

REVIEW OF SOME CALIFORNIA FISHERIES FOR 1998: PACIFIC SARDINE, PACIFIC MACKEREL, PACIFIC HERRING, MARKET SQUID, SEA URCHIN, GROUNDFINCHES, SWORDFISH, SHARKS, NEARSHORE FINFISHES, ABALONE, DUNGENESS CRAB, PRAWN, OCEAN SALMON, WHITE SEABASS, AND RECREATIONAL

CALIFORNIA DEPARTMENT OF FISH AND GAME

Marine Region
8604 La Jolla Shores Drive
La Jolla, California 92037-1508
khill@ucsd.edu

In 1998, commercial fisheries harvested an estimated 116,069 metric tons (t) of fishes and invertebrates from California waters, a 47% decrease from the 219,497 t harvested in 1997. Preliminary total commercial landings in California were 129,328 t, 42% lower than in 1997. The preliminary ex-vessel economic value of California commercial landings decreased by 37%, to \$107 million. Statewide landings by recreational anglers aboard commercial passenger fishing vessels (CPFVs) decreased by 18%, to 3,155,995 individual fishes.

The El Niño event of 1997–98 continued to dramatically affect several important California fisheries, and was partly responsible for the significant decline in total landings and revenues. 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 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 continued high landings of Pacific sardine and mackerel. The El Niño event also had a devastating effect on the Pacific herring fishery, which had one of the poorest seasons since the early 1970s. Other commercial fisheries that declined for a variety of reasons (perhaps including El Niño) were sea urchin, chinook salmon, and numerous groundfish species.

In contrast to these declines, several fisheries increased in 1998. The Pacific sardine resource was declared fully recovered from a population decline which began in the 1940s. Fisheries with increased landings in 1998 included spot and ridgeback prawn, Dungeness crab, splitnose rockfish, white seabass (commercial), swordfish, thresher shark, and some fishes harvested by CPFVs (barracuda, albacore, bluefin tuna). Particularly notable was the continued growth of the fishery for live and premium fishes. Passage of the Marine Life Management Act (MLMA) will aid California Department of Fish and

Game (CDFG) efforts to monitor and manage this complex nearshore fishery.

PACIFIC SARDINE

Rebuilding of the Pacific sardine (*Sardinops sagax*) fishery continued in 1998, with the year's total landings of 41,056 t ranking among the highest since the reopening of the directed fishery in 1986 (table 1, fig. 1). The 1998 fishery had an approximate ex-vessel value of \$3.6 million, down from \$3.9 million in 1997. Approximately 94% of the 1998 quota was landed, and the directed fishery remained open until year's end.

Fish and Game Code (§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. 2). Based on a 1 July 1997 biomass estimate of 420,934 t, the harvest formula generated an initial 1998 southern fishery quota of 29,030 t, and a northern fishery quota of 14,515 t (table 2). In October, the CDFG reallocated uncaught quota portions equally between north and south. The southern California fishery filled its portion of the reallocation in mid-December, but the CDFG did not recommend closing the southern fishery because only a few weeks remained in the year and several thousand tons were left in the northern allocation. Consequently, 2,489 t of the 1998 allocation was not taken.

The Pacific sardine resource off California has now surpassed one million tons and is considered fully recovered for the first time since the mid-1940s. The most recent stock assessment, conducted jointly by the CDFG and the National Marine Fisheries Service (NMFS), estimated 1.07 million t in the area of California's coast (Ensenada, Mexico, to San Francisco) and up to 1.6 million t coastwide (Ensenada to British Columbia).

Current regulations give the CDFG considerable latitude in setting annual sardine quotas. When biomass is estimated to be more than 18,144 t, Fish and Game Code requires that allowable catch must be consistent with resource rehabilitation. To calculate the 1999 quota, the CDFG used a harvest formula selected by the Pacific Fishery Management Council (PFMC) as the preferred option in the draft Coastal Pelagic Species Fishery

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

Year	Pacific sardine	Northern anchovy	Pacific mackerel	Jack mackerel	Pacific herring	Market squid	Total
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	46,196	5,718	20,615	1,161	11,541	70,257	155,488
1998*	41,056	1,406	20,073	970	2,432	2,709	68,646

*Preliminary

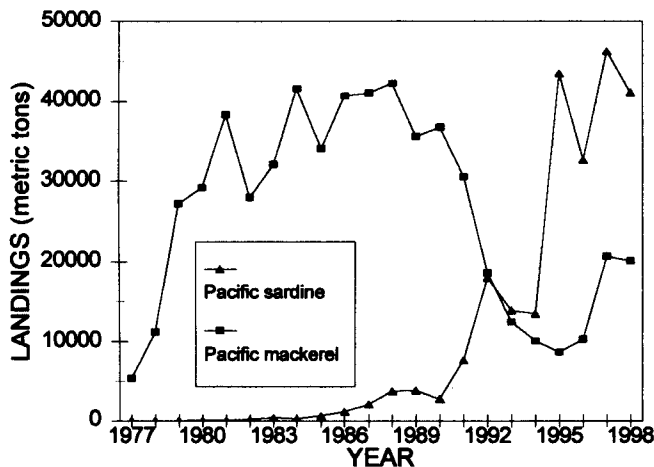


Figure 1. California commercial landings of Pacific sardine and Pacific mackerel, 1977–98.

Management Plan (Amendment 8). Based on the 1998 estimate of total biomass (age 1+), the 1999 sardine fishery opened on 1 January with a quota of 120,474 t for the California fishery. The 1999 quota was 177% higher than the 1998 allocation.

Prices paid to fishermen (ex-vessel price) for sardines remained relatively low in 1998, but were slightly higher than in 1997. Prices ranged from \$66 to \$110 per t, and averaged \$89. 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 in the summer. In northern California, Pacific herring (*Clupea pallasii*) is also an important target species from January to March. Squid and

TABLE 2
 Pacific Sardine Quota Allocations (Metric Tons)
 in California for 1998

	Initial quota	Reallocated quota	Landings
North	14,515	10,220	9,081
South	29,030	10,220	31,975
Total	43,545	20,440	41,056

tuna command significantly higher ex-vessel prices than sardines: \$564 per t for market squid and \$600–\$1,400 per t for tuna. During 1998, sardine landings varied by month because of availability, demand, and fleet participation in other fisheries.

In 1998, most Pacific sardine landings in southern California were sold to market processors (78%) or to the canneries (22%). Currently, fish are processed for human consumption (fresh or canned), pet food, or export. Of the exported sardines, most are either sold for human consumption or used as feed in aquaculture facilities. About 15% of all sardines landed in California were canned domestically for human consumption. The only southern California cannery that packs fish for human consumption continued intermittent canning of sardines. In northern California, two canneries packed fish for human consumption.

Besides the wetfish fishery for sardine, there is a small bait fishery 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 1998, the ex-vessel value of the sardine live bait fishery was approximately equal in value to the directed fishery.

