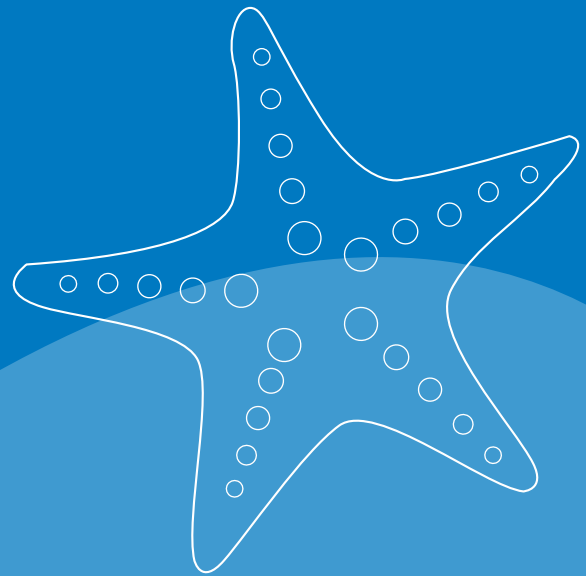


California Coast Educator Guide

Grade 6 - Grade 12



What's Inside:

- A. EXHIBIT OVERVIEW**
- B. EXHIBIT MAP**
- C. KEY CONCEPTS**
- D. VOCABULARY**
- E. MUSEUM CONNECTIONS**
- F. RESOURCES**



CALIFORNIA
ACADEMY OF
SCIENCES

The mix of sunshine, wind, water and geology has created one of the world's richest temperate marine communities. Come see why it's special and protected.

Welcome to the Northern California Coast, home to some of the world's richest temperate marine ecosystems. In this exhibit, students can learn about the coastal ecosystems of the Northern California Coast on both Level 1 and the Lower Level.

Upstairs on Level 1, students can follow a walkway along a transect of the coast from the San Francisco Bay estuary to the rocky coastline. Downstairs on the Lower Level, students will have several underwater views into the rocky coast tank, modeled on the habitats of the Gulf of the Farallones National Marine Sanctuary, including a dramatic floor-to-ceiling window. Students will walk through a gallery of medium-size and smaller tanks displaying characteristic habitats of the California coast, including rocky coast, rocky reef and sandy bottom.

Through interactive stations, students can learn more about the Gulf of the Farallones National Marine Sanctuary and California marine life. Students can also interact with docents and use magnifiers to explore a variety of marine organisms at the Tidepool.

Understanding the variety of animals and habitats on our California coast, our coastal resources, and how marine sanctuaries can play a role in protecting those resources sets the stage for fostering conservation awareness and environmental stewardship.

Students will encounter two major themes throughout the exhibit:

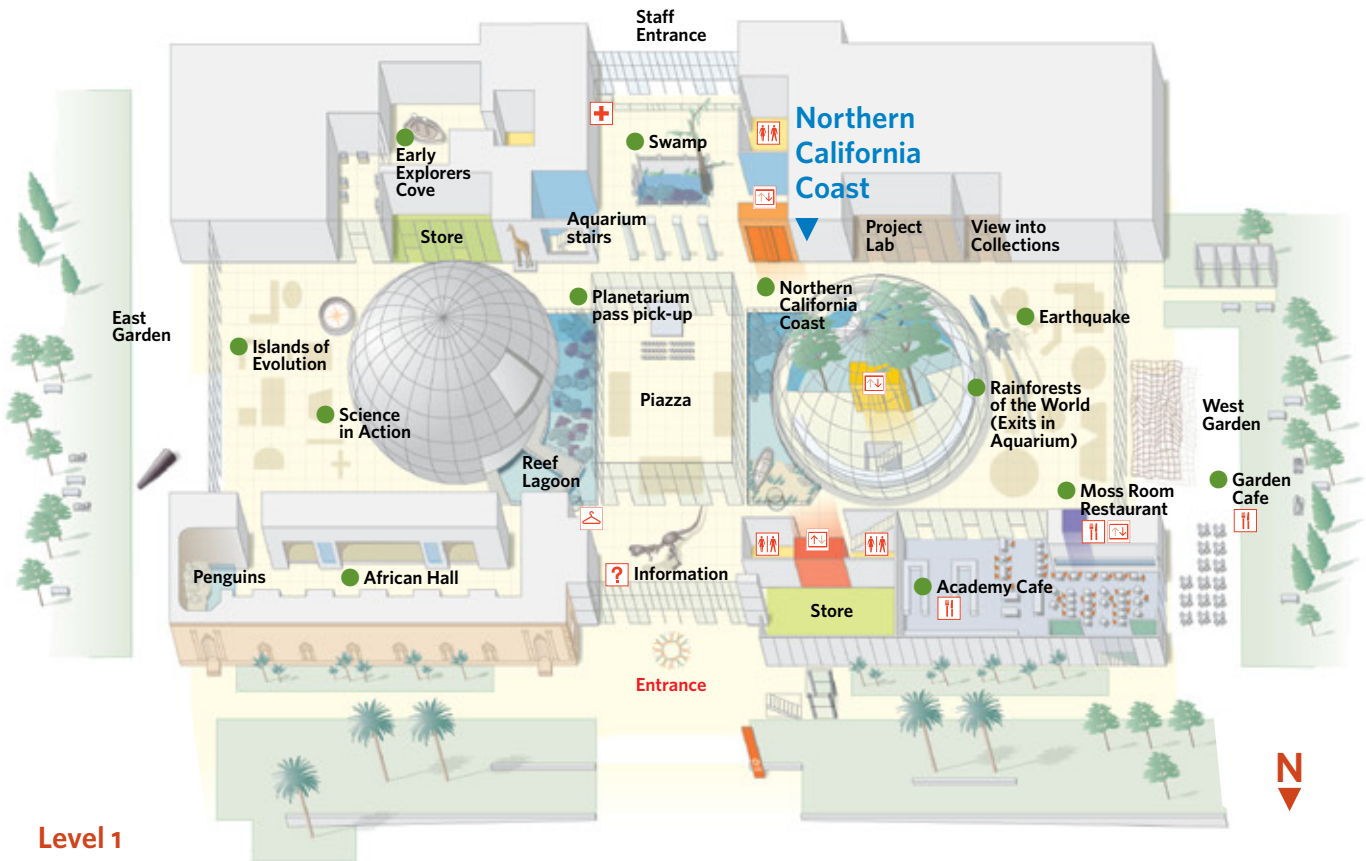
- » California coastal habitats
- » Conservation efforts

Use this guide to:

- » Plan your field trip to the California Academy of Sciences' Northern California Coast exhibit.
- » Learn about exhibit themes, key concepts and behind-the-scenes information to enhance and guide your students' experience.
- » Link to exhibit-related activities you can download.
- » Connect your field trip to the classroom.



