Fishery-at-a-Glance: Ocean Whitefish

Scientific Name: *Caulolatilus princeps*.

Range: Ocean Whitefish range from British Columbia to Peru.

Habitat: Ocean Whitefish are found in deep sandy bottom habitats during the day, but move to shallow rocky reef or kelp bed habitat at night.

Size (length and weight): The maximum length and weight of Ocean Whitefish is 102.0 centimeters (40.2 inches) total length and 6.3 kilograms (13.8 pounds).

Life span: Ocean Whitefish have a maximum lifespan of 13 years.

Reproduction: In California, Ocean Whitefish spawn from March to July, and may spawn multiple times during a season. Females mature at 3 to 4 years while males mature at 4 to 5 years of age. Based on estimated average total length at age, females will mature at 389 to 470 millimeters (15 to 19 inches) and males at 447 to 487 millimeters (18 to 19 inches).

Prey: Ocean Whitefish feed on a variety of benthic prey items including crustaceans (shrimp, crabs, and krill), small octopus, squid and small fish.

Predators: Giant Sea Bass and other large predatory fish, as well as sharks and rays often prey on Ocean Whitefish.

Fishery: Ocean Whitefish are not often targeted, but are mostly caught incidentally in the commercial and recreational sectors of fisheries targeting California Sheephead, rockfishes, and White Seabass among others.

Area fished: Ocean Whitefish are most often fished in the open ocean and around islands in both the commercial and recreational sectors. They are rarely caught north of Point Conception, and the bulk of the fishery is centered off Mexico.

Fishing season: The Ocean Whitefish fishing season is open from March 1 to December 31 (Southern Management Area) and from April 1 to December 31 (Central Management Area) for boat-based anglers. In the Cowcod Conservation Areas, Ocean Whitefish fishing is open from March 1 to December 31 for boat-based anglers. Ocean Whitefish is open year-round for divers and shore-based anglers.

Fishing gear: Recreationally, hook and line is the primary gear for Ocean Whitefish. There are no gear restrictions for commercially caught Ocean Whitefish, however, the primary gear types include hook and line, set longline, fish trap, and set gill net.

Market(s): Ocean Whitefish is sold in the fresh fish market in southern California and Mexico.

Current stock status: There is currently no information on the status of Ocean Whitefish populations.

Management: Ocean Whitefish is state-managed, but is often encountered by fishermen targeting federally managed groundfish. Thus, the Ocean Whitefish fishery is managed in concert with the federally managed groundfish group. Ocean Whitefish has similar depth and seasonal regulations to the Rockfishes, Cabezon, and Greenlings Complex. Based on the limited information currently available, the Department is not currently considering any changes in management for Ocean Whitefish.

1 The Species

1.1 Natural History

1.1.1 Species Description

Ocean Whitefish (*Caulolatilus princeps*), also called Blanquillo and Pez Blanco in Mexico and South America, are a tilefish in the family Malacanthidae. Tilefish are characterized by their elongate body with a long continuous dorsal fin. While other tilefish construct burrows that they reinforce with shell and coral, Ocean Whitefish are one of the species within this family that do not exhibit burrowing behavior, but live in loose aggregations. They are brown-yellow above and white below along the belly. Their fins are yellowish in color, with a blue streak in the pectoral and anal fins that fades after death. They have a continuous dorsal fin along the length from behind the head region to the tail, and a long anal fin from the vent to the tail (Figure 1-1).

Figure 1-1. Ocean Whitefish (Photo Credit: Edgar Roberts, CDFW).

1.1.2 Range, Distribution, and Movement

Ocean Whitefish have a large range along the eastern Pacific Ocean. They are found from Vancouver Island, British Columbia to Peru, including the Gulf of California (Figure 1-2), but are rare north of Monterey (Miller and Lea 1972). They are also found at the Channel Islands in California and the Galapagos Islands in Ecuador.

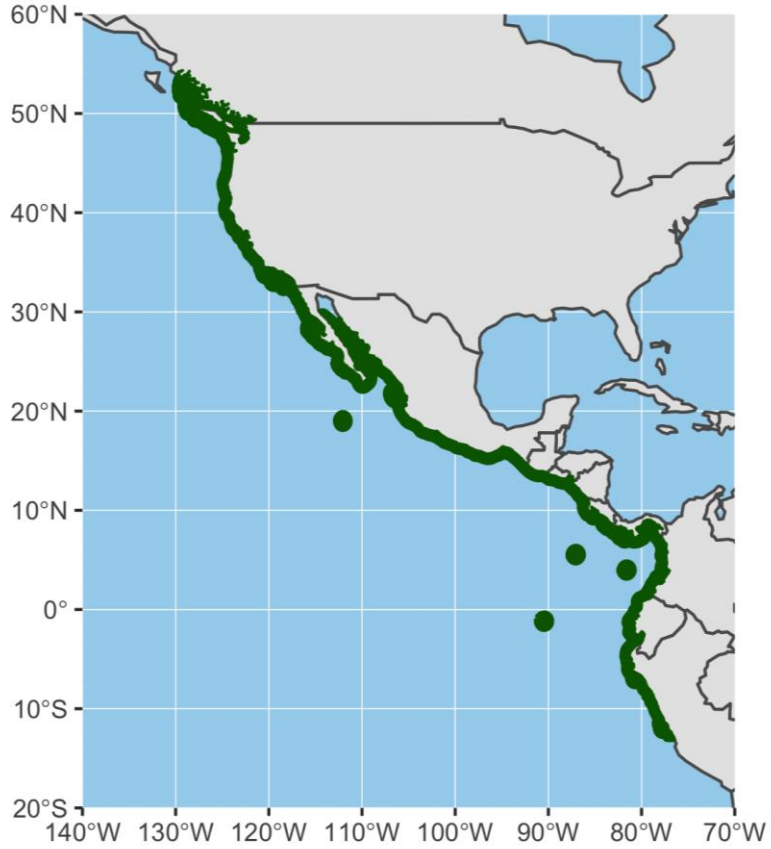


Figure 1-2. Spatial range of Ocean Whitefish.

Ocean Whitefish are found in sandy habitats and rocky reefs from the surface to depths of 300 feet (ft) (91 meters (m)) and are most common at the offshore islands (Miller and Lea 1972; Eschmeyer and Herald 1983). They are most active during the day when they are found in deep sandy bottom areas. At night they move into shallow rocky reefs or kelp beds (Bellquist et al. 2008).

Juvenile Ocean Whitefish are thought to migrate from Mexico and South America into California waters because no larval Ocean Whitefish have been captured in southern California (Love 2011). However, there is no direct information indicating adult migration into California waters.

1.1.3 Reproduction, Fecundity, and Spawning Season

Little is known about the reproduction of California Ocean Whitefish populations; however, a few studies have been conducted on spawning seasonality. In California, Ocean Whitefish were found to spawn from March to July based on their Gonadosomatic Index (GSI), which is the ratio of gonad weight to total body weight (Cooksey 1980). Cooksey (1980) also found an increase of gravid/spawning fish from May through October based on the external appearance of gonads. This contrasts with earlier observations from Fitch and Lavenberg (1971) that noted Ocean Whitefish from California, Mexico, and Ecuador spawn from October to April.

The most recent reproductive study on Ocean Whitefish occurred on samples collected from 1986 to1987 from Baja California Sur, Mexico (Elorduy-Garay and Ramirez-Luna 1994). This study found that fish spawned from October to April, echoing the findings of Fitch and Lavenberg (1971). This study also found evidence for multiple spawning events within this period. Spent ovaries with atretic oocytes or ovarian follicles (eggs of varying stages) that had begun to break down and be resorbed were found from January to April, implying that the reproductive season halts during these months. GSI was calculated across all months and it was found to increase during the months of June and July. No information is available on Ocean Whitefish fecundity.

1.1.4 Natural Mortality

Determining the natural mortality (M) of fish is important for understanding the health and productivity of their stocks. Natural mortality of a fish 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.

Natural mortality, which is defined as mortality from all non-fishing sources, has not been evaluated for Ocean Whitefish. However, mortality is known for a similar fish of the same genus – the Pacific Golden-Eyed Tilefish (*Caulolatilus affinis)*. Pacific Golden-Eyed Tilefish overlap with Ocean Whitefish in southern California and range from Point Loma, California to Peru (Kells et al. 2016). Natural mortality for Pacific Golden Eye Tilefish was calculated as 0.2142, 0.1316 and 0.1697 for males, females, and combined sexes, respectively (Elorduy-Garay and Ruiz-Cordova 1998). A value of 0.1697 for combined sexes equates to about 15.5% of the population dies from natural causes each year.

1.1.5 Individual Growth

Individual growth of marine species 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, 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. The von Bertalanffy growth function is:

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

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. Because Ocean Whitefish males were found to be slightly larger and grew slightly faster than females, separate sex-specific growth models were fit to the available data. Female growth parameters were estimated as L_{inf} = 772.92, k = 0.231, t_0 = -0.016 and males as L_{inf} = 784.56, k = 0.234, t_0 = 0.069 (Cooksey 1980). Since these growth parameters were not significantly different, male and female data were pooled to create a single growth model for Ocean Whitefish. Pooled parameters were calculated

as: L_{inf} = 778.74, k = 0.233, t_0 = 0.0267 (Cooksey 1980). The largest Ocean Whitefish encountered in this study was a 700 millimeters (mm) (28 in) male, with the largest female at 680 mm (27 in). The length-weight relationship, $W=aL^b$, was also calculated by Cooksey (1980) from 239 individuals where *W* is the weight in grams, *L* is the total length in millimeters, *a* is a constant indicating the intercept and *b* is a constant indicating the slope of the regression line. These parameters were estimated as: *a* = 3.04 X 10^{-6} and *b* = 3.22. Ocean Whitefish reach a maximum length and weight of 102.0 centimeters (cm) (40.2 inches (in)) total length and 6.3 kilograms (kg) (13.8 pounds (lb)) (Lavenberg and Fitch 1971; Eschmeyer and Herald 1983).

1.1.6 Size and Age at Maturity

Females mature at 3 to 4 years (yr) compared to male maturation at 4 to 5 yr of age. During the spawning season, males will mature earlier than females. Based on estimated average total length at age, females will mature at 389 to 470 mm (15 to 19 in) and males at 447 to 487 mm (18 to 19 in) (Cooksey 1980).

1.2 Population Status and Dynamics

Currently, status of the stock and how it has changed over time is unknown; there has not been a stock assessment for Ocean Whitefish. Since Ocean Whitefish are rare north of Monterey, southern California is considered to be at the northern edge of their range where they commonly occur. It has been speculated that the southern California population of Ocean Whitefish may be driven by strong recruitment events that are dependent upon marginal or cyclical environmental conditions (Ally et al. 1991). Based on distribution of larvae, the southern California Ocean Whitefish population appears to be recruited from Central and Southern Baja California; no larvae have been found in southern California waters (Moser et al. 1986). It is unknown if Ocean Whitefish spawn in California waters.

1.2.1 Abundance Estimates

There are no estimates of Ocean Whitefish abundance. However, they appear to be much more common in Baja California, Mexico and southward. In fact, out of 16 species and a group of rockfishes surveyed in the artisanal fishery in Northern Baja California, Ocean Whitefish were the second most important target species based on frequency of occurrence and numbers caught (Rosales-Casian and Gonzalez-Camacho 2003). In addition, Ocean Whitefish were the most abundant species available in the seafood market in Ensenada, Mexico (Hernandez-Hernandez 2000).

