

Water Wonders

Background Information

Students participating in the Water Wonders School Program discover how a myriad of creatures from sea snails to killer whales live, eat and protect themselves on the seashore and along the coast of B.C.

The animals you and your students will meet at the Vancouver Aquarium are introduced to you in this section of this educator's guide. The Teacher's Information section provides background material to help you teach your class about aquatic animals. The content provided is designed to make you confident and comfortable when answering inquiries posed by keen young minds! Use it as a resource when planning your lessons—pick and choose the animals you want to introduce to your students, and dive in!

Many of the animals featured in this program do not have backbones. These animals are called invertebrates (in-VUR-teh-braytes). Animals with backbones are called vertebrates (VUR-teh-braytes).

There are many more types of animals without backbones than there are animals with them.

The animals in this section are organized by phylum (FYE-lum), the same way scientists usually order them. Each phylum contains related animals that share a number of common characteristics.

MARINE INVERTEBRATES

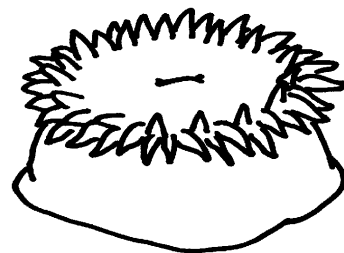
Phylum *Cnidaria* (NYE-dar-ee-ah); "cnid" = nettle; "aria"

Beachwalkers encountering cnidarians (NYE-dar-ee-anz) often confuse them with plants. Sticky sea anemones (ah-NEM-aw-nees) and their soft sea pen and jellyfish relatives resemble flowers, feathery quill pens and flying saucers more than they do other animals. Internally, however, they all share the same basic structure. Each has a central cavity with a single opening that acts as both mouth and anus.

This opening is surrounded by a circular fringe of tentacles laced with sticky, stinging cells.

Sea Anemones

Sea anemones are simple, well-armed animals. Their many, petal-like tentacles are laced with stinging cells that immobilize prey, such as small shrimps and crabs. Once anemones have successfully captured their dinner, they use their tentacles to manoeuvre it into their centrally located mouths. Anemones spit out the indigestible parts of their meals, including pieces of shell.



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At low tide, sea anemones that are attached to rocks or burrowed into sandy beaches prevent themselves from drying out by tucking their tentacles into the middle of their cylindrical bases. This action traps water inside their central cavities. Sea anemones often stick pieces of shells or tiny rocks to their columns to camouflage themselves. Many exposed anemones look more like drab stewed tomatoes with beach flotsam decorations than the exquisite aquatic flowers they resemble when seen "open" underwater.

Even when their tentacles are "out" in tidepools, or underwater, the stinging cells of sea anemones are harmless to most humans. Take care to gently use your pinky finger if you wish to touch one of these soft creatures.

Phylum *Mollusca* (MOLL-us-ka); "moll"=soft

The molluscs are a diverse group of more than 100,000 species of living animals including clams, snails, limpets, sea slugs, octopuses, squids and abalones. Most molluscs can be identified by three features: a large muscular foot, hard shells they create to cover their soft bodies, and a toothed, rasping tongue, called a radula (rad-YOU-lah). Octopuses and squids have deviated from the general mollusc body plan. In both of these types of animals, the foot has evolved into a number of many-suckered arms. Neither has a shell, but squids have a stiff internal rod, called a pen. Both octopuses and squids have a hard, bird-like beak which they use to bite prey.

Sea Snails

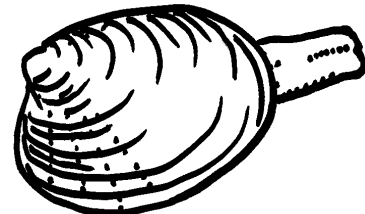
Sea snails make the shells that they carry on their backs and use them as mobile homes. They use their single, large foot to move slowly and for holding onto the ocean bottom. Most snails can pull their foot into their shells and firmly seal the "door" shut with the operculum (oh-PER-kew-lum), a tough, oval-shaped piece of material. Many snails scrape and eat algae from rocks with their sandpaper-like tongues, often leaving a maze of clear snail-trails behind them. Some sea snails use their rasping radulas to bore holes in other creatures' shells to feast on the animals inside.

Mussels

Mussels use their muscles to tightly close their two bluish-brown shells to protect their soft, moist insides from both predators and the drying effect of low tides. They attach themselves in large clumps to rocks and pilings with tough, byssal (BYE-sahl) threads and eat the miniscule plants and animals that they filter from the water.

