Shiner Perch, *Cymatogaster aggregata*,
Enhanced Status Report

Shiner Perch, *Cymatogaster aggregata.*
(Photo Credit: Ed Roberts, CDFW).

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Enhanced Status Reports

The Marine Life Management Act (MLMA) is California's primary fisheries law. It requires the California Department of Fish and Wildlife (Department) to regularly report to the California Fish and Game Commission (Commission) on the status of fisheries managed by the state. The 2018 Master Plan for Fisheries expanded on this general requirement by providing an outline for Enhanced Status Reports (ESRs) that is based on the MLMA's required contents for Fishery Management Plans (FMPs). The goal of ESRs is to provide an overview of the species, fishery, current management and monitoring efforts, and future management needs, and provide transparency around data and information that is unavailable or unknown. ESRs can help to guide Department efforts and focus future partnerships and research efforts to address information gaps and needs to more directly inform management. It is also anticipated that some ESRs will be foundations for future FMPs by providing background information and focusing analyses and stakeholder discussions on the most relevant issues.

Note that in order to describe management measures in clear terms, ESRs contain summaries of regulatory and statutory language. To ensure full compliance with all applicable laws and regulations, please refer directly to the relevant sections of the Fish and Game Code and/or Title 14 of the California Code of Regulations.

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List of Acronyms

APA	Administrative Procedures Act
BB	Beach/Bank
CCR	California Code of Regulations
CDFW	California Department of Fish and Wildlife
CFIS	Commercial Fisheries Information System
CPUE	Catch Per Unit Effort
CRFS	California Recreational Fisheries Survey
EFI	Essential Fishery Information
ESR	Enhanced Status Report
FIS	Fishery Independent Survey
FGC	Fish and Game Code
FL	Fork Length
FMP	Fishery Management Plan
MLDS	Marine License Data Base
MLMA	Marine Life Management Act
MLPA	Marine Life Protection Act
MM	Man-Made
MPA	Marine Protected Area
MRFSS	Marine Recreational Fisheries Statistics Survey
MSI	Marine Science Institute
NOAA	National Oceanic and Atmospheric Administration
NGO	Non-Governmental Organization

ONI	Oceanic Niño Indices
PPT	Parts Per Thousand
RecFIN	Recreational Fisheries Information Network
SL	Standard Length
TL	Total Length
YOY	Young of the Year

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Fishery-at-a-Glance: Shiner Perch

Scientific Name: *Cymatogaster aggregata*

Range: Shiner Perch range from Saint John Baptist Bay, Alaska to Bahia San Quintin, Baja California.

Habitat: Shiner Perch occupy a wide range of habitats including kelp, eelgrass, surf grass, rocky reefs, sandy bottoms, man-made structures, and the open coast. They are common in marine and estuarine waters and tolerate a wide salinity range.

Size: Shiner Perch have been reported to 8 inches TL (203 millimeters). A 6.75 inch (171.5-millimeter) pregnant female was recorded weighing 3 ounces (85 grams).

Life span: Shiner Perch live to 6 years—males have been aged to 3 years and females to 6 years.

Reproduction: Males reach sexual maturity soon after birth while females are reproductive at age 1. Shiner Perch mate in the summer; the sperm remains dormant within the ovaries while the eggs develop. When the eggs fully develop during the winter, the sperm activates, and fertilization occurs in the winter. The females give birth the following spring and summer in shallow nearshore, bay, and estuarine waters. Females produce from 2 to 25 embryos in California and up to 36 in Canada.

Prey: Shiner Perch are omnivores foraging on algae, detritus, and zooplankton as juveniles and adults. Adults feed primarily on zooplankton, crustaceans, polychaetes, mollusks, larval fish, and fish eggs.

Predators: A wide range of predatory marine mammals, birds, and larger fish forage on all life stages.

Fishery: Shiner Perch are taken and used as live bait primarily in San Francisco and Tomales bays. Most Shiner Perch are caught by anglers on man-made structures (jetties and piers) throughout their range.

Area fished: The most recent commercial Shiner Perch landings originated from Tomales and San Francisco bays; historically, they were landed in the Morro Bay area. No Shiner Perch fish tickets were received in 2018.The sport fishery occurs statewide.

Fishing season: There are no seasonal closures for commercial or sport fisheries. The seasonal commercial and sport closures for other surfperch do not apply to Shiner Perch.

Fishing gear: Commercial gear used for taking Shiner Perch includes trap, hook and line, and beam trawl. Sport fishermen use baited traps, dip nets, hoop nets, cast nets (north of Point Conception), and hook and line to take Shiner Perch.

Market(s): The primary market for Shiner Perch is for live bait; they have limited commercial value as food fish due to their small size.

Current stock status: Abundance indices from commercial and recreational fisheries as well as fisheries independent surveys show declines from averages in recent years.

Management: Presently, the Department of Fish and Wildlife (Department) does not anticipate implementing new regulations for the commercial or recreational Shiner Perch fisheries. There are no commercial seasonal closures or landing restrictions—a daily bag limit of 20 is in effect for sport anglers. Based on the available data, it does not appear that immediate management interventions are needed.

The Species

1.1. Natural History

1.1.1. Species Description

Shiner Perch (*Cymatogaster aggregata*), is a member of the surfperch family Embiotocidae, which is composed of 23 species, 18 of them occurring in California's coastal waters. Members of this family are commonly called surfperch, seaperch, and perch. Members of the sub-family, Embiotocinae, which include Shiner Perch, are associated with rocky substrates, kelp beds, man-made structures such as pier pilings, and estuaries. In California, this subfamily is represented by Tule Perch, (*Hysterocarpus traskii*), Reef Perch, (*Micrometrus aurora*), Dwarf Perch, (*M. minimus*), Pink Seaperch, (*Zalembius rosaceus*), Rubberlip Seaperch, (*Rhacochilus toxotes*), Pile Perch, (*R. vacca*), Sharpnose Seaperch, (*Phanerodon atripes*), White Seaperch, (*P. furcatus*), Rainbow Seaperch, (*Hypsurus caryi*), Black Perch, (*Embiotoca jacksoni*), Striped Seaperch, (*E. lateralis*) and Kelp Perch, (*Brachyistius frenatus*). *B. aletes* (common name unknown) may be a sister species of *B. frenatus* (Longo and Bernardi 2015).

Embiotocids can be identified by their compressed, elliptical outline with a furrow along either side of the dorsal fin, continuous spinous and soft dorsal fin, and forked tail. Shiner Perch are the archetype when describing a fish as "perch-like." They are typically silvery with three yellow vertical bars on each side with black spotting (Figure 1-1).

Figure 1-1. Shiner Perch. (Photo credit: Ed Roberts, CDFW). During the breeding season, male Shiner Perch may exhibit dusky coloration as shown below (Figure 1-2).

Figure 1-2. Male Shiner Surfperch exhibiting mating coloration. Note the thickened base of the anal fin (Photo credit: Ed Roberts, CDFW).

1.1.2. Range, Distribution, and Movement

Shiner Perch range from Saint John Baptist Bay, Alaska to Bahia San Quintin, Baja California (Figure 1-3) (Miller and Lea 1972; Love 2011). They appear to be abundant throughout their range in shallow nearshore areas and in bays and estuaries from tide pools and the surf zone to 480 feet (ft) (146 meters (m)) (Love 2011). Shiner Perch tolerate salinities from 0 to 35 parts per thousand (ppt) but are more abundant in waters greater than 10 ppt. Information regarding Shiner Perch coastal migration, i.e., tag recovery studies, are lacking in the literature. Bane and Robinson (1970) observed that most of the juveniles and 1-year-old adults remain in Newport Bay in their first year and migrate to coastal waters when they are 2 years old. Ganssle (1966) and Aplin (1967) found that young are common in San Francisco Bay and San Pablo Bay in the summer and fall months.

Generally, Shiner Perch are found in greater abundance in bays and estuaries during the spring and are noted in deeper water in the winter (Hart 1973; Odenweller 1975; Horn 1980; DeLeón 1999). In San Francisco Bay, Shiner Perch typically migrate from shallow flats to channels in the fall and winter based on catch per unit effort (CPUE) from trawl surveys (Fish et al. 2012). In Canada, Shiner Perch were commonly caught by shrimp trawlers operating between 10 to 40 fathoms (fm) in winter (Clemens and Wilby 1961).

Figure *1*-3. Range of Shiner Perch. (Google Earth Pro. Accessed October 2, 2019).

1.1.3. Reproduction, Fecundity, and Spawning Season

Shiner Perch are viviparous. Mating occurs in protected waters of bays and estuaries in late spring and summer (Clemens and Wilby 1961; Wilson and Millemann 1969; Odenweller 1975; DeLeón 1999). Females may retain sperm from multiple partners until the winter when the eggs ripen and are fertilized. Gestation occurs for 5 to 6 months—females migrate onto shallow flats from June to August to give birth and

mate—as early as May in southern California (Clemens and Wilby 1961; Odenweller 1975; Horn 1980; DeLeón 1999; Love 2011). Fecundity ranges from two to 25 neonates in California; however, up to 36 were reported in Canada (Clemens and Wilby 1961; Wilson and Millemann 1969; Odenweller 1975; Darling et al. 1980; Baltz 1984; Love 2011). Shiner Perch sexually mature shortly after parturition; male and female young of the year (YOY) may be sexually mature at parturition. Sexual maturity of the females and the number of embryos produced may be size dependent (Wilson and Millemann 1969). Anderson and Bryan (1970) detected the presence of a bulbous anal fin displayed by males, as described by Carlisle et al. (1960), “at or shortly after birth.”

1.1.4. Natural Mortality

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

Natural mortality has never been directly studied in Shiner Perch. Directly observing natural mortality rates in wild populations is certainly the most reliable method; however, these studies are difficult to implement (Jorgensen and Holt 2013). Applying empirical estimators to life history parameters using Hoenig’s method (Hoenig 1983) and Then et al. 2015 were used to calculate a natural mortality estimate of 0.705 and 0.949, respectively, using a maximum reported age of 6 for Shiner Perch.

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 and invertebrates but slows as adults approach their maximum size. The von Bertalanffy Growth Model is most often used in fisheries management, but other growth functions may also be appropriate.

Shiner Perch is among the smaller members of the Embiotocidae reaching a maximum length of 8 inches (in) (203 millimeters (mm) total length (TL)). Odenweller (1975) described length-weight relationships from 230 Shiner Perch randomly sampled in Anaheim Bay, California:

$$W = 4.91 \text{ x } 10^{-4}\ L^{3.05},\ or$$

$$\text{Log } W = 3.05 \text{ Log } L + 5.69119\text{-}10$$

where *W* = weight after preservation, and *L* = length after preservation. The equation complies with the formula $W = aL^b$ given in Ricker (1958), and

the power term (b = 3.05) indicates isometric growth.

Wilson and Millemann's (1969) samples of newly parturated young ranged in average length from 2.23 centimeters (cm) TL in May to 4.37 cm TL in July. Mean lengths of Odenweller's (1965) samples were: first year fish 56.8 mm standard length (SL) (2.2 in); second year fish 87.8 mm SL (3.5 in), and third year fish 100.6 mm SL (3.96 in). A logarithmic transformation of these data was plotted, a fitted line was produced, and expressed by the equation:

$$\text{Log } Y = 8.82 \text{ Log } X\text{- Log } 17.14$$

At birth, young range between 1.7 to 3.6 cm SL (0.7 to 2 in) (Odenweller 1975; Love 2011) which directly related to female parent size (Wilson and Millemann 1969). Wilson and Millemann (1969) determined embryo to female parent lengths (FL) and weight:

$$Y = 24.211 + 1.620\ X,\ (r = 0.79);\ \text{and}\ Y = 0.384 + 0.015\ X,\ (r = 0.72).$$

The equation computed for the relationship of embryo weight (*Y*) to embryo length at birth is:

$$Y = \text{-}2.266 + 0.712\ X,\ (r = 0.95).$$

1.1.6. Size and Age at Maturity

Both sexes of Shiner Perch reach sexual maturity shortly after birth (Clemens and Wilby 1961; Wilson and Millemann 1969; Shaw 1971; Hart 1973; Odenweller 1975). However, Hart (1973) reported that females do not breed until age 1 and 99% were gravid at age 2. Shaw (1971) noted that 5- to 6-cm males became sexually mature and 4- to 6- cm females were found to have received spermatozoa.

1.2. Population Status and Dynamics

No formal stock assessment has been conducted on Shiner Perch. Data from fishery dependent and independent sources indicate recent declines. However, fishery dependent indices such as commercial fishery landings and CPUE must be considered with care if used as indicators of abundance. Factors that may be

unrelated to abundance, such as market or regulatory changes, gear improvements, or hyperstability, may act to confound conclusions regarding the true status of stocks. Embiotocids in general have low spawning potential rates; however, Shiner Perch sexually mature shortly after birth promoting stock recovery following periods of low abundance or if an incoming year class strength is weak (Pikitch et al. 2012).

