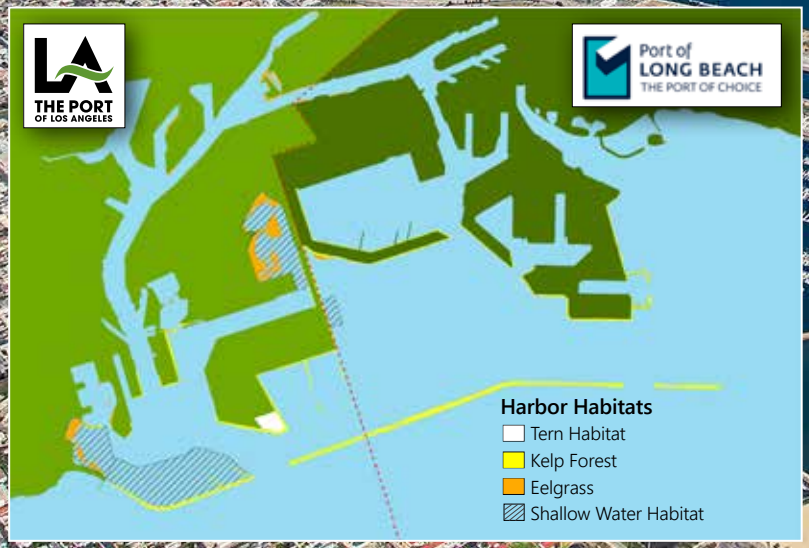
THE PORT OF LOS ANGELES

Port of LONG BEACH
THE PORT OF CHOICE

SAN PEDRO BAY

A Look Beneath the Surface

Welcome to San Pedro Bay, home to the ports of Los Angeles and Long Beach, America's busiest trade gateway.



Economic Engines, Environmental Stewards

Along the southern coastline of Los Angeles County, there are two seaports: the Port of Los Angeles and Port of Long Beach. Located side by side, together these twin ports comprise the San Pedro Bay Port Complex, which encompasses more than 15,000 acres of land and water in San Pedro Bay.

The ports play a vital role in the nation's economy, handling nearly 40% of all waterborne containers that are imported to the U.S annually. The Port Complex is a major economic driver at the local, regional, and national levels, and a key generator of jobs, commerce, and tourism in Southern California.

In addition to cargo-handling facilities, the ports provide coastal recreational and educational resources and have a stewardship role as caretakers of San Pedro Bay's marine wildlife. The ports are charged with ensuring that port operations are compatible with the preservation of those natural resources.

Since 2000, the ports have performed four comprehensive biological surveys of the Port Complex, covering the entirety of both harbors, to evaluate the area's physical and ecological characteristics. The surveys also address seasonal variations, assess the presence of invasive species, and compare the ecological characteristics of the various types of habitats found in the Port Complex.

The latest survey confirms commercial port operations and critical habitat in San Pedro Bay can coexist and flourish. Water clarity continues to improve, special-status species are abundant, and non-native species do not appear to be disrupting the bay's ecosystem.

The harbor is home to a variety of unique habitats — from the open water areas of the channels, to the mud and sand of the sea bottom.

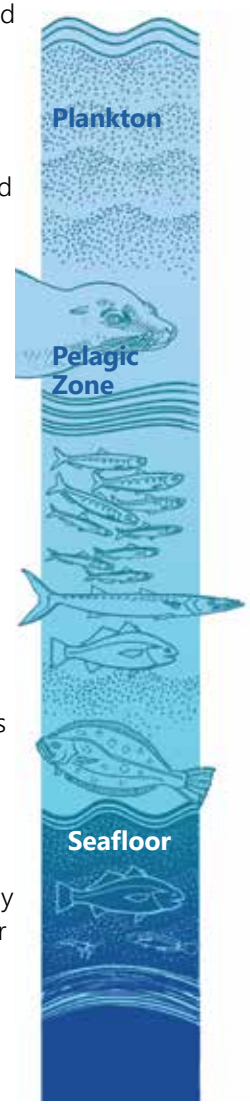
Satellite imagery, side-scan sonar, underwater photography, nets, bottom grabs, and diver transects are just some of the tools and methods the Biosurveys use to catalog harbor life.

