

## REVIEW OF SOME CALIFORNIA FISHERIES FOR 1986

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Total 1986 landings of fishes, crustaceans, and mollusks posted the first increase (6%) since the recent decline began in 1981. Even though landings remained below the ten-year average, some hopeful signs were noted.

Pelagic wetfish landings continued the upward trend first observed in 1985 after a four-year decline (Table 1). There was a particularly large increase in market squid landings. Both jack and Pacific mackerel posted gains relative to last year, and sardines apparently continued the long road back that has been evident in recent years.

Mixed returns were noted in other fisheries. Pacific ocean shrimp landings improved greatly. Dungeness crab landings also showed a significant increase.

A slight decrease was noted in groundfish landings; but although halibut landings were down

from 1985, the total was still above the ten-year average. Albacore fishing was very poor during the 1986 season.

Lobster catch per unit of effort improved, while the total catch was similar to 1985 because of a decrease in the number of fishermen. Sportfish catch, in general, reflected a decrease in rockfish and pelagic species and an increase in nearshore species.

### PACIFIC SARDINE

The opening of a 1,000-ton fishery for Pacific sardines (*Sardinops sagax*) on January 1, 1986, marked the first directed take of sardine since a moratorium went into effect in 1974. A cooperative survey in May 1985 by the California Department of Fish and Game (CDFG) and the National Marine Fisheries Service, Southwest Fisheries Center

TABLE 1  
 Landings of Pelagic Wetfishes in California in Short Tons

Year	Pacific sardine	Northern anchovy	Pacific mackerel	Jack mackerel	Pacific herring	Market squid	Total
1964	6,569	2,488	13,414	44,846	175	8,217	75,709
1965	962	2,866	3,525	33,333	258	9,310	50,254
1966	439	31,140	2,315	20,431	121	9,512	63,958
1967	74	34,805	583	19,090	136	9,801	64,489
1968	62	15,538	1,567	27,834	179	12,466	57,646
1969	53	67,639	1,179	26,961	85	10,390	106,307
1970	221	96,243	311	23,873	158	12,295	133,101
1971	149	44,853	78	29,941	120	15,756	90,897
1972	186	69,101	54	25,559	63	10,303	105,266
1973	76	132,636	28	10,308	1,410	6,031	150,489
1974	7	82,691	67	12,729	2,630	14,452	112,576
1975	3	158,510	144	18,390	1,217	11,811	190,075
1976	27	124,919	328	22,274	2,410	10,153	160,111
1977	6	111,477	5,975	50,163	5,827	14,122	187,570
1978	5	12,607	12,540	34,456	4,930	18,899	83,437
1979	18	53,881	30,471	18,300	4,693	22,026	129,389
1980	38	47,339	32,645	22,428	8,886	16,958	128,294
1981	31	57,659	42,913	15,673	6,571	25,915	148,762
1982	145	46,364	31,275	29,110	11,322	17,951	136,167
1983	388	4,740	35,882	20,272	8,829	2,010	72,121
1984	259	3,258	46,531	11,768	4,241	622	66,679
1985	653	1,792	38,150	10,318	8,801	11,326	71,040
1986*	1,310	2,051	44,824	12,172	8,405	23,124	91,886

\*Preliminary

(NMFS-SWFC) detected a sardine spawning area that was determined to be characteristic of a spawning biomass of at least 20,000 tons. Since current law allows a 1,000-ton quota when the spawning biomass reaches this level, a fishery was initiated. A second survey conducted in August 1986 detected a spawning area of 955 n. mi<sup>2</sup>, which was about 43% larger than the spawning area observed the year before. As a result, a 1,000-ton quota was established for the second season, which opened on January 1, 1987.

Landings of sardines in the 1986 fishery were steady and relatively high, averaging about 150 tons per month through June. The fishery was closed on July 11, when the 1,000-ton quota was reached. Sardines landed incidentally with mackerel in both northern and southern California accounted for 58% of the landings. The southern California catch, both incidental and directed, constituted 93% of sardine quota landings. Directed landings were used primarily as cut bait for the central California striped bass fishery.

Following the close of the season, sardines continued to be landed incidentally under a 15% tolerance limit. An estimated total of 867 tons was landed incidentally with mackerel during the year, which is an increase of 33% over incidental landings in 1985. This is higher than catches of the last 20 years, and continues the trend of increasing occurrences of sardines in the mackerel fishery. Similarly to last year, sardines constituted 1.5% of the overall mackerel catch, and occurred in 60% of observed landings. Total landings of sardines, including both quota landings and incidental landings made after the season closure, reached 1,310 tons (Table 1). Preliminary otolith readings indicated a slightly older age composition in the incidental catch (mostly of 2- and 3-year-old fish, with a small proportion of 4-year-olds) than in the directed landings (mostly 2- and 3-year-old fish, with a few 1-year olds).

