

REVIEW OF SOME CALIFORNIA FISHERIES FOR 1997

CALIFORNIA DEPARTMENT OF FISH AND GAME

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In 1997, commercial fisheries harvested an estimated 219,744 metric tons (t) of fishes and invertebrates from California waters, a 7% increase over the 205,493 t harvested in 1996. Preliminary total commercial landings in California were 222,597 t, 6% greater than in 1996. The preliminary ex-vessel economic value of California commercial landings decreased by 9%, to \$168.7 million. Statewide landings by recreational anglers aboard commercial passenger fishing vessels (CPFVs) increased by 17%, to 3,855,900 individual fishes.

The El Niño event of 1997–98 dramatically affected several California fisheries. Elevated water temperatures altered the seasonal availability of several harvested species; this, in turn, caused some fishers to redirect their efforts. Poor weather for fishing, partly resulting from El Niño, was an additional factor. Among the fisheries with suspected El Niño-related declines, none was more dramatic than the fall 1997 southern California market squid fishery. This fishery, usually among the most active and productive in California, was essentially nonexistent because of the almost complete absence of harvestable quantities of squid. This changed the dynamics of the wetfish fishery in California, and was partly responsible for in-

creased landings of other species, especially Pacific mackerel. Other commercial fisheries that declined for a variety of reasons (perhaps including El Niño) were sea urchin, Dungeness crab, white seabass, swordfish, thresher shark, abalone, and ridgeback prawn.

In contrast to these declines, several fisheries increased in 1997, some as a result of El Niño. The continued recovery of the sardine resource suggests that management efforts and industry cooperation are having an effect. Other fisheries with increased landings in 1997 included Pacific mackerel, Pacific herring, groundfishes, shortfin mako shark, and fishes harvested by CPFVs (especially warm-water fishes like yellowtail). Particularly notable was the continued growth of the fishery for live fishes. Efforts by the California Department of Fish and Game (CDFG) to monitor and manage this complex fishery may increase in the future.

PACIFIC SARDINE

Rebuilding of the Pacific sardine (*Sardinops sagax*) fishery continued in 1997, with the year's total landings of 43,632 t ranking highest since the reopening of the directed fishery in 1986 (table 1). The 1997 fishery had

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

Year	Pacific sardine	Northern anchovy	Pacific mackerel	Jack mackerel	Pacific herring	Market squid	Total
1977	5	99,504	5,333	44,775	5,200	12,811	167,628
1978	4	11,253	11,193	30,755	4,401	17,145	74,751
1979	16	48,094	27,198	16,335	4,189	19,690	115,542
1980	34	42,255	29,139	20,019	7,932	15,385	114,764
1981	28	51,466	38,304	13,990	5,865	23,510	133,163
1982	129	41,385	27,916	25,984	10,106	16,308	121,828
1983	346	4,231	32,028	18,095	7,881	1,824	64,405
1984	231	2,908	41,534	10,504	3,786	564	59,527
1985	583	1,600	34,053	9,210	7,856	10,275	63,577
1986	1,145	1,879	40,616	10,898	7,502	21,278	83,318
1987	2,061	1,424	40,961	11,653	8,264	19,984	84,347
1988	3,724	1,444	42,200	10,157	8,677	36,641	102,843
1989	3,845	2,410	35,548	19,477	9,046	40,893	111,219
1990	2,770	3,156	36,716	4,874	7,978	28,447	83,941
1991	7,625	4,184	30,459	1,667	7,345	37,388	88,668
1992	17,946	1,124	18,570	5,878	6,318	13,110	62,946
1993	13,843	1,954	12,391	1,614	3,882	42,708	76,392
1994	13,420	3,680	10,040	2,153	2,668	55,395	85,929
1995	43,450	1,881	8,667	2,640	4,475	70,278	131,391
1996	32,553	4,419	10,286	1,985	5,518	80,360	135,121
1997*	43,632	5,718	20,718	1,160	11,541	70,929	153,158

*Preliminary

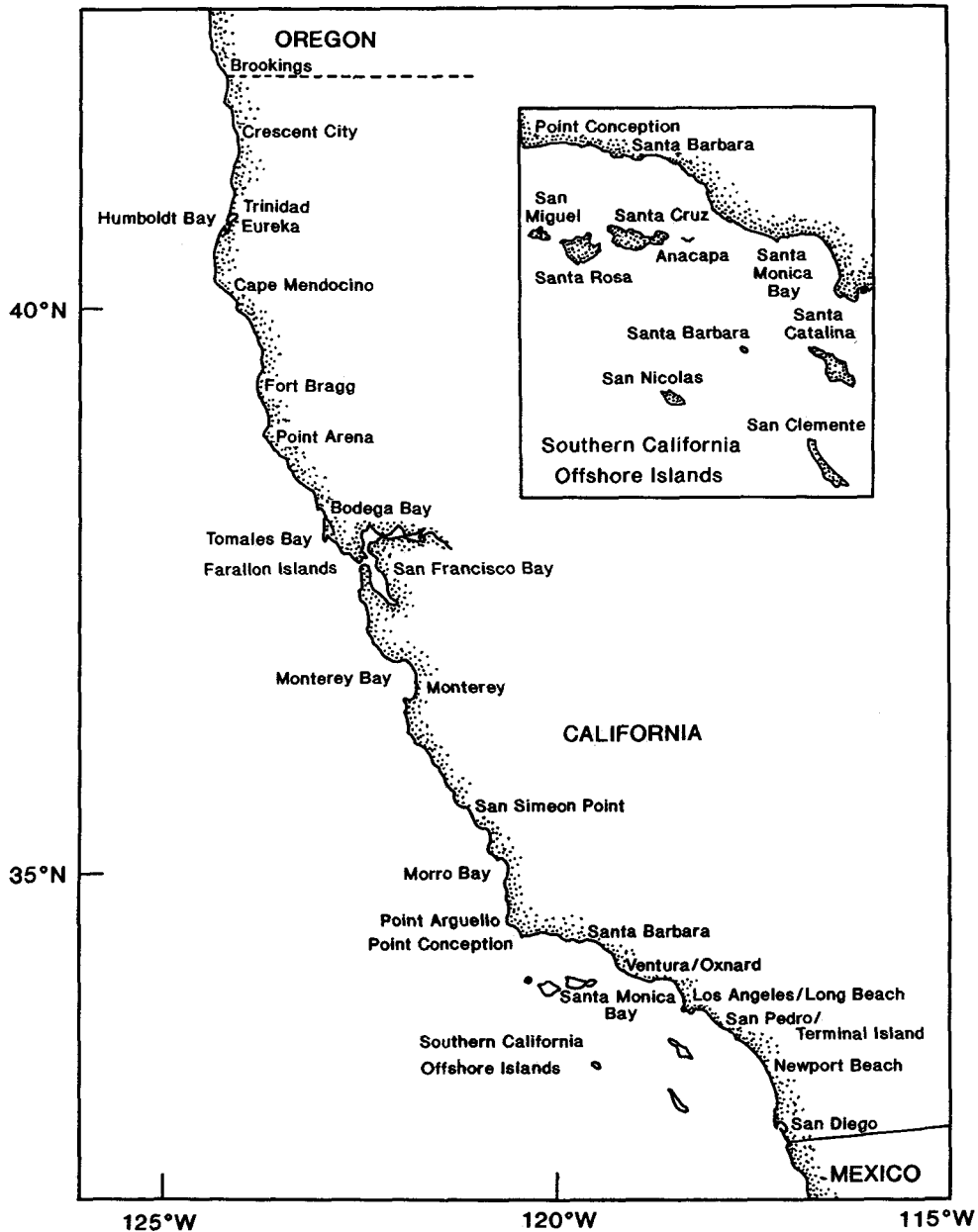


Figure 1. California ports and fishing areas.

an approximate ex-vessel value of \$3.9 million, up from \$3.11 million in 1996. Only 89% of the 1997 quota was landed, and the directed fishery remained open until the year's end.

Fish and Game Code (Section 8150.8) states that annual sardine quotas shall be allocated two-thirds to southern California (south of San Simeon Point, San Luis Obispo County) and one-third to northern California (fig. 1). Based on a 1 July 1996 biomass estimate of 462,664 t, the formula generated an initial 1997 southern fishery quota of 32,658 t, and a northern fishery quota of 16,329 t. In October, CDFG reallocated uncaught quota portions equally between north and

south (table 2). The southern California fishery filled its portion of the reallocation in mid-December, but CDFG did not recommend closure of the southern fishery because only a few weeks remained in the year and several thousand tons were left in the northern allocation. Consequently, 5,336 t of the 1997 allocation was not taken.

Sardine population biomass (age 1+) as of 1 July 1997 was estimated at 421,000 t, based on output from CANSAR (Catch-at-age ANalysis of SARdines model). A forward-casting stock-assessment model, CANSAR produces biomass estimates by incorporating both fishery-dependent and fishery-independent data, including

TABLE 2
 Pacific Sardine Quota Allocations (Metric Tons)
 in California for 1997

	Initial quota	Reallocated quota	Landings
North	16,329	14,349	10,847
South	32,658	14,349	32,785
Total	48,988	28,698	43,632

catch and weight-at-age information, landings data, egg and larval abundance, spawning biomass and area estimates, and spotter pilot observations. In 1997, CANSAR was modified into a two-area model (CANSAR-TAM) to include assumptions about migration and recruitment, and to address effects of net emigration on spawning biomass available to the fishery.

