FOR SEA photo CD
Script #2

Animals of the Rocky Shore

8-91The rocky intertidal zone is one of the most densely populated marine habitats.

8-86The waves crashing onto the rocks sweep away sediments and carve many nooks and crannies that serve as living space for everything

7-78 from tiny barnacles to giant sunflower sea stars.

7-63These animals all have unique stories about how they survive the pounding waves, protect themselves, and search for food.

8-21High up on the rocks, exposed for hours at low tide, live barnacles. The barnacle begins its life as a planktonic animal, drifting in the water currents. This larval barnacle is covered by an exoskeleton, but does not yet have the hard calcium carbonate shell that it will have as an adult. Once it is close to being fully mature, the barnacle begins to hunt for a hard surface to which it can attach.

8-62 It needs a surface near other barnacles and yet not too crowded. Once it finds an appropriate space, it stands on its head, secretes a glue through an antennae and effectively cements it head to the rock. It will live in this spot the rest of its life.

8-19Once barnacles have attached to the rocks, they secrete calcium carbonate. The calcium carbonate hardens into shell plates. The barnacle encircles its body with shell plates and then creates plates that function as doors at the top of its new shell house.

8-17When a predator threatens or the tide is low, the barnacle pulls in some saltwater, shuts its shell plate doors and waits for the predator to leave or for good conditions to return.

8-22A few predators can crack the barnacle's defenses, however. The snail can drill through a barnacle shell if the barnacle is small enough. Sea stars can pull the doors open. Many barnacles avoid these predators simply by living very high on the rocks. Most snails and sea stars cannot survive this high on the rocks where the tide can be out for hours.

8-18To obtain its own food, the barnacle opens the shell plates that seal its shell home and extends feathery legs into the water. These fan back and forth, functioning much like a fisherman's net, trapping tiny animal plankton floating in the water. When its net is full, the barnace pulls its legs in and passes the captured food to the mouth hidden inside the shell.

8-44Tube worms, like barnacles, use feathery appendages to capture plankton. The worm lives safely nestled in its sturdy tube house.

7-49 When it is hungry, it extends a feathery plume covered with tiny hairs.

7-48When plankton drift into the plume, the hairs grab on and pass the plankton from one hair to another until the plankton reaches the worm's mouth inside the tube.

7-50Burrowing sea cucumbers extend their tentacles from their hiding place under rocks and in crevices. These bright orange tentacles wait for plankton to come near.

7-51When the sea cucumber catches some food, it pulls one tentacle into its mouth at a time, licking off any food sticking to the tentacles.

8-97Sea anemones also create a net to capture plankton, but, instead of feathery legs, they use stinging tentacles.

7-9The tentacles are packed with very tiny cells, each containing a coiled thread. Each coiled thread is tipped with poison or a dart or a tiny lasso.

7-5When plankton, shrimp, fish or other unwary animals bump into the anemone, the coiled threads erupt out of the cells.

8-54They either fire poison into the prey, or prick the animal's skin, or wrap around the prey, holding it tight.

8-55Once the stinging tentacles catch food, they pass the meal to the mouth in the center. The anemone swallows its food whole, digests all the meat and spits back out any left over bones or shells.

7-13If an anemone doesn't capture food for some time, it simply shrinks. When food resources are plentiful again it eats well and grows. That's why it's impossible to tell an anemone's age by its size.

7-8Giant green sea anemones have an additional source of nutrition. They carry in their tissues a microscopic algae called *Zooxanthellae* (zo-zan-thell-e).

7-14The algae give the anemones their green color.

7-12In fact, if a giant green sea anemone lives in a cave where there is no sunlight, its algae will die and the anemone will be white.

7-11The algae capture sunlight energy and use it to photosynthesize their own food. They combine water and carbon dioxide to make sugar. This sugar feeds both the algae and provides some nourishment for the sea anemone. The algae gets a place to live, protected by the anemone's stinging cells, and can use the carbon dioxide the sea anemone produces as a waste product to make new sugar.

8-53Most sea anemones live low enough on the beach that they are rarely exposed at low tide.

8-59Some species, however, do spend some time exposed to air.

7-6Some pull in their tentacles and hide beneath a protective covering of pebbles and shell fragments until the tide returns.

7-7The same stinging tentacles that anemones use to capture food also help protect the anemone.

8-84Only a few creatures, some nudibranchs and sea stars, can digest the stinging cells without harm.

