

SEARCHING

SEA

HABITATS



The Kelp Forest



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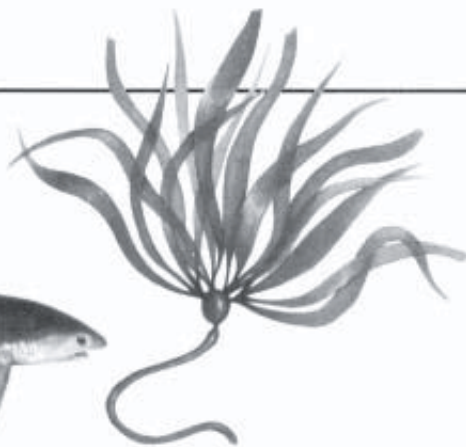
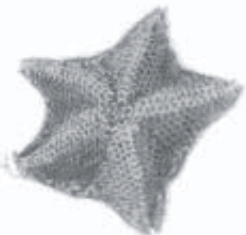
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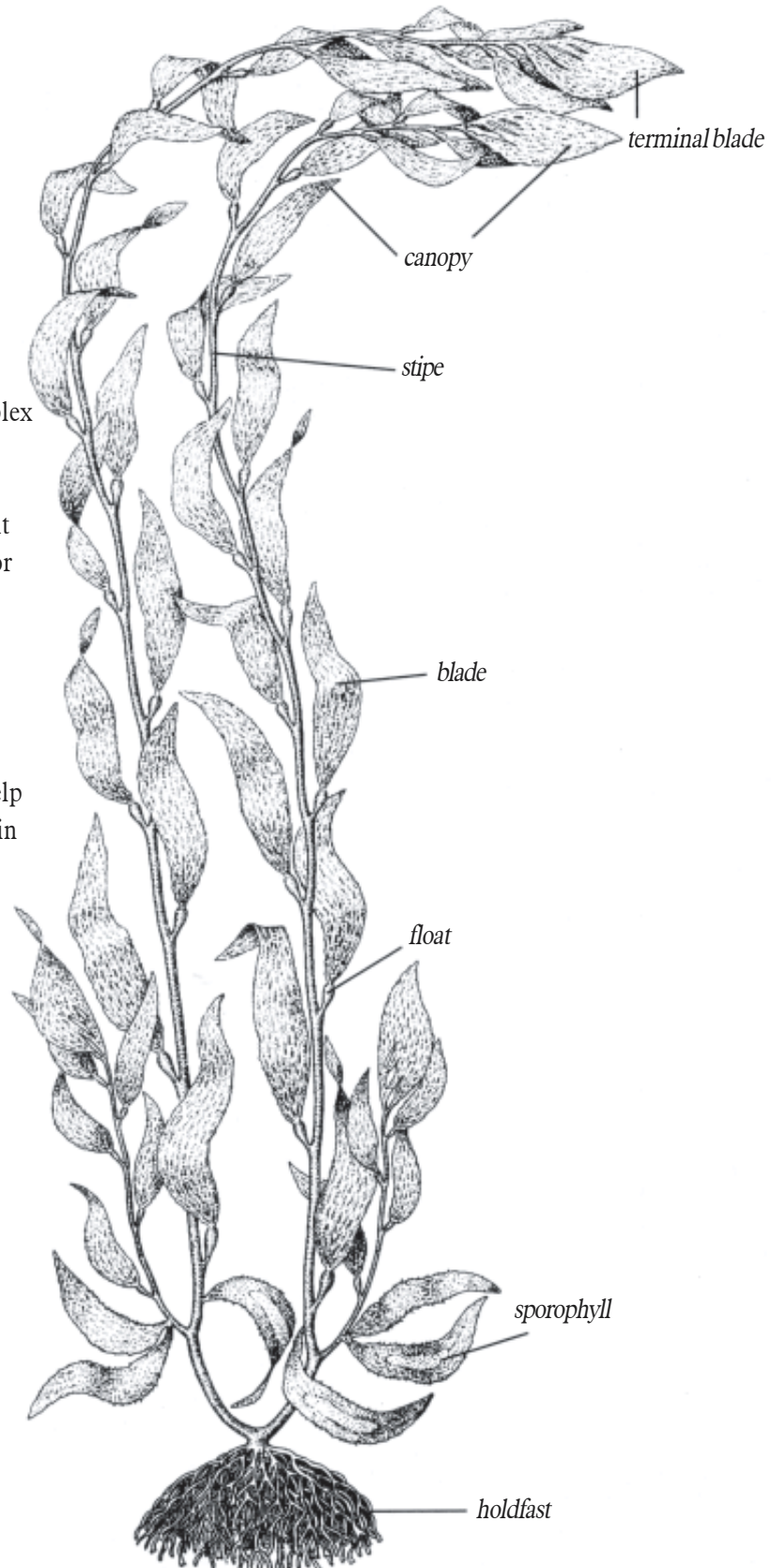
Kelp Forest Field Guide71



What is a Kelp Forest?

Giant kelp plants form submarine forests in the cool waters of many of the world's oceans. Extensive forests grow along the Pacific coast of North America. Beautiful, biologically complex communities, they provide food and shelter for a rich array of plants and animals. They're also a very important economic and recreational resource for fishermen and drivers in places like Monterey Bay, California.

During World War I, California kelp forests were harvested as a source of potash for gunpowder. Today, giant kelp is harvested for a gel called algin. Algin is used in many products including foods like ice cream, pharmaceuticals such as tablets (to help them dissolve) and cosmetics and clothing (to keep the color dyes from bleeding). Between 100,000 and 170,000 tons of giant kelp are harvested annually in California.