1.2.1. Abundance Estimates

The Department has several active data streams for Shiner Perch. Existing databases include a combination of fishery dependent and fishery independent sources that can be used for stock evaluation. These sources include the following: estimated recreational catch and effort, provided by the California Recreational Fisheries Survey (CRFS); commercial fish tickets from California Fisheries Information System (CFIS), which in 2018 were incorporated into the Marine Landings Data System (MLDS) and fishery independent surveys (FIS) conducted by the Interagency Ecological Program's San Francisco Bay Study (Bay Study). In combination, these data sources provide estimates of relative effort, landings (catches), catch composition, and length at capture and can be used to develop abundance indices provided that potentially confounding factors unrelated to stock abundances are identified, e.g., market, environmental conditions, fishermen behavior, and regulatory changes.

The Bay Study conducts indices of abundance surveys for a range of finfish and invertebrate species including Shiner Perch. Sampling gears include midwater trawl data from established stations in San Francisco and San Pablo bays since 1980 (Figure 1-4). CPUE indices were determined from midwater trawl catches and adjusted by the volume of water filtered through the mouth of the net (DeLeón 1999). Results of the Bay Study surveys indicate several periods of decline followed by periods of recovery since 1980; however, CPUEs have trended downward since the late 80s and are very low in recent years.

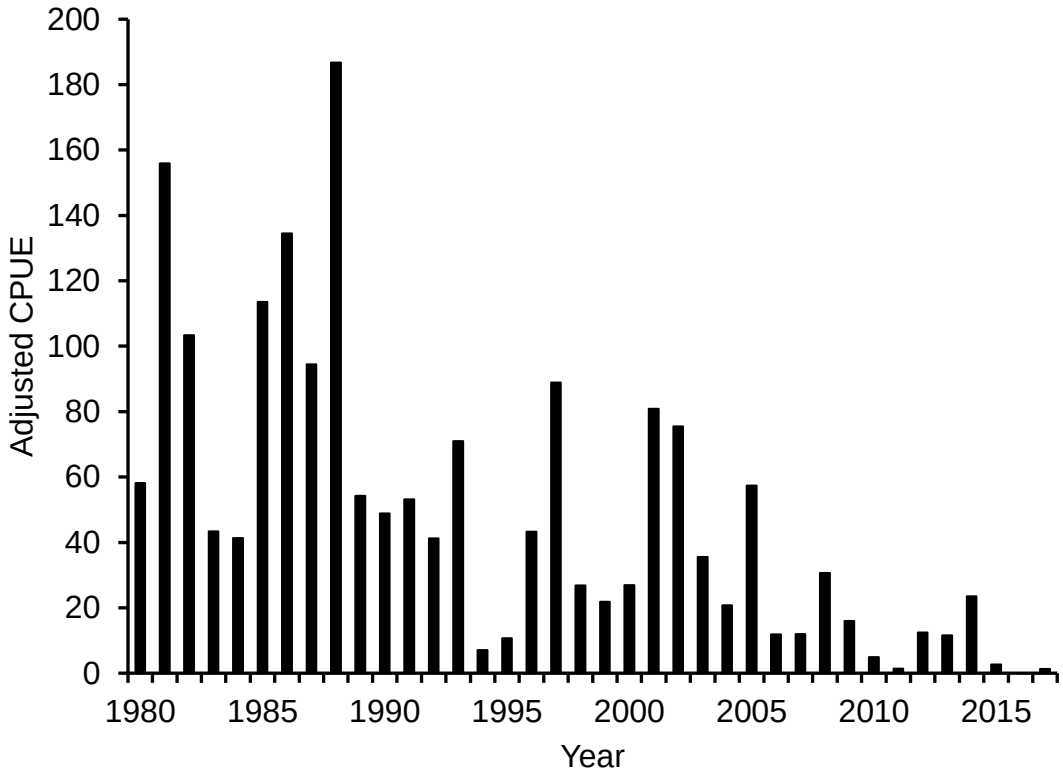

Figure 1-4. Shiner Perch abundance indices from the Interagency Ecological Program San Francisco Bay Study: 1980 to 2017 (CDFW Bay Study 2019).

1.2.2. Age Structure of the Population

The true age composition or age frequency of Shiner Perch is not known primarily due to issues related to sampling logistics and gear selectivity. Generally, age frequencies derived from hook and line gear used by commercial and recreational fishermen/anglers reflect only the age composition of the fished population due to a variety of reasons such as gear selectivity, minimum size regulations, and seasonal availability. Consequently, YOY and 1-year old fish are very likely to be underrepresented in sampled catches and therefore biased.

Length frequency of CRFS-sampled Shiner Perch, all samples combined from 2005 to 2018 (n = 2,911), is shown below in Figure 1-5. Based on previously established length at age data (Odenweller 1975) and the range of lengths from 60 to 200 mm SL sampled, length frequency analysis indicates that there are multiple year classes in the fishery; however, samples reflect only the retained catch. The Department does not have length frequency sample data from the Shiner Perch commercial fishery.

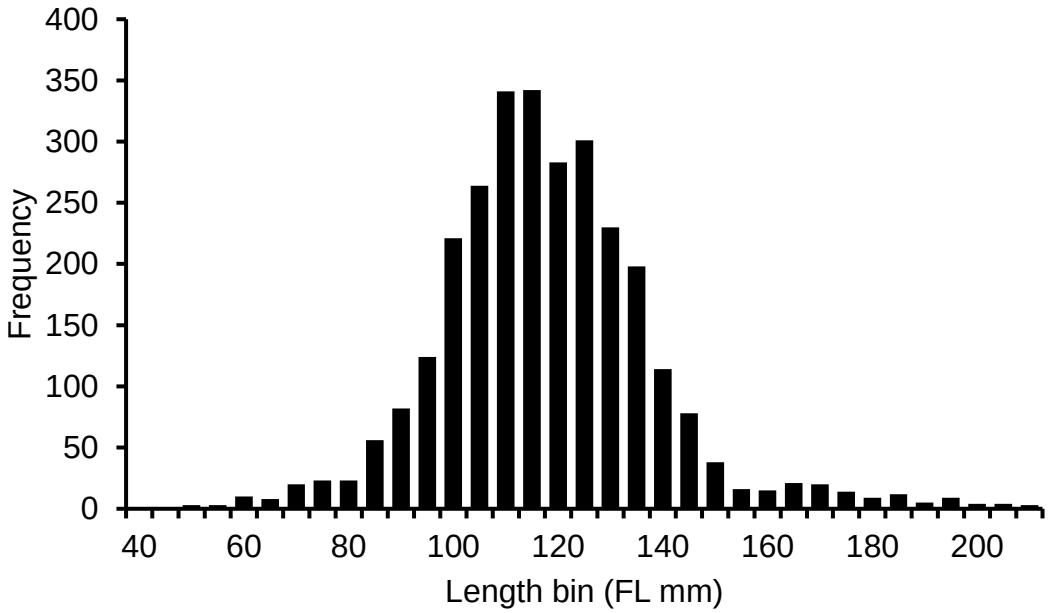

Figure 1-5. Length composition of CRFS sampled Shiner Perch catch by sport anglers: 2005 to 2018 (RecFIN 2019).

Odenweller (1975) determined that the mean length of first year fish averaged 56.8 mm SL and ranged between 31 to 87 mm; 2 year olds averaged 87.8 mm SL and ranged from 68 to 115 mm SL; and, 3 year olds averaged 100.6 mm SL and ranged between 81 and 117 mm standard length.

1.3. Habitat

Shiner Perch are found in shallow habitats during the spring to fall months, typically in estuaries and bays, associated with kelp canopy, subtidally near beaches, and in proximity to man-made structures such as piers and pilings (Hart 1973; Odenweller 1975; Chamberlain and Barnhart 1993; DeLeón 1999; Love 2011). In California, eelgrass (*Zostera marina*) habitat provides important foraging, spawning, and nursery habitat for Shiner Perch particularly in bays and estuaries (Odenweller 1975; DeLeón 1999). In winter, Shiner Perch transition to deeper waters and forage on benthic invertebrates and fish eggs when plankton become less abundant in shallow waters (Odenweller 1975). Juveniles and adults primarily school in nearshore waters at 1.5 to 15 m (5 to 50 ft) depth, although they can be found in depths up to 29 m (95 ft) (DeLéon 1999).

1.4. Ecosystem Role

Juvenile and adult Shiner Perch fill a role in pelagic ecosystems as forage to a range of middle to high trophic level predatory fish, birds, and mammals. Juveniles and

adults feed primarily on zooplankton in the spring through fall and shift to small invertebrates, tunicates, and fish eggs in winter when zooplankton are less abundant (Odenweller 1975; Love 2011).

1.4.1. Associated Species

California's open coast nearshore ecosystem is comprised of a range of habitats including sandy beach, soft mud, and rocky reef which Shiner Perch occupy. Open coast sandy beach habitat is characterized by high energy surf conditions, tidal flow, turbulence, seasonally strong winds, and currents, with varying beach slope and swash zones (Allen and Pondella 2006; Nielsen et al. 2013; Dugan et al. 2017; Nielsen et al. 2017). These factors confound efforts to conduct direct assessment surveys of species with scuba and beach seine methods along many central and northern California coast locations. Although southern California surf conditions are less extreme relative to northern California, direct sampling surveys are difficult (Carlisle et al. 1960; Allen and Pondella 2006).

The Department conducted FIS at selected stations in southern California using beach seines during the 1950s, 1990s, and 2000s (Carlisle et al. 1960; Gliniak et al. 2009). Gliniak et al. (2009) noted temporal changes in species composition and abundance of species in these beach seine data from the 1950s to the 2000s (CDFW unpublished data). Species sampled with Shiner Perch in Department beach seine surveys included the following: Northern Anchovy (*Engraulis mordax*), California Corbina (*Menticirrhus undulatus*), Walleye Surfperch (*Hyperprosopon argenteum*), Spotfin Croaker (*Roncador stearnsii*), Yellowfin Croaker (*Umbrina roncador*), Queenfish (*Seriphus politus*), Topsmelt (*Atherinops affinis*), Leopard Shark (*Triakis semifasciata*) and Pacific Sardine (*Sardinops sagax*). Summed catch by species is presented in Appendix A.

The Department's Bay Study based in Stockton samples from South San Francisco Bay to the western Delta on a monthly basis. Samples are collected by a combination of beach seine, midwater and bottom trawl gear (Fish et al. 2012). Beach seines were conducted only from 1980 to 1987 while midwater and otter trawls are ongoing. Abundance indices are routinely calculated for more than 35 species of fishes, several species of crabs, and Caridean shrimp. Finfish species associated with Shiner Perch included: Topsmelt, Northern Anchovy, Pacific Herring (*Clupea pallasii*), Longfin Smelt (*Spirinchus thaleichthys*), Striped Bass (*Morone saxatilis*), White Croaker (*Genyonemus lineatus*), Inland Silverside (*Menidia beryllina*), Plainfin Midshipman (*Porichthys notatus*), Yellowfin Goby (*Acanthogobius flavimanus*), Arrow Goby (*Clevelandia ios*), and Staghorn Sculpin (*Leptocottus armatus*) (Orsi 1999).

The Marine Science Institute (MSI), based in Redwood City, California, is a nonprofit organization focusing on marine science research and education. Since 1970, MSI has conducted FIS in San Francisco, San Pablo, and Suisun bays using bottom trawls with small-mesh cod ends. Approximately 12,140 tows were conducted through 2015 with 90.7% occurring in southern San Francisco Bay, 8.0% in central San Francisco Bay, and the remainder occurring in San Pablo and Suisun bays. No tow data were collected during 1982 to 1984 and 1987 to 1991. For each tow, all finfish were counted and identified to species, except for gobies and sanddabs, the latter of which were subsequently determined to be Speckled Sanddabs (*Citharichthys stigmaeus*). Shiner Perch were caught in all but 10 years of the sampling period. Shiner Perch (coded SSP) ranked second to Northern Anchovy in mean frequency of occurrence for the entire period 1970 to 2015 (Figure 1-5). A list of common names and species codes are found in Appendix B.