For southern California, estimates of Catch Per Unit Effort (CPUE) using commercial and recreational data can be used to infer changes in abundance. Because CPUE is fishery-dependent rather than fishery-independent, these estimates should be considered relative rather than absolute. Trends in Ocean Whitefish CPUE differ between the commercial and recreational sectors. The peaks in CPUE for both commercial and recreational fisheries followed strong El Niño Southern Oscillation (ENSO or El Niño) events in 1982-1983, 1987-1988, and 1991-1992. Recreational CPUE for Ocean Whitefish increased sharply again following the 1997-1998 and 2015 -

2016 El Niños; however, the commercial fishery CPUE did not respond similarly (Figure 1-3). It is not known why commercial CPUE remained low for Ocean Whitefish during these periods, but it may be due to other factors such as targeting more desirable species.

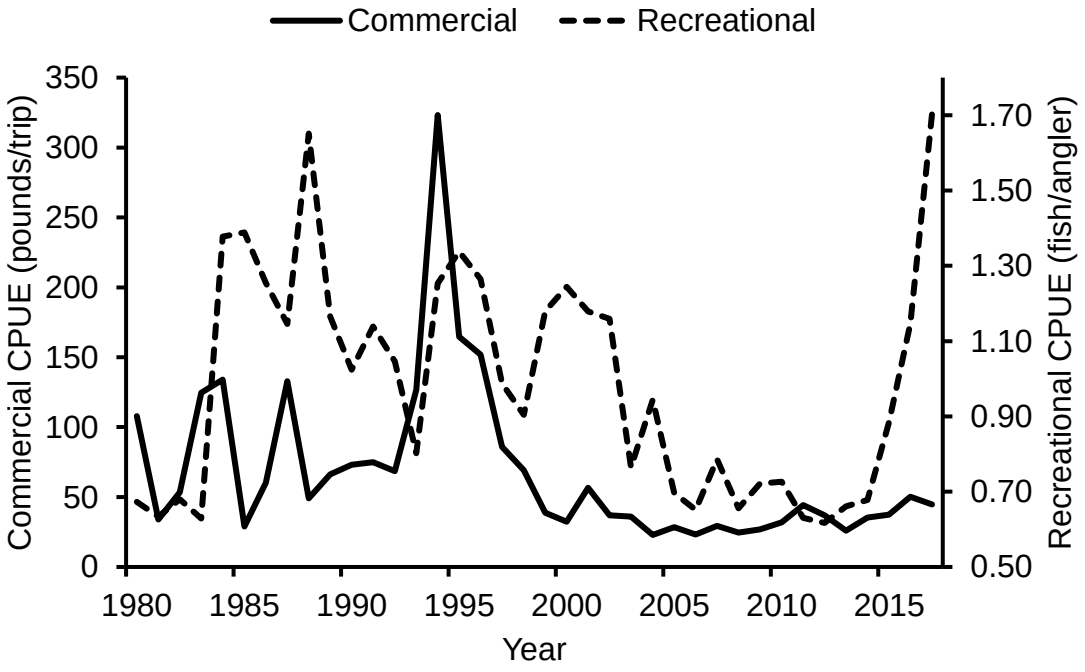
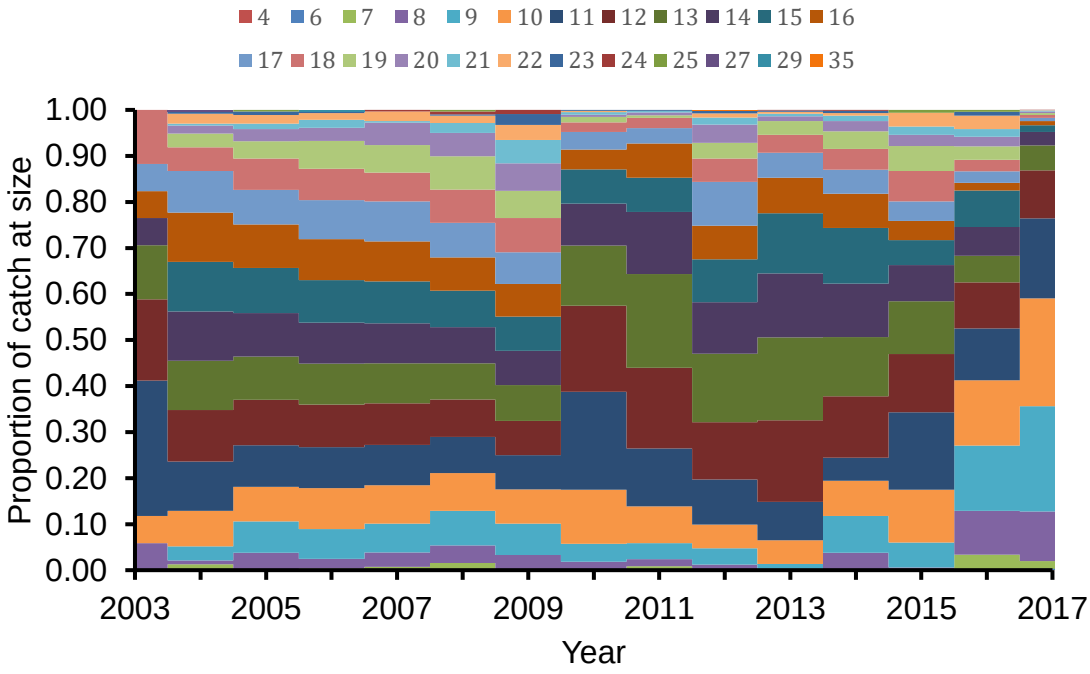


Figure 1-3. CPUE of Ocean Whitefish in the recreational and commercial sectors. Recreational data are collected from CPFV logbooks (CDFW Marine Landings Database System (MLDS)). Commercial data are from commercial landing receipts (CDFW MLDS).

1.2.2 Age Structure of the Population

Ocean Whitefish are thought to have a maximum life span of 13 yr (Eschmeyer and Herald 1971; Fitch and Lavenberg 1983; Love 2011). There is no direct information on the age structure of Ocean Whitefish in California. However, length structure can also alert managers to changes in the population. The length structure of Ocean Whitefish was estimated from fish sample data collected by the California Recreational Fisheries Survey (CRFS) project. The length structure of Ocean Whitefish has been consistent over much of the sample period (Figure 1-4). From 2004 to 2009 there was very little change in structure and an even distribution of fish sizes was observed. In 2010, more smaller fish from 11 to 12 in (28 to 30 cm) were caught, which was similar to 2003. This trend continued for several years until 2015 to 2017 when the catch was dominated by fish between 8 and 12 in (20 and 30 cm). The cause of this trend is unknown, although it seems likely that warmer water in southern California in 2015 to 2017 resulted in more of these smaller juveniles moving up from Mexico.

Figure 1-4. Total lengths of harvested Ocean Whitefish over time from 2003 to 2017. Data are from all modes sampled by CRFS. Color blocks represent sizes in inches. Missing sizes indicate that no fish were sampled at that size (Recreational Fisheries Information Network (RecFIN)).



1.3 Habitat

As with most fish, habitat usage of Ocean Whitefish varies depending on life stage. Juveniles are found in low reef habitats and sandy bottoms (Love 2011). However, adults split their time between day and night habitats at depths of 18 to 68 m (60 to 223 ft); during the day they are commonly found in deep sand habitats and during the night in shallow high-relief structure or kelp beds (Bellquist et al. 2008). Unlike many other tilefish, Ocean Whitefish do not create burrows and so have little impact on their physical ecosystem (Dooley 1978).

1.4 Ecosystem Role

The specific role Ocean Whitefish play in the ecosystems of California nearshore and offshore waters is unknown. However, we can deduct from their prey items that Ocean Whitefish are at a mid-trophic level (consumers), with most of their diet comprised of benthic invertebrates (Elorduy-Garay and Caraveo-Patino 1994).

1.4.1 Associated Species

Ocean Whitefish are commonly associated with other groundfish such as rockfish species (*Sebastes* spp.), Cabezon (*Scorpaenichthys marmoratus*), greenling species (*Hexagrammos* spp.), California Sheephead (*Semicossyphus pulcher*) and pelagic

species such as Yellowtail Jack (*Seriola lalandi*), tuna species (*Thunnus* spp.), and White Seabass (*Atractoscion nobilis*).

1.4.2 Predator-prey Interactions

The diurnal lifestyle of Ocean Whitefish makes them active foragers during the day with little feeding occurring at night. Ocean Whitefish will feed on a large variety of benthic prey items including crustaceans (shrimp, crabs, and krill), small octopus, squid and small fish. Giant Sea Bass (*Stereolepis gigas*) and other large predatory fish, including sharks and rays commonly prey on Ocean Whitefish (Fitch and Lavenberg 1971; Elorduy-Garay and Caraveo-Patino 1994).

1.5 Effects of Changing Oceanic Conditions

As ocean temperatures continue to experience warming trends, many finfish species off the West coast of the United States may shift their spatial range towards preferred thermal habitats (Morley et al. 2018). For Ocean Whitefish, this could mean the reproductive center moving north into California waters, which may affect management of the species. Jarvis et al. (2004) found a negative response in Ocean Whitefish catch with the Pacific Decadal Oscillation (PDO) of the 1980s and 1990s, decreasing as sea surface temperatures increased. However, they reasoned that fishing pressure may be the driving force on these small populations rather than environmental conditions. The effects of changing environmental factors on Ocean Whitefish life history, such as reproduction, feeding, and growth, is largely unknown making predictions associated with changing oceanic conditions difficult.

2 The Fishery

2.1 Location of the Fishery

Because of their depth range, Ocean Whitefish are primarily caught recreationally from sea rather than from shore. RecFIN sample data from 2004 to 2017 indicate Ocean Whitefish are most often caught at sea by two modes: Commercial Passenger Fishing Vessels (CPFVs) (72% to 94%) and private/rental boats (6% to 28%). Two other modes sampled by CRFS, beach/bank and man-made/jetty, had less than 1% Ocean Whitefish sampled in any one year for either mode. Although Ocean Whitefish can be caught throughout state waters, they are predominantly caught in southern California, especially around the Channel Islands (Figure 2-1).

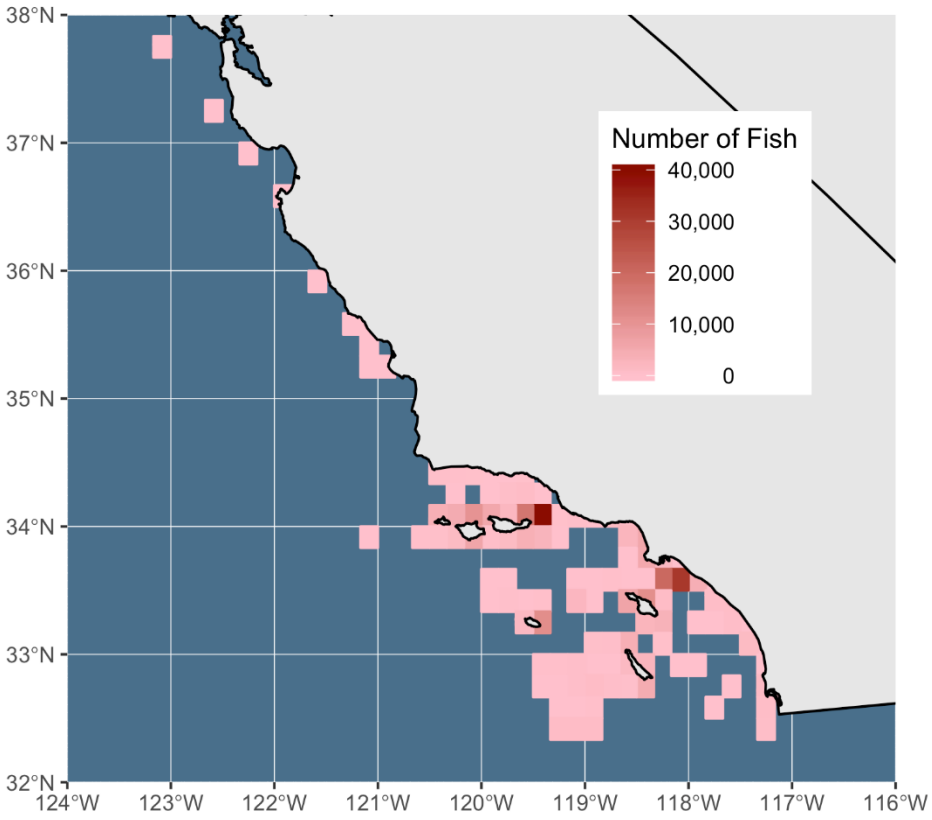


Figure 2-1. Numbers of Ocean Whitefish caught on CPFVs by block in 2017 (CDFW MLS 2018)

Ocean Whitefish are not often targeted by commercial fishing activities; they are mostly caught incidentally in other fisheries. Like recreational Ocean Whitefish take, most commercial landings occur in southern California (Figure 2-2). Historically, Ocean Whitefish otoliths (ear bones) have been found in kitchen middens at San Clemente

Island indicating this species was an important food source for Native Americans (CDFG 2004).

