REVIEW OF SELECTED CALIFORNIA FISHERIES FOR 2008: COASTAL PELAGIC FINFISH, MARKET SQUID, OCEAN SALMON, GROUNDFISH, CALIFORNIA SPINY LOBSTER, SPOT PRAWN, WHITE SEABASS, KELP BASS, THRESHER SHARK, SKATES AND RAYS, KELLET'S WHELK, AND SEA CUCUMBER

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SUMMARY

In 2008, commercial fisheries landed an estimated 141,377 metric tons (t) of fishes and invertebrates from California ocean waters (fig. 1). This represents a decrease of nearly 18% from the 172,125 t landed in 2007, and a 44% decline from the peak landings of 252,568 t observed in 2000. The preliminary ex-vessel economic value of commercial landings in 2008 was nearly $112 million, a decrease of 7% from the $120 million in 2007.

Pacific sardine (*Sardinops sagax*) remained the largest volume fishery in the state at nearly 58,000 t even though landings dropped by nearly a third from 2007. Although the fishery took nearly all of the allocation, the decline in landings was due to a more restrictive harvest guideline (HG) based on declining stock abundance. Market squid (*Loligo apalescens*) was second in landings at over 36,000 t. Other species in the top-five volume fisheries included northern anchovy (*Engraulis mordax*) at 14,200 t, Pacific whiting (*Merluccius productus*) at 4,900 t, and red sea urchin (*Strongylocentrotus franciscanus*) at 4,700 t. Market squid was the highest valued fishery at $25.3 million followed by Dungeness crab (*Cancer magister*) at $22.4 million. Other species in the top-five valued fisheries include California spiny lobster (*Panulirus interruptus*) at nearly $7.9 million, Pacific sardine at $7.6 million and red sea urchin at $6.5 million.

Noticeably absent from the 2008 high value fisheries was Pacific Chinook salmon (*Oncorhynchus tshawytscha*). The Pacific Fishery Management Council (Council), the National Marine Fisheries Service (NMFS), and the California Fish and Game Commission (Commission) closed the recreational and commercial ocean salmon fishing seasons in April 2008 because Sacramento River fall Chinook (SRFC) were projected to not meet their Salmon Fishery Management Plan (FMP) conservation objective. In 2008, no commercial landings occurred compared to total commercial landings of 114,141 Chinook (686 t) in 2007 valued at $7.8 million. In the 2008 recreational fishery, six fish were landed during February and March in Fort Bragg (prior to an emergency closure enacted on 1 April 2008) compared to 47,704 salmon landed in California during 2007.

California's commercial groundfish harvest for 2008 (13,000 t) increased 25% over landings in 2007 (10,500 t). Pacific whiting, Dover sole (*Microstomus pacificus*), and sablefish (*Anoplopoma fimbria*) continued to be the top species landed. The ex-vessel value of groundfish landings for 2008 was $19.7 million, 12% higher than in 2007, but still 12% lower than the peak value in 1998. A review of the status of yelloweye rockfish (*Sebastes ruberrimus*) is also provided in this report.

In 2008, commercial landings of California spiny lobster were nearly 335 t and valued at $7.9 million. A recreational report card for lobster was first introduced for the 2008–09 recreational season with nearly 25,000 cards sold at the beginning of the season. Recent investigations by the California Department of Fish and Game (Department) indicate that recreational effort has switched primarily from divers to hoop netting, and that the new rigid hoop nets are more effective at catching lobsters.

Commercial 2008 spot prawn landings were 130 t, a 9% increase from 2007. Almost all spot prawns are sold live with one of the highest ex-vessel prices, ranging from $22/kg to $31/kg, resulting in a fishery valued at $3.2 million.

Commercial landings of white seabass (*Atractoscion nobilis*) in 2008 (291 t) increased 41% over 2007, while recreational landings decreased by 11% from 57 t to 51 t in 2008. The combined commercial and recreational catch for 2008 was 342 mt. Disease issues within the hatchery and growout facilities in 2008 reduced hatchery-raised white seabass releases by 71% from 2007.

Nearly 200,000 kelp bass (*Paralabrax clathratus*), one of the most popular species caught by recreational anglers in southern California, were landed in 2008. This is a 15% decline from 2007 and a 19% decline from the ten-year average from 1999 to 2008.

Skates and rays are not usually targeted in commercial fisheries, but have been primarily taken as incidental catch by trawlers in California. In 2008, commercial landings for skates totaled 177 t, the highest landings since 2001 and were valued at nearly $97,000. The most common species landed include big (*Raja binoculata*), California (*Raja inornata*), and longnose (*Raja rhina*) skates.

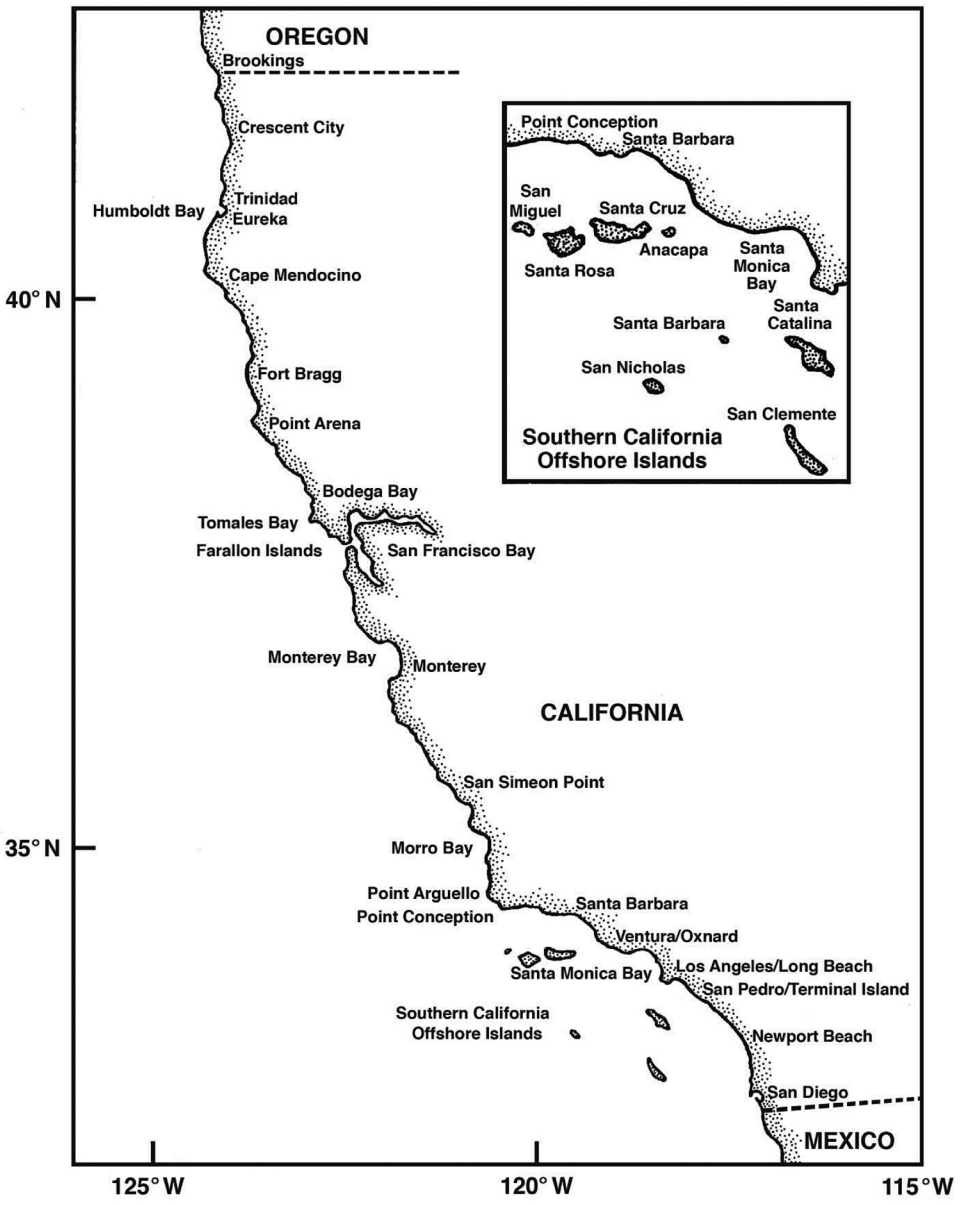

Figure 1. California ports and fishing areas.

For rays, landings totaled 10.4 t and were valued at nearly $12,000. Bat rays and shovelnose guitarfish accounted for over 70% of ray species landed.

Concern over a rapidly expanding recreational fishery for thresher shark (*Alopias* spp.) led to an evaluation of the current thresher shark management strategies by NMFS and the Department. Although no actions were taken by the Council at the time, several recommendations including a new stock assessment, investigations to better estimate the number and condition of released fish and to determine if gear modifications can increase survival were initiated.

Two interesting invertebrate fisheries are also reviewed. An update of the Kellet's whelk (*Kelletia kelletii*) fishery, first described in the 2006 CalCOFI report, indicates that in 2008, landings (73 t) decreased by 6% from 2007 and 16% from the peak landings in 2006. In contrast, 2008 sea cucumber (*Parastichopus* spp.) landings (370 t) increased by two thirds over 2007 landings and increased in value by over a million dollars.

In 2008, the Commission undertook 10 rule-making actions that addressed marine and anadromous species. The Commission adopted changes to salmon, groundfish, sea urchin, halibut, prawn, shrimp, herring and Dungeness crab regulations and revised commercial permit renewals. The Commission also finalized plans for a series of 24 marine protected areas (153 square miles) in the north-central coast region, defined as State waters

TABLE 1
Landings of Coastal Pelagic Species 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	46,196	5,718	20,615	1,161	11,541	70,257	155,488
1998	41,056	1,457	20,073	970	2,432	2,709	68,646
1999	56,747	5,179	9,527	963	2,207	90,322	164,945
2000	53,586	11,504	21,222	1,135	3,736	117,961	209,144
2001	51,811	19,187	6,924	3,615	2,715	85,828	170,080
2002	58,353	4,643	3,367	1,006	3,339	72,878	143,586
2003	34,292	1,547	3,999	155	1,780	44,965	88,741
2004	44,293	6,793	3,569	1,027	1,596	40,324	99,606
2005	34,599	11,178	3,243	199	219	55,407	104,845
2006	46,672	12,815	5,904	1,169	37	49,248	115,845
2007	80,950	10,390	5,018	632	597	49,438	147,025
2008	57,803	14,285	3,535	274	757	36,596	113,250

Data Source: Commercial Fisheries Information System (CFIS)

between Point Arena (Mendocino County) and Pigeon Point (San Mateo County) under the Marine Life Protection Act. In addition, the Commission removed the California Brown Pelican (*Pelecanus occidentalis californicus*) from the list of rare and endangered species pursuant to the California Endangered Species Act.

Coastal Pelagic Finfish

Pacific sardine (*Sardinops sagax*), Pacific mackerel (*Scomber japonicus*), jack mackerel (*Trachurus symmetricus*), northern anchovy (*Engraulis mordax*), and Pacific herring (*Clupea pallasi*) are part of a finfish complex known as coastal pelagic species (CPS). These species, with the exception of Pacific herring, are jointly managed by the Council and NMFS. In 2008, total commercial landings for these four species equaled 75,897 t (tab. 1), and were worth nearly $9.9 million in ex-vessel value. Compared to landings in 2007, this represents a 29% and 4% decrease in quantity and ex-vessel value, respectively. Once again Pacific sardine ranks as the largest fishery among these four species, contributing 51% of the combined quantity and 77% of the combined ex-vessel value.

Pacific Sardine. In 2008, the total tonnage of Pacific sardine landed (57,803 t) was 29% lower than in 2007 (80,950 t) due in large part to an HG that was 48% lower than in 2007. California landings of Pacific sardine generated an ex-vessel value of approximately $7.6 million. Commercial landings of sardine averaged 51,910 t over the ten-year period from 1999–2008 (fig. 2). Nearly all (99%) of California's 2008 sardine catch was landed in Los Angeles (54%, 30,949 t) and Monterey (45%, 26,212 t) port areas (tab. 2). In 2008, California exports of sardine product decreased by 23% over 2007 exports (66,896 t).

TABLE 2
Landings (metric tons) of Pacific sardine (*Sardinops sagax*) and Pacific mackerel (*Scomber japonicus*) at California port areas in 2008.

	Pacific Sardine		Pacific Mackerel	
Area	Landings	% Total	Landings	% Total
Eureka	0	0	0	0
San Francisco	500	1	0	0
Monterey	26,212	45	206	6
Morro Bay	0	0	0	0
Santa Barbara	142	0	136	4
Los Angeles	30,949	54	3,187	90
San Diego	0	0	0	0
Total	57,803	100	3,529	100

Data Source: CFIS

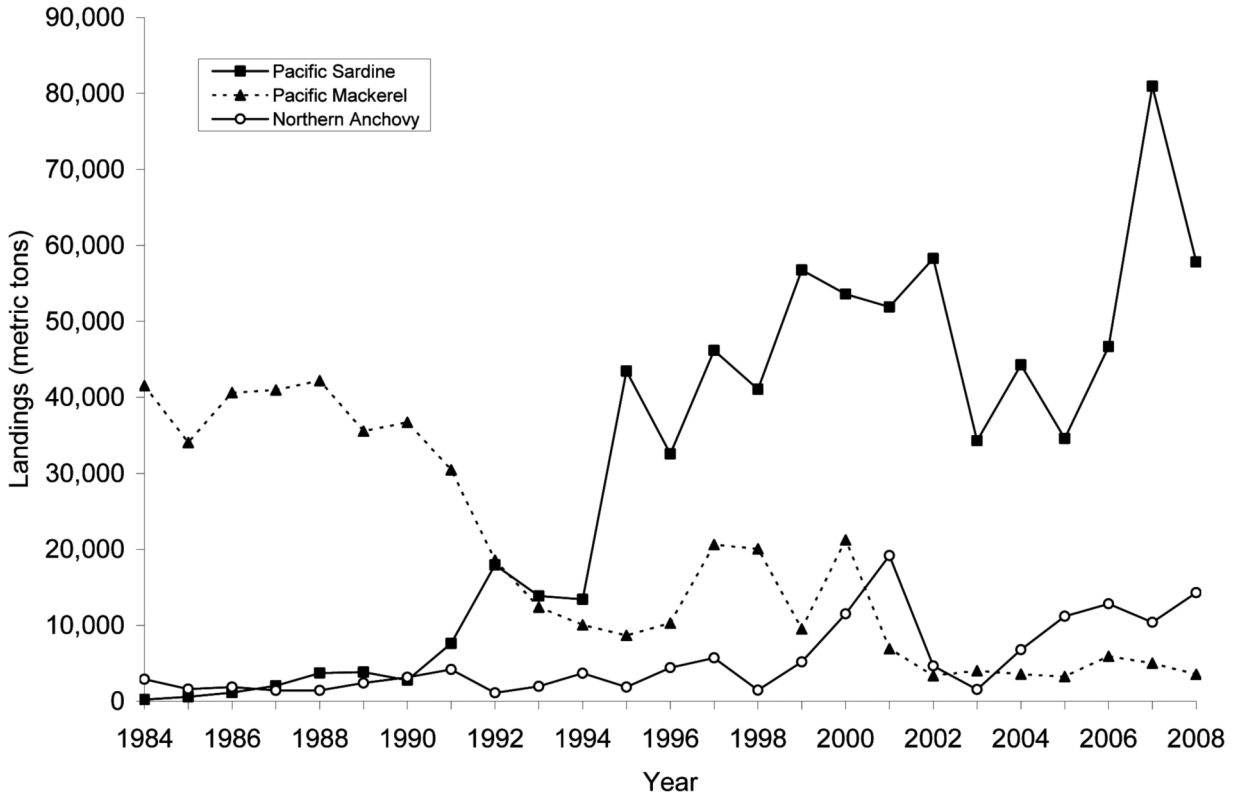

Figure 2. California commercial landings of Pacific sardine (*Sardinops sagax*), Pacific mackerel (*Scomber japonicus*), and northern anchovy (*Engraulis mordax*), 1984–2008.

A total of 51,844 t of sardine product was delivered to 30 countries. The majority (72%) of this product was exported to Australia (16,457 t), Japan (11,259 t), and Thailand (9,409 t). These three countries represent 66% of the total export value of approximately $37 million.

The Pacific sardine fishery ranges from British Columbia, Canada, southward to Baja California, Mexico (BCM). Since the 1970s the majority of landings have occurred in southern California and northern Baja California. However, since the expansion of the sardine fishery in 1999, landings have steadily increased in the Pacific Northwest. The combined landings of Pacific sardine for California, Oregon, and Washington totaled 87,183 t in 2008, down 30% from the 127,597 t landed in 2007. The Pacific sardine HG for each calendar year is determined from the previous year's stock biomass estimate (of ≥1-year-old fish on 1 July) in U.S. and Mexican waters. The HG for the 2008 season was 89,093 t based on a biomass estimate of 832,706 t. This was 48% lower than the HG for 2007. The Pacific sardine HG was apportioned coast-wide through the year with 35% allocated from 1 January through 30 June, 40% allocated plus any portion not harvested in the previous allocation from 1 July through 14 September, and the last 25%, plus any portion not harvested from the first two allocations, released on 15 September.

In 2008, U.S. west coast fisheries harvested a greater proportion (98%) of the HG compared to the previous year (84%). The 1st allocation (1 Jan–30 June) lasted 150 days. This was markedly longer than the 2nd (1 July–14 Sept) and 3rd (15 Sept–31 Dec) allocations, which lasted 40 and nine days, respectively. Increased fishing efforts, such as multiple landings per day, were observed during all allocation periods. During the 2nd and 3rd allocations, fishing effort continued during weekends, a period normally not fished. The 2008 fishery behavior was characteristic of a "derby" style fishery, resulting in a temporally shortened directed fishery. The directed Pacific sardine fishery was officially closed by NMFS on 23 September 2008.

