BAY ACADEMY

CHAPERONE GUIDE

Aquarium of the Bay Self-Guided Tour

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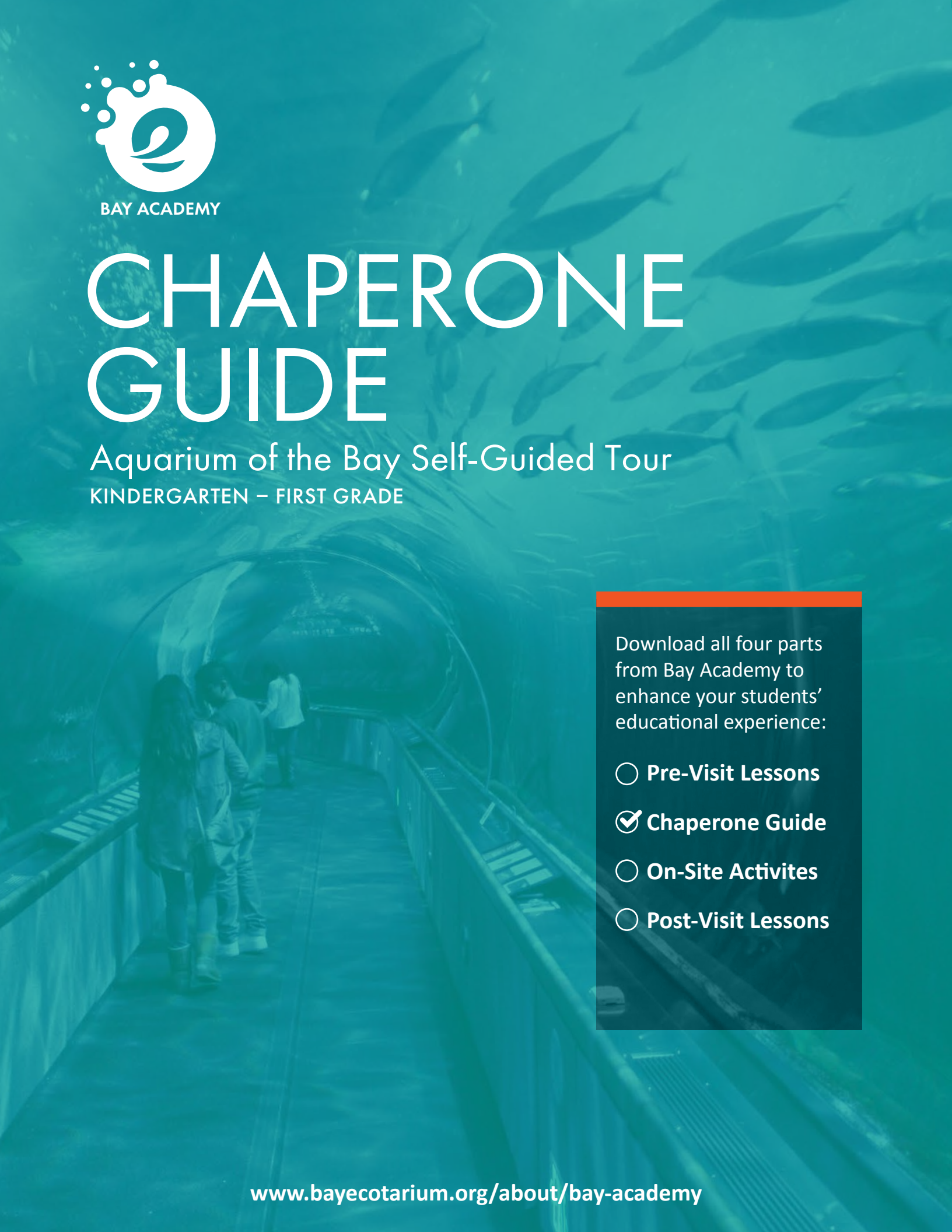


Download all four parts from Bay Academy to enhance your students' educational experience:

- ◯ **Pre-Visit Lessons**
- ☑ **Chaperone Guide**
- ◯ **On-Site Activites**
- ◯ **Post-Visit Lessons**

www.bayecotarium.org/about/bay-academy

Hello and welcome to the Aquarium of the Bay

Today during your self-guided tour, you will be instrumental in helping your students experience the unique beauty and importance of our local estuary, the San Francisco Bay.

