Fishery-at-a-Glance: California Corbina

Scientific Name: *Menticirrhus undulatus*

Range: California Corbina range from Point Conception, California, to Baja California, Mexico.

Habitat: All life stages of California Corbina are dependent upon shallow, sandy/soft bottom habitat located either along surf swept open coast, just beyond the surf zone, or inside shallow bays.

Size (length and weight): The largest California Corbina verified by the Department was 28 inches (71 centimeters) total length, and weighed 7.25 pounds (3.3 kilogram). The longest reported California Corbina was 33 inches (84 centimeters) and the heaviest reported was 8.5 pounds (3.9 kilogram).

Life span: The oldest recorded California Corbina was 11 years old.

Reproduction: California Corbina have two distinct sexes, and release eggs and sperm into the water column where fertilization occurs and eggs are pelagic. Spawning occurs from May through September with activity peaking from June through August. California Corbina generally mature between the ages of 2 and 3 years old.

Prey: California Corbina primarily feed upon clam siphons, feet, and gills.

Predators: California Corbina have been noted as prey for Pacific Angel Shark, California Halibut, and Bottlenose Dolphin.

Fishery: Only a recreational fishery exists for California Corbina. They were historically fished commercially, but in 1915 commercial fishing for California Corbina was banned.

Area fished: The California Corbina fishery ranges from Point Conception to the Mexico border. Anglers fish mostly along sandy shores exposed to surf and sometimes within shallow bays.

Fishing season: California Corbina are fished year-round.

Fishing gear: California Corbina are caught using hook and line.

Market(s): There is no market for California Corbina given the lack of a commercial fishery.

Current stock status: No formal stock assessment exists for California Corbina.

Management: California Corbina may only be taken recreationally. The take of California Corbina with nets has been illegal since 1909, and the sale or purchase of

this species has been illegal since 1915. Recreational take is addressed under the general bag limit for finfish. There is no size limit.

1 The Species

1.1 Natural History

1.1.1 Species Description

California Corbina (*Menticirrhus undulatus*) are a nearshore croaker species common to southern California sandy beaches and are quite popular among shore anglers. Their body shape is elongate and slightly compressed. They are uniformly grey in color with incandescent reflections and wavy diagonal lines on their sides. California Corbina can be distinguished from Yellowfin Croaker (*Umbrina roncador*) by looking at the front of the anal fin; California Corbina typically have one weak spine, while Yellowfin Croaker have two strong spines. Both California Corbina and Yellowfin Croaker have a single barbel projecting from the chin, which helps distinguish these two species from the other croakers found in southern California's coastal waters.

1.1.2 Range, Distribution, and Movement

California Corbina range from Point Conception, California down to the Gulf of California (Miller and Lea 1972), but they have also been reported from Ecuador to northern Chile (Love 2011) (Figure 1-1). California Corbina can be found along the sandy shores of the open coast and within shallow bays in waters within inches from the surface down to 65 feet (ft) (20 meters (m)) (Kells et al. 2016). Limited tagging studies indicate they do not move far and have no discernable migratory pattern. The farthest a tagged California Corbina has traveled is 51 miles (mi) (82 kilometer (km)) (Baxter 1980).

Figure 1-1- Range of California Corbina.

1.1.3 Reproduction, Fecundity, and Spawning Season

California Corbina have two distinct sexes, and release eggs and sperm into the water column where fertilization occurs and eggs are pelagic. Spawning occurs from

spring through fall (June through August or September) with slight temporal differences in the literature that report a one month variability within each of these seasons (Baxter 1980, CDFG 2013, CDFW unpublished data). Peak spawning activity occurs from June through August (CDFG 2013; CDFW unpublished data). Baxter (1980) speculates that because running ripe (full of gonads ready to be released) fish are rarely found in the surf zone, spawning most likely takes place offshore.

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.

Estimating M is difficult and often relies on evaluation of life history traits, and several different methods have been developed. An estimate for M has not been published for California Corbina.

1.1.5 Individual Growth

Individual growth of fishes is quite variable, not only among different groups of species but also within the same species. The largest California Corbina verified by the Department was 28 inches (in) (71 centimeters (cm)) Total Length (TL), weighed 7.3 pounds (lb) (3.3 kilogram (kg)), and was taken at Son Onofre in 1955 (Baxter 1980). The longest reported California Corbina was 33 in (84 cm) (Love 2011) and the heaviest reported was 8.5 lb (3.9 kg) (Baxter 1980). The current world weight record verified by the International Game Fish Association is 7.9 lb (3.6 kg) for a fish caught in Mission Bay, California in 2015. The oldest recorded California Corbina was an 11 yr old female. The female was 23 in (58 cm) TL, and caught on the open coast (CDFG 2013; CDFW unpublished data).

In many fish species, male and female fish can have different growth rates. Joseph (1962) noted after the age of 3 yr old, female California Corbina grew faster than males. 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. Using fish aged with otoliths, as opposed to scales, the Department estimated growth parameters for California Corbina for both sexes separately by fitting data to the von Bertalanffy growth function:

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

where L_t is the standard length at age t in millimeters, 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. The values of those estimated parameters for males (n=198) were L_∞ = 387.8 millimeters (mm) (15.3 in), k = 0.2986, t_0 = -0.8087. The values

for females (n=629) were L_∞ = 567.7 mm (22.4 in), k = 0.2635, t_0 = -0.2608 (CDFW unpublished data).

Because the relationship between weight and length for California Corbina (both sexes combined) has been modeled, and the associated parameter estimates published multiple times (Joseph 1962; Miller et al. 2008; Williams et al. 2013), results from the most recent parameter estimates were reported here. Williams et al. (2013) used the exponential equation:

$$W = aL^b$$

where W is the weight in grams, L is the TL in millimeters, a is a constant indicating the intercept, and b is a constant indicating the slope of the regression line with the estimated parameters values of: a = 0.0000258 and b = 2.91.

1.1.6 Size and Age at Maturity

California Corbina generally mature between the ages of 2 and 3 yr old. Over 50% of females are mature by 12 in (30 cm) TL (2 yr) and all by 15 in (38 cm) TL (3 yr) (CDFG 2013). Males mature at around 10 in (25 cm) TL (2 yr) (Baxter 1980).

1.2 Population Status and Dynamics

No formal stock assessment exists for California Corbina in southern California. However, a review of fishery-dependent catch (Section 2.3.1) and size structure trends (Section 1.2.2) along with the results of several fishery-independent surveys (Section 1.2.1) leads the Department to believe the California Corbina resource is being sustainably managed.

1.2.1 Abundance Estimates

A long term, annual index of abundance for California Corbina in southern California from fishery-independent data sources is not available. However, some short-term fishery-independent surveys have been conducted by the Department and other researchers throughout the decades. Beach seine hauls along the open coast in southern California from 2007 to 2010 yielded slightly higher yet similar numbers of California Corbina to those obtained during two previous, similar studies from 1994 to 1997 (CDFW unpublished data) and 1953 to 1956 (Carlisle et al. 1960). These three studies also yielded similar Catch Per Unit Effort (CPUE), indicating that the populations were self-sustaining under recreational harvest levels. California Corbina ranked seventh in abundance during the most recent Department beach seine study conducted from 2007 to 2010 (CDFW unpublished data), below other common surf fish species, such as Queenfish (*Seriphus politus*), Yellowfin Croaker, and Walleye Surfperch (*Hyperprosopon argenteum*). When compared to the two previous Department studies in the 1990s and 1950s, California Corbina abundance ranked second and ninth, respectively.