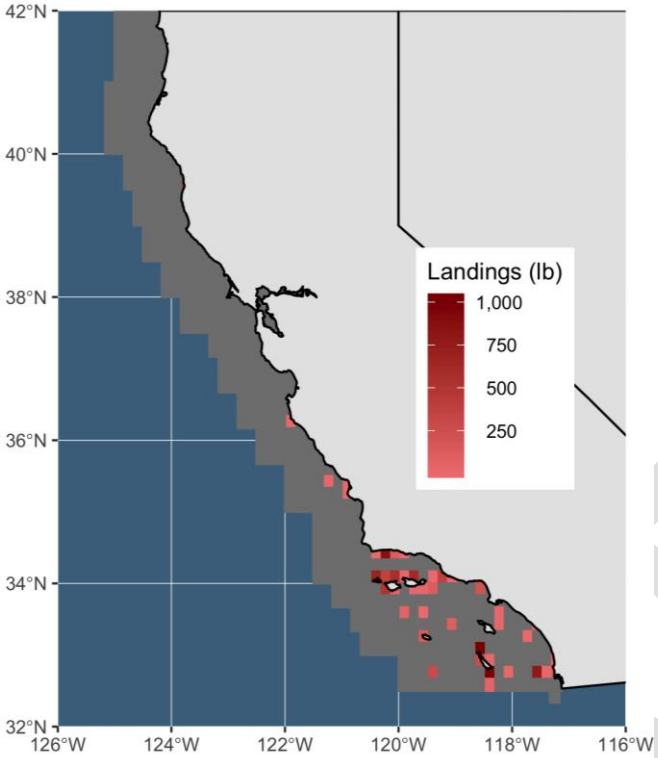


Figure 2-2. Numbers of Ocean Whitefish landed commercially by block in 2017 (CDFW MLDS 2018).

2.2 Fishing Effort

2.2.1 Number of Vessels and Participants Over Time

Participation in the recreational Ocean Whitefish fishery is estimated from the number of anglers on CPFV boats (party and charter trips), as this is the most prevalent mode catching Ocean Whitefish (section 2.1). Boat captains of CPFV vessels are required to report effort (number of anglers) and landings (number of fish) for all trips. Participation, defined as the number of anglers on CPFV trips when one or more Ocean Whitefish were landed on that trip, slowly increased from 1980 until 2004. Participation then decreased until 2015. In 2016 and 2017, however, both participation and landings of Ocean Whitefish dramatically increased (Figure 2-3).

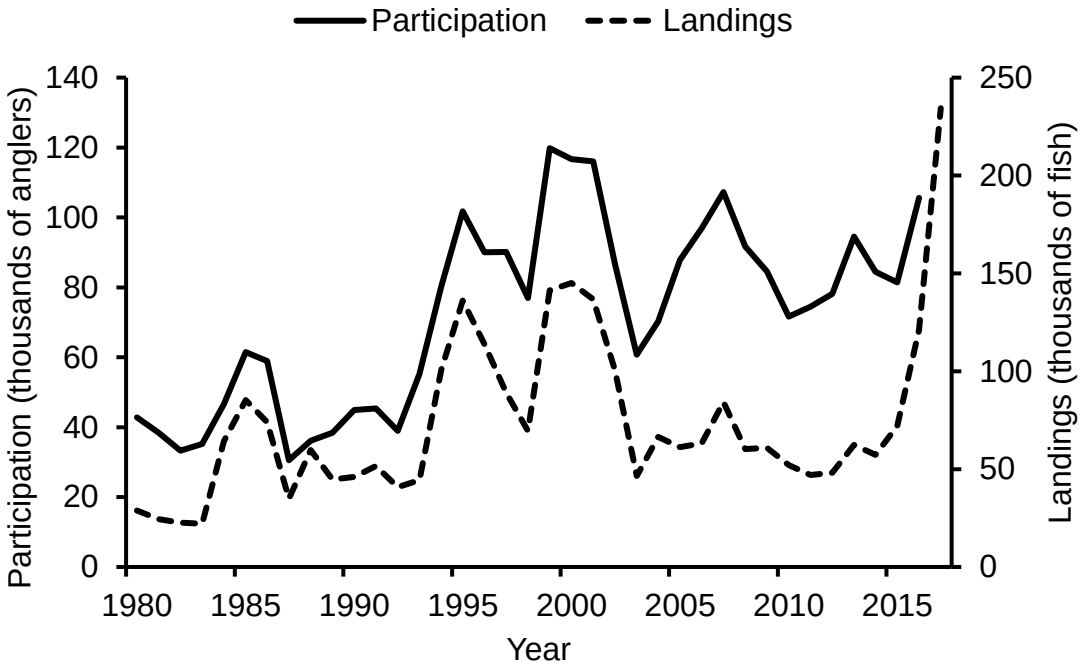


Figure 2-3. Recreational fishing effort for Ocean Whitefish. Number of anglers and landings (number of fish) from 1980 to 2017 (CDFW MLS 2018).

Because there is no directed commercial fishery, the number of trips in other fisheries (using all gear types) that have caught at least one Ocean Whitefish were used to estimate commercial effort for Ocean Whitefish. This does not include trips where no Ocean Whitefish were landed. Hence, this is an imprecise estimate of participation and the number of participants may be higher than reported. Landings information is obtained from landing receipts submitted to the Department by fish dealers (Figure 2-4). Both landings and participation of Ocean Whitefish increased slowly from 1980 to 1993 and then sharply increased in 1994. Landings peaked in 1994 and effort peaked a few years later in 1998. After these peaks, both landings and effort generally declined until 2014 when they both increased again through 2017 (Figure 2-4).

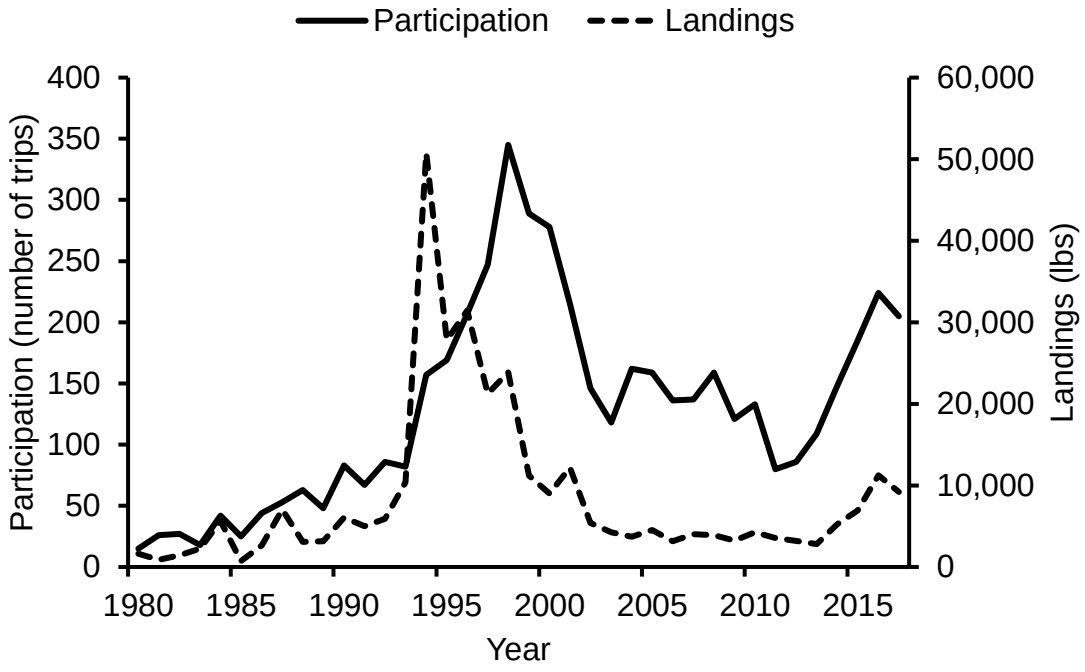


Figure 2-4. Commercial fishing effort for Ocean Whitefish. Number of trips and landings (lb) from 1980 to 2017 (CDFW MLDS 2018).

2.2.2 Type, Amount, and Selectivity of Gear

Ocean Whitefish may be caught with any gear type. The primary gear types (top four by pounds landed) used from 1980 to 2017 for commercial catch of Ocean Whitefish included hook and line, set longline, fish trap, and set gill net (Table 2-1). The recreational fishery exclusively catches Ocean Whitefish with hook and line.

Table 2-1. Commercial landings of Ocean Whitefish by gear type from 1980 to 2017. Other gear types include unspecified and various entangling nets, trawls, and traps (CDFW MLDS 2018).

Gear type	**Landings (lb)**	**Percent landings by gear**
Hook and Line	127,283	40
Set Longline	80,669	25
Fish Trap	68,005	21
Set Gill Net	12,203	4
Other	31,925	10
Total	320,085	100

2.3 Landings in the Recreational and Commercial Sectors

2.3.1 Recreational

Catch data for the recreational fishery are provided by three sources: (1) CPFV logbooks within the Department's MLS database (1936 to 1979), 2) Marine Recreational Fisheries Statistics Survey (MRFSS) estimates produced by the Pacific States Marine Fisheries Commission (1980 to 2003) and (3) CRFS estimates (2004 to 2017). The latter two data sources collect data from all fishing modes and are available from the RecFIN website. The sampling protocols are different between these sources and the data are not directly comparable. However, these data may be used to look at relative trends and patterns within a fishery over multiple years. For further information on these datasets see section 4.2.1.

Ocean Whitefish were caught off CPFVs as early as 1936. The numbers of fish caught were relatively low until the 1970s when peaks of over 40,000 fish occurred in 1970 and 1973, and over 60,000 fish in 1977 (Figure 2-5). These increases in Ocean Whitefish catch are probably due to their increased availability during these warmer water periods in southern California as a result of several weak to strong El Niños in 1968 to 1969,1972 to 1973, 1976 to 1977, and 1977 to 1978.

