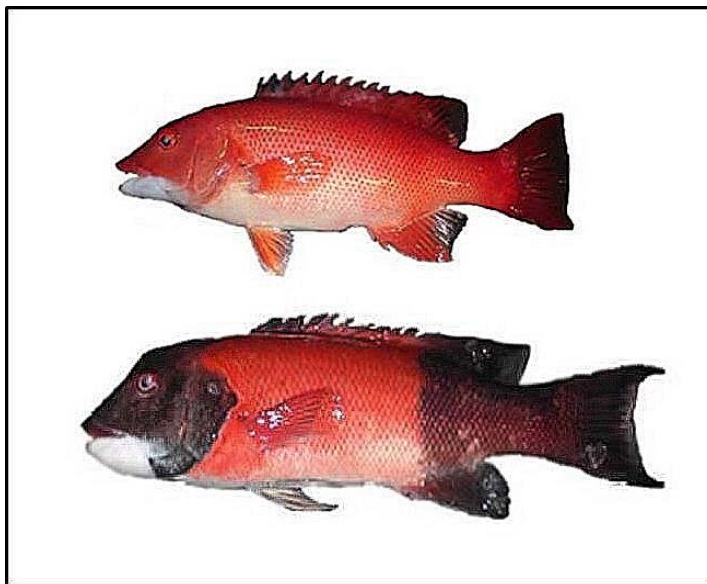


15 California sheephead, *Semicossyphus pulcher*



California sheephead, *Semicossyphus pulcher*. Female top, male bottom.
Photo credit: KA Loke-Smith, CDFW.

History of the fishery

California sheephead, *Semicossyphus pulcher*, have been part of the commercial catch in California since the late 1800s. Commercial landings records show that the fishery has experienced two booms since 1916. During the first boom from 1925 to 1951, sheephead landings averaged 139,500 pounds (63,276 kilograms) per year and reached a historical high of 373,000 pounds (169,190 kilograms) in 1928. For nearly four decades from 1952 to 1989, sheephead catch declined and average landings were less than 16,000 pounds (7,258 kilograms) per year. Then in the 1990s, a boom in landings occurred again, driven in part by a live fish commercial market and a jump in the market price from an average of \$0.57 per pound (\$0.26 per kilogram) in the 1980s to \$2.34 per pound (\$ 1.06 per kilogram) in the 1990s. This accounted for a five-fold increase in the value of the fishery (Figure 15-1). The live fish fishery is primarily a trap fishery which is size selective for “plate-size” individuals. The average commercial landings for sheephead in the 1990s were 234,000 pounds (106,141 kilograms) per year. With the implementation of catch limits and size restrictions since 1999, annual landings have decreased; however, the average landings for sheephead from 2000-2011 were 97,000 pounds (43,998 kilograms) per year, well above the pre-boom average in the 1950s-1980s of 16,000 pounds (7,258 kilograms) per year. The market price for California sheephead has increased steadily since the 1990s reaching an average high price of \$4.34 per pound (\$1.97 per kilogram) in 2008. Most commercially landed sheephead are caught by trap but some are caught by hook-and-line, and also as bycatch in the gill net fishery (Figure 15-2).

