5.7 Marine Province

5.7.1 Geophysical and Ecological Description of the Province

California's Marine Province is part of the California Current Large Marine Ecosystem (Sherman et al. 2004). The combination of California's bathymetry, ocean currents, and seasonal wind patterns provide the necessary conditions that lead to significant abundance and richness of its coastal ocean waters (California Department of Fish and Game [CDFG] 2008). The large array of ecosystems and habitats in California's marine region gives way to a high level of plant and animal biodiversity and abundance (CDFG 2005a). Examples of this unique province's many types of habitats include ridges, submarine canyons, and kelp forests (CDFG 2005a). Because of its productivity, many Californians depend on it for their livelihoods (in terms of consumptive and non-consumptive uses). Examples of consumptive and non-consumptive uses include aquaculture (e.g., shellfish, finfish, and aquatic plants), fishing, recreation, and sight-seeing. In addition, California is ranked in the top five states for its ocean economy across the United States and is "the only state ranked in the top five states by employment for five of the six ocean economy sectors" (National Ocean Economics Program 2014).

The Marine Province, composed of the portion of the Pacific Ocean within the state's three-mile territorial limit, stretches along approximately 1,100 miles of California's coastline. CDFW defines California's state waters as the three-nautical mile maritime limit as shown on National Oceanic and Atmospheric Administration (NOAA) navigational charts. (For information about these charts see http://www.nauticalcharts.noaa.gov/csdl/boundarymetadata_CA.html.) The state marine waters include the coastline of mainland California, coastline of islands, offshore rocks, and three-nautical miles of ocean that extends between selected points across the mouth of coastal bays (primarily Monterey Bay) (FindLaw 2015). Typically no wider than five miles, California's shallow continental shelf is quite narrow compared to the Atlantic and Gulf coasts (Johnson and Sandell 2014). For much of the year, the California Current brings colder northern waters southward along the shore as far as Baja California, while the Southern California Countercurrent flows into the Santa Barbara Channel. These currents, and other minor currents, are critical for driving connectivity and larval dispersal across the coastline and among Marine Province targets (Gaines et al. 2003;

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Gaines et al. 2010a). Seasonal changes in wind direction commonly create seasonal patterns for these currents. For example, northwesterly winds help trigger upwelling of cold, nutrient-rich water from the depths, which lead to high levels of primary productivity that attracts foraging marine life. When these northwesterly winds die down in fall each year, a surface current, known as the Davidson Current, develops and flows in a northerly direction north of Point Conception. Laid over this pattern are both short-term and long-term changes arising from sources such as massive changes in atmospheric pressure (El Niño and La Niña), large-scale change in ocean temperatures, local winds, topography, tidal motions, and discharge from rivers (CDFG 2008).

The marine environment includes a variety of ecosystems, including (1) embayments, estuaries, lagoons; (2) intertidal zone; (3) nearshore subtidal zone; (4) mid-depth zone; (5) deep zone; (6) offshore rocks; and (7) islands. Water depth, temperature, salinity, light penetration, wave energy, substrate type, available nutrients, currents, and many other factors contribute to creating marine habitats.

Many embayments occur along the California coast. They are often bordered on the landward side by shoreline and/or estuarine habitats. Although there is often reduced wave and tidal energy in embayments, there is still a predominant influence of seawater and association with the marine environment (Schaffer 2002). Many species of fish, such as Pacific herring and Chinook salmon, rely on embayments for food, shelter, and spawning habitat. Depending on their life cycles, they may use local watersheds, shallow mud flats, or tidal marshes, as well as deeper portions of the embayment. Like embayments, estuaries are bodies of water that have constant exchanges and interactions with ocean water or marine embayments (Schaffer 2002). There are currently 121 recognized California estuaries covering 393,784 acres. As a water passage where the tide meets a freshwater source, estuaries provide food and habitat for a diverse range of species including crabs, salmon, rockfish, marine mammals, and shorebirds. California's nearly 20 estuaries greater than 0.5 square mile support a high biodiversity of fish, birds, invertebrates, and marine mammals in the Marine Province (CDFW 2014a). Coastal lagoons, on the other hand, are bodies of water often separated from ocean water exchange by a strip of terrestrial substratum such as sand dunes, gravel, or mud berms. Breaching can be infrequent and unusual in lagoons and may not occur annually or for several years. Lagoon salinities fluctuate. In addition, lagoons are often frequented by terrestrial vertebrates, and when breached and upon initial re-closure, are occupied by marine and estuarine aquatic species (Schaffer 2002).

The intertidal zone includes all coastal habitats that are subject to periodic tidal inundation and exposure to air (Tillman 2013; Schaffer 2002). The intertidal zone can include different types of habitats, such as intertidal rocky areas, sandy beaches, beach wrack, seagrass beds, wetlands, or mudflats (Tillman 2013; Schaffer 2002). The intertidal zone along with headlands, offshore rocks, and islands provide crucial habitat for marine birds and mammals.

By definition, the nearshore subtidal marine zone contains benthic and pelagic habitats bounded inshore by the coastal intertidal and extending out to where the ocean bottom reaches

a depth of 30 meters. At this point, the nearshore subtidal zone continues seaward, encompassing the top 30 meters of water column from that point out to three-nautical miles, including marine nearshore habitats around islands (Tillman 2013; Schaffer 2002). This belt or area of shallow water adjoining the coast provides habitat for different plant and animal species including seagrasses, fish, and shellfish (Schaffer 2002). These areas support seagrass beds, kelp forests, subtidal reefs, and vast expanses of muddy or sandy bottom, as well as open water where birds and marine mammals feed upon coastal pelagic species like anchovies and squid.

Mid-depth zone includes the water column and substrate between 30 and 100 meters. The mid-depth zone is bound by the nearshore subtidal depth (Schaffer 2002). The mid-depth zone support rocky reefs and outcrops that provide habitat for sea anemones, sponges, and a variety of fish and invertebrates (OceanSpaces 2015a). Tops of ridges and canyon heads may be found in this zone. Deep zone includes the water column and substrate found below 100 meters and its uppermost limit is bound by the deepest depth of the mid-depth zone (Schaffer 2002). The deep zone supports vast expanses of both rocky, and muddy or sandy bottoms, where species such as rockfish, flatfish, and spot prawns inhabit the wide home range ecosystem (OceanSpaces 2015b). The base of underwater mountain ridges as well as canyon walls and floors occur in this zone. Offshore rocks include rocks and small islands stretching the length of the California coast, above mean high tide, and out to 12-nautical miles. They are included within the California Coastal National Monument (CCNM), which is protected by the Bureau of Land Management (BLM) as National Conservation Lands. Offshore rocks do not include major islands such as the eight Channel Islands, the Farallon Islands, or the islands in San Francisco Bay (BLM 2013). CDFW and California State Parks are partners with BLM for managing the CCNM. The management plan for offshore rocks and islands can be found at the following link: http://www.blm.gov/ca/st/en/prog/blm_special_areas/nm/ccnm/ccnm_rmp_index.html.

Because of the diversity of its ecosystems, California's Marine Province is home to an array of macroscopic and microscopic animals (mammals, birds, fish, reptiles, amphibians, and invertebrates) and plants (vascular and non-vascular) (CDFG 2005a). Seasonal upwelling fosters high productivity and biodiversity in the nearshore marine, supporting biogenic habitats such as the extensive kelp forests and animals that depend on them like the rockfish, greenlings, lingcod, and kelp crabs. Offshore rocks and islands provide important nesting and haul-out sites for marine birds and mammals (CDFW 2014a).