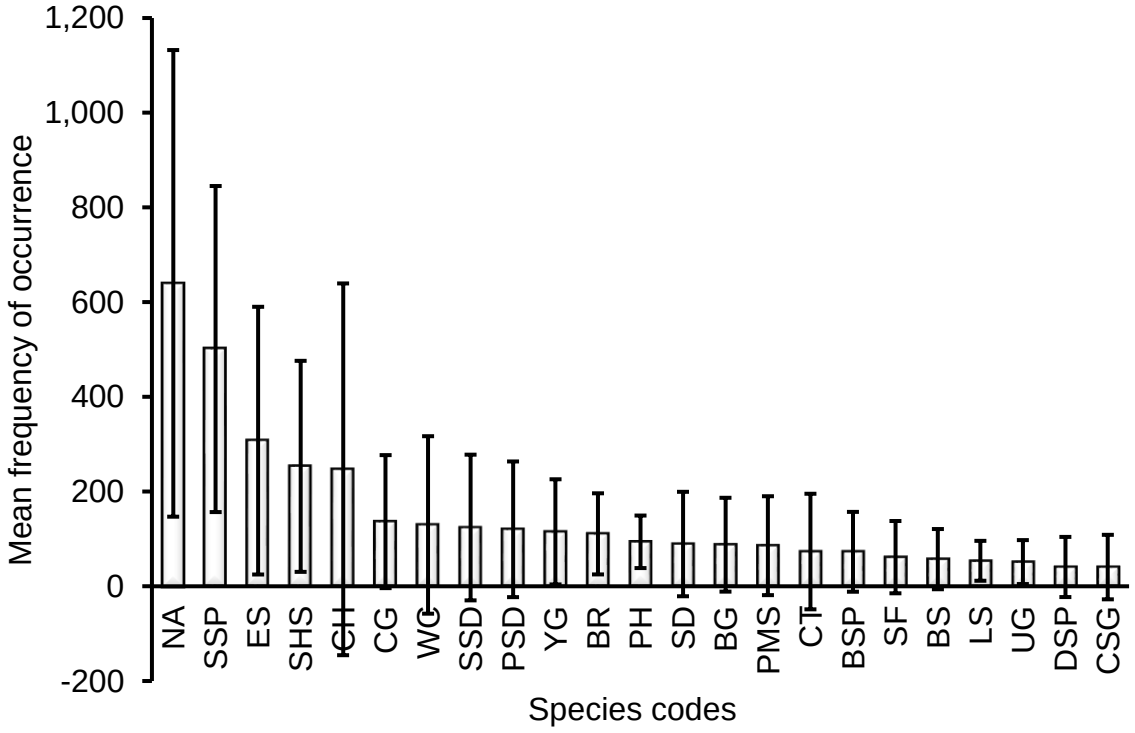

Figure 1-6. Mean frequency of occurrence with standard deviations of species/species groups from MSI trawl data collected from 1970 to 2015. No tows occurred during 1982 to 1984 and 1987 to 1991 (MSI, Redwood City 2017: All Catch Data).

Species/species groups co-occurring with Shiner Perch in decreasing order of relative abundance are as follows: English Sole (*Parophrys vetulus*), Staghorn Sculpin, California Halibut (*Paralichthys californicus*), Chameleon Goby (*Tridentiger trigonocephalus*), White Croaker, Speckled Sanddab, Pacific Sanddab (*Citharichthys sordidus*), and Yellowfin Goby. Other associated species among the top 20 that

occurred frequently in the catch but in lower relative abundances include Bat Ray (*Myliobatis californica*), Pacific Herring, sanddab species, Bay Goby (*Lepidogobius lepidus*), Plainfin Midshipman, California Tonguefish (*Symphurus atricauda*), Starry Flounder (*Platichthys stellatus*), Brown Smoothhound (*Mustelus henlei*), and Longfin Smelt.

In 1989 and 1990, the Department observed a total of 138 commercial Bay Shrimp trawl tows in San Pablo and South San Francisco bays and recorded all bycatch. In San Pablo Bay, Shiner Perch ranked sixth in abundance among finfish species. The ten most frequently co-occurring finfish species, in order of decreasing abundance were as follows: Yellowfin Goby, Staghorn Sculpin, Northern Anchovy, Striped Bass, White Croaker, Plainfin Midshipman, Pacific Herring, Longfin Smelt, American Shad (*Alosa sapidissima*), and English Sole.

In South San Francisco Bay, Shiner Perch ranked first in abundance among finfish species. The ten most frequently co-occurring finfish species, in order of decreasing abundance were as follows: Northern Anchovy, Staghorn Sculpin, White Croaker, Bay Goby, Speckled Sanddab, English Sole, Jacksmelt (*Atherinopsis californiensis*), American Shad, Brown Smoothhound, and Yellowfin Goby.

Fish abundance and diversity in Humboldt Bay (Humboldt County, California) were determined from September 2000 to November 2001 (Gleason et al. 2007). Sixty-seven fish species from 25 families were documented using a variety of sampling gears including pole seine, beach seine, otter and beam trawl. Shiner Perch ranked second to the most frequently observed species, the Threespine Stickleback (*Gasterosteus aculeatus*). Topsmelt was the third most abundant fish sampled.

1.4.2. Predator-prey Interactions

The diet of Shiner Perch is highly varied, but zooplankton is an important component. Juveniles and adults forage on amphipods, copepods, isopods, polychaetes, barnacles, mussels, clams, gastropods, larval fish, fish eggs, detritus, algae, and aquatic insects (Odenweller 1975; Love 2011). Shiner Perch are forage for a variety of species including game fish, marine mammals, and birds. Common fish predators include Striped Bass, California Halibut, sturgeon (*Acipenser* spp.), Lingcod (*Ophiodon elongatus*), salmon (*Onchorhynchus spp*.), rockfishes (*Sebastes spp*.), Kelp Bass (*Paralabrax clathratus*), Barred Sand Bass (*P. nebulifer*), Bat Ray, Brown Smoothhound, and Leopard Shark (Thomas 1967; Feder et al. 1974; Odenweller 1975; Love 2011). Probable avian predators of Shiner Perch include: Great Blue Heron (*Ardea herodias*), Black-crowned Night Heron (*Nycticorax nycticorax*), Tricolored Heron (*Egretta tricolor*), Pied-billed Grebe (*Podilymbus podiceps*), Least Tern (*Sternula antillarum*), Caspian Tern (*Hydroprogne caspia*),

Forster's Tern (*Sterna forsteri*), cormorants (*Phalacrocorax* spp.), Common Loon (*Gavia immer*), and various gulls (Odenweller 1975). Marine mammals such as Harbor Seals (*Phoca vitulina*), California Sea Lions (*Zalophus californianus*), and Common Bottlenose Dolphins (*Tursiops truncates*) may also forage on Shiner Perch (Odenweller 1975; Love 2011).

1.5. Effects of Changing Oceanic Conditions

Environmental conditions play a critical role in reproductive patterns and distribution of marine organisms and, consequently, the fisheries that they support (Radovich 1961, Parrish et al. 1981, Fiedler et al. 1986, Norton and Mason 2004). Significant changes in ocean current flow and water temperatures, for example during El Niño events, are attributed to displacing or shifting species within faunal groups (Parrish et al. 1981). Water temperature directly affects metabolic functions, reproduction, preferred food availability, and the distribution of predators (Radovich 1961, Fiedler et al. 1986).

During strong El Niño events, many warm water marine species were documented north of their typical range and some successfully spawned—among these were Yellowtail (*Seriola dorsalis*), Striped Mullet (*Mugil cephalus*) and most notably, Grunion (*Leuresthes tenuis*) (Radovich 1961; Martin et al. 2013). Rainfall and resulting runoff or outflow associated with El Niño/La Niña may also influence Shiner Perch abundance. Pearson (1989) determined from MSI data that Shiner Perch abundance indices were lowest during 1977 (dry year) and highest in 1974, a wet year.

Figure 1-6 presents commercial landings of Shiner Perch as the deviation from the historic average landing per fish ticket multiplied by 7.5 for scaling purposes; this is a form of CPUE. These are plotted against the National Oceanic and Atmospheric Administration (NOAA) Climate Prediction Center's Oceanic Niño Indices (ONI). The relationship is unclear for Shiner Perch although declines in CPUE coincided with the strong 1982 to 1984 El Niño. CPUE of Shiner Perch may be more sensitive to changes in attributes such as market demand and the number of fishermen unlike the Barred and Redtail Surfperch which possess stronger markets.

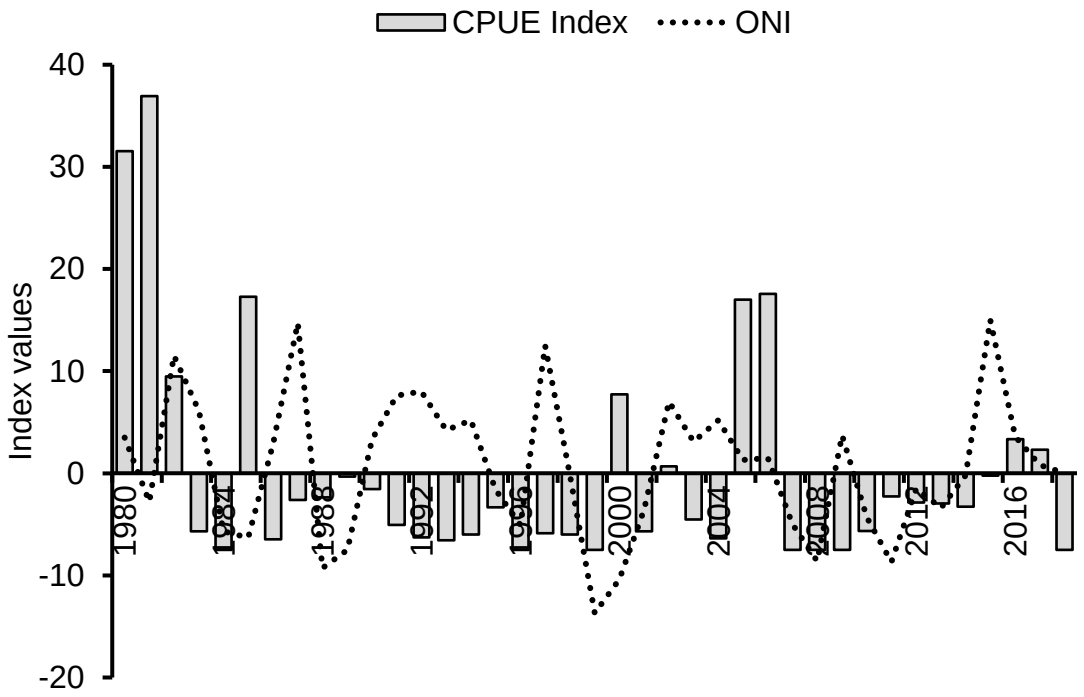

Figure 1-7. Shiner Perch commercial landings deviations from long-term mean multiplied by 7.5 for scaling purposes versus Oceanic Niño Indices (ONI) from 1980 to 2018. (NOAA, CDFW MLDS 2019).

Declines in seagrasses, including eelgrass, which is important habitat for Shiner Perch, have been observed worldwide and attributed to anthropogenic pressures as well as natural disturbances (Short and Wyllie-Echeverria 1996; Orth et al. 2006; Orth et al. 2010; NOAA 2014; Sherman and DeBruyckere 2018). Human activities causing declines in eelgrass include nutrient and sediment loading from runoff, sewage disposal, dredging and filling, pollution, coastal and estuarine development, and boating and fishing activities. Natural disturbances such as warming water, rising sea level, drought, climate change, disease, and grazing by herbivores are contributing factors to declines in eelgrass beds (Orth et al. 2006; Ramey 2010; Orth et al. 2010). Estimates of California's eelgrass habitats range from 11,000 to 15,000 acres statewide (NOAA 2014). Loss of eelgrass habitat may be a contributing factor in Shiner Perch declines.