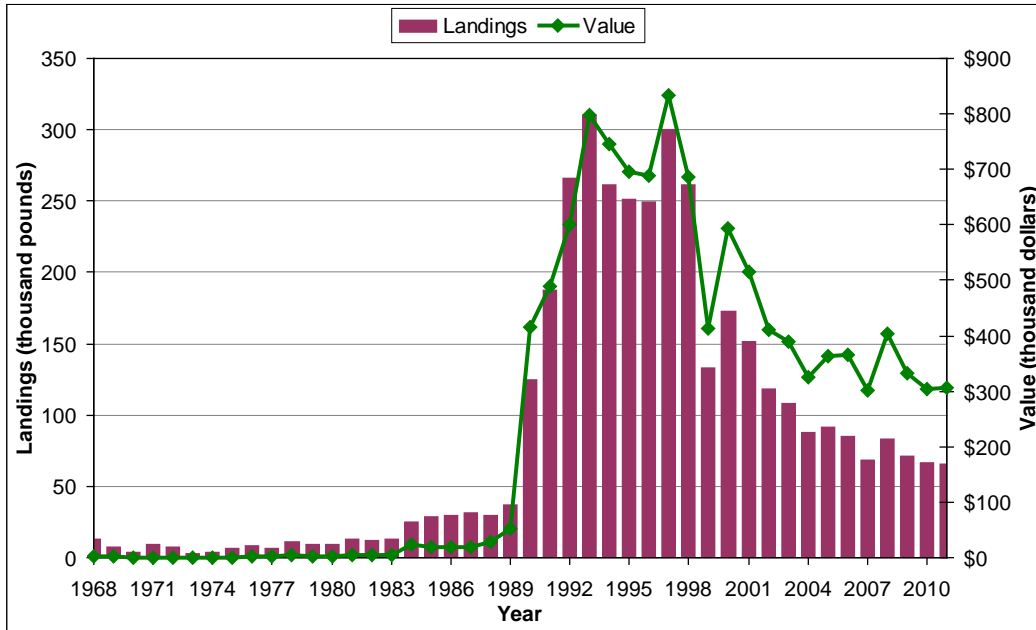


Figure 15-1. California sheephead commercial landings and value, 1969-2011. Data source: Commercial Fisheries Information System (CFIS) data, all gear types combined.

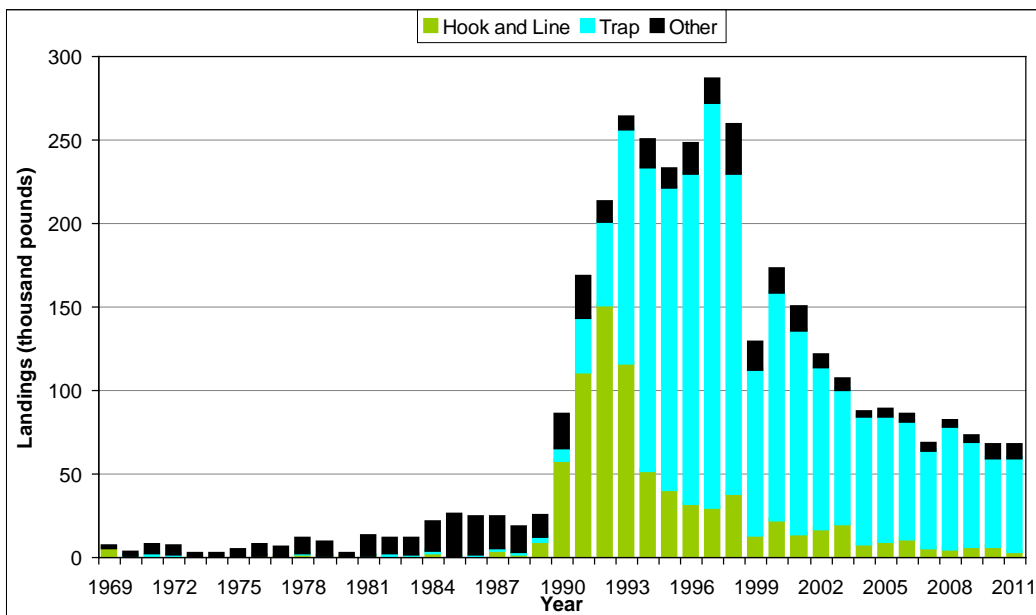


Figure 15-2. California sheephead commercial landings by gear type, 1969-2011. Data source: CFIS data.