Clams

Clams have two shells which they shut together tightly to protect their soft insides. They live in the sandy or muddy bottoms of beaches or the sea. To eat, they extend long tubes, called siphons, to the surface of the sea floor and filter small plants and animals, called plankton, out of



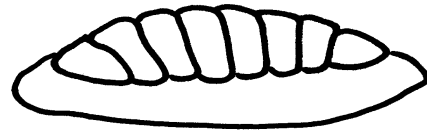
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the water. When disturbed, these animals withdraw their siphons, pulling them down toward their shelled bodies. This gives clam diggers the false idea that all clams dig deeper into the sand to escape predators. Clams are a favourite food of some sea stars.

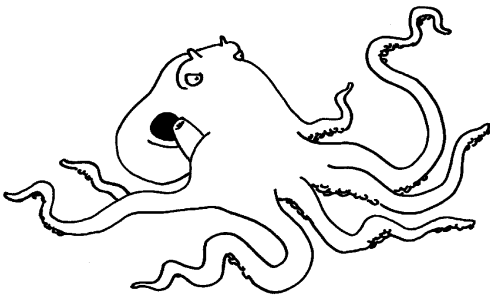
Chitons

The flattened bodies of chitons (KYE-tons) are covered by eight partially overlapping shell plates. Chitons' strong feet and low profiles allow them to cling to rocks in turbulent surf and strong currents. Some chitons have eyespots that sense light. Many chitons feed at night, using their toothed tongues to scrape algae off rocks.



Octopus

All octopuses use their well-developed eyes to scan for prey and predators. They use their eight sucker-lined arms to grasp potential dinner items, such as crabs, snails, oysters, abalone, clams, mussels and small fishes. They transfer their prey to their mouth, located on their undersides, in the middle of their many arms.



When octopuses see predators, they flee as quickly as possible, often hidden by murky clouds of ink that they squirt behind them into the water to confuse any pursuers.

Octopuses use other talents to avoid predators and hunt prey—they shape-shift and colour-change. They can squeeze their soft bodies through very, very small openings under rocks and at the entrances of caves, where they often live. Octopuses are also masters of skin-colour changes, either blending with their surroundings or pulsating red when alarmed. These disguise artists can even alter the texture of their skin to match their backgrounds.

Phylum Arthropoda (arth-ROE-poe-dah); "arthro"=jointed; "poda"=foot

Hermit crabs, crabs, barnacles and shrimps belong to the most abundant animal group on Earth, the arthropods (arth-ROE-pawds). Including their land-based insect relatives, these animals comprise approximately 80 percent of all living species on land, air and water.

The common features of this group include jointed legs and a hard external shell, or exoskeleton (x-OH-skeleton), which covers the



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three main parts of their bodies—head, thorax and abdomen. As they grow, arthropods shed their hard external shells and make bigger new ones.

Crabs

Most crabs have hard shells that cover their bodies, antennae, powerful claws, and two-to-four pairs of walking legs. Crabs use their specialized pincers and appendages as knives, forks and spoons to eat everything from marine worms to seaweeds. Most crabs use eight legs to move quickly—sideways.

When the crabs' hard shells become too small and tight for them, they develop a soft, new covering underneath the old shells. The smaller, older shells split along the back and the crabs reverse out of them. They are very vulnerable to predators during this process and usually hide while their newly exposed shells are hardening. This process is called moulting. Crabs moult many times before they are fully grown.

Hermit Crabs

Hermit crabs differ from other types of crabs as they have soft abdomens that make them vulnerable to predators and they use only two pairs of legs for walking. Their remaining specialized two pairs of legs are used to hold their bodies inside the shells, tube worms and sponges that they use to keep their soft bellies from harm. Many hermit crabs will engage in combat with each other for larger shells, but usually do not fight with the original owners for possession of the shells. Their claws can be used as a door to seal out predators.

Barnacles

Barnacles resemble miniature, grey volcanoes cemented to rocks. To feed, they open the tiny, movable, trapdoor plates at the "summit" of their shells, and use six pairs of feathery, jointed legs to sift through the water for the tiny animals and plants that they eat. When the barnacles have finished feeding, they close these plates, sealing themselves inside for protection. They also close them to retain moisture inside their shells during low tide. Try not to step on these tiny animals when you are exploring the seashore.

