Barred Surfperch, *Amphistichus argenteus*, and Redtail Surfperch, *Amphistichus rhodoterus*  
Enhanced Status Report

Barred Surfperch, *Amphistichus argenteus* (Photo Credit: Ken Oda, CDFW);  
Redtail Surfperch, *Amphistichus rhodoterus* (Photo credit: Ken Oda, CDFW)

California Department of Fish and Wildlife  
Marine Region

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Status Report.

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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<td>Description</td>
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Fishery-at-a-Glance Barred and Redtail Surfperch

Scientific Name: Amphistichus argenteus–Barred Surfperch; Amphistichus rhodoterus–Redtail Surfperch

Range: Barred Surfperch range from Mendocino (Mendocino County), California to Bahia Santa Rosalia, central Baja California, Mexico. Redtail Surfperch range from Vancouver Island, British Columbia to Avila (San Luis Obispo County), California.

Habitat: Both species are found in the surf on open coast sandy beaches, and in bays and estuaries.

Size (length and weight): The largest documented Barred Surfperch measured 19.5 inches (49.5 centimeters) total length (TL) and 4 pounds 12 ounces (2.15 kilograms). The largest Redtail Surfperch recorded measured 16 inches (40.6 centimeters) and 4 pounds 1 ounce (1.84 kilograms).

Life Span: The maximum age of both Redtail and Barred Surfperch is estimated to be age 9 to 10 in California. A 14-year-old Redtail Surfperch was reported aged in the literature from Oregon.

Reproduction: Surfperch are viviparous, giving birth to live young. Mating for most species initiates in the fall, and birthing occurs in the spring and summer. Barred Surfperch have been found with full-term embryos earlier in the year south of Point Arguello. The number of young produced by a single female varies by size from less than ten to over 100. Surfperch newborns are fully developed and free swimming, ranging in size from 2 to 3 inches (5.08 to 7.62 centimeters).

Prey: The diets of Barred and Redtail Surfperch consist primarily of invertebrates such as the Pacific Mole Crab, amphipods, skeleton shrimps, and polychaete worms. They also will consume smelt embryos and small fish such as Pacific Sardine and Northern Anchovy.

Predators: Surfperch are forage for a variety of species including fish, marine mammals, and birds. Predatory fish include Barred Sand Bass, Kelp Bass, California Halibut, Lingcod, Leopard Shark, Pacific Bonito, Striped Bass, rockfishes, and salmon. Surfperch also fall prey to Harbor Seal, River Otter, and birds such as Great Blue Heron, Common Loon, Osprey, cormorants, gulls, and terns.

Fishery: Barred and Redtail Surfperch support commercial and sport fisheries. The commercial fishery is relatively minor in terms of landings and the number of active participants, whereas, the sport fishery is popular statewide. Barred Surfperch ranks as
the number one and Redtail Surfperch number three retained species taken by shore anglers statewide from 2015 to 2017.

**Area Fished:** The Barred Surfperch commercial fishery occurs primarily in San Luis Obispo County while Redtail Surfperch are fished along Mendocino, Humboldt, and Del Norte County open coast sandy beaches. The commercial fishery is prohibited from taking Barred, Calico, and Redtail Surfperch south of Point Arguello. Recreational anglers target surfperch species over a broader range: Barred Surfperch are taken from Sonoma to San Diego counties including San Francisco Bay and other estuaries while Redtail Surfperch are targeted from Del Norte to San Mateo counties.

**Fishing Season:** Surfperch, including Barred and Redtail Surfperch, may not be taken commercially from May 1 to July 31 statewide except for Shiner Perch which is open all year. The surfperch recreational fishery is open year-round except within San Francisco and San Pablo bays from April 1 to July 31; however, Shiner Perch is open all year.

**Fishing Gear:** The primary fishing gear used by shore-based commercial fishermen and recreational anglers for Barred and Redtail Surfperch is hook and line by rod and reel.

**Market(s):** The market for both species caught commercially is local. Surfperch are sold live, gutted and gilled, and as fillets.

**Current Stock Status:** There are no population estimates or stock assessments for either species. Trends in commercial and recreational catch are monitored along with coarse-scale relative abundance indices from fishery-dependent and fishery-independent sources. While Barred Surfperch landings and distribution appear to fluctuate with climatic events (e.g., the 2009 to 2011 La Niña and 2014 to 2016 El Niño) and likely other factors, the relative abundance indices appear stable. Redtail Surfperch recreational catch show a strong upward trend following 2010 similarly to Barred Surfperch and continued increasing through the 2014 to 2016 El Niño into 2017. Redtail Surfperch commercial landings have greatly diminished over the past several decades as a result of reduced accessibility to historical fishing grounds. Abundance indices from the recreational fishery show an increasing trend in recent years for Redtail Surfperch in Humboldt and Del Norte counties, suggesting the populations have increased.

**Management:** Surfperch management measures include: commercial and recreational season closures (San Francisco Bay), area closures (no commercial take of Redtail, Barred, and Calico Surfperch south of Point Arguello), recreational bag and possession limits, minimum size limit of 10.5 inches (26.67 centimeters) for recreational Redtail Surfperch, tag requirement for commercial Barred, Redtail, and Calico Surfperch sold south of Point Arguello, and marine protected areas (MPAs) implemented in 2012 under
the Marine Life Protection Act (MLPA). State Parks regulations prohibit commercial fishing within their parks. Authorized beach access by motorized vehicles is limited to specified beaches in San Luis Obispo, Mendocino, Humboldt, and Del Norte counties serving to reduce impacts to sensitive habitat, species, and for public safety.
1. The Species

1.1. Natural History

Natural history involves the observation and understanding of functional relationships between the organism and its environment. It includes describing a species’ distribution and movement, reproductive strategies, growth and mortality, and size and age structure.

1.1.1. Species Description

Barred Surfperch (Amphistichus argenteus) (Figure 1-1), and Redtail Surfperch (A. rhodoterus) (Figure 1-2), are members of the family Embiotocidae, sub-family Embiotichinae which includes Calico (A. koelzi), Walleye (Hyperprosopon argenteum), Spotfin (H. anale), and Silver Surfperch (H. ellipticum). 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. The dorsal fin has 9 to 11 spines and 19 to 28 soft rays, and the anal fin has three spines with 15 to 35 soft rays (Miller and Lea 1972). The lateral line canal is continuous and located high on the side. Scales are cycloid. A non-barred color variant (Figure 1-3) is commonly reported north of Santa Cruz to Marin County (Love 2011).
Figure 1-1. A female Barred Surfperch, *Amphistichus argenteus*, displaying mating coloration (Photo credit: Ken Oda, CDFW).
Figure 1-2. Redtail Surfperch, *Amphistichus rhodoterus* (Photo credit: Mark Won, angler).

Figure 1-3. Barred Surfperch, *Amphistichus argenteus*, non-barred color variant (Photo credit: Mark Won, angler).
The surfperch family, Embiotocidae, is composed of 23 species, 18 of which occur in California’s coastal waters. Members of this family are commonly called surfperch, seaperch, and perch. Members of the sub-family Amphistichinae share similar habitat preferences-open coast sandy beaches and seasonally, estuaries while member of the sub-family, Embiotocinae, which include perch and seaperch, are associated with rocky substrates, kelp beds, man-made structures such as pier pilings, and estuaries (Appendix A).

1.1.2. **Range, Distribution, and Movement**

The geographic range of Barred Surfperch extends from Bodega Bay (Sonoma County) to central Baja California, Mexico (Miller and Lea 1972). Redtail Surfperch range from Vancouver Island, British Columbia to Avila Beach (San Luis Obispo County) but are rarely found south of San Mateo County. Redtail and Barred Surfperch ranges overlap from Bodega Bay (Sonoma County) to Avila Beach. Love (2011) notes Redtail Surfperch have been reported by anglers (with photo documentation) from northern Baja California (Punta Colonett to Baja San Quintin); however, specimens have not been collected for validation purposes to date. Ranges of Barred and Redtail Surfperch extend approximately 1,000 miles (mi) (1,609 kilometers (km)) each with 300 mi (483 km) of range overlap from Bodega Bay to Port San Luis (Figure 1-4).
Figure 1-4. Ranges of Barred (green) and Redtail Surfperch (red). Source: 39° 11.460' N and 103° 7.673' W (Photo credit: Google Earth Pro. December 13, 2015. Sourced: February 20, 2018).
Tagging studies have been conducted on southern California Barred Surfperch and southern Oregon Redtail Surfperch (Carlisle et al. 1960; Pruden 2000; Heather Gliniak, CDFW, personal communication). Findings from these studies indicate that both species demonstrated the capability of significant movement, traveling up to approximately 36 and 70 mi (58 and 113 km) for Barred and Redtail Surfperch, respectively. However, many fish did not venture significant distances from the original tagging locations. Redtail Surfperch exhibited an annual migration southward in the spring and returned northward during late summer and fall (Pruden 2000). Annual directional migration patterns for Barred Surfperch have not been documented in the literature; however, recreational catch and fishery-independent sample data indicate higher catches related to seasonal mating and parturition movement inshore (CDFW unpublished data).

The degree and direction of movement varied between the two species. Pruden (2000) observed seasonal directional movement of Redtail Surfperch. Redtail and Barred Surfperch movement appeared to be hindered by physical “barriers” such as rocky headlands and industrial harbors, neither of which are considered habitat for either species—which may cause stock separation (Carlisle et al. 1960; Pruden 2000).

1.1.3. Reproduction, Fecundity, and Spawning Season

Barred and Redtail Surfperch are viviparous, mate in the winter, and parturate (emerge and separate from the female) in the summer (Carlisle et al. 1960; Triplett 1960; Bennett and Wydoski 1977; Brookins 1995; CDFW unpublished data). Barred and Redtail Surfperch may move in proximity to river mouths, bays, and estuaries for mating and parturition (Miller and Gotshall 1965; Bennett and Wydoski 1977; Ngoile 1978).

Analysis of central coast Barred Surfperch males collected from Department hook and line fishery-independent surveys (FIS) indicated ripeness commenced in September and peaked in November based on Gonadal Somatic Index (GSI)—gonad weight/total body weight (Figure 1-5). Based on FIS in northern California, Redtail Surfperch populations begin spawning approximately 1 month sooner with an October peak in male GSI (Figure 1-6). Gestating females for both species retain the young for 3 to 6 months before giving birth in the spring and summer. However, female Barred Surfperch south of Point Arguello, Santa Barbara County were found with full-term embryos earlier in the year.
Figure 1-5. Central California Barred Surfperch male mean GSI by month: 2007 to 2018 (CDFW unpublished data).

Figure 1-6. Northern California Redtail Surfperch male mean GSI by month, plus and minus one standard deviation: 2012 to 2018 (CDFW unpublished data).

The number of young produced is approximately proportional to the size of the female while varying with species. Barred Surfperch may produce close to 100 embryos while Redtail Surfperch are less fecund—the maximum number of offspring documented in
the literature is 51 (Bennett and Wydoski 1977; Ngoile 1978; Baltz 1983; CDFW unpublished data). For Barred Surfperch collected from central California coastal counties, San Luis Obispo to Marin, fecundity is geometrically proportional to length (Figure 1-7).

\[ y = 3E-07x^{3.2619} \]
\[ R^2 = 0.6607, n = 154 \]

**Figure 1-7.** Central California Barred Surfperch fecundity: number of embryos versus mother fork length (mm) (CDFW unpublished data).

Redtail Surfperch also experienced length-based fecundity, but the number of embryos appears to increase more quickly with length even though overall fecundity is lower (Figure 1-8).
1.1.4. **Natural Mortality**

Determining the natural mortality (M) of marine species is important for understanding the health and productivity of their stocks. Natural mortality results from all causes of death not attributable to fishing such as old age, starvation, 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 for either Surfperch species. However, empirical estimators can be applied to certain life history parameters which can approximate M in the absence of direct estimates. Several of these methods, which use relationships between the maximum reported age and M values across species, were applied to Redtail using the max. reported age of 14 and Barred Surfperch using the max. reported age of 9. The resulting M estimates for Barred Surfperch ranged from 0.488 to 0.655 and from 0.3 to 0.437 for Redtail Surfperch (Hoenig et al. 1983, Then et al. 2015). Although directly observing natural mortality rates in wild populations is
undoubtedly the most reliable method, these studies are difficult to implement, and the above estimates are likely acceptable approximations.