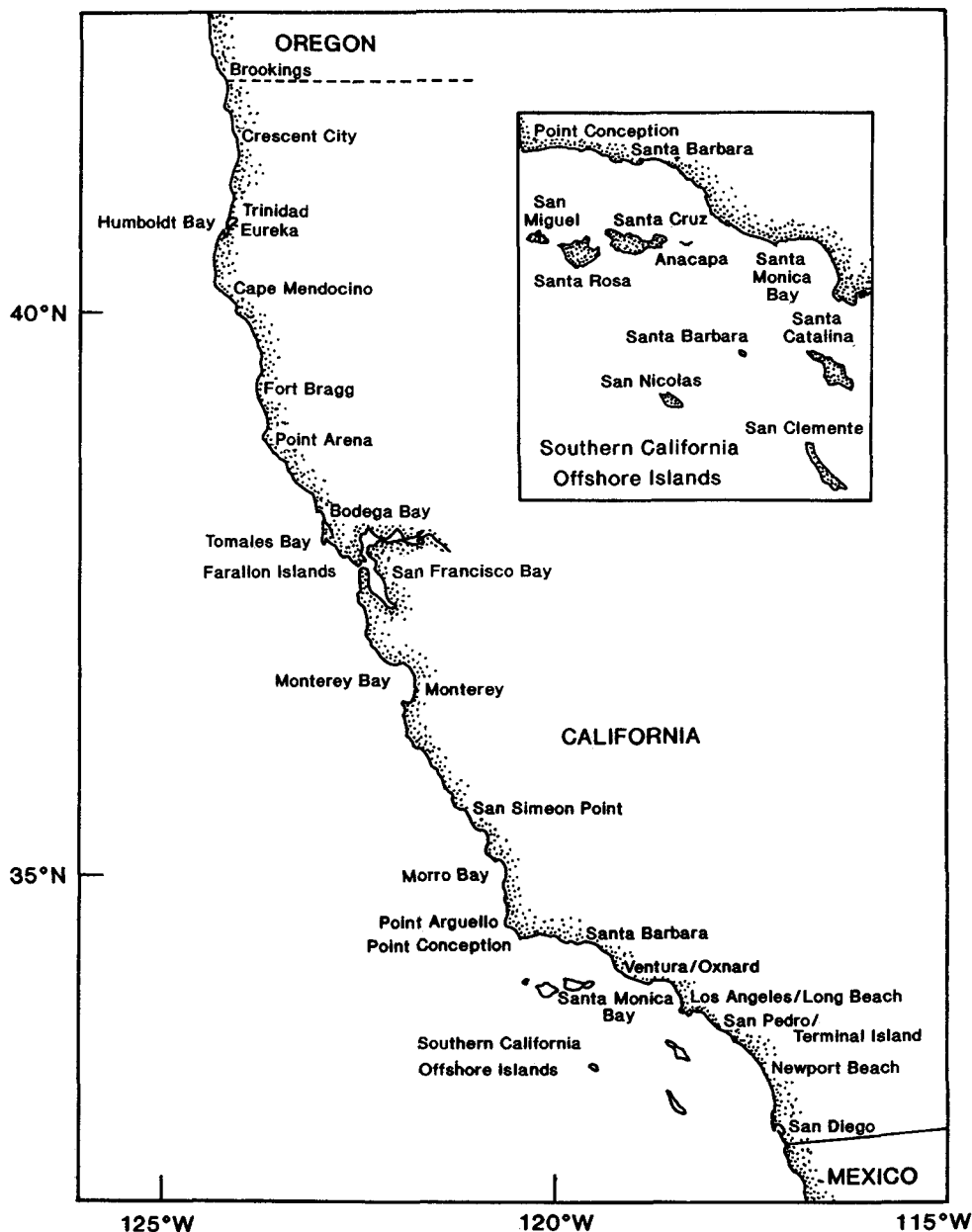


Figure 2. California ports and fishing areas.

Approximately 55% of California's sardine landings were exported in 1998, sold primarily (84%) as frozen blocks. In 1998, 22,397 t of sardines were exported, more than doubling the 1997 total of 10,977 t. Export revenues totaled \$11.96 million at approximately \$534 per t. The top importers of Pacific sardine were Australia (77%), Japan (9%), China (4%), Malaysia (2%), and Panama (2%). Australia imports sardines for fish food in aquaculture facilities, while Japan supplements its catch to meet consumer demand following the recent decline of its own sardine resource.

In September 1998, the PFMC approved the draft Coastal Pelagic Species Fishery Management Plan (Amendment 8 to the Northern Anchovy Fishery Management Plan) and submitted the plan to the U.S. Secre-

tary of Commerce for review. At the outset of the plan, Pacific sardine will be actively managed. The plan implements new harvest control rules for Pacific sardine that retain a portion of the biomass as forage and provide a stable fishery.

PACIFIC MACKEREL

El Niño conditions continued to affect the Pacific mackerel (*Scomber japonicus*) fishery through the first half of 1998. The 1998 annual landings in California totaled 20,073 t, a 2.6% decrease from the 1997 total of 20,615 t (table 1, fig. 1). Effort was focused on traditional fishing grounds from Monterey south to the U.S./Mexican border. Ninety-three percent of the landings were made in southern California, primarily at San Pedro and

Terminal Island. Most northern California landings were made in the Monterey area. Persisting oceanic conditions favored a continued northward extension of the Pacific mackerel population up to British Columbia.

The Pacific mackerel fishing season is specified in the Fish and Game Code (§8410) as a 12-month period from 1 July through 30 June of the following calendar year. Based on an estimated biomass of 91,626 t on 1 July 1997, a 22,045 t quota was set for the 1997–98 season, a 2.5-fold increase from last season's quota of 8,709 t. When the total biomass is estimated by CDFG to be greater than 18,144 t but less than 136,078 t, allowable harvest is defined as 30% of the total biomass in excess of 18,144 t.

Unlike the 1996–97 quota, which was filled by the middle of March 1997, the 1997–98 quota remained open throughout the season. Monthly landings followed a pattern similar to the previous season, with most landings made in spring and fall. This pattern was driven not only by availability, but also by fishers' participation in other fisheries (sardine, market squid, and tuna), weather conditions, and market demands.

The 1998–99 fishing season quota was based on a biomass projection derived from a tuned virtual population analysis (VPA) model called ADEPT. On the basis of a projected biomass of 120,200 t for 1 July 1998, the commercial quota for 1998–99 was recommended and set at 30,572 t. The CDFG and NMFS continued to collect Pacific mackerel along with other fishery-dependent and fishery-independent data for the 1999 assessment. In 1998, approximately 2,350 Pacific mackerel were collected, and indices of length, weight, sex, maturity, and age were obtained for use in the biomass projection for 1 July 1999.

The ex-vessel price paid for Pacific mackerel (landings over one t) ranged from \$22 to \$441 per t, with an average of \$132. The sale of the catch generated approximately \$2.13 million paid to fishermen. Many landings (less than one t) were sold to small specialty markets and dealers and can inflate the price upward from \$0.02 per kg to \$0.91 per kg, with an average price of \$0.25 per kg (\$1,235 per t). Although these landings totaled only 84 t, they generated approximately \$103,500.

PACIFIC HERRING

Pacific herring (*Clupea pallasii*) fisheries for 1998 clearly illustrated the devastating effects of the 1997–98 El Niño. Annual statewide landings declined to 2,432 t, down 79% from the previous year (table 1), and the 1997–98 sac roe season (December–March) produced only 1,825 t, an 83% drop from the previous season and arguably one of the poorest seasons since the fishery began in 1972–73. All sac roe fishery landings were significantly less than the allotted quotas: the San Francisco gill net

fleet, composed of three platoons (385 permits), landed 280 t, 96% under the 7,007 t quota; and 25 round haul (purse seine and lampara) permits landed 1,523 t, 21% under the 1,932 t quota. For the first time during an open season, the Tomales Bay fishery did not land herring (the quota was 200 t); Crescent City permits landed 21 t, 22% less than the 27 t quota; and Humboldt Bay landings totaled approximately 1 t, 98% less than the 49 t quota. The fishery for herring as live or dead bait was nonexistent in 1998.

In addition to the decline from the 1996–97 season, herring collected from commercial catch and CDFG research nets manifested symptoms similar to herring sampled during the 1983–84 sac roe season. Mean weights per given lengths were as much as 25% lower than normal. Female herring appeared in San Francisco Bay with impaired gonadal development noted by roe technicians as “pencil roe” and lacking the typical golden coloration of ripe skeins, conditions related to a lack of food. Skeins containing opaque eggs or eggs in varying stages of resorption were observed with increased frequency in the latter part of the season and attributed to prolonged periods between spawning events.

Ex-vessel prices for herring with 10% roe recovery averaged about \$441 per t for gill net landings and \$276 per t for round haul fish during the 1997–98 season; an additional 10% of the base price per t was paid for each percentage point above 10%. The ex-vessel price per t was approximately 60% less per t than in the 1996–97 season, reflecting the downturn in the Japanese economy. Total ex-vessel value of the sac roe fishery was an estimated \$600,000, down 96% from the 1996–97 season, and well below the average for the previous twelve seasons (approximately \$11 million).

The San Francisco Bay herring eggs-on-kelp fishery landings totaled 30 t, 84% less than the 190 t quota. Record high landings of 173 t were made in the 1996–97 season. The total estimated value of the 1997–98 eggs-on-kelp harvest was \$330,000, based on an average ex-vessel price of \$5.00 per pound. El Niño-related effects plagued permittees: supplies of giant kelp (*Macrocystis pyrifera*) that met market criteria were very limited; low salinity in the bay severely reduced the time kelp could remain in suspension and yield a marketable product; and spawning events were inhibited by heavy rainfall and poor gonadal development related to a lack of food.

The CDFG conducted hydroacoustic and spawn deposition surveys to estimate herring spawning biomass in San Francisco Bay. Spawn deposition estimates were used to assess the Tomales Bay population. No surveys were conducted for Humboldt Bay or Crescent City Harbor. The 1997–98 herring spawning biomass estimate for the San Francisco Bay population was 18,182 t, the third lowest ever recorded. This represents an 80%

decline from the previous season, which was the third highest recorded. Given the large spawning biomass estimates for 1995–96 (90,000 t) and 1996–97 (81,454 t) and multiple consecutive years of successful recruitment (1992–95 year classes), far fewer fish returned to spawn than expected. El Niño conditions may have increased adult mortality, prevented herring from reaching reproductive condition, and driven herring farther than usual in a quest for favorable foraging conditions.

