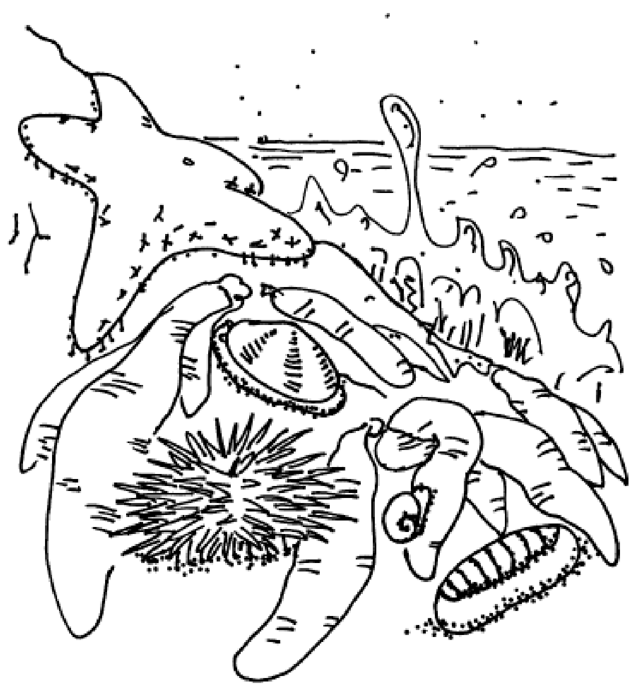
Spring Beach Walks
Background Information

DIVING DEEPER

The animals you and your students will encounter during your Vancouver Aquarium's School Program are introduced to you in this section of the Spring Beach Walks Educator's Guide.

The Intertidal Habitat
Only hardy plants and animals can live in the harsh habitats between the high and low tides of the sea, called the intertidal zone. Rapid changes in exposure from air to water make the intertidal zone an extremely challenging environment for animals to survive in. Changing tidal levels create distinct zones of life, often resulting in horizontal bands along many seashores. The animals and plants living in these intertidal habitats settle themselves in specific layers along the shore depending on their tolerance to the sun, air and water.

Despite the challenges of the intertidal zone, a riotous profusion of life thrives and fills the many niches created by the widely varying conditions. The physical rigors of the intertidal region combined with abundant and varied forms of life, result in intense and dynamic competition for resources and space.



Shoreline space is at a premium and competition for it is intense. All shores are extremely rich habitats with every square centimetre of rock, sand and crevice occupied by some form of life. Plants and animals frequently grow on top of each other, sometimes several layers deep, when it is impossible to spread out horizontally.

The behaviours, diets, and deaths of seashore animals are closely interconnected. Algae capture light from the sun and nutrients from the salt water, providing food for snails, sea urchins, and other plant eaters.
Sea stars, sea anemones, small fishes and other predators eat these plant eaters. Scavengers, such as shrimps and crabs, eat live and dead plant and animal matter. Barnacles, mussels and other filter feeders sift tiny animals and plants, called plankton, out of the water for their dinners. Algae recolonize areas where plant eaters have bared surfaces, and the intricate cycle of growing, grazing, and predating continues.

Spring Beach Walks
Background Information

The uppermost zone of the seashore is the spray zone, also called the supra-littoral zone. This transition area between the influence of land and sea is exposed to air, but regularly receives the ocean's spray. This zone appears almost barren when compared to the profusion of life that thrives in the lower zones of the seashore. The animals and plants of the spray zone are almost terrestrial and some cannot survive extended submersion in seawater.

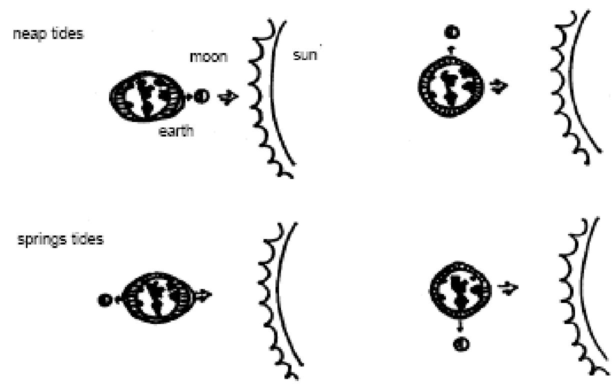
The intertidal zone lies between the high- and low tide marks on the seashore. A large and diverse assemblage of animals and plants has evolved to fill many intertidal niches caused by the widely varying conditions in this zone. This abundance and diversity, as well as the physical rigors of this zone, make it a region of intense and dynamic competition for resources and space.