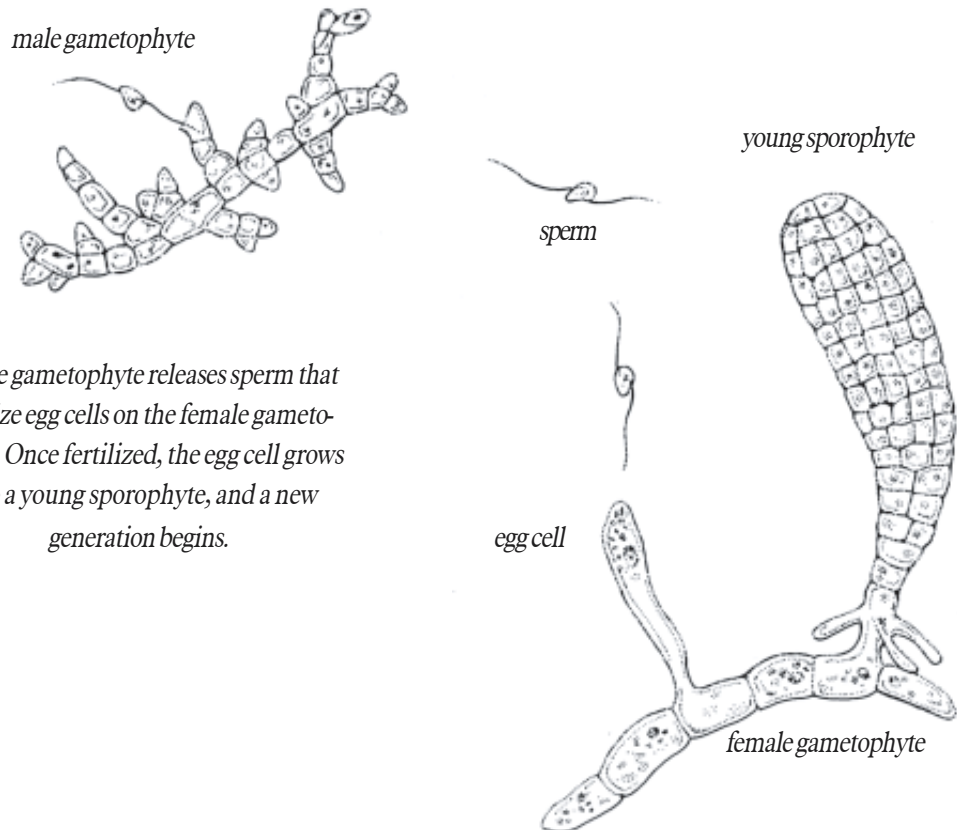


The giant kelp plant

Kelp refers to large brown algae in the division Phaeophyta. Like other algae, giant kelp has not true roots, stems, leaves or flowers. A single frond can live for more than six months.

The huge plants you see in the bay are only half of the kelp's life cycle. These large plants, called sporophytes, release spores that swim to the bottom and grow into tiny male and female plants (gametophytes) which carry out the other half of the cycle. The tiny male plants release sperm that fertilize the female's eggs. The resulting embryos grow into huge giant kelp plants (sporophytes) and the cycle begins again. It takes about a year for the kelp to complete the reproductive cycle.

Giant kelp grows best in areas with rocky bottoms, plenty of light and enough water motion to keep nutrients circulating around the plant. Interactions with other organisms also affect where kelp grows. First, kelp must compete with plants and animals for space to settle and grow. Then, as it grows toward the surface, kelp competes with nearby plants for light. At all stages of its life, kelp must survive being grazed by sea urchins, abalones, other invertebrates and some fishes.



A male gametophyte releases sperm that fertilize egg cells on the female gametophyte. Once fertilized, the egg cell grows into a young sporophyte, and a new generation begins.

The kelp forest community

A kelp forest has a greater variety and higher density of plants and animals than almost any other ocean community. This is largely because its complex physical structure offers more kinds of homes than homogeneous areas like beaches. Like trees, kelp plants provide a variety of living spaces. Some organisms swim in the canopy, and others live on the fronds, between the stipes or in the holdfast.

Another reason this community is rich and diverse is that kelp is an abundant, continuous source of food. Some animals, like turban snails, graze directly on the growing plant, but many animals (like abalones, sea urchins and bat stars) feed on detached fronds that have drifted to the bottom. Drift kelp that isn't eaten is decomposed by bacteria into small particles called detritus. The detritus is filtered from the water by filter-feeders, like sponges, or ingested from the sediment by deposit-feeders, like some sea cucumbers. In turn, many of these animals are eaten by predators including crabs, rockfishes and sea stars.

About 90 percent of the kelp produced in the forest each year ends up on the beach or in deep water. Only about 10 percent gets eaten within the kelp forest itself.