The Tomales Bay herring spawning biomass continued to fluctuate widely. The 1997–98 spawning biomass estimate was 533 t, a decline of 60% from the previous season and the fourth lowest recorded. This was the third consecutive season of decline. Age-structure analysis of the Tomales Bay commercial catch did not forecast large changes in abundance, but commercial gill net web size regulations allow escapement of smaller, younger fish and therefore do not indicate abundance of two- and three-year-old herring. Sample sizes from research gill nets were not robust enough to be conclusive. Spawns were probably inhibited by abnormally high rainfall, which lowered salinity and increased turbidity in Tomales Bay waters.

Northwesterly winds cooled the ocean waters off of central California considerably during the spring of 1998. Because of the degeneration of El Niño conditions, projections of a prevailing La Niña, and a return to normal ocean conditions, herring fisheries were expected to improve in the 1998–99 season. The 1998–99 December fishery in San Francisco Bay opened with good catches. The herring were in far better physical condition than in the previous season and had normal gonadal development. Ex-vessel prices, however, were expected to remain low because of uncertainty about the troubled Japanese economy.

MARKET SQUID

Statewide landings in the California market squid fishery plummeted in 1998. For the previous two years, market squid had ranked as the state's number one commercial marine resource in terms of volume and revenue. Distinguished by volatility, annual landings for the fishery totaled only 2,709 t, down from over 70,257 t in 1997 (table 1, fig. 3). This decrease was a consequence of the 1997–98 El Niño, resulting in warm water conditions inhospitable to squid.

The year was important with respect to management developments. Passage of the Sher Bill (SB364) in 1997 implemented a \$2,500 permit fee for all fishery participants for the commercial season beginning 1 April 1998. As specified in Article 9.7 of the Fish and Game Code, fishers must hold a commercial market squid vessel permit in order to land more than two short tons of squid per day, and must hold a commercial squid light boat

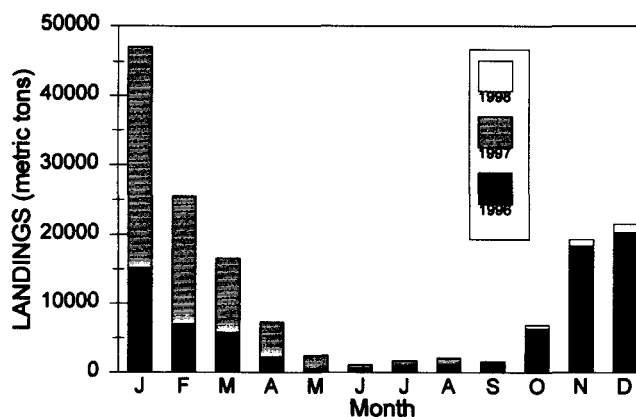


Figure 3. Monthly landings of California market squid, 1996–98.

owner's permit in order to attract squid by light to seine vessels. In order to renew a permit, an applicant must have been issued a permit in the immediately preceding year. Before passage of the Sher Bill, the fishery had been open access and essentially unregulated.

By mid-1998, 240 market squid vessel permits and 41 light boat permits were issued for the 1998–99 season, generating nearly \$750,000 in revenue. Of the 240 vessel permit holders, only 54 landed two tons or more in 1998. Many out-of-state vessels either did not participate or returned home early in the season to fish for groundfish or salmon because of poor prospects for squid for the remainder of the year. Other permits were purchased on speculation. Revenue generated from permit sales will be used by the CDFG to fund a 3-year pilot study to provide information for developing a squid conservation and management plan by April of 2001.

Northern and southern California have distinctly different fisheries for market squid, although the resource is harvested on the spawning grounds in both areas. In recent years, 90% of landings have been made in southern California, in sandy nearshore areas and around the Channel Islands in winter months during peak spawning activity. Conversely, squid in the northern California fishery, primarily centered in Monterey Bay, tend to aggregate and spawn during summer. In 1998, over 99% of the statewide total was taken in southern California, with most landings in Port Hueneme or Ventura. Less than 20 t of squid were landed in northern California, the lowest annual total for the area recorded since monitoring of the fishery began in 1930.

Because of low availability, the average price paid to fishermen was \$564 per t, significantly higher than the \$292 paid in 1997. Ex-vessel value of the fishery in 1998 is estimated at approximately \$1.7 million, well below the \$20.6 million generated in 1997. Revenues from sardine (\$3.6 million) and Pacific mackerel (\$2.13 million), often targeted by the same fleet, also exceeded squid revenues in 1998.

TABLE 3
 Preliminary California Commercial
 Red Sea Urchin Landings (Metric Tons) for 1998

Port	Landings	Percentage of statewide catch	Value	Price per kg
Fort Bragg	734.1	15.6	\$1,004,574	\$1.37
Albion	194.8	4.1	\$ 245,167	\$1.26
Point Arena	344.3	7.3	\$ 508,619	\$1.48
Bodega Bay	233.0	4.9	\$ 310,309	\$1.33
Half Moon Bay	5.7	0.1	\$ 7,943	\$1.39
Other	21.0	0.4	\$ 27,014	\$1.29
N. Calif. subtotal	1,532.9	32.6	\$2,103,626	\$1.37
Santa Barbara	1,462.8	31.1	\$2,659,150	\$1.82
Oxnard/Ventura	1,024.4	21.8	\$1,802,322	\$1.76
Los Angeles	475.4	10.1	\$ 810,818	\$1.71
Orange	7.5	0.2	\$ 11,842	\$1.58
San Diego	200.8	4.3	\$ 251,536	\$1.25
Other	4.1	0.1	\$ 5,951	\$1.44
S. Calif. subtotal	3,175.1	67.4	\$5,541,620	\$1.75
Grand total	4,708.0		\$7,645,246	

Despite the relatively high price paid for squid in 1998, international demand for California squid diminished significantly. Processors reported that the product was not being sought by foreign markets that had supported the fishery in the previous two years. In 1997, China purchased over 26,000 t of market squid, with statewide exports totaling approximately 48,000 t. Nearly \$50 million was paid to California processors for these exports, mostly packaged in frozen blocks of 25 pounds, and representing approximately 71% of total California landings that year. In 1998, exports accounted for only 1,600 t and \$2.4 million to processors. Leading export nations for the year included Mexico, the United Kingdom, and Japan, with China accounting for only a negligible portion of the total.

In an effort to provide information to the CDFG for squid research and development of the management plan, two advisory committees were established in 1998. The Squid Research and Scientific Committee and the Squid Fishery Advisory Committee were asked to recommend interim management measures for the fishery, and a series of statewide public hearings were held on the matter. Although no additional regulations were imposed in 1998, proposals for mandatory logbooks, time or area closures, limited entry, and gear restrictions were under consideration by the committees late in the year.

SEA URCHIN

Statewide landings of red sea urchin (*Strongylocentrotus franciscanus*) for 1998 totaled 4,708 t, continuing the downward trend since 1988 (table 3, fig. 4). Landings dramatically decreased by 42% from the 1997 total of 8,146 t. Northern California sea urchin landings de-

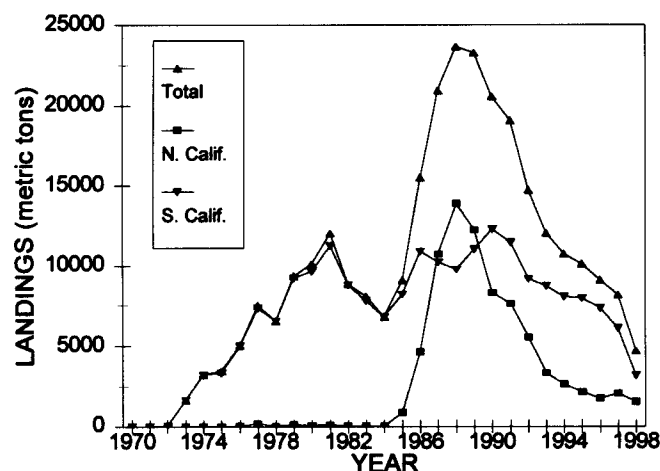


Figure 4. California sea urchin landings, 1970–98.

clined by 26% from 1997, southern California by 48%. A combination of El Niño conditions and depressed Japanese market demand were responsible for lower prices. Most harvesters opted not to fish during most of the year because of decreased value and poor quality of product.

