

REVIEW OF SOME CALIFORNIA FISHERIES FOR 1987

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Total landings of fishes, crustaceans, and mollusks increased (4%) for the second year in a row, following a decline from 1981 to 1985.

Pelagic wetfish landings continued to increase (Table 1). Market squid landings were relatively high for the second year in a row; landings of Pacific and jack mackerel increased slightly; and sardines continued their recovery.

Landings of ridgeback and spot prawns both declined, although catch per unit of effort in the spot prawn fishery has improved since 1984.

A slight decrease was noted in groundfish landings, and although the halibut catch decreased for the third year, the annual total was still above the 10-year average.

Albacore landings were very poor for the second year in a row, and in fact hit a 50-year low.

Lobster landings were the third highest of the last 20 years. The sport catch was similar to the catch of the last 3 years.

PACIFIC SARDINE

The Department of Fish and Game, in a coop-

erative effort with the National Marine Fisheries Service, conducted sea surveys in August 1986 to determine the spawning biomass of Pacific sardines (*Sardinops sagax*). These surveys consisted of (1) evaluating the spawning biomass relative to 20,000 tons, based on the spawning area (egg production area method), and (2) estimating sardine reproductive parameters for use in an egg production method (EPM) to estimate spawning biomass. This was the first attempt at an EPM biomass estimate for sardines; methods used were adapted from a model developed for northern anchovy. Results of the egg production area survey indicated that the spawning biomass of sardines remained above 20,000 short tons in 1986, based on an observed spawning area of 970 nautical miles² (n.mi.²). This provided for the opening of a commercial fishery of 1,000 tons on January 1, 1987. This was only the second year of directed fishing allowed since the moratorium on fishing sardines was enacted in 1974.

The first EPM application for sardines was completed in March 1987. Estimated reproductive pa-

TABLE 1
 Landings of Pelagic Wetfishes in California (Short Tons)

Year	Pacific sardine	Northern anchovy	Pacific mackerel	Jack mackerel	Pacific herring	Market squid	Total
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	1,283	2,105	45,503	12,188	8,405	23,454	92,938
1987*	2,309	1,595	45,890	13,055	9,258	21,578	93,685

*Preliminary

rameters, which included daily egg production rate, average female weight, batch fecundity, spawning fraction, and sex ratio, differed markedly from north to south. The resulting biomass estimate within the survey area was 8,400 tons. The new parameter estimates, when used in the egg production area technique, suggested that the spawning biomass might still have been lower than 20,000 tons. In addition, it appears that the area of egg occurrence indicative of a 20,000-ton spawning biomass is much larger than previously estimated.

The directed catch of sardines was used primarily as dead bait for the central California striped bass sport fishery. All landings were made to southern California commercial markets. Total landings of sardines averaged 325 tons per month through April 1987. The directed fishery was closed on April 17, when the 1,000-ton quota was reached. In contrast, the fishery extended until July 11 in 1986. Incidental landings of sardines in the mackerel fishery accounted for 68% of the 1,000-ton directed quota in 1987. The incidental tolerance limit for sardines mixed with other species was increased from 15% to 25% by weight following the closure of the directed fishery. State law provides for a 10% increase in the tolerance limit if the overall incidental catch of sardines in a fishery for any month averages one-third of the current tolerance limit. Sardines constituted 5% of total landings of mackerel in March 1987, providing for the increased tolerance.

Sardines were an important component of the live bait fishery for the first half of 1987, primarily because of the unavailability of schools of northern anchovy. In May, sardines constituted 60%–70% of the bait catch from Dana Point to San Pedro. In an effort to alleviate the effects of poor availability of anchovy, the allowable catch of sardines for live bait purposes was increased from 150 tons to 350 tons in September 1987. The live bait catch for 1987 totaled 250 tons, according to fishermen's voluntary logs, but information from Department observers on partyboats suggested that live bait catches exceeded 850 tons.

A second set of egg production cruises was conducted in July and August 1987. An attempt was made to survey farther offshore than in the previous year for evidence of sardine spawning. The spawning area detected from occurrence of eggs was 1,850 n.mi.², including a 50% increase in spawning within the region surveyed in 1986. The detected spawning area was only about 75% of the critical area estimated for a 20,000-ton spawning biomass, according to 1986 EPM results. However,

because the 1986 survey was the first EPM application for sardines and consisted of small sample numbers from a restricted geographic area, the spawning area estimate was considered conservative, and a commercial fishery of 1,000 tons was opened on January 1, 1988.