California sheephead are one of 19 species listed in the State’s Nearshore Fishery Management Plan and are regulated by the California Fish and Game Commission. The commercial fishery for sheephead is part of the nearshore restricted access program that applies to 10 of the 19 nearshore species, and a Nearshore Fishery Permit

is required to take California sheephead with hook-and-line gear. A trap endorsement is also needed to use trap gear. The minimum size limit for sheephead was first set at 12 inches (30.5 centimeters) total length in 1999 for the commercial fishery, but the size limit was increased to 13 inches (33 centimeters) in 2001. Also in 2001, state quotas for sheephead based on optimum yield estimates were first set and to avoid surpassing the quotas, the commercial fishery was closed early every year from 2001 to 2007. Current regulations for sheephead still include 12 inch (30.5 centimeters) and 13 inch (33 centimeters) minimum size limits for the recreational and commercial fisheries, respectively, along with a five-fish bag limit for the recreational fishery. The commercial fishery has bimonthly trip limits of 2000 pounds (907 kilograms) for January-February, and 2400 pounds (1088 kilograms) for May-June, July-August, September-October, and November-December; the commercial fishery is closed in March and April. The recreational fishery south of Point Conception is closed in January and February to boat-based anglers. Divers and shore based angler can fish year round. The current statewide total allowable catch for California sheephead is 205,000 pounds (92,986 kilograms), with 130,300 pounds (59,103 kilograms) allocated to the recreational fishery and 75,200 pounds (34,110 kilograms) allocated to the commercial fishery.

Recreational anglers target large trophy California sheephead by spear and by hook-and-line. Since the late 1970s, sheephead have been a consistent part of the recreational catch although it has decreased in recent decades. The average number of California sheephead landed annually by commercial fishing passenger vessels (CFPVs) has decreased from 36,047 in the 1980s to 29,022 in the 1990s, and 27,564 in 2000-2011 (Figure 15-3). The decrease in recreational landings may be in part due to increased competition for fish from the commercial fishery in the 1980s and the introduction of minimum size limits and catch limits in the early 2000s. Previous publications on sheephead biology have estimated biomass landed by CPFVs using an average weight of 2 pounds (0.9 kilogram) per fish; however, new research indicates that spatial and temporal differences in sheephead biological parameters exist (including growth rates and average size) such that using an average weight for all populations over time may be inaccurate and may under or over estimate the biomass landed from year to year.

For the recreational fishery, a minimum size limit was set in 2001 at 12 inches (30.5 centimeters) total length and the recreational bag limit for sheephead was reduced from 10 fish to 5. In 2003, the Rockfish Conservation Areas (RCAs) were established and recreational bottom fishing was limited to waters less than 30 or 60 fathoms (55 or 110 meters), depending on the month. Depth limits for the Southern RCA (Point Conception to the U.S./Mexico border) varied until 2006, when they were set at 60 fathoms (110 meters) for all months. The Cowcod Conservation Area was established in 2007 and limited bottom fishing to waters less than 20 fathoms (37 meters). In 2002 and 2003, the recreational fishery for California sheephead closed early. Beginning in 2004, the recreational fishery for sheephead has been closed in January and February along with cabezon, greenlings and rockfish. Since the two-month closure went into effect there has been no need to close the sheephead recreational fishery early.

