year	Pounds
1916	88,390,465	1932	542,060,362
1917	202,987,474	1933	811,002,474
1918	254,238,270	1934	1,378,154,189
1919	256,120,774	1935	1,433,616,046
1920	215,431,810	1936	1,753,632,108
1921	129,086,209	1937	1,354,050,220
1922	176,216,485	1938	1,298,036,943
1923	246,383,030	1939	1,472,988,721
1924	325,948,382	1940	1,284,881,633
1925	425,695,707	1941	1,517,533,106
1926	382,602,891	1942	1,166,614,194
1927	471,210,260	1943	1,215,161,305
1928	572,070,120	1944	1,430,202,850
1929	841,149,549	1945	1,138,943,309
1930	680,858,788	1946	855,997,768
1931	491,083,110	1947	763,324,829

[1] Includes sardine deliveries to reduction ships and tuna importations.
See Figure 3.

TABLE 37

YEARLY LANDINGS IN POUNDS—COMMERCIAL FISH

Exclusive of Mollusks and Crustaceans

TABLE 38

YEARLY LANDINGS IN POUNDS—TUNA

Yellowfin

Year	California	Shipments from		Total pounds
		South of international boundary	Japan	
1919	348,081			348,081
1920	1,965,024			1,965,024
1921	1,297,451			1,297,451
1922	7,405,279			7,405,279
1923	10,836,925			10,836,925
1924	3,063,398			3,063,398
1925	13,237,898			13,237,898
1926	12,564,986			12,564,986
1927	25,933,966			25,933,966
1928	32,253,206			32,253,206
1929	37,444,924			37,444,924
1930	56,654,181		3,587	56,657,768
1931	36,579,480		1,896	36,581,376
1932	36,923,410			36,923,410
1933	51,075,630			51,075,630
1934	60,913,160		223,942	61,137,102
1935	72,294,127			72,294,127
1936	78,352,644		8,628	78,361,272
1937	91,522,458		884,148	92,406,606
1938	78,288,144		74,861	78,363,005
1939	110,417,801			110,417,801
1940	113,759,900	138,309		113,898,209
1941	76,664,531	37,289		76,701,820
1942	41,466,614			41,466,614
1943	49,261,328			49,261,328
1944	63,143,891			63,143,891
1945	87,331,440			87,331,440
1946	127,246,675			127,246,675
1947	150,388,754	70,630 [1]		150,459,384

[1] 1947 shipment included 70,630 pounds yellowfin from Chile.

TABLE 38

YEARLY LANDINGS IN POUNDS—TUNA

TABLE 38—Continued

YEARLY LANDINGS IN POUNDS—TUNA

Skipjack

Year	California	Shipments from Japan	Total pounds
1918	3,022,964		3,022,964
1919	6,892,427		6,892,427
1920	7,957,277		7,957,277
1921	1,134,993		1,134,993
1922	11,857,833		11,857,833
1923	11,462,522		11,462,522
1924	3,774,058		3,774,058
1925	14,222,453		14,222,453
1926	20,951,348		20,951,348
1927	33,805,960		33,805,960
1928	15,948,096		15,948,096
1929	27,007,013	59,575[2]	27,066,588
1930	20,485,587		20,485,587
1931	16,506,761		16,506,761
1932	21,636,577		21,636,577
1933	16,687,308	405,733	17,093,041
1934	14,830,194	1,579,245	16,409,439
1935	17,197,186	2,606,768	19,803,954
1936	27,006,105	2,264,925	29,271,030
1937	47,104,092	7,594,903	54,698,995
1938	22,653,631	3,499,343	26,152,974
1939	30,120,891	1,066,059	31,186,950
1940	56,650,155	260,367	56,910,522
1941	25,585,468	121,596	25,707,064
1942	38,735,228		38,735,228
1943	28,893,784		28,893,784
1944	30,037,236		30,037,236
1945	33,347,896		33,347,896
1946	41,087,994		41,087,994
1947	52,462,104		52,462,104

[2] 1929 shipment included 59,575 pounds skipjack from Hawaii.

Albacore

Year	California	Shipments from			Total pounds
		North of state boundary	Hawaii	Japan	
1916	22,899,309				22,899,309
1917	30,556,242				30,556,242
1918	7,265,422				7,265,422
1919	13,630,899				13,630,899
1920	18,876,647				18,876,647
1921	15,276,727				15,276,727
1922	13,231,823				13,231,823
1923	12,514,833				12,514,833
1924	17,695,362				17,695,362
1925	22,206,923				22,206,923
1926	2,469,921				2,469,921
1927	4,579,367			77,592	4,656,959
1928	283,321		57,453	3,724,955	4,065,729
1929	269,101		43,054	5,798,175	6,110,330
1930	283,117		5,426	7,000,142	7,288,685
1931	37,322			6,939,079	6,976,401
1932	619,694		98,720	2,368,801	3,087,215
1933	487		43,612	2,750,353	2,794,452
1934	93,929		25,900	4,167,467	4,287,296
1935	2,447,528			3,231,265	5,678,793
1936	945,595	11,176		1,499,233	2,456,004
1937	2,020,016	1,176,754		1,546,939	4,743,709
1938	6,814,900	5,707,694		1,052,041	13,574,635
1939	10,000,362	2,346,496		4,076,376	16,423,234
1940	3,940,638	1,703,354		1,434,342	7,078,334
1941	3,341,209	528,959		444,340	4,314,508
1942	10,621,360	470,506			11,091,866
1943	21,384,864				21,384,864
1944	18,453,932	2,535,547			20,989,479
1945	21,275,300	60,901			21,336,201
1946	18,077,899				18,077,899
1947	13,171,751	255,530			13,427,281

TABLE 38
YEARLY LANDINGS IN POUNDS—TUNA

TABLE 38—Continued

YEARLY LANDINGS IN POUNDS—TUNA

Bluefin

Year	Total pounds	Year	Total pounds
1918		1933	560,492
1919	14,990,860	1934	18,357,828
1920	10,530,272	1935	25,173,083
1921	1,971,813	1936	18,924,883
1922	2,811,283	1937	12,694,352[1]
1923	3,218,090	1938	17,728,031
1924	3,241,110	1939	11,835,715
1925	3,803,677	1940	19,970,268
1926	6,526,533	1941	9,519,012
1927	4,898,465	1942	12,844,564
1928	13,700,870	1943	10,178,768
1929	7,526,857	1944	20,343,550
1930	21,921,282	1945	20,594,309
1931	3,534,030	1946	22,031,791
1932	1,071,206	1947	20,837,634

[1] 1937 shipment included 430 pounds bluefin from east coast of U. S.

Oriental Tuna

Year	Shipments from Japan	Year	Shipments from Japan
1932	1,053,795	1936	765,422[2]
1933	899,336	1937	523,632
1934		1938	4,328
1935	146,531		

[2] 1936 shipment included 20,370 pounds big-eyed tuna from Japan.

Unclassified Tuna

Year	California	Year	California
1918	6,240,971	1923	662,370
1919	2,461,311	1924	546,538
1920	5,482,574	1925	426,553
1921	1,552,845	1926	260,855
1922	692,352		

TABLE 38
YEARLY LANDINGS IN POUNDS—TUNA

TABLE 39

YEARLY LANDINGS IN POUNDS

Sardines

Year	Shore plants	Reduction ships [1]	Total pounds
1916	15,648,839		15,648,839
1917	104,103,331		104,103,331
1918	157,652,811		157,652,811
1919	153,877,179		153,877,179
1920	118,520,914		118,520,914
1921	59,332,305		59,332,305
1922	93,399,900		93,399,900
1923	158,159,356		158,159,356
1924	242,685,958		242,685,958
1925	315,294,986		315,294,986
1926	286,741,250		286,741,250
1927	342,275,289		342,275,289
1928	420,269,665		420,269,665
1929	651,771,904		651,771,904
1930	494,450,747	7,612,000	502,062,747
1931	301,307,801	63,044,000	364,351,801
1932	312,171,716	110,438,000	422,609,716
1933	509,797,481	116,600,000	626,397,481
1934	902,585,099	217,346,000	1,119,931,099
1935	829,512,548	266,246,000	1,095,758,548
1936	955,525,700	508,018,000	1,463,543,700
1937	891,430,525	180,060,000	1,071,490,525
1938	935,611,489	87,778,000	1,023,389,489
1939	1,160,793,581		1,160,793,581
1940	905,973,403		905,973,403
1941	1,262,480,393		1,262,480,393
1942	969,747,099		969,747,099
1943	972,269,915		972,269,915
1944	1,147,207,882		1,147,207,882
1945	845,062,774		845,062,774
1946	510,759,173		510,759,173
1947	255,513,948		255,513,948

[1] Totals obtained by the U. S. Fish and Wildlife Service from the books of the companies.

TABLE 39

YEARLY LANDINGS IN POUNDS

Sardines

TABLE 40

YEARLY LANDINGS IN POUNDS

Mackerel

Year	Unclassified	Pacific mackerel	Jack mackerel	Total pounds
1916	1,113,998			1,113,998
1917	3,345,563			3,345,563
1918	4,005,906			4,005,906
1919	2,654,596			2,654,596
1920	2,997,308			2,997,308
1921	2,914,613			2,914,613
1922	2,466,762			2,466,762
1923	3,553,954			3,553,954
1924	3,227,300			3,227,300
1925	3,506,103			3,506,103
1926		3,610,098	235,151	3,845,249
1927		4,728,903	462,539	5,191,442
1928		35,251,298	538,446	35,789,744
1929		57,973,952	698,290	58,672,242
1930		16,531,364	368,828	16,900,192
1931		14,254,081	563,108	14,817,189
1932		12,473,746	536,409	13,010,155
1933		69,613,680	1,010,850	70,624,530
1934		113,848,585	1,581,274	115,429,859
1935		146,427,202	9,983,924	156,411,126
1936		100,542,214	4,599,382	105,141,596
1937		60,936,701	6,541,026	67,477,727
1938		79,848,015	4,133,918	83,981,933
1939		80,909,374	3,760,155	84,669,529
1940		120,504,412	1,432,637	121,937,049
1941		78,167,200	2,068,685	80,235,885
1942		52,553,663	5,348,501	57,902,164
1943		75,214,799	12,698,974	87,913,773
1944		83,656,900	12,777,077	96,433,977
1945		53,716,765	9,032,987	62,749,752
1946		53,875,327	15,093,321	68,968,648
1947		46,478,182	129,048,318	175,526,500

TABLE 40

YEARLY LANDINGS IN POUNDS

Mackerel

TABLE 41

YEARLY LANDINGS IN POUNDS

Salmon [1]

Year	Ocean caught	Sacramento-San Joaquin Rivers	Other rivers [2]	Total pounds
1916	5,592,216	3,450,787	1,896,591	10,939,594
1917	6,085,997	3,975,487	999,097	11,060,581
1918	5,933,346	5,938,029	1,221,813	13,093,188
1919	7,208,382	4,529,222	1,408,123	13,145,727
1920	6,066,190	3,860,312	1,207,317	11,133,819
1921	4,483,105	2,511,127	996,700	7,990,932
1922	4,338,317	1,765,066	1,131,741	7,235,124
1923	3,736,924	2,243,945	1,109,391	7,090,260
1924	6,374,573	2,640,110	1,000,586	10,015,269
1925	5,481,536	2,778,846	1,265,371	9,525,753
1926	3,863,677	1,261,776	958,626	6,084,079
1927	4,921,600	920,786	669,543	6,511,929
1928	3,444,306	553,777	480,483	4,478,566
1929	4,033,660	581,497	429,714	5,044,871
1930	4,085,650	1,213,698	703,546	6,002,894
1931	3,666,841	941,605	686,065	5,294,511
1932	2,649,194	1,264,987	703,990	4,618,171
1933	3,657,661	454,253	446,520	4,558,434
1934	3,921,530	397,572	----------	4,319,102
1935	4,773,112	888,868	----------	5,661,980
1936	4,093,475	949,179	----------	5,042,654
1937	5,934,996	974,871	----------	6,909,867
1938	2,170,921	1,668,376	----------	3,839,297
1939	2,238,755	496,933	----------	2,735,688
1940	5,160,403	1,515,588	----------	6,675,991
1941	2,945,994	844,963	----------	3,790,957
1942	4,063,306	2,552,944	----------	6,616,250
1943	5,285,527	1,295,424	----------	6,580,951
1944	7,021,848	3,265,143	----------	10,286,991
1945	7,912,754	5,467,960	----------	13,380,714
1946	7,134,472	6,524,991	----------	13,659,463
1947	8,080,780	3,403,808	----------	11,484,588

[1] The commercial catch of king and silver salmon in California has not been separated. Occasional samples and partial separation for a few areas are available for a few years. The recent samples indicate that the silver salmon constituted about 9 percent by weight of the ocean catch in 1939-1942. Silver salmon are not taken by the Sacramento-San Joaquin fishery.

[2] Eel, Klamath, Mad and Smith Rivers were closed to commercial fishing in 1934.

TABLE 41
YEARLY LANDINGS IN POUNDS
Salmon

TABLE 42

YEARLY LANDINGS IN POUNDS

River Fish

Year	Shad	Striped bass	Catfish [1]
1916	4,692,695	941,849	372,420
1917	5,675,509	1,095,856	443,316
1918	2,383,635	1,407,841	409,752
1919	1,574,413	768,934	329,716
1920	1,409,768	671,747	224,730
1921	862,897	601,614	296,232
1922	1,109,445	684,198	251,358
1923	1,285,383	909,573	258,572
1924	1,539,217	661,777	703,920
1925	2,439,726	837,773	732,558
1926	902,202	750,801	514,754
1927	4,103,423	647,594	742,606
1928	2,088,878	484,113	918,202
1929	1,602,970	528,981	1,012,318
1930	1,199,462	866,808	866,382
1931	851,974	975,807	741,360
1932	1,173,471	537,427	508,112
1933	1,157,526	485,926	344,926
1934	872,603	801,341	369,710
1935	1,602,251	502,080	586,648
1936	2,272,989	----------	610,054
1937	652,657	----------	637,942
1938	1,338,727	----------	624,618
1939	1,316,768	----------	434,072
1940	1,764,027	----------	303,260
1941	113,101	----------	353,846
1942	2,571,633	----------	341,160
1943	2,348,143	----------	419,050
1944	2,688,664	----------	680,936
1945	1,483,674	----------	850,668
1946	771,303	----------	820,666
1947	305,566	----------	599,744

[1] Catfish totals increased 100 percent over former published records to cover cleaning loss.