California Corbina have also been caught in other short-term surveys in southern California bays. Allen et al. (2002) surveyed quarterly in San Diego Bay from 1994 to

1999 and estimated the biomass of California Corbina to have been 0.5 metric tons (mt) in Sand Diego Bay at that time and making up about 0.1% of the bay's biomass. Records of fish entrainment in the cooling water intakes of southern California's coastal electric generating stations provided a useful dataset from 1979 to 2010 (Miller et al. 2011). However, these data became unavailable after 2012 following the shutdown of major power plants like San Onofre Nuclear Generating Station. New regulations now prevent active power plants from using once-through cooling of seawater due to the damaging environmental impacts.

1.2.2 Age Structure of the Population

As there is no stock assessment for California Corbina, recreational catch data were used to assess the age structure of the population. Length data of retained catch from all fishing modes (manmade, beach and bank, private/rental boats), with the majority of length data taken from the beach and bank and manmade modes, were analyzed to visualize the length composition by year (Figure 1-3). Lengths were not converted to age to directly assess age composition; females and males exhibit different growth rates, but sex is not included in the data to allow the Department to account for the differences in length to age conversions.

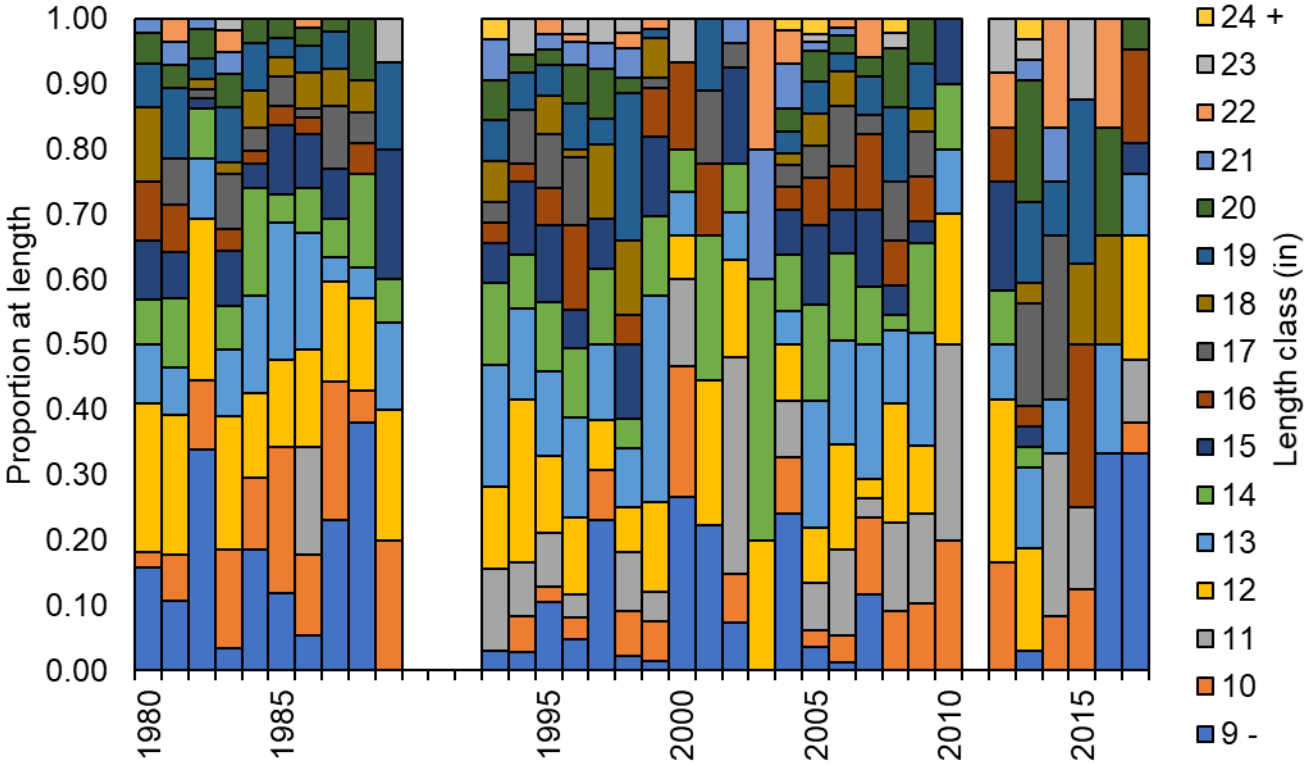

Figure 1-2. Fork Length structure of harvested California Corbina (all modes) from 1980 to 2017. All fish 24 in (61 cm) and larger and 9 in (23 cm) and shorter are represented in summed categories, 24+ and 9- respectively. No data collected from 1990 to 1992 (Recreational Fisheries Information Network (RecFIN)).

Size composition fluctuates throughout the time series (Figure 1-3). Beginning in 1993, length classes 11.0 in (27.9 cm) and smaller constitutes some proportion (typically less than 20%) of the retained sampled catch in most years. Most males are mature by 10.0 in (25.4 cm) and about 50% of females by 12.0 in (30.5 cm); therefore, anglers are consistently retaining some fish that have not yet reached sexual maturity. Despite the retention of immature fish, the majority of the retained catch is mature and characterized by several different size classes. The high number and distribution of size classes translates to several well distributed mature age classes being represented in a long time series of retained catch data, which is indicative of a healthy adult population structure.

1.3 Habitat

Adult and juvenile California Corbina are dependent upon shallow, sandy and soft bottom habitat located either along surf swept open coast, in deeper waters beyond the surf zone, or inside shallow bays (Skogsberg 1939, Joseph 1962). While collecting California Corbina for a life history study, Joseph (1962) noticed many large specimens in deeper waters from November to April, while at the same time large adults were absent in their shallow surf zone and bay collections. This, in addition to known life history traits of other related sciaenid species led Joseph (1962) to hypothesize California Corbina may spawn over soft bottom habitat outside the surf zone. In addition, young-of-the-year (YOY) California Corbina have been caught just outside the surf zone (CDFW unpublished data); therefore, newly settled larvae most likely depend upon subtidal soft bottom habitat. It is unlikely protected embayments serve as nursery habitat, as YOY California Corbina have not been collected there.

1.4 Ecosystem Role

The Department is not aware of any published studies directed specifically at the ecosystem role of California Corbina in southern California, but they are known to be benthic carnivores (Skogsberg 1932, Joseph 1962, O'Brien and Valle 2000). California Corbina may occupy a specific niche in southern California with little competition for prey due to differences with co-occurring species in regards to feeding habits, morphology, and microhabitat preferences (O'Brien and Valle 2000).

1.4.1 Associated Species

California Corbina primarily reside in the nearshore, sandy surf zone habitat. Other commonly co-occurring southern California species in this type of habitat include the species in Table 1-1 below (Carlisle et al. 1960; CDFW unpublished data).

Table 1-1. Species co-occurring with California Corbina.

Common name	**Scientific name**
Barred Surfperch	*Amphistichus argenteus*
Bat Ray	*Myliobatis californica*
Black Perch	*Embiotoca jacksoni*
California Butterfly Ray	*Gymnura marmorata*
California Grunion	*Leuresthes tenuis*

California Halibut	*Paralichthys californicus*
California Needlefish	*Strongylura exilis*
~~Deepbody Anchovy~~	~~*Anchoa compressa*~~
Diamond Turbot	*Hypsopsetta guttulata*
Dwarf Perch	*Micrometrus minimus*
Gray Smoothhound	*Mustelus californicus*
Jack Mackerel	*Trachurus symmetricus*
Leopard Shark	*Triakis semifasciata*
Pacific Chub Mackerel	*Scomber japonicus*
Pacific Pompano	*Peprilus simillimus*
Queenfish	*Seriphus politus*
Round Stingray	*Urobatis halleri*
Salema	*Xenistius californiensis*
Shiner Perch	*Cymatogaster aggregata*
Shovelnose Guitarfish	*Rhinobatos productus*
Spotfin Croaker	*Roncador stearnsii*
Striped Mullet	*Mugil cephalus*
Topsmelt	*Atherinops affinis*
Walleye Surfperch	*Hyperprosopon argenteum*
White Croaker	*Genyonemus lineatus*
White Seaperch	*Phanerodon furcatus*
Yellowfin Croaker	*Umbrina roncador*
Zebraperch	*Hermosilla azurea*