Landings of sardines in live bait increased compared to 1985 estimated landings, but were well below the 150-ton annual quota. As in 1985, the availability of squid, which are often preferred as live bait for big game fish, resulted in a decreased demand for sardines.

As in 1984 and 1985, CDFG young-fish surveys in October found little evidence of sardine recruitment. Trawling success for both adults and juveniles declined. In recent years, only the 1983 year class has been captured in high numbers as young-of-the-year and 1-year-olds in these surveys. Young-of-the-year sardines caught in 1986 were

considerably larger than their counterparts last year, suggesting that they originated from a spring rather than a summer spawning.

#### NORTHERN ANCHOVY

Landings of northern anchovy (*Engraulis mordax*) for reduction purposes during the 1985–86 season totaled 909 tons through December 1985. All landings were made in the Morro Bay area, against the northern permit region quota of 10,000 short tons. No landings were made in the southern permit region because of poor market conditions for fish meal and more lucrative fishing for mackerel, tuna, and squid.

A single boat delivered 14 loads totaling 402 tons to the northern area reduction plant in May and June 1986. The 1985–86 reduction season closed on June 30 with 1,511 tons landed (Table 2).

Using a stock synthesis biomass estimation model, National Marine Fisheries Service biologists estimated the 1986 spawning biomass of northern anchovy to be at least 848,770 short tons. The U.S. optimal yield was set at 159,723 tons and the U.S. reduction harvest limit at 154,350 tons. Northern and southern permit area allocations for the 1986–87 reduction season were unchanged from the 1985–86 season, at 10,000 and 144,350 tons, respectively. The fishery opened on August 1 in the north and on September 15 in the south. The northern area processor issued unlimited orders

TABLE 2  
Anchovy Landings for Reduction Seasons in the Southern and Northern Areas, in Short Tons

Season	Southern area	Northern area	Total
1966–67	29,589	8,021	37,610
1967–68	852	5,651	6,503
1968–69	25,314	2,736	28,050
1969–70	81,453	2,020	83,473
1970–71	80,095	657	80,752
1971–72	52,052	1,314	53,366
1972–73	73,167	2,352	75,519
1973–74	109,207	11,380	120,587
1974–75	109,918	6,669	116,587
1975–76	135,619	5,291	140,910
1976–77	101,434	5,007	106,441
1977–78	68,467	7,212	75,688
1978–79	52,696	1,174	53,870
1979–80	33,383	2,365	35,748
1980–81	62,161	4,736	66,897
1981–82	45,149	4,953	50,102
1982–83	4,925	1,270	6,195
1983–84	70	1,765	1,835
1984–85	78	0	78
1985–86*	0	1,511	1,511

\*Preliminary

for anchovy throughout the first half of the season, but landings were not anticipated because of a price per ton of less than \$30. Northern area boats fished primarily for mackerel, salmon, herring, and squid. The southern permit region experienced a decrease in processing capacity when one former reduction plant closed and two others expressed no interest in this market. No reduction landings were made in either permit region through December of the 1986–87 season.

Total landings of anchovy during 1986 included 402 tons for reduction, 1,649 tons for nonreduction, and 4,942 tons for live bait. The decrease in live bait landings from the 1985 total of 5,055 tons was due to the failure of the summer albacore sport fishery in waters accessible to the large San Diego-based fishing fleet.

Trawl surveys conducted by CDFG during 1986 indicate that the 1985 year class is weak; not since the 1981 year class have 1-year-olds constituted a lower percentage of age-composition samples. The 1986 year class, however, made the strongest showing as young-of-the-year fish since 1980. Young-of-the-year fish also appeared abnormally small relative to recent year classes, which may be attributable to late spawning. Mexican reduction fishery representatives reported a continuation of the decline in anchovy landings since the most recent El Niño, with small, young fish dominating the catch.

#### JACK MACKEREL

An estimated 12,172 tons of jack mackerel (*Trachurus symmetricus*) were landed during 1986 (Table 1). Similarly to last year, jack mackerel accounted for 21% of total mackerel landings. Since 1979, jack mackerel have contributed less than Pacific mackerel to the California mackerel fishery. In the last three years, the proportions of annual mackerel landings composed of jack mackerel have been the lowest since this fishery began in the late 1940s.