Total reported landings of sardines in 1987 are estimated at 2,560 tons and include 425 directed tons in the open fishery, 1,885 tons incidental to mackerel, and 250 tons for live bait. Incidental landings constituted 3% of total mackerel landings for the year. Comparative figures for 1986 include 445 tons of directed take, 840 tons incidental to mackerel (1% of mackerel total), and 20 tons for live bait.

NORTHERN ANCHOVY

Landings of northern anchovy (*Engraulis mordax*) for reduction purposes in 1987 were limited by poor market conditions for fish meal and by poor availability of fish schools. Anchovy were rarely found in any abundance close to shore, and fishermen would not travel far offshore for the \$30 per ton being offered for anchovy. Two boatloads totaling 42 tons were landed for reduction purposes in April 1987. These landings were made in the northern permit area against the 1986–87 season quota of 10,000 short tons for the northern region. The fish were used in an experimental production of trout pellet food for hatcheries. The product was well received, and the Richmond-based processor was hopeful that large-scale production would begin in the 1987–88 reduction season. No landings were made in the southern permit region during the 1986–87 reduction season, although a new processor issued reduction orders. Southern California purse seiners concentrated instead on more lucrative mackerel and squid. The 1986–87 reduction season closed on June 30 with 42 tons landed.

National Marine Fisheries Service biologists estimated the 1987 spawning biomass of northern anchovy to be at least 1,335,988 tons (1,212,000 MT), based on a stock synthesis model. The U.S. harvest quota for reduction was set at 154,322 tons, with allocations of 10,000 tons for the northern permit region, and 144,322 tons for the southern. The fishery opened on August 1 in the north and on September 15 in the south. Landings totaling 122 tons were made during September and October in the northern permit area, and were delivered to the Salinas reduction facility. The Richmond processor did not issue orders for anchovy for trout food production. No landings were made in the south-

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

Season	Southern area	Northern area	Total
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	75,679
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	1,595	1,595
1986-87*	0	42	42

*Preliminary

ern region through December 1987. The price for fish meal almost doubled during the first half of the 1987-88 season because of poor import markets. However, this increase did not result in a higher price for anchovies.

Total landings of anchovy during 1987 (Table 2) included 164 tons for reduction, 1,431 tons for non-reduction purposes, and 4,920 tons for live bait. The live bait fishery was heavily impacted for the first half of the year by the offshore schooling patterns of anchovy. Most bait haulers could not effectively fish anchovy with their shallow-water lampara nets.

JACK MACKEREL

Approximately 13,055 tons of jack mackerel (*Trachurus symmetricus*) were landed during 1987. This is the third consecutive year that jack mackerel constituted 21% of total mackerel landings. Since 1979, jack mackerel have contributed less than Pacific mackerel to the California mackerel fishery. Over the last four years, the jack mackerel proportion of total annual mackerel landings has been the lowest since the fishery began in the late 1940s.

Jack mackerel dominated statewide landings in only one month during 1987, and then only by a small margin. This is probably due to unrestricted Pacific mackerel landings. In northern California, jack mackerel never dominated the mackerel landings, but did occur in fairly equal proportions to

Pacific mackerel about half the time. The rest of the year they contributed only a very small proportion to the mackerel fishery. The monthly composition of jack mackerel in the total 1987 mackerel catch ranged from 1% to 50% of the landings, and 97% of all 1987 jack mackerel landings occurred in southern California. Calculated throughout the year, jack mackerel made up 29% of the total mackerel landings in northern California, and 21% in southern California.

Sea surveys conducted during 1987 suggest that the jack mackerel 1987 year class may be weak. The 1986 year class appears fairly strong.

PACIFIC MACKEREL

The year began with 26,973 tons of Pacific mackerel (*Scomber japonicus*) already landed through the first half of the 1986-87 season. Current law allows an open fishery when the biomass exceeds 150,000 tons. Since the biomass was estimated at the beginning of the season to range between 375,000 and one million tons, no quota restrictions were established.

A substantial change in the mackerel fishing industry occurred when Starkist, the major southern California processor, closed its canning facility on Terminal Island in April. The plant was sold to the San Pedro-based Fisherman's Cooperative Association, a group of about 30 boat owners, which reopened the facility in early June under the name United Food Processors (UFP). Landings at UFP have been high and relatively steady, and management is making improvements to take advantage of a promising international market for mackerel. Starkist moved to a secondary plant, where mackerel landings have been low. Processors continued to impose landing limits (40-50 tons per boat per day, on average) most of the year. The ex-vessel price for mackerel was steady at \$155 per ton.