This Chaperone Guide has everything you need to ensure that you and your group have the best trip possible, including:

+ Four interactive activities that correspond to different Aquarium exhibits

+ A chaperone-focused guide to all of the exhibits your group will be exploring

+ An FAQ to help you answer some common questions that your group may ask

Discover the Bay

The Exhibit

Discover the Bay is our first exhibit and features tanks that introduce guests to some of the habitats inside the San Francisco Bay, including the coastline, sandy bottom, and rocky reef. This exhibit also has our Tropical Tank, which includes tropical fish that may be more familiar to the students. There are also videos throughout the exhibit that highlight important issues that impact our oceans, including the importance of sharks, Marine Protected Areas, as well as our local National Marine Sanctuary, the Gulf of the Farallon.

Activity Overview

The first activity is the Shape Scavenger Hunt. This activity aims to get students to focus on the animals inside the tanks, trying to match one to the appropriate shape. All of the animals are commonly found in the Bay and beyond, and many should be at least somewhat familiar to the students.

This activity can be accomplished in many different ways depending on the needs and size of your group. You can choose to identify the animals as a group, either working animal-by-animal or tank-by-tank. You may also use the included index cards to assign each students a specific animal to find. If your group needs help finding an animal, or has questions about the animals, there is an answer sheet on the back of the activity as well as more information on each animal in the "Animal Overview" section on the next page.

Introduction Talking Points

- This is our first stop at the Aquarium of the Bay, the Discover the Bay exhibit. Each tank in here shows a different ecosystem inside our local estuary, the San Francisco Bay.
- Do you remember learning about estuaries in class? Well they are a special place where salty ocean water and fresh river water meet. This creates brackish, or slightly salty slightly fresh water that is constantly changing.
- The San Francisco Bay is not just one habitat. Inside the San Francisco Bay there are a lot of habitats where different animals live. Remember that a habitat is a place in nature that includes all of the living and nonliving things an animal needs to survive. In these tanks we can see animals that live on the Sandy Seafloor, the Kelp Forest, and the Shallow Reef.

Discover the Bay

Talking Points Continued...

- There is one tank that looks very different. It's brighter and more colorful. Can anyone find that? This is the Tropical Tank and it's the only tank in this exhibit that does not have animals that live here in the San Francisco Bay.
- Do you recognize any of the fish? There's Nemo- a clownfish or anemonefish, and Dory- a Royal Tang. The Aquarium has this tank to show you that not all fish are found in every habitat. Our estuary is much too cold for Nemo and Dory, which is why they live in the tropics.
- Now that we've looked around, we're going to look at some specific animals in these tanks. Animals of all shapes and sizes live in the Bay, and. it's going to be our job to find six animals that have shapes like the ones you see here. Once we have found the animal, we're going to try to use the signs to figure out its name.

Animal Overview

#1. Sea Stars

Located in the Sandy Seafloor, West Coast Beauties, and Kelp Forest Tanks

We have many different kinds of sea stars in Discover the Bay as well as throughout the Aquarium. We choose to call them sea stars, not starfish, because sea stars are not fish! They are a type of invertebrate- an animal without a backbone- and its relatives include the sea cucumber, sea urchin, and the sand dollar. Some of our most common sea stars include the Ochre Star, Leather Star, Giant Pink Star, Vermilion Star, as well as the Bat Star. All sea stars have hundreds of tube feet that allow them to move throughout the bottom of the Bay. Believe it or not, sea stars are predators and love to eat mussels, clams, algae, and snails.

#2. Pacific Sanddab

Located in the Sandy Seafloor Tank

This large flatfish lives on the sandy bottom in estuaries and lives all throughout the Eastern Pacific coast. Adult Pacific sanddab have both eyes on the same side of their head, however they don't start that way! As the flatfish begin to grow up, one eye will begin to migrate around the head until they are fully grown. They hunt during the day, using sight and smell to dig for marine worms, snails, and crustaceans.

Discover the Bay

Animal Overview Continued...