TABLE 42
YEARLY LANDINGS IN POUNDS
River Fish

TABLE 43

YEARLY LANDINGS IN POUNDS

Rough Fish [1]

Year	Carp	Hardhead [2]	Sacramento Pike [3]	Split-tail	Sucker
1916	222,746	23,478	12,942	5,956	2,130
1917	199,642	35,569	10,357	2,909	1,990
1918	312,774	27,861	13,365	7,980	7,267
1919	261,830	49,291	6,864	24,790	5,833
1920	134,420	13,323	8,138	14,084	2,712
1921	102,126	75,811	9,120	13,168	4,158
1922	66,913	18,206	7,444	10,408	1,352
1923	148,607	9,563	4,624	13,956	342
1924	75,965	19,023	4,953	3,671	2,085
1925	94,935	24,028	5,764	6,557	5,709
1926	72,178	43,625	2,990	5,322	1,988
1927	63,014	32,898	7,865	10,601	1,020
1928	157,283	61,699	3,780	10,740	1,029
1929	84,937	55,410	3,264	8,738	842
1930	69,387	38,884	5,207	18,528	1,990
1931	77,497	46,022	2,501	9,136	649
1932	55,965	431,372	2,004	27,945	16,575
1933	57,856	156,687	727	17,509	14,187
1934	179,710	147,368	1,605	54,984	63,033
1935	152,178	78,044	1,655	37,591	44,368
1936	108,890	106,670	497	29,342	48,051
1937	38,631	54,162	499	10,826	7,882
1938	38,896	12,946	985	11,127	462
1939	14,213	12,921	183	15,461	53
1940	10,404	4,962	161	12,298	131
1941	185,236	1,841	606	20,383	83
1942	72,618	92,822	173	15,391	95
1943	17,241	2,796	273	10,925	
1944	18,218	1,664	716	8,179	
1945	122,521	9,314	188	2,633	1,328
1946	235,311	33,676	123	2,869	335
1947	237,131	51,138	291	5,088	

[1] An estimated 425,000 pounds taken in Clear Lake in 1941 and approximately 1,000,000 pounds taken under permit in 1947 not included.
[2] Includes greaser blackfish.
[3] Sacramento squawfish.

15—12201

TABLE 43
YEARLY LANDINGS IN POUNDS
Rough Fish

TABLE 44

YEARLY LANDINGS IN POUNDS

Flatfish

Year	California halibut	Pacific halibut	Starry flounder	Sand dab	Sole	Turbot
1916	4,052,173	70,344	453,916	2,228,734	6,407,186	2,608
1917	4,379,312	131,585	1,151,876	2,631,862	8,728,429	1,327
1918	4,624,218	129,473	818,835	1,751,609	7,027,767	3,664
1919	4,698,123	161,375	435,731	709,738	5,528,685	2,115
1920	4,279,582	165,308	481,587	721,810	3,821,748	855
1921	3,653,861	141,896	293,656	784,011	4,870,870	219
1922	3,254,505	148,979	539,220	1,170,979	7,043,336	1,534
1923	2,229,381	197,456	508,961	1,363,911	7,086,035	1,011
1924	2,576,882	132,016	379,770	1,699,832	8,835,351	1,868
1925	2,452,551	161,310	594,420	1,952,847	8,762,535	3,926
1926	1,349,031	338,689	667,711	1,143,935	8,649,870	1,365
1927	1,303,559	568,672	590,064	892,718	10,479,765	3,950
1928	1,187,651	375,840	399,880	1,108,764	10,281,719	9,234
1929	1,102,573	750,624	580,752	1,051,868	11,706,761	1,323
1930	1,097,760	413,958	391,096	616,349	10,924,085	7,345
1931	969,773	790,384	169,806	472,805	9,412,882	18,284
1932	949,702	645,828	543,806	665,345	8,890,840	23,422
1933	989,649	321,664	457,998	562,994	8,311,095	49,615
1934	1,037,008	1,022,965	537,164	767,025	8,967,603	72,548
1935	1,575,863	872,971	656,113	675,597	9,164,263	72,287
1936	1,582,907	530,457	621,186	621,675	8,325,008	116,275
1937	1,207,235	316,641	974,770	516,195	8,302,222	75,990
1938	1,078,229	421,910	542,812	639,328	7,737,647	85,896
1939	991,621	402,250	739,311	821,204	9,744,792	104,585
1940	948,457	309,491	804,089	779,078	7,388,005	62,124
1941	706,650	234,762	601,577	442,484	4,625,855	26,940
1942	750,539	238,988	370,125	353,540	3,155,757	6,571
1943	1,111,998	281,121	505,399	505,338	4,782,379	38,047
1944	1,485,463	250,946	366,520	551,269	4,700,374	72,826
1945	1,748,656	290,138	339,313	588,356	7,754,945	159,870
1946	2,455,955	403,070	509,448	679,072	10,567,058	49,847
1947	1,787,901	282,100	527,072	701,403	12,333,594	101,764

TABLE 44
YEARLY LANDINGS IN POUNDS
Flatfish

TABLE 45

YEARLY LANDINGS IN POUNDS—CABRILLA AND GROUPER [1]

Cabrilla

Year	California	Shipments from Gulf of California	Total pounds
1928	6,564	1,575	8,139
1929	242,124		242,124
1930	509,539		509,539
1931	228,949	30,944	259,893
1932	340,008	8,191	348,199
1933	84,612	64,044	148,656
1934	331,743	44,356	376,099
1935	124,295	41,160	165,455
1936	196,823	24,944	221,767
1937	131,127	14,592	145,719
1938	153,531	63,660	217,191
1939	111,337	30,366	141,703
1940	90,579	29,589	120,168
1941	383,677	8,572	392,249
1942	225,426		225,426
1943	233,886		233,886
1944	208,909		208,909
1945	578,158		578,158
1946	261,689		261,689
1947	128,689		128,689

Grouper

Year	California	Shipments from Gulf of California	Total pounds
1931	21,609		21,609
1932	18,689		18,689
1933	565		565
1934	61,408		61,408
1935	31,363	200	31,563
1936	60,535		60,535
1937	57,860	3,693	61,553
1938	67,958		67,958
1939	41,430		41,430
1940	78,823	312	79,135
1941	277,778		277,778
1942	128,594		128,594
1943	81,887		81,887
1944	95,623		95,623
1945	92,435		92,435
1946	157,764		157,764
1947	124,372		124,372

[1] Records incomplete for all shipments from Gulf of California. Tables show cleaned weight, round weight 30 or 40 percent greater.

TABLE 45
YEARLY LANDINGS IN POUNDS—CABRILLA AND GROUPER

TABLE 46

YEARLY LANDINGS IN POUNDS—MEXICAN CORBINA AND TOTUAVA [1]

Year	Mexican corbina			Totuava	
	California	Shipments from Gulf of California	Total pounds	Year	Shipments from Gulf of California
1928		14,374	14,374	1928	841,357
1929	2,014		2,014	1929	
1930				1930	
1931	2,084	106,346	108,430	1931	1,169,467
1932	2,469	37,411	39,880	1932	1,126,685
1933	290	79,661	79,951	1933	930,314
1934	967	67,959	68,926	1934	943,179
1935	150	116,776	116,926	1935	1,484,741
1936		82,118	82,118	1936	1,423,800
1937		69,363	69,363	1937	1,171,623
1938	721	137,815	138,536	1938	2,781,186
1939		43,602	43,602	1939	2,308,140
1940		36,088	36,088	1940	1,114,451
1941		73,731	73,731	1941	738,953
1942					
1943	5,106		5,106		
1944	1,405		1,405		
1945	1,219		1,219		
1946	23		23		

[1] Records incomplete for all shipments from Gulf of California. Tables show cleaned weight, round weight 30 or 35 percent greater.

TABLE 46
YEARLY LANDINGS IN POUNDS—MEXICAN CORBINA AND TOTUAVA

TABLE 47

YEARLY LANDINGS IN POUNDS

Swordfish

Year	Unclassified swordfish	Marlin	Broadbill	Total pounds
1918		2,275	18,442	20,717
1919	18,252			18,252
1920	12,513			12,513
1921	14,803			14,803
1922	23,256			23,256
1923	11,691			11,691
1924	31,833			31,833
1925	27,045			27,045
1926	45,543			45,543
1927	130,288			130,288
1928	426,001			426,001
1929	693,081			693,081
1930	562,729			562,729
1931		41,080	340,769	381,849
1932		25,911	661,470	687,381
1933		6,859	850,699	857,558
1934		64,796	263,958	328,754
1935		19,062	669,283	688,345
1936		16,645	577,402	594,047
1937		4,049	625,307	629,356
1938			722,478	722,478
1939			594,360	594,360
1940			887,168	887,168
1941			916,739	916,739
1942			445,908	445,908
1943			336,386	336,386
1944			751,596	751,596
1945			363,093	363,093
1946			863,494	863,494
1947			1,009,957	1,009,957

TABLE 47
YEARLY LANDINGS IN POUNDS
Swordfish

TABLE 48
YEARLY LANDINGS IN POUNDS
Fishes

Year	Anchovy	Barracuda	Bonito	Cabezone	Eel	Flying fish	Hake	Pacific herring	Kingfish	Lingcod
1916	531,209	2,687,362	480,406	569	50		189,219	2,928,591	779,287	617,256
1917	538,753	3,060,323	880,376	434			254,331	7,435,997	835,230	930,519
1918	868,161	4,837,284	2,441,714	167			193,018	7,938,290	1,014,820	915,836
1919	1,609,548	5,824,957	2,506,098		10		133,181	4,289,899	609,178	1,063,136
1920	569,774	8,201,335	823,648		180		141,981	274,564	461,459	687,954
1921	1,046,881	7,625,102	324,737				90,218	542,124	391,085	425,543
1922	652,516	6,290,218	937,942		20		74,316	341,621	581,963	568,481
1923	307,074	7,300,575	1,115,247		188		78,969	383,950	411,564	467,347
1924	316,951	7,125,523	1,045,282		56		60,780	435,620	384,317	400,432
1925	93,071	8,656,449	879,166	3,352	246		22,017	865,774	336,694	683,130
1926	60,157	5,022,464	3,121,604		238		55,355	453,607	484,921	649,902
1927	368,201	6,199,739	1,718,008	752	5		84,553	1,168,321	329,267	556,308
1928	357,470	6,452,456	2,105,903	2,628	227	32,501	109,648	1,139,682	441,758	853,537
1929	382,445	5,278,610	2,918,544	1,186	337	35,263	145,669	957,563	476,497	1,167,120
1930	319,561	4,763,706	3,164,260	1,045	20	48,458	56,068	717,631	457,167	1,288,172
1931	302,494	4,177,538	3,079,673	1,115	226	46,265	12,501	685,759	414,034	1,229,088
1932	299,217	2,926,775	2,862,286	4,678	242	40,315	29,001	765,724	447,531	959,912
1933	317,292	3,072,962	2,252,199	4,265	103	16,396	37,539	601,445	564,274	1,088,935
1934	257,505	2,182,822	3,202,694	5,265	23	26,437	56,901	801,601	634,345	857,600
1935	178,970	2,617,824	2,806,484	10,537	96	37,928	73,843	928,880	768,676	1,017,501
1936	195,122	2,977,842	7,215,916	18,468	86	55,627	50,791	840,530	652,134	758,547
1937	226,229	2,938,490	7,809,070	8,189	160	41,880	63,454	631,330	645,750	968,258
1938	735,144	2,529,812	7,839,993	5,425	68	62,857	36,428	591,884	493,209	646,004
1939	2,147,901	4,092,054	9,918,875	4,023		20,321	13,661	302,242	542,901	576,972
1940	6,317,797	3,714,532	5,291,147	3,392	7	37,709	18,049	453,193	412,228	692,243
1941	4,105,382	4,201,928	10,907,602[1]	13,356	103	37,876	15,044	789,753	325,155	529,772
1942	1,694,290	3,454,537	1,650,689	2,312	103	2,806	41,981	190,515	284,225	314,334
1943	1,570,803	3,778,338	2,282,299	7,532	92	2,271	10,505	630,358	396,633	719,318
1944	3,891,029	3,648,308	818,871	3,906	1,159	3,112	4,751	422,290	367,701	746,039
1945	1,616,880	3,873,287	2,714,181	4,417	37	6,167	2,415	460,465	430,515	758,704
1946	1,921,627	3,107,024	5,625,648	2,860	660	41,308	350	481,776	437,023	1,156,398
1947	18,940,521	2,665,745	13,697,171	4,326	1,435	31,671	606	1,654,850	458,686	1,940,747

[1] 1941 shipment included, 80,903 pounds bonito from south of international boundary.

TABLE 48
YEARLY LANDINGS IN POUNDS
Fishes

TABLE 48—Continued
YEARLY LANDINGS IN POUNDS
Fishes

Year	Mullet	Perch	California pompano	Mexican pompano	Rock bass	Rockfish	Sablefish	Sculpin	Black sea bass	White sea bass
1916	11,439	221,186	25,014	.....	852,059	4,918,952	83,023	8,014	153,440	798,115
1917	33,883	252,503	33,926	.....	607,734	7,774,026	909,846	17,423	138,380	899,997
1918	91,402	205,420	24,260	.....	783,864	8,342,734	498,937	28,237	248,755	1,613,520
1919	9,199	192,481	61,424	.....	450,229	5,398,109	334,950	23,432	183,270	2,435,367
1920	17,603	186,381	30,126	251	210,380	5,633,077	781,033	35,671	148,037	2,628,108
1921	28,855	253,199	16,333	370	363,456	4,761,558	1,022,642	58,380	127,431	2,569,489
1922	30,946	243,776	16,050	372	316,051	4,312,014	268,554	42,121	97,354	2,032,051
1923	71,225	330,682	19,780	13,138	357,269	5,096,622	538,292	60,466	226,995	2,373,547
1924	61,571	305,726	13,059	4,520	466,208	4,742,885	603,310	109,070	221,404	1,189,589
1925	36,807	272,351	9,111	1,425	330,283	5,488,621	722,472	223,104	189,072	1,885,109
1926	51,753	308,910	8,135	.....	636,333	7,340,969	175,643	108,008	377,934	2,216,402
1927	39,976	262,933	4,725	50,402	525,810	6,390,604	992,654	113,457	467,305	2,273,407
1928	82,739	267,078	3,295	26,787	626,239	6,419,909	916,955	97,083	382,115	1,300,214
1929	64,594	327,502	2,790	22,648	482,536	6,606,466	1,459,408	107,797	404,386	1,562,232
1930	21,307	304,737	2,223	.....	500,125	7,225,424	1,359,147	88,610	394,009	1,626,422
1931	21,327	265,937	3,073	738	544,879	7,277,688	1,021,215	91,688	502,064	1,399,413
1932	22,690	241,048	3,557	4,076	436,575	5,626,319	975,573	85,503	473,546	804,795
1933	24,024	228,166	2,879	710	348,392	4,787,774	1,332,573	64,190	453,023	1,163,083
1934	19,055	225,230	4,480	35	412,371	4,604,031	2,117,048	65,939	861,498	851,197
1935	15,724	281,607	5,824	.....	364,554	4,831,174	2,848,672	69,549	631,759	1,098,419
1936	10,571	251,742	7,524	402	416,145	4,603,904	1,033,330	110,417	398,385	808,093
1937	8,492	249,589	4,827	162	325,000	4,291,214	733,499	137,312	715,584	599,419
1938	3,806	183,421	1,203	.....	286,087	3,637,137	415,536	155,386	467,826	626,647
1939	3,018	140,187	3,404	.....	296,153	3,333,126	767,044	128,628	460,943	994,396
1940	2,004	58,643	10,593	86	245,559	3,570,636	573,785	122,133	366,683	915,716
1941	1,334	26,052	4,963	.....	141,977	2,405,622	536,549	95,277	409,537	908,296
1942	50,017	58,084	2,342	.....	122,812	1,423,440	1,572,522	41,332	378,780	553,955
1943	194,641	113,055	5,168	.....	198,132	2,762,192	3,205,374	42,550	700,855	500,183
1944	339,022	148,858	12,178	.....	229,032	6,422,230	4,116,431	37,270	434,880	393,988
1945	562,940	218,870	70,949	.....	163,846	13,285,974	6,359,087	94,636	330,168	527,355
1946	176,331	192,626	86,693	.....	207,548	11,168,277	2,656,873	145,129	432,561	616,511
1947	135,536	260,610	202,062	.....	251,413	8,498,584	903,110	127,048	244,354	1,083,023

