Philippine Coral Reef Educator Guide

Grade 6 – Grade 12

What's Inside:

CALIFORNIA ACADEMY OF SCIENCES

Coral reefs are the sparkling jewels of tropical marine habitats.

Welcome to the Philippine Coral Reef Exhibit, which represents one of our planet's most diverse and fragile marine ecosystems. This exhibit is home to a broad range of aquatic life found in the coral reefs and mangrove lagoons of the Philippine Islands. This includes animals such as delicate soft and hard corals, blacktip reef sharks, stingrays, and more than 2,000 colorful reef fish representing more than 100 species. In this exhibit, students can explore the amazing array of life that exists in the warm, shallow waters off the Philippine coasts.

This exhibit can be seen on two levels. On Level 1, students can walk on a path above a shallow, sandy mangrove lagoon—a calm, protected area inhabited by sharks, rays, and schools of fishes. Where the lagoon drops off to the deep reef, hundreds of brightly colored fishes are visible near the surface, enticing students to view the immersive spectacle one floor below. As you enter the aquarium on the Lower Level, you will see the main Philippine Coral Reef tank. At a depth of 25 feet and holding 212,000 gallons of water, the Philippine Coral Reef tank is one of the deepest exhibits of live corals in the world. Curiosity leads to exploration of several small galleries along the perimeter of the exhibit that highlight the unique adaptations and complex interactions of reef organisms.

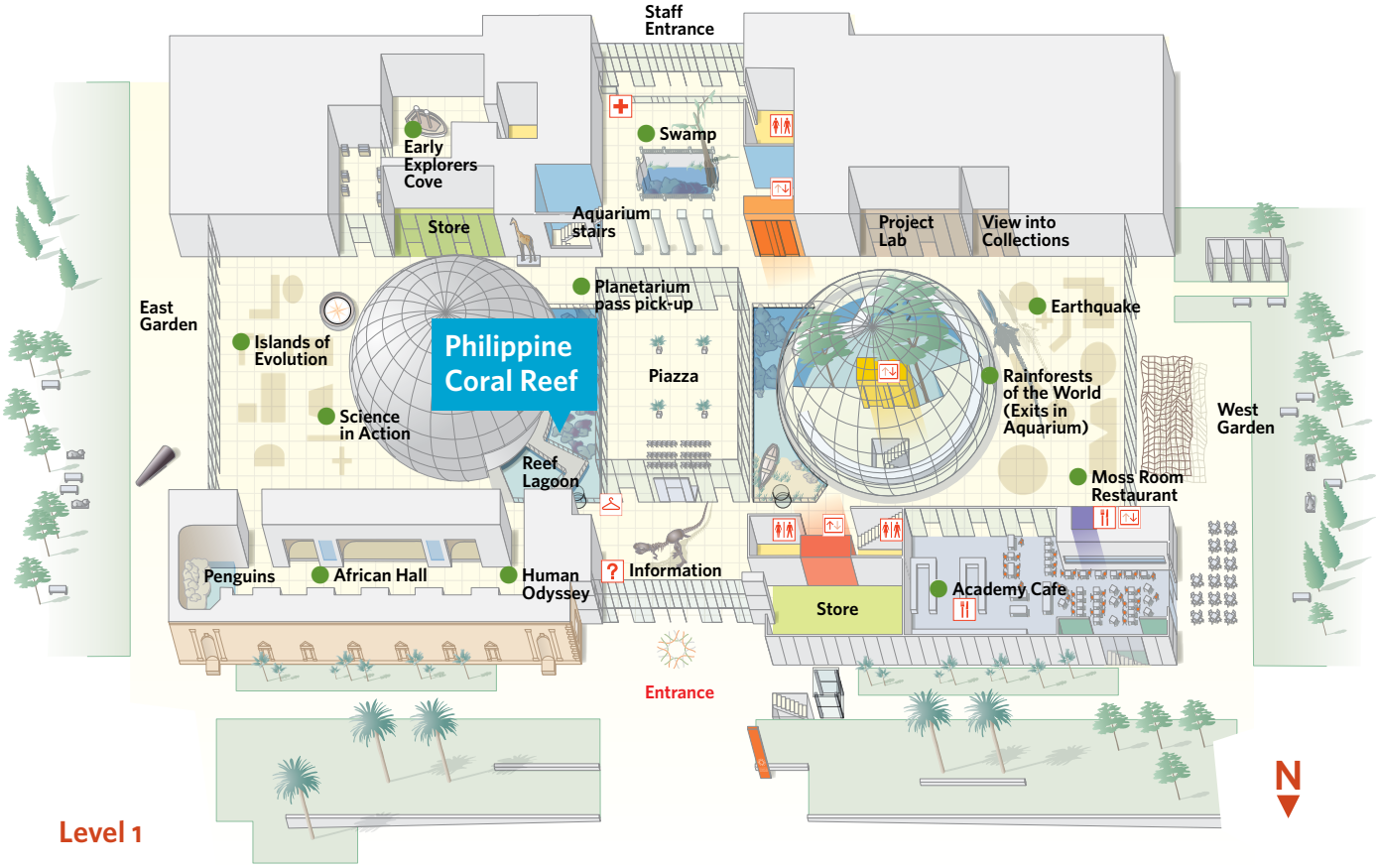
The following main themes are found in the Philippine Coral Reef exhibit:

