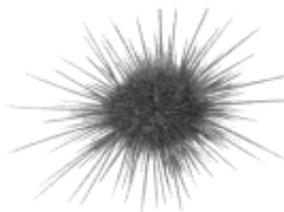


SEARCHING

SEA

HABITATS



# The Sandy Shore



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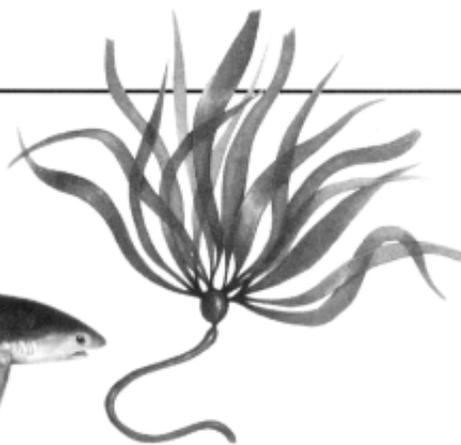
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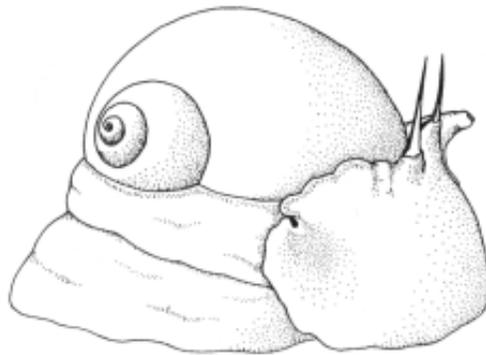
## What is a Sandy Shore?

In many areas, the shore is surrounded by an almost continuous stretch of sandy beach, popular with swimmers, surfers, fishermen, beachcombers, bird watches and clambers. But when the people are gone, the beach seems deserted — barren except for shorebirds and kelp flies. If you were to look closer, though, you'd see sandy shores that are filled with life: most of the inhabitants are in hiding. Many burrow into the sand for protection; there are even microscopic animals living between the grains.

## Conditions are harsh

Wave action is one of the most important factors governing life on a sandy beach. Successive waves, changing tides and passing seasons continually restructure the beach. In winter, strong waves create steep-sloped beaches of coarse sand; in summer, gentle waves produce broad, flat areas of fine sand.

Sand protects burrowing animals. It hides them from the drying sun at low tide and buffers them from extremes in temperature and salinity.



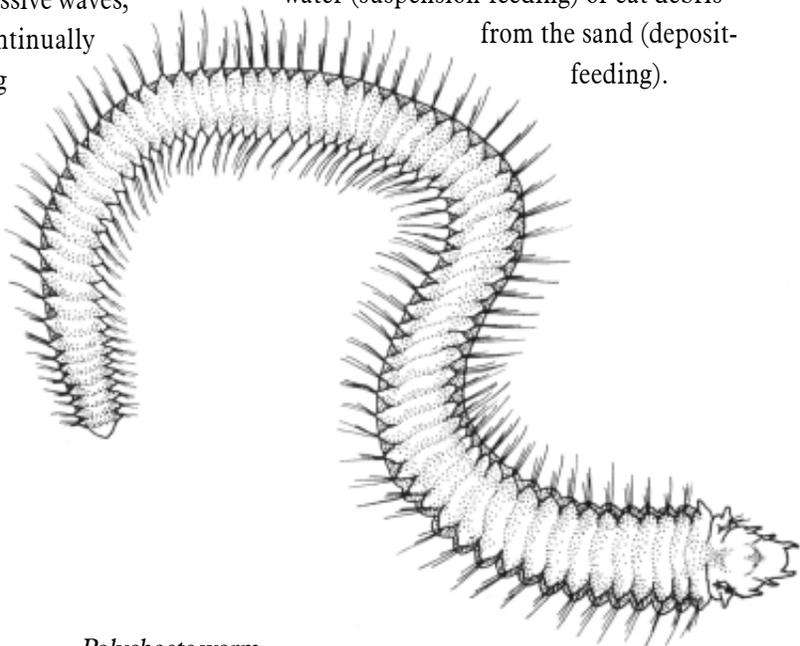
*Moon Snail*

## How animals cope

Shifting sand offers no firm places to attach, so large marine plants and sessile (attached) animals cannot live here. The only large

plants are beach-cast seaweeds. Large sandy beach animals are either visitors (birds and fishes) or burrowers, able to dig back down whenever waves uncover them. Polychaete worms, small clams and crustaceans are rapid diggers; pismo clams have heavy shells to anchor them. Burrowing protects sandy shore animals from predators as well as waves and drying sun.

Since no large plants live here, shore animals eat other animals or whatever food the water carries in. Most either scavenge dead plants and animals, filter tiny plant and animal plankton from the water (suspension-feeding) or eat debris from the sand (deposit-feeding).



*Polychaete worm*

## Zonation

Animals live in different zones of the beach depending on their ability to withstand crashing waves and air exposure. These zones move up and down the beach with the tides.