Current regulations give CDFG considerable latitude in setting annual sardine quotas. When biomass is estimated to be more than 20,000 t, Fish and Game Code requires that allowable catch must be consistent with resource rehabilitation. To calculate quotas, CDFG has (since 1996) used a harvest formula originally selected as the preferred option in the draft Coastal Pelagic Species Fishery Management Plan (Amendment 7). Based on the 1997 estimate of total biomass (age 1+), the 1998 sardine fishery opened on 1 January with a quota of 43,545 t for the California fishery. The 1998 quota was 11% less than the 1997 allocation.

Prices paid to fishers (ex-vessel price) for sardines remained relatively low in 1997, but were slightly higher than in 1996. Price ranged from \$70 to \$110 per t, and averaged \$87 per t. Other important target species for the southern California wetfish fleet include Pacific mackerel (*Scomber japonicus*) and market squid (*Loligo opalescens*) in the winter, and tunas during the summer. In northern California, Pacific herring (*Clupea pallasii*) is also an important target species from January to March. Squid and tuna command significantly higher ex-vessel prices than sardines: \$140–\$300 per t for market squid and \$600–\$1,400 per t for tuna. During 1997, sardine landings varied by month due to availability, demand, and fleet participation in other fisheries. Over half of the 1997 sardine landings were made during the fourth quarter of the year, probably driven by lack of market squid availability to the southern California fall-winter fishery.

In 1997, about 89% of sardines landed in southern California were sold to market processors (56% frozen whole bait; 33% fresh fish for human consumption), and the remaining amount was canned for human consumption (6%) or pet food (5%). This ratio has changed dramatically since 1991, when canneries purchased about 75% of the landings. No California landings were used for the production of fish meal.

Besides the wetfish fishery for sardine, a small bait fishery exists that is not subject to a quota, and usually takes less than 5,000 t annually. Live bait ex-vessel prices, more than \$600 per t in 1996, were approximately seven times greater than prices for the directed fishery. In 1997, the ex-vessel value of the sardine live bait fishery was approximately equal in value to the directed fishery.

Approximately 25% of California's sardine landings were exported in 1997, sold primarily (94%) as frozen blocks. In 1997, 10,977 t of sardines were exported, slightly less than the 1996 total of 12,347 t. Export revenues totaled \$5.38 million at approximately \$490 per t. The top four importers of Pacific sardine were Australia (73%), Japan (10%), Malaysia (4%), and China (3%). Australia imports sardines for use as fish food in aquaculture facilities, while Japan supplements its catch to meet consumer demand following the recent decline of its sardine resource. Exports to the Philippines dropped significantly in 1997, despite ranking first in 1995 and second in 1996.

In 1997, the Pacific Fishery Management Council (PFMC) voted unanimously to resubmit a draft Fishery Management Plan (FMP) for coastal pelagic species including Pacific sardine. Recent events have increased the need for federal management of this species. Sardine biomass continues to grow by 30% annually, and commercial fisheries are harvesting sardines off Mexico, California, Oregon, Washington, and Canada. The Council is expected to adopt and send out a draft of the amendment for public review in June 1998.

PACIFIC MACKEREL

Landings of Pacific mackerel (or chub mackerel, *Scomber japonicus*) in California increased significantly in 1997, countering a mid-1990s trend of reduced catches attributed to low biomass and lack of abundance on the traditional fishing grounds. Annual landings in California in 1997 totaled 20,178 t, nearly double the 10,286 t caught in 1996 (table 1). The surge in landings was largely due to increased effort by the wetfish fleet, prompted by the absence of a late fall and winter market squid fishery.

The Pacific mackerel fishing season is specified in the Fish and Game Code as the 12-month period from 1 July through 30 June of the following calendar year. Based on an estimated biomass of 47,173 t on 1 July 1996, an 8,709 t quota was set for the 1996–97 fishery, the lowest allocation in two decades. When total biomass is estimated by CDFG to be greater than 18,144 t but less than 136,080 t, allowable harvest is defined as 30% of the total biomass in excess of 18,144 t.

On 12 March 1997 the season quota was filled, and the directed fishery for Pacific mackerel closed for the first time since 1985, although regulations allowed

incidental landings of mackerel mixed with other wet-fish species. Following the closure, bycatch tolerance was limited to 35% mackerel by weight, resulting in approximately 730 t of mackerel landed incidentally between 12 March and the close of the 1996–97 season on 30 June. Landings for the season totaled 9,787 t, surpassing the 1995–96 season total of 7,615 t, which was the lowest since the commercial fishery reopened in 1977.

Using refinements in assessment methodology such as the age-structured model ADEPT, the 1997–98 quota allocation for mackerel was 22,045 t, based on an estimated biomass of 91.2 t. Landings throughout the summer were consistently higher than in recent years, followed by monthly totals surpassing 4,500 t in both October and November of 1997. Southern California fishers reported generally good availability on the traditional fishing grounds, with many landings at the east end of Catalina Island, and from waters adjacent to the coast from San Pedro to Newport Beach.

During the winter of 1997–98, abnormally high water temperatures associated with an El Niño condition caused a decline in market squid abundance in southern California waters. Consequently, effort that the wetfish fleet would normally have directed toward squid was redirected to Pacific mackerel and sardine. Although closure of the mackerel fishery before 30 June seemed likely (as of April 1998, 20,178 t, or 92% of the quota, had been landed), this did not happen. Total landings for the 1997–98 season approximated the quota.

Nearly 85% of California landings during 1997 were made by the southern California wetfish fleet, with the remainder in the Monterey area. Although no directed commercial fishery for Pacific mackerel exists north of Monterey, it is suspected that the stock has more fully occupied the northernmost portions of its range during recent years in response to a warm oceanographic regime in the northeast Pacific Ocean; schools have been found as far north as British Columbia. There has been notable bycatch of Pacific mackerel in the Oregon and Washington whiting fisheries throughout the 1990s, and interest in developing directed mackerel fisheries in these states is increasing.

The ex-vessel value of the catch of the 1997 Pacific mackerel fishery was approximately \$2.99 million paid to fishers, with a mean price of \$148 per t. Throughout the year, the price paid to fishers ranged from \$66 to \$165 per t, with higher-quality fish in the fall months generating higher prices. Approximately 3,700 t were exported (18.6% of the statewide total landed in 1997), earning approximately \$3.3 million in revenue for California processors. Australia ranked highest among export nations, followed by Japan and Uruguay. Mean export price was approximately \$880 per t.

Age composition of the commercial catch in 1997

changed dramatically, as indicated by routine sampling by CDFG at southern California ports. Over 43% of nearly 3,000 fish sampled were age three or older, compared with only 13% in 1996.

PACIFIC HERRING

Annual statewide landings for Pacific herring (*Clupea pallasii*) were 11,541 t, an increase of 109% from the previous year (table 1). Statewide landings for the roe fishery during the 1996–97 fishing season (December–March) totaled 10,694 t, largest in the history of this fishery. Three gill net platoons (383 permittees) in San Francisco Bay landed 7,774 t, which was 19% under their 9,633 t quota. Twenty-five round haul (purse seine and lampara) permittees in San Francisco Bay landed 2,655 t, exceeding the quota by 1 t. The quota for Tomales Bay was 236 t, and the 39 permittees landed 201 t. The four Humboldt Bay permittees landed 35 t, 35% less than their 54 t quota. Three Crescent City permittees landed 28 t, 4% more than their quota of 27 t.

Ex-vessel prices for herring with 10% roe recovery averaged about \$1,000 per short ton during the 1996–97 fishing season; an additional \$100 per short ton was paid for each percentage point over 10%. Total ex-vessel value of the roe fishery was \$14.7 million, down 26% from last season, but still above the average for the previous eleven seasons (roughly \$11 million).

Eleven permittees participated in the San Francisco Bay herring eggs-on-kelp fishery and harvested 190 t, 27% less than their quota of 260 t. Eggs-on-kelp landings were the largest ever recorded, and nearly double the previous record of 97 t. Total estimated ex-vessel value of the eggs-on-kelp fishery was \$6.3 million, with prices ranging from \$10 to \$20 per pound.

To estimate herring spawning biomass in San Francisco Bay and Tomales Bay, CDFG biologists used hydro-acoustic and spawn-deposition surveys. No surveys were conducted in Humboldt Bay or Crescent City Harbor. The 1996–97 herring spawning biomass estimate for San Francisco Bay was 81,260 t, down 9.5% from last season, but still one of the three highest ever. The large biomass estimate was attributable to very large numbers of three-, four-, and five-year-old fish from the 1994, 1993, and 1992 year classes. The 1994 year class, one of the largest in the history of the fishery, was fully recruited as three-year-old fish this season. The moderately strong 1995 year class represents the fourth consecutive year of successful recruitment for the San Francisco Bay population.

