Fishery-at-a-Glance: White Croaker

Scientific Name: *Genyonemus lineatus*

Range: White Croaker have a large range along the eastern Pacific from Barkley Sound, British Columbia to Bahia Magdalena, Baja California Sur.

Habitat: Adult White Croaker are found in cloudy waters, nearshore and within bays over benthic muddy soil or mid-water. Larvae reside just outside of the surf line until settlement (transition from larvae to juvenile fish).

Size (length and weight): White Croaker can reach a maximum length of 41 centimeters (16 inches). Maximum weight is unknown.

Life span: White Croaker have a maximum life span of 12 years.

Reproduction: White Croaker spawn from November to April with peak spawning occurring in February and March. They are batch spawners, and depending on age and size of the female, released batches can have 800 to 37,200 eggs each. Larger females produce more eggs. Also depending on size and age, females spawn on average 18 to 24 times during the spawning. Larger females spawn more often.

Prey: Adult White Croaker primarily feed on benthic invertebrates. Their food items predominately include crustaceans (dominated by amphipods and copepods) (45%) and polychaetes (44%). Larval White Croaker feed on rotifers, copepod nauplii, tintinnids (ciliates), and invertebrate eggs.

Predators: Predators of White Croaker include fish (sharks and rays, Barred Sand Bass, California Halibut, California Lizardfish, Longnose Skate, Pacific Bluefin Tuna), birds (Brandt's and Double-Crested Cormorants), and mammals (seals, sea lions, and dolphins).

Fishery: White Croaker is primarily a recreational shore-based fishery. They are also caught and sometimes landed in the Ridgeback Prawn, California Halibut, and Petrale Sole commercial fisheries. In 2018, about 48,000 fish were caught in the recreational fishery and about 50,000 pounds in the commercial sector.

Area fished: White Croaker are most often fished from the shore but are occasionally caught further offshore along their range.

Fishing season: There is no closed season for White Croaker.

Fishing gear: Hook and line are the primary gear used recreationally. White Croaker is caught in commercial fisheries by several gear types, including but not limited to:

entangling nets (drift gillnet, set gillnet and trammel net), surrounding nets (purse seine and lampara net), trawl nets (single-rigged and bottom trawl), set longline, and hook and line.

Market(s): White Croaker is sold at fresh fish markets in California and Mexico. However, concern regarding toxin levels in the flesh has limited the marketability of the species.

Current stock status: Currently, there is no available estimate of White Croaker abundance or stock status.

Management: There are no restrictions on the commercial harvest of White Croaker. There is a recreational bag limit of 20 fish. There is no current information or concern that would indicate the need for any potential changes in management.

1 The Species

1.1 Natural History

1.1.1 Species Description

White Croaker (*Genyonemus lineatus)* is a member of the Sciaenid family (drums and croakers) – a family of commercially important fish characterized by its sound production emanating from its gas bladder and controlled by attached muscles (Helfman et al. 1997). They are a small schooling fish often found nearshore. White Croaker are silvery gray in color with a lighter-toned belly. Their fins are yellow or white and a small black spot can be found where the pectoral fin and body meet. They have small inconspicuous barbels under their chin (Figure 1-1).

White Croaker are commonly referred to as “tomcod” in southern California, “roncador” near Santa Barbara, and “kingfish” in central California. White Croaker is traditionally viewed as an undesirable fish, although they are very popular with some groups of Californians (Love 2011; Kells et al. 2016).

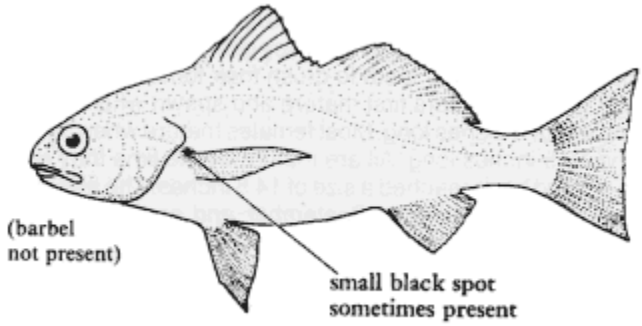

Figure 1-1. White Croaker image (Accessed March 20 2019. https://www.wildlife.ca.gov/Fishing/Ocean/Fish-ID/Sportfish/Croakers)

1.1.2 Range, Distribution, and Movement

White Croaker have a large range from Barkley Sound, British Columbia to Bahia Magdalena, Baja California Sur (Figure 1-2). They are often found nearshore and in bays although they may be found deep. They are most abundant south of San Francisco Bay and north of Baja California. In southern California, White Croaker are often found near sewage discharge sites (Wolfe and Lowe 2015). White Croaker are most abundant in the surf zone (0 feet (ft)/meters (m)) but may be found at depths up to 238 m (781 ft) (Love 2011). Fine-scale movements of White Croaker indicate possible diurnal movement habits (more fish abundant near the surface of the water column at night than during the day) (DeMartini and Allen 1984). The observed size distribution of sampled fish suggests the presence of ontogentic movement, in which juveniles are found in shallower waters closer to shore but move offshore into deeper water as they

age (Love et al. 1984). Evidence also suggests White Croaker migrate during the winter months of October to December away from southern California (DeMartini and Allen 1984). However, there is no direct movement data (tagging, telemetry, etc.) for White Croaker, and it is unknown how many, when, and how long they use depths, habitats, or areas (Wolfe and Lowe 2015). Genetic structure of southern California White Croaker populations indicates that there is no population separation. This is also evident by the lack of natural barriers across their range (Beckwitt 1983) allowing for adult and larval dispersal.

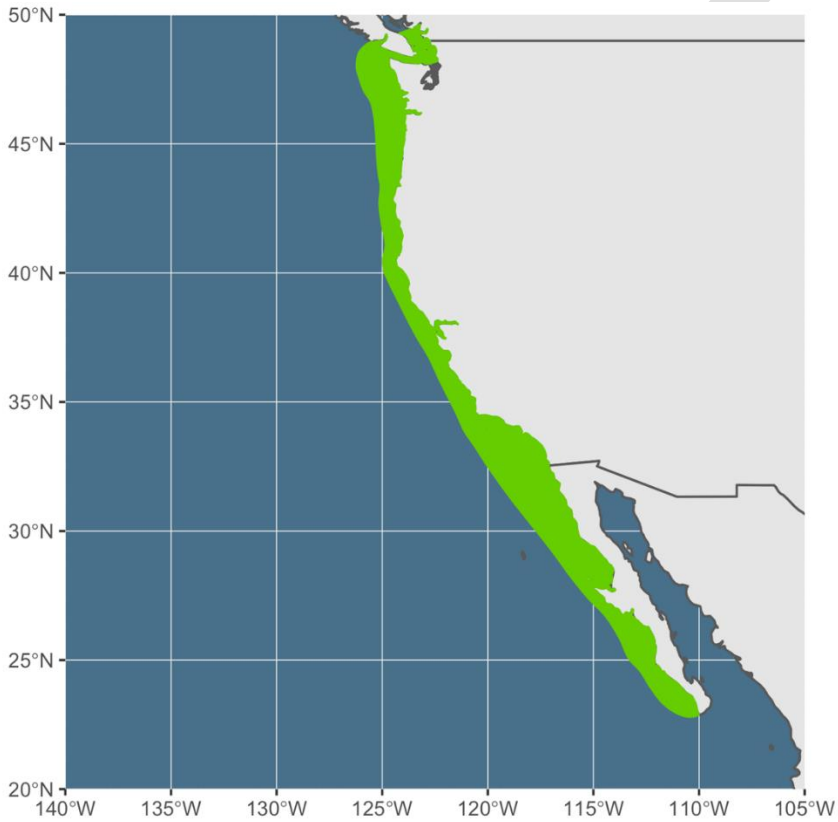

Figure 1-2. White Croaker range map.

1.1.3 Reproduction, Fecundity, and Spawning Season

White Croaker spawn from November to April off southern California and all year off the central California coast, with peak spawning occurring from January through April. They are batch spawners (females retain eggs of varying maturity within the ovary to be released) and will spawn multiple times throughout the spawning season. Each released batch ranges from 800 to 37,200 eggs depending on the size of the female. Larger females produce more eggs. Females spawn on average 18 to 24 times during the spawning season, also, depending on their size and age. Older, larger females spawn more often (Love et al. 1984). Data from larval surveys indicated two spawning centers, one located from Redondo Beach to Laguna Beach and a smaller one centered

off the coast of Ventura (Love et al. 1984). Fertilized eggs of White Croaker will hatch within one week at approximately 1.6 mm standard length (0.06 in) (Watson 1982). Miller et al. (2011) described larval growth as a linear relationship described by the equation: $L = -0.833 + 0.242A$, $R^2 = 0.84$.

1.1.4 Natural Mortality

Determining the natural mortality (M) of marine species is important for understanding the health and productivity of their stocks. Natural mortality results from all causes of death not attributable to fishing such as old age, disease, predation or environmental stress. Natural mortality is generally expressed as a rate that indicates the percentage of the population dying in a year. Fish with high natural mortality rates must replace themselves more often and thus tend to be more productive. Natural mortality along with fishing mortality result in the total mortality operating on the fish stock.

It is management's responsibility to ensure the total mortality rate is below what will allow for persistence of the population. Estimating natural mortality is difficult and often relies on evaluation of life history traits. Currently, there is no information on the natural mortality of White Croaker, though they generally live to at least 12 years of age, with a possible maximum of 17, suggesting a moderate rate of natural mortality (Love et al. 1984 and Love 1996). However, Queenfish (*Seriphus politus*), a related species within the same family (Scianedae), has a calculated total mortality coefficient estimate (instantaneous natural and fishing mortality combined, Z) of 0.42 (Miller et al. 2009). This coefficient is unit-less but may be converted into percent yearly loss with the equation: $A = 1 - e^{-z}$, which indicates that 39% of the population is removed each year from natural and fishing mortality combined, or total mortality.

1.1.5 Individual Growth

Individual growth of marine fishes can be quite variable, not only among different groups of species but also within the same species. Growth is often very rapid in young fish and invertebrates, but slows as adults approach their maximum size. The von Bertalanffy Growth Model is most often used in fisheries management, but other growth functions may also be appropriate.