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### High beach

Kelp wrack



Snowy plover



Beach hoppers



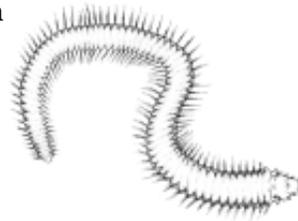
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### Surflines

Sand crab



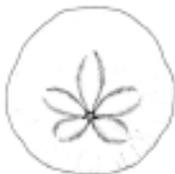
Polychaete worm



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### Submerged beach

Sand dollar



Moon snail



Pismo clam



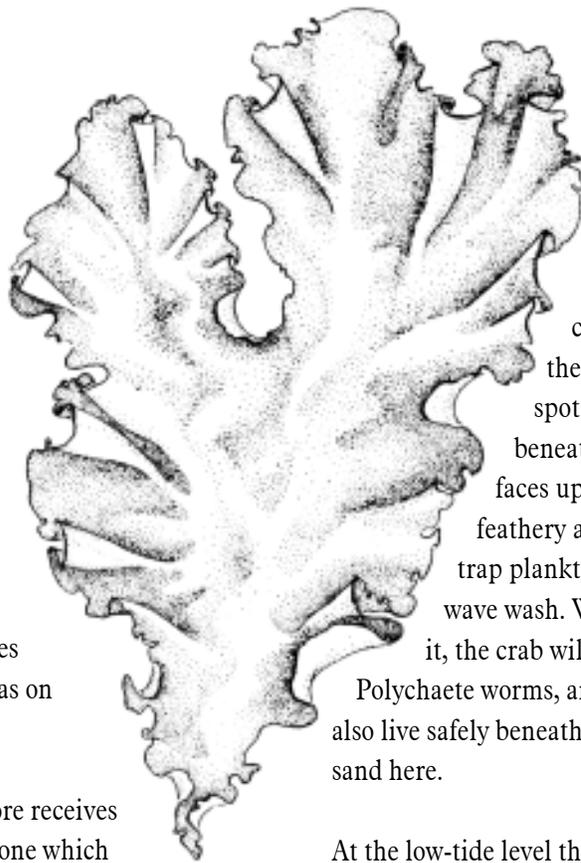
# THE SANDY SHORE

## FIELD NOTES

### Life between the tides

Though sandy shores support relatively few species, those that live here generally occur in great numbers. While different animals are found in different zones, many move up and down the beach with the tides. Because of this, zonation patterns along sandy shores are not as clearly defined as on rocky shores.

The higher part of the shore receives only the occasional wave, one which has spent most of its force on the lower beach. Piles of drift seaweed (wrack) are left high on the beach by the falling tides. Amphipods called beach hoppers burrow in moist sand where they're protected from shorebirds and waves. They stay in their burrows during the day, venturing out at night to feed on decaying animals and seaweed in the wrack. Beach isopods (which are related to pill bugs) are found a little farther down the beach, but still above the washing waves. Like amphipods, the isopods feed on wrack and detritus.

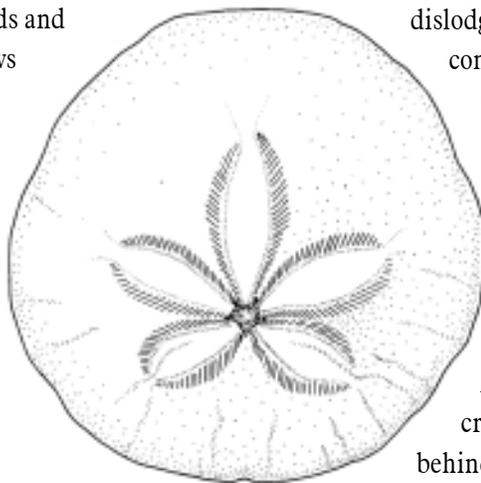


*Sea lettuce*

The mid-tide zone has periods of calm and periods of disturbance from wave action. The sand crab, a relative of the hermit crab, migrates up and down the beach to stay in the right spot to feed. Burrowing just beneath the surface, the sand crab faces up the beach, extending feathery antennae into the water to trap plankton and detritus from the wave wash. When a strong wave exposes it, the crab will quickly rebury itself.

Polychaete worms, amphipods and mysid shrimps also live safely beneath the shifting layer of the sand here.

At the low-tide level the sand is kept in almost constant turmoil by the waves; this zone is rarely exposed to air. Though sand dollars usually live in subtidal areas beyond the surf, some live at low-tide levels. When wave surge threatens to dislodge them, they bury themselves completely. Young sand dollars store a few heavy sand grains in the gut for added weight and stability.

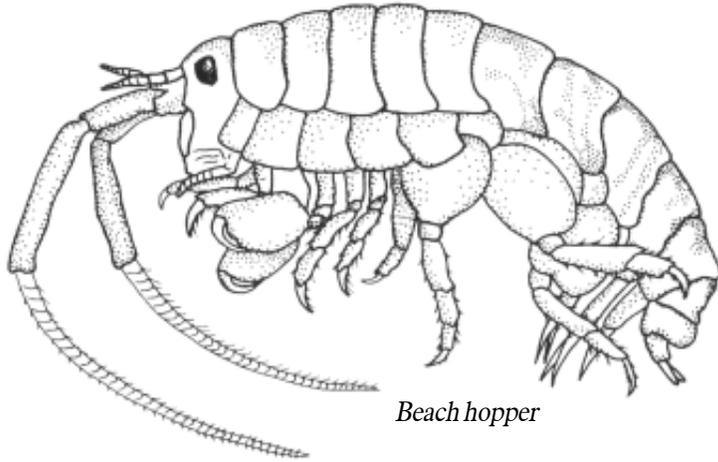


*Sand dollar*

There are different predators prowling the sandy shore at high tide than at low tide. At high tide, fishes prey on crustaceans and worms. Just behind the surfline, sanddabs and surfperches feed on invertebrates

# THE SANDY SHORE FIELD NOTES

exposed by the waves. A major sandy shore predator, the moon snail, burrows along till it bumps into a clam. Using its radula (filelike tongue) to bore a hole in the clamshell, it eats the soft tissue inside.