Within the intertidal zone at low tide, light and temperature levels may exceed or fall below those of the sea. A heavy rainfall can lower the salinity of any nearby saltwater pools forcing animals living there to adjust their body chemistries. Herons, gulls, and other air-based and land predators can access exposed seashore inhabitants. Particular tidal sequences may result in levels low enough to separate organisms from the sea for many days leaving "water-breathing" animals high and dry.

Waves generated by violent storms can carry pebbles, rocks and other missiles as the tides rise and fall. Seaweeds and creatures must be very tough to survive the constant changes in their habitats. At high tide, the opposite occurs—the amount of light decreases and predators are now primarily marine.

The lowest zone, the subtidal zone, is located below the low-tide line. It is a more stable zone where conditions change little on a daily basis. Wave-action effects are minimal, temperatures change only seasonally, and associations and interactions among animals are more permanently established. The animals and plants that live here do not need to invest as much energy into surviving physical stresses. Instead biological competition and predation are the main difficulties to be overcome by subtidal creatures.

The tides that cause these zones generally rise and fall twice each day and follow the lunar cycle. Tidal movements are caused by the gravitational pull of the moon and to a lesser extent, the sun. These two interplanetary bodies pull our planet's water toward them, creating oceanic bulges on the Earth's surface. When the sun and moon are pulling in the same direction, the sun behind the moon, their pull is the greatest, and the tidal fluctuations most extreme.



Rocky Shores

Dense forests, damp fogs and waves foaming on jagged rocks form a scene characteristic of our B.C. coast. It is on these wave-beaten rocky shores that the greatest abundance and largest variety of seashore creatures live.

A rocky shore is crowded with plants and animals competing for food, light, shelter and the little space available. Occupying every nook and cranny, organisms can be found inhabiting many different "homes." They live on or under rocks, in crevices, in tidepools, under protective curtains of seaweeds, in the anchors of algae or even apartment-style, on top of one another! To survive the rigors of a seashore existence, rocky shore creatures show some complex and fascinating adaptations.

Within the intertidal zone, more than seven sub-zones may exist. Each sub-zone is comprised of a different community of plants and animals.

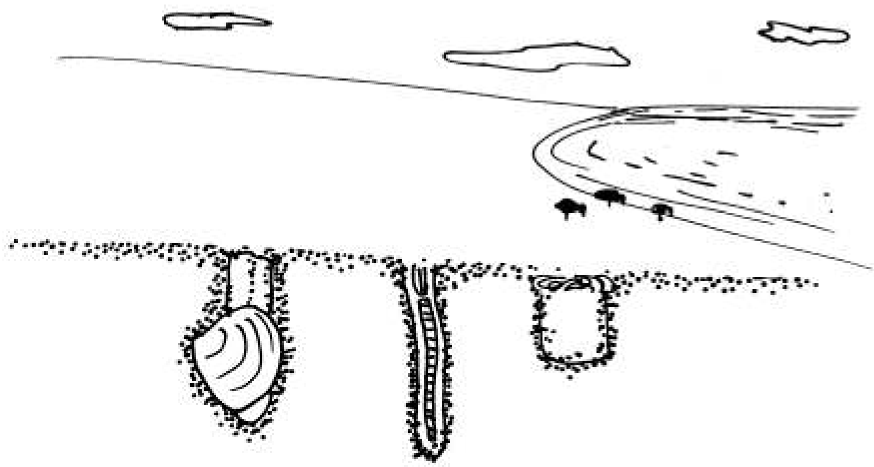
Spring Beach Walks
Background Information

The physical location of each of these subzones is determined by a fascinating interplay of biological interactions and physiological tolerances. In general, the upper limits of the plants and animals of each sub-zone are determined by physical factors while the lower limits are set by biological factors such as competition and predation.

Sandy Shores
Sandy shores are unstable, in continual motion and reshaped by every wave. The ever-shifting substrate and harsh conditions of the outer coast make survival impossible for all but a few hardy animals—the flora and fauna of unprotected sandy shores appear extremely sparse when compared to the richness of the rocky shores.

Conversely, in the quiet, sheltered waters of sand and mud flats, a utopia exists for many organisms. The sand-mud mixture is rich in food, wave action is minimal and the substrate is usually still. At first glance these shores may appear empty of life, but just below their bare surfaces many well-adapted creatures thrive.