During the first three months of 1987, Pacific mackerel landings were high, because fish were available on traditional fishing grounds and Starkist accumulated a large inventory before moving. Landings dropped during the second quarter of the year, primarily as a result of the changes in plant ownership and lulls in operation. The 1986-87 season closed on June 30, 1987, with a total catch of 48,830 tons. This is the highest seasonal total since the fishery reopened in 1977. Pacific mackerel contributed 84% to statewide landings of mackerel, and 96% of all Pacific mackerel landings were made in southern California.

The 1987-88 season opened on July 1, 1987, with no quota restrictions, based on a biomass esti-

mated to be about 290,000 tons. This estimate is considerably lower than the range of estimates calculated the previous year, and is the result of a stricter set of assumptions regarding the use of cohort analysis.

Landings during July, August, and September were the highest since 1981, as processing reached full levels and landing limits were often lifted. Fish were available at southern California islands, along the coast, and at the offshore banks. Landings during October, November, and December were limited by rough weather, by poor availability of fish, and because fishermen directed their efforts towards bonito, squid, and herring. By the end of the year, 24,032 tons of Pacific mackerel had been landed toward the 1987-88 season total. Landings of Pacific mackerel for the year totaled 45,890 tons. This is the second highest annual catch since 1977 and exceeds the average annual landings for the previous five years. Northern California landings contributed only 2% to the year's total. The proportion of the Pacific mackerel catch occurring in Monterey has declined steadily since 1984, when it was 18%.

The 1985 and 1986 year classes, both strong, together accounted for 71% of the fish landed during the year. The 1987 year class also appears to be strong, since it occurred in both the third and fourth quarters of 1987 as yearlings. The consistently high annual catches of Pacific mackerel during the last decade have been the result of several strong year classes, which have sustained the fishery in spite of weak recruitment in a number of years, particularly the successive years of the 1982-84 El Niño.

MARKET SQUID

The current California squid (*Loligo opalescens*) fishery is best described as two separate fisheries: the northern California (or Monterey) fishery, and the southern California fishery. In Monterey, the fishery normally follows a summer-fall season. The southern fishery typically has a fall-winter season. Most squid is frozen for human consumption or bait, or used as live bait.

There are three main gear types used to fish squid in California. In Monterey, nearly all squid are caught with lampara gear. In southern California, brail, or night-light, boats are used. This is a fairly simple method, using bright lights to attract the squid and then brailing, or dipnetting, them into the vessel. The local purse seine fleet, which typically catches mackerel, sardine, and bonito, or tuna when it is available, also participates in the

southern California squid fishery. A purse seine can be used in deeper water than a lampara net, since it has heavy rings at the bottom so the net can be pursed closed. Squid caught in this manner are generally of poorer quality than squid taken by the more gentle night-lighting technique, and therefore often bring a lower price. It is not uncommon for a night-light boat and purse seiner to work together, with the night-light boat attracting the squid to the surface and the seiner wrapping around them.

Biologists in northern California have been concerned with the amount of damage to the spawning grounds caused by the lampara net's lead chain. Sometimes large quantities of squid eggs are torn from the bottom and brought up in the net. When squid are in high supply, one or two sets are adequate, and damage to the spawning grounds is limited. However, when squid are in poor supply a dozen sets may be needed; most of the spawning squid are then caught, and the gear denudes the grounds of eggs. Experimental gear permits were issued this season to two boats in Monterey with a modified purse seine. It is called a half-ring net, and has a regular rope with a lead core to help weight it. A Department observation program has been established to evaluate the effectiveness of this new gear relative to egg-case mortality and habitat destruction.

Over the last 25 years, southern California landings have been less than half of the total squid landings. But in the last 2 years this has changed, and southern California landings have been more than double the northern California squid landings. In 1985, squid landings in southern California resumed a normal pattern and increased greatly over the previous 2 years' poor landings, which were associated with El Niño. Landings approximated 7,000 tons in 1985 and reached nearly 16,500 tons in 1986 in southern California. This was the highest annual landing ever to occur in southern California, and more than double the 10-year average. Southern California squid landings for 1987 are estimated to approximate 15,000 tons, at a price that remained stable throughout the season at \$200 per ton.

During the 1985 Monterey fishery, squid were scarce. Although 4,300 tons were landed, a recovery from the poor landings associated with El Niño years, this was 35% below the last 10-year average for Monterey. In 1986, the northern California fishery caught most of their 7,000 tons of squid north of Monterey Bay in the Año Nuevo-Pigeon Point area, instead of Monterey Bay. This was the

first time in the history of the fishery that large numbers of squid were caught in this area, although it had been known that squid spawn there. During most of the 1987 season in Monterey, the price remained a relatively low \$200 per ton, compared to as high as \$400 per ton in the previous two seasons, and the squid were small, of poor quality, and primarily frozen for bait. However, near the end of the season during the first week of September, large, high-quality squid were brought in, and the price rose to \$240 per ton. These squid were used for human consumption, and brought the season total to about 6,500 tons. Landings for 1986 and 1987 are considered mediocre.