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.

Barred and Redtail Surfperch are the largest members of the sub-family Amphistichinae. The sport angling world record for a Barred Surfperch verified by the International Game Fish Association was submitted in 2016. It measured 19.5 in (495 mm) total length (TL) and weighed 4 pounds (lb) 12 ounces (oz) (2.15 kilogram (kg)). The largest Redtail Surfperch reported in the literature is 16 in (41 mm) TL and weighed 4 lb 1.6 oz (1.8 kg) (Love 2011).

Terminal length of Barred Surfperch embryos prior to parturition is approximately 2.75 in (70 mm) TL for both species (Carlisle et al. 1960; Bennett and Wydoski 1977; CDFW unpublished data). Based on samples collected from San Luis Obispo to Marin counties, Barred Surfperch embryo growth by month is uniform after reaching a length of approximately 1.6 in (40 mm) (Figure 1-9). Surfperch newborns are fully developed and free swimming, ranging in size from 2 to 3 in (38 to 76 mm). Juvenile Barred Surfperch collected using beach seine and hook and line gear from Monterey Bay indicate that growth rates for young-of-the-year (YOY) are comparable to those reported from samples south of Point Arguello (Carlisle et al. 1960; Department unpublished data).
Both Barred and Redtail Surfperch display differential growth by sex. Carlisle et al. (1960) reported that growth based on scale samples from YOYs caught in the spring accelerated through the summer and slowed in the fall and winter. As 1- and 2-year-olds, growth rates are essentially identical; however, females grew faster from age 3 compared to males and reached a larger terminal size (Carlisle et al. 1960; Bennett and Wydoski 1977; Pruden 2000; CDFW unpublished data). This change in growth rate by age 3 was attributed to males slowing in growth upon reaching sexual maturity (Bennett and Wydoski 1977). CDFW regularly collects length-at-age data for both species, which are awaiting age-validation (described in detail below). Upon completion of that study, descriptions of species-specific growth and growth models are anticipated.

The Department is completing work on validating ages using oxytetracycline (OTC) injected into captive Barred Surfperch. The samples (n = 12) were taken with hook and line gear from two locations: Francis State Beach in Half Moon Bay, San Mateo County, and Beer Can Beach, Aptos, Santa Cruz County. They were transported to the Marine Science Institute (MSI) in Redwood City, San Mateo County, treated, held for approximately 1 year, and processed. A subsample of whole otoliths was examined under fluorescence microscopy to confirm the presence of OTC in otoliths. Otoliths were sectioned, polished, and examined using a confocal laser scanning fluorescence microscope. The OTC band was successfully incorporated and visible in an expected...
pattern on every otolith. The margin of otolith growth beyond the OTC marker requires examination for the formation of one opaque and one translucent growth band to validate that these two bands are equivalent to 1 year of growth.

Although female surperch attains a greater maximum size and grow more quickly than their male conspecifics, the underlying relationship between length and weight is a function of their body shape which varies little between the sexes. Both Barred and Redtail Surfperches length – weight relationships are described well with power functions (Figure 1-10 and Figure 1-11), exhibiting nearly isometric growth. The size to weight relationships are also very similar between species.

![Graph showing weight against fork length with the equation W = 0.000014 x L^{3.09} and 95% confidence intervals. R^2 = 0.98, n = 1,861.](image)

**Figure 1-10.** Weight length relationships of Barred Surfperch from central California (CDFW unpublished data).
1.1.6. **Size and Age at Maturity**

Age at first maturity for southern California male Barred Surfperch was determined to be 1 year (Carlisle et al. 1960; Triplett 1960) which is consistent with several other Embiotocids (Hubbs and Hubbs 1954; DeMartini et al. 1983). Triplett (1960) reported that all 2-year-old female Barred Surfperch examined after the middle of January contained developing embryos. He assigned fish with two winter growth bands as age 2. Carlisle et al. (1960) reported that 2-year-old Barred Surfperch averaged 6.8 in (172 mm) standard length (SL). Bennett and Wydoski (1977) determined that 70% of 2-year-old male Redtail Surfperch were mature. Ngoile (1978) found that approximately 17% of 3-year-old females and 88% of 4-year-old females were mature. An assessment of age at maturity using CDFW’s FIS data, as above, is pending results from an age validation study but is anticipated to be presented in the future.

Length at maturity, however, is assessed using CDFW data for both Redtail and Barred Surfperch by replicating the methods presented in Bennett and Wydoski (1977). Department staff estimated that 50% of female Redtail Surfperch were mature at 259 mm fork length (FL) (Figure 1-12), in contrast to previous estimates of 241 mm FL (Figure 1-13), Bennett and Wydoski 1977). Although the same methods with similar sample sizes were applied, the difference can most likely be attributed to either latitudinal or temporal influences on population dynamics.

![Graph showing weight vs. fork length relationship](image-url)

**Figure 1-11.** Weight length relationships of northern California Redtail Surfperch (CDFW unpublished data).
Figure 1-12. Maturity ogive for female Redtail Surfperch estimated from Department-collected data. Length at 95% maturity ($L_{95}$) is represented by the largest dashed line, length at 50% maturity ($L_{50}$) is represented by the medium dashed line, and the minimum legal size (MLS) for Redtail Surfperch is converted to millimeters fork length for comparative purposes (CDFW unpublished data).

Figure 1-13. Maturity ogive for Redtail Surfperch reconstructed using data presented in Bennett and Wydoski 1977. Approximate length at 95% maturity ($L_{95}$) is represented by the largest dashed line, approximate length at 50% maturity ($L_{50}$) is represented by the medium dashed line, and the minimum legal size (MLS) for Redtail Surfperch is converted to millimeters fork length for comparative purposes.
Barred Surfperch were 50% mature at 239 mm FL (Figure 14), smaller than the recent estimate for Redtail which is consistent with the differences in ages at maturity reported in the literature.

![Maturity ogive for Barred Surfperch](image)

**Figure 1-14.** Maturity ogive for Barred Surfperch with estimated lengths at 50% (large dashed line) and 95% maturity (small dashed line) (CDFW unpublished data).

1.2. **Population Status and Dynamics**

No formal stock assessments have been conducted on Barred or Redtail Surfperch. Recent data from fishery-dependent and fishery-independent sources suggest recent improvement in Barred and Redtail Surfperch abundance indices. Landings and catch per unit effort data (CPUE), for example, must be considered with care if used as an indicator of abundance. The total CPUE (total pounds/number of fish ticket) for commercial hook and line gear has fluctuated the past two decades with inter-annual variation ranging from 14 to 36 and 46 to 129 lb/fish ticket for Barred and Redtail Surfperch, respectively (Figure 1-15).
Figure 1-15. Average annual CPUE for Barred and Redtail Surfperch commercial fish tickets: 2005 to 2018 (CDFW MLDS 2019).

Other factors that may be unrelated to abundance, such as market or regulatory changes, gear improvements, or hyperstability, may act to confound conclusions regarding status of stocks.

Surfperch possess low spawning potential. They may not recover as quickly following periods of low abundance; however, producing free swimming young in the surf environment that are relatively large and ready to forage upon parturition is advantageous. Surfperch populations appear to be more stable than those of surf spawning species that are oviparous (for example, atherinopsids and osmerids) and whose embryos are exposed to environmental factors causing mortality including desiccation and predation (Martin and Swiderski 2001).

1.2.1. Abundance Estimates

There are no formal population estimates for any species of surfperch in California. The Department has relied on a combination of fishery-dependent and fishery-independent sources to evaluate trends in surfperch populations. These sources include: estimated recreational catch and effort provided by the California Recreational Fisheries Survey (CRFS); Progressive Angler Surveys (PAS) to determine relative effort on the majority of Monterey County sandy beaches; commercial fish tickets from California Fisheries
Information System (CFIS), which in 2018 became the Marine License Data Base (MLDS); commercial landing sampling; and, fishery-independent sampling.

In combination, these data sources provide estimates of relative effort, landings (catches), and size and/or age composition of the catch. They can be used to develop abundance indices provided that potentially confounding factors unrelated to stock abundances are identified, e.g., market and environmental conditions, and regulatory changes. Data sources that are used to evaluate other fisheries such as logbooks do not provide data relevant to sandy beach surfperch—surfperch are rarely targeted by CPFVs and logbooks are not required of hook and line commercial surfperch fishermen.

The Department conducted FIS at selected stations in southern California using beach seines during the 1950s, 1990s, and 2000s (Carlisle et al. 1960, Department unpublished data, Gliniak et al. 2009). Carlisle et al. (1960) identified Barred Surfperch, California Corbina (Menticirrhhus undulatus), Spotfin Croaker (Roncador stearnsi), and Yellowfin Croaker (Umbrina roncador) to study. Gliniak et al. (2009) noted temporal changes in species composition in the beach seine surveys—relative abundance, number of individuals caught in hauls, of Barred Surfperch in beach seine data suggesting population responses to either fishing pressure or environmental changes between sampling periods.

The Department’s San Francisco Bay Study (based in Stockton) has conducted surveys for a range of species including Embiotocidae using beach seine, midwater and bottom trawl gear in San Francisco and San Pablo bays since 1980 to develop relative abundance indices. Although abundance indices were relatively high in 1980 to 1981, 1983, and 1984, in-bay abundances of Barred Surfperch were at low levels from the late 1980s through the early 2000s (Figure 1-16) and were characterized as an uncommon San Francisco Bay complex inhabitant (DeLeón 1999).
Figure 1-16. Barred Surfperch indices of abundance from San Francisco Bay Study: 1980 to 2010 (Fish et al. 2012.)

Statewide commercial fish ticket analysis indicates differing trends for Barred and Redtail Surfperch. Barred Surfperch average annual landings increased from low levels during the 1980s to highs in the 1990s, declined in the 2000s, and increased in the late 2010s. Redtail Surfperch, on the other hand, decreased slightly from the 1980s to the 1990s, and continue to decline into the 2010s (Figure 1-17).
1.2.2. Age Structure of the Population

The true age composition or age frequency of open coast Barred Surfperch and Redtail Surfperch are not known from available commercial and recreational catch samples. Age frequencies derived from hook and line gear used by commercial and recreational fishermen/anglers do not reflect all ages composing the population; YOY and 1-year-old fish are under-represented relative to larger older fish. Department FIS using hook and line methods show a higher proportion of YOY relative to larger fish than fishery-dependent samples; however, retention of small fish is difficult even with appropriately sized hooks under typical surf conditions (Figure 1-18).
Figure 1-18. Central California Barred Surfperch length (mm) frequency from hook and line fishery-independent — all samples combined, n = 1,775, 2008 to 2018 (CDFW unpublished data).

Other sampling gear such as beach seines may produce representative samples on a given day; however, catch composition can be influenced by other factors unrelated to gear selectivity such as seasonal behavior related to parturition when fish aggregate by sex and size or in locations where YOY were recently birthed (Carlisle et al. 1960; CDFW unpublished data). Due to Department staff safety issues related to deploying beach seines under typical surf conditions in central and northern California, which are characterized by high gradient beaches, tidal rips, and generally overall rougher surf, beach seining efforts are limited to protected and “flatter” profile beaches (Figure 1-19).
Beach seines have the capability of capturing YOY surfperch where they are underrepresented in hook and line samples. The combined catch of Barred Surfperch sampled by Department beach seine hauls in Monterey Bay and MSI trawl surveys in San Francisco Bay from 2012 to 2013 indicate a multi-modal size class distribution (Figure 1-20).
Size composition of the retained portion of the Barred Surfperch recreational catch was compared with that from Department fishery-independent hook and line surveys where no fish were released (Figure 1-21). Although the length modes differ, both show that smaller size classes dominate the sampled population. In contrast, the Redtail Surfperch plot differs significantly from that of Barred Surfperch; this is attributed to the implementation of the 10.5-in (266-mm) TL minimum size regulation, § 28.59(d), Title 14, California Code of Regulations (CCR), established for Redtail Surfperch in 2006.
Figure 1-21. Percent size composition of central (San Luis Obispo to Sonoma County), southern (Santa Barbara to San Diego County) Barred and Redtail Surfperch recreational fishery samples combined from 2005 to 2018 (RecFIN 2019).