White Croaker reach a maximum total length (TL) of 41.4 cm (16.3 in) (Miller and Lea 1972). The three-parameter von Bertalanffy growth equation was used to model growth of White Croaker. This function is used to predict body size as a function of age, as follows:

$$L_t = L_\infty(1 - e^{-k(t-t_0)})$$

where L_t is the length at age t, L_∞ is the maximum average length, k is the relative growth rate, t is the age of the fish, and t_0 is the theoretical age when the length of the fish is zero. Love et al. (1984) estimated growth parameters for females as: $L_\infty = 60.72$ centimeter (cm) (23.91 inch (in)), $k = 0.037$, and $t_0 = -7.54$ and for males as: $L_\infty = 59.17$ cm, $k = 0.033$, and $t_0 = -8.66$. Females grow slightly faster and are larger than males at

age, evident by L_∞ (61.0 cm versus 59.0 cm (24.02 in versus 23.23 in), respectively) and k (0.037 versus 0.033, respectively). The oldest aged fish for both male and female in this study were 12 years (yr); both male and females grew at a constant rate (k = 0.037 and 0.033), meaning that growth does not slow or increase much as the fish mature. This constant rate of growth results in an estimate L_∞ parameter that is much larger than the observed maximum size.

Weight at length of White Croaker was also calculated and the relationship was fit to the equation:

$$W = aL^b$$

where a and b are constants with no biological meaning, *W* is the predicted weight, and *L* is the observed length. These parameters were estimated as: *a* = 0.0109 and *b* = 3.0239 for females and *a* = 0.0111 and *b* = 3.0114 for males. Males were found to be heavier at a given length than females in southern California, but there was no difference of sex in central California (Monterey). The reason for this spatial difference is unexplained.

1.1.6 Size and Age at Maturity

Length at maturity of White Croaker was estimated from macroscopic evaluation of reproductive organs (gonads) during the spawning season. Fifty percent of males are mature at 14.0 cm (5.5 in) and females at 15.0 cm (5.9 in) TL, which corresponds to 1 year of age (Love et al. 19984). Ninety-nine to 100% of fish >19.0 cm (7.5 in) (3 to 4 yr) are mature during the months of January and February (Love et al. 1984).

1.2 Population Status and Dynamics

There are no direct abundance estimates of White Croaker. They do not have a FMP or a stock assessment, and the status of the stock is unknown. However, fishery-dependent data is available from logbooks, landing receipts and Department sample data (CRFS) to estimate Catch Per Unit Effort (CPUE), which provides some information on changes in abundance over time.

1.2.1 Abundance Estimates

Fluctuations in population abundances over time may be estimated using CPUE data for both the recreational and commercial sectors of the White Croaker fishery. Catch Per Unit Effort of White Croaker in the recreational sector is calculated from CRFS,2005 to 2018 estimate data (RecFIN 2019). Data used was catch estimates (kept and discarded live and dead fish) and effort estimates of all angler trips from man-made and private/rental modes summed across the two modes. All other modes (party/charter and beach/bank) had very little White Croaker catch and/or would over inflate the angler trip effort estimates if included.

These estimates have been decreasing since 2005 with a steadying trend starting in 2011 and continuing to 2018. (Figure 1-3).

Commercial CPUE of White Croaker is estimated from landing receipts, which are required to be submitted by any fisherman who engages in for-profit fishing and/or fish receivers. Pounds of fish landed are used with number of trips to calculate CPUE as an estimate for abundance. From 1980 to 1984 the fishery experienced an increase in landings with a sharp decline in 1987 followed by another decline in 1990. Abundances were steady, although about 50% lower than in the 1980s, until 2018 with one unexplained small peak in 2009 (Figure 1-4).

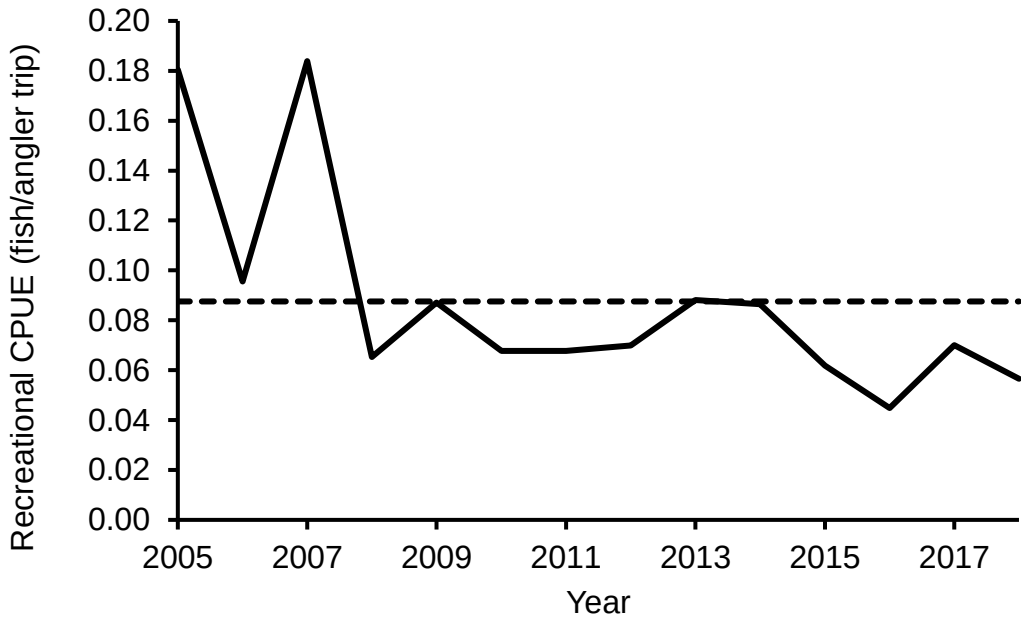

Figure 1-3. Recreational White Croaker estimate CPUE (fish/angler trip) from man-made and private/rental modes across 2005 to 2018 (RecFIN 2019).

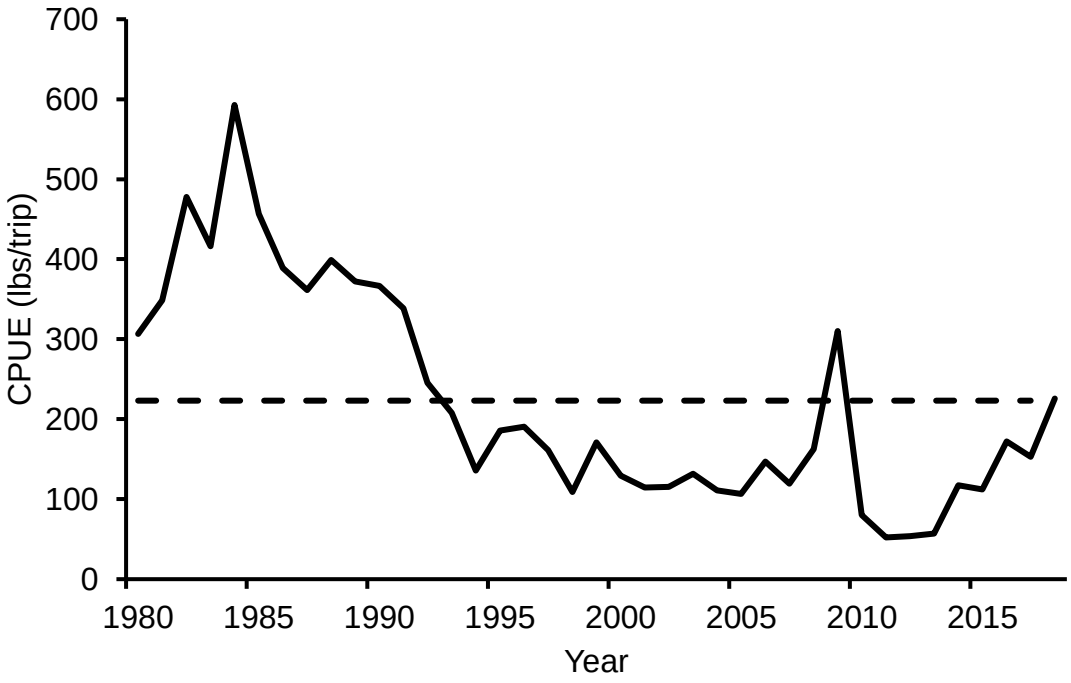

Figure 1-4. Commercial White Croaker CPUE (pounds/trip) from 1980 to 2018 (MLDS 2019).

Abundance of White Croaker in both sectors has been steadily decreasing overall with intermittent increases and decreases throughout the last few decades. The White Croaker fishery is not actively managed, and these abundances may only be used as approximate estimates. The lower average CPUE observed in both the commercial and recreational sectors since 1995 and 2011, respectively, remains unexplained, however, because White Croaker has become less desirable during this time and may be released more frequently with less effort to harvesting this species (see Chapter 2 for more information) it is possible that this decline is due to lower overall biological productivity within the environment (Miller et al. 2011). Additionally, contaminants of DDT and PCB are known sources of lessened reproductive success in White Croaker which may cause overall decreases in abundance (Cross and Hose 1988).

While the absolute abundance of White Croaker has not been directly studied and no stock assessment has been completed, there are some incidental data from fishery-independent studies that have captured White Croaker. For example, bottom trawl surveys conducted by the National Oceanic and Atmospheric Administration's (NOAA) Northwest Fisheries Science Center from 2003 to 2010 show significant decreasing abundances of White Croaker (Figure 1-5) (Keller et al. 2011). Although this study shows decreasing abundance, it is a small snapshot of the White Croaker fishery and might not reflect current abundances.

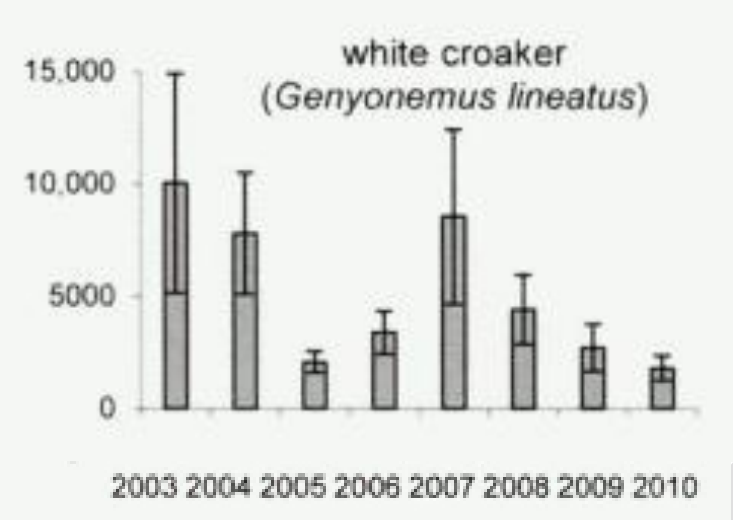

Figure 1-5. Significant (P<0.05) decreasing biomass trend of White Croaker sampled in the Northwest Fisheries Science Center's West Coast Groundfish Bottom Trawl Survey from 2003 to 2010 (Reproduced from Keller et al. 2011).