1.4.2 Predator-prey Interactions

California Corbina are benthic carnivores that feed by scooping sand with their mouth and filtering the contents through their gill openings. Skogsberg (1939) and Joseph (1962) both described the California Corbina diet as consisting mainly of sand crabs, while O'Brien and Valle (2000) found clams to be the main prey item, followed by crustaceans and polychaetes. These differences were most likely due to shifts in prey abundances between the different time periods of the studies (O'Brien and Valle 2000). O'Brien and Valle also noted shifts in the diet according to size. California Corbina less than or equal to 400 mm (18 in) Standard Length (SL) fed primarily on clam siphons, whereas the larger fish fed mostly on clam feet and gills (O'Brien and Valle 2000). California Corbina have been noted as prey for Pacific Angel Shark (*Squatina californica*) California Halibut (*Paralichthys californicus*) (Limbaugh 1955; Feder et al. 1974); and Bottlenose Dolphin (*Tursiops truncatus*) (Love 2011).

1.5 Effects of Changing Oceanic Conditions

Oceanic changes impacting water temperature and nutrient availability such as El Niño Southern Oscillation (ENSO), the Pacific Decadal Oscillation (PDO), and the North Pacific Gyre Oscillation (NPGO) can have profound effects on fishes and fisheries. Those effects can be very difficult or impossible to predict and oftentimes species-specific impacts are unclear. In the case of California Corbina, several studies have looked at power plant entrainment data to explore relationships with various environmental variables. Allen et al. (2003) and Jarvis et al. (2004) found a positive correlation between California Corbina impingement (caught in the in-take) rates and offshore sea surface temperatures with a 2 yr lag, however Miller et al. (2011) found a

negative correlation between California Corbina impingement rates and offshore sea surface temperatures (without a lag). More research is needed to understand how climate change may impact California Corbina distribution and abundance.

2 The Fishery

2.1 Location of the Fishery

In California, the California Corbina fishery ranges from Point Conception to the Mexico border. Recreational anglers fish for California Corbina with hook and line, mostly along sandy shores exposed to surf and sometimes within shallow bays.

2.2 Fishing Effort

2.2.1 Number of Vessels and Participants Over Time

Effort data for recreational fisheries in California are provided by the California Recreational Fisheries Survey (CRFS) estimates on all fishing modes available from the Recreational Fisheries Information Network (RecFIN) website. The annual number of beach/bank or manmade/jetty angler trips specifically targeting California Corbina cannot be calculated, but a more generalized approach to effort may be taken by considering the estimated number of angler trips occurring for modes that most commonly land California Corbina. An average of 249,903 angler trips per year from 2005 to 2017 were estimated for the beach/bank mode in southern California. The number of angler trips were below the average from 2005 to 2009 (Figure 2-1). No data are available for this mode in 2010 and 2011 due to decreased sampling effort. Angler trips remained above average from 2009 to 2017, with a peak of 425,503 estimated angler trips in 2012 and a low of 244,084 trips in 2015.

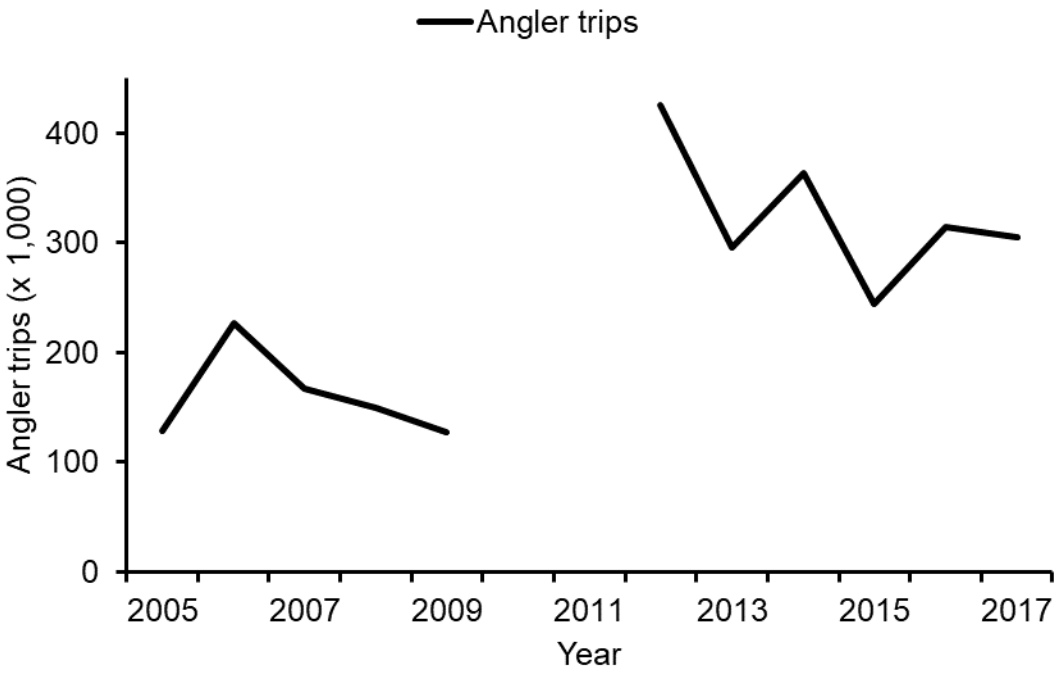

Figure 2-1. Estimated number of beach/bank based angler trips for 2005 to 2017 in southern California nearshore waters (RecFIN).

From 2005 to 2017, an average of 678,030 angler trips were made per year in southern California from the manmade/jetty mode. The estimated number of angler trips fluctuated above average from 2005 to 2012 (no year 2011 data available for this mode), with a peak in 2006 of 931,949 angler trips. There was a downward trend from 2009 to 404,131 angler trips in 2015 (Figure 2-2). Effort for this mode has begun to gradually increase from 2015 to 2017, but remains below average for the time series.

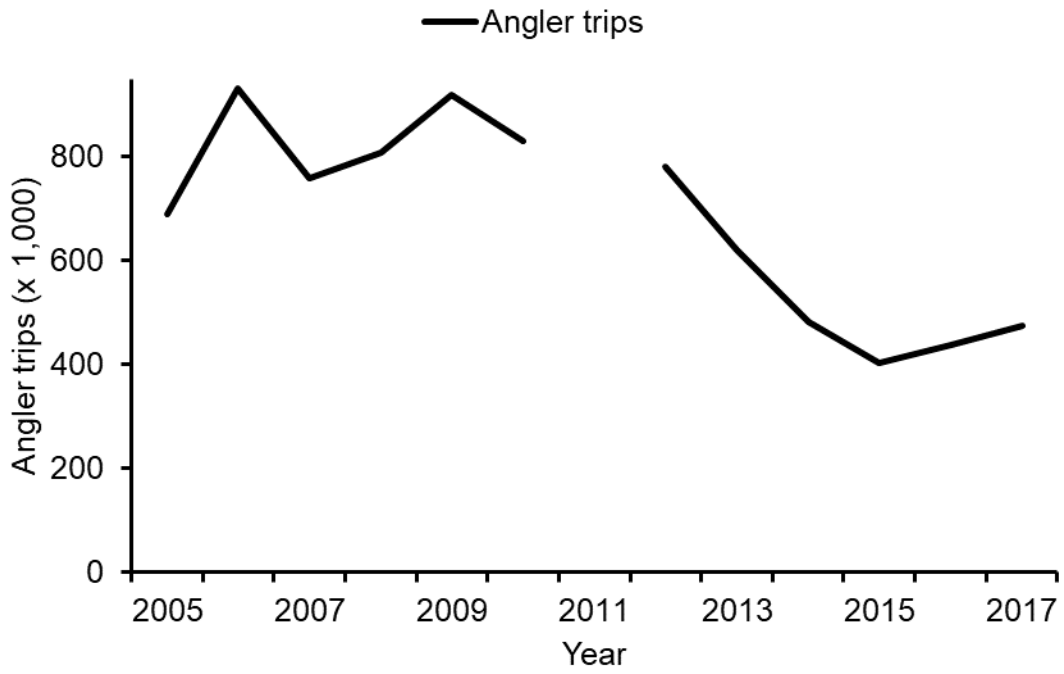

Figure 2-2. Estimated number of manmade/jetty based angler trips (solid line) for 2005 to 2017 in southern California nearshore waters (RecFIN).