TABLE 48
YEARLY LANDINGS IN POUNDS
Fishes

TABLE 48—Continued
YEARLY LANDINGS IN POUNDS
Fishes

Year	Shark	California sheepshead	Sierra	Skate	Smelt	Tomcod	Whitebait	Ocean whitefish	Yellowtail	Miscellaneous fish [2]
1916	36,247	3,549	50,154	307,716	991,509	65,218	161,797	32,196	1,153,394	196,786
1917	287,872	3,906	10,835	314,837	984,270	25,060	123,079	25,976	2,745,995	256,148
1918	403,093	22,978	70,178	398,031	796,984	8,811	133,857	31,014	11,315,372	593,777
1919	612,643	17,972	48,046	295,900	256,980	31,310	5,015	28,016	5,000,365	573,241
1920	811,349	14,567	50,732	479,812	744,187	37,237	678	13,711	2,704,937	259,450
1921	530,333	23,925	60,646	69,932	763,073	41,779	5,229	29,459	2,490,796	1,242,180
1922	282,018	18,295	29,166	121,210	820,140	32,114	84,007	30,270	3,414,423	254,285
1923	360,363	31,628	58,495	134,333	806,380	41,767	67,818	39,908	4,062,608	183,829
1924	292,634	24,267	13,224	131,137	721,912	42,524	122,483	273,057	4,714,149	348,488
1925	372,332	48,811	16,316	183,484	751,669	14,508	70,968	222,112	3,179,891	230,698
1926	506,723	138,927	17,305	232,993	883,123	4,325	83,557	398,994	3,023,114	230,124
1927	328,653	159,397	16,573	263,715	965,921	660	134,149	313,102	4,224,883	207,453
1928	623,816	372,677	13,102	462,222	926,116	11,923	135,186	222,192	2,683,514	117,289
1929	833,985	298,422	11,906	427,986	933,085	15,884	243,116	301,725	3,075,364	288,331
1930	647,297	243,689	42,965	286,390	1,054,663	23,172	174,917	225,102	4,770,756	133,995
1931	596,134	198,347	24,110	174,785	1,074,810	3,799	141,495	221,200	2,525,853	490,502
1932	850,888	89,501	10,922	202,412	899,216	4,271	133,540	162,027	1,796,364	131,167
1933	471,030	58,609	5,166	193,711	729,702	729	95,751	95,053	3,898,888	142,822
1934	526,280	143,552	6,942	232,305	732,191	923	105,982	93,191	2,347,161	234,399
1935	535,256	188,022	4,606	307,122	875,480	685	164,315	57,771	8,148,718	229,557
1936	471,861	128,577	17,992	381,944	841,231	4,153	197,738	46,603	10,092,470	178,417
1937	914,205	81,466	27,122	447,392	682,070	1,056	86,177	57,198	5,371,475	163,102
1938	7,531,667	72,031	12,294	528,273	567,861	3,040	106,724	68,012	6,812,318	284,101
1939	9,228,500	71,361	16,041	336,854	474,936	4,675	166,883	43,688	2,866,288	271,855
1940	7,860,020	62,352	2,932	238,287	449,360	4,567	127,449	59,606	5,956,804	243,994
1941	7,617,334	49,119	3,946	224,698	452,739	959	131,102	36,970	9,830,690	264,516
1942	3,551,566[1]	50,258	11,321	165,791	443,959	145	159,254	35,986	2,726,269	113,290
1943	3,729,334	151,048	18,652	81,109	1,566,273	13	141,367	97,434	4,934,879	160,391
1944	2,613,431	168,653	14,263	50,419	1,541,044	135	209,425	100,801	2,957,171	100,120
1945	2,438,096	249,584	11,854	74,089	2,309,580	----------	291,152	61,988	2,334,683	373,011
1946	1,608,876	267,120	6,390	78,038	793,463	----------	344,462	37,271	4,561,883	174,796
1947	2,637,926	193,489	5,229	103,696	713,264	----------	326,603	40,946	9,952,761	312,900

[1] 1942 shipment 1,229 pounds of shark from north of state boundary included.
[2] Items of miscellaneous fish discussed in the text are not included in these totals.

TABLE 48
YEARLY LANDINGS IN POUNDS
Fishes

TABLE 49

YEARLY LANDINGS IN POUNDS—CRUSTACEANS

Year	Crab			Spiny lobster			Shrimp	
	Market crab	Rock crab	Total pounds	California	Mexico	Total pounds	California	Shipments from Gulf of California [1]
1916	1,296,912		1,296,912	250,632	382,379	633,011	411,847	
1917	2,580,840		2,580,840	355,299	246,656	601,913	603,001	
1918	1,619,280		1,619,280	195,750	735,077	930,827	722,178	
1919	1,304,904		1,304,904	296,894	852,371	1,089,065	747,023	
1920	1,220,568		1,220,568	247,156	942,020	1,189,176	817,001	167
1921	800,952		800,952	334,271	943,547	1,277,818	908,473	951
1922	860,328		860,328	376,310	640,466	1,016,776	990,349	1,391
1923	1,073,800		1,073,800	384,381	708,477	1,092,858	1,113,358	
1924	1,306,816		1,306,816	294,356	732,956	1,027,312	1,551,086	
1925	3,234,312		3,234,312	432,059	1,054,347	1,486,406	1,460,234	
1926	3,295,280		3,295,280	442,198	731,025	1,173,223	1,431,511	
1927	2,960,712		2,960,712	508,123	982,833	1,490,958	1,697,265	
1928	3,574,464	270	3,574,734	355,800	720,814	1,076,614	2,280,871	
1929	1,792,776		1,792,776	396,764	1,034,908	1,431,672	3,054,748	
1930	1,992,384	12	1,992,396	374,430	1,019,689	1,394,120	2,606,567	32,105
1931	2,231,264	56	2,231,449	383,697	963,350	1,347,047	1,688,877	2,386
1932	2,433,987	145	2,434,132	318,633	700,014	1,018,647	2,592,789	23,985
1933	3,208,494	14,818	3,223,312	380,014	669,891	1,049,905	2,088,730	1,500
1934	3,768,081	24,370	3,792,451	366,651	816,188	1,182,839	1,784,573	
1935	3,680,188	12,817	3,693,005	371,661	973,135	1,344,796	3,447,442	
1936	2,311,802	16,202	2,328,004	414,183	921,676	1,335,859	2,242,710	21,739
1937	1,627,733	1,710	1,629,463	393,242	936,501	1,329,743	1,111,802	12,784
1938	3,873,600	3,847	3,877,447	309,378	889,593	1,197,973	1,831,211	4,932
1939	5,953,351	3,994	5,957,345	376,028	912,968	1,289,896	3,180,250	
1940	5,151,014	3,460	5,154,474	281,102	813,719	1,094,821	1,092,551	48,592
1941	4,260,340	2,645	4,262,985	357,334	947,771	1,305,105	957,509	186,278
1942	2,414,110	89	2,414,199	168,641	687,659	856,300	800,958	
1943	2,315,338		2,315,338	208,377	687,148	985,525	253,258	
1944	2,925,316		2,925,316	512,669	407,463	920,132	291,974	
1945	4,333,805	12,188	4,345,993	476,119	795,835	1,272,954	393,599	
1946	9,633,630	11,606	9,645,236	692,428	1,225,767	1,918,193	437,320	
1947	10,733,398	15,235	10,748,633	593,401	1,169,368	1,762,769	842,773	

[1] Record incomplete for shipments from Gulf of California.

TABLE 49
YEARLY LANDINGS IN POUNDS—CRUSTACEANS

TABLE 50
YEARLY LANDINGS IN POUNDS
Mollusks

Year	Abalone			Clams				Pismo clam		
	California	Shipments from south of the international boundary	Total pounds	Cockle	Softshell	Washington	Miscellaneous clams	California	Shipments from south of the international boundary [1]	Total pounds
1916	762,001	223,084	985,085	90,945	75,674	----------	534,291	220,566	----------	220,566
1917	637,780	----------	637,780	61,005	187,864	----------	308,497	302,069	----------	302,069
1918	602,919	----------	602,919	44,933	312,143	----------	129,084	665,684	----------	665,684
1919	790,203	65,905	825,108	24,817	302,876	----------	66,741	417,315	----------	417,315
1920	806,716	95,110	901,826	18,054	233,134	----------	70,875	299,015	----------	299,015
1921	1,481,170	8,094	1,489,264	14,504	216,600	----------	88,803	219,507	----------	219,507
1922	1,523,394	37,040	1,560,434	31,564	343,262	----------	35,291	193,491	----------	193,491
1923	1,555,134	32,599	1,587,733	36,117	283,095	----------	25,845	237,948	----------	237,948
1924	2,241,812	5,000	2,246,812	6,341	243,324	----------	40,379	203,149	----------	203,149
1925	2,352,861	802	2,353,663	2,991	264,056	----------	61,839	323,245	----------	323,245
1926	2,060,770	----------	2,060,770	17,976	245,962	----------	35,202	274,317	----------	274,317
1927	2,816,530	----------	2,816,530	5,914	151,383	----------	64,693	133,000	----------	133,000
1928	2,066,243	----------	2,066,243	22,651	148,542	----------	44,662	125,832	----------	125,832
1929	3,438,858	448,354	3,887,212	65,466	101,460	----------	13,498	109,744	----------	109,744
1930	3,176,513	----------	3,176,513	125,213	116,571	----------	17,266	108,860	----------	108,860
1931	3,262,166	----------	3,262,166	92,250	101,738	10,442	30,793	104,672	----------	104,672
1932	2,817,345	----------	2,817,345	153,433	165,041	22,908	8,193	110,277	----------	110,277
1933	2,756,188	----------	2,756,188	87,668	173,039	29,929	1,258	106,215	----------	106,215
1934	3,229,492	----------	3,229,492	82,667 [1]	222,011	39,620	4,918	140,737	----------	140,737
1935	3,870,921	----------	3,870,921	81,093	153,495	42,042	4,454	181,555	14,225	196,080
1936	3,302,195	----------	3,302,195	22,902	90,971	33,272	4,496	209,805	----------	209,805
1937	2,863,175	----------	2,863,175	78,552	92,915	21,629	2,396	223,955	----------	223,955
1938	2,121,468	----------	2,121,468	23,831	87,219	23,086	4,545	214,371	----------	214,371
1939	1,804,440	----------	1,804,440	23,070 [1]	78,731	21,133	4,149	192,694	----------	192,694
1940	1,724,094	----------	1,724,094	14,476	63,235	22,803	3,188 [2]	167,478	----------	167,478
1941	1,002,330	----------	1,002,330	600 [1]	65,988	20,764	1,624 [2]	168,797	86,696	255,493
1942	164,462	----------	164,462	257	73,144	9,848	760	93,613	727,832	821,445
1943	680,274	170	680,444	----------	46,557	728	120	45,970	4,525,112	4,571,982
1944	1,630,602	----------	1,630,602	407	31,316	1,423	----------	34,534	11,719,792	11,754,326
1945	2,429,312	17,269	2,446,581	1,069	13,425	6,565	----------	26,079	33,414,200	33,440,279
1946	2,095,762	----------	2,095,762	43	22,239	20,341	132	69,127	11,408,496	11,477,623
1947	2,669,285	875	2,670,160	282	22,581	8,009	2,656	60,357	1,279,744	1,340,301

[1] Includes 1934—7,800 pounds, 1939—2,163 pounds, 1941—210 pounds cockles, shipments from Gulf of California.
[2] Includes 1940—150 pounds, 1941—84 pounds, miscellaneous clams shipments from Gulf of California.
[3] Cleaned weight reported on fish receipts, multiplied by 8 to supply round weight figure given above.

