

REVIEW OF SOME CALIFORNIA FISHERIES FOR 1991

CALIFORNIA DEPARTMENT OF FISH AND GAME

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Total landings of fishes, crustaceans, echinoderms, and mollusks decreased 8% from 1990. This is the third consecutive year that California has experienced a decline in total landings. The 1991 landings exceeded the 1985 low by only 2%, and are 27% below the last ten-year average.

Pelagic wetfish landings increased 4% from last year, marking a return from last year's decline to the upward trend that began in 1985. Squid and sardine landings increased, but Pacific and jack mackerel landings declined (table 1).

Groundfish landings decreased slightly. Landings of Dover sole and Pacific whiting increased, while all other species remained the same or decreased. California halibut landings increased from the ten-year low in 1990.

Landings of swordfish declined for a second year, to the lowest catch in nine years. Shortfin mako shark landings decreased considerably from last year, while common thresher shark landings increased to the highest level since 1986.

The red sea urchin fishery continued to be a major California fishery. Although landings in northern

and southern California dropped, the value of the catch reached a record high. Dungeness crab landings increased dramatically.

Both the numbers of anglers and the sport catch declined in 1991, although developing warm-water conditions may improve the sport catch in southern California. Albacore landings were the lowest on record.

PACIFIC SARDINE

In July 1990, the California Department of Fish and Game (CDFG) conducted a survey to assess the spawning biomass of the Pacific sardine (*Sardinops sagax*). The egg production area method (EPAM) was used to determine if the observed spawning area exceeded the critical spawning area of 2,300 nautical miles² (n.mi.²), which is considered indicative of a 20,000-ton spawning biomass. The observed spawning area of 1,480 n.mi.² was 62% smaller than the area observed in 1989, and 35% smaller than the 2,300-n.mi.² critical spawning area. The decrease in observed spawning may have been due to warm

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

| Year | Pacific sardine | Northern anchovy | Pacific mackerel | Jack mackerel | Pacific herring | Market squid | Total |
|-------|-----------------|------------------|------------------|---------------|-----------------|--------------|---------|
| 1971 | 149 | 44,853 | 78 | 29,941 | 120 | 15,759 | 90,900 |
| 1972 | 186 | 69,101 | 54 | 25,559 | 63 | 10,800 | 105,763 |
| 1973 | 76 | 132,636 | 28 | 10,308 | 1,410 | 6,031 | 150,489 |
| 1974 | 7 | 82,691 | 67 | 12,729 | 2,630 | 14,453 | 112,577 |
| 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 | 5,826 | 14,122 | 187,569 |
| 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 | 16,957 | 128,293 |
| 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 | 2,001 | 72,112 |
| 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 | 12,209 | 8,405 | 23,454 | 92,959 |
| 1987 | 2,309 | 1,595 | 45,890 | 13,055 | 9,258 | 22,028 | 94,135 |
| 1988 | 4,172 | 1,618 | 47,278 | 11,379 | 9,721 | 41,040 | 115,208 |
| 1989 | 4,308 | 2,700 | 39,825 | 21,820 | 10,134 | 45,076 | 123,863 |
| 1990 | 3,103 | 3,536 | 41,134 | 5,460 | 8,938 | 31,357 | 93,528 |
| 1991* | 8,543 | 4,238 | 34,124 | 1,868 | 7,945 | 40,529 | 97,247 |

*Preliminary

water in the Southern California Bight before the survey.

After a review of the status of the sardine, including various sources of information in addition to the CDFG survey, participants at a sardine management workshop in September 1990 estimated the adult sardine population to be 100,000 tons. As a result, a 2,499-ton directed quota (based on a 5% harvest guideline, which included a 3,000-ton reserve for incidental take) was opened in January 1991. This was the sixth consecutive year that a directed sardine fishery was allowed since the moratorium went into effect in 1974, and was the first time since 1986 that the directed fishery quota exceeded 1,000 tons.

The 2,499-ton quota was divided between northern California (one-third reserved for landings north of San Simeon Point; figure 1) and southern California (two-thirds reserved for landings south of San Simeon Point). This was a change from the 20%/80% allocation scheme in effect in 1989 and 1990, and resulted from legislation passed in the last year. In addition to the directed fishery and the 3,000-ton reserve for incidental take, there was a 350-ton quota for live bait (opened January 1, 1991) and a 250-ton quota for dead bait (opened March 1, 1991).

The southern California allocation of the directed fishery opened on January 6, 1991. In an effort to minimize landings in excess of the quota, the southern directed fishery was open for one day (24 hours) per week until the quota was taken. A total of 1,879 tons was landed against the 1,667-ton quota during two 24-hour fishing periods, and the fishery was closed on January 14, 1991.

During February, the CDFG reexamined the information developed at the workshop and considered comments received at a meeting with industry representatives. Several series of data suggested that the sardine resource had shown net annual increases of 30% to 40% during recent years, even with annual harvest levels of at least 5% and perhaps as high as 10%. As a result, the CDFG increased the 1991 harvest level to 10%, or 10,000 tons, since this harvest level would allow the sardine population to continue to grow. The revised harvest level resulted in a 6,150-ton directed fishery quota, with 4,100 tons allocated to southern California and 2,050 tons allocated to northern California. The dead bait quota was increased to 500 tons (as specified in current regulations); the live bait quota remained at 1,000 tons; and the incidental reserve remained at 3,000 tons.

The take of sardines in the live bait fishery, as estimated from logs submitted by fishermen, amounted to 300 tons. Most of the sardines landed

as bait were caught from July through November. Live bait fishermen reported a decrease of large sardines in 1991 compared to 1990.

The southern California directed fishery opened again on March 4, 1991, with an additional 2,434-ton quota. The fishery was closed on March 25, with 2,636 tons landed during four 24-hour periods. A total of 28 boats participated in the January and March fisheries, and made 114 landings. Most of the catch consisted of pure loads of sardines, and was canned for human consumption.

The northern California directed fishery opened on August 1, 1991, and remained open until the end of the year. Unlike the southern California fishery, the northern California fishery had no landing restrictions. A total of 977 tons was landed against the 2,050-ton allocation. Approximately half of the 41 landings consisted of pure loads of sardines, and four boats made most of the landings.

Current law allows a 250-ton dead bait quota when the directed fishery quota is less than 2,500 tons, and increases the dead bait quota to 500 tons when the directed quota is 2,500 tons or greater. This dead bait quota is allocated among three geographic areas: 376 tons are reserved for landings south of San Simeon Point; 62 tons are reserved for landings between San Simeon Point and Pescadero Point; and 62 tons are reserved for landings north of Pescadero Point.

The southern California dead bait fishery was closed on April 8, 1991, with 424 tons landed during one 24-hour fishing period. Most of the catch consisted of pure loads of sardines. The central California dead bait fishery was closed on May 24, with 70 tons landed. No landings were made against the northern California dead bait allocation in 1991.

The tolerance limit for sardines landed incidentally in the mackerel fishery remained at 35% by weight throughout the year. Incidental landings of sardines totaled 1,295 tons, and represented 3% of the total mackerel catch. This was similar to 1990 (2.9%), but less than in 1989 (4.5%). Although the 1991 proportion of sardines in mackerel landings was similar to 1990, the total amount of sardines landed incidentally in 1991 decreased 12% from 1990 because of a 23% decrease in total mackerel landings.