Spawning biomass estimates have fluctuated widely in Tomales Bay since the reopening of the fishery in the 1992–93 season. The 1996–97 spawning biomass estimate was 1,331 t for Tomales Bay, a 30% decrease from the 1995–96 estimate of 1,892 t. The 1996–97 biomass

estimate was below the four-year average of 2,853 t, and well below the 24-season average of 3,968 t. Aside from the weak 1991 year class, other year classes were well represented in the population. Heavy rains beginning in January 1997 reduced bay salinities, which probably inhibited spawning.

A dead-bait-and-animal-food fishery for Pacific herring is usually conducted during the summer in Monterey Bay. However, participation in this fishery was minimal in 1997, with only 45 pounds landed. Increased landings of Pacific sardine in 1997 may have met the demand for dead bait and animal food.

MARKET SQUID

The 1997 market squid (*Loligo opalescens*) fishery suffered as a result of the 1997–98 El Niño event. Nevertheless, market squid remained the state's most valuable commercial fishery. Statewide landings totaled 70,304 t and generated an ex-vessel value of \$20.6 million. This was a 13% decrease from the record landings of 80,360 t in 1996 (table 1).

Two fisheries for market squid exist in California: the southern California fishery, conducted primarily in fall and winter, and the central–northern California fishery, conducted primarily in spring and summer. The southern California fishery has accounted for approximately 90% of the statewide landings for the past several years, and 1997 was no exception: landings in southern California were 61,813 t, 88% of the statewide total. Port Hueneme and Ventura were the most active ports, receiving most of the landings (33,222 t and 9,445 t, respectively). This activity, however, occurred mainly during January–March; the southern California fishery was virtually nonexistent the following fall because of the influence of the 1997–98 El Niño (fig. 2). The average monthly landings in southern California for January–March 1997 were 20,124 t; the corresponding average for 1994–96 was 6,287 t. In contrast, total landings in southern California for October–December 1997 were only about 403 t, dramatically less than the average of 12,641 t for October–December 1994–96.

The 1997 central–northern California squid fishery ended before the 1997–98 El Niño event, and was less affected. This fishery, centered in the southern bight of Monterey Bay, began on the last day of March, and by the end of May a total of 6,078 t had been landed. This two-month period accounted for 72% of the area's annual total of 8,490 t. Landings were made through September, then stopped abruptly in Monterey Bay. A few small landings were made in October and December in ports north of Monterey Bay. This year's pattern of landings was unusual; historically, the annual peak of the central–northern California squid fishery occurs in August.

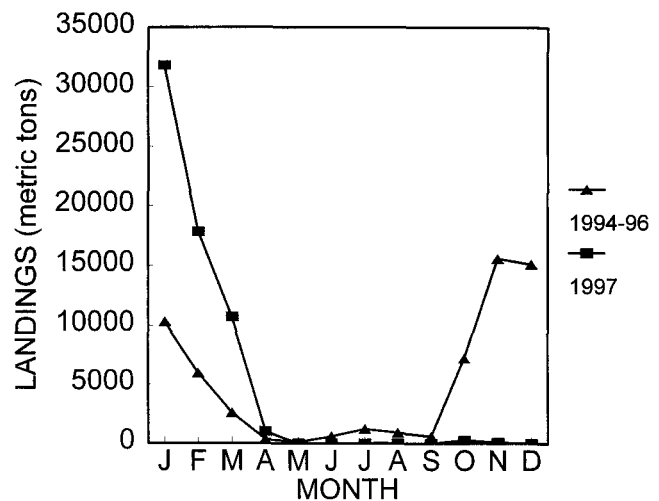


Figure 2. Monthly landings of California market squid during 1997 compared to monthly averages for 1994–96.

A total of 149 boats participated in the 1997 fishery; of these, 120 boats used purse seine and/or brail gear, and the remainder used miscellaneous gears. As in previous years, purse seine boats dominated the fishery, landing over 99% of the statewide total. In central–northern California, 30 vessels used purse seines, the only gear used. In southern California, 106 purse seiners (7 also using brail) landed squid, and 11 other boats landed squid by using brail only. Some boats participated in both regional fisheries.

Annual statewide ex-vessel prices for squid averaged \$265 per short ton. As in many previous years, the ex-vessel price per ton in the Monterey Bay area was the highest in the state: it averaged \$309 and generated a total of approximately \$2.8 million. Ex-vessel prices for squid in the Santa Barbara area averaged \$243 per ton and generated \$11.8 million, while the ports of San Pedro and Terminal Island averaged \$300 per ton and generated \$5.7 million.

Demand for squid on the international market once again stimulated the fishery, with China as the dominant foreign market. But industry representatives reported that the success of the 1996–97 southern California squid fishery, coupled with substantial landings worldwide, resulted in saturation of the Chinese market by the middle of 1997. This was due primarily to the limited cold-storage capacity of most of the coastal Chinese processors. Few, if any, squid cold-storage facilities exist in inland China. As a result, at least one California processor repurchased squid and shipped it to European markets in frozen 25-pound blocks during the second half of 1997. The Japanese market remained steady because it is based primarily on a “presentation” product of one-pound packages of squid.

As in previous years, the 1997 squid fishery was essentially an unregulated, open fishery. However, after several years of effort by some fishers and industry members, Senate Bill 364 (Sher) was passed. Among other provisions, this bill requires that all boats landing more than two tons of squid per trip, and all light boats, buy a \$2,500 annual permit. Funds generated from the sale of these permits for the next three years are to be used by the California Department of Fish and Game for squid research. The bill also mandated that the CDFG submit a report on the status of the squid fishery, with recommendations for a market squid conservation and management plan, to the legislature by 1 April 2001. It also authorized the director to establish a Squid Research Scientific Committee to help develop research protocols, and a Squid Fishery Advisory Committee.

SEA URCHIN

Overall, red sea urchin (*Strongylocentrotus franciscanus*) landings continued to decline from previous years, a trend that has continued since 1988, when landings peaked at 23,577 t. Total 1997 landings decreased by 8% from 1996. Landings in northern California increased by 16%, while they decreased 14% in southern California (fig. 3). El Niño-related warming of seawater had a devastating effect on kelp, the primary food of urchins, in southern California. This, together with poor weather and sea conditions, was responsible for declining catches in southern California. There was a shift of urchin divers from the south to the north, partly because of sea conditions, but also because of the closure of the southern California abalone fishery. Divers with dual permits for abalone and urchin, who usually dive for abalone at the Farallon Islands and Half Moon Bay, shifted to sea urchin and caused an increase of effort in the north. This is reflected in increased landings at Bodega Bay, the southernmost of the northern California ports.

While northern California landings increased in 1997, they made up about 25% of statewide landings. Santa Barbara continued to be the most active port for sea urchin landings, with about 25% of the statewide total. Sea urchins landed there came from coastal southern California and the northern Channel Islands, as did landings at Oxnard, Ventura, and Los Angeles (table 3).

The statewide value of the 1997 fishery declined to about \$15 million, from \$17.1 million in 1996, a 15% decrease. This may be due to lower landings, and also to the current economic situation in Japan. The unit price per kg was about \$1.80, down from \$2.20 in 1995, and caused serious economic hardship for California divers. The number of permits—469—dropped by 50 from 1996 and was the largest drop since 1989.

The outlook for sea urchin is mixed. Detrimental El Niño conditions are likely to dissipate, but the effects

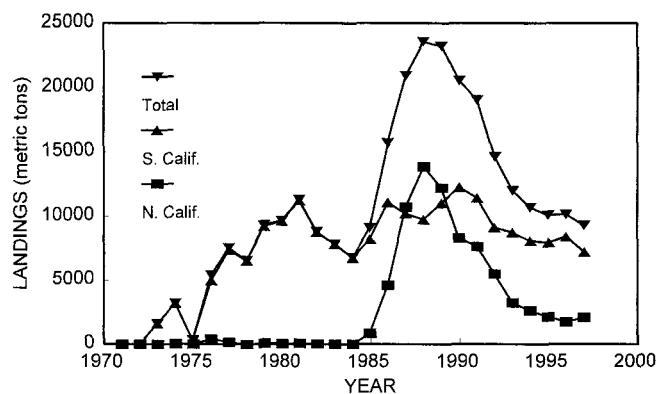


Figure 3. California sea urchin landings, 1970–97.

were severe, and how long it will take the resource to recover is uncertain. Economic conditions in Japan will determine the final value of the fishery. The changing market will adversely affect the California product, because high-quality California sea urchin brings premium prices, which fewer Japanese are able to afford. The market has turned to a lower-quality, lower-cost product for the general consumer market. Finally, the sea urchin fishery is threatened by expanding sea otter populations, which appear to be extending their range to south of Point Conception (as of March 1998) and also northward to a lesser degree. Past experience suggests that most invertebrate fisheries cannot coexist with persistent populations of sea otters.