#3 Moray Eel

Located in the West Coast Beauties Tank

The California Moray is a long, snake-like fish that lives throughout the west coast of North America in reefs and other shallow waterways. During the day, they lay in the cracks or crevices of rocks, waiting for night when they can hunt, catching small fish, octopuses, and other bottom-dwelling creatures. Although they are a fish, they don't have many of the body parts we associate with fish. They don't have side(pectoral) or bottom(pelvic) fins and they also don't have scales! Instead, they have a mucus that covers their body to protect them. When you see a Moray Eel, you might notice it looks like its trying to catch its breath. In fact, Moray Eels must constantly open and close their mouths to breathe because they do not have gill covers to push water into their gills.

#4. Rockfish

Located in the Shallow Reef Tank

We have over 20 species of rockfish here at the Aquarium of the Bay, all different shapes, sizes, and color patterns. All rockfish share large eyes, a constantly frowning mouth, as well as large spines on their fins. Rockfish who live in the San Francisco Bay spend most of their time in kelp, camouflaging with their surroundings. rockfish can also be one of the longest living fish species, possibly living to over 200 years old!

#5. Sand Dollar

Located in the Sandy Bottom Tank

Sand dollars are related to sea stars, sea cucumbers, and sea urchins. They have a hard skeleton, known as a test, made of calcium carbonate plates which are covered in velvet textured spines and very small hairs called cilia.. Sand dollars live just below the water line in sandy and muddy bottom areas. Their small spines on the flat side of their body allow them to borrow or crawl through the sand. Their mouth is located on the bottom side of their body and they feed on algae, plankton, and detritus.

#6 Anchovy

Located in the Anchovy Tank

Anchovies are found in the Pacific, Atlantic, and Indian Ocean and the Mediterranean and Black Sea. They are a small green fish with blue reflections due to a silver stripe that runs down the length of their body. They are an important food source for fish such as halibut, salmon, and sharks, as well as marine mammals and birds. You might see the anchovies opening their mouths while swimming around the tank. As filter feeders, they trap food in their gill rakers as water passes through their mouth and out their gills.

Explore the Tunnels

The Exhibit

Downstairs on our first floor, we have five different exhibit spaces. The first is our Go With the Flow jelly exhibit, featuring jellies from all over the world, including two species that live right here in the San Francisco Bay: the moon jelly and the Pacific sea nettle. Our first tunnel is our Nearshore Tunnel, which features animals that can be found right off of the California coast. The most noticeable animals in this tank are the various species of rockfish, which can be found resting all over the tunnel. Other fish include the swell sharks, giant sea bass, sea stars, Northern anchovies, California sheephead as well as our state marine fish, the Garibaldi.

Between our tunnels is the Octopus Grotto, which holds our giant Pacific octopus as well as various other animals that are found in the similar rocky bottom habitat of the San Francisco Bay.The second tunnel is our Offshore Tunnel which features some of our larger fish, as well as most of our sharks, rays, and skates. Most notable in this tunnel are our broadnose sevengill sharks, which are the largest resident sharks in the San Francisco Bay. The two other shark species we have in this tank are the tope shark and the leopard shark. We also have other cartilaginous fish such as bat rays, big skates, shovel-nosed guitarfish, and bony fish including the white sturgeon and the striped bass. Finally, right in front of the elevator is our Pipefish Gallery which shows some of the smaller species of fish that can be found in the California eelgrass along the coast.

Activity Overview

After you have identified all of the animals in Discover the Bay, you and your group will head downstairs to the tunnels. As you wait for the elevator, you can encourage your group to think of a question they would like to ask the Naturalist in the elevator. In almost every exhibit in the Aquarium there will be a staff naturalist there to assist you and answer any questions you or your group may have. Please take advantage of their expertise throughout your field trip.

Once you have entered the tunnels, let the students explore the Go with the Flow exhibit, but collect them before entering the first tunnel. Use the second worksheet to explain how you can learn about a fish's diet from their mouth position. Show the students the worksheet and then tell them that they will be walking through the tunnels, trying to figure out which mouth position each fish has. Let the students explore both tunnels without much guidance, reminding them to pay attention to mouth position and try to encourage all students to identify at least one fish and its mouth position. Use the following pages to help you discuss the activity, identify specific fish, and discuss their diet.