In October 1991, the CDFG estimated that only 1,000 of the 3,000 tons of sardines initially reserved for the annual incidental take would be landed by the end of the year. As a result, the remaining 2,000 tons were made available as a directed fishery. This quota was allocated and managed similarly to the directed fisheries in January and March. The southern California allocation (1,333 tons) was opened on

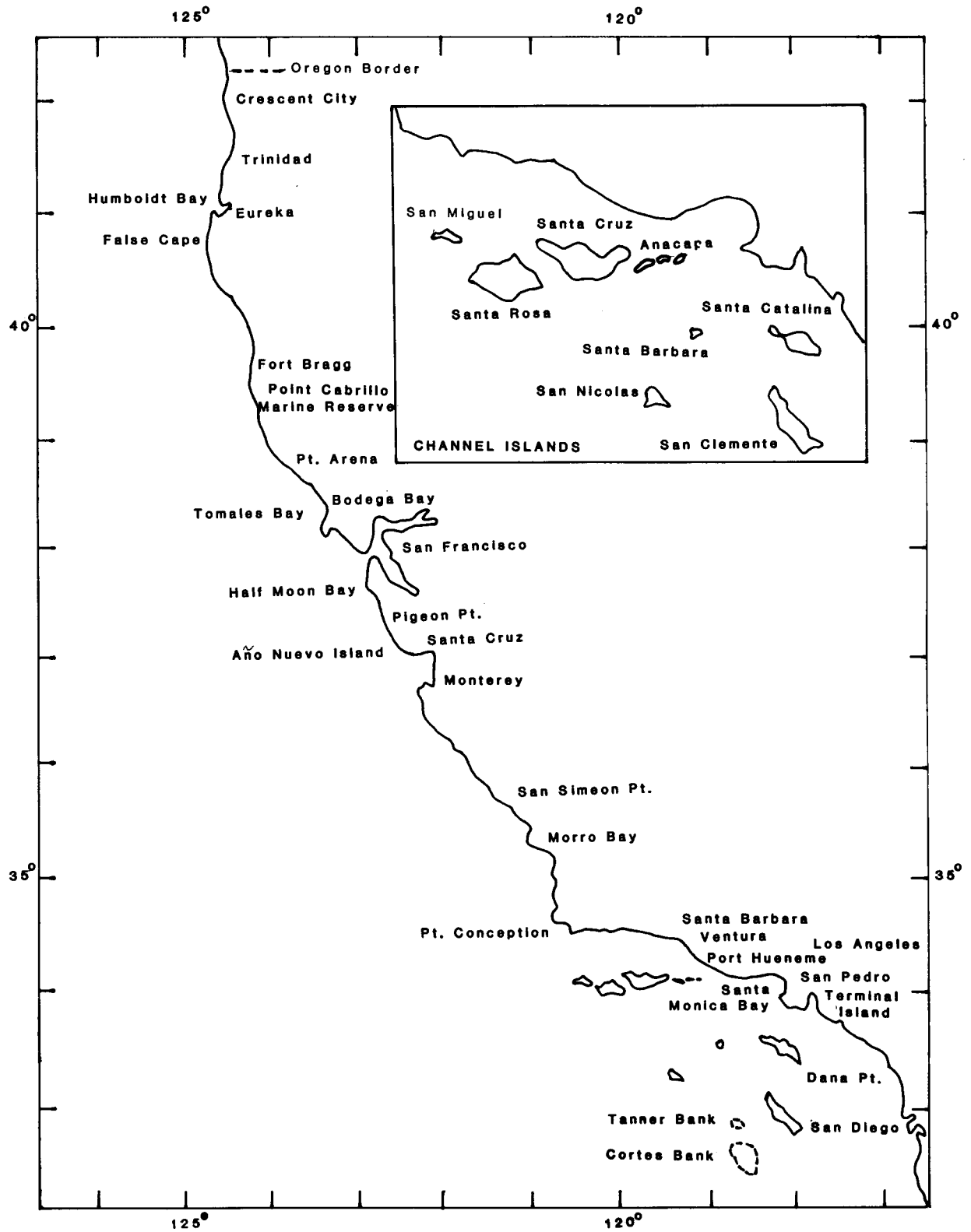


Figure 1. California ports and fishing areas.

October 27. A total of 1,232 tons were landed in two 24-hour fishing periods, and the fishery was closed on November 4. There were no additional landings made against the northern allocation.

The total 1991 landings of sardines from all sources (directed, dead bait, live bait, and incidental) was 8,543 tons (table 1), an increase of almost 200% over the total 1990 sardine take. The increase in 1991 was due to the increased directed quota. As in 1990, sardines landed in 1991 were canned for human consumption and pet food, and were used for dead bait.

In June 1991, the CDFG conducted an EPAM survey to evaluate the sardine spawning biomass. The survey covered the waters off southern California from Point Conception to the Mexican border, from close to shore to as far out as 200 miles. The observed spawning area of 3,840 n.mi.² was 2.6 times larger than the area observed in 1990, and 4% larger than the area observed in 1989. With the exception of 1990, the size of the sardine spawning area as estimated by CDFG surveys has increased steadily since the surveys were begun in 1985. During 1991, sardines spawned in patches southwest of San Clemente Island, and in smaller concentrations along the coast from Santa Barbara to Dana Point. The observed spawning area indicated an adult population well above the 20,000-ton critical level.

In October 1991 the third annual workshop on sardine management was held by the CDFG and attended by state, federal, and fishing-industry biologists. The 1991 population of adult sardines was estimated to range between 275,000 and 495,000 tons, with an average estimate of 385,000 tons. This estimate was derived from various sources, including the occurrence of sardine eggs and larvae in CalCOFI surveys, observations of sardines by aerial fish spotters, CDFG spawning area surveys, and catch and age data from historical and current sardine fisheries. A total harvest level of 10% was recommended. This is similar to the 1991 harvest level, except that the sardine catch by Mexico was not considered in setting U.S. quotas for 1991. In contrast, 13,500 tons were subtracted from the 1992 total harvest of 38,500 tons, to account for the expected Mexican catch. As a result, the total U.S. harvest for 1992 was set at 25,000 tons, including 500 tons for dead bait, 1,000 tons for live bait, a 3,000-ton incidental reserve, and a directed fishery quota of 20,050 tons.

Legislation (AB 173) was enacted in July 1991 to reestablish the procedures for setting the tolerance limit for sardines caught incidentally with mackerel. A sunset clause eliminated this section of the Fish

and Game Code in January, but the 35% tolerance remained in effect during the interim. AB 173 also eliminates the sunset clause pertaining to the 350-ton live bait quota and the use of bait nets to take sardines in Santa Monica Bay, and allows the CDFG to increase the live bait quota provided the increases do not affect the recovery of the sardine resource. The bill also allows sardines taken as dead bait to be sold to commercial fishermen; previously, sardines taken under the dead bait quota could be used only by sport fishermen.

PACIFIC MACKEREL

At the start of 1991, there were 28,954 tons of Pacific mackerel (*Scomber japonicus*) already landed towards the total for the 1990–91 fishing season (July 1 through June 30). There were no quota restrictions, since a preliminary estimate indicated that the biomass was well above 150,000 tons. Current legislation allows an open fishery when the biomass exceeds 150,000 tons.

Landings during the first quarter of the year totaled 7,136 tons and were higher than in 1990, despite the availability of squid (*Loligo opalescens*) and the directed sardine fishery in January and March. Individual fish in the catch tended to be large.

Landings decreased during April and May. One cannery issued no orders in April and closed down for three weeks in May. As a result, most of the fleet remained in port. Pacific mackerel landings increased at the end of May and were high during June. Second quarter landings totaled 7,976 tons, with the majority (7,044 tons) landed in June.

The 1990–91 season ended on June 30, 1991, with a total catch of 44,066 tons of Pacific mackerel, a 60% increase over the 1989–90 season. Jack mackerel (*Trachurus symmetricus*) landings in the mackerel fishery totaled 3,839 tons for the 1990–91 season. The species composition of the total statewide mackerel landings was 89% Pacific mackerel, 8% jack mackerel, and 3% Pacific sardine. During the 1989–90 season, when jack mackerel made up an unusually large proportion of the catch, the species composition was 55% Pacific mackerel, 40% jack mackerel, and 5% Pacific sardine. Landings in northern California made up 5% of total statewide landings, up considerably from 0.3% during the 1989–90 season, and the highest proportion since northern California landings contributed 6% to the total in 1985–86.