The zonation typical of rocky shores does not exist as clearly on sandy areas. Generally, however, the upper reaches of sandy shores are poorly inhabited as the dry, loose, continually shifting sand is not well tolerated by plants and animals. The damp lower regions support more bountiful arrays of life.



Spring Beach Walks
Background Information

ANIMAL NAMES AND SCIENTIFIC CLASSIFICATION

Your class will be introduced to the scientific classification system during their Intertidal Marine Biology School Program. A Swedish scientist named Carolus Linnaeus created this scientific system for naming living organisms in the 1700s. Linnaeus named plants and animals in a way that made it possible to identify each species and to document their relationships to each other.

Each organism has only one scientific name, although it may have many common names. Scientific names are usually formed through a combination of Greek or Latin root words. These names frequently refer to the organism's most obvious characteristics, the geographic area where it naturally lives, or the scientist who first described or discovered it. The scientific names of organisms often reveal them.

In a similar way to how surnames describe the family relationships of people, the kingdom, phylum, class, order, family and genus divisions tell us even more about the relationships among the innumerable forms of life. These inter-relationships are measured in terms of the structure and function of the anatomy of the organisms.

Kingdoms are the most general divisions and separate life into five basic groups: bacteria, protista, plants, fungi and animals. Kingdoms are broken into phyla. Animals within each phylum can be very different in size, appearance and habitat, but all share some common features. Each phylum, in turn, is divided into one or more classes, the classes into orders, orders into families, families into genera, and the genera into species. Each division describes the increasing number of characteristics that the organisms within them share.

The order of these groupings can be remembered with the simple mnemonic:
King Philip Came Over For Ginger Snaps

An example of how this classification works is given for the purple shore crab:

Kingdom Animalia
Phylum Arthropoda
Class Malacostraca
Order Decapoda
Family Grapsidae
Genus *Hemigrapsus*
Species *nudus*

A very closely related species, the green shore crab, *Hemigrapsus oregonensis,* shares the same Kingdom, Phylum, Class, Order, Family and Genus with the purple shore crab, *Hemigrapsus nudus*. Only the species name, *oregonensis,* is different. These two species are very similar with the exception of colour, the presence of a few "hairs" on the legs of one species and their habitats. Their scientific names reflect their similarities and differences.

A flatworm, with its completely different body structure, belongs to a different phylum, the Platyhelminthes. A cedar tree, a plant that generates its energy from light, oxygen and water, and has a basic cellular structure which differs from animals, belongs in an entirely different kingdom, the Plantae.

MARINE INVETEBRATES

PHYLUM PORIFERA (POUR-if-er-ah); "por" = pore; "fer" = bearing

More than 5,000 species of these simple, colonial animals exist worldwide. They range in shape from small nodules to lumpy carpetlike forms and massive, vaselike structures. Despite a wide variety of appearances, all sponges are based on essentially the same basic body plan—a vaselike structure that is attached at the bottom to rocks, shells or the sea bottom.

Sponges are composed of several kinds of cells, but do not have true tissues. These animals lack muscles, nerves, sensory cells, and even a mouth. They do have specialized cells, including collar cells, that beat their whiplike tails to create a current which draws water into the many small pores that puncture their body walls. The water entry points are called ostia (aw-STEE-ah, plural; ostium: aw-STEE-um, singular). Sponges filter the newly entered sea water to remove oxygen and microscopic organisms, called plankton. The water then flows out of the animals through a large craterlike hole, or series of holes, called the oscula (aus-KEW-lah, plural; osculum: aus-KEW-lum, singular).

Some sponges use spicules, small skeletal elements imbedded in their body walls, to make their bodies spiny and hard. These elements are made of protein, calcium carbonate or silica. Spicules make sponges less inviting to most predators, but some sea slugs and sea snails persevere and eat them anyway.

Sponges
The species of sponges we use in bathtubs do not grow in the coastal waters off B.C.—and, of course, neon-coloured plastic sponges are mimics of the real ones.

In the Northeast Pacific seas, sponges are often brightly coloured mats of greens, purples, golds, reds and grays. These irregularly shaped animals grow on hard surfaces and feel like velvet or rubber to the gentle touch. They can reach thicknesses of two centimetres. Other sponges, called boring sponges, grow on the shells of many molluscs. They use chemicals to dissolve the shell and cause it to disintegrate.

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.

Cnidarians have two basic body types: a free-swimming medusa, well known as the jellyfish, and a stationary polyp (PAUL-up) of which sea anemones are large examples. Some species have both medusa and polyp forms as part of their life cycles. Many others are either polypoid or medusoid.