California Academy of Sciences Map

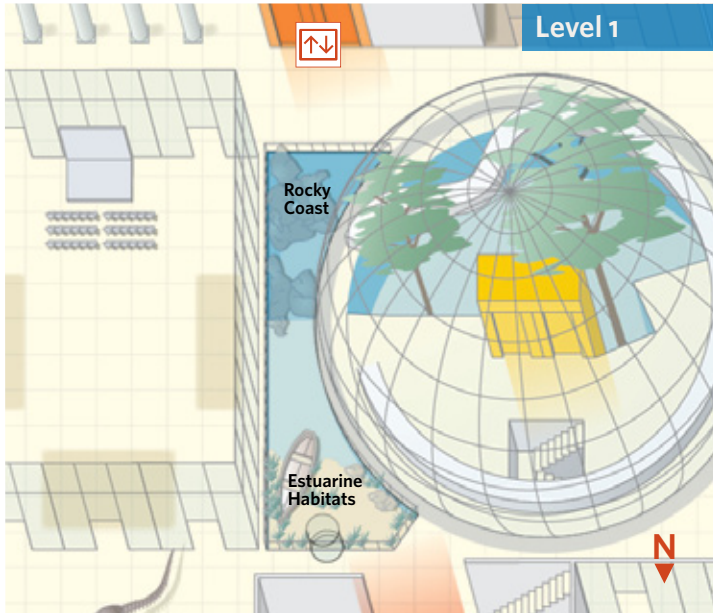


Level 1

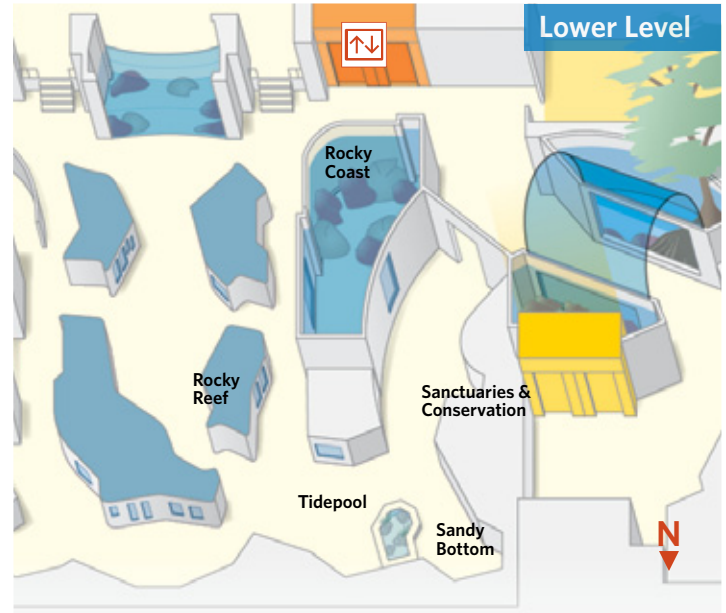


Lower Level (Aquarium)

Aquarium Map



▲
**Northern
California
Coast**



▲
**Northern
California
Coast**

Found on Level 1 and the Lower Level of the Aquarium, the Northern California Coast exhibit focuses on two main themes: California coastal habitats and conservation.

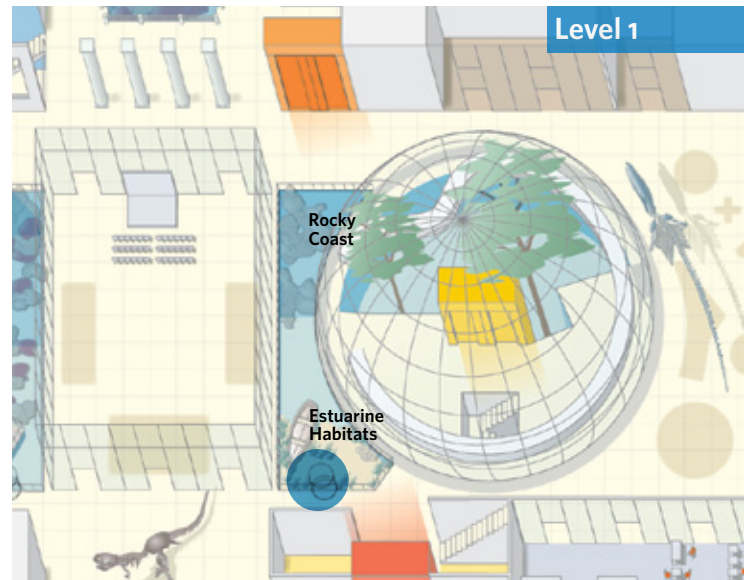
Your students will encounter an abundance of organisms, as well as interactive stations, video presentations and information panels. Spend some time viewing the information on the Academy's website at www.calacademy.org to begin planning your visit.

Estuarine Habitats

Estuaries include many types of habitats such as salt marsh and mudflats.

Main ideas:

- » San Francisco Bay is an estuary, a mixture of fresh water from rivers and salt water from the ocean.
- » San Francisco estuary is vitally important to us, and to the health of the Pacific Ocean and onshore ecosystems.
- » Protection and restoration of San Francisco Bay benefits inland and marine ecosystems as well as the Bay itself and enriches our lives.



Take a closer look!

These animals call the San Francisco Bay home.

Bay pipefish

Syngnathus leptorhynchus

Look closely among the blades of eelgrass to spot the bay pipefish. They blend right in. Similar to their seahorse relatives, it is the male pipefishes that tend the eggs in a brood pouch until they hatch.