2.2.2 Type, Amount, and Selectivity of Gear

California Corbina are caught using hook and line. Recreational anglers fishing from boat or shore may use any number of hooks and lines. On public piers, no person may use more than two rods and lines. Hook and line anglers typically use sand crabs, but worms, clams, and mussels are also used.

The most common size of California Corbina caught and retained by hook and line from 2013 to 2017 was 499 mm (20 in) Fork Length (FL) and the average size was 385 mm (15 in) FL (RecFIN). The smallest Department sampled retained fish was 134 mm (5 in) (RecFIN), though it may be possible that even smaller fish are caught using hook and line and then discarded.

2.3 Landings in the Recreational and Commercial Sectors

2.3.1 Recreational

Catch data for the recreational fishery are provided by the CRFS estimates on all fishing modes available from the RecFIN website. In southern California, California Corbina are caught year-round, but most commonly fished June through August (Figure 2-3).

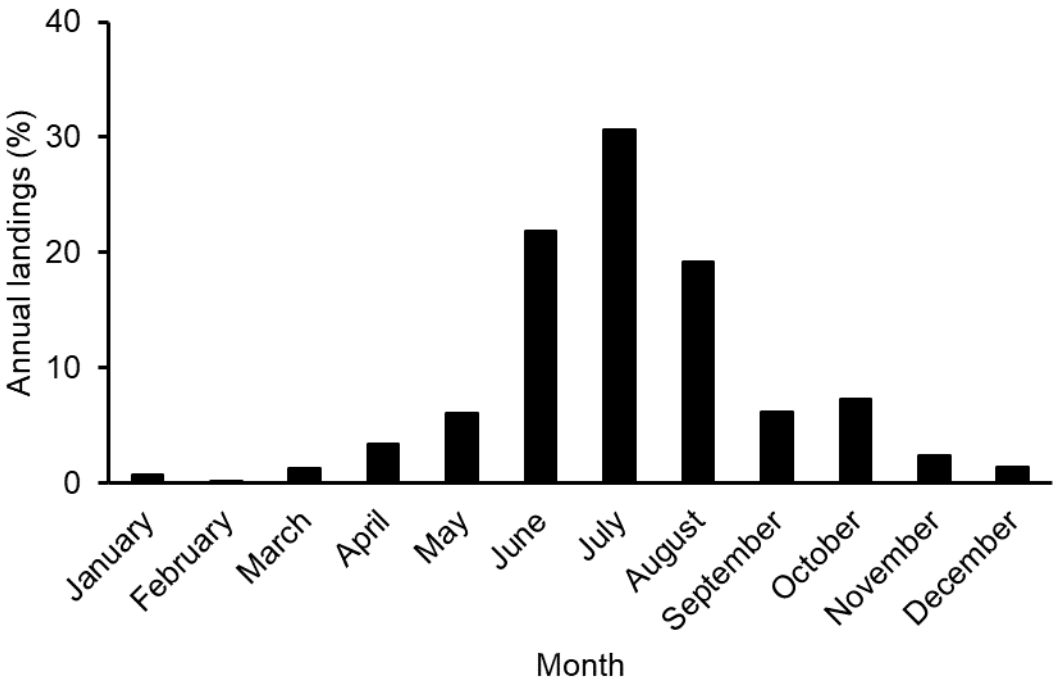

Figure 2-3. Proportion of yearly landings (kept fish) of California Corbina by month in southern California from 2005 to 2017 (RecFIN estimates of all fishing modes).

Saltwater anglers can fish from a variety of different modes, including from private and rental boats, shore, piers, jetties, and “party boats” (Commercial passenger Fishing Vessels (CPFVs)). Almost all California Corbina are landed from the beach/bank and manmade/jetty modes (Table 2-1).

Table 2-1. Percent of California Corbina catch (retained fish) in the recreational fishery by mode from 2004 to 2017 and the total number of California Corbina retained by all modes (RecFIN).

Fishing mode	Percent of catch
Beach/bank	54
Manmade/jetty	45
Private/Rental	1
Party/charter	0
Total Number of Fish Retained	203,307

From 2006 to 2013, the ranking of California Corbina harvested catch (kept fish) from the beach/bank and manmade/jetty modes relative to other finfish species in southern California declined from 14th to 33rd (Figure 2-4) (years 2010 and 2011 have been omitted due to reduced sampling effort for beach/bank and manmade/jetty modes). After 2013, California Corbina experienced an increase in ranking to 13th in 2016 and 2017 (Figure 2-4).

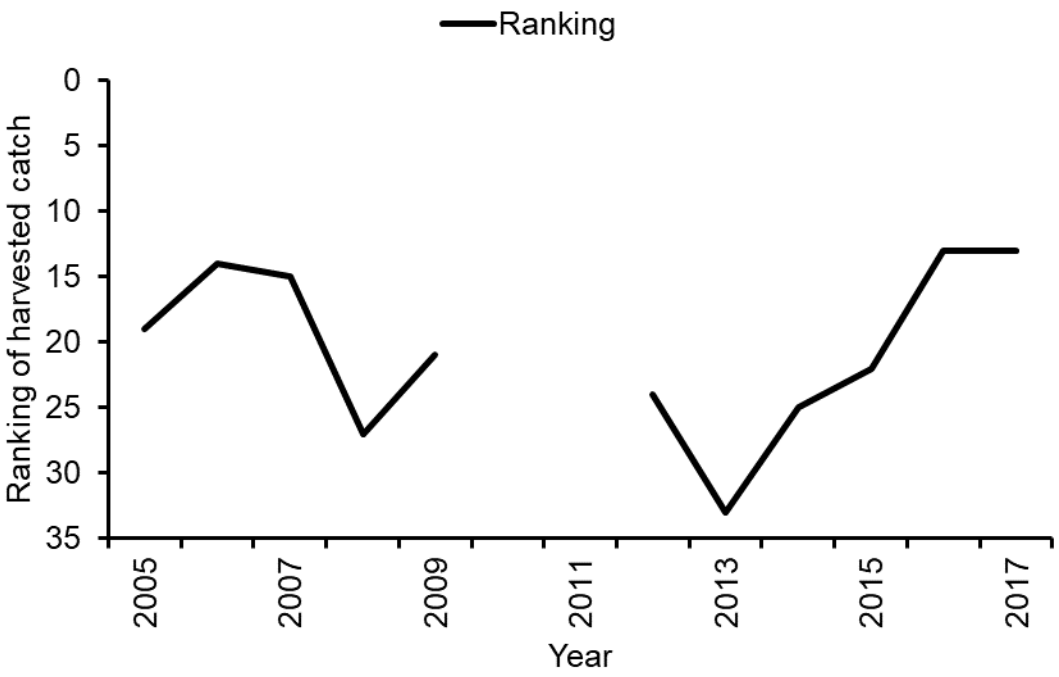

Figure 2-4. Ranking of California Corbina harvested catch (kept fish) estimates in beach/bank and manmade/jetty modes relative to other finfish species in southern California from 2005 to 2017 (RecFIN).