2. The Fishery

2.1. Location of the Fishery

Shiner Perch recently supported a small live bait commercial fishery for San Francisco Bay area fishermen targeting Striped Bass and California Halibut, and a small fresh fish market in Tomales Bay; no landings were reported in either location in 2018. Shiner Perch were taken primarily by beach seine in Tomales Bay and traps in San Francisco Bay. Primary ports of landing from 2000 to 2017 in order of importance were: Tomales Bay, San Rafael, Berkeley, and Oakland (Figure 2-1)

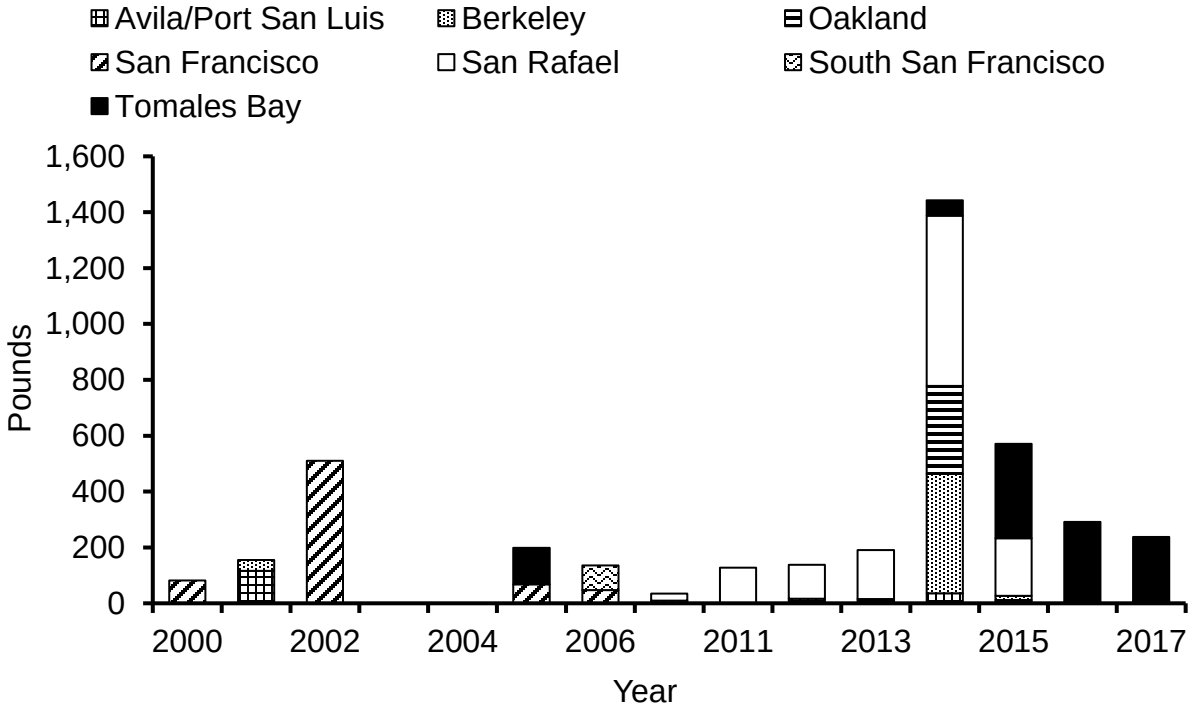

Figure 2-1. Shiner Perch primary commercial fishery landings by port since 2000 (CDFW MLDS 2019).

CRFS data indicate that the bulk of the Shiner Perch recreational catch originates from San Francisco Bay area counties. CRFS divides California into six survey areas, or Districts, using county lines as described below. Districts have two naming conventions, a number and a CRFS name. They may be used interchangeably:

- District 6 or Redwood: Del Norte and Humboldt counties
- District 5 or Wine: Mendocino and Sonoma counties

- District 4 or Bay: Marin to San Mateo County including those adjacent to San Francisco Bay and San Pablo Bay
- District 3 or Central: Santa Cruz County south through San Luis Obispo County
- District 2 or Channel: Santa Barbara and Ventura counties
- District 1 or South: Los Angeles County south through San Diego County.

Recreational anglers fishing from man-made (MM) structures in the San Francisco Bay area counties accounted for approximately 65% of the statewide catch (Figure 2-2).

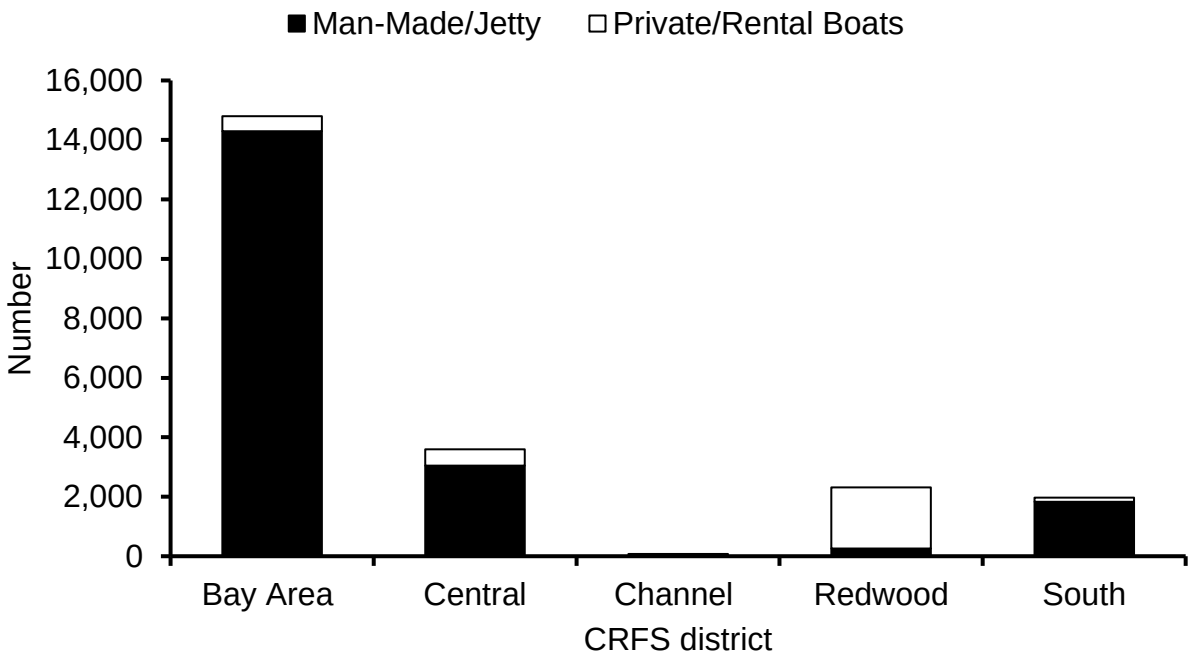

Figure 2-2. 2018 Shiner Perch catch by CRFS district and fishing mode except Beach/Bank (BB) which were discontinued in 2018 (RecFIN 2019).

2.2. Fishing Effort

2.2.1. Number of Vessels and Participants Over Time

The Shiner Perch commercial fishery has historically been sporadic—the number of vessels, participants and annual landings have ranged widely. Fluctuations in the number of participants and vessels may be attributed to market demand, abundance, and availability of other live bait species. It is important to note that between 1980 and 2017, approximately 61% of the 947 fish tickets containing Shiner Perch did not

indicate whether a vessel was used. During this same period, hook and line gear comprised 92% of these landings followed by trap gear contributing 7% of the landings. It's unknown if hook and line fishermen fished from shore or if the vessel information was omitted from fish tickets. The number of participants not linked to vessels ranged from zero to 27 annually. Figure 2-3 shows statewide Shiner Perch landings and the number of participants from 1990 to 2017—crew members, if any, were not entered on fish tickets. Landing declines were attributed to several factors related to market changes, attrition in participants, and fluctuations in fish abundance.

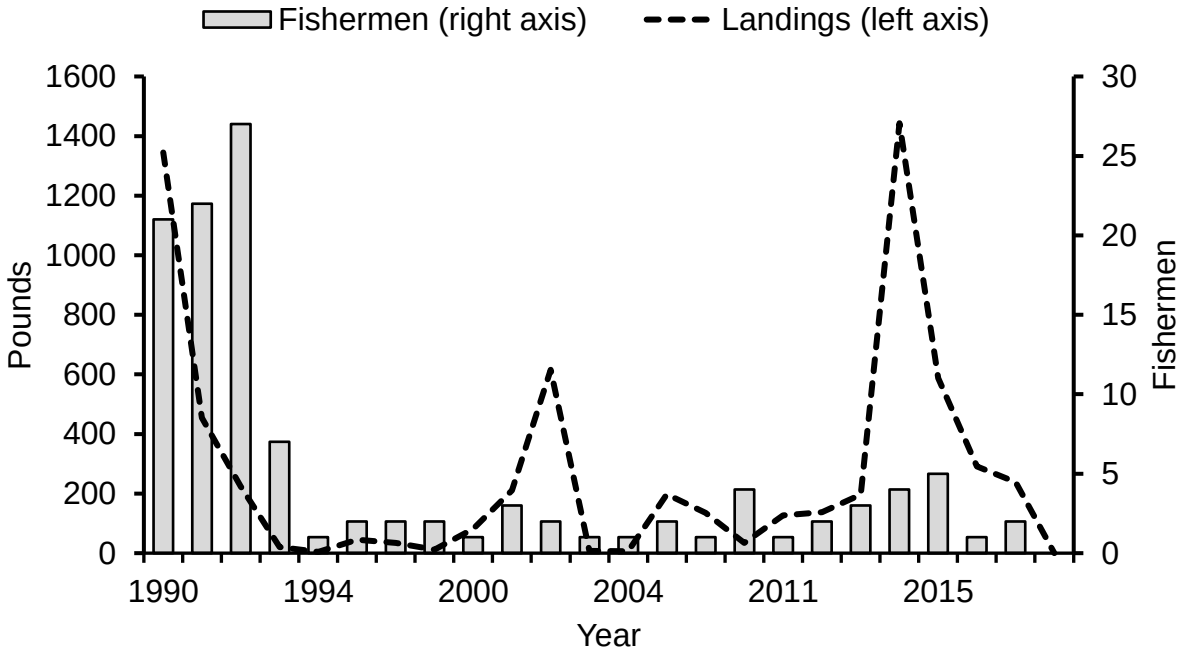

Figure 2-3. Shiner Perch fishery participation (number of fishermen) and landings (lb), 1990 to 2018 (CDFW MLDS 2019).

Recreational Shiner Perch angling effort is comprised primarily by two shore-based modes as defined by CRFS: BB and MM structures. CRFS does not collect species specific effort data; effort is summed by fishing mode. Shiner Perch are not often targeted by anglers for consumption but are commonly caught incidentally by multiple shore and boat modes. Figure 2-4 shows the estimated number of trips by angler modes that frequently include Shiner Perch (BB, MM, and private/rental (PR) boat) statewide based on CRFS data. Although the Recreational Fisheries Information Network (RecFIN) does not currently produce species-specific effort, it is important to note that a declining trend is observed in the number of MM and private/rental boat angler trips since 2009 to 2018. Note, BB surveys were discontinued in 2018 and resulted in underestimates of shore caught species such as the surfperches.

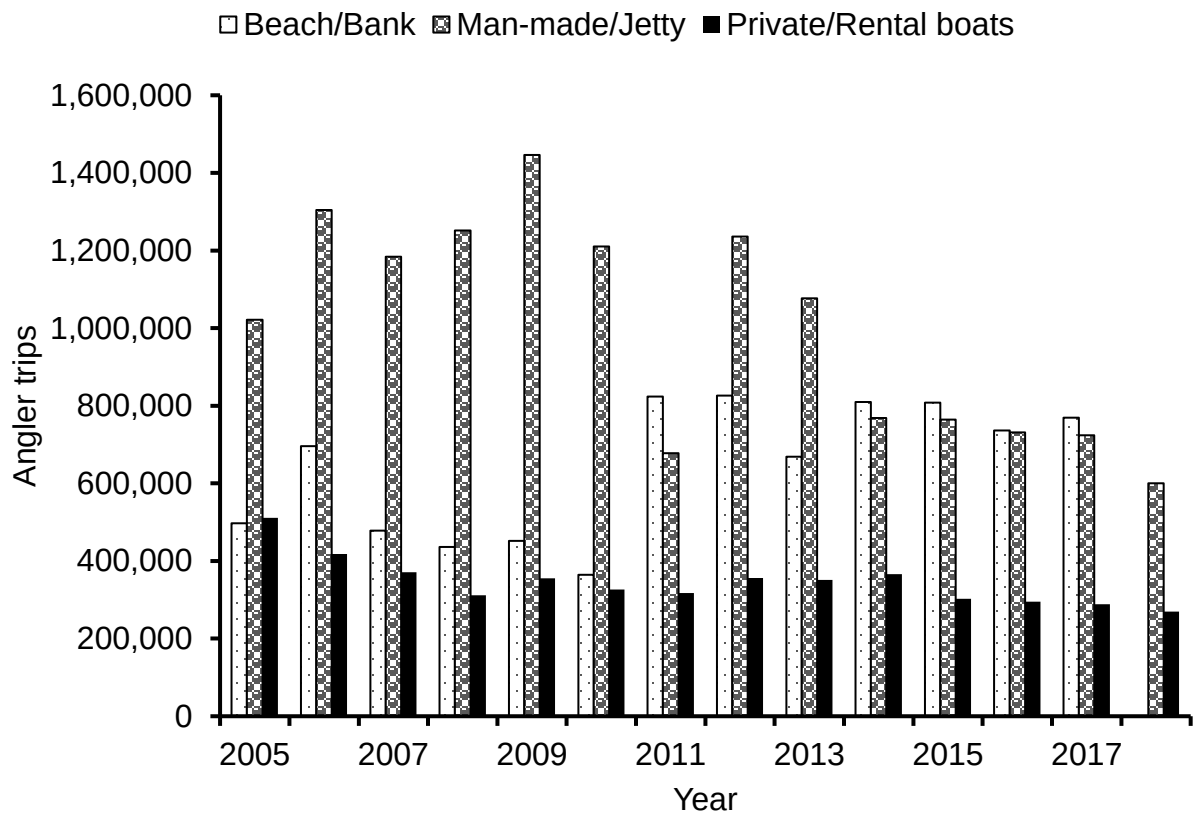

Figure 2-4. Estimated angler effort statewide from beach bank, man-made, and private/rental boat modes: 2005 to 2018 based on CRFS (RecFIN 2019).