Learn more about our survey methods. (Click here)

Bottom: Surveying intertidal habitats. Top (left to right): Surveying subtidal habitats, beach seine in Seaplane Lagoon, measuring fish on survey vessel

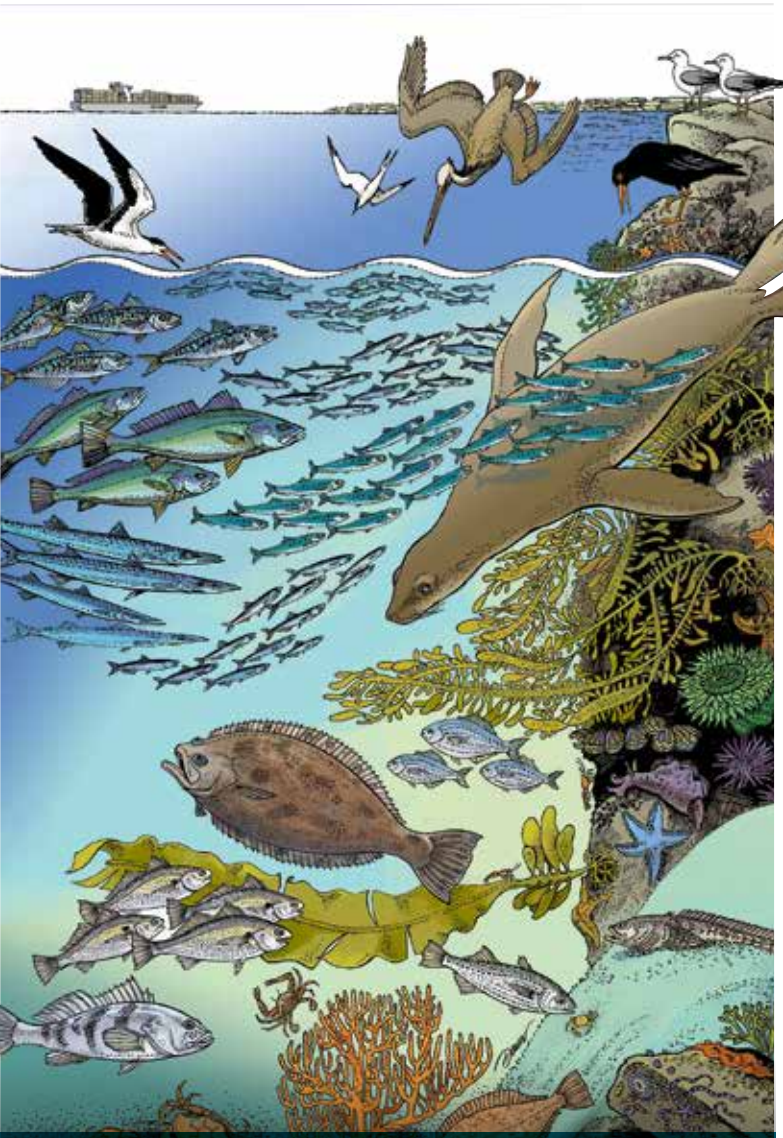
Rich in Habitat, Rich in Diversity

The ports support abundant marine life in a variety of habitats: from sea lions to pelicans, anchovies to kelp, shrimp to eelgrass. Over one thousand species of animals and plants live and thrive in the major habitats of Los Angeles-Long Beach Harbor, namely the **pelagic zone** (the open water column); **the seafloor** (the sand and mud harbor bottom, beaches, and eelgrass beds); and **the hard-substrate habitat** (rocky shoreline, dock pilings, and kelp beds).



The ports study these biological resources every five years in year-long, harborwide surveys of animals and plants, at more than 40 points throughout the two ports. During the latest 2018 Biosurvey, dozens of scientists and technicians collected and analyzed samples of fish eggs and larvae, adult and juvenile fish, bottom-dwelling (benthic) animals in the sediments, and scrapings of rocks and pilings. They also conducted diver surveys, measured the kelp and eelgrass beds, conducted bird surveys, and counted marine mammals. Over 56,000 fish and nearly 50,000 birds were identified, and over 62,000 tiny animals were separated from sediment and scraping samples and then identified and weighed.

Animals and plants interact with one another in what biologists call a food web. All life becomes food for another organism within the web of life in the harbor.



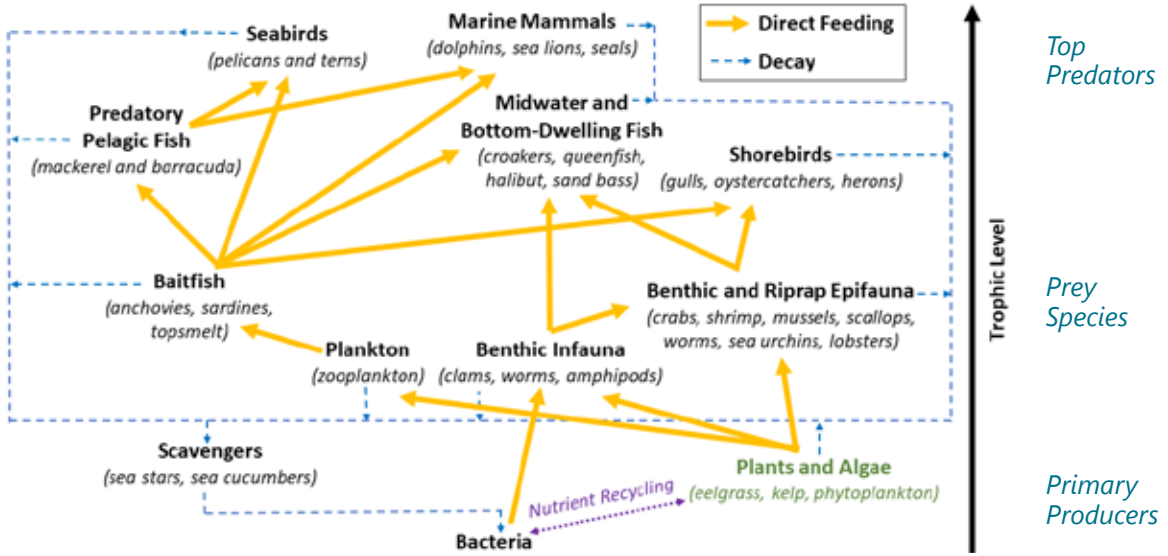
What makes habitats in the port diverse? (Click here)