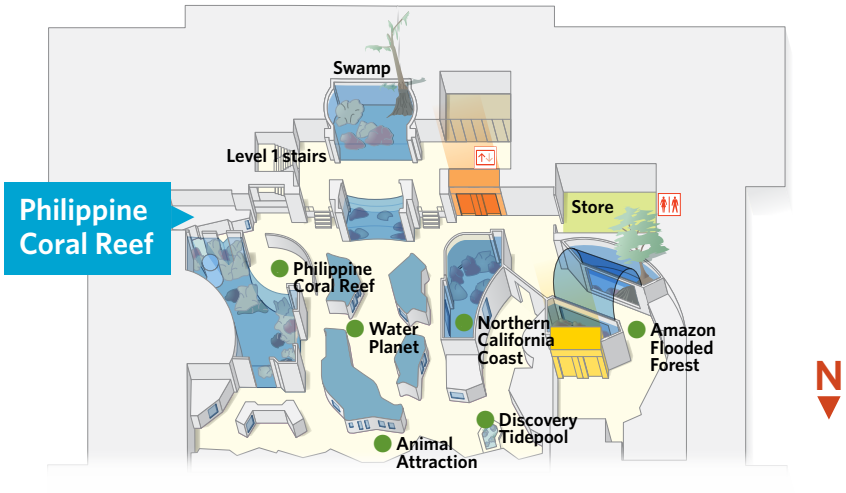
» Tropical coral reef **ecosystems**, especially those found in the Philippines, are **biodiversity hotspots**.
» Many organisms living in tropical reef ecosystems depend on one another for survival.

Use this guide to:

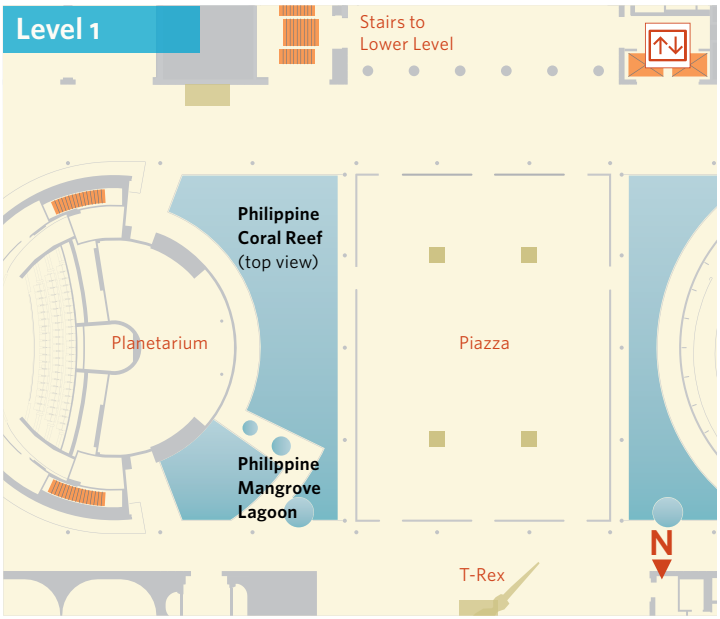
» Plan your field trip to the California Academy of Sciences' Philippine Coral Reef exhibit.
» Learn about exhibit themes, key concepts and behind-the-scenes information to enhance and guide your students' experience.
» Link to exhibit-related activities you can download.
» Connect your field trip to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

California Academy of Sciences Map





Aquarium Map



Welcome to the Philippine Coral Reef Exhibit, which represents one of our planet's most diverse and fragile marine ecosystems.

Located on Level 1 and Lower Level, the Philippine Coral Reef exhibit focuses on two main themes:

» Tropical coral reef ecosystems, especially those found in the Philippines, are biodiversity hotspots.

» Many organisms living in tropical reef ecosystems depend on one another for survival.

Philippine Mangrove Lagoon

Reefs and mangrove lagoons are ecological partners.