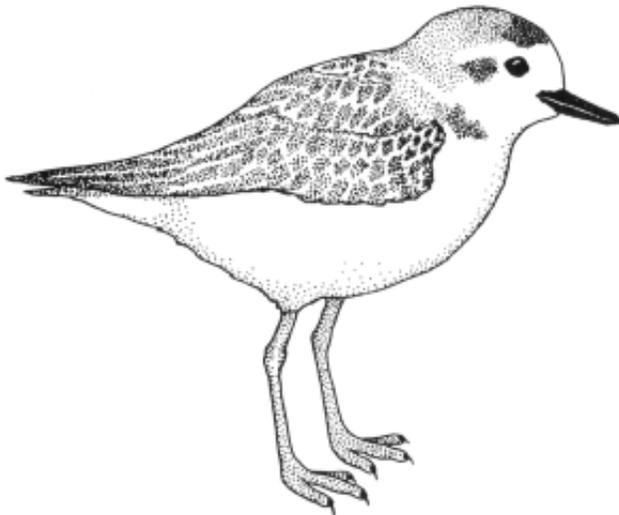
*Beach hopper*

At low tide the sandy beach offers a feast of amphipods, wrack insects, worms and sand crabs for shorebirds like godwits, willets, turnstones and sanderlings.

## **People and beaches**

Because of their beauty, beaches are popular for home building as well as recreation. But their summer serenity belies their changeable nature; it's the winter storms that smash houses that remind us how harsh a beach can be.

Though sandy beach creatures are well-adapted to survive the difficult conditions, they are vulnerable to human activity: house, jetty and pier construction, offroad vehicles and other recreational use. In some places clam digging has decimated extensive pismo clam beds (it's now strictly regulated). Many people who go to the beach never realize they're sharing this environment with an array of marine life. When you visit, walk with care. Remember its hidden secrets, and look for signs of life.



*Snowy plover*

# THE SANDY SHORE

## SEARCHING FOR MORE

### Sandy Shore Survival Suit

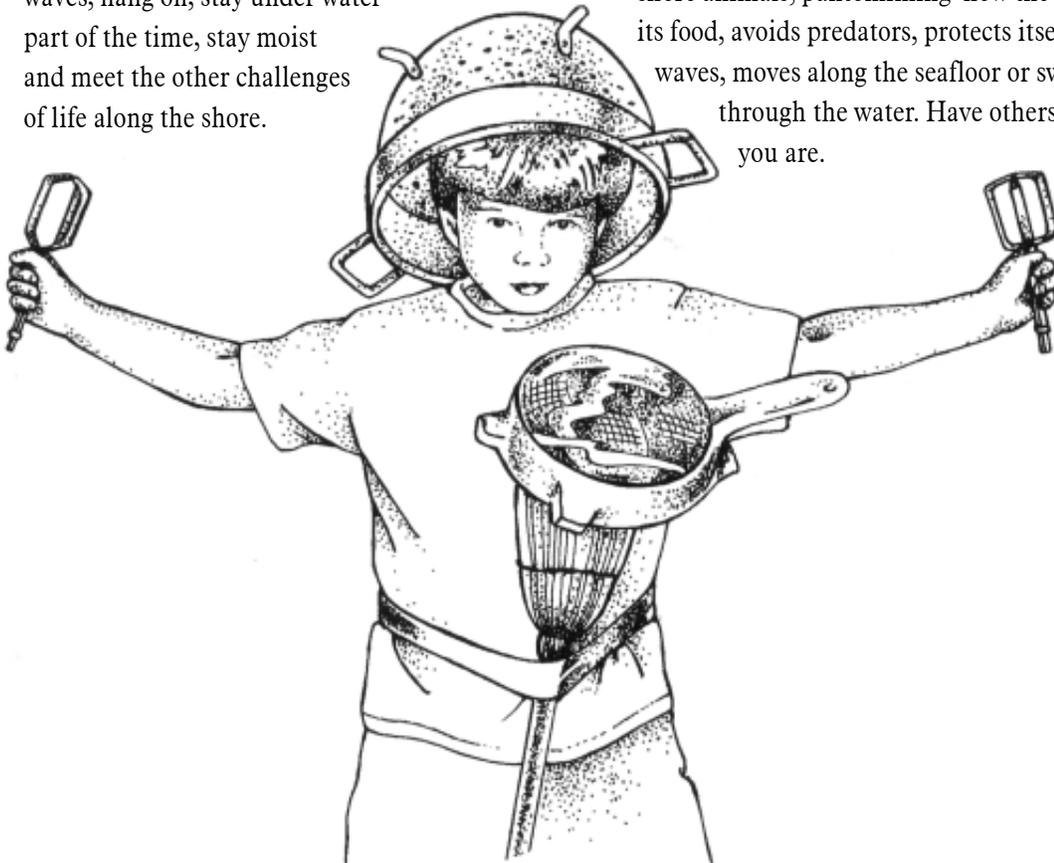


#### MATERIALS

- A variety of clothes, scarves, fabrics and props to create a survival suit

Read about sandy shores on pages 30-33. What challenges do intertidal plants and animals face? (They face challenges like wave shock, air exposure and predation.) How do

they cope? Design, draw and construct a shoreline survival suit that would make it possible to live between high and low tides. The suit should enable you to eat, protect yourself from crashing waves, hang on, stay under water part of the time, stay moist and meet the other challenges of life along the shore.