Explore the Tunnels

Activity Talking Points

- Did everyone enjoy the jellies? Now we're going to move onto our second activity, which is going to happen inside the two tunnels of the Aquarium.
- Each tunnel shows a different habitat and has many different kinds of fish inside. During this activity, we are going to pay attention to the mouths of the fish we see and we're going to try to see if the mouth is pointing up, in the middle, or pointing down.
- Since most fish eat while they're swimming, the position of their mouth helps us see what kind of food they like to eat.
- If their mouth is on the top of their face, like the fish here on this worksheet, then it probably goes up to the surface of the water to feed, eating small fish, insects and algae.
- If their mouth is in the middle, like this picture here, then they eat mostly in the middle of the water and will eat anything they can catch, including algae, plants, insects, fish, and crustaceans.
- Finally, if their mouth is on the bottom of their face, like this fish, then they usually will eat on the ocean floor. That means that they like to eat crustaceans like crabs, worms, clams, and other bottom-dwelling animals.
- It's going to be our job to work together to find two animals with each type of mouth, then we can talk about what we noticed at the end.

Animal Overview

Fish with Superior Mouths (pointing up)

Northern Anchovy - Both Tunnels
Their diet includes phytoplankton, krill, copepods, arrowworms, and larval fishes.

Treefish- Tunnel 1
Their diet includes mollusks, crustaceans, and small fish.

Kelp Greenling- Tunnel 1
Their diet includes mollusks, small fishes, crustaceans, worms, and brittle stars

Striped Bass - Tunnel 2
Their diet includes alewives, flounder, herring, smelt, eels, lobster, crab, and squid.

Kelp Bass- Tunnel 1
Their diet includes small fishes, squid, crustaceans, and plankton.

Barred Sand Bass- Tunnel 1
Their diet includes crabs, octopuses, squid, and small fishes.

California Halibut- Tunnel 1
Their diet includes anchovies, squid, and other small fishes.

Bocaccio- Tunnel 1
Their diet includes anchovies, shellfish, sardines, and squid.

Explore the Tunnels

Animal Overview Continued....

Fish with Terminal Mouths(pointing forward)

Surfperch - Tunnel 1
Their diet includes worms, small crabs, mussels, and snails.

Ocean Whitefish- Tunnel 1
Their diet includes aquatic insects, snails, clams, fish eggs, and larvae.

Opaleye - Tunnel 1
Their diet includes crustaceans, worms, and mollusks.

Rock Wrasse - Tunnel 1
Their diet includes worms, mantis shrimp and bristleworms.

Rockfish - Tunnel 1
Their diet includes crabs, worms, small fish, and squid.

California Sheephead - Tunnel 1
Their diet includes sea urchins, mollusks, and crustaceans.

Giant Black Sea Bass- Tunnel 1
Their diet includes .crustaceans as well as anchovies, croaker, mackerel, and whitefish.

Blacksmith - Tunnel 1
Their diet includes algae and zooplankton.

Halfmoon - Tunnel 1
Their diet includes marine worms, crustaceans, limpets, and squid.

Sevengill Shark- Tunnel 2
Their diet includes bony fish, baby sharks, cartilaginous fish, and marine mammals.

Tope Shark- Tunnel 2
Their diet includes mackerel, herring, crustaceans, and mollusks.

Fish with Inferior Mouths(pointing down)

Swell Shark- Tunnel 1
Their diet includes bony fish, mollusks, and crustaceans.

Leopard Shark- Both Tunnels
Their diet includes crab, shrimp, bony fish, anchovies, herring, croakers and rockfish.

White Sturgeon - Tunnel 2
Their diet includes dead fish, crustaceans, mollusks, and lamprey.

Horn Shark- Tunnel 1
Their diet includes crab, shrimp, sea urchins, clams, oysters, snails and slugs.

Big Skate - Tunnel 2
Their diet includes mollusks, crustaceans, small fish and worms.

Bat Ray - Tunnel 2
Their diet includes mollusks, crustaceans, small fish and clams.

Touch the Bay

The Exhibit

The third large area of our Aquarium is the Touch the Bay and Bay Lab exhibit area. After the tunnels, you will wait for the elevator to take you back upstairs where you will see information about the National Estuarine Research Reserve. Allow the students to look through the photo slideshows, artifacts, and maps, but stop them before they enter the rest of the exhibit so that you can explain the activity.