1.3. Habitat

Along the California coast, Barred and Redtail Surfperch, both juveniles and adults, inhabit open coast sandy beaches (Carlisle et al. 1960; Bennett and Wydoski 1977; Brookins 1995; Pruden 2000; Nielsen et al. 2013; Nielsen et al. 2017). Sandy beach habitat composes 57% of the open coastline north of Point Conception and 82% of the mainland coastline south of Point Conception to the Mexican border (Allen and Pondella 2006). This 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). Physically, sandy beaches have been classified as either long beaches or pocket beaches. Nielsen et al. (2013) differentiated long and pocket beaches: "long beaches (>1 km (0.621 mi)) of contiguous sandy shoreline and pocket beaches (< 1 km (0.621 mi) of contiguous sandy shoreline bounded by rocky shoreline) (Figure 1-22). Substrate ranges from rock, cobble, and sand along the open coast sandy beaches (Allen et al. 2006).
Figure 1-22. An example of a long beach (left)—San Gregorio Beach, San Mateo County and pocket beaches (right)—Spooner’s Cove, San Luis Obispo County (Photo credit (left): Ken Oda, CDFW; Google Earth, earth.google.com/web/ (right)).

Although Barred and Redtail Surfperch are commonly found along open sandy beaches and sandy pocket beaches juveniles and adults are also found in bays and estuaries but less abundantly (Carlisle et al. 1960; Miller and Gotshall 1965; Smith 1967; Bennett and Wydoski 1977; Ngoile 1978; Baltz 1983; Brookins 1995; DeLeón 1999; Pruden 2000). Bays and estuaries are characterized by temporal and spatial variability in physical and chemical parameters including current, temperature, salinity, pH, dissolved oxygen, and productivity (Allen and Pondella 2006). Bays and estuaries are comprised of an array of habitats: eel grass beds, mud flats, shallow to deep channels, and sandy beaches.

Fish abundance surveys conducted by the Department’s San Francisco Bay Study indicate sporadic usage of the San Francisco estuary by Barred Surfperch (DeLeón 1999). Gravid Redtail Surfperch females appear in estuaries prior to giving birth (Bennett and Wydoski 1977). Ngoile (1978) noted that males were lower in relative abundance than females indicating that estuaries may play a role in the birthing process.

1.4. Ecosystem Role

Barred and Redtail Surfperch fill a mid-level predator role in sandy beach and estuarine ecosystems. Newly birthed and YOY surfperch feed upon zooplankton while larger fish forage on a variety of invertebrates on sandy beach habitats. They also consume fish eggs, as well as other fish, such as Northern Anchovy (Engraulis mordax), Pacific Sardine (Sardinops sagax caeruleus), and smelts—Osmerids and Atherinopsids. In turn, both species are forage for larger fish, marine mammals, and birds. Barred and Redtail Surfperch recruitment shows sensitivity to El Niño-Southern Oscillation (ENSO) events and may be less available as forage to species that prey upon them (Radovich 1961; Brookins 1995).
1.4.1. Associated Species

Conducting direct assessment surveys of species associated with Barred and Redtail Surfperch using scuba and beach seine methods in the surf zone statewide is problematic given limited visibility and surge (Carlisle et al. 1960, Allen and Pondella 2006). Beach seine data are limited to calmer waters along the open coast or within bays and estuaries. The Department conducted fishery-independent surveys at selected stations in southern California using beach seines during the 1950s, 1990s, and 2000s (Carlisle et al. 1960; CDFW unpublished data; Gliniak et al. 2009). Department staff conducted hook and line surveys from Orange to San Diego counties from 2007 to 2011. Species sampled with Barred Surfperch in Department beach seine and hook and line surveys included the following: Northern Anchovy, California Corbina, Walleye Surfperch, Shiner Perch (Cymatogaster aggregata), Spotfin Croaker, Yellowfin Croaker, Queenfish (Seriphus politus), Topsmelt (Atherinops affinis), Jacksmelt (Atherinopsis californiensis), Leopard Shark (Triakis semifasciata), and Pacific Sardine (Appendix C).

The Department’s CRFS Project documents surf species composition data based on angler interviews and sampled catches statewide. For southern California (Ventura to San Diego counties) during 2005 to 2017, Barred Surfperch was ranked the number one species, kept and released, by beach/bank anglers followed by Spotted Sand Bass (Paralabrax maculatofasciatus), California Halibut (Paralichthys californicus), Kelp Bass (P. clathratus), Yellowfin Croaker, Pacific (Chub) Mackerel (Scomber japonicus), atherinopsids(Topsmelt and Jacksmelt), Walleye Surfperch, and Barred Sand Bass (P. nebulifer).

Department staff conducted routine FIS from 2007 to 2018 along Del Norte to San Luis Obispo county beaches using hook and line (CDFW unpublished data). From Santa Cruz to San Luis Obispo counties, catches were dominated by Barred Surfperch and included: Silver, Walleye, and Calico Surfperch, Striped Bass, Jacksmelt, California Halibut, Leopard Shark, and Shovelnose Guitarfish (Rhinobatis productus). Data were also collected by beach seines on Monterey Bay beaches. In addition to the species listed above, other species caught with Barred Surfperch included Pacific Sardine, Sand Sole (Psetticthys melanostictus), and Kelp Perch (Brachyistius frenatus), (CDFW unpublished data).

Common species caught with Redtail Surfperch from 2008 to 2018 from Sonoma to San Mateo counties open coast beaches in hook and line FIS included: Barred, Silver, Walleye Surfperch, Striped Seaperch (Embiotoca lateralis), Black Perch (E. jacksoni), Striped Bass (Morone saxatilis), and Jacksmelt. Pilot FIS hook and line surveys were
conducted on Mendocino County beaches beginning in 2016. Species collected with Redtail Surfperch were Calico, Silver, and Walleye Surfperch, and Striped Seaperch.

Angler survey work by Miller and Gotshall (1965) indicated that hook and line anglers landed primarily Walleye and Silver with Redtail Surfperch on sandy beaches in Humboldt and Del Norte counties. Surf netters on the same beaches landed Night Smelt (Sprinchus starksi), Surf Smelt (Hypomesus pretiosus), and Pacific Herring (Clupea pallasi), as well as Redtail Surfperch. The Department initiated hook and line FIS in Humboldt and Del Norte counties in 2012, continuing through 2016 including collaborative work in 2014 and 2015 (Nielsen et al. 2017). The only other species caught in addition to Redtail Surfperch was Silver Surfperch; however, Night Smelt were targeted with dip nets at sample sites. Common species associated with Redtail Surfperch in CRFS beach/bank surveys conducted in 2005 to 2017 in Humboldt and Del Norte counties included: Surf Smelt, Black Rockfish, (Sebastes melanops), Striped Seaperch, Silver Surfperch, Kelp Greenling, (Hexagrammos decagrammus), Jacksmelt, and Shiner Perch (Figure 1-23). It is important to note that the Night Smelt recreational catch is under-represented even though they are common at locations where Redtail Surfperch may be abundant. Fishermen targeting Night Smelt were not interviewed by CRFS staff due to Night Smelt fishing typically commencing at dusk and continuing into the night.

![Bar chart showing common fish species kept by Del Norte and Humboldt County beach/bank anglers from 2005-2017](Figure 1-22).

*Figure 1-22.* Estimated total number of fish kept by Del Norte and Humboldt County beach/bank anglers from 2005-2017 (RecFIN 2019).
The Department’s San Francisco Bay Study samples annually from South San Francisco Bay to the western Delta monthly. Samples were collected by a combination of beach seine, midwater and bottom trawl gear. There are some data gaps that may influence data relevant to surfperch: limited midwater trawl sampling in 1994 and no winter sampling from 1989 to 1997 (Interagency Ecological Program Newsletter Winter 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 Barred Surfperch included: Topsmelt, Jacksmelt, Northern Anchovy, Pacific Herring, Longfin Smelt (Spirinchus thaleichthys), Striped Bass, White Croaker (Genyonemus lineatus), Inland Silverside (Menidia beryllina), Plainfin Midshipman (Porichthys notatus), Yellowfin Goby (Acanthogobius flavimanus), Arrow Goby (Clevelandia ios), Staghorn Sculpin (Leptocottus armatus), and Shiner Perch—only one Redtail Surfperch was sampled from 1980 to 1995 (Orsi 1999).

MSI, based in Redwood City, California, is a nonprofit organization focusing on marine science research and education. Since 1970, MSI has conducted fishery-independent surveys 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, 8.0 percent in central San Francisco Bay and the remainder occurring in San Pablo and Suisun Bays (MSI, Redwood City 2017: All Catch Data). No tow data were available 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).

Barred Surfperch were caught in all years except 1971. In the 1970s and from 2010 to 2015, Barred Surfperch was among the ten most frequently observed species. Barred Surfperch (coded BSP) ranked 17th in mean frequency of occurrence for the entire period 1970 to 2015 (Figure 1-24). No tows occurred during 1982 to 1984 and 1987 to 1991. Species/species groups co-occurring with Barred Surfperch in decreasing order of relative abundance were: Northern Anchovy (NA), Shiner Surfperch (SSP), English Sole (ES) (Parophrys vetulus), Staghorn Sculpin (SHS), California Halibut (CH), Chameleon Goby (CG) (Tridentiger trigonocephalus), White Croaker (WC), Speckled Sanddab (SSD), Pacific Sanddab (PSD) (Citharichthys sordidus), and Yellowfin Goby (YG). Other associated species that occurred frequently in the catch but in lower relative abundances include Bat Ray (BR), Pacific Herring (PH), sanddab species (SD), Bay Goby (BG) (Lepidogobius lepidus), Plainfin Midshipman (PMS), California Tonguefish (CT) (Symphurus atricauda), Starry Flounder (SF) (Platichthys stellatus), Brown Smoothhound (BS) (Mustelus henlei) and Longfin Smelt (LFS) (Spirinchus thaleichthys).
round out the top 20 species (Appendix B). Redtail Surfperch were observed in trace quantities in their surveys.

The diets of Barred and Redtail Surfperch consists primarily of invertebrates such as the Pacific Mole Crab (*Emerita analoga*), amphipods (*Gammarus* spp.), skeleton shrimps (*caprellid* spp.), and polychaete worms. They also will consume fish embryos, e.g., *Osmeridae* and *Atherinidae*, and young Pacific Sardine and Northern Anchovy (Carlisle et al. 1960, Bennett and Wydoski 1977, Brookins 1990). Redtail Surfperch have been reported taking Night Smelt by anglers (CDFW unpublished data). Pacific Mole Crabs are important forage for members of the Amphistichinae (Carlisle et al. 1960, Brookins 1995). Pacific Mole Crabs form aggregations in the early spring and again in late summer in southern California (Perry 1980). These periods also coincide with higher angler catch rates for Barred Surfperch relating to and are associated with the winter mating and summer spawning phases.

Surfperch are forage for a variety of species including game fish, marine mammals, and birds. Predatory fish include Striped Bass, California Halibut, Pacific Bonito (*Sarda chiliensis*), Lingcod (*Ophiodon elongatus*), salmon (*Onchorhynchus* spp.), rockfishes (*Sebastes* spp.), Kelp Bass, Barred Sand Bass, and Leopard Shark (Thomas 1967; Oda and Crane 2013). Surfperch also fall prey to birds such as Great Blue Heron (*Ardea herodias*), Least Tern (*Sternula antillarum*), Caspian Tern (*Hydroprogne caspia*),

**Figure 1-23.** Mean frequency of occurrence of species/species groups co-occurring with Barred Surfperch with standard deviations of species/species groups from Marine Science Institute trawl data collected from 1970 to 2015 (MSI 2017). Abbreviations defined in text above.
Forster’s Tern (Sterna forsteri), cormorants (Phalacrocorax spp.), Common Loon (Gavia immer), Osprey (Pandion haliaetus), and various gulls. Marine mammals, such as Harbor Seals (Phoca vitulina), and California Sea Lions (Zalophus californianus) also forage on surfperch; and in estuaries North American River Otters (Lontra canadensis), consume surfperch (DeLeón 1999; Leet 2001).