GROUNDFISHES

The California commercial groundfish harvest for 1997 was 28,932 t, with an ex-vessel value of approximately \$34 million. Total 1997 landings increased 4%,

TABLE 3
Preliminary California Commercial
Red Sea Urchin Landings (Metric Tons) for 1997

Port	Landings	Percentage of statewide catch	Value	Price per kg
Crescent City	28.9	0.4	\$ 30,267	\$1.05
Fort Bragg	646.8	7.9	\$ 1,207,110	\$1.87
Albion	371.5	4.6	\$ 676,531	\$1.82
Point Arena	613.3	7.5	\$ 1,156,224	\$1.89
Bodega Bay	383.1	4.7	\$ 660,919	\$1.73
Half Moon Bay	10.6	0.1	\$ 4,309	\$0.41
N. Calif. subtotal	2,054.2	25.2	\$ 3,735,360	\$1.82
Santa Barbara	2,072.6	25.4	\$ 3,672,377	\$1.70
Oxnard/Ventura	1,693.5	20.8	\$ 3,165,869	\$1.87
Los Angeles	1,868.9	22.9	\$ 3,109,850	\$1.66
Orange County	39.9	0.5	\$ 88,937	\$2.23
San Diego	417.6	5.1	\$ 852,535	\$2.04
S. Calif. subtotal	6,092.5	74.7	\$10,889,568	\$1.79
Grand total	8,146.6		\$14,624,928	

or 1,112 t, from 1996. Dover sole (*Microstomus pacificus*), thornyheads (*Sebastobus* spp.), sablefish (*Anoplopoma fimbria*), rockfishes (*Sebastes* spp.), and Pacific whiting (or Pacific hake, *Merluccius productus*) continued to dominate the harvest. Total landings were similar to those in 1995 and 1996, but the whiting contribution increased sharply while other groups showed modest declines.

Many of the declines shown in table 4 reflect increasingly restrictive Washington-Oregon-California (WOC) landing limitations. This is most apparent for bocaccio: the harvest guideline has been in a step-down mode, and trip limits have been reduced to bring landings in line with lower allowable yields. Nontrawl landings of grenadiers also fell sharply, but in this case, reduced limits on species associated with grenadiers have made the fishery unprofitable.

In 1997, 86% of the groundfishes landed in California were taken with bottom and midwater trawl gear, a slight increase from the 83% observed in 1996. Line gear accounted for 12% of 1997 landings, a decrease from the 15% observed in 1996. The gill and trammel net component stabilized at just under 1% after a steady decline from 5% in 1993. The trap component remained steady at close to 1%.

For 1997, the Pacific Fishery Management Council (PFMC) maintained harvest guidelines (HGs) for Dover sole; shortspine thornyhead (*Sebastobus alascanus*); longspine thornyhead (*Sebastobus altivelis*); the *Sebastes* complex; widow rockfish (*S. entomelas*); yellowtail rockfish (*S. flavidus*); and canary rockfish (*S. pinniger*). Also, commercial harvest guidelines (CHGs) were set for Pacific whiting; sablefish; bocaccio (*S. paucispinis*); and lingcod (*Ophiodon elongatus*). For Pacific whiting and sablefish, CHGs do not include the portion of the total allowable catch assigned to Washington treaty tribes of Native Americans; the CHGs for lingcod and bocaccio exclude the portion set aside for the recreational fishery. These HGs and CHGs were allocated between a limited-entry fleet and open-access fleet; furthermore, the limited-entry allocation for sablefish was divided between the trawl fishery (58%) and nontrawl fisheries (42%). The PFMC used two-month cumulative landing limits in the limited-entry fishery and one-month cumulative landing limits in the open-access fishery, as well as trip limits, to stay within the annual HG or CHG while providing a year-round fishery.

The 1997 California shoreside Pacific whiting fishery began on 15 March; the opening in Oregon and Washington was delayed until 15 June. The directed season for at-sea catcher-processors and vessels delivering to mother ships began on 15 May off Oregon and Washington. A new catch allocation formula, expected to be in effect for five years, was determined by PFMC before the season opening. A CHG of 207,000 t was

TABLE 4
 California Groundfish Landings (Metric Tons) for 1997

Species	1996	1997	Percent change
Dover sole	6,379	5,282	-17
English sole	585	648	11
Petrals sole	817	827	1
Rex sole	502	453	-10
Other flatfishes	995	1,107	11
Widow rockfish	1,060	1,336	26
Bocaccio	478	286	-40
Other rockfishes	5,922	5,667	-4
Thornyhead	3,270	2,754	-16
Lingcod	477	502	5
Sablefish	3,172	2,888	-9
Pacific whiting	2,901	6,332	118
Grenadier	1,133	632	-44
Other groundfishes	129	218	69
Total	27,820	28,932	4

divided among vessels landing at shoreside processing plants (42%), catcher-processors (34%), and vessels delivering to mother ships (24%). Total 1997 WOC-area landings of 207,841 t were just over the CHG. In California, eight midwater trawl vessels fishing off Eureka and Crescent City landed 6,357 t shoreside, an increase over the 2,901 t landed in 1996, but still only 3% of total WOC-area landings. The California salmon bycatch rate was 0.022 salmon per t of whiting, a slight increase from the 1996 rate of 0.008, but well below the 0.05 threshold. All salmon observed were chinook (*Oncorhynchus tshawytscha*). The nonsalmon bycatch rate in observed landings was 5.8 pounds per t, nearly identical to last year's 5.2 pounds per t.

Dover sole, longspine thornyhead, shortspine thornyhead, and trawl-caught sablefish (DTS complex) management was similar to that for 1996. The coastwide Dover sole HG was again set at 11,050 t. The thornyhead HGs for the WOC area north of Point Conception remained at 6,000 t for longspine thornyhead and 1,380 t for shortspine thornyhead. The amount of sablefish allocated to the trawl fishery north of the Point Conception area was 3,803 t.

The coastwide catch of Dover sole was 10,093 t, 957 t under the 1997 HG, and a 2,036 t decrease from 1996 landings. The decreased landings were primarily caused by restrictive management measures, implemented by the PFMC to constrain the take of shortspine thornyhead and trawl-caught sablefish within the DTS complex. California 1997 Dover sole landings of 5,282 t represented a 17% decrease from 1996, and were 52% of total WOC landings (similar to the 53% observed in 1996).

WOC-area landings (north of Point Conception) of longspine and shortspine thornyhead were 4,011 t and 1,323 t, respectively. Shortspine thornyhead landings

were very close to the HG, but longspine thornyhead landings were nearly 2,000 t below the 6,000 t allowable harvest. This reduced harvest demonstrates the difficulties inherent in managing mixed-species fisheries. In this case, landing limits designed to constrain short-spine thornyhead and sablefish catches made it uneconomical to maximize catches of the other species in the complex. California landed 2,754 t (52%) of the total WOC thornyhead catch.

The allocation formula in the Groundfish Management Plan resulted in 2,754 t of sablefish for the limited-entry nontrawl fishery and 463 t for the open-access fishery. In an attempt to eliminate the limited-entry nontrawl sablefish derby, the PFMC initially recommended that a primary fishery be managed as a three-week equal cumulative limit. However, the National Marine Fisheries Service (NMFS) determined that the proposal would be classified as an individual quota, which is prohibited until 1 October 2000 by the Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA). At its June meeting, the PFMC adopted an alternate proposal for a nine-day primary fishery with equal cumulative limits. As in previous years, a mop-up fishery would be established to harvest fish left over. In addition, a sablefish endorsement was required for fishing in the primary fishery. The primary season opened 25 August and closed 3 September, with an equal limit of 34,100 pounds for all vessels. The nontrawl limited-entry sablefish fishery outside of the derby and mop-up fisheries was again managed under a daily limit of 300 pounds north of 36°N latitude, and 350 pounds south of 36°N. The open-access sablefish fishery was limited to daily trip limits of 300 pounds north of 36°N, and 350 pounds south of 36°N. The total nontribal WOC-area catch of sablefish (limited-entry trawl and nontrawl, and open-access) in 1997 was 7,536 t, exceeding the overall 7,020 t CHG by 507 t. California accounted for 2,888 t, or 38%, of the total WOC-area nontribal catch (percentage identical to 1996).

A WOC-area CHG for lingcod was set at 1,500 t, and 900 t was set aside for recreational gear. The 22-inch size limit remained in effect during 1997, with a 100 pound-per-trip trawl allowance for fish under 22 inches. Recreational fishers were limited to three fish per bag and the 22-inch size limit. The total WOC-area commercial lingcod landings of 1,562 t slightly exceeded the 1,500 t CHG. California commercial fishers landed 502 t, or 32%, of the WOC-area commercial allotment. The estimated recreational catch for 1997 was 400 t, considerably less than the amount set aside.

New HGs for the *Sebastes* complex (rockfishes other than widow) were established for the northern area (Vancouver-Columbia) at 6,656 t and for the southern area (Eureka-Monterey-Conception) at 9,284 t. The new

HGs are substantially below the levels of previous years, and near the levels of recent landings. California's commercial *Sebastes* complex landings were 5,953 t in 1997.