2.2.2. Type, Amount, and Selectivity of Gear

Historically, Shiner Perch were taken commercially primarily with beam trawl, hook and line, beach seine, and fish trap gear, and less frequently with beach seine and entangling net (Figure 2-4). Commercial San Francisco Bay fishermen target Shiner Perch using baited traps placed beneath docks and piers (Kristine Lesyna, CDFW, personal communication). Hook and line fishermen fish in proximity to piers with small baited hooks or sabiki jigs with light spinning or conventional rod and reel gear. Anecdotal reports from anglers indicate that sport fishermen use Hawaiian throw nets to target Shiner Perch in Tomales Bay.

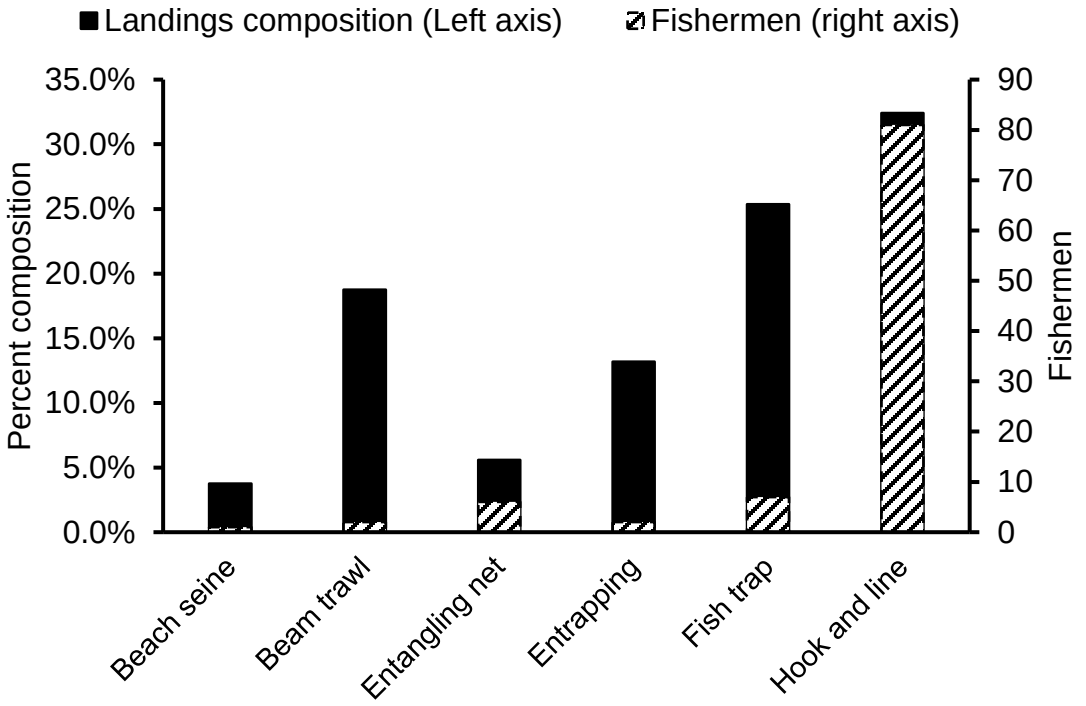

Figure 2-5. Total number of Shiner Perch fishermen by gear type: 1980 to 2017 combined. Note, no Shiner Perch were landed in 1996, 1999, 2007 to 2009, and 2018 (CDFW MLDS 2019).

2.3. Landings in the Recreational and Commercial Sectors

2.3.1. Recreational

Estimates of recreational catch were generated by the Marine Recreational Fisheries Statistics Survey (MRFSS) from 1981 to 1989 and from 1993 to 2003. From 2004 to the present, catch estimates are produced by CRFS, which uses an improved sampling design. Both surveys rely on an angler-intercept method to determine species composition and catch rates, coupled with a telephone survey to estimate fishing effort. Due to potential sampling bias in the telephone survey, interpreting the total catch estimates as absolute measures is problematic; however, the catch estimates are useful for identifying trends in catches. Though similar methodology in general was used for each, the two sampling designs are sufficiently different that catch estimates generated from MRFSS and CRFS are not considered comparable.

MRFSS catch estimates indicate a decline in overall recreational surfperch take between 1981 and 2003. Beginning in 1986 and for 3-years thereafter, the BB and MM modes were collectively designated the shore mode. This change in methodology may have been partly responsible for the huge single-year spike in estimated catch in 1986; however, more recent estimates from CRFS indicate a generally stable level of catch from 2004 to 2009. CRFS reduced sampling levels for

the BB mode in 2010 and BB and MM in 2011; therefore, the estimates for 2010 and 2011 are not comparable with the 2004 to 2009 estimates. Shiner Perch represented approximately 30% of the total surfperch catch from all modes except for BB surveys which were discontinued in 2018 (Figure 2-6). In 2018, recreational anglers were estimated to have released 49% of their Shiner Perch catch (RecFIN 2019). Overall estimated catch indicates a decline attributed to in part to the elimination of BB surveys which may be resumed in the future.

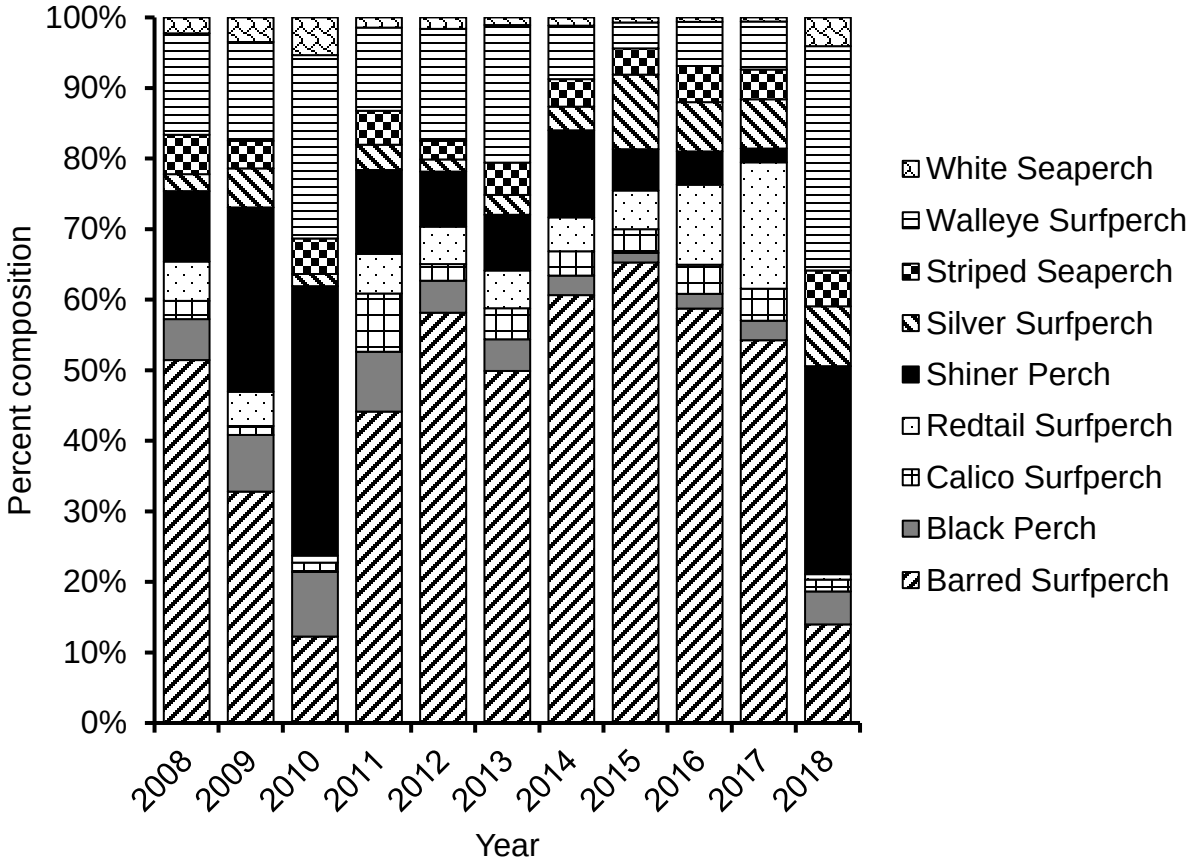

Figure 2-6. Surfperch species percent catch composition by number of the recreational catch from 2008 to 2018. Note, BB surveys were discontinued in 2018 (RecFIN 2019).

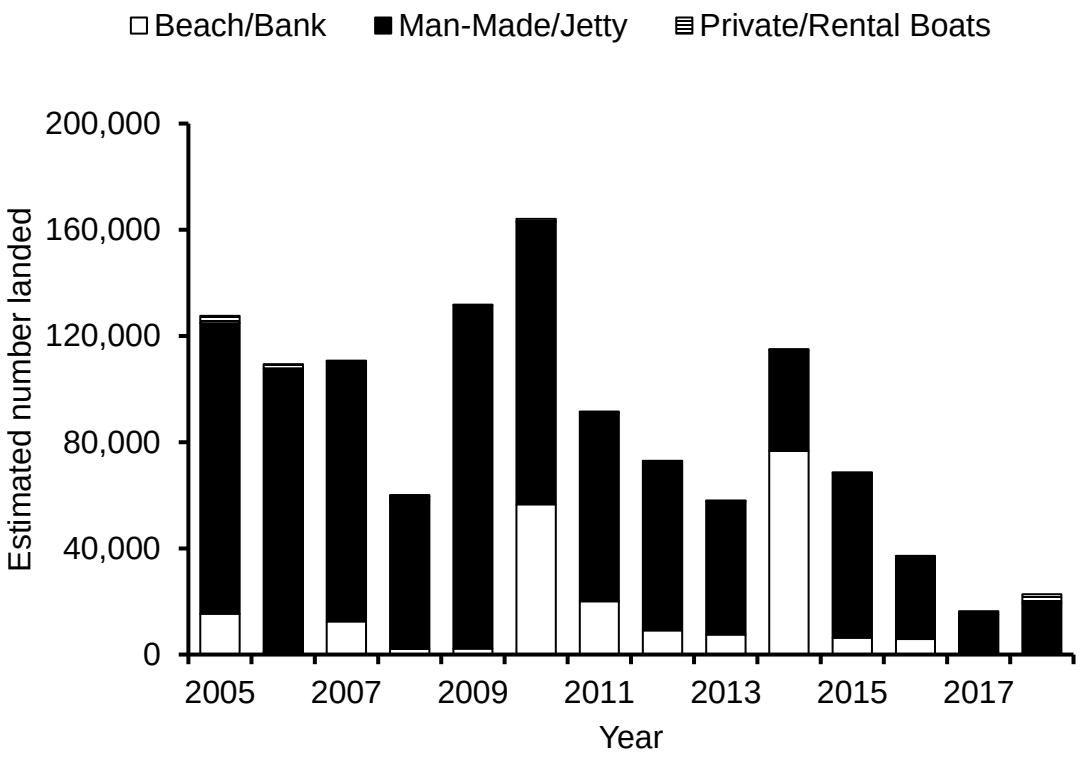

Figure 2-7. Estimated catch of Shiner Perch by angling mode: 2005 to 2018. Note, Beach/Bank surveys were discontinued in 2018 (RecFIN 2019).

2.3.2. Commercial

Commercial fishery landings data are available from 1916 to 2017. Prior to 1927, "perch" landings included a combination of surfperch and perch-like species. Subsequently, landings for surfperch, Blacksmith (*Chromis punctipinnis),* Halfmoon (*Medialuna californiensis),* Opaleye (*Girella nigricans),* and Sargo (*Anisotremus davidsonii)*, were reported separately; however, fish dealers on occasion have combined other species with surfperch on fish tickets. In addition, individual fish tickets composed of multiple surfperch species were frequently coded as "surfperch" (Leet et al. 2001).

