Coastal Capers: A Marine Education Primer

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COASTAL ZONE INFORMATION CENTER

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Coastal Capers:
A Marine Education Primer

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Introduction

Purpose

Coastal Capers is a marine education primer designed to provide elementary grade teachers with activities or "capers" that introduce the marine environment. The primer also may be used by teachers with remedial or special education students, or by 4-H and scout leaders. The twenty capers are designed to motivate students to learn basic skills in science, math, language arts, social studies and art.

Coastal Capers is part of the UNC Sea Grant Marine Education Manual series. The other five manuals (Coastal Geology, Seawater, Coastal Ecology, Coastal Beginnings and Connections) have activities more suitable for older students (fourth through eighth graders).

Coastal Capers consist of three parts: 20 capers, a glossary of animals and an elementary marine education materials appendix.

How to use the capers

First choose a caper in the subject area of your choice. Each caper consists of a section on purpose, vocabulary, materials, teacher background and/or preparation, procedure, and, occasionally, spin-off ideas or additional reading.

As these capers cover many subject areas, teachers can develop a unit around them or insert them into existing lesson plans. Each caper can stand by itself. Most capers can be completed within one class period.

The illustrations are suitable for duplication. No copyright prohibits their use for educational purposes.

How to use the glossary

Information about the marine and freshwater animals mentioned in the capers is listed alphabetically in the glossary. It provides facts about where the creature lives, what it eats and who eats it.

How to use the appendix

The appendix lists other education resources and illustrations for activities. The national access system for marine education materials, MEMS, is a computerized index of articles and curricula and a major resource for marine educators.

CAPER ONE

Let's go fishing

Purpose

To identify animals with their natural habitat.

Vocabulary

Salt water—seawater. A mixture of pure water and elements dissolved from the earth's crust. The salt water of the ocean is diluted in sounds and bays by fresh water from rivers.

Fresh water—water that contains few dissolved elements. Found in rivers and lakes. Ground water is fresh water. The typical source for fresh water is rain.

Environment—all of the physical, chemical and biological conditions, living and nonliving, that affect an organism or group of organisms.

Materials

Scissors, crayons, laminating film (optional), paper clips, magnet, string, two shoe boxes, "fishing pole" (any yardstick, meter stick or pole will do), large box.

Teacher preparation

Duplicate and cut out figures. (**The figures are located in Appendix I.**) You may wish to color and laminate the figures. Slide a paper clip onto each figure. Tie a two-foot long string to the end of the pole or stick. Attach a magnet to the end of the string. Label one shoe box fresh water; label the other salt water.

Procedure

Place figures face down on the floor or in a large box. Students sit in a circle around the box and take turns fishing for the animals using the magnet hook. When a student "catches" an animal, he/she decides if it lives in fresh water or salt water and puts it in one of the two labeled boxes. If possible, the child names the animal.

Students are awarded one point for correctly classifying the animal's home and one point for correctly identifying the animal's name.

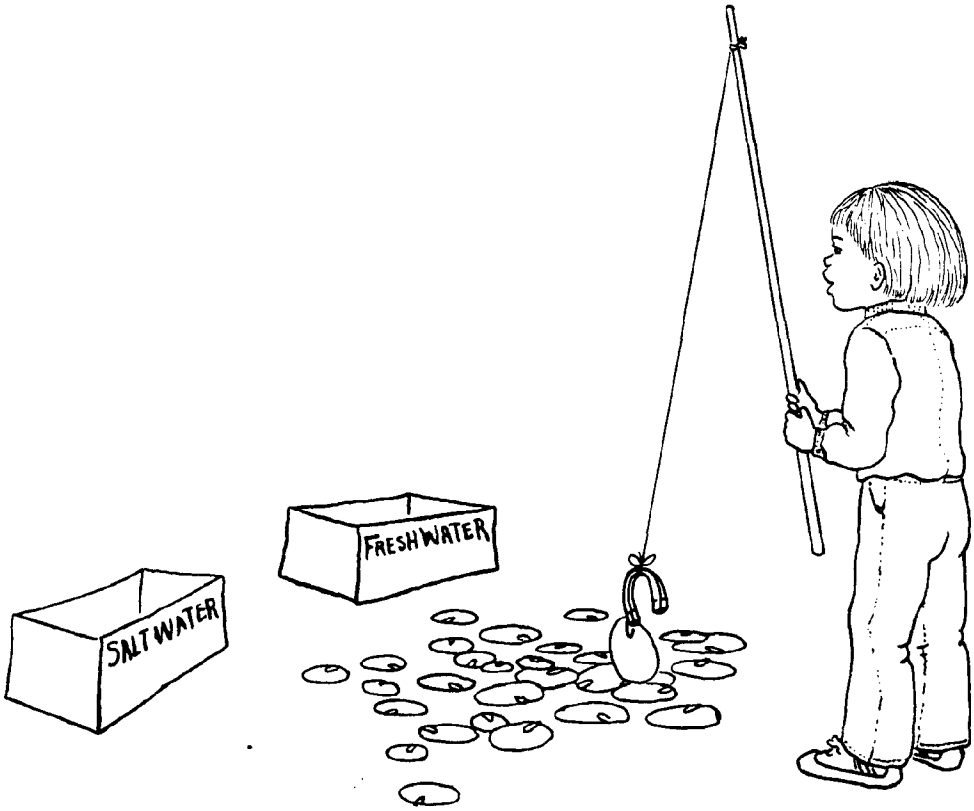
The saltwater creatures in the "fishing hole" are: a sea turtle, a sea horse, a porpoise, a hammerhead shark, a marlin, an oyster, a clam, a squid, a flounder, a whelk, a shrimp, an urchin, a sea anemone, a whale, a jellyfish, a starfish, an octopus, a sting ray and a crab.

The freshwater creatures are: a water snail, an alligator, a newt, a frog, a tadpole, a pond turtle, a catfish, a water strider and a salamander.

Spin-off

Play the riddle game. The student takes an animal card from the fishing hole and keeps the card covered. The "fisherman" makes up a riddle about the animal for the other students to guess. Example: I have eight arms and no shell. What am I? Answer: octopus. Example: When I'm young I have a tail, but when I grow up the tail goes away. What am I? Answer: tadpole and frog.

Show the card to the group once the riddle is solved. At the end of the unit or for older students, the game could be changed into animal charades.



CAPER TWO

The sand dollar game

Purpose

To practice the match skills of number comparison.

Vocabulary

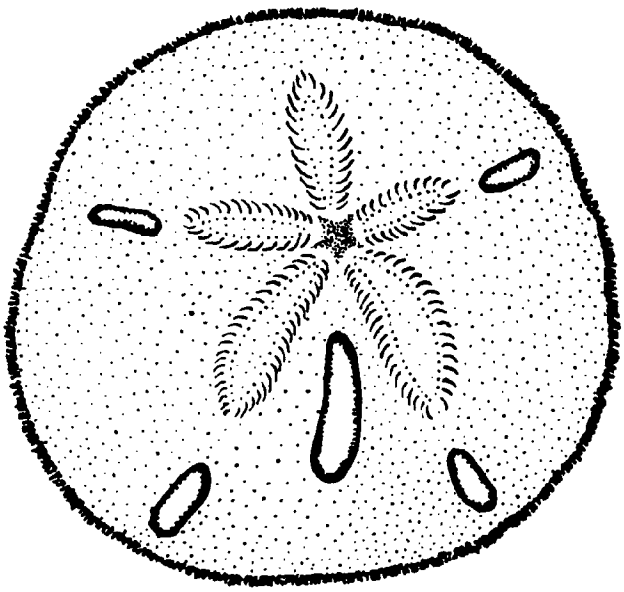
Sand dollar—a flat, round animal with short, hairy spines. It eats plant matter. Its name reflects its shape, which is similar to a silver dollar. When dried, the sand dollar is white. Alive, its color is brownish-green.

Materials

Construction paper, pencil, scissors, lamination film (optional).

Teacher preparation

Using the pattern, make 20 copies of the sand dollar. If the students have the motor skills to cut out the patterns, let them make the set. On one side of the figure, draw the holes shown on the pattern. On the other side, write a number. Numbers such as 18, 81, 99 and 66 should be underlined to prevent misreading. Use a different number for each sand dollar.

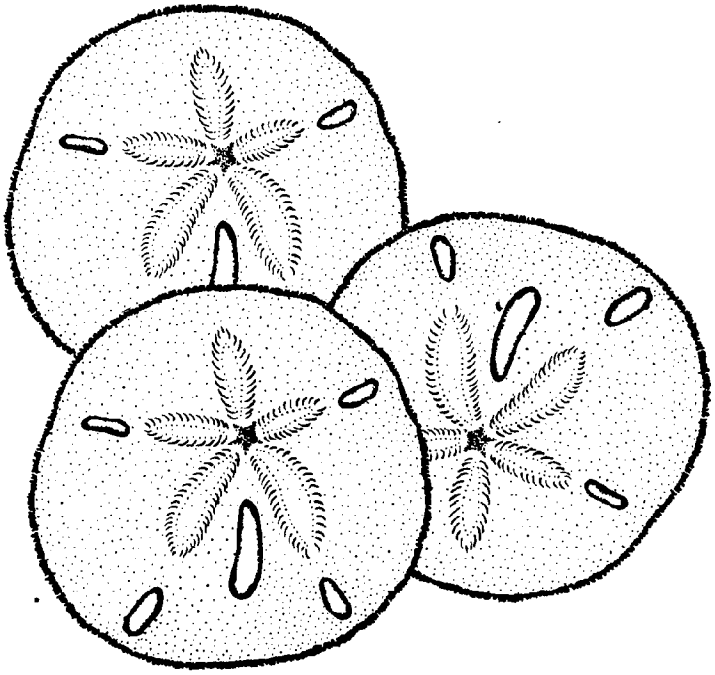


Sand dollar pattern

Procedure

This is a partner game. Player One deals out the set of 20 sand dollars, number side down, ten to each player. The players keep the dollars in a stack in front of them. Player Two starts the game by removing the top sand dollar from his/her stack and placing it, number side down, in the center of the table or desk. Player One places the top sand dollar from his/her stack beside it, number side up. Player One then guesses whether the number is greater than or less than the number on Player Two's dollar.

After Player One has guessed, Player Two turns his/her sand dollar over. If Player One guessed correctly, then he/she keeps both dollars. If the guess was incorrect, Player Two keeps both dollars. Players take turns guessing. Play continues until one player has all of the sand dollars.



CAPER THREE

Float an Egg

Purpose

To investigate the density of fresh and salt water or how objects float.

Vocabulary

Investigation—careful examination of a situation with the intent to answer a question or solve a problem.
Prediction—educated guess of a future event.
Sink—when an object is not buoyed by water and gravity pulls the object to the bottom. Objects sink when they displace a volume of water that weighs less than the object.
Float—when an object is light enough to be buoyed by water. Objects float when they displace a volume of water that weighs more than the object.
Dissolve—when a solid compound, such as salt, is divided by water molecules into two or more parts. Salt is made of sodium chloride, which divides into sodium and chloride ions.
Buoyancy—the ability to float.

Materials

Jar, a fresh egg (a freshly boiled egg will also work), salt, water, teaspoon.

Procedure

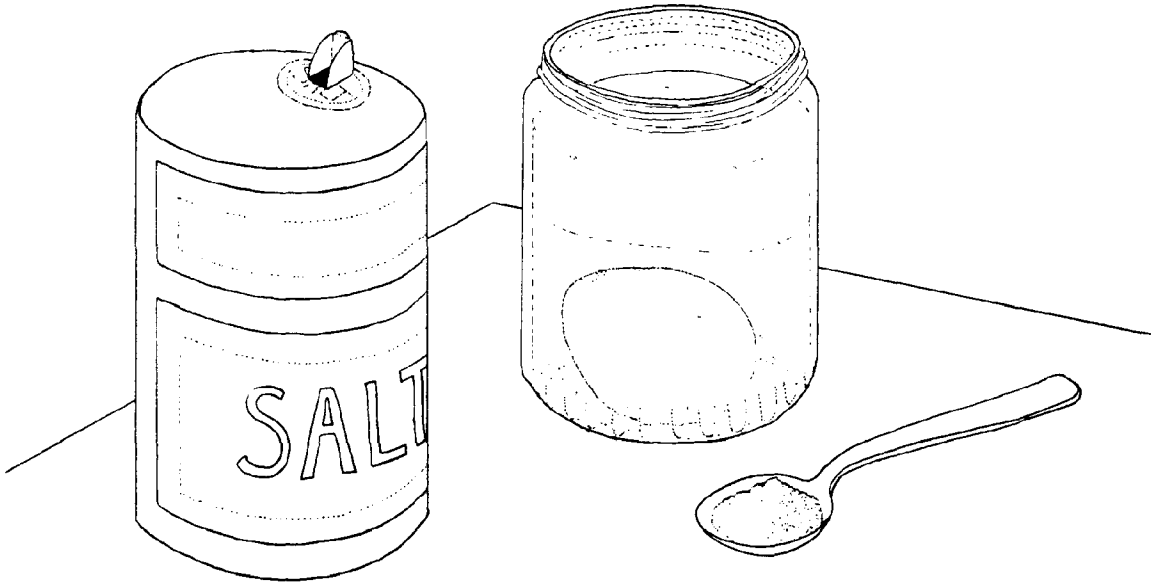
This activity is suggested as a team competition. Before dividing students into teams, explain the materials to be used and the principles involved in the demonstration.
Demonstration: Fill a glass jar with fresh water, and put the egg beside the glass. Ask the class to predict whether the egg will sink or float. Place the egg in the water. (The egg should sink.) Ask the group what will happen if salt is added to the water.

Slowly add one teaspoon of salt at a time to the water, stirring. The egg will eventually float off the bottom of the glass. The salt water is heavier or denser now and can buoy up heavier objects than the lighter fresh water.
Directions for each team: Choose one member of the team to measure and another to record. Others can observe. Fill the jar with water. Predict whether the egg will float in the water. Lower the egg carefully into the water. Did it sink or float? Add one level teaspoon

of salt at a time to the water, stirring carefully to dissolve the salt. Count each teaspoon added to the water until the egg floats. How many teaspoons did it take to float the egg? What is the difference between the tap water in which the egg sank and the salt water in which it floated? In which water could a person float best? The team that floats an egg with the fewest teaspoons of salt is the winner.

Teacher references

Anderson, Norman D. *Investigating Science in the Swimming Pool and Ocean.* McGraw-Hill Book Co., New York. 1978.



CAPER FOUR

Food web connections

Purpose

To show the links within the food chain and food web. To introduce marine animals to students.

Vocabulary

Investigation—careful examination of a situation designed to answer a question or solve a problem.

Food chain—a sequence of food relationships in which the sun is the primary source of energy. The first link to the sun is plants; second is plant eaters (herbivores); third is animal eaters (carnivores).

Food web—the type of food relationships in which several food chains are joined so that one type of plant is eaten by several herbivores and one herbivore eats more than one type of plant. Likewise, one kind of animal (the rabbit) is eaten by several carnivores (cats, wolves, man), and one carnivore (the wolf) eats several kinds of animals (rabbits, chickens, squirrels). A food web increases the chances for survival if one species of animal or plant becomes scarce.

Herbivore—plant eater. Rabbits and sand dollars graze on plants. Some marine herbivores filter microscopic, single-celled plants and animals called plankton using gills, antennae or mouth parts. Mole crabs and blue whales use this method. Animals that eat detritus, or decaying plant matter, also are herbivores. Fiddler crabs, clams and mullet (a fish) fit into this category

Carnivore—meat eater. Cats and flounders eat meat.

Omnivore—an animal that eats either plants or animals, depending on which is available. People, bears, raccoons, blue crabs and shrimp eat plants and animals.

Plankton—microscopic plants and animals that float in the water and are carried by the current. Planktonic plants include diatoms and dinoflagellates. Planktonic animals include the larvae of fish and crabs that grow out of their planktonic stage and arrow worms that remain planktonic their entire life. The one-ton sunfish, or mola-mola, is planktonic because it drifts with the currents.

Materials

Scissors, balls of different-colored yarn, arm bands of red, yellow and green plastic or construction paper.

Teacher background

Students must learn how food chains work before they can understand food webs. Spend time discussing the roles of the sun, plants and consumers—both herbivores and carnivores. For example, a simple land-based food chain begins with the sun as the energy source for corn (a plant), which provides food for a mouse (a herbivore), that in turn becomes food for a cat (a carnivore).

Marine food links along the Carolina coast begin with the sun, which provides energy to plants to photosynthesize carbon dioxide and nutrients into plant material.

Next come plants. Marine grasses, turtle grass and eel grass grow in shallow sounds and bays. Seaweeds attach to rocks and piles or float free. Microscopic plants, called phytoplankton, float with the currents. Diatoms, or single-celled green algae, and dinoflagellates are the base of many food webs in nearshore and offshore waters. Detritus, or decaying plant material, is a common food source for herbivores in marshes. Decaying salt marsh cordgrass, an abundant food source, makes Carolina marshes productive in fish and shellfish.

Herbivores eat by grazing on larger plants or by filtering smaller plants from the water. Filter feeders include shellfish (clams, mussels and oysters), some marine worms, barnacles and fish (menhaden, anchovies and mullet). Grazers include periwinkle snails (that feed on algae that grow on marsh grass), sea hares and sea urchins.

Carnivores eat other animals. Some animals are easy meals when young, but are unappealing to eat as adults. Few carnivores prey on adult jellyfish, starfish, sea horses or sea hares. Blue crabs eat shellfish, fish and other crabs. Octopus eat fish, crabs and shellfish. Fish eat smaller fish, shrimp, shellfish and worms.

Procedure

Either by personal choice or teacher direction, each student should represent a marine plant or animal. Plant people wear green arm bands; herbivores, yellow; carnivores, red. It is important for the students to know the eating habits of the animals they represent.

Here are examples for a class of 25. Use resource books to enrich and enlarge this set.

Plants: phytoplankton, green seaweed, detritus.

Herbivores: filtering animals—mole crab, barnacle, mullet, fish larvae; grazing or filtering animals—fiddler crab, marsh minnow, worm, mud snail, shrimp.

Carnivores (eat any herbivore or each other depending on their size): blue crab, octopus, spot, croaker, grouper, flounder, stone crab, eel, starfish.

To begin the activity, take a colored ball of yarn from a central location, called the sun, to one of the children representing a plant. Ask who will eat this plant. Several children should volunteer their animal. Pass the ball of yarn from the "plant" to one of the

volunteers. Then ask who will eat this animal. Again, several students should volunteer. Pass the ball of yarn from the first animal to one of the volunteers. Remind the first students to continue to hold the yarn. This is one food chain. Cut the string. Repeat the exercise with another plant and animal using a different color of yarn.

Continue making food chains, allowing some of the chains to connect by either common herbivores or carnivores. Be sure each child is part of a food chain. The students have created a food web that looks almost like a spider's web.

Evaluation

Discuss the following points.

1. One plant or animal may be consumed by several other animals.
2. One animal consumer may prey on several other animals.
3. Food webs can be very complex and represent real life better than food chains.
4. Food webs are affected by environmental problems.
5. Pretend acid rain kills one type of plant. How many consumers does it affect?
6. Pretend a pesticide kills one type of plant eater. How many carnivores does it affect?