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). 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, preferred food availability, and the distribution of predators (Radovich 1961). Figure 1-25 shows Barred and Redtail Surfperch commercial landings indices (mean landings per fish tickets) versus the National Oceanic and Atmospheric Administration (NOAA) Climate Prediction Center’s Oceanic Niño Indices (ONI) multiplied by 50 for scaling purposes. The relationship is unclear—correlation analysis suggests a weak positive association for Barred Surfperch and a weak negative relationship for Redtail Surfperch. Fluctuations may be attributed to changes in abundances, market, and regulations affecting fishing effort.
Figure 1-24. Commercial Barred and Redtail Surfperch mean catch per fish ticket versus mean annual Oceanic Niño Indices (ONI) multiplied by 50 for scaling purposes from 1980 to 2018 (NOAA, CDFW MLDS 2019).

El Niño/La Niña events may cause distribution shifts in Barred and Redtail Surfperch—northward during El Niño events (Radovich 1961; Parrish et al. 1981; Brookins 1995). Recreational landing estimate fluctuations from CRFS have been attributed to El Niño effects. Barred Surfperch catches increased as coastal waters warmed in 2015 then trended lower south of Santa Barbara County while landings continued trending higher from San Luis Obispo to Marin County (Figure 1-26).
Figure 1-25. Regional estimated catch of retained recreational Barred Surfperch from 2005 to 2017 by CRFS. Note, no beach/bank surveys were conducted in 2018 (RecFIN 2018).

Redtail Surfperch recreational catch reflect an overall increase from 2013 through 2017 (Figure 1-27) indicating a possible positive response to warming sea surface temperatures improving catch rates and possibly recruitment. Brookins (1995) noted changes in abundance and recruitment on beaches in Oregon from the 1982 to 1984 El Niño.
During strong El Niño events, many southern marine species such as Pelagic Red Crabs (*Pleuroncodes planipes*), were documented north of their typical range and some, e.g., Yellowtail (*Seriola dorsalis*) and Striped Mullet (*Mugil cephalus*), have successfully spawned (Radovich 1961). El Niño winter storm activity producing inclement conditions including high surf, flooding, and sand excavation (Glynn 1988; Dugan et al. 1994) reduced fishing effort on impacted beaches and increased effort on “fishable” beaches. Pacific Mole Crab life history characteristics, i.e., fecundity, are negatively correlated with surf water temperatures (Dugan et al. 1994) which suggests that El Niño events diminish primary forage for surfperch and impact fisheries; however, Mole Crab incursions were documented in Washington State and British Columbia in the 1957 to 1958 and 1982 to 1984 El Niños (Glynn 1988).
2. The Fishery

2.1. Location of the Fishery

California’s surfperch fisheries are supported primarily by Barred Surfperch and Redtail Surfperch. Much of the targeted catch is taken from open coast sandy beaches that are accessible from the shore by commercial and recreational fishermen. A smaller portion of the statewide recreational catch is taken from manmade structures; the contribution from private/rental boats and private/charter boats is negligible due to the hazards of operating boats in the surf as well as lower catch rates beyond the surf zone.

Barred Surfperch support fisheries from Santa Cruz County to the Mexican border while Redtail Surfperch dominates sport and commercial landings in Mendocino, Humboldt, and Del Norte counties. Both species are caught by sport anglers along the Sonoma to San Mateo counties sandy beaches; commercial effort is minimal on these beaches due to the number of beaches where commercial fishing is not authorized by State Parks statute (§4305, Title 14, CCR). Note, taking Barred, Calico, and Redtail Surfperch south of Point Arguello (Santa Barbara County) for commercial purposes is not authorized by California Department of Fish and Wildlife (Department) regulations in §112(b), Title 14, CCR; however, these species may be transported for sale south of Point Arguello provided they are affixed with Department-issued tags.

2.2. Fishing Effort

Fishing effort, sometimes referred to as fishing pressure, can be expressed in terms of the number of participants in a fishery, the number of vessels, or the amount of gear used over a period (generally a year or season) in the active pursuit of the target species.

2.2.1. Number of Participants Over Time

Recreational surfperch angling effort is comprised primarily by two shore-based modes, as defined by CRFS: beach/bank (BB) and man-made (MM) structures. BB anglers contribute the bulk of the Barred and Redtail Surfperch catch (Miller and Gotshall 1965; Karpov et al. 1995). Historically, surfperch recreational fisheries catch, and effort were reported by Miller and Gotshall (1965) for central to northern California—Barred and Redtail Surfperch, and southern California by Pinkas et al. (1968)—Barred Surfperch. More recently, Karpov et al. (1995) presented statewide recreational angler survey data collected by the Marine Recreational Statistics Survey. Historical estimates of surfperch angler effort were “angler days” by Miller and Gotshall (1965), “pole hours” by Pinkas et al. (1968), and “fishing days” by Karpov et al. (1995).
More recent effort estimates are available through the Recreational Fisheries Information Network (RecFIN). From the RecFIN website, (https://www.recfin.org/):

“Established in 1992, the Pacific Coast Recreational Fisheries Information Network is designed to integrate state and federal marine recreational fishery sampling efforts into a single database to provide important biological, social, and economic data for Pacific coast recreational fishery biologists, managers and anglers.”

RecFIN https://reports.psmfc.org/recfin/f?p=601:1000 enables users to generate reports using recreational sample data for California, Oregon, and Washington. Figure 2-1 shows the estimated number of trips by BB anglers statewide based on CRFS data. Note, RecFIN does not currently produce species-specific effort; therefore, Figure 2-1 reflects effort for all species by BB anglers.

![Graph showing estimated beach/bank angler effort Barred and Redtail Surfperch catch statewide from 2005 to 2017 based on CRFS recreational angler surveys (RecFIN 2019).](image)

**Figure 2-1.** Estimated beach/bank angler effort Barred and Redtail Surfperch catch statewide from 2005 to 2017 based on CRFS recreational angler surveys (RecFIN 2019).

The number of BB “Angler Trips” averaged 643,570 per year statewide from 2005 to 2017 which is comparable to 632,000 BB “fishing days” estimated by Karpov et al. (1995) for 1981 to 1986. Approximately, 33% of all BB angler trips indicated that either Barred Surfperch, Redtail Surfperch, or the surfperch family were the primary target species from 2015 to 2017. Adjusted BB angler trips based on angler interviews specifically targeting the surfperch family including Barred and Redtail are: 285,287 (2015), 244,215 (2016), and 238,315 (2017)—note, these adjusted trips were produced by Department staff using RecFIN data. Surfperch family was the number one targeted
species for this time period with Barred and Redtail Surfperch among the top ten for all interviewed BB anglers.

Historically, surfperches were caught by anglers using 10- to 14-foot (ft) (3.0- to 4.3-meter (m)) heavy surf rods with a variety of natural baits including clams, mussels, polychaete worms, backs of Dungeness Crab (*Metacarcinus magister*), mackerel, Pacific Mole Crabs, and various species of shrimp. Although many anglers and commercial fishermen use traditional bait fishing methods, there is a growing trend among anglers to fish with 7- to 10-ft (2.1- to 3.0-m) lighter rods, traditionally used for steelhead and freshwater bass, and cast artificial baits, soft plastic “grubs”, and hard plastic minnows.

A growing trend in recreational saltwater fisheries is fly fishing for species traditionally targeted by other fishing methods. Fly fishing for surfperch was described by an outdoor writer in the early 1970s; however, anglers fly fishing on beaches were a rarity until the early 2000s. It is now a common sight to see fly anglers along sandy beaches in southern and central California at times outnumbering those fishing with conventional gear. Most fly fishing surf anglers use “stripping baskets” to keep fly line from tangling in moving water while fishing (Figure 2-2). There are a growing number of fishing guides specializing in targeting surf species statewide for their clientele and local fly fishing shops offering fly fishing in the surf workshops and derbies.

![Figure 2-2. Fly anglers fishing a Monterey Bay beach in the spring for Barred and Redtail Surfperch](Photo credit: Ken Oda, CDFW).

Participation in the commercial surfperch fisheries has declined over time. The number of participants in the Barred and Redtail Surfperch commercial fishery, based on fish
ticket data from 1980 to the present, ranged from a high of 100 in 1992 to a low of 19 in 2008 and 2010 (Figure 1-17).

Historically, the number of commercial fishermen fluctuated with changes in regulations in other fisheries, for example, closures for gill net rockfish (1992) and salmon (2003), when fishermen looked to alternative fisheries for sources of income (Leet 2001). Due to the shore-based nature of the fishery and the tide-related availability of surfperch, the expectation of landing limited volumes of surfperch is a disincentive for many commercial fishermen. Most fishermen were part-time participants who fished to supplement their income, fished as the tide and conditions allowed, or fished seasonally when fish were more abundant and available. Following the 1992 "boom" when effort spiked, the fishery gradually declined due to changes in the market and attrition as fishermen left the fishery. This in turn was partly due to a significant increase in license fees in the early 1990s.

In the early 2000s, Barred Surfperch abundances north of Point Arguello increased, likely related to a major El Niño event in the late 1990s. This distribution shift sparked renewed interest in the commercial fishery. In 2016, a new fishery developed in Fort Bragg (Mendocino County) due to a combination of factors: 1) a poor forecast and reduced season for Chinook Salmon (Onchorynchus tshawytscha); and 2) favorable market conditions and ex-vessel prices for live surfperch. Landings from the Fort Bragg area composed approximately 1.9% of the state’s Redtail Surfperch landings in 2018.

Commercial hook and line surfperch fishermen are not required to submit fishing logs; therefore, daily landings from fish ticket data are used as a proxy for measures of effort.

2.2.2. Type, Amount, and Selectivity of Gear

The commercial fishery for surfperch caught from sandy beaches is dominated by fishermen using shore-based hook and line gear generally consisting of heavy surf rods. Recently, however, the use of lighter gear introduced by sport anglers has become increasingly popular among commercial fishermen as well. Hook and line gear accounts for approximately 93% of surfperch landings, followed by A-frame dip nets, beach seine, round haul nets, and trawl gear; surfperch taken by A-frame gear are taken incidentally by fishermen targeting Night or Surf Smelt. Historically, gill and trammel nets also caught surfperch incidental to targeting other species (e.g., California Halibut, White Seabass (Atractoscion nobilis), and White Croaker prior to the implementation of Proposition 132 which imposed restrictions regarding the use of gill and trammel nets in nearshore waters in central and southern California (Leet 2001).

Shore-based anglers and fishermen do not have the ability to locate fish schools as efficiently or effectively as those in boats. All reconnaissance is conducted on foot and
by actual fishing. Boats have fishing electronics, e.g., echo sounders and sonar, to identify schools of fish and underwater structure that may hold or attract fish and follow fish as they move; shore-based fishermen do not. Fishing power is limited; it is difficult to effectively fish more than two rods and three to five hooks if bait fishing, and fish must also voluntarily take the bait or lure in addition to constraints mentioned in Section 3.1.2.1.

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. Estimated landings for 2018 reflect the elimination of BB surveys; however, BB surveys may be resumed in the future. Although many surfperch species are caught statewide, Barred Surfperch comprised approximately 56% of the catch by weight while Redtail comprised (12%) from 2005 to 2017. All other surfperch species contributed less than 4% each of the total catch (Figure 2-3).
Figure 2-3. Surfperch species (including Barred and Redtail Surfperch) percent catch composition by number of the recreational catch from 2005 to 2018. Note, BB surveys were discontinued in 2018 (RecFIN 2019).

Much of the recreational catch of Barred and Redtail Surfperch occurs from open coast sandy beaches as opposed to man-made structures (Figure 2-4).
Figure 2-4. Percent catch of Barred and Redtail Surfperch by recreational angling mode: 2005 to 2017 (RecFIN 2018).

Recognizing the potential bias in total recreational catch estimates, recreational fisheries dominated landings over the Barred and Redtail Surfperch commercial fisheries from 2010 to 2017 (Figure 2-5). During this period, sport harvest averaged 316,904 lb (143,747 kg) and comprised 93.8% of the combined commercial and sport landings while commercial landings averaged 9,656 lb (4,380 kg) and 8,668 lb (3,932 kg) for Barred and Redtail Surfperch, respectively. In 2017, recreational anglers landed an estimated 302,939 lb (137,412 kg) of Barred Surfperch and 127,420 lb (57,797 kg) of Redtail Surfperch. Note, 2018 comparisons were not presented due to the discontinuation of CRFS BB surveys; however, BB may be reinstated in the future.
Surfperch tend to aggregate during mating and parturition periods in late fall and spring/summer, respectively (there are factors that may reduce their vulnerability to overfishing. These factors relate to the primary fishing gear used by fishermen and anglers. Limitations on commercial and recreational shore-based hook and line fishing include tide and surf conditions. Storm-based swells decrease vulnerability to fishing gear and pose personal safety issues to anglers and fishermen, thus decreasing catch during the winter (Figures 2-6 and 2-7).