The steady increase of sardines landed in Oregon since 1999 may have leveled off or slowed in the last three years (fig. 3). Oregon landings of sardine totaled 22,949 t in 2008, a considerable decrease from 2007 (42,144 t). In 2008, Oregon exported 4,050 t of sardine product worth a little over $3.8 million.

Washington landings of Pacific sardine decreased to 6,435 t in 2008 since a peak in 2000 (15,832 t, fig. 3). This is an increase from 2007 (4,665 t). Washington exported more sardine (19,201 t) than they landed (6,435 t), possibly product that was landed in Oregon or California or landed in 2007.

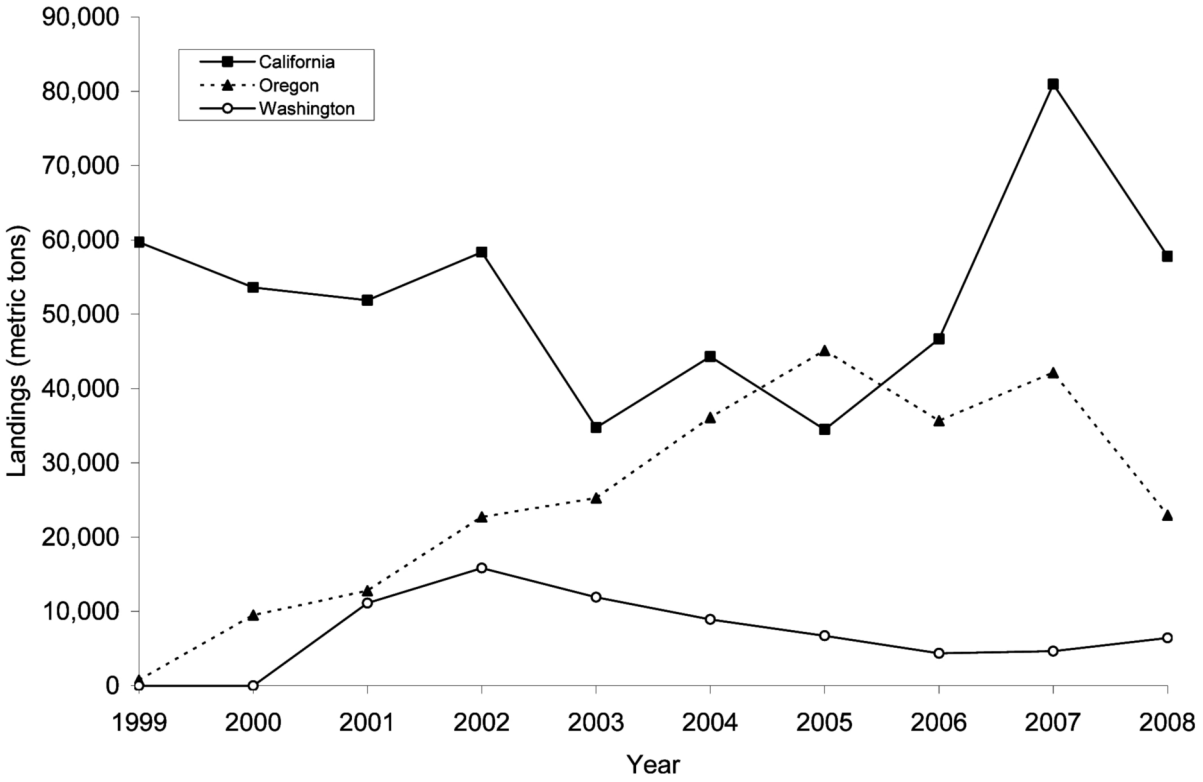

Figure 3. Commercial landings of Pacific sardine (*Sardinops sagax*) in California, Oregon, and Washington, 1999–2008.

In November 2008, the Council adopted an HG of 66,932 t for the 2009 Pacific sardine fishery based on a biomass estimate of 662,886 t and the harvest control rule in the CPS FMP. This HG is a 25% reduction from the 2008 HG. It also incorporated a new-for-2009 2,400 t set-aside allocated for dedicated Pacific sardine research activities during the 2nd allocation period.

The 2008 recreational Pacific sardine catch as sampled from the California Recreational Fisheries Survey (CRFS) was 29 t (595,000 fish), a 142% (185%, by number of fish) increase from 2007. The majority of the fish landed were from man-made structures, such as piers (97% by number and 100% by weight).

Pacific Mackerel. Pacific mackerel landings in California continue to be relatively low with 3,535 t in 2008 (tab. 1) following a seven-year trend (fig. 2). A majority of this catch was landed in southern California port areas (tab. 2). The total ex-vessel value generated for Pacific mackerel in 2008 was $686,589. Industry exported 1,876 t of mackerel product, valued at nearly $1.6 million, to 22 countries. China (405 t), Nauru (240 t), and Indonesia (227 t) received over 46% of this product.

Oregon reported 58 t of Pacific mackerel landed there in 2008 for a total ex-vessel value of $7,810. This is considerably down from the 2007 catch of 702 t. No landings of mackerel have been reported in Washington since 2005. Washington landings of Pacific mackerel are typically low, with an annual average of 72 t (unspecified mackerel) since 1999.

Similar to sardines, the majority of Pacific mackerel landings occur in southern California and Ensenada, BCM. In the U.S., the fishing season for Pacific mackerel is 1 July to 30 June the following year. At the start of the 2008–09 season NMFS estimated the biomass at 264,732 t and the Council set the HG at 40,000 t, with an 11,772 t set-aside for incidental landings in other fisheries. These values are lower than the prior season (biomass: 359,290 t; HG: 40,000 t). Landings above the HG would be constrained by an incidental catch rate of 45% by weight when landed with other CPS.

The 2008 recreational Pacific mackerel catch as sampled from CRFS was 291 t (1,904,000 fish), a 22% (45%, by number of fish) increase from 2007. Commercial passenger fishing vessels (CPFVs) reported 49,150 fish landed with <1% landed in Mexico.

Jack Mackerel. In 2008, jack mackerel landings represented less than 1% of the total catch of CPS in California with 274 t landed. This is less than half of the total 2007 catch (632 t) and generated $57,354 in ex-vessel revenue. Landings in Oregon continue to be low with 46 t landed in 2008 for an ex-vessel value of $415. Washington reported no landings of jack mackerel during 2008.

The 2008 recreational jack mackerel catch as sampled

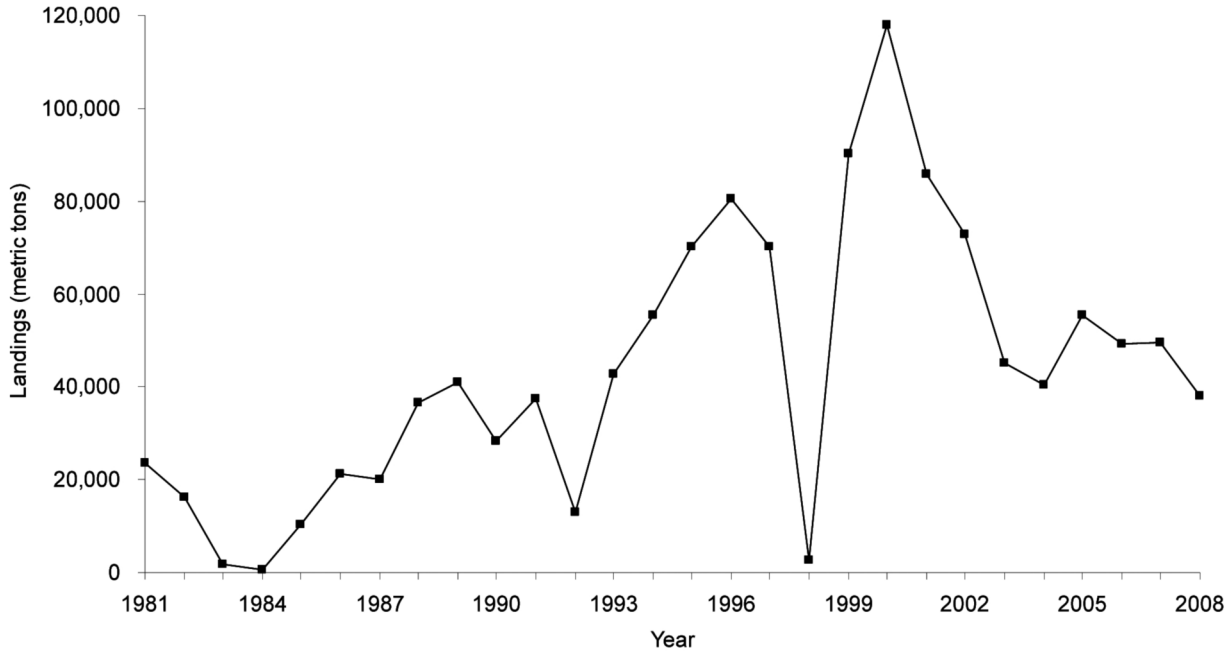

Figure 4. California commercial market squid (*Loligo opalescens*) landings, 1981–2008.

from CRFS was 5 t (86,000 fish), a 67% (161%, by number of fish) increase from 2007. CPFV vessels reported 408 fish landed.

Northern Anchovy. Landings of northern anchovy in California have been reported since 1916. Historically, anchovy was reduced to oil or fish meal and the fishery was modest compared to Pacific sardine and Pacific mackerel. However, periods of low sardine abundance saw increased anchovy landings. Peak landings were seen in the early-to-mid 1970s with total annual harvest exceeding 100,000 t at times. Presently, landings of northern anchovy are relatively modest, averaging about 9,800 t per year over the last 10 years (fig. 2). The vast majority of northern anchovy are landed in California, with occasional landings in Oregon and Washington. Anchovy are currently used for human consumption, animal food, and live bait.

California landings of northern anchovy in 2008 amounted to 14,285 t (tab. 1) with an ex-vessel value of nearly $1.6 million. This is a 37% increase from 2007 landings (10,390 t) and ranked as the second most valuable CPS finfish after Pacific sardine. Exports of northern anchovy product from California totaled 564 t for an export value of $338,303. While six countries received anchovy product from California, South Korea and Australia received the majority at 50% and 48%, respectively.

For 2008, Oregon reported landings totaling 260 t with an ex-vessel value of $56,674. Oregon exports of anchovy totaled 23 t to China with a value of $80,505. Washington reported 109 t valued at $35,280 ex-vessel value for 2008. Approximately 42 t was exported to Thailand with a value of $103,166. The 2008 California recreational catch for northern anchovy as sampled by CRFS totaled 3 t (194,000 fish).

Pacific Bonito. From 1999–2008, annual Pacific bonito (*Sarda chiliensis lineolata*) landings averaged 405 t, a small percentage of the total CPS quantity landed in California. In 2008, landings increased 262% from last year's low of 222 t to 803 t. The landings generated an ex-vessel value of $644,528. No landings of Pacific bonito were reported from Oregon or Washington in 2008.

The California recreational catches for Pacific bonito in 2008 were 146 t (76,000 fish), a 128% increase from 2007, although there was a 26% decrease in the number of fish. This disparity is the result of an increase in the average size of bonito landed from 384 mm (15.1 in.) in 2007 to 449 mm (17.7 in.) in 2008, and an increase in the average weight from 0.9 kg (2.0 lb.) in 2007 to 1.5 kg (3.3 lb.) in 2008. CPFV vessels reported 101,604 fish landed with 10.57% landed in Mexico.

California Market Squid

Of all the marine commercial species landed in California during 2008, market squid, *Loligo* (*Doryteuthis*) opalescens, generated the most ex-vessel revenue and ranked second in volume. Landings in 2008 were just 77% of the 2007 landings, at 38,100 t compared to 49, 473 t (fig.4). The ex-vessel value also dropped from $29.1 million in 2007 to $26.5 million. However, the ex-vessel price per ton of market squid has increased in recent years. In 2008, the average ex-vessel price was $639/t,

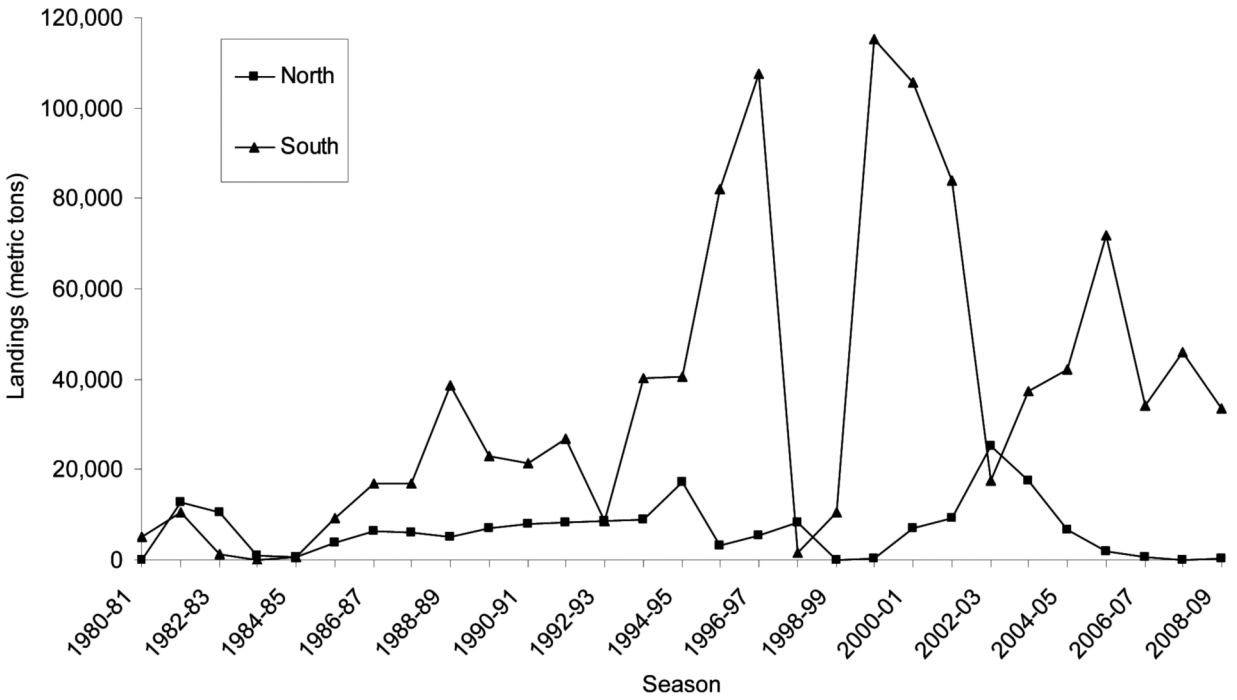

Figure 5. Comparison of market squid (*Loligo opalescens*) landings for northern and southern fisheries by fishing season (1 April–31 March), from 1980–81 to 2008–09 seasons.

up from $597/t in 2007 and $560/t in 2006. California fish businesses exported 25,371 t of market squid to 28 countries for a value of $35.8 million in 2008. The majority of those exports were to China (70%) with no other country contributing more than 5% of the market share.

The fishery can be separated into a northern and southern component based on the timing of when environmental conditions are optimal for squid spawning. The northern component is centered in and around Monterey Bay in the spring and summer, while the southern component is centered in the Southern California Bight usually in the fall and winter. Although the fishery has its historical origins in Monterey Bay, the fishery has been dominated by the southern component especially in the last few seasons, which have seen minimal landings in the northern component (fig. 5).

The fishery targets market squid during spawning events when they form dense schools usually over shallow sandy substrate. The fishery primarily uses purse and drum seine vessels with attracting lights to catch market squid, often working with a smaller vessel called a light boat, which also attracts squid using lights. A third type of vessel, a brail boat, uses attracting lights and scoops squid from the water using a dip net. A commercial live-bait fishery now exists for market squid; however, the amount of market squid harvested and the value of the fishery are largely unknown, as there are no permitting and reporting requirements. The live-bait fishery is likely a low-volume, high-value endeavor, as recreational anglers, primarily targeting white seabass, are willing to pay up to $85 for a "scoop" of live squid.

Commercial fishing for market squid is limited by fishery control rules set forth in the Market Squid FMP. Vessels are required to have a permit to possess or land over two short tons (1.8 t) of squid, except when fishing for use as live bait. The fishing permit is valid from 1 April to 31 March the following year. The number of permits issued per annum has declined from a high of 296 in 1998 to 211 in 2004. In 2005, a new permit structure was put into place and the number of permits issued has remained relatively constant at around 175. In 2008, there were 83 transferable market squid vessel, 59 light boat, 22 brail, 11 nontransferable market squid vessel, and three nontransferable light boat permits issued. Other fishery control rules include an annual catch limit of 107,048 t (118,000 short tons), weekend closures, lighting requirements, area closures for birds, and the use of an egg escapement model as a proxy for maximum sustainable yield (MSY).

Ocean Salmon

Ocean salmon fisheries in California primarily target Chinook salmon (*Oncorhynchus tshawytscha*). The retention of coho salmon (*O. kisutch*) has been prohibited in the commercial and recreational fisheries since 1993 and 1996, respectively. Pink salmon (*O. gorbuscha*) are taken occasionally in the fisheries, usually in odd years. Each

season, the Council and the Commission regulate California's ocean salmon fisheries to meet the conservation objectives for Klamath River fall Chinook and SRFC stocks as described in the Salmon FMP. In addition, the fisheries must meet the NMFS Endangered Species Act (ESA) consultation standards for listed stocks, including Sacramento River winter Chinook (endangered), Central Valley spring Chinook (threatened), California coastal Chinook (threatened), Central California coast coho (endangered), and southern Oregon/northern California coho stocks (threatened).