Everything is Connected

The variety of harbor habitats support over 1,000 different species of fish, invertebrates, algae, birds, and marine mammals. The organisms that occupy each of these habitats are well adapted to the unique physical conditions in each habitat. For example, the organisms in the intertidal zone have evolved to handle wave action, bright sunlight, and exposure to the air during low tides, whereas animals that live in the deep, soft-bottom habitats (the benthos) have to handle dim or no light and variable food sources.

The proximity of habitats such as shallow eelgrass beds and kelp forests to these deep habitats help fuel food webs in these areas through 'detritus': pieces of organic matter such as blades of kelp and eelgrass that break off and decay as they settle to the bottom, similar to tree leaves that fall to the forest floor. Detritus is an important food source to planktonic animals, invertebrates that live in (infauna) and on (epifauna) the seafloor, and bacteria. In turn, the animals that eat detritus become important food sources for larger animals such as shrimp, crabs, and fish. These, in turn, are eaten by larger fish, by birds, and by marine mammals. When animals die and settle to the bottom, they are consumed by scavengers such as sea stars and tiny benthic animals and eventually are entirely recycled by bacteria to return nutrients to the environment. Those nutrients are used by phytoplankton, algae, and seagrasses to start the cycle of production over again.

It's called a food web instead of a food chain because of the many directions of the interactions.

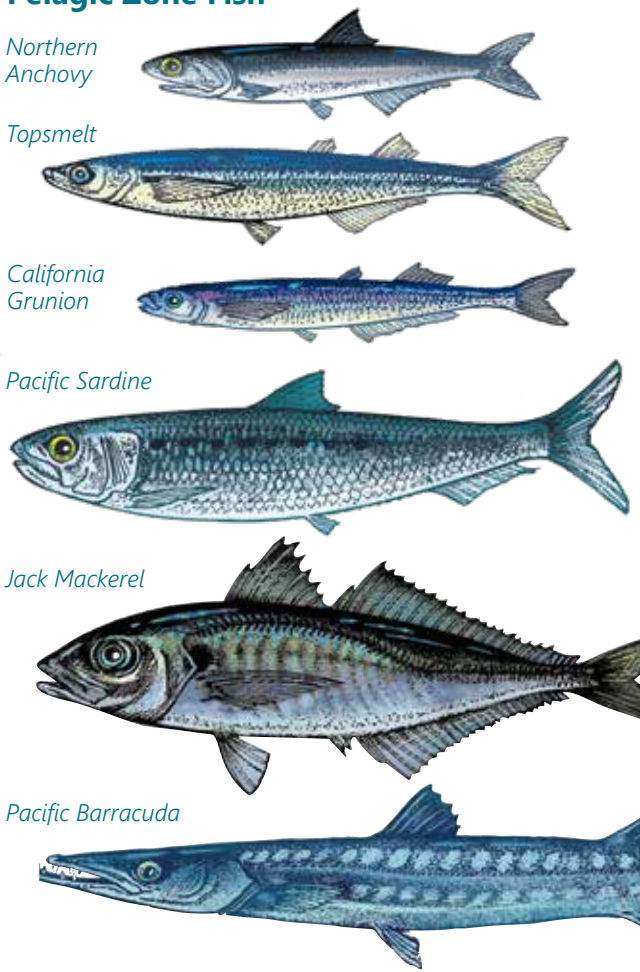


What lives here? The harbor is home to a diverse array of animals that use the various habitats for shelter, to find food, and as nursery areas.

The Pelagic Zone

The 'pelagic zone' refers to the water that is not near the shoreline and stretches from the surface to the seafloor. This zone makes up the largest habitat type in the harbors. Animals living in the pelagic zone, such as plankton (tiny floating plants and animals) and fishes, move up and down in the water column to find food and avoid predation. They are camouflaged for their life in the open water because this zone is an important foraging habitat for larger predators such as barracuda, mackerel, dolphins, sea lions, harbor seals, and fish-eating birds such as terns, pelicans, and cormorants. The 2018 Biosurvey found 23 different species of fish in the pelagic zone.