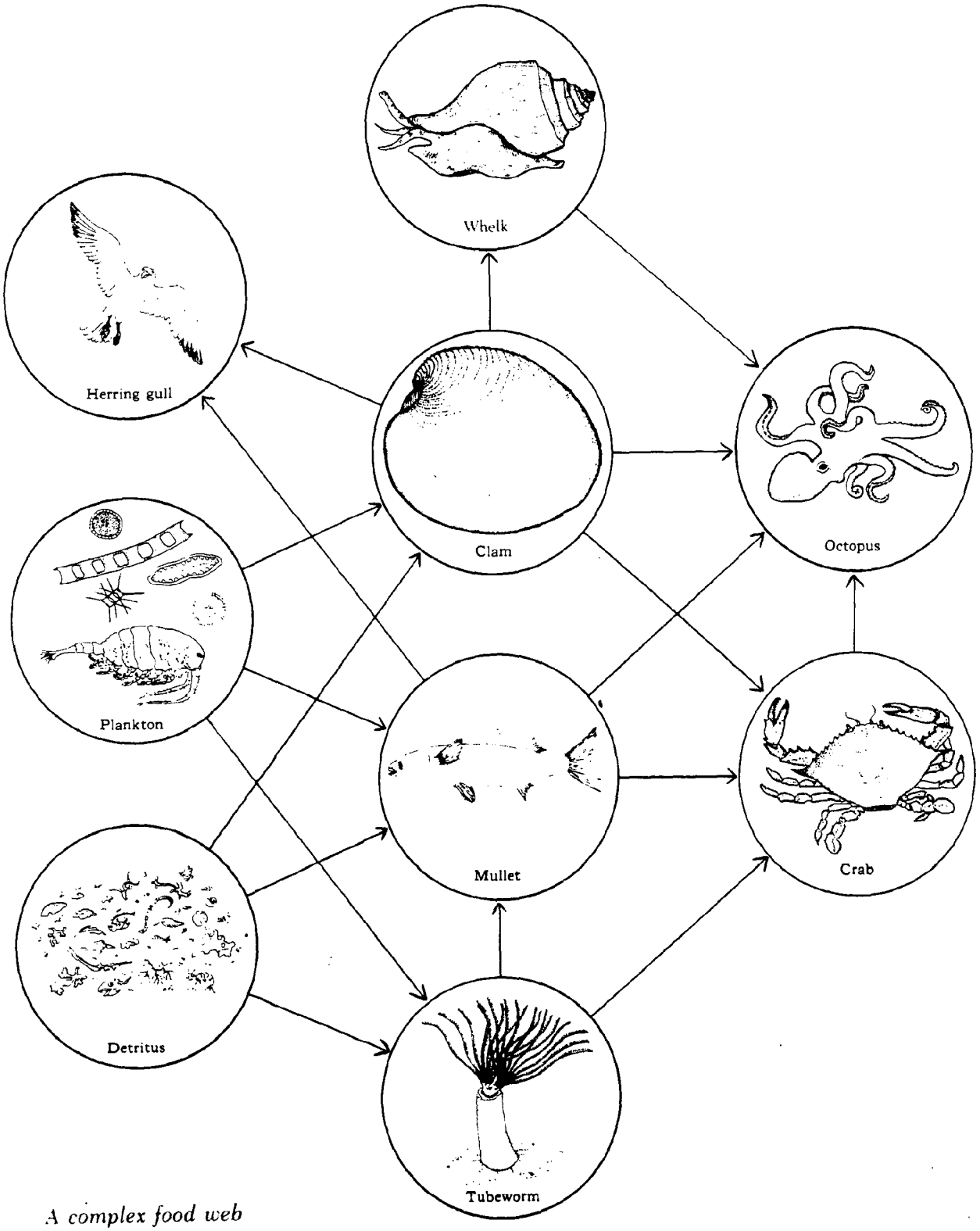
Student reading

Buck, Margaret. *Along the Seashore*. Abingdon Press. 1964.
Morris, Dean. *Underwater Life: The Oceans*. Raintree.
Morris, Robert A. *Seashore*. Harper. 1972.
Most, Bernard. *My Very Own Octopus*. Harcourt Brace Jovanovich. 1980.
Shepherd, Elizabeth. *Tracks Between the Tides*. Lothrop, Lee, and Shepard. 1972.

Teacher references

"The Living Coast," a 16 mm film, is available from the N.C. Regional Education Centers or the N.C. Office of Marine Affairs, 107 Blount Street, Raleigh, N.C. 27611. Provides excellent examples of coastal food chains.

"Ecological Characterization of the Sea Island Coastal Region of South Carolina and Georgia," a resource atlas, is available from the Marine Resources Division, S.C. Wildlife and Marine Resources Department, P.O. Box 12559, Charleston, S.C. 29412. Ask for publication number FWS-OB5-79/43. Provides excellent illustrations on food webs in different habitats.



A complex food web

CAPER FIVE

Potato fish

Purpose

To learn about the external parts of a fish and to show some adaptations to different lifestyles.

Vocabulary

Adaptations—changes in a plant or an animal that increase its chances of survival in its environment.

Fins—appendages of a fish that assist it in swimming (equivalent to human arms and legs).

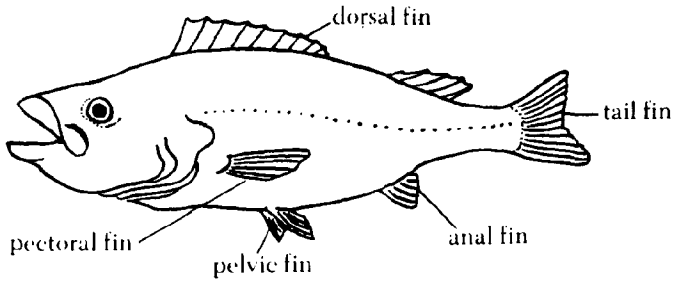
Materials

A potato for each child, construction paper or poster board, scissors, crayons, tape, straight pins.

Teacher background

Introduce the general body shape of a fish by using the illustration provided. Near the gills, the fish has pectoral fins that are equivalent to human arms. Below the gills are pelvic fins that are equivalent to human legs. An additional fin along the bottom of the fish is the anal fin. The dorsal fin along the top of the fish acts as a stabilizer. The tail fin is the major fin for motion. Pectoral and pelvic fins are used to maneuver the fish or propel it slowly.

Fins, mouth, teeth and body shape are clues that define a fish's lifestyle. For example, big eyes indicate a night fish or a fish living in deep water. A fish whose mouth points downward usually feeds off the bottom. A fish whose mouth points upward feeds from the surface. Some fish have big teeth—the flounder and some sharks. Others have grinders—skates. And some fish have no teeth at all—the sea horse and pipefish. They suck their food.



Procedure

Cut patterns for fins and mouths out of construction paper or poster board. Use the potato as the fish's body. Make slices in the potato to slide in fins and mouth made of poster board. Use straight pins to add fins, mouth and eyes made of construction paper.

Some children may create realistic fish, but others may create fantasy fish, such as a "cheerleader fish" with a big mouth or a four-eyed fish wearing glasses.

Suggestion

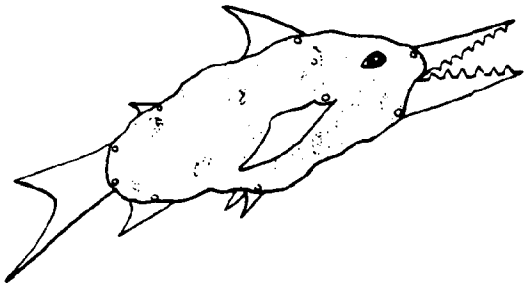
Bring a goldfish in a bowl to the classroom so that children can see a real fish.

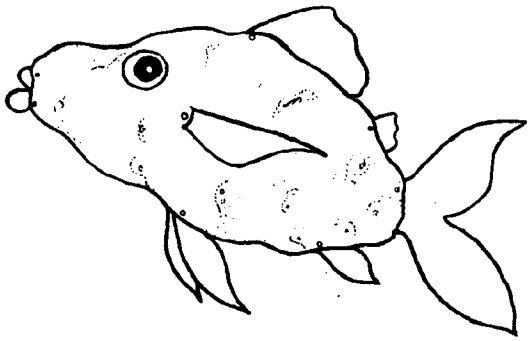
Student reading

Lionni, Leo. *Fish is Fish*. Pantheon. 1970.

Teacher references

Unit Three, Coastal Ecology: North Carolina Marine Education Manual. UNC Sea Grant, Box 8605, NCSU, Raleigh, N.C. 27695-8605. Cost: $1.50.





CAPER SIX

Whale songs and wild moves

Purpose

To practice listening skills; to identify high and low notes.

Vocabulary

Marine mammals—mammals such as whales, porpoises and seals that once lived on land but have evolved to a life in the sea. They breathe air, grow hair and nurse their young. Whales belong to the mammal group called cetaceans, which have been hunted for oil and meat.

Materials

Cassette tape of whale songs, tape player.

Teacher preparation

The most difficult part of this caper is finding a record of whale songs to record on a cassette tape. The albums listed can be obtained by your librarian or purchased through a record store.

Teacher background

Here are a few facts about vocal communication among whales and porpoises to use in the classroom. Whales and porpoises can make sounds that travel for miles in water. Water carries sound-wave vibrations better than air. Scientists are trying to find out if the marine mammals are communicating with each other or singing songs.

Whale songs have distinct high and low notes. Scientists, using underwater listening devices called hydrophones, have recorded whale sounds. National Geographic produced a tape in which the sounds were sped up. The result? A whale song that sounds much like a bird chirp.

Procedure

The entire class can participate in this caper as a listening/doing exercise. Play a recorded section of a whale song. As the students listen, ask them to move their hands up or down to indicate low and high notes. Once they have learned to listen and react to the sounds, they are ready to move their entire body with the notes.

The students should squat for low notes and stand on tip toe for high notes. As whale songs are slow, the students' movements become a slow dance. It does not matter if all students move at the same time or with the same elevation.

Student reading

Beauregard, Sue and Jill Fairchild. *Ocean Plants*. The Sea Library. Children's Book Company. 1982.
McCloskey, Robert. *Burt Dow: Deep Water Man*. Viking Press. 1963.
McGovern, Ann. *Little Whale*. Four Winds. 1979.
Morris, Robert. *Dolphin*. A Science I CAN READ Book. Harper and Row. 1975.
Ricciuti, Edward. *Catch a Whale by the Tail*. A Science I CAN READ Book. Harper and Row. 1969.

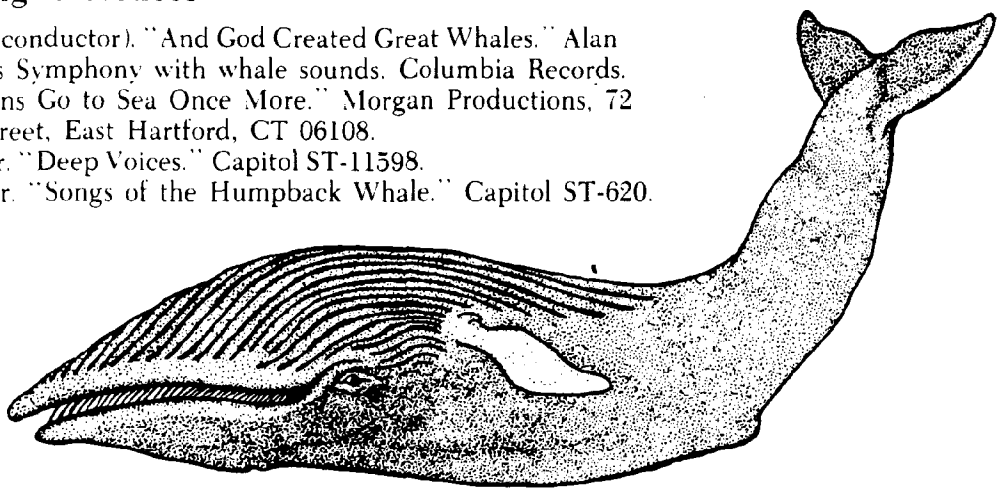
Teacher references

Center for Environmental Education, 924 Ninth Street, Washington, D.C. 22202. CEE has a wealth of information on whales and seals. The information is designed for teachers oriented toward conservation.

"Listening to Whales," Module 11—Process is Observing. SAPA. Delta Education, P.O. Box M., Nashua, NH 03061-6019. 1974.

Whale song references

Kostelanetz (conductor). "And God Created Great Whales." Alan Hovhaness Symphony with whale sounds. Columbia Records.
"The Morgans Go to Sea Once More." Morgan Productions, 72 Stanley Street, East Hartford, CT 06108.
Payne, Roger. "Deep Voices." Capitol ST-11598.
Payne, Roger. "Songs of the Humpback Whale." Capitol ST-620.



CAPER SEVEN

Grandma's Catch

Purpose

To show why management of natural resources, such as fish, is necessary.

Vocabulary

Predict—an educated guess of a future event.
Conserve—to save. To keep from being lost or wasted.
Natural—objects used by people that come from nature. Examples are trees, coal, soil, water, fish and air.

Materials

Small fish bowl or large-mouth jar, two bags of "goldfish" crackers.

Teacher background

Natural resources come in two types—those that are renewable, such as trees and fish, and those that are limited, such as coal and oil. People need to manage both so that we can continue to use them as long as we need them. Different methods can be used to manage resources.

In the Pacific Northwest, salmon are valuable fish. Fishermen catch salmon either in the ocean or in the rivers. To keep the salmon from being overfished, regulations allow only certain people to catch the fish at certain times.

In the Chesapeake Bay, oysters are valuable shellfish. To manage the stocks, some regulations allow fishermen to use only sail-powered oyster boats and oyster tongs to harvest the shellfish. Using boats and tongs are inefficient ways to harvest oysters, which prevent large quantities from being taken. Similarly, Carolina sounds are home for the bay scallop. Regulations allow bay scallop harvest only a few weeks in the winter months.

Procedure

In this caper, students will investigate how a fish population may become overfished and how to control the problem through management.

Assign students the following roles. First generation: grandma, grandpa. Second generation: son #1, son #2, daughter #1, daughter #2. Third generation: grandchild #1, grandchild #2, grandchild #3, grandchild #4, grandchild #5, grandchild #6, grandchild #7, grandchild #8.

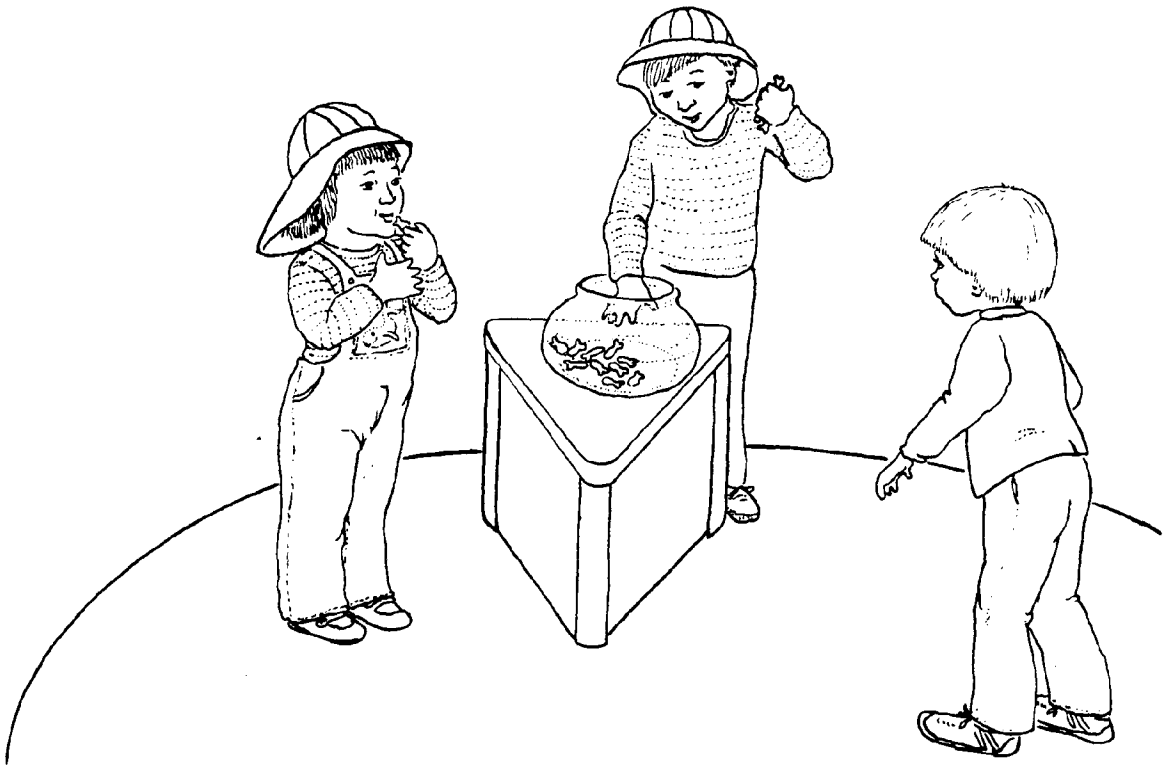
Tell the students that each generation wants to make a living fishing. Then begin the exercise:

1. Pour the contents of one goldfish bag in the jar or bowl.
2. Let each grandparent fish from the bowl by scooping up a handful of fish. Let the grandparents decide if this is enough fish for them.
3. Let the second generation fish in the same manner.
4. Let the third generation fish in the same manner. (Probably there will be no fish left for them.)

What have we forgotten? Fish reproduce. Repeat steps 1 through 4, but add fish. After the first generation fishes, add two handfuls of fish to the bowl. After the second generation fishes, again add two handfuls of fish. Repeat after the third generation. You should still run out of goldfish.

Who did not get enough fish? Why? How could the fish be conserved for each generation? Would you limit the number of people who could fish? Would you change the fishing method to allow use of only the thumb and forefinger? Would you allow a shorter time to fish? Would you set a limit for the number of fish that could be caught?

This exercise has no right answer because fisheries managers are still discussing these problems. Your students may evolve a better solution.



CAPER EIGHT

Fishy fun

Purpose

To identify marine creatures. Minimum reading ability required.

Vocabulary

Marine—having to do with the sea or ocean.
Tentacles—the "arms" of an octopus or stinging parts of a jellyfish.

Materials

One die, four small shells (all different) for tokens, a file folder, glue, construction paper in one color, fine point felt-tip pen, scissors, crayons, laminating film.

Preparation

Duplicate the game board on two sheets of paper, the chance card directions, and the fish pattern. (**The game board pattern and chance card directions are located in Appendix II.**) To make the game board, glue the duplicated sheets to the inside of the file folder and color them. Laminate. To make the chance cards, trace the fish pattern 16 times on the construction paper. Cut the cards out. Cut out the chance card directions, and glue them to the back of the fish patterns. Laminate chance cards. Store them in a small sandwich bag stapled to the outside of the file folder.

Print game directions on the outside of the file folder. This game is easily stored in a learning center.

Procedure

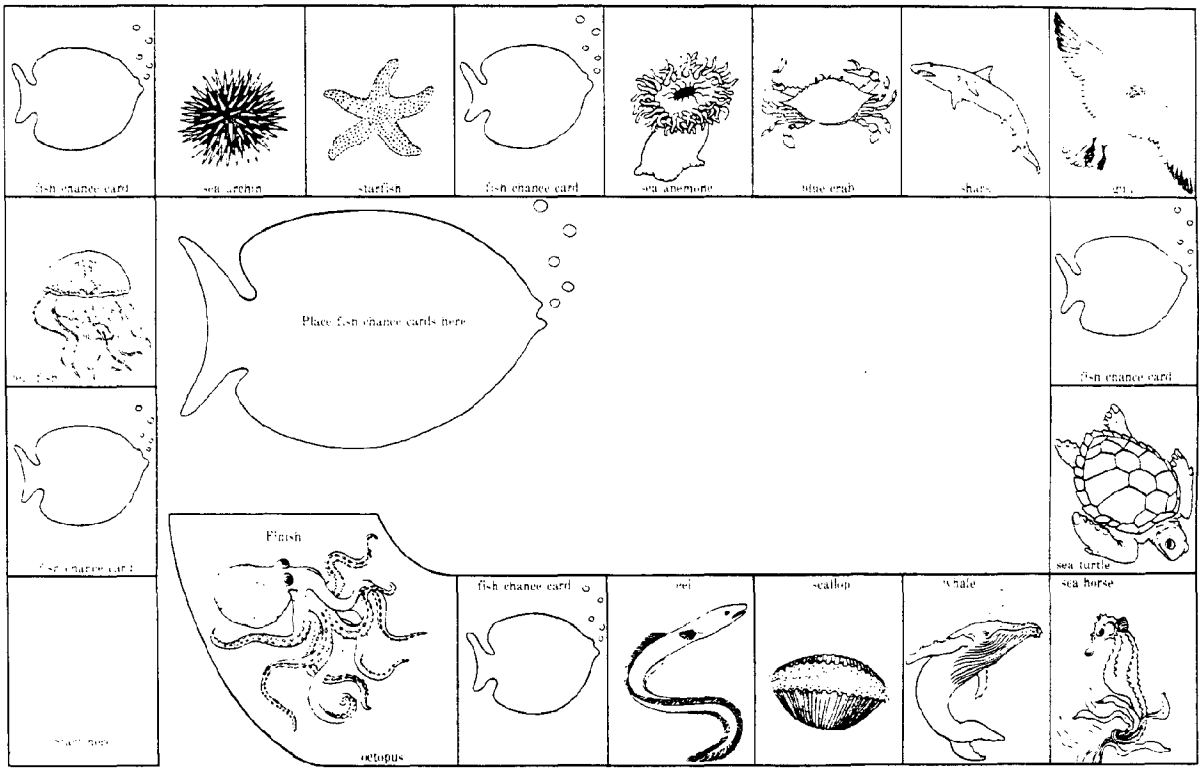
The game is designed for two to four players. Each player picks a shell token and places it on START. Each player tosses the die. The highest number begins the game.

To play, each player, in turn, tosses the die and moves the token the number of spaces shown on the die. If the token lands on a Fish Chance block, the player removes the top Fish Chance card from the deck, reads the directions and moves accordingly. The first player to arrive at the FINISH block is the winner. (The die must have the exact number of spaces needed to reach the FINISH.)