Annual trends in beach/bank landings estimates for California Corbina have varied greatly throughout the CRFS time series (Figure 2-5). Landings estimates ranged from 22,100 to 2,100 fish with an average of about 9,100 fish per year (no data for 2010 and 2011 because of decreased sampling effort). Landing trends generally vary along with fishing effort for the beach/bank mode (Section 2.2.1).

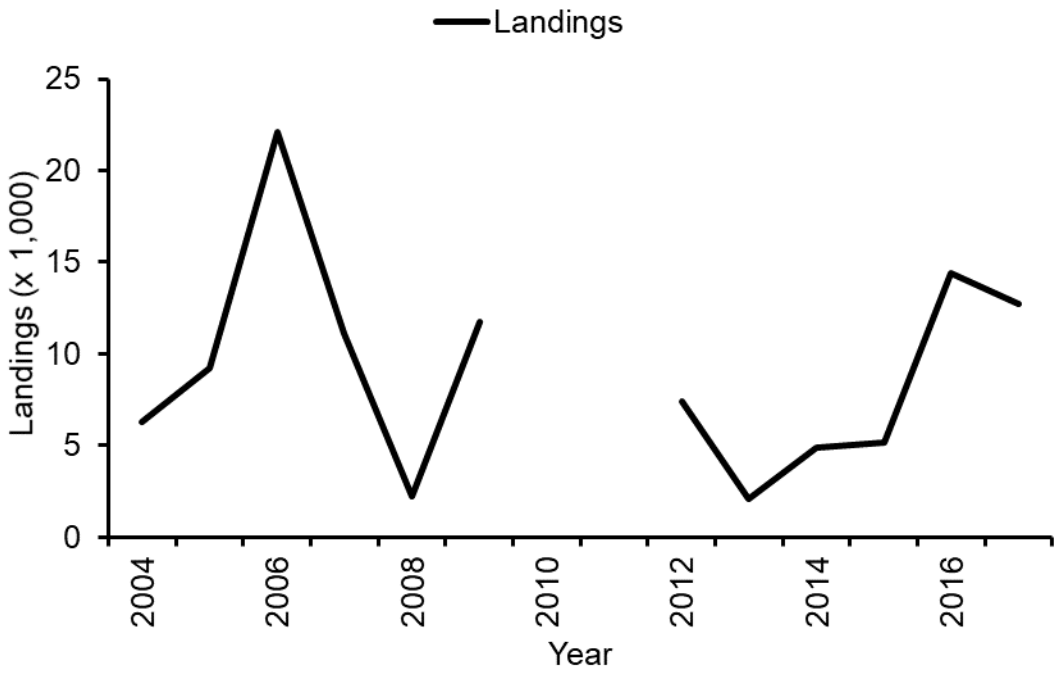

Figure 2-5. California Corbina annual landing (retained fish) estimates for beach and bank fishing mode from 2004 to 2017. Note that no sampling occurred in January 2015 or January through April 2017 (RecFIN).

Annual trends in manmade/jetty landing estimates for California Corbina exhibited an overall decline over the course of the CRFS time series (Figure 2-6). Landing estimates ranged between 22,600 and 10,000 fish with an average of about 7,000 fish per year (no data for 2011 because of decreased sampling effort). Landings dropped by about 85% from 2005 to 2008, followed by a more gradual decline through 2016 and a small increase in 2017. Landings tend to vary along with manmade/jetty fishing effort (Section 2.2.1).

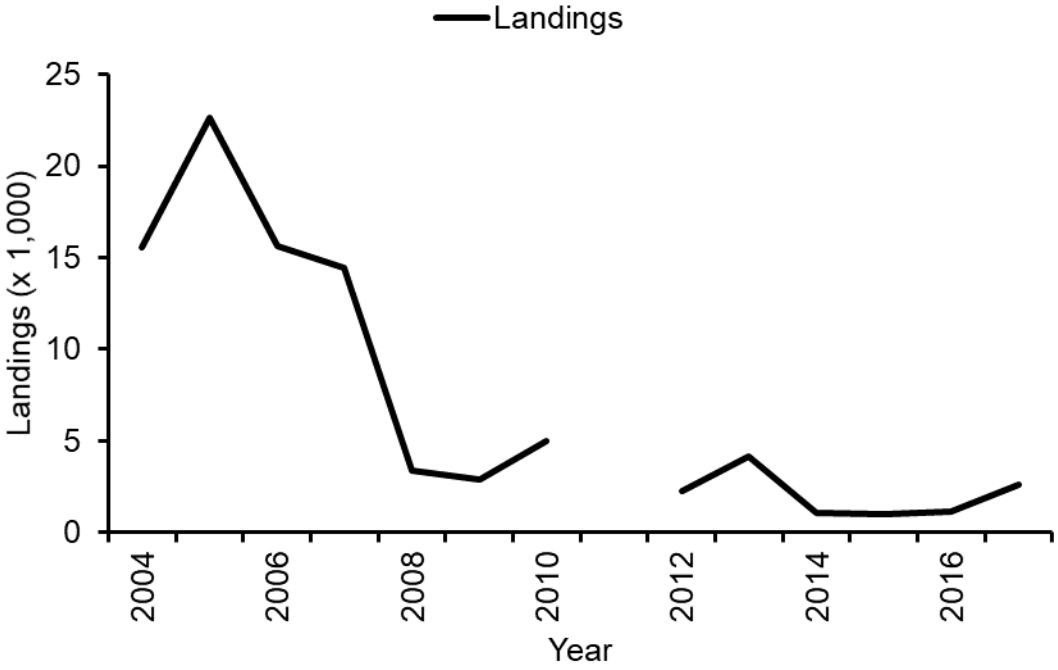

Figure 2-6. California Corbina annual landings (retained fish) for manmade/jetty fishing mode from 2005 to 2017 (RecFIN).

2.3.2 Commercial

A commercial fishery has not existed for California Corbina since 1915.

2.4 Social and Economic Factors Related to the Fishery

Marine recreational fishing in general supports the economy through the contributions of various local businesses and other indirect, fishing related expenditures. The total economic contribution generated for California in 2011 was roughly $2.8 billion and 10,000 jobs (Lovell et al. 2013). An official socioeconomic analysis has never been completed for California Corbina; however, this species is very popular with anglers fishing in the surf zone as well as from piers and jetties in southern California. Declines in California Corbina availability could negatively impact the southern California recreational fishing industry and other associated businesses (or other more available finfish species) if other, equally desirable fishing opportunities are not available.

In the Southern California Bight, health risks related to the consumption of seafood exist mainly due to the presence of dichloro-diphenyl-trichloroethane (DDT) and Polychlorinated Biphenyl (PCB) in the sediment (Schiff et al. 2000). As of 2018, the Office of Environmental Health Hazard Assessment continues to list health advisories related to the consumption of California Corbina: https://oehha.ca.gov/fish/advisories. Although the California Corbina fishery has a relatively high discard rate, fish kept for consumption may present a health risk to those members of the public if the consumption guidelines are not adhered to.

3 Management

3.1 Past and Current Management Measures

California Corbina may only be taken recreationally. The take of California Corbina with nets has been illegal since 1909 and the sale or purchase of this species has been illegal since 1915 (Skogsberg 1939). Since the commercial fishing ban, recreational take of California Corbina has been addressed under the general bag limit for finfish. There is no size limit for California Corbina.

3.1.1 Overview and Rationale for the Current Management Framework

The recreational California Corbina fishery is currently managed under the general finfish take (FGC §27.56) and limit (FGC §27.60) restrictions. Therefore, there are no closed seasons, closed hours, or size limits for California Corbina. Because there is a general 20 finfish bag limit and only ten finfish of any one species may be kept, by default the bag limit for California Corbina is ten fish. Bag limits are utilized to reduce the number of individuals that can be removed from the population.