TABLE 50
YEARLY LANDINGS IN POUNDS
Mollusks

TABLE 50—Continued
YEARLY LANDINGS IN POUNDS
Mollusks

Year	Oysters			Mussels	Octopus	Squid
	Native	Eastern	Pacific			
1916	35,845	1,969,519		53,799	26,383	275,620
1917	41,176	816,276		69,042	37,935	439,438
1918	63,194	1,360,685		49,154	32,739	361,714
1919	91,950	1,515,125		25,005	21,492	3,698,242
1920	39,741	1,121,160		33,112	70,740	508,199
1921	6,760	767,124		9,196	56,266	432,539
1922		743,352		43,872	98,588	209,641
1923		688,103		60,606	110,222	1,180,446
1924		526,775		49,223	166,291	6,831,020
1925	165	569,003		25,942	133,149	1,891,220
1926	360	610,422		14,614	63,304	3,135,561
1927		554,921		29,631	36,693	6,014,113
1928	26,850	726,298		1,610	9,732	1,351,992
1929	61,862	457,245		1,628	87,123	4,660,572
1930	41,243	582,267		325	76,980	10,969,162
1931	173,677	456,255		1,800	64,601	1,758,621
1932	100,220	290,571		230	21,187	4,229,743
1933	19,475	340,003	68,763	465	31,521	834,513
1934	41,358	518,500	50,240		30,385	1,530,450
1935	23,000	346,682	299,375	10	81,204	815,944
1936	33,669	318,912	310,683	790	62,452	945,459
1937	44,217	364,649	680,081	1,490	23,884	501,602
1938	32,161	280,742	1,207,421	150	32,632	1,399,319
1939	13,751	130,641	1,459,355	1,800	29,339	1,162,056
1940	24,524	113,360	1,202,505	100	26,580	1,800,632
1941	9,338	102,040	1,717,781		40,075	3,431,136
1942	5,682	92,426	609,253		7,396	943,783
1943	30,448	79,878	741,105	50	18,020	9,164,361
1944		106,896	636,686		7,336	10,936,595
1945		65,581	309,738		12,586	15,225,664
1946		84,662	88,006	620	37,997	38,024,528
1947		133,779	46,033	330	53,019	14,542,649

TABLE 50
YEARLY LANDINGS IN POUNDS
Mollusks

4. TABLES
COMMERCIAL FISH LANDINGS IN CALIFORNIA DURING 1947
POUNDS
STATE-WIDE
REGIONAL POUNDS AND VALUE
STATE-WIDE

TABLE 51

ORIGIN OF COMMERCIAL FISH LANDINGS IN CALIFORNIA DURING 1947

Species	California	North of the state boundary	South of the international boundary	Total pounds
Anchovy	18,940,521			18,940,521
Barracuda	1,695,867		969,878	2,665,745
Bonito	384,315		13,312,856	13,697,171
Cabezone	4,526			4,526
Cabrilla			128,689	128,689
Carp	237,131			237,131
Catfish	599,744			599,744
Eel	1,435			1,435
Flounder	525,045	2,027		527,072
Flying fish	31,671			31,671
Grouper			124,372	124,372
Hake	606			606
Halibut, California	1,172,638		615,263	1,787,901
Halibut, Pacific	282,100			282,100
Hardhead	51,138			51,138
Herring, Pacific	1,654,850			1,654,850
Kingfish	458,686			458,686
Lingcod	1,876,986	62,225	1,536	1,940,747
Mackerel, jack	129,048,318			129,048,318
Mackerel, Pacific	46,478,182			46,478,182
Mullet	135,536			135,536
Perch	290,610			290,610
Pike, Sacramento	291			291
Pompano, California	202,062			202,062
Rock bass	211,627		39,786	251,413
Rockfish	7,604,510	853,911	40,163	8,498,584
Sablefish	891,173	10,937		902,110
Salmon	11,483,734	854		11,484,588
Sand dab	701,288	115		701,403
Sardine	255,513,948			255,513,948
Sculpin	125,204		1,844	127,048
Sea bass, black	18,922		225,382	244,304
Sea bass, white	692,314		390,709	1,083,023
Seatrout, greenling	115			115
Shad	305,341	225		305,566
Shark	2,632,444	437	5,045	2,637,926
Sheepshead	178,836		14,653	193,489
Sierra			5,229	5,229
Skate	102,063		1,633	103,696
Smelt	713,264			713,264
Sole	11,673,856	659,411	327	12,333,594
Split-tail	5,088			5,088
Swordfish, broadbill	790,218		219,739	1,009,957
Tuna, albacore	7,395,523	269,397	5,762,361	13,427,281
Tuna, bluefin	14,755,622		6,082,012	20,837,634
Tuna, skipjack	893,046	1,936	51,567,122	52,462,104
Tuna, yellowfin	3,234		150,456,150	150,459,384
Turbot	101,767			101,767
Whitebait	326,603			326,603
Whitefish, ocean	22,613		18,333	40,946
Yellowtail	103,613		9,849,148	9,952,761
Miscellaneous fish	310,123		2,777	312,900
Crustacean:				
Crab	10,748,440	183		10,748,623
Lobster, spiny	593,401		1,169,368	1,762,769
Shrimp	842,773			842,773
Mollusk:				
Abalone	2,669,285		875	2,670,160
Clam, cockle	282			282
Clam, gaper	2,656			2,656
Clam, Pismo	60,557		1,279,744	1,340,301
Clam, softshell	22,584			22,584
Clam, Washington	8,009			8,009
Mussel	530			530
Octopus	52,889	130		53,019
Oysters, eastern	133,779			133,779
Oysters, Pacific	46,035			46,035
Squid	14,542,649			14,542,649
Total pounds	551,352,216	1,861,788	242,284,994	795,498,998

TABLE 51
ORGIN OF COMMERCIAL FISH LANDINGS IN CALIFORNIA DURING 1947

TABLE 52 *

MONTHLY COMMERCIAL FISH LANDINGS IN CALIFORNIA DURING 1947

Species	January	February	March	April	May	June	July	August	September	October	November	December	Total pounds
Anchovy	160,179	281,527	126,273	1,555,301	2,933,147	742,050	62,787	2,849,590	6,415,044	781,717	300,926	2,761,790	18,949,521
Barracuda	92,371	118,435	230,260	447,290	440,166	359,460	305,851	158,231	160,027	131,293	162,176	80,183	2,665,745
Bonito	165,655	235,500	73,733	15,808	44,041	1,999,111	7,320,689	2,080,293	833,584	356,929	190,957	249,871	13,697,171
Cabezone	1,950	345	145	78	173	213	220	392	73		510	421	4,326
Cabrilla	20,173	23,736	15,144	3,169	4,401	2,352	927	4,383	1,795		12,533	38,056	126,649
Carp	15,002	13,852	24,491	25,108	9,796	1,625	230	7,974	41,694	33,926	20,346	35,089	227,131
Catfish	72,322	20,326	34,288	72,129	4,860		50		43,436	168,760	122,272	84,276	599,744
Eel					1,435								1,435
Flounder	175,183	72,181	22,563	19,995	22,119	14,312	35,023	37,416	59,344	28,566	23,756	16,351	527,072
Flying fish					10,869	11,044	4,778	2,781	2,171	498			31,671
Grouper	5,381	21,518	17,294	31,039	7,883	3,979	390	1,242	1,468	303	16,200	17,875	124,372
Hake							91	165				350	606
Halibut, California	148,081	209,316	213,079	155,777	96,737	150,176	169,010	124,401	123,952	145,623	86,971	153,678	1,787,901
Halibut, Pacific	13,495	12,644	4,286	1,343	75,803	30,171	94,491	30,197	3,323	4,179	1,462	8,506	282,100
Hardhead	2,993	11,993	11,427	4,269						4,198	7,160	9,525	51,138
Herring, Pacific	261,595	152,500	13,813				8,000	574,200	314,534	4,033	4,438	321,735	1,654,850
Kingfish	36,260	35,179	49,028	37,179	48,427	51,463	19,896	28,935	43,411	35,333	33,340	18,254	438,696
Lingcod	208,197	256,167	147,387	181,625	113,486	96,933	199,621	193,215	173,801	95,349	151,279	123,705	1,940,747
Mackerel, jack	3,349,295	10,129,651	2,793,172	1,427,423	21,417	637,988	337,389	631,534	7,265,438	6,891,173	44,177,017	31,316,611	129,048,318
Mackerel, Pacific	4,261,015	2,984,557	1,247,771	224,492	325,226	491,234	1,303,111	3,088,138	11,311,229	9,928,983	16,209,215	1,393,798	46,478,182
Mullet	67,199	23,936	6,379	20,467	304							15,031	135,536
Perch	17,000	36,067	51,318	73,474	6,919	1,483	18,537	13,504	18,303	18,304	16,209	19,151	290,610
Pike, Sacramento	66	7	12	44	70			6	5	68	7	6	291
Pompano, California	9,055	20,516	19,641	37,027	20,222	5,807	14,525	20,942	16,499	6,400	18,828	12,680	202,062
Rock bass	8,589	14,549	19,121	19,617	27,512	52,843	43,693	8,967	7,523	15,604	15,063	17,108	251,113
Rockfish	601,773	633,507	906,449	857,629	706,605	1,168,780	1,034,768	1,112,812	622,399	227,785	308,241	317,926	8,498,584
Sablefish	69,336	48,262	36,161	57,776	68,430	55,929	123,799	122,505	136,067	49,960	72,447	61,434	602,110
Salmon	14,370	64,314	28,901	745,778	1,421,999	587,696	3,314,966	2,637,679	2,613,314		5,221	18,560	11,454,588
Sand dab	53,862	60,003	77,903	74,884	70,781	60,586	58,786	46,377	51,540	43,900	59,065	52,714	701,403
Sardine	17,745,469	24,353,468	1,042,530	621,880	2,773,336	2,038,826	8,108,566	15,244,804	6,033,631	134,311,437	36,180,160	6,931,493	255,513,945
Scalpin	6,010	6,272	10,445	25,396	8,615	17,880	13,658	12,394	10,681	5,679	5,690	4,328	127,048
Sea bass, black	7,173	26,318	26,608	16,117	21,242	32,043	13,728	10,239	10,434	12,071	33,737	34,594	244,304
Sea bass, white	17,581	23,470	16,076	40,890	104,163	179,153	143,220	142,017	245,465	107,564	30,999	32,115	1,082,623

TABLE 52
MONTHLY COMMERCIAL FISH LANDINGS IN CALIFORNIA DURING 1947

Seatrout, greenling								65	50					115
Shad	44		157	47,942	237,423									305,566
Shark	141,143	180,650	404,683	331,834	157,502	117,132	140,845	113,146	38,333	36,566	73,470	916,934		2,637,926
Sheepshead	67,475	47,416	11,884	5,404	6,103	4,344	675	334	5,250	14,893	16,043	13,468		193,489
Sierra		215	469			500		418		30	505	2,672		3,229
Skate	15,251	18,853	11,111	9,323	5,461	4,088	2,464	6,656	6,674	9,322	7,424	10,069		103,698
Smelt	50,144	106,291	123,521	109,347	43,779	54,836	30,275	28,006	47,517	46,903	38,722	27,953		713,264
Sole	1,113,977	1,005,719	763,335	861,196	1,134,656	826,077	1,281,502	803,969	1,371,676	890,648	1,311,774	996,925		12,333,594
Split-tail	25	226	194	65	218	369		1,647	2,154	55		125		5,088
Swordfish, broadbill					4,715	16,861	132,152	249,294	354,893	227,675	24,146	321		1,009,957
Tuna, albacore				2,100		415,849	3,077,126	6,508,151	1,284,910	2,016,073	122,780			13,427,281
Tuna, bluefin		957,505	1,576,809	480,192	259,997	190,267	2,554,444	7,971,935	6,461,336	383,091				20,837,684
Tuna, skipjack	578,735	1,789,207	2,169,492	1,794,009	3,368,363	5,393,411	6,023,417	8,312,686	7,987,091	9,938,277	3,402,311	1,809,977		52,462,104
Tuna, yellowfin	5,885,265	7,028,816	10,296,148	14,953,678	22,374,917	23,066,947	18,758,481	10,238,956	9,818,158	7,434,665	5,572,827	15,003,716		150,430,384
Turbot	13,745	12,618	6,518	8,312	6,589	2,418	1,852	6,835	7,988	10,223	10,329	15,149		101,767
Whitefish	32,496	41,133	51,208	48,912	59,269	25,541	23,907	13,759	226	3,601	14,856	9,605		326,603
Whitefish, ocean	6,921	8,503	5,631	991	1,778	1,975	338	85	1,897	935	5,769	6,003		40,946
Yellowtail	113,818	340,073	150,849	88,248	404,607	592,302	1,205,508	2,701,070	743,475	948,855	1,218,294	1,357,662		9,865,761
Miscellaneous fish	12,452	15,379	8,176	4,609	6,303	7,561	5,443	5,233	41,033	122,834	38,773	25,077		312,900
Crustacean:														
Crab	1,168,543	1,329,218	1,238,943	1,237,368	1,519,206	598,315	389,979	110,199	3,120	2,242	1,602,728	1,518,732		10,748,623
Lobster, spiny	351,736	371,981	211,220						547	255,972	260,963	330,353		1,762,769
Shrimp	22,009	24,770	31,284	16,909	83,861	168,700	184,574	92,373	49,859	37,269	69,479	30,695		842,773
Mollusk:														
Abalone	49,225		47,719	363,169	280,984	197,400	277,935	334,267	188,389	217,632	261,286	429,634		2,670,109
Clam, cockle		55	145	40			42							282
Clam, gaper	100	320	476	420	280	300	180	140	140	120	100	80		2,656
Clam, Pismo	626,367	664,940	6,496	6,618	7,767	8,306	9,260	8,481	2,166					1,340,301
Clam, softshell	2,129	1,849	2,544	2,824	2,681	2,443	2,047	1,021	822	1,394	1,366	1,464		22,584
Clam, Washington	1,743	1,329	1,567	1,567					1,112	545		149		8,009
Mussel	290	130		90										530
Octopus	5,088	9,817	5,594	4,720	3,054	4,125	3,010	1,826	1,247	1,770	5,189	7,579		53,019
Oyster, eastern	8,685	7,820	8,474	7,262	7,273	4,747	5,328	3,074	44,724	4,824	11,033	18,324		133,779
Oyster, Pacific	3,030	4,260	4,200	3,960	3,960	8,960	4,050	5,775	4,410	2,850		1,680		46,035
Squid	25,742	192,794	1,361,750	4,922,374	113,609	343,826	1,101,645	1,605,611	2,118,745	759,906	1,934,323	62,274		14,542,649
Total pounds	37,908,528	53,955,269	25,803,494	32,144,678	39,534,410	40,598,994	58,277,106	68,332,548	67,153,483	176,888,772	108,636,107	86,563,699		795,498,998

* This table includes actual landings at California ports by the commercial fishing fleet as well as shipments from other states and foreign countries by truck, rail and ocean liner to California canneries and to the fresh fish dealers.

TABLE 52—Cont'd.