Spin-off

To see if students can identify the animals used in the above game, teachers may test them with this match problem.

Duplicate the game board and cut out the animals. Glue the animals to the left side of a sheet of paper. Write the names of the animals in a different order on the right side. Duplicate this master with directions for the students to draw a line from the animal's name to its picture.



Miniature version of game board (see Appendix II for larger version)

CAPER NINE

Now you see me, now you don't

Purpose

To show how fish conceal themselves with camouflage.

Vocabulary

Adaptation—a change in a plant or an animal that increases its chance of survival.
Camouflage—to disguise by changing color, shape or behavior to blend with a background.
Habitat—the area where a plant or an animal lives. A fiddler crab's habitat is the edge of the marsh.

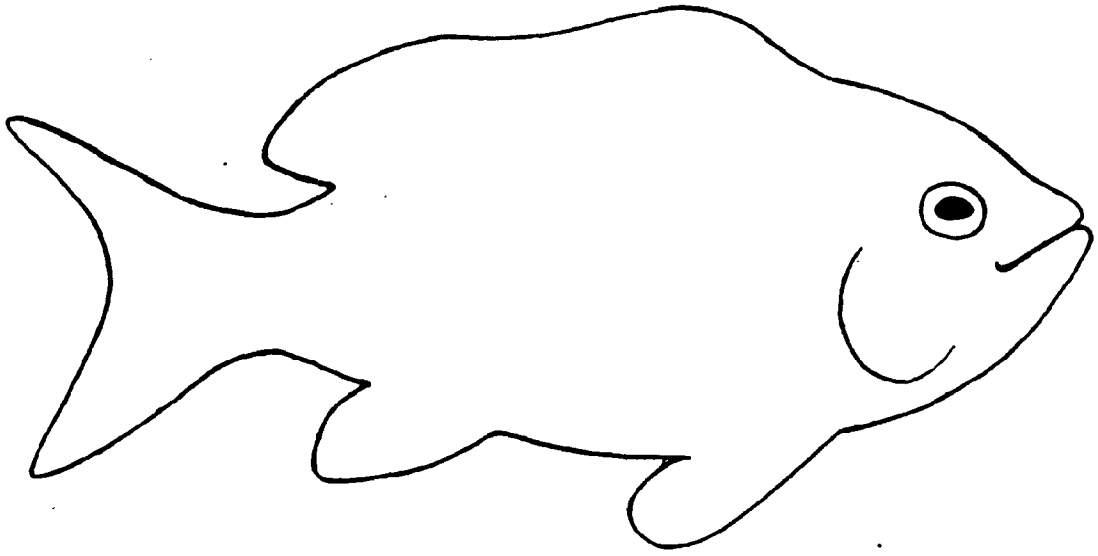
Materials

Fish pattern, construction paper, scissors, crayons.

Teacher background

Marine and terrestrial animals camouflage themselves to blend in with their surroundings. This helps them avoid being found and eaten or assists them in making surprise attacks on other creatures. Many marine animals have excellent camouflage. A flounder, octopus or squid can lighten or darken its color, depending on the surroundings.

A decorator crab puts seaweed on its shell to resemble moving seaweed gardens. A pipe fish is long and slender, and it hangs almost vertically in the water to imitate the sea grasses of its habitat.



Procedure

Outline the fish pattern on construction paper. Color it with vertical stripes. Cut it out.

Using a whole sheet of construction paper, ask the class to make a marine scene with seaweeds. Use the same colors used on the fish. Using scissors, cut vertical slits about 1-inch apart into the background scene.

Slide the fish in and out of the slits. Ask the class these questions. Does the color help the fish blend with its surroundings? How does this help the fish survive?

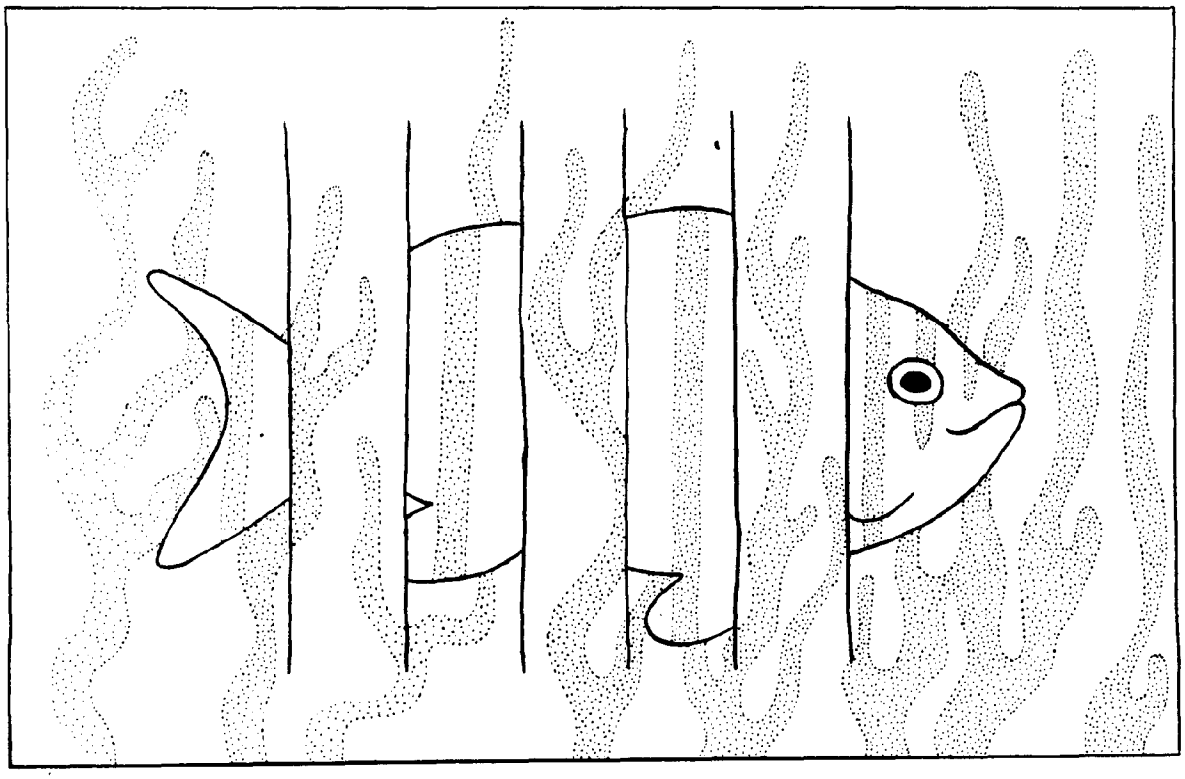
Spin-off

Once the students understand the idea, ask them to repeat the exercise and match the fish to its surroundings. Which student can make his/her fish almost invisible?

Try the reverse. Color a fish that doesn't blend. Some fish, such as the lion fish, are colorful and standout from their habitat. Many times these fish are harmful for other fish to eat. The color is a warning—"don't eat me."

Student reading

Lionni, Leo. *Swimmy*. Pantheon Press. 1977.



CAPER TEN

What bird are you?

Purpose

To show that a bird's physical features—its beak, legs and neck—reflect how it has adapted to its surroundings.

Vocabulary

Adaptation—change in a plant or an animal that increases its chances for survival.

Environment—all of the biological, chemical and physical conditions, living and nonliving, that affect an organism or group of organisms.

Materials

Scissors, crayons, glue, construction paper.

Teacher background

Birds come in many shapes and sizes. Each evolved over a long time to its present size and shape. Often the bird's features identify where the bird lives and how its feeds.

The long-legged heron wades in shallow water to hunt for minnows. The osprey, which possesses sharp claws and excellent eyesight, swoops down and nabs fish from coastal sounds and bays. Sandpipers use their beaks to poke the surf for worms and small shrimp-like crustaceans.

Teacher preparation

Introduce the class to the various shapes of birds by using films and books. A bird feeder outside the window will attract a variety of birds for direct observation.

Put together a demonstration bird while students discuss the functions of feet, necks and beaks.

Procedure

Duplicate a bird pattern for each team or student. (**The bird pattern is located in Appendix III.**) Have the students cut out the bird parts and choose the features they want to include on their bird. Ask the students to form a bird with the parts they've chosen and glue it to construction paper. The students may paint a scene on the construction paper to illustrate the bird's habitat.

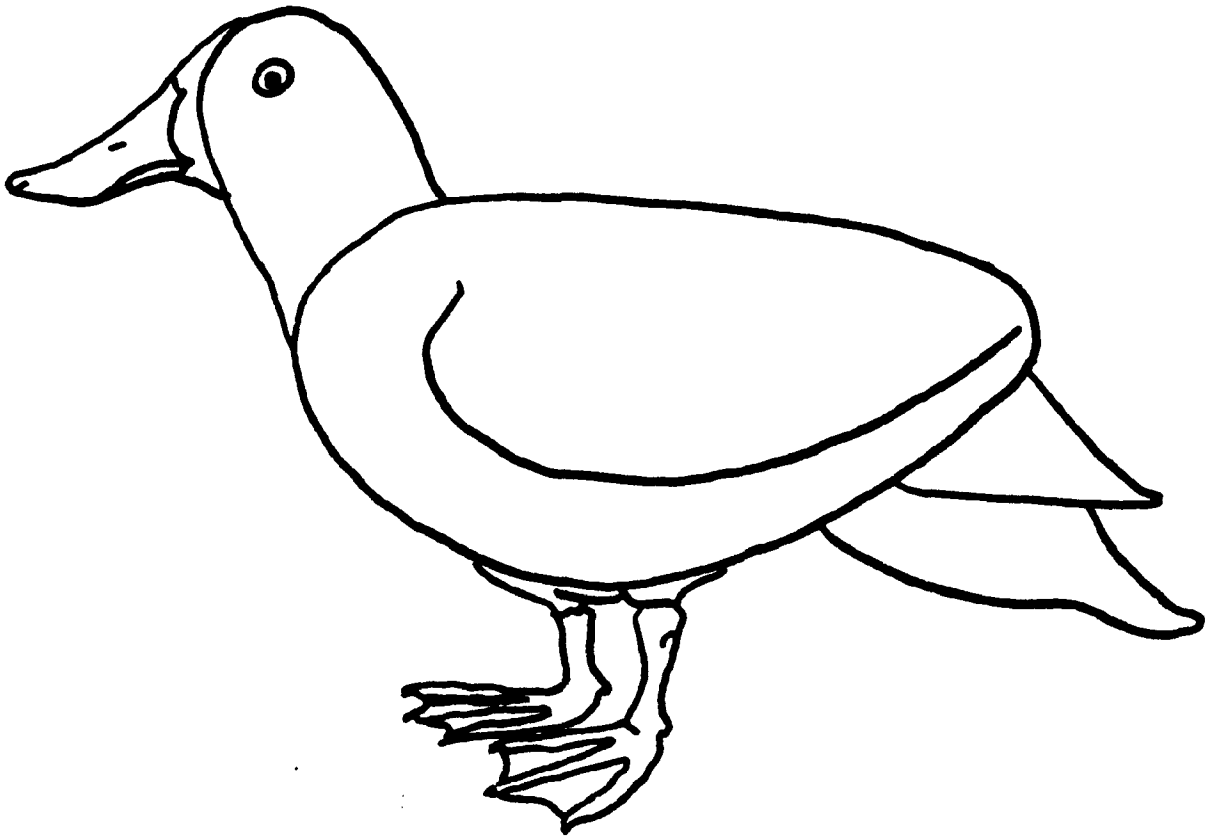
It is important to follow the exercise with a group discussion of the bird designs. Why did they use that particular leg or beak? How would the bird feed or where would it live?

Student reading

Hamsa, Bobbie. *Your Pet Penguin*. Children's Press. 1980.
May, Julian. *Why Birds Migrate*. Holiday House. 1970.

Teacher reference

"Living Coast" is a free film available from the N.C. Office of Marine Affairs, 116 W. Jones St., Raleigh, N.C. 27611 or one of the eight N.C. Regional Education Centers.
Peterson, Roger Tory. *A Field Guide to the Birds of North America*. Houghton Mifflin Co., Boston. 1980.



CAPER ELEVEN

Shark

Purpose

To teach students about surveys and bar graphs. Students may also learn that some perceptions they have about sharks are wrong.

Vocabulary

Survey—a detailed study in which information is gathered through observation or questionnaire, then analyzed.

Materials

Duplicated copies of survey and graph forms, crayons, overhead projector.

Teacher background

A shark's skeleton is made of cartilage (like the end of your nose), not bone. They are a cold-blooded fish, found most often in the temperate and tropical zones of ocean and coastal waters. Some sharks, such as the Greenland shark, live in polar waters. The Lake Nicaragua shark in Central America is the only known shark that lives in fresh water. But several types of sharks travel up rivers for food.

Shark fossils over 300 million years old reveal a fish very similar to modern sharks. The extinct great white shark had 6-inch teeth that can still be found along the shores of the Pamlico and Neuse Rivers in North Carolina. This extinct shark may have been up to 100 feet long. The whale shark is the largest fish today. It is over 45 feet long. Like its relative, the Basking shark, it is a filter-feeder that strains tiny organisms from the water.

Not all sharks are dangerous to people. Of the 300 species or more alive today, only 15 to 20 species have attacked people. Sharks have few predators except people.

Scientists continually study the behavior and physiology of sharks. For instance, no sharks have been found with cancer.

And sharks have captured the fancy of several poets. In 1923 Ogden Nash wrote this short, humorous poem:

The Shark

Many scientists have written
That the shark is gentle as a kitten.
But this I know about the shark,
His bite is worser than his bark.

Another humorous, anonymous poem is entitled "The Chivalrous Shark." A more serious poem, "The Maldive Shark," was written by Herman Melville.

Teacher preparation

Bring some library books on fish, sharks and the ocean to class. You also may present the background information provided here.

Duplicate the survey form provided. Get permission for your class to survey other classes in the school.

Procedure

Introduce your class to this caper by doing "free word association." Ask each child to say one word that comes to mind when he/she thinks of sharks. Write words on a large shark shape taped to the wall.

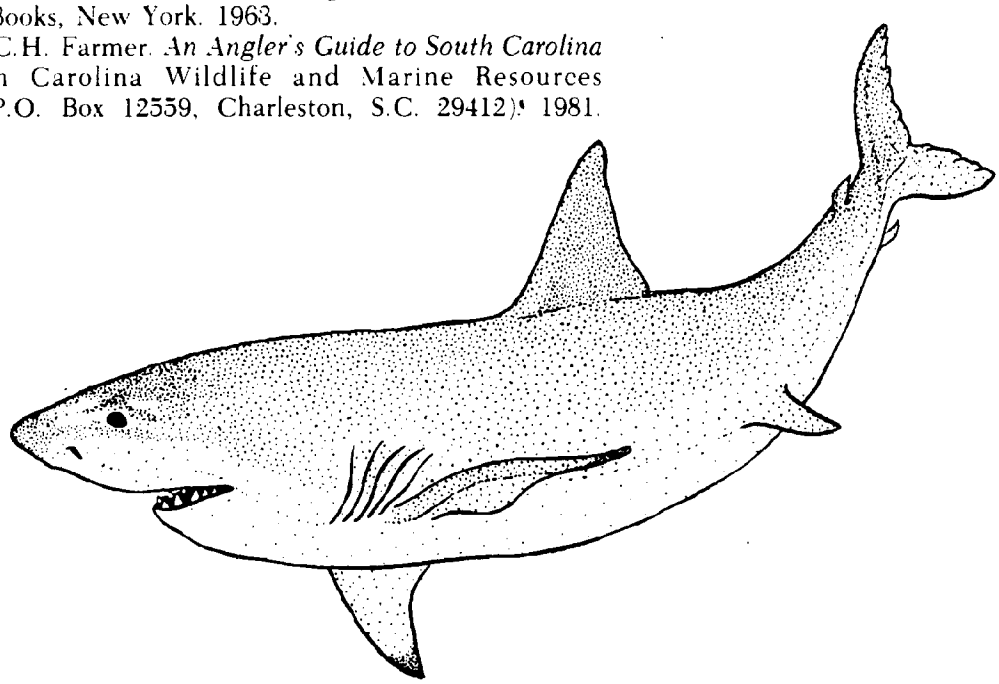
Use the survey form to test the students. Using an overhead projector, plot the results on the bar graph for the students to see. Explain to your class that they are going to investigate what other students think about sharks. Survey another class and plot the results on a bar graph.

Teacher references

"Dangerous Sea Creatures." Wild, Wild World of Animals. Time-Life Films, Inc. 1977.

McCormick, H.W., Tom Allen and W. Young. *Shadows in the Seas.* Weathervane Books, New York. 1963.

Moore, C.J. and C.H. Farmer. *An Angler's Guide to South Carolina Sharks.* South Carolina Wildlife and Marine Resources Department (P.O. Box 12559, Charleston, S.C. 29412). 1981. $3.50.



Shark Survey

Grade _____

Circle yes, no or don't know for each statement.

1. All sharks are dangerous	Yes	No	Don't know
2. Sharks are fish.	Yes	No	Don't know
3. People are the greatest enemies of sharks.	Yes	No	Don't know
4. Sharks have a well-developed sense of smell.	Yes	No	Don't know
5. Have you seen a living shark?	Yes	No	Don't know
6. Would you be afraid to swim in the ocean because of sharks?	Yes	No	Don't know
7. Are you willing to taste cooked shark meat?	Yes	No	Don't know
8. Do you want to learn more about sharks?	Yes	No	Don't know

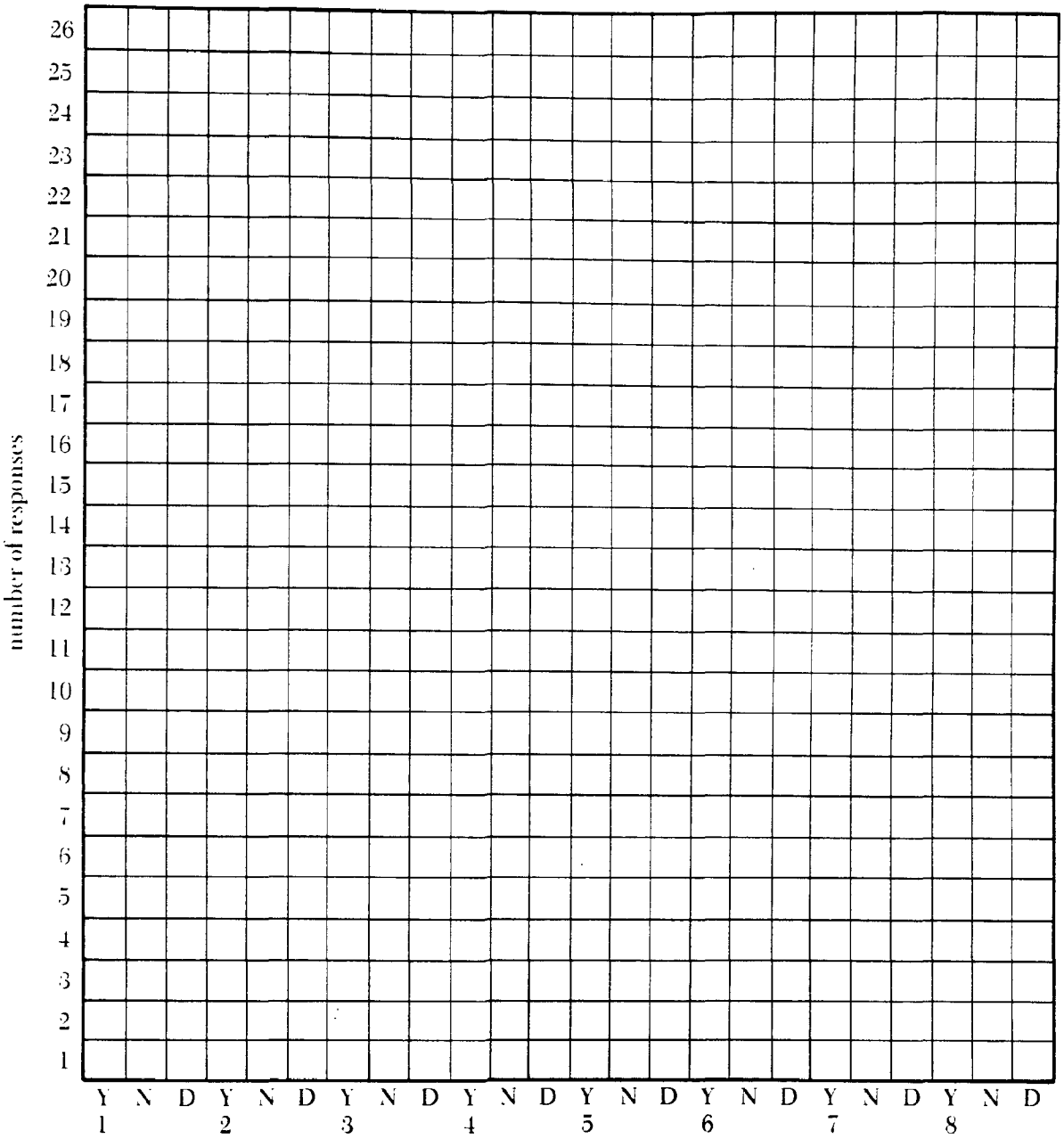
(Cover answers before photocopying.)