While being one of the most biologically diverse ecosystems, the combined 220,000 square miles of the state's Marine Province and federal waters, which extend approximately 200 nautical miles from shore, also support some of the busiest shipping lanes and ports in the world, multimillion-dollar commercial and recreational fisheries, and coastal tourism. These waters also offer unparalleled opportunities for wildlife viewing and other non-consumptive forms of recreation. The coast's natural beauty and economic opportunities support residents and attract many visitors. For example, in 2010 more than 80 percent of the state's 37.35 million residents lived in coastal watershed counties compared to a national average of 52 percent of residents

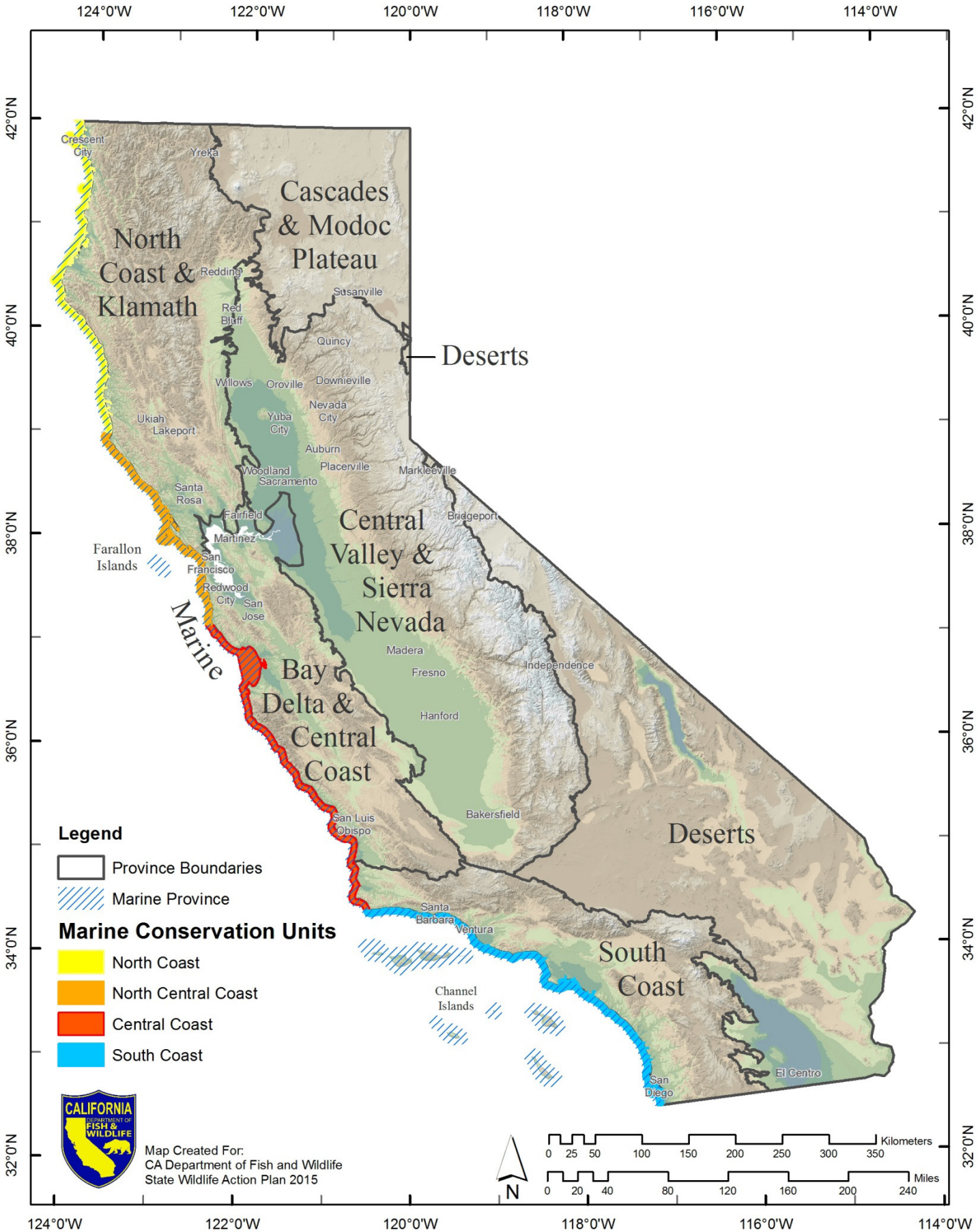
living in coastal watershed counties (NOAA 2013a). With such a significant portion of the population residing along California's coast, there are many pressures and impacts to consider and address such as loss of habitat, pollution, invasive species, resource extraction, and global climate change (CDFG 2005a). Because of its global significance, productivity, and biodiversity, the activities implemented in the Marine Province have consequences for marine fauna and flora across the Pacific Ocean (CDFG 2005a). In recognizing this regional and global significance, the Marine Province boasts a number of marine managed areas (MMA) and protected areas including, but not limited to, marine protected areas (MPA) developed through the Marine Life Protection Act (MLPA); the latter include State Marine Reserves (SMR), State Marine Conservation Areas (SMCA), State Marine Parks (SMP), State Marine Recreational Management Areas (SMRMA), and Special Closures (to learn more about each type of managed or protected area, please see http://www.dfg.ca.gov/marine/mpa/defs.asp#mma). More detail on these state managed and protected areas is provided in the sections below. Augmenting state-protected and managed areas, federal protected and managed areas exist including, but not limited to, National Marine Sanctuaries and National Conservation Lands. In addition, specific fishery closures have been designated in regulation such as the Cowcod Conservation Areas.

5.7.2 Marine Conservation Units and Targets

The Marine Province is divided into four Marine Conservation Units (MCU): North Coast, North Central Coast, Central Coast, and South Coast (Figure 5.7-1). For the purposes of SWAP 2015, the boundary between each MCU uses those defined and used in the MLPA process (Aseltine-Neilson, pers. comm., 2014). Although the conservation strategies for the Marine Province were developed across the province as a whole and are not differentiated by MCU, they provide the spatial foundation for future planning efforts.

Since San Francisco Bay is part of an ecologically and economically important region of the state (the San Francisco Bay Delta), a separate interdisciplinary team including CDFW staff from Marine Region, Bay Delta Region, Water Branch, and Fisheries Branch developed conservation strategies for this area, designated as the Bay Delta conservation unit. Information on this unit can be found within Section 5.3.

Seven conservation targets have been identified for the Marine Province based on marine ecosystems: (1) embayments, estuaries, lagoons; (2) intertidal; (3) nearshore subtidal zone; (4) mid-depth zone; (5) deep zone; (6) offshore rocks; and (7) islands; however, conservation strategies have only been developed for the embayments, estuaries, lagoons target at this time. This target was chosen because of the available information from similar strategic planning processes, its high level of diversity that includes a number of endangered and threatened species, the ecosystem services it provides at the land-sea interface, its vulnerability



Data Source: CA Dept of Fish and Wildlife Marine Region (marine conservation units), U.S.Geological Survey (hillshade).

Figure 5.7-1 Marine Conservation Units

to climate change impacts (such as sea level rise), the greater coordination needed among multiple agencies and organizations with jurisdiction over its management, and the in-depth process undertaken using the system *Open Standards for the Practice of Conservation*. As described in Section 1.5.4, the *Open Standards* process included developing key ecological attributes (KEAs); identifying stresses and pressures for each KEA; ranking these stresses and pressures for the target; and developing strategies, goals, and activities. As such, the discussion below of stresses and pressures, as well as strategies and goals focuses on the embayments, estuaries, lagoons target. The six additional targets will be addressed in the future using a similar process, as described in the Section 5.7.7, "Next Steps for the Marine Province." Please note, unless otherwise stated, information for each MCU is drawn from corresponding MPA Guides that may be found at CDFW's California's MPA Network website: http://www.dfg.ca.gov/marine/mpa/mpa_summary.asp.

North Coast Marine Conservation Unit

The North Coast MCU encompasses approximately 1,027 square miles of state water from the California-Oregon border south to Alder Creek in Mendocino County. A network of 20 MMAs, including 19 MPAs and one SMRMA, covers approximately 137 square miles, or about 13 percent of northern California's state waters. Specifically the North Coast MCU includes six SMRs, 13 State SMCA, one SMRMA, and seven Special Closures (CDFW 2014a). This North Coast MCU includes the coastline of Del Norte, Humboldt, and most of Mendocino counties. It is adjacent to the towns of Crescent City, Eureka, Fort Bragg, and Trinidad. The following major rivers or portions of these rivers flow into the North Coast MCU: Eel River, Garcia River, Gualala River, Klamath River, Mad River, Navarro River, Noyo River, Smith River, and Ten Mile River. The Smith River is the largest river system in California that flows freely along its entire course, while the Eel River has the third largest watershed in California, and has the highest average sediment yield per drainage area of any river of its size or larger in the contiguous United States (CDFW 2014a; CDFG 2010).