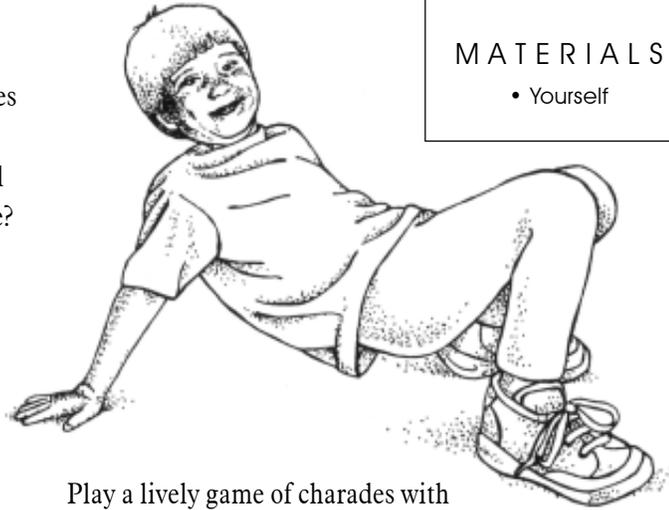


### Crawl Like a Crab



#### MATERIALS

- Yourself



Play a lively game of charades with your friends, family or classmates. Act out sandy shore animals, pantomiming how the animal gets its food, avoids predators, protects itself from waves, moves along the seafloor or swims through the water. Have others guess who you are.

## A Sand Collection



### MATERIALS

- Pencil and paper
- Containers with lids for your sand collection
- Magnifying lens
  - Magnet
- Map of area from which you're collecting sand
  - Glue

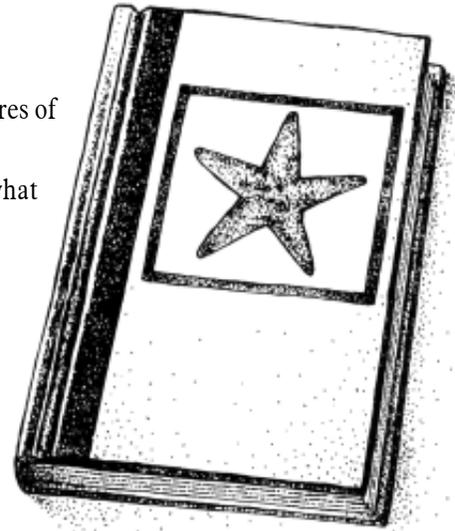
Create a sand collection for your room. Write to people that live along the shore in other states; ask them to describe their beaches, beach plants and animals and swap sand with samples with them. Compare the colors, smells, size of grains and how the sand feels when rubbed between your fingers. Take a close look at the grains with a magnifying lens. What effect does a magnet have on sand? Where do you think the different kinds of sand originated? Why are they different? Post a map and glue a sample of each kind of sand near its origin?



## Make a Sandy Shores Book

Draw pictures of your home, including what you need to live (water, food, a safe place to sleep). What do sandy shore animals need to survive in their homes?

Cut out magazine pictures and draw your own to make a book of you in your home compared to animals in their sandy shore home.



### MATERIALS

- Paper
- Pen or pencil
- Your favorite drawing materials
- Magazines
- Scissors
- Glue

# THE SANDY SHORE

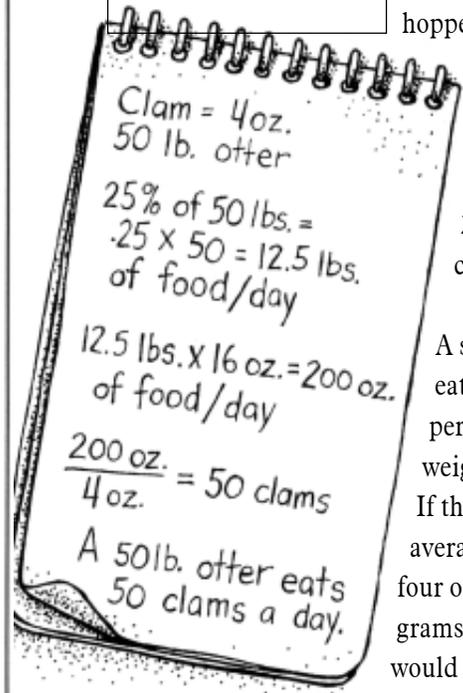
## SEARCHING FOR MORE

### Seashore Math



#### MATERIALS

- Paper
- Pencil



If you were a beach hopper, how far could you hop? Use the ratio: your height/x=length of hopper/distance hopper hops. For hopper length, use .8 inches (two centimeters) and for distance hopper hops, use 20 inches (50 centimeters).

A sea otter needs to eat approximately 25 percent of its body weight per day in food. If the meat in an average clam weighs four ounces (113 grams), how many clams would a 50-pound (23 kilograms) otter eat in one day?

### It's Game Time!



#### Game 1

Make two copies of the Sandy Shore Field Guide. Cut the pictures into individual cards and play "Concentration."

#### MATERIALS

- Sandy Shore Field Guide (pages 40-43)
- Scissors

#### Game 2

Sort the pictures in the Sandy Shore Field Guide into different piles, then explain why you sorted them that way.

#### Game 3

Make several copies of the Sandy Shore Field Guide and use the cut-up cards to play "Go Fish."