From 1990 to 1999, approximately 58% of surfperch fish tickets appearing in the Department's CFIS database were reported as "unspecified surfperch". Following a concerted effort by Department staff to gain fish buyer cooperation in sorting species on fish tickets, unspecified surfperch landings declined to 11 lb statewide by 2018. There were no documented commercial Shiner Perch landings for 2018. In 2017, statewide landings totaled 238 pounds (lb) (108 kilograms (kg)) and were valued at $2,322. (Figure 2-8). Due to their size, it is believed that small individual Shiner Perch would not be marketable and instead would be released, based on sizes retained by the sampled sport catch.

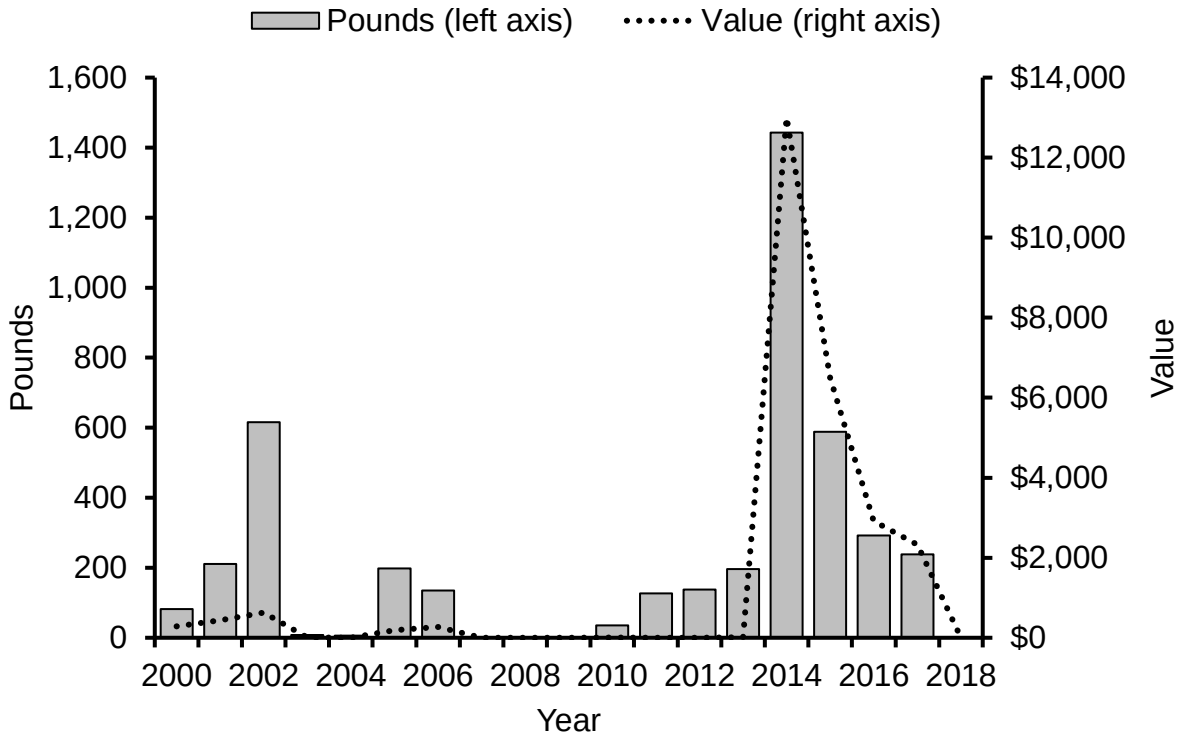

Figure 2-8. Shiner Perch commercial fishery landings (lb) and value (US dollars): 2000 to 2018 (CDFW MLDS 2019).

2.4. Social and Economic Factors Related to the Fishery

Commercial fishery trends, historically, are impacted by factors beyond the scope of fish behavior and abundance. The contemporary markets for Shiner Perch are for local fresh fish and live bait with demand related to the availability of other local bait species, i.e., Northern Anchovy and Pacific Sardine. Generally, landings have been sporadic and during some years, absent—1996, 1999, 2007 to 2009 and 2018. Recent retirements and changes in fish businesses contributed to lower landings. The ports of San Rafael and Tomales Bay contributed the bulk of statewide landings from 2005 to 2017 (Figure 2-9).

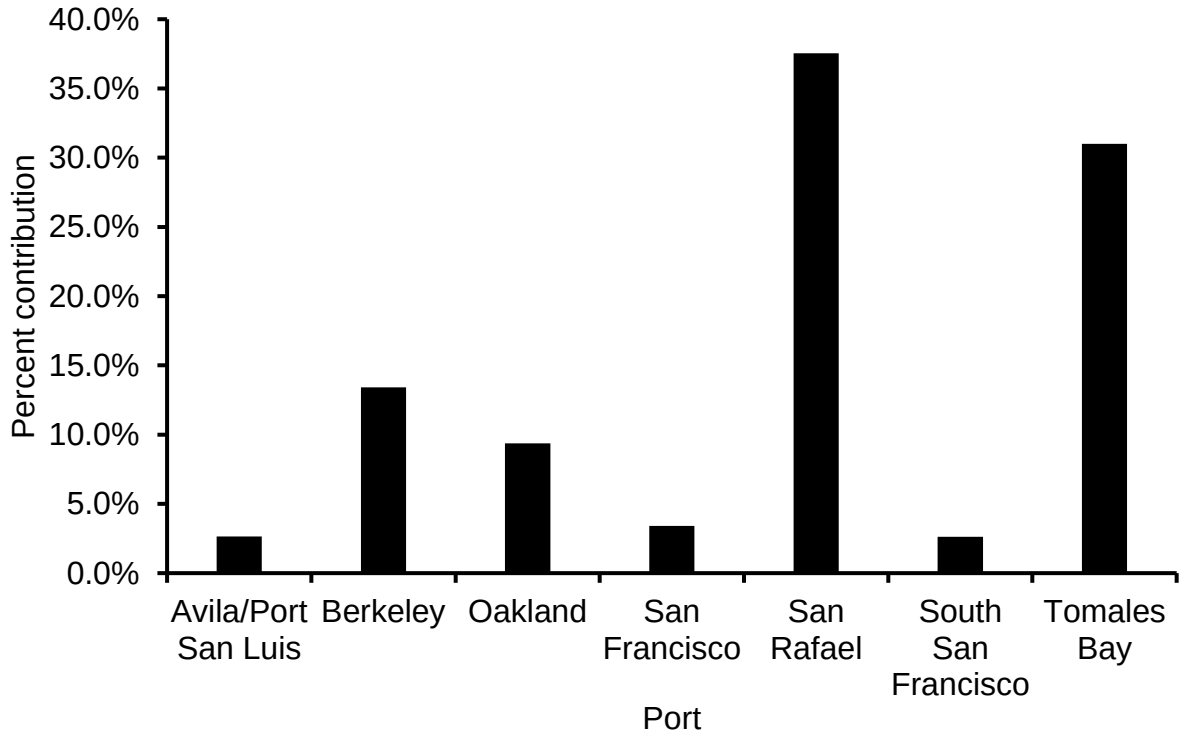

Figure 2-9. Shiner Perch commercial landings by port: 2005 to 2017 combined (CDFW MLDS 2019)

Management

3. Management

3.1. Past and Current Management Measures

Surfperches are managed solely by the State. The California State Legislature adopted Fish and Game Code (FGC) §8395 which authorized the California Fish and Game Commission (Commission) to adopt regulations for managing the surfperch resource and commercial and recreational fisheries. Below is a list of past regulatory measures relevant to Shiner Perch fisheries:

- 1913—initial conservation measures implemented a seasonal closure to prohibit commercial surfperch fisheries statewide from May 1 through July 15.

- 1953—§112, Title 14, California Code of Regulations (CCR), was adopted and prohibited taking of all surfperch south of Point Arguello for commercial purposes.

- 1957—a basic personal recreational fishing license or commercial fishing license is required, and an Ocean Enhancement Stamp (1983) is required for recreational and commercial fishing south of Point Arguello (Santa Barbara County).

- 1959—§112, Title 14, CCR, was amended to clarify that taking Barred, Calico, and Redtail Surfperch south of Point Arguello was prohibited while authorizing taking other surfperches for commercial purposes.
- 1963—taking Shiner Perch was authorized during the closed season.
- 2002—§27.60, Title 14, CCR, was amended and §28.59,Title 14, CCR, was added to reduce the recreational bag limit from ten of any one species to five in the aggregate, to establish an April 1 through July 31 closure in San Francisco and San Pablo bays, to establish a 10.5-in (267-mm) minimum size for Redtail Surfperch, and a special limit of 20 Shiner Perch in addition to the overall daily bag limit of 20 finfish specified in §28.59(c)(1), Title 14, CCR.

- 2003—§28.59(b), Title 14, CCR, was amended in an emergency order to exempt Shiner Perch from the San Francisco and San Pablo bays April 1 through July 31 closure.
- N/A—§28.75, Title 14, CCR, was adopted authorizing the use of taking Shiner Perch, Pacific Staghorn Sculpin, and Longjaw Mudsuckers (*Gillichthys mirabilis*) with baited traps and baited hoop nets in San Francisco and San Pablo bays and their saltwater tributaries, open ocean, and the contiguous bays of Mendocino, Sonoma and Marin counties.

- N/A—§28.80, Title 14, CCR, was adopted authorizing the use of taking Shiner Perch with dip nets and Hawaiian-type throw nets north of Point Conception.

3.1.1. Overview and Rationale for the Current Management Framework

Shiner Perch are managed using a combination of bag limits, and spatial closures. Bag limits are used primarily to limit the number of reproducing individuals that can be removed from the population and to prevent wastage. Shiner Perch were exempted from the San Francisco and San Pablo bays restrictions applying to the other surfperches in 2002 which decreased the bag limit of five in the aggregate and established a closure from April 1 to July 31. Instead, Shiner Perch have a special bag limit of 20 which is also separate from the bag limit of 10 for one finfish species and 20 in the aggregate as specified in §27.60, Title 14, CCR. A size minimum has not been considered for Shiner Perch due to their small size and that they are sexually mature at a young age.

Spatial closures, e.g., Marine Protected Areas (MPA) and de facto reserves, may restrict or prohibit sport and commercial fishing activities. Shiner Perch are widely distributed and occupy a range of habitats within spatial closures, thus providing protection to spawning fish. The commercial fishery is open access. There are no catch limitations or seasonal closures that apply to the commercial or sport fisheries; however, demand for Shiner Perch is during the spring through the fall for live bait in San Francisco Bay.

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 Shiner Perch fishery. Department staff continue to monitor catch, effort and size trends with fishery-dependent and fishery-independent datasets on a monthly to annual basis. These data are evaluated relative to historic trends and environmental factors. The Department will continue to monitor fisheries landings data; however, the potential of overfishing Shiner Perch is minimized by relatively low and sporadic take in combination with limited market demand.

3.1.1.2. Past and Current Stakeholder Involvement

As part of the Office of Administrative Law’s rulemaking process, recreational and commercial fishing regulations are adopted pursuant to the Administrative Procedure Act (APA). New regulations and regulation change proposals are submitted to the Commission by interested parties which include the public, agencies, and other interested stakeholders. Regulation change proposals may be submitted to the

Commission by email, hard copy mail, oral testimony, or by letter at public meetings and scoping sessions. Interested parties notified by the lead agency (Commission) can review and comment on regulation proposals.

There has been little need for stakeholder involvement with the Shiner Perch fishery, given the last regulation change related to Shiner Perch was in 2003. If there is need for change in Shiner Perch management strategies, the Department will work with various stakeholder groups including Tribes, recreational and commercial anglers, Non-Government Organizations (NGOs), scientists, and the general public to ensure input from all groups is considered.

3.1.2. Target Species

3.1.2.1. Limitations on Fishing for Target Species

3.1.2.1.1. Catch

There are no daily limits or annual quotas for the commercial fishery.
Recreational anglers have a 20 Shiner Perch bag limit.

3.1.2.1.2. Effort

There are no statutes or regulations limiting the number of commercial fishery participants. In San Francisco Bay, finfish may not be taken under the authority of a sport fishing license between one hour after sunset to one hour before sunrise except from shore or piers (§27.56, Title 14, CCR). The commercial Shiner Perch fishery is open access.

3.1.2.1.3. Gear

Recreational fishermen are authorized to use a variety of gears to take Shiner Perch including hook and line, baited traps as specified in §27.56, Title 14, CCR, Hawaiian throw nets, dip nets, and baited hoop nets. Recreational anglers fishing from shore may use any number of hooks and lines, with the following exceptions: in San Francisco Bay, only one line with not more than three hooks may be used; on public piers, no person shall use more than two rods and lines. Commercially, Shiner Perch are taken primarily by hook and line and traps; they may be taken by other gear where authorized, e.g., beach seine, dip net, and round haul.
There are no current restrictions on hook and line gear that apply to the open coast Shiner Perch commercial fishery; however, when fishing within San Francisco Bay (Districts 12 and 13), commercial fishermen are restricted to no more than four lines and two hooks per line or if more than one fisherman is onboard a vessel, no more than six lines and two hooks per line are authorized—FGC §9025.5(c).