Thousands of species, including invertebrates, plants, fish, marine mammals, and seabirds, live in the North Coast MCU. Seasonal upwelling along the coast contributes to its high productivity and biodiversity. With this upwelling, nutrients travel from the depths to surface waters where they support plankton blooms and serve as the basis for the unit's food web. Unlike other MCUs, the North Coast has some of the least developed adjacent coastal areas in the state.

In the widespread, bull kelp-dominated forests that grow on the North Coast's rocky reefs, many marine species thrive including juvenile and adult rockfish, greenlings, lingcod, kelp crab, and red abalone. In addition, blades from bull kelp and giant kelp are torn away during storms and provide food for some species including the red abalone (CDFW 2014a; CDFG 2010).

In the offshore portions of the MCU, several submarine canyons (such as Mendocino, Mattole, Delgada, and Spanish) shelter and/or serve as forage areas for fish, marine mammals, and

invertebrates, including deep-water corals. Offshore rocks and islands also support key marine bird nesting and foraging sites. For example, the largest population of common murres resides at Castle Rock, near Crescent City, while numerous marine mammals (primarily California sea lions, northern elephant seals, and harbor seals) use rocky islands, shores, sandy beaches, tidal flats, and estuaries, as haul-out and rookery sites (CDFW 2014a; CDFG 2010).

The brackish water of estuaries along the North Coast plays an important part in marine plant and animal life cycles. Many fish depend on estuaries for breeding, foraging, and transit between fresh water and seawater including sharks, staghorn sculpin, surf perches, Chinook salmon, steelhead, and smelt. Many shorebirds and seabirds roost and forage in estuaries, while numerous invertebrates such as crabs, shrimps, and snails inhabit estuaries (CDFW 2014a). For example, the state's second largest estuary, Humboldt Bay, supports nearly 40 percent of the state's eelgrass beds. Estuary plants such as eelgrass are beneficial for humans and wildlife—not only do they support diverse marine species; they also cushion shorelines from wave energy and break down pollutants (CDFW 2014a).

The North Coast MCU provides habitat for productive commercial fisheries, targeting a wide diversity of species that helps support economies of coastal communities. Recreational consumptive use opportunities include shore- and vessel-based fishing, kayak angling, clamming, and abalone picking and diving. Recreational non-consumptive use activities include diving, surfing, kayaking, beach-going, swimming, and shore- and boat-based wildlife viewing (CDFW 2014a; CDFG 2010).

North Central Coast Marine Conservation Unit

The North Central Coast MCU encompasses approximately 763 square miles of state waters from Alder Creek, near Point Arena in Mendocino County, to Pigeon Point in San Mateo County. Within these waters, a network of 25 MMAs, including 22 MPAs and three SMRMAs, covers approximately 152 square miles (approximately 20 percent of the unit's waters). Specifically the North Central Coast has 10 SMRs, 12 SMCAs, three SMRMAs, and six Special Closures (CDFW 2014b). The North Central MCU includes the coastlines of the counties, Mendocino from Point Arena south, Sonoma, Marin, San Francisco, and San Mateo, as well as being adjacent to the towns of Bodega Bay, Gualala, and Half Moon Bay. Major rivers flowing into the unit include the Petaluma River and Russian River (CDFW 2014b; CDFG 2007).

The diverse marine ecosystems found in this MCU support thousands of animal and plant species. Coastal embayments, estuaries, lagoons provide resting and feeding grounds for migratory waterfowl and shorebirds, including Bolinas Lagoon, Drakes Estero, and Tomales Bay. Nearshore kelp forests dominated by bull kelp support many types of fish assemblages including species of rockfish; whereas, submerged surfgrass beds serve as shrimp, fish, and crab nurseries. Rocky reefs found nearshore support species or species groups such as sea urchin, abalone, lingcod, sculpin, and octopus (CDFW 2014b; CDFG 2007).

Although outside of the Marine Province, a unique and significant feature of the North Central Coast MCU is the Farallon Islands, which serve as key habitat for the ashy storm-petrel and dozens of other threatened or endangered bird species (CDFW 2014b). The islands also serve as a rookery for one of the largest concentrations of nesting seabirds in the United States. The islands also provide shelter for numerous migrating bird species. The waters of the North Central Coast MCU support "26 species of marine mammals, 94 species of seabirds, 345 species of fish, four species of sea turtles, over 5,000 species of invertebrates and more than 450 species of marine algae" (CDFW 2014b; CDFG 2007).

This area also supports many consumptive and non-consumptive activities including fishing (commercial and recreational), diving, kayaking, and whale-watching (CDFW 2014b; CDFG 2007).

Central Coast Marine Conservation Unit

The Central Coast MCU includes approximately 1,144 square miles of state waters from Pigeon Point in San Mateo County to Point Conception in Santa Barbara County. Of these waters, 207 square miles (18 percent) are protected as a network of 29 MMAs composed of (28 MPAs and one SMRMA). Specifically the Central Coast MCU includes 13 SMRs, 14 SMCAs, one SMCA/State Marine Park, and one SMRMA (CDFW 2014c). This Central Coast MCU touches the coastlines of counties including some of San Mateo, Santa Cruz, Monterey, San Luis Obispo, and Santa Barbara. It also is adjacent to the towns and cities of Santa Cruz, Monterey, and Morro Bay, as well as receiving flows from the San Lorenzo, Pajaro, Salinas, Carmel, and Big Sur rivers (CDFW 2014c; CDFG 2005b).

Habitats found in this unit range from rocky tide pools to large submarine canyons. Like other MCUs, this unit receives nutrient rich water from upwelling, which supports the area's high biodiversity. The coastal intertidal includes sandy beaches, rocky shores, coastal marsh, and tidal flats. Estuaries, where coastal streams meet the sea, provide habitat for fish, invertebrates, plants, birds, and mammals. In addition to the bull kelp dominated kelp forests similar to the North Coast and North Central Coast, the Central Coast also has kelp forests dominated by giant kelp in nearshore areas south of the Monterey Bay Submarine Canyon. There are two regionally important estuaries in this unit, Elkhorn Slough (part of the National Estuarine Research Reserve System) and Morro Bay (part of the National Estuary Program). Public awareness about the marine ecosystem is supported by the education activities in and adjacent to estuaries like these and numerous marine research and educational institutions that study this MCU (CDFW 2014c; CDFG 2005b).

In total, central California waters are home to 26 species of marine mammals, 94 species of seabirds, 345 species of fish, four species of sea turtles, thousands of species of invertebrates, and more than 450 species of marine algae (CDFW 2014c; CDFG 2005b).

Like other MCUs, the Central Coast supports fishing (commercial and recreational) as well as offers unparalleled diving, kayaking, fishing, and whale-watching (CDFW 2014c; CDFG 2005b).

South Coast Marine Conservation Unit

The South Coast MCU covers approximately 2,351 square miles of state waters from Point Conception in Santa Barbara County to the California-Mexico border and includes state waters around the offshore islands. Within these waters, nearly 355 square miles (approximately 15 percent) are protected by 50 MPAs and two Special Closures. Specifically the South Coast MCU includes 19 SMRs, ten SMCAs, 21 SMCAs, and two Special Closures (CDFW 2014d). The South Coast MCU follows the southern coastline and includes most of Santa Barbara, Ventura, Los Angeles, Orange, and San Diego counties as well as being adjacent to the cities of Santa Barbara, Ventura, Santa Monica, Long Beach, Oceanside, and San Diego. Key rivers or portions of rivers flowing into this unit include the Santa Clara, Los Angeles, San Gabriel, and Santa Ana rivers (CDFW 2014d; CDFG 2009).