In 2008, California salmon fisheries were closed due to a significant decline in the abundance of SRFC. This stock generally contributes 80%–90% of California's ocean landings. In the fall of 2008, only 66,264 SRFC adults returned to spawn in the Sacramento River basin, which was the lowest escapement on record and is well below the FMP's conservation goal of 122,000–180,000 adult spawners. In addition, only 4,061 SRFC jacks (age-2 fish) returned to spawn in 2008, the second lowest return on record. The number of returning jacks is used to estimate the following year's adult ocean abundance. Based on these data, the forecasted ocean abundance for 2009 was approximately 122,196 SRFC, without any additional ocean or river fishing. This would predict the third-lowest adult escapement of SRFC since 1992. In April 2009, the Council and Commission closed all commercial and severely limited recreational ocean salmon fishing in California during 2009, specifically to protect SRFC.

No commercial landings occurred in 2008 compared to estimated total commercial landings of 114,141 Chinook (686 t) in 2007. There were zero days open compared to 341 (days open in each of four management areas combined) in 2007.

The 2008 recreational fishery was open for 45 days in the Fort Bragg area prior to the 1 April closure, compared to a season total of 794 days (days open in each of four management areas combined) in 2007. In the abbreviated 2008 recreational fishery an estimated six Chinook were landed compared to 47,704 salmon in 2007. There were an estimated 391 angler days in 2008 compared to 105,889 angler days in 2007. No salmon were landed by CPFVs. Regulations permitted two salmon per day of any species except coho. Single point, single-shank barbless hooks were required north of Point Conception and anglers fishing with bait and by any means other than trolling were required to use circle hooks. The minimum size limit was 508 mm (20 in.) total length (TL).

In 2009, a limited recreational fishery was set for the Eureka and Crescent City major port areas from 29 August through 7 September 2009. The waters from the Oregon border to Horse Mountain, California will be open to ocean sport anglers. Regulations permit two salmon per day of any species except coho. Single point, single-shank barbless hooks are required north of Point Conception and anglers fishing with bait and by any means other than trolling are required to use circle hooks. The minimum size limit is 609 mm (24 in.) TL.

Groundfish

More than 90 species of bottom-dwelling marine finfish are included in the federally-managed groundfish species complex. The groundfish fishery includes all rockfishes, sablefish (*Anoplopoma fimbria*), thornyheads (*Sebastolobus alascanus* and *S. altivelis*), lingcod (*Ophiodon elongates*), Dover sole (*Microstomus pacificus*) and other flatfishes (not including halibut), Pacific whiting (*Merluccius productus*), and some sharks and skates.

Commercial Fishery. In 2008, 13,109 t of commercial groundfish were landed in California. This is a 25% increase from landings in 2007 (10,513 t, tab. 3), a 9% increase from 2006 landings (12,047 t), and a 44% decrease from 1998 landings (23,364 t). Pacific whiting (4,944 t), Dover sole (3,018 t), and sablefish (1,549 t) continued to be the top species landed by weight in 2008, identical to species dominating landings in 1998, 2006, and 2007. Dover sole, thornyheads, and sablefish (collectively referred to as the "DTS" complex) landings accounted for 73% (9,511 t) of all commercial groundfish landings. Overall in 2008, the species groups caught most frequently were roundfishes (e.g., sablefish, lingcod, cabezon (*Scorpaenichthys marmoratus*), greenlings (*Hexagrammos* spp.), Pacific whiting (*Merluccius productus*), and Pacific cod (*Gadus macrocephalus*) (50%), followed by flatfishes (34%) and rockfishes (14%). Sharks and skates accounted for two percent of the total commercial groundfish landings. The most important rockfish species to the 2008 commercial groundfish fishery in terms of total landings by weight (101 t) was chilipepper rockfish (*Sebastes goodie*); black rockfish (*Sebastes melanops*) was the most important in terms of ex-vessel value ($438,000). Overfished rockfish species accounted for less than one percent (68 t) of the landings in 2008, although 21% more were landed than in 2007 (56 t); the predominant species was widow rockfish (*Sebastes entomelas*) in both years.

The 2008 ex-vessel value for commercial groundfish was approximately $19.7 million, a 12% increase from 2007 ($17.6 million), and a 12% decrease from the peak in 1998 ($22.4 million). Among species with landings greater than one metric ton per year, grass rockfish (*Sebastes rastrelliger*) was the most valuable species landed in 2008 with an average price of $11.46/kg, followed by China rockfish (*Sebastes nebulosus*) at $8.46/kg, and gopher rockfish (*Sebastes camatus*) $8.16/kg. The high market value of these species is due to their live condi-

TABLE 3
California commercial groundfish landings (in metric tons) and ex-vessel value in 2008 with comparisons to 2007. The top five species by weight for flatfish and rockfish species groups are represented in the table.

	2008		2007		% change from 2007	% change from 2007
	Harvest (t)	Value ($)	Harvest (t)	Value ($)	(t)	($)
Flatfishes						
Arrowtooth flounder	44.5	$9,896	60	$13,556	–26%	–27%
Dover sole	3,018	$2,576,384	2,767	$2,378,010	9%	8%
English sole	139	$109,650	181	$143,256	–23%	–23%
Petrale sole	923	$2,187,129	916	$2,122,955	1%	3%
Rex sole	142	$112,274	172	$132,952	–17%	–16%
Sanddabs	126	$132,131	162	$170,337	–22%	–22%
Other flatfish	28	$42,767	46	$7,1967	–39%	–40%
Total Flatfishes	4,420	$5,170,231	4,305	$5,033,033	3%	3%
Rockfishes						
Chilipepper rockfish	101	$192,346	57	$103,278	76%	86%
Black rockfish	99	$437,968	81	$357,522	22%	23%
Bank rockfish	71	$158,210	26	$63,214	175%	150%
Splitnose rockfish	71	$61,234	80	$61,663	–12%	–1%
Blackgill rockfish	40	$148,029	25	$87,698	59%	69%
Gopher rockfish	24	$394,018	20	$312,944	21%	26%
Other rockfish	191	$1,425,288	238	$1,538,591	–20%	–7%
Overfished species						
Bocaccio	6	$18,260	7	$20,965	17%	15%
Canary rockfish	1	$1,537	0.8	$1,395	–20%	–9%
Cowcod	No Data	0.1	$130			
Darkblotched rockfish	30	$39,606	41	$53,704	–27%	–26%
Pacific ocean Perch	0.2	$223	0.03	$27	567%	726%
Widow rockfish	31	$100,461	8.3	$19,899	273%	405%
Yelloweye rockfish	0.02	$34	0.2	$801	–90%	–96%
Total Rockfishes	665	$2,977,345	587	$2,622,147	14%	14%
Roundfishes						
Cabezon	23	$310,362	25	$326,941	–8%	–5%
Kelp greenling	1.3	$20,046	1.5	$20,760	–13%	–3%
Lingcod	69	$236,514	80	$258,822	–14%	–9%
Pacific whiting	4,944	$1,646,925	2,968	$1,956,261	67%	–16%
Sablefish	1,549	$6,230,990	1,448	$4,882,907	7%	28%
Total Roundfishes	6,587	$8,444,837	4,523	$7,445,691	46%	13%
Scorpionfish, California	3.6	$25,722	3.6	$25,657	0%	0%
Sharks & Skates	232	$155,864	147	$109,405	58%	42%
Thornyheads	1,110	$2,866,271	844	$2,322,391	32%	23%
Other Groundfish	92	$43,243	105	$41,394	–12%	4%
Total Groundfish	12,967	$19,571,239	10,339	$17,466,766	25%	12%

Data Source: CFIS

tion and limited availability. The majority of groundfish landed in 2008 were taken by trawl gear (89%). The remainder was caught with hook-and-line gear (9%) and trap gear (2%). Net gear accounted for less than one percent of the total catch. Pacific whiting and Dover sole were the main contributors to trawl landings.

Recreational Fishery. The Recreational Fisheries Information Network (RecFIN) Program houses recreational data from California, Oregon, and Washington. The California data, available from 1980 to present, provide the best available information regarding recreational catch off California. RecFIN incorporates two recreational fishery sampling programs: the Marine Recreational Fisheries Statistical Survey (MRFSS), which sampled from 1980 to 2003, and CRFS, which was initiated by the Department in 2004. Due to changes in the sampling protocol and how the data are used to estimate landings, these two surveys are not comparable. Information from CRFS indicated that in 2008, California anglers targeting bottomfish participated in an estimated 798,000 trips. This was an 8% increase from 2007 (734,000 angler trips) and a 36% increase from 2006 (587,000 angler trips). Seventy-nine percent of the bottomfish effort occurred in southern California (south of Point Conception), particularly from CPFVs and man-made structures. Central California (Point Conception to Cape Mendocino) accounted for 17% of the bottomfish effort and northern California (Cape Mendocino to the California/Oregon border) accounted for four percent. An estimated 945 t of groundfish were taken by the recreational fishery in 2008 (tab. 4), a 27% decrease from 2007 (1,292 t) and a 41% decrease from 2006 (1606 t). The top five species accounting for approximately half (52%) of the groundfish catch by weight were

TABLE 4
California recreational groundfish landings (A+B1)* greater than 5 metric tons in 2008 with 2007 comparisons

	2007 Harvest (t)	2008 Harvest (t)	% Change from 2007
Black Rockfish	139	150	9%
Vermilion Rockfish	195	104	–47%
Lingcod	174	99	–43%
Blue Rockfish	148	83	–44%
CA Scorpionfish	68	60	–12%
Brown Rockfish	56	48	–14%
Copper Rockfish	67	48	–27%
Gopher Rockfish	34	40	17%
Olive Rockfish	52	40	–23%
Bocaccio	52	34	–35%
CA Sheephead	30	28	–8%
Leopard Shark	22	28	30%
Pacific Sanddab	20	26	33%
Starry Rockfish	29	21	–27%
Yellowtail Rockfish	56	19	–65%
Cabezon	22	15	–29%
China Rockfish	13	14	7%
Greenspotted Rockfish	13	10	–24%
Kelp Greenling	9.5	9.5	0%
Grass Rockfish	9.1	7.3	–20%
Black & Yellow Rockfish	3.4	5.9	75%
Flag Rockfish	7.8	5.5	–29%
SpeckledRockfish	4.9	5.2	6%
Other Rockfish	67	44	–34%
Total Groundfish	1292	945	–27%
Angler Trips			
Bottomfish Effort	734,000	798,000	8%

Rockfish species of concern yelloweye rockfish (0.7 t), cowcod (0.2 t) and canary rockfish (1.7 t) are included in the "Other" category.
(A+B1) – Fish caught and either identified or not available for identification
Data source: RecFIN

black rockfish, vermilion rockfish (*Sebastes miniatus*), lingcod, blue rockfish (*Sebastes mystinus*), and California scorpionfish (*Scorpaena guttata*). The same five species accounted for 56% of the total groundfish catch in 2007 although vermilion rockfish was the dominant species. Black rockfish was the dominant species caught in the north, followed by lingcod, vermilion rockfish, and blue rockfish. Blue rockfish was the dominant species caught on the central coast, followed by lingcod, vermilion rockfish, and black rockfish. California scorpionfish was the dominant species caught in southern California, followed by vermilion rockfish, bocaccio (*Sebastes paucispinis*), and California sheephead (*Semicossyphus pulcher*).

Yelloweye Rockfish Stock Assessment. The first yelloweye rockfish (*Sebastes ruberrimus*) stock assessment was completed in 2001 for the population along the coast of northern California and Oregon. The study concluded that the stock was approximately 7% of its unfished biomass and, as a result, was declared "overfished" by NMFS in 2002. Subsequent stock assessments in 2006 and 2007 also concluded that the stock was overfished and that rebuilding the stock to a sustainable level would take approximately 75 years. As a result of the 2002 overfished designation, increased regulations were put in place for the recreational and commercial fisheries to reduce the catch of yelloweye rockfish, including season, area, and depth restrictions. By 2003, yelloweye rockfish were not allowed to be retained by either recreational or commercial anglers and were only taken as bycatch.

Since 1969, when data first became available for yelloweye rockfish, commercial landings peaked in 1971

TABLE 5
Commercial landings of yelloweye rockfish (*Sebastes ruberrimus*) in metric tons with ex-vessel value and average price per pound, 1969–2008

Year	Harvest (t)	Ex-vessel Value	Average Price per Pound	Year	Harvest (t)	Ex-vessel Value	Average Price per Pound
1969	633	$91,588	$0.07	1989	23	$32,630	$0.66
1970	665	$110,436	$0.08	1990	39	$70,064	$0.81
1971	711	$119,342	$0.08	1991	39	$70,305	$0.81
1972	639	$125,412	$0.09	1992	29	$50,875	$0.79
1973	302	$99,643	$0.15	1993	18	$33,669	$0.84
1974	202	$88,859	$0.20	1994	26	$58,283	$1.03
1975	210	$109,293	$0.24	1995	30	$85,871	$1.28
1976	296	$182,306	$0.28	1996	45	$132,317	$1.33
1977	305	$225,448	$0.34	1997	42	$98,222	$1.06
1978	345	$302,653	$0.40	1998	17	$50,752	$1.33
1979	344	$345,969	$0.46	1999	10	$36,785	$1.74
1980	22	$20,760	$0.42	2000	3.3	$16,259	$2.23
1981	248	$279,725	$0.51	2001	3.8	$19,920	$2.36
1982	63	$29,961	$0.22	2002	0.07	$130	$0.89
1983	0.9	$468	$0.24	2003	0.01	$20	$0.91
1984	0.3	$235	$0.36	2004	0.02	$46	$1.07
1985	0.4	$243	$0.29	2005	0.02	$23	$0.50
1986	5.2	$8,828	$0.76	2006	0	$6	$0.61
1987	23	$31,779	$0.62	2007	0.18	$800	$2.00
1988	16	$22,627	$0.63	2008	0.02	$16	$0.30

Data Source: CFIS

TABLE 6
Recreational landings (in metric tons) of yelloweye rockfish (*Sebastes ruberrimus*).

Year	Harvest (t) (MRFSS)	Year	Harvest (t) (MRFSS)	Harvest (t) (CRFS)
1980	75.9	1995*	12.6	
1981	46.9	1996	12.5	
1982	103.8	1997	15.1	
1983	51	1998	5.8	
1984	80.8	1999	12.6	
1985	125.8	2000	7.5	
1986	65.5	2001	4.6	
1987	75.2	2002	2.1	
1988	57.5	2003	3.7	
1989	58.7	2004		0.8
1990	No Data	2005		1
1991	No Data	2006		1.1
1992	No Data	2007		3.8
1993*	8.5	2008		0.7
1994*	14.4			

Data not available for 1990 through 1992.
*CPFV mode data not available for central and northern California for 1993 through 1995.
Data source: RecFIN (MRFSS and CRFS)

when 711 t were landed (tab. 5). The highest ex-vessel value from the commercial yelloweye rockfish fishery occurred in 1979 with an approximate value of $345,969 (tab. 5). Yelloweye rockfish are primarily taken with hook-and-line gear.

An evaluation of both MRFSS and CRFS data suggests that landings of yelloweye rockfish peaked in 1985 with an estimated 125 t of fish landed (tab. 6). Landings decreased significantly once the non-retention regulation for yelloweye rockfish was put in place in 2003. In addition, CRFS estimates indicated that 99% of the total harvested catch came from boat-based recreational anglers. Since 1980, almost half of the catch has been landed on CPFVs and half from private and rental boats. The primary reason for such high catch values from the boat-based anglers is the average depth range for the species (18.2 to 549 m, 60 to 1,800 ft), which often makes them inaccessible to shore-based anglers.

Management History. Yelloweye rockfish became a federally designated groundfish in 1982 after the Council adopted the Pacific Coast Groundfish FMP. Since then, yelloweye rockfish have been managed under the joint jurisdiction of the state and federal governments. In 2004, the Council adopted a yelloweye rockfish rebuilding plan; since then, yelloweye rockfish has been managed with its own acceptable biological catch and optimum yield (OY). In the case of overfished species, the OY level is adjusted to rebuild the species population to a sustainable level while considering impacts of low harvest levels on fishing communities. Strict management measures in state and federal waters were adopted for both commercial and recreational user groups to prohibit retention and rebuild the stock as quickly as possible.

In 2007, the California recreational HG for yelloweye rockfish was exceeded despite early closures for the northern and north-central groundfish management areas. In 2008, the Department's in-season tracking model projected the HG for the recreational yelloweye rockfish fishery would be exceeded again if the season continued at the current rate. Since most of the yelloweye rockfish were caught in northern California, an emergency closure was instituted in September 2008 from the Oregon-California border to Point Arena (Mendocino County), which kept the final annual harvest below the HG.

California Spiny Lobster

The commercial and recreational seasons for harvesting the California spiny lobster, (*Panulirus interruptus*) occur from late September to the middle of March. Essential commercial fishery information is collected using fishermen-submitted logbooks and dealer-submitted landing receipts. Logbooks record location and date of catch, number of traps, and number of kept and released lobsters. Landing receipts record catch location, size of catch in pounds, and the price paid per pound. The recreational season is monitored through the use of a lobster report card introduced at the beginning of the 2008–09 recreational season and from data collected by CRFS samplers. Additional information on the recreational fishery was collected by an intercept survey, a nighttime extension to CRFS, during the first 10 weeks of the 2007–08 season.

Commercial Fishery. The commercial lobster fishery is a restricted access program with 204 lobster operator permits for 2008. Most (142) of these permits are transferable. While there have been no restrictions on the number of transferable permits that can be transferred since 1 April 2008, only 11 transfers took place in calendar year 2008. In 2008, the number of fishermen with operator permits that actually fished was 174, up from 169 the previous year. In the 2007–08 season, however, the number of active fishermen was 167, a decline from 176 fishermen during 2006–07.