Diet: small crustaceans

Distribution: eastern Pacific Ocean, Alaska to southern Baja California



Photo: Ron DeCloux © California Academy of Sciences

Dwarf surfperch

Micrometrus minimus

Adults and young dwarf surfperch live in shallow waters throughout San Francisco Bay. Like their other surfperch cousins, these little fish give birth to live young rather than laying eggs!

Diet: algae and small invertebrates

Distribution: eastern Pacific Ocean, Bodega Bay to central Baja California



Photo: Ron DeCloux © California Academy of Sciences

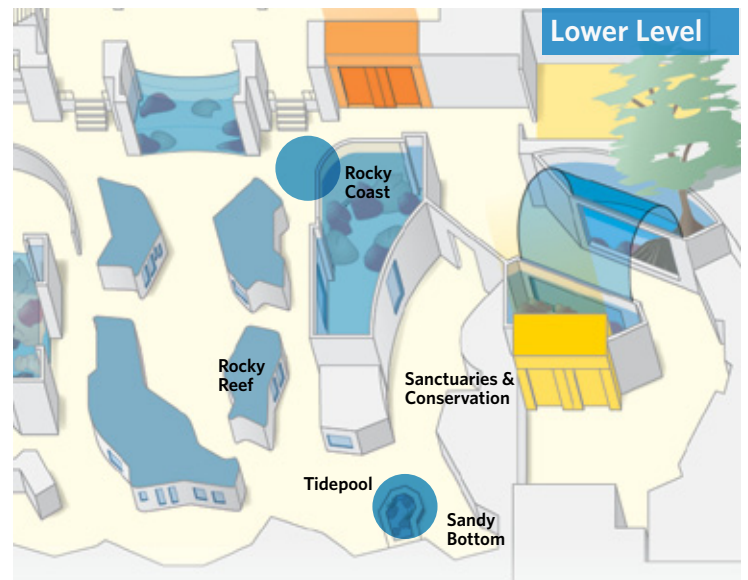


Rocky Coast Habitat

Life on Northern California’s rocky coast is shaped by waves and tides.

Main ideas:

- » The biodiversity of Northern California’s rocky coast is rich and diverse.
- » The daily tidal cycle creates a harsh, changing intertidal environment to which species have adapted.
- » Organisms that live in tidepools face extreme fluctuations in environmental conditions including uv light, oxygen levels, temperature and wave action.
- » Organisms that live on the rocky shore are exposed to waves every day and have adaptations for hanging on and for deflecting waves.



Take a closer look!

These animals can be found in rocky tidepools.

Green Sea Anemone

Anthopleura xanthogrammica

The green sea anemone has built-in chemicals that prevent sunburn during low tide. Its short body may reduce stress from waves and surge, while the large ring of tentacles increases the chance of capturing prey that happen by.

Diet: mussels, crabs, small fishes

Distribution: eastern Pacific Ocean, Alaska to Panama



Photo: Ron DeCloux © California Academy of Sciences

Bat Star

Patiria miniata

This common sea star lives from the rocky shore down to 300 meters (984 ft) and can be orange, red, yellow, purple or other colors.

Diet: dead animals, algae

Distribution: eastern Pacific Ocean, Alaska to Baja California



Photo: Ron DeCloux © California Academy of Sciences

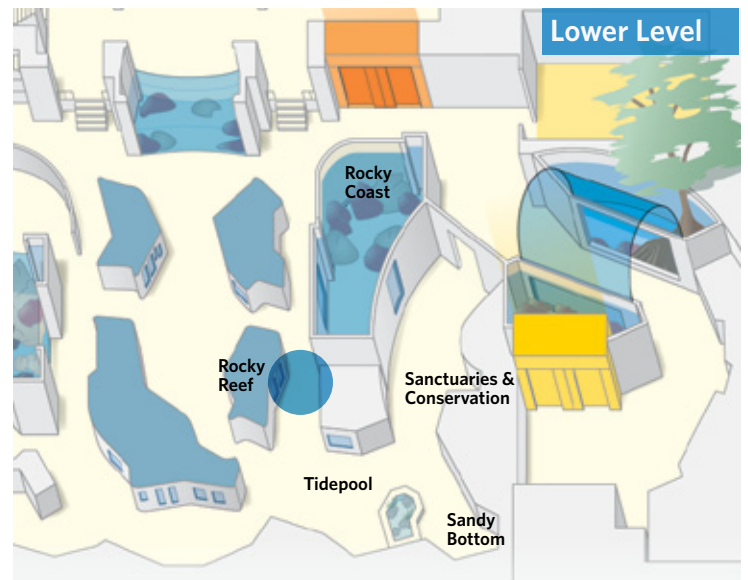


Rocky Reef Habitat

Rocky reefs are like underwater islands. The rocky substrate provides habitat for a variety of marine organisms.

Main ideas:

- » Rocky reefs provide habitat for a high diversity of marine invertebrates, algae and fish.
- » The Cordell Bank National Marine Sanctuary, just north of and contiguous with the Gulf of the Farallones National Marine Sanctuary, contains submerged rocky reefs.



Take a closer look!

These animals make their homes on rocky reefs.

Cup coral

Balanophyllia elegans

Cup corals in cold California waters don't build huge reefs like their tropical cousins do. Instead, these animals build individual limestone homes, or "cups," to live in.

Diet: tiny drifting life (plankton)

Distribution: eastern Pacific Ocean, British Columbia to Baja California



Photo: Ron DeCloux © California Academy of Sciences

Spiny Brittle Star

Ophiothrix spiculata

This sea star relative raises its long arms to catch small animals floating by in the currents. They use the small spines along their arms to move food down to their mouth on the central disc.