TABLE 53

COMMERCIAL FISH LANDINGS IN THE EUREKA REGION DURING 1947

Species	January	February	March	April	May	June	July	August	September	October	November	December	Total pounds
Fishing boat landings from California waters									4,500				4,500
Anchovy					1,435								1,435
Eel													
Flounder	114,460	21,230	10,463	5,667	9,842	4,255	30,080	24,404	13,144	2,886	11,891	2,046	232,988
Hake							91	165				350	606
Halibut, Pacific	725	272	84	138	74,564	27,936	93,285	26,027	4,409	2,016	159	207	229,792
Herring, Pacific	10,717	47,264	11,388										69,369
Lingcod	172,511	213,872	122,142	141,979	61,608	69,383	178,422	169,110	145,383	64,549	100,775	88,462	1,529,196
Perch	1,493	3,743	10,679	26,642	485		1,499	996	469	45	165		45,856
Rockfish	390,936	368,551	614,734	557,284	309,769	811,937	801,580	748,183	475,339	153,992	135,432	135,294	5,903,031
Sablefish	18,594	8,712	9,974	21,401	47,463	49,675	117,168	116,449	132,266	44,631	61,418	41,046	668,827
Salmon				402,905	627,513	358,186	2,760,542	1,540,585	157,492				5,857,723
Sand dab	20,418	28,898	37,904	40,997	41,702	38,189	46,904	34,925	23,929	13,825	25,191	11,305	364,178
Sea bass, white	350	369	152	685	749		184	226	11	30	37	58	2,877
Shad	44		150										194
Shark	69,833	13,521	2,129	4,061	534	179	1,833	14,914	5,026	1,540	4,267	824,400	942,237
Skate		7	113	100				500					720
Smelt		773	80	1,195	2,827	3,253	3,518	2,216	806	2,346			17,034
Sole	606,967	658,137	457,623	471,161	586,722	441,119	1,026,519	571,393	943,280	483,567	863,325	353,866	7,467,679
Tuna, albacore							121	164,255	214,621	152,120			531,117
Turbot	170	2,883	2,953	410	1,115		600	4,202	1,195	1,472	2,065	2,801	19,926
Whitebait	9,931	33,286	45,703	47,060	53,928	24,172	22,984	12,349	10		178	338	252,939
Miscellaneous fish	6,776	5,332	1,889	285	1,852	3,071	2,219	1,376	1,156	2,210	4,131	21,621	51,518
Crustacean													
Crab	618,501	868,637	1,068,258	992,920	1,281,117	477,277	240,677	56,067			275		5,604,229
Mollusk													
Clam, Washington	1,743	1,326	1,567	1,567					1,112	545		149	8,009
Octopus	3,627	7,627	2,690	2,043	394	382	1,979	1,201	437	825	1,064	881	25,250
Squid	110	36	1,094	1,510									2,750
Total pounds	2,049,926	2,284,506	2,403,649	2,721,110	3,115,415	2,309,505	5,360,905	3,460,333	2,104,695	926,799	1,212,403	1,484,824	29,464,080

TABLE 53
COMMERCIAL FISH LANDINGS IN THE EUREKA REGION DURING 1947

Fishing boat landings from waters north of the state boundary													
Flounder		120		410		150				484	893		2,027
Lingcod		696	2,831	6,822	17,326	8,564	4,944	2,566	4,450	4,335	7,368	1,300	62,225
Rockfish		28,540	66,364	107,111	240,021	126,791	35,851	132,309	31,470	17,503	9,182	8,169	853,911
Sablefish				16	2,833	1,854	3,509	908	512	1,023	182		10,937
Salmon				357		96	401						854
Sand dab		35		80									115
Shad				120	105								225
Shark		35	46	4				91				261	437
Sole		5,709	9,143	50,122	225,557	44,512	76,066	17,870	22,156	73,616	110,972	12,697	659,411
Crustacean													
Crab			183										183
Mollusk													
Octopus		40	40	50									130
Total pounds		35,166	78,607	174,092	486,442	211,997	120,771	174,777	58,668	98,951	128,467	22,517	1,590,455
Grand totals Eureka region	2,049,535	2,319,672	2,482,256	2,895,202	3,601,857	2,521,502	5,451,676	3,665,110	2,163,363	1,025,750	1,340,870	1,507,341	31,054,535

TABLE 53—Cont'd.

TABLE 54
COMMERCIAL FISH LANDINGS IN THE SACRAMENTO REGION DURING 1947

Species	January	February	March	April	May	June	July	August	September	October	November	December	Total pounds
Fishing boat landings from California waters													
Carp	728	1,422	12,520	16,023	9,756	1,362		7,918	33,204	30,411	6,433	1,686	121,503
Catfish	71,944	39,326	49,154	65,792	4,899				36,610	96,078	119,474	82,472	565,770
Hardhead	289									1,027	917	715	2,948
Pike, Sacramento	66	7	12	44	70			6	5	68	7	6	291
Salmon	14,370	64,314	38,801	78,353	414,041	109,071		230,523	2,377,230		5,221	18,560	3,380,484
Shad			7	47,822	257,318								305,147
Split-tail	25	236	194	65	218	309		1,647	2,154	55			4,903
Miscellaneous fish		36											36
Crustacean Crab												264	264
Grand totals, Sacramento Region	87,422	105,341	100,688	208,099	716,333	110,802		240,094	2,449,233	127,639	132,052	103,703	4,381,406

TABLE 54
COMMERCIAL FISH LANDINGS IN THE SACRAMENTO REGION DURING 1947

TABLE 55

COMMERCIAL FISH LANDINGS IN THE SAN FRANCISCO REGION DURING 1947

Species	January	February	March	April	May	June	July	August	September	October	November	December	Total pounds
Fishing boat landings from California waters													
Anchovy			3,400	5,040	27,793	19,250	19,960	16,750	143,050	72,330	64,800	13,800	390,173
Cabezone	242	171	60										473
Carp	14,274	12,430	11,971	9,095		261	230	56	8,490	5,515	19,913	33,403	115,628
Catfish	378		5,132	7,334			30		6,796	9,682	2,798	1,804	33,974
Flounder	48,467	39,897	10,761	13,360	7,799	5,029	1,886	10,173	37,330	21,522	4,653	4,273	205,150
Halibut, California	1,809	1,373	670	131	138	248	134	663	124	240	145	932	5,812
Halibut, Pacific	12,680	12,372	4,232	1,205	1,239	2,255	1,206	4,170	1,114	2,163	1,303	8,389	52,308
Hardhead	2,614	11,665	11,427	4,260						3,171	6,243	8,810	48,190
Herring, Pacific	250,878	105,236	2,425					5,100		535	4,278	293,505	662,257
Kingfish	243		163	704	473	148	858	100	775	536	365	223	4,588
Lingcod	20,957	29,770	19,727	22,796	27,244	10,462	12,418	15,689	22,046	24,347	25,482	12,301	242,240
Perch	1,143	7,643	18,495	13,672			3,149	3,818	3,680	4,991	2,230	4,305	69,328
Pompano, California	24						41		374	17	14		470
Rockfish	8,133	26,161	14,693	13,979	22,098	13,630	8,646	27,278	22,986	21,733	20,418	11,520	211,505
Sablefish	2,328	2,725	29	384	7,240	3,650	2,056	1,827	61	650	357		21,610
Salmon				148,353	152,763	30,563	260,999	763,540	100,463				1,485,657
Sand dab	28,512	21,429	30,270	26,849	19,605	15,188	10,941	8,878	18,420	27,286	20,816	33,163	261,357
Sardine	448,200	50			2,700			161,550	13,700			28	626,228
Sea bass, white	137	93				256	618	564	9,252	824	271	78	12,093
Seatrout, greenling								63	50				113
Shark	21,318	37,988	5,395	4,664	49,159	29,193	18,802	34,744	10,545	2,676	11,700	37,128	263,372
Skate	11,217	16,238	7,987	2,790	2,630	3,330	1,493	2,525	5,250	6,199	6,023	5,400	70,942
Smelt	29,415	96,002	118,796	103,674	34,144	29,647	3,494	1,000	11,491	2,465	2,177	861	433,202
Sole	466,483	302,000	221,389	274,695	276,345	291,281	156,937	113,707	342,037	301,194	311,377	536,923	3,596,758
Split-tail												125	125
Tuna, albacore			27					1,247	30,922	327,716	12,883		372,795
Turbot	11,842	8,521	3,565	7,902	5,574	2,418	1,352	2,573	5,803	8,751	7,712	9,382	75,395
Whitebait	23,565	7,847	5,505	1,852	3,341	2,369	923	410	216	3,601	14,690	9,355	72,664
Miscellaneous fish	366	4,227	808	444	257	40	673	1,220	1,130	1,055	805	841	11,866
Crustacean													
Crab	547,330	452,555	163,993	240,020	233,987	117,194	146,572	51,582			1,589,598	1,534,130	5,076,871
Shrimp	23,009	24,661	30,666	46,549	83,795	168,700	184,574	92,373	49,859	37,260	69,353	30,284	841,086
Mollusk													
Clam, softshell	2,129	1,519	2,544	2,824	2,681	2,443	2,047	1,021	822	1,394	1,566	1,464	22,554
Octopus	992	1,369	811	851	1,529	2,440	1,031	525	198	843	2,884	5,593	19,967
Oysters, eastern	8,685	7,820	8,474	7,262	7,275	4,757	5,525	5,074	44,724	4,824	11,035	18,324	133,779
Squid								1,058		40		1,039	2,137
Grand totals San Francisco Region	1,988,880	1,232,419	702,988	961,889	969,270	756,078	875,552	1,331,080	895,804	893,581	2,218,882	2,619,886	15,446,509

TABLE 55
COMMERCIAL FISH LANDINGS IN THE SAN FRANCISCO REGION DURING 1947

TABLE 56

COMMERCIAL FISH LANDINGS IN THE MONTEREY REGION DURING 1947

Species	January	February	March	April	May	June	July	August	September	October	November	December	Total pounds
Fishing boat landings from California waters													
Anchovy	24,262	177,500	3,800	1,434,006	2,829,002	676,725	3,200	2,700,072	5,127,674	32,380	450	2,486,745	15,495,816
Cabezone	1,708	76		16	159						554	319	2,832
Flounder	10,152	10,866	1,297	350	4,339	5,066	1,733	2,526	8,870	3,704	5,889	9,992	64,454
Halibut, California	27,700	12,880	6,891	11,680	4,047	11,155	13,441	6,666	1,420	712	3,286	35,500	135,378
Herring, Pacific							8,000	569,100	314,534	3,500	160	27,930	923,224
Kingfish	10,039	11,819	26,328	10,166	18,022	41,346	11,761	23,529	14,457	6,324	11,261	1,145	185,227
Lingcod	4,499	1,976	613	9,064	1,734	1,857	3,485	3,297	1,892	1,869	14,695	19,208	64,192
Mackerel, jack	66,500	497,496	138,845	9,732	32,797	1,193	29,789	59,100	616,758	540,948	145	160,616	2,153,919
Mackerel, Pacific	105	57,260	2,020	195	525	240	6,250	41	299,048	8,035	75		373,803
Perch	2,092	1,865	9,977	16,043	66		4,240	5,365	4,518	726	1,748	2,729	49,349
Pompano, California	3,074	3,180	11,392	35,744		19,954	13,895	16,797	14,274	1,662	12,460	106	137,381
Rockfish	153,264	137,088	167,937	151,877	103,326	156,498	183,431	173,928	86,515	20,053	89,588	95,770	1,521,275
Sablefish	44,812	29,539	22,834	33,929	10,709	420	524	2,569	369		3,398	13,760	162,902
Salmon				115,376	177,523	89,370	233,609	122,508	83				738,469
Sand dab	2,157	6,564	5,939	4,187	4,398	6,602	757	2,482	8,745	2,130	2,011	4,848	51,003
Sardine	634,196	922,165	887,921	381,740	2,706,315	2,030,041	8,065,061	14,970,718	4,874,296	389,279	55,110	656,157	36,773,189
Sea bass, black	249												249
Sea bass, white	1,601	1,309	197			1,100	3,440	6,413	8,838	313	233	707	26,057
Shark	19,044	93,958	349,351	209,726	18,525	8,488	10,284	5,506	2,066	1,944	38,114	24,452	781,858
Skate	1,788	1,527	1,541	1,337	405	535	318	112	29		76	4,200	11,864
Smelt	6,622	795	513	1,015	3,596	12,044	15,455	19,515	23,725	9,039	9,924	6,039	111,190
Sole	20,023	21,446	53,974	40,052	37,388	46,424	7,209	79,278	44,942	10,601	10,403	49,816	421,736
Swordfish, broadbill										521			521
Tuna, albacore								4,943	200,870	968,846	97,481		1,272,140
Turbot	1,733	1,314										1,799	4,746
Miscellaneous fish	13	20	913		14		12			14		59	1,045
Crustacean													
Crab	2,441	7,392	5,718	3,220	3,459	2,303	2,069	310			11,876	13,063	51,851
Shrimp		106	618	360	66						126	411	1,687
Mollusk													
Abalone	12,325		10,314	22,834	15,071	7,551	23,117	24,798	10,713	4,288	5,925	11,400	148,736
Clam, gaper	100	320	476	420	289	300	189	140	140	120	100	80	2,656
Clam, Pismo	1,098	461	473	406									2,438
Mussel	290	150		90									530
Octopus	559	719	1,138	876	867	223			592	79	1,222	1,126	7,401
Squid	12,507	180,908	1,356,926	4,920,864	113,609	337,636	1,101,645	1,604,215	2,118,230	750,866	1,882,468	54,965	14,443,859
Grand total Monterey region	1,074,023	2,180,429	3,067,876	7,615,335	6,106,571	3,443,324	9,745,163	20,405,928	13,785,594	2,766,044	2,238,827	3,682,962	76,132,076

TABLE 56
COMMERCIAL FISH LANDINGS IN THE MONTEREY REGION DURING 1947

TABLE 57
COMMERCIAL FISH LANDINGS IN THE SANTA BARBARA REGION DURING 1947

Species	January	February	March	April	May	June	July	August	September	October	November	December	Total pounds
Fishing boat landings from California waters													
Anchovy										9,610	92,325	97,515	199,450
Barracuda	337		143		174	692				64	1,904		3,114
Bonito	173						43		549	8	11	26	812
Cabezone		98	85	59	14	212	220	302	73		56	102	1,221
Flounder				93			329				290	73	1,089
Halibut, California	52,664	37,365	48,271	35,487	25,176	17,849	45,960	43,737	40,627	53,914	37,886	49,896	488,835
Kingfish	189	2,099	268	20			50	352	1,139	1,472	273	137	5,999
Lingcod	8,035	8,928	636	476	2,438	1,803	184	1,431		30	1,468	749	26,208
Mackerel, jack										428,850	5,591,184	7,528,678	13,548,712
Mackerel, Pacific		431	1,745	228		16	8	115	1,649	135,555	1,196,765	108,207	1,445,110
Perch	1,448	2,222	608	1,467	135	472	2,005	946	980	1,338	760	629	13,010
Rock bass	683	163	769	1,673	2,119	10,509	2,970	443	219	208	62	428	20,246
Rockfish	5,699	12,797	5,743	3,316	3,333	3,024	2,910	6,195	2,214	5,306	4,502	3,956	59,195
Salmon				534	9,659	394	215	523	46				11,401
Sand dab	153	265	168			83		80	66	345	516	1,512	3,188
Sardine									74	1,538,665	2,261,334	541,255	4,341,328
Sculpin	71	25	18	46	62				13	304	81	397	1,017
Sea bass, black			89	18	86	56				4,236	84	201	4,770
Sea bass, white	14,439	2,898	7,055	8,955	22,365	50,240	40,658	24,580	16,581	3,517	7,431	7,094	205,793
Shark	15,056	18,597	17,819	19,307	18,733	24,385	5,064	3,452	2,487	12,443	7,321	7,153	151,817
Sheephead	19,570	16,594	3,244	97	157	315	22	8	120	432	880	1,218	42,657
Skate			323	678	1,328		300			819			3,448
Smelt	1,295	300	241	786	110	278	164	334	311	5	228	79	4,121
Sole	20,230	18,372	20,879	16,665	8,247	2,323	14,713	21,351	19,164	19,305	10,554	11,200	183,003
Swordfish, broadbill						483	24,096	58,142	93,454	65,646	1,012		242,833
Tuna, albacore							1,570	11,136	232,712	455,772	6,244		707,234
Tuna, bluefin						47		806	6,392				7,245
Turbot											552	1,158	1,710
Whitefish, ocean		712	1,347		160	185	75		172		235	356	3,242
Miscellaneous fish	3,638	2,482	2,467	1,813	1,707	1,400	1,033	562	713	398	937	373	17,523
Crustacean													
Crab, rock	63		396	435									894
Lobster, spiny	36,000	20,785	11,428							26,115	16,860	19,312	130,500
Mollusk													
Abalone	36,900		36,100	340,440	259,485	189,089	252,298	326,717	170,536	188,980	203,753	372,073	2,376,371
Clam, Pismo	5,565	4,439	6,023	6,212	7,767	8,306	9,260	8,451	2,166				58,119
Octopus		62										4	66
Oysters, Pacific	3,930	4,290	4,200	3,990	3,960	6,960	4,050	5,775	4,410	2,850		1,680	46,095
Grand total Santa Barbara region	226,137	153,904	170,088	442,767	367,215	319,023	408,199	515,488	596,858	2,957,077	9,445,608	8,755,373	24,357,737