7-1Some sea anemones even use their stinging cells to protect their living space from other anemones. Pink tipped anemones grow in colonies that are essentially many anemones cloned from an original anemone. One animal reproduces by stretching into an oblong shape and then pinching off its cell walls until it has formed two individuals.

7-2If two of these colonies expand enough to meet each other, the anemones on the leading edge give warning to the encroaching colony by firing their stingers upon contact with the invaders.

7-4Typically, the two colonies stop expanding towards each other and maintain a bare strip of rock between them that serves as a border.

Most rocky shore animals do not carry such an effective arsenal of stinging cells.

8-100Some protect themselves with shells instead of weapons and, to eat, bring the sea water, rich with food, into their bodies instead of reaching out and capturing it.

8-3Mussels and scallops, for example, open their shells and begin siphoning in water.

8-8The water passes across their gills. The gills are covered by tiny hairs which absorb oxygen and sort out plankton and send it to the animal's stomach. Any particles the mussel or scallop doesn't want and any waste products are squirted back out of the shell in the outgoing flow of water.

8-1The mussel, like the barnacle, creates a glue to attach itself to rocks, but it secretes its cement down a groove in its foot. The mussel extends its foot out of its shell probing the nearby area for a place to attach. Then it sends the glue down the thin groove along its foot. As this glue is exposed to the seawater, it hardens into a tough thread. The mussel then moves its foot and sends out more glue.

8-2Soon it is firmly attached to the rocks by a clump of threads called byssal threads. The threads are strong enough to bend and stretch some in the waves without breaking.

8-8The scallop can cement itself to rocks as well, but, when seriously threatened by a sea star or some other predator, the scallop can loosen itself and swim away by clapping its shells together.

8-14Snails, like mussels and scallops, are protected by shell, but they grow theirs in a spiral shape.

8-9The limpet carries a volcano shaped shell on its back.

8-5 And the chiton protects its soft body with eight shell plates.

8-12All three of these animals crawl on a strong muscular foot.

8-10When the animal is moving, waves of contractions move along the foot, pushing against the rock and propelling the animal forward.

8-4A special slime coats the foot and allows the animal to glide as it moves. When the animal needs to clamp down, however, the foot creates suction against the rock and the slime becomes sticky under the pressure of the foot. It is extremely difficult for waves, predators or beach combers to pry loose one of these animals.

8-16When threatened, the snail can pull its muscular foot inside the shell and close a trap door on the opening to its shell. This trap door, also known as an operculum, is made of chitin, a substance very much like our fingernails.

8-64Limpets clamp down tightly on the rocks when they are threatened or when the tide goes out.

8-7When a chiton is firmly attached to rocks, a predator will encounter the shell plates instead of the fleshy foot underneath.

8-67If the chiton is attacked when it is not stuck to a rock, it curls up in a ball, like a pill bug, protecting its foot.

8-71When these animals are hungry, they crawl along the rocks. Snails and limpets extend a pair of sensory tentacles that can detect their favorite foods.

8-69Limpets, chitons and some snails prefer algae and use a special tongue, called a radula, to scrape algae off the rocks. This radula is covered with tiny teeth made of calcium-carbonate (shell material) or minerals such as opal.

8-66The giant gumboot chiton, the largest chiton in the world, has a radula with iron teeth. (Notice that its shell plates are covered by a velvety skin.)

8-13Many types of snails use their radula to drill a hole through the shell of another marine animal and then scrape out the meat inside.

8-15Nudibranches are similar to snails but they carry neither a spiral shell nor eight shell plates. Some rely on camouflage for protection. Most, however, escape being eaten by tasting bad.

8-45In fact, scientists believe that many nudibranches are brightly colored to warn would-be predators that they taste bad. A few species of nudibranches actually receive a special line of defense from their food. Some nudibranches feed on sea anemones. Instead of being harmed by the anemone's stinging tentacles, the nudibranch swallows the stingers and then the stingers move into feathery looking projections on the nudibranch's back. If another animal tries to eat the nudibranch, it will swallow a mouthful of stingers.

8-77Sea urchins are primarily interested in seaweeds for their food.

7-27They prefer brown algae, or kelp, and can eat enormous quantities.

7-90They crawl on top the seaweed and chew it into tiny pieces using the complicated mouth parts on its underside. Its mouth structure, known as Aristotle's Lantern, consists of many tiny teeth arranged into a beak shape.