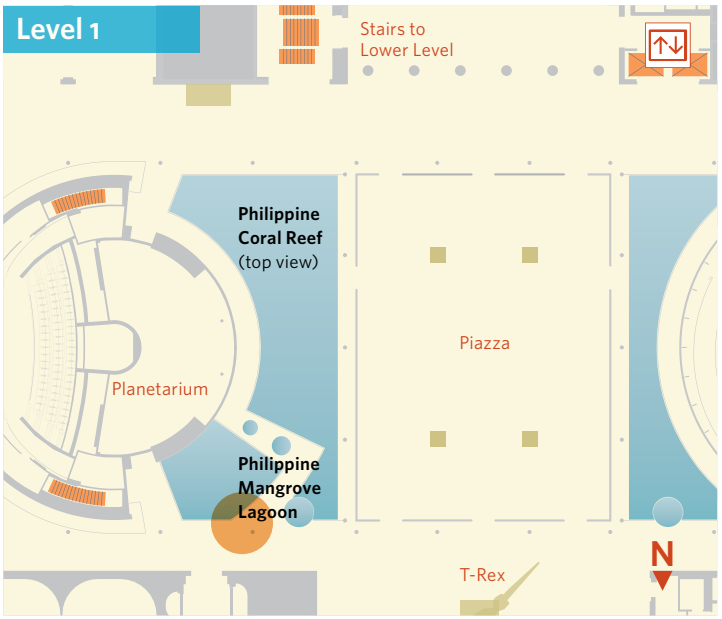
Main ideas:

» Mangroves are types of trees that grow along tropical shorelines.

» Mangroves are buffers that protect the coast against storms.

» Young reef animals, such as sharks and fish, find shelter and food among mangrove roots and in lagoon waters.

» Conserving coral reefs means protecting mangroves, too.



Take a closer look!

Learn about some of the animals found in the lagoon shallows.

Blacktip Reef Shark
Carcharhinus melanopterus

Easy to identify by the black tips on their fins, these sharks are often seen cruising reef shallows in large schools.

Diet: Small fish
Distribution: Indian and Pacific Oceans

Honeycomb Stingray
Himantura uarnak

This ray has a system of sensory organs that run the entire length of its body and tail, called the lateral line. Its extra long tail can sense approaching predators well in advance.

Diet: Crustaceans and small fish
Distribution: Indian and Pacific Oceans

Photo: J. Charles Delbeek © California Academy of Sciences

Philippine Coral Reef

The more you watch, the more you'll see. At first, a coral reef looks like a moving mosaic. Watch carefully and you'll see order in the mix.

Main ideas:

» Coral reefs in the Philippines are home to some of the world's richest variety of marine life—about 500 coral species and 2,000 fish species.

» Complex relationships are created as reef organisms compete and cooperate for food, space, and mates.

» From big fish resting in caverns to tiny shrimp nibbling in crevices, every square centimeter hosts members of the reef community.

Take a closer look!

Learn about some of the remarkable animals found on the reef.

Emperor Angelfish
Pomacanthus imperator

This stunning fish has a blue body with horizontal yellow stripes and a jet black face mask. Juveniles of this species have been observed cleaning parasites off larger fish.

Diet: Sponges and tunicates
Distribution: Indian and Pacific Oceans

Photo: Ron DeCloux © California Academy of Sciences

Carpet Anemone
Stichodactyla spp.

Often mistaken for a plant, carpet anemones are actually animals. Red, green, and blue carpet anemones are an important part of the reef ecosystem and can live up to 100 years. Many larger anemones provide homes for other reef animals including crabs, shrimp, and anemone fish.

Diet: Small drifting animals
Distribution: Indian and Pacific Oceans

Photo: Charles Delbeek © California Academy of Sciences

Color on the Reef

A rainbow of color sparkles on the reef. Have you ever wondered why tropical coral reef residents are some of the most colorful creatures on Earth?

Main ideas:

» Because coral reefs grow in clear, sunny waters, reef animals use their vision more than those that live in murky waters. Therefore, reef animals use color to communicate in various ways.

» Color is used to attract mates, fool predators, signal danger, or help animals hide in plain sight.

Take a closer look!

These animals are some of the reef's most colorful residents.

Spotted dragonet

Synchiropus picturatus

Bright colors aren't always for show. The colorful patterns of this fish help it blend in with the reef. See if you can find a greenish fish with blue, orange, and black spots, large eyes and frilly fins.

Diet: Small **invertebrates**

Distribution: Indian Ocean to Western Pacific Ocean

Photo: John E. Randall

Moorish idol

Zanclus cornutus

The color patterns and shape of this fish's body visually breaks up its body outline which may help protect it from predators. This fish has been the iconic symbol of the Steinhart Aquarium since 1923.

Diet: Small invertebrates, algae

Distribution: Indian and Pacific Oceans

Photo: Terry Goslinger © California Academy of Sciences

Caribbean Coral Reef

It's not enough to save a single reef because each one is unique.