Bocaccio are included in the overall *Sebastes* complex HG, but the species has also been managed with a separate HG since 1991. The 1996 bocaccio assessment indicated a dramatic decline in the stock and recommended the allowable biological catch be set at 265 t for 1997. The PFMC recommended a step-down approach and set the southern-area HG at 387 t for 1997, with the intent of moving to a 265 t HG in 1998. The HG was further divided into a CHG of 231 t, and 55 t was set aside for the recreational fishery based on estimated 1996 catches. The 1997 *Sebastes* complex harvest included 286 t of bocaccio, a 40% drop from the 478 t landed in 1996. Another 60 t was estimated to have been caught in the recreational fishery.

In 1997 the PFMC implemented a new stock-assessment review process to improve public participation, increase the level of scientific peer review, and provide a greater separation between the scientific and management processes. New assessments for Dover sole, short-spine thornyhead, longspine thornyhead, sablefish, widow rockfish, and lingcod indicated that immediate and substantial harvest reductions were needed to prevent further stock declines. The PFMC responded with greatly reduced HGs and more restrictive trip limits for 1998.

In 1998, the PFMC will continue to investigate a groundfish industry capacity-reduction program, and the feasibility of a comprehensive groundfish observer program. Amendments to the FMP required by the MSFCMA regarding essential fish habitat, bycatch, and overfishing are scheduled for adoption by the PFMC. Allocations of lingcod and rockfishes within the limited-entry fishery, and between the commercial and recreational fisheries, will also be considered. New assessments are scheduled for chilipepper (*S. goodei*); blackgill rockfish (*S. melanostomus*); Pacific ocean perch (*S. alutus*); black rockfish (*S. melanops*); sablefish; and shortspine thornyhead.

SWORDFISH AND SHARKS

Swordfish (*Xiphias gladius*) landings were 725 t in 1997 (table 5), 10% less than in 1996. During the past decade the drift gill net fishery has accounted for the majority of the catch. This year, 53% of the catch was taken with drift gill nets, down from last year's 60%. Longline landings constituted 37% of the catch. Nine vessels used longline gear outside the U.S. Exclusive Economic Zone (EEZ) and landed swordfish in southern California ports. Only three of these vessels, however, were based in California. As usual, harpoon landings constituted 8% of the catch. Seventy-two percent of the swordfish catch was landed in southern California ports.

TABLE 5
 California Landings (Metric Tons) of Swordfish
 and Selected Shark Species, 1986–1997

	Swordfish	Common thresher shark	Shortfin mako shark
1986	1,749	276	215
1987	1,246	239	274
1988	1,129	250	222
1989	1,296	295	177
1990	851	210	262
1991	711	344	151
1992	1,068	179	97
1993	1,218	162	84
1994	1,165	194	88
1995	796	155	66
1996	803	181	64
1997*	725	169	88

*Preliminary

As expected, gear type affected swordfish ex-vessel prices. Typically, fishers landing drift gill net-caught swordfish received \$3.00 to \$9.00 per pound (averaging \$3.00), whereas longline-caught fish commanded only \$2.00 to \$4.00 per pound (averaging \$2.00). Fishers landing harpoon-caught swordfish received the highest average price of more than \$5.50 per pound, with a range of \$3.00 to \$7.50 per pound.

Landings of common thresher shark (*Alopias vulpinus*) totaled 169 t in 1997 (table 5). This was a slight decrease from 1996. Thresher sharks (*Alopias* spp.) were taken primarily with drift gill nets (81%), followed by set gill nets (14%), and assorted other gears (5%). The greater part (85%) of landings continued to be made in southern California. Typically, ex-vessel prices varied from \$1.00 to \$3.00 per pound, with an average price of \$1.50.

Shortfin mako shark (*Isurus oxyrinchus*) landings in 1997 were 88 t (table 5), an increase of nearly 40%. Most of the catch (80%) was landed in southern California ports, at ex-vessel prices between \$0.30 and \$4.50 per pound, with an average price of \$1.00. Mako sharks were caught primarily by the drift gill net fishery (83%). The remainder of the catch was landed with set gill nets (4%), hook and line gear (3%), longline vessels operating outside the EEZ (2%), and as incidental catch with other gears (8%).

LIVE FISHES

The 1997 statewide landings of live nearshore finfishes were estimated at 617 t, 10% more than in 1996 (fig. 4). Sixty-eight different species of fishes were landed in live form, and had an ex-vessel value of over \$3.9 million. Field observations suggest that documented landings underestimate the activity of this fishery. Additionally, many fishes intended for the live-sale market did not survive the rigorous process of capture, transport, and de-

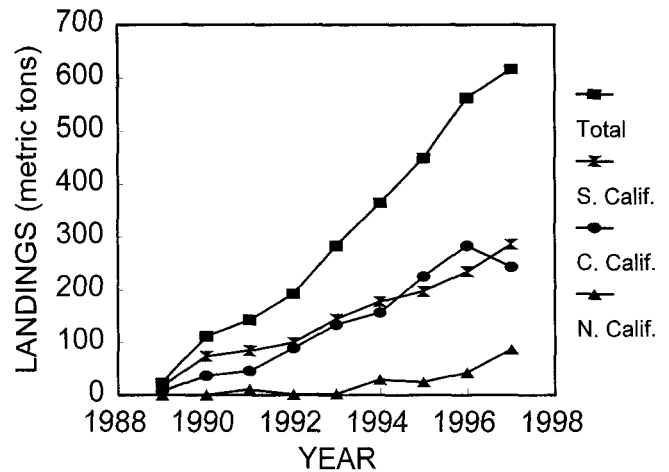


Figure 4. California landings of live fishes, 1989–97.

livery, and were sold as fresh (dead) fishes at reduced prices. These landings, and those of premium-quality fresh fishes (sold at live prices) were not included in estimates of live-fish landings because of the difficulty of collating data. The market for premium-quality nearshore finfishes has evolved to include a variety of options for product delivery, but the origin and ultimate destination of these fishes remains the same. All of these landing options should be considered when attempting to accurately describe current demand. This complex fishery continues to evolve as market interest, fishing success, and participants change, and as new ways to access previously inaccessible fishing grounds are developed.

Ex-vessel prices ranged between \$0.50 to \$9.00 per pound, with the average price about \$3.00 per pound. Larger fishes were popular “large party” specialties at local restaurants. Prices fluctuated with market demand, fish size and condition, and fishing and weather conditions. Hook and line gear were used to capture 63% of the live fish landed statewide; trap gear landed 26%. These values were consistent with those for 1995 and 1996.

Fishing activity in northern California (Sonoma County northward) increased markedly as live-fish landings totaled 87 t, 102% more than in 1996 (fig. 4). As previously, most landings were made with a variety of hook and line gears, but trapping gained in popularity (table 6). The number of fishers making at least one live-fish landing virtually doubled from 1996 (from 71 to 140), as urchin divers reported a downturn in urchin prices and sought a more profitable fishery (table 7). Landings of the original target species continued to climb: rockfishes (*Sebastes* spp.); cabezon (*Scorpaenichthys marmoratus*); and lingcod (*Ophiodon elongatus*) increased 37%, 115%, and 165%. Landings increased for principal species of rockfishes: 82% for China (*Sebastes nebulosus*); 132% for gopher (*S. carnatus*); and 393% for grass (*S. rastrel-*

TABLE 6
Percentages of Annual Landings of Live Fishes
by Gear Type in 1996 and 1997

Gear type	Northern California		Central California		Southern California	
	1996	1997	1996	1997	1996	1997
All line	98	97	82	80	34	39
All trap	1	3	14	18	35	39
All trawl	<1	<1	4	2	15	10
All net	0	<1	<1	<1	15	11
All dive	<1	0	<1	<1	1	1

liger). Copper (*S. caurinus*) was the only targeted rockfish with reduced landings (72% of 1996). Statewide fluctuations in landings of rockfishes may be partly due to misidentifications of species on the landing receipts; this possibility is enhanced by markets that prefer to sort their catch by size and condition rather than by species. A dramatic increase of fishing effort was recorded for kelp greenling (*Hexagrammos decagrammus*), as landings grew sevenfold over 1996.

Central California fishers landed 244 t of live fishes, a decrease of 16% from 1996 (fig. 4). Although landings of virtually all target species including rockfishes, cabezon, lingcod, and California halibut (*Paralichthys californicus*) declined, the central coast remained the hub of live rockfish activity; 70% of all rockfishes in California were delivered primarily to Morro Bay and Avila-Port San Luis. Diminished landings of specific rockfishes such as gopher, copper, and grass were also recorded. Kelp greenling was the only market category that increased. Hook and line gear were employed to harvest 80% of the region's live catch, with the predominate device being the "fishing stick." This small, lightweight device consists of weighted plastic tubing or rebar with hooked leaders and a buoy attached. Trapping operations showed only a modest increase from 1996. The anticipated influx of trappers displaced by the full implementation of the limited-entry program for finfish trapping in southern California never materialized.