#### Game 4

Secretly pick an animal from the Sandy Shore Field Guide. Have your partner ask "yes" and "no" questions to guess your animal.

MAKE UP YOUR OWN GAME  
with the Sandy Shore Field Guide!

### Get Involved!



What are some ways you can help protect shoreline communities? (Leave animals where you found them, pick up litter.) Why is it important to leave animals and shells where we find them?

## Clancy Clam Costume



### MATERIALS

- Foam (check the phone book for local foam or mattress stores)
- 6' to 7' sheet of 1" thick foam for shell, shell straps and foot band
- 6' to 9' of 1/2" thick foam for foot, gill band and siphons
  - 12' of butcher paper or newsprint
  - Contact cement or spray adhesive
    - Scissors
    - 2-1/2' of 3/4" Velcro
  - 2 large costume feathers about 1' long
- Spray paint; 2 cans of beige and 1 can of a contrasting color like pink, yellow or brown
- 6" piece of electrical, packing or duct tape
  - Highlighter pen
  - Rubber gloves (optional)

1. Enlarge pattern pieces onto butcher paper or newsprint using an overhead projector. Outline the shell, foot, siphons, shell straps and gill and foot bands on the foam with a highlighter pen. Cut out the body parts.

2. Shell: Glue the two shells pieces together at the smallest ends (A), forming the hinge of the clam. (See illustration on page 39.) Glue the ends (B and C) of the straps vertically to the center of the shell. (You may want to wear gloves.)

3. Foot: Glue the foot (D) to its band (E), and glue Velcro to the ends (F and G).

4. Siphons: Glue the sides of the siphon pieces together to form two tubes (H). Glue the siphon tubes to the middle of the band (I), and glue Velcro to the ends (J and K).

5. Gills: Bind the shafts of the two feathers together with tape. Glue the joined feathers to the middle of the gill band at its lowest point (L), and glue Velcro to the ends (M and N).

### To make Clancy Clam

Read all the directions and study the illustrations before constructing Clancy Clam. Find a comfortable, well-ventilated workplace and have clean-up materials handy. Read and follow the health warnings on the glue and paint containers.

### Clancy Clam dress-up

Here's one way you can use the clam costume. If you're with a group, pick one volunteer to dress up as a clam. Discuss how the clam might be adapted to its living conditions, then show the clam's relevant body part. The dress-up might go something like this:

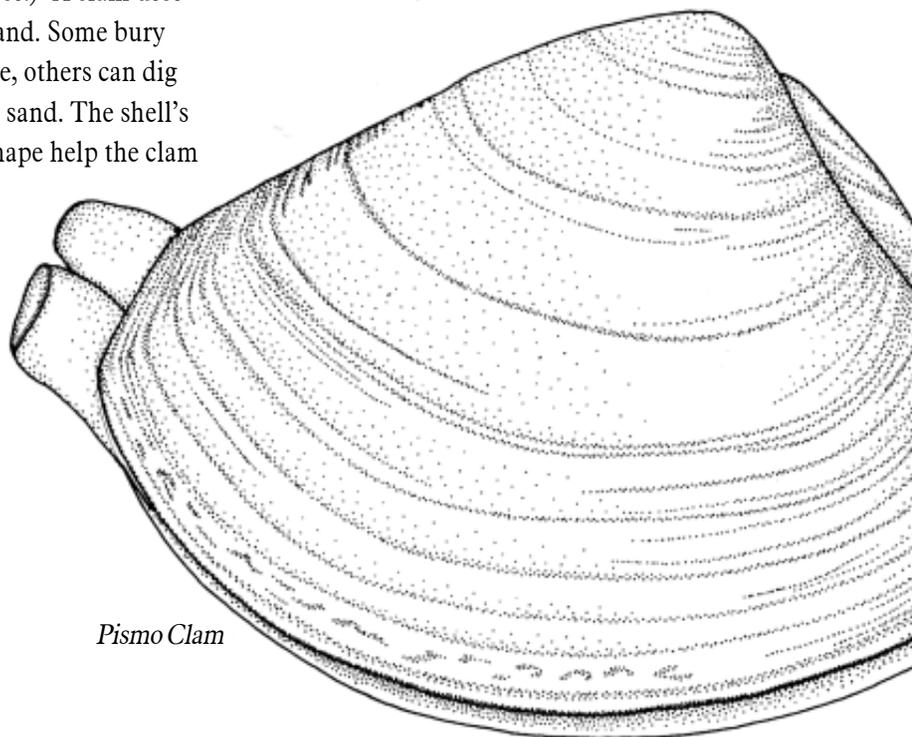
**Shell:** "Most clams live near the surf zone where waves crash. How could an animal with a soft body like this (point to volunteer) survive there?" (Wait for responses) "Right, a hard shell protects the clam from being torn apart by waves or predators." (Have volunteer slip arms through the shell's straps, then close outstretched arms in front of body.)

**Foot:** "How do clams keep from being swept away by the waves?" (Wait for responses.) "A clam uses its strong foot to plow into the sand. Some bury themselves just below the surface, others can dig three feet or more down into the sand. The shell's heavy weight and streamlined shape help the clam burrow more easily."

(The foot goes inside the shell around the volunteer's waist and closes with Velcro.)