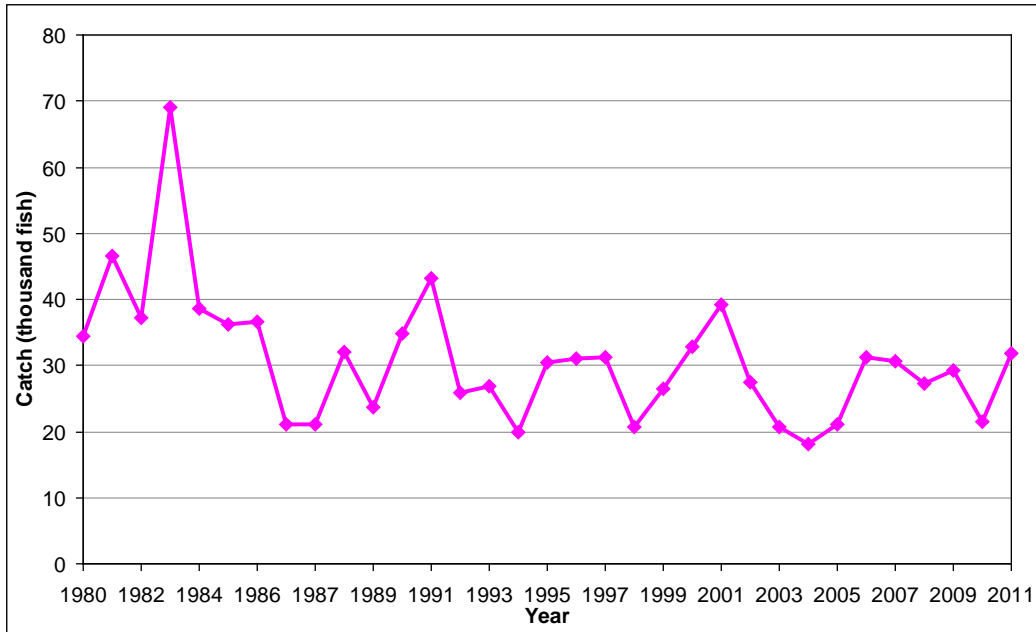


Figure 15-3. California sheephead CPFV catch, 1980-2011. Data source: CPFV logbook data.

Status of the Biological Knowledge

California sheephead, like other wrasses in the family Labridae are monandric protogynous hermaphrodites, meaning that they all begin life as females and may change sex to become male. California sheephead range from Monterey, California to southern Baja California, Mexico and the Gulf of California. Sheephead have been reported to reach sizes of 36.5 pounds (16.6 kilograms) and three feet (0.9 meters) in length. They are sexually dimorphic, with most females having uniformly pink color pattern, a gently sloping forehead and a slight chin, while most males have a distinctive black and red color banding pattern, and a pronounced nuchal hump (enlarged forehead). In spite of the distinctive differences in typical female and male appearance, morphology may not be an accurate indicator of sex in all populations. California sheephead have protruding canine-like teeth and crushing pharyngeal plates and they are a generalist predator whose diet varies geographically and developmentally. As sheephead grow they shift their prey from small filter feeders to larger invertebrates including sea urchins. Sheephead predation may play a role in controlling urchin grazing; however, recent studies indicate that this predation may only have a significant effect in altering urchin populations at certain locations and on small scales.

Sex change in sheephead is thought to be triggered by social cues; specifically, the absence or removal of a dominant male in a population triggers the next dominant female to change sex. California sheephead spawn almost every day during the summer months. New estimates of fecundity indicate the relationship between length and number of eggs increases exponentially (to the power of 5.5), showing the importance of large females to the overall reproductive potential of the sheephead stock.

Sheephead have been reported from shallow subtidal depths to 280 feet (85 meters) and are typically associated with rocky reefs and kelp forests. Tracking studies at Santa Catalina Island have found that California sheephead have relatively small home ranges of 0.23 to 20.26 acres (938 to 82000 meters²) and they show a high degree of site fidelity. They use hard and soft substratum in equal proportions during the day, but use primarily hard substratum when refuging at night. They also show a very strong association with ecotone habitat (where habitat changes from one type to another). On offshore oil platforms, sheephead exhibited daily vertical migrations from shallow water during the day to deeper water at night.

There is wide spatial variation in the demography and life history of California sheephead populations in southern California. New research indicates that California sheephead in four southern populations (Santa Catalina Island, San Clemente Island, Palos Verdes, and Point Loma) attain smaller maximum sizes (for females and males), reach maturity, and undergo sexual transition at smaller sizes and younger ages than five northern populations within southern California (Santa Cruz Island, Santa Rosa Island, Anacapa Island, Santa Barbara Island, and San Nicolas Island). The growth rate of sheephead was also slower in the southern populations than in the northern populations. Plasticity (ability to change) in biological traits is commonly seen in fishes to increase fitness and may be affected by environmental conditions including temperature and diet composition as well as manmade conditions including fishing. Indeed, temperature and diet vary significantly across southern California populations and size selective fishing by the commercial and recreational fisheries across southern California has been shown to have significant effects on population size structure, growth rate, size/age at maturation, and size at sex change of California sheephead.