Live-fish landings in southern California (Santa Barbara southward) totaled 286 t, 22% more than in 1996 (fig. 4). Target species included California sheephead (*Semicossyphus pulcher*); California halibut; cabezon; California scorpionfish (*Scorpaena guttata*); rockfishes; and

thornyheads (*Sebastolobus* spp.). Line and trap gear each accounted for approximately 39% of the landings; line users focused on nearshore rockfishes and cabezon; users of trap gear primarily targeted California sheephead. Trapping accounted for 84% of all live sheephead delivered to market, over half of the catch coming from the Santa Barbara-Ventura area (including the northern Channel Islands). The number of trappers making at least one landing of live fishes declined precipitously in 1997 (from 285 to 185), as did fish trap permittees (from 316 to 195). The impending limited-entry program apparently fueled the flurry of trapping and permit purchases in 1996, as fishermen secured their future participation in the fishery. Increases in estimated landings were recorded for California sheephead, California scorpionfish, cabezon, sablefish (*Anoplopoma fimbria*), and thornyheads. However, landings declined for rockfish and California halibut.

Legislation that would further restrict the fishery for live finfishes is pending. In addition, more restrictive federal groundfish regulations now apply to many of the target species such as rockfishes, thornyheads, lingcod, and sablefish. Innovative management options are currently being evaluated by the CDFG to improve conservation of the nearshore ecosystem.

ABALONE

The commercial and recreational abalone fishery in central and southern California was closed to all fishing under emergency action by the Fish and Game Commission in May 1997. Legislative action under Senator Thompson's SB463 extended the closure indefinitely in January 1998. Under the new legislation, the Fish and Game Commission may lift all or part of the closure following completion and acceptance of a detailed Abalone Recovery and Management Plan (ARMP) to be prepared by the Department of Fish and Game on or before 1 January 2003. The ARMP requires scientifically valid evidence of a broad recovery before reopening any of the closed abalone species to harvest.

Commercial landings for red abalone (*Haliotis rufescens*) totaled 50 t, or about half the 102 t landed in 1996. Landings were concentrated in March as fishing effort increased in anticipation of the May moratorium. The Commission and the legislature chose to allow continued

TABLE 7
Number of Participants Making at Least One Live-Fish Landing, by Region, 1989-1997

Region	1989	1990	1991	1992	1993	1994	1995	1996	1997*
Northern California	16	16	20	18	13	45	12	71	140
Central California	26	70	171	273	356	428	356	378	349
Southern California	34	104	82	151	246	315	285	405	361

Note: Some fishers operate in more than one region.

* Preliminary

recreational red abalone harvest north of San Francisco. This action was based on fisheries-dependent and independent data indicating that a sustainable fishery for red abalone still exists in this area.

Laboratory transmission studies indicate that withering syndrome, first observed in black abalone populations, has tentatively been identified as a rickettsiales-like bacteria. Studies continue. Experiments are also being conducted on antibiotics that may be used to treat cultured abalone. DNA-based probes using polymerase chain-reaction technology are being developed to compare the 16S gene sequences of known rickettsiales organisms with organisms observed in symptomatic abalone.

White abalone (*Haliotis sorenseni*) was added to the candidate species list by NMFS. Pending a status review, further action may be initiated. Recent scuba diving and Delta submarine surveys indicate that current population densities are far too low for recovery. Recent densities were one abalone per hectare, compared with historic densities of about one abalone per square meter. Recovery of this abalone may require extensive human intervention.

DUNGENESS CRAB

California Dungeness crab (*Cancer magister*) landings during the 1996–97 season totaled 1,809 t, a decrease of 5,052 t from the previous season, and well below the ten-year average of 4,226 t. These were the lowest landings in 22 years.

In northern California, the crab season opened on 1 December after a price settlement of \$1.35 per pound. The low volume of crabs was followed by escalating prices, which reached \$4.00 per pound by the end of the season. A fleet of 498 vessels landed approximately 995 t in northern California, including 383 t at Crescent City, 182 t at Trinidad, 357 t at Eureka, and 73 t at Fort Bragg.

San Francisco–area Dungeness crab fishing opened on 15 November, with fishers settling on a price of \$1.75 per pound. Total crab landings decreased by only 80 t from the previous season, to 779 t. Crab fishers landed 249 t at Bodega Bay, and 530 t at ports in San Francisco Bay and Half Moon Bay. Monterey and Morro Bay contributed 35 t to the statewide landings.

The California legislature passed SB 144-Thompson which provides that no person shall take Dungeness crab for commercial purposes in the area from the Oregon border to the Mendocino–Sonoma county line (Districts 6, 7, 8, 9) for 30 days after the opening of Dungeness crab season if there has been a delay in the opening, and if the person has taken Dungeness crab from ocean waters outside of those specified districts before the opening of the season in Districts 6, 7, 8, or 9. The bill also provides that no person shall take Dungeness crab for

commercial purposes in ocean waters off Washington, Oregon, or California for 30 days after the opening of the season off these states if both of the following have occurred: (1) the opening of the season has been delayed in Washington, Oregon, or California, and (2) the person has taken crab for commercial purposes in either of the two other states before the delayed opening in the ocean waters off any one of the three states. This “reciprocity” legislation was requested by the Tri-State Dungeness Crab Committee to prevent pulse fishing in association with season-opening delays during years when crabs are soft-shelled.

In MSFCMA of 1996, the U.S. Congress urged the PFMC to develop a fishery management plan for Dungeness crab. The PFMC reviewed an analysis of options for management of Dungeness crab, and heard a report from the Tri-State Dungeness Crab Committee (whose membership includes shellfish biologists and industry representatives from California, Oregon, and Washington). The committee recommended that the PFMC suggest language for the MSFCMA that amends the current interim authority given to California, Oregon, and Washington. Currently, the interim authority extends the states’ management authority to the EEZ over season opening and closing dates, and size and sex restrictions, but excludes limited-entry programs. In addition, the proposed language would prevent harvesting and processing of Dungeness crab in the EEZ by a vessel without a permit issued by California, Oregon, or Washington. The PFMC unanimously passed this option in September 1997 in lieu of developing a fishery management plan. Congressional legislation was subsequently proposed for an amendment to the MSFCMA, because the current interim authority expires in October 1999.

SPOT AND RIDGEBACK PRAWN

Preliminary 1997 ridgeback prawn (*Sicyonia ingentis*) landings totaled 174 t. This represented a 37% drop in landings from the 275 t landed in 1996 (fig. 5). Ridgeback prawn are taken exclusively by trawl nets, and there is a closed season from 1 October through 31 May, when an incidental catch of 50 pounds is allowed. All of the 1997 landings were made in southern California ports, and over 95% of all ridgeback prawn were caught within the Santa Barbara Channel. The proportion of ridgeback prawn landed live has increased greatly since 1994. In 1997, the ex-vessel prices were \$2.00 per pound for live prawn, and \$1.30 per pound for dead prawn. The average ex-vessel price in 1997 increased to \$1.80 per pound from \$1.33 per pound in 1996; this increase resulted from the greater proportion of higher-priced live ridgeback prawn in the catch (66%, versus 44% in 1996).

Preliminary 1997 spot prawn (*Pandalus platyceros*) landings were 343 t, a 41% increase over the 244 t landed

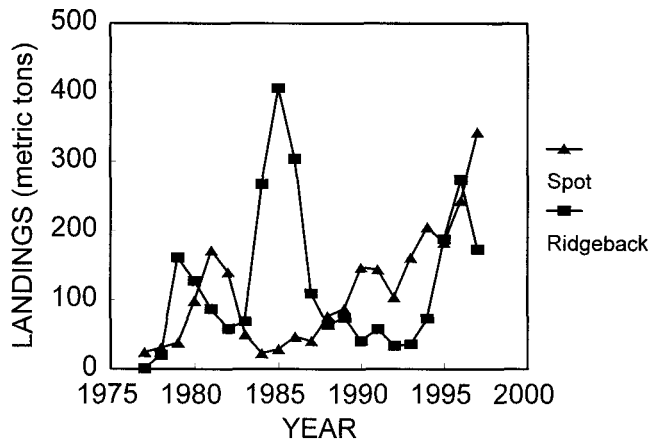


Figure 5. California spot and ridgeback prawn landings, 1977-97.

in 1996. Landings of spot prawn have followed a ten-year upward trend (fig. 5). Spot prawn are caught with both trap and trawl gear. In 1997, 143 vessels (68 trap and 75 trawl) made landings; table 8 shows types of gear and landings for spot prawn by port area. Over 45% of the combined trap and trawl spot prawn landings in 1997 were made in the Santa Barbara area. In the past, boats using trap gear dominated the fishery, but since the mid-1970s the number of boats using trawl gear has increased, and their landings now dominate. Approximately 257 t of spot prawn were harvested by trawl in 1997, while 86 t were taken with trap gear (table 8).

The larger spot prawn commanded a much higher ex-vessel price than the ridgeback, averaging \$6.00 per pound. This represented a decrease of \$0.77 from 1996. The decrease in average price was partly a result of the increased supply of spot prawn that, at times, exceeded market demand. Also, because 75% of the spot prawn landings were made with trawl gear, which tends to cause mortalities, a larger portion of the catch was landed dead and sold at a lower price. Live spot prawn had an average ex-vessel price of \$7.50 per pound, whereas dead spot prawn averaged \$4.50 per pound. Thirty-eight

percent of trawled spot prawn were sold as dead product, while just 9% of trapped spot prawn were sold as dead product.