Cnidarians are essentially hollow bags with a central mouth. Both medusa and polyps have radially symmetrical bodies—that is, their bodies are formed in a circle around a central point. The central cavity acts as both mouth and anus. A fringe of tentacles laced with sticky, stinging cells, called cnidocytes (nye-DOH-sites), surrounds this opening.

The stinging cells shoot minute harpoonlike devices at whatever touches the animal—even your finger. In virtually all local species, potential prey or predators can be immobilized as these tiny stinging harpoon mechanisms can wrap themselves around small organisms, penetrate thin coverings (not your skin), inject venoms, or perform combinations of all three of these feats. The tentacles may then manoeuvre appropriately-sized prey into the mouth. Waste material is "spat" out through the mouth/anus.

Class Hydrozoa
Hydroids
Most types of fernlike hydroids attach themselves to rocks, kelps, wharf pilings, shells, or virtually any hard object. The stalks of colonial species can grow to 15-centimetres tall, but many are smaller. These primitive animals are capped with bell-shaped polyps. Each individual animal is joined to the rest of the colony and shares a common digestive system.

Individual members of the hydroid colony, called polyps, are usually specialized for different functions. Feeding polyps gather food and defensive polyps sting. Like all their cnidarian relatives, hydroids have stinging cells that they launch at predators to defend themselves or to immobilize their prey. The miniature harpoonlike stinging cells explode upon contact with tiny organisms floating in the water, called plankton. The hydroids' tiny tentacles then guide the paralyzed prey into their mouths.

Another specialized type of polyp is responsible for reproduction. These polyps break off to produce free-swimming medusas which resemble tiny jellyfishes, although not all hydroid species have a medusoid stage. These medusas reproduce sexually, shedding eggs or sperm into the water. Fertilized eggs develop into mobile larvae which later settle on solid ground and grow into a new sessile generation of hydroids. This process is known as alternation of generations or metagenesis.

Class Scyphozoa
True Jellyfishes

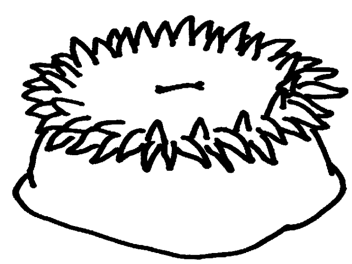
Jellyfishes are composed largely of a gelatinous substance, called the mesoglea, or more commonly "jelly"—hence the name "jellyfish". Jellyfishes often resemble upside-down, transparent bowls with tentacles extending from their rims. Their many tentacles host stinging cells that are used to capture planktonic prey, small crustaceans and fishes, and as a defense against predators. In B.C., the giant red jellyfish can give you a severe and nasty rash, so it is best to leave them alone when you are swimming or see them washed up on the beach.

Jellyfishes swim by contracting their bells in mesmerizing, pulsating movements. They are not strong swimmers and drift horizontally with waves and currents, sometimes accumulating in immense numbers in quiet bays and estuaries. Many jellyfishes can propel themselves vertically to the surface during cloudy weather or at dusk.

The sex organs, or gonads, are often horseshoe-shaped and visible through the clear bells, or mesogleas, of many jellyfishes. Most species of jellyfishes are dioecious—that is, sexes are separate and individual medusas are either male or female. Eggs and sperm are released by females and males respectively into the open ocean. Fertilized eggs settle and develop into tiny polyps that resemble hydroids. Eventually many young medusas budd off and grow into mature jellyfishes, and the cycle continues.

Class Anthozoa
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.



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 stingin 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 pre y.

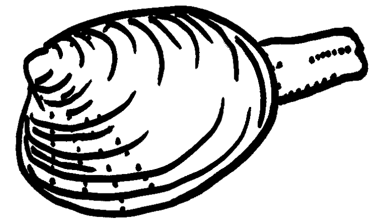
Class Gastrapoda
Sea Snails
Sea snails make the shells that they carry on their backs and use them as mobile homes. They use their single, large foot to move slowly and for holding onto the ocean bottom. Most snails can pull their foot into their shells and firmly seal the "door" shut with the operculum (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.