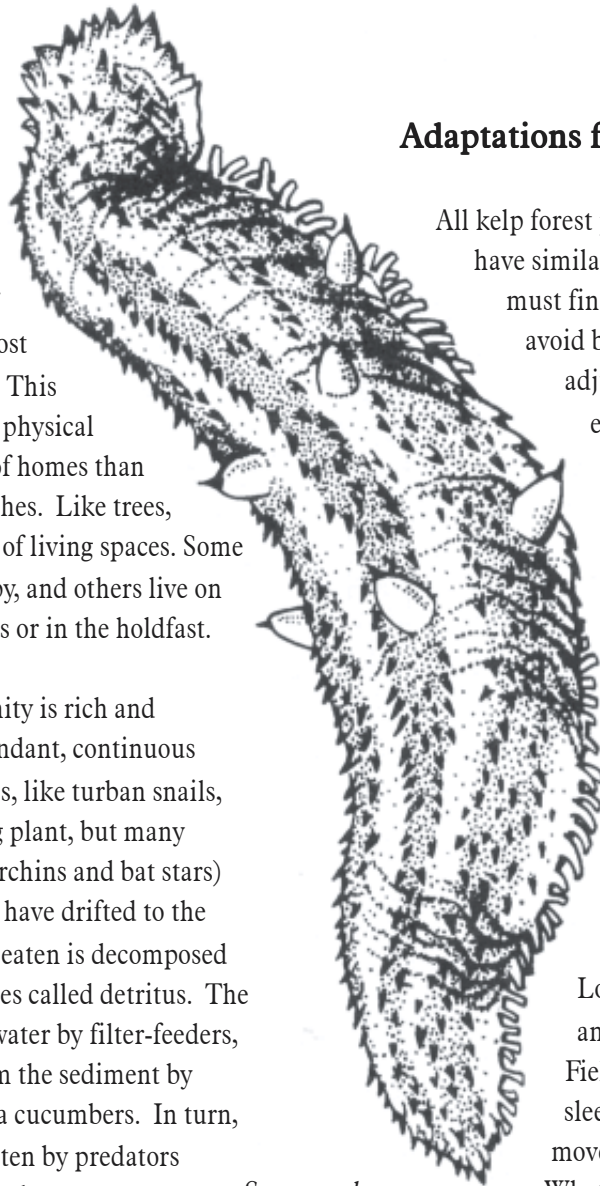
Adaptations for kelp forest life

All kelp forest plants and animals have similar basic needs: they must find food, reproduce, avoid being eaten and adjust to the physical environment. We study characteristics like mouthparts, shape and locomotion to tell what such adaptations are for and what role (producer, predator, herbivore or planktivore) the plant or animal plays in the community.

Look at the illustrations of animals in the Kelp Forest Field Guide. A sea otter's sleek body is adapted to move through the water.

What about the orange sea cucumber? A planktivore, its finely divided tentacles are adapted to filter plankton and detritus from the water; the soft body is adapted to fit into rocky cracks and crevices.

Making similar studies of other kelp forest plants and animals will help you understand the roles and relationships of organisms in the kelp forest community.



Sea cucumber

Growing Tall



MATERIALS

- Six containers or cups (the bottoms of milk cartons work great)
- Potting soil
- Bean seeds
- Graph paper
- Measuring cup
- Pencil

Grow bean seeds under different conditions to see when plants grow best. Take a guess before you start your experiment: do you think seeds grow best with lots of sunlight or little sunlight? How much water helps plants grow tallest? Now experiment to find out!

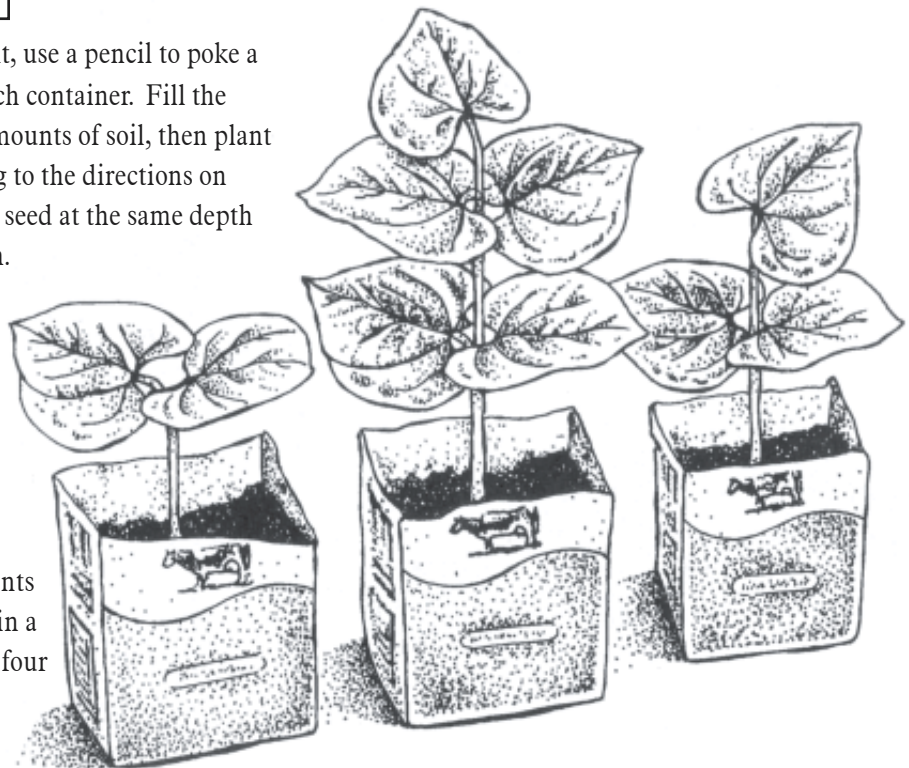
With the help of an adult, use a pencil to poke a hole in the bottom of each container. Fill the containers with equal amounts of soil, then plant the bean seeds according to the directions on the package. Plant each seed at the same depth and in the same position.

Give them each a measured amount of water . . . enough so that a few drops of water drain out the hole.

Put two of your bean plants in a dark room and two in a sunlit room. Give these four plants the measured amount of water during their growth. Put the

remaining two plants in the sun, but only water them half as much as the other plants. Measure your plants and record their heights on a graph. Which plants grow faster? Why? What other experiments could you try? (Remember to guess what will happen first, then try the experiment to prove or disprove your guess.) What do your bean plants need to survive? (They need sunlight, water, nutrients, protection from bad weather.) What do you think an ocean plant like giant kelp needs to survive? What parts of the plant fulfill these needs?

How is a kelp forest similar to a forest on land? How is it different? How are trees important to the inhabitants of a forest? How is kelp important to the inhabitants of a kelp forest?