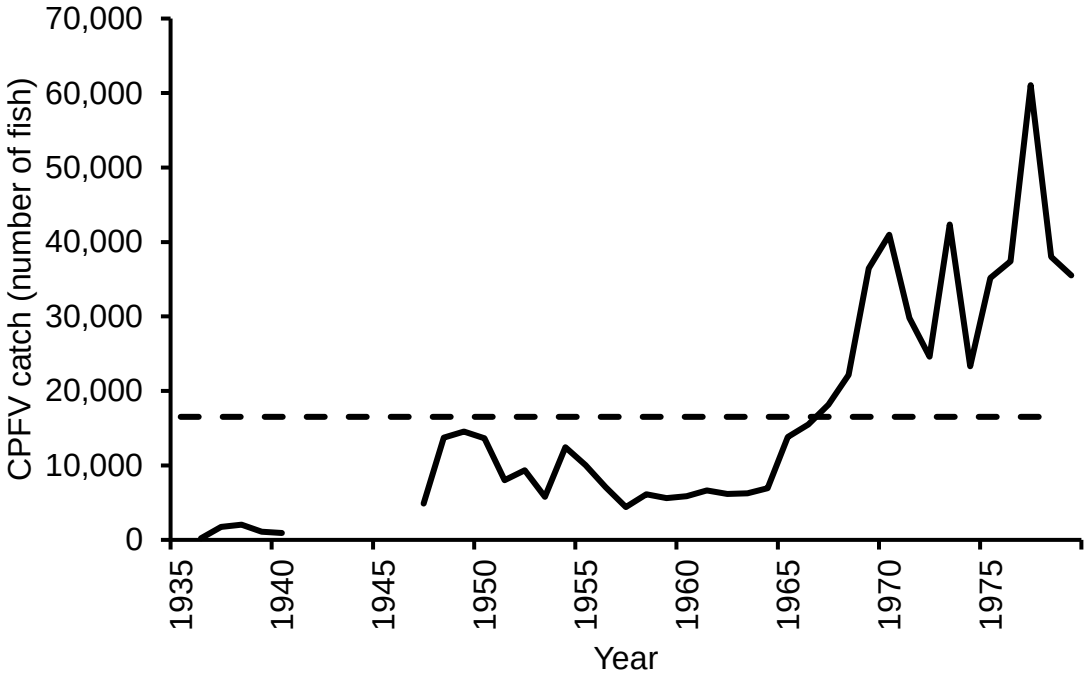


Figure 2-5. Historical recreational catch (kept fish) of Ocean Whitefish off CPFVs from 1935 to 1979. Dashed line is the average over the time series. No data were collected from 1941 to 1946 (CDFW MLS 2018).

During MRFSS data collection from 1980 to 2003, estimated landings of Ocean Whitefish averaged over 130,000 fish per year with several peaks occurring in the mid-1980s, mid-1990s, and from 1999 to 2001 (Figure 2-6). These increased catches

occurred during warmer water periods due to moderate to very strong El Niños in 1982 to 1983, 1994 to 1995, and 1997 to 1998.

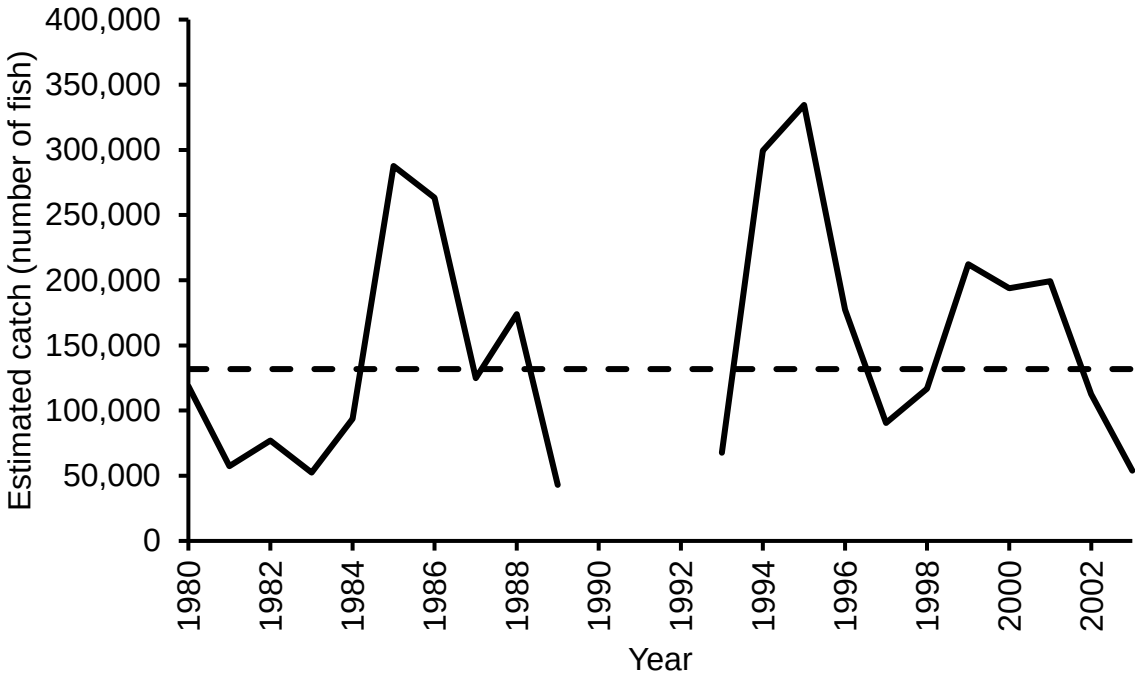


Figure 2-6. Recreational Ocean Whitefish catch estimates (number of fish kept) from all fishing modes, 1980 to 2003. Dashed line is the average over the time series. No data were collected from 1990 to 1992 (RecFIN 2018).

During CRFS data collection from 2004 to 2017 landings averaged about 70,000 fish per year. In 2005, landings estimates were significantly higher than the average, and then dropped below average until 2016 when the estimated landings of Ocean Whitefish increased dramatically (Figure 2-7). Again, the large increases in landings were probably due to the greater abundance of Ocean Whitefish in southern California as a result of the warmer water during these years from the moderate to weak (2002 to 2003, 2004 to 2005) and strong (2015 to 2016) El Niño events. Relative to other finfishes caught in southern California during this period across all CRFS sampled modes, Ocean Whitefish ranked as high as 2nd and 7th in 2017 and 2016, respectively; however, during years of cooler water, e.g. 2011, they ranked much lower (Figure 2-8).

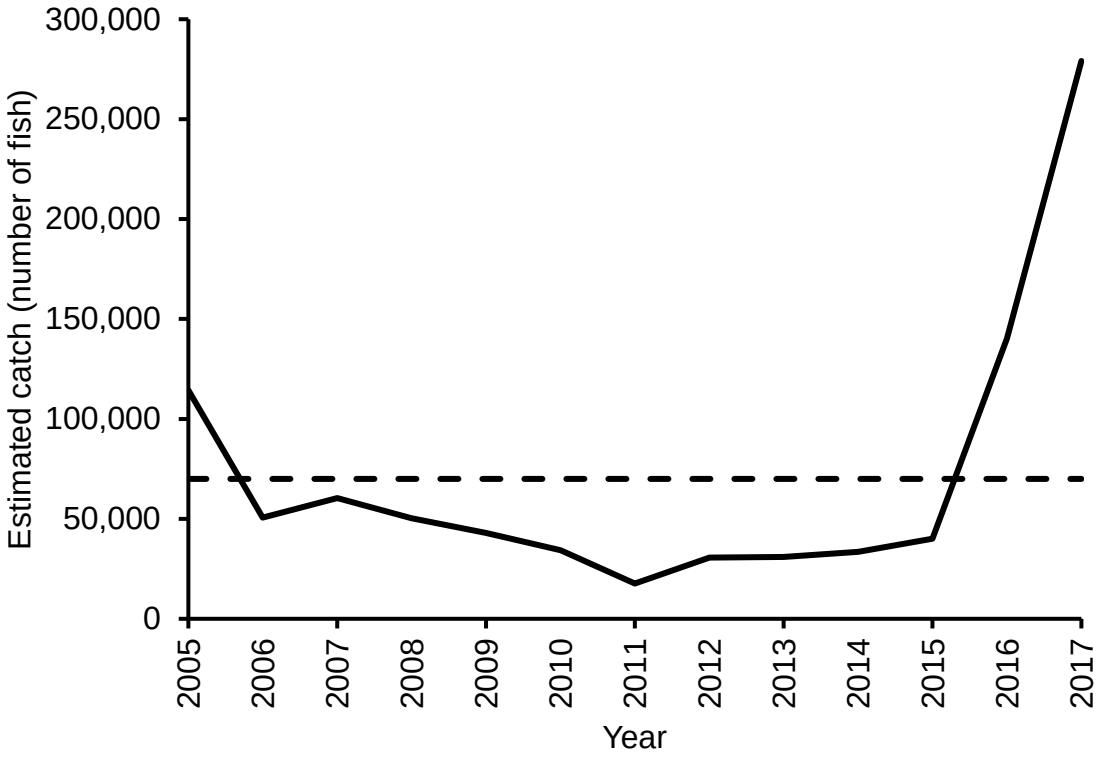


Figure 2-7. Recreational Ocean Whitefish catch estimates (number of fish kept) from all fishing modes, 2005 to 2017 (RecFIN 2018).

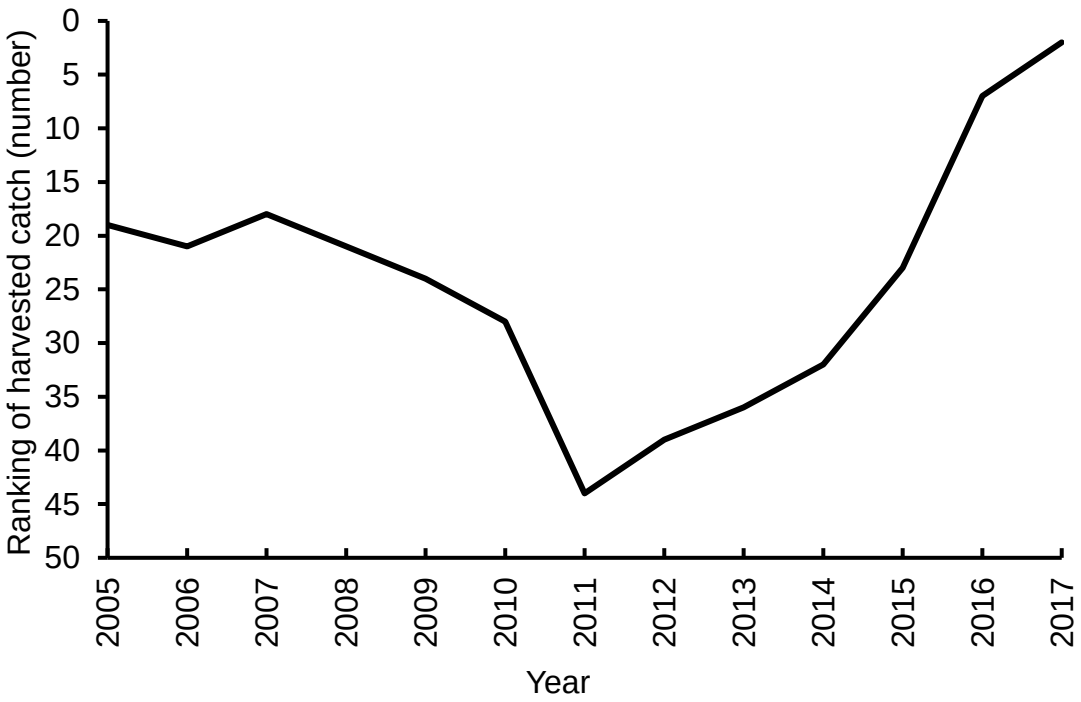


Figure 2-8. Ranking of Ocean Whitefish catch relative to other finfish species in southern California from 2005 to 2017. Results are based on the estimated retained catch for all fishing modes (RecFIN 2018).