Nudibranchs
Nudibranchs are snails that have lost their shells. These marine slugs have a pair of sensory tentacles, called rhinopores, in the head region. Some species are very well camouflaged and blend with the browns, blacks and greens of their habitats. Other nudibranchs are bright, flamboyant and frilly and employ their loud colours to warn potential predators to stay away. Many species contain body toxins or carry an arsenal of undischarged stinging cells that are stored in projections, called ceratae, along their backs. These stinging cells are acquired when eating cnidarians. Few animals eat adult nudibranchs. The diet of nudibranchs, however, includes sponges and various cnidarians.

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.

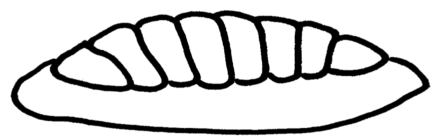
Clams



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 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.

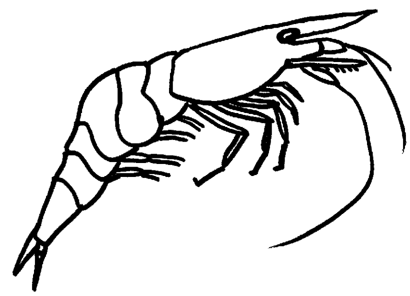


Spring Beach Walks
Background Information

PHYLUM ARTHROPODA (arth-ROE-poe-dah); "arthro"=jointed; "poda"=foot

Jointed legs define the arthropods, and the phylum derives its name from this feature (arthro=joint and pod=leg). These appendages have been adapted to a myriad of functions including moving, sensing, feeding, defense and offense.

Each segment of the bodies of primitive arthropods bears a pair of appendages, indicating a probable relationship to the annelids. The number of segments and, consequently, the number of appendages, have tended to decrease in more complex arthropods, such as crabs and shrimps.



Arthropods also possess an external skeleton made of chitin (KYE-tin). In many marine arthropods, this chitinous exoskeleton is reinforced with calcium carbonate. These animals must moult their exoskeletons and develop larger ones as they grow. In most species moulting continues throughout the life of the individual at varying intervals depending on the age of the animal and the availability of food. In some cases moulting may occur seasonally.

Prior to the shedding of the old exoskeleton there is an increase in food storage and blood calcium. A new, soft skeleton is created underneath the old one, and the body tissues swell with water. The old exoskeleton eventually splits and the vulnerable creatures struggle free. The newly formed, soft skeleton offers little protection. The animal continues to swell with water, stretching the new covering before it hardens. Once the shell hardens, the creature "grows" into its new shell by adding tissue. In times of famine, many arthropods can actually shrink during a moult.

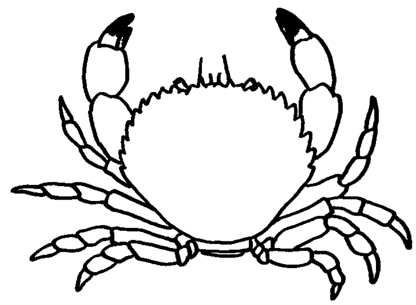
The major marine component of the Arthropoda is the class Crustacea. Crustaceans are distinguished from insects by the presence of two pairs of antennae as compared to the insects' single pair. The crustacean body is divided into a head, thorax and abdomen. The head bears the antennae, antennules, mouth parts, (mandibles, maxillae, maxillipeds) and the eyes. The thorax, like the head, is also covered by a hard carapace. Often the head and thorax are fused into a single unit—the cephalothorax as in the shrimps and crabs.

There are over 32,000 known crustacean species which occupy most marine habitats, much as the insects do on land. And, much like insects, they are extremely important to the ecosystems they inhabit. The developing larvae of the bottom-dwelling forms and many adult species of crustaceans are very small and are a major component of the zooplankton. These tiny animals form a vital base for the entire marine food web.

vancouver aquarium

Spring Beach Walks
Background Information

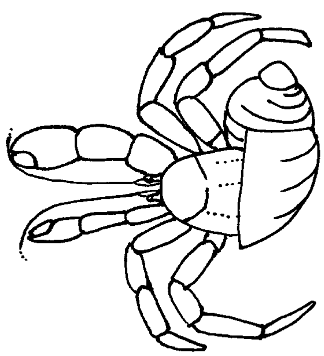
Crabs



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.

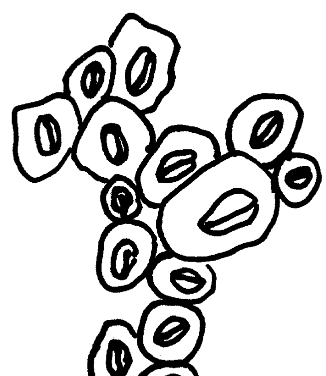
When the crabs' hard shells become too small and tight for them, they develop a soft, new covering underneath the old shells. The smaller, older shells split along the back and the crabs reverse out of them. They are very vulnerable to predators during this process and usually hide while their newly 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.