1.2.2 Age Structure of the Population

While the age structure of the White Croaker population has not been monitored, information about the age structure of the stock can be inferred from the size structure and the von Bertalanffy growth model (described in section 1.1.5). White Croaker lengths were collected by the Department's California Recreational Fisheries Survey (CRFS) project and includes representation of all modes: beach/bank, party/charter, private/rental, and man-made/jetty. The size structure of White Croaker has been steady from 2004 to 2018 (Figure 1-6). Despite a maximum observed length of 16 in (41 cm) TL, the majority of White Croaker measured were 8.0 and 9.0 in (25.4 and 27.9 cm). These fish are estimated to be 6 and 8 yr old, respectively.

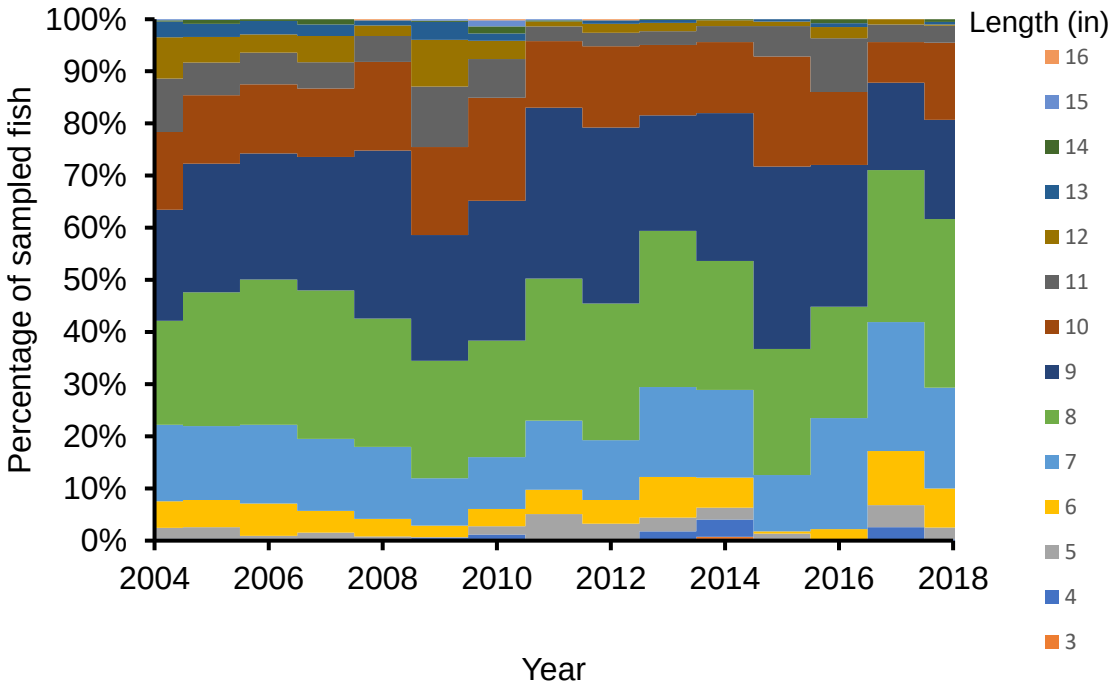

Figure 1-6. Total length size structure of White Croaker from 2004 to 2018. Color blocks represent size in inches (in). Data is from all modes sampled by CRFS (RecFIN 2019).

1.3 Habitat

Adult White Croaker are found in cloudy waters, nearshore and within bays over muddy soil. They spawn nearshore and their larvae reside just outside of the surf line until settlement (transition from larvae to juvenile fish). Adults are found in the benthos or mid-water, but occasionally they will rise to the surface when chasing prey (Love 2011). In southern California, White Croaker congregate near the Los Angeles County sewage outfall site at White Point, Palos Verdes and other polluted areas such as the Los Angeles/Long Beach Harbor (Wolfe and Lowe 2015). Pollution at these sites has negative effects on both the surrounding ecosystem and within White Croaker, includes liver lesions, low reproductivity, and impaired growth rates (Basmadjian et al. 2007; Cross and Hose 1998; Moore 2001). A 2015 study of habitat usage within the Los Angeles/Long Beach Harbor showed selection of different habitats by White Croaker. White Croaker were passively tracked and found to spend the most time over habitat that was highly contaminated. These habitats were found to have smaller sand grain size, higher Total Organic Carbon (TOC), and high polychaete density. It is likely that White Croaker were foraging over these areas (Ahr et al. 2015).

1.4 Ecosystem Role

There is little information available on the ecosystem role played by White Croaker. They are a mid-trophic level fish species, consuming small invertebrates and

providing a prey species for several large fish, sea birds, and marine mammals. Because White Croaker can accumulate marine pollutants in their tissues, there is the possibility that they play a role in passing these pollutants up the food chain.

1.4.1 Associated Species

A otter trawl survey in southern California from 1972 to 1980 caught White Croaker in depths between 18.0 to 27.0 m (59.1 to 88.6 ft) along with Speckled Sanddab (*Citharichthys stigmaeus*), California Tonguefish (*Symphurus atricauda*), Queenfish (*Seriphus politus*), White Seaperch (*Phanerodon furcatus*), Northern Anchovy (*Engraulis mordax*), Hornyhead Turbot (*Pleuronichthys verticalis*), Walleye Surfperch (*Hyperprosopon argenteum*), Pacific Sanddab (*Citharichthys sordidus*), and California Lizardfish (*Synodus lucioceps*) (Love et al. 1984).

1.4.2 Predator-prey Interactions

Adult White Croaker primarily feed on benthic invertebrates. Their food items predominately include crustaceans (45%) and polychaetes (44%) and within crustacea, amphipods and copepods dominate (Ware 1979). Larval White Croaker feed on rotifers, copepod nauplii, tintinnids (ciliates), and invertebrate eggs (Jahn et al. 1988).

Predators of adult and larval White Croaker include fish (sharks and rays, Barred Sand Bass (*Paralabrax nebulifer),* California Halibut (*Paralichthys californicus*), California Lizardfish (*Synodus lucioceps*), Longnose Skate (*Eringraja binoculata*), Pacific Bluefin Tuna (*Thunnus orientalis*)), birds (Brandt's cormorant (*Phalacrocorax penicillatus*) and Double-Crested Cormorants (*Phalacrocorax auritus*)) and, mammals (seals, sea lions, and dolphins) (Love et al. 1984).

1.5 Effects of Changing Oceanic Conditions

The projections for many species off the West Coast of the United States indicates a shift towards preferred thermal habitats as ocean temperatures continue to experience warming trends (Morley et al. 2018). White Croaker have shown sensitivity to oceanic changes, as seen during the 1983 El Niño when White Croaker were found in Oregon (Love 2011).

However, the direct effects of environmental factors on White Croaker life history (i.e. breeding, feeding, growth) is largely unknown, making predictions associated with changing oceanic conditions difficult.

2 The Fishery

2.1 Location of the Fishery

White Croaker are primarily caught by the recreational fishery, with most fish caught from man-made/jetty structures (61%) and landed by private/rental boaters (26%). The other two modes of catch come from party/charter boats (3%), and beach/bank (12%) (Table 2-1). From 2004 to 2018, the percent estimates by mode of White Croaker has remained steady. The mode of sampling has ranked consistently, in order of most to least encounters with White Croaker, from man-made/jetty, private/rental, beach/bank, and party/charter boats). The White Croaker fishery centered in southern California counties from 2004 until 2012, then shifted north to the central and bay areas (of estimated White Croaker catch for unknown reasons Figure 2-1).

Table 2-1. Average percent of White Croaker estimated catch (retained and discarded alive/dead fish) in the recreational fishery by mode and average yearly estimate from 2005 to 2018 (RecFIN 2019).

Fishing mode	**Percent of catch (%)**
man-made/jetty	61
private/rental	26
beach/bank	12
party/charter	3
average yearly estimate (all modes)	105,704

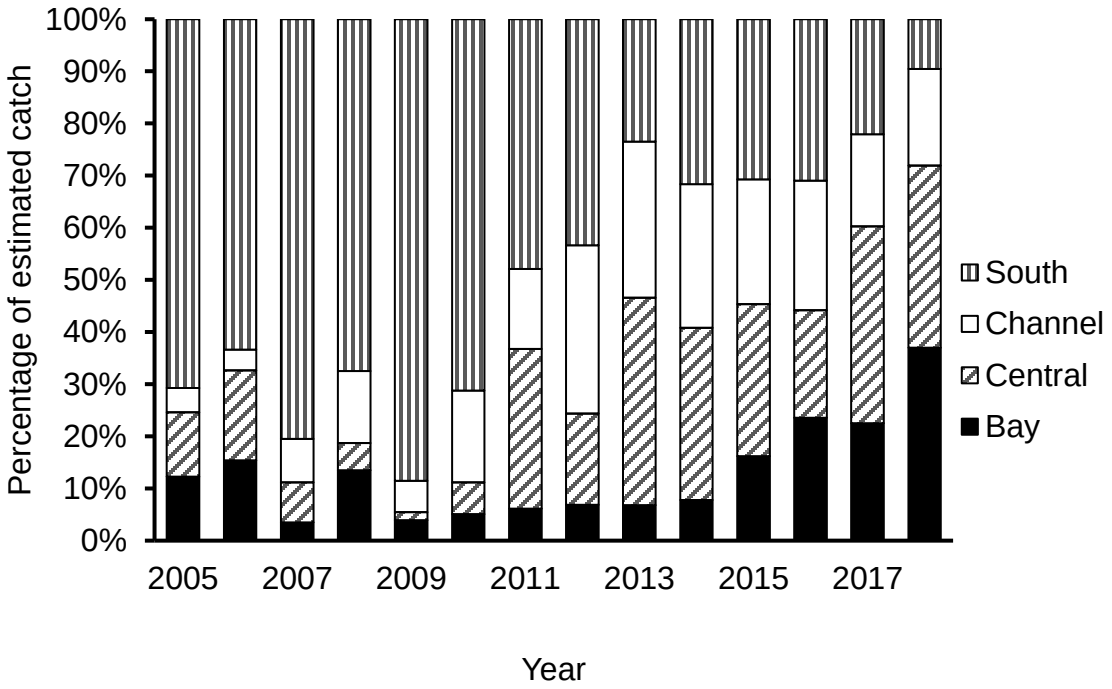

Figure 2-1. Percent (%) recreational catch of White Croaker by port from 2005 to 2018. Ports include South (San Diego, Orange and Los Angeles counties), Channel (Ventura and Santa Barbara counties), Central (San Luis Obispo, Monterey, and Santa Cruz counties), and Bay (Sonoma, Marin, Solano, Napa, Contra Costa, Alameda, Santa Clara, San Mateo, and San Francisco counties).

There is no directed commercial fishery for White Croaker, however they are caught and landed in several fisheries as discussed below. Figure 2-2 shows a map of commercial landings by area in 2017.