Currently, there are no restrictions on the amount of lobster that permittees can land or the number of traps they can use. Traps are generally set along depth contours in the vicinity of kelp beds along the mainland and at all the Channel Islands. Typically, between 100 and 300 traps are set at a time although those with larger boats or a crewmember may set more. Soak times in 2007–08 averaged three days. The total number of trap pulls in the 2007–08 season was estimated at 808,000 resulting in a catch of approximately 1.7 million lobsters, of which 27% were retained. This translates to a preliminary landing weight of approximately 306 t. This effort and catch was lower than during the 2006–07 sea-

Figure 6. California landings of California spiny lobster (*Panulirus interruptus*), 1916–2008.

son which had 852,000 trap pulls, an approximate catch of 1.9 million lobsters with 31% retained, and a landing weight of 398 t. By calendar year, however, 335 t was landed in 2008, 35 t more than in 2007 (fig. 6). While substantially lower than the recent peak of 403 t in 2006, the 2008 landing total continues a trend of 300 t, or more, lobsters landed per calendar year since 2000.

Approximately 42% of the total 2007–08 landings (127 t) occurred in the first month (October) of the season, with San Diego County accounting for 41% of that month's take; Santa Barbara/Ventura counties had the lowest first month landings at 25% (32 t). Interestingly, 23% of the total landings for the 2007–08 season, by weight, occurred along Point Loma in San Diego County.

The median ex-vessel price for both calendar year 2008 and the 2007–08 season was $24.25/kg ($11.00/lb) and ranged from $19.84/kg ($9.00/lb) to $27.56/kg ($12.50/lb). Overall, the ex-vessel value of the lobster fishery was $7.91 million in calendar year 2008, up from the $7.32 million in 2007, and approaching the decadal high of $8.06 million set in 2006. The ex-vessel value of the 2007–08 lobster season was $7.22 million. Point Loma landings had the highest ex-vessel value at $1.58 million representing 22% of the total season value.

Recreational Fishery. Recreational fishermen are allowed to catch lobster by hand when snorkeling or scuba diving, or by using baited hoop nets. Up to five baited hoop nets per person, with a maximum of ten hoop nets per boat, can be used. There is a daily bag and possession limit of seven lobsters per fisherman. In both the recreational fishery as well as the commercial fishery, lobsters must exceed a carapace length of 82.6 mm (3.25 in.) to be kept. A 1992 Department creel survey involving four sites in San Diego and Ventura counties during the first two weekends of the season revealed that approximately 80% of the interviewed lobster fishermen used scuba gear to catch lobsters; 20% used hoop nets. A more recent creel survey was conducted during the first 10 weeks of the 2007–08 lobster season. At the same 1992 survey sites, using data from the first two weekends, the 2007 creel survey found the opposite; approximately 82% of the fishermen used hoop nets while only 20% used scuba gear. Recent years have seen the introduction of a more efficient hoop net into the fishery which a Department study showed can catch 57% more lobster than a traditional hoop net with the same effort. During the 2007–08 season, the traditional hoop nets were still responsible for catching more lobsters, although in Santa Barbara/Ventura counties the catch was evenly split between the two types of hoop nets.

A total of 2,833 fishermen were interviewed during the 2007 creel survey. Of these, most did not catch legal-size lobsters. Of those that did, only 24 (<1%) were found with the bag limit of seven lobsters, and 21 (88%) of these occurred on private boats. About 81% of the lobsters caught were below the legal size limit and released.

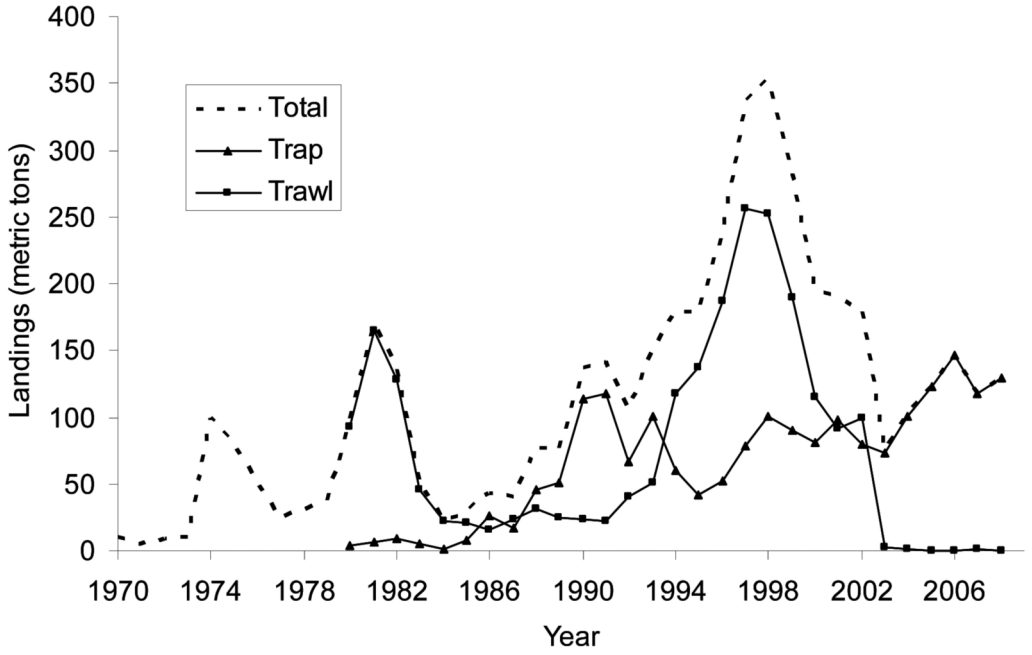

Figure 7. California landings of spot prawn (*Pandalus platyceros*) by gear type, 1970–2008.

Overwhelmingly, San Diego County accounted for the most effort (recorded as hours fished) in southern California (64% of the total hours) followed by Los Angeles/Orange counties (25%) and Santa Barbara/Ventura counties (11%). Interestingly, the number of lobsters kept per hour was highest in Santa Barbara/Ventura counties at about 0.5 lobster kept per hour fished while the other regions were about half that catch rate. Lobsters ranged in size from 58 mm (2.3 in.) to 183 mm (7.2 in.) carapace length and the study indicated that the highest number of lobster caught are just at the legal size limit of 82.6 mm (3.3 in.).

A lobster report card was introduced for the 2008–09 recreational season that records the time, location, gear, and retained catch size by outing for anyone fishing for lobster. Approximately 25,000 cards were sold at the beginning of the season, with about 5,000 completed cards returned to date. The information from the first half of the 2008–09 season is currently being analyzed.

Spot Prawn

Preliminary 2008 spot prawn (*Pandalus platyceros*) landings were 130 t, a 9% increase from 2007 (118 t) (fig. 7). Until 2002, spot prawn were harvested by trawl and trap gear. In 2003, the use of trawl gear for the take of spot prawn was prohibited due to the bycatch of rockfish, particularly bocaccio an overfished species. Consequently, 2003 spot prawn landings were the lowest since 1987 when trapping was just getting underway in southern California. Current harvest levels are well below those of the mid-to-late 1990s and appear to be sustainable.

Spot prawn is currently caught only with trap gear, although a small amount shows up as bycatch in the ridgeback trawl fishery (0.5 t). Spot prawn traps are required to be made of mesh with a minimum inside measurement of 2.22 × 2.22 cm (7/8 × 7/8 in). The traps may not exceed 1.8 m (6 ft) in any dimension. The baited traps are fished in strings at depths of 174 to 302 m (571 to 991 ft) along submarine canyons or shelf breaks. Each string consists of a groundline with anchors and a buoy at one or both ends, and 10 to 30 traps attached. No other species may be taken in a prawn trap, so all bycatch is returned to the water immediately.

A two-tiered restricted access trap vessel permit program was initiated in 2002. Tier 1 permittees may use up to 500 traps, unless fishing in state waters north of Point Arguello where they are only allowed to use 300 traps. Eighteen trap vessel owners originally qualified and purchased these permits, and 17 remained when they became transferable on 1 April 2005. Three permits have been sold on the open market for approximately $200,000 each. The Department receives a transfer fee of $50.00 when a permit is sold.

Tier 2 vessel permittees made a smaller number of qualifying trap landings, and are limited to an annual harvest quota of just over 2 t. Permittees may use no more than 150 traps and the permits are non-transferable. Initially there were six permittees, but only three Tier 2 permittees remain.

When the use of trawl gear for the take of spot prawn was prohibited, the Commission directed the Department to develop a conversion program for the trawl fleet. The

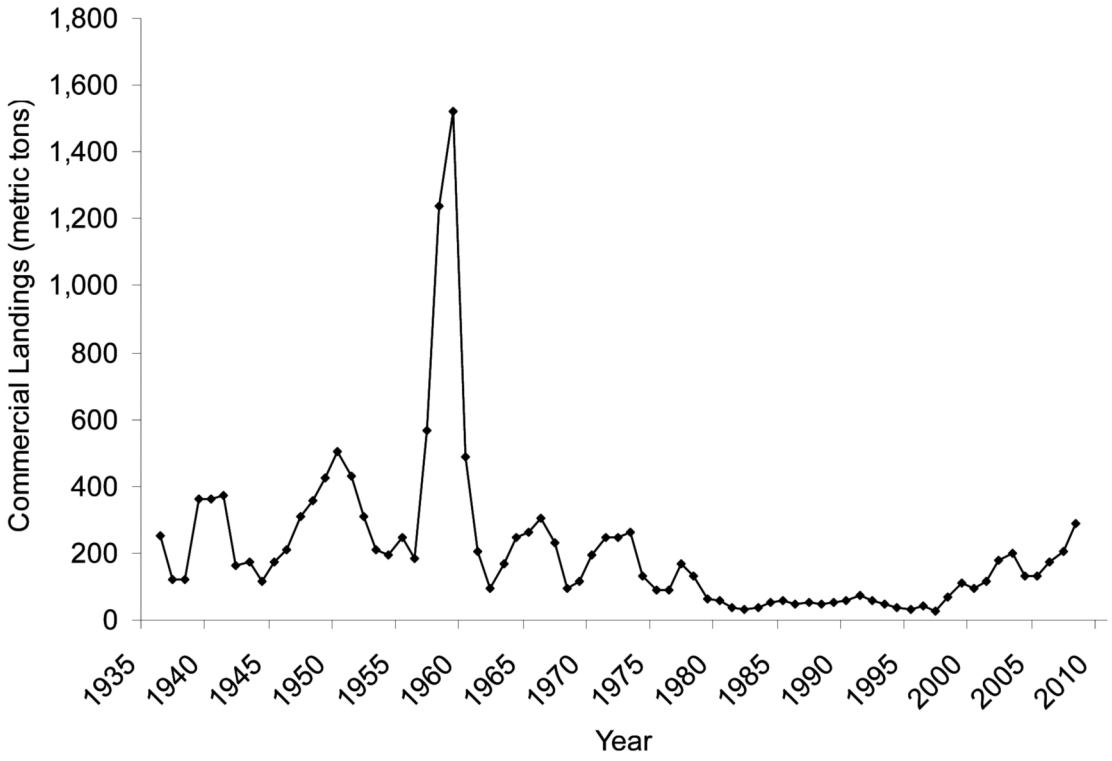

Figure 8. California commercial landing of white seabass (*Atractoscion nobilis*), 1936–2008. Note: Fish caught in US waters only (does not include fish caught in Mexico and landed in California).

conversion program went into effect in 2005, which allowed the owners of 12 former spot prawn trawl vessels to purchase Tier 3 spot prawn trap vessel permits in 2005. Tier 3 permittees have the same restrictions as Tier 1 permittees although the permits are non-transferable. Ten Tier 3 permittees remain. In 2008, the fee for the Tier 3 permit was $1,184.75, whereas, both Tier 1 and Tier 2 vessel permits were $296.

In 2008, 19 trap permittees landed spot prawn. Four of the 19 permittees fished in the vicinity of Monterey Bay, and the remaining vessels fished in southern California, frequently off one of the Channel Islands. Fifteen of the 17 Tier 1 trappers landed 87% of the catch with each vessel averaging 7.5 t. All three Tier 2 fishermen fished, and only one of the Tier 3 permittees went fishing. Most of the Tier 3 permittees have not had the funds necessary to purchase either a vessel more suitable for trapping, or the traps and associated ground tackle. A 0.023 t allowance of spot prawn while trawling for ridgeback prawn is still legal, but spot prawn may not be landed as bycatch when trawling for pink shrimp.

Almost all harvested spot prawn are sold live, with ex-vessel prices ranging from $22 to $31/kg ($10.00 to $14.00/lb). Fresh dead spot prawn generally sell for half the price of live. Most trap permittees have invested in live tanks and chillers on their vessels to keep the prawn in top condition for the live market.

The trap fishery in southern California (south of Point Arguello) is closed from 1 November to 31 January to provide protection for ovigerous females. North of Point Arguello, the spot prawn trap season is closed from 1 May to 31 July, an accommodation to prevent serious fishing gear conflicts in the Monterey Bay area.

White Seabass

The white seabass (*Atractoscion nobilis*) is the largest member of the Sciaenid family found in California waters. In addition to being a popular sport fish, white seabass are also targeted by a commercial fishery. The commercial white seabass fishery landed 291 t in 2008 (fig. 8), a 41% increase from the 2007 total of 207 t. Recreational landings decreased by 11% to 51 t in 2008 from the previous year's total of 57 t. The RecFIN estimates prior to 2004 are from a different survey and are not directly comparable to the estimates from the CRFS. However, historical trends in the recreational catch of white seabass can be determined from CPFV logbook data (fig. 9). The combined commercial and recreational catch for 2008 was 342 t.

There have been commercial and recreational fisheries for white seabass in California since the 1890s. Historically, commercial landings have fluctuated widely, including the landings of white seabass taken in Mexican waters by California commercial fishermen. Before 1982,

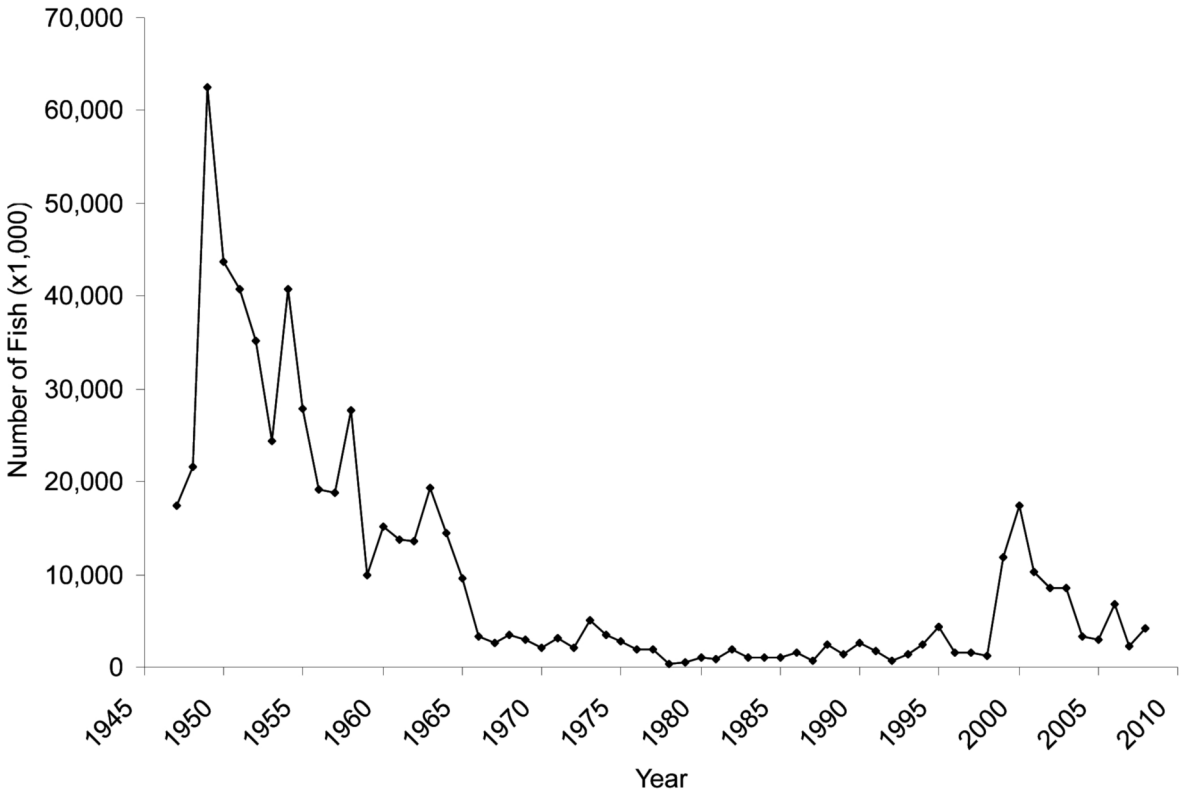

Figure 9. California recreational catch (in numbers of fish) of white seabass (*Atractoscion nobilis*) from CPFV, 1947–2008. Notes: Fish caught in US waters only (does not include fish caught in Mexico and landed in California), 1947–2008 recreational catches from Commercial Passenger Fishing Vessel (CPFV) logbook database.

the white seabass commercial take in Mexican waters comprised from 1% in 1959 to 89% in 1981 of California's white seabass annual landings (fig. 10). Since then, the Mexican government has prohibited access permits to the U.S. commercial fleet. Beginning in 1994, the use of set and drift gill nets within three nautical miles (3.5 mi) of the mainland shore from Point Arguello to the U.S.-Mexico border and in waters less than 128 m (70 fathoms) or within 0.9 nautical miles (1 mi) (whichever is less) of the Channel Islands was prohibited. In April 2002, the use of gill and trammel nets in depths of 110 m (60 fathoms) or less was prohibited from Point Reyes (approximate latitude 38.0°N) to Point Arguello (approximate latitude 34.6°N). Despite restrictions, most commercial white seabass landings are still taken with set and drift gill nets. In 2008, set and drift gill nets accounted for 98% of the commercial landings by weight and less than 1% of commercial white seabass landings were from north of Point Arguello. White seabass have a minimum legal size limit of 710 mm (28 in) TL.