Historically, market squid have been regarded as an underutilized resource off California. There seem to be no major concerns about the status of the squid resource in southern California, where landings have increased to above their pre-El Niño levels. However, in Monterey, squid fishing has not fully recovered. It is thought that perhaps, after the initial decline from El Niño, the fishery has failed to come back to previous levels of the late 1970s and early 1980s because of the fishing gear's destructive action on egg cases and spawning habitat.

PACIFIC HERRING

The 1986–87 fishing season (December–March) was successful in all areas except Crescent City Harbor, where herring (*Clupea harengus pallasii*) did not spawn as expected. The statewide herring catch for the 1986–87 season totaled 9,036 tons. There was a quota overrun of 446 tons, primarily because of short periods of intense fishing in San Francisco Bay. The 1987 annual catch of 9,258 tons is the highest since 1982 (Table 1).

Ex-vessel value of the 1986–87 herring catch was about \$8 million, down from \$11 million last season. Japanese herring buyers offered \$600 to \$800 per ton for 10% roe recovery this season, a 30% decrease in price from the 1985–86 season.

Population estimates from spawn deposition surveys indicate that the San Francisco Bay biomass increased 8,000 tons, to 57,000 tons. Tomales Bay experienced a nearly normal season, with biomass estimated at 5,800 tons. This represents a dramatic recovery from 1985–86, when the biomass estimated from spawn surveys was only 1,200 tons. Similar biomass estimates were made in 1984 and 1985. Repeated fluctuations of this magnitude indicate a change in the distribution of Tomales Bay herring.

Four strong year classes—1982 to 1985—are re-

sponsible for the increased abundance of San Francisco Bay herring. The apparent change in the distribution of Tomales Bay herring, however, is cause for concern and could potentially affect the future of that fishery.

Based on biomass estimates in the 1986–87 season, catch quotas were adjusted for the 1987–88 season. The San Francisco Bay quota was increased 1,000 tons, to 8,500 tons; Tomales Bay was reduced 250 tons, to 750 tons. The overall 1987–88 season quota was increased to 9,340 tons.

Initial herring catches in the 1987–88 season were very good in San Francisco Bay, where fishing usually begins in December. However, fishing in Tomales Bay typically does not begin until January. Herring buyers were offering \$1,200 per ton for 10% roe recovery at the beginning of the season.

GROUND FISH

Commercial landings of groundfish by California fishermen totaled 41,363 metric tons (MT), which were valued at \$32,944,000 ex-vessel. Trawlers landed 34,042 MT (82%), and other gear vessels landed the remaining 732 MT (18%) of the 1987 total.

Rockfish, a multispecies group; Dover sole (*Microstomus pacificus*); Pacific whiting (*Merluccius pacificus*); and sablefish (*Anoplopoma fimbria*) were again the leading species in landings. Changes in landings of these species from 1986 to 1987 were less than 10%, except for the increase of 52% for Pacific whiting. Overall, 1987 landings declined 1%, or 432 MT, from those of 1986 (Table 3).

State and federal coastwide quotas for widow rockfish (*Sebastes entomelas*) and sablefish were

TABLE 3
 California Groundfish Landings (Metric Tons)

Species	1986	1987*	Percent change
Dover sole	10,987	10,758	- 2%
English sole	1,074	1,318	23%
Petrale sole	711	818	15%
Rex sole	840	824	- 2%
Thornyheads	2,939	2,954	1%
Widow rockfish	2,468	2,245	- 9%
Other rockfish	11,505	10,931	- 5%
Lingcod	514	813	58%
Sablefish	6,099	4,339	- 29%
Pacific whiting	2,982	4,518	52%
California halibut	549	534	- 3%
Other groundfish	1,127	1,310	16%
Total	41,795	41,363	- 1%

*Preliminary

12,500 MT and 12,000 MT, respectively. Management measures for trip frequency, trip limits, and gear allocation failed to prolong these fisheries throughout the year. The widow rockfish fishery was closed on November 25, 1987; the sablefish fixed-gear fishery was closed on October 22, 1987; and the sablefish trawl fishery was closed on November 4, 1987, when respective gear quotas of 5,800 MT and 6,200 MT were reached.