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

The Department has not established overfishing criteria for the California Corbina fishery and a stock assessment and FMP have not been completed for the California Corbina resources. There is no specific trigger for making a regulation change in this fishery and any decision to re-evaluate the current management strategy is based on supporting evidence from multiple sources. Staff continue to monitor catch, effort, and size trends annually and these data are evaluated relative to historic trends and environmental factors. Specifically, declines in catch and CPUE, along with the truncation of several age classes relative to the size structure data from retained catch or an increase of the immature proportion of retained catch could all be trends that may warrant a management response. In the future, fishery modeling techniques may be applied to the California Corbina fishery that project stock status into the future, in which case poor future projections for this stock in addition to the previously mentioned indicators could also warrant a management response.

3.1.1.2 Past and Current Stakeholder Involvement

Due to the limited management attention on California Corbina to date, there has not been significant stakeholder involvement in the management of the fishery. However, if changes in management become necessary, the Department will work closely with stakeholders to understand their interests and draw upon their expertise.

3.1.2 Target Species

3.1.2.1 Limitations on Fishing for Target Species

3.1.2.1.1 Catch

Catch limitations for California Corbina are addressed under the general bag limit for finfish, whereas there are no regulations in place to specifically address this species. California Corbina therefore fall under the general bag and possession limit of ten fish for any one finfish species, unless otherwise specified.

3.1.2.1.2 Effort

There are no regulatory limits on effort where only a sport fishing license is required for recreational anglers not fishing off a pier.

3.1.2.1.3 Gear

California Corbina are taken only by hook and line. Recreational anglers fishing from boat or shore may use any number of hooks and lines. However, while on public piers, no more than two lines may be used.

3.1.2.1.4 Time

The California Corbina fishery is open year-round with no limits on the time of day when fishing can occur.

3.1.2.1.5 Sex

Both sexes of California Corbina may be taken in the fishery since it is not possible to determine sex externally.

3.1.2.1.6 Size

There are no regulatory limits on the size of California Corbina landed in the recreational fishery.

3.1.2.1.7 Area

Aside from Marine Protected Areas (MPAs), there are no limitations on where fishing can occur for California Corbina.

3.1.2.1.8 Marine Protected Areas

Under the direction of the Marine Life Protection Act of 1999, the Department redesigned and expanded a network of regional MPAs in state waters from 2004 to 2012. The resulting network increased total MPA area from 2.7% to 16.1%. Along with the MPAs created in 2002 for waters surrounding the Santa Barbara Channel Islands,

California now has a scientifically designed statewide network of 124 MPAs. The MPAs contain a wide variety of habitats and depth ranges.

MPAs in southern California can benefit temperate reef fish populations that are targeted by commercial and/or recreational fisheries as evidenced by increased average density, size, biomass, and egg production inside the reserves (Tetreault and Ambrose 2007). Although the MPA network was not designed to benefit specific species such as California Corbina, the network does protect some of their primary and secondary habitat types, including 14% of sandy or gravel beaches and 8.6% of shallow soft bottom habitats in southern California. No studies specific to California Corbina have been conducted to analyze MPA effects, but given that a relatively small proportion of their potential habitat is protected by MPAs and the high probability that California Corbina do not travel far (Baxter 1980), the current network of MPAs in southern California likely provides some protection for California Corbina. For more information on the specific Southern California MPAs, visit https://www.wildlife.ca.gov/conservation/marine/mpas/network/southern-california.

3.1.2.2 Description of and Rationale for Any Restricted Access Approach

The California Corbina fishery is an open access fishery.

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”. Discards are 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, are desirable and are thus retained as incidental catch, and does not always indicate a negative impact.

To assess the most commonly caught species with California Corbina, all beach/bank and manmade/jetty angler trips that were sampled by CRFS and where at least one California Corbina was caught, were analyzed. Because all anglers fishing from these modes are not required to submit logs, these data are not as precise as those for modes with that requirement (e.g. CPFVs), but still represent the best available data.

The most common species caught in 2017 on beach/bank and manmade/jetty angler trips where California Corbina were caught included Yellowfin Croaker, Pacific Mackerel, unspecified croaker species, Shovelnose Guitarfish, Spotfin Croaker, Barred Sand Bass (*Paralabrax nebulifer*), Leopard Shark, Walleye Surfperch, California Scorpionfish (*Scorpaena guttata*), and Sargo (*Anisotremus davidsonii*) (Table 3-1). Note that most of these species are also associated with nearshore, sandy surf zone habitat in southern California (Section 1.4.1). Other species such as Barred Sand Bass, California Scorpionfish, and Sargo (Table 3-1) can be caught off piers and/or jetties, where anglers target California Corbina along with many other possible species. All species listed in Table 3-1 have state and/or federal management measures in place,

though some species (Shovelnose Guitarfish and Sargo) do not have species specific regulations and are managed under the general recreational finfish restrictions. No species whose take is prohibited or of special concern were caught with California Corbina on these evaluated CRFS sampled angler trips.

Table 3-1. Number caught and percent of trips (frequency of occurrence) for the top ten most abundant species on beach/bank and manmade/jetty trips (n=48) where at least one California Corbina was also caught in 2017 (RecFIN 2018).

Species	Number caught	Percent of trips	Number of California Corbina caught on associated trips
California Corbina	73	100	73
Yellowfin Croaker	29	25.8	25
Pacific Mackerel	20	3.2	1
Croaker unspecified	7	3.2	3
Shovelnose Guitarfish	6	12.9	16
Spotfin Croaker	5	12.9	8
Barred Sand Bass	4	6.5	5
Leopard Shark	4	3.2	1
Walleye Surfperch	4	3.2	2
California Scorpionfish	3	3.2	2
Sargo	3	3.2	2

Catch and release rates of the target species are relatively high in the California Corbina fishery, with an average of 51% of California Corbina being released between 2004 and 2017 according to CRFS estimates (RecFIN). The estimated total number of discards in the manmade/jetty mode generally decreased over the course of the CRFS time series (no 2011 data are available due to decreased sampling effort), with a high of about 13,800 fish in 2005 to a low of about 500 fish in 2016 (Figure 3-1). The annual discard estimates for the beach/bank mode fluctuated widely from 2004 to 2017 (no 2010 or 2011 data are available due to decreased sampling effort); the number of discards peaked around 32,600 fish in 2005 and was lowest in 2008 when no discards were recorded (Figure 3-2). This corresponds with very low landings in the same year (Figure 2-5). Despite the roughly equal distribution in estimated retained catch between the two modes, beach/bank-based anglers appear to discard more California Corbina overall then manmade/jetty based anglers.