Answers:

Question 1: No
Question 2: Yes
Question 3: Yes
Question 4: Yes
Questions 5-8: Any answer would be correct.

1. Based on the number of correct answers to Questions 1-4, did your group know facts about sharks?
2. Based on the answers to Question 6, are people afraid of sharks?
3. What else did you find out about the group you surveyed?

Bar Graph for Tabulating the Results of the Survey



Y—Yes answers color yellow
N—No answers color blue
D—Don't know answers color red

CAPER TWELVE

Sea prints—art in the ocean

Fish prints

Purpose

Students will produce a Japanese fish print. This art form records the size and type of fish.

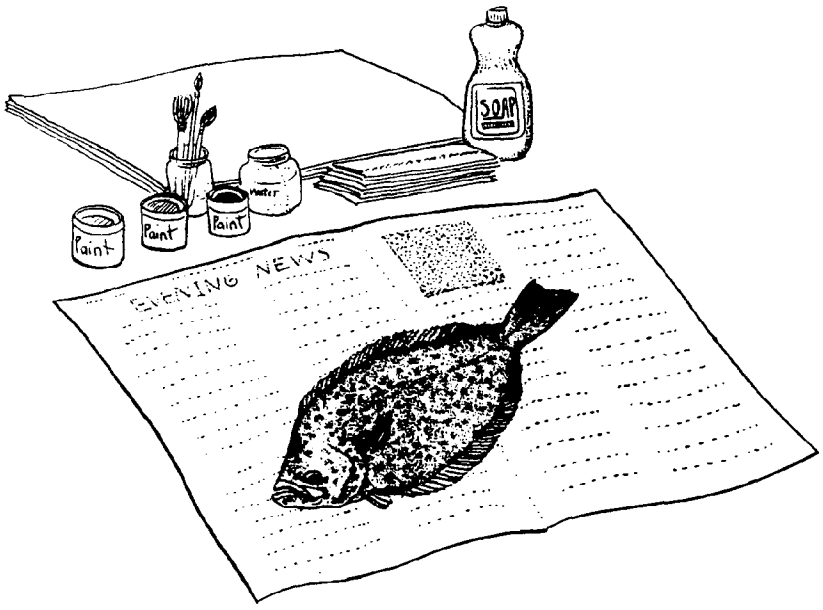
Materials

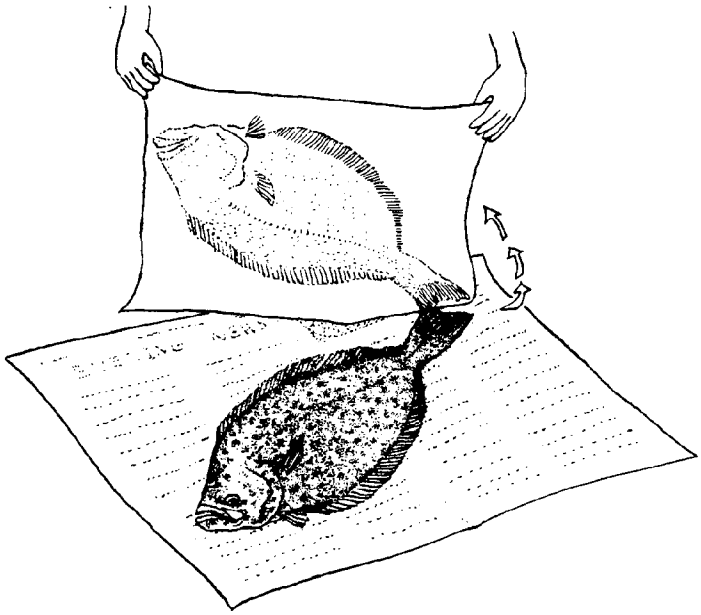
Blank newsprint paper, water soluble printer's ink or tempera colors, old newspaper to cover desks, small jars to hold paint, large brushes and small brushes, paper towels, fresh or frozen fish.

Procedure

For printing, it's best to choose a flat fish such as a flounder, spot or pinfish. But any fish will do, fresh or frozen. Fish should be whole, neither gutted nor scaled. (You can reuse the fish for printing by freezing.) First, wash the fish with soap and water to remove body slime. Dry with a paper towel.

Lay the fish on an old newspaper and extend its fins. (To extend the fins, you may need to prop them against a ball of clay and insert pins.) Brush a thin coat of paint on the top of the fish, avoiding the





eye if possible. If the paint smears onto the newspaper, slide a clean piece of paper under the fish before printing.

Gently drop a sheet of blank newsprint over the fish. Press evenly and lightly over the entire body. Peel off paper without blurring the print. Add the eye dot later.

Teacher Reference

Earley, Lawrence. "Art Prints from Nature," *North Carolina Wildlife Magazine*. July, 1983.

Zimmerman, Sally. "Art Prints from Nature," *Current: The Journal of Marine Education*. Spring, 1984.

Sun print

Purpose

Students produce silhouettes of shells, leaves, flowers and other objects or patterns.

Materials

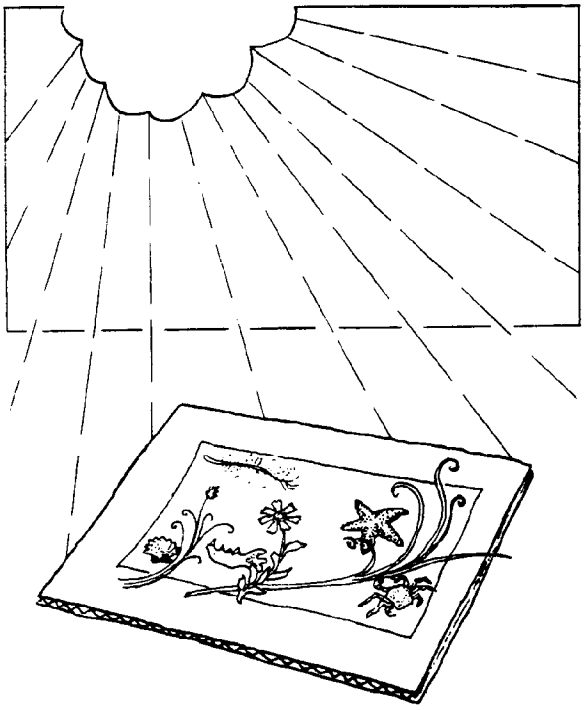
Blueprint paper (blueline ammonia paper) obtained from office supply stores or biological supply houses (store in light-proof envelopes), one or two trays large enough to hold a sheet of blueprint paper, a piece of cardboard as large as the blueprint paper, a bottle of hydrogen peroxide.

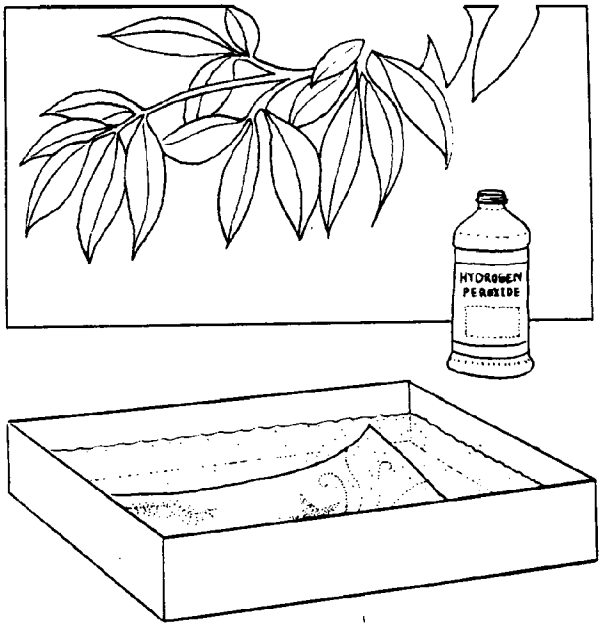
Procedure

Collect specimens that are flat. Or cut out your own patterns. Working outdoors in the shade, fill trays half full with water and add a few drops of hydrogen peroxide.

Decide how the specimens will be arranged on the paper. While still in the shade, slide the blueprint paper out of the envelope and onto the cardboard, yellow side up. Quickly arrange objects on the paper, then expose it to direct sun until the paper turns white. Return the paper to the shade.

Remove the specimens. Slide the exposed blueprint paper into the tray of water and hydrogen peroxide. Jiggle the paper in the water for about one minute or until an image begins to appear. Remove the blueprint paper and let it dry.





Screen printing

Purpose

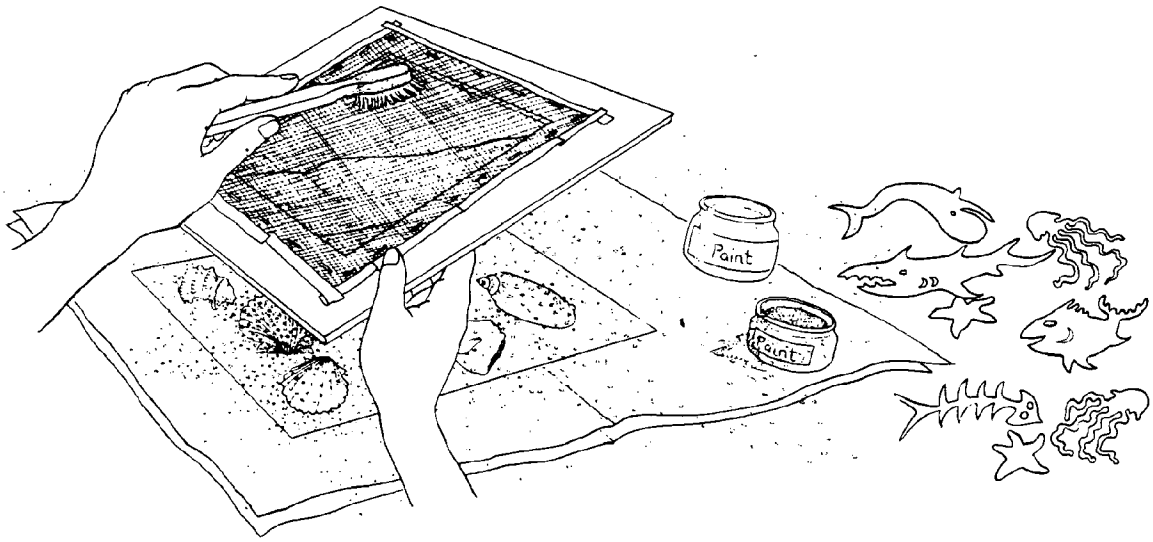
Students will outline the form of shells, leaves or patterns.

Materials

An 8-inch-by-8-inch sheet of mosquito screen stapled on a cardboard frame, old toothbrushes, tempera paints, construction paper.

Procedure

Arrange objects or patterns on the construction paper. Dip the toothbrush into the paint. Hold the screen over the construction paper, and rub the toothbrush over the screen to achieve a splatter effect. For variation, use more than one color to splatter.



CAPER THIRTEEN

Buried treasure

Purpose

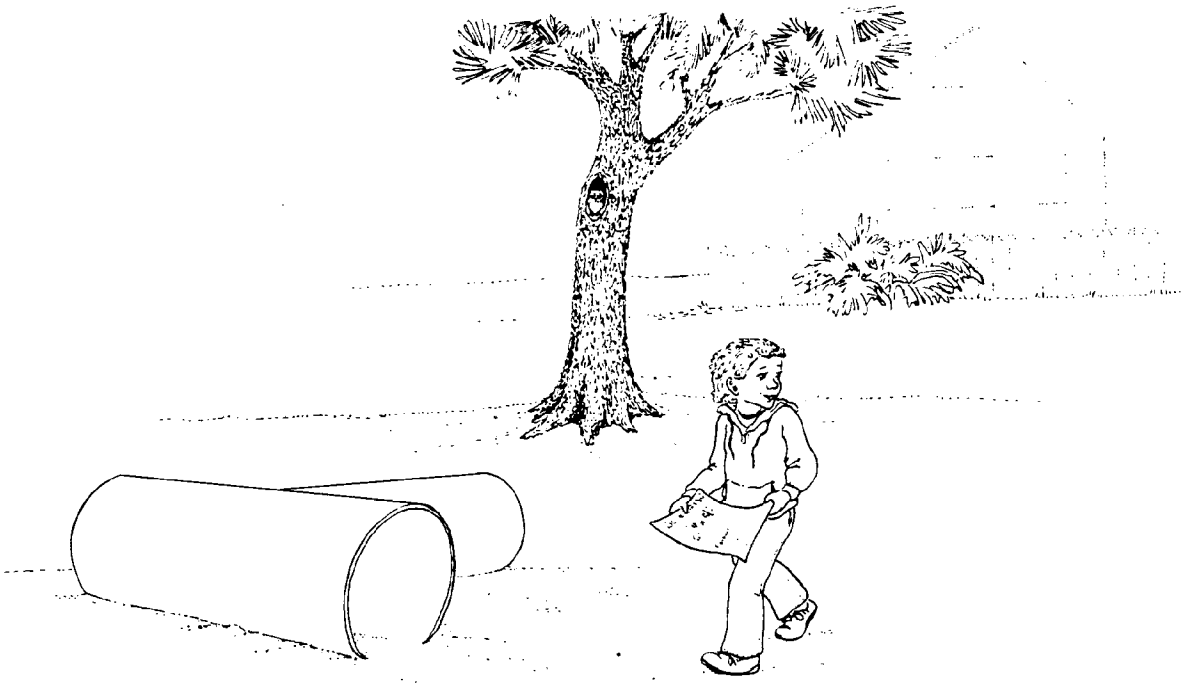
To teach students to follow directions on a map using visual clues and motor skills.

Materials

Treasure treats or awards, a digging instrument such as a trowel, maps.

Teacher preparation and procedure for young children

After burying the treasure on the playground, the teacher will draw a treasure map. Use right and left for directions, and count the paces for distance. Markers such as a tree or a sidewalk are helpful hints. Also use directional and distance words that have been emphasized in reading exercises. The map illustrated here may help you design one for your class.



Teacher preparation and procedure for older children

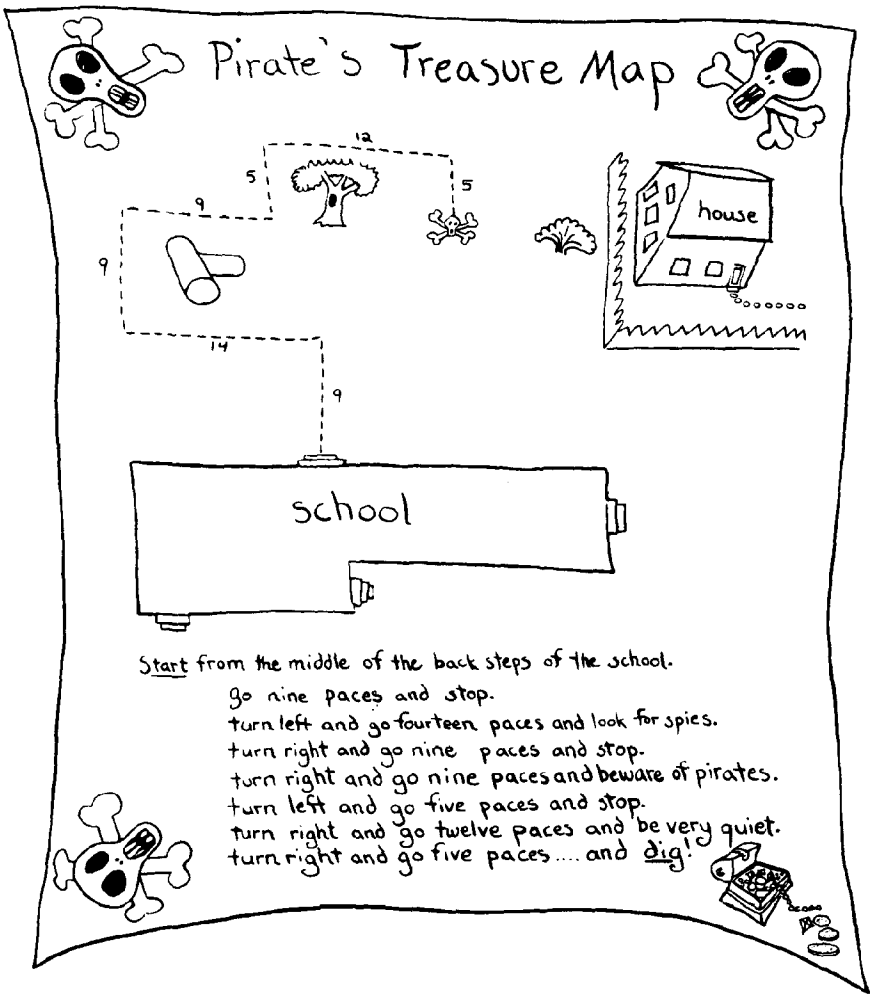
Divide the class into two groups, pirates and explorers. Make it the responsibility of the pirates to hide the treasure and draw the map. It is up to the explorers to read the map and find the treasure.

Older students can use compass skills and metric distances to design the map. Directions may include north, south, east and west. Mapping distances may require the use of a measuring tape or meter stick.

Student reading

Pirates of North Carolina. N.C. Department of Cultural Resources, Division of Archives and History, Raleigh, N.C. 27611.

Stevenson, Robert Louis. *Treasure Island.* 1883.



CAPER FOURTEEN

Name that shell

Purpose

To sort shells into groups. Older students can learn to make a line key, while younger students can observe differences in shell shapes. Students also learn to identify shells by matching a fragment of a shell to its whole.

Vocabulary

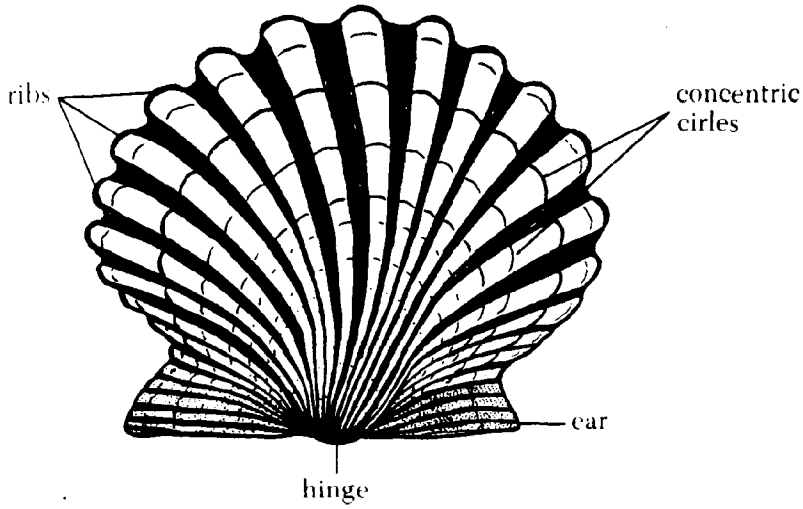
Line Key—a method to identify objects. To create a line key, divide a group of objects, such as shells, into smaller and smaller sets, using a single distinguishing characteristic. For instance one group of shells is clam-like; the other group is not. The clam-like group is then subdivided into two groups, again using a single characteristic (for example, shells having ears at the hinge or not). When a single shell is isolated, it is named.

Univalve or gastropod—a class of mollusk with a single, often spiraled shell, such as a snail.

Bivalve—a class of mollusk that possesses two hinged shells, such as a clam.

Shell terminology:

ribs—lines from the hinge to the edge of the clam shell.
concentric circles—growth lines that curve around the hinge.
ears—extra shell at the hinge.
hinge—spot where two halves of a clam shell come together.
apex—top of snail shell.



Materials

A collection of whole shells and shell fragments, hammer.

Teacher preparation

Collect enough shells for each team of four children to have five to eight. Slightly damaged shells work well, but be sure the shell can be easily recognized.

You will also need shell fragments for the spin-off activity. You can break a whole shell with a hammer or just keep broken shell pieces from the collection.

Ask parents and students to donate shells for the shell activity.