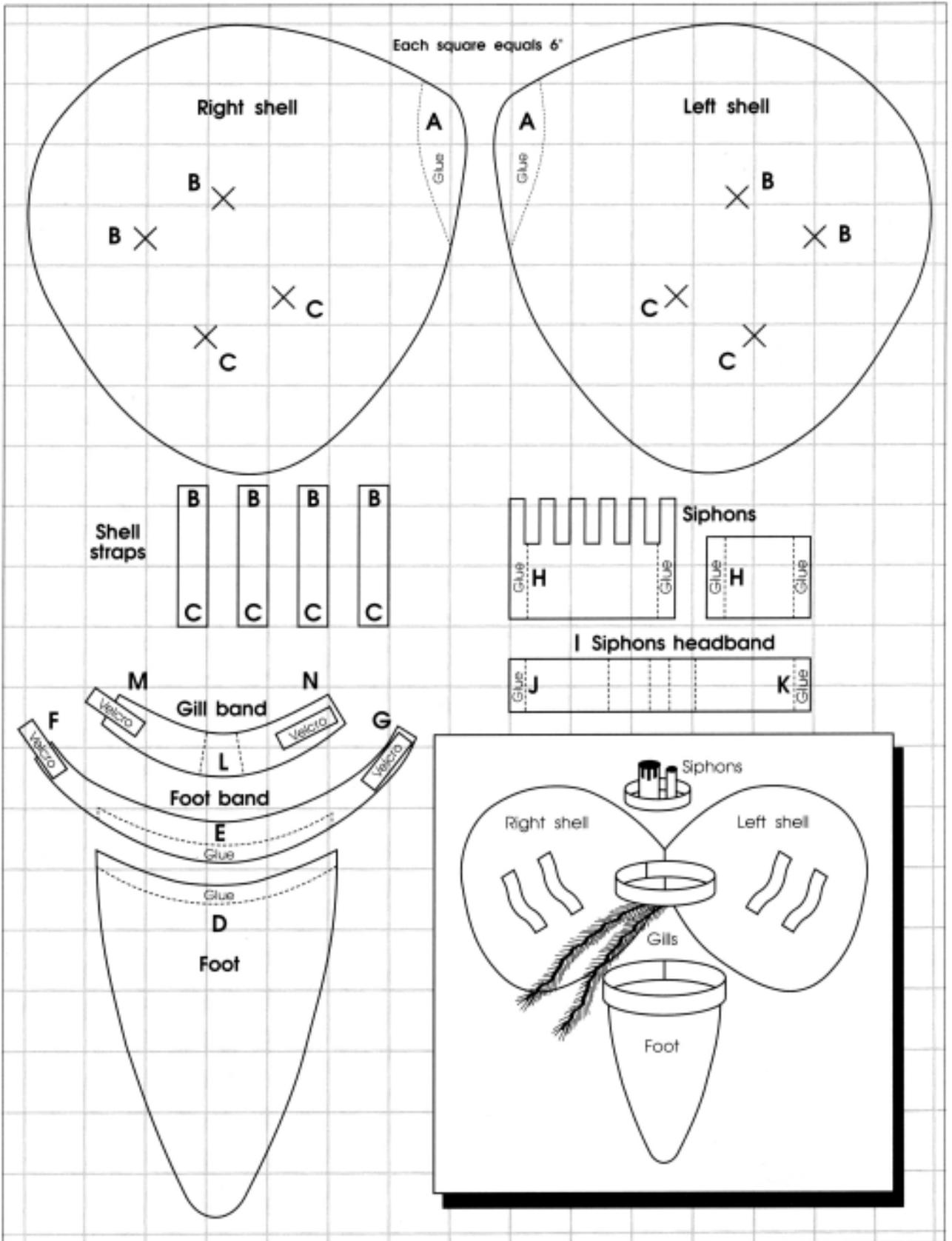
**Siphons:** "If a clam lives under the sand, how does it eat and breathe?" (Wait for responses.) "Clams have siphons like straws that they send up to the sand's surface. One siphon sucks in water, the other one pumps out waste. The incoming water contains oxygen to breathe and tiny plants and animals to eat. The deeper a clam lives in the sand, the longer its siphons must be to reach the water." (Siphons fit around volunteer's head and close with Velcro.)

**Gills:** "Clams also have gills to help them eat and breathe. Incoming water passes across the clam's gills. The gills absorb the water's oxygen (like a fish's gills) and trap small pieces of food." (Gills fit inside the shell around the student's neck with the feather pointing down and close with Velcro.)

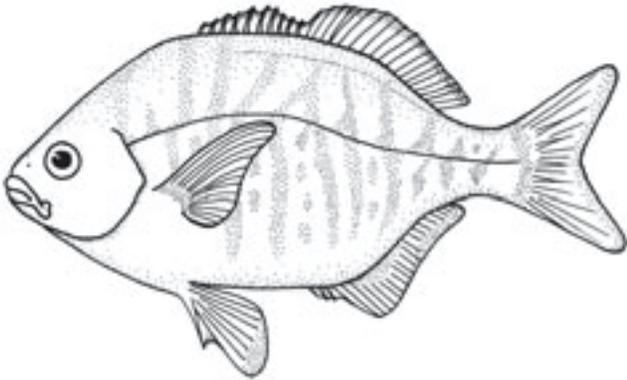


*Pismo Clam*

# THE SANDY SHORE SEARCHING FOR MORE



## Critter Cards - Sandy Shore



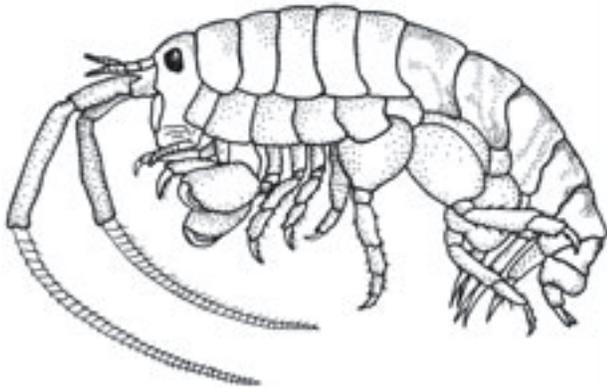
**Barred surfperch**

### **Barred surfperch**

*Amphistichus argenteus* [size: to 17 in. (43 cm)]