After you have explained the activity, students will enter Touch the Bay, which has two touchpools, the first with baby bat rays and big skates, as well as a horn shark, and the second with our tidepool invertebrates- sea stars, sea anemones, and sea cucumbers. Also in this area is our Bay Lab, which features science experiments and animal encounters every hour, as well as our Climate Change Ambassador animals.

Activity Overview

The Touch the Bay exhibit is a very exciting place for students and adults alike. Rather than having students focus on identifying or examining animals closely, this activity focuses on communication skills and problem solving. In their pre-visit activity, they learned that an estuary is a great place for baby animals to live. In this activity, students will need to use their resources, including our Aquarium Naturalists and the chaperones, to figure out which animals in the exhibit are babies, why the Bay is a good place for babies to grow up, and to think about how we can help these baby animals by saving freshwater.

Allow them to play and interact with both touchpools before bringing the group back together to discucss the worksheet. The area next to the Tidepool touchpool would be a good resting spot as you discuss the worksheet and what students experienced in the exhibit.

Activity Talking Points

- Alright everyone, before we head into the next exhibit I want to introduce our next activity.
- Do you all remember learning about baby animals that live in the Bay? Well today, you're going to get a chance to see some of those baby animals. But it is going to be your job to talk to the people that work at the Aquarium to figure out which animals are babies and to learn why they need an estuary to survive.
- After we all have had a chance to walk around this area, we will stop, sit down, and then talk about how people use water everyday. We will also talk about how we can save water and find ways to protect water in nature.

Touch the Bay

Baby Animals and the Bay

Estuaries are aquatic environments where freshwater and saltwater meet. In the case of the San Francisco Bay, freshwater from the Sacramento and San Joaquin Rivers mix with the saltwater from the Pacific Ocean, creating a semi-saline environment that constantly changes as the freshwater flows increase or decrease. Estuaries are often known as the "nurseries of the sea" because of the role they play as a nesting site for many aquatic fish and shellfish. Animals who grow up in estuaries are protected from large waves by the large land areas that surround it, and are protected from many predators who prefer the deep, salty waters of the ocean. Estuaries are also productive habitats because of the influence of freshwater flows which bring in nutrients, plankton, and sediments that feed and provide a habitat for many of the bottom-dwelling animals that baby animals will feed on. In fact, a healthy estuary can produce between 4 and 10 times as much organic matter as a cornfield of the same size.

Here in Touch the Bay, we focus on two species of cartilaginous fish who use the Bay as a nursery- the bat rays and big skates. These animals, along with others such as leopard sharks, swell sharks, marine mammals, salmon, and sturgeon rely on the estuary at different points in their lives. If we want to protect and maintain a healthy ocean for the future, we need to make sure that our estuaries are healthy too.

Freshwater Flows and Us

Over 40% of the water that falls on the state of California flows through the land and into the ocean through the San Francisco Bay. If you think of the land in the middle of California as a giant bathtub, with the mountains that surround the Central Valley as the edges, the San Francisco Bay would be the drain. That "bathtub" is a watershed, or an area of land that drains into the same body of water. The San Francisco Bay-Delta watershed is the largest watershed in California, providing habitat, freshwater, electricity, and recreation for millions of Californians. However, due to the impact of dams, groundwater removal, and water exports for agriculture and urban development, the Bay has lost over 50% of its freshwater flows. Not only does this affect salmon who depend on the river, estuary, and ocean for its life cycle, but it also dramatically affects animals who live or grow up in the Bay, reducing nutrient and food availability, increasing the salinity, and changing the water temperature.

If we want to help protect the animals who depend on our estuaries, then we need to take steps to reduce the amount of freshwater that we use. We can do that through a variety of individual and communal actions. In your home you can reduce shower times, regularly check for leaks, and remind each other that water is a limited resource. As a community, you can support legislation to legalize rainwater catchment, encourage municipalities to use native plants and drip irrigation in landscaping decisions, and vote for projects to take down dams.