Jack mackerel did not dominate statewide landings at any time during 1986, probably because Pacific mackerel landings were unrestricted. Jack mackerel are in less demand than Pacific mackerel, and were generally less available throughout the year. In northern California, however, jack mackerel dominated landings from October through December. The composition of the total 1986 catch varied, with jack mackerel constituting from 5% to 43% of the landings. Nearly 94% of all jack mackerel landings occurred in southern California. Calculated throughout the year, jack mackerel made

up 22% of the total mackerel landings in northern California, and 21% of the total mackerel landings in southern California.

Sea surveys conducted in 1986, and the occurrence of large numbers of young-of-the-year fish in the mackerel fishery suggest that the 1986 year class is fairly strong.

#### PACIFIC MACKEREL

The year began with 22,933 tons of Pacific mackerel (*Scomber japonicus*) already landed through the first half of the 1985–86 fishery season. No quota restrictions were in effect because the total biomass had been estimated to range between 178,000 and 260,000 tons, and current law allows an open fishery when the biomass exceeds 150,000 tons. Landings during January were limited by extended closure of southern California processing plants over the holiday season. Monthly landing totals increased beginning in February. Catch locations through May ranged along the coast of southern California between Long Beach and Ventura. Pacific mackerel constituted 70% or less of monthly catch totals through April, as 1-year-old jack mackerel made a strong showing in the fishery. During the second half of the season, southern California processors set landing limits between 40 and 60 tons per boat per week, and the price per ton was steady at \$150–\$155. The 1985–86 season closed on June 30, 1986, with a total catch of 41,400 tons of Pacific mackerel, down slightly from the previous season's total of 43,255 tons. Pacific mackerel contributed 75% to statewide landings of mackerel, and 93% of all Pacific mackerel landings were made in southern California.

The 1986–87 season opened on July 1, 1986, with no quota restrictions, based on a total biomass estimated to exceed 500,000 tons. Catches were very low in July, because the southern California purse seine fleet concentrated its efforts on bluefin tuna. Southern California processing plants lifted all landing limits on mackerel from July through September, resulting in catches of over 5,500 tons per month. Varied landing limits and plant closures for holidays reduced landing totals in November and December. Catch locations from July through December included coastal waters between Long Beach and Ventura, and off San Clemente, Santa Catalina, and Santa Cruz islands. Pacific mackerel constituted over 80% of total mackerel landings each month. By the end of December, 26,317 tons of Pacific mackerel had been landed toward the 1986–87 season total. Landings of Pacific mackerel for the year totaled 44,824 tons. This is the third

highest annual catch since the Pacific mackerel fishery reopened in 1977, and exceeds the average annual landings for the previous five years. This is also the first year during which no quota restrictions were in effect, which may in part account for the relatively high annual catch under conditions of cannery landing limitations and low price. Northern California landings contributed only 6% to the year's total, down from 8% in 1985 and 18% in 1984.

The 1980, 1981, and 1982 year classes together accounted for 44% of fish landed. The 1985 year class, which was first thought to be very weak, made a good showing as 1-year-olds in the fishery, contributing 14% to the year's catch, and over 35% of fish landed in October and December. Young-of-the-year also made a strong showing, first appearing in the fishery in October, and contributing 11% to December's catch and 1% to total landings for the year.

#### MARKET SQUID

Landings of market squid (*Loligo opalescens*) in 1986 totaled 23,124 short tons. These landings exceeded any since 1981, and were 65% higher than the 10-year average of 13,998 tons (Table 1).

Only 20% of this year's total was landed in northern California ports (north of Morro Bay). It was hoped that squid would return to Monterey Bay in great numbers this second season after an El Niño so sharply reduced squid growth and survival. However, the 5,544 tons landed in Monterey Bay in 1986 was a far cry from the 10,000 to 14,000 tons expected in a good year. On the positive side, landings were 24% better than in 1985, and more than ten times higher than landings in either 1983 or 1984.

Monterey fishermen began landing squid on April 11 at \$300 per ton, but the price dropped to \$200 per ton by the second week of the season. In complete contrast to the large squid landed early in the 1985 season, the first squid landed this year were small, averaging 16 per pound. Later in April, the average size increased, producing a count of 13 per pound. In May counts improved slightly, to about 11 per pound.

Fishermen experienced highly variable success early in the season. Throughout May, fishermen had several good days among the many very poor days. Fishing became even worse during the next two months. Boats averaged less than two tons per day, putting a severe crimp in the incomes of fishermen, who work for a share of the catch rather than a fixed wage. Some boat owners had so much

trouble finding crew members that they quit fishing for the remainder of the season.