Barred surfperch usually live in or just beyond the waves, but also venture into waters as deep as 240 ft. (73 m). Instead of releasing eggs, surfperches give birth to live young.

Barred surfperch feed on sand crabs, clams and other invertebrates. Fishermen catch and eat surfperches, as do seals and larger fishes.



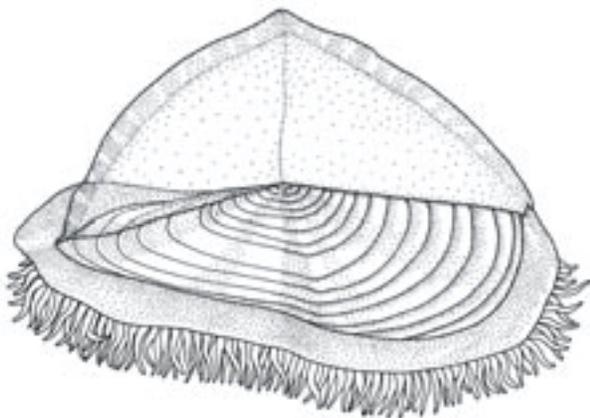
**Beach hopper**

### **Beach hopper**

*Orchestoidea californiana* [size: to 1.1 in. (2.8 cm)]

Beach hoppers live high on the beach, out of reach of the waves. They burrow during the day to keep cool and moist and to hide from hungry shorebirds. At night, they come out and hop about in search of food.

Beach hoppers eat the seaweed that washes up on the beach.



**By-the-wind sailor**

### **By-the-wind sailor**

*Velella velella* [size: to 3 in. (7.6 cm)]

By-the-wind sailors usually live far out to sea, but many get blown ashore in the spring. The angle of the sail may determine where they land. Those whose sails angle to the left are blown to our coast, while right-angled ones sail toward Japan.

These jelly relatives use their tentacles to catch passing plankton.

## Critter Cards - Sandy Beach

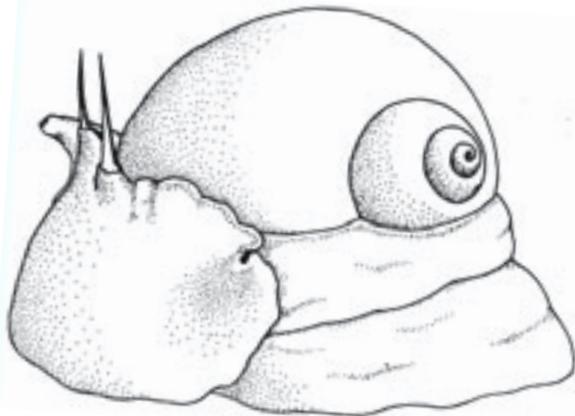


**Drift seaweed**

### **Drift seaweed**

Rough waves rip seaweed from offshore rocks and toss it onto beaches. Often these tangles bring in offshore creatures that lived on the seaweed.

These seaweeds are the only large plants you'll see on the beach, so they're centers of activity. Small animals like beach hoppers eat the decaying algae and hide beneath it. Larger animals, like shorebirds, come to hunt the smaller animals.

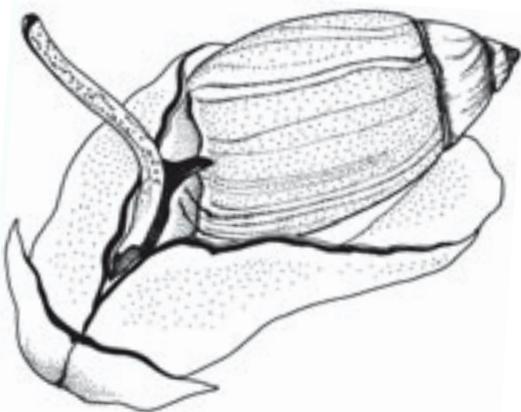


**Moon snail**

### **Moon snail**

*Polinices lewisii* [size: to 5 in. (13 cm)]

The moon snail plows slowly through the sand, hunting for clams. Finding one, the snail surrounds the clam with its huge foot. It drills a hole in the shell, rasping with its filelike tongue and softening the shell with a special liquid. When the hole is finished, the snail eats the clam's soft insides.



**Olive snail**

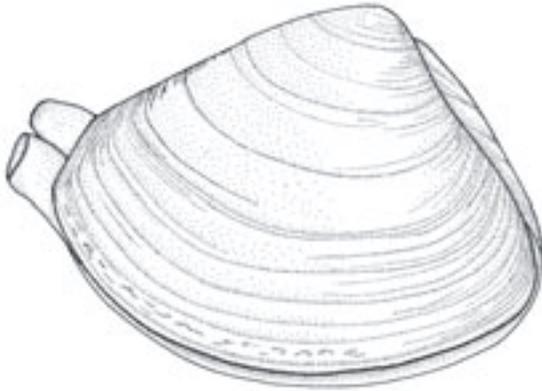
### **Olive snail**

*Olivella biplicata* [size: to 1 in. (2.5 cm)]

The olive snail plows through the sand just below the surface, leaving a furrow behind. Its smooth, streamlined shell helps it slip through the sand. To breathe, the snail sends a tube above the sand.