8-43These teeth make quick work of seaweeds and, if opportunity arises, can scavenge meat as well.

7-89Sea urchins' most obvious protection is their spines. They are long and make the urchin look like a pin cushion.

7-93The spines are attached to the urchins shell, known as a test. The spines can rotate and point toward an invader.

7-97Urchins also use more evasive protection techniques. They can carve holes in rock with their spines.

7-98 Wedged in these tight crevices, they are safe from predators and pounding surf.

7-84An additional layer of defense is camouflage. Urchins often pick up shell pieces, rocks and seaweed and hold it onto their backs like a protective blanket.

8-39Sea urchins has another defense which they share with their relatives, the sea stars. Both sea stars and sea urchins grow special pinchers, called pedicellaria.

7-61The pedicellaria cover the bodies of both animals but are hard to see because they are small. Each pincher has five teeth that when closed look something like tulip buds. When a predator comes near, the teeth open and close, clamping shut on the predator's soft skin.

7-58Both animals have hundreds of tiny suction cup tube feet.

7-92Each foot is a hollow tube connected by canals to all the other tube feet.

7-59The sea star or sea urchin sucks in seawater through a pore on its back and pumps the water in and out of its feet. When a tube foot is full of water, it lets go of the rocks and the animal can move. When the sea star or urchin sucks water back out of the foot, it creates suction that allows the foot to stick.

7-75By coordinating hundreds of these tiny feet, sea stars and urchins can move as fast as a meter or more a minute or they can stick so tightly to rocks that any attempt to dislodge them will risk tearing their feet.

8-42Sea stars may have the most dramatic eating style of all the invertebrates at the rocky shore. When they find suitable prey, say a clam, for example, they crawl on top of the animal and begin pulling on the shelll with their suction cup tube feet.

7-57Since the sea star operates the tube feet by pumping water in and out of them so it doesn't tire very easily. The clam, on the other hand, holds its shells closed with muscles. These muscles do tire.

7-56Eventually, the clam cannot hold its shells closed any longer. The sea star then everts, or sticks out, its stomach into the clam shell and digest the meat. Its stomach looks very much like a plastic bag sticking out of the sea star's mouth and into the clam shell.

7-72Some sea stars prefer other prey. The blood star, for example, everts its stomach to eat sponge.

8-93The leather star digests sea anemones or sea pens.

7-60While the sea urchin's body is covered with long spines, the sea star wears a covering of much smaller, less obvious spines.

7-62The sea star's body also is covered with tiny shell plates all hooked together to look something like mesh. Skin grows over these plates, so we don't usually see them, but they are there making the sea star's body more rigid and less appetizing.

7-77 In addition, sea stars can protect themselves by shedding a ray. If a predator threatens, the sea star actually can make one of its limb detatch. Scientists believe that the predator will try to eat the shed ray while the sea star can crawl away and, over time, grow back the missing limb.

7-42As amazing as it may sound, sea stars are not the only tidepool inhabitants that can regenerate a missing appendage. Crabs often shed a leg or even a pincher when they are threatened. The crab gradually grows a new leg, but the process is a little more complicated than it is for a sea star.

7-44 Crabs grow a protective exoskeleton around their bodies. This hard outer skeleton is jointed to allow the crab to walk and to pick up and tear meat. From time to time the crab becomes too big for its exoskeleton and must molt. It opens the back of its covering and pulls its entire body, including its legs, pinchers, antennae, gills and eyes, out of the exoskeleton. The crab had been growing a new, larger, but still soft exoskeleton under its old covering. Now that new exoskeleton absorb seawater, swells to its larger size and then hardens.

7-43When a crab sheds a leg, the replacement limb will not have its own exoskeleton until the next time the crab molts.

7-46Hermit crabs, like other crabs, grow an exoskeleton to protect their bodies. A hermit crabs, however, has a tail that is soft and not covered by hard exoskeleton material.

7-45To protect its tail, it must find an empty snail shell and crawl in tail first. Tiny hook-like legs along its tail hold on tightly to the shell. Whenever a predator approaches, the hermit crab pulls inside its borrowed shell home.

8-88The hermit crab and all the other animals of the rocky shore have an astounding variety of body parts and behaviors that enable them to survive at the rocky shore.

8-87They endure pounding waves, hours exposed at low tides and the threat of predators.

8-82These hardy creatures also enjoy the cool, oxygen rich waters, numerous hiding places, and abundant food of the rocky shores.