The remaining fishermen found greater concentrations of squid north of Monterey Bay near Pigeon Point, and fished there for the rest of the season. The squid caught there in 1985 were larger, better-quality squid than those caught near Monterey. In 1986, however, the quality of the Pigeon Point area squid was similar to that caught near Monterey—11 per pound. For the remainder of the year fishing was spotty at best. August produced the greatest catch (1,259 tons), followed by July (884 tons), November (822 tons), and May and June (more than 500 tons each month).

In keeping with its typical fall-winter abundance pattern, the 1986 southern California market squid fishery was most active during the months of January, October, November, and December. Of the total 16,450 tons landed in southern California, 88% was brought in during these months. Over 5,000 tons was estimated to be used as live bait during the year.

Fishing effort this season was primarily at Catalina and the northern Channel Islands, with a good deal of effort occurring at Santa Cruz Island. Approximately 42 vessels worked the squid grounds during the season, including several from the Monterey area, and one from as far as Washington. Many boats worked in pairs at night, one attracting squid to the surface with lights, the other wrapping the school with a purse seine or lampara net.

In spite of excellent landings, fishermen did not claim a bonanza season. Boats working in teams split profits between two crews. In addition, markets were essentially flooded with squid, keeping the price fairly low. The going price for squid at the San Pedro markets, where 40% of southern California squid was landed, was \$200 per ton, except for March and April when it jumped to \$400. Prices elsewhere ranged widely, but were primarily within \$120 to \$240 per ton. Because of high local availability, some squid was trucked north to Monterey, Moss Landing, and even Newport, Oregon, for processing.

#### PACIFIC HERRING

In the 1985–86 season (December–March) 8,139 tons of Pacific herring (*Clupea harengus pallasi*) were caught. This represents a quota shortfall of 451 tons. Fishing was generally excellent in most areas. In San Francisco Bay, however, herring spawned in areas that were closed to round-haul gear, and fishing during February was largely curtailed by a series of storms. Most of the shortfall

resulted from the fact that herring were subsequently not available to purse seine or lampara boats. The annual catch totaled 8,247 tons, down slightly from 1985 (Table 1). Base price for 10% roe recovery was \$1,200 per ton for gill netters and \$800 per ton for round-haul boats. The estimated ex-vessel value of the 1985-86 herring catch was over \$11 million.

Population estimates from 1985-86 spawning-ground surveys indicate that herring spawning biomass in San Francisco Bay increased 3,000 tons, to 49,000 tons, but in Tomales Bay the biomass decreased 600 tons, to 6,000 tons.

During the past four seasons, recruitment of 2-year-old herring into the San Francisco Bay round-haul fishery has been relatively good, and the trend of increasing abundance is expected to continue. Recruitment of recent year classes in Tomales Bay is unknown. Tomales Bay is a gill net-only fishery, and herring are not fully recruited until 5 or 6 years old. However, a major change in the status of the Tomales Bay fishery is unexpected.

No adjustment was made to the 1986-87 herring quota, which remains at 8,590 tons, based on relatively stable 1985-86 biomass estimates. Early 1986-87 season catches have been very good, but a lower base price of \$600 to \$800 per ton for 10% roe recovery will reduce the value of the 1986-87 catch.

## GROUND FISH

California's 1986 commercial harvest was 41,795 metric tons (MT), valued at \$31,000,000 ex-vessel. The 1986 catch declined by 1,935 MT, or 4% from the 43,730-MT catch in 1985 because of landing decreases for most of the major species. The major share of the catch, 78% and 32,469 MT, was taken by trawlers. Setnet landings were 12% of the total (4,983 MT). The line catch followed at 7% (2,856 MT), and other gear accounted for 1% (629 MT).

Rockfish (a multispecies group), Dover sole (*Microstomus pacificus*), and sablefish (*Anoplopoma fimbria*) were the leading species in 1986 landings (Table 3). Trawl landings of major groundfish species, with the exception of sablefish and Pacific whiting, declined 1%-35% from 1985 levels. A shift of trawl effort from groundfish to the rejuvenated pink shrimp fishery off northern California and Oregon resulted in less groundfish effort and an 8% decrease in trawl landings. Market demand for groundfish, particularly sablefish, remained strong throughout the year. The elimination of the directed Japanese sablefish effort in U.S. waters off Alaska in 1985, together with Jap-

TABLE 3  
 California Groundfish Landings (Metric Tons)

Species	1985	1986*	Percent change
Dover sole	12,159	10,987	-10%
English sole	1,073	1,074	—
Petrale sole	863	711	-18%
Rex sole	906	840	-7%
Thornyheads	2,975	2,939	-1%
Widow rockfish	3,065	2,468	-19%
Other rockfish	11,812	11,505	-3%
Lingcod	696	514	-16%
Sablefish	5,167	6,099	18%
Pacific whiting	3,023	2,982	-1%
California halibut	574	549	-4%
Other groundfish	1,991	1,127	-43%
Total	44,304	41,795	-4%

\*Preliminary values as of March 16, 1987.

anese market demand, stimulated U.S. fishing effort. Higher prices for all sablefish size categories resulted.