Watershed Ambassadors

The Exhibit

The North American River Otter exhibit is our last exhibit and features the residents of freshwater ecosystems all over the Bay Area and across North America. We have four male North American river otters here at the aquarium, all named after different parts of the area of California that drains to the San Francisco Bay. The otters are only on exhibit during the day and at night they have a whole other space behind the scenes. Each otter gets a day off to have a nice break from the other otters, play with toys, catch up on some sleep, and to have some individual training time with the biologist caretakers. For this reason, there are usually only two otters on exhibit unless it's a holiday or a special occasion. This exhibit also has monitors with photo slideshows that highlight each of the river otters as well as other general river otter information. The Augmented Reality experience is also in this area; however, this experience requires an additional $2 fee per person.

Activity Overview

The students will be observing the otters and asking our Aquarium Naturalist about the otters' body parts and how they help them live in their environment. Let the students explore the whole river otter exhibit to observe the habitat, the artifacts in the Otter Nook, and the monitors with photo slideshows to collect general information about the otters. Then gather the students and write down some of their observations on the Otter-ly Amazing worksheet in your folder.

Activity Talking Points

- This is our last stop at the Aquarium of the Bay, the river otter exhibit.
- North American river otters are playful animals that have fun on both land and in the water. They have special adaptations, or parts of their body, that help them survive in the estuary environment.
- How do you think their fur/tail/ears & nose/whiskers/paws help the river otters?
- You can observe the otters, ask the Aquarium Naturalist, or look around the exhibit and artifacts to learn how their body parts help the otters live in the freshwater environment.
- Otters are truly incredible animals who help keep their freshwater homes balanced, safe, and clean. We can protect river otters by conserving water and by reducing chemicals and pollutants used on land (i.e. fertilizers and pesticides from landscaping and agriculture, industrial runoff, toxins leaching from landfills, etc.). Can you think of ways to conserve water?