The 1991–92 season opened on July 1, 1991, with no quota restrictions, since the total biomass was estimated to be 192,000 tons. In fishery samples from January to June 1991, the 1990 year class made

up 36% of the landings, and the 1989 year class made up 13%. From July to December 1991, these two year classes made up 44% and 3% of the landings, respectively. Landings of Pacific mackerel during the first two months of the third quarter were lower than in the previous year. Several seiners searched for bluefin tuna during August. Landings increased during September and were comparable to landings in September 1990. A total of 9,651 tons was landed during the third quarter.

During October, landings were low, partly because the directed sardine fishery reopened, and effort was also directed toward squid during the last two weeks of the month. Landings increased during November, despite the directed sardine fishery during the first week of the month. December landings were higher than in 1990, even though one cannery closed for two weeks because of financial problems. In the fourth quarter 9,361 tons were landed. By year's end, 19,012 tons of Pacific mackerel had been landed towards the 1991-92 season catch. This is about 80% of the last five-year average for midseason landings. Pacific mackerel landings for 1991 totaled 34,124 tons (table 1), down 17% from 1990 landings, and 22% lower than the average landings for the previous five years. Jack mackerel landings in the mackerel fishery totaled 1,868 tons in 1991. An apparent decline in the Pacific mackerel population over the last five years, warm water conditions (which tend to displace Pacific mackerel to the north), and the financial difficulties of a major southern California processor contributed to low landings.

NORTHERN ANCHOVY

Landings of northern anchovy (*Engraulis mordax*) for reduction purposes in 1991 were limited primarily by poor market conditions, although landings were the highest since the 1983-84 season (table 2). California processors offered \$30 to \$50 per ton for anchovy, but most fishermen directed their effort to other fisheries. The 1990-91 season closed on June 30, 1991, with 1,143 tons landed against a reduction quota of 128,088 tons (116,200 metric tons [MT]). Of the total catch, 943 tons were landed under the northern permit area quota (10,000 tons), and 200 tons under the southern permit area quota (118,088 tons).

The reduction fishery in Mexico slowed in 1991, partly because Zapata Company, a primary reduction processor in Ensenada, went out of business. Mexican biologists also attributed the fishery decline to weak demand and a reduced anchovy popu-

TABLE 2
Anchovy Landings (Short Tons) for Reduction

| 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 |
| 1987-88 | 0 | 122 | 122 |
| 1988-89 | 0 | 258 | 258 |
| 1989-90 | 157 | 32 | 189 |
| 1990-91* | 200 | 943 | 1,143 |

*Preliminary

lation, probably a result of changing environmental conditions and heavy fishing.

A U.S. total of 3,095 tons of anchovy was landed for nonreduction use in 1991. This represents a 12% decrease from the previous year, and may have been partly due to the presence of domoic acid, a toxin that causes amnesiac shellfish poisoning, in anchovy in 1991.

The production of domoic acid has been attributed to two commonly occurring diatoms, *Nitzschia pungens* and *Nitzschia pseudoseratiata*. In September several pelicans in Monterey Bay died apparently as a result of high levels of domoic acid. Subsequent investigations by the U.S. Food and Drug Administration revealed toxin levels in some anchovy viscera that were well above established safety standards. As a result, harvesting of anchovy for human consumption was prohibited from November 1, 1991, to January 1, 1992, and shipments of anchovies from Monterey Bay and San Pedro were subject to an embargo.

The anchovy live bait catch was 5,555 tons in 1991, an increase of 4% from 1990. California bait haulers were able to meet demand throughout the season and considered 1991 a good year. Total anchovy landings during 1991, including reduction and nonreduction, but excluding live bait, totaled 4,238 tons (table 1).

National Marine Fisheries Service biologists estimated the 1991 spawning biomass of northern anchovy to be 287,700 tons (261,000 MT) and the total biomass to be 292,112 tons (265,000 MT). Since the spawning biomass estimate is below the 300,000-MT minimum level required for a reduction quota by the Anchovy Fishery Management Plan, no take for reduction purposes is allowed during the 1991-92 season. The nonreduction harvest allocation was set at 5,201 tons (4,900 MT), with an unspecified amount for use as live bait.

MARKET SQUID

Market squid (*Loligo opalescens*) landings in 1991 were 40,529 tons (table 1): 31,516 tons (77.8%) were from the southern California fall-winter fishery, 7,389 tons (18.2%) from the central California (Monterey Bay area) spring-summer-fall fishery, and 1,624 tons (4.0%) from north of the Monterey Bay area (table 3). The 1991 total landings increased 29% from the 31,357 tons landed in 1990. Southern California landings were 40% higher; landings in the Monterey Bay area were 15% lower; and landings from north of Monterey Bay were up dramatically from the 143 tons landed in 1990. The total ex-vessel value was approximately \$5.6 million, 30% above the \$4.3 million earned in 1990.

Prices continued to fluctuate during the year and compared to the previous year. In 1991, prices in southern California remained lower than those paid

in central and northern California. Southern California prices ranged from \$40 to \$140 per ton and averaged about \$120 per ton. This was down from the 1990 range of \$110 to \$150 per ton and the average of \$130 per ton. Monterey Bay prices ranged from \$200 to \$300 per ton and averaged about \$209. Prices in 1990, by comparison, ranged from about \$130 to \$200 per ton and averaged about \$160. In northern California, 1991 prices ranged from \$60 to \$300 per ton and averaged about \$212 per ton.

Frozen squid for human consumption continued to supply the major market, with most exported to European countries and Japan. Some squid was sold fresh or for use as dead and live bait. The squid live bait fishery is centered in southern California, and in 1991 approximately 158 tons were caught. This represents about 3% of southern California's multispecies live bait fishery. In Monterey Bay, one boat began fishing for squid for live bait in late 1991.

Most 1991 southern California landings were made in two ports: Port Hueneme and San Pedro. Approximately 17,000 tons (54% of the southern California total) were landed in Port Hueneme, and approximately 10,300 tons (33%) in San Pedro. A third port, Terminal Island, received about 2,700 tons (8%). Landings in Port Hueneme were high, mainly because several large boats from Monterey fished around the Santa Barbara Channel Islands and landed squid at Port Hueneme. This squid was trucked to dealers in the Monterey Bay area for processing.

Squid were consistently larger in 1991 than in 1990. A possible reason for the decreased southern California landings in 1990 was because small squid, averaging over 15 per pound, were common throughout the area during much of the latter part of the season. Some dealers had difficulty marketing these small squid and set trip limits for their boats, or stopped buying squid altogether. In 1991, much larger squid dominated the catches, resulting in increased demand and increased landings.

In 1991 the squid season in the Monterey Bay area was unusual. Typically, squid appear on the spawning grounds in catchable quantities beginning April. In some years (most recently 1981, 1985, and 1989) small catches have been made as early as March. In 1991, however, the fishery had its slowest start since commercial squid landing records began in 1916. Fewer than 500 pounds were landed from January to May. In June, fishermen landed approximately 30 tons, and in July they landed about 440 tons. In August fishermen brought in just over 1,400 tons, and September's landings exceeded 4,000 tons, making that month one of the highest on record.