3.1.2.1.4. Time

There are no closed seasons for the commercial and recreational Shiner Perch fisheries. Finfish may not be taken except from shore or piers between one hour after sunset to one hour before sunrise within San Francisco Bay as described in §27.56 Title 14 CCR.

3.1.2.1.5. Sex

Both sexes of Shiner Perch may be taken.

3.1.2.1.6. Size

There are no size restrictions that apply to Shiner Perch.

3.1.2.1.7. Area

There are no area closures, other than specified MPAs, prohibiting the taking of Shiner Perch. Private property and areas that fishermen cannot access due to physical barriers such as pocket beaches bordered by unscalable cliffs function as de facto MPAs by preventing access.

3.1.2.1.8. Marine Protected Areas

Pursuant to the mandates of the Marine Life Protection Act (MLPA) (Fish and Game Code §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 plus several special closures. MPAs contain a wide variety of habitats and depth ranges.

Although MPA usage as a fishery management tool was not one of the primary goals of the MLPA, they function as one for the following reasons:

- They serve as spatial closures to fishing if the species of interest is within their boundaries and is prohibited from harvest.
- They function as comparisons to fished areas for relative abundance and length or age/frequency of the targeted species.
- They serve as ecosystem indicators for species associated with the target species, either as prey, predator, or competitor.

- Many of the MPAs served to displace fishing effort when they were implemented.

Although the network was not designed specifically to protect populations of surfperches, many MPAs have significant amounts of their preferred habitat—shallow subtidal open-coast soft bottom

An overview of California's MPAs and special closures network are linked (here) with information regarding specific MPAs: Northern California MPAs (here); North Central California MPAs (here); San Francisco Bay MPAs (here); Central California MPAs (here); and, Southern California MPAs (here). Most MPAs contain Shiner Perch habitat except for those located offshore over deep water, e.g., Portuguese Ledge State Marine Conservation Area; however, it is not known which MPAs contain Shiner Perch.

3.1.2.2. Description of and Rationale for Any Restricted Access Approach

The commercial and recreational fisheries are open access.

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). The term "Bycatch" may include fish that, while not the target species, and are desirable and are thus retained as incidental catch and does not always indicate a negative impact.

There are no formal studies documenting bycatch in the commercial and recreational fisheries targeting Shiner Perch. Fish ticket information may be used to determine the composition of other authorized marketable species that were taken in association with Shiner Perch. Fish ticket analysis indicates that the only other marketable live bait species appearing with Shiner Perch is Longjaw Mudsucker. Longjaw Mudsuckers comprised 48% of landing weights of fish tickets that also included Shiner Perch from 1980 to 2017.

Shiner Perch have been identified as a significant component of the finfish bycatch in the San Francisco Bay estuary commercial Bay Shrimp beam trawl fishery. This is the only trawl fishery operating within this ecosystem providing bait for many decades. Commercial Bay Shrimp fishermen must return immediately to the water all

finfish and non-target invertebrate species except for Staghorn Sculpin, Yellowfin Goby, and Longjaw Mudsucker. In 1989 and 1990 the Department observed on board a total of 138 trawl tows and recorded all bycatch by species and number (CDFW unpublished data). In San Pablo Bay, 86 tows were observed on one vessel from September 1989 to September 1990. Among 15,450 finfish observed as bycatch species, Shiner Perch ranked fourth in abundance with 2,232 individuals (14.4% of observed finfish bycatch). A total of 12 tows in April/May 1990 accounted for 79% of the observed Shiner Perch.

In South San Francisco Bay, 52 tows were observed on two vessels from April 1989 to September 1990. Among 19,127 finfish observed as bycatch species, Shiner Perch ranked first in abundance with 9,925 individuals (51.9% of observed finfish bycatch). A total of seven tows in April/May 1990 accounted for 63% of the observed Shiner Perch. Observed mortality for most Shiner Perch was extremely low, primarily due to the relatively short duration of tows, averaging 79 minutes in San Pablo Bay and 51 minutes in South San Francisco Bay. The Bay Shrimp fishery strives to maintain a live product for sale and crew members use care in handling of the catch and bycatch.

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

No measures are required at present to reduce unacceptable levels of bycatch. Recreational and commercial fisheries use similar hook and line gear as well as baited traps. It is reasonable to use the recreational catch as a proxy for the commercial fishery in combination with commercial fish tickets within a given locale. Known bycatch from the San Francisco Bay Shiner Perch trap fishery based on fish ticket data is Longjaw Mudsucker—also valued as a live bait. Some recreational anglers targeting “anything” from piers and jetties will keep Shiner Perch but the impact to the fishery is believed to be insignificant.

Further investigation would be in order if recreational catch data showed that bycatch posed resource issues or if bycatch levels of an unmanaged species increased significantly on commercial fish tickets. Information collected would be evaluated. Appropriate measures would be developed and vetted by staff and managers to reduce resource impacts.

3.1.4. Habitat

3.1.4.1. Description of Threats

Threats to Shiner Perch habitat (estuaries and nearshore areas) include anthropogenic and natural sources. Examples of anthropogenic threats include pollution from “point source” discharges, e.g., oil spills, discharges from water treatment facilities, power plant thermal effluent, and dredging operations. Anthropogenic “non-point source” discharges including runoff from land-based sources, coastal development, sedimentation, nutrient pollution, hydromodification, and invasive species (Leet et al. 2001). Other sources of anthropogenic threats leading to habitat losses include development, fill, hydromodification, and flood control projects (Leet et al. 2001; NOAA 2014). Natural threats to Shiner Perch habitat include climate change (discussed in Section 1.5), harmful algal blooms, and invasive species (Leet et al. 2001).

Existing damage and potential threats to critical habitat are important factors to consider when managing a fishery, although the potential of habitat impacts by Shiner Perch fisheries are low. At this time, no Shiner Perch fishery restrictions or closures have directly resulted from critical habitat degradation, modification, or loss. However, existing anthropogenic impacts on critical habitat, particularly in estuaries and eelgrass habitat, are an important consideration in fishery management.

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

Risk of habitat impacts from commercial and sport hook and line and round haul gear are considered relatively low as stated in the 2018 Master Plan for Fisheries (CDFW 2018). The Shiner Perch trap fishery has been conducted from or in proximity to docks where additional habitat effects would be minimal. Shiner Perch are wide ranging and live in a variety of nearshore pelagic, open coast sandy beach, and bay and estuarine habitats. Shiner Perch generally occupy shallow midwater depths—rod and reel hook and line gear fished off the bottom from vessels does not contact substrate. Shiner Perch are targeted by commercial trap and recreational fishermen suspending traps beneath docks that are generally not in contact with substrate. Shiner Perch are only occasionally caught by round haul vessels targeting Market Squid nearshore. Vessel operators infrequently set their nets in depths where the bottom of the net will contact substrate. This substrate is characterized by low relief mud and sand flats interspersed by depressions which may provide habitat for fish and invertebrates (Dayton et al. 1995).

Shiner Perch are occasionally taken by shore-bound surf anglers. High energy of the surf zone habitat would shortly fill in substrate displaced by sinkers or by bait collecting devices. Additionally, California State Parks closures to vehicle use and MPA closures limit threats to sandy shore habitat. Authorized vehicle access to beaches is limited to non-State Parks beaches except for Oceano Dunes (San Luis Obispo County) and specified county beaches in Mendocino, Humboldt, and Del Norte counties. Limiting vehicle access may reduce impacts caused by vehicles driven within the intertidal zone, compacting substrate, and potential disruption of forage species, for example, California Mole Crab (*Emerita analoga*) beds and beach wrack species.

3.2. Requirements for Person or Vessel Permits and Reasonable Fees

The Shiner Perch fishery is open access. Participants in the commercial fishery need a commercial fishing license. Fishermen that sell directly to the public are required to have a Fisherman's Retail License. A sport fishing license is required for recreational anglers. Table 3-1 lists the relevant licenses for individuals required to take and/or sell Shiner Perch for commercial purposes.

Table 3-1. List of commercial license and permit fees related to the Shiner Perch fishery: from April 1, 2019 to March 31, 2020 (2019 California Commercial Fishing Regulations Digest and 2019 Commercial Fish Business Information Guide. Accessed October 29, 2019

Title	Permit Fee (US Dollars)	Description
Resident Commercial Fishing License	$145.75	Required for any resident 16 years of age and older who uses or operates or assists in using or operating any boat, aircraft, net, trap, line, or other appliance to take fish for commercial purposes, or who contributes materially to the activities on board a commercial fishing vessel.
Nonresident Commercial Fishing License	$431.00	Required for any nonresident 16 years of age or older who uses or operates or assists in using or operating any boat, aircraft, net, trap, line, or other appliance to take fish for commercial purposes, or who contributes materially to the activities on board a commercial fishing vessel.
Commercial 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.
Nonresident Commercial Fishing License	431.00	Required for any nonresident 16 years of age or older who uses or operates or assists in using or operating any boat, aircraft, net, trap, line, or other appliance to take fish for commercial purposes, or who contributes materially to the activities on board a commercial fishing vessel.

Title	Permit Fee (US Dollars)	Description
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.
Fish Receiver's License	$824.00	Any person who purchases or receives fish for commercial purposes from a commercial fisherman not licensed as a fish receiver must obtain a Fish Receiver's License.
Fisherman's Retail License	$105.32	A commercial fisherman is required to have this license only if he/she sells all or a portion of his/her catch to ultimate consumers
Fish Processor's License	$824.00	Any person who processes fish for profit and who sells to other than the ultimate consumer must obtain a Fish Processor's License.
Commercial trap	$54.08	Required for every person who uses traps to take finfish, mollusks, or crustaceans for profit except spiny lobster and Dungeness crab, as defined in FGC §9001.

No Shiner Perch were landed in 2018 by the commercial fishery—as a result, no revenue was generated from landing fees. FGC §8041(c) provides for an exemption to landing fees on live bait —it states: “Notwithstanding subdivision (a), a person who purchases, sells, takes, or receives live marine fish for use as live bait as described in subdivision (g) of Section 8030 is exempt from the landing fee imposed under this article.” This exemption applies to finfish caught for use as live bait that is not brought to a shore facility as stated in FGC 8030(g)—”A person who purchases, sells, takes, or receives live marine fish for use as live bait, that are not brought ashore, and who does not engage in any activity described in Section 8033, 8033.1, 8034, 8035, or 8036.”

Unless recreationally fishing off a public pier, all anglers 16 years or older are required to purchase a fishing license to fish for Shiner Perch. In 2019, the cost of an annual resident sport fishing license is $49.94 (Table 3-2). An undetermined proportion of recreational fishing revenue contributes to fisheries since recreational licenses fees are not species specific. Recreational license fees vary based on residency and term of the license selected, e.g., annual or single/multiple day, or lifetime (Table 3-2).

Table 3-2. Recreational license fees related to the Shiner Perch fishery from April 1, 2019 to March 31, 2020 (2019 Sport Fishing Fees. Accessed October 29, 2019).

Title	License Fee (US Dollars)	Description
Resident Sport Fishing	$49.94	Available for any resident 16 years of age or older.
Nonresident Sport Fishing	$134.74	Available for any non-resident 16 years of age or older.
Reduced-Fee Sport Fishing License - Disabled Veteran	$7.47 at CDFW Offices $7.82 from license agents	Available for any resident or nonresident 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.
Free Sport Fishing License - Low Income Native American	NO FEE	Available for any American Indian or lineal descendant whose household income does not exceed federal poverty guidelines. The Free Sport Fishing License for Low Income Native Americans is only available at CDFW License Sales Offices.
Free Sport Fishing License - Mobility Impaired, Blind or Developmentally Disabled	NO FEE	Available for a person who is blind, developmentally disabled, or mobility impaired. Your first Free Sport Fishing License must be obtained from the CDFW License and Revenue Branch. Subsequent licenses may be obtained from any license agent. See application for details.
One-day Sport Fishing License	$16.20	Allows a resident or nonresident to fish for one specified day. One-day sport fishing licenses are exempt from the Ocean Enhancement Validation requirement.
Two-day Sport Fishing License	$25.10	Allows a resident or nonresident to fish for two consecutive days. Two-day sport fishing licenses are exempt from the Ocean Enhancement Validation requirement.
Ten-day Nonresident Sport Fishing License	$49.94	Allows a nonresident to fish for ten consecutive days.