Diet: organic particles, small plankton, small animals
Distribution: Eastern Pacific Ocean, Northern California to Peru; also Galápagos Islands



Photo: Ron DeCloux © California Academy of Sciences

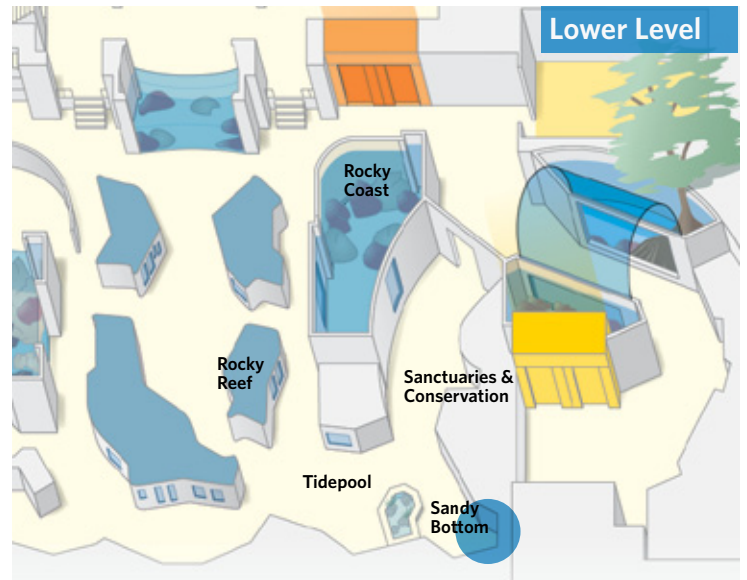


Sandy Bottom Habitat

Many animals make their homes in the shifting sands.

Main idea:

- » Many species live in and on the sandy bottom. Some of them are of commercial value.
- » Trawling for bottom-dwelling fish can harm sandy bottom habitat and bottom-dwelling species.
- » Protection of habitat and sustainable fishing practices are needed to ensure the long-term health of sandy bottom and other ocean ecosystems.



Take a closer look!

These animals make their homes in the shifting sands.

Sand dollar

Dendraster excentricus

Sand dollars are well suited for sandy seafloors. They're covered with small spines for burrowing into the sand and have tiny tube feet for collecting food.

Diet: tiny drifting life (plankton)

Distribution: eastern Pacific Ocean, Alaska to Baja California



Photo: Gerald and Buff Corsi © California Academy of Sciences

Speckled sanddab

Cytharichthys stigmaeus

Blending in with the sandy seafloor helps this small fish avoid predators, but not trawler's nets. Too many end up in nets as part of unwanted bycatch.

Diet: small invertebrates

Distribution: eastern Pacific Ocean, southeast Alaska to Baja California



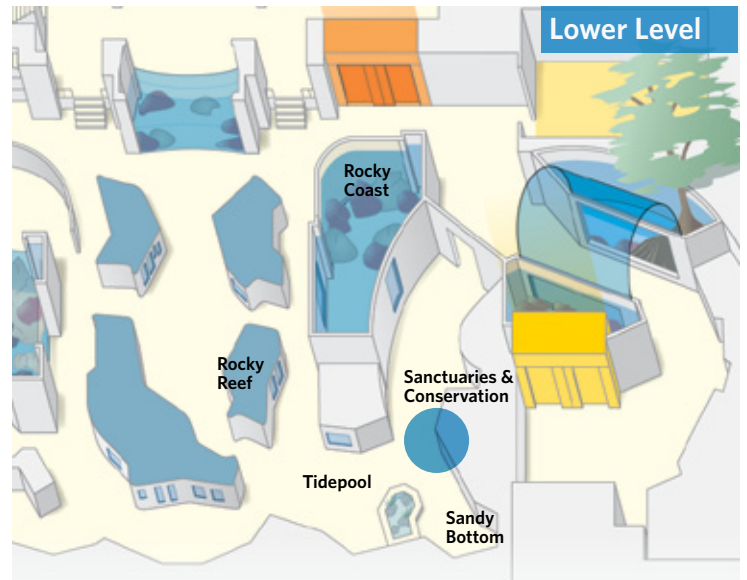
Photo: Gerald and Buff Corsi © California Academy of Sciences

Sanctuaries & Conservation

We can protect our precious marine resources through more sustainable fishing practices and by designating and enforcing marine sanctuaries.

Main ideas:

- » Many resources come from the California coast, including seafood, but harvesting resources can be damaging to marine ecosystems.
- » Many giant-sized marine species are susceptible to overfishing because they are slow growing, long-lived and slow to reach sexual maturity.



Take a closer look!

These animals were once threatened but are now protected.

Garibaldi

Hypsypops rubicundus

This colorful fish's future was once threatened by overcollecting. In 1995, it became California's official state marine fish and gained full protection.

Diet: invertebrates, small fishes

Distribution: eastern Pacific Ocean, Monterey to central Baja California



Photo: Ron DeCloux © California Academy of Sciences

Giant sea bass

Stereolepis gigas

Scientists aren't sure how many individuals of this species there are. They do know it's critically endangered due to overfishing, and it is now protected.

Diet: crustaceans, fishes

Distribution: eastern Pacific Ocean, Humboldt Bay to Baja California



Photo: Ron DeCloux © California Academy of Sciences

Exhibit Highlights



© Charles Kannard

Tule Reed Boat

This boat was used by Californian native peoples.

In San Francisco Bay and along its tributaries, the Ohlone and Coast Miwok people used reed boats for gathering aquatic food plants, fishing and hunting waterfowl. Although the boats are seldom used today, a few artisans keep the tradition alive by building examples like the one shown here.



Gulf of the Farallones

Some of the world's richest temperate marine waters are found off the Northern California coast.

Effective management of California's coastal waters is important to the health of the ocean ecosystem and will ensure the future of its rich biodiversity.

The 100,000 gallon Northern California Coast tank replicates the habitats of the Gulf of the Farallones National Marine Sanctuary (GNMS). Protected under the GNMS, the Gulf of the Farallones is a significant area of marine biodiversity.

Effective management by GNMS allows ongoing, multiple uses by the people of California and beyond. In addition to protecting the habitat and the organisms within it, the GNMS protects these resources for research and recreation.

This tank is home to many species of fish and invertebrates found on the Northern California coast. Use the identification guide on pages 18-19 to try to identify species in the tank.



Exhibit Highlights



Tidepool

Seastars, urchins and anemones, oh my!