The olive snail eats dead animals and plants. It may also gather tiny food bits from the sand.

# Critter Cards - Sandy Shore



**Pismo clam**

## **Pismo clam**

*Tivela stultorum* [size: to 6 in. (15 cm)]

Pismo clams dig into the sand near the surf zone. To dig, a clam pushes its foot downward through the sand like a wedge. Then it anchors the foot and pulls the shell along after it.

Clams send a feeding tube above the sand. They inhale water through it, filtering out tiny plants and animals called plankton.



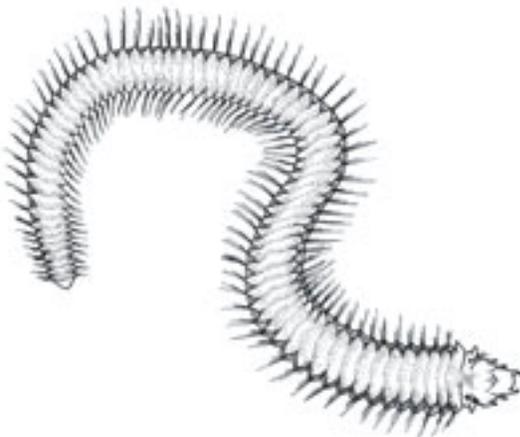
**Plankton**

(Plant plankton, top row from left: two dinoflagellates, chain diatom, diatom. Animal plankton, bottom row: sea urchin larva, crab larva, snail larva, copepod.)

## **Plankton**

Plankton are plants and animals that drift on ocean currents instead of swimming. Most are tiny; these pictures are many times larger than the actual organisms.

Plant plankton form the first link in many of the ocean's food chains. Animal plankton eat these tiny plants. Filter-feeders like clams and sand crabs eat both kinds of plankton.



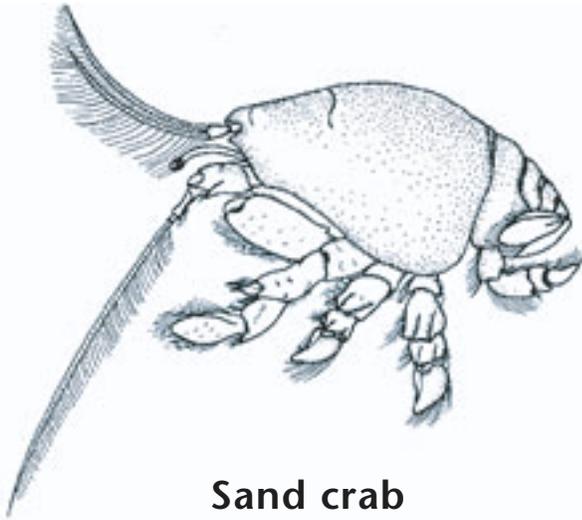
**Polychaete worm**

## **Polychaete worm**

*Nephtys californiensis* [size: to 12 in. (30 cm)]

This sandworm is similar to earthworms, but has a row of bristled flaps on each side. It burrows through the beach sand. If a wave uncovers the worm, it quickly swims down and digs in again. This worm preys mostly on smaller sand-dwellers.

## Critter Cards - Sandy Shore



**Sand crab**

### **Sand crab**

*Emerita analoga* [size: to 1.4 in. (3.5 cm)]

Sand crabs live in the surf zone, following the tide up and down the beach. To keep from washing away, they burrow tail-first into the sand. Burrowing also protects them from predators, like surfperches and plovers.

To filter plankton from the water, a sand crab sends fringed antennae up from the sand into the passing waves.



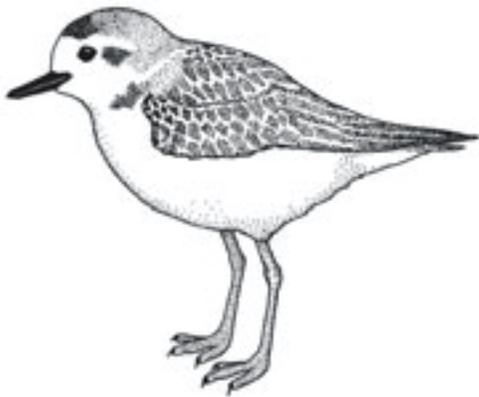
**Sand dollar**

### **Sand dollar**

*Dendraster excentricus* [size: to 3 in. (7.6 cm)]

Sand dollars live half-buried in the sand just beyond the waves. They stand on end when the water is calm, but dig in during storms using their short spines. Young ones swallow heavy sand to weigh them down.

Sand dollars feed on plankton and small organic particles found on the sand or in the water.



**Snowy plover**

### **Snowy plover**

*Charadrius alexandrinus* [size: to 6.5 in. (16.5 cm)]

Snowy plovers skitter about on the dry upper beach. They hollow out their nests right on the sand. This is safer than it might seem; both eggs and bird blend in so well, they're almost impossible to see.

Plovers eat sand crabs, beach hoppers and other invertebrates. They hunt in quick spurts, stopping to grab a bite, then darting off again.