DUNGENESS CRAB

California Dungeness crab (*Cancer magister*) landings during the 1986–87 season totalled 8.4 million pounds, an increase of 2.5 million pounds from the 1985–86 seasonal landings.

In the north coast region, the ports of Crescent City, Trinidad, Eureka, and Fort Bragg received 4.16, 0.79, 1.64, and 0.20 million pounds, respectively. Fishing began on December 1, after a price agreement of \$1.25 per pound. The bulk of production (87%) occurred in December, and the price peaked at \$1.75 per pound in January as supply greatly diminished. The season closed off the north coast on July 15.

Commercial fishermen in the San Francisco region caught 1.6 million pounds of Dungeness crab during the 1986–87 season. This is more than four times the 0.38 million pounds landed the previous season and is the largest season total in the past 26 years. Landings for Bodega Bay, San Francisco, and Half Moon Bay were 0.48, 0.57, and 0.56 million pounds, respectively. Landings for November 1986, the first month of the season in the San Francisco region, were 0.72 million pounds—45% of the seasonal total. Landing totals decreased monthly, with only 0.03 million pounds being landed in June 1987, the last month of the season for this region.

Fishermen were paid \$2.10 per pound from the start of the season in the San Francisco region until the north coast season opened in December at \$1.25. As a result, the San Francisco price dropped to \$1.35 per pound but soon began climbing. The ex-vessel crab price was \$1.80 by early January and \$2.00 by February. By the end of the season fishermen were receiving \$2.30 per pound.

PACIFIC OCEAN SHRIMP

Statewide landings of Pacific Ocean shrimp (*Pandalus jordani*) in 1987 totaled 7.8 million pounds, which is an increase from the 6.7 million pounds landed in 1986, and is the third highest total ever. Areas of production were Area A (Oregon

border to False Cape), Area B-1 (False Cape to Point Arena), and Area C (Pigeon Point to the Mexican border). The ex-vessel price started at \$0.65 per pound coastwide on April 1, increased to \$0.85 per pound two months later, then decreased to \$0.70 per pound in August, where it remained until October 31, the end of the season.

Area A started off with a record month, when 2.8 million pounds were landed in April, the best start of a season ever. However, catches did not hold up, and the total of 5.6 million pounds, the third largest total ever for Area A, was only a 14% increase over the 4.9 million pounds caught in 1986. An additional 0.87 million pounds, which had been caught off Oregon, were landed in Crescent City. A total of 60 vessels (43 single-rigged and 17 double-rigged) delivered shrimp to Area A ports during the season (April 1 through October 31). This represents the greatest number of vessels since 1981.

One-year-old shrimp constituted a high percentage (81%–87%) of the catch throughout the season. The incoming year class (0's) constituted 21.1% of the samples in October. This was surpassed only by October 1986, when 24.8% of the unweighted samples were made up of 0's. With such strong recruitment, 1988 should be a good season.

Area B-1 produced 743,000 pounds this season, up from 9,799 pounds during 1986. The last year that Area B-1 yielded any significant landings was in 1978, when over 2 million pounds were produced. Three local single-rigged boats, along with one single-rigged and five double-rigged vessels from Crescent City, fished Area B-1 this year.

A total of 664,828 pounds of Pacific Ocean shrimp was landed during the 1987 season in Morro Bay and Port San Luis (Area C), a decrease from 1986, when over 800,000 pounds were landed. Thirteen vessels landed more than 419,000 pounds in April, but fishermen began to drop out in favor of other fisheries or areas in May, and landings dropped to less than one-quarter of April's. The decline continued as boats left the fishery because of decreased catches and an increase in net fouling by salps. Landings were virtually nonexistent in this area from late July to the end of the season in October.

Catch per unit of effort (CPUE) in Area C was only slightly lower this year for single-rigged vessels compared to last year (291 lb/hr versus 306 lb/hr), but double-rigged vessel CPUE declined substantially from 548 lb/hr in 1986 to 316 lb/hr in 1987. For the second year the Morro Bay-

Avila fleet contained more single-rigged (9) than double-rigged (3) vessels. One additional vessel tried both types of rigging.

In the April market samples, 69% of the shrimp were two years old, and that year class continued to dominate the samples through May (56%), June (69%), and July (69%). In contrast, the one-year-old shrimp peaked in percent composition in May (35%) and declined through July (23%). This relative lack of one-year-olds in the fishery may indicate a poor year for 1988.

PELAGIC SHARK AND SWORDFISH

During 1987, 228 permits were issued for harpooning swordfish (*Xiphias gladius*), and 241 drift gill net permits were issued for taking pelagic sharks and swordfish.