THE KELP FOREST

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Producers on Land and in the Sea



MATERIALS

- Two sheets of paper
- Pencil

Take a walk in your backyard, school yard or through a park. Draw a map of the area, then draw a producer (plant), herbivore (plant-eater), carnivore

(meat-eater), scavenger and decomposer that live there. On another sheet of paper, draw a picture of a kelp forest with a producer (kelp), herbivore (sea urchin), carnivore (sea otter), scavenger (crab) and decomposer (bacteria). Compare your two food chains. What happens to an ecosystem when its food chain is disrupted? What kinds of things disrupt food chains and webs? What can you do to help prevent these disruptions from taking place?

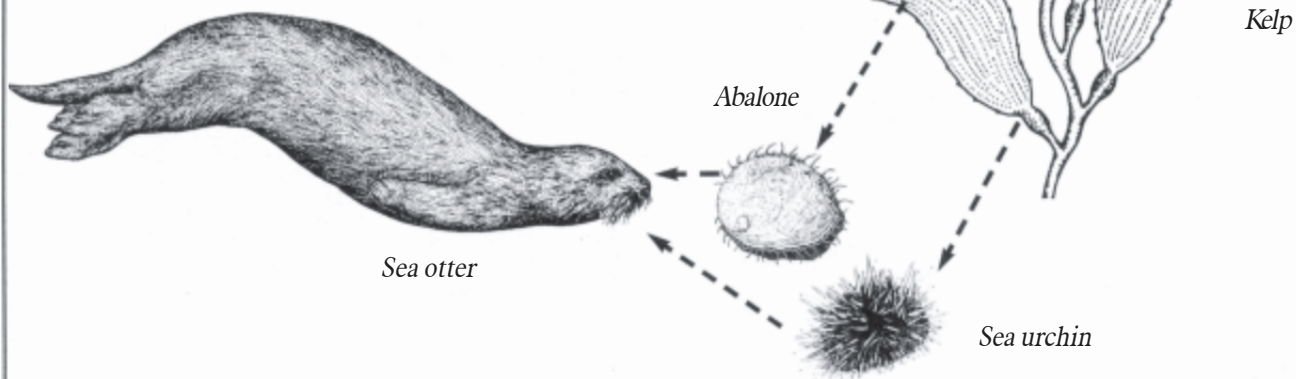
Take a Dive



MATERIALS

- Favorite drawing materials
- Paper

Pretend you're scuba diving in a kelp forest. Write and illustrate a log of what you see and do during your dive.



Do You Eat Kelp?

Did you know that you probably eat kelp and other seaweeds? On your next visit to the market, look for products with ingredients like algin, alginic acid, carageenan and nori. If you need help getting started, look at the ingredients in toothpaste, ice cream and puddings. What are other ways people use kelp? (People use kelp for commercial products, sport fishing in kelp forests, diving, harvesting and industrial products.)

What's the difference between a renewable resource and a non-renewable resource? Are kelp forests renewable or non-renewable? (Kelp grows very quickly and is a renewable resource.) Since kelp is renewable, does that mean we can harvest as much as we want?

What are some non-renewable resources?

(Oil is a non-renewable resource.) Do you think people should rely on non-renewable resources? What are the alternatives?