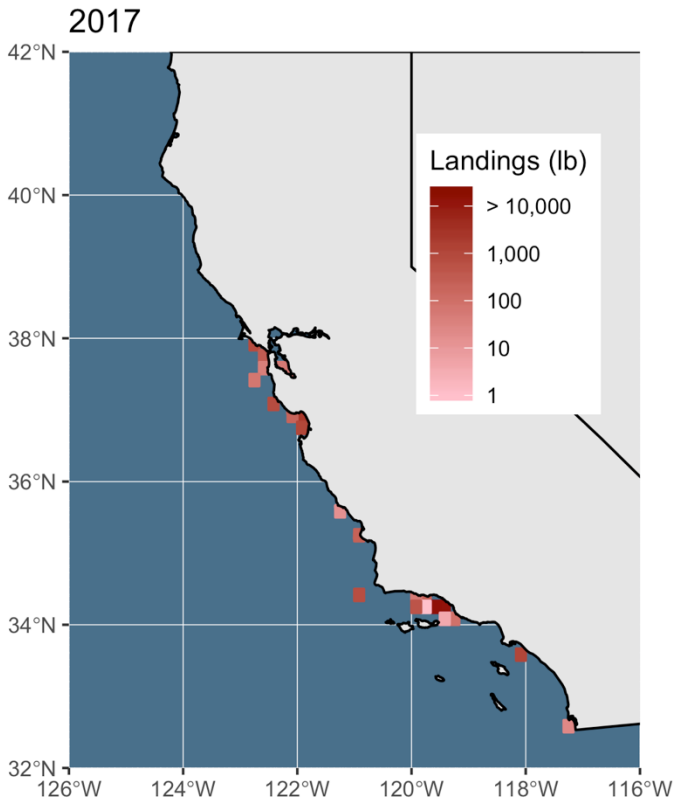

Figure 2-2. Map of commercial fishery landings of White Croaker by block in 2017 (CDFW MLDS 2018).

2.2 Fishing Effort

2.2.1 Number of Vessels and Participants Over Time

Sample data from California Recreational Fisheries Survey (CRFS) across 2004 to 2018 were used to estimate participation and landings of White Croaker. The recreational fishery for White Croaker has not shown any steady increases or decreases from 2004 to 2018, but instead has a predominant peak and trough trend across time with landings and participation tightly associated with each other (Figure 2-3). The maximum kept during this time was 3,738 fish in 2005 and in 2018 2,640 fish were kept by ~1,650 anglers. Participation is estimated with number of anglers who kept one or more White Croaker and landings is from kept fish sampled by CRFS samplers.

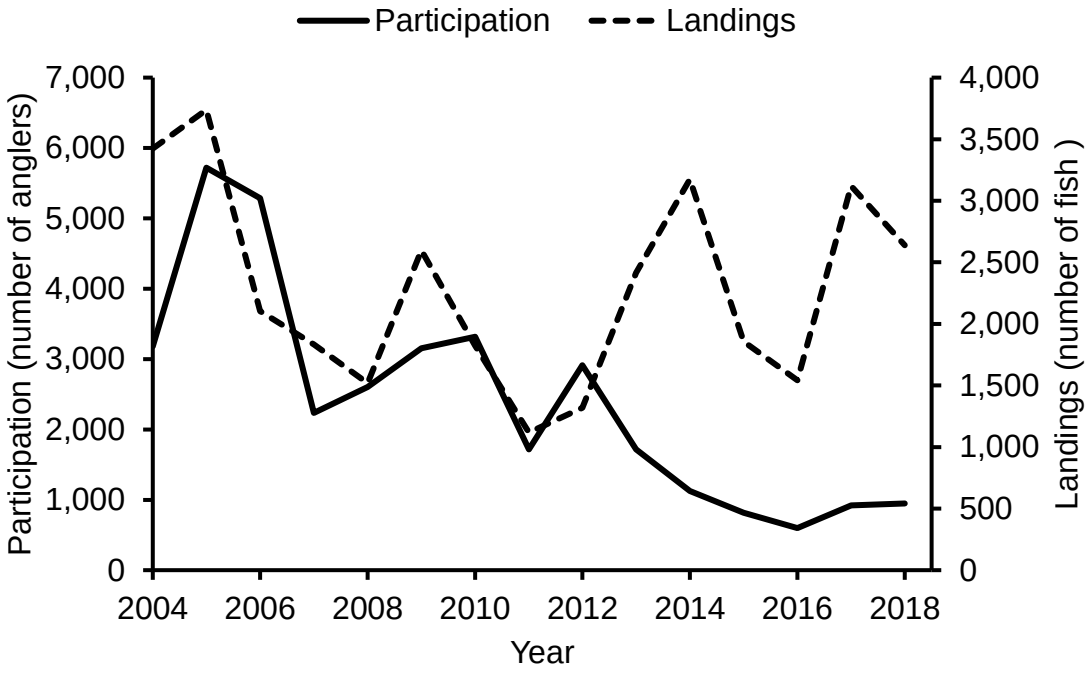

Figure 2-3. Recreational White Croaker participation (number of anglers that kept a fish) and sampled catch (number of kept fish) from 2004 to 2018 (RecFIN 2019).

While there is no directed commercial fishery for White Croaker, they are caught and retained primarily by the Ridgeback Prawn, California Halibut, and Petrale Sole fisheries (CDFW MLDS 2017). Based on landing receipts, this catch of White Croaker has shown a steady decrease from 1980 to 2018 (Figure 2-4) with the maximum of 1,437,117 pounds (lb) being landed in 1985. From 2010 to 2018, the landings have remained at an average of ~20,000 pounds (lb) with ~50,000 pounds (lb) caught in 2018 by ~220 vessel trips. The decrease in landings and participation may be attributed to the increase in outreach about the pollution levels of Dichlorodiphenyltrichloroethane (DDT) and Polychlorinated biphenyls (PCBs) within White Croaker tissues of fish near Palos Verdes, California and the associated health risks, encouraging fishers to discard caught White Croaker. This possible increase in discards also has an impact on the Department's ability to accurately track participation, because the only method of estimation is via landing receipts. It is unclear whether less fishermen are participating in the fishery, or whether those that do catch White Croaker discard rather than land them.

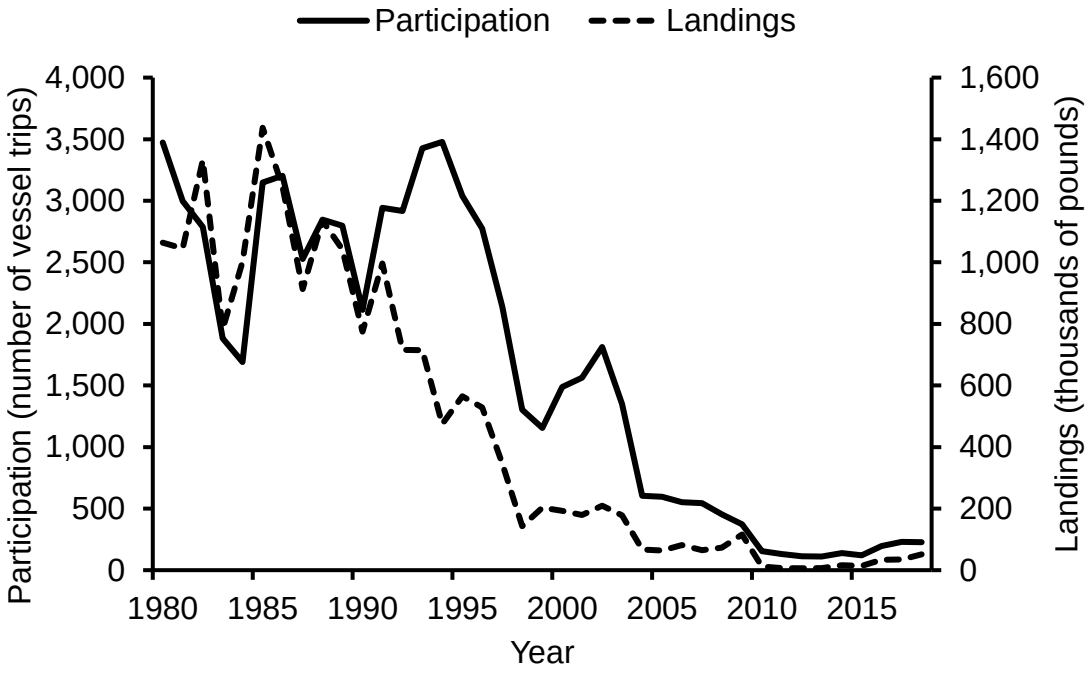

Figure 2-4. Commercial White Croaker participation (number of vessel trips) and landings (thousands of pounds) from 1980 to 2018 (CDFW MLDS 2019).

2.2.2 Type, Amount, and Selectivity of Gear

The primary recreational gear type for White Croaker is hook and line. From the available size structure data from the recreational catch this fishery appears to land individuals that are primarily 4 yr and older (Figure 1-5) from length at age estimates by Love et al. (1984). This suggests that this gear type selects mature fish (Section 1.1.6).

White Croaker have been caught commercially with several gear types, including, but not limited to: entangling nets (drift gillnet, set gillnet and trammel net), surrounding nets (purse seine and lampara net), trawl nets (single-rigged and bottom trawl), set longline, and hook and line. These have fluctuated in importance since 1980 to 2018 (Figure 2-5).

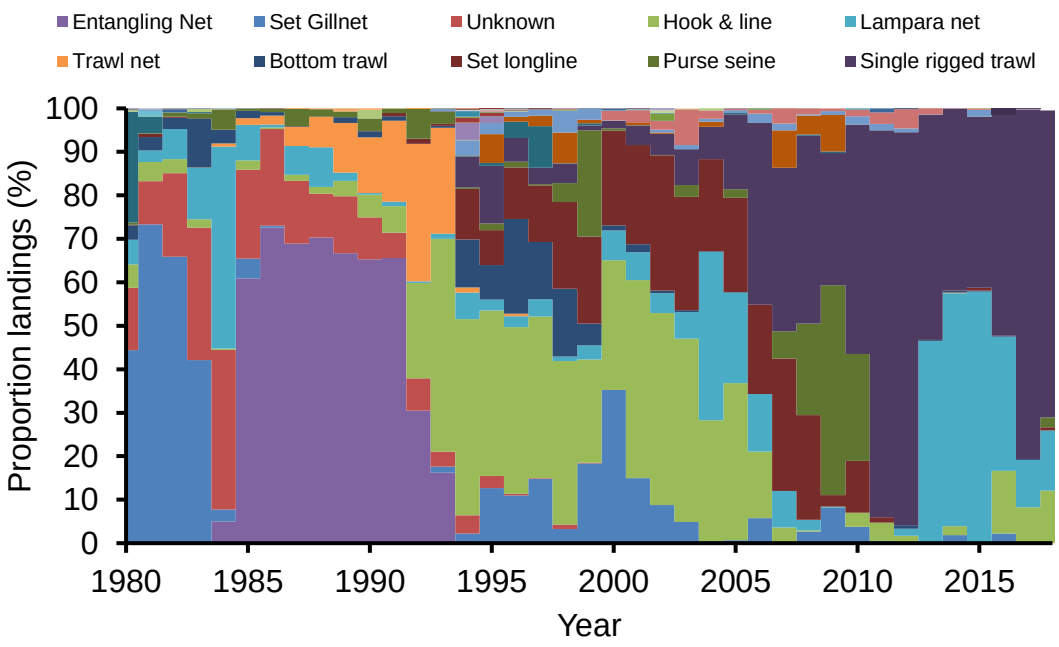

Figure 2-5. Proportion of commercial gear types (%) landing White Croaker from 1980 to 2018 (CDFW MLDS 2019).