At the Tidepool, your students can get their hands wet and meet some creatures that live in Northern California's tidepools. A video microscope lets students get even closer. Docents in orange coats are available to answer questions you or your students may have about the animals you see.



Giant Pacific Octopus

The octopus has many talents.

It's smart, stealthy and communicative. Unlike most other animals without backbones, the octopus is highly intelligent and an accomplished escape artist. It's also a master of disguise, changing skin color and texture to match its surroundings. It can even communicate moods, such as "Go away," or "I find you attractive."

After mating, the female octopus lays up to 100,000 eggs. For several months, she tends them until they hatch. That effort ends her short life.

Diet: crabs, mollusks, fishes

Distribution: northern Pacific Ocean, Japan to Alaska to California



Vocabulary

Biodiversity	the diversity of living things in an area including the variation of individuals within a species, the variety of different species and the variety of types of habitats or ecosystems
Fishery	the organized activity or business of taking certain species of marine organisms for human use
Introduced species	a species living outside of its native range. The introduced species may have been introduced to the new area accidentally or intentionally.
Marine sanctuary	a designated area of the marine environment that is protected because of its special significance due to its natural or cultural qualities
Open waters	exposed areas of the ocean located away from the shore (<i>pelagic</i>)
Overfishing	the over-harvesting of seafood to the point that the targeted organisms cannot sustain their populations
Phytoplankton	plant-like plankton that carry out photosynthesis (get their energy from sunlight)
Plankton	organisms that drift in the oceans and other bodies of water. Plankton cannot swim or move strongly against water currents, so they tend to drift. Plankton may be microscopic like fish larvae, or large like some jellies.
Rocky reef	a marine habitat that is made up of rocks that rise up from the ocean floor



Vocabulary

Sustainable fishing practices	methods of harvesting seafood that minimize the catch of unwanted species (bycatch), minimize destruction to the ecosystem, and prevent the targeted fish from being overfished.
Temperate	having mild climatic conditions, as opposed to tropical (hot) or arctic/antarctic (cold)
Tidepool	a pool of water remaining in the intertidal zone during low tides
Tides	the rise and fall in sea level resulting from the gravitational pull of the moon and sun
Topography	the three dimensional shape of the features of a landscape
Trawling	a fishing method that involves towing a net behind a boat
Upwelling	a process by which cold, deeper water moves up from the deep, bringing along nutrients
Zooplankton	animal and animal-like plankton



Science Behind the Scenes

Discovering the Unknown

When you think of corals you may think of tropical reefs, but not all corals and their relatives are found in the tropics.



“Reef-building corals make up only about 15% of all coral diversity” says Dr. Gary Williams, Curator of Invertebrate Zoology and Geology at the California Academy of Sciences. Dr.

Williams researches octocorals (soft corals, sea fans, and sea pens), which don’t build a massive, hard skeleton and therefore do not build reefs. As it turns out, many species of octocorals can be found here in the temperate water off California’s coast. Even though California marine life has been well-studied, species new to science are still being discovered.

Many new species of octocorals are being discovered in the cold, deep trenches of Monterey Bay, called Monterey Canyon, an area where a lot of ongoing research is focused. Dr. Williams occasionally goes on expeditions to Monterey Canyon with the Monterey Bay Research Institute. They use a remotely operated vehicle (ROV) to investigate the canyon, and when they find a potentially new or interesting species of octocoral, a specially trained technician uses the ROV’s robotic arm to carefully collect the specimen and place it in a special collecting jar. “This technology has changed our ability to describe new species. In the past, we could only get photos of specimens, but



Gary Williams © California Academy of Sciences

now we are able to collect specimens, some of which are brand new to science,” says Dr. Williams.

Even more interesting is that not all of these new species are being discovered from deep water. Many are being discovered in more easily accessible tidepools right on the Pacific coast. This is truly astounding since historically there has been much research done on California marine life, and many research stations are present along the coast. It’s exciting to have new coral species right on our coastal doorstep and shows that there is still a lot of life waiting to be discovered in our own backyard. You may even see some the next time you go tidepooling!

To see some examples of octocorals, make sure to check out the sea pens on display in a tank in the Sandy Bottom area of the California Coast exhibit.



Specimen Spotlight

Rockfishes

Sebastes spp.

Take a look into the Northern California Coast tank and you are guaranteed to see a rockfish! Like their relatives, lionfish and stonefish, rockfishes have venom glands associated with some or all of their fin spines, though they are not as toxic as their cousins. Most of the fish we call rockfish belong to the genus *Sebastes*, which means “magnificent” in Greek. And magnificent they are! Worldwide, there are about 102 species of *Sebastes*, and California waters are home to between 40 and 60 species.

Rockfishes can be found in a variety of habitats from the rocky intertidal, to the kelp forest, to deeper waters with rocky outcrops. Some common species found off the Central to Northern California coast include Canary, Blue, Black, Vermilion, and Bocaccio, along with many others. How many different species can you find in the tank?

There is a lot of variation in size and life history within the rockfishes. Some species may grow to less than 10 inches in length as adults, while some species may grow up to four feet in length. Some species of rockfishes can live to be quite old, such as the Rougheye Rockfish (*Sebastes aleutianus*), which has been shown to live to be at least 205 years old!

Long-lived rockfishes don't become sexually mature for 20 or more years. These fishes are particularly vulnerable to overfishing. Populations of many species of rockfishes have been severely depleted and because they take so long to mature, it may



Vermillion rockfish (*Sebastes minitus*)



Blue rockfish (*Sebastes mystinus*)



China rockfish (*Sebastes nebulosus*)



Canary rockfish (*Sebastes pinniger*)

Photos © Ron DeCloux/California Academy of Sciences

take tens of years before some of these can recover. As consumers, it is our responsibility to make sure that the fishes we consume are being sustainably harvested. We can do this by checking guides such as the Seafood Watch guide to make sure that the seafood we buy is harvested in a way that doesn't threaten fish populations. As a society, we can designate and protect marine sanctuaries to reduce pressures on marine animal populations and establish fishing quotas to ensure that fishes and other seafood are not overfished. With proper management, we can continue to enjoy the magnificence of our diversity of rockfishes for future generations.