2.3.2 Commercial

The historical landings of commercial Ocean Whitefish are available from California Department of Fish and Game (CDFG) Bulletins from 1916 to 1980 (Figure 2-9). The CDFG bulletins reported landings for many of the popular and profitable fish caught or landed in California. Since 1980, landing receipt data has been stored electronically in the Department's Commercial Fisheries Information System (CFIS) and as of 2018 is now being housed in the Department's electronic MLDS. During the early years, landings were comparatively significant, peaking at 368,000 lb (167 mt) in 1926. This may have been due to the Great Depression (1929 to 1940) and the associated need for increased protein and revenue as well as a large El Niño event (1925 to 1926) occurring during this time. However commercially caught landings of Ocean Whitefish have mostly remained relatively low, below about 40,000.0 lb (18.1 mt) since the 1950s.

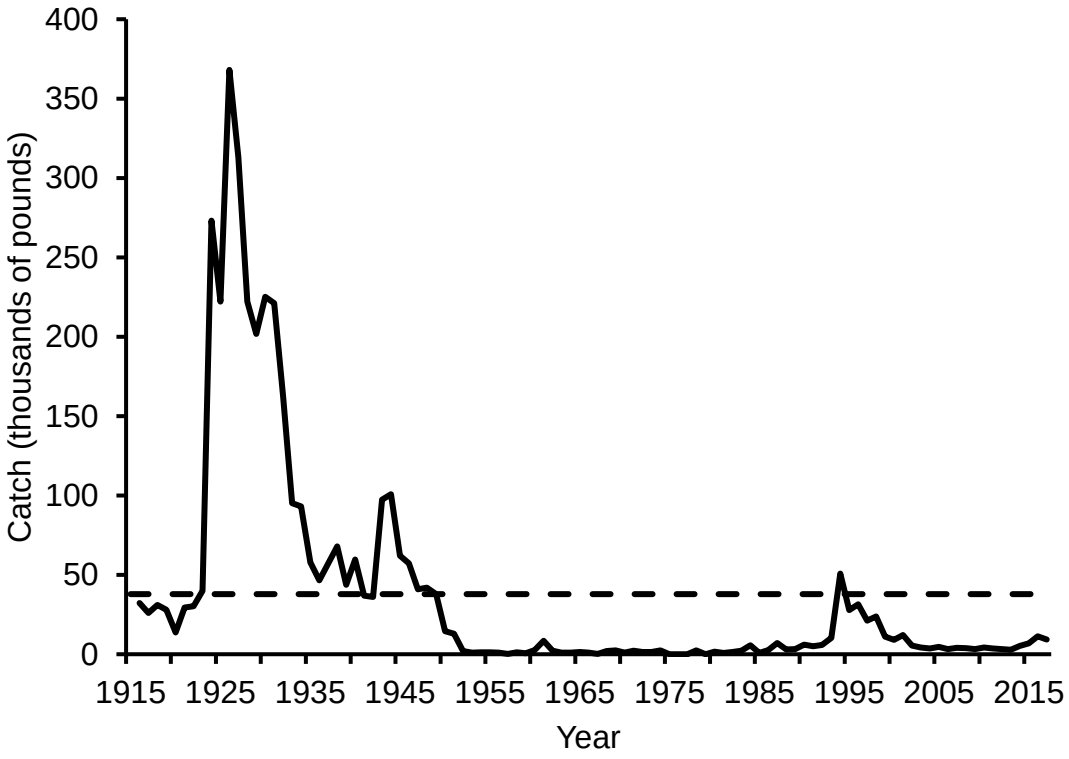


Figure 2-9. Historical commercial Ocean Whitefish landings (lb) from 1916 to 2017. Dashed horizontal line is the average across all years (CDFW MLDS 2018).

Commercial Ocean Whitefish landings and value are obtained from landing receipts submitted by fish dealers to the Department. The landings and value of commercial Ocean Whitefish have fluctuated together from 1980 to 2017 except during 2005 to 2008 when only values increased, indicating a possible increase in demand for Ocean Whitefish (Figure 2-10). Landing estimates were low from 1980 until 1994, averaging about 2,000.0 lb (0.9 mt) per year, when landings peaked at about 50,000.0 lb (22.7 mt) of fish. There was a strong El Niño in 1991-1992 and a moderate El Niño in 1994-1995 increasing water temperature and perhaps allowing conditions to be more hospitable for Ocean Whitefish in southern California. After the peak in 1994, landings rapidly decreased and were well below 10,000.0 lb (4.5 mt) from 2002 to 2015. As with the recreational fishery, Ocean Whitefish commercial landings increased dramatically in 2016 and 2017, again possibly due to the warmer water conditions in southern California during this time.

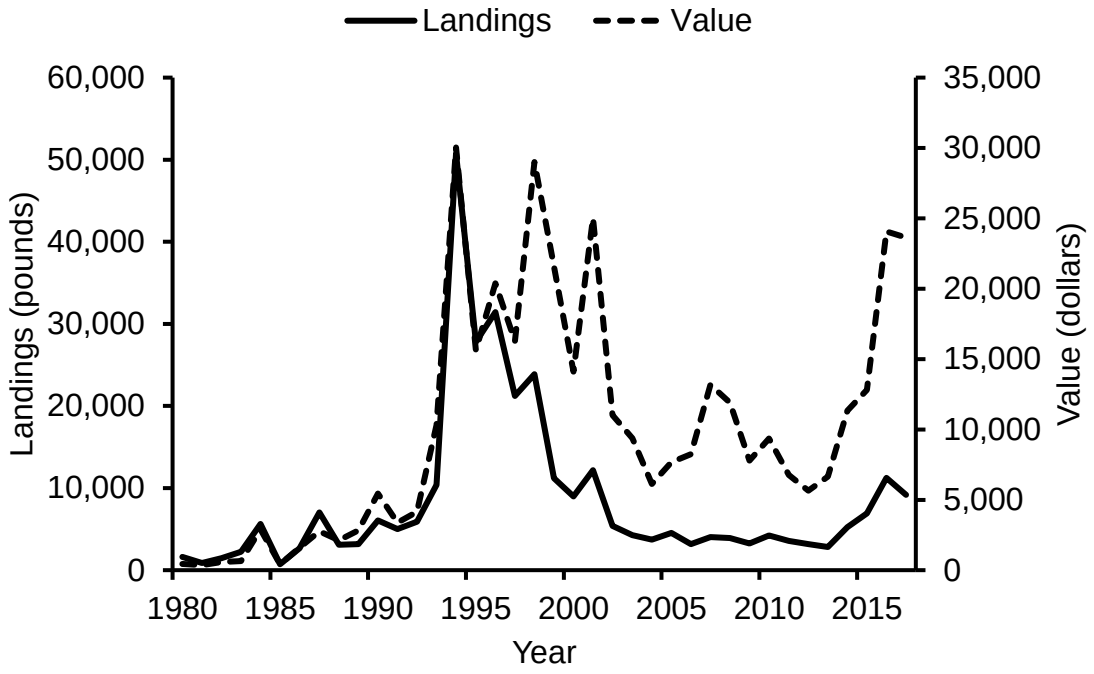


Figure 2-10. Commercial Ocean Whitefish landings (lb) and value (dollars) from 1980 to 2017 (CDFW MLDS 2018).

2.4 Social and Economic Factors Related to the Fishery

Recreational

The economic value of recreational Ocean Whitefish is unknown. With no current observable trend in social, cultural, or economic motivation for Ocean Whitefish specifically, it is unknown if this species has a social value or importance today. However, recreational fisheries provide economic benefit to California residents via income generated by recreational fishing operators and associated tourism. Shore fishing, CPFV trips and private boat trip expenditures together comprise California's $923 million annual recreational fishing industry (Lovell et al. 2013). The distribution of landings can provide information on what areas in California are most likely to benefit from this fishery. In the recreational fishery, Ocean Whitefish are most commonly landed in Los Angeles, followed by Santa Barbara and San Diego Counties (Figure 2-11). There is no spatial trend (more fish landed north versus south) with landings of Ocean Whitefish.

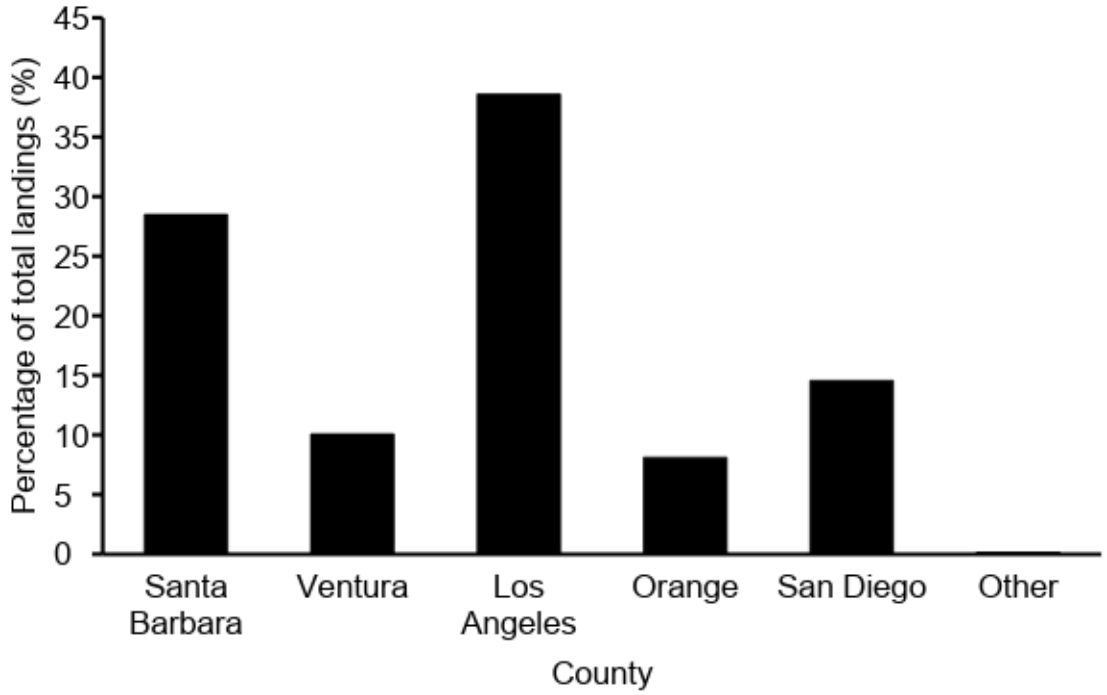


Figure 2-11. Percentage of total Ocean Whitefish landed on CPFVs by county in 2017 (CDFW MLS 2018).

Commercial

As with the recreational fishery, there is no spatial trend for commercially landed Ocean Whitefish. In 2017, Santa Barbara Harbor had the most landings with 23% of the total state catch (Figure 2-12).