Status of the Population

A stock assessment of California sheephead conducted in 2004 estimated the stock was approximately 20 percent of the unfished level, well below the target level of 50 percent estimated as sustainable. Unfortunately, most of the biological data used in the stock assessment were collected before the boom in the fisheries that began in the 1990s and before the effects of size limits and catch limits set between 1999 and 2001 could be fully observed. Since the 2004 stock assessment, new research shows the variability in life history parameters of sheephead populations across southern California depends on the population's exposure to environmental conditions and fishing pressures.

The data available to estimate temporal changes in sheephead populations are sparse because long term historic and current data are only available for two populations: Santa Catalina and San Nicolas Islands. Since 1970, a decrease in size at maturity, size at sex change, and maximum size of both females and males have occurred for the sheephead population at Santa Catalina Island. Since smaller females produce exponentially fewer eggs than larger females, a small reduction in the maximum size of females indicates a large loss in the number of eggs produced. In addition, two

separate studies conducted on opposite sides of Santa Catalina Island found approximately 25 percent of the population undergoing sexual transition in the summer breeding season. Sex change involves a period of reproductive inactivity and until 2005, this had never been reported in California sheephead during the summer breeding season. The temporal changes in the Santa Catalina Island population and the change in the timing of sexual transition suggest a reduction in the reproductive potential in that population. In contrast, the temporal data for San Nicolas Island shows a decrease in the maximum sizes of females and males from 1980 to 1998; however, by 2007 the population structure was very similar to the structure observed in 1980 suggesting that the San Nicolas population may be recovering.

Although the data from San Nicolas Island shows the potential for California sheephead populations to recover, this may be due to the unique conditions at the island. The island's sheephead population may have benefited due to increased recruitment during the 1998 El Niño followed by decreased fishing pressure. San Nicolas Island is located 62 miles (100 kilometers) from any mainland port making travel to the island an expensive endeavor with the increased fuel prices over the last decade. In addition, the island is owned by the U.S. Navy and since September 11, 2001, the island has been periodically closed to fishing without warning making it an unattractive fishing destination.

If the observed temporal changes in life history at Santa Catalina Island are more indicative of temporal changes in life histories across the range, then there has likely been an overall decrease in the reproductive potential of California sheephead relative to the unfished condition of the stock.

Management Considerations

As a sex changing species, California sheephead present a unique challenge for fisheries managers. Further confounding sheephead management is the geographic variation in sheephead life history parameters with populations in the northern part of their California range having faster growth rates, maturing at larger sizes and achieving larger maximum sizes for females and males than their more southern California counterparts. For populations of sheephead in the most southern populations in California, the current minimum size limit of 12 inches (305 millimeters) preserves some mature females and males allowing them to spawn at least once before they are recruited to the fishery; however, in the more northern populations, sheephead are still immature at 12 inches (30 centimeters) and individuals may not get to spawn before they are recruited to the fishery.

A new modeling study for sheephead made estimates of fishery yields under different minimum size limits. Models indicate that a statewide increase in the minimum size limit by at least 2 inches (5 centimeters) would allow more individuals in northern populations to spawn at least once and may increase fishery yield by up to 15 percent. Models also highlight the potential for increasing fishery yield by dividing the management area into northern and southern management zones with unique size limits.

Alternative management considerations also include slot limits which would preserve both males and females of the species; however, variability in life history parameters across California may limit the effectiveness of a statewide slot limit option.