PHYLUM ENCHINODERMATA (ee-KYE-noh-der-mah-tah);
"echino"= spiny; "dermata"= skin

Echinoderms are exclusively marine and adapted to a bottom dwelling existence. The phylum name Echinodermata means "spiny skinned" and is derived from their characteristic spines, called ossicles. Ossicles are made up of hard calcareous bits embedded in their skins. Like us, echinoderms possess an internal skeleton. Their skeleton, however, is composed of interlocking calcite plates. Although many living echinoderms feel shell-like, the outside layer consists of delicate skin, muscles and various other organs.

The typical adult echinoderm body consists of five similar sections repeating around a central point. This is called pentaradial symmetry. This five-rayed symmetry, most readily seen in sea stars, is a secondary development. Their early bilaterally symmetric larval development before metamorphosis is very similar to that of the chordates.

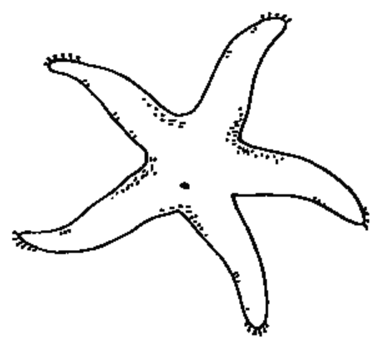
Most echinoderms move by using their tube feet which are long flexible appendages usually tipped with a suction cup. These are part of a water vascular system, consisting of interconnecting fluid-filled hydraulic canals. Tube feet also function in respiration, sensing and food gathering.

Many echinoderms also have pedicellaria (pincers). Depending on the species, these tiny two to five fingered grasping appendages can function in food gathering, cleaning and defense against parasites, large predators or the settling planktonic larvae of barnacles and others.

Echinoderm sexes are generally separate. The fertilization and development of their young are usually external.

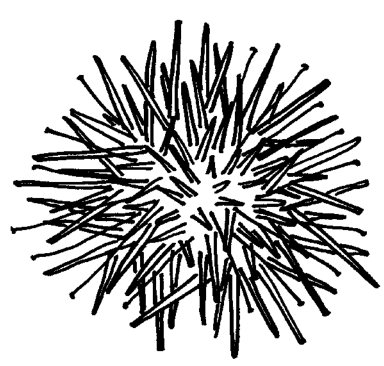
Class Asteroidea
Sea Stars

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.



Class Echinoidea
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.

Class Holothuroidea
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.

PHYLUM CHORDATA

The Phylum Chordata spans life forms from the bloblike sea squirts to fishes, whales, seals, sea otters and humans. These animals have three features in common at some stage in their life cycles: gill slits, a spinal cord, and a supporting notochord, or type of backbone. In vertebrates, notochords develop during the embryonic stages and evolve into a full spinal column. In the sea squirts, the notochord disappears as they assume their adult shapes.

Not all of the species in this phylum are vertebrates—animals with backbones. Some animals come close to having a backbone, but do not quite make it—vertebrates comprise only one of the three chordate subphyla, the Vertebrata. Vertebrates have a notochord during the larval or embryonic state. This then develops into a full spinal column.

In the urochordates (sea squirts), the notochord is present only in the larva and it disappears as the animal develops into an adult. In the cephalochordates (lancelets), the notochord retains throughout the life of the animal.

Class Ascidiacea
Sea Squirts
Sea squirts can be solitary or live in complex colonies. Immature, tadpole like sea squirts possess a nerve cord, a notochord and gill slits— all the hallmarks of the Phylum Chordata.

Spring Beach Walks
Background Information

After their short larval lives, the tiny larva settle down on the sea bottom using their adhesive organs to attach themselves to rocks and other hard surfaces. They then reabsorb their tails, notochords and nerve cords and rearrange their internal organs—the sea squirt changes from a freeswimming tadpole like organism into a bloblike creature encased in a leathery sac, called a tunic.

Water flows into the taller of sea squirts' two siphons or "holes". Tiny plankton is filtered from the circulating water via a fine, netlike sac inside the animal before it is expelled from the "shorter" opening.