Pelagic Zone Fish




Lampara net recovery at night

Northern anchovy (19,768 caught) and topsmelt (8,409 caught) were the most common pelagic species found in the harbor. For both, over 90% of the fish caught were juveniles that appear to use the harbor as nursery habitat.

Gobies, blennies, and northern anchovies accounted for nearly 85% of the 8,461 larval fish captured during plankton surveys.

Ichthyoplankton

Many marine animals spend a portion of their life cycle in a planktonic state before morphing into their adult form. The 2018 Biosurvey sampled the planktonic fish ('ichthyoplankton'), to assess the value of the harbor to larval and juvenile fishes. As adults these fish may remain in the harbor or travel out of the harbor into coastal habitats. Some fishes, such as gobies and blennies that burrow into the seafloor or hide in rock crevices, are hard to detect as adults and are only seen as larvae.

Larval Northern Anchovy


Bongo nets for ichthyoplankton sampling

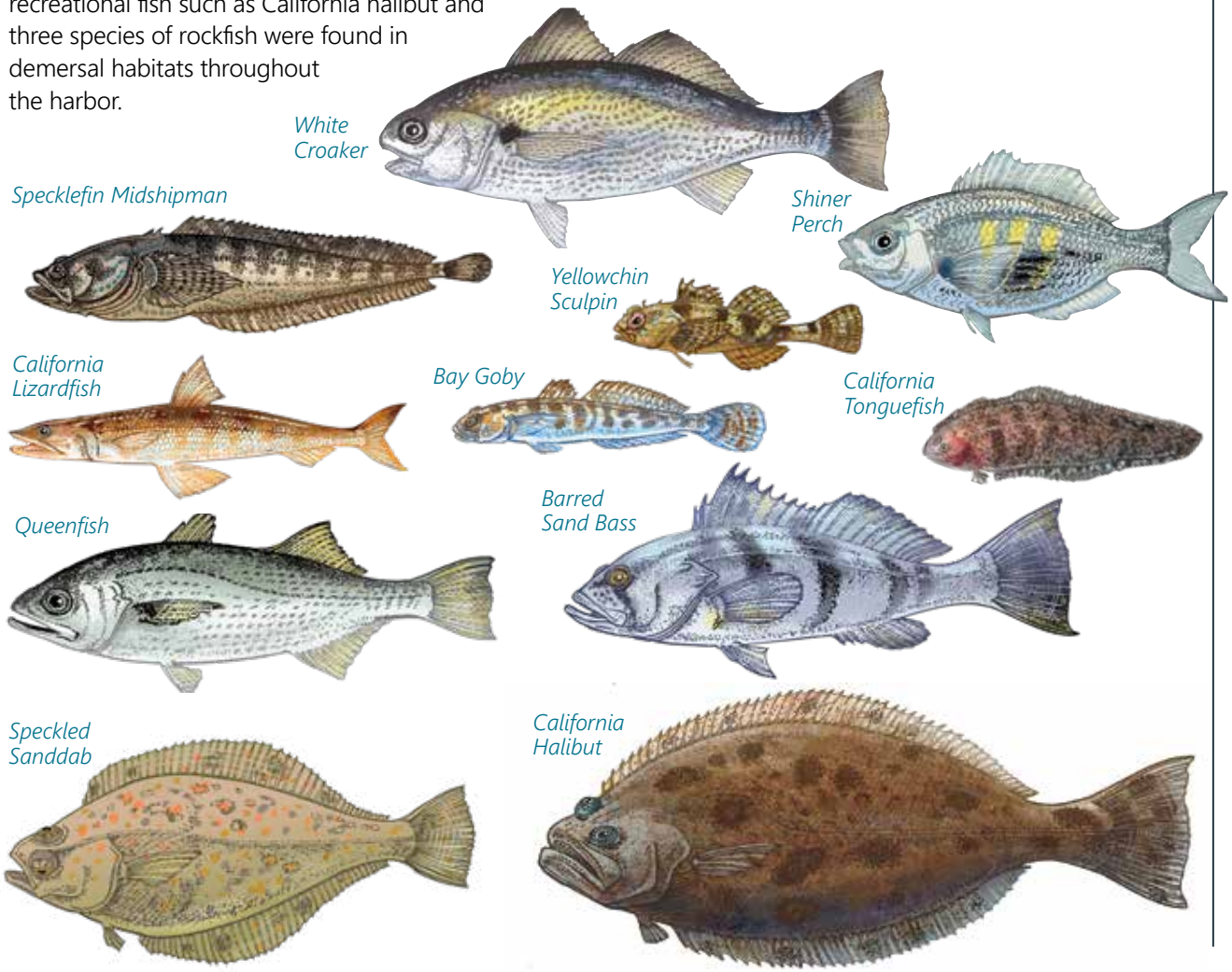
The Seafloor

The seafloor, called the benthic habitat, is the second largest harbor habitat and includes open-water areas with sandier sediments as well as more protected areas with muddier sediments that have higher organic carbon content. Species living in soft-bottom habitats have evolved to thrive in the range of conditions found in the Port Complex, with subtly different communities found in inner and outer harbor areas.