During 1997, the trap and trawl spot prawn permit fisheries in southern California (south of Point Arguello) operated under nonconcurrent closures; the trap closure between 15 January and 31 March, and the trawl closure between 1 November and 16 January. To provide more protection for gravid female spot prawn, regulations were enacted in 1997 that changed the southern California trap and trawl seasonal closures; they will run concurrently between 1 November and 31 January, beginning in 1998.

OCEAN SALMON

In 1997, the PFMC enacted restrictive commercial and recreational ocean salmon regulations in California to (1) protect endangered Sacramento River winter chinook (*Oncorhynchus tshawytscha*) and Snake River fall chinook; (2) ensure fall chinook spawner escapement goals for Klamath, Sacramento, and Oregon coastal rivers; and (3) protect depressed coho (*Oncorhynchus kisutch*) stocks coastwide. Among the regulations were reduced seasons and specific gear restrictions for the area between Horse Mountain and Point Conception. Under authority of the Endangered Species Act, NMFS required the PFMC to take specific action to reduce harvest impacts on the endangered Sacramento River winter chinook to increase spawning escapement by 31%.

In 1997, commercial fishing for ocean salmon (all species except coho) in California was allowed coastwide from 1 May to 30 September with various time and area closures. The minimum size limit was 26 inches total length (TL). Approximately 2,360 t (487,500 fish) of dressed chinook were landed by commercial trollers who fished approximately 18,700 days (fig. 6). Ex-vessel prices for dressed salmon averaged \$1.38 per pound, and total ex-vessel value exceeded \$7.2 million.

Recreational fishing regulations in California were less restrictive than in 1996, with various time and area

TABLE 8
 1997 California Spot Prawn Landings (Metric Tons) by Port Area and Gear Types

Port areas	Number of fishing vessels by gear type		Spot prawn landings			Percentage of Total
	Trap	Trawl	Trap	Trawl	Totals	
Eureka	3	7	0.9	10.9	11.8	3.4
San Francisco	6	18	4.9	87.3	92.2	27.0
Monterey	6	10	19.3	14.9	34.2	10.0
Santa Barbara	10	37	18.5	141.5	160.0	46.6
Los Angeles	25	3	25.5	2.5	28.0	8.0
San Diego	18	0	16.9	0	16.9	5.0
Totals	68	75	86.0	257.1	343.1	100.0

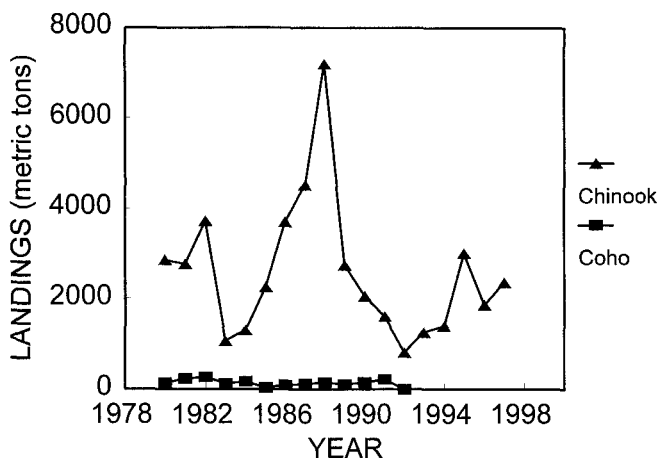


Figure 6. California commercial salmon landings, 1980–97.

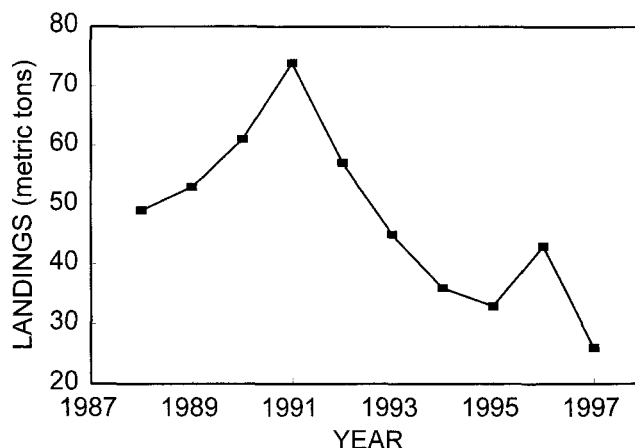


Figure 8. California commercial white seabass landings, 1988–97 (California and Mexican waters).

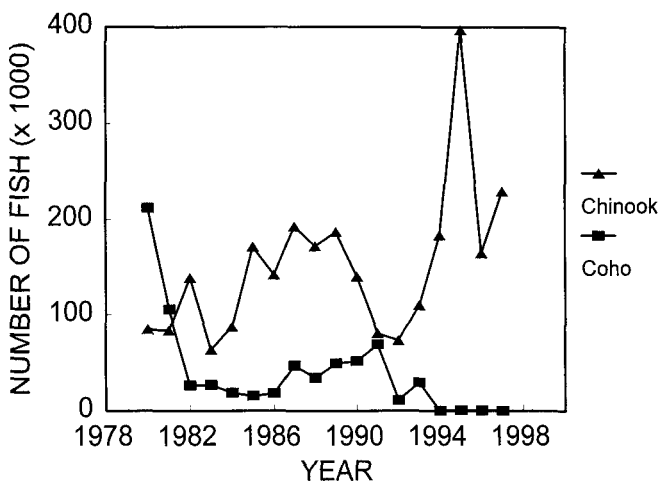


Figure 7. California recreational salmon landings, 1980–97.

closures (15 February–16 November). Statewide recreational landings increased by almost 40% compared to the previous year (fig. 7), totaling 228,900 chinook during 234,300 angler trips (catch per unit angler = 0.98). Anglers were limited to two salmon per day (all species except coho), with a minimum size limit of 24 inches TL, except from 1 July to 1 September between Point Reyes and Pigeon Point, where anglers were required to keep the first two salmon regardless of size. After 1 September, anglers fishing with bait between Horse Mountain and Point Conception were required to use circle hooks and 1 pound or less of weight.

In the Klamath Management Zone (KMZ: Horse Mountain, California, to Humbug Mountain, Oregon) season management, rather than quotas, continued, with fewer fishing days because of reduced abundance of Klamath fall chinook. In the KMZ, three separate seasons were enacted: 24 May–30 May, 17 June–6 July, and 12 August–14 September, open all days of the week.

The bag limit was one salmon per day (all species except coho) with no more than four fish in seven consecutive days; a 20-inch TL limit existed north of Horse Mountain. In the California portion of the KMZ, anglers landed 9,000 chinook salmon during 19,000 trips made mostly on private skiffs.

WHITE SEABASS

The 1997 white seabass (*Atractoscion nobilis*) commercial catch was 26 t, with an ex-vessel value of \$127,270. This was a 40% decrease from the 43 t landed in 1996 (fig. 8). While most of the commercial catch was taken from southern California waters, 5 t came from fishing areas off San Francisco, Monterey, and Morro Bay. Early in the century, the center of the commercial fishery was off San Francisco, but by the mid-1910s the fishery had shifted to south of Point Conception. The 1997 take of white seabass in central and northern California waters probably reflected the strong El Niño event that resulted in elevated sea-surface temperatures along much of California's coast. White seabass is considered a stenothermal species that prefers warmer water, and is generally most abundant south of Point Conception. The ten-year average take by commercial vessels is 48 t. Set and drift gill nets were the reported method of take for 84% of the catch in 1997, while hook and line gear took 12%. Trawl, seine, and miscellaneous gears took the remainder of the catch. Commercial regulations prohibited take of white seabass in California waters south of Point Conception between 15 March and 15 June. In 1997, 72% of the commercial landings were between 16 June and the end of August. The average ex-vessel value was \$2.27 per pound.

Recreational landings reported on commercial passenger fishing vessel (CPFV) logs increased to 2,017 fish in 1997, compared with 1,452 fish in 1996 (fig. 9). Most of the fish were caught in southern California. The ten-

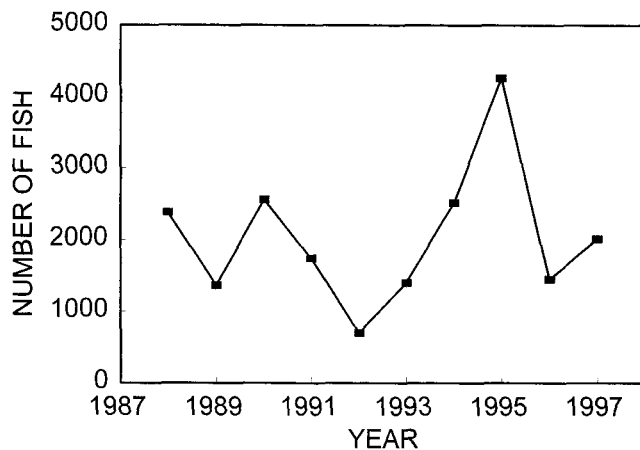


Figure 9. Landings of white seabass by California CPFVs, 1988-97 (California and Mexican waters).

year average number of white seabass taken by CPFVs is 2,057.