TABLE 57
COMMERCIAL FISH LANDINGS IN THE SANTA BARBARA REGION DURING 1947

TABLE 58

COMMERCIAL FISH LANDINGS IN THE LOS ANGELES REGION DURING 1947

Species	January	February	March	April	May	June	July	August	September	October	November	December	Total pounds
Fishing boat landings from California waters													
Anchovy	135,917	104,027	119,073	116,455	76,352	46,002	38,397	132,768	1,135,810	637,397	143,351	161,720	2,847,070
Barracuda	3,094	20,736	93,288	168,270	299,376	294,093	262,214	81,647	3,851	10,341	2,531	91	1,249,575
Bonito	9,159	2,127	183	314	10,164	472	13,854	10,414	39,828	2,708	749	9,002	98,974
Flounder	74	78	72	114	139	12	197	343			70	65	1,164
Flying fish					10,899	11,044	4,278	2,781	2,171	498			31,671
Halibut, California	17,789	57,524	67,858	60,540	42,581	14,769	22,499	18,893	14,787	25,237	18,398	10,834	371,889
Kingfish	16,414	20,036	21,379	24,479	29,066	8,496	6,685	3,571	11,007	23,647	16,139	15,008	194,937
Lingcod	1,999	849	398	336	118	272	75	57	50	176	1,378	109	5,748
Mackerel, jack	3,282,705	9,632,245	2,654,327	1,447,691	38,720	636,805	327,600	572,534	8,648,880	5,917,807	38,349,583	43,624,952	113,103,649
Mackerel, Pacific	4,260,870	2,807,266	1,243,961	197,028	233,033	326,878	1,246,089	2,061,707	10,987,076	9,747,671	9,005,628	1,111,368	44,320,575
Mullet	500			5,363								2,616	8,479
Perch	10,834	20,583	11,559	13,650	6,353	1,011	7,674	779	6,656	11,494	11,317	11,288	113,067
Pompano, California	5,567	17,336	8,309	1,283	268	995	499	4,145	1,761	4,720	6,364	12,574	64,211
Rock bass	5,147	6,562	5,433	12,447	17,676	15,599	30,243	6,419	4,571	9,366	6,677	7,121	127,261
Rockfish	40,588	51,528	32,563	27,652	26,324	26,024	2,022	2,388	2,511	4,868	35,629	42,037	290,134
Sablefish	3,632	7,266	3,304	2,046	195	30	542	752	2,756	3,656	7,962	6,632	37,834
Sand dab	2,622	3,812	3,624	2,771	3,078	438	184	12	380	324	1,531	1,786	21,562
Sardine	15,761,088	23,331,651	174,939	40,140	63,633	2,107	28,832	112,536	1,137,201	130,178,026	31,532,629	5,733,963	208,067,435
Sculpin	1,430	5,171	8,583	14,160	8,072	17,309	12,973	12,087	10,362	4,687	4,187	3,394	103,617
Sea bass, black	842	309	91	1,500	1,235	1,270	3,827	1,949	212	219	475	280	12,209
Sea bass, white	879	2,808	6,392	30,084	64,963	102,744	50,209	67,951	19,533	10,934	5,684	14,277	376,468
Shark	12,295	21,057	22,638	81,974	36,465	36,798	89,499	40,544	16,505	13,564	6,886	13,182	391,497
Sheephead	47,866	21,160	7,458	4,984	5,443	2,663	626	243	4,552	8,958	5,861	4,850	109,694
Skate	2,246	1,061	1,167	1,448	1,128	203	446	1,886	1,399	2,313	1,323	469	15,089
Smelt	18,822	8,216	3,891	2,477	3,602	8,684	7,646	4,911	9,091	32,806	26,268	20,971	147,385
Sole	274	94	347	161	197	216	178	43	97	165	143	423	2,278
Swordfish, broadbill						7,695	73,164	74,714	170,392	143,093	22,329	16	491,003
Tuna, albacore				2,573		30,050	203,526	1,463,351	226,728	40,396	4,749		2,071,185
Tuna, bluefin						60,649	931,130	6,907,766	6,394,397	332,843			14,626,785
Tuna, skipjack				161				163,621	606,459	40,159	1,013	2,782	814,166
Tuna, yellowfin								29					29
Whitefish, ocean	4,248	4,305	2,333	498	1,425	950	283	85	75	224	1,714	2,711	18,860
Yellowtail	31	16	89	804	2,544	1,284	2,371	1,096	931	757	39	46,070	56,142
Miscellaneous fish	1,232	2,704	1,780	2,003	2,321	2,262	1,338	1,751	37,960	118,776	52,855	1,790	226,872
Crustaceans:													
Crab	208	664	455	773	643	1,041	661	2,240	3,120	2,242	979	1,275	14,231
Lobster, spiny	50,776	21,659	9,430							100,898	60,410	54,146	297,319
Mollusk:													
Abalone			1,305	1,990	5,010				5,304	21,784	46,163	39,880	121,406
Clam, cockle		55	145	40			42						282
Octopus			5		73	80				23	19	5	205
Squid	13,125	11,850	3,730			6,240		338	315		51,855	6,250	93,903
Total pounds	23,700,594	36,276,754	4,511,881	2,220,919	994,007	1,666,356	3,482,549	12,761,351	27,508,149	147,452,777	79,432,038	50,964,037	390,981,389

TABLE 58
COMMERCIAL FISH LANDINGS IN THE LOS ANGELES REGION DURING 1947

Fishing boat landings from waters north of the state boundary													
Tuna, albacore									13,867				13,867
Total pounds									13,867				13,867
Fishing boat landings from waters south of the international boundary													
Barracuda	46,593	85,065	62,487	66,588	651	1,095	75	53,265	73,825	84,613	107,231	54,574	637,062
Bonito	41,866	66,524	16,994	237	20,286	1,986,437	6,998,417	1,943,690	727,655	234,246	14,702	19,814	12,100,668
Cabrilla	3,996	4,160	422	63	4,317	2,297	833		1,795		12,333	26,932	57,280
Grouper	1,238	1,580	1,746		4,161	3,730			1,468		16,124	8,964	39,071
Halibut, California		14,861	23,285		133	21,298	39,735	2,116		123	27	999	96,478
Lingcod												467	467
Rock bass	324	1,035	9,876	1,270		2,241	32		144		35	2,589	18,116
Rockfish	61	2,701	1,132									18,840	22,734
Sea bass, black	3,076	9,721	18,313	180	9,990	14,719	9,188	1,383	6,536	770	28,417	13,786	116,079
Sea bass, white	56	15,185				378	656	1,765	76,479	61,108	7,061	1,708	164,435
Shark	1,121	187	46				670	223				269	2,418
Sheepshead	135	2,783			142	270			72				3,402
Sierra		215	64					448		30	505	2,149	3,411
Skate								1,633					1,633
Sole								327					327
Swordfish, broadbill								4,290		2,425			6,715
Tuna, albacore						44,582	275,701	656,197	21,427	2,824	30		980,761
Tuna, bluefin		957,503	1,576,899	480,192	259,997	119,950	1,399,739	983,993	60,394	52,248			5,890,795
Tuna, skipjack	2,876	290,396	335,395	641,671	1,301,145	1,789,909	934,709	3,818,694	939,701	1,503,273	632,123	191,627	12,093,567
Tuna, yellowfin	563,033	1,169,436	1,661,082	7,854,505	10,204,574	9,860,612	4,961,289	3,185,835	2,068,900	1,405,969	1,156,396	2,067,581	46,189,185
Whitefish, ocean	452	1,695	120	195							190	626	3,278
Yellowtail	8,654	150,300	35,417	34,240	305,812	487,478	1,109,033	2,442,147	355,545	269,839	488,817	286,474	5,969,016
Miscellaneous fish	280	300	313		295		168	248					1,515
Crustacean:													
Lobster, spiny	82,398	69,190	33,235							4,772	2,464	3,581	195,640
Total pounds	759,329	2,873,377	3,777,454	9,079,141	12,111,416	14,362,954	15,721,056	13,073,296	4,333,941	3,624,240	2,266,655	2,611,074	84,593,943
Shipments to canneries from east coast of the United States													
Tuna, skipjack				1,936									1,936
Total pounds				1,936									1,936
Shipments to canneries from Chili													
Tuna, yellowfin					52,640			17,990					70,630
Total pounds					52,640			17,990					70,630
Grand totals, Los Angeles region	24,459,923	39,150,131	8,289,335	11,311,996	13,158,063	16,029,300	19,209,602	25,852,637	31,855,957	151,077,017	81,698,693	53,575,111	475,661,765

TABLE 58—Cont'd.

TABLE 59

COMMERCIAL FISH LANDINGS IN THE SAN DIEGO REGION DURING 1947

Species	January	February	March	April	May	June	July	August	September	October	November	December	Total pounds
Fishing boat landings from California waters													
Anchovy						73	1,420		2,010				3,503
Barracuda		445	36,776	173,285	139,725	60,945	31,501	75	97	329			443,178
Bonito	200	80		883	1,977	537	46,913	30,761	13,083	46,618	31,966	109,391	284,329
Halibut, California	20,977	22,174	23,994	30,258	24,660	2,060	1,291	1,687	6,451	6,436	6,218	15,815	171,024
Kingfish	375	1,216	890	1,780	1,876	1,483	542	1,384	15,033	23,353	7,282	1,721	57,935
Lingcod	235	16	50	242	3,018	4,562	63	32		44			8,262
Mackerel, jack										4,468	230,165	2,355	242,938
Mackerel, Pacific	40		45	26,951	89,670	74,100	50,667	26,275	23,465	36,422	6,747	4,223	338,605
Mullet	66,699	23,956	6,579	13,104	204							12,415	127,057
Rock bass	1,826	4,373	2,089	2,686	7,404	18,326	10,158	2,105	2,059	4,350	5,158	3,586	64,120
Rockfish	1,788	5,461	1,698	1,410	1,134	856	56	531	397	2,103	2,318	1,706	19,370
Sardine	911,905				488	5,678	4,653		10,390	2,405,447	2,337,087		5,675,768
Sculpin	963	1,076	1,842	11,190	481	371				688	1,422	537	18,570
Sea bass, black				113	443	323	218	150	300			47	1,594
Sea bass, white	9	10	95	985	15,989	17,649	20,064	8,518	5,130	546		31	69,026
Shark	2,440	1,511	3,573	11,962	14,086	18,073	14,671	13,535	1,634	2,991	4,898	9,889	98,063
Sheepshead	1,901	3,280	781	63	231	77	12			4,925	8,464	5,191	26,455
Smelt		205								12	125		342
Swordfish, broadbill						2,013	6,060	14,067	22,504	9,517	805	305	55,271
Tuna, albacore						178,052	656,041	1,558,236	34,951	13,532	217		2,441,032
Tuna, bluefin						9,621	58,602	53,369					121,592
Tuna, skipjack								21,499	36,332	1,038	11		78,880
Tuna, yellowfin								1,469		1,736			3,205
Whitefish, ocean									288	212	11		311
Yellowtail			1,799	60	11,807	3,403	312	29,319	308	278		255	47,431
Miscellaneous fish	147	19	6	64	248	408				16		255	1,163
Crustacean													
Lobster, spiny	18,190	7,470	4,928						547	85,737	31,975	16,726	165,573
Mollusk													
Abalone				235	1,418	360	1,665	2,732	2,036	2,380	5,445	6,281	22,772
Total pounds	1,036,535	75,292	85,145	277,271	314,959	398,970	904,912	1,765,764	199,818	2,653,350	2,685,954	190,749	10,588,719

TABLE 59
COMMERCIAL FISH LANDINGS IN THE SAN DIEGO REGION DURING 1947

Fishing boat landings from waters south of the international boundary																
Barracuda	42,347	12,189	34,466	39,147	240	2,892	7,061	244	82,254	35,946	50,510	25,520	332,816
Bonito	111,167	136,769	56,556	14,374	11,614	2,695	461,460	98,628	50,469	73,319	83,529	111,638	1,212,188
Cabrilla	16,177	21,596	14,722	3,106	84	145	92	4,383				1,104	61,409
Croaker	4,143	19,878	15,558	21,039	3,422	249	280	2,242		303	76	9,011	75,301
Halibut, California	18,542	62,337	42,907	27,678		79,799	55,040	50,839	60,570	58,961	21,011	40,101	518,785
Lingcod		50										1,079	1,129
Rock bass	409	1,946	1,254	1,541	313	7,168	290		530	1,774	3,161	3,284	21,670
Rockfish	1,304	380	1,675				272		57	1,935	11,172	634	17,429
Sculpin	546					200	685		106				1,844
Sea bass, black	3,006	16,288	8,115	14,306	9,488	15,675	495	6,757	3,386	6,846	4,761	20,180	109,303
Sea bass, white	110	898	2,185	181	81	6,796	25,372	32,000	109,651	30,292	10,276	8,432	226,274
Shark	36	96	55	240		16	57	135		1,408	584		2,627
Sheepshead	3,343	1,599	401	260	130	1,019	15	283	506	678	808	2,269	11,251
Sierra			405			590						823	1,818
Swordfish, broadbill	409				4,715	6,070	28,842	97,991	68,333	6,473			213,024
Tuna, albacore	546					163,156	1,842,261	2,491,396	263,340	16,262	1,185		4,778,600
Tuna, bluefin							164,973	26,091	153				191,217
Tuna, skipjack	572,859	1,498,901	1,834,099	1,150,232	2,067,215	3,510,472	5,088,708	4,308,902	6,384,538	8,391,807	2,960,364	1,696,518	39,473,615
Tuna, yellowfin	5,020,262	5,850,380	8,625,066	7,098,573	12,117,703	13,116,335	13,797,192	7,033,613	7,749,258	6,026,390	4,816,431	12,936,132	104,196,335
Whitefish, ocean	2,221	1,871	1,851	298	193	831			1,362	499	3,619	2,330	15,075
Yellowtail	105,133	189,727	113,524	51,144	84,444	105,037	183,822	228,208	386,791	677,981	729,438	1,024,853	3,880,102
Miscellaneous fish		259				280		75	80	385	45	138	1,262
Crustacean													
Lobster, spiny	164,363	252,877	152,199							18,450	149,251	236,588	973,728
Total pounds	6,065,968	8,078,041	10,905,028	8,432,119	14,299,642	17,019,995	21,657,127	14,385,004	15,161,384	15,349,699	8,855,221	16,130,574	156,339,802
Shipments to canneries from waters north of the state boundary													
Tuna, albacore								171,443	45,472	38,615			255,530
Total pounds								171,443	45,472	38,615			255,530
Shipments to canneries from south of the international boundary													
Mollusk													
Abalone							875						875
Clam, Pismo	619,704	660,040											1,279,744
Total pounds	619,704	660,040					875						1,280,619
Grand totals													
San Diego region	7,722,207	8,813,373	10,990,173	8,709,390	14,614,601	17,418,965	22,662,914	16,322,211	15,406,674	18,041,664	11,541,175	16,321,323	168,464,670

TABLE 59—Cont'd.