Main idea:

» Scientists study similarities and differences of coral reefs worldwide to understand how to protect them.

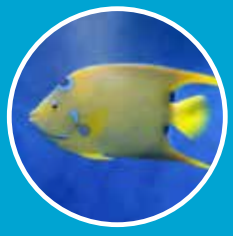
» Tropical coral reefs around the world are threatened by human activities and climate change.

Take a closer look!

Explore some of the animals found only on Caribbean coral reefs.

Queen angelfish

Holacanthus ciliaris



The queen angelfish lives mainly on coral reefs surrounding Caribbean islands. Adults of this species extend their mouth and scrape food from the reef with brush-like teeth.

Diet: Invertebrates & algae
Distribution: Western Atlantic, Gulf of Mexico and Caribbean Sea

Photo: Ron DeCloux © California Academy of Sciences

Cherubfish

Centropyge argi

This is one of the Caribbean's smallest angelfish. It retreats into holes when frightened to avoid predators. Look for a dark blue fish with orange markings.

Diet: Algae
Distribution: Western Atlantic Ocean and the Caribbean Sea

Photo: Ron DeCloux © California Academy of Sciences

Life in the Dark

Some reef species prefer night to day. Learn how reef organisms find their way in the dark.

Main ideas:

» Even the darkest recesses of the reef are teeming with life.

» Some reef organisms live exclusively in dark caves, or are active only at night. These animals have special **adaptations** for life in the dark.

» Some reef fish have a symbiotic relationship with bacteria. These bacteria produce light that helps the fish communicate, navigate, hunt, and avoid predators.

Take a closer look!

See what's hiding in the dark.

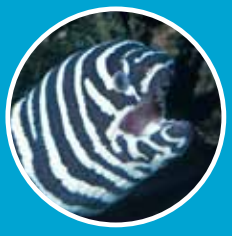
Splitfin flashlight fish
Anomalops katoptron

A chemical reaction in bioluminescent bacteria under this fish's eye produces light similar to fireflies.

Diet: Tiny drifting animals (zooplankton)
Distribution: Western Pacific Ocean

Photo: John E. Randall

Zebra moray
Gymnomuraena zebra



This eel is active at night (nocturnal), and emerges from its crevice or cave to hunt. A keen sense of smell helps it locate prey, and its snakelike body can slip into tight spaces to capture a meal.

Diet: Crabs, clams, sea urchins
Distribution: Indian and Pacific Oceans

Photo: Martk Smith/Photo Researchers, Inc.

Venom on the Reef

Chemical tools aid in reef animals' survival.

Main ideas:

» Some reef organisms use venom and other defensive chemicals to catch prey, defend against predators, and fight infection.

» The words venom and poison are often used interchangeably, but they actually have very different meanings. Poison is absorbed or ingested, while venom is injected by a specialized structure, such as teeth, spines, or stinging cells.

Take a closer look!

Learn about some of the animals that use chemicals for self-defense.

Fire coral

Millepora spp.

Despite their name and appearance, these marine organisms are not coral at all. Like their close relatives, jellyfish and anemone, fire coral polyps defend the colony by delivering a burning sting.

Diet: Tiny drifting animals (zooplankton)
Distribution: Tropical oceans

Photo: Ron DeCloux © California Academy of Sciences

Lionfish

Pterois volitans

The flashy lionfish uses its venomous spines for aggression and defense. During courtship, a male lionfish will charge an intruding male with its spines held forward like a charging bull.

Diet: Small fishes, invertebrates
Distribution: Indian and Pacific Oceans; introduced

Photo: Ron DeCloux © California Academy of Sciences

Reef Partnerships

Organisms living in partnership are common on coral reefs—this is called symbiosis. Explore some different types of symbiosis in this exhibit.

Main idea:

» There are three broad categories of **symbiosis**: mutualism, parasitism, and commensalism.

» Mutualism occurs when both partners benefit from the relationship. The foundation of coral reefs is the mutualism between coral **polyps** and the **algae** (**zooxanthellae**) living in their cells.

» Parasitism occurs when one partner benefits while the other partner is harmed.

» Commensalism occurs when one partner benefits and the other partner is not affected.

Take a closer look!

These animals are interesting examples of different types of partnerships.

Upside-down jellies

Cassiopea andromeda

Most jellies drift through the ocean on currents, but not this one. It lives upside-down on the sea floor in shallow water of less than 10 meters (33 feet). These jellies have algae living inside their tentacles. Because the jellies are upside-down, the tentacles get plenty of sun exposure so the symbiotic algae can photosynthesize.