Common Demersal Fish

The 2018 Biosurvey found a total of 59 species of 'demersal' fish (living close to or on the seafloor). White croaker, queenfish, and barred sand bass were the most abundant. Valuable commercial and recreational fish such as California halibut and three species of rockfish were found in demersal habitats throughout the harbor.

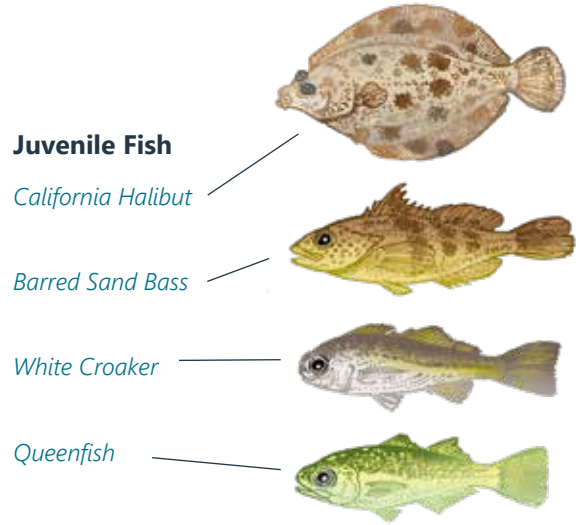
Only two non-native fish species were detected in the 2018 Biosurvey, the chameleon goby (larvae only) and the yellowfin goby (adults and larvae).



Eelgrass grows most rapidly in the summer. The summer 2018 Biosurvey found 86 acres of eelgrass in the harbor.

Eelgrass Beds

Eelgrass beds support a rich detrital food web and provide structure, food, and nursery habitat for many fish, invertebrates, and birds. Eelgrass was found in 12 locations in 2018, but 95% of it was in the Cabrillo Beach area and the Pier 300 Basin.



83% of white croaker and 99% of barred sand bass captured in the harbor were juveniles.

Invertebrates

Benthic invertebrates living in (the 'infauna') and on (the 'epifauna') the sediments at the bottom of the harbor are diverse and abundant. Infaunal communities are comprised of burrowing animals that feed by capturing floating specks of organic material (filter feeders) or material settled on the seafloor (deposit feeders). Stuck in one place and varying in their tolerance to stress, including pollution, these organisms can be valuable indicators of habitat quality.

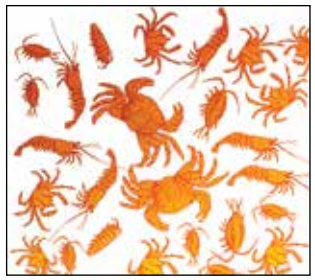
Epibenthic invertebrates include mobile animals such as shrimp, crabs, sea stars, and snails, and sessile animals such as sea squirts and soft corals. Benthic invertebrates are an important link between primary producers and higher trophic levels of the food web (e.g., fish, birds, and sea lions), and perform crucial ecological functions such as water filtration, nutrient cycling, and mixing of sediments.

Less than 5% of the 1,003 species of fish, invertebrates, and algae were non-native: 2 fish, 3 algae, 41 invertebrates.

Percent of non-native species by community type

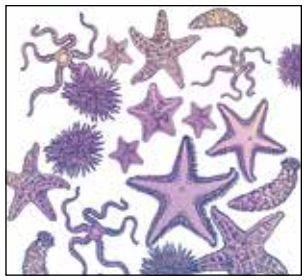
Benthic infauna: 5.2%
Riprap epifauna: 4.9%
Piling epifauna: 6.2%

Annelids
Polychaete Worms



Crustaceans
Amphipods, shrimp, crabs

Mollusks
Clams and snails



Echinoderms
Sea stars, urchins, sea cucumbers

Since the 2013 Biosurvey, the target shrimp *(Sicyonia penicillata)* has been the most abundant epibenthic invertebrate as the species shifted its distribution northward from its native Gulf of Mexico in response to warm water events.

Epifauna

Trawls and beach seines captured more than 14,000 invertebrates composed of 121 different species. Target shrimp, sea squirts, blackspotted shrimp, green shrimp, western mud nassa snail, and purple olivella snail were the most abundant.