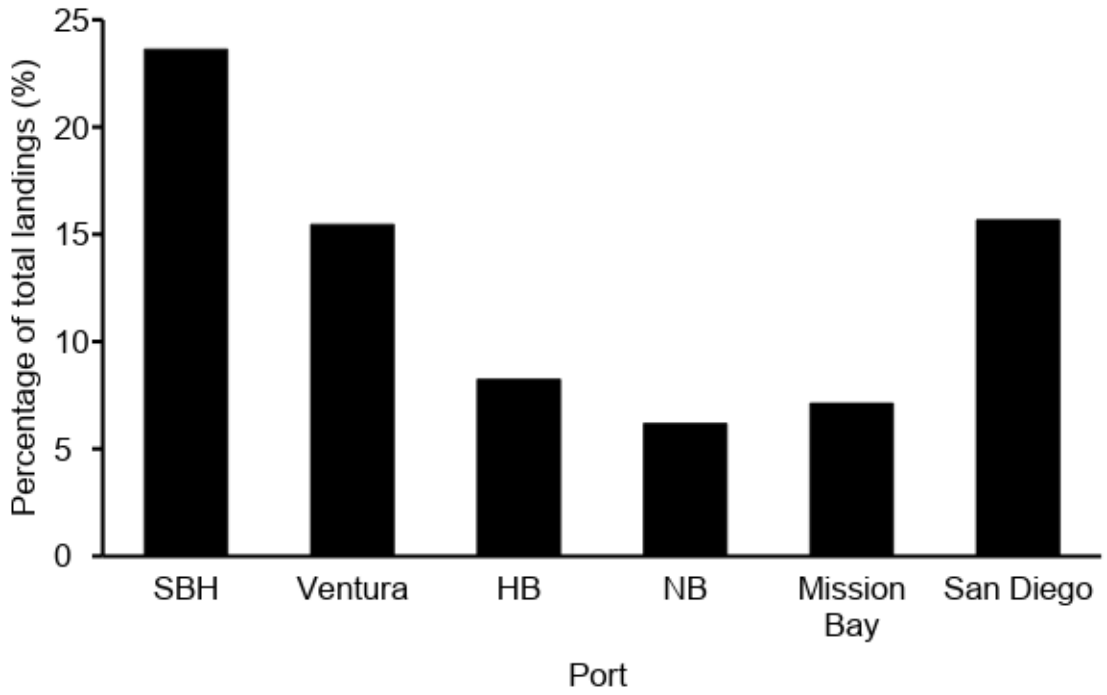


Figure 2-12. Percentage of total Ocean Whitefish landed commercially by port in 2017. SBH = Santa Barbara Harbor, HB = Huntington Beach, NB = Newport Beach (CDFW MLDS 2018).

Although there is no directed commercial fishery for Ocean Whitefish, they are typically retained and sold. The value of the Ocean Whitefish catch has varied throughout the last 10 yr but has been relatively low. In 2008, the combined value of the catch for all gear types was about $12,000. From 2008 to 2015, the value of Ocean Whitefish landings never exceeded $13,000 and averaged about $9,000 during this time. As with the landings of Ocean Whitefish, value also increased in 2016 and 2017 ($24,067 and $23,652, respectively). Average ex-vessel price per pound has been relatively consistent, staying at around $2.00 from 2009 to 2016. However, price increased in 2017 to approximately $3.00 per pound (Table 2-2). The ex-vessel price for Ocean Whitefish does vary by gear type and has slowly increased from 1980 to 2017 for hook and line, fish trap, and set longline. Hook and line caught fish receives the highest price per pound (Figure 2-13).

Table 2-2. The average ex-vessel price per pound paid for all gear types combined and total value for Ocean Whitefish from 2008 to 2017 (CDFW MLDS 2018).

Year	Price ($) per pound	Total value (dollars)
2008	3.08	11,898
2009	2.81	7,785
2010	2.69	9,357
2011	2.75	6,757
2012	2.32	5,638
2013	2.89	6,654
2014	2.67	11,339
2015	2.43	12,806
2016	2.52	24,067
2017	3.04	23,652

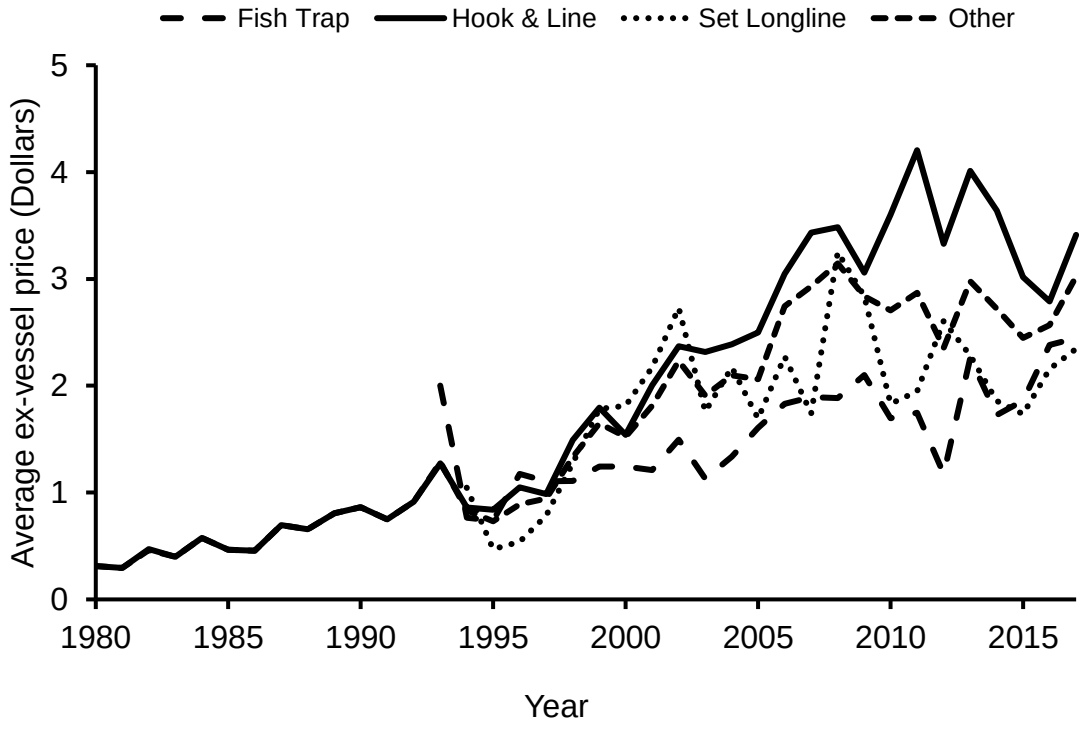


Figure 2-13. Average ex-vessel price (dollars) of commercially caught Ocean Whitefish from 1980 to 2017 by the three gear types with highest catch and all others (CDFW MLDS 2018).

3 Management

3.1 Past and Current Management Measures

Since Ocean Whitefish populations in California appear to be dependent upon strong recruitment events in Mexican waters, do not reproduce in California waters, and are mostly caught incidentally in commercial and recreational fisheries, there are few specific measures in place solely for their management. In the recreational sector, Ocean Whitefish 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. In addition, Ocean Whitefish have regulations similar to those species within the Rockfish, Cabezon, and Greenlings Complex (RCG); however, this is primarily to reduce the take of rockfishes that are often encountered when fishing for Ocean Whitefish (see below). The Department monitors effort and landings when needed, with the intention of applying additional management measures if necessary.

3.1.1 Overview and Rationale for the Current Management Framework

Currently, without a directed commercial fishery for Ocean Whitefish, there are no commercial regulations to control harvest. There are no harvest control rules or reference points for Ocean Whitefish.

Although not a federally managed groundfish species, Ocean Whitefish are often encountered by recreational fishermen targeting federally managed groundfish. Thus, the Ocean Whitefish fishery is managed in concert with the federally managed groundfish group. Ocean Whitefish has similar open areas, seasons, and depth constraints as the RCG Complex. These regulations are meant to protect species within the RCG Complex and not because of concern for Ocean Whitefish populations.

Minimum size limits are set to allow fish to live long enough to reproduce for one or more seasons before reaching a size at which they can be legally retained. Since there is no evidence that Ocean Whitefish spawn in California waters, it is unclear whether a minimum size limit would increase successful reproduction. In addition, there may be considerable mortality of undersized (immature) fish that are released due to depth-related trauma. There is a fillet length minimum of 6.5 in (16.5 cm) that must include entire skin intact for Ocean Whitefish. However, this regulation was primarily meant to restrict the take of sub-legal individuals of other species with a similar fillet appearance (Kelp Bass (*Paralabrax clathratus)*, Barred Sand Bass (*Paralabrax nebulifer)*, and Spotted Sand Bass (*Paralabrax maculatofasciatus*)) rather than Ocean Whitefish. The area, depth and seasonal closures for the RCG Complex, along with Marine Protected Areas (MPA), likely provide adequate protection for Ocean Whitefish (see below).

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

Currently, no criteria have been established to identify when Ocean Whitefish is overfished or if overfishing is occurring. However, as noted above, the Department will monitor effort and catch data to determine if additional management measures are

needed. 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 Ocean Whitefish 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.

3.1.1.2 Past and Current Stakeholder Involvement

Because Ocean Whitefish is mostly an incidental fishery, the Department has not had any directed stakeholder processes specific to Ocean Whitefish. Any future consideration of management changes will require communication with stakeholders to obtain feedback and understand the impacts of those changes. Additionally, any new regulations will be developed through the Commission process which provides prescribed opportunities for public and stakeholder input.

3.1.2 Target Species

3.1.2.1 Limitations on Fishing for Target Species

3.1.2.1.1 Catch

There are no catch limits placed on recreational Ocean Whitefish other than the general finfish daily limit of ten fish of a single species per angler in the recreational fishery. This falls under the general provision of 20 fish per day and only ten of any one species (§27.60, Title 14, CCR). There are no commercial catch limits for Ocean Whitefish.

3.1.2.1.2 Effort

There are no effort limits specific to the commercial or recreational take of Ocean Whitefish.

3.1.2.1.3 Gear

There are no commercial gear restrictions specific to Ocean Whitefish.
A recreational fishing license allows catch of Ocean Whitefish by hook and line, hand, slurp gun, harpoon, bow and arrow, and spear.

3.1.2.1.4 Time

Ocean Whitefish have the same seasonal and depth constraints as the RCG Complex within designated Groundfish Management Areas (§28.58, Title 14, CCR). For the Southern Groundfish Management Area where most Ocean Whitefish fishing occurs, §27.45, Title 14, CCR lists the following season and depth constraints:
"(1) January 1 through the last day in February: Closed.
(2) March 1 through December 31: Take of all species is prohibited seaward of a line approximating the 75-fathom depth contour along the mainland coast and along islands and offshore seamounts. The 75-fathom depth contour is defined by straight lines

connecting the set of 75-fathom waypoints as adopted in Federal regulations (50 CFR Part 660, Subpart G).” Other seasonal and depth constraints for Ocean Whitefish by Groundfish Management Area can be found in §27.20 through §27.50, Title 14, CCR or in the current California Ocean Sport Fishing Regulations booklet.

3.1.2.1.5 Sex

Both sexes of Ocean Whitefish may be retained.

3.1.2.1.6 Size

There are no size limits for commercial or recreational Ocean Whitefish. However, there is a minimum fillet size limit for recreationally caught Ocean Whitefish set at 6.5 in (16.5 cm) (§27.65, Title 14, CCR) with entire skin intact because of its similarity in appearance to other species (Kelp Bass, Barred Sand Bass, and Spotted Sand Bass) with size limits.

3.1.2.1.7 Area

As mentioned above, Ocean Whitefish are included in regulations for the RCG Complex within five Groundfish Management Areas (Figure 3-1). These areas are described in §27.25 through 27.45, Title 14, CCR. Since most Ocean Whitefish fishing occurs in southern California, only the Southern Groundfish Management area is described here from §27.45, Title 14, CCR “(a) The Southern Groundfish Management Area means ocean waters between 34^{o} 27' North latitude. (at Point Conception, Santa Barbara County) and the U.S./Mexico border. The Cowcod Conservation Areas are special closure areas within the Southern Groundfish Management Area.” See §27.50, Title 14, CCR or the current California Sport Fishing Regulations booklet for specific coordinates for the Cowcod Conservation Area.