Shrimps

There are over 80 species of shrimps along the West Coast. Their prey includes small invertebrates and worms. They avoid their predators by camouflage and by "flipping" away. To make an escape, shrimps spread the ends of their tails as wide as they can and then pull them forward using the large muscles in their abdomen. This propels the shrimps backwards quickly. To go forward, shrimps can walk, jump or, less frequently, swim. Shrimps are fastidious animals, scrubbing themselves with tiny grooming brushes.

Phylum *Echinodermata*; (ee-KYE-noh-der-mah-tah);
"echino"= spiny; "dermata"= skin

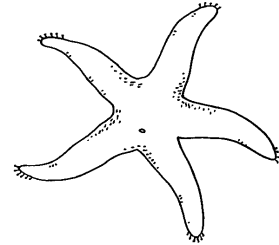
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Sea stars, sea urchins, sea cucumbers and other related spiny-skinned invertebrates share a basic body plan of five identical sections that surround a central mouth. Most echinoderms (ee-KYE-noh-derms) can move and manipulate food by extending or contracting hundreds of tiny, muscle-bound cylinders of water, called tube feet. Sea stars also owe their formidable staying power to these suction-tipped tube feet, which you will have experienced if you have ever tried removing one of these animals from a rock.

Sea Stars

Most sea stars have five arms, but some species, such as the sunflower star, can have up to 26! If sea stars lose any of their arms, they can usually grow a new one. These animals use hundreds of suction-tipped tube feet located on the undersides of each arm to move slowly along the bottom of the ocean. Most sea stars eat by using their tube feet to pry apart the shells of their mussel, clam or snail dinners. Once they have “opened” their prey, they push their stomachs out of their bodies through their mouths. Sea stars digest the soft meat of their prey outside their bodies. They use eyespots located at the tip of each arm to detect how light or dark their surroundings are.



Sea Urchins

Sea urchins are bristling balls of spines. Like porcupines, sea urchins use spines as protection. They use five double rows of tube feet to anchor themselves to the sea bottom, to move slowly, to seize bits of food, and to keep their spines free of debris. They also use five interconnecting teeth on their undersides to graze kelp and other seaweeds. This feeding apparatus is called Aristotle’s lantern.

Sea Cucumbers

Most sea cucumbers are the shape of—yes cucumbers—and some are the consistency of jello. Although some sea cucumbers do have soft spines and hundreds of tube feet, sea cucumbers do not outwardly resemble their close relatives, the sea stars and the sand dollars. The internal organs of sea cucumbers are arranged into five equal parts, in a similar fashion to their relatives. Some sea cucumbers mop up food from the water or the ocean bottom using the sticky feeding trees, or tentacles, around their mouths. Others are filter feeders that sift tiny plants and animals out of the water.

MARINE VERTEBRATES

Fishes

Phylum Chordata (KOR-data); animals with backbones

There are more than 30,000 living species of fishes. They are so diverse that almost anything said about them will have many exceptions. There are three

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basic types of fishes: jawless, bony, and cartilaginous (kar-ti-LAGE-in-us) fishes. Most fishes are either bony or cartilaginous fishes.

Most fishes have six senses: sight, touch, taste, hearing, smell and “lateral line”. Their lateral lines are filled with nerve endings arranged in a horizontal band along their sides. Fishes use their lateral lines to detect vibrations and changes in water movement. Most have scales and they have an outer layer of mucus to protect them from parasites and infection. Most fishes are cold-blooded—they cannot control their body temperatures and remain the same temperature as the water that surrounds them.

Fishes breathe oxygen that they remove from water with their gills. Many fishes also use air in swim bladders, the air sacs in their bodies, to control their buoyancy. Most fishes have fins that they use to propel themselves forwards or backwards, and for steering and braking.

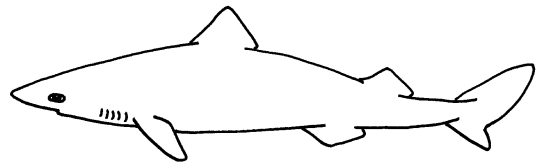
Different fishes have different mouths for eating different things. Some fishes have teeth, other fishes have barbels, or whiskers.

Herring

Herring hunt for prey and baffle predators as they dart about in huge schools. These small, silvery fish group together in search of waters thick with plankton. Herring gain protection from predators through their immense numbers. When a predator approaches a school, it may be overwhelmed by the flashing silver sides of thousands of herring, and be unable to pick out one individual prey. A dense school of herring moving in unison may also discourage a predator by appearing as a single, much bigger creature.