A unique feature of the South Coast MCU is that it is part of the Southern California Bight, where waters from two major biogeographic regions intersect: cold, temperate water from the north, and warmer water from the south. The South Coast MCU includes a wide range of habitats from soft and hard-bottomed deep water to nearshore rocky reefs. Its giant kelp dominated kelp forests support species such as white seabass and California spiny lobster. The estuaries and lagoons provide opportunities for foraging and/or breeding, as well as serve as nurseries for young animals. Anaheim Bay, Upper Newport Bay, and Bolsa Chica lagoons are a few of the nearly 40 estuaries and lagoons found in the South Coast MCU. Offshore islands (including the Channel Islands, which form an archipelago of eight major islands) support a diverse array of plants, invertebrates, fish, birds, and mammals that are found in the coastal intertidal and ocean waters surrounding the offshore islands (Aseltine-Neilson, pers. comm., 2015; CDFW 2014d). In total, this area is home to 481 species of fish, four species of sea turtle, 195 species of birds, seven species of pinnipeds, and more than 5,000 species of invertebrates. The island waters also offer unparalleled recreation opportunities including diving, kayaking, and wildlife viewing (CDFW 2014d; CDFG 2009).

Like other MCUs, the South Coast unit provides for productive fisheries and offers diverse recreational opportunities such as diving, surfing, kayaking, beach-going, swimming, and shore and boat-based wildlife viewing. The South Coast MCU is adjacent to several large urban centers, which contribute to water quality challenges (CDFW 2014d; CDFG 2009). For example, between 1970 and 2010 Los Angeles had the highest single county population growth in the state, increasing by over 2.7 million people (NOAA 2013b).

The Marine Province includes seven targets:

- **Embayments, Estuaries, Lagoons**
- **Intertidal Zone**
- **Nearshore Subtidal Zone**
- **Mid-depth Zone**
- **Deep Zone**
- **Offshore Rocks**
- **Islands**

SWAP 2015 addresses Embayments, Estuaries, Lagoons as the priority target.

Embayments, Estuaries, Lagoons Conservation Targets

In embayments, ocean wave action is not an essential component of the shoreline-water interface because the shoreline creates a semi-protected water body with relatively restricted flow to the open ocean (Schaffer 2002). Embayment habitats are not only important for aquatic organisms, but also sea birds and some mammals that move between deep and shallow waters. Embayment habitats are typically divided into two categories: areas of deep water (deep bays and channels) and areas of shallow water (shallow bays and channels). Deep bay sediments range from coarse sand to very fine clays and silts and provide habitat for species such as harbor seals, salmon, and clams. Shallow bays are primarily composed of mud sediment and provide important feeding grounds for jacksmelt and other fish (Monroe et al. 1999).

Estuaries connect rivers with the sea and act as a nursery, feeding ground, and shelter for migratory birds and other organisms. Freshwater collected over vast regions of the land pours into an ocean primarily through major rivers and ocean tides send higher density salt water into estuaries and occasionally upstream far beyond the river mouth. Mixing between fresh and salt water creates a unique environment, and provides habitat for species that can handle variability in environmental conditions (Tomczak 1996). In addition, these environments offer unique research opportunities. For example, Elkhorn Slough National Estuarine Research Reserve is one of the 22 national estuarine research reserves around the country that serve as a representative estuary for research, education, and ecosystem stewardship (CDFW n.d.). Estuaries include an array of habitats such as salt marsh, oyster bed, and mud flat. Eelgrass is an important estuarine plant that provides nursery habitat for many fish and other aquatic organisms. Estuaries are exceedingly valuable for residing biodiversity, as well as for providing ecosystem services including improving water quality, buffering against sea level rise and storm surge impacts, providing food and recreation opportunities, and serving as natural barriers to erosion (NOAA 2013c; Gleason et al. 2011). There are many potential threats to estuaries, including altered tidal exchange, altered nutrient dynamics and water quality, altered freshwater inputs, altered sediment regime, invasive species, direct habitat loss, and climate change (California Coastal Conservancy and Ocean Protection Council 2010).

Lagoons are areas of shallow salt water periodically separated from the ocean by sand dunes or other features (Merriam-Webster 2015). Periodic opening and flooding allow for efficient sediment export from the lagoon systems (Jacobs et al. 2011). Lagoons, whether natural or artificial, may or may not receive water inflow from a stream or other form of uplands runoff.

Lagoons support many of the same aquatic invertebrates and fishes that occur in nearby shallow bays and channels. They also provide feeding grounds for a variety of waterfowl such as brown pelican, canvasback, and ruddy duck (Monroe et al. 1999).

5.7.3 Key Ecological Attributes

To identify the KEAs, the SWAP regional team for the Marine Province participated in a process to assess and better understand the overall health of the embayments, estuaries, and lagoons target. Through this process, the team developed indicators for each attribute that can be used to measure change in the attribute's status.

The attributes for the embayments, estuaries, lagoons target that are the most important for the viability of the target are:

- area or extent of the communities for embayments, estuaries, or lagoons, such as total area or the area of eelgrass beds in lagoons;
- community structure and composition, including various aspects of biotic assemblages, such as age class heterogeneity, diversity, endemic diversity, key species population, native versus non-native diversity, and structural diversity, indicated for example by metrics such as the number of shorebird or other key species, or the proportion of native species to non-native species;
- connectivity among communities and ecosystems, measured by the level of physical or desired genetic connectivity in terms of miles or acres or gene flow, respectively;
- hydrologic characteristics of freshwater input into target, such as indicated by surface flow, channel pattern, level of natural hydrologic regime and quality of freshwater inflow;
- circulation and connectivity of waters within the target such as tidal circulation, connectivity between the back and front sections of the target, and connectivity to the ocean such as indicated by residence times and salinity profiles;
- characteristics of ocean or estuarine water input into target in terms of water quantity and quality, indicated, for example, by altered inputs from the ocean;
- water quality levels, indicated by square miles with level of desired water quality as defined by the level of contamination of pollutants or changes in dissolved oxygen or pH within the target or linear miles entering target; and
- sediment quality indicated by square miles with level of desired water quality as defined by the level of contamination of pollutants or changes in dissolved oxygen.

5.7.4 Species of Greatest Conservation Need in the Marine Province

The SWAP regional team identified the Species of Greatest Conservation Need (SGCN) for the Marine Province (Table 5.7-1). The criteria used to determine SGCN are described in Section 2.4 and the complete list of SGCN for California is presented in Appendix C. In Table 5.7-1, species

are indicated for embayments, estuaries, lagoons, intertidal zone, nearshore subtidal zone, and other (includes species found in one or more of the following targets mid-depth zone, deep zone, offshore rocks, and islands).

SWAP 2005 identified 638 vertebrate species that inhabit the Marine Province at some point in their life cycle, including 163 birds, 62 mammals, 15 reptiles, four amphibians, and 394 fish (CDFG 2005a). For SWAP 2015, 31 birds species, nine mammalian species, nine reptilian species, four amphibian species, 34 finfish species, seven invertebrate species, and five plant species are included as SGCN for the Marine Province (Table 5.7-1).

Marine invertebrate diversity is poorly known, but it is known that marine invertebrate species far outnumber vertebrate species in the ocean (CDFG 2005a). In the Marine Province, the seven invertebrate taxa included on the SGCN list are all mollusks.

In the table below, climate vulnerable species have also been identified as appropriate using expert opinion and available literature research. Those species identified in this manner are ones that may be adversely affected by changes in climate such as habitat, food, and water availability shifts.

Table 5.7-1 Species of Greatest Conservation Need – Marine Province

Common Name	Scientific Name	Conservation Target				Climate Vulnerable
		Embayments, Estuaries, Lagoons	Coastal Intertidal	Nearshore Marine	Other[1]	
Invertebrates						
Pink abalone	*Haliotis corrugata*			X		X
Black abalone	*Haliotis cracherodii*		X	X		X
Green abalone	*Haliotis fulgens*		X	X		X
Pinto abalone	*Haliotis kamtschatkana*			X		X
White abalone	*Haliotis sorenseni*			X	X	X
Flat abalone	*Haliotis walallensis*			X		X
Speckled (bay) scallop	*Argopecten circularis*	X				X
Fish						
Pacific lamprey	*Entosphenus tridentatus*	X		X	X	X
River lamprey	*Lampetra ayresii*	X		X		X
White shark	*Carcharodon carcharias*			X	X	
Green sturgeon	*Acipenser medirostris*	X		X	X	X
White sturgeon	*Acipenser transmontanus*	X				X
Coastal cutthroat trout	*Oncorhynchus clarkii clarkii*	X		X		X
Coho salmon - central California coast ESU	*Oncorhynchus kisutch*	X		X	X	X
Coho salmon - southern Oregon / northern California ESU	*Oncorhynchus kisutch*	X		X	X	X
Steelhead - Central Valley DPS	*Oncorhynchus mykiss irideus*	X		X	X	X
Steelhead - central California coast DPS	*Oncorhynchus mykiss irideus*	X		X	X	X