Figure 2-5. Barred and Redtail Surfperch recreational catch in pounds versus commercial landings: 2010 to 2017 (RecFIN and CDFW MLDS 2018).
Figure 2-6. Barred Surfperch recreational catch by month 2005 to 2017 combined (RecFIN 2019).

Figure 2-7. Redtail Surfperch recreational catch by month 2005 to 2017 combined (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 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 in 2018. Barred and Redtail Surfperch dominated surfperch landings in the 1990s through the 2000s, comprising approximately 38% and 51%, respectively, of all specified surfperch landings. Commercial Barred Surfperch landings for 2018 totaled 10.341 lb (4,690 kg) and $31,383. Redtail Surfperch generated 9,158 lb (2,685 kg) in landings with a value of $9,436 (Figure 2-8).
Important commercial ports for Redtail Surfperch are Crescent City, Eureka, Fields Landing, and Fort Bragg, while Barred Surfperch are landed primarily in Morro Bay and Avila/Port San Luis (Figure 2-9). These ports accounted for 81% of all surfperch landings statewide since 1990.
Barred and Redtail Surfperch ports of landing.


Barred and Redtail Surfperch are a minor component in the San Francisco Bay port complex where landings are comprised primarily of Black Perch, Shiner Perch, Striped Seaperch, and White Seaperch (*Phanerodon furcatus*).

Barred and Redtail Surfperch primarily are sold dead, either gutted and gilled or as fillets; recently however, commercial fishermen in the Morro Bay area and Fort Bragg landed fish live, transported them in aerated bins to their buyers to receive a higher ex-vessel price. Ex-vessel prices range from $1.00 to $7.00 and average $2.81 per lb for Barred Surfperch. Redtail Surfperch prices range from $1.00 to $3.00 and average $1.15 per lb. In 2018, most of the landings were for dead fish with a relatively minor component of live fish receiving a slightly higher premium price averaging $3.88 per lb.

The commercial Redtail Surfperch hook and line fishery was sampled by Department staff in 1994 to 2000 from buying stations in Eureka and Crescent City. Length frequency analysis of sampled Redtail Surfperch indicate that sampled females were larger and comprised most of the catch by number relative to males, 58% and 42%,
respectively. Males averaged 9.8 in (250 mm) TL while females averaged 10.6 in (268 mm) TL (Figure 2-10).

![Graph showing percent composition of commercial Redtail Surfperch: 1994 to 2000 (CDFW unpublished data).](image)

**Figure 2-10.** Percent length frequency of commercial Redtail Surfperch: 1994 to 2000 (CDFW unpublished data).

### 2.4. Social and Economic Factors Related to the Fishery

Commercial fishery trends, historically, have also been impacted by factors beyond the scope of fish behavior and abundance. Market demand for surfperch declined from 1938 to 1942 resulting in low prices offered by fish buyers and depressed landings. A landings peak in the early 1990s was associated with increased demand for surfperch to partially fill a market void left by reduced availability of rockfish due to regulatory actions. Regulations were implemented prohibiting near shore gill nets resulting in displaced fishermen exploring alternative fisheries such as the hook and line surfperch fishery (Leet 2001).

In 2015, effort increased significantly in the Morro Bay area resulting in increased landings of Barred and Redtail Surfperch; however, Redtail Surfperch are rare south of San Mateo County. Calico Surfperch sometimes are misidentified as Redtail Surfperch by buyers and some fishermen. Some buyers/fishermen in the Morro Bay area used Department issued fish ticket books where Barred and Redtail were the only surfperch species listed. Since Calico and Redtail have reddish fins and similar markings, they
may have presumed that Calico Surfperch (Figure 2-11) were Redtail Surfperch (Figure 1-2).

Figure 2-11. Calico Surfperch, Amphistichus koelzi (Photo credit: Ken Oda, CDFW).

The commercial Barred and Redtail Surfperch fisheries have become artisanal fisheries over time. Interest in the fisheries waned for some fishermen who purchased commercial licenses prior to the mid-1990s when license fees increased from $50 to $90 in 1992 and again to $96.50 in 2004. Some commercial fishermen were recreational anglers who also purchased commercial licenses which authorize them to switch to commercial fishing and sell their catch. Unlike boat-based fisheries, the landings of shore-bound sandy beach fisherman are limited to beaches that can be accessed by four-wheel drive vehicles or dependent on good catch rates within reasonable hiking distance of vehicles. Vehicle usage is restricted to select beaches in San Luis Obispo, Sonoma, Mendocino, Humboldt, and Del Norte counties.

Shore based hook and line fisheries require relatively little capital for participation and gear. Expenses are low relative to boat-based fisheries. Aside from a license, scale, and fishing gear, commercial surfperch fishermen often are equipped identically to sport anglers.

Most of the commercial fishermen live within the county that they fish and sell their catch to local fish buyers: Barred Surfperch—Tomas Bay, Moss Landing, Avila/Port San Luis, Morro Bay, and Guadalupe; Redtail Surfperch—Fort Bragg, Eureka, and Crescent City. Humboldt and San Luis Obispo counties were the top producers of sandy beach surfperch, Redtail and Barred, respectively for 2017 (Figure 2-12).
Figure 2-12. Barred (grey bars) and Redtail (black bars) Surfperch percentage of total surfperch landings by port in 2018 (CDFW MLDS 2019).
3. Management

3.1. Past and Current Management Measures

Surfperches are managed solely by the Department. 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:

- 1913—initial conservation measures implemented a seasonal closure to prohibit commercial surfperch fisheries statewide from May 1 through July 15 (Ryan et al. 2004).
- 1953—§112, Title 14, 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.
- 1959—tags purchased from the Department are required to be affixed to Barred, Calico, and Redtail Surfperch for sale south of Point Arguello (§112, Title 14, CCR).
- 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, and to establish a 10.5-in (267 mm) minimum size for Redtail Surfperch.
- 2003—§28.59, 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.
• 2003—§112, Title 14, CCR, was amended to extend the statewide closure of the commercial fishery 2 weeks from May 1 through July 16 to July 31.

• 2006—§28.59, Title 14, CCR, was amended to revert the five-surfperch bag limit in the aggregate to ten of one species and 20 in the aggregate.

3.1.1. **Overview and Rationale for the Current Management Framework**

The surfperches are managed using a combination of bag and size limits, and spatial and temporal closures. Bag limits are used primarily to limit the number of reproducing individuals that can be removed from the population and prevent wastage. Decreased to five in the aggregate in 2002, then reverted to the previous bag limit in 2006. The Department determined based on angler bag analysis that the average angler bag was less than five; however, the decreased bag limit of five in the aggregate and April 1 to July 31 closure remained for San Francisco and San Pablo bays. Size minimums serve to allow fish, particularly females, to spawn at least once prior to being taken. The 10.5-in (26.7-cm) minimum size limit for Redtail Surfperch (implemented in 2002) was informed using Bennett and Wydoski’s (1977) length-maturity data, which showed approximately 95% of Redtail Surfperch were sexually mature at that size. An evaluation more regional and recent data suggests that the current minimum legal size may be protecting less of the spawning population than initially thought. However, it remains clear that at least some of the spawning population is protected and currently no evidence suggests that additional management intervention is needed. A recent analysis of available Barred Surfperch data estimated that size at 50% maturity was 239 mm FL, or approximately 10.15 inches, providing a basis for considering a minimum legal size for if management action ever proves necessary.

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 Barred and Redtail Surfperch 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 Redtail Surfperch fishery is currently being evaluated with a Management Strategy Evaluation (MSE) using the Data Limited Methods Toolkit framework. Results from this effort are anticipated to be presented in a report in the future.

3.1.1.2. **Past and Current Stakeholder Involvement**

Carlisle et al. (1960), Nielsen et al. (2013), and Department staff have enlisted volunteer anglers to conduct citizen science surveys, and to assist with data collection and
sample processing. Department staff were contacted by Nielsen et al. (2013) and Nielsen et al. (2017) to provide angler contacts, adapt Department FIS sampling protocols, and train volunteers and collaborators on surfperch fishing methods and techniques. The Department has worked cooperatively with fishing groups to collect life history data and other information from northern to southern California surf fishing derbies (Carlisle et al. 1960; CDFW unpublished data).

As part of the Office of Administrative Law’s rulemaking process, fishing regulations, recreational and commercial, 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. https://oal.ca.gov/rulemaking_process/regular_rulemaking_process/.

As an example of a regulatory change involving stakeholders, commercial fishermen proposed extending the statewide commercial closure 2 weeks as a conservation measure. The proposed regulatory change was brought forward to the Commission per the APA process and §112, Title 14, CCR, was amended in 2003.

3.1.2. Target Species

3.1.2.1. Limitations on Fishing for Target Species

Aside from directed Department fisheries conservation measures described below, the ability to access beaches with motorized vehicles impacts commercial fishermen. Fishermen using vehicles on specific beaches are required to have a vehicle use and/or parking permit issued by a jurisdictional agency such as State and/or National Parks. Off-road vehicle access by motorized vehicles on sandy beaches is extremely limited. With few exceptions, e.g., Oceano Dunes (San Luis Obispo County), beaches with motorized vehicle access are located within Sonoma to Del Norte counties. As a result, fishing effort tends to be concentrated: 1) near vehicle parking areas leaving remote stretches of beach less impacted by human activities, including fishing, or 2) on beaches where vehicle access is authorized. The lack of motorized vehicle access also self-restricts the amount landed to what fishermen are willing to manually transport to their vehicles; individual Barred and Redtail Surfperch landings exceeding 500 lb (227 kg) composed less than 0.2% of all catches from 1996 to 2018 statewide.

Other factors limiting take of Barred and Redtail Surfperch include:
• Commercial and recreational fishermen do not target surfperch at night; surfperch are believed to be primarily sight feeders

• Market demand for both species is limited and supply is seasonal

• Surf, weather, and tide conditions limit fishing effort

• Surfperch abundance changes seasonally

• Some de facto marine reserves—pocket beaches or sandy beaches limit or restrict public access, e.g., Vandenberg Air Force Base

3.1.2.1.1. Catch

Sport anglers daily bag and possession limits are established in §28.59, Title 14, CCR Surfperch:

• “(a) For purposes of this Section, the term “surfperch” refers to all species of the family Embiotocidae, in any combination.

• (b) Open season: Open all year, except surfperch may not be taken or possessed by a person in San Francisco Bay and San Pablo Bay between April 1 and July 31, inclusive. Shiner surfperch (Cymatogaster aggregata) are exempt from this seasonal closure and may be taken and possessed up to their daily bag limit in these areas during the closure period.

• (c) Daily bag limits.

• In San Francisco Bay and San Pablo Bay, the aggregate limit is five surfperch, not including shiner surfperch. For all other areas, the aggregate limit is 20 surfperch, not including shiner surfperch. Not more than 10 surfperch may be of any one species.

• The special limit for shiner surfperch is 20, which may be taken or possessed in addition to the overall daily bag limit of 20 finfish specified in subsection 27.60(a).

• (d) Minimum size: redtail surfperch, ten and one-half inches total length. All other surfperch, none.”

There are no daily limits or annual quotas for the commercial fishery.
3.1.2.1.2. Effort

There are no regulatory limitations on effort; recreational and commercial surfperch fisheries are open access. Only a sport fishing license is required for recreational anglers. Only a commercial fishing license is required for commercial fishermen, although a Tidal Invertebrate Permit is required for taking invertebrates, e.g., Pacific Mole Crabs and polychaete worms, as bait.

3.1.2.1.3. Gear

Barred and Redtail Surfperch may only be taken by hook and line recreationally. They are taken primarily by hook and line commercially, although they can be taken by other gear where authorized, e.g., beach seine, dip net, round haul, and trap. 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 and on public piers, no person shall use more than two rods and lines.

Although other gear types are not specifically prohibited for taking surfperch, such as trap, trawl, trammel net, purse seine, beach seine, and A-frame dip net, the commercial Barred and Redtail Surfperch fishery is dominated by shore-based fishermen using hook and line gear—93% of total landings (1996 to 2017). There are no current restrictions on hook and line gear that apply to the open coast Barred and Redtail Surfperch 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 is authorized—FGC §9025.5(c).