Procedure

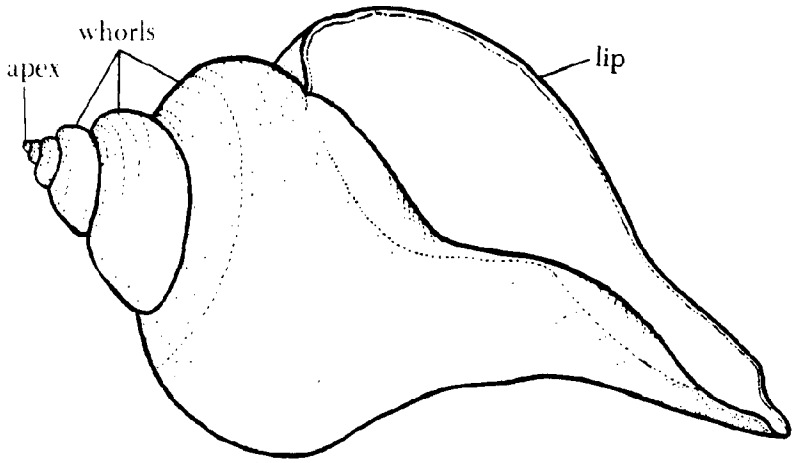
Place a drawing of a snail and a clam shell on the bulletin board to show shell parts.

Give each team five to eight shells—gastropods and bivalves. The object is for the team to make a line key to identify the shells. It is not important for the children to know the scientific or common names of the shells. But it is important for them to discriminate characteristics that divide the shells into successively smaller groups. Each division is based on an agreed characteristic and splits the group or subgroup into two. When a subgroup has only one shell in it, the shell is named.

Students can name their shells fun names like "Sam," "Suzie" or "Spot," or try to identify the actual name using a shell guide.

If it is within their ability, have the students copy their line key or system of divisions on paper.

Students can test their line key by giving the key and one shell to another team. If the other team can follow their key and correctly identify the shell, then the key works.



Spin-off

Beachcombers walk the beaches, find a shell fragment and identify the shell's name. They have learned to associate color, texture and surface design by close observations. Students can learn to do the same skills.

Put whole shells on the table. Give shell fragments or damaged shells to each team. Their task is to match their fragment to the whole shell. Smaller pieces increase the difficulty of this game. (If you identify the shells on the table, then the students will learn their correct names.)

Further reading

Fredlee. *The Magic of Sea Shells*. Windward Press. 1976.

Lionni, Leo. *The Biggest House in the World*. Pantheon Books. 1978.

Mauldin L. and D. Frankenberg. *Unit Three, Coastal Ecology*. UNC Sea Grant (Box 8605, NCSU, Raleigh, N.C. 27695-8605). 1978. $1.50. pg. 53-54.

Morris, Dean. *Animals That Live in Shells*. Raintree Children's Books. 1977.

Porter, Hugh and Jim Tyler. *Sea Shells Common to North Carolina*. UNC Sea Grant (Box 8605, North Carolina State University, Raleigh, N.C. 27695-8605). 1981. $.75.

Romashko, Sandra. *The Shell Book*. Windward Press. 1974.

CAPER FIFTEEN

Squeaky sand

Purpose

To examine sand collected from different places and observe the variances in size, color and composition.

Vocabulary

Sand—loose grains of rock, mostly quartz and feldspar, and other materials, such as heavy minerals, shell and coral fragments, that are moved by wind and water. Moving sand builds beaches and dunes.

Weathering—breakdown of rock by both mechanical and chemical forces.

Materials

Two buckets of sand collected from two different locations (dune top and surf, inside and outside of a river bend, lake beach and ocean beach, Atlantic Ocean beach and a beach from another part of the world, an area of dark sand and an area of light sand), two paper cups for each team of students, magnifying lenses, magnets.

Teacher background

Sand, composed mainly of quartz, tends to squeak when beachcombers walk on it. And often along the beach, light-colored sand is interrupted by dark streaks of sand. Usually, this is not

"dirty" or polluted sand, but sand that is composed of different minerals that have been separated by the wind. These streaks consist of heavy minerals that usually contain iron, magnetite and some crystals, such as garnets or tourmaline.

The size of the sand grains varies along the beach. Sand that is moved by water has larger grains than sand moved by wind. Water has more energy to carry the larger grains. That's why coarse sand is found in the surf and very fine sand at the top of the dunes.

Procedure

This exercise could take place in a learning center or, with enough sets of cups and equipment, could be a class activity.

Label cups A and B. Fill cup A with sand from one location; cup B with sand from the other location. Students should work in small groups to compare and contrast the sand.

This is an open-ended investigation. Students can use their own approach to the study of their sand. If possible, have them record their observations. A possible record sheet is shown below.

Teacher references

Bascom, Williard. *Waves and Beaches*. Doubleday and Company, New York. 1964.

"Sand." ESS. 1974. Delta Education, Inc. Box M, Nashua, NH 03061-6012.

Student reading

McFall, Christie. *Wonders of Sand*. Dodd, Mead and Company, Inc., New York. 1966.

Investigation of sand

	Cup A	Cup B
Color		
Size of grains		
Feel when rubbed between fingers		
Smell		
Observations under a magnifying lens		
Results with magnet		

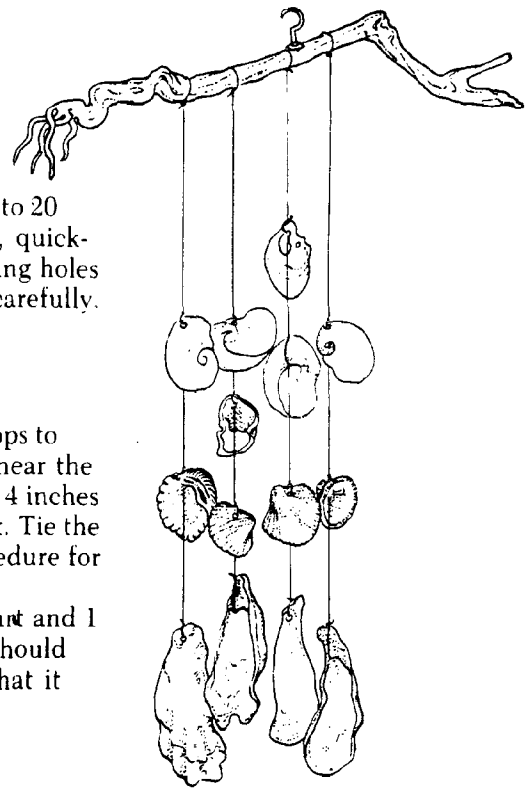
CAPER SIXTEEN

Blowing in the wind—mobiles with sea themes

Wind chimes

Purpose

To learn how to build a wind chime from shells and sharpen measuring skills.



Materials

A piece of driftwood or a 10-inch-by-1-inch strip of wood, 10 to 20 shells for each mobile, one cup hook, fishing line, scissors, quick-setting glue, small loops of ribbon if an electric drill for making holes in the shells is not available. (The drill works well if used carefully. Otherwise, the shells will break.)

Procedure

Cut four 24-inch pieces of fishing line. Either glue ribbon loops to shells and allow the glue to dry or drill holes in the shells near the hinge. Slide the first shell onto the line and position it about 4 inches from the top. Tie it to the fishing line using an overhead knot. Tie the remaining four shells about 2 inches apart. Repeat the procedure for the other three lines.

Tie the four lines to the wood, placing them 2 inches apart and 1 inch from each end of the wood. Remember the mobile should balance. Attach the cup hook to the top of the wood so that it balances the four lines. Hang.

Soft Sculpture—Portuguese man-of-war

Purpose

To construct a hanging model of a Portuguese man-of-war.

Materials

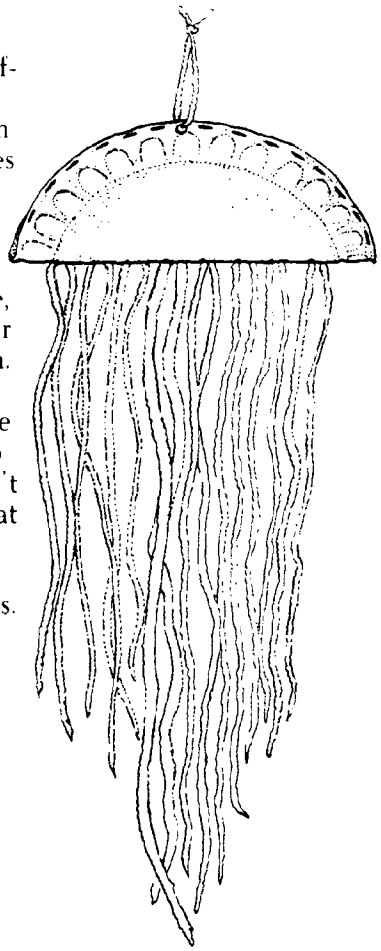
One white paper plate per model, lots of scrap yarn, tapestry needles, scissors, paper for stuffing, stapler.

Teacher background

The Portuguese man-of-war is a jellyfish that has long (up to 100 feet) tentacles containing many stinging cells. The sting of a Portuguese man-of-war is more dangerous than a regular jellyfish.

The Portuguese man-of-war floats on the surface due to its air bladder, which is colored iridescent shades of pink and purple. Although its tentacles are toxic, some fish are immune to the man-of-war sting.

The Portuguese man-of-war is found in the Gulf Stream and often washes ashore on Carolina beaches. Emphasize that even dead ones can still sting.



Procedure

Make a sample model to show students. Then give each child a plate, crayons, yarn, a needle and scissors. Color the outside of the paper plate purple, pink, blue or green. The ridged edge should be reddish. Fold the plate in half with the crayoned side on the outside.

Cut a length of yarn 24 inches long. Thread the needle with the yarn. Working from the outside of the plate, push the needle up through one half of the plate and return about 1 inch away. (Don't pull the thread through both halves of the plate.) Pull the yarn so that about half hangs out either hole. Continue this process until the desired number of tentacles are made.

Stuff paper inside the folded paper plate. Staple the ribbed edges. Thread yarn through the top of the plate to hang the mobile.

Fishy puzzle mobile

Purpose

To learn how to make a puzzle from a marine animal pattern, then hang and balance it on a mobile.

Materials

Marine animal patterns, construction paper, yarn, coat hanger, hole puncher.

Teacher preparation

Duplicate whale pattern or use your own fish outline. You may want to enlarge the pattern by using an overhead projector. Divide the pattern into five puzzle pieces.

Procedure

Give a set of puzzle pieces to each team. Students will trace patterns onto a sheet of construction paper, cut the pieces out and punch a

hole in the top. Thread one end of the yarn through the hole and tie a knot. Arrange the pieces to form a complete whale or fish. Tie each piece of the puzzle to a coat hanger in this order.

Stuffed bird

Purpose

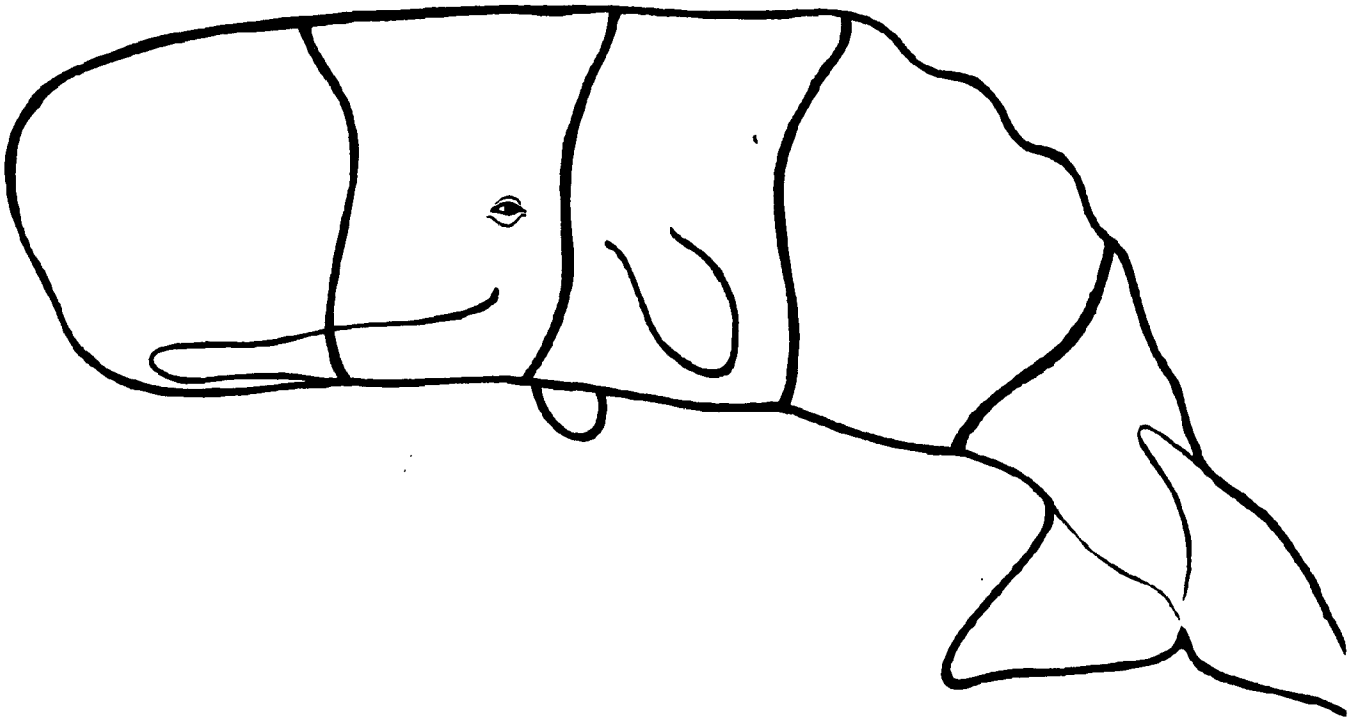
Students learn to make a hanging model of a marine creature using a soft-sculpture technique.

Materials

Two sheets of 12-inch-by-18-inch newsprint or construction paper per model, pencils, scissors, crayons or paint, stapler, yarn, tapestry needle.

Teacher preparation

Enlarge the bird pattern in this book or make your own from library books. The teacher can make transparencies of a pattern and project them on a sheet of paper hung on the wall for students to trace.

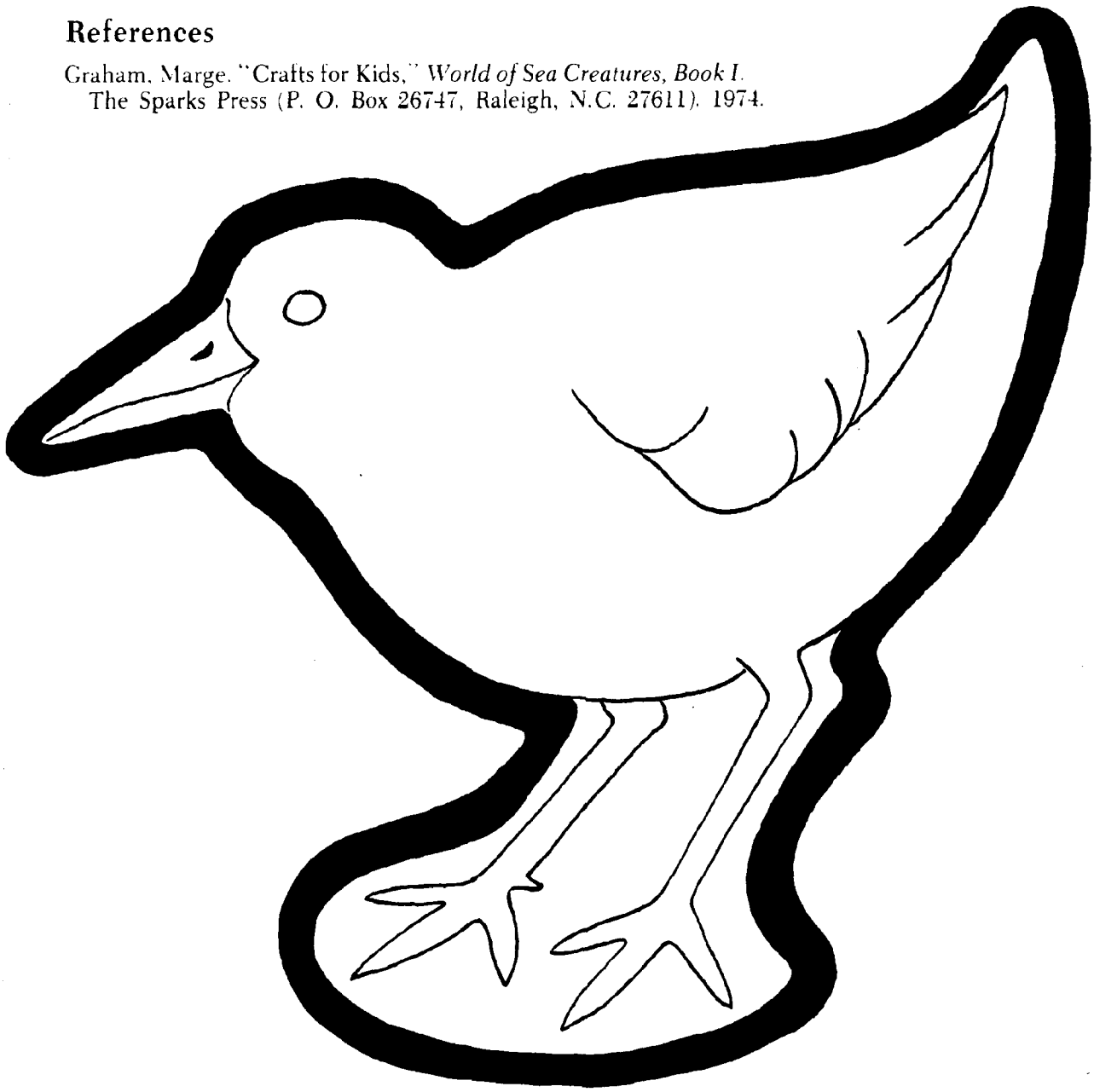


Procedure

Using a bird or fish pattern, trace it on two sheets of paper. Color or paint the design. Cut out pattern. Staple the edges together, leaving space to stuff the fish or bird with paper. Stuff. Staple the remaining edges. Use a tapestry needle to thread a yarn hanger at the top of the animal. Hang from the ceiling.

References

Graham, Marge. "Crafts for Kids," *World of Sea Creatures, Book I.* The Sparks Press (P. O. Box 26747, Raleigh, N.C. 27611). 1974.



CAPER SEVENTEEN

Clean water

Purpose

To investigate how natural materials such as soil and sand act as filters to clean some contaminants from water.

Vocabulary

Pollution—an unnatural addition to the environment. Oil can be a pollutant, but so can fresh water. If too much fresh water enters a saltwater bay or sound, marine animals, particularly young ones, may be harmed.
Runoff—rainwater that flows from the land into rivers and streams instead of absorbing into the soil.
Sediment—particles of soil.

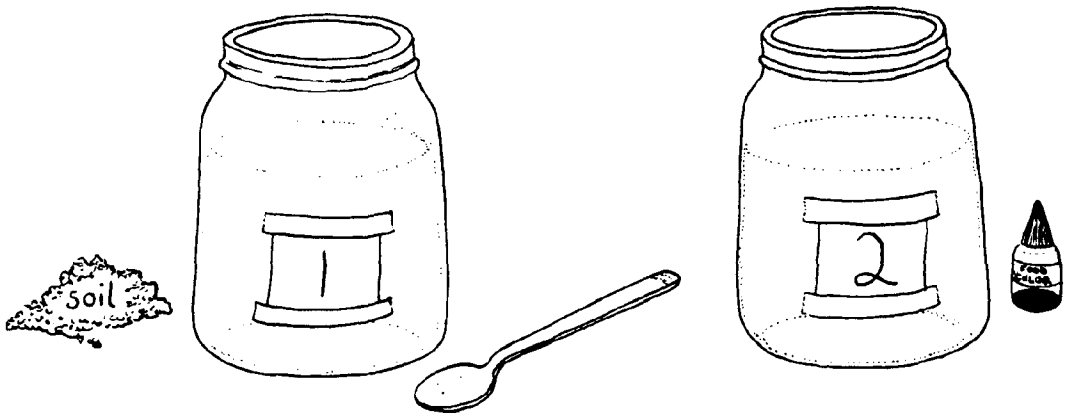
Materials

Two plastic or poster board funnels, four jars, food coloring, gravel or pebbles, sand, soil or potting dirt, water.

Teacher background

Water quality is a major issue among scientists, politicians and concerned citizens. Cities, farms and small communities use the same water over and over as rivers flow to the sea. Providing clean water is becoming more expensive.

This investigation simulates clean water that is contaminated with sediment. This problem occurs with the runoff of rainwater from farms and city streets. After a heavy rain, rivers become very muddy (full of suspended sediment), which can suffocate fish (their gills



become clogged) and also can block sunlight from the bottom. Often the sediment settles to the bottom, silting the natural plants.