The commercial fishery for white seabass is closed between Point Conception (approximate latitude 34.45°N) and the U.S.-Mexico border from 15 March to 15 June, with the exception of one fish not less than the minimum size limit may be taken, possessed, or sold by a vessel each day if taken incidental to gill and trammel net fishing operations. In 2008, the average ex-vessel value paid by dealers was $6.37/kg ($2.89/lb) and the total ex-vessel value was $1.5 million, approximately 30% more than in 2007.

The recreational fishery for white seabass occurs almost entirely (97%) south of Point Arguello (approximate latitude 34.6°N). The fishery is open all year, but the majority of the recreational take occurs between March and September. White seabass have a minimum legal size limit of 710 mm (28 in.), and the daily bag limit is three fish, except from 15 March through 15 June when the daily bag limit is one fish. Most fish are caught by hook-and-line anglers onboard CPFVs and private boats.

In 1982, the California Legislature established the Ocean Resources Enhancement and Hatchery Program (OREHP). The legislation was adopted to fund research into the artificial propagation of marine finfish species whose populations had become depleted. The ultimate goal of the legislation is to enhance populations of marine finfish species important to California for their recreational and commercial fishing value. Initially, research was focused on California halibut and white seabass; however, white seabass was eventually chosen as the primary species to focus on because of the depressed con-

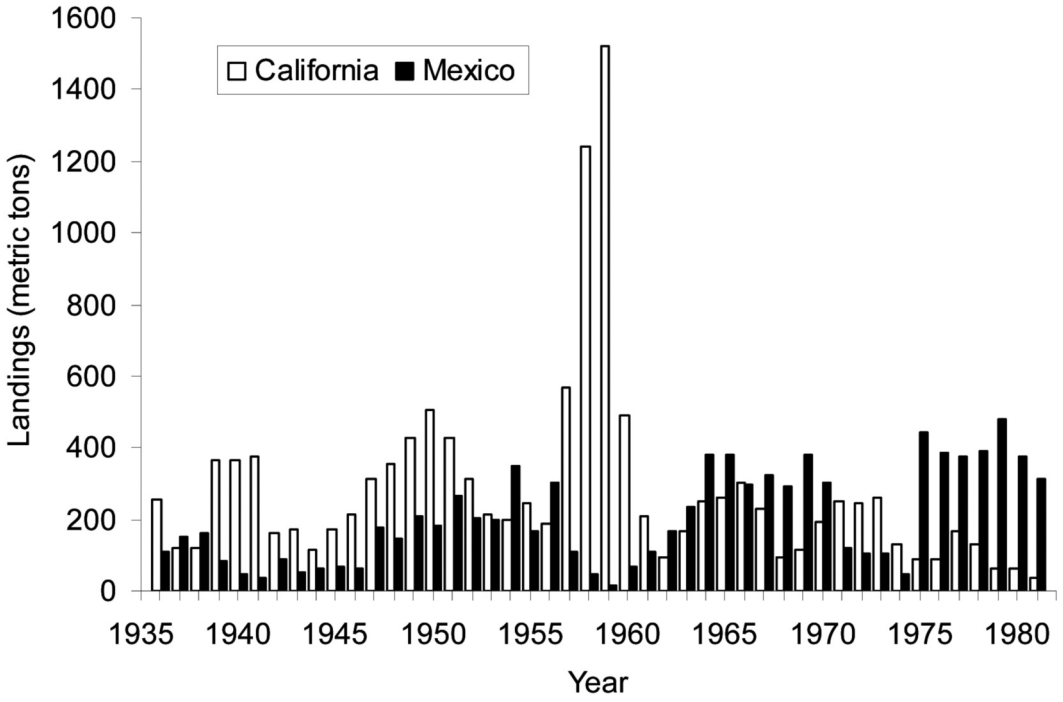

Figure 10. California and Mexico commercial landings of white seabass (*Atractoscion nobilis*), 1936–1981. Note: Fish caught in US waters only (does not include fish caught in Mexico and landed in California).

dition of the stock at the time and its higher value to recreational and commercial fishermen.

The Department manages the OREHP with the assistance of an advisory panel that consists of academic and management agency scientists, representatives of both commercial and recreational fishing groups, and the aquaculture industry. The program is funded through the sale of recreational and commercial marine enhancement stamps for all saltwater anglers south of Point Arguello. In 1995, the OREHP completed construction of the Leon Raymond Hubbard, Jr. Marine Fish Hatchery in Carlsbad, California. The primary function of the hatchery, operated by the Hubbs-Sea World Research Institute (HSWRI), is to provide juvenile white seabass, approximately 100 mm TL (3.9 in.), to growout facilities operated by volunteer fishermen. The hatchery is designed to produce 350,000 juvenile white seabass; however, the current release limit, which is imposed by the California Coastal Commission as a condition of the Coastal Development Permits for the growout facilities, is set at 125,000 fish per calendar year.

Currently, there are 13 growout facilities located in bays and marinas from Santa Barbara to San Diego in southern California. The growout facilities rear juvenile white seabass to 200 to 250 mm (7.8 to 9.8 in.) TL before releasing them at or near the growout site. In 2008, 58,484 hatchery-raised white seabass were released, approximately 29% of last year's release of 199,682 fish. This decline in production was due to disease issues within the hatchery and growout facilities. Since 1986, over 1.5 million white seabass, each implanted with a coded wire tag (CWT), have been released from the OREHP facilities.

Since the mid-to-late 1980s, the OREHP has contracted with researchers to develop juvenile and adult gill net sampling programs to assess the proportion of hatchery-raised fish to the wild population using coded wire tagged fish. Since the inception of both programs, 1,400 hatchery-raised juvenile white seabass have been recovered in the juvenile gill net studies while 125 tagged adult white seabass (legal-size) have been recovered from the recreational and commercial fisheries. The results of both the juvenile and adult sampling programs will be used in evaluating the success of the OREHP.

To manage the state's commercial and recreational fisheries for white seabass, the Commission adopted the White Seabass Fishery Management Plan (WSFMP) in 1996. To implement the WSFMP in accordance with the Marine Life Management Act adopted in 1998, the Commission adopted regulations in 2002 to establish a fishing season of 1 September through 31 August of the following year. The Commission also adopted an OY in 2002 based on an MSY proxy of the unfished biomass, and currently set at 540 t. The OY has never been reached since its implementation, but came close in the 2001–02 fishing season when it reached 530 t. In the 2007–08 fishing season, the total recreational and commercial harvest was 344 t, or 64% of the allowable catch.

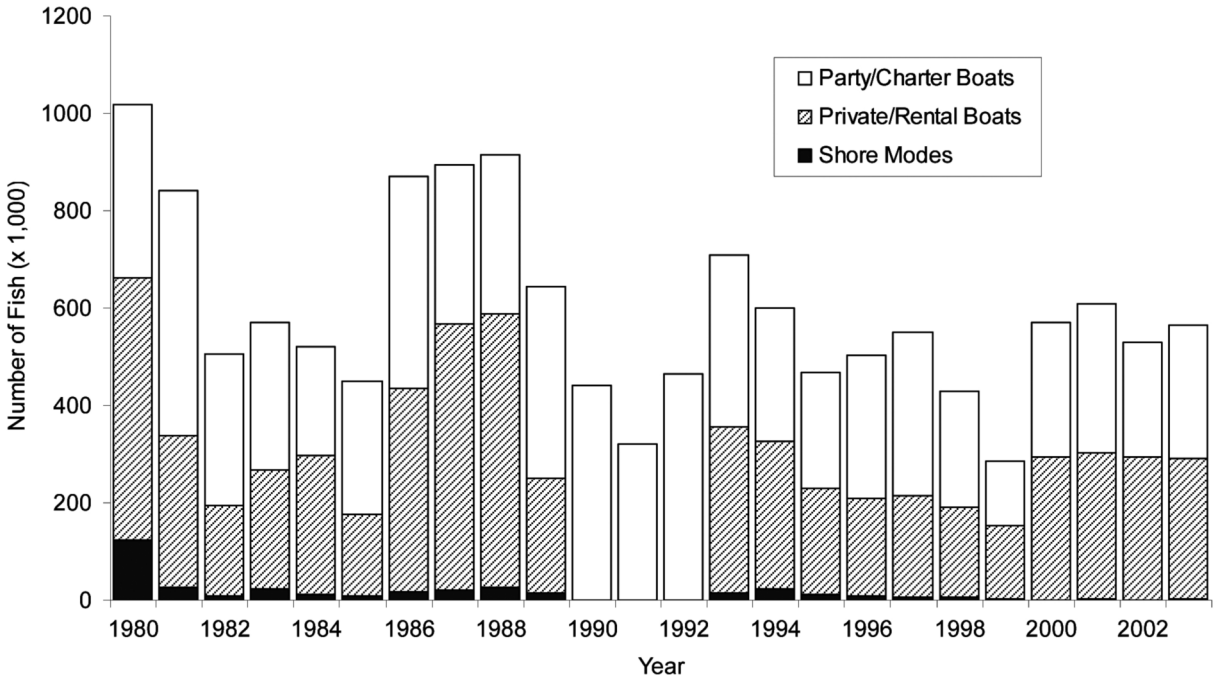

Figure 11. California recreational landings of kelp bass (*Paralabrax clathratus*) as reported in the Marine Recreational Fisheries Statistical Survey (MRFSS) by three different fishing modes, 1980–2003.

The WSFMP includes a provision for annual monitoring and assessment of the white seabass fisheries.

Kelp Bass

The kelp bass (*Paralabrax clathratus*) commonly referred to as calico bass, is one of the most popular species caught by recreational anglers in southern California. Kelp bass are found in nearshore waters and have historically ranged from the Washington/Oregon border in the north to Magdalena Bay, Baja California, Mexico in the south; however, their occurrence is rare north of Point Conception. Kelp bass live in relatively shallow water (typically less than 50 m) and tend to be associated with rocky structures and kelp. The best time of year to catch kelp bass is from May through September when the fish tend to feed more aggressively. Kelp bass are known to reach 721 mm (28.4 in) and can weigh up to 6.6 kg (14.5 lb).

In the first half of the twentieth century, kelp bass were targeted by both commercial and recreational fishermen. At that time, they were recorded on landing receipts and logbooks in a general "rock bass" category which included barred sand bass (*Paralabrax nebulifer*) and spotted sand bass (*Paralabrax maculatofasciatus*). In 1953, it became illegal to fish for kelp bass commercially in California due to a sharp decline in annual landings. Recreational anglers were still permitted to take kelp bass, but in 1959 a minimum size limit of 12 in (305 mm) TL was imposed. This minimum size limit is still in effect today, as well as a bag limit that allows a maximum of 10 kelp bass per day to be taken or possessed by each licensed angler.

The MRFSS and CRFS has collected historical size and total estimated catch data for kelp bass from the private/rental boat, beach-and-bank, and man-made structure fishing methods, and historical size data from the CPFV fishery. Total estimated catch data for CPFVs are available from CPFV logbooks. MRFSS provided data from 1980 to 2003 (fig. 11, tab.7), with the exception of 1990–92, and CRFS has provided data from 2004 to the present (fig. 12, tab. 7). Survey methods are not comparable. MRFSS data and CPFV logbook data in aggregate show an overall decline in number of fish caught by recreational anglers since 1980 when an estimated 1,019,000 kelp bass were caught. CRFS and CPFV logbook data estimated that 256,000 kelp bass were caught by recreational anglers in 2008, a decrease of 16% from 2007. Shore-based fishing modes, which include beaches, banks, and man-made structures, comprised only 4% of the recreational kelp bass catch in 2008, while CPFVs and private/rental boats comprised the remaining 96%. From 1999 to 2008 MRFSS and CRFS samplers measured over 52,000 kelp bass with an average TL of 365 mm (14.4 in.). In 2008, average TL of approximately 4,800 kelp bass measured was 366 mm (14.4 in.), slightly less than the 373 mm (14.7 in.) average TL from approximately 4,200 fish in 2007.

CPFV logbook data are available from 1935 to the present, but kelp bass were not differentiated from the other "rock basses" until 1975. CPFV logbook data in-

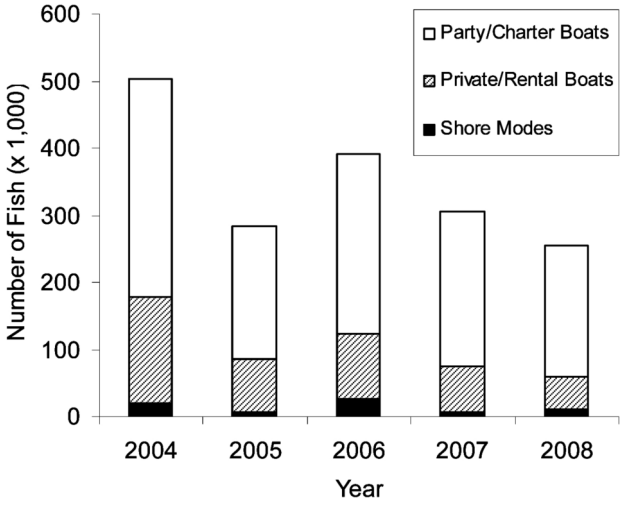

Figure 12. California recreational landings of kelp bass (*Paralabrax clathratus*) as reported in the California Recreational Fisheries Survey (CRFS) by three different fishing modes, 2004–08.

dicate annual kelp bass catches from 1980 to the present have fluctuated but have declined overall since 1992 (fig. 13). In general, the number of CPFV anglers on trips in which kelp bass were caught also declined, indicating that the average catch per angler has remained fairly consistent during that time period. The number of CPFV anglers participating in trips where kelp bass were caught peaked during the major El Niño event of 1997–98, and

TABLE 7
California estimated annual kelp bass (*Paralabrax clathratus*) recreational catch in metric tons, 1980–2008.

Year	Metric Tons (mt)
1980	726.4
1981	588.4
1982	308.5
1983	372.0
1984	407.1
1985	246.0
1986	567.6
1987	606.6
1988	564.5
1989	373.0
1993	562.0
1994	435.0
1995	354.2
1996	335.4
1997	363.6
1998	294.8
1999	192.8
2000	415.2
2001	389.0
2002	330.5
2003	378.4
Values above and below are not comparable due to different survey methods	
2004	325.4
2005	184.2
2006	261.8
2007	201.0
2008	162.6

Note: recreational data from MRFSS were unavailable from 1990-1992.

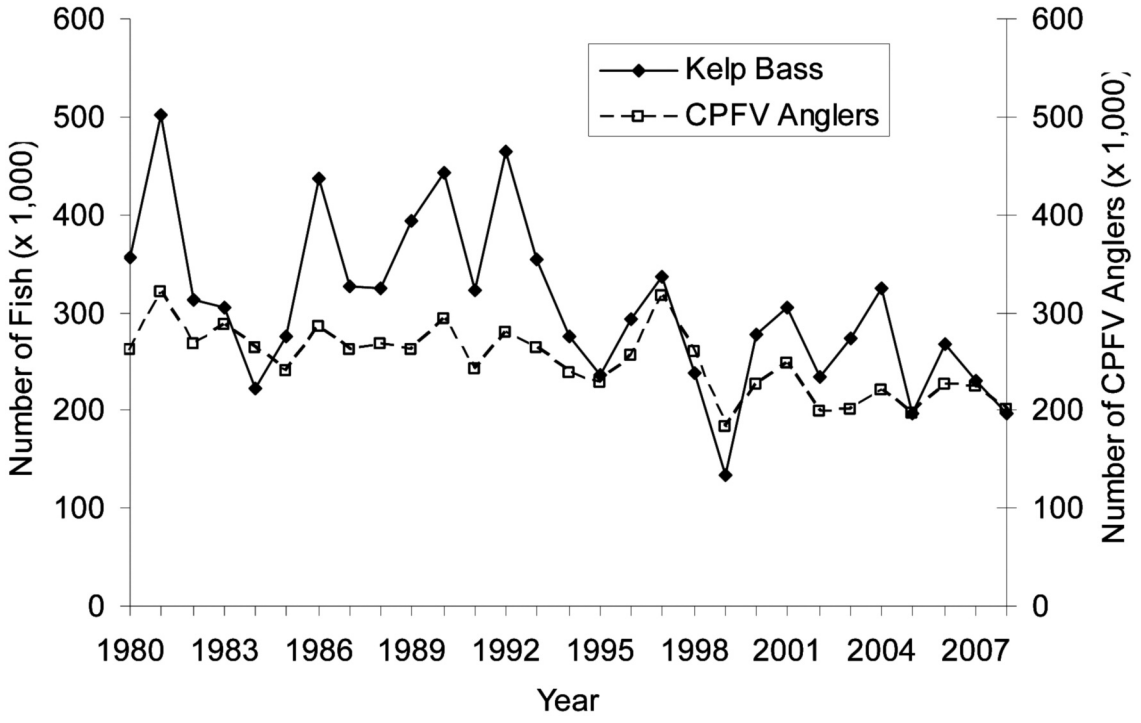

Figure 13. California recreational landings of kelp bass (*Paralabrax clathratus*) as reported in Commercial Passenger Fishing Vessel (CPFV) logbooks, 1980–2008.

TABLE 8
Annual number of kelp bass (*Paralabrax clathratus*) caught by California commercial passenger fishing vessels (CPFVs) statewide by port for 2008 and 2007 and 10-year average (1999–2008).