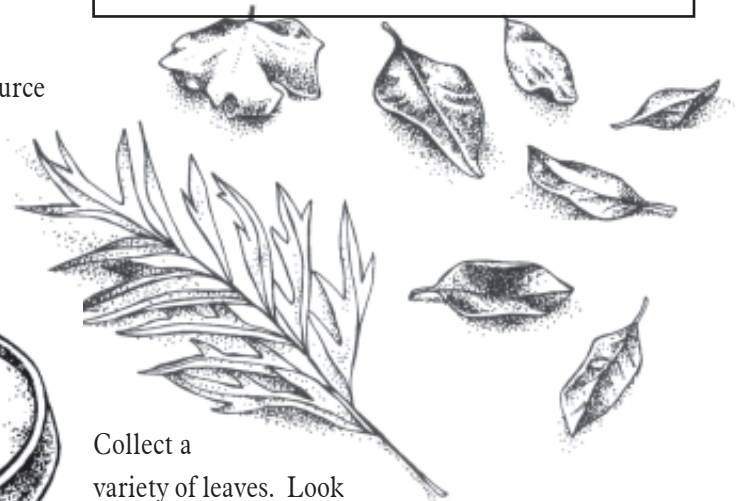


Leaf Rubbing Note Cards



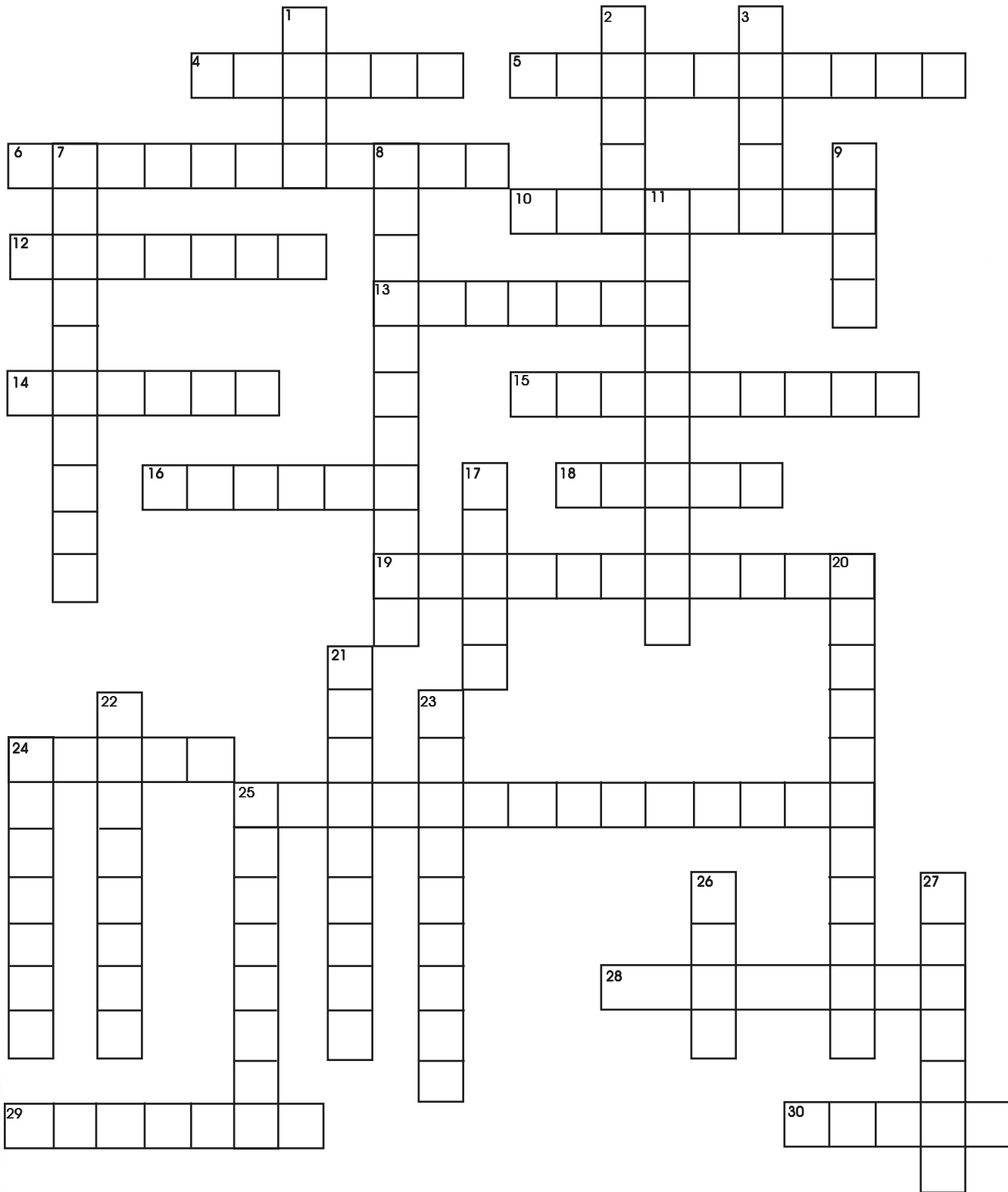
MATERIALS

- A variety of leaves, grasses and fern fronds
- Paper, folded in half or cut in half and folded in quarters to make note cards
- Crayons with the paper peeled off
- Newspaper



Collect a variety of leaves. Look for large ones and small ones, wide ones and skinny ones, pointed ones and round ones. Layer the newspapers on your work area; the more you have, the better your rubbings will look. Place the leaves on the newspaper and lay your note card paper on top. Using the side of a crayon (instead of the pointed ends), rub over the leaf. Create designs by using different leaves and by rubbing hard in some places and gently in others. When you're done, return the leaves to your yard. Compare your leaves to the illustration of the giant kelp plant on page 62. How are the plants the same? How are they different?

THE KELP FOREST
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THE KELP FOREST

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Kelp Forest Crossword Puzzle