TABLE 3
 California Market Squid Landings (Tons)

| Year | Monterey | Southern California | Other | State total |
|-------|----------|---------------------|-------|-------------|
| 1970 | 4,314 | 7,982 | 0 | 12,296 |
| 1971 | 8,323 | 7,435 | trace | 15,758 |
| 1972 | 6,129 | 3,950 | 0 | 10,079 |
| 1973 | 620 | 5,410 | 0 | 6,030 |
| 1974 | 7,248 | 7,205 | 0 | 14,453 |
| 1975 | 2,495 | 9,316 | trace | 11,811 |
| 1976 | 2,511 | 7,462 | 0 | 9,973 |
| 1977 | 2,234 | 11,887 | 1 | 14,122 |
| 1978 | 10,326 | 8,571 | trace | 18,897 |
| 1979 | 14,183 | 7,842 | 1 | 22,026 |
| 1980 | 7,856 | 9,100 | 1 | 16,957 |
| 1981 | 14,134 | 11,779 | 2 | 25,915 |
| 1982 | 11,670 | 6,276 | 5 | 17,951 |
| 1983 | 542 | 950 | 509 | 2,001 |
| 1984 | 431 | 84 | 107 | 622 |
| 1985 | 4,202 | 7,039 | 85 | 11,326 |
| 1986 | 6,049 | 16,488 | 917 | 23,454 |
| 1987 | 5,269 | 16,665 | 94 | 22,028 |
| 1988 | 5,329 | 34,634 | 426 | 40,389 |
| 1989 | 7,877 | 37,195 | 4 | 45,076 |
| 1990 | 8,728 | 22,486 | 143 | 31,357 |
| 1991* | 7,389 | 31,516 | 1,624 | 40,529 |

*Preliminary

Most of the squid landed in Monterey Bay ports are traditionally caught in southern Monterey Bay. However, roughly 70% of the squid landed in August and September was caught north of Santa Cruz near Año Nuevo Island (figure 1). This area has been fished only sporadically since the 1983–84 El Niño period. During late September and October, most of the catches again came from the traditional fishing grounds in the southern part of the bay. Many fishermen and processors felt that the availability of squid in the Año Nuevo Island area caused the 1991 Monterey Bay area squid season to be good, rather than only fair. The 1991 total landings of 7,389 tons were higher than the previous 20-year average of 6,213 tons.

The use of attracting lights has been controversial since this practice was first approved for southern Monterey Bay in 1989, and disputes among squid fishermen over their use continued throughout the season. Fishermen opposed to the lights believe that they disrupt spawning, and that small boats cannot compete with large boats with large light systems. Those who favor lights claim that lights allow them to use shallower nets that can be fished off the bottom, thus protecting squid eggs attached there. They also point out that fishermen in southern California and elsewhere have used lights for years without any apparent adverse effects on the squid resource and spawning.

The 1991 landings of 1,624 tons of squid at ports north of Monterey Bay were 77% greater than the previous highest annual landings of 917 tons in 1986. Approximately 91% (1,403 tons) of the 1991 northern California total was landed in Half Moon Bay. Most of this squid was landed in July, August, and September, and was caught in the Año Nuevo Island area (figure 1).

PACIFIC HERRING

Annual statewide landings for the 1991 roe herring fishery (*Clupea harengus*) were 7,945 tons, an 11.1% decrease from 1990 (table 1). Statewide landings for the 1990–91 season (November to March) totaled 7,936 tons. San Francisco Bay gill net permittees landed 5,832 tons, 443 tons short of the 6,274-ton quota. Round haul permittees fishing in San Francisco Bay landed only 1,909 tons, which was 675 tons less than their quota. Bodega Bay permittees landed 95 tons (200-ton quota); Humboldt Bay permittees landed 63 tons (60-ton quota); and Crescent City permittees landed 36 tons (30-ton quota). Ex-vessel prices ranged from \$750 to \$1,000 per ton for 10% roe-recovery herring and were low because of a weak Japanese market at the end of 1991.

San Francisco Bay roe-on-kelp permittees had a very difficult 1990–91 season. They processed only 48 tons (144-ton-quota) of roe-on-kelp, with an estimated ex-vessel value of \$1 million. Fishermen attributed the low landings to patchy spawns and unpredictable spawning behavior.

Spawning biomass estimates were determined for San Francisco, Tomales, and Humboldt bays. Both hydroacoustic and spawn deposition surveys were employed in San Francisco Bay, but only spawn deposition surveys were used in the remaining bays. The 1990–91 season estimate for San Francisco Bay was 51,000 tons, a 21% decline from the 1989–90 season. Tomales Bay and Bodega Bay herring are managed as one stock; therefore the total spawning biomass of 874 tons included 95 tons of Bodega Bay landings missed by the survey. This total spawning biomass is 10.6% higher than the 1989–90 season estimate of 790 tons. The first spawning deposition survey in Humboldt Bay since 1976 estimated a spawning biomass of 400 tons, compared with previous estimates by independent researchers of 372 tons in 1974–75, and 242 tons in 1975–76.

This was the fourth consecutive poor season in Tomales Bay. Although the Tomales Bay herring population appears to be depressed, the age structure of the sampled catch has remained relatively stable and does not seem to reflect a declining population. Drought conditions have persisted for five years, however, and low freshwater runoff into Tomales Bay may be the primary reason why herring have not spawned in the bay at historic levels.

Results of young-of-the-year (YOY) trawl surveys in San Francisco Bay suggest a weak 1991 year class. Relatively few YOY herring were collected in midwater trawl tows at stations located throughout the bay. This is the second consecutive poor year class and may be due to abnormal oceanic conditions.

GROUND FISH

California's 1991 commercial groundfish harvest was 35,763 MT, with an ex-vessel value of approximately \$27.13 million. All-species landings decreased approximately 8%, or 3,086 MT, from 1990 (table 4). Rockfish (*Sebastes* spp.), Dover sole (*Microstomus pacificus*), sablefish (*Anoplopoma fimbria*), Pacific whiting (*Merluccius productus*), and thornyheads (*Sebastolobus* spp.) were the principal species harvested in 1991. Landings of Dover sole and Pacific whiting increased, while landings of other species or species groups either remained the same or declined.

Fishing effort in the Washington–Oregon–Calif-

TABLE 4
California Groundfish Landings (Metric Tons)

| Species | 1990 | 1991 | Percent change |
|------------------|--------|--------|----------------|
| Dover sole | 6,419 | 7,726 | 20 |
| English sole | 912 | 812 | -11 |
| Petrale sole | 691 | 735 | 6 |
| Rex sole | 570 | 621 | 9 |
| Other flatfish | 1,429 | 880 | -38 |
| Widow rockfish | 1,975 | 1,201 | -39 |
| Other rockfish | 11,019 | 9,708 | -12 |
| Thornyheads | 5,391 | 2,864 | -47 |
| Lingcod | 1,118 | 786 | -30 |
| Sablefish | 3,531 | 3,308 | -6 |
| Pacific whiting | 5,519 | 6,893 | 25 |
| Other groundfish | 275 | 229 | -17 |
| Total | 38,849 | 35,763 | -8 |

fornia (WOC) area was higher in 1991 than in 1990. The largest increase in effort occurred in the trawl fishery, when 13 trawler/processors and three mother-ships from Alaska came south to fish for Pacific whiting. There was also a large influx of displaced salmon trollers to the groundfish fishery because of shortened salmon seasons.

Incidental catch of salmon by the whiting fleet was of special concern to the Pacific Fishery Management Council (PFMC) because of area closures and severe quota reductions in salmon fisheries off southern Oregon and northern California. An estimated 6,280 salmon were taken in the WOC area, resulting in an overall by-catch rate of 0.032 salmon per ton of whiting. On average, salmon by-catch was lower than the target rate of 0.05 salmon per ton of whiting established by the PFMC and trawl industry. The incidental rockfish catch in the WOC area was 1,536 MT, nearly all of which was discarded.

The general distribution of 1991 California landings among gear types was similar to last year. Bottom and midwater trawl landings dominated the statewide groundfish catch and contributed 78.9% of total landings in 1991, up slightly from 77.4% in 1990. The trap component dropped slightly, from 1.9% in 1990 to 1.2% in 1991, and setnet landings decreased from 8.3% to 5.9%. The line portion of the catch was 14% of the California groundfish harvest in 1991, up from 6.6% in 1989 and 12.4% in 1990.

Various quotas, harvest guidelines, and trip limits were used in 1991 to limit the total harvest of species or species groups in order to meet the PFMC objective of a year-round groundfish fishery. The PFMC established a widow rockfish harvest guideline of 7,000 MT for the WOC area in 1991. This was 20% (1,800 MT) less than the 1990 quota (8,800 MT) and

represents a considerable decrease from the 1989 quota (12,400 MT). Trip limits were 10,000 pounds per week or 20,000 pounds per two-week period. On September 25, a 3,000-pound trip limit was implemented to further restrain landing rates. The widow rockfish catch in 1991 totaled 6,932 MT in the WOC area, and was 1% under the quota. California landings were 1,201 MT, 17% of the WOC total.