Title	License Fee (US Dollars)	Description
Lifetime-Age 0-9	$550.25	Available to residents of California. Lifetime fishing licensees receive an annual sport fishing license each year for life. Lifetime Fishing Packages must first be purchased from a CDFW License Sales Office. See Lifetime License Information for more detail.
Ages 10-39	$899.25	Available to residents of California. Lifetime fishing licensees receive an annual sport fishing license each year for life. Lifetime Fishing Packages must first be purchased from a CDFW License Sales Office. See Lifetime License Information for more detail.
Ages 40-61	$810.25	Available to residents of California. Lifetime fishing licensees receive an annual sport fishing license each year for life. Lifetime Fishing Packages must first be purchased from a CDFW License Sales Office. See Lifetime License Information for more detail.
Ages 62+	$550.25	Available to residents of California. Lifetime fishing licensees receive an annual sport fishing license each year for life. Lifetime Fishing Packages must first be purchased from a CDFW License Sales Office. See Lifetime License Information for more detail.

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.”

4.2. Past and Ongoing Monitoring of the Fishery

There are many studies on life history EFI for Shiner Perch described in Section 1.1, including age and growth, reproduction, and movement. This current 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 assess trends in the Shiner Perch fisheries.

4.2.1. Fishery-dependent Data Collection

The Department collected EFI on Shiner Perch from a variety of sources: angler surveys in the 1950s and 1960s (Miller and Gotshall 1965; Pinkas et al. 1968); a Monterey Bay angler survey in 1979 (Spratt 1982); San Francisco Bay complex Bay Shrimp beam trawler observations in the late 1980s; MRFSS from the 1980s through the early 2000s; and CRFS from 2005 to the present.

The Department monitors the commercial Shiner Perch fishery through analyzing fish tickets and contacting fishermen. Data from fish tickets provides a measure of fishing effort, catch levels, recruitment into the fishery by buyers and fishermen, general fishing location (Fish and Game blocks), and ports of landing. Specific EFI collected from fish tickets includes weight of the finfish landed by market category (general groupings of fish that may or may not be species specific), seasonal activity, and fishing gear used. Fish tickets are digitized into the MLDS database which allows staff to generate queries of commercial fisheries landings. Analyses of commercial fisheries fish ticket data are presented throughout Chapters 1 to 3. Several recreational surveys conducted by the Department (Miller and Gotshall 1965; Spratt 1982) documented catch and/or effort on beaches. The multi-state MRFSS and now the CRFS have conducted recreational angler interviews since 1980, with some interruptions of shore-based angler surveys. CRFS collects data on species composition, length and weight, location, effort, and angler avidity.

4.2.2. Fishery-independent Data Collection

Contemporary Department fishery independent data streams include the (Surf Fish Population Study) first conducted in the 1960s (Carlisle et al. 1960) was resumed in the 1990s and 2000s (CDFW unpublished data; Gliniak et al. 2009). Department staff conducted surf fish beach seine surveys at stations in southern California to investigate temporal changes in length frequency, relative species abundances based on catches, and influences by surf and tide conditions. The study was reinstated in 2007 to 2009. A total of 386 beach seine hauls were conducted yielding 31,631 fish and comprised 47 species. Results were compared with historical data indicating changes in relative abundance (number caught) of Shiner Perch. Shiner Perch was the 5th most frequently observed species in the 1950s and dropped to 17th in relative abundance in the late 2000s (Appendix A).

The Bay Study conducts comprehensive biotic surveys related to freshwater outflow in the San Francisco Bay estuary. The Bay Study uses otter and midwater trawl gear to sample 42 stations downstream of the Sacramento-San Joaquin Delta to Alcatraz Island and south to the Dumbarton Bridge. Effort (e.g., distance towed, volume of water filtered) from tows are used to calculate CPUE and abundance indices by month and year. Abundance indices for Shiner Perch from 1980 to 2017 were presented in Figure 1-4 (Fish et al. 2012). A precursor to the Bay Study was conducted by the Department in southern San Francisco Bay from 1963 to 1966 (Aplin 1967). Six stations located between the San Rafael Bridge to south of the Dumbarton Bridge, Palo Alto were sampled once a month using a midwater trawl, an otter trawl, a water sampler, and a sediment sampler during the study period (Aplin 1967). Shiner Perch were second to Northern Anchovy as the most abundant fishes that appeared in samples.

The MSI, formerly the Marine Ecological Institute, based in Redwood City, California, is a private nonprofit organization focusing on marine science research and education. Since 1970, MSI initially conducted FIS in southern San Francisco Bay prior to expanding surveys to San Pablo and Suisun bays. The surveys use otter trawls with 0.64-cm (0.25-in) cod ends. MSI surveys are unique in that they intensively sampled a small area of San Francisco Bay and provide a long-term time series of valuable data.

5. Future Management Needs and Directions

5.1. Identification of Information Gaps

Identifying, obtaining, and maintaining EFI data are vital to staff conducting assessments on fish stocks from fishery-dependent and fishery-independent sources. The primary goal is to develop appropriate measures to ensure resource sustainability. EFI includes data on age, growth, reproduction, and other life history characteristics that are important for managing a sustainable fishery. Fishery-independent abundance indices beyond San Francisco Bay for Shiner Perch are outdated or unknown. EFI will be a critical component for developing stock assessments and FMPs, if additional management is needed. Existing data gaps for Shiner Perch include:

- Species composition, length, weight, sex, and age of the commercial catch
- Fishery independent abundance indices and identification of existing long-term monitoring databases beyond San Francisco Bay
- Recruitment index
- Biological and socioeconomic fishery responses to large scale ecosystem changes

Table 5-1. Informational needs for the Shiner Perch fishery and their priority for management.

Type of information	Priority for management	How essential fishery information would support future management
Fishery-independent index of abundance—beyond San Francisco Bay	High	Determines relative abundance for evaluating the status of the population by developing/resuming abundance indices surveys in bays and estuaries throughout the state.
Recruitment index	Medium	Monitors the number of young age classes entering the population in order to assess stock health and forecast fluctuations in abundance.
Age and growth characteristics	Medium	Information used to monitor stock status, to determine if the fishery supports a broad age composition and sustainable recruitment of younger age classes into the fishery.
Location and spatial extent of spawning grounds	Low	Provides information on where the key spawning habitats are located, and how they have changed over time, which is important for directing survey efforts.
Habitat assessment	Low	Refines understanding of fine-scale habitat requirements and uses information to develop habitat maps across the region. Helpful for anticipating the impacts of sea level rise and coastal development on the spawning population.

5.2. Research and Monitoring

5.2.1. Potential Strategies to Fill Information Gaps

The Department may apply several strategies to address priority EFI needs for Shiner Perch. One approach may be to expand the geographic scope of fishery-independent surveys. Current monitoring efforts of Shiner Perch are limited to long-term fishery-independent surveys conducted in San Francisco Bay, e.g., Bay Study and MSI trawl surveys. Data from long-term fishery-independent surveys are helpful to inform managers monitoring stocks that are characterized by sporadic and localized fishing activity or when fishery-dependent surveys, i.e., CRFS, funds are impacted, and data collection is halted. Short-term fishery-independent surveys were conducted in other locations such as Humboldt Bay, Morro Bay, Anaheim Bay, and on several southern California beaches (Odenweller 1975; Horn 1980; Gleason et al. 2007; Gliniak et al. 2009). However, they were not designed as long-term projects.

Fishery-independent surveys of known Shiner Perch habitat can be expanded, particularly in bays and estuaries, to identify spawning locations. Contemporary information is currently limited to San Francisco and Humboldt bays. Abundance and recruitment measurements may be estimated with fishery-dependent data collected from existing Department data streams, e.g., CRFS and fish tickets. These may also

be estimated with fishery-independent data from Department led studies or supplemented with data collected by outside partners with well-established surveys, e.g., MSI, National Marine Fisheries Service, and Reef Check.

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, NGOs, 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.

The Department does not have the capacity to monitor all aspects of surfperch fisheries over their entire geographic range. Partnerships with stakeholders, NGOs, and researchers would be valuable in assisting Department staff with developing and implementing periodic sampling surveys conducted in Shiner Perch habitat. Data collected would be used to develop abundance indices to augment San Francisco Bay indices to determine the status of Shiner Perch statewide. These data could be invaluable to detect changes in size/age composition and spatial distribution in the face of variable environmental conditions.

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.

Presently, the Department does not anticipate implementing new regulations for the commercial or recreational Shiner Perch fisheries. Although Department fishery-dependent, e.g., commercial landings, and fishery-independent data sources (e.g., Bay Study indices) indicate declines in abundance, it does not appear that immediate management interventions are needed. Shiner Perch are not highly valued as a food fish and the live bait fishery has limited demand when other baits are available. If, in the future, the best available data indicate that the fisheries are causing resource issues, further investigation will be required to consider additional conservation measures.

5.4. Climate Readiness

Historically, changes in surfperch abundances and their targeted fisheries have been attributed to El Niño and La Niña events (Carlisle et al. 1960; Gotshall and Miller 1965; and Karpov et al. 1995; CDFW unpublished data). The Department monitors notices from various online sources including: NOAA's Pacific Fisheries Environmental Laboratory (here) and the National Weather Service Climate Prediction Center (here) to increase awareness of imminent El Niño and La Niña events. The Department monitors the commercial fishery by analyzing landing receipts submitted by fish buyers monthly; this may reflect possible environmental changes affecting surfperch fisheries—both positive and negative. The Department also monitors the sport fishery with CRFS; however, beach/bank surveys were discontinued in 2018. These monitoring programs, in combination with the Bay Study and MSI fishery-independent surveys may indicate responses to climate changes.
It is unknown what impacts climate change will have on the ports of landing providing infrastructure supporting the surfperch fisheries; however, the Shiner Perch commercial fishery is very small, takes place within bays, and fishermen land their fish daily. The Shiner Perch fleet has less frequent needs than other fisheries that are composed of larger vessels, operate offshore, require ice, or are dependent on buyers for offloading their catch, e.g., salmon troll or groundfish trawl.
If circumstances instigated by climate related changes evolve in the Shiner Perch fisheries to warrant emergency action, the APA process can be abbreviated, and closures may be implemented relatively quickly. The Commission and the Department have the authority to adopt emergency regulations under the APA process (here).

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7. Appendices

Species abundance ranks from beach seine surveys conducted from May 2007 to September 2009 by CDFG at selected southern California sites (here).

Rank	Species	Abundance
1	Queenfish	8601
2	Pacific Sardine	4298
3	Yellowfin Croaker	4285
4	Walleye Surfperch	2257
5	Topsmelt	2175
6	California Corbina	1858
7	Round Stingray	1830
8	Salema	1119
9	Jacksmelt	1014
10	Spotfin Croaker	972
11	Barred Surfperch	507
12	Deepbody Anchovy	484
13	White Croaker	435
14	Bat Ray	244
15	California Halibut	234
16	Shovelnose Guitarfish	234
17	Shiner Perch	228
18	Striped Mullet	125
19	Jack Mackerel	113
20	White Seabass	98
21	Pacific Barracuda	96
22	Pacific Chub Mackerel	91
23	Leopard Shark	65
24	California Needlefish	55
25	Gray Smoothhound	36
26	Barred Sand Bass	25
27	Barcheek Pipefish	24
28	White Seaperch	21
29	California Butterfly Ray	17
30	Pacific Butterfish	12
30	Zebraperch	12
31	Diamond Turbot	9
31	Northern Anchovy	9
32	Pacific Staghorn Sculpin	7
32	Thornback	7
33	Black Perch	6
33	Giant Kelpfish	6
34	Dwarf Perch	4
35	California Grunion	3
35	Kelp Bass	3
35	Pile Perch	3

Rank	Species	Abundance
36	Hornyhead Turbot	2
36	Mexican Lookdown	2
36	Sargo	2
37	Black Croaker	1
37	Bonefish	1
37	Speckled Sanddab	1

Common species, in decreasing order of abundance, caught by Marine Science Institute trawl gear: 1970 to 2015. Source: Marine Science Institute, Redwood City 2017: All Catch Data.

Rank	Common name	Species code
1	Northern Anchovy	NA
2	Shiner Perch	SSP
3	English Sole	ES
4	Staghorn Sculpin	SHS
5	California Halibut	CH
6	Chameleon Goby	CG
7	White Croaker	WC
8	Speckled Sanddab	SSD
9	Pacific Sanddab	PSD
10	Yellowfin Goby	YG
11	Bat Ray	BR
12	Pacific Herring	PH
13	Sanddab species	SD
14	Bay Goby	BG
15	Plainfin Midshipman	PMS
16	California Tonguefish	CT
17	Barred Surfperch	BSP
18	Starry Flounder	SF
19	Brown Smoothhound	BS
20	Leopard Shark	LS
21	Goby species	UG
22	Dwarf Surfperch	DSP
23	Cheekspot Goby	CSG