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California sheephead commercial landings, 1969-2011.								
Year	Pounds	Value	Year	Pounds	Value	Year	Pounds	Value
1969	13,285	\$1,432	1984	25,085	\$23,245	1999	129,598	\$412,832
1970	3,805	\$419	1985	28,486	\$18,476	2000	173,615	\$593,155
1971	8,419	\$932	1986	29,228	\$17,805	2001	150,118	\$516,488
1972	7,084	\$947	1987	32,865	\$19,385	2002	121,470	\$411,830
1973	3,072	\$472	1988	29,314	\$29,122	2003	108,552	\$390,191
1974	3,721	\$599	1989	33,019	\$54,169	2004	87,213	\$328,138
1975	6,031	\$1,104	1990	123,539	\$414,701	2005	89,228	\$361,852
1976	8,325	\$1,813	1991	191,705	\$491,588	2006	85,599	\$367,214
1977	6,409	\$1,611	1992	258,502	\$600,719	2007	67,869	\$300,861
1978	11,139	\$5,233	1993	314,151	\$800,644	2008	81,479	\$402,661
1979	8,813	\$3,039	1994	259,099	\$745,063	2009	72,374	\$335,491
1980	9,102	\$3,274	1995	253,658	\$697,687	2010	67,256	\$308,121
1981	12,900	\$4,960	1996	252,123	\$690,037	2011	68,040	\$312,167
1982	11,761	\$4,800	1997	301,878	\$835,471			
1983	12,620	\$5,317	1998	261,640	\$687,697			

Data source: CFIS data, all gear types combined.

California sheephead commercial landings by gear type, 1969-2011.							
Year	Hook-and-line	Trap	Other	Year	Hook-and-line	Trap	Other
1969	5,732	746	6,807	1991	191,705	32,510	111,781
1970	555	767	2,483	1992	258,502	49,666	151,864
1971	1,548	1,591	5,280	1993	314,151	140,171	117,146
1972	940	1,776	4,368	1994	259,099	182,069	54,225
1973	630	34	2,408	1995	253,658	181,335	54,075
1974	263	106	3,352	1996	252,123	197,777	44,346
1975	181	107	5,743	1997	301,878	241,830	45,660
1976	1,584	127	6,614	1998	261,640	192,145	50,827
1977	425	48	5,936	1999	129,590	99,486	23,898
1978	2,043	1,062	8,034	2000	173,615	135,847	33,022
1979	505	974	7,335	2001	150,118	121,903	23,916
1980	453	578	8,071	2002	121,470	96,367	22,555
1981	794	795	11,311	2003	108,552	79,762	25,798
1982	969	1,788	9,004	2004	87,213	76,720	9,493
1983	1,792	696	10,131	2005	89,228	74,574	13,288
1984	3,421	1,156	20,509	2006	85,599	70,790	14,044
1985	331	763	27,392	2007	67,869	58,526	6,852
1986	666	1,563	26,999	2008	81,479	73,667	6,481
1987	4,250	1,593	27,022	2009	72,374	62,638	9,548
1988	3,286	1,277	24,752	2010	67,256	52,667	13,665
1989	9,795	3,234	19,990	2011	68,020	56,686	10,922
1990	58,451	7,471	57,616				

Data source: CFIS data.

California sheephead CFPV landings, 1980-2011.					
Year	Number of Fish	Year	Number of Fish	Year	Number of Fish
1980	34,368	1991	43,158	2002	27,396
1981	46,479	1992	25,785	2003	20,781
1982	37,242	1993	26,910	2004	18,192
1983	68,972	1994	19,922	2005	21,124
1984	38,522	1995	30,430	2006	31,316
1985	36,267	1996	30,976	2007	30,696
1986	36,707	1997	31,195	2008	27,286
1987	21,146	1998	20,610	2009	29,175
1988	21,146	1999	26,498	2010	21,440
1989	32,058	2000	32,780	2011	31,834
1990	23,612	2001	39,156		

Data source: CPFV logbook data, all gear types combined.