Sharks—(Cartilaginous fishes)

There are close to 375 different species of sharks. Sharks are boneless fishes that have skeletons made of cartilage (KAR-tih-lage), the same type of material that is in the tip of your nose. Unlike other fishes, most sharks cannot pump enough oxygen carrying water over their gills to breathe and must increase the flow of water over them by resting in water with a current or by swimming.



The grey backs and light-coloured undersides of sharks make them hard to see in the open ocean. This helps to make them efficient predators as it is difficult for their prey to see them coming from any angle. But not all sharks are flesh-eating. The huge basking and whale sharks nourish themselves by filtering small plants and animals out of the water, while still other sharks feed on bottom-dwelling animals, such as snails, crabs and shrimps.

The skins of sharks are covered with tiny, sharp scales, called dermal

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denticles, that point mostly toward their tails. If you ever were to rub a shark from tail to nose, it would feel like sandpaper enveloped in a slimy mucous layer. This mucus protects all fishes from parasites and infection.

Three to 15 sets of specialized, enlarged dermal denticles are loosely embedded in shark jaws—these are their teeth. Sharks lose these teeth easily, but new ones continually grow on a conveyor belt-like reserve system. The fearsome jaws of many sharks are large and flexible which allows them to thrust their jaws out to capture prey.

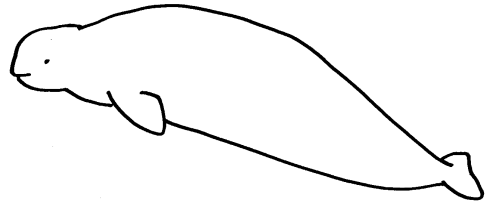
MARINE MAMMALS

Whales, seals, sea lions and humans are mammals. All mammals have five things in common:

1. Breathe air,
2. Are warm blooded,
3. Give live birth to their young,
4. Feed young with milk and,
5. Have hair or fur.

Beluga Whales

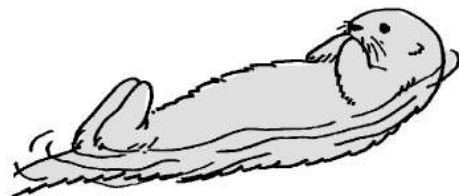
Belugas are grey when they are young and become paler as they grow older. Their mature white bodies blend well with the snow and floating ice in the Arctic, where most Belugas live. This is excellent camouflage! Belugas do not have dorsal fins, but do have hard dorsal ridges which they use to crack open ice up to 7.5 cm thick. As much as 40 percent of their body weight is blubber, so they can keep warm in icy waters. All this blubber, however, does not make them fast swimmers. They are fast enough to catch some schooling fishes to eat, but also feed on slower animals that live on the bottom of the ocean. They have jointed necks that enable them to pick up the mud that they sift through for food.



Sea Otters

Sea otters live in the cold waters of the North Pacific Ocean, ranging from Japan to California. Unlike other marine mammals, sea otters do not have a thick layer of blubber to keep them warm. Instead, they consume great quantities of food—up to one quarter of their body weights each day, or approximately 11 kilograms. Sea otters recline on their backs at the water's surface often enveloped in blades of the kelp forest, frequently employing tools to hammer and pry open abalones, sea urchins, crabs and clams.

Sea otters also use their baggy fur coats to keep warm. They grow the densest fur of any animal on earth. Their constant grooming ensures that a layer of



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insulating air becomes trapped in their coats and that their fur remains clean enough to insulate them from the chilly waters they live in.

Harbour Seals

These rounded, doe-eyed seals are called Harbour seals because they live in shallow "harbour" waters near beaches, sandbars, rocks or other flat land areas. They prefer these flat places because they cannot move easily on land. Seals come on shore to rest and to give birth. In the water, Harbour seals dart about gracefully using their hind flippers for power and their front ones to steer. They eat fishes, shrimps, and other invertebrates.

Steller Sea Lions

Steller sea lions are huge, eared seals. Males grow to be the size of two record-sized grizzly bears! They have very powerful front flippers that they use for propulsion. Steller sea lions hunt fishes, squids, octopuses, and some eat seals. They are much more comfortable on land than harbour seals, and come ashore to rest, lounge in the sun, and to breed.

Pacific White-sided Dolphins

Pacific white-sided dolphins travel in schools of between 2 and over 1000 individuals. They are the most active and playful cetacean in northeast Pacific waters. They are among the fastest dolphin species and can reach up to 40 kilometers per hour. They hunt for squid, herring, sardines, anchovies, salmon, cod and hake and swallow their food whole. They use echolocation to find their way around and to catch their food. Killer whale and sharks are predators of dolphins.