Two methods have been devised to help solve this problem. One method traps rainwater runoff in holding ponds. The sediment is given time to settle to the bottom of the pond before the water is released into the river. The second method provides enough distance between the farm/city and river to allow the land to filter the sediment from the water.

Procedure

Mix soil and water in jar one. This is water muddied with sediment. Mix food coloring and water in jar two. This represents dissolved contamination in water.

Place funnel A over a collecting jar, and fill it with gravel. Place funnel B over another collecting jar, and fill it with sand.

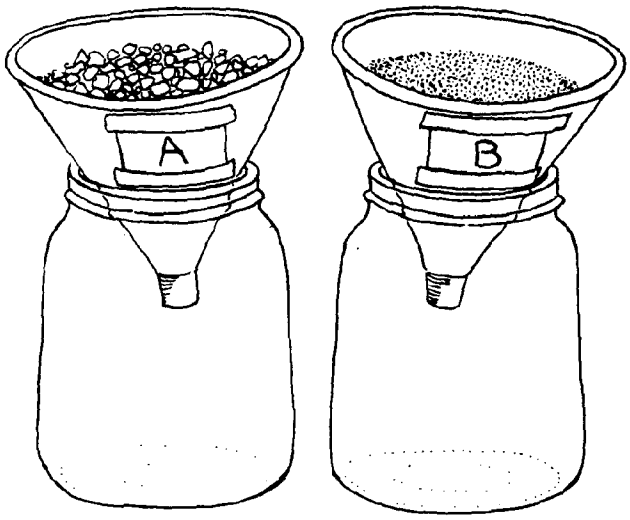
Pour about a cup of the muddy water in funnel A. Allow the water to seep into the collecting jar. Did the water change? Pour another cup of muddy water in funnel B. Allow the water to seep into the collecting jar. Did the water change?

Pour out the contents of the collecting jars, rinse and repeat the procedure by pouring the colored water through each funnel into the jars.

Discussion

Which filter (gravel or sand) cleaned the water most effectively of mud? Which filter cleaned the water most effectively of the color? What does a filter do? What other types of filters could you use in the funnel (cotton, coffee filters, aquaria charcoal)? Investigate other filters and evaluate their effectiveness.

Let older students record the results of the experiment.



CAPER EIGHTEEN

Whale of a tale

Purpose

To improve listening and communication skills by creating an imaginary sea story. This is a good activity for ending a sea unit.

Materials

Imagination.

Procedure

Arrange five to eight students in a circle. A student begins a tale and stops it in mid-sentence. The student to his/her right finishes the sentence and begins another that he/she stops in the middle. The story is completed when everyone in the circle has added a sentence. Repeat until every student in the group has begun a tale.

Samples

"Willie, a whale, was a terrific gymnast in the circus. He would do somersaults with one flipper. One night, he nearly flipped out when he saw . . ."

"Molly, an octopus, was a dancer in Core Sound. One night at a sea party, Molly was captured by a strange looking . . ."

"I'm Captain Ferdinando of the good ship *Admiral*. I took John White to the New World colony on Roanoke Island in 1590. He was anxious to see his granddaughter, Virginia Dare. When we arrived at Fort Raleigh, it was empty. I think all the people went . . ."

"Susie was watching the sea gulls flying at the stern of the boat. One sea gull swooped down and whispered a secret in Susie's ear. It was a story about . . ."

Teacher references

Bagnal, Norma. *Children's Literature—Passage to the Sea*. Texas A&M University Sea Grant College Program (Texas A&M University, College Station, Texas 77843). 1980. $2.

Student reading

Cowan, Elizabeth and Karen Davis (compilers). *Fairy Tales of the Sea*. Texas A&M University Sea Grant College Program. 1981. $4.50 (Teacher's guide available for $2).

Water World Creatures (three booklets for K-2: "Longfin," "Cecil's Journey" and "The Lighthouse Party"). Project CAPE (P.O. Box 640, Manteo, N.C. 27954). $4.75.

CAPER NINETEEN

Pin the fin on the fish

Purpose

To learn about fins on a fish.

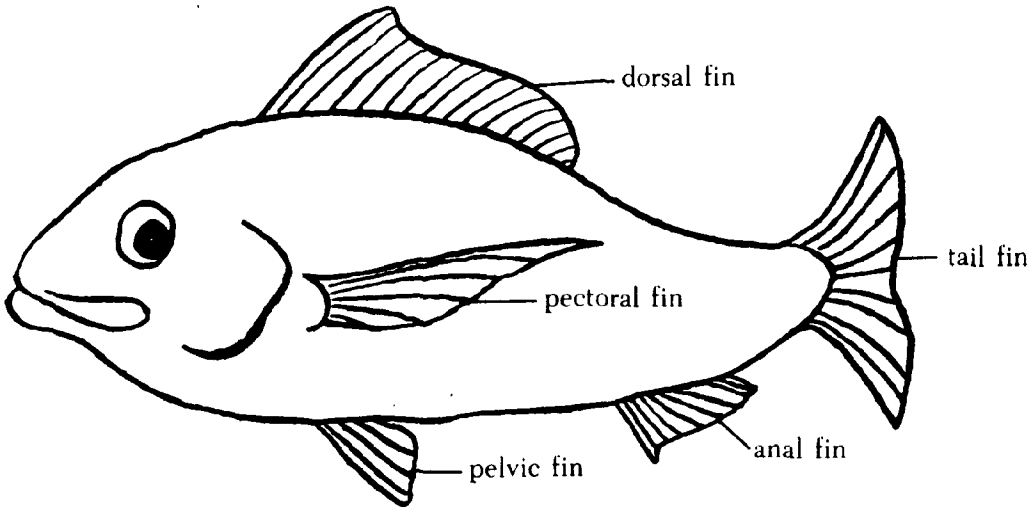
Materials

Large pattern of a fish without fins, (**The fish pattern is located in Appendix IV.**) fins, thumb tacks, cork board, blindfold.

Teacher background

Fins provide motion and stability for fish. Some fins are paired. The pectoral fins near the gill are equivalent to our arms, and the pelvic fins below the gill are equivalent to legs.

Single fins include the tail fin, the anal fin and the dorsal fin along the fish's back, which provides stability much like a boat's keel. In most fish, the tail fin is the major source of motion. But fish that move slowly around coral reefs or docks to find their food usually use their pectoral fins. The coral reef parrot fish seems to swim using only its pectoral fins.



Teacher preparation

Using the pattern in this paper, make a large fish about three feet long. Cut out appropriately sized fins. Color and laminate if desired.

As a demonstration, pin the fins onto the fish and explain what function each serves.

Procedure

Pin the blank fish pattern on a cork board. Have a group of students seated at a reasonable distance from the pattern. Choose a student to pin the first fin. Hand the child the fin, and check to make sure he/she knows where it should go.

Blindfold the student and let him/her start walking to the pattern. Students in the semicircle are allowed to provide the blindfolded child with directions. As soon as he/she pins on the fin, remove the blindfold.

Repeat the activity until all the fins are pinned on the fish pattern. Review the fin positions with the group and correct any misplaced fins.

CAPER TWENTY

Oil spill

Purpose

To investigate methods for cleaning up an oil spill in water.

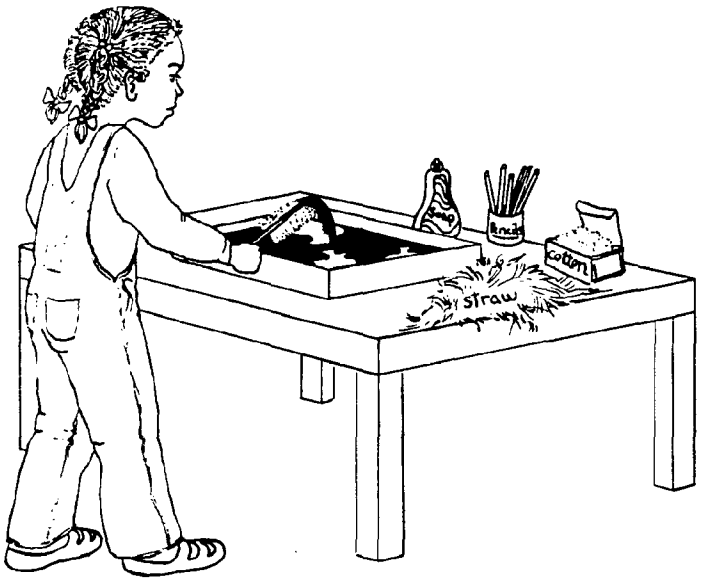
Materials

A small jar of motor oil, a feather, detergent, cotton balls, tray.

Teacher background

Oil is the most visible pollutant to find its way into our coastal and ocean waters. How does it get in the water? Oil tankers hold thousands of gallons of unrefined oil. They carry oil from the countries where it is drilled to the United States and other nations to use for energy and petroleum products. Occasionally, these tankers run aground, break up in heavy storms or collide with other ships. The oil is spilled in the water.

After oil tankers deliver their shipments, sometimes they clean out their tanks and illegally dump waste oil in the ocean. Offshore oil wells can "blow-out," catch fire or be damaged. Before the pipes can be capped, many gallons of oil can spill into the ocean.



Oil is lighter than water. It floats. After an oil spill, birds and marine mammals can become coated with oil from the water's surface and die. Likewise, much of their food becomes contaminated. And since oil is dark and shadows the water below, it prevents marine plants from receiving the light they need to grow.

When an oil spill comes ashore, it coats the beaches and marshes. This is harmful to intertidal animals and plants, and unpleasant to tourists.

Cleaning up oil spills is very costly and time-consuming. Scientists are trying to develop better methods for containing oil spills. Here are some of the methods used now: 1) containing the oil spill with floating boundaries, then drawing oil and water from the ocean's surface; 2) using detergents to break down the oil; and 3) soaking up the oil with straw or other porous materials, then collecting the straw.

Procedure

In a tray of water, pour a teaspoon of motor oil. Note that oil spreads and very little is needed. Let a student dip his or her finger in the water to see how the oil coats. Sweep the surface with the feather. What happens?

Explore different ways to clean up the oil and evaluate the results. Try containing the oil with floating pencils or dissolving the oil with detergent. Also, try soaking up the oil with cotton or straw.

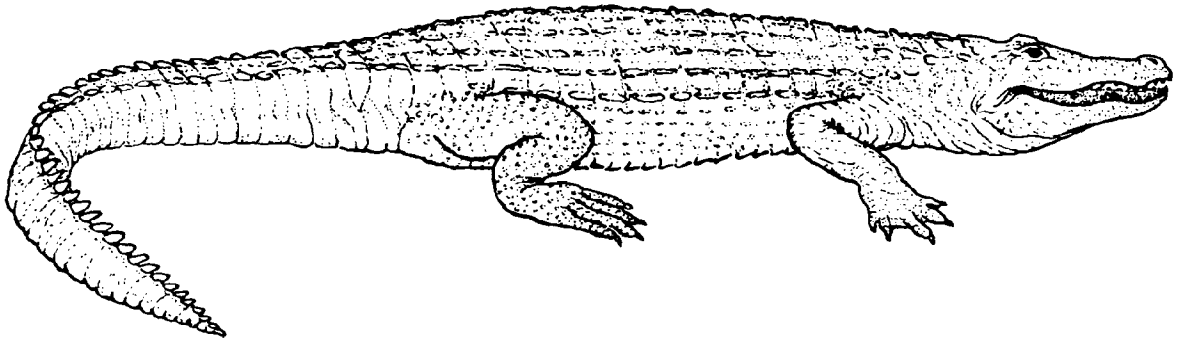
Teacher references

Smithsonian Estuarine Activities. "Menace Oil Slick" (#10) and "Oil Slick Cleanup" (#11). Chesapeake Bay Center, P.O. Box 28, Edgewater, MD 21037.

GLOSSARY

This glossary is designed to provide the teacher with some basic facts about the organisms mentioned in this book. It includes where the organism lives, what it eats, what eats it, and some miscellaneous information of interest. For more information, please check with the library. This glossary is only a beginning.

Alligator—vertebrate. Freshwater reptile. Lives in coastal rivers, lakes and swamps from North Carolina to Florida. Carnivore. Eats ducks, fish and turtles. Can grow 12 to 14 feet long. Was endangered due to over hunting, but populations recovered. Hunting is allowed in some states.



Blue Crab—invertebrate. Saltwater crustacean. Lives in shallow, brackish creeks and bays. Eats anything—living or dead—that it can grab. Preys on young clams, oysters, fish, other crabs and worms. Eaten by fish, octopuses and people.

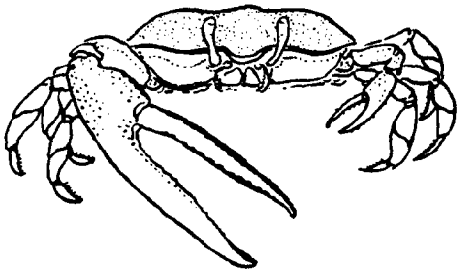
Catfish—vertebrate. Freshwater fish. Lives in lakes and slow-moving rivers. Carnivore. Eats smaller fish. Eaten by larger fish and turtles. Successfully "farmed" in ponds in Southeastern U.S.

Clam—invertebrate. Saltwater mollusk. Lives in sounds, buried slightly beneath the substrate. Eats plankton and detritus, or decaying plant material, by filtering it from the water. Eaten by sting rays, crabs and some fish. Harvested by fishermen for human consumption during winter months.

Dolphin—vertebrate. Saltwater mammal. Order: cetacea. Often called porpoise. Breathes air, suckles its young and possesses high intelligence. Travels in schools. Communicates through squeaks and clicks. Uses sound waves, which reflect off objects, to navigate in the dark. Eats fish. Eaten by sharks and killer whales. Sometimes caught in fishermen's nets and drowns.

Egret—vertebrate. Waterbird. Nests in colonies in thickets of wax myrtle and yaupon on estuarine islands. Feeds in marshes and tidal creeks, spearing fish with its sharp bill. White.

Fiddler crab—invertebrate. Saltwater crustacean. Lives in holes along tidal mudflats. Eats detritus. Eaten by wading birds such as herons, egrets, fish and other crabs.



Flounder—vertebrate. Flat, boney saltwater fish. Lives in bays and coastal waters. Carnivore. Eats shrimp, small fish and crabs. Eaten by larger fish. Considered a popular food fish for people. Has both eyes on one side of its head as an adult. As larvae, has eyes on each side of its head. Has a white belly and dark upper body. Can intensify its color to blend with the surroundings.

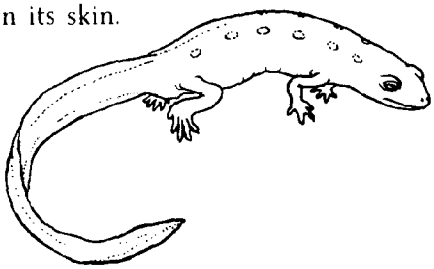
Frog—vertebrate. Freshwater amphibian. Begins as a tadpole and metamorphoses into a frog. Lives near ponds, rivers or swamps. Carnivore. Eats insects and worms. Larger frogs eat mice and birds. Eaten by birds, snakes and raccoons.

Hammerhead shark—vertebrate. Saltwater fish. Unusual because its head is flattened by two projections which hold its eyes. Carnivore. Common off the Carolina coast. Eats fish, turtles and any other food that appeals to its senses. Eaten by people and other larger sharks.

Jellyfish—saltwater invertebrate. Phylum: cnidaria. Poor swimmer. Drifts with the currents. Abundant in bays and estuaries during summer. Undulating umbrella covers tentacles that sting. Eats small organisms that it stings. Eaten by only a few animals, notably sea turtles.

Marlin—vertebrate. Saltwater boney fish. Lives offshore near the Gulf Stream. Blue and white marlin are most common. Carnivore. Sweeps through schools of fish for its meals. Fast swimmers. Considered excellent sport fish because they run with the bait and leap and fight when caught. Not generally eaten by people.

Newt—vertebrate. Freshwater amphibian. Lives in ponds and forest pools. Eats insects and tadpoles. Protected from most predators by lethal toxins in its skin.



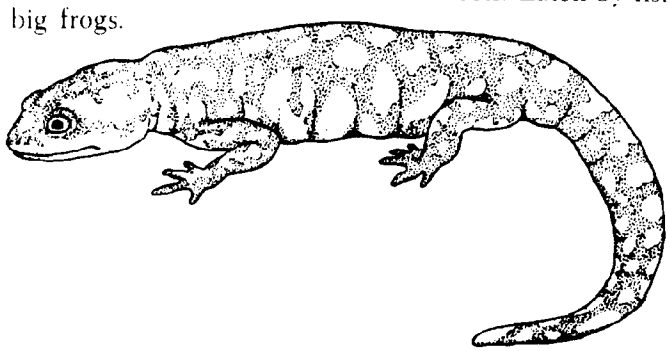
Octopus—invertebrate. Saltwater mollusk. Has no hard parts in its body except a beak-like mouth. Can squeeze through the tiniest cracks to escape from aquariums. Lives in sound and offshore waters, usually hiding in rocks or debris. Eats fish and crabs. Eaten by fish and moray eels. Moves with its eight arms, which have suckers, or swims using jet propulsion. Squirts ink as a screen for escape when frightened.

Oyster—invertebrate. Saltwater mollusk. Lives attached to hard substrate or shells in bays or sounds. Filters plankton and detritus for food. Eaten by crabs, fish and raccoons. Harvested in the fall and winter for human consumption.

Pelican—vertebrate. Waterbird. Nests in colonies on isolated estuarine islands. Web-footed. Eats fish. Is an endangered species, but its numbers are rebounding.

Portuguese man-of-war—saltwater invertebrate. Phylum: cnidaria. Has a purplish, iridescent gas bladder that acts as sail enabling the man-of-war to float at the surface. Possesses long stinging tentacles that stun prey. Common in tropical and Gulf Stream waters. Frequently blows ashore on Carolina beaches. Even dead, tentacles still sting. Beachcombers should be wary of these creatures.

Salamander—freshwater vertebrate. Found in burrows and under rocks or logs in streams, ponds, springs or other damp areas. Eats small invertebrates such as worms and insects. Eaten by fish, snakes and big frogs.



Sand dollar—saltwater invertebrate Phylum: echinoderm. Lives on sandy bottom where currents move sand. Eats detritus found among the sand grains. Eaten by few animals as adults, but eaten by filter feeders as larvae.

Sea anemone—saltwater invertebrate. Phylum: cnidaria. Looks much like an underwater flower. Attaches to rocks and hard substrate. Uses stinging tentacles to catch small fish and other prey. Eaten by few animals as adults. Can move short distances with their basal foot. Also can live in intertidal areas by retracting their tentacles and storing water until high tide allows it to feed again.

Seal—saltwater vertebrate. Marine mammal. Breathes air. More land oriented than whales or porpoises. Has thick fur to insulate them from cold water instead of blubber. Their fur has enticed hunters to kill them in great numbers. Eats fish and shellfish. Eaten by killer whales and sharks. Rarely seen in Carolina waters.

Sea turtle—vertebrate. Saltwater reptile. Breathes air. Spends most of its life at sea. The loggerhead is common along the Carolina coast. Nests on less developed southern islands. Eats fish, crabs and jellyfish. Eaten by few animals as adults. As hatchlings, eaten by birds, crabs and raccoons on land, and crabs and fish at sea. Endangered because too many have been killed for food and jewelry and because development on beaches threatens nesting sites.

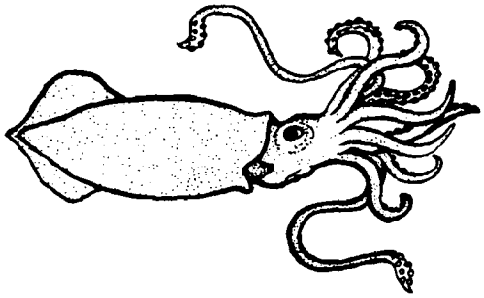
Sea urchin—saltwater invertebrate. Phylum: echinoderm. Round, spiny herbivores. Grazes on algae and detritus from grass beds and rocky areas. Spines protect its back. Vulnerable on its mouth-side to attack from fish, crabs, eels and sea otters.

Shark—vertebrate. Saltwater fish. Comes in many sizes and shapes. Some have teeth for slashing prey; others have ridges for crunching mollusks; some filter the water for plankton. Lives in nearly all bays, seas and oceans. Possesses excellent senses to detect prey. Detects pressure vibrations at long range; smells and sees at closer ranges; detects electrical pulses within a few feet.

Shrimp—invertebrate. Saltwater crustacean. Matures in sounds and bays. Migrates through inlets to spawn in the ocean. Eats detritus and small organisms. Eaten by fish and crabs. Harvested in spring and summer for human consumption.