Effort levels and gear preferences in the target fisheries in which White Croaker is caught have fluctuated over time. From 1980 to 1994 the predominant fisheries landing White Croaker were the set gillnet California Halibut fishery as well as other fisheries using entangling nets. In 1994 increased restrictions on the use of gill nets were established. Since, catch from entangling nets, like gill nets, has virtually disappeared. White Croaker were primarily caught with hook and line in the California Halibut fishery from 1993 to 2004 and from 2006 to 2016 the White Croaker catch in the Northern Anchovy fishery using lampara nets significantly increased. Trawl gear is the primary gear catching White Croaker from 2010 to 2018 with single-rigged trawl in the Ridgeback Prawn fishery landing the most pounds in 2018 (Table 2-2).

Table 2-2. Commercial landings of White Croaker by gear type in 2018 (CDFW MLDS 2019). Other gear types include set longline, troll (Albacore), small mesh set gillnet, Danish/Scottish seine, diving, and trawl (footrope less than 8 inches in diameter)

Gear Type	Landings (pounds)	Percent of total landings (%)
Single-rigged trawl (Prawn Ridgeback)	35,995	71
Lampara net (Northern Anchovy)	7,069	14
Hook-and-line (California Halibut)	6,110	12
Purse Seine (Jacksmelt)	1,158	2
Other	686	1

2.3 Landings in the Recreational and Commercial Sectors

2.3.1 Recreational

The recreational White Croaker fishery mainly occurs inshore with most of the catch made from man-made/jetty structures. The recreational catch of White Croaker has fluctuated significantly from 2005 to 2018. Catch estimates are calculated from CRFS sample data from 2005 to 2018 (Figure 2-6). The cause of this variation in catch is currently unknown, although Miller et al. (2011) noted that declines have been occurring since the 1970's and attributed this trend to environmental factors (mainly ocean warming)The historical landings of recreationally caught White Croaker started steadily decreasing after 1954 (Figure 2-7)-. The cause of this decrease is unknown but may be attributable to public awareness of the health risks and environmental reasons discussed in previous sections (Section 2.2.1).

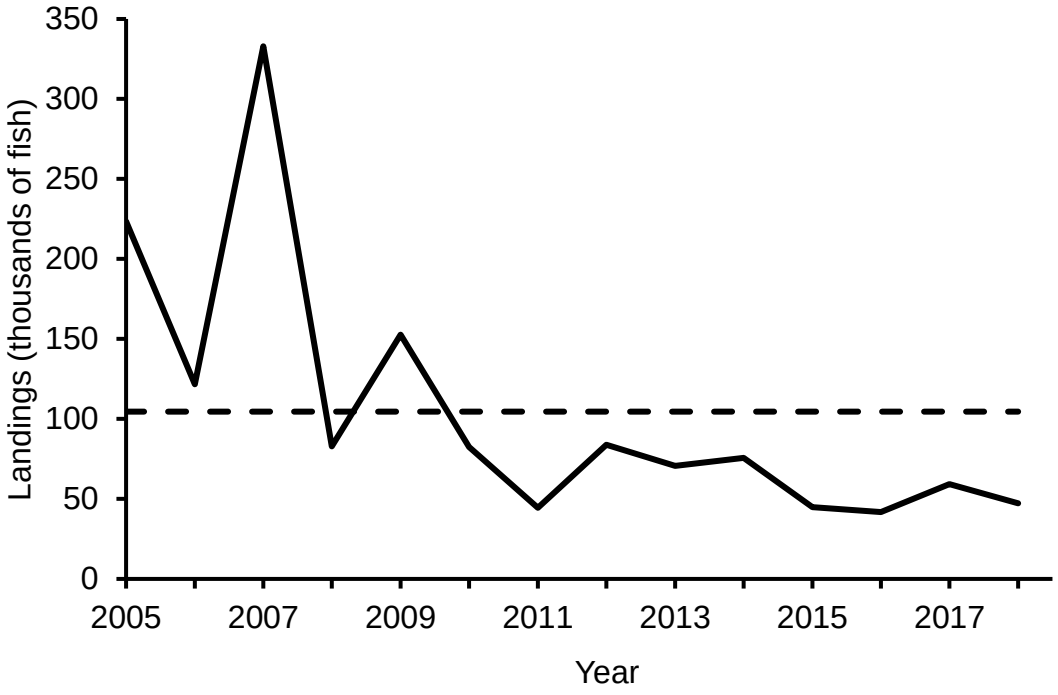

Figure 2-6. Recreational White Croaker catch from CRFS estimates for all modes from 2005 to 2018 (RecFIN 2019). Dashed line is average number of fish kept over the time series.

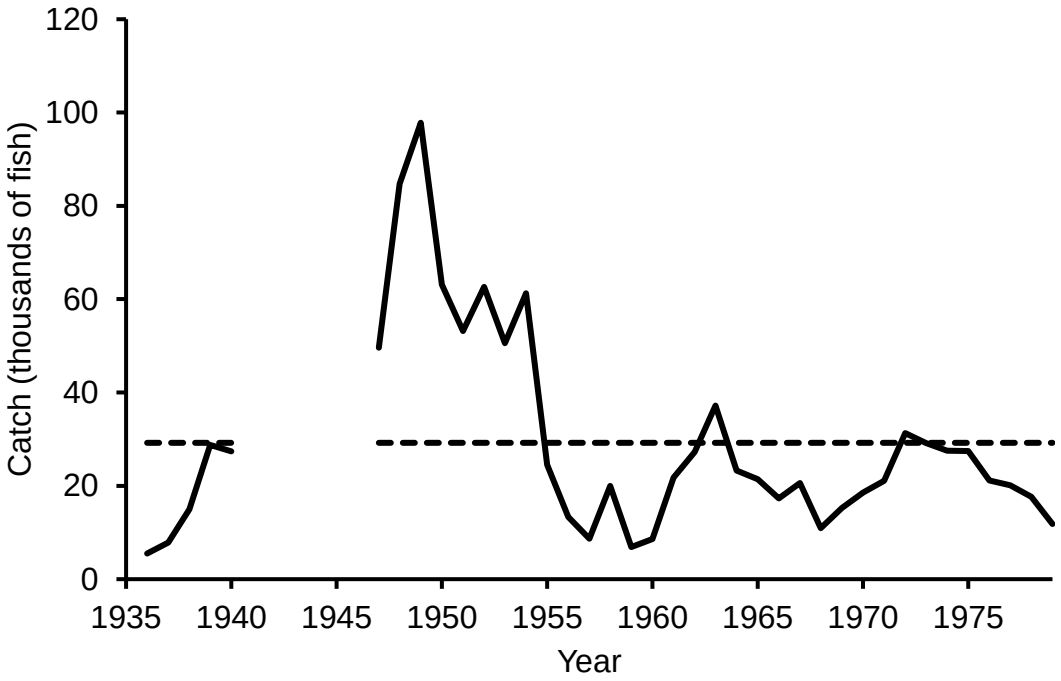

Figure 2-7. Historical recreational catch (kept fish) of White Croaker on CPFVs from logbook data, 1936 to 1979 (Hill and Schneider 1999). No data available from 1941 to 1946. Dashed line is average over the time series.

2.3.2 Commercial

The commercial landings and value of White Croaker from 1980 to 2018 were estimated from commercial landing receipts submitted to the Department by fish receivers. Landings and value of White Croaker has been steadily decreasing since 1984 and 1985 (Figure 2-8). Prior to 1980, White Croaker landings averaged 658,000 pounds annually and exceeded one million pounds in several years (Figure 2-9). Peak landings in 1952 were probably in response to the total collapse of the sardine fishery that year (Moore and Wild 2001). As with the recreational sector, the historical commercial catch of White Croaker indicate that landings of White Croaker have been on the decline and are at an all-time low for this species. The cause of the decrease is unknown but could be attributable to reduced market demand and increased discarding due to human health concerns with White Croaker consumption (see section 2.2.1). Additionally, the decrease in landings may be from an overall decrease in White Croaker availability from low reproductive output (see section 3.1.4.1).

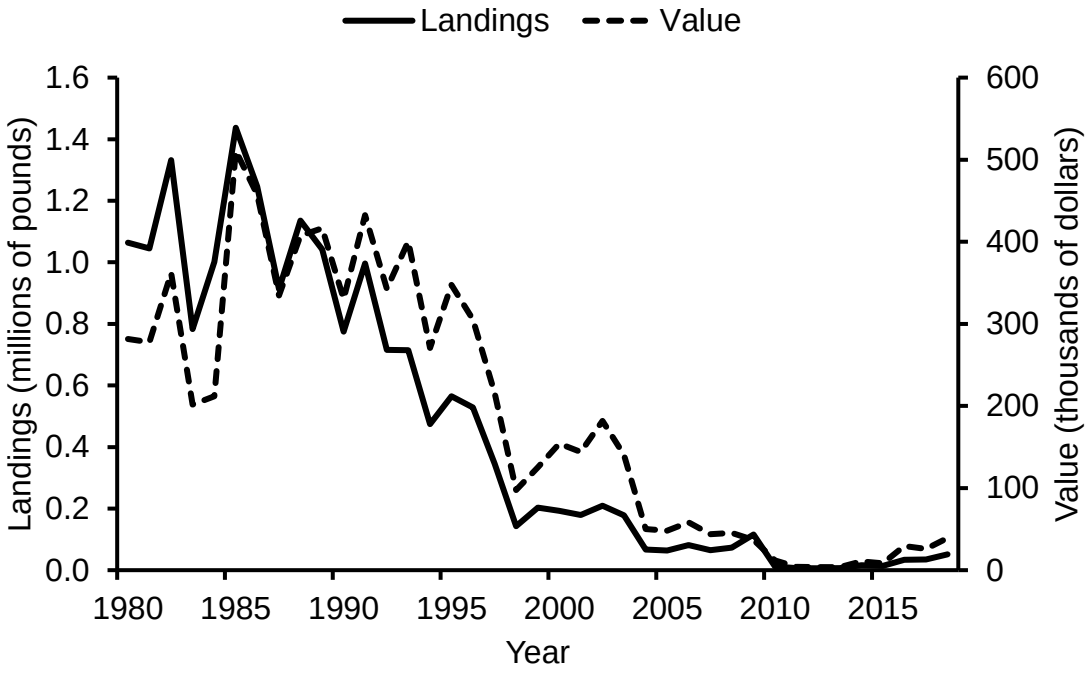

Figure 2-89. White Croaker commercial landings and value from 1980 to 2018 (CDFW MLDS 2019).