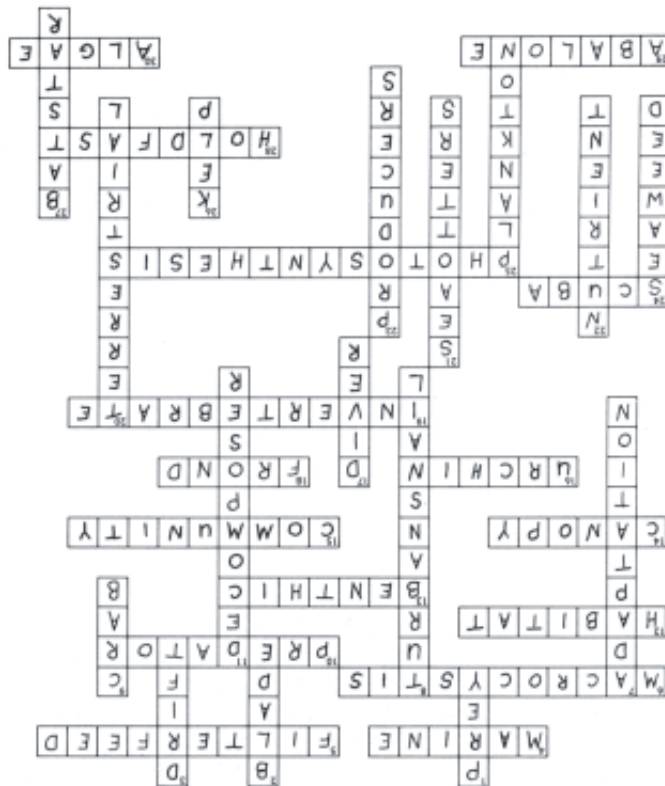
ACROSS

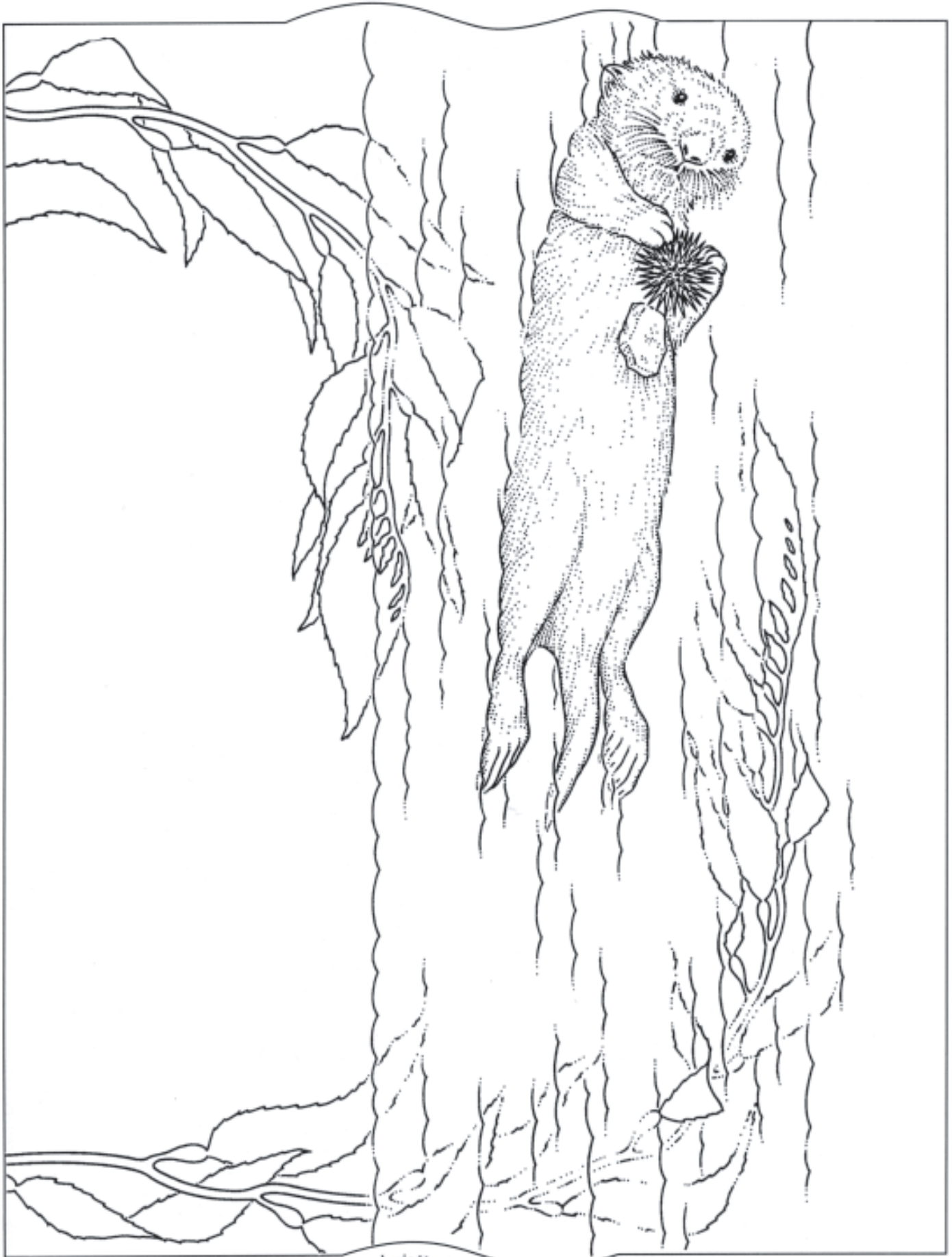
4. of the sea
5. how barnacles eat
6. scientific name of giant kelp
10. an animal that kills and eats animals
12. where a plant or animal lives
13. decorator crabs are bottom-dwelling, or _____
14. the top layer of the kelp forest
15. all of the plants and animals living in a specific area
16. a spiny sea _____ lives at the bottom of the kelp forest
18. a kelp stipe and the attached blades
19. an animal without a backbone
24. abbreviation for self-contained underwater breathing apparatus
25. how green plants use sunlight to produce food
28. the part of the seaweed that attaches it to the seafloor
29. a large flat snail that eats kelp and is a preferred prey of sea otters
30. the name of simple non-seed-bearing plants

DOWN

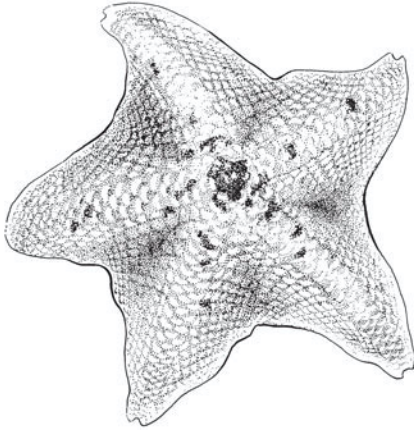
1. an animal that is killed and eaten by a predator
2. the leaflike part of a seaweed
3. _____ seaweed: a piece of seaweed that has broken its attachment and floats freely with the ocean currents
7. a characteristic (body part, behavior or other) that helps a plant or animal survive
8. many hermit crabs live in empty _____ shells

9. a predatory crustacean
11. organism that causes the decay of dead plant and animal matter
17. SCUBA _____: a person adapted to spend time under water
20. of the land
21. marine mammals found in the kelp forests off the coast of Monterey
22. the minerals giant kelp needs for growth (singular)
23. life forms that produce their own food through photosynthesis
24. common name for large ocean plants
25. tiny plants and animals that swim weakly or drift with ocean currents
26. any of the large brown seaweeds, like *Macrocystis*
27. common sea star found in kelp forests





Critter Cards - Kelp Forest

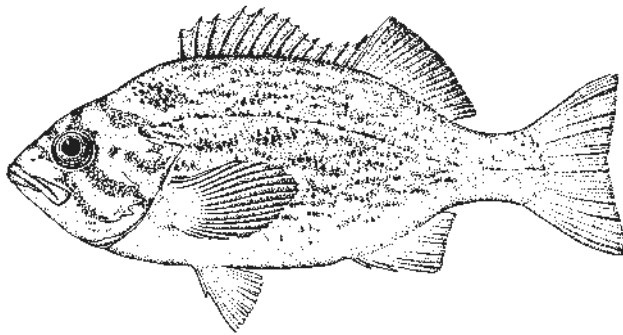


Bat star

Bat star

Asterina miniata [size: to 8 in. (20 cm)]

Bat stars live on the kelp forest floor. They eat seaweeds and small animals, and scavenge dead animals on the seafloor. A bat star's stomach comes out of its mouth and covers its food to eat. The stomach can feel around on the seafloor for bits of food.