3.1.2.1.4. Time

There are no seasonal closures in the recreational fishery for Barred and Redtail Surfperch, except in San Francisco and San Pablo Bays where taking surfperch is prohibited from April 1 through July 31 (§ 28.59(b), Title 14, CCR). The commercial surfperch fishery is closed coastwide from May 1 through July 31 (§112, Title 14, CCR). Shiner Perch are exempt from seasonal closures.

3.1.2.1.5. Sex

Both sexes of Barred and Redtail Surfperch may be taken in the recreational and commercial fisheries. It is possible to determine sex externally by examining the pelvic area of the fish (Figure 3-1). See also:
Figure 3-1. Male Barred Surfperch (top) exhibiting the male bulbous organ versus a female on the bottom. Males have two visible pores with thickened angular anal fin rays while females display three pores (Photo credit: Ken Oda, CDFW).

3.1.2.1.6. Size

Redtail Surfperch have a minimum size limit of 10.5 in (267 mm) total length in the recreational fishery only. Barred Surfperch have no minimum size limit.

3.1.2.1.7. Area

In the commercial fishery, Barred, Calico, and Redtail Surfperch may not be taken south of Point Arguello (Santa Barbara County).

3.1.2.1.8. Marine Protected Areas

Pursuant to the mandates of the Marine Life Protection Act (FGC §2850), the Department redesigned and expanded a network of regional MPAs in state waters from 2004 to 2012. The resulting network increased total MPA coverage from 2.7% to 16.1% of state waters. Along with the MPAs created in 2002 for waters surrounding the Santa Barbara Channel Islands, California now has a statewide scientifically based ecologically connected network of 124 MPAs. The MPAs contain a wide variety of habitats and depth ranges.
Even though the use of Marine Protected Areas (MPAs) as a fishery management tool was not one of the primary goals of the Marine Life Protection Act, they function as one for the following reasons:

1. They serve as spatial closures to fishing if the species of interest is within their boundaries and is prohibited from harvest.

2. They function as comparisons to fished areas for relative abundance and length or age/frequency of the targeted species.

3. They serve as ecosystem indicators for species associated with the target species, either as prey, predator, or competitor.

4. 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. Table 3-1 lists MPAs from north to south that contain habitat for members of the Amphistichinae. State Marine Reserves (SMR) prohibit all take, while State Marine Conservation Areas (SMCA) and State Marine Recreational Management Areas (SMRMA) prohibit some recreational and/or commercial take.

Table 3-1. Marine Protected Areas listed north to south containing Amphistichinae.

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<thead>
<tr>
<th>Marine Protected Areas</th>
<th>County</th>
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<tbody>
<tr>
<td>Pyramid Point State Marine Conservation Area (SMCA)</td>
<td>Del Norte</td>
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<tr>
<td>Reading Rock SMCA</td>
<td>Humboldt</td>
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<tr>
<td>Samoa SMCA</td>
<td>Humboldt</td>
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<tr>
<td>South Cape Mendocino State Marine Reserve (SMR)</td>
<td>Mendocino</td>
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<td>Sea Lion Gulch SMR</td>
<td>Mendocino</td>
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<tr>
<td>Double Cone Rock SMCA</td>
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<tr>
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<tr>
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<tr>
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<td>Mendocino</td>
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<tr>
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<td>Marin</td>
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<td>San Mateo</td>
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<tr>
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<td>Santa Cruz</td>
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<tr>
<td>Point Conception SMR</td>
<td>Santa Barbara</td>
</tr>
<tr>
<td>Naples SMCA</td>
<td>Santa Barbara</td>
</tr>
<tr>
<td>Campus Point SMCA</td>
<td>Santa Barbara</td>
</tr>
<tr>
<td>Goleta Slough SMCA</td>
<td>Santa Barbara</td>
</tr>
<tr>
<td>Point Dume SMCA</td>
<td>Los Angeles</td>
</tr>
<tr>
<td>Point Dume SMR</td>
<td>Los Angeles</td>
</tr>
<tr>
<td>Point Vincente SMCA</td>
<td>Los Angeles</td>
</tr>
<tr>
<td>Abalone Cove SMCA</td>
<td>Los Angeles</td>
</tr>
<tr>
<td>Laguna Beach SMR</td>
<td>Orange</td>
</tr>
<tr>
<td>Laguna Beach SMCA</td>
<td>Orange</td>
</tr>
<tr>
<td>Bolsa Chica Basin SMCA</td>
<td>Orange</td>
</tr>
<tr>
<td>Batiquitos Lagoon SMCA</td>
<td>San Diego</td>
</tr>
<tr>
<td>San Elijo SMCA</td>
<td>San Diego</td>
</tr>
<tr>
<td>San Diego-Scripps Coastal SMCA</td>
<td>San Diego</td>
</tr>
<tr>
<td>Matlahuayl SMR</td>
<td>San Diego</td>
</tr>
<tr>
<td>South La Jolla SMR</td>
<td>San Diego</td>
</tr>
<tr>
<td>Famosa Slough SMCA</td>
<td>San Diego</td>
</tr>
<tr>
<td>Cabrillo SMR</td>
<td>San Diego</td>
</tr>
<tr>
<td>Tijuana River Mouth SMCA</td>
<td>San Diego</td>
</tr>
<tr>
<td>San Miguel Island Special Closure</td>
<td>Channel Islands</td>
</tr>
<tr>
<td>Harris Point State and Federal Marine Reserves (SMR)</td>
<td>Channel Islands</td>
</tr>
<tr>
<td>Judith Rock SMR</td>
<td>Channel Islands</td>
</tr>
<tr>
<td>Skunk Point SMR</td>
<td>Channel Islands</td>
</tr>
<tr>
<td>Gull Island SMR</td>
<td>Channel Islands</td>
</tr>
</tbody>
</table>
3.1.2.2. Description of and Rationale for Any Restricted Access Approach

There is currently no restricted access program for surfperch. Both the recreational and commercial surfperch 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.

There are no formal studies documenting bycatch of the commercial and recreational hook and line fisheries targeting Barred and Redtail Surfperch. Although bycatch of the commercial fishery has not been documented, fisheries independent surveys using similar hook and line gear based on information from interviewed fishermen, the Department believes that species composition of catches by recreational, and commercial fishermen are similar. From FIS conducted by Department staff on beaches fished commercially, catches of non-target species can be significant but sporadic. Non-marketable species can be released alive with proper handling and minimized by moving to another location.

The primary bycatch species along San Luis Obispo to Sonoma County sandy beaches, as documented by Department staff, are Jacksmelt and Striped Bass (CDFW unpublished data). Jacksmelt are generally released by commercial fishermen due to low ex-vessel price, limited market demand, and logistical difficulties related to transporting weight in addition to their surfperch catch. Some are kept for personal use. Striped Bass cannot be taken for commercial purposes and must be released. Other commonly landed surfperch encountered, including Calico, Walleye, and Silver Surfperch, have market value and are landed. This may be considered as incidental catch or secondary targets; the MLMA defines bycatch to include non-target species.

In addition to the above species, assorted flatfishes, including Sand Sole, California Halibut, and Starry Flounder, and elasmobranchs such as, Shovelnose Guitarfish, Thornback (*Platyrhinoidis triseriata*), Leopard Shark, and Bat Ray, are commonly caught by recreational anglers while targeting surfperch (CRFS and CDFW unpublished data). Threatened and endangered species that are uncommon incidental catch include Steelhead (*Onchorhynchus mykiss*), and Coho Salmon (*Onchorhynchus kisutch*). An
unknown quantity of Pacific Mole Crabs is inadvertently hooked as fishermen retrieve their baited hooks, lures, or flies through the sand. In the summer, Dungeness Crab are occasionally inadvertently hooked in the same manner along the San Mateo County beaches and released alive (Kristine Lesyna, CDFW, pers. comm.).

Fish ticket data and fisheries-independent sampling indicates that bycatch of marketable non-target species is an uncommon occurrence. Recreational angler survey data indicate that an average of 47.7% of the Barred Surfperch catch from 2005 to 2017 were released (Figure 3-2) and the percentage of kept fish trended upward since 2011. Note, BB surveys were discontinued by CRFS in 2018; however, they may be reinstated in the future.

![Barred Surfperch - Kept vs Released](image)

**Figure 3-2.** Percentage of recreational angler kept and released Barred Surfperch from 2005 to 2017 (RecFIN 2018).

From 2005 to 2017, the percentage of Redtail Surfperch kept generally has trended upward (Figure 3-3), and generally is at higher rate than Barred Surfperch. This may indicate increasing numbers of larger fish over the minimum size limit with the implementation of the 10.5 in (26.7 cm) minimum size limit in 2002 (Oda and Crane 2011).
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. CRFS conducts routine angler interviews statewide. Due to the same type of hook and line gear used by the recreational and commercial fisheries, 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. As described above, bycatch from the Barred and Redtail Surfperch fisheries has little market demand, for example, Jacksmelt, and bycatch species are released by commercial fisherman. Fish tickets from fishermen targeting Barred and Redtail Surfperch contain no other non-surfperch species based on CFIS extracts—buyers will accept marketable species of surfperch such as Calico, Silver, and Walleye Surfperch. Some recreational anglers targeting surfperch keep Jacksmelt 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 to reduce resource impacts developed and vetted by managers and staff.
3.1.4. Habitat

3.1.4.1. Description of Threats

Habitat impacts from the Barred and Redtail Surfperch fisheries are minimal. Based on the primary gear used, shore-based hook and line, high energy of the surf zone habitat would shortly cover holes displaced by sinkers or by mole crab collecting devices. Additionally, California State Parks closures to vehicle use, seasonal closures (recreational and commercial closures within San Francisco Bay (April 1 through July 31) and statewide commercial closure from May 1 through July 31), and MPA closures limit threats to 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, e.g., mole crab beds and beach wrack species.

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

Impact of sinkers on sandy bottom is temporary given continuously moving water and sand. Loss of terminal gear (line, sinkers, and hooks) is minimal due to lack of structure to snag. Use of off-road vehicles on beaches is restricted and/or prohibited by State Parks and local jurisdictions to minimize habitat impacts as well as address personal safety issues.

3.2. Requirements for Person or Vessel Permits and Reasonable Fees

The Surfperch fishery is open access. Participants in the commercial fishery do need a commercial fishing license and sale of Barred, Calico, and Redtail Surfperch south of Point Arguello requires a Department-purchased tag. A sport fishing license is required for recreational anglers. Table 3-2 lists the relevant licenses for individuals required to take and/or sell surfperch for commercial purposes, including those for recreational fishing guides. A Tidal Invertebrate License is required if a fisherman wishes to collect tidal invertebrates for use as bait, for example, Pacific Mole Crabs or nereid worms.
Table 3-2. List of commercial license and permit fees related to the surfperch fishery: April 1, 2019 to March 31, 2020 (Accessed October 29, 2019).