Related Exhibits

Rainforests of the World

Expand your exploration of life and its connection to water in Rainforests of the World where your journey through this hot and humid environment begins on the forest floor and takes you through the different layers of a rainforest. Explore the diversity of plants and animals found in the tropical rainforests of Borneo, Madagascar, Costa Rica and the Flooded Amazon and discover how life there has adapted to the presence of abundant water and seasonal flooding typical of tropical rainforest ecosystems.

Philippine Coral Reef

Explore a tropical coral reef without getting wet in the stunning Philippine Coral Reef exhibit which focuses on the world's most diverse of marine ecosystems. The 25 foot deep, 212,000 gallon tank offers spectacular underwater views of reef algae and animals and focuses on their unique adaptations and ecological interactions.

Water Planet

Explore the essential connections between life and water. This exhibit displays a variety of animals that live in and without water and have unique adaptations for reproducing, moving, feeding, sensing and defending themselves in their environments. Through interactive stations in the exhibit, students can also explore the different properties of water found on Earth—fresh water, salt water, hot and cold water, surface and subsurface water, frozen, liquid and vapor forms, and how organisms are adapted to each.

African Hall

Explore the wilds of Africa from its hot and dry deserts to high elevation rainforests and discover the adaptations plants and animals have for surviving in harsh conditions when water is scarce. African Hall offers an in-depth look into Africa's diverse and changing ecosystems showcasing iconic animals including lions and zebras. Five living dioramas include pancake tortoises, chameleons and the watery world of an entire colony of African penguins.



Gulf of Farallones Guide



Bocaccio rockfish

Sebastes paucispinis

Most fishes lay eggs, but all rockfish females give birth to live larval young.

Diet: squid, other invertebrates, small fishes

© Robinson, D. Ross CC-BY-NC
http://eol.org/data_objects/13235820



Vermillion rockfish

Sebastes miniatus

Unlike most other bony fishes, rockfish, like this one, have their eggs fertilized internally.

Diet: fish, squids, octopi

© Ron DeCloux/California Academy of Sciences



Ocean whitefish

Caulolatilus princeps

Widely distributed from Peru to Canada, including the Galapagos, where Charles Darwin caught the first scientific specimen.

Diet: worms, shrimp, crabs, octopi, squids, small fish

© Ron DeCloux/California Academy of Sciences



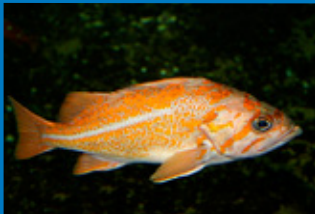
Walleye surfperch

Hyperprosopon argenteum

Named for their large light-reflecting eyes, which allow them to see well in dim light.

Diet: small crustaceans

© Ron DeCloux/California Academy of Sciences



Canary rockfish

Sebastes pinniger

All rockfish are long-lived, with a lifespan of 20 to 50 years. They may not have their first offspring until age 10.

Diet: small fish, krill

© Ron DeCloux/California Academy of Sciences



China rockfish

Sebastes nebulosus

Like all species of rockfish, these fish have mildly venomous spines on their dorsal, anal and pelvic fins.

Diet: fish, crustaceans, brittlestars, squids, octopi

© Ron DeCloux/California Academy of Sciences



Rainbow surfperch

Hypsurus caryi

Selects prey by taking mouthfuls of turf, sand or gravel, then spitting out the rejected items.

Diet: small crustaceans, mussels, snails, brittlestars

© Ron DeCloux/California Academy of Sciences



Leopard shark

Triakis semifasciatus

Look carefully at the underside of the shark's lower rear fin. Does it have 2 fleshy rods between the fins? If it does, it's a male.

Diet: crabs, shrimp, bony fish, fish eggs, clam necks, innkeeper worms

© Ron DeCloux/California Academy of Sciences



Gulf of Farallones Guide



Wolf eel

Anarrhichthys ocellatus

Not true eels; more closely related to surfperch and freshwater perch. Male-female pairs live in the same shelter for years and may mate for life.

Diet: sea urchins, scallops, various crustaceans

© Ron DeCloux/California Academy of Sciences



Jacksmelt

Atherinopsis californiensis

Schooling, surface fish often caught by pier anglers.

A staple food for early Native Americans.

Diet: small crustaceans, algae, decaying matter

© Ron DeCloux/California Academy of Sciences



Bat star

Asterina miniata

Sensory structures at the ends of each arm detect other bat stars, light and prey.

Diet: surfgrass, algae, colonial tunicates, dead plants and animals

© Ron DeCloux/California Academy of Sciences



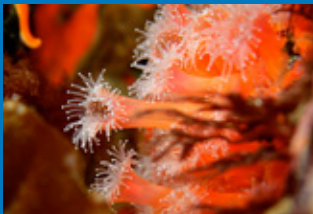
Purple sea urchin

Strongylocentrotus purpuratus

Sometimes form large groups that move slowly, grazing on living kelp forests.

Diet: algae, plankton, kelp, decaying matter

© Ron DeCloux/California Academy of Sciences



Club-tipped anemone

Corynactis californica

Also known as strawberry anemone, it is really a colonial soft coral closely related to anemones.

Diet: crustacean larvae, copepods, other zooplankton

© Ron DeCloux/California Academy of Sciences



Fish-eating anemone

Urticina piscivora

Fish called painted greenlings lie amongst the tentacles of this animal for protection.

Diet: shrimp, small fish

© Marty Snyderman/Visuals Unlimited



Giant plumose anemone

Metridium giganteum

When attacked, these animals force special stinging cells out from their mouth and body wall.

Diet: small zooplankton, small worms, fish, squid

© Ron DeCloux/California Academy of Sciences



Suggested Activities to Download

Download these activities from our website to enrich your field trip experience.

» **Anytime Lesson Plan: Banishing Bycatch**

www.calacademy.org/teachers/resources/lessons/banishing-bycatch/

In this hands-on activity, students will learn why turtles and sharks often end up as bycatch and how sustainable fishing practices can prevent this from happening.