	2008		2007		10-Year Average (1999-2008)	
Port Name	No. Fish Caught	% Total	No. Fish Caught	% Total	No. Fish Caught	% Total
Oxnard/Channel Islands	16,734	8.5	5,922	2.6	15,749	6.5
Redondo Beach	14,364	7.3	16,233	7.1	17,433	7.1
San Pedro	33,957	17.3	35,902	15.6	39,234	16.1
Long Beach	24,935	12.7	37,600	16.4	34,453	14.1
Newport Beach	17,541	8.9	20,391	8.9	22,494	9.2
Balboa	3,118	1.6	8,380	3.6	5,183	2.1
Dana Point	25,379	12.9	30,708	13.4	30,423	12.5
Oceanside	8,767	4.5	9,342	4.1	9,385	3.8
Mission Bay	17,230	8.8	28,494	12.4	30,755	12.6
San Diego	23,329	11.9	30,533	13.3	25,164	10.3
Other	11,043	5.6	6,334	2.8	13,677	5.6
Total CPFV Catch	196,397	100.0	229,839	100.0	243,950	100.0

Data Source: CFIS

TABLE 9
Annual commercial landings (metric tons) and value (dollars) of common thresher shark (*Alopias vulpinus*) into California port complexes for 2007 and 2008 and ten year average (1999–2008).

	2008		2007		10-Year Average (1999-2008)	
Area	Landings (t)	Value ($)	Landings (t)	Value ($)	Landings (t)	Value ($)
San Francisco	<0.1	50	0.9	810	0.4	546
Monterey	1.5	2,399	3.6	3,594	3.7	5,806
Santa Barbara	75.1	126,626	65.7	108,079	60.7	90,387
Los Angeles	21.7	40,625	56.2	86,498	65.8	100,247
San Diego	48.7	109,962	77.1	137,912	97	164,289
Total Landings	147	279,662	203.5	336,893	227.5	361,275

after a substantial decline during the next two years fluctuated with no trend. Since 1980, a peak of 502,000 kelp bass were caught by CPFV anglers in 1981 and a low of 133,000 were caught in 1999. From 2007 to 2008 a 15% decline in CPFV catch was observed.

Kelp bass have consistently ranked among the top ten species or species groups caught by southern California CPFV anglers during the past 20 years. In terms of number of fish caught in 2008, kelp bass ranked second, with rockfish as an aggregate ranking first (only some rockfish are required to be reported by species). On average, over the past 10 years, the port of San Pedro had the highest number of kelp bass caught by CPFVs (tab. 8). In 2008, 17% (33,957) of the kelp bass caught in California were brought into San Pedro. In 2007, however, Long Beach was the number one port for kelp bass catch with 16% (37,600). Other major ports for kelp bass include Dana Point, Mission Bay, San Diego, and Newport Beach.

Thresher Shark

The common thresher shark (*Alopias vulpinus*) is the most common commercially-landed shark in California. The common thresher sharks are large pelagic sharks whose most defining characteristic is the enormous upper lobe of the tail, which can be up to half their TL, and is used to stun their prey. They can be differentiated from two other thresher sharks that occur in California, the bigeye thresher (*A. superciliosus*) and the pelagic thresher (*A. pelagicus*) by the white belly markings extending over the top of the large pectoral fins and a slight bronzy-green iridescence to the skin. Common thresher sharks have a world-wide distribution in temperate seas and are found in the Mediterranean Sea and the Atlantic, Pacific, and Indian Oceans. They tend to be most common over continental shelves, associated with areas of high productivity where concentrations of the small schooling organisms that make up most of their diet are found. Young threshers tend to remain within three miles of the coast in their early years and as they grow larger, range much farther offshore. Migratory patterns inferred by seasonal catches seem to indicate that adult threshers move north from Baja California in the spring, into the Southern California Bight, where "pupping" is thought to occur.

Commercial Fishery. Although primarily targeted using large-mesh drift gillnets (73% of total) and hook-and-line gear (6%), thresher sharks are also caught incidentally with small mesh gillnets (21%) and occasionally by harpoon. Commercial landings declined 28% in 2008 to 147 t (round weight) from 204 t in 2007 (tab. 9). The ex-vessel value of thresher shark totaled $279,661 with

an average price of $3.24/kg ($1.47/lb), down from $336,894 in 2007, with the average price at $2.81/kg ($1.28/lb). Much of the commercial fishing for thresher shark occurs in the Southern California Bight, with the highest average proportion of landings over the last ten years occurring in the San Diego port complex. In 2008, however, the greatest amount of landings occurred in the Santa Barbara port complex, followed by San Diego and then Los Angeles/Orange Counties (tab. 10).

Prior to 1977, all sharks were reported in one market category and not separated by species, and it is assumed threshers were caught as "bycatch" in gears at levels similar to or greater than today. The first significant fishery for thresher sharks began in the late 1970s to early 1980s when drift-gillnet fishermen began to target them close to the southern California coastline. The fishery expanded rapidly and, due to overfishing concerns, the Department began an observer program, monitored landings, and implemented a logbook program. A limited entry permit program for drift gear was initiated in 1982, with permits issued to fishermen rather than boats to prevent false inflation in value. The drift-gillnet fishery for thresher sharks peaked in 1981 when 113 drift gillnet boats landed nearly 446 t. However, total landings using all gears were highest the following year with a total of more than 1,800 t taken by all gears (fig. 14).

By the late 1980s, research monitoring of the commercial catch indicated that entire size classes were no longer being caught. Legislation was enacted for a series of time/area closures in order to protect the shark resource. The objectives of these closures were threefold: (1) to protect large females who moved into the Southern

TABLE 10
Estimated recreational catch (A+B1) of common thresher shark (*Alopias vulpinus*) in metric tons by fishing modes as sampled in the Marine Recreational Fisheries Statistics Survey (MRFSS), 1980–2003 and the California Recreational Fisheries Survey (CRFS), 2004–08.

Year	Man Made Beach/Bank	Charter Vessel	Private/ Rental Vessel	Total of All Modes	Percent Private/ Rental Vessel
1980	0.0	1.8	0.0	1.8	0%
1982	0.0	0.0	4.4	4.4	100%
1983	0.5	0.0	38.5	39.1	99%
1984	0.0	0.0	39.7	39.7	100%
1985	0.0	0.0	4.9	5.7	86%
1986	0.0	0.0	25.5	25.5	100%
1987	0.0	0.0	100.5	100.5	100%
1988	0.0	4.8	17.2	21.9	78%
1993	0.2	0.0	10.3	10.5	98%
1994	0.0	0.0	33.5	33.5	100%
1995	0.0	0.0	19.6	19.6	100%
1996	0.0	0.0	4.3	4.3	100%
1997	0.0	0.0	11.7	11.7	100%
1998	3.8	0.0	39.2	42.9	91%
1999	0.0	2.7	13.1	15.8	83%
2000	5.7	0.0	7.9	13.6	58%
2001	0.0	0.0	20.6	20.6	100%
2002	0.0	0.0	3.2	3.2	100%
2003	2.5	0.0	24.9	27.4	91%
Sub-Total	**12.7**	**9.2**	**419.0**	**441.8**	
Avg. 80-03	**1.3**	**0.9**	**41.9**	**44.2**	**89%**
2004	0.0	0.5	2.8	3.3	85%
2005	0.0	0.0	11.6	11.6	100%
2006	7.1	0.0	15.6	22.7	69%
2007	25.9	0.6	25.3	51.8	49%
2008	6.8	0.0	28.8	35.6	90%
Sub-Total	**39.8**	**1.1**	**84.1**	**125.0**	
Avg. 04-08	**8.0**	**0.2**	**16.8**	**25.0**	**79%**
Total	**52.5**	**10.3**	**503.1**	**566.8**	

Note: recreational data from MRFSS were unavailable from 1981, 1989–92.

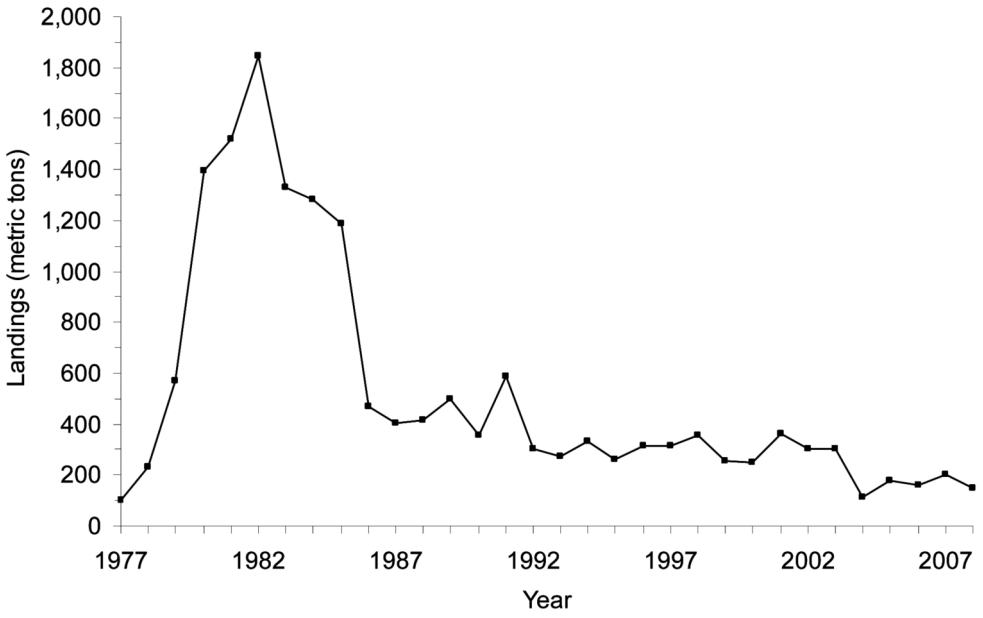

Figure 14. California commercial landings of common thresher shark (*Alopias vulpinus*), 1977–2008. Notes: Data sources are Department Catch Bulletins from 1977 to 1985 and CFIS landing receipt database from 1986 to 2008.

California Bight during their pupping season, (2) to prevent interactions with marine mammals, sea turtles, and sea birds, and (3) to prevent conflicts with harpoon fisheries. Several revisions to the time and area closures resulted in the fishery being completely closed between 1 February and 30 April, and closed within 75 miles of the coast from 1 May through 14 August.

In the early 1980s, most drift-gillnet vessels switched to swordfish as their primary target species. Thresher sharks, along with shortfin mako sharks (*Isurus oxyrinchus*), were targeted secondarily and landings of threshers began to decline (fig. 14). In 1990, a California voter referendum banned gillnets in state waters (within three miles of shore). A further federal closure to protect leatherback turtles (*Dermochelys coriacea*) from Point Conception to central Oregon from 15 August to 31 October was enacted in 2001. In addition, during El Niño conditions, the area south of Point Conception is closed to drift gillnet fishing 15–31 August and for January to protect loggerhead turtles (*Caretta caretta*). These closures have caused a further drop-off in thresher shark landings since being enacted and landings of thresher sharks have averaged 161 t since 2004 (fig. 14). At present, the only requirement for purchasing a drift gillnet permit is possession of one during the preceding season; there is no landing requirement. Currently, there are 83 drift gillnet permittees and only about half of those are actively fishing.

Thresher sharks are also taken by other commercial gears, including hook-and-line, small mesh gillnets, and harpoon. Small mesh gillnets include set nets targeting California halibut and drift nets targeting barracuda (*Sphyraena* spp.) and white seabass. Small mesh drift gillnets, mesh 8 in (203 mm) or smaller, targeting white seabass and barracuda are not required to have a drift gillnet permit, however state regulations limit possession to no more than two threshers along with 10 barracuda or five white seabass, while federal regulations have a limit of 10 highly migratory species (HMS), except for swordfish (*Xiphias gladius*). In 1996, a ban on landing detached shark fins became effective for all commercial fishing gears. Because of their size, threshers are the only exception to this rule; however, the fins must match a corresponding carcass.

Recreational Fishery. Thresher sharks have long been a desired species for recreational fishermen, and considered a prized fighting fish. California sportfishing regulations impose a two fish per day per angler limit on thresher sharks. This is cumulative for multi-day trips and most anglers seldom fill bag limits. Boat limits are in effect for multiple anglers per boat, with no more than the bag limit for each of the number of licensed anglers per boat. Again, these limits are seldom filled. If filleted at sea, a one-inch patch of skin must be left on the fillets. In recent years, interest in thresher shark has increased as other sportfishing species become more heavily regulated, and some fishing areas are closed to protect other fish species. Many shark anglers practice a catch and release ethic. However, the survival of these released fish, often caught using a species specific tactic of tail-hooking, may be much lower than previously thought. Research is currently underway to determine specific survival rates of tail-hooked sharks. Alternative gears, which have a higher probability of hooking the shark in the mouth rather than the tail, are also being studied.

Recreational thresher shark catches are highest May through August, for both kept and released fish. Most recreational thresher shark take occurs in the private/rental boat mode (89% in MRFSS data, 77% in CRFS data) (tab. 10). In 14 of the 24 (58%) sampling years since 1980, the estimated number of threshers released alive has been greater than or equivalent to those kept. Since 2004, estimates of the tonnage of fish released alive have been available; in four of the five sampling years the estimated tonnage of fish released has also been greater than or equivalent to those kept. Threshers are often taken incidentally while fishermen are targeting other species. Those taken in northern California were all incidental to salmon or halibut recreational fishing trips, while in southern California, 69% were caught on trips targeting threshers and incidentally caught on halibut, yellowtail, and barred sand bass trips. CPFV logs indicate that the take of thresher sharks aboard their vessels is much less than that taken by anglers fishing from private boats. For the last fifteen years, the CPFV take of threshers averaged about 40 fish a year with a high of 163 fish during the El Niño of 1993.

Management History. The Council adopted the Highly Migratory Species Fishery Management Plan (HMS FMP) in February 2005, putting thresher shark under federal management, although California regulations were used as a model for most HMS species. The HMS FMP establishes a biennial management cycle in which measures to be implemented are introduced in June and, if approved, implemented the following April. For thresher sharks, a harvest guideline of 340 t was established for total commercial and recreational catch. The HMS FMP identified priority research needs for additional life history information for thresher shark including: (1) identify stock structure and boundaries of the populations and, where they interact with other populations, the seasonal migration patterns for feeding and reproduction and life stages vulnerable to fisheries; (2) determine ages and growth rates including comparisons to other areas; and (3) determine maturity and reproductive schedules. Preliminary assessment analyses indicated that West Coast drift-gillnet fishery catch and catch-per-unit-effort were increasing from the lows of the early 1990s; from this it was inferred that the pop-

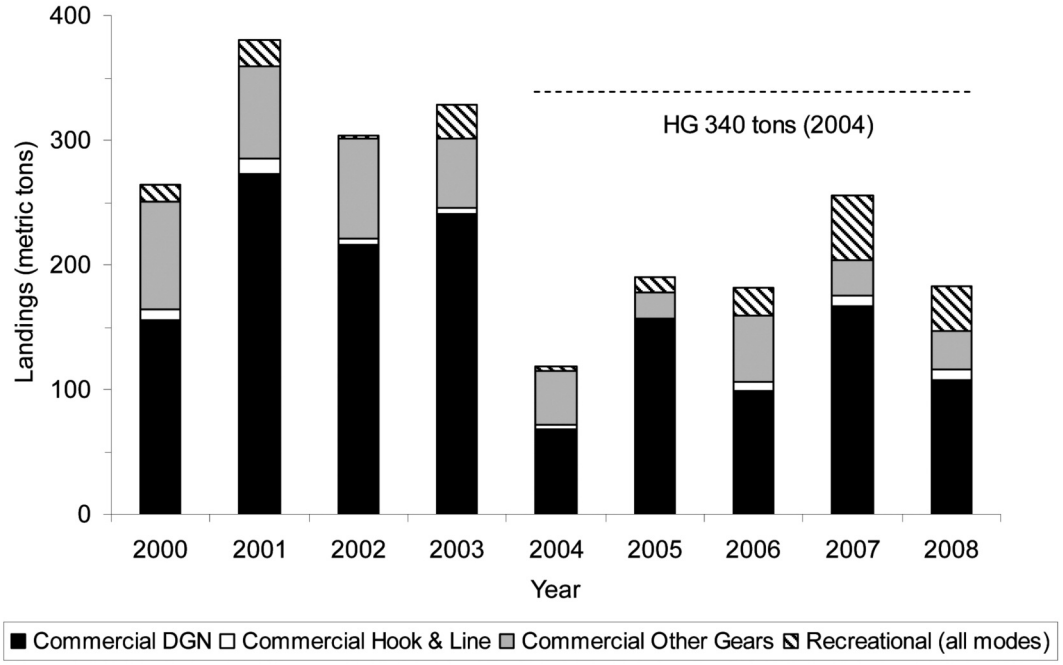

Figure 15. California landings of common thresher (*Alopias vulpinus*) by commercial gear type and by the recreational fishery compared to the harvest guideline adopted in 2004. Notes: Commercial landings are from CFIS converted from pounds to round weight in metric tons, recreational landings as reported in MRFSS (all modes) from 2000 to 2003, and CRFS (all modes), 2004–08.

TABLE 11

Catch Estimates (metric tons) for common thresher shark (*Alopias vulpinus*) harvested by commercial and recreational fisheries for the period 2000–08 compared to the current 340 mt harvest guideline (HG).