In contrast to trawl landings, line groundfish catches increased by 76% (1,236 MT), and setnet catches by 25% (1,005 MT) over 1985 landings. These increases resulted from higher effort and not from increases in resource abundance. Rockfish and sablefish were the major species taken by these fixed gear.

Federal and state groundfish regulations for the Washington-Oregon-California (WOC) region affected the California harvest of sablefish and widow rockfish (*Sebastes entomelas*). Coastwide catch ceilings and optimum yield (OY) for sablefish and widow rockfish were 13,600 MT and 10,200 MT, respectively. Vessel-trip and trip-frequency limits were management measures used to provide a year-round fishery within the optimum yields. The 1986 widow rockfish fishery began with a trip limit of 30,000 lbs. By late September, a reduction to 3,000 lbs was necessary to keep the widow rockfish landings below the OY. Sablefish landings were unrestricted except for a 5,000-lb limit north of Point Conception on fish smaller than 22 inches. By late August, 61% of the OY was attained, and the remaining 5,304 MT were allocated 55% to trawlers and 45% to fixed gear. The fixed-gear allocation was caught in October, and the fishery was closed. The trawl allocation was accompanied by an 8,000-lb trip limit. In late October this trip limit was increased to 12,000 lbs to allow attainment of the OY.

## DUNGENESS CRAB

The 1985-86 California commercial Dungeness crab (*Cancer magister*) season yielded 5.92 million

pounds, which exceeded 1984–85 seasonal landings by more than 1 million pounds.

Production for the northern California ports of Crescent City, Trinidad, Eureka, and Fort Bragg was 3.08, 0.63, 1.60, and 0.23 million pounds, respectively.

A total of 353 vessels fished for a December 1 opening price of \$1.25 per pound. The price rose rapidly to \$1.75 per pound as catches diminished after the first three weeks. The season closed on July 15.

Dungeness crab landings for the San Francisco region totaled 384,000 pounds. This is a decrease from the 600,000 pounds landed the previous season and well below the ten-year average of 574,000 pounds.

Half of the season's landings occurred in November 1985, and the price ranged from \$2.00 to \$2.85 per pound.

#### PACIFIC OCEAN SHRIMP

Ocean shrimp (*Pandalus jordani*) landings increased to over 5.8 million pounds in 1986. This represents the third successive annual increase in both Area A (California-Oregon border to False Cape) and Area C (Pigeon Point to the Mexican border).

Shrimp landings from Area A totaled 5.0 million pounds during the April 1 to October 31 season. This was a substantial increase over the 2.9 million pounds caught in 1985, and the third highest poundage ever landed in Area A. Ports in Area A also received an additional 0.91 million pounds that had been caught off Oregon (Pacific Marine Fisheries Commission areas 88 and 86). The ex-vessel price started at \$.45/lb in April; there were five subsequent increases to a high of \$.75/lb at the end of September.

A total of 42 vessels (28 single-rigged and 14 double-rigged) delivered shrimp to Area A ports during the season, an increase of 11 boats over 1985 (12 additional single-rigged vessels and one less double-rigged vessel). Single-rigged boats had an average seasonal catch rate of 288 lb/hr, down from 398 lb/hr during 1985. Double-riggers averaged 465 lb/hr, down from 573 lb/hr in 1985.

One-year-old shrimp again constituted a very high percentage (55.0%–92.1%) of the catch throughout the season. The most notable catch statistic, however, was that the 1986 year class made up 33.6% of the catch in October. This is the highest ever seen in California and indicates potentially good 1987 and 1988 seasons, barring adverse oceanic conditions.

Ocean shrimp landings in Morro Bay and Avila (Area C) in 1986 totaled 839,649 pounds, including approximately 800 pounds taken incidental to prawn trawling. This was a tremendous increase over the 22,889 pounds landed in 1985 and was the most pounds landed since 1983, when 944,695 pounds were unloaded.

Seven single-rigged vessels made 51 trips and caught an average of 306 pounds of ocean shrimp per hour of fishing. Four double-rigged vessels made 28 trips with an average per-hour catch of 548 pounds. However, one single-rigged vessel switched to double nets after the first month, to bring the total number of vessels for the year to ten.

The catch per hour for both types of rigs started very high in April (383 lb/hr for single-rig and 758 lb/hr for double-rig) then declined steadily through June. The scarcity of shrimp in late June caused most of the fishermen to switch to other fisheries, and in July only six landings of ocean shrimp were made. By mid-July all effort had ceased.