» **Anytime Lesson Plan: Buoyancy Bullseye**

<http://www.calacademy.org/teachers/resources/lessons/buoyancy-bulls-eye/>

In this hands-on activity, students will learn how organisms float, sink, or hover in water as they construct a neutrally buoyant scuba diver.

» **Anytime Lesson Plan: Sensational Seaweed**

<http://www.calacademy.org/teachers/resources/lessons/sensational-seaweed/>

In this culinary activity, students use multiple senses (sight, smell, touch, and taste!) to explore real seaweed samples. They will compare and contrast land plants with seaweed to review the structures and functions of parts, understand that algae is an important producer in aquatic ecosystems, and learn how kelp is adapted to live along the California Coast.

» **Connected Experience: Taxonomist for a Day**

<http://www.calacademy.org/teachers/resources/lessons/taxonomist-for-a-day/>

The Connected Experience includes a classroom-based pre-visit activity, an at-museum dichotomous key activity for the California Coast tank, and a post-visit activity discussion.

» **Connected Experience: Marine Invertebrate Anatomy**

www.calacademy.org/teachers/resources/lessons/marine-invertebrate-anatomy/

In this lesson, students will learn about invertebrate diversity and compare the anatomy of marine invertebrates anatomy with that of humans. The Connected Experience includes a classroom-based pre-visit activity, an at-museum scavenger hunt, and a post-visit activity to do back at school.

» **Anytime Lesson Plan: Academy Seafood Market and Fishery**

<http://www.calacademy.org/teachers/resources/lessons/academy-seafood-market-and-fishery/>

In this activity, students will learn why choosing sustainable seafood is important to the health of marine environments. Students will then use their seafood watch cards when they go shopping.

CA Science Content Standards

Grade Six

Life Science

- 5a. Transfer and transformation of energy
- 5e. Factors influencing organisms in ecosystems

Earth Science

- 6b. Natural energy and material resources

Grades Nine through Twelve

Biology

- 6a. Biodiversity
- 6b. Analyze changes in an ecosystem

Earth Science

- 5d. Properties of ocean water



Bibliography

Want to find out more?

Here is a selection of additional resources to explore in the Academy's Naturalist Center or at your public library. Naturalist Center staff can also answer any questions you have about this exhibit via email or phone. The Naturalist Center is located on the third floor of the Academy and is open Monday–Friday from 11AM to 4PM and Saturday–Sunday from 10AM to 5PM. 415.379.5494 / naturalist@calacademy.org

Books

- » **California Kelp Forest** scientific editor, Mike Schaadt; illustrations, Dawn N. Ericson and Dominique Navarro. Malibu, CA: Manta Publications, 2010. (Weekend Naturalist Series). Nat. Ctr. QH105 .C2 C355 2010
This small laminated pamphlet holds a wealth of information about California's biologically rich kelp forests. Scientifically accurate illustrations complement the engaging text.
- » **California Reefs** by Chuck Davis. San Francisco: Chronicle Books, 1991. Nat. Ctr. QH105 .C2 D378 1991
Stunning photographs and poetic yet informative text immerse the reader in the world of California reefs. From giant kelp to delicate crabs and playful sea lions to spiky urchins, these and many other creatures spring from the pages as you dive into another world.
- » **The Coast** by Pam Walker and Elaine Wood. New York: Facts on File, 2005. (Life in the Sea Series). Nat. Ctr. Juv. QH541.5 .C65 W34 2005
An overview of coastal ecosystems with chapters on: physical aspects of coasts; microbes and plants; sponges, cnidarians and worms; mollusks, arthropods and echinoderms; fish; reptiles, birds and mammals; and human influences on coastal ecosystems.
- » **Encyclopedia of Tidepools and Rocky Shores** edited by Mark W. Denny and Steven D. Gaines. Berkeley, CA: University of California Press, 2007. Nat. Ctr. Ref. QH541.5 .S35 E52 2007
A comprehensive look at coastal ecosystems with entries on everything from individual organisms to human uses of coastal resources to techniques for studying and monitoring tidepools.
- » **The Saltwater Wetland** by Pam Walker and Elaine Wood. New York: Facts on File, 2005. (Life in the Sea Series). Nat. Ctr. Juv. QH541.5 .M3 W34 2005
An in-depth look at coastal wetlands including their flora, fauna, physical characteristics and their present and future conditions.

Curricula/Activity Books

- » **Beach Exploration: A Curriculum for Grades 5 – 10** by Gloria Snively. Corvallis, OR: Oregon Sea Grant Program; Seattle, WA: Seattle Sea Grant Program, 1998. Nat. Ctr. QH541.5 .S35 S64 1998
This book is full of lesson plans that act as a course on the basics of marine ecology through hands-on activities in the classroom and explorations in the field.
- » **The Seaside Naturalist: A Guide to Study at the Seashore** written and illustrated by Deborah A. Coulombe. New York: Fireside, 1992. Nat. Ctr. QH95.7 .C68 1992
This combination field guide and introductory text on marine biology contains a wealth of information complemented by playful yet accurate illustrations. Several sections include quizzes and ideas for activities to do while at the seashore.

DVD

- » **Life on the Edge: A Guide to Pacific Coastal Habitats** presented by the Seattle Aquarium, the Poulsbo Marine Science Center, and Earthwise Media. Silverdale, WA: Earthwise Media, 2004. Nat. Ctr. Media QH95.3 .L54 2004
This 35-minute DVD is perfect for classroom use as it is divided into seven chapters that cover various coastal habitats, including sandy beaches, rocky shores, estuaries and kelp forests. It also includes a section that can be used to review coastal marine animals.



Online Resources

Websites

- » **Friends of Fitzgerald Marine Reserve**
www.fitzgeraldreserve.org
A plethora of information about the Reserve, including links to the Friends' newsletter, a recommended reading list and logistics for visiting.

- » **A Guide to the Side of the Sea: A Teacher's Guide for Field Trips to Rocky Intertidal Areas**
www.parks.ca.gov/?page_id=24075
Lessons plans and field trip tips for a visit to a tidepool.

- » **Marine Science: Tidepools in California**
www.marinebio.net/marinescience/03ecology/tpindex.htm
Extensive information and amazing photos of wildlife found along the California coast.