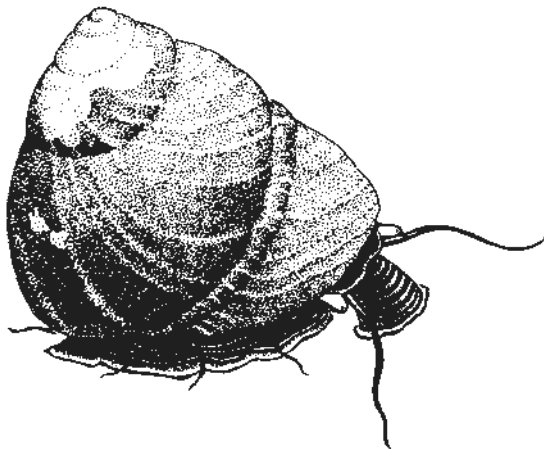
Blue rockfish

Blue rockfish

Sebastes mystinus [size: to 21 in. (53 cm)]

Schools of blue rockfish swim among the kelp plants. Sport fishers often catch these fish, but they must be careful when they do: rock fishes have poisonous spines on some of their fins.

Blue rockfish eat small floating animals, like shrimp and jellies.



Brown turban snail

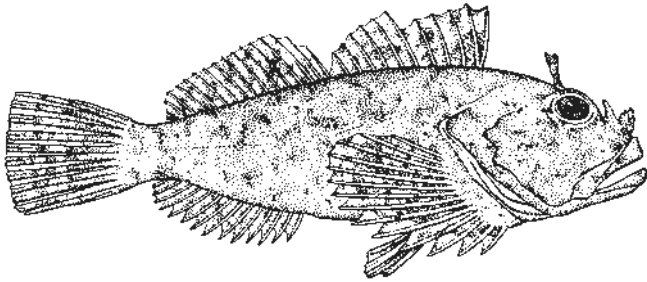
Brown turban snail

Tegula brunnea [size: to 1 in. (2.5 cm)]

Brown turban snails live on kelp plants, most often on the upper blades. Predators like the sea star live on the seafloor below, so the turban snail is safer up high in the canopy.

Kelp provides lunch as well as a living-place for the turban snail. The snails rasp away the algae with their filelike tongues.

Critter Cards - Kelp Forest



Cabezon

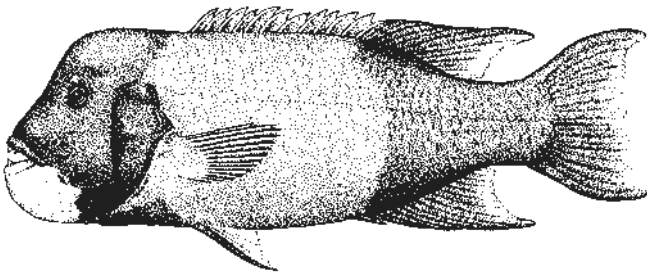
Cabezon

Scorpaenichthys marmoratus

[size: to 3.25 ft. (99 cm)]

Like their relatives, the small tidepool sculpins, cabezons live on the bottom in rocky areas. When they sit still, their waving fins and mottled color blend in with the surrounding seaweed.

Cabezons eat invertebrates like crabs and snails, and some fishes. They swallow abalones whole, then spit out the shells. "Cabezon" means "big head" in Spanish. This fish has a big mouth, too—it can gulp large prey.



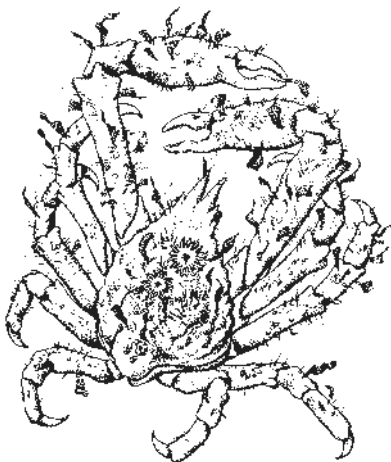
California sheephead

California sheephead

Semicossyphus pulcher [size: to 3 ft. (91 cm)]

Sheephead swim above rocky areas. These fish are all born female, but turn into males when they grow to about 12 inches. They also turn color, from red to red-and-black with white chins.

Sheephead eat snails, crabs, urchins and other shellfish. They're good to eat, so divers often catch them.



Decorator crab

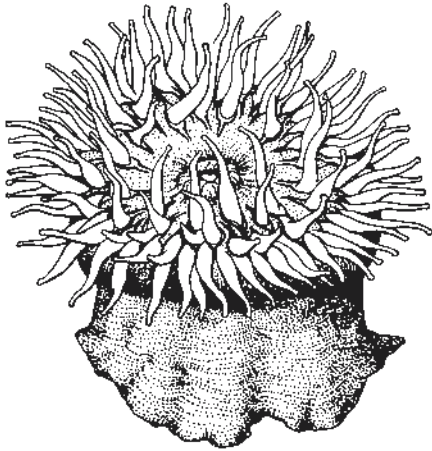
Decorator crab

Loxorhynchys crispatus [size: to 3.5 in. (8.8 cm)]

A decorator crab camouflages its shell with algae, sponges and other things that grow on local rocks. When the crab sheds the shell for a new one, it has to redecorate. Often, the crab will transfer material from the old shell to the new.

Decorator crabs eat algae, sea urchins, small crustaceans and sponges.