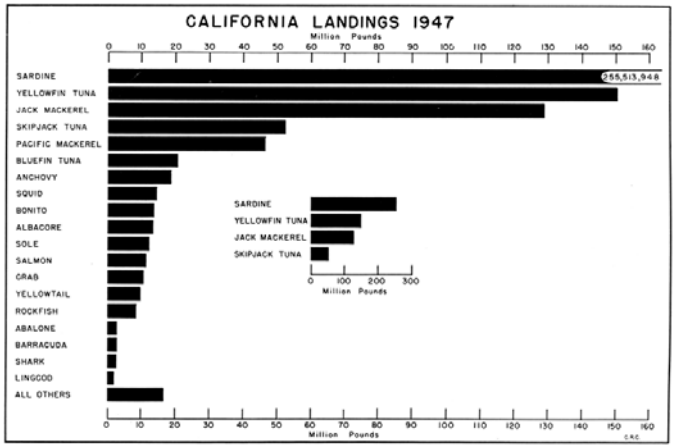

FIGURE 99. See Table 60. For value array see Figure 95

FIGURE 99. See Table 60. For value array see Figure 95

TABLE 60 *

COMMERCIAL FISH LANDINGS—1947

Leading Species by Pounds and Value

Species	Pounds	Species	Value
Sardine	255,513,948	Yellowfin tuna	$23,445,120
Yellowfin tuna	150,459,384	Skipjack tuna	7,586,433
Jack mackerel	129,048,318	Sardine	5,801,658
Skipjack tuna	52,462,104	Jack mackerel	3,323,098
Pacific mackerel	46,478,182	Bluefin tuna	3,321,160
Bluefin tuna	20,837,634	Albacore	3,139,571
Anchovy	18,940,521	Salmon	2,273,676
Squid	14,542,649	Bonito	1,606,364
Bonito	13,697,171	Pacific mackerel	1,389,823
Albacore	13,427,281	Shark	1,325,249
Sole	12,333,594	Crab	1,306,546
Salmon	11,484,588	Yellowtail	1,123,640
Crab	10,748,623	Sole	628,351
Yellowtail	9,952,761	Spiny lobster	512,538
Rockfish	8,498,584	Rockfish	416,374
Abalone	2,670,160	Squid	391,133
Barracuda	2,665,745	Barracuda	350,634
Shark	2,637,926	Anchovy	335,373
Lingcod	1,940,747	California halibut	331,218
California halibut	1,787,901	Broadbill swordfish	322,252
Spiny lobster	1,762,769	Abalone	307,087
Pacific herring	1,654,850	White sea bass	231,437
Pismo clam	1,340,301	Lingcod	163,282
White sea bass	1,083,023	Catfish	85,368
Broadbill swordfish	1,009,957	Sablefish	77,335
Sablefish	902,110	Pacific halibut	61,990
All others	7,618,167	All others	605,844
Total pounds	795,498,998	Total value	$60,462,554
Fish landings exclusive of mollusks and crustaceans			763,324,829

* This table includes actual landings at California ports by the commercial fishing fleet as well as shipments from other states and foreign countries by truck, rail and ocean liner to California canneries and fresh fish dealers. Value to the fisherman is presented.

TABLE 60
COMMERCIAL FISH LANDINGS—1947
Leading Species by Pounds and Value

TABLE 61 [1]

POUNDS AND VALUE OF COMMERCIAL FISH LANDINGS IN CALIFORNIA DURING 1947

Species	Eureka region		Sacramento region		San Francisco region		Monterey region	
	Pounds	Value	Pounds	Value	Pounds	Value	Pounds	Value
Anchovy	4,500	$68			390,173	$9,521	15,495,816	$257,231
Barracuda								
Bonito					473	10	2,832	62
Cabezone								
Cabrilla								
Carp			121,503	$5,893	115,628	8,646		
Catfish			565,770	79,679	33,974	5,689		
Eel	1,435	86						
Flounder	255,015	10,620			205,150	8,268	64,654	4,086
Flying fish								
Grouper								
Hake	606	28						
Halibut, California					5,812	885	135,378	26,724
Halibut, Pacific	229,792	54,025			52,306	7,567		
Hardhead			2,948	884	48,190	14,240		
Herring, Pacific	69,369	1,720			662,257	13,312	923,224	14,218
Kingfish					4,588	222	193,227	11,187
Lingcod	1,501,421	135,388			243,380	18,570	64,192	5,142
Mackerel, jack							2,153,019	60,284
Mackerel, Pacific							379,852	12,358
Mullet								
Perch	45,856	4,352			69,328	11,119	49,349	4,066
Pike, Sacramento			291	17				
Pompano, California					470	148	137,381	25,142
Rock bass								
Rockfish	6,356,942	263,802			211,505	16,739	1,521,275	96,601
Sablefish	679,761	61,926			21,610	1,081	162,803	10,801
Salmon	5,868,577	1,247,072	3,380,481	586,054	1,485,657	279,897	738,469	158,032
Sand dab	364,293	15,118			261,357	11,761	51,003	3,657
Sardine					626,228	17,410	36,773,189	915,553
Sculpin								
Sea bass, black							249	50
Sea bass, white	7,877	593			12,093	2,624	26,057	5,670

TABLE 61
POUNDS AND VALUE OF COMMERCIAL FISH LANDINGS IN CALIFORNIA DURING 1947

Seatrout, greenling					115	10		
Shad	419	17	305,147	15,410				
Shark	942,674	336,910			263,372	702,747	781,558	39,000
Sheepshead								
Sierra								
Skate	720	13			70,942	795	11,864	215
Smelt	17,034	1,478			433,202	24,518	111,180	6,093
Sole	8,127,090	417,732			3,308,738	177,418	421,750	24,595
Split-tail			4,963	316	125	9		
Swordfish, broadbill							521	191
Tuna, albacore	331,117	146,003			372,795	103,863	1,272,140	338,100
Tuna, bluefin								
Tuna, skipjack								
Tuna, yellowfin								
Turbot	19,926	816			75,385	3,136	4,746	199
Whitebait	252,939	25,166			73,664	7,587		
Whitefish, ocean								
Yellowtail								
Miscellaneous fish	51,618	2,131	36	11	11,866	870	1,045	133
Crustacean:								
Crab [2]	5,604,412	619,285	264	44	5,076,871	676,748	51,851	8,841
Lobster, spiny								
Shrimp					841,086	50,381	1,687	689
Mollusk:								
Abalone							148,726	18,726
Clam, cockle								
Clam, gaper							2,636	160
Clam, Pismo							2,438	319
Clam, softshell					22,584	1,355		
Clam, Washington	8,009	624						
Mussel							530	53
Octopus	25,380	1,425			19,987	1,304	7,401	1,073
Oyster, eastern					133,779	22,381		
Oyster, Pacific								
Squid	2,750	297			2,137	158	14,443,859	387,664
Total pounds and value	31,054,535	$3,346,703	4,381,406	$688,308	15,446,909	$2,290,797	76,132,076	$2,435,063

[1] This table includes actual landings at California ports by the commercial fishing fleet as well as shipments from other states and foreign countries by truck, rail and ocean liner to California canneries and to the fresh fish dealers.
[2] For regions north of Santa Barbara crab landings are market crab; in Santa Barbara Region both market and rock crab, in Los Angeles Region rock crab.

TABLE 61—Cont'd.

TABLE 61 [1]—Continued

POUNDS AND VALUE OF COMMERCIAL FISH LANDINGS IN CALIFORNIA DURING 1947

Species	Santa Barbara region		Los Angeles region		San Diego region		Total	
	Pounds	Value	Pounds	Value	Pounds	Value	Pounds	Value
Anchovy	199,450	$2,992	2,847,079	$65,482	3,593	$79	18,940,521	$335,373
Barracuda	3,114	493	1,886,637	252,055	775,994	98,086	2,665,745	350,634
Bonito	812	103	12,199,642	1,429,799	1,496,717	176,462	13,697,171	1,606,364
Cabezone	1,221	104					4,529	181
Cabrilla			57,280	8,598	71,409	7,876	128,689	16,474
Carp							237,131	14,542
Catfish							899,744	85,568
Eel							1,455	86
Flounder	1,089	71	1,164	80			827,072	22,935
Flying fish			31,671	2,179			31,671	2,179
Grouper			39,071	7,880	85,301	9,935	124,372	16,905
Hake							609	28
Halibut, California	488,833	87,159	468,067	92,630	689,909	123,820	1,787,901	331,218
Halibut, Pacific							282,100	61,990
Hardhead							51,138	15,134
Herring, Pacific							1,654,850	29,250
Kingfish	5,999	223	191,937	10,838	57,935	4,310	456,686	26,780
Lingcod	26,208	2,479	6,155	603	9,391	900	1,940,747	163,282
Mackerel, jack	13,348,712	261,730	113,105,649	2,895,452	242,938	5,612	129,048,318	3,223,998
Mackerel, Pacific	1,445,110	39,162	44,230,575	1,325,185	338,605	13,138	66,678,182	1,389,823
Mullet			5,479	959	127,057	11,111	133,536	12,110
Perch	13,010	1,149	113,067	18,837			296,610	39,523
Pike, Sacramento							291	17
Pompano, California			64,211	9,966			202,062	35,256
Rock bass	20,246	2,233	145,377	20,693	83,790	9,968	251,413	32,895
Rockfish	59,195	5,008	312,868	30,442	36,799	3,791	8,498,584	416,374
Sablefish			37,834	3,827			902,110	77,335
Salmon	11,401	2,631					11,484,588	2,273,676
Sand dab	3,188	134	21,562	3,675			701,403	34,345
Sardine	4,341,328	102,030	208,097,435	4,640,573	6,675,768	126,002	253,513,948	5,801,558
Sculpin	1,017	70	105,617	18,926	20,414	2,363	127,048	21,359
Sea bass, black	4,770	800	128,389	22,416	110,897	16,853	244,504	40,201
Sea bass, white	205,793	38,936	340,903	127,384	295,300	56,196	1,082,023	231,437

TABLE 61
POUNDS AND VALUE OF COMMERCIAL FISH LANDINGS IN CALIFORNIA DURING 1947

Seatrout, grunion							115	10
Shad							305,566	18,427
Shark	151,817	88,713	396,915	95,260	101,590	7,619	2,657,926	1,325,249
Sheepshead	42,657	2,709	113,095	9,559	37,736	3,004	193,489	15,272
Sierra			3,411	319	1,818	115	5,229	434
Skate	3,448	127	16,722	930			103,696	2,060
Smelt	4,121	364	147,385	10,479	342	37	713,264	42,959
Sole	183,035	8,382	2,605	201			12,333,594	626,351
Split-tail							5,088	325
Swordfish, broadbill	242,823	88,317	498,318	155,475	268,265	78,389	1,009,957	322,252
Tuna, albacore	707,254	180,279	3,065,813	709,235	7,478,162	1,663,891	13,427,281	3,129,871
Tuna, bluefin	7,245	1,092	20,517,580	3,272,553	312,809	47,515	20,837,634	3,321,160
Tuna, skipjack			12,909,939	1,847,306	39,532,495	5,739,067	52,462,104	7,586,453
Tuna, yellowfin			46,259,844	7,137,893	101,199,549	16,307,227	150,459,284	23,448,120
Turbot	1,710	96					101,767	4,247
Whitebait							326,603	32,763
Whitefish, ocean	3,242	373	22,118	2,429	15,586	1,527	40,946	4,329
Yellowtail			6,025,208	679,042	3,927,553	444,598	9,952,761	1,123,640
Miscellaneous fish	17,825	1,633	228,387	7,709	2,425	230	312,900	12,477
Crustacean:								
Crab[2]	894	93	14,331	1,535			10,748,623	1,306,546
Lobster, spiny	130,509	40,471	492,959	175,394	1,139,301	296,673	1,762,709	512,538
Shrimp							842,773	51,079
Mollusk:								
Abalone	2,376,371	272,095	121,405	13,087	23,647	3,179	2,670,160	307,087
Clam, cockle			282	12			282	42
Clam, gaper							2,656	160
Clam, Pismo	58,119	7,673			1,279,744	24,009	1,240,201	32,601
Clam, softshell							22,584	1,355
Clam, Washington							8,009	624
Mussel							330	33
Octopus	66	6	205	26			53,019	3,834
Oyster, eastern							133,779	22,381
Oyster, Pacific	46,035	3,140					46,035	3,140
Squid			93,933	3,014			14,542,649	391,133
Total pounds and value	24,357,737	$1,308,013	475,661,765	$25,110,287	168,464,670	$25,283,444	705,498,998	$60,462,554

[1] This table includes actual landings at California ports by the commercial fishing fleet as well as shipments from other states and foreign countries by truck, rail and ocean liner to California canneries and to the fresh fish dealers.
[2] For regions north of Santa Barbara crab landings are market crab; in Santa Barbara Region both market and rock crab, in Los Angeles Region rock crab.

TABLE 61—Cont'd.