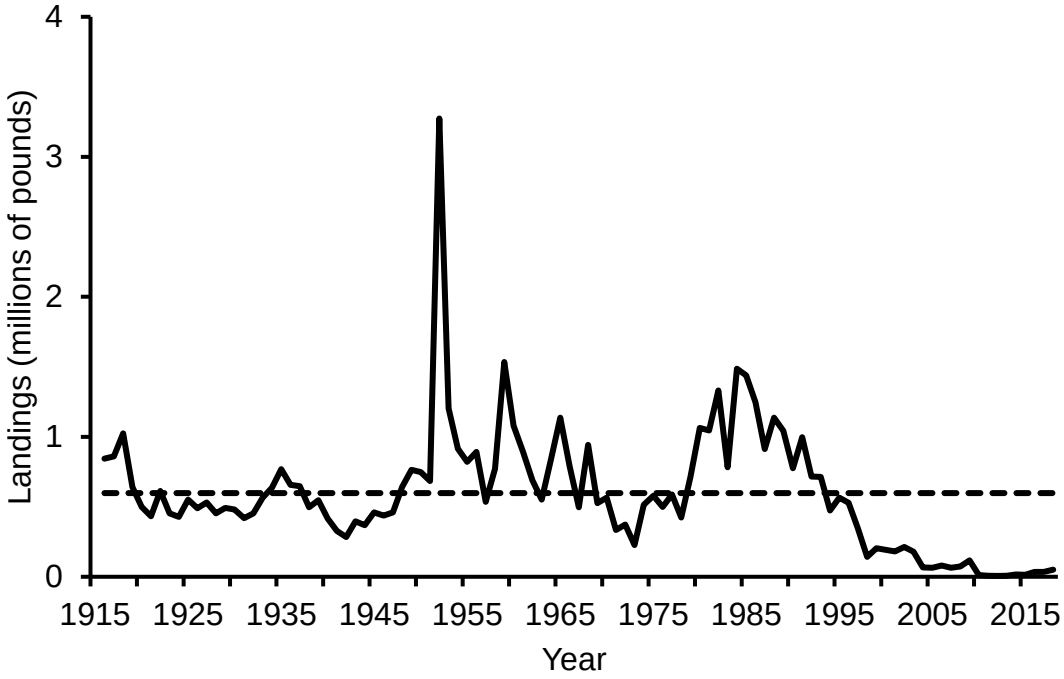

Figure 2-9. Historic and recent commercial catch of White Croaker from 1916 to 2018. Dashed line is the average over time. Years 1916 to 1979 are from Fish and Game Bulletins and 1980 to 2018 are from landing receipts (CDFW MLDS 2019).

2.4 Social and Economic Factors Related to the Fishery

Information on social and economic factors related to White Croaker are limited. White Croaker has become less desirable over the last 30 years, possibly, because of concerns about accumulated DDT and PCB within White Croaker tissue and the associated health risks, and it is believed that more fishers may be discarding caught White Croaker for this reason. White Croaker are very easy to catch from piers or jetties in sand or mud areas and are often considered a nuisance fish to anglers targeting other species.

In 2001, the Department's status report on White Croaker noted that before 1980 most commercial landings occurred in southern California and then shifted to central California with the entrance of Southeast Asians into the fishery (Moore and Wild 2001).

3 Management

3.1 Past and Current Management Measures

There are no commercial or recreational management measures in place specifically for White Croaker. However, White Croaker do fall under the general commercial and recreational regulations. Fishers engaging in commercial fishing activity must have a commercial fishing license. In the recreational sector, White Croaker fall under the general bag limit of ten fish per day of any one species §27.60, Title 14, California Code of Regulations (CCR) and §28.58, Title 14, CCR. The Department monitors effort and landings when needed, with the intention of applying additional management measures if necessary. Available data used to estimate catch includes fishery-dependent Department collected logbooks and the CRFS data.

3.1.1 Overview and Rationale for the Current Management Framework

The recreational bag limit of White Croaker was based on a general bag limit put in place for many species during that time. A ten fish bag limit was considered a satisfying number for sport take without risking stock depletion. While the recreational fishery is not actively managed, populations are monitored by the Office of Environmental Health Hazard Assessment (OEHHA) because of pollution history associated with White Croaker.

As of 2018, White Croaker does not have a management plan nor has a stock assessment been conducted.

3.1.1.1 Criteria to Identify When Fisheries Are Overfished or Subject to Overfishing, and Measures to Rebuild

There are no set criteria to determine if White Croaker are being overfished or subject to overfishing in either the commercial or recreational sector. However, the Department may monitor catch and effort data to detect unusual declines and ensure the fishery remains sustainable. Specifically, the Department will evaluate landings and effort trends in relation to environmental parameters such as water temperature. If landings decrease in warm water periods, when White Croaker abundance typically increases, and if the recreational fishery continues to consist mostly of immature fish, this may indicate the fishery needs management changes to ensure sustainability. If problems arise, the Department will work closely with stakeholders and the Commission to address them. Specifically, if a species or fishery is determined to be overfished or subject to overfishing, FGC §307 allows for a reduction in the bag limit for any species in danger of depletion.

3.1.1.2 Past and Current Stakeholder Involvement

Given the nature of the fishery (not a directed fishery) and the limited management measures in place, stakeholders have not been involved in White Croaker management to date.

3.1.2 Target Species

3.1.2.1 Limitations on Fishing for Target Species

3.1.2.1.1 Catch

As of 2018, the recreational catch of White Croaker is limited by the general bag limit of 20 fish per day and only ten of one species (CCR §27.60). This was established in 1984 to limit take while satisfying angler demands. There is no commercial catch limit for White Croaker.

3.1.2.1.2 Effort

There are no commercial or recreational effort restrictions.

3.1.2.1.3 Gear

There are no commercial or recreational gear restrictions for White Croaker.

3.1.2.1.4 Time

There are no seasonal closures for White Croaker in either commercial or recreational sectors.

3.1.2.1.5 Sex

There are no limits relating to sex for White Croaker.

3.1.2.1.6 Size

There are no size or fillet limits for recreational or commercial White Croaker.

3.1.2.1.7 Area

There are no area closures for recreational White Croaker. However, since 1990, it has been unlawful to take White Croaker in the commercial sector as described here from §104, Title 14,CCR "it is unlawful to take white croaker under a commercial fishing license issued pursuant to section 7850 of the Fish and Game Code, in waters from 0 to 3 nautical miles from shore extending oceanward between a line extending 312 degrees magnetic from Point Vicente in Los Angeles County, and a line extending 166 degrees magnetic from Point Fermin in Los Angeles County."

Marine Protected Areas

Pursuant to the mandates of the Marine Life Protection Act (FGC §2850), the Department redesigned and expanded a network of regional MPAs in state waters from 2004 to 2012. The resulting network increased total MPA coverage from 2.7% to 16.1% of state waters. Along with the MPAs created in 2002 for waters surrounding the Santa Barbara Channel Islands, California now has a statewide scientifically-based ecologically connected network of 124 MPAs. The MPAs contain a wide variety of habitats and depth ranges.

Marine Protected Areas (MPAs) created under the Marine Life Protection Act were not designed for fisheries management purposes, however, they present related opportunities and considerations including the following:

- They serve as long-term spatial closures to fishing if the species of interest is within their boundaries and is prohibited from harvest
- They can function as comparisons to fished areas for relative abundance and length or age/frequency of the targeted species
- They can serve as ecosystem indicators for species associated with the target species, either as prey, predator, or competitor
- To varying degrees, they displaced fishing effort when they were implemented

White Croaker are most commonly found nearshore and as such, a portion of the population is protected from fishing practices under the Department's current MPA network. The breakdown of protected habitat utilized by White Croaker can be found below, Table 3-1. However, White Croaker were not designated as a species that would benefit from MPAs (State of the Southern California Coast 2011 to 2015 (2017)) given their movement patterns and life history characteristics.

Table 3-1. MPA protected habitat utilized by White Croaker. Percent (%) of total habitat type protected by MPAs. From Master Plan for MPAs 2016.

Habitat Type	Life Stage Utilization	Habitat type protected by MPA (%)
Estuary	Juvenile and Adult	12.7
Sandy or gravel beach	Juvenile and Adult	16.7
Soft substrate 30 to 100 m	Adult	17.0
Soft substrate 0 to 30 m	Juvenile	10.1

3.1.2.2 Description of and Rationale for Any Restricted Access Approach

There is no restricted access approach for White Croaker.

3.1.3 Bycatch

3.1.3.1 Amount and Type of Bycatch (Including Discards)

The Fish and Game Code (FGC §90.5) defines bycatch as "fish or other marine life that are taken in a fishery but which are not the target of the fishery." Bycatch includes "discards," defined as "fish that are taken in a fishery but are not retained because they are of an undesirable species, size, sex, or quality, or because they are required by law not to be retained" (FGC §91). The term "Bycatch" may include fish that, while not the target species, and are desirable and are thus retained as incidental catch, and does not always indicate a negative impact.

Recreational

Since recreational anglers targeting White Croaker are often targeting a suite of other fishes as well, the Department classifies these fishes commonly targeted and caught in association with White Croaker as incidental catch. The Master Plan defines incidental catch as fish caught incidentally during the pursuit of the primary target species that are legal and desirable to be sold or kept for consumption. In order to assess the most commonly caught species with White Croaker, all trips from private/rental boat and man-made/jetty modes where at least one White Croaker was caught were analyzed. This eliminates offshore fishing trips that solely target pelagic species; however, it is not possible to avoid trips where effort is split between multiple habitats, and both nearshore and offshore species are landed on the same trip. The most common species caught in 2018 along with White Croaker include Northern Anchovy (*Engraulis mordax*), Brown Rockfish (*Sebastes auriculatus*), Jacksmelt (*Atherinopsis californiensis),* Pacific Mackerel *(Scomber japonicus),* Blue Rockfish *(Sebastes Mystinus),* Pacific Sanddab *(Citharichthys sordidus),* Lingcod (*Ophiodon elongatus*), Dungeness Crab (*Metacarcinus magister*), and Shiner Perch (*Cymatogaster aggregata*) (Table 3-2). Although White Croaker were caught on 100% of these trips, these other species may be primary targets or secondary targets that may, or may not, be targeting White Croaker. Note that several of these species are also associated with

White Croaker habitat (see Section 1.4.1). All species listed in Table 3-2 have state or federal management measures in place. Species with no take allowed, such as Giant Sea Bass, Yelloweye Rockfish, Cowcod, and Bronzespotted Rockfish were not caught along with any White Croaker in 2018.