Diet: Tiny drifting animals (zooplankton)
Distribution: Western Pacific Ocean

Photo: © W. Gregory Brown / Animals Animals

Pistol shrimp and Shrimp goby

Alpheus spp. and *Amblyeleotris spp.*

The shrimp creates a burrow in the sand that both animals use for protection. If a predator passes by, the goby flicks its tail which alerts the shrimp, and they both retreat into the burrow.

Diet: Tiny drifting animals (zooplankton)
Distribution: Western Pacific Ocean

Photo: Charles Delbeek © California Academy of Sciences

Exhibit Highlights

Photo: © Johan Fredriksson CC BY-SA

Children's Eel Garden

In the wild, a group of garden eels can exceed 1,000 individuals! Garden eels live in sea grass beds on the edges of tropical coral reefs. They stretch their bodies upward and pluck tiny animals (zooplankton) drifting in the current. When threatened, they duck for cover in the sandy bottom.

Garden eels are also homebodies—each rarely leaves its burrow. Their sandy burrows are supported by the eels' hardened skin secretions which prevent cave-ins.

In this exhibit, your students can crawl through a tunnel for an eye-level view of a thriving eel garden.

Voices of the Philippines

Thanks to coral reef advocates, reefs in the Philippines are making a comeback. Many Filipino communities have successfully embraced the challenge of caring for their reefs. Filipinos rely on reefs for food, income, and protection from storms. Yet their reefs are among the world's most damaged due to pollution, development, unsustainable fishing practices, and other human impacts. Through community education, responsible fishing practices, and establishment of marine protected areas, citizen groups and government agencies are working to help Philippine coral reefs stage a comeback.

In this exhibit, your students can listen to the compelling stories of Filipinos who are working tirelessly to protect their country's coral reefs through stewardship, advocacy, and restoration.

Exhibit Highlights

Photo: © Kevin Twomey

Coral Reef Conservation

Communities that rely on coral reefs are learning that wise actions today mean healthy reefs for future generations. In the Philippines and elsewhere, over-harvesting from reefs results in **habitat** destruction and loss of biodiversity and natural resources.

Think about protecting coral reefs when you shop. Choose fish for home aquaria that were captive bred or collected by hand. When shopping for souvenirs, avoid shells and other trinkets that came from coral reefs. You can also help by preventing trash and pollution from getting into the ocean.

Night and Day, Day and Night

Animals living on a coral reef have a daily rhythm. As the sun sets on the reef, the animals that are active during the day (diurnal species) hunker down, and a new cast of characters appears. The first to show are the twilight-active (crepuscular) species. The night-active (nocturnal) species follow. These shifts are one way that competition for resources and exposure to predators for reef life are reduced.

The Chambered Nautilus (*Nautilus pompilius*) is an example of an animal with a day and night shift. During the day, the nautilus lives in the dark, cool waters 275 to 610 meters (900 to 2,000 feet) below the surface. This helps it avoid predators. When night falls, it ascends to shallower waters to feed.

Vocabulary

adaptation	a physical characteristic or behavior that helps an organism survive and reproduce in its environment
algae	plant-like organisms found in many aquatic (water-based) habitats
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
biodiversity hotspot	a region with high levels of biodiversity that is also threatened by human activity
conservation	the protection, preservation, management, or restoration of natural environments and the ecological communities that inhabit them
ecosystem	an ecological community together with its environment, functioning as a unit
invertebrate	an animal that does not have a backbone, such as a jelly or a sea star
ocean acidification	the decrease in the pH (increased acidity) of the Earth's oceans, caused by their uptake of man-made carbon dioxide from the atmosphere.
polyp	a form of a marine animal with a body shaped like a cylinder and tentacles around a central mouth
photosynthesis	the process in which organisms use water along with sunlight and carbon dioxide to make sugar

Vocabulary (continued)

plankton	plants and animals that drift in the oceans and other bodies of water. Plankton cannot swim or move against water currents, so they tend to drift. Plankton may be microscopic, like fish larvae, or large like some jellies.
sustainable	maintaining a long-term ecological balance by avoiding the over-use of natural resources.
symbiosis	a close relationship between two or more organisms of different species, which is beneficial for at least one of the organisms
vertebrate	an animal that has a backbone, such as a fish or a snake
zooxanthellae	tiny algae that sometimes live inside other marine organisms such as coral, anemones, and giant clams

Science Behind the Scenes

Caring for the coral reef animals in the Steinhart Aquarium

Have you ever wondered who takes care of the thousands of animals living in the Philippine coral reef exhibit?

It takes a team of expert biologists and engineers working together to recreate a vibrant living Philippine coral reef here at the Academy. Some of the living corals on display were sustainably collected as coral fragments by Steinhart Aquarium biologists in the Philippines. While diving off the coast, biologists removed small pieces of coral from colonies and legally exported them to the California Academy of Sciences. Back at the Academy biologists continued to grow these corals in tanks behind the scenes. This is a process known as propagation. Once corals are large enough, biologists carefully transfer the corals to tanks on the public floor.