Santa Barbara and the Oxnard/Ventura areas were the most active ports for sea urchin landings in 1998, with a combined 53% of the statewide catch (table 3). Northern California urchin landings made up a larger portion of the statewide total—33%, compared to 25% in 1997. Fort Bragg was the third most active port for sea urchin landings; Los Angeles landings were only 10% of the total.

The overall value of the fishery in 1998 decreased by 49%, from \$15 million in 1997 to \$7.6 million (table 3). The unit price per kg decreased from \$1.80 in 1997 to \$1.62 in 1998. Northern California showed a larger decline in the unit price per kg, dropping from \$1.82 to \$1.37; southern California decreased slightly, from \$1.79 to \$1.75. The number of permits, 464, decreased by 9 from 1997. The return of cooler oceanic conditions toward the end of 1998 improved sea urchin quality, but depressed economic conditions in Japan kept unit prices low.

The expansion of sea otters into southern California may seriously affect sea urchins and other invertebrate species. In 1998 a significant number of sea otters (approximately 100) were observed and documented south of Point Conception for the first time. This southern expansion poses a direct threat to the sea urchin fishery in southern California.

GROUND FISHES

The California commercial groundfish harvest for 1998 was 22,419 t (table 4), with an ex-vessel value of approximately \$22 million. Total 1998 landings decreased by 23%, or 6,513 t, and ex-vessel revenues dropped 30%, or nearly \$10 million, from 1997.

TABLE 4
 California Groundfish Landings (Metric Tons) for 1998

Species	1997	1998	Percent change
Dover sole	5,282	3,556	-33
English sole	648	425	-34
Petrале sole	827	472	-43
Rex sole	453	289	-36
Other flatfishes	1,107	813	-27
Widow rockfish	1,336	928	-31
Bocaccio	286	141	-51
Splitnose rockfish	396	1,404	255
Other rockfish	5,271	4,426	-16
Thornyhead	2,754	1,909	-31
Lingcod	502	149	-70
Sablefish	2,888	1,435	-50
Pacific whiting	6,332	5,723	-10
Grenadier	632	500	-21
Other groundfish	218	249	14
Total	28,932	22,419	-23

Dover sole (*Microstomus pacificus*), thornyheads (*Sebastes* spp.), sablefish (*Anoplopoma fimbria*), rockfish (*Sebastes* spp.), and Pacific whiting (*Merluccius productus*) continue to dominate the harvest. The 1998 harvest of most species or species groups was off sharply from that of the previous three years, although landings of splitnose rockfish (*Sebastes diploproa*, "rosefish") increased dramatically. Many of the declines, particularly those for sablefish and lingcod, reflect increasingly restrictive PFMC landing limitations; other declines may be related to the strong 1997-98 El Niño event. Paradoxically, the large increase in splitnose rockfish landings, a species normally found on the continental slope, reflects their increased availability on the continental shelf during the northern propagation of a strong El Niño signal along the West Coast. The drop in sablefish landings was responsible for more than half of the decline in total groundfish ex-vessel revenues.

Most of the groundfish landed in California is taken by bottom and midwater trawl gear. In 1998, 88% of the groundfish landed was taken by those gears; a slight increase from 86% in 1997. Line gear accounted for the second largest percentage, 10%, a decrease from 12% in 1997, 15% in 1996, and a high of 18% in 1992. The gill and trammel net component is now stable at just under 1% after a steady decline from 5% in 1993. Traps account for approximately 1% of total groundfish landings.

For 1998, the PFMC maintained harvest guidelines (HG) for Dover sole, shortspine thornyhead (*Sebastes alascanus*), longspine thornyhead (*Sebastes altivelis*), the *Sebastes* complex, widow rockfish (*Sebastes entomelas*), yellowtail rockfish (*Sebastes flavidus*), and canary rockfish (*Sebastes pinniger*). In addition, commercial harvest guidelines (CHG) were set for Pacific whiting, sablefish, bocaccio, and lingcod (*Ophiodon elongatus*). In the case

TABLE 5
 California Landings (Metric Tons) of Swordfish and Selected Shark Species

	Swordfish	Common thresher shark	Shortfin mako shark
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	861	178	93
1998*	923	187	66

*Preliminary

of Pacific whiting and sablefish, CHG do not include that portion of the total allowable catch assigned to Washington treaty Indian tribes. For lingcod and bocaccio, CHG do not include the portion set aside for the recreational fishery. The PFMC again 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 in order to meet its objective of staying within the annual HG or CHG while providing a year-round fishery.

During 1998, stock assessments were prepared for sablefish, shortspine thornyhead, blackgill rockfish, chilipepper rockfish, and Pacific ocean perch by stock assessment teams and then reviewed by three stock assessment review (STAR) panels at public workshops. The Groundfish Management Team then developed recommendations based on the scientific information forwarded by the STAR panels. Assessments planned for 1999 include bocaccio, cowcod, canary rockfish, petrale sole, and southern lingcod.

In 1999, the PFMC will continue to investigate a program to reduce capacity in the groundfish industry, and the feasibility of a comprehensive observer program for groundfish. The PFMC will also reexamine rockfish harvest policies and adopt rebuilding plans for bocaccio rockfish and lingcod. Allocation of lingcod and rockfish within the limited entry fishery and between the commercial and recreational fisheries will continue to be evaluated.

SWORDFISH AND SHARKS

Swordfish (*Xiphias gladius*) landings totaled 923 t in 1998 (table 5), 7% higher than in 1997. During the past decade, the drift gill net fishery has accounted for the majority of the catch. In 1998, 59% of the catch was taken with drift gill nets, up slightly from 53% in 1997. Longline landings made up 32% of the catch. Fifteen vessels used longline gear outside the U.S. Exclusive Economic Zone (EEZ) and landed swordfish in south-

TABLE 6
 Landings (Metric Tons) of Top Ten Nearshore Finfishes in California in 1998

Market category	California		Northern California	Central California	Southern California
	t	Value (\$1,000's)	t	t	t
Cabezon	152	1,067	31	121	<1
Black rockfish	84	103	66	18	<1
Gopher rockfish group ^a	67	395	4	63	<1
Bolina rockfish group ^b	62	270	3	59	<1
California sheephead	56	341	<1	1	55
California scorpionfish	45	168	0	<1	45
Blue rockfish	41	56	21	20	<1
Grass rockfish	35	369	5	31	0
Lingcod ^c	29	79	8	22	<1
Copper rockfish	22	60	15	6	<1
Subtotal	593	2,908	153	342	101
Other fishes	77	341	22	38	13
Grand total	670	3,249	175	380	114

Source: Preliminary 1998 CDFG market receipt landing data.

^aIncludes market category gopher rockfish.

^bIncludes market category brown rockfish.

^cOnly live landings; January–July 1998.

ern California ports. Only three of these vessels, however, were based in California. Harpoon landings were down, constituting only 4% of the catch. Fifty-six percent of the swordfish catch was landed in southern California ports.

Gear type affected swordfish ex-vessel prices. Typically, fishermen landing swordfish caught with either drift gill nets or longlines received \$1.50 to \$5.00 per pound, although the average price for drift gill net fish (\$2.99) was nearly \$0.25 higher than for fish caught on longlines. Fishermen landing harpoon-caught swordfish received the highest average price—\$5.85 per pound, with a range of \$2.75 to \$7.50 per pound.

Common thresher shark (*Alopias vulpinus*) landings totaled 187 t in 1998 (table 5), increasing 5% from 1998. Thresher shark were taken primarily with drift gill nets (78%), followed by set gill nets (18%) and other assorted gears (4%). Most landings (73%) were made in southern California. Typically, ex-vessel price varied from \$0.40 to \$2.75 per pound, with an average of \$1.36.

Shortfin mako shark (*Isurus oxyrinchus*) landings in 1998 were 66 t (table 5). Although this is a decrease of nearly 30% from 1997, it shows a return to the pre-El Niño levels seen in 1995 and 1996. Most of the catch (74%) was landed in southern California ports, at ex-vessel prices between \$0.50 and \$2.25 per pound, with an average of \$1.12. Mako sharks were also caught primarily by the drift gill net fishery (79%). The remainder of the catch was landed with set gill nets (9%), hook and line gear (4%), longline vessels operating outside the EEZ (4%), and as incidental catch from other gears (4%).