Table 3-2. Number caught and percent of trips (frequency of occurrence) for the top ten most abundant species on private/rental boat and man-made/jetty trips (n=707) where at least one White Croaker was also caught in 2018 (CDFW MLS) (RecFIN 2019).

Species	Total number caught and % of total catch	Percent of trips	Number of White Croaker caught on associated trips
White Croaker	**4,332 (37%)**	**100**	**4,332**
Northern Anchovy	993 (9%)	7	230
Brown Rockfish	743 (6%)	22	1,157
Jacksmelt	690 (6%)	17	803
Pacific Mackerel	685 (5%)	10	327
Blue Rockfish	457 (4%)	12	593
Pacific Sanddab	342 (3%)	6	374
Lingcod	323 (3%)	15	747
Dungeness Crab	296 (3%)	4	303
Shiner Perch	214 (2%)	5	178
Other	2,605 (22%)	56	2,293

Given that White Croaker is caught recreationally with a suite of other targeted species there is little bycatch associated with this fish species other than discarded White Croaker. The amount of released White Croaker is moderately high ranging from 36% to 63% (Table 3-3).

Table 3-3. Estimates of White Croaker retained, released, and total caught from 2008 to 2018 sampled from man-made/jetty and private/rental modes by CRFS (RecFIN 2019).

Year	Number retained	Number released	Total	Percent released (%)
2008	73,165	66,155	139,319	47
2009	120,915	69,092	190,006	36
2010	76,148	69,745	145,893	48
2011	38,783	45,968	84,751	54
2012	76,235	56,740	132,975	43
2013	66,533	115,492	182,025	63
2014	57,252	60,950	118,202	52
2015	41,153	41,770	82,923	50
2016	35,945	21,450	57,396	37
2017	49,297	43,588	92,885	47
2018	46,294	33,196	79,491	42

Commercial

Because there is no directed commercial fishery for White Croaker any bycatch associated with their catch is considered to be the bycatch of the target fisheries. In the commercial sector, Ridgeback Prawn, California Halibut, and Petrale Sole commercial fisheries land the largest amount of White Croaker. Please refer to their respective ESRs for further bycatch information. Species with no take, such as Giant Seabass, Yelloweye Rockfish, Cowcod, and Bronzespotted Rockfish, may be caught on the same trips that also catch White Croaker, however none were recorded in 2018.

3.1.3.2 Assessment of Sustainability and Measures to Reduce Unacceptable Levels of Bycatch

As described above, the bycatch in the White Croaker fishery is primarily other common shallow reef, sandy bottom, and coastal pelagic species that are monitored and managed separately. White Croaker are primarily caught and landed from the shore, as such, there is limited to no data available for bycatch or bird and mammal interactions. No mammal interactions were recorded from CPFVs in 2015, 2016, and 2017. Before that, the average White Croaker lost to sea lions was 4 (2010 to 2014) per year. Bird interactions have not been recorded for White Croaker. However, given the fishing methodology used for White Croaker (small hooks and small pieces of dead bait) it is likely that few bird interactions occur. With so little bycatch associated with the catch of White Croaker, there are currently no concerns about the impact of bycatch on the sustainability of any other stocks.

3.1.4 Habitat

3.1.4.1 Description of Threats

White Croaker are greatly impacted by non-fishing activities in southern California. The history of pollution in southern California and its impacts has placed a large concern on White Croaker and its role in the pollution chain. White Croaker experience biomagnification (increasing concentration of toxins as it moves through the food chain) of DDT and PCBs and negatively impact the food chain of which they belong. Studies have found White Croaker from the Los Angeles area experience liver lesions and reproductive stress (low fecundity, earlier oocyte destruction and atresia, lower fertilization rates compared to reference site fish) (Cross and Hose 1988).

The recreational fishery for White Croaker is exclusively hook and line. Use of this gear type may create marine debris when fishing line is lost within the habitat. Fishing line will entangle other wildlife and cause damage and death (Dayton et al. 1995; Stevenson 2011). Commercially, White Croaker are caught with trawl, lampara nets, and hook and line (See section 2.2.2). Gear loss is a threat to habitat that may occur with many of these gear types. Lost gear may inhibit the growth of ecological engineers and habitat-forming organisms. Bottom trawl and other mobile gears are also known to have impacts on benthic habitats, particularly those with high relief. (National Research Council 2002).

3.1.4.2 Measures to Minimize Any Adverse Effects on Habitat Caused by Fishing

The primary measures to limit gear impacts have occurred in the various commercial fisheries that land White Croaker. Finfish traps are required to have the fisherman's commercial fishing license identification number attached to the buoy and each trap must be equipped with a trap destruct device (FGC §9001.7, §9003, and §9006). The Department currently does not have an in-house program to retrieve derelict gear. However, the Department is actively involved with outside agencies efforts to establish lost fishing gear recovery programs and the implementation of these programs. Two of these programs are SeaDoc Society's Lost Fishing Gear Recovery Project and Ocean Defenders Alliance that removes gear in southern California. The Department also has authority to remove nuisance traps that may be causing habitat destruction (FGC §9008).

3.2 Requirements for Person or Vessel Permits and Reasonable Fees

Recreational

Unless recreationally fishing off a public pier, all anglers 16-yr-old or older are required to purchase a fishing license to fish for White Croaker. Anglers fishing south of Point Arguello must also have an ocean enhancement validation. Captains operating their vessels as CPFVs or private charters must purchase a permit. In 2019, the cost of an annual resident sport fishing license is $49.94, and an ocean enhancement validation is $5.66. The most current license options and fees for the recreational fishery can be found in Table 3-4 and may also be accessed at https://www.wildlife.ca.gov/Licensing/Fishing.

Table 3-4. Annual sport fishing license fees from January 1 to December 31, 2019.

License	Fee	Description
Commercial Passenger Fishing Vessel License	$379.00	Required for any boat from which persons are allowed to sport fish for a fee.
Resident Sport Fishing	$49.94	Required for any resident 16 years of age or older to fish.
Recreational Non-resident Sport Fishing	$134.74	Required for any non-resident 16 years of age or older to fish.
Recreation Ocean Enhancement Validation	$5.66	Required to fish in ocean waters south of Point Arguello (Santa Barbara County). An Ocean Enhancement Validation is not required when fishing under the authority of a One or Two-Day Sport Fishing License.
Reduced-Fee Sport Fishing License – Disabled Veteran	$7.47 at CDFW offices. $7.82 from license agents	Available for any resident or non-resident honorably discharged disabled veteran with a 50 percent or greater service-connected disability. After you prequalify for your first Disabled Veteran Reduced-Fee Sport Fishing License, you can purchase disabled veteran licenses anywhere licenses are sold.

Reduced-Fee Sport Fishing License – Recovering Service Member	$7.47	Available for any recovering service member of the US military. The Recovering Service Member Reduced-Fee Sport Fishing License is only available at CDFW License Sales Offices.
Reduced-Fee Sport Fishing License – Low Income Senior	$7.47	Available for low income California residents, 65 years of age and older, who meet the specified annual income requirements. The Reduced-Fee Sport Fishing License for Low Income Seniors in only available at CDFW License Sales Offices.

Commercial

Any resident 16 years of age or older who uses or operates, or assists in using or operating, any boat, aircraft, net, trap, line, or other appliance to take fish for commercial purposes is required to have a commercial fishing license. The Department issues licenses for all commercial fishermen, fishing vessels, passenger fishing boats, and fish businesses in California. The commercial fishing season generally runs from April 1 through March 31. In 2019 to 2020, the cost of a Resident Commercial Fishing license is $145.75. If commercially fishing south of Point Arguello, a $54.08 additional fee is charged for a Commercial Ocean Enhancement Stamp. Additional permits are needed depending upon the gear type used. The most current license options and fees for commercial fishing may be accessed at https://www.wildlife.ca.gov/Licensing/Commercial/Descriptions

Table 3-5. Annual commercial fishing license fees from April 1, 2019 to March 31, 2020.

License	Fee	Description
Resident Commercial Fishing License	$145.75	Required for any resident 16 years of age or older who uses or operates or assists in using or operating any boat, aircraft, net, trap, line, or other appliance to take fish for commercial purposes, or who contributes materially to the activities on board a commercial fishing vessel.
Nonresident Commercial Fishing License	$431.00	Required for any nonresident 16 years of age or older who uses or operates or assists in using or operating any boat, aircraft, net, trap, line, or other appliance to take fish for commercial purposes, or who contributes materially to the activities on board a commercial fishing vessel.
Commercial Ocean Enhancement Stamp	$54.08	Required for commercial passenger fishing vessels operating south of Point Arguello (Santa Barbara County). Any commercial fisherman who takes, possesses aboard a commercial fishing vessel, or lands any white sea bass south of Point Arguello.
Commercial Boat Registration (Resident)	$379.00	Required to fish in ocean waters south of Point Arguello (Santa Barbara County). An Ocean Enhancement Validation is not required when fishing under the authority of a One or Two-Day Sport Fishing License.
Commercial Boat Registration (Nonresident)	$1,122.00	Required for any nonresident owner or operator for any vessel operated in public waters in connection with fishing operations for profit in this State; or which, for profit, permits persons to sport fish.

Commercial Passenger Fishing Vessel License	$379.00	Required for any boat from which persons are allowed to sport fish for a fee.

4 Monitoring and Essential Fishery Information

4.1 Description of Relevant Essential Fishery Information

The Department collects length and weight data on White Croaker through the CRFS program (for detailed information please see, CRFS Methods: https://www.wildlife.ca.gov/Conservation/Marine/CRFS). The Department also tracks catch of White Croaker through landing receipts submitted by buyers and processors. Both these data streams allow for estimates of fishing effort and catch levels. Currently, no fishery-independent data is collected on White Croaker by the Department, however, there is impingement data from five power plants from 1977 to 1988 (see section 4.2.2).

4.2 Past and Ongoing Monitoring of the Fishery

4.2.1 Fishery-dependent Data Collection

Catch and effort may be estimated for White Croaker from available Department data sets. Lengths and weights are collected in the field by the CRFS program. Also collected is the number of anglers, number of fish released dead, fishing time, target fishery and location. Sample data is collected from different modes: private/rental boats, party/charter boats, beach/bank and man-made jetty. From this data, monthly estimates of catch and effort are made.