Sablefish management in the WOC area during 1991 was similar to 1990. After a native American tribal allotment of 300 MT was deducted from the harvest guideline, 8,600 MT of sablefish were allocated between trawl and nontrawl in a 58%:42% ratio. The nontrawl season opened on January 1 with a 1,500-pound trip limit, and unrestricted fishing began on April 1. The April 1 opening was intended to coincide with the sablefish season opening in Alaska to reduce fishing effort in the WOC area, but the Alaska season did not open until May 15. Many longline vessels, particularly from Washington, participated in both the Alaska and WOC sablefish fisheries. Nontrawl landings in April 1991 were four times the 1985-89 average April landings of 392 MT. This pulse of effort shortened the season substantially, and a 500-pound trip limit was established on May 24. Last year a 500-pound trip limit was not set until June 24, and that limit was raised to 2,000 pounds in October to allow the entire nontrawl quota to be taken. The 1991 nontrawl season closed on July 1. An emergency action to allow continued incidental and low-level catches under a 300-pound daily trip limit was recommended by the PFMC in July, but was not implemented until September 30. The total catch of sablefish by nontrawlers in 1991 was 4,522 MT, and exceeded the nontrawl quota by 25%. California landings (1,167 MT) accounted for 26% of the nontrawl total. WOC-area sablefish landings by trawl gear were 4,918 MT, about 1% less than the trawl allocation. California landings (2,141 MT) accounted for 44% of the trawl total.

The deepwater complex (sablefish, Dover sole, and thornyheads) was managed in 1991 by a weekly trip limit of 27,500 pounds. The first thornyhead stock assessment was conducted, resulting in a harvest guideline of 7,900 MT for this species, and a weekly trip limit of 7,500 pounds within the overall weekly limit for the deepwater complex. The sablefish component of the deepwater complex was limited to 1,000 pounds per trip, or 25% of the deepwater complex, whichever was greater.

Thornyhead landings were 6,536 MT, down sharply from the 10,126 MT landed in 1990, primarily because of more restrictive management and

weak market demand. This declining trend was evident by midyear, and in response the Council increased the weekly trip limit to 12,500 pounds on July 31. Despite the increased trip limit, total landings were less than the harvest guideline. California landed 2,864 MT, 44% of the WOC thornyhead catch. The 1991 coastwide catch of Dover sole was 18,203 MT, an increase of 2,408 MT from the previous year, primarily as a result of increased market demand. California landings (7,726 MT) constituted 42% of total WOC-area Dover sole landings.

For the area south of Coos Bay, Oregon, the PFMC set the trip limit for the *Sebastes* complex (rockfishes other than widow) at 25,000 pounds, with no restriction on trip frequency. The PFMC also established a 1991 harvest guideline of 1,100 MT for bocaccio rockfish (*Sebastes paucispinis*) and restricted the take of bocaccio to 5,000 pounds of the allowable 25,000 pounds of rockfish per trip. Landings of the *Sebastes* complex in California dropped from 11,019 MT in 1990 to 9,708 MT in 1991. This total included nearly 1,300 MT of bocaccio. The combined commercial and recreational bocaccio catch in 1991 was 1,500 MT.

A limited entry plan for groundfish was adopted by the PFMC in 1991 and has been submitted to the National Marine Fisheries Service for approval. The plan is tentatively scheduled for implementation on January 1, 1994. The plan includes all trawl vessels, and any longline or pot vessel with minimum landings (as yet undetermined) in the limited entry system. The PFMC also determined that the section of the California public initiative (Proposition 132) prohibiting the take of rockfish with gill nets in the Exclusive Economic Zone (EEZ; 3 to 200 miles from shore) was inconsistent with the Magnuson Fisheries Conservation and Management Act. As a result, the commercial take of rockfish with gill nets in the EEZ is still allowed.

PACIFIC WHITING

The combined U.S. and Canadian coastal Pacific whiting (*Merluccius productus*) harvest for 1991 was 316,000 MT. The total catch exceeded the 228,000-MT quota by 39%, and is the largest whiting harvest on record. The U.S. portion of the catch in 1991 was approximately 218,000 MT: 197,000 MT were taken by at-sea processors, and 21,000 MT went to shore-based processors.

In 1991 an estimated 63% (116,000 MT) of the total U.S. coastal whiting harvest that was processed at sea was captured off California. California shore-based landings were 6,893 MT, an increase of 25% over the 5,519 MT landed in 1990 (figure 2).

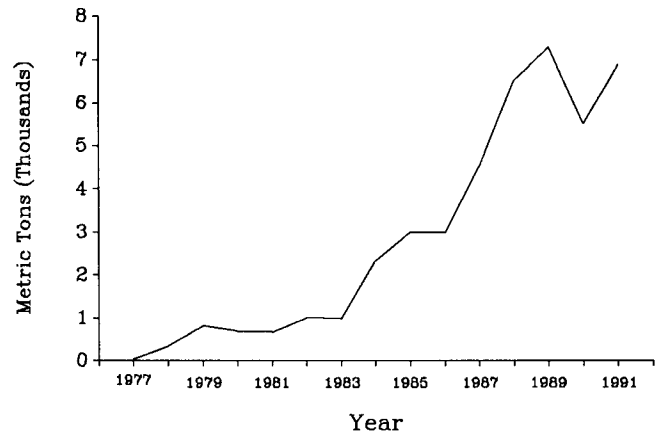


Figure 2. California landings of Pacific whiting, 1977–91.

The California total accounted for one-third of all shore-based whiting landings in Washington, Oregon, and California in 1991. Five midwater trawl vessels, fishing off Eureka and Crescent City, caught most of the California shore-based harvest.

The U.S. fishery for coastal Pacific whiting became exclusively domestic in 1991. U.S. at-sea processing vessels, which typically operate in the Gulf of Alaska and Bering Sea and are capable of high production, displaced foreign processors off the West Coast. Domestic processing capability in 1991 greatly exceeded the 228,000-MT quota for whiting, and allocation of the quota between trawler-processor vessels and trawl vessels that could deliver to either at-sea or shore-based facilities was necessary.

The fishery for Pacific whiting has depended heavily on the declining 1980, 1984, and 1987 year classes. The U.S. harvest is expected to decline below 200,000 MT unless a strong year class of whiting occurs.

DUNGENESS CRAB

California Dungeness crab (*Cancer magister*) landings during the 1990–91 season totaled 12.0 million pounds, an increase of 7.4 million pounds (261%) from the previous season's landings of 4.6 million pounds.

The season opened in northern California on December 1, 1990, with an ex-vessel price of \$1.50 per pound — \$0.25 per pound higher than the 1989–90 season. The northern California ports of Crescent City, Trinidad, Eureka, and Fort Bragg (figure 1) received 5.5, 1.2, 3.6, and 0.3 million pounds, respectively, from 340 vessels, for a total of 10.6 million pounds. This was 6.88 million pounds more than the catch of the previous season.

The San Francisco area Dungeness crab season opened on November 14, 1990, with the price set at \$2.10 per pound. Season landings totaled 1.25 million pounds, an increase of 0.52 million pounds from the 1989–90 season. Landings for Bodega Bay were 0.55 million pounds; San Francisco, 0.44 million pounds; and Half Moon Bay, 0.26 million pounds. Sixty-seven percent of the catch was taken in November and December. Approximately 114 boats participated in the fishery.

The ports of Monterey and Morro Bay contributed 0.12 million pounds to the statewide total, slightly more than the 0.10 million pounds landed in the 1989–90 season.