TABLE 62

CALIFORNIA COMMERCIAL FISH LANDINGS—1947

Values for Eureka Region, Indicating Leading Ports, Species and Pounds

		Value	Pounds
Eureka region totals		$3,346,703	31,054,535
Eureka	Salmon	$355,545	1,673,151
	Sole	249,699	4,857,952
	Crab	210,357	1,903,702
	Shark	176,286	493,247
	Rockfish	153,215	3,692,196
	Albacore	67,781	246,566
	Lingcod	43,623	512,014
	Pacific halibut	41,529	176,646
	Sablefish	24,173	265,351
	Sand dab	8,092	194,998
	All other	18,745	359,626
		$1,349,045	14,375,449
Fort Bragg	Salmon	$313,602	1,475,776
	Lingcod	60,988	715,827
	Rockfish	59,154	1,425,408
	Albacore	57,896	210,609
	Sole	53,755	1,045,826
	Crab	39,444	356,959
	Sablefish	15,239	167,277
	Shark	9,187	25,705
	All other	13,392	174,562
		$622,657	5,597,949
Fields Landing	Shark	$150,525	421,167
	Sole	112,277	2,184,385
	Crab	111,386	1,008,018
	Rockfish	48,965	1,179,884
	Salmon	36,607	172,270
	Sablefish	22,155	243,189
	Lingcod	17,438	204,671
	Pacific halibut	8,488	36,105
	All other	19,964	292,808
		$527,805	5,742,497
Crescent City	Salmon	$245,207	1,153,916
	Crab	221,715	2,006,474
	Albacore	9,692	35,257
	Lingcod	8,901	104,476
	Whitebait	7,549	75,867
	All other	6,885	115,227
		$499,949	3,491,217
Point Arena	Salmon	$159,005	748,260
	Crab	5,416	49,017
	All other	7,276	46,286
		$171,697	843,563
Shelter Cove	Salmon	$116,695	549,154
	Lingcod	2,376	27,893
	All other	561	5,162
		$119,632	582,209
Trinidad	Crab	$30,607	276,982
	Salmon	20,297	95,515
	All other	371	3,264
		$51,275	375,761
Arcata	Whitebait	$3,873	38,928
	All other	268	2,847
		$4,141	41,775
All other ports	All other	$502	4,115
		$502	4,115

TABLE 62
CALIFORNIA COMMERCIAL FISH LANDINGS—1947
Values for Eureka Region, Indicating Leading Ports, Species and Pounds

TABLE 63

CALIFORNIA COMMERCIAL FISH LANDINGS—1947

Values for Sacramento Region, Indicating Leading Ports, Species and Pounds

		Value	Pounds
Sacramento region totals		$688,308	4,381,406
Pittsburg	Salmon	$368,876	2,120,755
	Catfish	45,999	326,566
	Shad	13,979	276,817
	Carp	5,700	117,527
	All other	295	4,646
		$434,849	2,846,311
Sacramento	Salmon	$127,747	740,991
	Catfish	8,868	62,984
	Shad	1,338	26,500
	All other	1,117	7,383
		$139,070	837,858
Martinez	Salmon	$58,168	337,404
	All other	74	1,462
		$58,242	338,866
Stockton	Catfish	$20,566	146,068
	Salmon	3,022	17,527
	All other	47	595
		$23,635	164,190
Benicia	Salmon	$22,018	127,712
		$22,018	127,712
Collinsville	Salmon	$6,223	36,095
	All other	5	102
		$6,228	36,197
Tracy	Catfish	$4,240	30,112
		$4,240	30,112
All other ports	All other	$26	160
		$26	160

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TABLE 63
CALIFORNIA COMMERCIAL FISH LANDINGS—1947
Values for Sacramento Region, Indicating Leading Ports, Species and Pounds

TABLE 64

CALIFORNIA COMMERCIAL FISH LANDINGS—1947

Values for San Francisco Region, Indicating Leading Ports, Species and Pounds

		Value	Pounds
San Francisco region totals		$2,290,797	15,446,809
San Francisco	Shark	$649,371	215,738
	Crab	419,530	3,147,259
	Sole	119,901	2,432,065
	Albacore	90,864	327,086
	Salmon	38,334	203,471
	Shrimp	25,020	417,704
	Smelt	21,998	388,664
	Hardhead	14,240	48,190
	Perch	11,108	69,254
	Sardine	10,126	364,228
	Pacific herring	9,884	491,725
	Sand dab	8,952	198,943
	Rockfish	8,634	109,149
	Lingcod	8,380	109,835
	Anchovy	7,554	309,573
	Carp	7,500	100,270
	All other	24,957	356,714
		$1,476,353	9,289,868
Point Reyes	Salmon	$161,710	858,335
	Crab	100,521	754,096
	Sole	34,773	705,336
	Shark	27,619	9,176
	Eastern oyster	20,549	122,829
	Rockfish	6,275	79,328
	Albacore	6,022	21,677
	Lingcod	3,891	50,992
	All other	5,746	116,891
		$367,106	2,718,660
Bay (Bodega)	Crab	$93,258	699,611
	Shark	49,746	16,527
	Salmon	34,909	185,294
	Sole	22,369	453,723
	Lingcod	5,977	78,329
	Flounder	3,787	93,966
	All other	10,721	134,365
		$220,767	1,661,815
Princeton-by-the-Sea	Shark	$66,011	21,931
	Salmon	40,482	214,871
	Crab	20,758	155,726
	All other	8,978	225,856
		$136,229	618,384
Oakland	Crab	$30,850	231,432
	Catfish	5,523	32,984
	Carp	1,108	14,811
		$37,481	279,227
Richmond	Shrimp	$11,583	193,366
	Sardine	5,004	180,000
	All other	833	30,093
		$17,420	403,459
All other ports	All other	$35,441	475,396
		$35,441	475,396

TABLE 64
CALIFORNIA COMMERCIAL FISH LANDINGS—1947
Values for San Francisco Region, Indicating Leading Ports, Species and Pounds

TABLE 65

CALIFORNIA COMMERCIAL FISH LANDINGS—1947

Values for Monterey Region, Indicating Leading Ports, Species and Pounds

		Value	Pounds
Monterey region totals		$2,435,003	76,132,076
Monterey	Sardine	$742,920	29,836,142
	Squid	383,579	14,312,648
	Albacore	313,768	1,187,614
	Anchovy	245,259	14,774,616
	Salmon	106,653	498,380
	Rockfish	91,714	1,444,317
	Jack mackerel	56,270	2,009,658
	Abalone	18,726	148,736
	California halibut	14,156	71,714
	Pacific herring	14,141	918,224
	Sole	12,777	219,167
	Pacific mackerel	10,390	314,850
	Kingfish	9,890	172,600
	California pompano	6,527	35,604
	All other	24,684	315,724
		$2,051,454	66,259,994
Santa Cruz	Sardine	$137,357	5,516,342
	Salmon	51,369	240,044
	Albacore	22,332	84,526
	California pompano	18,615	101,777
	California halibut	12,338	62,501
	Sole	11,713	200,914
	Sablefish	7,536	113,659
	All other	32,017	575,291
		$293,277	6,895,054
Moss Landing	Sardine	$35,376	1,420,705
	Shark	35,237	706,153
	Anchovy	11,869	715,000
	Crab	4,112	24,120
	All other	3,617	110,577
		$90,211	2,976,555
All other ports	All other	$61	473
		$61	473

TABLE 65
CALIFORNIA COMMERCIAL FISH LANDINGS—1947
Values for Monterey Region, Indicating Leading Ports, Species and Pounds

TABLE 66

CALIFORNIA COMMERCIAL FISH LANDINGS—1947

Values for Santa Barbara Region, Indicating Leading Ports, Species and Pounds

		Value	Pounds
Santa Barbara region totals		$1,308,012	24,357,737
Santa Barbara	Abalone	$115,442	1,008,227
	Broadbill swordfish	87,252	240,165
	California halibut	81,996	459,879
	Jack mackerel	60,117	2,251,584
	Sardine	47,036	2,001,535
	Shark	42,721	120,748
	Albacore	40,128	157,427
	Spiny lobster	39,847	128,497
	White sea bass	36,655	193,634
	Pacific mackerel	11,291	416,663
	Sole	7,322	160,224
	All other	13,295	159,456
		$583,102	7,298,039
Port Hueneme	Jack Mackerel	$301,633	11,297,128
	Sardine	54,979	2,339,559
	Pacific mackerel	27,852	1,027,754
	All other	2,938	190,669
		$387,402	14,855,110
Morro Bay	Abalone	$83,608	730,200
	Albacore	56,190	220,439
	Pacific oyster	3,140	46,035
	All other	5,530	44,401
		$148,468	1,041,075
Avila	Albacore	$83,961	329,388
	Abalone	24,630	215,106
	Shark	10,046	28,394
	California halibut	3,476	19,494
	All other	9,240	83,230
		$131,353	675,612
Cambria	Abalone	$48,415	422,838
		$48,415	422,838
Pismo	Pismo clam	$4,983	37,750
		$4,983	37,750
All other ports	All other	$4,289	27,313
		$4,289	27,313

TABLE 66
CALIFORNIA COMMERCIAL FISH LANDINGS—1947
Values for Santa Barbara Region, Indicating Leading Ports, Species and Pounds

TABLE 67

CALIFORNIA COMMERCIAL FISH LANDINGS—1947

Values for Los Angeles Region, Indicating Leading Ports, Species and Pounds

		Value	Pounds
Los Angeles region totals		$25,110,287	475,661,765
Terminal Island	Yellowfin tuna	$5,086,972	32,968,065
	Sardine	3,338,279	149,698,605
	Jack mackerel	1,847,767	72,178,414
	Bluefin tuna	1,648,582	10,335,939
	Skipjack tuna	1,271,943	8,888,489
	Bonito	898,070	7,662,717
	Pacific mackerel	589,343	19,710,480
	Albacore	569,751	2,461,126
	Yellowtail	407,978	3,620,034
	Spiny lobster	15,074	42,366
	All other	5,403	148,458
		$15,679,162	307,714,693
Long Beach	Yellowfin tuna	$1,379,748	8,941,985
	Sardine	795,739	35,683,377
	Bluefin tuna	659,515	4,134,893
	Jack mackerel	489,351	19,115,275
	Bonito	399,716	3,410,543
	Skipjack tuna	377,371	2,637,112
	Yellowtail	167,457	1,485,868
	Pacific mackerel	108,032	3,613,098
	Spiny lobster	51,212	143,936
	Albacore	17,322	74,825
	Barracuda	15,650	117,141
	Anchovy	8,479	368,671
	All other	5,943	35,391
		$4,475,535	79,762,115
Wilmington	Yellowfin tuna	$663,250	4,298,445
	Jack mackerel	482,984	18,866,565
	Sardine	361,818	16,225,035
	Bluefin tuna	266,667	1,671,894
	Skipjack tuna	177,322	1,239,144
	Bonito	125,042	1,066,912
	Pacific mackerel	111,418	3,726,358
	Yellowtail	68,951	611,808
	Albacore	31,092	134,308
	All other	5,095	38,156
		$2,293,639	47,878,625
San Pedro	Bluefin tuna	$681,628	4,273,531
	Barracuda	157,784	1,181,017
	White sea bass	109,190	463,652
	Sardine	73,151	3,280,294
	Jack mackerel	66,927	2,614,345
	California halibut	57,595	291,032
	Pacific mackerel	45,632	1,526,143
	Spiny lobster	42,110	118,352
	Shark	39,039	162,663
	Broadbill swordfish	23,443	75,139
	Yellowtail	21,508	190,840
	Perch	17,735	106,457
	Rockfish	17,502	179,875
	Black sea bass	16,242	93,022
	Albacore	15,433	66,667
	Sculpin	14,835	82,783
	Anchovy	14,012	609,226
	Rock bass	10,624	74,815
	Smelt	10,123	142,374
	Kingfish	8,536	153,522
	California pompano	7,622	49,108
	All other	44,224	538,141
		$1,494,895	16,272,998

TABLE 67
CALIFORNIA COMMERCIAL FISH LANDINGS—1947
Values for Los Angeles Region, Indicating Leading Ports, Species and Pounds

TABLE 67—Continued

CALIFORNIA COMMERCIAL FISH LANDINGS—1947

Values for Los Angeles Region, Indicating Leading Ports, Species and Pounds

		Value	Pounds
Newport Beach	Pacific mackerel	$259,527	8,679,846
	Broadbill swordfish	107,957	346,015
	Albacore	67,861	293,139
	Sardine	58,012	2,601,415
	Barracuda	38,351	287,057
	Shark	37,394	155,807
	Spiny lobster	21,332	59,956
	California halibut	20,514	103,658
	Anchovy	20,146	875,921
	Skipjack tuna	19,837	138,620
	Bluefin tuna	16,108	100,991
	Yellowtail	12,994	115,301
	Abalone	7,655	71,008
	All other	49,553	581,035
		$737,241	14,409,769
Santa Monica	Pacific mackerel	$187,119	6,258,133
	Spiny lobster	32,285	90,741
	Barracuda	25,922	194,030
	Anchovy	16,097	699,886
	Shark	16,120	67,169
	California halibut	11,857	59,915
	White sea bass	10,191	43,274
	Albacore	7,488	32,346
	Broadbill swordfish	7,104	22,769
	All other	30,620	835,472
		$344,803	8,303,735
Redondo Beach	Pacific mackerel	$24,059	804,657
	Spiny lobster	5,787	16,264
	Barracuda	5,670	42,437
	Sardine	2,745	123,099
	All other	11,899	162,115
		$50,160	1,148,572
Avalon	Broadbill swordfish	$12,703	40,714
	Spiny lobster	3,290	9,246
	Barracuda	2,265	16,953
	All other	4,974	44,126
		$23,232	111,039
All other ports	All other	$11,620	60,219
		$11,620	60,219

TABLE 67
CALIFORNIA COMMERCIAL FISH LANDINGS—1947
Values for Los Angeles Region, Indicating Leading Ports, Species and Pounds

TABLE 68

CALIFORNIA COMMERCIAL FISH LANDINGS—1947

Values for San Diego Region, Indicating Leading Ports, Species and Pounds

		Value	Pounds
San Diego region totals		$25,283,444	168,464,670
San Diego	Yellowfin tuna	$13,237,903	84,587,247
	Skipjack tuna	4,922,378	33,924,036
	Albacore	1,189,239	5,344,896
	Yellowtail	380,618	3,362,351
	Spiny lobster	288,571	1,108,186
	Bonito	153,083	1,298,418
	Sardine	126,002	5,675,768
	California halibut	123,075	685,654
	Barracuda	97,769	773,489
	Broadbill swordfish	78,369	268,295
	White sea bass	55,471	291,490
	Bluefin tuna	41,799	275,175
	Pismo clam	24,699	1,279,744
	Black sea bass	16,852	110,359
	Pacific mackerel	12,998	334,988
	Mullet	11,111	127,057
	Grouper	9,025	85,301
	Rock bass	8,106	69,762
	All other	36,085	586,284
		$20,813,153	140,188,500
Point Loma	Yellowfin tuna	$3,069,324	19,612,293
	Skipjack tuna	816,689	5,628,459
	Albacore	474,652	2,133,266
	Yellowtail	63,960	565,022
	Bonito	23,379	198,299
	Bluefin tuna	5,716	37,634
		$4,453,720	28,174,973
All other ports	All other	$16,571	101,197
		$16,571	101,197

TABLE 68
CALIFORNIA COMMERCIAL FISH LANDINGS—1947
Values for San Diego Region, Indicating Leading Ports, Species and Pounds

INDEX

All species taken in commercial quantities during 1947 are listed in the tables of landings, pages 237–263, inclusive.