NEARSHORE FINFISHES

California commercial landings of nearshore live and premium marine finfishes were 670 t (417 t live) in 1998, with an ex-vessel value of approximately \$3.2 million (\$2.7 million live; table 6). Nearshore species were defined in the Nearshore Fisheries Management Act (NFMA) of the MLMA of 1998. The NFMA includes as nearshore finfishes: rockfish (genus *Sebastes*), California sheephead (*Semicossyphus pulcher*), greenlings (genus *Hexagrammos*), cabezon (*Scorpaenichthys marmoratus*), California scorpionfish (*Scorpaena guttata*), and other species found primarily in rocky reef or kelp habitat in nearshore waters.

The principal goal of this nontraditional fishery is to deliver fish live to the consumer in as timely a manner as possible. Trucks or vans equipped with aerated tanks are used to transport fish directly to buyers. Many fishers deliver and sell their own catch. All of these elements have complicated the required documentation of landings.

Ex-vessel prices for live and premium fish ranged from \$0.20 to \$12.00 per pound, with an average of \$2.50 per pound. Prices vary with the condition and size of the fish. Many fish do not survive the rigors of capture and transport and are sold dead, sometimes at greatly reduced prices. Some buyers purchase only live fish. Dead fish may be sold to other buyers, taken home for personal use, or discarded. This fishery has increased substantially since 1988, and continues to supply California's Asian communities with live and premium quality fishes. Before 1988, the price per pound for line-caught rockfish ranged from \$0.50 to \$1.50. The impetus of this fishery is the unprecedented high price paid for live fish.

TABLE 7
Number of Fishers Landing Nearshore Finfishes in 1998

Total landings (kg)	Number of fishers ^a			
	California	Northern California	Central California	Southern California
<50	323	58	198	80
50 to 499	341	71	182	93
500 to 4,999	206	56	113	38
>5,000	31	8	19	4
Total	901	193	512	215

Source: Preliminary 1998 CDFG market receipt landing data.
^aSome fishers operate in more than one area.

TABLE 8
Percentage of Annual Landings of Nearshore Finfishes by Gear Type in 1998

Gear type ^a	California	Northern California	Central California	Southern California
Line	72	97	80	34
Trap	22	<1	18	45
Net ^b	3	2	2	15
Dive	<1	0	0	5
Other	<1	<1	<1	1

Source: Preliminary 1998 CDFG market receipt landing data.
^aSome fishers may use more than one gear type during a trip.
^bIncludes trawl and other net types.

Vessels of the nearshore fishery ranged in size from 8 ft (kayak) to 67 ft, with an average of 26 ft. Larger vessels may serve as mother ships for several smaller skiffs. Some fishers fish from shore. In 1998, 802 fishers made at least one landing of nearshore fishes, but the most active participants (landings of at least 500 kg during the year) numbered only 237 (table 7). These active fishers landed 90% of the total statewide landings.

Nearshore fishes were caught with a variety of gear types including line, trap, and net, as well as by divers. Line gear was the reported method of take for 72% of the statewide landings (table 8). Hook and line gear included rod and reel; horizontal and vertical set lines; pipes (sticks) consisting of short (4–8 ft) sections of PVC pipe (rebar or cable) with up to 15 (typically 5) hooked leaders attached; and groundfish troll lines. Fishers traveled farther from their home ports and explored more remote fishing grounds as the demand for live and premium fishes continued and the resources close to ports declined.

Fish landings are often recorded by market categories, not individual species. This is an important consideration when attempting to describe landings by species. Commercial landings are reported in market categories that include specific (e.g., cabezon) and nonspecific (e.g., small rockfish group) categories. Markets typically buy fish in groups based on value, not species. In 1998, CDFG sampling of market categories indicated that specific categories may contain from one to seven species, while nonspecific categories may contain from three to twelve species. For example, market sampling in Morro Bay

found the species composition of market category cabezon to include cabezon, grass rockfish (*S. rastrelliger*), kelp greenling (*Hexagrammos decagrammus*), and copper rockfish (*S. caurinus*).

Approximately one hundred market categories of marine fishes were documented as landed live in 1998. Only twenty-nine categories are included in this review: eighteen rockfish, five targeted species, and six incidental categories. Four categories (red, unspecified, and small rockfish groups; as well as lingcod) included both nearshore and offshore catches. Only live fish were included from these four categories.

Landings of cabezon, black rockfish (*S. melanops*), gopher rockfish (*S. carnatus*) group, bolina rockfish group, California sheephead, and California scorpionfish categories dominated the harvest with 466 t (304 t live), 70% of statewide landings, with an ex-vessel value of \$2.3 million (\$2.0 million live; see also table 6).

Northern California (port complexes of Eureka and Fort Bragg) landings totaled 175 t (61 t live), 26% of statewide landings, with an ex-vessel value of \$550,000 (\$374,000 live). Landings were dominated by black rockfish, cabezon, blue rockfish (*S. mystinus*), copper rockfish, lingcod, China rockfish (*S. nebulosus*), and vermilion rockfish (*S. miniatus*) categories, which accounted for 82% of the area's landings. Line gear caught 97% of the landings.

Central California (port complexes of Bodega Bay, San Francisco, Monterey Bay, and Morro Bay) landings totaled 380 t (280 t live), 57% of statewide landings, with

an ex-vessel value of \$2.2 million (\$1.9 million live). Central California landings were dominated by cabezon, gopher rockfish group, bolina rockfish group, grass rockfish, lingcod, and blue rockfish categories, which accounted for 83% of the area's landings (table 6). The port of Morro Bay was number one in both landings (131 t, 20%) and ex-vessel value (\$973,000, 30%) statewide. Line gear caught 80% of the landings, followed by trap gear at 18%.

Southern California (port complexes of Santa Barbara, Los Angeles, and San Diego) landings totaled 114 t (75 t live), 17% of statewide landings, with an ex-vessel value of \$548,000 (\$423,000 live). Landings were dominated by California sheephead, California scorpionfish, kelp greenling, and leopard shark (*Triakis semifasciata*) categories, which accounted for 95% of the area's landings (table 6). Trap gear caught 45% of the landings, followed by line gear at 34% and net at 15%.

The MLMA of 1998 represents a fundamental and significant change in the way California's marine resources are to be managed. The act transfers management authority for nearshore fisheries from the legislature to the Fish and Game Commission, mandates the development of a nearshore fishery management plan by 1 September 2002, and authorizes the Fish and Game Commission to adopt regulations implementing the plan. The act also implements commercial size limits for ten nearshore species.

The MLMA requires all commercial fishing vessels to be commercially registered through the CDFG and requires the possession of a Nearshore Fishery Permit to take, possess, or land any of the ten species. Additionally, federal regulations require that groundfish species for which there is a size limit be sorted prior to weighing and the weight reported separately on the Fish and Game receipt. This is an important first step to help biologists more accurately estimate by species the number and pounds of fishes being removed from the nearshore ecosystem.

If these regulations are to be effective in protecting the nearshore fishes, it is essential that fishers and buyers be educated in (1) identification of species; (2) the importance of size limits and their purpose to allow more fish to reproduce before being harvested; (3) the basic biology of nearshore fishes, especially the rockfishes, which are slow-growing, long-lived, residential, and have irregular recruitment patterns. Other essential elements include rigorous enforcement of regulations and verification of species composition in market categories with market sampling. In all, the act will aid in the proper management and conservation of the complex nearshore ecosystem. In addition to state regulations, federal groundfish regulations apply to most of the species targeted in the nearshore fishery, except for California sheephead.

ABALONE

The commercial and recreational abalone fisheries were closed by the Fish and Game Commission in 1997. Subsequently, the California legislature established a moratorium on the fishery south of San Francisco, including the Farallon Islands. The recreational fishery in northern California was not included in this closure. The legislation (SB463) included a requirement that the CDFG develop a management plan for abalone by 2003. The legislation also established a \$12 recreational abalone stamp with funds earmarked to a dedicated abalone account. Monies will be used to fund new biologist and wildlife protection positions, in addition to abalone research.

The northern California recreational fishery has not been closely monitored since 1994 because of a lack of personnel, but the legislation has resulted in new staff, so surveys and creel censuses will be resumed in 1999. In southern California, surveys have continued while the fishery is closed.

Black abalone have disappeared from southern California coastal areas. Central California still has small populations of older individuals. Juveniles have not been observed recently, probably because of higher seawater temperatures during El Niño. Withering syndrome has been found as far north as Carmel Bay, its spread probably influenced by increased seawater temperatures. Island populations have continued to decline as a result of withering syndrome and fishing pressure, and some sites are now totally without black abalone. Although the final testing of the pathogen is not completed, it appears that withering syndrome can be attributed to an undescribed rickettsial bacteria that interferes with food absorption.