Figure 3-1. Groundfish Management Areas for 2019 to 2020; Ocean Whitefish are included with groundfish.

The establishment of depth-based California Rockfish Conservation Areas (CRCA) indirectly protects Ocean Whitefish because they share common areas with California rockfish species. From §27.51, Title 14, CCR "California Rockfish Conservation Area (CRCA) means the ocean waters that are closed to recreational groundfish fishing at specified times, or closed in specified depths or areas. CRCAs serve to minimize interaction with particular species of overfished groundfish that cannot be selectively avoided and thus must be protected from overharvest by closing times, depths or areas to recreational fishing for federal groundfish and associated species managed by California. See Section 27.20."

"(a) In the CRCA, take and possession is prohibited for federally-managed groundfish species as defined in Section 1.91, California sheephead, ocean whitefish, and all greenlings of the genus *Hexagrammos*."

3.1.2.1.8 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.

Ocean Whitefish are most commonly found around islands. As mentioned in section 1.3, juvenile Ocean Whitefish are found in low reef habitats and sandy bottoms while adults are found in the same habitats and in deeper water. The amount of these habitats within MPAs has been determined by the Department and offers Ocean Whitefish protection from fishing practices. (CDFW 2016; Table 3-1).

Table 3-1. Amount of habitat protected by MPAs (CDFW 2016) and utilized by Ocean Whitefish

Habitat type	**Life stage utilization**	**% Habitat type protected by MPA**
Hard substrate 0-30 m (low and high relief)	Juvenile and Adult	18.8
Soft substrate 0-30 m (sandy bottom)	Juvenile and Adult	10.1
Soft substrate 30-100 m (sandy bottom)	Adult	17.0
Kelp beds	Adult	19.8

There is no information on the effects of MPAs on fishing practices for Ocean Whitefish specifically. However, it is reasonable to conclude that MPAs may benefit Ocean Whitefish as they show strong site fidelity (Bellquist et al. 2008).

3.1.2.2 Description of and Rationale for Any Restricted Access Approach

There is no restricted access program in place for Ocean Whitefish.

3.1.3 Bycatch

3.1.3.1 Amount and Type of Bycatch (Including Discards)

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).

Recreational

Since recreational anglers fishing for Ocean Whitefish are often targeting a suite of other fishes as well, the Department classifies these fishes commonly targeted and caught in association with Ocean Whitefish as incidental catch. The 2018 Master Plan for Fisheries 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. To assess the most commonly caught species with Ocean Whitefish, all trips where at least one Ocean Whitefish 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 2017 on CPFV trips where Ocean Whitefish was caught include unspecified rockfish, Kelp Bass, California Scorpionfish (*Scorpaena guttata),* Copper Rockfish *(Sebastes caurinus),* Vermilion Rockfish *(Sebastes miniatus),* Blue Rockfish *(Sebastes mystinus),* Pacific Bonito *(Sarda Chiliensis),* Bocaccio *(Sebastes paucispinis),* Lingcod (*Ophiodon elongatus*), California Sheephead, and Yellowtail (*Seriola lalandi*) (Table 3-2). These species may be secondary targets or primary targets on CPFV trips that are targeting Ocean Whitefish and may include undersized fish. All species listed in Table 3-2 have state or federal management measures in place.

Table 3-2. Number caught and percent of trips (frequency of occurrence) for the top ten most abundant species on CPFV trips (n=5,599) where at least one Ocean Whitefish was also caught in 2017 (CDFW MLS 2018).

Species	Number caught	Percent of trips	Number of Ocean Whitefish caught on associated trips
Ocean Whitefish	**251,577**	**100**	**251,577**
Unspecified Rockfish	332,907	69	194,020
Kelp Bass	83,470	40	71,073
California Scorpionfish	58,271	23	48,595
Copper Rockfish	50,399	21	58,378
Vermilion Rockfish	44,995	23	56,493
Blue Rockfish	33,909	11	32,172
Pacific Bonito	28,473	23	43,937

Bocaccio	28,353	21	43,685
Lingcod	25,763	30	91,478
California Sheephead	23,353	53	163,887
Yellowtail	17,889	28	68,949

Catching any species whose take is prohibited is of special concern. Of the species that are prohibited from recreational take, Giant Sea Bass (*Stereolepis gigas*), Garibaldi (*Hypsypops rubicundus*), Cowcod (*Sebastes levis*) and Yelloweve Rockfish (*Sebastes ruberrimus*) were the only species recorded as caught and discarded on CPFV trips in 2017 where at least one Ocean Whitefish was also caught. No information is available on whether these fish were discarded dead or alive. However, the absolute numbers and frequency of these occurrences are extremely low (Table 3-3).

Table 3-3. Species prohibited from recreational take that were caught aboard CPFV trips along with Ocean Whitefish in 2017 (CDFW MLS 2018)

Species	**Number caught**	**Percent of trips**
Giant Sea Bass	12	0.22
Garibaldi	3	0.05
Cowcod	10	0.18
Yelloweye Rockfish	6	0.11

Ocean Whitefish discards are also considered bycatch by the Department (FGC §90.5). Ocean Whitefish which will result in a fillet size less than 6.5 in (16.5 cm) are commonly discarded during the open season. Discards of Ocean Whitefish caught on CPFVs were minimal from 2008 to 2015, but increased in 2016 and 2017 (Table 3-4). The increased number of discards is consistent with the increased retained catch of Ocean Whitefish in both the commercial and recreational sectors, and indicates an overall increase in Ocean Whitefish abundance. The discard mortality rate for Ocean Whitefish bycatch is unknown.

Table 3-4. Number of Ocean Whitefish caught on CPFVs from 2008 to 2017 (CDFW MLS 2018)**.**

Year	**Number of fish kept**	**Number of fish discarded**	**Total number of fish caught**	**Percent discarded**
2008	60,167	3,038	63,205	5
2009	60,928	3,012	63,940	5
2010	52,028	1,326	53,354	2
2011	46,946	1,438	48,384	3
2012	48,175	1,107	49,282	2
2013	62,419	1,999	64,418	3
2014	57,307	2,045	59,352	3
2015	71,949	3,413	75,362	5
2016	121,079	9,614	130,693	7
2017	234,362	16,024	250,386	6

Commercial

Because there is no directed commercial fishery for Ocean Whitefish, any bycatch associated with their catch is considered to be the bycatch of the target fisheries. The top three commercial fisheries that caught Ocean Whitefish in 2017 were California Sheephead, White Seabass, and rockfishes (CDFW MLDS). Please refer to their respective ESRs and/or FMPs for details regarding bycatch in these fisheries.

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

As described above, the bycatch in the Ocean Whitefish fishery is primarily other common shallow reef, sandy bottom, and coastal pelagic species that are monitored and managed separately. While some sensitive or protected species are caught in the r fishery for Ocean Whitefish, the reported numbers caught per year are low. This is partly due to groundfish management regulations that apply to Ocean Whitefish. Yelloweye Rockfish and Cowcod are managed by the National Oceanic and Atmospheric Administration (NOAA) and the Pacific Fishery Management Council as part of the Pacific Coast Groundfish FMP, and take of these species is accounted for in their annual limits. The Ocean Whitefish fishery has not had any adverse interactions with marine mammals, and while seabirds are sometimes hooked by anglers or tangled in fishing line, further research is needed to determine the degree of impact to individual birds and their populations. Although there is no information on discard mortality, the proportion of Ocean Whitefish discarded is relatively low. However, as mentioned in section 3.1.3.1, further information on the long-term survivorship of discards is needed to fully evaluate the effect of discards on the population. For these reasons, the Department does not consider the type and amount of bycatch for the Ocean Whitefish fishery to be at an unacceptable level and additional measures have not been developed to reduce it.

3.1.4 Habitat

3.1.4.1 Description of Threats

Coastal development and urban runoff can pose a risk to inshore nursery habitats due to negative effects on water quality (Zedler 1996), but this is less of a concern for Ocean Whitefish as they are mostly found around offshore islands. However, invasive species, climate change and increased variability in sea surface temperatures may have detrimental effects on the health of kelp forest and rocky reef ecosystems (Caselle et al. 2017; Provost et al. 2017; Ramírez-Valdez et al. 2017) where Ocean Whitefish are commonly found.

Recreational Fishing

The recreational fishery for Ocean Whitefish is exclusively hook and line. Adverse impacts of the Ocean Whitefish recreational hook and line fishery on soft bottom, rocky reef, and kelp forests habitats are most likely insignificant. Some impact

to kelp forests or marine invertebrates associated with rocky reef or soft bottom substrates can result from anchoring of vessels or fishing gear snagging on structure or organisms, but this is likely minimal. Use of this gear type may create marine debris when fishing line is lost within the habitat.

Commercial Fishing

Ocean Whitefish are incidentally caught in several commercial fisheries using a variety of gear types. In 2017 gear types with incidentally caught Ocean Whitefish included nine types (Table 3-5). All these gear types have the potential to negatively impact habitat to varying degrees (Kaiser et al. 2003).

Table 3-5. Ocean Whitefish catch by commercial gear type in 2017 (CDFW MLDS 2018).

Gear Type	Catch (pounds)	Percent of catch
Hook and line	4,360 (1977.7 kg)	50
Set longline	2,100 (952.5 kg)	24
Fish trap	1,200 (544.3 kg)	14
Vertical hook and line/Portuguese longline	750 (340.2 kg)	8
Large mesh set gill net	120 (54.4 kg)	1.5
Prawn trap	70 (31.8 kg)	<1
Crab or lobster trap	46 (20.9 kg)	<1
Diving	9 (4.1 kg)	<1
Set gill net	7 (3.2 kg)	<1

Depending on the gear type, gear loss can be a threat to habitat, as it may damage bottom organisms and inhibit the growth of such as tube-dwelling annelids, anemones, mollusks, and crustaceans. In addition, biogenic structures used by fauna (refuge from predators, feeding, protection from environmental forces) such as reef corals, kelp holdfasts, shells, tubes and tunnels may be damaged (National Resource Council 2002).

Lost gear does occur with commercial fishing activities. This may include fish traps that have broken free from their buoys and are dragged by currents across the ocean bottom. Often, studies on the impact of lost gear are difficult to interpret. Nevertheless, lost lobster pots and nets have been shown to damage reef habitat (Dayton et al. 1995). There is no current available data on the incidence of lost gear of this type, but the implemented trap limit in the Spiny Lobster (*Panulirus interruptus*) fishery (§122.1(c)(1), Title 14, CCR) is likely to provide data on rates of trap loss.

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

The impacts of a recreational hook and line fishery on habitats is likely very minor and measures to minimize potential impacts have not been developed. A description of California gear types catching Ocean Whitefish from 2010 until 2017, associated habitat impacts, and common mitigation measures can be found below in Table 3-6.

Table 3-6. Common California gear types catching Ocean Whitefish, associated habitat impacts, and common mitigation measures. Modified from Appendix N1 in the 2018 CDFW Master Plan for Fisheries (CDFW 2018).