PHYLUM PLATYHELMINTHES

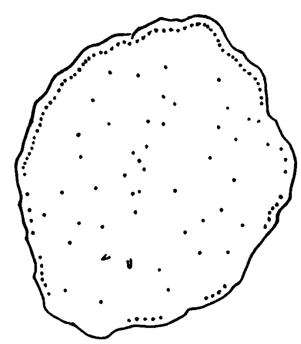
Commonly called flatworms, members of the Phylum Playhelminthes are unsegmented and have no appendages. They are the type of animals that are bilaterally symmetrical—their modest organ system is arranged in two equal parts along a central line.

The flukes and tapeworms comprise two very specialized classes of flatworms which are entirely parasitic. The third class contains the turbellarians which are primarily free-living marine animals. Most flatworms have two, four or six eyes that merely detect light, which they tend to avoid.

Flatworms

Most flatworms are bottom dwellers, living in the sand or in mud under rocks and algae. Microscopic species live among sand grains on the beach. These minute marine worms glide along a mucous trail propelled by undulating muscular contractions or by hairlike cilia located on their undersides.

Unlike the cnidarians, flatworms do not have a separate oral and anal opening—food and waste both enter and exit through the same orifice. These worms feed on small invertebrates and dead animal matter. Small food is swallowed whole through the pharynx—an extendible tube ending with the mouth—and digested in the gut. When flatworms feed on larger corpses, some digestive enzymes are released through the pharynx to break down the food. The resulting mix is then swallowed and the digestion is completed in the gut.



Flatworms reproduce both sexually and asexually. Sexual reproduction starts with two animals fertilizing each other—each animal is hermaphroditic and carries both male and female sex organs. Their fertilized eggs are then released into the ocean. To reproduce asexually, flatworms split in two. Their front and back halves form new worms.

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PHYLUM NEMERTEA

Nemerteans are elongated worms with flattened bodies and spatula-like heads. They are commonly called ribbon worms because of their shape. Most of these worms are marine, but a few species do inhabit fresh water and still others colonize terrestrial habitats. Although nemerteans have no appendages and no segments, they are structurally more complex than flatworms and as a consequence are able to grow larger.

Ribbon worms have a closed circulatory system and tubular alimentary canal, a passage through the body from mouth to anus in which food is received, digested and waste is excreted. Nemerteans also have light-detecting eye spots on the underside of their heads, near their slitlike mouths.

Nemerteans have a unique proboscis, which has lead to another of their common names, proboscis worms. Their proboscises are long, tonguelike organs that shoot out of their bodies from a sac near their mouths. When discharged, the proboscises evert themselves and can extend far beyond their bodies. They use their proboscises to defend themselves, burrow, and to capture prey. These missile-organs are not harmful to people.

Ribbon Worms

Ribbon worms dwell in the mud and sand, under rocks, on algae, or in mussel beds. They are usually most active at night and glide along surfaces on a coating of slime that they produce as they move.

Their prey includes annelid worms, small molluscs, crustaceans and even small fishes. Waiting until their prey approaches, ribbon worms shoot out an extendible proboscis and sink a venomous spike, called the stylet, into their quarry. They will occasionally attack, kill and swallow prey much larger than themselves. When searching for food, a 20-centimetre-long worm may stretch out to more than one metre in length. If food is limited, ribbon worms can stave off starvation by shrinking.

Ribbon worms are very delicate and easily fall apart when handled, so be extremely gentle if you must handle them. If the head breaks off with a section of the foregut, that part of the worm can usually regenerate the lost portion.

PHYLUM ANNELIDA

Although most marine worms belong to the Phylum Annelida, terrestrial earthworms are probably more familiar to most people. Another well-known class of true segmented worms is the leeches.

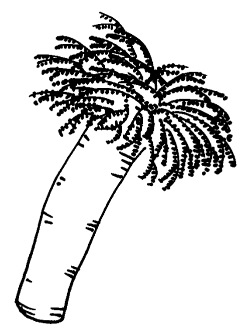
Marine or terrestrial, annelids are distinguished from other kinds of worms by the rings around the trunks of their bodies. Each ring delineates a separate segment. Their bodies begin with a head that contains a primitive brain, and end with a terminal segment that possesses an anus. Between the two, each of many segments contains an identical set of blood vessels, lateral nerves, and reproductive and excretory organs. As the worm grows, it adds new segments to the middle—the oldest segments are located closer to their heads. In many species, the heads are frequently highly specialized with feathery food collectors, eyes, sensory tentacles and sharp, hard jaws.

To move, worms contract their body segments in sequence, creating waves of muscular contractions. The small, paired bristles that protrude from each segment of the dominant marine worms improve their grip as they inch themselves forward.