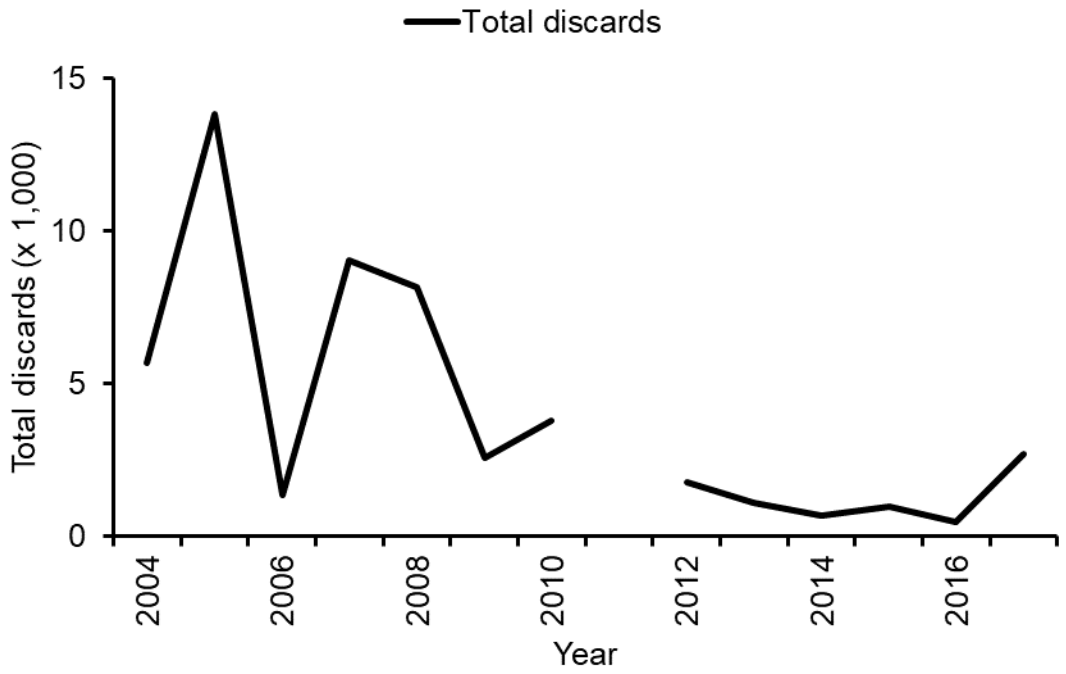

Figure 3-1. Annual trends in bycatch of California Corbina presented as the estimated total number of discards for manmade/jetty anglers from 2004 to 2017 (RecFIN 2018).

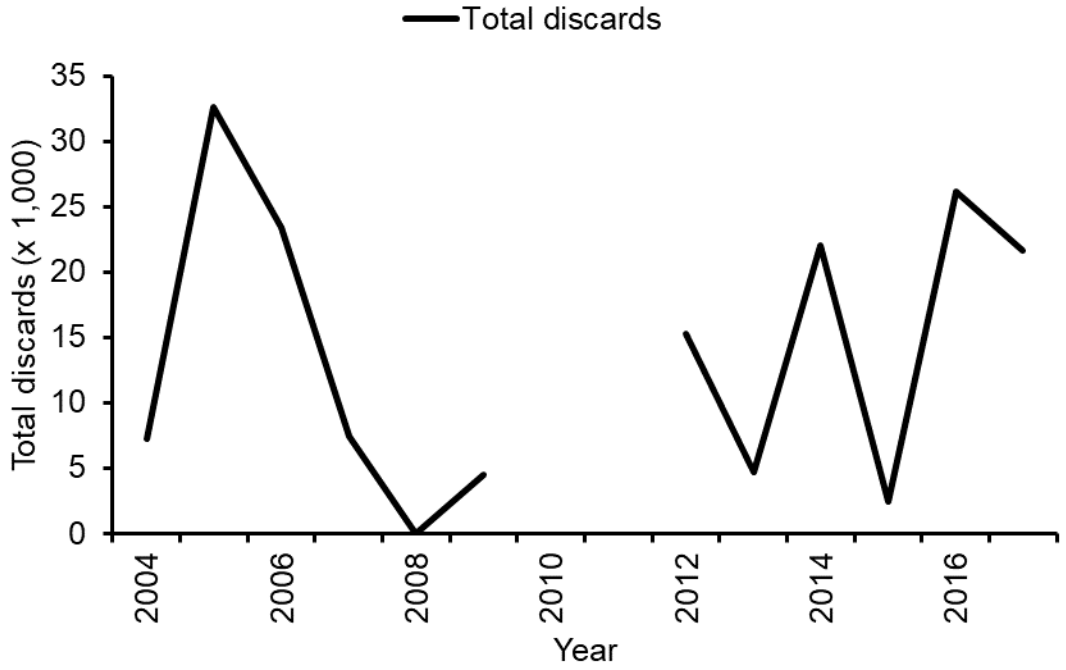

Figure 3-2. Annual trends in bycatch of California Corbina presented as the estimated total number of discards for beach/bank anglers from 2004 to 2017 (RecFIN 2018).

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

Given that it is a recreational fishery, anglers are often targeting a suite of other fishes as well as California Corbina. With such a high discard rate of California Corbina, there may be cause for concern if discard mortality is high. As of 2019, California discard mortality rates are unknown, however, unlike other croaker species, California Corbina do not have a swim bladder and are caught in shallow waters, which eliminates concern over barotrauma induced discard mortality. Nevertheless, several other factors related to catch and release fishing practices along with the hardiness of the species could affect post-release mortality and more research is needed. While bycatch information is limited for this fishery, there are currently no concerns about the impact of bycatch on the sustainability of any other stocks, and there are no measures specific to California Corbina in place to reduce bycatch.

3.1.4 Habitat

3.1.4.1 Description of Threats

Southern California is densely populated and its habitats are subject to adverse impacts from several anthropogenic sources, such as inputs from urban runoff, oil platforms, waste water treatment facilities, and hazardous material spills (Schiff et al. 2000). Sandy beach habitat can be polluted with contaminants that settle into the sediment or remain circulating within the water column. However, the effects are unclear because studies analyzing sediment are usually collected farther offshore and water samples are either collected in harbors or outside of the surf zone. Sand loss also occurs as a result of coastal development. In some cases, sand is moved from other locations to fill in beaches.

The California Corbina fishery is primarily a shore-based hook and line recreational fishery. Adverse impacts of this fishery on California Corbina habitat is most likely insignificant in this high-energy environment. In most southern California sandy beach habitat where California Corbina are targeted, there is little structure present to pose a risk of snagging and gear lose.

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

The impacts of a hook and line fishery on any habitat is likely very minor and thus measures to minimize them have not been developed.

3.2 Requirements for Person or Vessel Permits and Reasonable Fees

Unless recreationally fishing off a public pier, all anglers 16 yr old or older are required to purchase a fishing license. 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 license. 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 may be accessed at https://www.wildlife.ca.gov/Licensing/Fishing.

Table 3-2. Annual Department sport fishing license fees from January 1 to December 31, 2019 (CDFW).

License	Fee	Description
CPFV 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.
Non-resident sport fishing	$134.74	Required for any non-resident 16 yr of age or older to fish.
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 1 or 2-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 is only available at CDFW License Sales Offices.

4 Monitoring and Essential Fishery Information

4.1 Description of Relevant Essential Fishery Information

FCG §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". A limited number of studies are available on life history EFI for California Corbina as described in Section 1, including age and growth, diet composition, and size at maturity. This section summarizes the EFI that is routinely collected and used to monitor the health of the stock and ecosystem. The Department relies on a combination of fishery-dependent and fishery-independent sources to monitor the status of the California Corbina fishery.

4.2 Past and Ongoing Monitoring of the Fishery

4.2.1 Fishery-dependent Data Collection

Fishery-dependent data collected by the Department provides an excellent way to monitor fishing effort, catch levels, and the size structure of retained California Corbina. Fishery-dependent data are collected from CPFV logbooks and from all fishing modes sampled by the CRFS. Both CRFS data CPFV logbooks collected by the Department contribute valuable estimates of catch and effort that help staff monitor the status of many finfish stocks, but because California Corbina are rarely caught aboard CPFVs, Department staff rely heavily on CRFS data.

All modes of recreational fishing were surveyed by the Marine Recreational Fisheries Statistics Survey (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 methods.

Current RecFIN 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. Estimates from CRFS and MRFSS are not directly comparable due to differences in methodology, so only CRFS data are presented in this report. CRFS data on catch estimates and mortality are available electronically to the public within 40 days of collection on the updated RecFIN website (https://www.recfin.org).

4.2.2 Fishery-independent Data Collection

Fishery-independent data can provide a better, less-biased assessment of relative abundance because sampling can be standardized and information on all life

stages can be collected. No fishery-independent data sets that could provide an index of abundance for California Corbina are available on a continual, annual scale. There have been some ‘snapshot’ studies on the open coast in southern California that analyzed whole fish assemblages in various years and they included California Corbina (Carlisle et al. 1960; CDFW unpublished data), but a continual monitoring program would be most useful for analysis of trends in abundance. Records of fish entrainment in the cooling water intakes of southern California’s coastal electric generating stations provided a useful dataset from 1979 to 2010 (Miller et al. 2011). However, these data became unavailable after 2012 following the shutdown of major power plants like San Onofre Nuclear Generating Station.