"No one person could do it all," says Bart Shepherd, Director of the Steinhart Aquarium at the California Academy of Sciences. A team of six biologists propagate the corals, feed the animals, clean the tanks, and maintain the careful balance of animals living inside each exhibit.

"My role at the aquarium is to care for a wide range of aquatic animals. Although live corals may look like rather simple animals, they are also one of the hardest to keep thriving. Much of my time is spent behind the scenes ensuring that these animals are living healthy lives," says aquarium biologist Matt Wandell.

Photo: Will Love © California Academy of Sciences

To help biologists care for the corals, special lights that simulate tropical sunlight makes it possible to grow corals indoors. Inside each coral animal (polyp) live thousands of microscopic algae (zooxanthellae) that share nutrients with their hosts.

One of the main responsibilities of the Aquarium engineers is to ensure that the water in each tank is maintained at the proper temperature and pH level. When oceans absorb the greenhouse gas carbon dioxide, the pH of the water changes, becoming more acidic. This process is known as **ocean acidification** and poses a serious threat to coral reefs. Exhibits such as the Philippine Coral Reef remind us what healthy reefs should look like.

When asked about his favorite part of his job, aquarium biologist Nick Yim says, "I enjoy feeding the animals, watching the animals grow and the exhibits mature and develop into living art displays."

Specimen Spotlight

Giant clams

Tridacna spp.

On the first floor, in the shallow pool above the main Philippine Coral Reef tank, you'll find some of the Academy's most colorful residents, giant clams.

The bright colors you see on the clam's body come from tiny algae (zooxanthellae) living inside the clam's tissue, and no two clams have the exact same color pattern. These algae convert sunlight into nutrients that help feed the clam. Clams also use their siphon to draw water into their bodies and filter out tiny drifting plants and animals (plankton). Take a closer look—do you see dark spots along the edges of the clam's colorful body? These are simple eyes that detect changes in light and dark.

Giant clams can grow to a length of 1.2 meters (4 feet), can weigh more than 227 kg (500 pounds), and can live for more than 100 years. Once a giant clam larva settles on a coral reef, it remains in that same spot for the rest of its life! Reef organisms, such as small invertebrates, plants, and sponges, can also be found living on the clam's fluted shell.

There are legends that warn that giant clams can swallow a human whole! There has never been a confirmed report of a giant clam swallowing a human, and we know that the muscle the clam uses to close its shell moves too slowly to take any swimmer by surprise. Most likely, the giant clam would simply hide in its shell rather than attack.

Tridacna gigas

Tridacna crocea

Tridacna crocea

Tridacna maxima

Photo: Bart Shepard © California Academy of Sciences

Because giant clams average only 12 cm (4.7 inches) of growth a year, it takes a long time for them to become giants. The giant clams in our exhibit were produced through aquaculture. Many Filipinos are planting captive-raised giant clams on their coral reefs to restore wild populations.

Related Exhibits

California Coast
Dive into the underwater world of the northern coast of California which contains some of the world's richest temperate marine ecosystems. Compare the animals found in the Philippine Coral Reef to those found along the California coast. At the Discovery Tidepool in the California Coast exhibit, students can get up close and personal with animals of the rocky intertidal zone and learn about the adaptations they have for surviving the changing water conditions of daily high and low tides.

Water Planet
Learn how aquatic animals are specially adapted to survive in their environment as students explore the essential connections between life and water. Learn about a variety of animals that live in and without water. Learn how each animal has 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.

Rainforests of the World
Learn about another ecosystem that relies on water in the Rainforests of the World exhibit. Here, the journey through this hot and humid environment begins on the forest floor and takes you up 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 Guide