Harpoon fishermen reported landing 1,681 swordfish, a significant decline from their 1986 landings of 2,581 fish.

Drift gill netters reported only 10,858 swordfish taken during 1987. This was less than half the number reported for each of the previous two seasons. Although the average size of fish landed during 1987 was quite good (about 160 pounds) only 2.68 million pounds were landed overall. This represents a significant decline from the previous two seasons, when 5.25 million pounds were taken in 1985, and 3.62 million in 1986. No clear reason for this decline in landings by both gears is evident. It should be noted, however, that historically the harpoon-only fishery was subject to similar fluctuations.

Common thresher shark (*Alopias vulpinus*) landings off California remained low during 1987, with only 0.43 million pounds being reported by fish wholesalers.

A quota of 0.82 million pounds was established for the Oregon-Washington experimental shark fishery for 1987. Only 0.24 million pounds of this quota were actually landed.

The bonito shark (*Isurus oxyrinchus*) has surpassed the common thresher shark as the second most important shark species to California fishermen, with the Pacific angel shark (*Squatina californica*) registering the highest landings. During 1987, 0.6 million pounds of bonito shark were landed by drift gill net vessels and by a growing hook-and-line fishery.

Markets are just beginning to open for the blue shark (*Prionace glauca*). In future years, the importance of this species to the commercial industry is likely to overshadow all other shark species off the California coast, if the industry can solve the

marketing problems associated with the poor quality of blue shark flesh as it is currently handled.

CALIFORNIA HALIBUT

California halibut (*Paralichthys californicus*) landings for 1987 were 537 MT, which is 3% less than the 552 MT taken in 1986. The 10-year average from 1977 to 1986 was 423.3 MT (Table 4). Following a low catch of 122 MT in 1973, catches have steadily increased, averaging 534 MT for the last five years. In 1987, 64% of the halibut landings occurred south of Point Conception, compared to 49% in 1983 during the El Niño period. Traditionally, spring and summer months have produced the highest halibut catches; this was again the case in 1987, with the high occurring in March (78 MT) and the low in September (20 MT).

Entangling nets (trammel and set gill nets) accounted for 63% of all halibut taken. Average ex-vessel prices for California halibut ranged from \$1.44 to \$3.51 per pound.

Beginning in September, two new regulations were implemented. Senate Bill 40 (effective September 28, 1987) set restrictions on areas and seasons where gill and trammel nets may be used off central and northern California. Assembly Bill 1094 (effective September 29, 1987) prohibits the use of gill and trammel nets within a specified distance of shore around several points between San Diego and Santa Barbara.

CALIFORNIA SPINY LOBSTER

California spiny lobster (*Panulirus interruptus*) landings during the 1986-87 season (first Wednesday in October through the first Wednesday after March 15) were about 494,000 pounds, a 17% increase from the 1985-86 season. This is the third highest level of landings in the last 20 years, behind 1978-79 (566,800) and 1983-84 (520,850).

TABLE 4
 California Halibut Landings (Metric Tons)

Year	North of Pt. Conception	South of Pt. Conception	Total
1977	25	186	211
1978	34	165	199
1979	54	205	259
1980	90	231	321
1981	163	409	572
1982	206	339	545
1983	256	248	504
1984	153	345	498
1985	144	429	573
1986	240	312	552
1987*	191	346	537

*Preliminary values as of March 21, 1988

The lobster permit fee was increased from \$100 to \$200, and there was a 6% increase in permits issued. The 376 permittees made an estimated minimum 500,000 trap hauls, an 11% increase over the 1985–86 season.

Catch per unit effort of legal-sized lobsters was estimated at 0.99 pounds per trap haul. Sublegal-sized lobsters, retained by the traps and released at the surface, continued to be captured at a rate of 0.9 animals per trap haul.

Forty-four percent of the catch was made in October, 19.5% in November, 17.4% in December, and 19.1% in January, February, and March combined.

The San Diego region accounted for about 40% of the catch; the Los Angeles and Santa Barbara regions trailed with about 35% and 25%, respectively.

Ex-vessel price averaged \$4.55 per pound, only a 1.5% increase above 1985–86 prices. The estimated 494,000 pounds landed give the fishery a value of \$2.27 million to the fishermen.

ALBACORE

In 1987, albacore (*Thunnus alalunga*) landings in California hit a 50-year low. Only 1,545 tons of albacore were brought in, approximately 15% of the previous 25-year average. Effort was low, and although 331 vessels participated in the fishery, only 180 boats landed more than a ton of fish during the season.