Clam Worms

Clam worms may or may not live in mucous-lined burrows in the sand, but all can quickly plow their ways through sand or crawl through spaces in mussel beds. These worms move using their legs, called parapodia (par-ah-PODE-ee-ah). The parapodia are attached to bristles that project in pairs from each segment of their bodies, which can grow as long as one metre. Clam worms are scavengers and carnivores that seize their prey, including crustaceans and molluscs, with their sharp, formidable jaws.

Tube Worms



The featherlike tentacles that protrude from the top of the tubes of the tube worms are used to breathe and to filter planktonic food from water.

These worms secrete the tubes they live in. When threatened, tube worms withdraw their tentacular crowns into their tube homes for protection. A few species may seal the top of the tube with a trapdoorlike operculum.

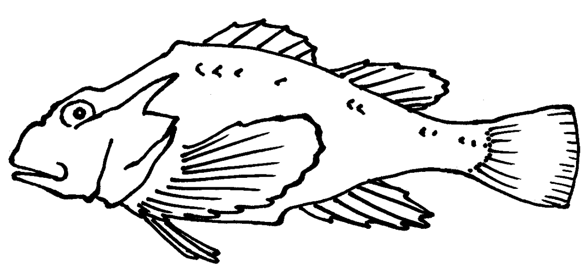
MARINE VERTEBRATES

Fish

Intertidal fish species are found in tidal pools or in small pools under rocks.

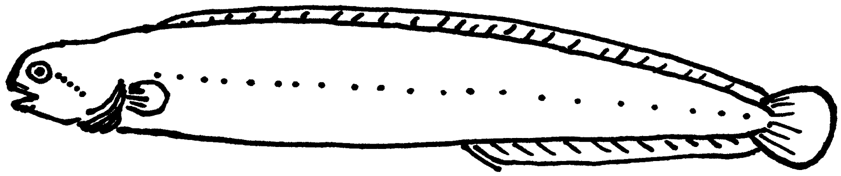
Tidepool Sculpin

These fish are often difficult to see at first glance because of their excellent camouflage. The Tidepool sculpin is very tolerant of high temperatures and low salinities and therefore makes this species one of the most common sculpins found in the intertidal zone.



Spring Beach Walks
Background Information

Gunnels
A very small family of fishes that look like eels on first sight, the gunnels contain about 13 different species which inhabit exclusively shallow marine or intertidal environs. Gunnels tend to be brightly coloured and frequent bottom habitats where they find secure shelter, such as rock outcrops or crevices, plant life or pilings.



Birds
There is a wide diversity of bird life that inhabits the intertidal shoreline. Characteristics to look for are the type of beak, type of legs, and whether they frequent the water of land more.

Glaucous-winged Gull
This scavenger is more commonly known as a sea gull and are often seen breaking clams open or attempting to eat sea stars.

Great Blue Heron
These long legged elegant birds are common throughout Stanley Park and are often seen wading in shallow waters of off the shoreline.

Canada Goose
These geese have a black head and neck, with a white saddle under their cheek. The body is grey in colour.

Double Crested Cormorant
These black beauties can be recognized by their curvy neck and may be seen with their wings spread in the sun to dry. The cormorant is a bird that looks quiet awkward out of water.

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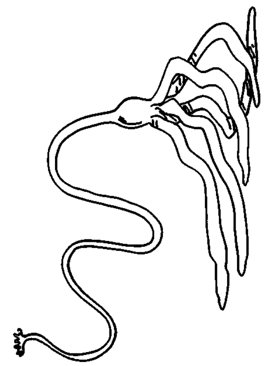
MARINE ALGAE



Algae (Sea Weed)

Algae are divided into three phyla:

1. Heterokontophyta (brown seaweed)
2. Cholorphyta (green seaweed)
3. Rhodophyta (red seaweed)

The brown algae include the giant kelps, which form large underwater forests. The dominant pigments for photosynthesis determine the colour and they range in shades from brown to olive green.

The green algae include many intertidal species, including rock weed and sea lettuce. This phylum is the most closely related to the flowering land plants. Species range in colour from bright to dark, olive green.

The red algae are definitely always red! They come in shades ranging from red to brown to even green. A good way to identify red algae is the highly scientific "boingy-boigny" test. Red algae often have elastic properties. Other red algae have incorporated calcium carbonate into their structures, and take on a stiff, crusty form as a result. These types of algae are called corrallines.