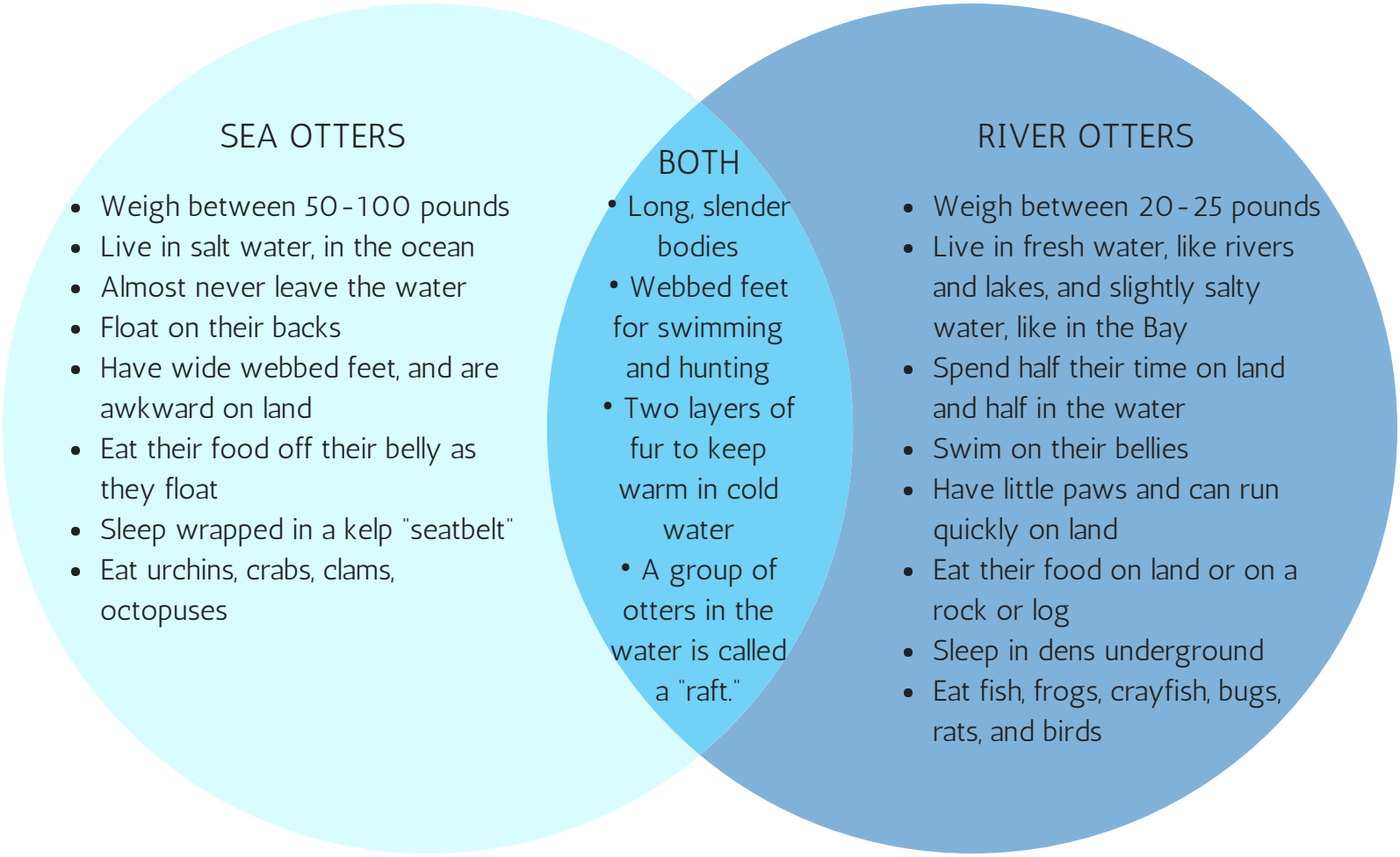
Watershed Ambassadors

Animal Overview

River otters are excellently adapted to their role in aquatic food webs because of the following body parts:

Fur: Otters have two layers of fur. One layer to keep them warm, and one to keep them dry!
Tail: Otters use their tail for steering, swimming, and balancing.
Ears & Nose: When swimming, otters are able to tightly close their ears and nostrils.
Whiskers: Long whiskers help them find food and swim safely in the murky estuary.
Paws: Their webbed feet allow them to swim and their feet pads help them travel on land.What's the difference between Sea Otters and River Otters?

What's the difference between Sea Otters and River Otters?



Frequently Asked Questions

Do rays have stingers?

What we think of as rays are actually two groups of closely related animals, rays and skates. Both are elasmobrachs, and have flattened bodies, skeletons made of cartilage, and the ability to sense natural electrical signals, like heartbeats and electric fields. Skates are flattened fish that have fleshy tails, lay egg cases, and have dorsal fins.

Rays, on the other hand, usually have long, thin tails, hatch their young inside their body, and many, but not all have stingers. Many kinds of rays, including sawfish, guitarfish, electric rays and manta rays, do not have stingers. We have two kinds of rays at the Aquarium of the Bay. The Bat Ray is a kind of eagle ray that does have a venomous spine, which is not dangerous to humans. The Shovelnose Guitarfish, which you can see in Tunnel 2, does not have a spine.

Are we going to see sharks today?

The Aquarium of the Bay has sharks in almost every exhibit, although many of our sharks do not look like what you see in the movies. In Discover the Bay, we have a swell shark in the middle tank. In the first tunnel, swell sharks and horn sharks hide in the rocks as leopard sharks swim throughout. In the second tunnel, we have leopard sharks as well as some of the larger Bay shark species, the tope shark and the broad-nosed sevengill. Finally, we have a horn shark in Touch the Bay.

Why is this shark so small?

Not all sharks can be as large as whale sharks or great white sharks. In fact, almost half of the 400 shark species found all over the world are smaller than 4 ft long. The smallest shark in the world is the spined pygmy shark which grows to be only 7-8 in long!

At the Aquarium of the Bay, our largest shark species is the broad-nosed sevengill shark which can be between 7-8 ft long. Many of our sharks don't look that large, but that isn't the sharks' fault! The acrylic in the tanks that holds our animals is very thick, so thick that all of our fish look about 20% smaller in their tanks then they are in real life.

Are these fish dead?

If students ask this, they are most likely referring to our Rockfish(for more information about our Rockfish, go to page 4). Many of our Rockfish spend a lot of their time sitting still. This is a defense strategy for these types of fish,. They are able to hold onto to kelp with spines in their fins, and by sitting very still they can avoid predators and catch food!