Red abalone have virtually disappeared from the southern California coast. The only remaining adult aggregations occur off San Miguel Island, and a few are still found at Santa Rosa Island. Surveys at San Miguel Island indicate that only 5% of individuals are of commercial legal size (if the fishery were open). Withering syndrome has been found in populations of red abalone at San Miguel Island. Central coast populations of red abalone are generally small and restricted to crevices and protected areas, but they occur in large numbers at some locations. The central coast is within the range of the sea otter, and the fishery there is not expected to recover.

Pink abalone have disappeared from most southern California coastal areas, and population numbers are down at the Channel Islands. Surveys reveal that many of the remaining individuals are not sufficiently aggregated for effective reproduction. Populations were probably also affected by poor giant kelp productivity during the recent El Niño.

Green abalone have virtually disappeared from coastal areas, and populations are at very low levels at the Channel

Islands, where withering syndrome has had a severe impact. Because this species has narrow geographic and depth distributions (subtidal to about 8 m deep) there is concern about the continued existence of this species in southern California.

White abalone was listed as a candidate for consideration as threatened or endangered under the Endangered Species Act by NMFS. The status of white abalone is being reviewed. Recent surveys have found few individuals remaining in southern California, and those are solitary and reproductively ineffective.

During 1998, about 100 sea otters moved into southern California between Point Conception and Santa Barbara. These animals are mostly males, which range great distances. They will move back into their northern territory during the mating season, but will probably return to southern California again later. Persistent occupation and continued immigration into southern California could have serious ramifications for the recovery of the abalone resource and for other invertebrates as well. Several abalone species, including green, pink, and possibly white, are at such low densities that continued foraging by sea otters—in combination with the cumulative effects of predation, environment, and anthropogenic factors—could extirpate them.

DUNGENESS CRAB

California Dungeness crab (*Cancer magister*) landings during the 1997–98 season totaled 5,136 t, an increase of 3,327 t from the previous season, and higher than the ten-year average of 4,339 t.

In northern California, the crab season opened on 1 December after a price settlement of \$1.35 per pound. By mid-February the price peaked at \$3.00 per pound. A fleet of 308 vessels landed approximately 3,518 t in northern California, including 1,489 t at Crescent City, 345 t at Trinidad, 1,188 t at Eureka, and 496 t at Fort Bragg.

The San Francisco–area Dungeness crab season opened on 15 November, but fishing was delayed until a price settlement of \$2.00 per pound was reached on 17 November. Total crab landings increased by 801 t from the previous season, to 1,580 t. Crab fishers landed 644 t at Bodega Bay and Bolinas, and 936 t at ports in San Francisco Bay and Half Moon Bay. Monterey and Morro Bay fishers contributed 38 t to the statewide landings.

SPOT AND RIDGEBACK PRAWN

Preliminary 1998 ridgeback prawn (*Sicyonia ingentis*) landings totaled 185 t. This represented a 6% increase in landings from the 174 t landed in 1997 (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. Thirty-five

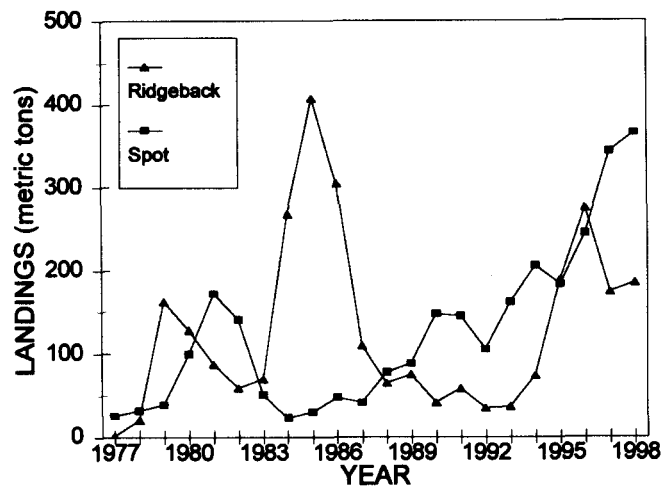


Figure 5. California ridgeback and spot prawn landings, 1977–98.

trawl vessels landed ridgeback prawn in 1998. All of the landings were made in southern California ports, and over 98% of all ridgeback prawn were caught within the Santa Barbara Channel. The proportion of ridgeback prawn landed live has increased steadily since 1994. Live ridgeback prawn constituted 65% of total ridgeback landings in 1998, matching the proportion of live ridgeback prawn in the 1997 landings. The average ex-vessel price paid for all ridgeback prawn was \$1.80 per pound. Live ridgeback prawn sold for an average of \$2.00, dead ridgeback prawn for an average ex-vessel price of \$1.50 per pound.

Preliminary 1998 spot prawn (*Pandalus platyceros*) landings were 365 t, a 6% increase over the 343 t landed in 1997 (table 9). Spot prawn landings have trended upward over the last ten years (fig. 5). Spot prawn are caught with both trap and trawl gear. A total of 102 vessels (57 trap and 45 trawl) made landings in 1998; table 9 shows types of gear and landings for spot prawn by port area. Note that some trap and trawl vessels fished in several different port areas during the year. Of the combined trap and trawl spot prawn landings in 1998, 57% were made in the Santa Barbara port area.

In the past, spot prawn were caught primarily with trap gear. More vessels have been using trawl gear since the mid-1970s, and their landings now dominate the fishery. In the last ten years the number of spot prawn trawlers has increased rapidly with an influx of vessels from other groundfish fisheries that have quota or seasonal restrictions. Approximately 257 t of spot prawn were harvested by trawl in 1998; 108 t were taken with trap gear (table 9).

Spot prawn are considerably larger than ridgeback prawn and command a much higher ex-vessel price, averaging \$6.30 per pound. Live spot prawn had an average ex-vessel price of \$7.50, and prices ranged as high

TABLE 9
 1998 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	5	0.4	2.1	2.5	0.6
San Francisco	0	17	0.0	52.2	52.2	14.0
Monterey	10	12	26.7	17.2	43.9	12.1
Santa Barbara	11	36	22.9	184.0	206.9	57.0
Los Angeles	29	2	45.2	1.1	46.3	12.7
San Diego	14	0	13.0	0	13.0	3.6
Totals	67	72	108.2	256.6	364.8	100.0

as \$9.00. Dead spot prawn sold for an average of \$3.50 per pound. Approximately 72% of all spot prawn were sold as live product.

In 1998, the trap and trawl spot prawn permit fisheries in southern California (south of Point Arguello) operated under concurrent closures that ran between 1 November 1997 and 31 January 1998. Regulations were enacted in 1997 that changed the southern California trap and trawl seasonal closures to provide more protection for gravid female spot prawn. Previously, the trap closure in southern California ran between 15 January and 31 March, and the trawl closure ran between 1 November and 16 January.

OCEAN SALMON

In 1998, the PFMC again enacted restrictive commercial and recreational ocean salmon regulations in California to achieve (1) the escapement goal range for Sacramento River fall chinook salmon (*Oncorhynchus tshawytscha*) of 122,000 to 180,000 hatchery and natural adults combined; (2) a 9% exploitation rate on age-4 Klamath River fall chinook to accommodate inriver recreational and tribal subsistence and commercial fisheries, as well as a minimum adult natural spawning escapement of 35,000; (3) a 31% increase in escapement of Sacramento River winter chinook; and (4) a reduction in harvest impacts on depressed coho salmon (*Oncorhynchus kisutch*) stocks coastwide.

In 1998, 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 793 t (216,200 fish) of dressed chinook were landed by commercial trollers, who fished approximately 12,000 days (fig. 6). Ex-vessel prices for dressed salmon averaged \$1.59 per pound, and the total ex-vessel value of the fishery exceeded \$2.7 million.

Recreational fishing regulations in California were less restrictive than in 1997, with various time and area closures (14 February to 15 November). Statewide recre-

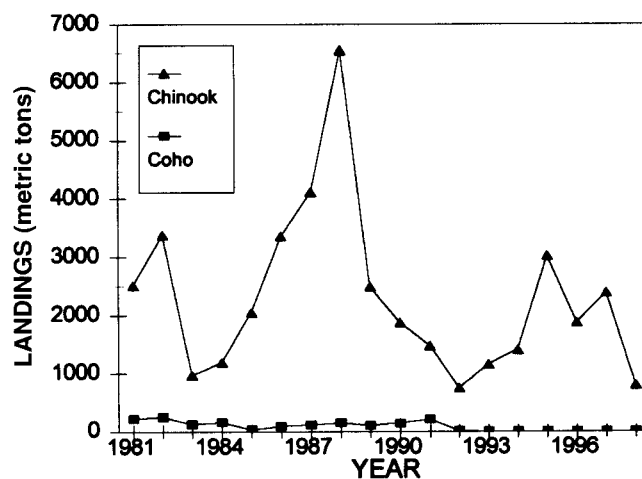


Figure 6. California commercial salmon landings, 1981-98.