The price per pound started at \$.45 and stayed around that level throughout the short season except for some small purchases at \$.65 per pound.

In the April market samples 51% of the shrimp were two years old, either in the transitional or young female stages. In May this group constituted 38% of the shrimp in the samples and only 30% by June. By contrast, the ratio of the 1-year-old males in the market samples increased from 37% in April to 66% in June. These 1-year-old shrimp should compose the bulk of the catch in the early part of the 1987 season. This follows the catch pattern of 1986 and other years for Morro Bay and Avila, where 2-year-old shrimp dominate the fishery early in the season.

#### PELAGIC SHARK AND SWORDFISH

During 1986, 264 permits were issued for harpooning swordfish (*Xiphias gladius*), and 240 drift gill net permits were issued for taking pelagic sharks and swordfish.

Harpoon fishermen, assisted by spotter aircraft, caught 0.5 million pounds of swordfish, equalling last year's landings.

Drift gill netters reported 22,737 swordfish on logbooks during 1986. This approximately equals the number of fish reported for 1985. However, there was a significant difference in the average size of fish landed. During 1986, the average dressed weight of swordfish was only 105 pounds, compared to a 160-pound average for the previous year. Accordingly, total landings for 1986

amounted to only 3.62 million pounds, compared to the 5.25 million pounds in 1985.

Also noteworthy were differences in the areas where swordfish were taken. During the previous two years, large numbers of swordfish were taken along the outer escarpment adjacent to the Southern California Bight. The 1986 season was labeled an "inside year" by gill net fishermen, because most fish were taken around southern California islands.

Common thresher shark (*Alopias vulpinus*) landings fell sharply during 1986: only 0.56 million pounds were taken. This decrease was due in large part to the establishment of a closed season (June 1–August 14) in an attempt to take pressure off what is believed to be a depressed stock.

Of special significance during 1986 was the participation by California-based vessels in an experimental fishery for thresher sharks conducted by the states of Oregon and Washington. Approximately 0.7 million pounds of large thresher sharks were taken. These fish represent the adult segment of the thresher stock, in contrast to the mostly immature fish taken in the California fishery.

#### CALIFORNIA HALIBUT

California halibut (*Paralichthys californicus*) landings for 1986 were 1 million pounds, which was less than the 1.26 million pounds taken in 1985. The ten-year average from 1976 to 1985 was 0.88 million pounds (Table 4). Following a low catch of 0.27 million pounds in 1973, halibut catches have increased steadily, averaging 1.19 million pounds for the last five years. Nearly 70% of the 1986 halibut landings occurred south of Point Conception, compared to 60% during the El Niño period of 1982–84. Traditionally, the spring and summer months have produced the highest halibut catches; this was again the case in 1986.

TABLE 4  
 California Halibut Landings (1,000s of Pounds)

Year	North of Pt. Conception	South of Pt. Conception	Total
1976	74	553	627
1977	56	412	468
1978	77	364	441
1979	120	454	665
1980	199	511	710
1981	360	902	1,262
1982	456	748	1,204
1983	566	547	1,113
1984	338	762	1,100
1985	319	946	1,265
1986*	302	734	1,036

\*Preliminary

Entangling nets (trammel and set gill net) accounted for 80% of all halibut taken. The remainder were taken by trawl net, pot, and hook-and-line gear. Average ex-vessel prices for California halibut ranged from \$1.80 per pound in Monterey to \$3.00 per pound in the San Francisco area.

Beginning August 15, 1986, a new regulation for trammel and set gill nets was implemented to increase minimum mesh size from 8 to 8½ inches in waters that encompass the major halibut fishing grounds. In addition, these nets were limited to 6,000 feet in length, and a moratorium was established on the issuance of new general gill and trammel net permits.

#### CALIFORNIA SPINY LOBSTER

The 1985–86 (first Wednesday in October to first Wednesday after March 15) southern California commercial fishery for California spiny lobster (*Panulirus interruptus*) made a resilient comeback from record low levels in 1984–85. Catch per unit of effort (CPUE) levels documented median seasonal success in 1985–86 when compared to the 13-year data base recorded from daily onboard logbooks.

Because of poor catches the previous season, participation declined 20%, to 354 permittees. The 181-boat fleet was down 10%. However, the logged effort of 451,000 traps hauled was only 4% below the previous season, probably reflecting the improved catch success.

The traps continued retaining sublegal-sized ("short") lobsters in large numbers. The 407,000 shorts represent a catch-per-trap rate of 0.9 animals, a level maintained for the past three years. A total catch of 264,000 legal-sized lobsters was logged. Landing receipts documented a total weight of 421,000 pounds.