Table 5.7-1 Species of Greatest Conservation Need – Marine Province

Common Name	Scientific Name	Conservation Target				Climate Vulnerable
		Embayments, Estuaries, Lagoons	Coastal Intertidal	Nearshore Marine	Other[1]	
Steelhead - northern California DPS	*Oncorhynchus mykiss irideus*	X		X	X	X
Steelhead - south/central California coast DPS	*Oncorhynchus mykiss irideus*	X		X	X	X
Steelhead - southern California DPS	*Oncorhynchus mykiss irideus*	X		X	X	X
Chinook salmon - California coastal ESU	*Oncorhynchus tshawytscha*	X		X	X	X
Chinook salmon - Central Valley spring-run ESU	*Oncorhynchus tshawytscha*	X		X	X	X
Chinook salmon - Sacramento River winter-run ESU	*Oncorhynchus tshawytscha*	X		X	X	X
Delta smelt	*Hypomesus transpacificus*	X		X	X	X
Longfin smelt	*Spirinchus thaleichthys*	X		X		X
Eulachon	*Thaleichthys pacificus*	X		X	X	X
Unarmored threespine stickleback	*Gasterosteus aculeatus williamsoni*	X				X
Pacific Ocean perch	*Sebastes alutus*				X	
Darkblotched rockfish	*Sebastes crameri*				X	
Bronzespotted rockfish	*Sebastes gilli*				X	
Cowcod	*Sebastes levis*			X	X	
Bocaccio rockfish	*Sebastes paucispinis*			X	X	
Canary rockfish	*Sebastes pinniger*			X	X	
Yelloweye rockfish	*Sebastes ruberrimus*			X	X	
Giant sea bass	*Stereolepis gigas*			X		
Gulf grouper	*Mycteroperca jordani*			X		
Broomtail grouper	*Mycteroperca xenarcha*			X		
Tidewater goby	*Eucyclogobius newberryi*	X				X
Bluefin tuna	*Thunnus orientalis*				X	
Petrale sole	*Eopsetta jordani*				X	
Garibaldi	*Hypsypops rubicundus*			X		
Amphibians						
Santa Cruz long-toed salamander	*Ambystoma macrodactylum croceum*	X				
California newt (Monterey County and South)	*Taricha torosa*	X				
Northern red-legged frog	Rana aurora	X				X
California red-legged frog	*Rana draytonii*	X				
Reptiles						
Loggerhead sea turtle (North Pacific)	*Caretta caretta*	X	X	X	X	X
Green sea turtle	*Chelonia mydas*	X	X	X	X	X
Olive ridley sea turtle	*Lepidochelys olivacea*	X	X	X	X	X
Leatherback sea turtle	*Dermochelys coriacea*	X	X	X	X	X

Table 5.7-1 Species of Greatest Conservation Need – Marine Province

Common Name	Scientific Name	Conservation Target				Climate Vulnerable
		Embayments, Estuaries, Lagoons	Coastal Intertidal	Nearshore Marine	Other[1]	
Northern western pond turtle	*Actinemys marmorata*	X				
Southern western pond turtle	*Actinemys pallida*	X				
Two-striped gartersnake	*Thamnophis hammondii*	X				
California red-sided gartersnake (Ventura County and South)	*Thamnophis sirtalis infernalis*	X				
San Francisco gartersnake	*Thamnophis sirtalis tetrataenia*	X				
Birds						
Barrow's goldeneye	*Bucephala islandica*	X				X
Ashy storm-petrel	*Oceanodroma homochroa*			X	X	X
American white pelican	*Pelecanus erythrorhynchos*	X				X
California brown pelican	*Pelecanus occidentalis californicus*	X		X		X
Pelagic cormorant	*Phalacrocorax pelagicus*			X	X	X
Brandt's cormorant	*Phalacrocorax penicillatus*	X		X	X	X
California black rail	*Laterallus jamaicensis coturniculus*	X				X
Light-footed Ridgway's rail	*Rallus obsoletus levipes*	X				X
California Ridgway's rail	*Rallus obsoletus obsoletus*	X				X
Snowy plover (coastal population)	*Charadrius nivosus*		X			X
Black oystercatcher	*Haematopus bachmani*		X		X	X
Ruddy turnstone	*Arenaria interpres*		X		X	X
Black turnstone	*Arenaria melanocephala*		X		X	X
Sanderling	*Calidris alba*		X			X
Red knot	*Calidris canutus*	X	X			X
Surfbird	*Calidris virgata*		X		X	X
Wandering tattler	*Tringa incana*		X		X	X
Black skimmer	*Rynchops niger*	X				X
Gull-billed tern	*Gelochelidon nilotica*	X				X
California least tern	*Sternula antillarum browni*	X		X		X
Elegant tern	*Thalasseus elegans*	X		X		X
Royal tern	*Thalasseus maximus*	X		X		X
Marbled murrelet	*Brachyramphus marmoratus*			X		X
Pigeon guillemot	*Cepphus columba*			X	X	X
Rhinoceros auklet	*Cerorhinca monocerata*			X	X	X
Tufted puffin	*Fratercula cirrhata*			X	X	X
Cassin's auklet	*Ptychoramphus aleuticus*			X	X	X
Craveri's murrelet	*Synthliboramphus craveri*			X		X
Guadalupe murrelet	*Synthliboramphus hypoleucus*			X		X

Table 5.7-1 Species of Greatest Conservation Need – Marine Province

Common Name	Scientific Name	Conservation Target				Climate Vulnerable
		Embayments, Estuaries, Lagoons	Coastal Intertidal	Nearshore Marine	Other[1]	
Scripps's murrelet	*Synthliboramphus scrippsi*			X		X
Common murre	*Uria aalge*			X	X	X
Mammals						
Guadalupe fur seal[2]	*Arctocephalus townsendi*			X	X	NE
Southern sea otter[2]	*Enhydra lutris nereis*	X		X	X	NE
Sei whale[2]	*Balaenoptera borealis*			X	X	NE
Blue whale[2]	*Balaenoptera musculus*			X	X	NE
Fin whale[2]	*Balaenoptera physalus*			X	X	NE
North Pacific right whale[2]	*Eubalaena japonica*			X	X	NE
Humpback whale[2]	*Megaptera novaeangliae*			X	X	NE
Killer whale (southern resident DPS)[2]	*Orcinus orca*			X	X	NE
Sperm whale[2]	*Physeter macrocephalus*			X	X	NE
Biogenic Habitat						
Southern sea palm	*Eisenia arborea*		X	X		
Giant kelp	*Macrocystis sp.*			X		X
Surfgrass	*Phyllospadix*		X	X		X
Sea palm	*Postelsia palmaeformis*		X			
Eelgrass	*Zostera marina*	X				X

DPS= distinct population segment, ESU= evolutionarily significant unit, NE= Not evaluated

[1] SGCN occurs in other marine ecosystems that have not yet been developed as conservation targets.

[2] Species not evaluated for climate vulnerability.

5.7.5 Pressures on Conservation Targets

Commonly Identified Pressures in the Marine Province for Embayments, Estuaries, Lagoons Target

- **Climate Change**
- **Dams and Water Management/Use**
- **Housing and Urban Areas; Commercial and Industrial Areas - Shoreline Development**
- **Agricultural and Forestry Effluents**
- **Industrial and Military Effluents, Household Sewage and Urban Wastewater – Point Discharges**
- **Invasive Plants/Animals**
- **Other Ecosystem Modifications - Modification of Mouth/Channels**
- **Household Sewage and Urban Wastewater-Urban Runoff**
- **Industrial and Military Effluents – Hazardous Spills**

The diversity and abundance of marine wildlife in California are profoundly affected by human activities in, on, and alongside the water. The focus of this subsection is on ten pressures most commonly identified by the Marine Province regional team. The conservation strategies presented in Section 5.7.6 describe ways to address the pressures.