Infauna

Sediment sampling throughout the harbor found 369 infauna species. Annelids (mostly marine worms known as polychaetes) were the most abundant group followed by crustaceans (mostly amphipods and small crabs), then molluscs (clams and snails), and finally echinoderms (sea stars and sea cucumbers). The past two Biosurveys (2013 and 2018) have found a sensitive, pollution-intolerant amphipod to be the most abundant benthic infauna species, suggesting that sediment quality continues to improve within the harbor. While some non-native species rank in the top ten in abundance, they are no longer the most abundant species, as was seen in previous surveys, and their distribution is limited to only a few areas within the harbor.

Riprap and Pilings


Green abalone

Most of the shoreline and the breakwaters of the Port Complex consist of rock dikes known as riprap, which provides nearly 50 miles of rocky habitat. There are also thousands of concrete, wood, and steel pilings that support the wharfs and docks of the marine terminals, marinas, and other infrastructure. These structures provide a large amount of habitat for animals that have adapted to life on rocky shorelines where they can tolerate pounding by waves, exposure to sun and air, and sharp fluctuations in temperature. The 2018 Biosurvey found 476 species of invertebrates and 31 species of algae on riprap and pilings within the harbor.


Rock scallop and purple urchins

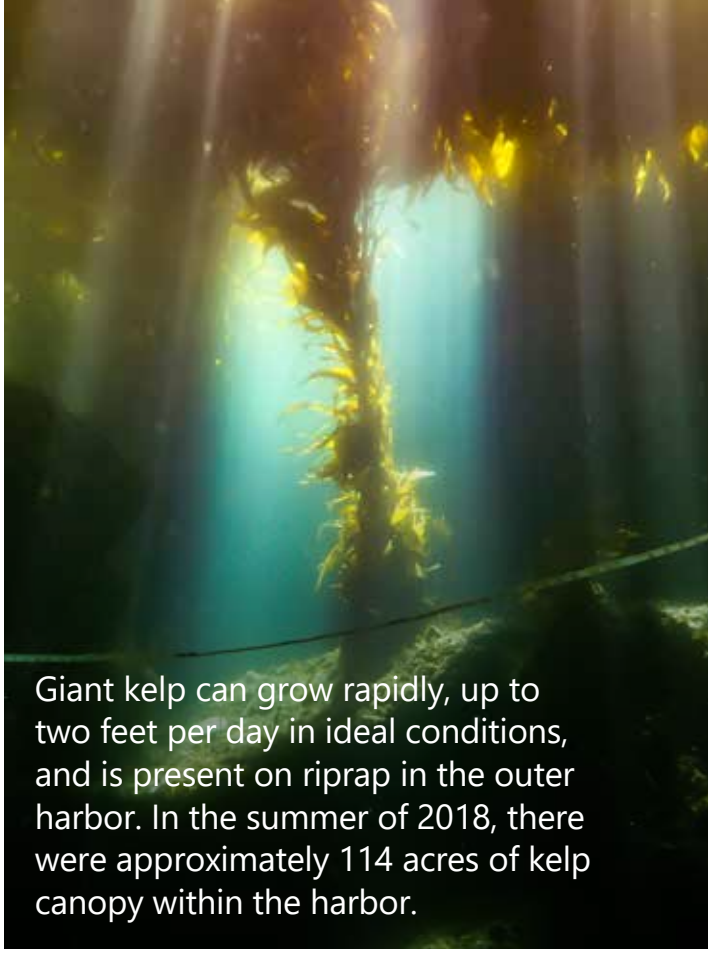
Intertidal Zones

The intertidal zone in Southern California shows strong vertical zonation — different species living at different levels — because of the tides that submerge and expose the shoreline each day. This is a harsh environment, but many species have adapted to it.

High intertidal zone
The high intertidal zone is underwater only at high tide. Few species — notably barnacles and limpets — are adapted to living in this zone.

Low intertidal zone
The low intertidal is exposed to the air only during low tides. Mussels, oysters, and algae — common inhabitants of this zone — are adapted to living underwater but can tolerate short exposure to air.

Subtidal zone
The subtidal zone is always underwater, even during the extreme low tides. Animals like scallops, sponges and tunicates are more common here, in addition to numerous species of algae