In 1989 the Pacific States Marine Fisheries Commission received a federal grant to help resolve crab industry issues of coastwide concern. As a result, a tristate (Washington, Oregon, and California) Dungeness crab committee of fishermen, processors, and state agency advisors was formed in 1990. The committee identified four issues for consideration: (1) the occurrence of soft-shell crabs at the beginning of the season, (2) soft-shell crabs during the season, (3) “groundlining” of crab traps (traps attached by a line), and (4) a limited entry fishery. Soft-shell crabs are less marketable, and the committee agreed that when soft-shell conditions occur (typically in Washington and Oregon), the season opening should be delayed until the conditions improve. Groundlining of crab traps causes gear conflicts with vessels trawling with bottom nets, but the committee was unable to resolve this issue. Most committee members recommended a limited-entry fishery, with eligibility restricted to fishers or vessels that participated in the fishery before September 15, 1991.

Local meetings were held in ports from Eureka, California, to Westport, Washington, to discuss these issues with fishermen and processors. A coastwide questionnaire to all crab fishers revealed that 61.6% of the respondents favored a study of possible limited entry programs and establishment of an eligibility cutoff date.

PACIFIC OCEAN SHRIMP

Statewide landings of Pacific Ocean shrimp (*Pandalus jordani*) for the 1991 season totaled 10.2 million pounds, an increase of 18.4% over the 8.7 million pounds landed in 1990 (figure 3). The 1991 season landings were the fifth largest since the beginning of the fishery in 1952. There were only two areas of production in 1991: Area A (Oregon border to False Cape), which accounted for 99% of the catch, and Area B-1 (False Cape to Point Arena) (figure 1). Area

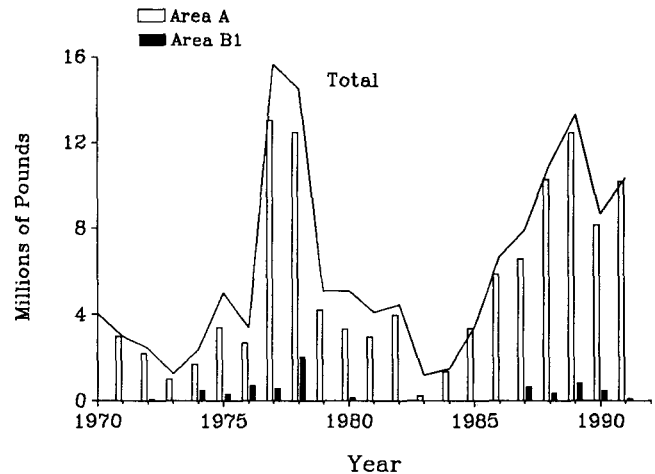


Figure 3. California landings of Pacific ocean shrimp, 1970–91. Total includes landings from Area C.

C (Pigeon Point to the Mexican border) reported no catch for the second straight year.

The season opened on April 1 with an ex-vessel price of \$0.54 per pound. On May 28 the price increased slightly to \$0.60 per pound; in late July it dropped to \$0.53 per pound, where it remained. Shrimp landings in Area A ports reached 10.2 million pounds, an increase of 25% from the 8.16 million pounds landed in the previous season. Of total Area A landings, 9.56 million pounds were caught in Area A waters; 450,000 pounds were taken off Oregon; and 190,000 pounds were caught in Area B-1.

Eighty-six trawl vessels (54 single-rigged and 32 double-rigged trawlers) delivered shrimp to Area A ports during 1991, an increase of 29 boats from 1990, and the largest fleet on record to make deliveries in Area A. Single-rigged vessels had an average catch rate of 342 pounds per hour, a 2% decrease from the previous year; double-rigged vessels averaged 556 pounds per hour, a 12% decrease.

The biological characteristics of the 1991 catch were similar to those observed during 1980–89, in contrast to the anomalous size and age composition noted in 1990. One-year-old shrimp constituted 85.7% of the 1991 catch, compared to 18.8% in 1990 and the 1980–89 average of 80.5%. Female shrimp made up only 7.1% of the catch, compared to an average of 17.1% during the 1980–89 period. The count per pound averaged 113 shrimp (the legal maximum is 160 per pound).

Area B-1 shrimp landings were 137,000 pounds, down 74% from the 519,000 pounds landed in 1990. Over 95% of the catch was landed during the first month of the season. Thirty-four landings, a decrease of 53% from 1990, were made by six single-

rigged trawl vessels. These vessels caught an average of 364 pounds per hour, a decrease of 17% from last season. One-year-old shrimp were less abundant in Area B-1, constituting 25% of the sampled catch in April and 51% in August. As a result, fishermen landed exceptional counts of 85 shrimp per pound in April and 110 shrimp per pound in August. Ex-vessel price trends were the same as in Area A.

SWORDFISH AND SHARKS

Landings of swordfish (*Xiphias gladius*) in 1991 fell to 1.54 million pounds, a 17% decline from 1990. This was the second consecutive year that landings decreased, and is the lowest catch in nine years (table 5). Harpoon fishermen landed only 123 swordfish, a 70% decline from the previous season; 1991 was the seventh consecutive year of declining catches. The drift gill net catch remained stable at 9,000 fish, although the average size of swordfish was smaller, as evidenced by a decrease in the total weight of the landings.

During the season, 160 gill net permits were issued for taking pelagic sharks and swordfish, and 132 permits were issued for harpooning swordfish. Catch-per-unit-of-effort (CPUE) for gill net gear increased from 1.6 fish per day in 1990 to 2.0 fish per day in 1991, while CPUE for harpoon gear declined from 0.3 fish per day to 0.2 fish per day. San Francisco, Morro Bay, and San Diego continued to receive most of the landings.

Three vessels from San Pedro used longline gear to target swordfish. These vessels were required to fish outside the EEZ, but were able to land their catches in the U.S. with a federal permit.

Common thresher shark (*Alopias vulpinus*) landings increased 64% in 1991 to 756,701 pounds, the

highest since 1986. Thresher sharks were landed along the entire California coast — 57% in southern California. Market sampling data indicate that this fishery continues to harvest immature fish (average age two years) almost exclusively.

Shortfin mako shark (*Isurus oxyrinchus*) landings were just over 331,000 pounds, a decrease of 43% from last year (table 5). The drift gill net fishery accounted for 67% (220,703 pounds) of this total; the remaining 33% (110,513 pounds) was taken by the experimental drift longline fishery. The California Fish and Game Commission approved continuing the experimental drift longline fishery for shortfin mako sharks, and established a limited season, a 175,000-pound quota, and a limited number of permittees. The drift longline catch, down 37% from last year and only 63% of the season quota, was limited in part by unfavorable market conditions. Drift longline length-frequency data indicate that the catch consisted of immature fish (one-, two-, and three-year-olds).

Landings of Pacific angel shark (*Squatina californica*) were a dismal 181,553 pounds. This represents a decline of 28% from last year, and is the lowest catch in 11 years. A low ex-vessel price, reduced availability, and the minimum size limit contributed to the low landings. As in the past, the Santa Barbara-Ventura area was the major fishing location (figure 1).