5 Future Management Needs and Directions

5.1 Identification of Information Gaps

Additional EFI data are necessary for effectively monitoring the California Corbina resource. A long-term fishery-independent monitoring program that is conducted in surf zone habitat could provide an index of abundance on an annual basis (Table 5-1). Growth parameters such as k, Linf, and t0 are needed and are presently being calculated by Department staff.

Table 5-1. Informational needs for California Corbina and their priority for management.

Type of information	Priority for management	How essential fishery information would support future management
Index of abundance	Low	Index used as an indicator of stock status.
Post-release mortality (initial, short, and long term)	Medium	Quantifying discard mortality is necessary for a more accurate estimate of overall fishing mortality. It is especially important for species that already are, or may be considering, a minimum size limit as a management tool.
Calculate growth parameters: k, L_∞, t_0	Medium	Growth parameters used to estimate age at length when catch at age data are not available. Parameters are utilized in stock assessments and when modeling forward projections of the fishery.
Estimate of natural mortality	Medium	Natural mortality estimates are used in the calculation of total mortality. Estimated total mortality rates are utilized in stock assessments and when modeling forward projections of the fishery.
Fecundity	Medium	Number of eggs produced per individual annually can be used to estimate spawning potential.
Genetics	Low	Information used to assess the connectivity of populations and the degree of vulnerability of the species based on local population genetic profiles.
GIS analysis	Low	Information used to determine what percentage of catch occurs in each habitat type. This helps to evaluate new MPAs relative to historic fishing.

5.2 Research and Monitoring

5.2.1 Potential Strategies to Fill Information Gaps

Department staff will continue to utilize CRFS data to monitor California Corbina fishery trends. The Department will also continue to search for and incorporate any relevant results from other fishery-dependent or fishery-independent studies conducted

by others. As mentioned above, additional fishery-independent indices of abundance for California Corbina will be important for monitoring future trends in the stock. This may require a combination of efforts led by the Department and independent researchers through various grants or other funding sources. Studies could include a discard study to assess post-release mortality, regular surveys of the surf zone fish fauna to provide a fishery-independent index of abundance, or the collection of gonads to calculate fecundity.

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-government organizations, citizen scientists, and both commercial and recreational fishery participants to help fill information gaps related to the management of state fisheries. Please refer to Section 5.1 to identify potential areas for collaboration. 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 California Corbina. Several of the information gaps identified above (Section 5.1) are potential areas for collaboration. In particular, a post-release mortality study and more regular sampling of the surf zone to provide an index of abundance could be studies appropriate for collaborative work, potentially involving both anglers and academic entities.

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.

The Department is currently prioritizing fisheries within the Master Plan Update, which could potentially affect how the California Corbina fishery is managed. Presently, there are no plans for future management changes specifically for California Corbina because recreational take appears to be at sustainable levels. However, because anglers are retaining sublegal individuals (Figure 1-2), a minimum size limit could offer more protection if discard mortality is determined not to be an issue.

5.4 Climate Readiness

To make the management of California Corbina climate-ready, 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 the ENSO, the PDO, and the NPGO. Climate change will bring even further uncertainty to these trends, with potentially extreme implications for ecosystem function and fishery

sustainability in coastal areas. Climate change that results in warmer ocean temperatures could have either positive or negative effects on California Corbina populations, depending on what other factors are acting on the stock at the time of the episodic event. To manage California Corbina 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. Protecting the health of the primary habitat for California Corbina, sandy surf zone beaches in southern California, is a priority for climate readiness.

Literature Cited

Allen LG, Findlay AM, Phalen CM. 2002. Structure and standing stock of the fish assemblages of San Diego Bay, California from 1994 to 1999. Southern California Academy of Sciences. Bulletin 101(2): 49-85

Allen MJ, Smith RW, Jarvis ET, Raco-Rands V, Bernstein B, Herbinson K. 2003. Temporal trends in southern California coastal fish populations relative to 30-year trends in oceanic conditions. Southern California Coastal Water Research Project 2004: 264-285.

Baxter JL. 1980. Inshore fishes of California. 5th rev. California Department of Fish and Game, Sacramento. 72 p.

California Department of Fish and Game (CDFG). 2013. Status of the Fisheries Report: An Update Through 2011. Chapter 9 California Corbina, *Menticirruhus undulatus*. 9-1 p.

Calisle Jr. JG, Schott JW, Abramson NJ. 1960. The barred surfperch (*Amphistichus argenteus* Agassiz) in southern California. California Fish and Game Fish Bulletin 109. 79 p.

Feder HM,Turner CH, Limbaugh C. 1974. Observations on fishes associated with kelp beds in Southern California. California Fish and Game Fish Bulletin 160. 144 p.

Jarvis ET, Allen MJ, Smith RW. 2004. Comparison of recreational fish catch trends to environment-species relationships and fishery-independent data in the Southern California Bight, 1980-2000. CALIFORNIA COOPERATIVE OCEANIC FISHERIES INVESTIGATIONS REPORT 45: 167.

Joseph DC. 1962. Growth characteristics of two Southern California surffishes, the California corbina and spotfin croaker, Family Sciaenidae California Fish and Game Fish Bulletin 119: 1-54.

Kells VA, Rocha LA, Allen LG. 2016. A Field Guide to Coastal Fishes: From Alaska to California. Baltimore, Maryland: Johns Hopkins University Press. 448 p.

Limbaugh C. 1955. Fish life in the kelp beds and the effects of kelp harvesting. Institute of Marine Resources Reference. 55-9.

Love MS. 2011. Certainly More Than You Want to Know About the Fishes of the Pacific Coast: A Postmodern Experience. Santa Barbara, CA: Really Big Press. 672 p.

Lovell SJ, Steinback SR, Hilger JR. 2013. The economic contribution of marine angler expenditures in the United States, 2011. National Marine Fisheries Service (NMFS) Technical Memorandum NMFS-F/SPO-134: 1-196.

Miller DJ, Lea RN. 1972. Guide to the coastal marine fishes of California. California Fish and Game Fish Bulletin 157. 255 p.

Miller EF, Beck DS, Dossett W. 2008. Length-weight relationships of select common nearshore southern California marine fishes. Bulletin, Southern California Academy of Sciences 107(3): 183-186.

Miller EF,Pondella DJ,Beck DS, Herbinson KT. 2011. Decadal-scale changes in southern California sciaenids under different levels of harvesting pressure. ICES Journal of Marine Science: Journal du Conseil 68(10): 2123-2133.

O'Brien J, Valle C. 2000. Food habits of California corbina in southern California. California Fish and Game 86(2): 136-148.

Schiff KC, Allen MJ, Zeng EY, Bay SM. 2000. Southern California. Marine Pollution Bulletin 41(1-6): 76-93.

Skogsberg T. 1939. The fishes of the family Sciaenidae (croakers) of California. California Fish and Game Fish Bulletin 54. 62 p.

Tetreault I, Ambrose RF. 2007. Temperate marine reserves enhance targeted but not untargeted fishes in multiple no-take MPAs. Ecological Applications 17(8): 2251-2267.

Then AY, Hoenig JM, Hall NG, Hewitt DA. 2015. Evaluating the predictive performance of empirical estimators of natural mortality rate using information on over 200 fish species. ICES Journal of Marine Science 72: 82-92.

Williams CM, Williams JP, Claisse JT, Pondella DJ, Domeier ML, Zahn LA. 2013. Morphometric relationships of marine fishes common to central California and the southern California bight. Bulletin, Southern California Academy of Sciences 112(3): 217-227.