Because of large-scale shifts in oceanographic conditions, marine stresses need to be considered in the context of the natural variation, such as intra-annual (strengthening and relaxing of the Davidson Current), and decadal variations (Pacific decadal oscillation), as well as global warming and climate change related conditions. These shifts create a background of natural change that has a profound impact on marine diversity. For example, the distribution and abundance of marine species very much depend on the strength and temperature of the California Current, which itself varies on a scale measured in decades. When atmospheric pressure in the north Pacific is high, the California Current is stronger, the water temperature is colder, and significant upwelling drives high productivity of the ecosystem, allowing populations of many species adapted to colder water to flourish. When atmospheric pressure in the far northern Pacific is lower, the California Current weakens, water temperatures rise, and there is less upwelling of nutrient-laden water. As a result, the planktonic biomass shrinks, as do the size and range of populations of marine wildlife positioned higher in the food web and adapted to colder water (CDFG 2005a). Another possible response is a range shift, particularly for mobile species.

An oceanographic process that also affects the distribution and abundance of marine species is the El Niño–Southern Oscillation (ENSO), when the temperature of the equatorial ocean rises. When ENSOs are particularly strong, warming of ocean water extends further north of the equator than usual, affecting the California Current. Warmer ocean temperatures off the coast favor the presence of more of the species that prefer warmer water and are less hospitable for the cold water species, which then typically move offshore or to the north. The opposite occurs during a La Niña when the waters off the coast become cooler than usual. La Niñas often occur the year after an El Niño.

These regime shifts in oceanographic conditions mean that, over millions of years, marine organisms have evolved life-history strategies (growth processes, feeding preferences, movement patterns, and reproductive behaviors) that enable populations of species to survive periods of low food availability or years when ocean temperatures or ocean current characteristics do not favor successful reproduction and/or recruitment. The distribution and abundance of marine species naturally fluctuate over time with shifts and changes in the ocean, and populations and ecosystems remain intact because they are large and resilient enough to make it through years with unfavorable conditions (CDFG 2005a).

Using the *Open Standards* process, the SWAP 2015 Marine Province regional team identified 20 human-caused potential pressures for the embayments, estuaries, lagoons target. These pressures are identified and defined in Table 5.7-2. In addition to existing pressures identified and described in SWAP 2005, such as overfishing, degradation of marine ecosystems, invasive species, pollution, and human disturbance, the team identified new pressures including climate change.

Table 5.7-2 Potential Pressures Affecting Embayments, Estuaries, Lagoons

Pressure	Definition
Agricultural and Forestry Effluents	Includes runoff from crop and rangelands. Generally high in sediments, nutrients, and pollutants, medium in pathogens. Primarily through watershed inputs.
Airborne Pollutants	Includes particulates, pollutants, pathogens, etc. deposited from the air.
Climate Change	Human generated greenhouse gas (e.g., carbon dioxide, methane) emissions that contribute to climate change, such as released from vehicle exhausts and industrial emissions; includes ocean acidification and deoxygenation.
Dams and Water Management/Use	Diversion of watershed and groundwater inputs, including diversions for agriculture and urban use; altered inputs because of dams and levees; controlled inputs (dikes and weirs).
Other Ecosystem Modifications - Modification of Mouth/Channels	Dredging, widening mouth, armoring channels.
Other Ecosystem Modifications - Ocean/Estuary Water Diversion/Control	Jetties, breakwaters at mouth of embayments, estuaries, and inlets; intake pipes for power plants, aquariums, aquaculture facilities, etc.; levee, dikes, and weirs for controlling water flow within estuary (water discharged from power plants and other facilities covered under "Industrial and military effluents - Point Discharges").
Fishing, Harvesting, and Collecting Aquatic Resources	Extraction of marine species and associated indirect impacts; includes scientific collecting.
Garbage and Solid Waste	Includes plastics, discarded food items, household items, etc.
Household Sewage and Urban Wastewater – Urban Runoff	Includes runoff from residential and commercial areas, landscaped yards, roads and parking lots, domesticated animal feces; generally low in sediments and nutrients, medium in pollutants, high in pathogens.
Housing and Urban Areas; Commercial and Industrial Areas - Shoreline Development	Current and potential commercial and residential development, as well as agricultural development (e.g., grape production); may create artificial structures.
Hunting and Collecting Terrestrial Animals	Extraction of terrestrial species, gear use, disturbance - Only hunting for waterfowl allowed.
Industrial and Military Effluents- Hazardous Spills	Oil, gasoline, solvents, etc.
Industrial and Military Effluents, Household Sewage and Urban Wastewater- Point Discharges	Includes discharges from industry, power plants, sewage plants, aquariums and aquaculture facilities, dairies and stockyards; generally medium in sediments and nutrients, high in pollutants and pathogens.
Invasive Plants/Animals	Non-native species directly, either intentionally or unintentionally, brought into the system, rather than movement of species into the system from adjacent areas (e.g., moving in from Mexican waters).
Logging and Wood Harvesting	Removal of timber resulting in erosion, sedimentation, and deposition of particulates into waterways.
Marine and Freshwater Aquaculture	Kelp and other algae, invertebrates, fish pens and aquaculture operations in fresh and marine waters.
Other Ecosystem Modifications- Artificial Structures	Artificial structures currently in place along the shoreline (floating and submerged), including pier pilings, as well as potential for new artificial structures.
Parasites/Pathogens/Diseases	Pathogens introduced from outside (e.g., from feces of native and non-native species) or developing/growing within system.
Recreational Activities	Primarily disturbance of sensitive habitats or species; includes vessel use.
Shipping Lanes - Ballast Water	Water released from vessel storage tanks as they enter coastal waters.

Table 5.7-3 provides an overview of how the ten most commonly identified pressures are linked to stresses for the embayments, estuaries, lagoons target. Pressures are presented from highest (top) to lowest (bottom) priority. The five highest priority pressures include:

- climate change;
- dams and water management/use;
- housing and urban areas, commercial and industrial areas - shoreline development;
- agricultural and forestry effluents – agricultural runoff; and
- industrial and military effluents and household sewage and urban wastewater - point discharges.

These five highest pressures were followed by three pressures (equal in their ratings):

- invasive plants/animals;
- other ecosystem modifications - modification of mouth/channels; and
- household sewage and urban wastewater - urban runoff.

Table 5.7-3 Stresses and Pressures for Embayments, Estuaries, Lagoons

Priority Pressures	Stresses																								
	Ecosystem changes	Reduction in area in which to expand	Change in surface area	Decrease in native bivalve indicator species populations	Decrease in native shorebird indicator species populations	Decrease in proportion of native species	Decrease in seagrass beds	Change in floating vegetation	Changes in geophysical and disturbance regimes	Altered sediment delivery	Changes in freshwater hydrology and water characteristics	Change in freshwater input	Decrease in quality of water	Changes in coastal and ocean dynamics	Altered residence time	Change in circulation pattern	Altered tidal mixing	Change or loss in connectivity	Changes in ocean or estuarine hydrology and water characteristics	Altered ocean input	Changes in pH and aragonite saturation	Decrease in dissolved oxygen	Decrease in quality of water	Changes in soil characteristics	Decrease in quality of sediments
Climate change		X	X	X	X	X	X			X		X	X		X	X	X	X		X	X	X	X		
Dams and water management/use		X	X	X	X	X	X	X		X		X	X		X	X	X	X					X		X
Housing and urban areas, commercial and industrial areas - shoreline development		X	X	X	X	X	X	X		X		X	X		X	X	X	X							X
Agricultural and forestry effluents - agricultural runoff				X	X	X	X			X		X	X			X	X	X					X		X
Industrial and military effluents and household sewage and urban wastewater - point discharges				X	X	X	X					X	X			X	X	X					X		X
Invasive plants/animals				X	X	X	X					X				X	X	X							
Other ecosystem modifications - modification of mouth/channels				X		X	X									X	X	X		X	X				
Household sewage and urban wastewater - urban runoff					X	X	X					X	X			X	X								X
Industrial and military effluents - hazardous spills				X	X	X	X					X	X										X		
Parasites/pathogens/diseases				X	X	X	X	X					X												

Note: An X designates that the stress received either a High or Very High rating

5.7.6 Conservation Strategies

The SWAP 2015 regional team developed goals, conservation strategies, objectives, and conservation actions for addressing specific potential pressures that affect embayments, estuaries, lagoons. First, the overarching goals developed for this target are shared. Following each strategy, the pressures addressed and specific conservation actions are identified. Some strategies address all pressures, while others are targeted to specific pressures. In addition, related strategies share the types of activities that could be used to implement each strategy described. Table 5.7-4 summarizes the strategies for the embayments, estuaries, lagoons target.