Snail—saltwater or freshwater invertebrate. Phylum: mollusk. Possesses a single shell. Moves on a foot, feeding on plants or other animals. Found in many sizes and shapes. Freshwater snails are eaten by snakes, birds, fish and crayfish. Saltwater snails are eaten by other snails, crabs and fish.

Squid—saltwater invertebrate. Phylum: mollusk. Swims in large schools in bay and ocean waters. Eats small fish. Eaten by fish and whales. Possesses ten tentacles. Swims by using fins and jet propulsion. Squirts ink when frightened.

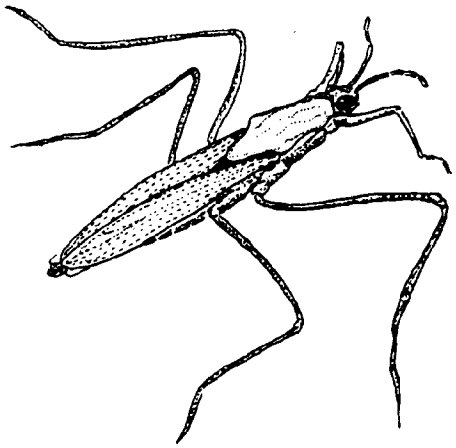


Starfish—saltwater invertebrate. Phylum: echinderm. Spiny, five-armed carnivore. Lives in bay and ocean waters. Eats clams and oysters. Eaten by few animals as adults, but eaten by filter feeders as larvae.

Sting ray—vertebrate. Saltwater fish. Related to sharks. Carnivore. Large wing-like fins enable it to sweep over grass beds in search of scallops and clams. Eaten by few animals as adults. As young, eaten by larger fish.

Turtle—vertebrate. Reptile. Lives on land or in the water. Musk turtles and cooters live in lakes and rivers, feeding on insects, worms and small fish. Eaten by snakes and birds when small. Eaten by few animals as adults.

Water strider—freshwater invertebrate. Insect. Possesses long, thin legs that enable it to move across the surface of the water. Eaten by trout, other stream carnivores and birds.



Whelk—saltwater invertebrate. Phylum: mollusk. Carnivore. Lives in sounds and intertidal areas. Eats clams. Eaten by crabs and octopuses. Moves just under the surface of the substrate.

Elementary Marine Education Materials Appendix

General references

Spitsbergen, Judith. *Seacoast Life: An Ecological Guide to Natural Seashore Communities in North Carolina.* UNC Press (P.O. Box 2288, Chapel Hill, N.C. 27514). $5.95.

Zim, Herbert and Lester Ingle. *Seashores.* Golden Press, New York. $2.95.

General sources

MARINE EDUCATION MATERIALS SYSTEM
Education Division
Virginia Institute of Marine Science
Gloucester Point, VA 23062
804/642-2111

Computerized collection of marine education materials. If you want to do research or use the computer search facility, use the above address or phone number. There is a fee involved.

DELTA EDUCATION
Box M
Nashua, NH 03061-6012
1 800/258-1302

The alphabet-soup, basal curriculum programs distributed by Delta Education are found in many school systems. Their approach to investigative science through activities and modules are excellent. Check with your local education resource library to review content. They are: ESS (Elementary Science Study), 1966-71; SAPA (Science, A Process Approach II), 1974; SCIS (Science Curriculum Improvement Study), 1978; OBIS (Outdoor Biology Instructional Strategies), 1975

North Carolina

UNC SEA GRANT
Box 8605
North Carolina State University
Raleigh, N.C. 27695-8605

The North Carolina Marine Education Manuals, by Lundie Mauldin, Dirk Frankenberg and Johanna Bazzolo, are designed to help educators present the coast as a setting and subject for study. They are: *Unit One, Coastal Ecology*, UNC-SG-78-14-A ($1); *Unit Two, Seawater*, UNC-SG-78-14-B ($1.50); *Unit Three, Coastal Ecology*, UNC-SG-78-14-C ($1.50); and *Unit Four, Coastal*

Beginnings, UNC-SG-78-14-E ($2). The final unit, *Connections: Guide to Marine Resources, Living Marine Systems and Coastal Field Trips*, UNC-SG-82-1-F ($2), was written by Lundie Spence and Jaynee Medlicott.

PROJECT CAPE
Dare County Board of Education
P.O. Box 640
Manteo, N.C. 27954

"Coastal Ecosystems." Grades K-2. Unit on marine animal classification. Student field guides include: salt marsh, pier and jetty, sandy beach and mud flat. Unit price: $4.

"Water World Creatures." Grades K-2. Multidisciplinary unit that introduces students to marine vertebrates: fish, sharks, rays, turtles, whales and birds. Lessons center around three reading booklets: "Longfin," "Cecil's Journey" and "The Lighthouse Party." Unit price: $4.75.

"A Sea Creature's Treasury." Grades K-2. Multidisciplinary unit introduces students to the world of marine invertebrates: oysters, clams, sand dollars, starfish, sea urchins, octopuses and jellyfish. Many games. Unit price: $4.75.

"Cape Hatteras Lighthouse." Grades 3-4. Unit on the history of the Cape Hatteras Lighthouse and its plight with erosion. Lessons include the U.S. Lifesaving Service, lighthouse keepers and shipwrecks. Includes a game, "Graveyard of the Atlantic." Color filmstrip: $2.50. Unit price: $3.

Write for a complete listing of units and prices.

N.C. AGRICULTURAL EXTENSION SERVICE
4-H Specialist
200 Ricks Hall
Box 7606
North Carolina State University
Raleigh, N.C. 27695-7606

The N.C. 4-H Marine Awareness Project developed the following pamphlets: Fish Printing (4H L-1-99a), 4-H Seafood Project (4H M-1-124), Seafood Planning Guide (4H PG-1-127), Transplanting Marsh Grass to Stop Shoreline Erosion (4H M-1-108), Transplanting Marsh Grass Planning Guide (4H PG-1-128), Sampling Plankton (4H M-1-107), Sampling Plankton Planning Guide (4H PG-1-129), Pressing Algae (4H M-1-106), Marine Photography (4H M-1-105), Marine Photography Planning Guide (4H PG-1-126), and Fishing Planning Guide (4H PG-1-125). Copies are available at the address above or in your county extension office.

SEABAG EDUCATIONAL ACTIVITIES
Vivian Barbee Coxe
4744-B Courtney Lane
Raleigh, N.C. 27604

"Seabag Math Games." Set I. Three patterns (whale, fish and octopus) and games for math skill development using marine themes. Unit price: $5.

MUDFLAT TOWN
N.C. Maritime Museum
120 Turner St.
Beaufort, N.C. 28516

Reader on primary level with information about mudflat and tidal areas. Mentions several animals and how they live. Reading and coloring book by Judith Spitsbergen. Unit price: $1.50 plus $1 for postage.

California

COME WITH ME
Pat Perea
Route 1, Box 1080
Shingle Springs, CA 95682

Primary level science series using sea animals: squid, lobster, seahorse, starfish, hermit crab. Cassette tape with five stories, five songs and five teaching pictures with matching games and teacher's guide. Unit price: $12.50.

WET AND WILD
Evaluation, Dissemination and Assessment Center
California State University, Los Angeles
5151 State University Drive
Los Angeles, CA 90032

A multidisciplinary marine education teacher guide. Grades K-6. 1983. Six topic units: physical ocean, ocean management, research, biological ocean, economic sea and marine ecology. Bilingual.

Delaware

PROJECT COAST
College of Education
University of Delaware
Newark, DE 19716
302/738-2184

Project COAST (Coastal, Oceanic and Aquatic Studies) is an aquatic education curriculum project with materials from K-12. Includes: "Animals with Shells," #101 ($1.50); "Dunes at Play," #107 ($2.75); and "Not so Common Oyster," #109 ($2). New units have been developed for K-6. Contact Les Picker for more information.

Florida

HABITATS AND COMMUNITIES
Environmental Studies Center
2900 NE Indian River Dr.
Jensen Beach, FL 33457

Materials include: "Your Environment" (kindergarten), "Habitats" (first grade), "Communities" (second grade), and "Grassflat Communities" (third grade). Teacher's guide plus slides and cassette tapes. Developed by the Martin County Schools. Write for cost.

Maine

NORTHERN NEW ENGLAND MARINE EDUCATION PROJECT
206 Shibles Hall
University of Maine
Orono, ME 04469

Series of units for K-12 students: "Whales," and "What Adventures Can You Have in Wetlands, Lakes, Ponds, Puddles?" Write for a list and prices.

New York

WET WORLDS
Coastal Education Curriculum Project K-6
S.I. Continuum of Education
130 Stuyvesant Place
Staten Island, N.Y. 10301

Units include: "Ship Shape" and "Shore Words."

Virginia

SENSING THE SEA
Marine Education Center
Virginia Institute of Marine Science
Gloucester Point, VA 23062

Unit One: Grades K-1. Curriculum guide. Using a small tank, students learn about sand, crabs, rocks and shells. Unit price: $2.

Unit Two: Grades 2-3. Curriculum guide. Develops inquiry and observation of marine animals. Provides practice with classifying and problem solving. Unit price: $2.

Washington

FOR SEA
Marine Science Project
17771 Fjord Drive N.E.
Poulsbo, WA 98370

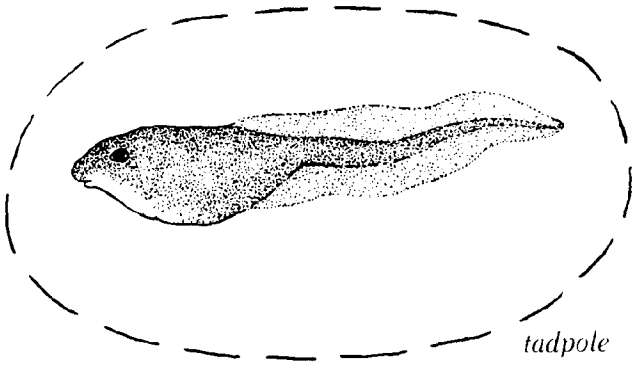
Validated by the National Dessemination Network. Provides curriculum guides for grades K-12. Developed a unit, "Marine Science Activities," for second graders. Unit price: $25.

ORCA
Marine Education Project
Pacific Science Center
200 Second Ave. N.
Seattle, WA 98109

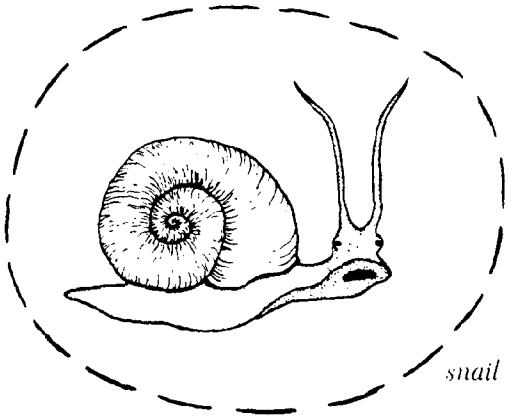
A series of units on marine topics such as "Whales" and "Waterbirds." Unit price: $6. Write for a more complete listing.