- » **Tidepool Treasures: Tidepool Field Trip Advice and Tidepool Field Guide**
<http://tlc.ousd.k12.ca.us/~acody/tidepool.html>
Recommendations for taking a school group to a tidepool, as well as a simple tidepool field guide.

- » **Tidepooling, Farallones Marine Sanctuary Association**
www.farallones.org/explore/tidepooling.php
Logistical and background information about tidepooling at different sites in the Farallones Marine Sanctuary.

- » **Watchable Wildlife: Tidepools**
www.dfg.ca.gov/viewing/tidepools.html
This section of the California Department of Fish and Game's website includes tips for tidepool viewing and locations of tidepools you can visit along the entire California coast.



Guiding Questions and Answers

Use these questions to get students thinking about the California Coast.

» **Pick two different kinds of fish in the California Coast tank. How are these two different from each other?**

There are several species of fish in the California Coast tank. In the exhibit, you can see that different types of fish live in different habitats in the tank—some live on the sandy bottom, some live on the rocky bottom, and others live towards the top of the tank. This happens in the wild too, and each of these species have adaptations that help them live in those habitats. For example, you may find some flatfish living in the sand at the bottom. These fish have a flattened shape and are well camouflaged for blending into the sand. Fish on the rocky bottom may have different camouflage that makes them difficult to see when they rest on the rocks. Other fish are found hanging out in the water. Among these, different species have different body shapes. If you look closely, you may notice body parts that are different shapes and sizes, useful to that particular fish's lifestyle.

» **What nonliving things are important to the California coast ecosystems and the animals that live there?**

The California coastal environment is home to many different species. These animals depend on each other and on other living things such as algae and plant-like plankton. However, many nonliving things influence life on the coast as well. Without sunlight, wind, water, sand and rocks, California marine life would not be as diverse.

» **Animals that live on the rocky shore have to make sure that they are not swept away by strong waves. If you lived on the rocky shore, how would you do this?**

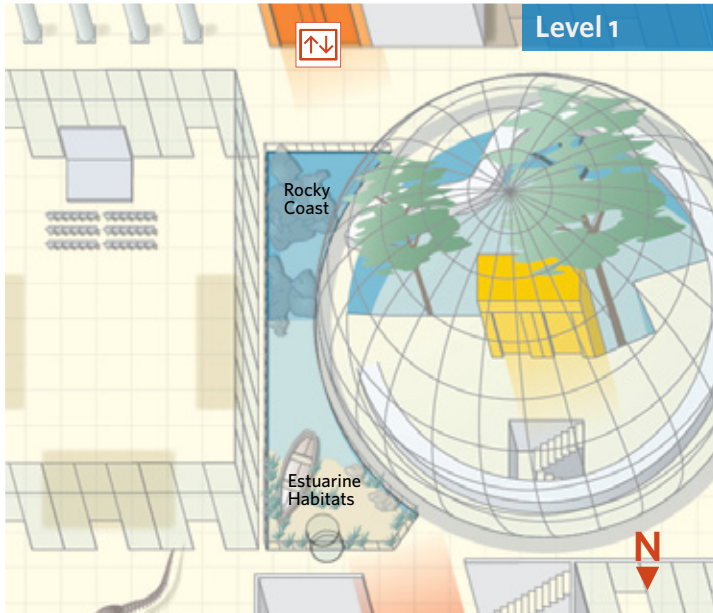
There are many ways that you could do this. Many of the animals that live on the rocky shore have special body parts or behaviors that help them stay put. Many have hard shells and shapes that protect them from strong waves. Others hunker down in crevices or hide under boulders, and some hang on with suction, glue, or anchoring threads!

» **On land, plants form the base of most food chains, collecting energy from the sun and providing food for other organisms. What organisms form the base of the food chains in California waters?**

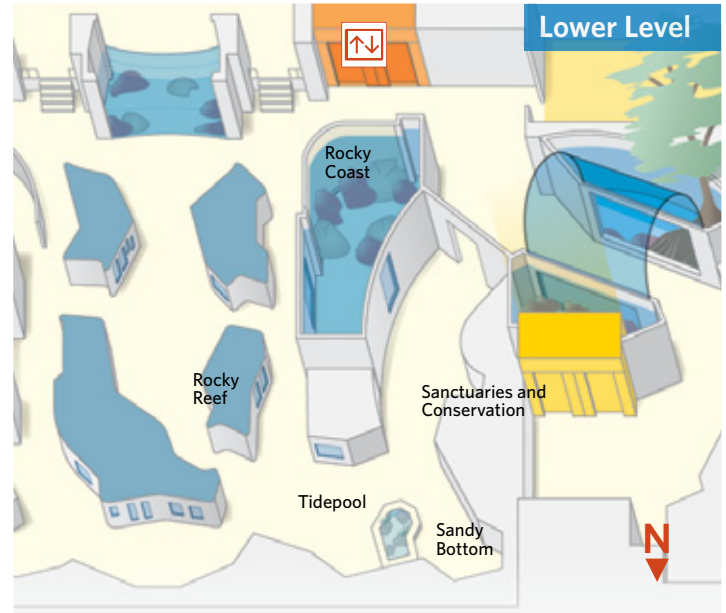
There are two main organisms that form the base of food chains in California waters. One of these is kelp. Kelp is an important organism that converts energy from the sun and provides food to many creatures that live in kelp forests. The other organism is so tiny that you would need a microscope to get a good look at it—plankton. Some of the plankton is plant-like and uses sunlight to make food, just like land plants. These plant-like plankton (*phytoplankton*) provide *a lot* of food to the animals in California waters.



Aquarium Map



▲
**Northern
California
Coast**



▲
**Northern
California
Coast**

Welcome to the Northern California Coast, home to some of the world’s richest temperate marine ecosystems.

The Northern California Coast exhibit focuses on two main themes: California coastal habitats and conservation, and is found on Level 1 and the Lower Level. Your students will encounter an abundance of organisms, as well as interactive stations, video presentations and information panels. Before you visit the exhibit, spend some time viewing the guiding questions and answers.