The Ocean Resources Enhancement and Hatchery Program, created in 1983 as part of a long-term program to determine if hatchery-produced fish can augment wild stocks, produces juvenile white seabass that are released into the ocean. The fish are raised to approximately three inches at the hatchery, injected with a coded-wire tag, then transported to grow-out pens along the coast. Volunteers then raise the fish to approximately nine inches. At that size, 10% receive an external anchor tag, and all the fish are released either at the pen site or nearby. In 1997, 57,800 hatchery-produced fish were released at eleven coastal sites. Information from tag returns is used to determine habitat preference for the juvenile fish.

RECREATIONAL FISHERY

Southern California

In southern California, saltwater recreational fishing with hook and line gear is conducted from private vessels, piers, shorelines, and CPFVs. Specific information about many of these recreational fisheries is difficult to collect. However, CDFG maintains a large database gathered from mandatory logbook information supplied by CPFVs. Much of our knowledge of recreational fishing in southern California is based on these data. Landings by CPFVs represent approximately 40% of the total landings by recreational fishers.

Traditionally, the taxa targeted by CPFVs in southern California and Baja California waters include Pacific barracuda (*Sphyraena argentea*); serranids, or sea basses (*Paralabrax clathratus*, *P. nebulifer*); scorpaenids, or scorpionfishes (*Scorpaena guttata*, *Sebastes* spp.); scombrids, or mackerels, tunas, and wahoo (*Acanthocybium solandri*, *Katsuwonus pelamis*, *Sarda chiliensis*, *Scomber japonicus*, *Thunnus alalunga*,

T. albacares); California halibut (*Paralichthys californicus*); ocean whitefish (*Caulolatilus princeps*); white seabass (*Atractoscion nobilis*); yellowtail (*Seriola lalandi*); halfmoon (*Medialuna californiensis*); and California sheephead (*Semicossyphus pulcher*). The taxa being targeted can vary with season, and also by year. Occasionally, El Niño conditions greatly increase the southern California availability of species normally found off Mexico; 1997 was such a year. Typically, CPFVs are quick to exploit these opportunities to catch subtropical species.

In 1997, 630,669 anglers aboard CPFVs landed 2,883,462 fishes south of Point Conception (table 9). The number of reporting CPFVs was 238. The number of fishes landed represented 75% of the total landings by CPFVs statewide (3,855,900 individuals). The number of fishes landed statewide was 17% greater than in 1996; landings in southern California increased by 13%. Angler participation in southern California rose by 28% over 1996, and represented 79% of angler participation statewide.

As in 1996, 1997 landings of barred sand bass in southern California exceeded those of all other species (table 9). However, the number of individuals landed decreased by 19% from the previous year. Next in rank was yellowtail, which showed a sixfold rise in landings over 1996. This remarkable increase was related to the 1997-98 El Niño event, which produced a great year for southern California anglers who love to fish for *Seriola lalandi*. Among the other species with increased landings, none was more spectacular than albacore, which rose 133-fold over 1996. Additional species with notably elevated landings included Pacific barracuda, Pacific bonito, yellowfin tuna, dolphinfish, skipjack tuna, bluefin tuna, California halibut, blacksmith, and white seabass. Several of these increases were associated with the warm waters of El Niño. The species with the largest decrease in landings was white croaker (-64%), which dropped in rank from twelfth in 1996 to seventeenth.

Northern California

Traditionally, CPFV anglers along the California coast north of Point Conception target rockfishes (*Sebastes* spp.); salmon (*Oncorhynchus* spp.); lingcod (*Ophiodon elongatus*); and, opportunistically, albacore (*Thunnus alalunga*). Cabezon (*Scorpaenichthys marmoratus*) and other nearshore species are also taken. California halibut (*Paralichthys californicus*); striped bass (*Morone saxatilis*); sturgeon (*Acipenser* spp.); and leopard shark (*Triakis semifasciata*) are primarily taken from San Francisco Bay. In 1997, warm oceanic water related to the El Niño event provided some unusual fishing opportunities.

In 1997, 164,356 anglers caught 972,438 fishes, a 31% increase in landings over 1996 (table 10). This increase was primarily due to increased landings of the top five

TABLE 9
 Southern California CPFV Landings (Number of Fishes) in 1997 and 1996

Species/species group	1997 landings*		1996 landings		Percent change
	Number	Rank	Number	Rank	
Barred sand bass	489,422	1	604,132	1	-19
Yellowtail	398,248	2	66,763	10	+497
Rockfishes, unspecified	397,094	3	455,040	2	-13
Kelp bass	335,043	4	282,673	4	+19
Pacific barracuda	334,552	5	271,856	5	+23
Pacific (chub) mackerel	224,694	6	329,146	3	-32
California scorpionfish	141,312	7	119,492	6	+18
Pacific bonito	102,423	8	72,664	8	+41
Yellowfin tuna	89,016	9	72,449	9	+23
Ocean whitefish	87,367	10	108,282	7	-19
Albacore	71,503	11	536	—	+13,240
Halfmoon	51,082	12	43,555	11	+17
Dolphinfish (dolphin)	28,606	13	21,939	14	+30
California sheephead	25,772	14	23,450	13	+10
Skipjack tuna	19,156	15	6,356	17	+201
Flatfishes, unspecified	9,602	16	11,052	15	-13
White croaker	9,332	17	25,654	12	-64
Bluefin tuna	7,959	18	2,477	22	+221
California halibut	7,878	19	5,829	18	+35
Blacksmith	7,245	20	4,926	20	+47
Lingcod	6,444	21	6,970	16	-8
Jack mackerel	5,481	22	5,403	19	+1
Wahoo	3,844	23	3,680	21	+4
White seabass	2,010	24	1,448	24	+39
Cabezon	1,468	25	1,501	23	-2
All others	26,909	—	9,635	—	—
Total number of fishes	2,883,462		2,556,372		+13
Number of anglers	630,669		494,091		+28
Reporting CPFVs	238		208		+14

* Preliminary

TABLE 10
 Central and Northern California CPFV Landings (Number of Fishes) in 1997 and 1996

Species/species group	1997 landings*		1996 landings		Percent change
	Number	Rank	Number	Rank	
Rockfishes, unspecified	769,598	1	621,070	1	+24
Chinook (king) salmon	110,338	2	60,650	2	+82
Lingcod	30,624	3	22,764	3	+35
Albacore	16,538	4	1,337	9	+1,137
Pacific mackerel	16,253	5	6,094	6	+167
California halibut	7,966	6	13,263	4	-40
Striped bass	6,926	7	6,096	5	+14
Jack mackerel	3,642	8	1,226	10	+197
Flatfishes, unspecified	3,616	9	2,285	7	+58
Cabezon	1,664	10	1,502	8	+11
White croaker	562	11	669	11	-16
Shark, unspecified	439	12	363	12	+21
Sturgeon, unspecified	429	13	308	13	+39
Leopard shark	285	14	179	14	+59
Ocean whitefish	146	15	88	15	+66
Pacific barracuda	105	16	3	18	+3,400
California sheephead	16	17	5	16	+220
Bluefin tuna	15	18	1	—	+1,400
White seabass	7	19	4	17	+75
Skipjack tuna	5	20	0	—	—
Blue shark	3	21	4	17	-25
Dungeness crab	7,148	—	—	—	—
Rock crab	3,939	—	—	—	—
Jumbo squid	686	—	—	—	—
All others	3,261	—	651	—	+401
Total number of finfishes	972,438		738,563		+32
Number of anglers	164,356		138,145		+19
Reporting CPFVs	129		121		+7

* Preliminary

species or species groups. The largest increases in landings among the top ten species or species groups were albacore; Pacific (chub) mackerel (*Scomber japonicus*); chinook (king) salmon (*Oncorhynchus tshawytscha*); and jack mackerel (*Trachurus symmetricus*). Changes in annual landings may reflect shifts in effort among preferred species, or changes in species availability, such as with albacore, Pacific mackerel, and jack mackerel (rather than actual changes in abundance). As in 1996, recreational anglers were not allowed to take coho (silver) salmon (*Oncorhynchus kisutch*).

Warm oceanic water near the coast was responsible for high albacore landings (1,137% over 1996), which increased dramatically from the low levels observed since 1986. Some albacore were taken within 5 miles of shore, but most were caught between 15 and 40 miles offshore. Other species associated with the unusually warm water were Pacific bonito (*Sarda chiliensis*); bigeye tuna (*Thunnus obesus*); bluefin tuna (*Thunnus thynnus*); skipjack tuna (*Katsuwonus pelamis*); jumbo squid (*Dosidicus gigas*); and Pacific mackerel.

Significant landings of crab and squid were reported in 1997. CPFVs caught 11,087 Dungeness (*Cancer magister*) and rock (*Cancer antennarius*) crabs in conjunction with fishing for rockfishes, mainly from the ports of Bodega Bay (76% of landings) and Trinidad (19%). In

1993, CPFVs (primarily from the Bodega Bay area) began running "crab combo" trips on which crab traps were set prior to fishing for rockfishes and lingcod, then pulled at the completion of fishing for the day. Bodega Bay CPFVs targeted giant squid when they became abundant late in the year; 686 were caught.

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