<table>
<thead>
<tr>
<th>Title</th>
<th>Permit fee (US dollars)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resident Commercial Fishing License</td>
<td>$145.75</td>
<td>Required for any resident 16 years of age or older who uses or operates or assists in using or operating any boat, aircraft, net, trap, line, or other appliance to take fish for commercial purposes, or who contributes materially to the activities on board a commercial fishing vessel.</td>
</tr>
<tr>
<td>Nonresident Commercial Fishing License</td>
<td>$431.00</td>
<td>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.</td>
</tr>
<tr>
<td>Guide License, Resident</td>
<td>$229.43</td>
<td>Any resident who engages in the business of guiding or packing, or who acts as a guide for any consideration or compensation at all, must first secure a guide license from the Department.</td>
</tr>
<tr>
<td>Guide License, Nonresident</td>
<td>$527.50</td>
<td>Any nonresident who engages in the business of guiding or packing, or who acts as a guide for any consideration or compensation at all, must first secure a guide license from the Department.</td>
</tr>
<tr>
<td>Guide Employee Registration</td>
<td>$50.21</td>
<td>Any employee of a guide licensee who acts as a guide only in connection with, and within the scope of their employment by a guide licensee is exempt from obtaining a guide license if all of the following conditions are met: (1) If the employment is subject to and the person is reported to the carrier of the employer’s workers’ compensation insurance. (2) If the person is subject and reported to the state and federal taxing authorities for withholding of income tax. (3) If the person is registered by the Department, as an employee of the guide prior to any contact with any person being guided and a registration fee has been paid.</td>
</tr>
<tr>
<td>Commercial Boat Registration (Resident)</td>
<td>$379.00</td>
<td>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.</td>
</tr>
<tr>
<td>Commercial Boat Registration (Nonresident)</td>
<td>$1122.00</td>
<td>Required for any nonresident owner or operator for any vessel operated in public waters in connection with fishing operations for profit in this State; or which, for profit, permits persons to sport fish.</td>
</tr>
<tr>
<td>Trap</td>
<td>$54.08</td>
<td>Required for any person who uses traps to take finfish, mollusks, or crustaceans for profit except spiny lobster and Dungeness crab, as defined in FGC §9001. Dungeness crab can only be taken on vessels with a valid Dungeness crab vessel permit. Commercial fishermen can only take lobster under the authority of a lobster operator permit. Spot prawn can only be taken on vessels with a valid Spot Prawn Trap Vessel Permit.</td>
</tr>
<tr>
<td>Title</td>
<td>Permit fee (US dollars)</td>
<td>Description</td>
</tr>
<tr>
<td>------------------------------</td>
<td>-------------------------</td>
<td>---------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Fish Receiver's License</td>
<td>$824.00</td>
<td>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.</td>
</tr>
<tr>
<td>Fisherman's Retail License</td>
<td>$105.32</td>
<td>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.</td>
</tr>
<tr>
<td>Fish Wholesaler's License</td>
<td>$558.75</td>
<td>Any person who, for resale to persons other than the ultimate consumer, purchases or obtains fish from a person licensed to engage in the activities of a fish receiver, fish processor, fish importer or fish wholesaler, is required to obtain a Fish Wholesaler's License.</td>
</tr>
<tr>
<td>Fish Processor's License</td>
<td>$824.00</td>
<td>Any person who processes fish for profit and who sells to other than the ultimate consumer must obtain a Fish Processor's License.</td>
</tr>
<tr>
<td>Commercial Surf Perch Tags</td>
<td>$10.30 (Per Order)</td>
<td>Surferch of the family Embiotocidae may be taken, transported, possessed and sold for commercial purposes. All such fish shall be individually tagged with Commercial Surfperch Tags.</td>
</tr>
<tr>
<td>Tidal Invertebrate license</td>
<td>$45.84</td>
<td>Authorizes taking specified tidal invertebrates for commercial purposes</td>
</tr>
</tbody>
</table>

A total of $130.64 of revenue was generated by 2018 commercial fish landing fees for Barred and Redtail Surfperch based on the current fee rate of $0.0067 per lb. An undetermined proportion of recreational fishing revenue contributes to surfperch 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 3-3).
Table 3-3. Recreational license fees related to the Barred and Redtail Surfperch fishery: April 1, 2019 to March 31, 2020 (Accessed October 29, 2019).

<table>
<thead>
<tr>
<th>Title</th>
<th>License fee (US Dollars)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resident Sport Fishing</td>
<td>$49.94</td>
<td>Available for any resident 16 years of age or older.</td>
</tr>
<tr>
<td>Nonresident Sport Fishing</td>
<td>$134.74</td>
<td>Available for any non-resident 16 years of age or older.</td>
</tr>
<tr>
<td>Reduced-Fee Sport Fishing License - Disabled Veteran</td>
<td>$7.47 at CDFW Offices $7.82 from license agents</td>
<td>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 Reduced Fee Sport Fishing License, you can purchase disabled veteran licenses anywhere licenses are sold.</td>
</tr>
<tr>
<td>Reduced-Fee Sport Fishing License – Recovering Service Member</td>
<td>$7.47</td>
<td>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.</td>
</tr>
<tr>
<td>Reduced Fee Sport Fishing License - Low Income Senior</td>
<td>$7.47</td>
<td>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.</td>
</tr>
<tr>
<td>Free Sport Fishing License - Low Income Native American</td>
<td>NO FEE</td>
<td>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.</td>
</tr>
<tr>
<td>Free Sport Fishing License - Mobility Impaired, Blind or Developmentally Disabled</td>
<td>NO FEE</td>
<td>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.</td>
</tr>
<tr>
<td>One-day Sport Fishing License</td>
<td>$16.20</td>
<td>Allows a resident or nonresident to fish for one specified day. One-day sport fishing licenses are exempt from the Ocean Enhancement Validation requirement.</td>
</tr>
<tr>
<td>Two-day Sport Fishing License</td>
<td>$25.10</td>
<td>Allows a resident or nonresident to fish for two consecutive days. Two-day sport fishing licenses are exempt from the Ocean Enhancement Validation requirement.</td>
</tr>
<tr>
<td>Ten-day Nonresident Sport Fishing License</td>
<td>$49.94</td>
<td>Allows a nonresident to fish for ten consecutive days.</td>
</tr>
</tbody>
</table>
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”. The Department began collecting Barred and Redtail Surfperch EFI for life history in the early 2007 using primarily hook and line gear, beach seine, and sampling midwater catches from an MSI educational program vessel. These fishery-independent surveys collect data on length, weight, sex, otoliths for ageing purposes, reproductive indices (for example, testes weight/total body weight), fecundity, and growth.

There are many studies on life history EFI for Barred and Redtail Surfperch described in Section 1.1, including age and growth, reproduction, and movement. This section however 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 Barred and Redtail Surfperch fisheries.

4.2. Past and Ongoing Monitoring of the Fishery

4.2.1. Fishery-dependent Data Collection

The Department monitors the commercial surfperch fishery through opportunistic market sampling and analyzing fish tickets. 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 CFIS and MLDS database which allows staff to generate queries of commercial fisheries landings. Analyses of commercial fisheries fish ticket data are presented throughout Chapters 1-3.

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, weight, and sex for Amphistichinae statewide, in addition, location, effort, and angler avidity data.

The Department’s State Managed Finfish Research and Management Project (SMFRMP) conducted sandy beach angler surveys using CRFS protocols commencing in 2007 in multiple southern and central California counties when CRFS discontinued surveying shore-based anglers. The SMFRMP angler surveys were discontinued when CRFS resumed sampling shore-based fishermen in 2010. Barred and Redtail Surfperch have long been the most frequently observed species in central and northern California sandy beach surveys, respectively.

4.2.2. **Fishery-independent Data Collection**

In the 1960s and 1990s, Department staff conducted surf fish beach seine surveys at stations in southern California (Carlisle et al. 1960; CDFW unpublished data) to investigate temporal changes in length frequency, relative species abundances based on catches, and influences by surf and tide conditions. (https://wildlife.ca.gov/Conservation/Marine/SCFRMP/Surf-Fish). The surf fish beach seine study was reinstated in 2007 to 2009. A total of 386 beach seine hauls were conducted yielding 31,631 fish and comprised by 47 species. Results were compared with historical data indicating changes in relative abundance (number caught) of Barred Surfperch. Barred Surfperch ranked number three in relative abundance in the 1950s dropping to 11 in the late 2000s (Appendix C).

The Department’s San Francisco Bay Study (Bay Study) http://www.dfg.ca.gov/delta/projects.asp?ProjectID=BAYSTUDY 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 Barred Surfperch from 1980 to 2010 were presented in Figure 1-9 (Fish et al. 2012).

From 2007 through December 2017 Department staff and volunteers completed 1,397 FIS, primarily in central California, and with some assistance from volunteers. A total of 6,686 surfperch were collected, many of which were retained for EFI. In addition to data collected by CRFS, EFI data was collected from central California sandy beach surfperch including length, weight, sex ratios, and age. These data were collected by the segment of the released catch CRFS sampling cannot capture. Two recent fisheries independent studies used protocols developed by the Department’s SMFRMP to collect EFI (Nielsen et al. 2013; Nielsen et al. 2017) in north central and northern California.
The Department conducts PAS, also called instantaneous angler counts, for recreational fishing effort along beaches in Monterey County (central California) as part of a long-term indicator database which began in April 2007. The term “indicator” means that the data are used to infer trends in a broader geographical area which cannot be sampled in its entirely due to resource limitations. If large-scale environmental parameters will affect the surfperch resource in a larger geographical area than a single county, indicator data will enable an understanding of these relationships and may be useful in management should regulatory changes be required.

From 2007 through June 2019, the Department completed 544 morning PAS in Monterey County (296 on weekends/holidays and 248 on weekdays); a total of 17,826 beach anglers were observed (13,077 on weekends/holidays and 4,749 on weekdays). Average monthly counts show substantially greater effort for both weekend/holidays and weekdays from May through August, when weather conditions are most favorable (Figure 4-1). This historical database serves as an independent estimator of relative fishing effort in an “indicator” coastal county and ultimately will be used to justify future beach and bank sampling methodology changes by CRFS.

Figure 4-1. Monterey County progressive angler survey (PAS)—mean weekend/holiday and weekday angler counts: April 2007 to June 2018 (CDFW unpublished data).

From 2004 to 2016 CRFS used telephone surveys to estimate shore-based fishing effort. Estimates are likely biased high due to the higher probability of encountering more avid anglers by phone and the small sample size in general. Compared with an independent PAS based survey conducted by the Department in 2007 to 2008 in
Monterey and Santa Cruz counties, monthly effort and catch estimates also showed greater variability using the phone survey method. From early 2016 to early 2017, CRFS completed a 1-year pilot study, called "site effort check routes", using techniques like PAS in all six of their districts; these were conducted twice each month per district. CRFS used the PAS data to assist in the design of this survey, but the data have not been used to produce catch estimates. Budget reductions in FY 2017 to 2018 resulted in the termination of beach and bank effort estimation and angler interviews by CRFS from in 2018 and these have not resumed. During that period the indicator effort surveys in Monterey County were the only survey of this type statewide.
5. Future Management Needs and Directions

5.1. Identification of Information Gaps

Identifying, obtaining, and maintaining EFI data are vital to staff conducting assessments of fish stocks from fishery-dependent and fishery-independent sources. The primary goal is to develop appropriate measures to ensure resource sustainability. Very early studies examined aspects of Embiotocid EFI in southern California (Rechnitzer and Limbaugh 1952; Carlisle et al. 1960; Triplett 1960). Bennett and Wydoski (1977), Brookins (1995), and Pruden (2000) presented aspects of Oregon Redtail Surfperch EFI, while Ngoile (1978) studied northern California Redtail Surfperch. The Department’s San Francisco Bay Study has conducted trawl surveys since 1980 throughout the San Francisco Bay estuary and calculates abundance indices of Bay surfperch species including Barred Surfperch (Figure 1-9). The MSI, https://www.sfbaymsi.org/, conducts bottom trawls for educational purposes and collects EFI on catches including surfperch. The Department continues collecting EFI through fishery-dependent surveys by CRFS, with FIS using hook and line by the SMFRMP, from the Department’s San Francisco Bay Study, and through collaboration with researchers.

There are remaining data gaps that Department staff identified for Barred and Redtail Surfperch which are discussed in detail below. These include age at first maturity, movement patterns as related to oceanic regime shifts, hooking mortality, EFI in new fishing locations, and changes in relative abundance as related to harmful algal blooms (HAB). These data can be used to estimate stock status and evaluate the relative effectiveness of current and alternative management strategies for ensuring long-term sustainability of the population (Table 5-1).

Table 5-1. Informational needs for sandy beach surfperch and their priority for management of Barred and Redtail Surfperch.