Target: Embayments, Estuaries, Lagoons

Goals:

- By 2025, in coordination with partners, area of target is increased by at least 5 (with 5 percent of this area available as buffer for sea level rise).
- By 2025, increase reproductive success of native shorebirds by at least 5 percent, increase native oyster populations by at least 5 percent, and reduce invasive species populations by at least 5 percent, as indicators of improved community structure in the embayments, estuaries, lagoons ecosystems.
- By 2025, protect at least 5 percent more shorebird habitats to secure high quality embayments, estuaries, lagoons ecosystems.
- By 2025, native seagrass (eelgrass) bed acreage is increased by at least 5 percent. (Will result in an increase in floating vegetation.)
- By 2025, in coordination with partners, surface water flow (both ephemeral and permanent) is increased by at least 5 percent into embayments, estuaries, lagoons.
- By 2025, in coordination with State Water Boards and other partners, improve the water quality of tributaries that flow into embayments, estuaries, lagoons by meeting at least 5 percent of Total Maximum Daily Loads (TMDLs).
- By 2025, in coordination with partners, at least 5 percent of the embayment, estuary, and lagoon water bodies improve circulation and hydro-connectivity so that key ecological processes are restored, for example, nutrient and other chemical mixings in the water body are functioning better and improved tidal marsh evolutions are experienced throughout the target.
- By 2025, in coordination with State Water Boards and other partners, the water quality standards for at least 5 percent of embayment, estuary, and lagoon water bodies are met.
- By 2025, in coordination with State Water Boards and other partners, the sediment quality objectives for at least 5 percent of the embayment, estuary, and lagoon water bodies are met.

Conservation Strategy 1 (Management Planning, Land Use Planning, Partner Engagement; Environmental Review): Improve engagement in decision-making process.

Objective(s):

- Increase capacity by procuring PYs (PY is the annual salary or wage per person).
- Increase time spent on internal and external communication and coordination.
- Increase review of CEQA project proposals and local coastal plans.
- Review and provide CDFW input on all relevant permits and monitoring programs.
- Develop collaborations with local and state agencies and other relevant partners to address threats.
- Work with appropriate internal and external groups to integrate efforts to address watershed needs.
- Increase participation at meetings.
- Develop a standardized approach for reviewing project proposals, permits, and monitoring plans and for generating recommendations.

Intended pressure(s) reduced: All pressures.

Conservation action(s):

- Increase capacity by procuring staff and appropriate funding for environmental review.
- Increase time spent on internal and external communication and coordination.
- Increase participation in California Environmental Quality Act (CEQA) reviews of project proposals and local coastal plans.
- Review and provide CDFW input on all relevant permits and monitoring programs.
- Develop collaborations with local and state agencies and other relevant partners to address pressures.
- Work with appropriate internal and external groups to integrate efforts to address watershed needs.
- Increase participation at interagency coordination meetings.
- Develop a unit within the CDFW to focus on land-sea interface.
- Develop a standardized approach for partnering with other organizations and agencies to address pressures.

Conservation Strategy 2 (Management Planning, Land Use Planning, Partner Engagement, and Environmental Review): Improve implementation of non-structural and structural best management practices (BMPs).

Intended pressure(s) reduced: All pressures.

Conservation action(s):

- Increase review and input on BMP implementation.
- Increase interaction with municipalities to ensure that they are complying with permits.
- Coordinate with partners to reduce storm water/runoff effluents.
- Conduct and compile information on user activities and socio-economic data, in support of BMP recommendations.

Conservation Strategy 3 (Direct Management, Partner Engagement, and Outreach and Education): Improve rapid response capabilities to events that degrade target.

Intended pressure(s) reduced: All pressures.

Conservation action(s):

- Increase capacity to respond to events that degrade target.
- Increase response to hazardous spills of less than 42 gallons.

Conservation Strategy 4 (Law and Policy): Support development, implementation, and enforcement of effective regulations.

Intended pressure(s) reduced: All pressures.

Conservation action(s):

- Work with CDFW staff to ensure that adopted regulations will be effective at conserving resources.
- Work with legislative liaison to develop regulations that require wetland and shoreline buffers.
- Streamline regulatory process for CDFW staff and other entities to implement control and eradication work.
- Work with agencies and partners to review coastal maintenance activities including those related to dredging and infrastructure (piers, seawalls) to determine how to effectively comply with regulations (e.g., those for MPAs), where needed.
- Support adoption of effective regulations on terminal market for shellfish and aquarium imports.
- Work with agencies and other partners to leverage resources (financial and human) to increase implementation and enforcement of regulations.

Conservation Strategy 5 (Data Collection and Analysis and Direct Management): Support target monitoring, compile results, and integrate data into management.

Intended pressure(s) reduced: All pressures.

Conservation action(s):

- Assess what data are available within CDFW and from external sources to manage the target.
- Encourage support for physical/chemical monitoring network that includes target (such as the Integrated Ocean Observing System network).
- Provide support for biological monitoring of target, including monitoring of the State MPA network.
- Provide support for compilation and maintenance of data into databases that are readily available to, and easily useable by, managers, as well as the public.
- Provide web access to databases and develop tools for accessing and using data.
- Integrate with socio-economic data collected on resource users, and activities that affect resource and habitat conditions.

Conservation Strategy 6 (Data Collection and Analysis, Direct Management, and Partner Engagement): Encourage research that addresses questions that would improve ability to manage this target.

Intended pressure(s) reduced: All pressures.

Conservation action(s):

- Increase the information available to manage target.
- Increase participation in collaborative partnerships.

Conservation Strategy 7 (Outreach and Education, and Partner Engagement): Improve education and outreach activities.

Intended pressure(s) reduced: All pressures.

Conservation action(s):

- Increase public awareness of major pressures to target.
- Increase awareness in intergovernmental forums about how water quality in embayments and estuaries may affect SGCN.
- Increase coordination with partners on education and outreach activities.

Conservation Strategy 8 (Training and Technical Assistance): Increase training.

Intended pressure(s) reduced: All pressures.

Conservation action(s):

- Provide training to increase staff abilities to achieve goals.
- Provide training on how to review environmental documents using a standardized approach.
- Provide training on how to evaluate damage from events that degrade the target (e.g., hazardous spills).
- Increase coordination between management and staff on training needs.

Conservation Strategy 9 (Direct Management): Improve management approaches for fostering the sustainability and resilience of the target.

Intended pressure(s) reduced: All pressures.

Conservation action(s):

- Explore whether a more integrated approach for managing watersheds can build resilience throughout the watershed.
- Examine the effectiveness of the current MPA network to increase the target's sustainability and resilience.

Conservation Strategy 10 (Data Collection and Analysis, Direct Management, and Partner Engagement): Work with partners to identify effects on the target of climate change and to develop and implement responses to these effects.

Intended pressure(s) reduced: Climate change.

Conservation action(s):

- Identify the expected effects (from research and models) of climate change on the target's key attributes.
- Work with partners to increase our understanding of the expected effects of climate change on the target (and associated species).
- Incorporate increased understanding of effects into marine resource management.
- Provide guidance to other state agencies on how the key ecological attributes change because of climate change that affect marine resources and how these changes may be best addressed.

Conservation Strategy 11 (Management Planning and Environmental Review): Coordinate with local and state relevant agencies on shoreline and water quality management planning.

Intended pressure(s) reduced: Climate change; agricultural and forestry effluents (agricultural runoff); household sewage and urban wastewater (point discharges); industrial and military effluents (point discharges).

Conservation action(s):

- Provide guidance on what should be included in state management planning documents to ensure that the effects of increased anthropogenic greenhouse gases are addressed.
- Improve communication with state and local agencies with shared auspices affecting shoreline and water quality management planning.
- Develop collaborations with local and state agencies to develop BMPs regarding shoreline and water quality management.
- Increase coordination with SWRCB and RWQCB to implement general strategies.