Catch success, in terms of pounds-per-hundred-trapping-hours (PPHTH) averaged 1.7, an improvement over the previous season's rate of 1.4. Monthly catch success was highest in October (2.5), declined to 1.1 in December, then recovered steadily to a 2.2 rate by the March closure.

Regionally, the Channel Islands (San Clemente, Santa Catalina, Santa Barbara, San Nicolas, Anacapa, Santa Cruz, Santa Rosa) continued to produce at the same 2.2 PPHTH rate recorded in 1984–85, with 29% of the effort accounting for 38% of the total landings. Fluctuating catch success levels are typical along the mainland coast. During 1984–85 the most depressed success levels (1.0 PPHTH) occurred along the lightly trapped coastline north of Santa Monica Bay. In 1985–86,

northern fishermen enjoyed a 2.3 PPTH success rate to produce 8% of the state's catch with 5% of the effort. Catch success along the mainland coast south of Santa Monica Bay improved modestly (1.4 PPTH compared to 1.1 PPTH in 1984–85), with 65% of the effort producing 54% of the southern California catch.

Despite the indication of a healthy resource with sublegal standing stock at a continued high level, regional catch success is subject to annual variations as high as 55%, probably because of environmental changes that affect catchability. Relatively warm overwintering temperatures in 1983–84 may have enhanced exploitation levels that season, decreasing the harvestable surplus for 1984–85. By 1985–86, recruitment of an additional year class had returned catches to a median level of success.

High variation in catch success has created an unstable financial basis for individual fishermen, and the fishery has long been characterized by transient participation. In the 1985–86 season only about half the fishermen were "veterans" returning from the previous season. Veteran fishermen seeking relief from this persistent turnover, with its inherent problems of territorial disputes, escalating effort, and overcapitalization, successfully sponsored legislation that would allow the establishment of a limited-entry fishery. Section 8259 of the Fish and Game Code authorizes the Fish and Game Commission to place a statewide or geographically selected limit on the number of lobster permits in order to "prevent overutilization or to ensure efficient and economic operation of the fishery."

Although subject to uncertain catch success from environmental change, and reaching out for legislated stability, the lobster fishery has achieved at least a recent economic peak. Commercial landing receipts available from six years since the 1980–81 season record the following achievements in 1985–86: (1) the highest ex-vessel price of \$4.48/lb, 35% above the 1980–81 price and 10% above a year ago; (2) a total fishery value of \$1.9 million, second only to the \$2.1 million value of 1983–84; (3) the highest per capita gross income—\$5,322; and (4) the highest gross income per unit of effort—\$4.18 per trap hauled.

#### ALBACORE

The 1986 California albacore (*Thunnus alalunga*) season was a disappointing one. Effort was low, prices were down, and fish were scattered and farther offshore than usual.

Landings for the season totaled approximately

3,509 tons. This total is half of last year's landings of 7,205 tons and only 32% of the 25-year average of 10,850 tons. Few boats contributed to the fishery this year. Approximately 448 boats participated, but only 244 made landings totaling over one ton. In 1985, 832 vessels landed albacore, and of these 456 made landings of over a ton. These numbers, however, are still low compared to the fishery's peak of over 3,000 vessels in 1950.

The 1986 season began in late June and early July, when boats fishing north of the Hawaiian Islands landed fish in California ports. Albacore made only sporadic appearances in southern California waters for the duration of the season; most commercial boats headed north in late July, and sportfishing boats in the area suffered from canceled charters and low participation throughout much of the season.

Commercial boats fishing 800 to 1,000 miles off Cape Mendocino in July and August did well, with catches of 200 to 600 fish per day, but from late August through September most offshore effort occurred off Oregon and Washington. The only persistent nearshore fishery occurred off Morro Bay, where large, 20-pound fish appeared in August, supporting trolling vessels with catches of generally 100 fish per day. In late September, bait boat activity began to increase in this area, and by October some vessels were reporting catches as high as 900 large fish per day. By the end of October most bait boats had made their final trips for the season. Many nearshore trollers ceased albacore fishing much earlier in the season, and others never switched from salmon gear at all, as a result of an excellent salmon season.

In recent years, 75%–80% of the total sampled catch occurred in nearshore waters (inside 140°W). In 1986 less than 50% of the sampled catch was caught in this region. Although reduced effort partly contributed to this, oceanic condition in southern California was an important factor as well. The cold, turbid waters of the California Current extending south from Point Conception acted like a barrier to albacore, keeping them farther offshore than usual.