In the commercial sector, White Croaker data are collected from landing receipts that commercial fisherman are required to submit to the Department. The data are maintained in the Department's Commercial Fisheries Information System database. Included is gear type, pounds of fish caught, value per pound, port of landing, block (area) fished, fish business owner or buyer, vessel name and identification, fish condition, and total calculated value.

4.2.2 Fishery-independent Data Collection

In northern California, the Department's Bay-Delta project collects otter trawl data within San Francisco Bay monthly since 1980. Although targeting other species, White Croaker are caught and relative abundances (fish per area towed) have been calculated for this species. The trends observed in this fishery-independent data set matches closely to the historical recreational catch displayed in Figure 2-9 (Figure 4-1).

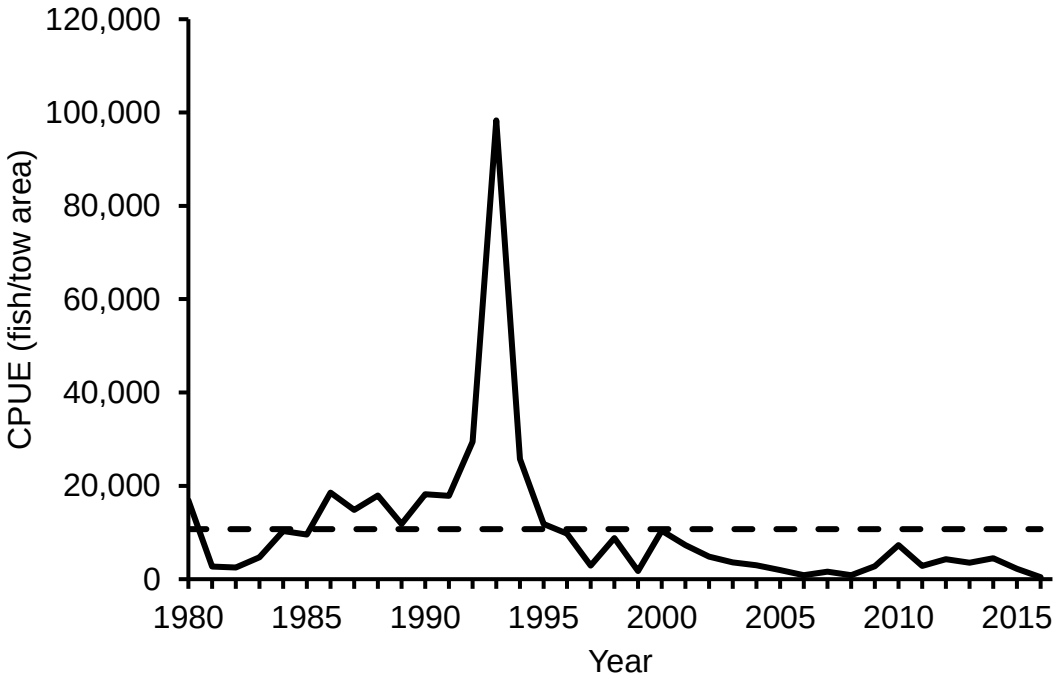

Figure 4-1. Catch-per-unit effort of White Croaker in San Francisco Bay from 1980 to 2016. Dashed line is average CPUE over the time series.

There is no actively collected fishery-independent data on White Croaker in southern California. However, impingement data are available that describes some abundance trends in southern California. Impingement data from five power-generating stations were collected from 1977 to 1998 (Figure 4-2). White Croaker were sampled in all years and showed a decreasing trend. Low numbers of White Croaker were collected in 1977 with a large increase occurring in 1978 until 1980 when captures decreased to low numbers for the remaining study period. The collected impingement data is similar to the trends in both the recreational and commercial sectors of White Croaker, figures 1-3 and 1-4.

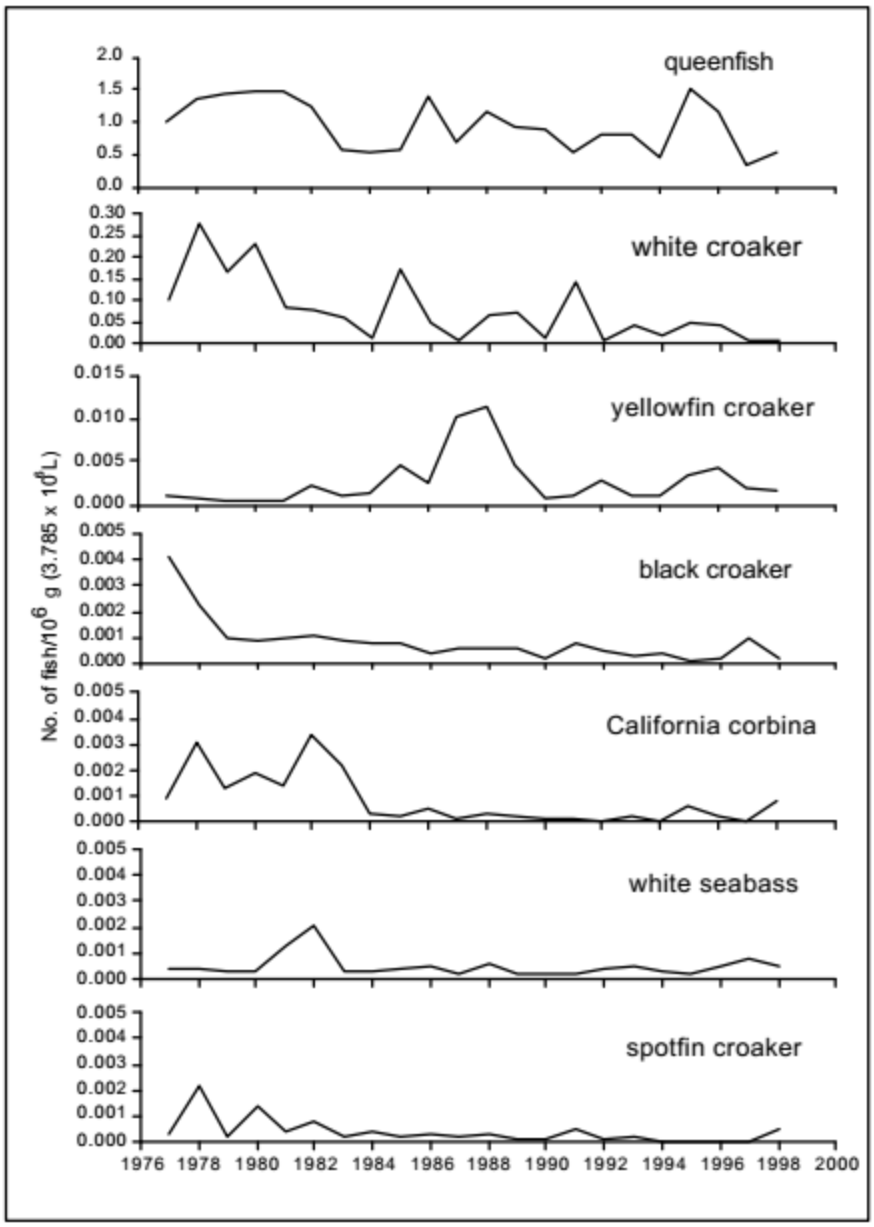

Figure 4-2. Annual mean abundance from Southern California power generating station impingement data of croaker species (family Sciaenidae), including White Croaker, from 1977 to 1998 (Reproduced from Herbinson et al. 2001).

5 Future Management Needs and Directions

5.1 Identification of Information Gaps

Because White Croaker is an incidentally caught species both commercially and recreationally, and is undesirable due to pollutant concerns, the Department is not actively managing this stock at this time. However, the EFI needs of White Croaker are summarized below in Table 5-1, which may be necessary should the Department determine that more active management is required.

Table 5-1. Informational needs for commercial and recreational White Croaker and their priority for management.

Type of information	Priority for management	How EFI would support future management
Catch (total mortality and effort)	High	Catch data will be used to estimate fishery-dependent total mortality and effort from fish being removed from the fishery via catch.
Total mortality estimations (from fishing and natural)	Medium	Total mortality is used to appropriately calculate maximum sustainable yield. The goal is to ensure that mortality is below a level that will allow the population to persist.
Recruitment	Medium	Recruitment information allows a more accurate prediction of the number of adults in the population from year to year. Accurate estimates will enhance knowledge of current and future stock status of White Croaker.
Abundance (Near-shore)	Medium	Statistically-designed, fishery-independent survey that samples fish at many locations throughout the stock's range.
Ecological	Low	Continued monitoring of White Croaker pollutants (DDT and PCBs) and its effects on the ecosystem.

5.2 Research and Monitoring

5.2.1 Potential Strategies to Fill Information Gaps

To fill in the information gaps of White Croaker, fishery-independent surveys should be conducted to assess abundances across their range. Recruitment may be assessed by surveying juvenile or larval White Croaker via minnow traps for juvenile abundances and plankton tows to capture larval abundances. A more substantial nearshore survey of White Croaker catch in the habitat they are most often found (in bays and muddy soil) would improve the Department's overall understanding of White Croaker abundance. Although the Department does not directly monitor White Croaker pollutants, outside agencies may be supported in their efforts.

5.2.2 Opportunities for Collaborative Fisheries Research

The Department has collaborated in the past and will continue to work with outside entities such as academic organizations, non-governmental organizations, citizen scientists, and both commercial and recreational fishery participants to help fill information gaps related to the management of state fisheries. The Department will also reach out to outside persons and agencies when appropriate while conducting or seeking new fisheries research required for the management of each fishery. White Croaker is intermittently evaluated for pollutants by other state agencies outside of the Department.

5.3 Opportunities for Future Management Changes

This section is intended to provide information on changes to the management of the fishery that may be appropriate, but does not represent a formal commitment by the Department to address those recommendations. ESRs are one of several tools designed to assist the Department in prioritizing efforts and the need for management changes in each fishery will be assessed in light of the current management system, risk posed to the stock and ecosystem, needs of other fisheries, existing and emerging priorities, as well as the availability of capacity and resources.

Given the limited scale of the fishery, the Department is not currently recommending or considering any changes to management. The impacts of pollutants on the fishery and the health of the fishery should be continually evaluated by other agencies and information should be shared and considered for possible future management action.

5.4 Climate Readiness

When monitoring and addressing the potential impacts of climate change, the Department has adopted an adaptive management strategy (FGC §13.5) and may employ several adaptive strategies to manage the White Croaker catch if needed. The creation and purpose of this ESR document is to adaptively manage White Croaker. This document is to be continually updated as scientific information is acquired. Additionally, the Department may also monitor catch data from RecFIN and MLDS to stay current and signal any possible changes in the population that would prompt management action. For example, a change in the spatial distribution of landings over time might indicate that White Croaker are experiencing a range shift to maintain their preferred temperature ranges. The Fish and Game Commission has regulatory power to modify current regulations when necessary (FGC § 205).

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