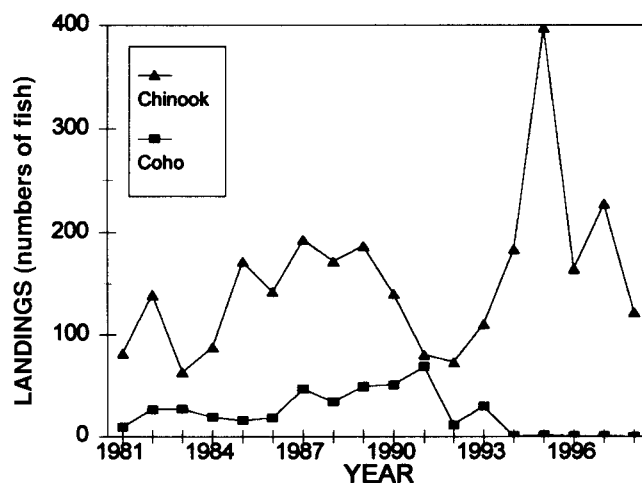


Figure 7. California recreational salmon landings, 1981-98.

ational landings decreased by almost 47% compared to the previous year (fig. 7), totaling 121,400 chinook during 149,900 angler trips (catch per unit angler = .81). 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 7 September between Point

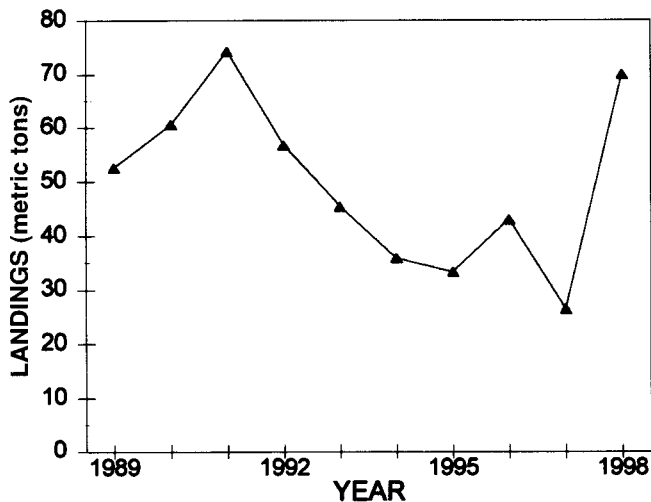


Figure 8. California commercial white seabass landings, 1989-98.

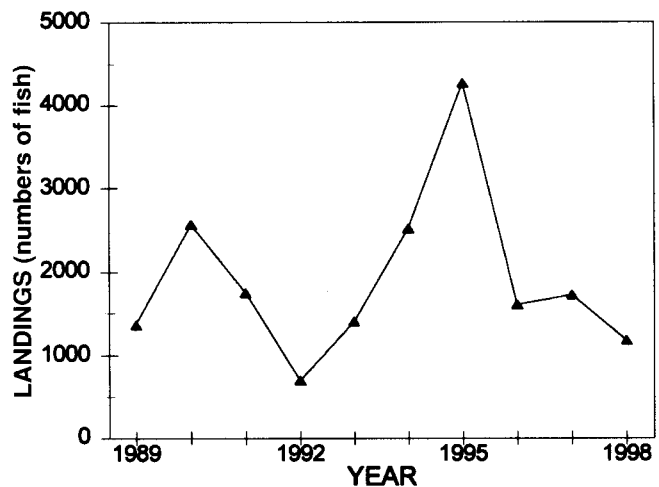


Figure 9. Landings of white seabass by California CPFVs, 1989-98.

Reyes and Pigeon Point, where anglers were required to keep the first two salmon regardless of size. Anglers fishing by any means other than trolling in the area between Point Conception and Horse Mountain were required to use only "circle" hooks.

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 Klamath fall chinook. In the KMZ, three separate seasons, open seven days a week, were enacted: 23 May to 10 June, 21 June to 5 July, and 11 August to 13 September. The bag limit was one salmon per day (all species except coho) with no more than 4 salmon in 7 consecutive days; there was a 20-inch TL limit north of Horse Mountain. In the California portion of the KMZ, anglers landed 2,900 chinook during 10,000 angler trips made primarily on private skiffs.

WHITE SEABASS

The commercial take of white seabass (*Atractoscion nobilis*) increased to 70 t in 1998 from 26 t in 1997 (fig. 8). Sixty-one percent of the catch was delivered to Terminal Island and San Pedro, 18% to Morro Bay and Port San Luis, 16% to Santa Barbara and Channel Islands Harbors, and 8% to ports in San Diego County. The 1997-98 El Niño event was probably responsible for the increased availability of white seabass to the commercial fishery.

Gill net gear was the reported method of take for 92% of the catch in 1998; hook and line gear was used to take 4%; trawl nets took 2%; and 2% was taken by miscellaneous gears. Data on catch location from gill net logs indicate that most of the effort occurred in the Huntington Flats area (56%) and in the closer islands (Anacapa, Santa Cruz, and Santa Rosa).

Commercial statutes prohibit taking white seabass in California water south of Point Conception between 15 March and 15 June. As in past years, much of the catch was landed soon after the fishery reopened in June. Fifty-two percent of the catch was landed after 15 June through the end of July.

The average ex-vessel price was \$1.92 per pound (the 1997 value was \$2.27). The threefold increase in landings from 1998 probably contributed to the overall decline in price.

Recreational catches reported on CPFV logs show 1,176 white seabass taken by anglers (fig. 9). This is a decrease of 547 fish from the reported catch of 1,723 in 1997. The ten-year average number of white seabass taken on CPFVs is 1,994. The scarcity of squid, a preferred bait for white seabass, and excellent fishing opportunities for yellowtail are probably why recreational anglers reported a lower catch of white seabass.

The Ocean Resources Enhancement and Hatchery Program (OREHP) released 32,000 fish in 1998 at eleven sites between San Diego and Santa Barbara, including Catalina. Since 1990, 281,000 hatchery-produced juvenile white seabass have been released. It takes four to five years for a white seabass to reach the legal size limit of 28 inches TL for the commercial and recreational fisheries. Staff of the CDFG and the Hubbs-Sea World Research Institute conducted a preliminary commercial market sampling program to detect if sampled white seabass contained a coded-wire tag (CWT) to indicate that the fish were a product of the OREHP hatchery in Carlsbad. In addition, several fishery technicians conducting a recreational fishing survey also checked for the presence of a hatchery CWT. No CWT was found in any of the 560 commercial fish or 7 recreational fish sampled. Eight white seabass taken during a broodstock collection effort in the fall of 1998 had CWT inserts. They

TABLE 10
 Southern California CPFV Landings (Number of Fishes) in 1998 and 1997

Species/species group	1998 landings*		1997 landings		Percent change
	Number	Rank	Number	Rank	
California barracuda	442,465	1	334,626	5	+32
Barred sand bass	368,180	2	489,966	1	-25
Rockfishes, unspecified	350,315	3	397,387	3	-12
Yellowtail	232,680	4	398,345	2	-42
Kelp bass	224,251	5	335,126	4	-33
Albacore	143,684	6	71,503	11	+101
Pacific (chub) mackerel	120,954	7	224,721	6	-46
California scorpionfish	115,426	8	141,350	7	-18
Ocean whitefish	67,096	9	87,525	10	-23
Yellowfin tuna	64,473	10	89,080	9	-28
Pacific bonito	54,688	11	102,468	8	-47
Bluefin tuna	18,091	12	7,959	18	+127
California sheephead	17,753	13	25,782	14	-31
Skipjack tuna	11,663	14	19,156	15	-39
Halfmoon	7,833	15	51,092	12	-85
White croaker	6,212	16	9,332	17	-33
Dolphinfish (dolphin)	5,344	17	28,606	13	-81
California halibut	4,669	18	7,880	19	-41
Wahoo	4,131	19	3,844	23	+7
Lingcod	3,367	20	6,474	21	-48
Flatfishes, unspecified	3,243	21	9,752	16	-67
Jack mackerel	3,175	22	5,485	22	-42
White seabass	1,176	23	1,723	24	-32
Blacksmith	815	24	7,245	20	-89
Cabezon	740	25	1,468	25	-50
All others	9,590	—	26,992	—	—
Total number kept	2,282,014		2,884,887		-21
Number of anglers	546,875		635,803		-14
Reporting CPFVs	246		235		+5

*Preliminary

ranged in TL from 15 to 25 inches and had been released from 1996 through 1998. The fish will not be used as broodfish.