Critter Cards - Kelp Forest

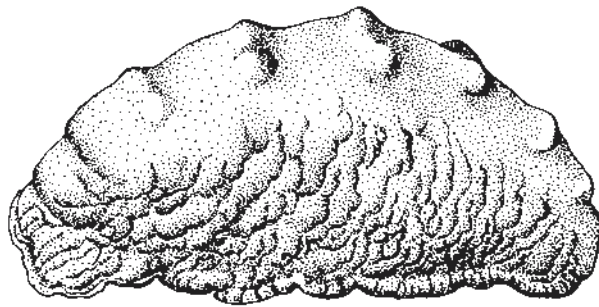


Fish-eating anemone

Fish-eating anemone

Urticina piscivora [size: to 8 in. (20 cm)]

This anemone snares shrimp and small fishes. Its stinging tentacles shoot thousands of tiny harpoons into the prey to hold it. A poison from the harpoons stuns the prey. After making a catch, the anemone stuffs the meal into its mouth then closes up to digest it.



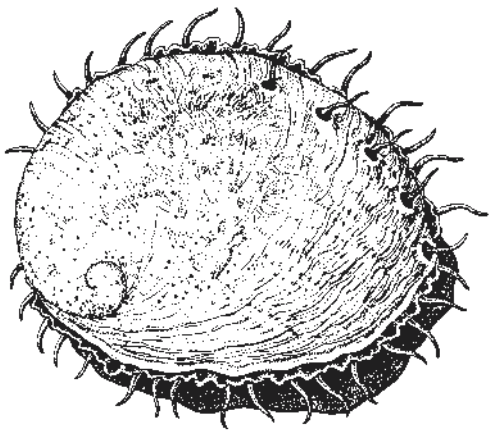
Gumboot chiton

Gumboot chiton

Cryptochiton stelleri [size: to 12 in. (30 cm)]

The gumboot chiton is the largest chiton in the world. It lives on the kelp forest floor, clinging to rocks with its single large foot. It looks like half a football, but is related to snails and clams. Its eight shells are inside, like a skeleton.

A gumboot chiton eats mostly red seaweeds, rasping with its filelike tongue.



Red abalone

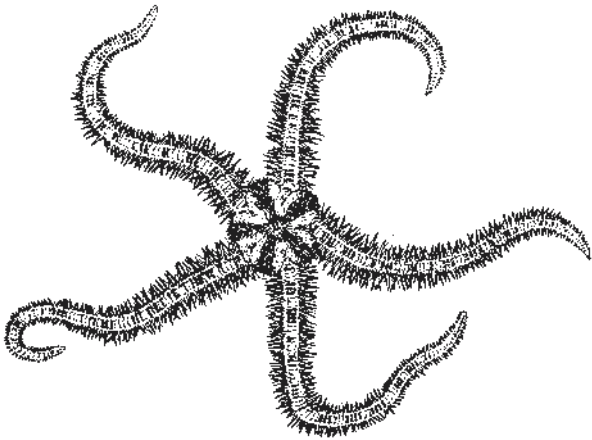
Red abalone

Haliotis rufescens [size: to 11.8 in. (30 cm)]

Red abalone live in crevices, rarely moving far from a chosen spot on the rock. The holes in the shell are outlets for water circulation.

These abalone catch passing seaweed for food. When the tentacles sense a large piece of drifting kelp, the abalone rears toward it, then grabs the seaweed with its big foot.

Critter Cards - Kelp Forest



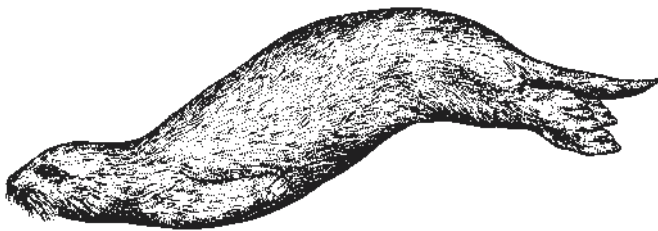
Spiny brittle star

Spiny brittle star

Ophiothrix spiculata [size: to 5.7 in. (14.4 cm)]

Brittle stars hide among rocks and in the rootlike kelp holdfasts, anchored into cracks by their long spines. Their delicate arms break easily, but also grow back quickly.

Brittle stars catch suspended food particles by waving their arms through the water. Small tube feet on each arm transfer the food to the mouth.



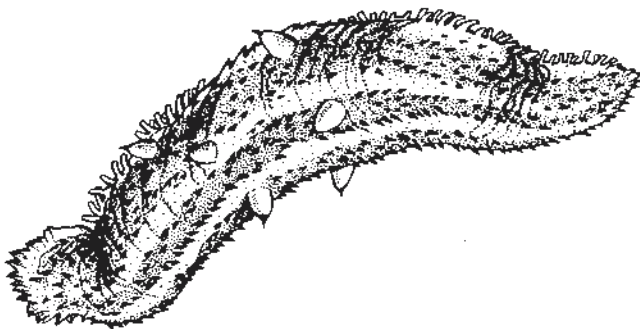
Sea otter

Sea otter

Enhydra lutris [size: to 5.5 ft. (1.7 m)]

For warmth, the sea otter relies on its thick fur coat with 600,000 hairs per square inch. The otter spends nearly half its waking hours grooming its fur coat to keep it waterproof.

The otter dives for shellfish, then eats lying on its back at the surface. Because it consumes abalones and crabs, the otter sometimes competes with people for food.



Sea cucumber

Sea cucumber

Parastichopus californicus [size: to 16 in. (40 cm)]

Sea cucumbers creep slowly across the kelp forest floor. Relatives of the sea stars, they use hundreds of tiny suction cup feet called "tube feet" to move.

The tentacles around a sea cucumber's mouth are also a type of tube foot. The sea cucumber brushes the tentacles across the seafloor as it moves, collecting organic particles and stuffing them into its mouth.