Many factors affect participation in the fishery, and one is certainly price. Albacore prices have steadily declined since 1981, when they peaked at \$1,800 per ton. This year the Western Fishboat Owners Association and Pan Pacific, the one cannery on the coast still processing albacore, agreed to a starting price of \$1,100 per ton for fish 9 pounds and over, and \$750 for those under 9 pounds. In 1985 prices began at \$1,300 and \$950 per ton, re-

spectively, but dropped by season's end to only \$1,000 per ton. Prices are low because albacore is highly available on a worldwide scale, and canneries must compete with inexpensive foreign imports and low tariffs.

Fishermen in northern ports received some encouragement when Pan Pacific began absorbing trucking costs in midseason. Instead of the \$200–\$250 per ton trucking fee, fishermen were charged only a \$75 handling fee per ton.

This season, sales made directly off the boat to the public were estimated at 100 tons, or 3.0% of the total landings. Fish sold for as little as \$.65, but generally between \$.80 and \$1.00 per pound. Most direct sales this season occurred in Fort Bragg and Eureka.

### RECREATIONAL FISHERY

The catch record of sport anglers fishing on commercial passenger fishing vessels (CPFVs, or party-boats) roughly reflects the success of oceangoing anglers on private boats. These two groups account for the vast majority of the marine sportfish catch.

This catch record has demonstrated wide fluctuations in relative catch success for many species during the past five years as a result of the 1982–84 El Niño phenomenon. Water temperatures along the coast of California returned to “normal” in 1986.

The 1986 recorded catch of some warm-water fishes shows a decline from the 1985 catch. For example, the yellowtail (*Seriola lalandei*) catch was down 10%, to 41,051 fish; Pacific mackerel (*Scomber japonicus*) down 14%, to 601,664; and bluefin tuna (*Thunnus thynnus*) down 86%, to 676 fish. The recorded catch of other warm-water fishes increased in 1986. California barracuda (*Sphyrna argentea*) increased 13%, to 85,304; Pacific bonito (*Sarda chiliensis*) increased 179%, to 334,693; skipjack tuna (*Euthynnus pelamis*) increased 782%, to 2,098; and yellowfin tuna (*Thunnus albacares*) increased 40%, to 5,474 fish. Especially significant is a 57% increase in the catch of white seabass (*Cynoscion atractoscion*), to 1,629. The catch of this fish actually dropped during the 1982–84 El Niño, although in previous warm-water years the catch usually improved as a result of northward shifts of fish from Mexican waters. Albacore (*Thunnus alalunga*) continued to decrease from near record catches in 1984, to 26,955—down 84% from the 1985 catch.

The temperate-water, resident fishes that were recorded in fewer numbers in 1986 were barred sandbass (*Paralabrax nebulifer*) down 12%, to

264,513 fish; the rockfish complex (*Sebastes* spp.) down 12%, to 1,797,378; the salmon complex (*Oncorhynchus* spp.) down 18%, to 88,614; and ocean whitefish (*Caulolatilus princeps*) down 13%, to 73,410.

The temperate-water resident fish with increased catches are predominately nearshore, kelp bed-related species including kelp bass (*Paralabrax clathratus*) up 58%, to 430,572 fish; halfmoon (*Medialuna californiensis*) up 646%, to 66,720; opaleye (*Girella nigricans*) up 832%, to 589; sargo (*Anisotremus davidsonii*) up 653%, to 881; and spotted scorpionfish (*Scorpaena guttata*) up 7%, to 71,432. The catch of some flatfish also increased: for example, sanddab (*Citharichthys* spp.) was up 118%, to 5,432 fish, and California halibut (*Paralichthys californicus*) was up 11%, to 7,823 fish. Two species associated with rocky reefs in central and northern California also increased: lingcod (*Ophiodon elongatus*) was up 24%, to 25,485 fish, and cabezon (*Scorpaenichthys marmoratus*) was up 148%, to 4,373 fish.

The 1986 total catch decreased 2%, to 4,046,659 fish, and the number of anglers declined 8%, to 653,668; in general, this means a slightly better catch per angler.

Several species had size limits or seasons imposed on sport anglers in the early 1980s. Such regulations generally reduce the catch immediately, because the undersized fish that are caught must be released, but the goal is to provide increased catches during the following years. In light of this, the following species show promising trends. California barracuda show a general increase since 1981; California halibut are increasing to levels recorded before El Niño; and lingcod are increasing from a slump coincident with El Niño. Although the white seabass increased slightly, the resource is still at a low level. The worst news is that the rockfish catch has not been this low (1.7 million) since 1966, when the fishery was in a development phase that peaked in 1974 with a catch of more than 4 million fish.

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