CALIFORNIA HALIBUT

California halibut (*Paralichthys californicus*) landings in 1991 were 469 MT, an increase of 12% from the 419 MT landed in 1990 (figure 4). Over 56% of the total landings were made south of Point Conception, mostly in the Santa Barbara area (table 6). Nearly 44% of the catch occurred north of Point

TABLE 5
 Landings of Selected Shark Species and Swordfish
 (Pounds)

| Year | Shortfin mako shark | Swordfish | Common thresher shark | Pacific angel shark |
|-------|---------------------|-----------|-----------------------|---------------------|
| 1977 | 19,911 | 511,388 | 129,522 | 366 |
| 1978 | 26,765 | 2,604,233 | 302,054 | 82,383 |
| 1979 | 35,079 | 586,529 | 735,726 | 128,295 |
| 1980 | 154,529 | 1,197,187 | 1,805,978 | 110,037 |
| 1981 | 274,217 | 1,142,897 | 1,973,411 | 268,640 |
| 1982 | 527,006 | 1,677,020 | 2,396,960 | 317,953 |
| 1983 | 322,854 | 2,601,600 | 1,722,056 | 351,344 |
| 1984 | 239,687 | 4,429,540 | 1,662,587 | 632,937 |
| 1985 | 225,535 | 5,196,685 | 1,540,770 | 1,237,810 |
| 1986 | 473,608 | 3,845,932 | 606,583 | 1,241,130 |
| 1987 | 602,718 | 2,741,015 | 525,076 | 940,187 |
| 1988 | 488,136 | 2,484,428 | 549,516 | 487,278 |
| 1989 | 388,322 | 2,850,734 | 649,174 | 268,252 |
| 1990 | 576,428 | 1,871,540 | 461,606 | 250,850 |
| 1991* | 331,216 | 1,541,333 | 756,701 | 181,553 |

*Preliminary

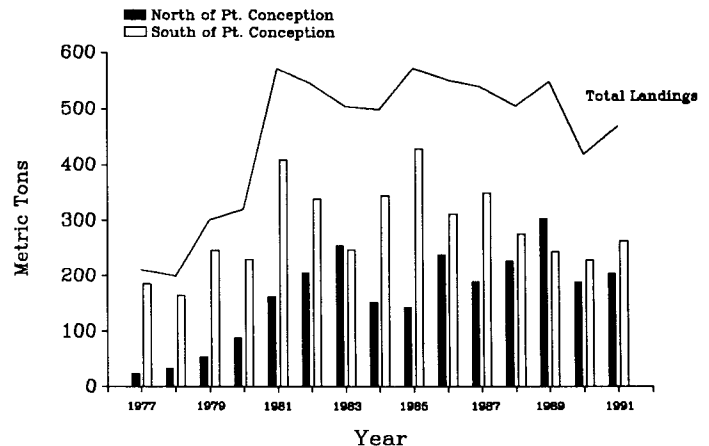


Figure 4. Landings of California halibut, 1977-91.

TABLE 6
1991 California Halibut Landings by Area

| Area | Metric tons | % of total |
|---------------|-------------|------------|
| Eureka | 4.2 | .9 |
| San Francisco | 116.8 | 24.9 |
| Monterey | 25.7 | 5.5 |
| Morro Bay | 58.3 | 12.4 |
| Santa Barbara | 155.8 | 33.2 |
| Los Angeles | 74.0 | 15.8 |
| San Diego | 34.1 | 7.3 |
| Total | 468.9 | 100.0 |

Conception, which was similar to 1990. The San Francisco area accounted for nearly a quarter of all halibut landings.

The highest monthly landings of California halibut in 1991 were made from June through August, although fishing in January and February was also productive. Entangling nets captured 50% of all halibut taken, followed by trawl (32%), miscellaneous and unspecified gears (10%), and hook and line (8%).

Most of the halibut caught by trawl were taken off central and northern California, whereas most of those caught in entangling nets were taken off southern California. Ex-vessel prices ranged from \$1.00 to \$3.50 per pound, with an average price of \$2.38 per pound. The total value of 1991 landings was estimated at \$2.5 million, compared to \$2.2 million in 1990.

ALBACORE

In 1991, albacore (*Thunnus alalunga*) landings in California totaled 750 tons. This was a 27% decrease from the 971 tons landed in 1990, and only 9% of the 25-year average (7,573 tons; figure 5). The number of California boats that participated in the 1991 fishery decreased 15% from 1990. Fishing success was

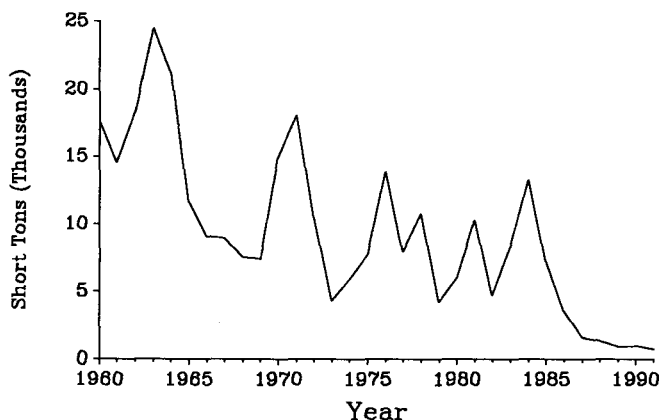


Figure 5. California landings of albacore, 1960-91.

poor compared to past years, with only 47 out of 133 boats landing more than one ton of albacore during the season.

The 1991 season started in mid-July off the Washington coast and progressed north to the Queen Charlotte Islands, Canada. By the end of September, the weather had forced many smaller vessels south, where they fished 100 to 150 miles off the Oregon coast. During October, schools of small albacore were reported 100 miles off the northern California coast. Fishing declined, however, because of the low price for small fish, and most vessels quit for the season.

For those boats that remained active, fishing improved off the California coast from October to November, with vessels making 2- to 3-day trips out of Eureka, Monterey, Morro Bay, and Ventura. The California fleet landed three-year-old (64 cm) and four-year-old (77 cm) fish in August and September, but mostly two-year-old fish (55 cm) were landed towards the end of the season. Vessels averaged about 100 fish per day. The sport fishery was poor and similar to the past few years, with 976 fish (average weight of 14 pounds) caught near San Diego, Los Angeles, Morro Bay, and San Francisco.

The 12th Northern Pacific Albacore Workshop in Shimizu, Japan, was attended by representatives of the California Department of Fish and Game and the National Marine Fisheries Service, Southwest Fisheries Science Center. The status of the international albacore fishery over the last ten years, and the future of the fishery were among the topics discussed.

Pan Pacific cannery and the Western Fishboat Owners Association (WFOA) did not agree on a price for albacore until September. The price was set at \$1,700 per ton for fish heavier than 9 pounds and \$1,000 per ton for lighter fish. The WFOA also agreed to pay a \$100-per-ton shipping fee for fish landed at buying stations. The delay in setting a price was caused by a glut of albacore on the world market. Fishermen selling their catch directly to the public received \$1.00 to \$1.50 per pound.

The 1991 season was the worst on record. Several factors contributed to poor albacore fishing, including the delay in setting a price, and the relatively low prices of the last few years. The general perception among albacore fishermen that international efforts have failed to effectively regulate the Asian drift-net fishery, and their concern about the effect of that fishery on albacore also contributed to a decreased interest in fishing. An apparent shift in the migration path has moved albacore into northern Pacific waters, thus shifting effort and landings away from California. In addition, the albacore population on

both sides of the Pacific seems to be declining, as evidenced by the lack of three- and four-year-old fish. These fish previously made up most of the commercial catch.

RIDGEBACK AND SPOT PRAWN

Ridgeback prawn (*Sicyonia ingentis*) are fished commercially with trawl nets. Ridgeback may be trawled by permit from October 1 through May 31. An incidental catch of 50 pounds is allowed during the closed season. Preliminary landings for 1991 totaled 129,000 pounds, 42% more than the decade's low catch of 91,000 pounds in 1990 (figure 6). Most of this year's catch came from the Santa Barbara Channel. The average ex-vessel price was \$1.25 to \$1.35 per pound.

The spot prawn (*Pandalus platyceros*) is a large shrimp, and commands a higher price than the ridgeback. Spot prawn were caught with traps until the mid 1970s, when trawl nets became the primary gear. Because of an increasing demand for live product, traps have again become preferred.

Spot prawn may be trawled by permit from February 1 through October 31. During the closed period, an incidental catch of 50 pounds is allowed. Trawling in 1991 took place in the Santa Barbara Channel. By trap, spot prawn may be harvested year-round, except for a 5-fathom restriction from Point Conception south to the southern boundary of Ventura County (figure 1). San Clemente and San Nicolas islands have become favored trapping areas. Preliminary landings for 1991 were 305,000 pounds, just 4% lower than last year. Ex-vessel prices ranged from \$3.50 (dead) to as much as \$6.00 (live) per pound.