	Commercial DGN* (all sizes)		Commercial Hook & Line		Recreational (all modes)		Commercial, Other Gears **		Total	
Year	Tons	%HG*	Tons	%HG	Tons	%HG	Tons	%HG	Tons	%HG
2000	155.5	45.7	9.0	2.6	13.6	4.0	86.5	25.4	264.5	77.8
2001	272.8	80.2	12.7	3.7	20.6	6.1	74.1	21.8	380.2	111.8
2002	216.2	63.6	5.4	1.6	3.2	0.9	79.1	23.3	303.9	89.4
2003	241.3	71.0	3.8	1.1	27.4	8.1	55.5	16.3	328.0	96.5
2004	67.4	19.8	4.3	1.3	3.3	1.0	43.0	12.7	118.1	34.7
2005	155.1	45.6	1.1	0.3	11.6	3.4	22.0	6.5	189.8	55.8
2006	98.3	28.9	7.4	2.2	22.7	6.7	53.5	15.7	182.0	53.5
2007	166.8	49.1	8.8	2.6	51.8	15.2	27.9	8.2	255.2	75.1
2008	106.9	31.4	9.2	2.7	35.6	10.5	30.9	9.1	182.6	53.7
Avg. 2000-2008	164.5	48.4	6.9	2.0	21.1	6.2	52.5	15.4	244.9	72.0

*- Drift Gill Net (DGN) all mesh sizes ranging from large mesh (>=14 in to small mesh (>3½ in and <14 in
** Other comercial gears include mainly set gillnet and harpoon
CFIS, converted from pounds to round weight in mt; Recreational estimates from RecFIN, MRFSS (2002–03) and CFRS (2004–08)

ulation was recovering. The most recent assessment of thresher shark in 2002 indicated that thresher shark is no longer overfished and recent average landings are about 75% of MSY. However the Council has recommended that a new stock assessment be a priority.

In 2008, the Council evaluated the need to limit the sport take of common thresher sharks. Recreational catch had been increasing, due to the sportfishing public becoming more educated on how to target them, and increasing use of internet websites to disseminate information on fishing areas and thresher shark occurrence. Concerns were raised that the HG might be exceeded and the majority of this catch was occurring during the spring thresher shark pupping season, and many of the fish caught appeared to be pregnant females. Additionally, although many thresher shark anglers advocate catch and release fishing methods, a preliminary study indicated that thresher sharks caught by foul hooking the tail had poor survival rates when released. On further examination of the recent CRFS data, estimates of recreational thresher shark catches were found not to be causing cumulative landings to exceed the HG (fig. 15, tab. 11). Further, an analysis of bag limits showed that few anglers caught limits and a change in the bag limit would

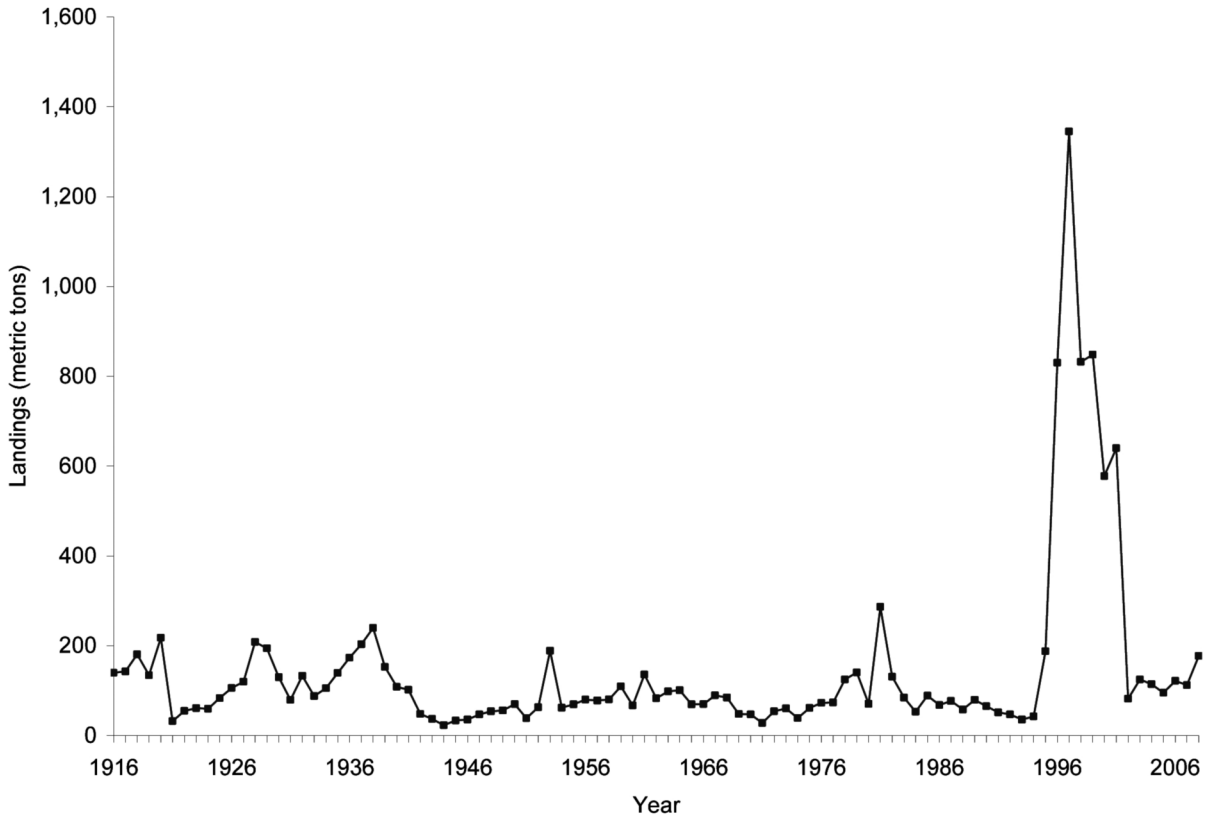

Figure 16. California commercial skate (Rajiformes) landings, 1916–2008.

likely have little effect on recreational catch. The Council decided not to make changes to thresher shark regulations for the 2009–10 management cycle, but did make a number of recommendations including to: (1) continue outreach to fishermen regarding best practices to increase survival of released animals, (2) improve data collection on thresher sharks (especially for private access marinas, and in commercial hook-and-line and non-HMS fisheries), (3) initiate a new stock assessment, incorporating data from Mexico, (4) better estimate the number and condition of released fish, (5) further investigate recreational gear modifications to increase survival, and (6) better identify thresher shark nursery areas.

Skates and Rays

Skates and rays (Rajiformes) have not historically been targeted in commercial fisheries, but have primarily been taken as incidental catch by trawlers in northern and central California. Of those identified in commercial catch, the most common skates are the big skate (*Raja binoculata*), California skate (*Raja inornata*), and longnose skate (*Raja rhina*). The most commonly identified rays are the shovelnose guitarfish (*Rhinobatos productus*) and bat ray (*Myliobatis californica*). This does not reflect actual species composition, however, because the majority of landings have been reported as "unspecified skate" or "stingray". Landings are also reported under specific market categories for those species above (longnose skate just added this year), as well as "unspecified ray", "Pacific electric ray" (*Torpedo californica*), and "thornback" (*Platyrhinoidis triseriata*). Of the 22 species of skates and rays currently known to be in California waters, only the big skates, California skates, and longnose skates are under management authority of the Council Groundfish FMP. Though these species are defined as groundfish, harvest of skates is not actively managed under the Groundfish FMP. The 11 species of rays found in California are not federally managed.

Skates. From 1916 to 1990, California commercial skate landings ranged from a low of 23 t in 1944 to a high of 286 t in 1981, averaging 95 t annually during that period (fig. 16). In the mid 1990s, skate landings increased significantly from about 42 t in 1994 to 1,345 t in 1997 due to increased demand from Asian markets. Landings fell sharply in 2002, corresponding with reduced market demand, and have averaged 118 t annually over the past seven years.

In 2008, commercial landings for skates totaled 177 t, the highest landings since 2001. Landings increased by 58% from the 112 t landed in 2007. Trawl gear accounted for most (94%) of the landings in 2008; longline, gill net, and seine gear accounted for the remaining amount (6%).

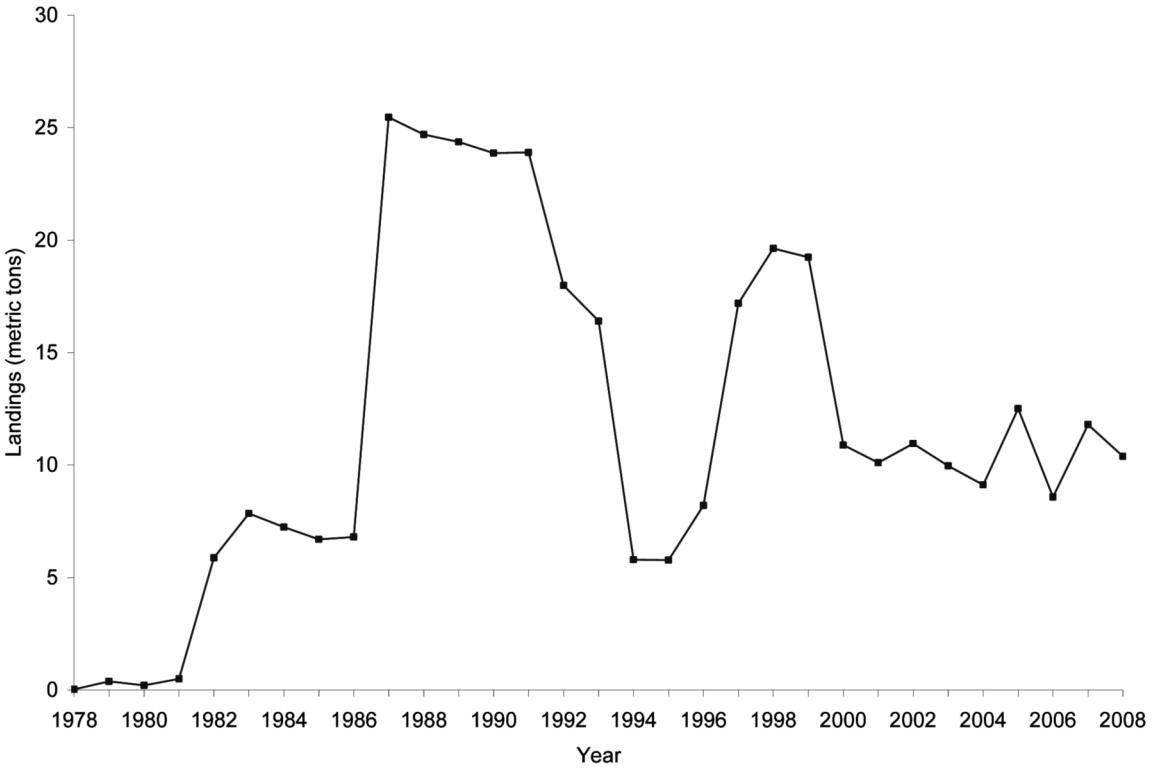

Figure 17. California commercial ray (Rajiformes) landings, 1978–2008.

Over 99% of the skates were landed as "unspecified skate"; the remaining fraction was landed in big skate and California skate market categories.

The ex-vessel economic value for skates during 2008 was $96,958, 89% higher than in 2007 ($51,292), but considerably lower than the peak value reached in 1997 ($510,994). The average ex-vessel price in 2008 was $0.83/kg ($0.40/lb). Historically, the statewide economic value of skate fisheries has been small compared to other fisheries. The average annual ex-vessel price for skates ranged from $0.02/kg ($0.01/lb) in the late 1950s to $0.60/kg ($0.27/lb) in the 1990s. From 2000 to 2008, prices averaged $0.73/kg ($0.33/lb) and reached as high as $22/kg ($10/lb).

The majority of skate landings in 2008 were made in northern California, with Crescent City, Eureka, and Fort Bragg port areas accounting for 90% of the catch. In the earlier years of the fishery, most of the skate catch came through central California (Monterey and San Francisco), which accounted for 41% to 100% of the annual landings from 1948 through 1989 (72% average). Since 1975, the northern California areas have become progressively more important for skate landings. In 1995, the catch from northern California increased dramatically, and has since accounted for 72% to 93% of the total catch. Total landings from areas south of Monterey have continued to be relatively insignificant.

The increase in skate landings may be attributed to retention of previously discarded catch. When the commercial groundfish fishery was divided into limited entry and open access components in 1994, new quotas and regulations were required. The significant reduction of groundfish quotas for both components created more space in boats' holds to retain non-quota species. Trawl vessels were able to supplement groundfish landings with skate and ray bycatch. It is uncertain whether the effort to target the skate and ray resource has increased or if previously discarded catch is simply being retained and landed.

New recommendations were made for the skate fishery in 2009. As a result of the longnose skate stock assessment completed in 2008, catch of this species is now required to be sorted upon landing (Title 14, CCR, § 189(b)(3)). Previously, market categories were limited to only big skates and California skates, though these and other species were mostly lumped into "unspecified skate" in the absence of sorting requirements. Under federal regulations, skates had been part of a species complex because they had not been thoroughly studied nor been assessed. Longnose skate is now removed from the "other species" complex and assigned species-specific allowable biological catch values for the 2009 and 2010 management cycle. State port samplers began sampling the species composition of skate market categories in 2009.

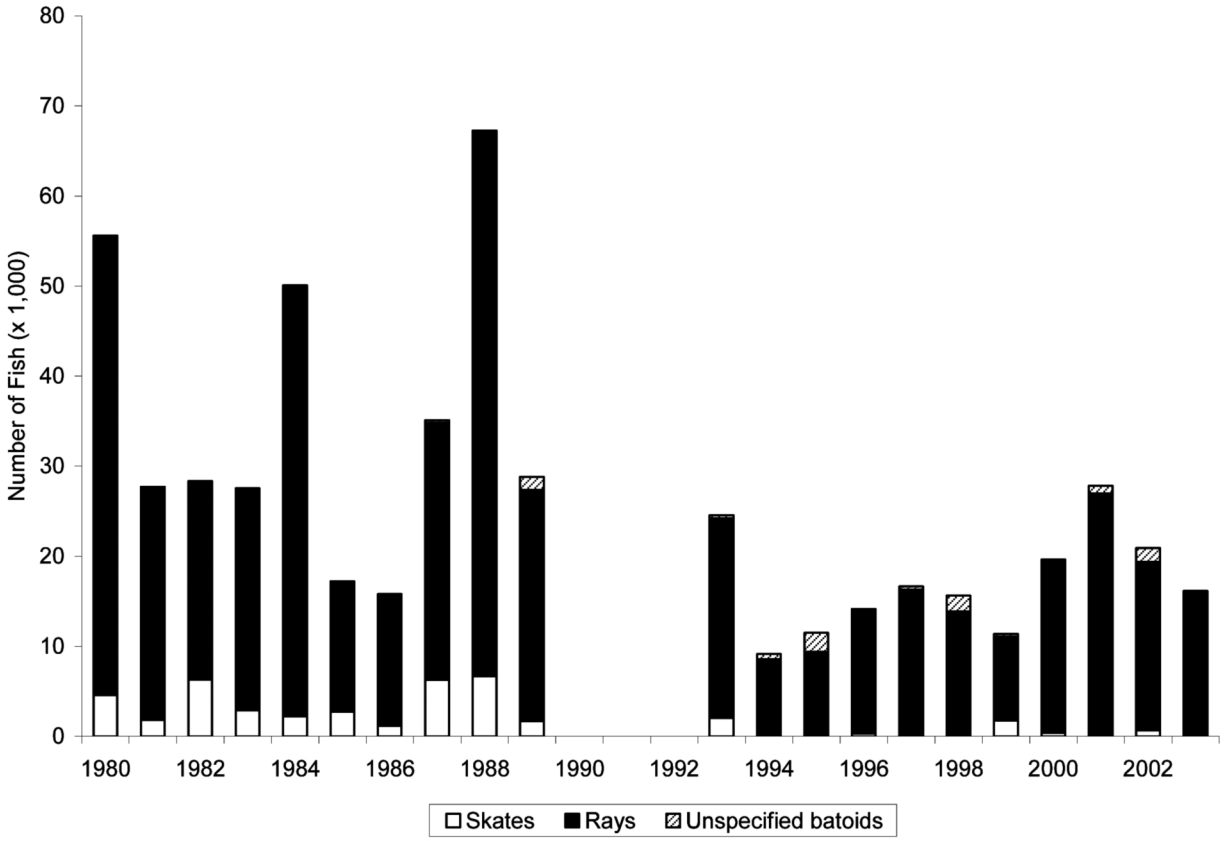

Figure 18. California recreational skate and ray (Rajiformes) landings as reported in the Marine Recreational Fisheries Statistical Survey (MRFSS), 1980–2003.

Current regulations also require all skates to be landed whole (FGC §5508, 8042). The possession of skate wings aboard a vessel is prohibited as there are no equivalents nor conversion factors established in statute or regulation under which not-whole skates may be brought ashore. In the past, only a portion of skate (and ray) catch was marketed whole; primarily, just the pectoral fins or "wings" of skates were sold. Skates are currently marketed both whole and as wings. Wings are sold largely in Asian markets as fresh or fresh-frozen, dried, or dehydrated and salted.

Rays. Commercial landings of rays have been relatively minor compared to skates. However, rays may have been included with skate landings prior to 1978 when commercial landings data became available for rays. Over the past 31 years, ray landings ranged from less than 1 t in 1978 to 25.5 t in 1987, averaging 11.7 t annually (fig. 17). In 2008, reported landings of rays totaled 10.4 t, a 12% decrease from 2007 (11.8 t). Bat rays (38%) and shovelnose guitarfish (33%) accounted for the majority of the landings in 2008. Ray landings have primarily been reported as shovelnose guitarfish, averaging 73% of the landings annually since 1978. The relative proportion of shovelnose guitarfish has been declining since 2006, when this species accounted for 65% of the landings.

The ex-vessel value of rays was $11,962 in 2008, a 16% decrease from 2007 ($14,198). The price of rays has fluctuated considerably compared to skates. The average price rose from $0.15/kg ($0.07/lb) to $4.01/kg ($1.82/lb) from the 1970s to 1980s, and then dropped to $1.63/kg ($0.74/lb) in the 1990s. Between 2000 and 2008, the average price was $1.50 kg ($0.68/lb) with a maximum of $110/kg ($50/lb). In 2008, the average ex-vessel price was $0.87/kg ($0.39/lb), a 37% decrease from 2007 ($1.39/kg; $0.62/lb). Over 99% of the rays were landed in the southern California region in 2008, with the Los Angeles port complex accounting for 77% of the landings.