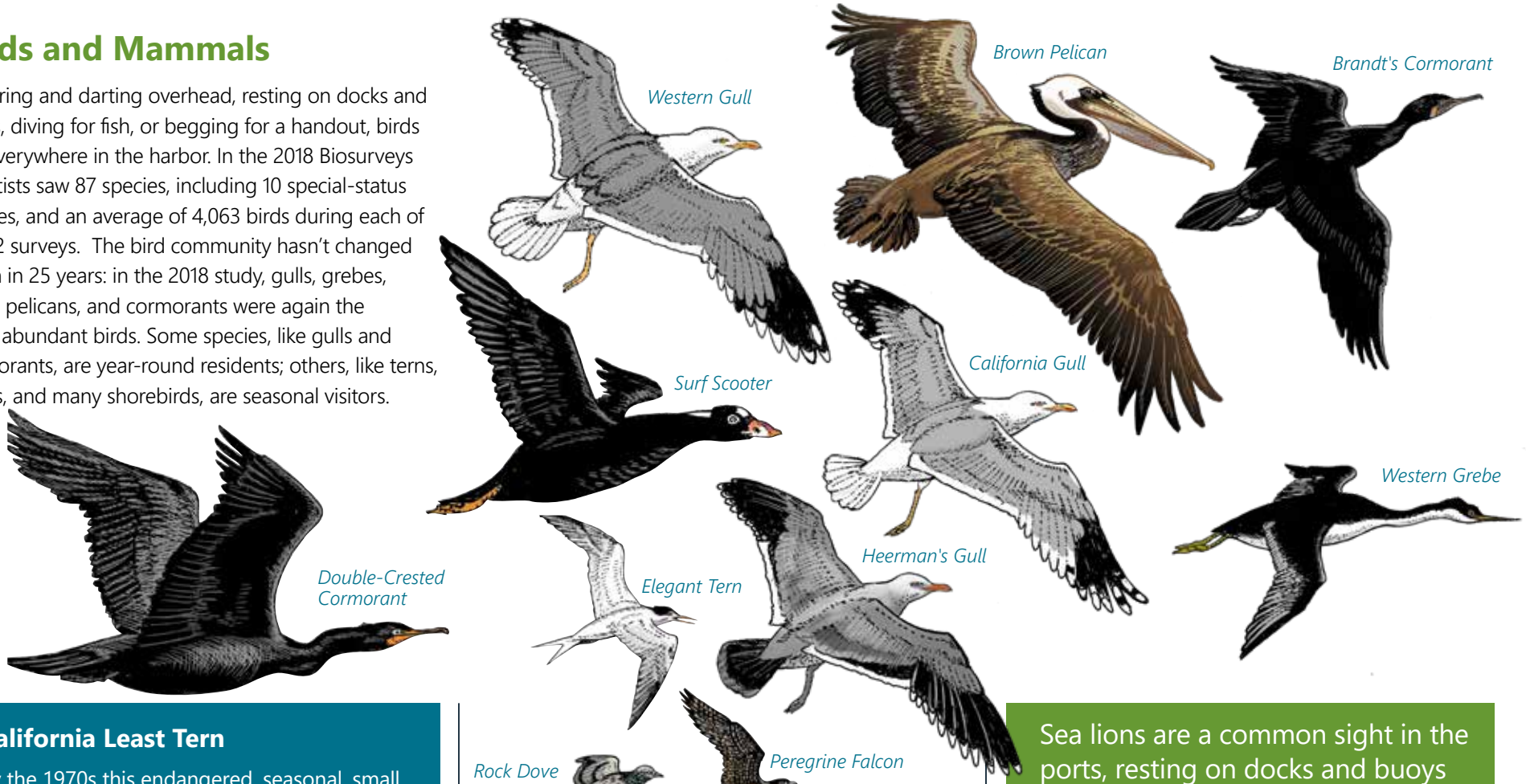

Giant kelp can grow rapidly, up to two feet per day in ideal conditions, and is present on riprap in the outer harbor. In the summer of 2018, there were approximately 114 acres of kelp canopy within the harbor.

Kelp Forest and Subtidal

Kelp forest habitat that grows on riprap in the outer harbor is one of the most valuable habitat types in the harbor due to the variety of microhabitats that it creates. The large riprap boulders in these areas promote the attachment of giant kelp, sea fans and scallops and have large crevices and caves that provide refuge from predators for invertebrates like urchins, abalone, and lobsters as well as fish such as garibaldi and horn sharks. Giant kelp creates vertical habitat, similar to trees in a forest, that forms a canopy on the surface. The kelp forest provides extensive habitat for fishes like kelp bass, blacksmith, and rockfish while also creating a valuable feeding ground for birds and marine mammals.

Birds and Mammals

Hovering and darting overhead, resting on docks and boats, diving for fish, or begging for a handout, birds are everywhere in the harbor. In the 2018 Biosurveys scientists saw 87 species, including 10 special-status species, and an average of 4,063 birds during each of the 12 surveys. The bird community hasn't changed much in 25 years: in the 2018 study, gulls, grebes, terns, pelicans, and cormorants were again the most abundant birds. Some species, like gulls and cormorants, are year-round residents; others, like terns, ducks, and many shorebirds, are seasonal visitors.



California Least Tern

By the 1970s this endangered, seasonal, small, fish-eating bird was nearly wiped out due to habitat loss, but for the past 30 years the Port of Los Angeles has maintained a nesting site on Terminal Island next to the habitats in which the birds hunt for the small baitfish their chicks depend on, giving the species a chance at success.