Common gear types	Common gear interactions	Habitat risks	Department Management response
Set nets	Weights pulled along sea floor as net is hauled up; net itself snags and may pull up organisms growing on seafloor (Chuenpagdee et al. 2003).	Area of seafloor that weights contact may lose structural species and fragile species may catch and break on net (Auster 1998).	Footrope (lead line) has a breaking strength of at least 50 lb less than the combined breaking strength of the headrope and cork line.
Pots and traps	Gear rests on seafloor; storms may cause them to drag; can drag during hauling.	Structure forming organisms or high relief habitat may be damaged as gear is dragged during hauling or storms; large numbers of traps can have a cumulative impact (Jenkins and Garrsion 2013).	No finfish traps shall be set within 750 ft of any pier, break wall, or jetty in District 6, 7, 17, 18, 19A, 19B,20, 20A ,20B, or 21. See footnotes). No more than 50 traps may be used in state waters along the mainland shore.
Hook and line	Light line suspends hook above seafloor, sometimes very light weight or hooks come into contact with seafloor.	Gear may snag on structure forming organisms, but risk is relatively low (Dayton et al. 1995).	Not needed
Bottom longline	Weighted longline with multiple hooks must be dragged across seafloor to retrieve, but it contacts a very small area.	Gear may snag on structure forming organisms, but risk is relatively low (Chuenpagdee et al. 2003).	Not to be used for take of Shortfin Mako Shark (*Isurus oxyrinchus*), Thresher Shark (*Alopias vulpinus*), Swordfish (*Xiphias gladius*), or Marlin species. Unlawful: 1) to use more than 100 ft above anchor or ocean bottom, 2) use more than 150 hooks on a vessel, 3) use hooks attached to the upper one/third of the line, 4) and to use fishing lines more than 900 ft in length.

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 the efforts of outside groups to recover lost gear. One of these programs is The SeaDoc Society's Lost Fishing Gear Recovery Project, which removes lost gear in southern California. The Department also has authority to remove nuisance traps that may be causing habitat destruction (FGC §9008) and has developed a gear retrieval program for the Commercial Dungeness crab fishery pursuant to FGC §9002.5.

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 Ocean Whitefish. 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 (Table 3-7). The most current license options and fees for the recreational fishery may be accessed at https://www.wildlife.ca.gov/Licensing/Fishing and https://www.wildlife.ca.gov/Licensing/Commercial/Descriptions.

Table 3-7. Annual sport fishing license fees from January 1 to December 31, 2019. Accessed June 24, 2019 at https://www.wildlife.ca.gov/Licensing/Fishing and https://www.wildlife.ca.gov/Licensing/Commercial/Descriptions).

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 yr of age or older to fish.
Recreational Non-resident Sport Fishing	$134.74	Required for any non-resident 16 yr 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 Department offices. $7.82 from license agents	Available for any resident or non-resident honorably discharged disabled veteran with a 50% 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 Department License Sales Offices.
Reduced-Fee Sport Fishing License – Low Income Senior	$7.47	Available for low income California residents, 65 yr of age and older, who meet the specified annual income requirements. The Reduced-Fee Sport Fishing License for Low Income Seniors is only available at Department License Sales Offices.

Commercial

Any resident 16 yr 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, 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 (Table 3-8). 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 3-8. Annual commercial fishing license fees from January 1 to December 31, 2019. Accessed June 24, 2019 at https://www.wildlife.ca.gov/Licensing/Commercial/Descriptions

License	Fee	Description
Resident Commercial Fishing License	$145.75	Required for any resident 16 yr 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 Seabass south of Point Arguello.
Commercial Boat Registration (Resident)	$379.00	Required for any resident 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.
Gill/Trammel Net Permit	$498.25	Required for the owner or operator of a currently registered commercial fishing vessel to use a gill or trammel net. At least one person aboard each commercial fishing vessel must have a valid general gill net permit when engaged in operations authorized by the permit.
Drift Gill Net Permit Transfer fee	$1500.00	Required for gill net permits to be transferred following all restrictions described in the Commercial regulations Transferring Permit Requirements (FGC §8561.5)
Drift Gill Net Vessel Transfer fee	$130.00	Required for gill net vessels to be transferred following all restrictions described in the Commercial regulations Transferring Permit Requirements (FGC §8561.5)

4 Monitoring and Essential Fishery Information

4.1 Description of Relevant Essential Fishery Information

FGC §93 defines Essential Fishery Information (EFI) as “information about fish life history and habitat requirements; the status and trends of fish populations, fishing effort, and catch levels; fishery effects on age structure and on other marine living resources and users, and any other information related to the biology of a fish species or to taking in the fishery that is necessary to permit fisheries to be managed according to the requirements of this code.” Fish weight at length is an indicator of fish health and a decrease in this index over time may indicate a decline in stock health. A change in length frequency of caught fish may also indicate a shift in fishery dynamics (changing gear, desirability of fish at size, etc.). Fishery-dependent data sets will be used to estimate fishing effort and catch levels, which in turn may be used to evaluate stock abundance and indicate stock health. Currently, there are no fishery-independent data collected on Ocean Whitefish by the Department.

4.2 Past and Ongoing Monitoring of the Fishery

4.2.1 Fishery-dependent Data Collection

Fishery-dependent data collected by the Department provide an excellent way to monitor fishing effort, catch levels and the size structure of retained Ocean Whitefish. Fishery data are collected from CPFV logbooks and from all fishing modes sampled by CRFS. Both CPFV logbook and CRFS data collected by the Department contribute valuable estimates of catch and effort that help staff monitor the status of Barred Sand Bass.

Beginning in 1935, CPFV operators were required to keep daily catch logs and submit them monthly to the Department. These data have been collected continuously, except for during World War II (1941 to 1946) when most CPFVs were not fishing (Hill and Schneider 1999). Logbook data have always included the date fishing occurred, port code, boat name, Department fishing block, angler effort and the number of fish kept by species, and after 1994 included discarded fish, bait type and sea surface temperature. Although initially recorded on paper, as of December 2017, 70% of all CPFV logs are voluntarily entered via the MLS electronic application which is accessible to Department scientists.

All modes of recreational fishing were surveyed by MRFSS for estimates of catch and effort between 1979 and 2003. The Pacific States Marine Fisheries Commission ran these surveys with both federal and state funding. A combination of dockside surveys, CPFV sampling and phone interviews were used to generate the estimates. In January 2004, the Department implemented its own sampling survey, CRFS, to replace the MRFSS surveys using similar but different methods.

Current CRFS estimates (2004 to present) use catch and effort data collected by samplers from all fishing modes. In addition, CRFS also collects size (length and weight) information on kept fish. Numbers of discards are also recorded for all modes and discard lengths are obtained opportunistically on CPFVs. From this data, monthly estimates of catch and effort are made.

In the commercial sector, Ocean Whitefish catch data are collected from landing receipts that fish dealers are required to submit to the Department. The data are maintained in the Department's MLDS database. Landing receipts include information on gear type, weight of fish caught, value per pound, port of landing, block fished, fish business owner of buyer, vessel name and identification, fish condition, and total calculated value.

4.2.2 Fishery-independent Data Collection

Fishery-independent data can provide a better, less-biased assessment of relative abundance since sampling can be standardized and information on all life stages can be collected. The Department is not collecting fishery-independent information specific to Ocean Whitefish and is not aware of any current efforts by others. However, past studies have been completed on larval dynamics (Moser et al. 1986); feeding habits (Elorduy-Garay and Caraveo-Patino 1994); movement (Bellquist et al. 2008); and age, growth and maturity (Cooksey 1980).

5 Future Management Needs and Directions

5.1 Identification of Information Gaps

The Ocean Whitefish fishery is currently data-limited. Priority information needs identified for Ocean Whitefish are listed in Table 5-1.

Table 5-1. Informational needs for the Ocean Whitefish fishery and their priority for management.

Type of information	Priority for management	How essential fishery information would support future management
Reproductive (fecundity, spawning frequency and fraction, and location)	High	Information used to determine amount of potential offspring. Will help estimates of fish abundance, stock availability, and stock yields. Location information to determine if spawning stock needs protection.
Determine proportion of mature fish in recreational and commercial fisheries	High	Used to determine the amount of fishing of the stock that is sustainable.
Short and long-term discard mortality	High	Quantifying discard mortality is necessary for a more accurate estimate of overall fishing mortality.
Age/growth parameters	Medium	Used to estimate the longevity of fish and age of a legal size that will recruit into the fishery.
Updated length/age at maturity	Medium	Provides information on the size and age that Ocean Whitefish first become reproductively mature. Ideally fish are able to spawn at least once in their lifetime and this information would allow for appropriate minimum size limits.
Examination of CalCOFI larval data series	Low	Recruitment information may provide a more accurate prediction of the number of fishes in the population from year to year.

5.2 Research and Monitoring

5.2.1 Potential Strategies to Fill Information Gaps

To address priority EFI needs for Ocean Whitefish the Department may use several strategies. Recreationally and commercially caught fish could be collected to determine reproductive age, growth, and maturity parameters. Abundance and recruitment measurements may be estimated with fishery-dependent data collected from Department data streams (CRFS, landing receipts, and logbook data). This may also be estimated with fishery-independent data from Department led studies or from data collected by outside partners with well-established surveys (Partnership for the Interdisciplinary Studies of Coastal Oceans (PISCO), Reef Check, etc.).

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.

As of 2018, no known directed studies are occurring specific to Ocean Whitefish. However, there are entities that conduct research that could enhance data to close the information gaps. For example, the California Cooperative Oceanic Fisheries Investigation (CalCOFI) is continually collecting data on larval and juvenile fishes, and PISCO conducts fish surveys. Ocean Whitefish have been noted in surveys; however, the data has not been analyzed for its potential significance to Ocean Whitefish management. Universities and academic institutions in California could engage with the Department to help fill these informational gaps (Table 5-1). In addition, it may be more successful to collaborate with researchers south of the border since Ocean Whitefish are much more common in Mexican waters.

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.

Currently, Ocean Whitefish is state-managed and shares some regulations with fishes under the RCG Complex. Given that this fishery is not often targeted and catch rates have generally been stable, the Department does not believe there is a need for additional management measures at this time. However, the recent increase in

availability and recreational and commercial catch of Ocean Whitefish could indicate an increase in popularity and the potential increased targeting of this species (Figures 2-5 and 2-7). Also, many of the Ocean Whitefish sampled by CRFS have been below the minimum fillet size limit of 6.5 in (16.5 cm) indicating a possible increase in recruitment and take of smaller juveniles. The Department will continue to monitor trends in catch and effort, and the size distribution of the catch The Department will try and determine if Ocean Whitefish are establishing permanent residence and spawning in California waters. If so, this might require management changes in the form of a minimum size and reduced bag limits.

5.4 Climate Readiness

Little is known about how climate change may affect Ocean Whitefish populations and habitats. To incorporate climate readiness into Ocean Whitefish management it is important to increase our understanding of possible impacts of climate variability. California's coastal waters are already subject to high variability due to episodic events such as ENSO, PDO and North Pacific Gyre Oscillation. Climate change will bring even further uncertainty to these trends, with potentially extreme implications for ecosystem function and fishery sustainability in coastal areas. To manage Ocean Whitefish populations effectively under climate change, it will be important to take a proactive approach to management. This may entail increased or targeted monitoring of populations and/or precautionary management measures until the uncertainties associated with climate change can be better understood.

As mentioned in section 1.5, many West Coast species projections suggest a shift to preferred thermal habitats if ocean temperatures continue to increase (Morley et al. 2018). This could affect Ocean Whitefish management if the reproduction center shifts northward, indicated by larval presence or more adults in southern California. The purpose of ESRs is to assist in the adaptive management of fisheries by compiling information, identifying data gaps, prioritizing research, and considering and presenting opportunities for change in management. The periodic update of this ESR and the underlying monitoring of catch and effort data will help ensure that trends are identified in a timely way and that management is strategic and adaptive over time.

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