Recreational fishery. The recreational fishery for skates and rays is relatively small. In 2008, only 3% (7 t) of the estimated 195 t of skates and rays landed in California was recreational and 97% (188 t) was commercial. Small sport fisheries target a few of the shallow nearshore species. Rays dominate the catch (figs. 18, 19); the most common species are bat rays, shovelnose guitarfish, and thornbacks (Raja clavata). In 2008, an estimated 14,900 skates and rays were taken. Catch estimates

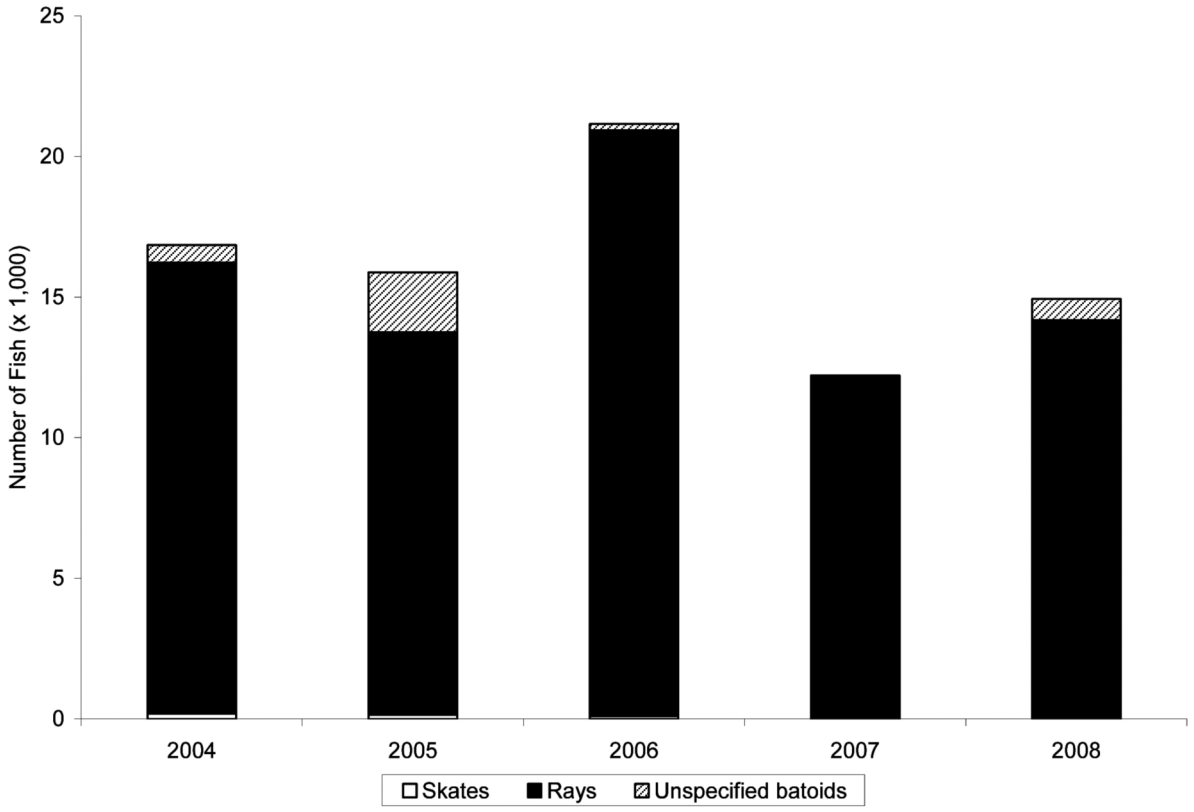

Figure 19. California recreational skate and ray (Rajiformes) landings as reported in the California Recreational Fisheries Survey (CRFS), 2004–2008.

(CRFS) indicate that an average of 16,200 fish (49 t) were taken per year from 2004 to 2008. During this period, rays composed 95% of the catch.

Kellet's Whelk

Statewide commercial landings for Kellet's whelk (*Kelletia kelletii*) in 2008 totaled 73 t, a 6% decrease from the 78 t landed in 2007, and a 16% decrease from the highest yearly recorded landings in 2006 of 87 t. Kellet's whelk landings increased steadily between 1993 and 2006 when they rose from 2 t to 87 t (fig. 20). The ex-vessel value from the 2008 commercial harvest of Kellet's whelks was approximately $132,000, a 3% decrease from the previous high value of approximately $136,000 in 2007. The 2008 ex-vessel price ranged from $0.55 to $6.61/kg with an average of $1.84/kg, up 9% from the 2007 average of $1.69/kg. Since 1979, the fishery's ex-vessel value has ranged from $94 in 1988 to approximately $136,000 in 2007 and the ex-vessel price has ranged from $0.53/kg in 1981 to $1.94/kg in 1992. Prior to 1979, landings were not recorded specifically for Kellet's whelks but minor landings may have occurred and been recorded as miscellaneous mollusks or sea snails.

Landings occurred at 13 ports in 2008 with five ports accounting for 85% of the catch. In 2007, landings occurred at 15 ports with three ports landing 80% of the total catch. Kellet's whelk landings have been reported at 24 ports from 1979 to 2008, with 80% of landings occurring at four ports. The majority of landings in this time period occurred at Santa Barbara (199 t), with approximately 40% of the total landings reported. The other three top ports were Terminal Island, San Diego, and San Pedro, with cumulative landings of 80 t, 69 t and 62 t, respectively.

In 2008, 98% of all harvested Kellet's whelks were taken incidentally in lobster or rock crab traps, compared to the 93% taken in 2007 in the same gear. The remaining take in 2008 occurred through diving or finfish traps, with approximately 1% of the take attributed to each of those gears. Divers harvested 5% of the landings in 2007 and finfish gear harvested the remaining 2%. Since 1979, 89% of all harvested Kellet's whelks have been taken incidentally in lobster and crab traps when they enter to prey on bait and injured crustaceans. Ninety-nine percent of Kellet's whelks are used for human consumption and are mainly sold in domestic live fish markets.

The Kellet's whelk is usually taken incidentally in the lobster and rock crab trap fisheries, both of which are restricted access fisheries. Commercial divers are required

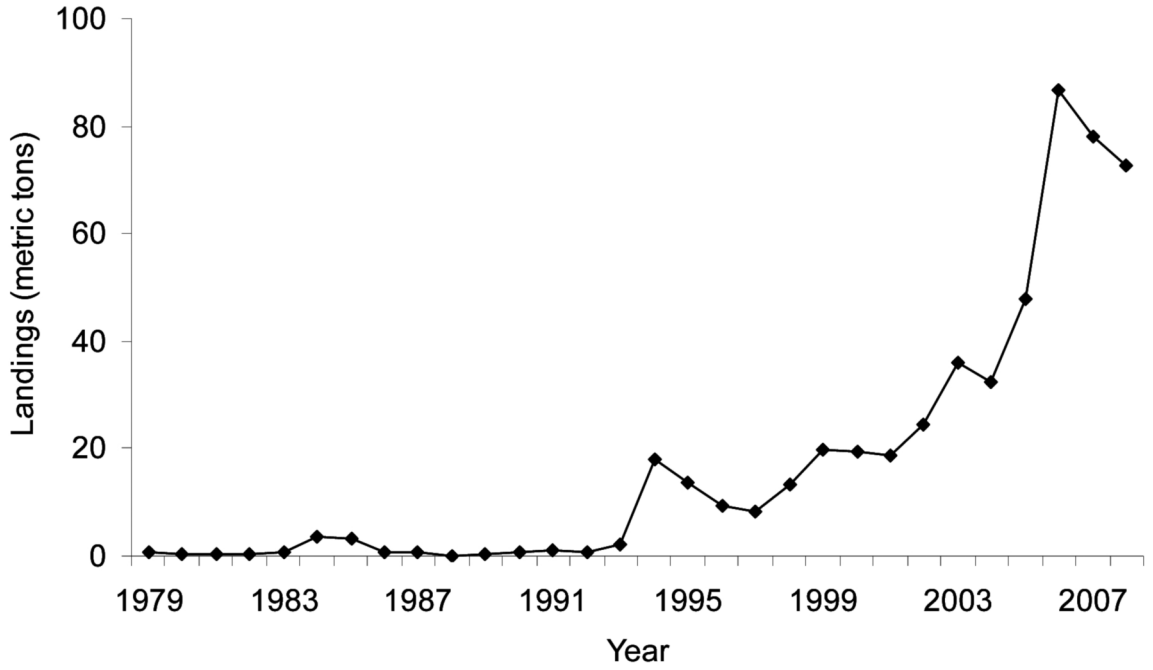

Figure 20. California commercial Kellet's whelk (*Kelletia kelletii*) landings, 1979–08.

to have a commercial license, and may only take whelks further than 1,000 feet (305 m) beyond the low tide mark, as the take of any snails is prohibited in the tidal invertebrate zone. Recreational take of Kellet's whelk by hand is allowed outside of the 1,000 ft (305 m) tidal invertebrate zone. Except where prohibited in state marine reserves, state marine parks and state marine conservation areas the bag limit is 35 animals, with no season.

The Kellet's whelk is a large predatory gastropod commonly found in rocky reefs and kelp bed habitat and ranges from Baja California, Mexico to Monterey, California. Historically the northern boundary of its range extended to Point Conception, California, but in 1980 Kellet's whelk was reported in Monterey, an expansion of over 400 km (248 mi). Studies suggest that the Kellet's whelk range expanded to Monterey Bay in the 1970s or early 1980s, possibly due to an El Niño-Southern Oscillation event, and is dependent on recruits from southern California.

Subject to an expanding fishery, the harvest of Kellet's whelks is not regulated by a minimum size limit, season, or any type of harvest quotas. Kellet's whelks are slow growing snails that aggregate for feeding and spawning, which could make them vulnerable to overfishing. Little is known about the impact of recent increased fishing rates on overall population size or on long-term catch sustainability. The Partnership for Interdisciplinary Studies of Coastal Oceans and Reef Check California currently collect abundance data on the Kellet's whelk during their surveys.

Sea Cucumber

In 2008 a combined total of 370 t of warty sea cucumbers (*Parastichopus parvimensis*) and giant red sea cucumbers (*Parastichopus californicus*) was landed in California (fig. 21). The ex-vessel value of these landings was $1.7 million, an increase of 67% over the 2007 sea cucumber landings (221 t). The average ex-vessel price paid for sea cucumbers in 2008 was $4.65/kg ($2.11/lb), a 53% increase from 2007 ($3.04/kg, $1.37/lb), and ranged from $1.76 to $6.60/kg ($.80 to $3.00/lb).

Warty sea cucumbers are found in the intertidal zone out to a depth of 27 m (14.7 fathoms) and range from Monterey Bay to Baja California. They are uncommon north of Point Conception. Giant red sea cucumbers inhabit the subtidal zone out to 90 m and range from the eastern Gulf of Alaska to Baja California. Both sea cucumber species feed on surface organic nutrients suspended in mud, sand, and detritus. Warty sea cucumbers migrate annually between shallow and deeper water habitats. Trawl fishermen claim that giant red sea cucumbers make similar seasonal migrations up and down their slope habitat, but this has not yet been verified by research.

Warty sea cucumbers are harvested almost exclusively by divers at depths of 4.6 to 24.4 m (2.5 to 13 fathoms), while giant red sea cucumbers are taken by fishing vessels towing bottom trawl gear in 36.6 to 183 m (20 to 100 fathoms) depths. The warty sea cucumber dive fishery occurs primarily in southern California from Santa Barbara County to San Diego County, including the off-

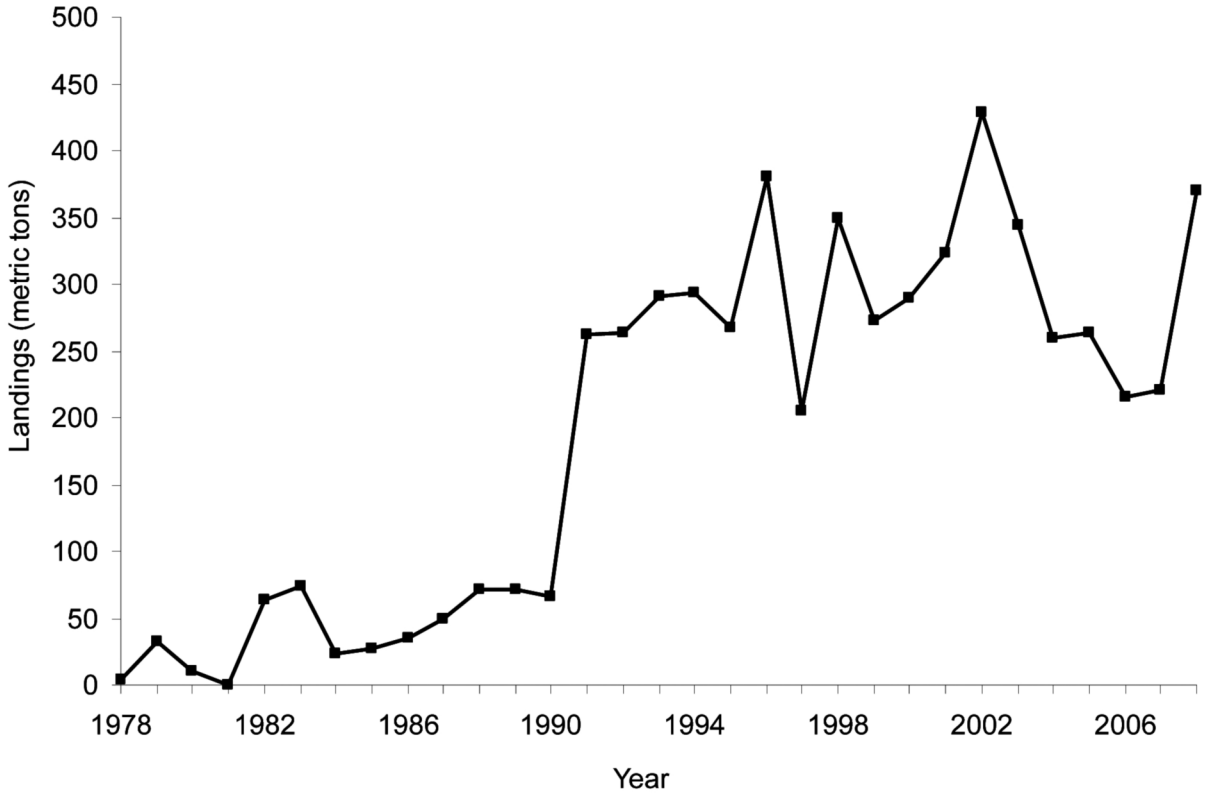

Figure 21. California commercial landings of warty (*Parastichopus parvimensis*) and giant red (*P. californicus*) sea cucumbers, 1978–08.

shore Islands. The giant red sea cucumber trawl fishery occurs in the Southern California Bight with most trawling occurring in the Santa Barbara and the Santa Catalina Channels. Most of the frozen or processed sea cucumber product is shipped overseas to Hong Kong, Taiwan, mainland China, and South Korea. Small quantities are also purchased by Asian markets within the United States. Processed sea cucumbers can sell for a wholesale price of up to $44/kg ($20/lb).

There is no significant sport fishery for sea cucumbers in California; however, recreational take of sea cucumbers is only permitted outside of the tidal invertebrate zone (defined as between the high tide mark and 1,000 ft (305 m) seaward of the low tide mark). Except where prohibited in state marine reserves, state marine parks, and state marine conservation areas, the bag limit is 35 animals, and there are no seasonal closures for sea cucumbers.

Commercial landings of sea cucumbers in California were first recorded in 1978 at Los Angeles County ports. Landings averaged less than 15 t annually until 1982, when the principal fishing area shifted to the Santa Barbara Channel. Landings of sea cucumbers fluctuated from 24 to 73 t over the next eight years, and in 1991 reached more than 262 t. Through the first 18 years of the fishery, trawl landings comprised an average of 75% of the annual sea cucumber harvest, but between 1997 and 2002, divers accounted for up to 88% of the combined sea cucumber landings. During this time period, more than a dozen trawlers were excluded from the fishery for permit violations. At the same time, sea cucumber divers were increasing their harvesting efforts for warty sea cucumbers, due in part to a downturn in the sea urchin fishery, and because the 1997 moratorium on the harvest of abalone had former abalone divers seeking other dive fisheries in which they could participate.

There are no seasonal restrictions, size limits or harvest quotas for the commercial take of sea cucumbers. A restricted access permit was required beginning with the 1992–93 fishing season. The permit was based on meeting a 22.7 kg (50 lb) landing requirement during a four-year (January 1988 to June 1991) window period. In 1997, new legislation imposed additional regulatory measures on the sea cucumber dive and trawl fisheries. The major management changes included the creation of separate permits for the dive and trawl fisheries, and the imposition of a permanent ceiling on the total number of permittees allowed to harvest sea cucumbers (130 divers and 40 trawl fishermen). Additionally, a mechanism allowing for the transfer of sea cucumber permits was included in the new legislation. By 2000

there were 113 sea cucumber dive permittees and 36 sea cucumber trawl permittees. In 2008, the numbers of permitted dive and trawl sea cucumber fishermen had further dropped to 84 and 18, respectively. The decline in numbers was primarily due to retirements and attrition among the older permittees, and by the shift of some dive and trawl fishermen into other, more lucrative, commercial fisheries.

Sea cucumbers exhibit a patchy distribution, a relatively short life span, a low age at maturity, sporadic recruitment, and a high natural mortality. Species with these characteristics typically have a low maximum yield per recruit and are vulnerable to overfishing; however, it is expected that the southern California populations of warty and giant red sea cucumber can sustain current harvest levels, based on the effort-limiting permit restrictions placed on the trawl and dive fisheries.

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