Foxface rabbitfish
Siganus unimaculatus

Diet: algae, marine plants, corals

Susan Potter © California Academy of Sciences

Pyramid butterflyfish
Hemitaurichthys polylepis

Diet: zooplankton

Ron DeCloux © California Academy of Sciences

Blue-and-yellow fusilier
Caesio teres

Diet: zooplankton

Ron DeCloux © California Academy

Palette tang
Paracanthurus hepatus

Diet: algae, zooplankton

Ron DeCloux © California Academy of Sciences

Orange-shoulder surgeonfish
Acanthurus olivaceous

Diet: algae

Ron DeCloux © California Academy of Sciences

Birdnose wrasse
Gomphosus varius

Diet: crustaceans, marine worms, clams, small fishes

Ron DeCloux © California Academy of Sciences

Blue-spine unicornfish
Naso unicornis

Diet: algae, zooplankton

Ron DeCloux © California Academy of Sciences

False clown anemonefish
Amphiprion ocellaris

Diet: zooplankton

J. Charles Delbeek © California Academy of Sciences

Sixbar wrasse
Thalassoma hardwicke

Diet: zooplankton*

Evan Barbour © California Academy of Sciences

Oriental sweetlips
Plectorhinchus vittatus

Diet: crustaceans, sea stars, molluscs

Ron DeCloux © California Academy of Sciences

Emperor angelfish
Pomacanthus imperator

Diet: corals, sponges, algae, tunicates, crustaceans

Ron DeCloux © California Academy of Sciences

Clown tang
Acanthurus lineatus

Diet: algae

J. Charles Delbeek © California Academy of Sciences

Philippine Coral Reef Guide

Lyretail anthias

Pseudanthias squamipinnis

Diet: zooplankton

Ron DeCloux © California Academy of Sciences

Square-spot fairy basslet

Pseudanthias pleurotaenia

Diet: zooplankton

Ron DeCloux © California Academy of Sciences

Lamarck's angelfish

Genicanthus lamarck

Diet: zooplankton

Ron DeCloux © California Academy of Sciences

Double whiptail

Pentapodus emeryii

Diet: brittlestars, marine worms, small fishes, zooplankton

Evan Barbour © California Academy of Sciences

Blacktail damselfish

Dascyllus melanurus

Diet: algae, zooplankton

Ron DeCloux © California Academy of Sciences

Striped cleaner wrasse

Labroides dimidiatus

Diet: scales, mucus and parasites of other fishes

Ron DeCloux © California Academy of Sciences

Corals

Corals such as those pictured below host tiny algae cells inside them called zooxanthellae ("zo-zan-thelly"). In exchange for the protection and nutrients the coral provides, zooxanthellae provide corals sugars and other nutrients. Like plants, zooxanthellae photosynthesize with the help of sunlight.

Green horn coral

***Hydnophora* species**

Evan Barbour © California Academy of Sciences

Leather coral

***Sarcophyton* species**

Ron DeCloux © California Academy of Sciences

Staghorn coral

***Acropora* species**

Bart Shepherd
© California Academy of Sciences

Plate coral

Montipora capricornis

Evan Barbour © California Academy of Sciences

Brain coral

***Leptoria* species**

Evan Barbour © California Academy of Sciences

Moon coral

***Acanthastrea* species**

Ron DeCloux © California Academy of Sciences

Suggested Activities to Download

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

» **At-Academy Activity:** Living Fossils Scavenger Hunt (suggested grades 6-8)
www.calacademy.org/teachers/resources/lessons/living-fossils-scavenger-hunt/
Through this scavenger hunt, students will observe examples of animals with evolutionarily primitive characteristics and record observations using drawings and words.

» **Post-Visit Activity:** Sustainable Fishing in the Philippines (suggested grades 3-8)
www.calacademy.org/teachers/resources/lessons/sustainable-fishing-in-the-philippines/
In this game, students will learn that unsustainable fishing risks depletion and extinction of fish populations, and brainstorm solutions to protect coral reefs and fish for future generations.

» **Connected Experience:** Comparative Physiology of Invertebrates (suggested grades 9-12)
www.calacademy.org/teachers/resources/lessons/comparative-physiology-of-invertebrates/
In this lesson, students will learn about invertebrate diversity, and compare marine invertebrates' respiratory and digestive systems with those of humans.

» **Connected Experience:** Fish Family Identification (suggested grades 6-8)
www.calacademy.org/teachers/resources/lessons/fish-family-identification/
In this game, students will become familiar with fish shapes, learn that fish within a given taxonomic family have similar body shapes, and discuss how different body shapes enable fish to survive in their environments.

» **Connected Experience:** Marine Invertebrate Anatomy (suggested grades 3-12)
www.calacademy.org/teachers/resources/lessons/marine-invertebrate-anatomy/
In this lesson, students will learn about invertebrate diversity and compare marine invertebrates' anatomy with those of humans.

» **Anytime Lesson Plan:** Coral and Chemistry (suggested grades 6-12)
www.calacademy.org/teachers/resources/lessons/coral-and-chemistry/
By testing whether increased carbon dioxide makes ours oceans more basic or more acidic, students will learn how human alterations of the atmosphere are changing the pH of the ocean, impacting coral reef survival.

Be sure to review our teacher resources online!
www.calacademy.org/teachers/resources

» **Pre–, during–, and post visit activities:** short, lively activities to focus your class trip to the Academy.

» **Connected experiences:** Activity combinations that extend the museum visit into the classroom.

» **Anytime lesson plans:** Full–period lessons to integrate into your yearly curriculum.