<table>
<thead>
<tr>
<th>Type of information</th>
<th>Priority for management</th>
<th>How essential fishery information would support future management</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age at first maturity</td>
<td>High</td>
<td>Information used to determine absolute abundance of spawning stock (in terms of biomass). Used for assessing stock status, setting quotas, and establishing size limits.</td>
</tr>
<tr>
<td>Age validation study for Redtail and Barred Surfperch</td>
<td>High</td>
<td>Completed study for Barred and new study for Redtail would validate annulus formation in otoliths, allowing correct age assignments. Resulting age data will be used to establish age-maturity and age-length relationships needed to understand fishery dynamics.</td>
</tr>
<tr>
<td>Type of information</td>
<td>Priority for management</td>
<td>How essential fishery information would support future management</td>
</tr>
<tr>
<td>-----------------------------------------------------------------------------------</td>
<td>-------------------------</td>
<td>-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Recreational effort estimates specific to sandy beach habitat</td>
<td>High</td>
<td>Used to more accurately calculate CPUE indices from recreational catch estimates. These indices are among the primary data streams used to monitor relative abundance trends for Redtail and Barred surfperches.</td>
</tr>
<tr>
<td>Recreational catch estimates for beach and bank species</td>
<td>High</td>
<td>As above, CPUE indices are needed to monitor trends in relative abundance in the population. Without catch estimates, we are unable to produce a recreational index.</td>
</tr>
<tr>
<td>Sex-specific recreational length composition data</td>
<td>Med</td>
<td>Annual length composition data can improve our stock status estimation abilities by making available a suite of length-based modeling approaches. Would increase our certainty in stock health over CPUE indices alone.</td>
</tr>
<tr>
<td>Regional differences in population structure</td>
<td>Med</td>
<td>Significant differences in population, weather, and beach accessibility across the state have likely led to varied impacts to the underlying population structure from fishing. This type of analysis will help identify localized depletions and help determine the appropriate scale of management.</td>
</tr>
<tr>
<td>Stock spatial shifts in response to El Niño/La Niña</td>
<td>Low</td>
<td>Determine if changes in abundance indices, e.g., CPUE and landings, are fisheries caused or stock shifts.</td>
</tr>
<tr>
<td>Catch and release mortality</td>
<td>Low</td>
<td>Quantifying catch and release mortality is necessary to accurately estimate fishing mortality.</td>
</tr>
<tr>
<td>EFI gaps—exist for isolated and/or pocket beaches</td>
<td>Low</td>
<td>EFI data is lacking from isolated “pocket” beaches. Prior sampling efforts have focused on “long” sandy beaches.</td>
</tr>
<tr>
<td>Harmful algal blooms and contaminant impacts</td>
<td>Low</td>
<td>Quantifying negative impacts of Harmful Algal Blooms can be used to refine natural mortality estimates.</td>
</tr>
<tr>
<td>EFI from the live fish fishery</td>
<td>Low</td>
<td>This is a new fishery in the Fort Bragg area and has not been sampled by the Department—length/age, sex ratio, and species composition have not been validated.</td>
</tr>
</tbody>
</table>

5.2. Research and Monitoring

5.2.1. Potential Strategies to Fill Information Gaps

Prior to the 2000s, Barred Surfperch studies in California were confined to the southern California Bight south of Point Conception, Santa Barbara County. Age at first maturity data are needed for Barred and Redtail Surfperch north of the southern California Bight to the Oregon border. Currently, age at maturity is based on work prior to the 1960s (Carlisle et al. 1960) for Barred Surfperch. Redtail Surfperch age at maturity work was
conducted in Oregon (Bennett and Wydoski 1977; Ngoile 1978; Brookins 1995) but has not been updated for more than 20 years. Currently, the Department examines all sampled females for the presence of embryos; however, ovaries were not histologically sectioned and examined. Females that have spawned and recovered prior to capture, were recorded as non-spawning (Carlisle et al. 1960; CDFW unpublished data). Only fish that have recently spawned or carried embryos visible to the naked eye were noted as mature or spent. Collecting age at first maturity data using modern histological techniques for both species may be used for comparison with existing literature and can be used to evaluate existing regulations, for example the 10.5-in (267-mm) minimum total length requirement for the recreational take of Redtail Surfperch.

Commercial and recreational Barred Surfperch catches have fluctuated greatly since 2010. During the 2014 to 2016 El Niño event, landings increased dramatically north of Point Arguello in 2015 while declining greatly from Santa Barbara south in 2016. Preliminary 2017 data indicate a rebound of Barred Surfperch recreational catch south of San Luis Obispo County. Previous tagging studies were conducted south of Point Arguello and in Oregon (Carlisle et al. 1960; DeMartini et al. 1983; Pruden 2000; CDFW unpublished data). With few exceptions, the bulk of the tags were recovered relatively close to the tagging site; however, there were tags recovered many miles from the tagging location (Carlisle et al. 1960; Pruden 2000). A central California tag recovery program may provide EFI relative to mass movement of fish in the face of strong El Niños and La Niñas and provide information to assist with assessing MPA performance. During El Niños, fish may move northward with currents and/or avoid warming water (Radovich 1961). In La Niñas, the reverse may occur with fish moving south with current flow.

In concert with a tagging program, a periodic beach seine survey would assist in collecting fish for tagging, tag recovery, EFI, and validate possible recruitment range extension episodes. Dentler and Grossman (1980) documented YOY Redtail Surfperch in a beach seine haul in Avila (San Luis Obispo County). Encountering Redtail Surfperch south of San Mateo County is an unusual occurrence (Miller and Lea 1972; Robert Lea, CDFW retired, pers. comm.). The data would validate or justify editing fish tickets from Redtail to Calico Surfperch. Historically, fish buyers and fishermen did not differentiate Calico Surfperch from Redtail Surfperch on fish tickets due to their similar coloration and body shape.

A new fishery in Mendocino County developed for Redtail and Calico Surfperch in 2016. In 2017, the Fort Bragg port complex contributed 19.2% and 35.2% of Redtail and Calico Surfperch landings, respectively, statewide; however, for landings in 2018, the proportion declined to less than 1% of the total Redtail landings. The proportion of the Calico landings, however, increased to 52.5%. Commercial salmon fishermen, who
expected shortened seasons due to a poor fishery forecast, began landing Calico and Redtail Surperch from local beaches using hook and line. The fish were transported live in aerated tanks and sold both live and dead; live fish received a premium price. Commercial fishermen are required to complete and submit landing fish tickets; however, this fishing port has not been sampled for EFI and therefore is considered data poor. EFI needs include length, weight, age and species composition, effort, and location information.

Pocket and long beaches along the open coast as well as estuaries have been identified as EFI for Barred and Redtail Surperch (Carlisle et al. 1960; Bennett and Wydoski 1977; Ngoile 1978; Dugan et al. 1994; Brookins 1995; Allen et al. 2006; Nielsen et al. 2013; Nielsen et al. 2017). Determining specific biological and physical habitat characteristics of beaches and areas within estuaries that are preferred by Amphistichinae would assist with collecting EFI data. In addition, characterizing these locations can be used in Natural Resource Damage Assessments and for developing future studies contributing to EFI acquisition and fisheries sustainability.

In recent years, HAB have become more frequent along the California coast, particularly, in the Monterey Bay, area (https://oceanservice.noaa.gov/news/sep15/westcoast-habs.html). In addition to plankton blooms directly affecting fishing effort (Ken Oda, CDFW, pers. comm.), contaminants may also impact forage by increasing metabolic rates and increasing uptake of pollutants per unit time. Contaminants contribute as stressors during the winter when outflows from streams are high and contaminants are flushed into estuaries and open coast (Brooks et al. 2012). A HAB was determined to the cause of a large kill of Red Abalone in Mendocino County in 2011. HAB episodes require monitoring of available HAB data sites, e.g., by the Central and Northern California Ocean Observing System, known as CeNCOOS, to increase the Department's understanding relative to potential impacts to surperch adults and recruitment.

5.2.2. Opportunities for Collaborative Fisheries Research

The Department has collaborated in the past and will continue to work with outside entities such as academic organizations, Non-Governmental Organizations (NGO), 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.

There are several types of life history information that are either lacking in literature or in need of update. As described in Section 5.2.1.1, refining age at first maturity for Barred and Redtail Surperch using histological techniques is needed to refine fisheries models.
Currently, staff rely on gross observation of gonads to determine reproductive state. The Department does not have the necessary equipment to prepare histological sections and has relied on contracted laboratories in the past for histological preparation of California Halibut gonads (Kristine Lesyna, CDFW, pers. comm.). The Department can provide samples, expertise relative to sampling protocols, and offer general advice based on over 10 years of conducting fishery-independent surveys in collaborative research efforts.

As described in Section 5.2.1.2, El Niño/La Niña events were thought to impact surfperch fisheries causing declines in angler catches primarily of Barred Surfperch (Carlisle et al. 1961; Karpov et al. 1995; CDFW unpublished data). A large-scale tagging and recovery program of Barred and Redtail Surfperch could be used to determine if surfperch distribution changes relative to water temperature, and generally, develop an understanding of their seasonal movements. A partnership with stakeholders, NGOs, and researchers could entail assisting Department staff with tagging and recovery efforts and developing or adapting an existing mobile or online application to log tag returns and document catches as well as distribute information.

The Department does not have staffing capacity to monitor all aspects of surfperch fisheries over their entire geographic range. Currently, staff conduct coastal FIS regularly from Monterey to Marin counties, and in Humboldt and Del Norte counties. Areas where monitoring would be helpful include the following: Mendocino County, Sonoma County, and from San Luis Obispo County to San Diego County. Using independent sampling methods by research partners in consultation with Department staff, monitoring data may include collecting life history information, documenting and sampling the commercial fisheries in San Luis Obispo, Mendocino, and Humboldt, and Del Norte counties. These data could be used to determine size/age composition and spatial distribution in the face of changing 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 considering 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 surfperch fisheries. Department fishery-dependent and fishery-independent data sources do not indicate an immediate need for additional
management interventions, and we believe that the existing regulations summarized in Chapter 3 are adequate. 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.

The Department is currently applying an MSE to the Redtail Surfperch fishery and may utilize the same approach for Barred Surfperch in the future. The MSE is a simulation approach designed to evaluate future fishery performance and sustainability under a broad range of management options. Results from this analysis are intended to identify the most effective long-term management strategies and may be used to inform management decisions in the future.

5.4. Climate Readiness

Historically, changes in the Barred and Redtail Surfperch fisheries have been attributed to El Niño and La Niña events (Carlisle et al. 1961; Gotshall and Miller 1965; and Karpov et al. 1995; CDFW unpublished data). Barred Surfperch recreational catches declined greatly south of Point Arguello in 2016 but increased in the northern extent of their range in both commercial and recreational fisheries in 2015, continuing at an above average level in 2016. It is unclear if the Barred Surfperch distribution shifted north of Point Arguello with prevailing currents from the south in 2015 and returned south with the resumption of northwesterly winds and cooler water temperatures, or if the stock shifted offshore in southern California. Redtail Surfperch catches have steadily increased since 2011 and appear to be less affected by El Niño impacts due to the higher latitude of their home range. ENSO neutral or mild La Niña conditions occurred in 2017 and are forecasted for 2018, which may result in relatively stable oceanic conditions.

The Department monitors notices from various online sources including: NOAA’s Pacific Fisheries Environmental Laboratory https://www.pfeg.noaa.gov/whats_new.html and the National Weather Service Climate Prediction Center http://www.cpc.ncep.noaa.gov/products/precip/CWlink/MJO/enso.shtml to increase awareness of imminent El Niño and La Niña events. The Department monitors the commercial fishery by analyzing fish tickets submitted by fish buyers monthly; this may reflect possible environment changes affecting surfperch fisheries—both positive and negative. The Department also conducts progressive angler surveys along selected Monterey County sandy beaches that enumerate anglers targeting surf fishes and resumed CRFS sandy beach surveys in 2018.

It is unknown what impacts climate change will have on the ports of landing providing infrastructure supporting the Barred and Redtail Surfperch fisheries. Both Barred and Redtail commercial fisheries are considered “artisanal” and relatively few fishermen land
their fish daily, fish from shore, and as a result do not use fishing vessels. Therefore, these fishermen require less infrastructure, for example, slips, fuel, ice, than other fisheries requiring vessels.

The Commission and the Department have the authority to adopt emergency regulations under the APA process https://oal.ca.gov/regulations/emergency_regulations/. If circumstances instigated by climate related changes evolve in the Barred and Redtail Surfperch fisheries to warrant emergency action, the APA process can be abbreviated and closures, for example, may be implemented relatively quickly.
Literature Cited


Love MS. 2011. Certainly, more than you want to know about the fishes of the Pacific Coast: a postmodern experience. Really Big Press.


Appendices

Appendix A. Members of the family Embiotocidae in California waters.

<table>
<thead>
<tr>
<th>Common Name</th>
<th>Scientific Name</th>
<th>Sub-family</th>
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Appendix C. Abundance ranks of fish taken in CDFW beach seine surveys. From: https://wildlife.ca.gov/Conservation/Marine/SCFRMP/Surf-Fish.

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