The season began late in July with a few landings from the Midway Islands and occasional catches from central and northern California. In August the best catches were 900 to 1,600 miles off northern California, although fishing improved during the month around central California seamounts. A commercial fishery in southern California failed to materialize, in spite of some good sportfishing outside the San Juan Seamount. By September, most offshore vessels were working off Oregon and Washington, and fishing in California occurred primarily between Morro Bay and San Francisco. Activity toward the end of the month was hampered by poor weather. October effort was primarily by drift gill net vessels off Morro Bay; they landed up to a ton per trip of very large fish.

Demand for albacore was higher this year than in 1986, when a worldwide market glut caused cannery prices to drop to \$1,100 per ton for fish over nine pounds. Price agreements in 1987 between the Western Fishboat Owners Association and Pan Pacific, the only albacore cannery on the coast, began at \$1,400 per ton for fish over nine pounds, and

\$950 for those nine pounds and under; by the end of the season, prices had increased to \$1,450 and \$975, respectively. No trucking fee was charged for fish unloaded at northern ports, but Pan Pacific (located in southern California) began offering \$1,500 per ton for quality fish delivered to the cannery. Other buyers in northern ports offered this price or higher for high-quality albacore. Because of high prices from buyers, few fishermen sold directly off their vessels to the public this year.

Low landings in California are attributable to a general lack of effort, as well as poor fish availability. Very few vessels attempted to fish in southern California waters, with most traveling north to more productive waters off Oregon and Washington. A large body of cold water in the mid Pacific, which showed surface temperatures up to 7° colder than normal, may have contributed to poor fish availability in southern California. Because of high prices and no trucking fees, vessels unloaded in northern ports rather than bringing fish directly to the Pan Pacific cannery. Many vessels were lured away by another excellent salmon season, both in terms of price and availability. A number of larger vessels traveled to fish albacore in the South Pacific this winter.

RIDGEBACK PRAWN AND SPOT PRAWN

Ridgeback prawn (*Sicyonia ingentis*) landings for 1987 totaled 233,000 pounds, which was a 66% decline from the 1986 total of 672,000 pounds (Table 5). The majority (77%) of landings occurred in the Santa Barbara-Ventura area, the rest at San Pedro.

Trawl gear is the primary method of capture, and CPUE is measured in pounds per hour. During 1987, there were 15 trawlers engaged in the fishery, and CPUE declined to 82 pounds per hour from a high of 240 pounds per hour in 1985. This dramatic drop probably resulted from several factors: poor recruitment of succeeding year classes of prawns; an increase in predators such as hake, sole, and

TABLE 5
 Ridgeback Prawn and Spot Prawn Landings (1,000s of Pounds)

Year	Ridgeback prawn	Spot prawn
1979	356	48
1980	276	69
1981	193	369
1982	141	300
1983	157	109
1984	623	49
1985	905	64
1986	672	102
1987	233	88

rockfish; and an increase in fishing mortality. Declining catches in the Santa Barbara Channel precipitated interest in other areas, such as Santa Monica Bay. Additional management measures are being considered to stabilize and improve the fishery.

During 1987, 88,000 pounds of spot prawns (*Pandalus platyceros*) were landed, as compared to 102,000 pounds in 1986. During the last nine years, this fishery was characterized by record landings in 1981 and a dramatic decline in following years (Table 5). CPUE also declined from 52 pounds per hour in 1980 to 20 pounds per hour in 1984. These dramatic declines in landings, coupled with decreasing CPUE and the results of biological studies, initiated Departmental recommendations for new regulations. A seasonal closure for the trawl fishery was adopted and implemented in 1984. Gradually, the landings began to increase as a result of successful recruitment of new year classes of prawns and increased effort to develop a trap fishery and new fishery grounds accessible to trap gear.

By 1986, trap gear accounted for 58% of spot prawns taken in southern California; the other 42% was taken by trawl gear. CPUE for trawl gear increased dramatically, rising from 20 pounds per hour in 1984 to 82 pounds per hour in 1987. It appears that the spot prawn resource has recovered from the effects of overfishing and of El Niño, thanks to spawning success, management measures, and improved environmental conditions.

RECREATIONAL FISHERY

Carrying passengers to fish for a fee in California probably began around the turn of the century. The earliest boats carried few passengers, were very expensive, and were available only to the affluent. As time went on, the vessels became larger, more affordable, and available to the general public. Through the 1920s and 1930s the fleet grew to around 200 boats. World War II brought a virtual halt to commercial passenger fishing vessel (CPFV or partyboat) operations. After the war there was a rapid expansion and modernization of the fleet, introducing more powerful engines and better accommodations. Vessels registered as partyboats peaked in the 1951–53 period at over 1,000 boats. Today there are 450 vessels registered. Boats range in size from 20 feet to luxurious vessels of over 100 feet. The smaller vessels carry six or fewer passengers, require no formal U.S. Coast Guard inspection, and have less rigorous regulations.