The harbor provides marine mammals with a rich source of the fish and large invertebrates they depend on. The California sea lion *(Zalophus californianus)* is the most abundant marine mammal in the ports, but by no means the only one. In addition to 598 sea lions, in the 2018 Biosurvey scientists counted 298 harbor seals, 119 dolphins, and a gray whale. Another gray whale and her calf were seen by a dive team near the Cabrillo boat launch.

Sea lions are a common sight in the ports, resting on docks and buoys and cruising the channels for food.

Regional perspectives and changing climate: The habitats in the port are connected with the coastal marine system of Southern California.

Marine Heatwaves

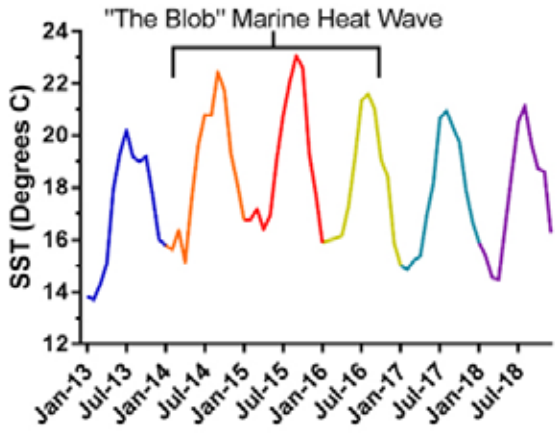
Just as on land, marine environments go through seasonal cycles that affect the growth, distribution, and abundance of plants and animals. In Southern California those cycles are driven by wind, waves, and the strength of currents moving warm and cold water along the coast. While most organisms can cope with short warm and cool periods, sustained extremes can cause stress and put vulnerable species at risk. For example, a coastwide "marine heatwave" in 2014-2016 disrupted food webs and caused mass strandings of marine mammals.

That warm event is also thought to have contributed to changes in the biological communities in the ports and the region, including the continued northward spread of target shrimp and decreases in the abundance of seabirds.

Source: SCCWRP

Unlike the previous three surveys, the 2018 Biosurvey occurred when the average water temperature was above the 20-year average

Sea Surface Temperature Monthly Average 2013-2018



From Coastal Data Information Program (Maintained by Scripps Institute of Oceanography) Buoy 215 - Long Beach Channel (LAT: 33.7003; LONG: -118.2007)


Non-native Undaria deteriorating in the late summer

Regional Monitoring Programs

Trends in the Southern California region cause changes in the biological communities of the harbor. Regional monitoring programs help scientists understand what they see in the Biosurveys of the harbor. Recent Biosurveys have coordinated sampling schedules and methods with regional programs such as the Bight monitoring and PISCO surveys of kelp forests and rocky reefs.

San Pedro Bay is part of the Southern California Bight, a bend in the coastline stretching from Point Conception to Punta Colonet in Mexico. Biological monitoring programs in the Port Complex participate in and have been designed to be comparable with ongoing long-term regional monitoring programs that survey habitat quality and biological communities in other embayments, such as San Diego Bay, and coastal habitats throughout the Southern California Bight.

Learn more about changes in communities across seasons and times. (Click here)


Giant kelp fronds growing in late spring

The ports continue to meet the challenge of environmental stewardship: supporting maritime commerce while protecting the harbor's natural resources.

The 2018 Biosurvey found the highest biodiversity to date with 104 species of fish, 859 species of invertebrates, 40 species of algae, 87 species of birds, and 5 species of marine mammals.

Kelp scallop

Giant kelp holdfast

Great Blue Heron

All of the photographs of plants and animals in this publication were taken in the waters of Los Angeles-Long Beach Harbor, a testimony to the ports' stewardship of the natural resources of the harbor. The commitment by the ports to control water pollution and protect wildlife habitats has allowed the biological communities in the harbor to flourish despite the enormous growth of trade in recent decades.

Effective Pollution Control Efforts

In the 1970s, water quality in the harbors was so poor there was virtually zero oxygen and no marine life in some areas, and very reduced biological communities in others. Through their environmental departments — some of the first in the world among ports — the ports looked seriously at the environmental impacts of their operations, and they have worked with state and federal wildlife agencies to develop and implement programs aimed at improving the quality of harbor waters, protecting aquatic wildlife, and ensuring that the ports comply with laws and regulations governing water quality and wildlife conservation and protection.

The ports have developed and are continuing to implement numerous programs to identify and eliminate remaining water and sediment pollution in the harbor in order to support the attainment of beneficial uses of harbor waters. These include programs for reducing storm water pollution and pollution from harbor maintenance and vessel activities, managing contaminated sediments, and controlling invasive species. Both ports have programs that include monitoring, education, and outreach, as well as cutting-edge structural controls. These programs help the ports meet their stewardship responsibilities — protecting the valuable biological resources of the harbor for the benefit of all of us.

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