SEA URCHIN

The California commercial red sea urchin (*Strongylocentrotus franciscanus*) fishery continued to be

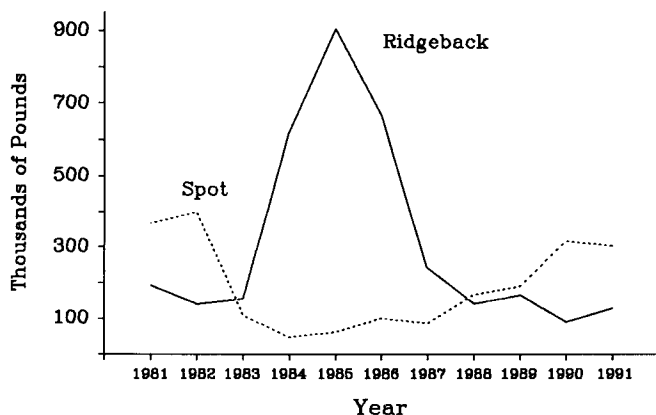


Figure 6. California landings of ridgeback and spot prawn, 1981-91.

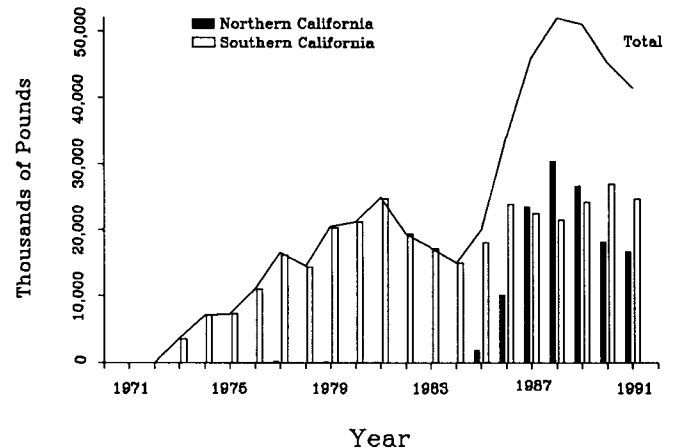


Figure 7. California landings of sea urchins, 1971-91.

among the most important fisheries in the state. Preliminary landings for 1991 reached 41.5 million pounds (figure 7), and were valued at a record \$30 million, despite an actual 8% decline in landings from the previous year. Landings dropped in the south from 27 to 24.7 million pounds (9% decline), and in the north from 18.3 to 16.8 million pounds (8% decline). Among the major northern ports, Fort Bragg (figure 1) registered the most severe reduction in landings, from 13.8 million pounds in 1989 to 4.9 million pounds in 1991. Despite more restrictive regulations enacted in northern California in 1990, including a complete July closure and an increase in the minimum size limit (test diameter) to 3.5 inches, Bodega Bay landings increased from 4.0 million pounds in 1989 to 5.4 million pounds in 1991. This increase was partly attributable to an influx of urchin vessels to the Bodega Bay area as Fort Bragg area stocks declined.

Divers harvest sea urchins using conventional hookah gear, consisting of a low-pressure compressor that feeds air through a hose to the diver's mouthpiece regulator. Harvesting takes place in water 5 to 100 feet deep, with most effort expended at 20 to 60 feet. Analysis of southern California logbook data for 1991 (through October) showed a mean CPUE of 288 pounds per hour, compared to 293 pounds per hour for 1990. This decrease represents a continuing trend over the past few years. Although mean CPUE remained higher in northern California, CPUE in Fort Bragg and Point Arena declined dramatically—about 40% from 1989 to 1991.

The final year of a three-year northern California survey, designed to gather information for more effective management of the fishery, was completed in 1991. Size-frequency distributions and relative abundances were determined at fished and unfished

sites in the Fort Bragg vicinity. Mean densities at Point Cabrillo Marine Reserve fluctuated from 5.4 red urchins/m² to 7.0/m² during summer surveys conducted from 1988 to 1991. Commercially fished sites declined from a high of 2.2 red urchins/m² in 1988 to just 0.3/m² in 1991.

Current management regulations include a 3.0-inch (76-mm) minimum size limit in southern California and a 3.5-inch (89-mm) minimum for northern California. Market sampling continued statewide in 1991, although it was interrupted for part of the year because of decreases in the state budget. The mean size of harvested red urchins in the north was 107 mm. In southern California, the mean size was 92 mm during the second half of 1991, when sampling was done.

During 1991, a review of how regulations are affecting the sea urchin resource was initiated, as required by the California Environmental Quality Act. Additional fishery restrictions are under consideration for 1992, partly in response to a continuing shift of effort to southern California.

RECREATIONAL FISHERY

The California commercial passenger fishing vessel (CPFV) fleet is capable of exploiting any sport-fish resource in ocean waters from Mexico to Canada. Although the fleet generally does not fish north of the Oregon border, considerable activity takes place in Mexican waters, where most fishing is done off northern Baja California, and some as far as 800 miles south of Cabo San Lucas, Baja California. Without access to Mexico, catches of semitropical species such as yellowtail (*Seriola lalandei*) and yellowfin tuna (*Thunnus albacares*) (table 7) would be significantly reduced, since California is the northern edge of their ranges.

The CPFV fleet was adversely affected by environmental conditions during 1991. Abnormally cool water during the summer resulted in fewer passengers and lower catches south of Point Conception (figure 1). This was especially true for CPFVs operating out of San Diego, since few yellowtail or yellowfin tuna were available in waters off northern Baja California. North of Point Conception, salmon (*Oncorhynchus* sp.) anglers were affected by the drought. Fishing was poor in both Monterey and San Francisco, where most salmon angling takes place. However, a few lucky anglers from Fort Bragg north did experience good fishing because of coho salmon produced in Oregon.

A total of 651,000 anglers on CPFVs landed 4.133 million fish in 1991 (table 7). The catch declined 13%, and the number of anglers declined 15% from

TABLE 7
1991 Commercial Passenger Fishing Vessel Catch

| Species/species group | Thousands of fish | Rank |
|-----------------------|-------------------|------|
| Rockfish | 2,015 | 1 |
| Barred sand bass | 484 | 2 |
| Pacific mackerel | 442 | 3 |
| Kelp bass | 317 | 4 |
| Sculpin | 180 | 5 |
| Barracuda | 176 | 6 |
| Pacific bonito | 118 | 7 |
| Halfmoon | 92 | 8 |
| Salmon | 54 | 9 |
| Ocean whitefish | 49 | 10 |
| Lingcod | 49 | 11 |
| Sheephead | 42 | 12 |
| White croaker | 16 | 13 |
| Yellowtail | 14 | 14 |
| Flatfish (misc.) | 11 | 15 |
| Yellowfin tuna | 11 | 16 |
| Pacific hake | 6 | 17 |
| Skipjack | 6 | 18 |
| California halibut | 6 | 19 |
| Blue shark | 5 | 20 |
| Others | 40 | — |
| Total | 4,133 | |

1990. Barred sand bass (*Paralabrax nebulifer*; up 14%) sculpin (*Scorpaena guttata*; up 12%), halfmoon (*Medialuna californiensis*; up 91%) and ocean whitefish (*Caulolatilus princeps*; up 10%) were the only species in the first ten ranks to show increased landings from 1990. Species among the first ten ranks with lower landings in 1991 were rockfishes (down 11%), Pacific mackerel (down 6%), kelp bass (*Paralabrax clathratus*; down 30%), barracuda (*Sphyræna argentea*; down 10%), Pacific bonito (*Sarda chilensis*; down 55%), and salmon (down 41%).

Three semitropical species showed the most dramatic declines in the CPFV landings. The dolphin-fish (*Coryphaena hippurus*) catch dropped 96% in 1991 from a record high of 31,548 fish in 1990. The yellowfin tuna catch decreased by 77%, and yellowtail landings decreased by 80%.

An El Niño event developed in the eastern Pacific in late 1991. If warm water conditions persist and spread north, CPFV angling could significantly improve in southern California. However, there does not appear to be any environmental event that could immediately restore fishing in northern California.

Contributors:

- | | |
|---------------------------------|------------------------------------|
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