CPFVs are located throughout California. San Diego is generally considered the saltwater sport-fishing capital of the western United States, with five major landings: three at Point Loma and two in Mission Bay. Between San Diego and Crescent City, there are no fewer than 35 locations where partyboats operate.

In 1935 the California legislature passed a law requiring partyboats to report their fishing activities to the Department of Fish and Game on log-books. The California Administrative Code spells out specific items to be reported, such as number of hours fished and number of fishermen. This has provided a fairly good long-term record of the fishery.

The CPFV fishery underwent a period of rapid growth from the post-World War II period to the late 1970s, when the statewide catch peaked at over 6 million fish in 1979. In 1987 the statewide total catch was just over 4.1 million fish (Table 6). This is about the same catch level as for the past three years. The overall decline from 6 to 4 million fish is mainly attributable to a decline in rockfish.

Rockfish catches have declined more than 50% since the mid 1970s. The 1974 catch of rockfish alone was just over 4 million fish. In 1987 the rockfish catch totaled only 1.7 million fish (Table 6), and was still a major contributor to the total statewide catch.

The kelp/sand bass complex, which has historically been a major contributor to the CPFV catches, peaked at over a million fish in the 1960s. In more recent years, the catches have ranged between 400,000 and 700,000 fish. In 1987, 734,000 kelp bass (*Paralabrax clathratus*) and sand bass (*Paralabrax nebulifer*) were taken by partyboats. It was an exceptional year for sand bass (409,000 fish) and an increase of 54% over 1986. The kelp bass catch declined 23% (to 325,000 fish), reversing the historical relationship in numbers.

TABLE 6
 1987 Commercial Passenger Fishing Vessel Catch

Species/ species group	Number of fish (thousands)	Rank
Rockfish	1,700	1
Kelp/sand bass	734	2
Bonito	518	3
Pacific mackerel	517	4
Barracuda	158	5
Salmon	125	6
Yellowtail	59	8
Albacore	7	18
Others	258	
Total	4,103	

Salmon (*Oncorhynchus* species) is the most highly prized and intensely regulated species group. It came under the jurisdiction of the Pacific Fishery Management Council by the Magnuson Act of 1976. Regulations are very strict and well enforced. The two high years of CPFV salmon catches were in 1955 (129,000 fish) and 1972 (172,000 fish). Catches in more recent years have ranged between 55,000 and 110,000 fish. In 1987 salmon landings from CPFVs were 125,000 fish; this was only the sixth time in the past 40 years that the 120,000-fish mark was exceeded.

Barracuda (*Sphyraena argentea*) is a latitudinally migratory species, and partyboat catches are subject to wide fluctuations. For the past 15 years catches have remained in the 50,000—90,000-fish range; however, in 1987 158,000 fish were caught.

Yellowtail (*Seriola lalandei*) is another migratory species also subject to great variability in catches, which generally increase during periods of warmer ocean temperatures. In the 1959 warm-water year, a record 457,000 yellowtail were landed. More recently, 178,000 fish were landed in 1983. In 1987 the partyboats caught 59,000 fish.

Albacore (*Thunnus alalunga*) is a highly migratory transoceanic species prized by southern California sportfishermen and noted for its vagaries. During the 1959 warm-water period only 39 fish

were logged by CPFVs. In 1987, 7,000 albacore were caught; this is the poorest year since the 1959 disaster.

The six aforementioned species and species groups—rockfish, kelp/sand bass, salmon, barracuda, yellowtail, and albacore—are sought by CPFV sport fishermen and make up large proportions of their catches. In 1987 they constituted 68% of the catch, and with bonito (*Sarda chiliensis*) and Pacific mackerel (*Scomber japonicus*) made up 93% of the total CPFV catch.

Contributors:

Dennis Bedford, pelagic shark, swordfish
Patrick Collier, Pacific Ocean shrimp (north)
Terri Dickerson, jack mackerel, market squid
John Duffy, California spiny lobster
Tom Jow, groundfish
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Sandra Owen, Pacific Ocean shrimp (south)
Christine Pattison, California halibut
Cheryl Scannell, Pacific sardine, northern anchovy
Jerome Spratt, Pacific herring
John Sunada, ridgeback and spot prawns
Ronald Warner, Dungeness crab
Patricia Wolf, Pacific mackerel
Karen Worcester, albacore
Compiled by Patricia Wolf