Conservation Strategy 12 (Data Collection and Analysis, and Management Planning): Improve Marine Province's management of resources that are vulnerable to climate change and ocean acidification.

Intended pressure(s) reduced: Climate change.

Conservation action(s):

- Develop and implement plan (including management actions) to build resilience or decrease vulnerability of sensitive resources to climate change.
- Conduct baseline survey of bivalve species in estuarine habitats.
- Incorporate climate tools into management toolbox.

Conservation Strategy 13 (Economic Incentives, and Law and Policy): Support policies and practices that minimize impacts on shoreline and wetlands.

Intended pressure(s) reduced: Housing and urban areas (shoreline development); commercial and industrial areas (shoreline development).

Conservation action(s):

- Identify, evaluate, and implement incentives that encourage and practices that result in minimal impacts to the target.
- Increase coordination with the Coastal Commission and upcoming changes to legislation.

Conservation Strategy 14 (Outreach and Education, Management Planning, and Environmental Review): Improve practices to reduce human error.

Intended pressure(s) reduced: Industrial and military effluents (hazardous spills).

Conservation actions:

- Improve public recreational users' awareness of how to prevent and respond to hazardous spills.
- Improve commercial users' awareness of how to prevent and respond to hazardous spills.
- Coordinate with appropriate regulatory entities to require that an appropriate spill prevention and response plan be developed before proposed permit activities.

Conservation Strategy 15 (Management Planning): Implement CDFW Aquatic Invasive Species Management Plan.

Intended pressure(s) reduce: Invasive plants/animals.

Conservation action(s):

- Ensure plan objectives are met.
- Provide input to improve the Aquatic Invasive Species Management Plan.
- Increase content within, and accessibility to, the CDFW invasive species database.
- Create early detection rapid response program for new occurrences of invasive species.

Conservation Strategy 16 (Environmental Review, and Law and Policy): Streamline permit processes that address control and eradication of invasive species.

Intended pressure(s) reduced: Invasive plants/animals.

Conservation action(s):

- Streamline regulatory process for CDFW staff and other entities to implement control and eradication work.
- Provide criteria on how to conduct eradication and/or control measures for invasive species.

Conservation Strategy 17 (Management Planning, and Direct Management): Improve implementation of estuary, lagoon mouth and channel modifications.

Intended pressure(s) reduced: Dams and water management/use (Modification of Mouth/Channel [Dredging]).

Conservation action(s):

- Participate in development of embayment, estuary, and lagoon management plans.
- Incorporate the existence of MPAs into the planning process.
- Strictly implement existing work windows.

Conservation Strategy 18 (Partner Engagement, Land Use Planning, and Land Acquisition/Easement/Lease): Encourage protection of lands that reduce runoff (buffers like greenways and gulches).

Intended pressure(s) reduced: Household sewage and urban wastewater (Urban Runoff); commercial and industrial effluents (Urban Runoff).

Conservation action(s):

- Work with other CDFW regions and other agencies to establish working groups to identify and prioritize lands like greenways and gulches that can act as buffers for urban runoff.
- In coordination with working group members, identify and implement efforts to protect highest priority lands.

Conservation Strategy 19 (Data Collection and Analysis): Improve understanding of distribution of important pathogens.

Intended pressure(s) reduced: Parasites/pathogens/diseases.

Conservation action(s):

- Conduct comprehensive baseline survey.

5.7.7 Next Steps for the Marine Province

As stated in Section 5.7.1, "Geophysical and Ecological Description of the Province," besides the embayments, estuaries, and lagoons target, the SWAP 2015 regional team for the Marine Province identified six other conservation targets: intertidal zone, nearshore subtidal zone, mid-depth zone, deep zone, offshore rocks, and islands; however, these targets were not completed for this update because less information was available for these targets, they were perceived to have lower vulnerability to climate change impacts than the chosen target, fewer management agencies and/or organizations exist with jurisdiction over these targets than the target chosen, and there was insufficient time to address each target using the in-depth *Open Standards* process. Although specific strategies were not developed for the other targets, many of the general conservation strategies outlined for the embayments, estuaries, lagoons target are also relevant and managers could refer to these in general terms, until more specific information becomes available.

CDFW will complete the other target strategies using the *Open Standards* process after completion of SWAP 2015. Once completed, the strategies can be folded into SWAP 2015 with the amendment process described in Section 7.7, "Review and Revision." Because this process is useful for identifying key priorities and strategies for implementing effective management, CDFW managers responsible for implementing management actions in the Marine Province will

use it in an ongoing manner to make updates between 2015 and the next comprehensive SWAP update prior to 2025. In addition to the review and revision process, CDFW is undergoing development of nine sector specific companion plans, as described in Section 1.6, "Companion Plans." One of the sectors is "Marine" and will help to supplement information in this section.

Table 5.7-4 Conservation Targets and Strategies for the Marine Province

Target*	Goals	Key Ecological Attributes (KEAs)	Pressures[1]	Strategy Categories
Embayments Estuaries Lagoons	▪ By 2025, in coordination with partners, area of target is increased by at least 5% (with 5% of this area available as buffer for sea level rise). ▪ By 2025, increase reproductive success of native shorebirds by at least 5%, increase native oyster populations by at least 5%, and reduce invasive species populations by at least 5%, as indicators of improved community structure in the embayments, estuaries, lagoons ecosystems. ▪ By 2025, protect at least 5% more shorebird habitats to secure high quality embayments, estuaries, lagoons ecosystems. ▪ By 2025, native seagrass (eelgrass) bed acreage is increased by at least 5%. (Will result in an increase in floating vegetation) ▪ By 2025, in coordination with partners, surface water flow (both ephemeral and permanent) is increased by at least 5% into embayments, estuaries, lagoons. ▪ By 2025, in coordination with State Water Boards and other partners, improve the water quality of tributaries that flow into embayments, estuaries, lagoons by meeting at least 5% of the TMDLs. ▪ By 2025, in coordination with partners, at least 5% of the embayment, estuary, and lagoon water bodies improve circulation and hydro-connectivity so that key ecological processes are restored, for example, nutrient and other chemical mixings in the water body are functioning better and improved tidal marsh evolutions are experienced throughout the target. ▪ By 2025, in coordination with State Water Boards and other partners, the water quality standards for at least 5% of embayment, estuary, and lagoon water bodies are met. ▪ By 2025, in coordination with State Water Boards and other partners, the sediment quality objectives for at least 5% of the embayment, estuary, and lagoon water bodies are met.	▪ Area and extent of community ▪ Community structure and composition (e.g., key species population levels, age class structure, biodiversity, endemic diversity, native versus non-native diversity) ▪ Connectivity among communities and ecosystems ▪ Biogenic habitat ▪ Hydrologic characteristics (e.g., flow coming into and out of target) ▪ Quantity of sediment delivered into target (sediment deposition) ▪ Circulation and connectivity within target ▪ Water quality ▪ Sediment quality	▪ Agricultural and forestry effluents ▪ Airborne pollutants ▪ Climate change ▪ Dams and water management/use ▪ Fishing, harvesting, and collecting aquatic resources ▪ Garbage and solid waste ▪ Household sewage and urban wastewater (urban runoff) ▪ Housing and urban areas, commercial and industrial areas (shoreline development) ▪ Hunting and collecting terrestrial animals ▪ Industrial and military effluents (hazardous spills) ▪ Industrial and military effluents, household sewage and urban wastewater (point discharge) ▪ Invasive plants/animals ▪ Logging and wood harvesting ▪ Marine and freshwater aquaculture ▪ Other ecosystem modifications (modification of mouth/channels, ocean/estuary water diversion/control, artificial structures) ▪ Parasites/pathogens/diseases ▪ Recreational activities ▪ Shipping lanes (ballast water)	▪ Data Collection and Analysis ▪ Partner Engagement ▪ Management Planning ▪ Direct Management ▪ Economic Incentives ▪ Environmental Review ▪ Land Acquisition/ Easement/ Lease ▪ Land Use Planning ▪ Law and Policy ▪ Outreach and Education ▪ Training and Technical Assistance

* Conservation strategies were only developed for the embayments, estuaries, lagoon target. Strategies for other marine conservation targets will be developed in the future.
[1] Pressures can be positive or negative depending on the intensity, timing, and duration of the action on the target habitat.