CA Science Content Standards

Grade Six

Life Science
5c. Organism populations
5d. Roles of organisms
5e. Factors influencing organisms in an ecosystem

Earth Sciences
2a. Water erosion/runoff

Grade Seven

Life Science
2a. Sexual and asexual organisms

Grade Nine through Twelve

Biology
6a. Biodiversity
6b. Analyze changes in an ecosystem
6c. Fluctuations in populations

Earth Science
5d. Properties of ocean water
6b. Effects on climate to large bodies of water and ocean currents

Guiding Questions and Answers

Use these questions to get students thinking about the Philippine Coral Reef.

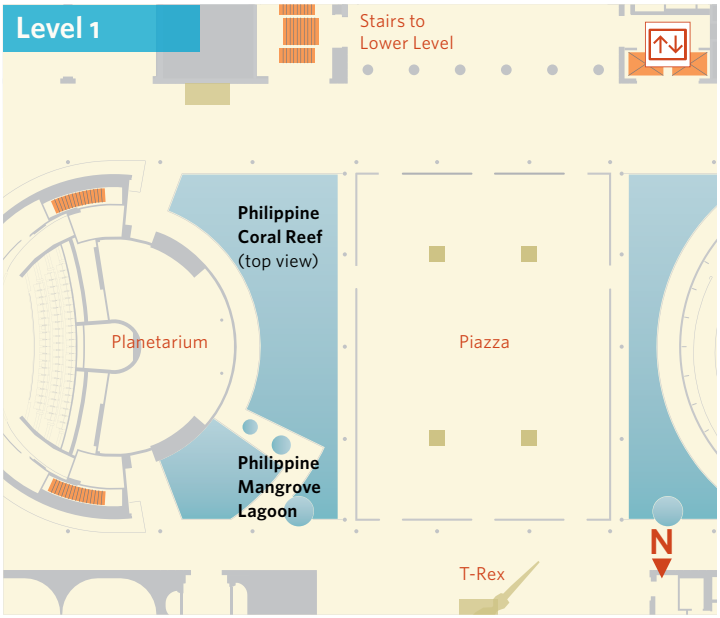
» **What role do mangrove lagoons play in supporting both coastal and coral reef ecosystems? How are mangroves related to coral reef conservation?**
Mangrove lagoons protect coral reefs and shorelines. They are a vital part of the reef ecosystem because they provide shelter and food for reef organisms. They also act as nurseries for the young of many reef residents that are still too small to survive in the open ocean. Lagoons also serve as a filter, cleansing the water of sediments and pollutants coming off the land that can harm corals. Without the partnership of mangroves, coral reefs could not survive. When considering coral reef **conservation** it is important to remember the vital role of mangroves.

» **Observe the Philippine Coral Reef tank and compare it to the California Coast tank. How are coral reefs similar and different from our local coastal California ecosystem?**
Both Philippine coral reefs and California coastal ecosystems are teeming with life. Both ecosystems are comprised of many different types of fish, invertebrates and algae. However, coral reefs are found in shallow waters where symbiotic zooxanthellae algae living in the corals convert sunlight into energy via **photosynthesis**. This partnership forms the foundation of the coral reef ecosystem. Along the California coast, large algae known as giant kelp, form "forests." These photosynthetic kelp are the foundation of this local ecosystem.

» **Can you find some examples of animals living in partnership, a relationship known as symbiosis, on the reef? What are some different types of symbiosis you observe on the reef?**
There are many reef relationships that are examples of symbiosis; one example is the partnership between anemones and clownfish. Anemones have stinging structures in their tentacles, called nematocysts, which help them defend against predators and capture prey. Clownfish that live with the anemones have a mucus coating that protects them from these stinging cells. Anemones provide the clownfish with leftover food scraps, protect clownfish from predators, and provide a safe place for the clownfish to lay their eggs and raise their young. In exchange, clownfish help defend the anemones from predators and parasites.

» **Many animals live in coral reef ecosystems. How do corals help these animals survive?**
Corals are an essential part of reef ecosystems. Corals form the structure of the reef and provide places for other organisms to live and breed. The diversity of coral species and their structural complexity provide many places and spaces for other animals to call home. Without coral reefs, oceans worldwide would be far less diverse. Although some animals may not be permanent residents of the reef, they rely on the reef at various stages in their lives—for breeding or raising young.

Aquarium Map



The Philippine Coral Reef Exhibit represents one of our planet's most diverse and fragile marine ecosystems.

Located on Level 1 and Lower Level, the Philippine Coral Reef exhibit focuses on two main themes:

» Tropical coral reef ecosystems, especially those found in the Philippines, are biodiversity hotspots.

» Many organisms living in tropical reef ecosystems depend on one another for survival.