RECREATIONAL FISHERY

Southern California

Hook and line saltwater recreational fishing is conducted from private vessels, piers, shorelines, and CPFVs in southern California. Specific information about these recreational fisheries is collected through phone surveys and field samplers (Marine Recreational Fisheries Statistics Survey, NMFS). In addition, the CDFG collects and maintains a large database derived from mandatory logbook information supplied by CPFVs. Much of our knowledge of CPFV recreational fishing in southern California is based on these logbook 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 California 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. Conversely, La Niña conditions may cause an increased catch of colder-water species. Anglers are typically quick to exploit the fishing opportunities provided by these changing oceanographic conditions.

Throughout much of 1998, sea-surface temperatures (SSTs) in the coastal zone off southern California and Baja California remained above normal (e.g., SST anomalies for July 1998 exceeded 2.4°C in parts of the Southern California Bight). However, SSTs offshore and to the north and south of this area began to slowly decrease. As a consequence, landings continued to be high for subtropical species such as yellowfin tuna and yellowtail, but they also included substantial increases in California barracuda, albacore, and bluefin tuna (table 10).

In 1998, 546,875 anglers aboard CPFVs landed 2,282,014 fishes south of Point Conception (table 10). The number of reporting CPFVs was 246. The number of fishes landed represents 72% of the total landings by

CPFVs statewide (3,155,995 fishes). The number of fishes landed statewide was 18% lower than in 1997; landings in southern California decreased by 21%. The number of anglers using southern California CPFVs dropped by 14% from 1997, and represented 81% of anglers using CPFVs statewide.

In contrast to 1997, the 1998 landings of California barracuda in southern California exceeded those of all other species, increasing by 32% (table 10). Banded sand bass, which ranked first in 1997, dropped to the second rank. As in 1997, rockfishes ranked third in 1998, but landings decreased from the previous year. Yellowtail dropped from the second rank to the fourth, but compared to 1996, yellowtail landings remained high (232,680 in 1998 compared to 66,763 in 1996). Kelp bass ranked fifth, with landings down by 33%. Albacore moved from the eleventh rank to the sixth rank as landings substantially increased. Pacific mackerel landings reported by southern California CPFVs dropped for the second year in a row. California scorpionfish (ranked eighth) and ocean whitefish (ranked ninth) also showed decreases. Yellowfin tuna ranked tenth in 1998, with landings falling by 28%. Similarly, Pacific bonito landings (ranked eleventh) dropped by 47%. The greatest increase in 1998 landings (127%) was shown by bluefin tuna.

Although landings increased dramatically for several species, particularly bluefin tuna, albacore, and California

barracuda, landings for most species in table 10 decreased. Blacksmith, halfmoon, and dolphinfish decreased the most, perhaps because CPFVs focused on California barracuda, yellowtail, and highly migratory species such as yellowfin tuna. There were more boat trips into Mexican waters in 1998, although the overall number of trips for southern California (including Mexico) dropped.

The decreases could also be a result of the changing oceanographic environment off of southern California. Landings of subtropical species like dolphinfish, yellowfin tuna, and yellowtail decreased, while landings of species more typical to the area (albacore, California barracuda) increased. Finally, it is possible that the lower numbers result from a reduction in the reporting of CPFV trips. The numbers in table 10 are preliminary and may change as this possibility is examined in more detail.

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, although recent occurrences

TABLE 11
 Central and Northern California CPFV Landings (Number of Fishes) in 1998 and 1997

Species/species group	1998 landings		1997 landings		Percent change
	Number	Rank	Number	Rank	
Rockfishes	746,223	1	769,014	1	-3
Chinook (king) salmon	56,392	2	110,446	2	-49
Striped bass	18,679	3	7,365	7	154
Lingcod	16,024	4	29,744	3	-46
Pacific mackerel	8,783	5	16,249	5	-46
Albacore	8,019	6	16,567	4	-52
California halibut	7,233	7	7,964	6	-9
Jack mackerel	2,648	8	3,638	8	-27
Cabezon	1,818	9	1,665	10	9
Flatfishes, unspecified	1,058	10	3,475	9	-70
Sturgeon	649	11	465	13	40
White croaker	464	12	628	11	-26
Leopard shark	397	13	288	14	38
Shark, unspecified	222	14	407	12	-45
California barracuda	97	15	78	16	24
Bluefin tuna	92	16	15	18	513
Kelp bass	59	17	1	—	5900
Ocean whitefish	44	18	130	15	-66
Pacific bonito	31	19	45	20	-31
White seabass	21	20	7	19	200
Dungeness crab	12,733		7,148		78
Rock crab	3,321		3,939		-16
Jumbo squid	1,588		686		131
Other fishes			3,261		-100
Total number kept	871,420		972,438		-10
Number of anglers	130,578		164,356		-21
Reporting CPFVs	129		120		8

of warm water close to the coast have provided good striped bass fishing outside, as well as inside, San Francisco Bay. El Niño conditions in 1997, which caused warm oceanic waters to move near shore, continued into the first half of 1998, with warmer than normal temperatures along the central and northern California coastline. This warm water provided some unusual fishing opportunities.

In 1998, the top ten species or species groups by number of fishes in landings were rockfishes, chinook (king) salmon (*Oncorhynchus tshawytscha*), striped bass, lingcod, Pacific (chub) mackerel (*Scomber japonicus*), albacore, California halibut, jack mackerel (*Trachurus symmetricus*), cabezon, and unspecified flatfishes (table 11). These species or species groups were the same as in 1997, although the order of rank abundance changed. In 1998, 130,578 anglers caught 871,420 fishes, a 10% decrease from 1997, primarily due to decreased landings of chinook salmon, lingcod, Pacific mackerel, albacore, and flatfishes. While albacore landings were lower than in 1997, they were still considerably higher than in the previous eleven years. Landings increased for bluefin tuna (*Thunnus thynnus*), striped bass, sturgeon, and leopard sharks.

Changes in annual landings may reflect shifts in effort among preferred species, or changes in species availability (as for albacore, bluefin tuna, and Pacific mackerel) rather than changes in abundance. Data suggest that white sturgeon abundance in the Sacramento–San Joaquin Estuary during 1998 was the highest since the mid-1980s. There were no appreciable changes in reported catches of rockfishes and California halibut. Recreational anglers were not allowed to take coho (silver) salmon (*Oncorhynchus kisutch*) in 1998.

Warm oceanic water near the coast was responsible for the continued presence of several subtropical and southern California species in northern California, including Pacific bonito (*Sarda chiliensis*), skipjack tuna (*Katsuwonus pelamis*), yellowtail (*Seriola lalandi*), bluefin tuna, dolphinfish (*Coryphaena hippurus*), Pacific mack-

erel, albacore, white sea bass (*Atractoscion nobilis*), and jumbo squid (*Dosidicus gigas*). Bluefin tuna were one of the only warm-water species whose landings increased over the previous year. It is notable that reports of northward migrations of subtropical pelagic species during the 1982–83 El Niño do not include landings of bluefin tuna off central and northern California. It is possible that landings of bluefin tuna north of Point Conception during the recent El Niño are tied to the increased abundance of Pacific sardines. Most bluefin tuna and Pacific bonito landings were made in September by CPFV anglers fishing as far north as Bodega Bay.

Considerable landings of crab and squid were reported in 1998 (table 11). CPFV anglers caught and kept 12,733 Dungeness (*Cancer magister*) crabs and 3,321 rock crabs (*C. antennarius*) in conjunction with fishing for rockfishes, mainly from the port of Bodega Bay and north. Bodega Bay CPFVs continued to target giant squid while they were still abundant; 1,588 giant squid were reported landed.

Editor:

K. Hill

Contributors:

D. Aseltine-Neilson, S. Calif. recreational

M. Dege, Pacific mackerel

M. Erickson, ocean salmon

P. Haaker and K. Karpov, abalone

K. Hill, Pacific sardine

K. Oda, Pacific herring

D. Ono, spot and ridgeback prawn

S. Owen, white seabass

C. Pattison, nearshore finfishes

I. Taniguchi, sea urchin

D. Thomas, groundfishes

J. Ugoretz, swordfish and sharks

R. Warner, Dungeness crab

D. Wilson-Vandenberg, N. Calif. recreational

M. Yaremko, market squid