APPENDIX I

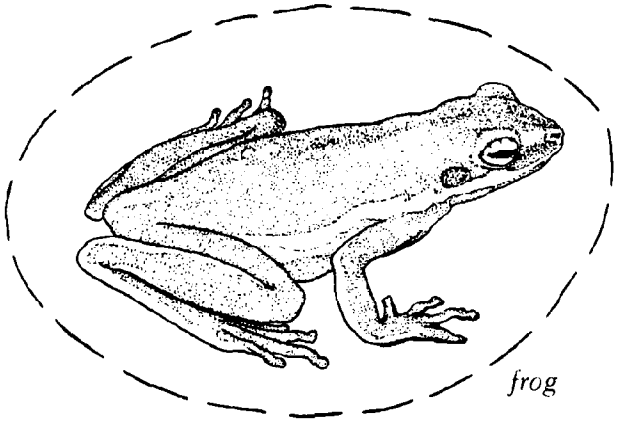
Fish patterns for Caper One



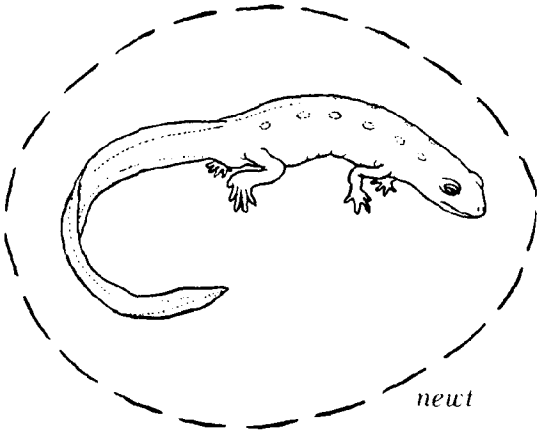
tadpole



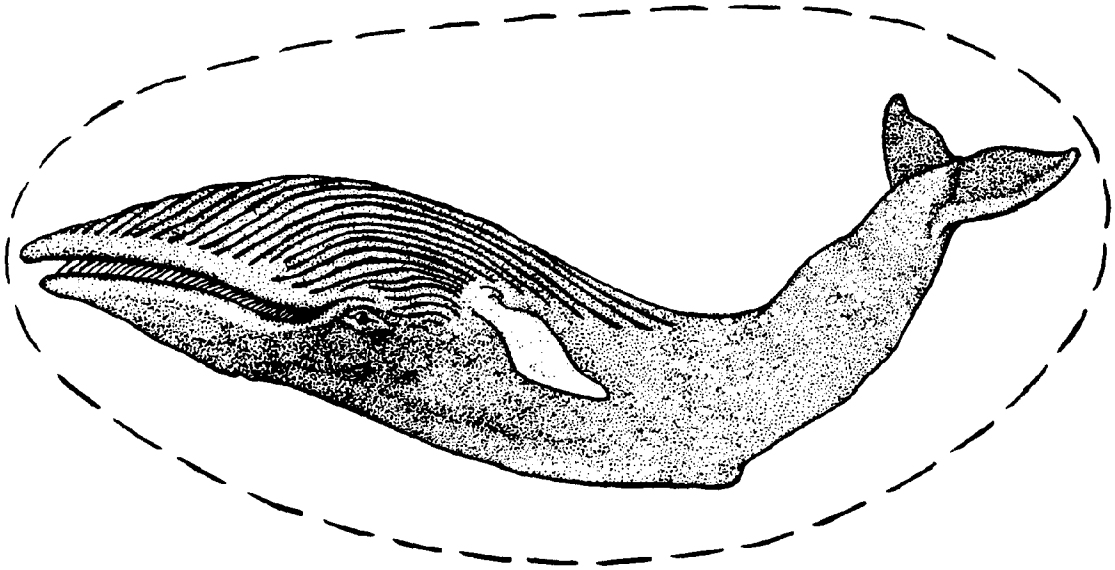
snail



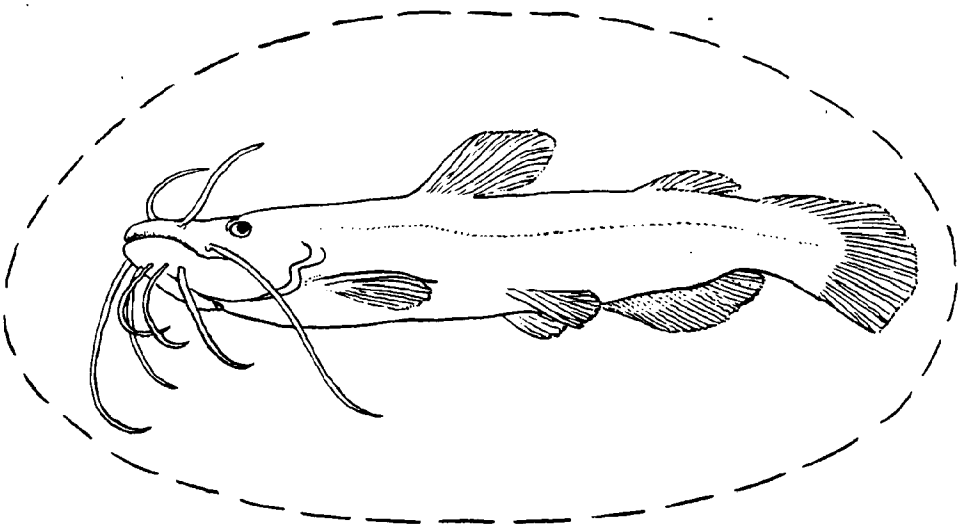
frog



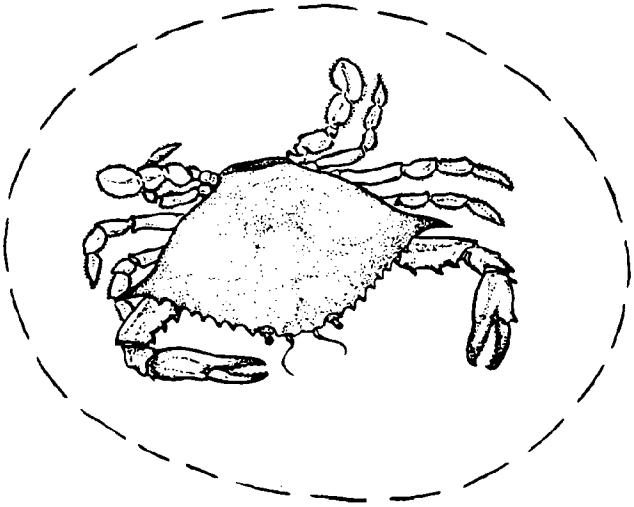
newt



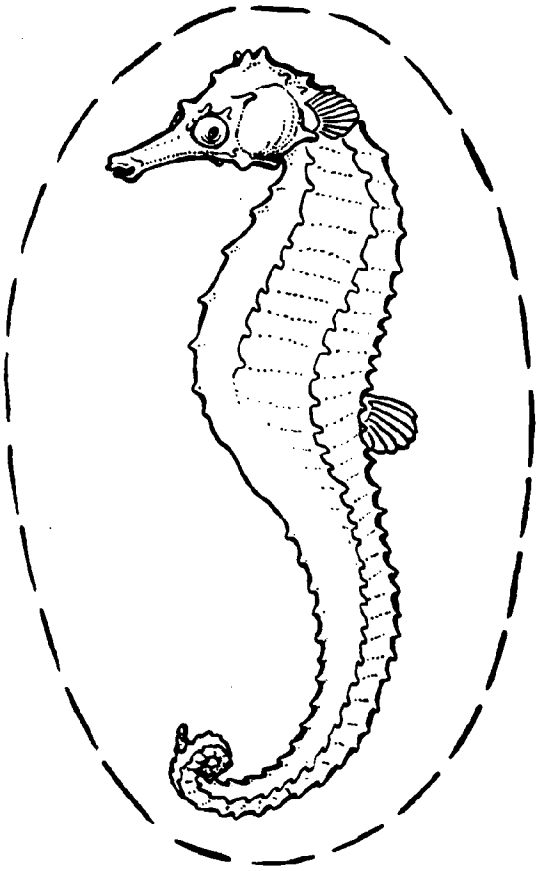
whale



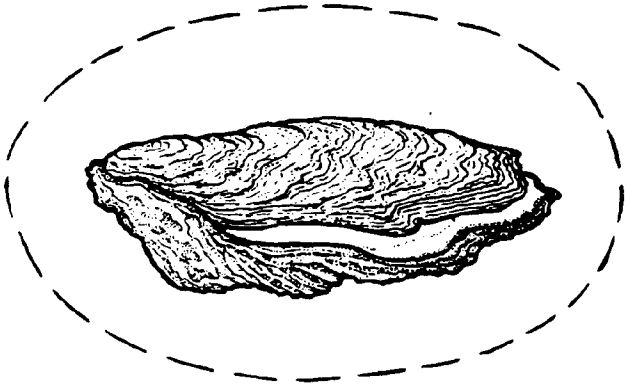
catfish



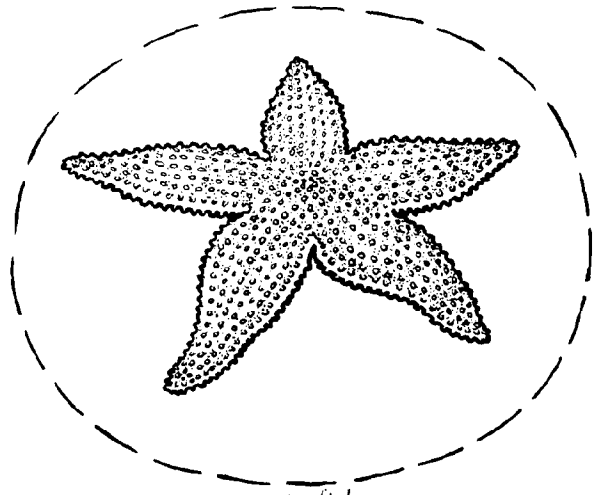
blue crab



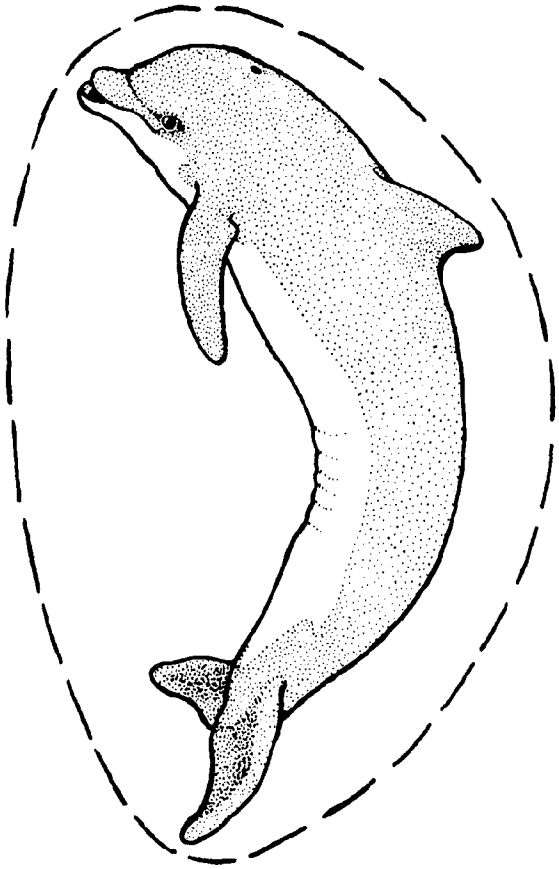
sea horse



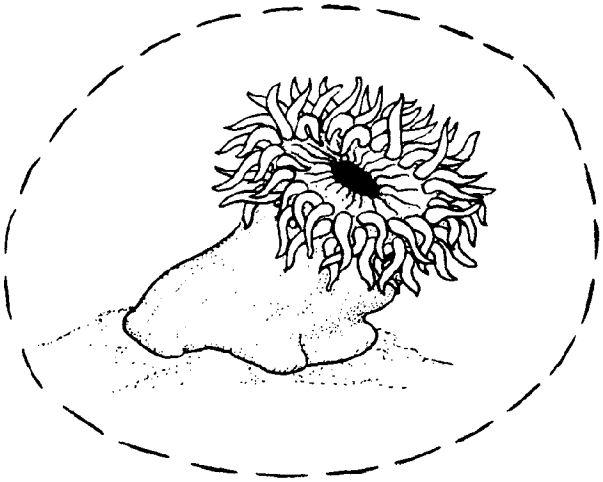
oyster



starfish

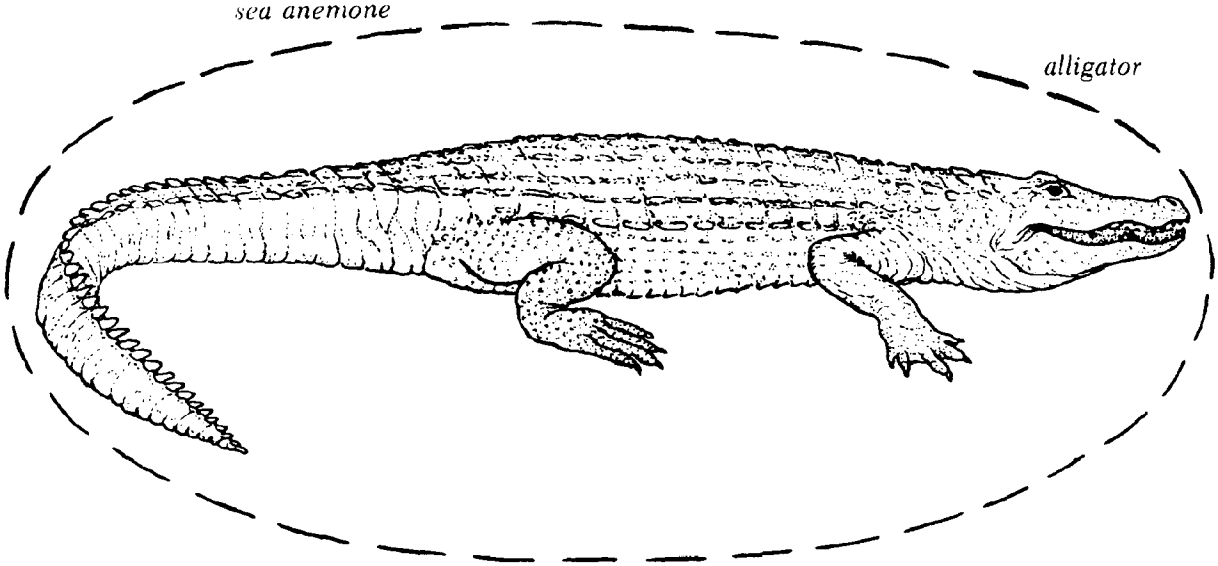


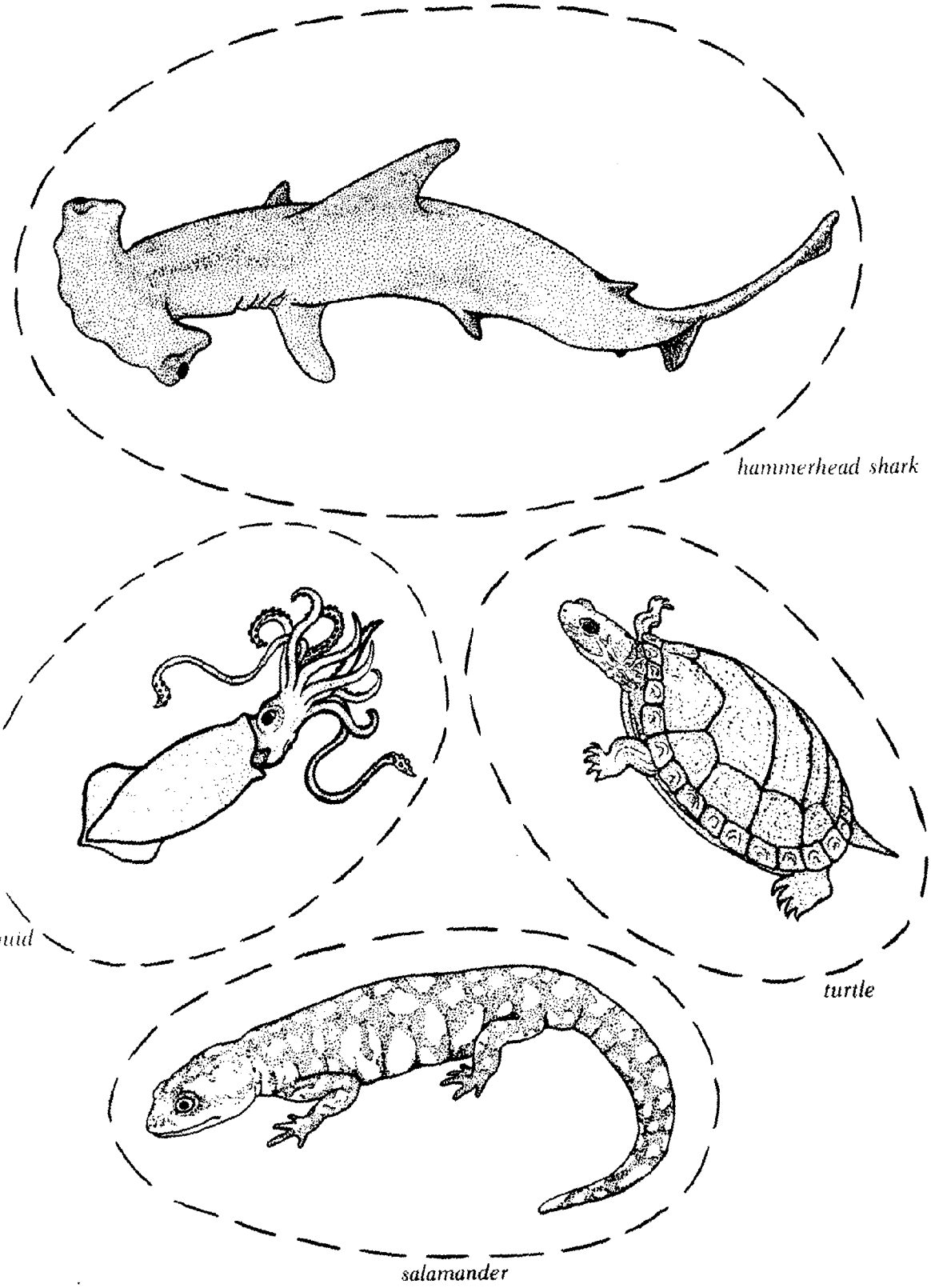
porpoise

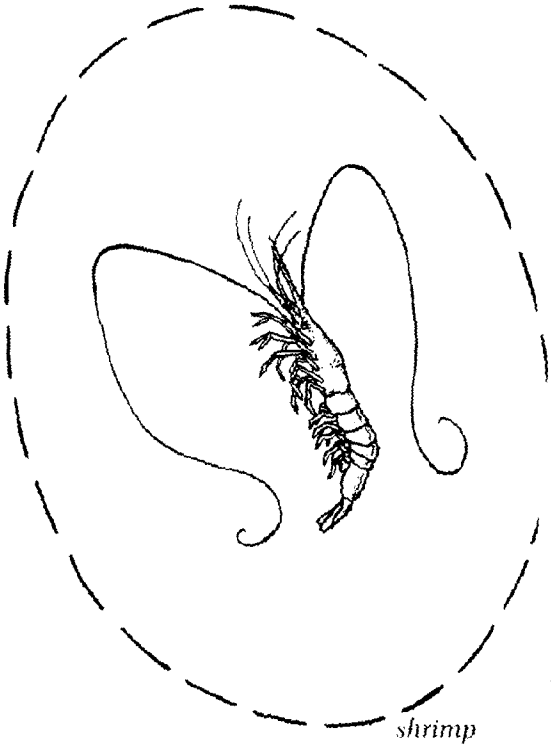


sea anemone

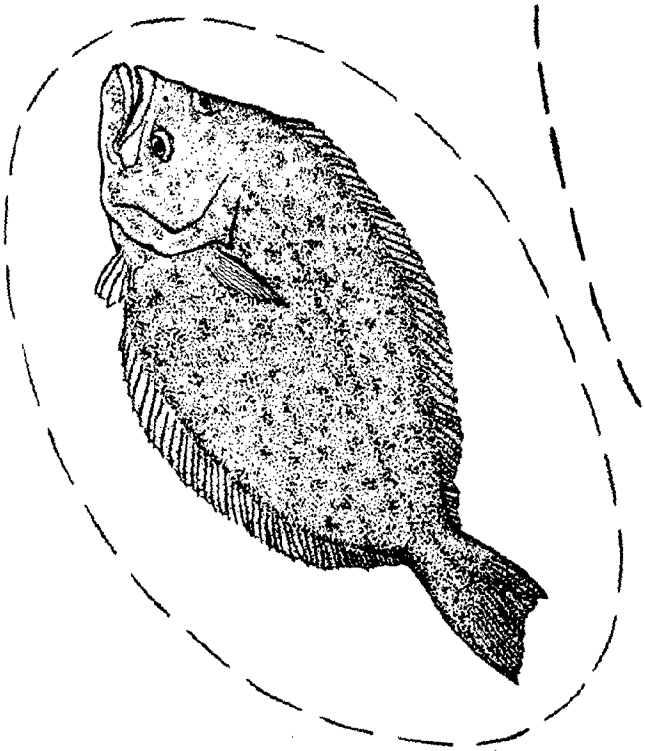
alligator



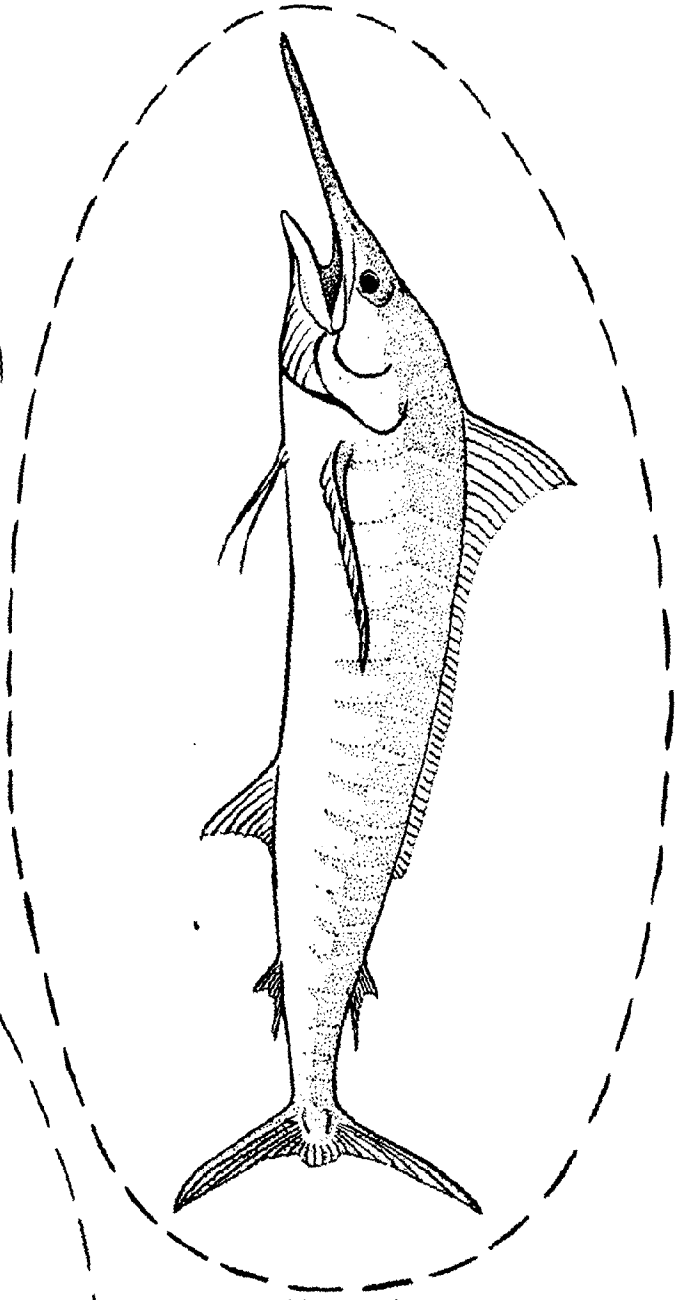

hammerhead shark
squid
turtle
salamander



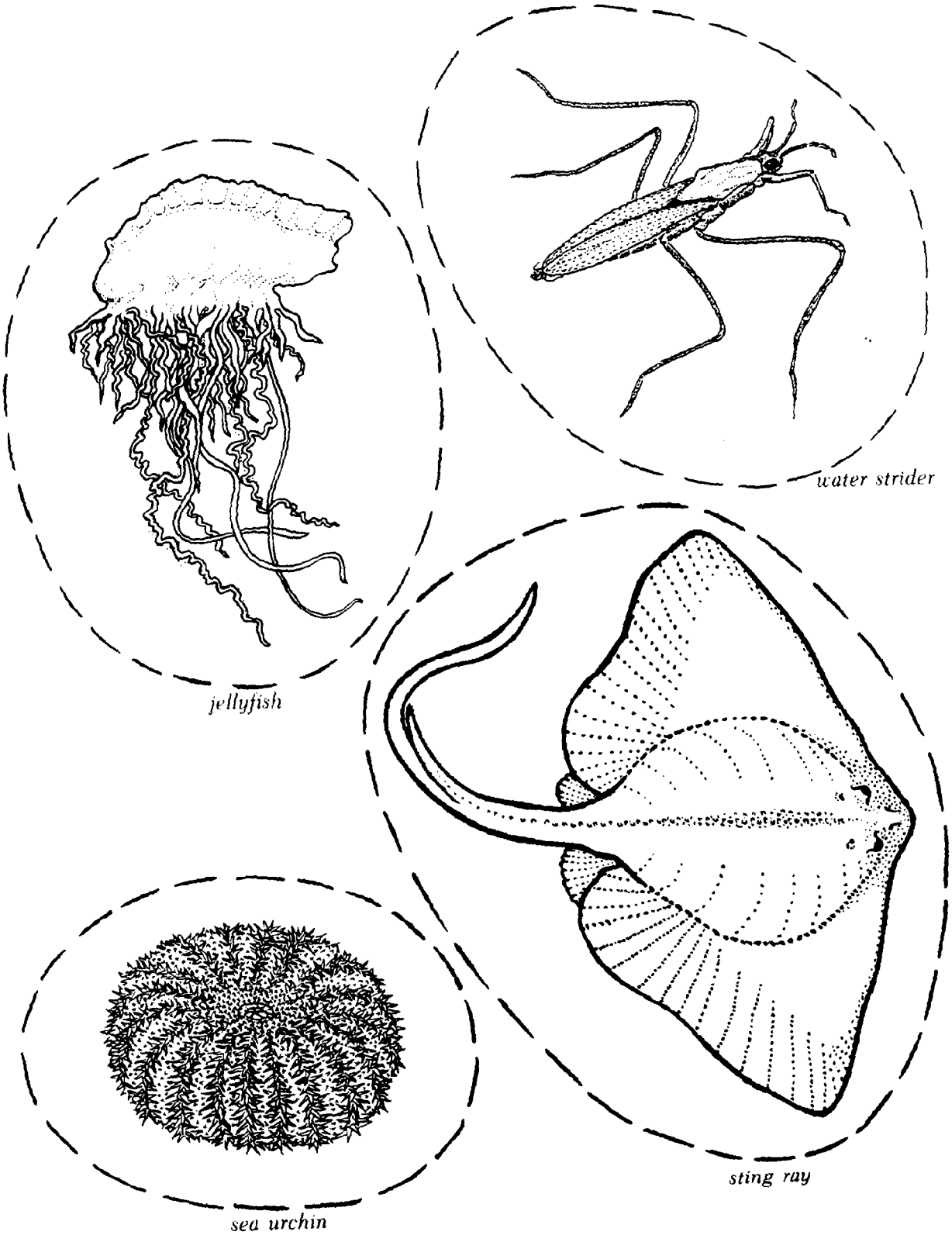
shrimp

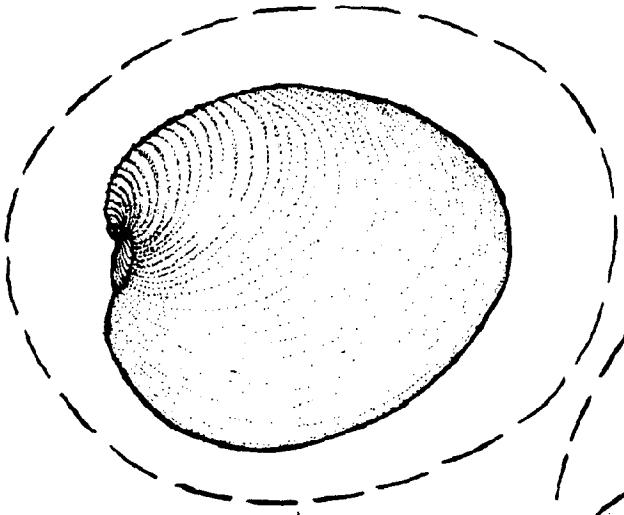


flounder



blue marlin


water strider
jellyfish
sting ray
sea urchin



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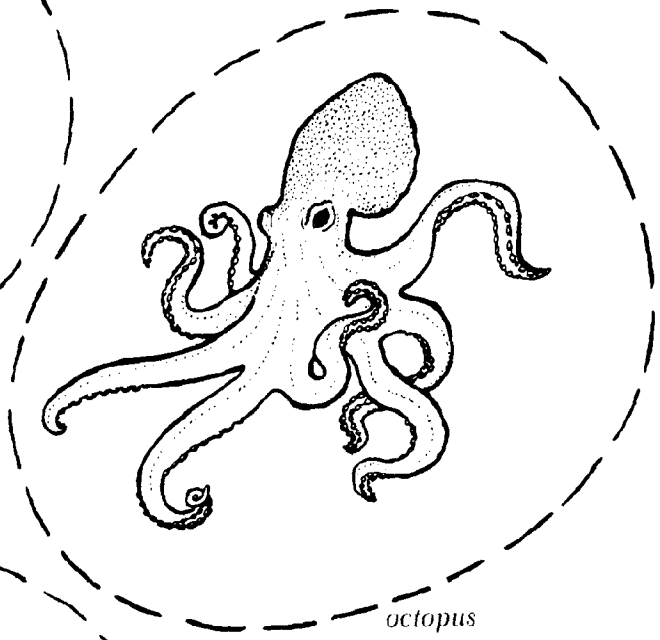
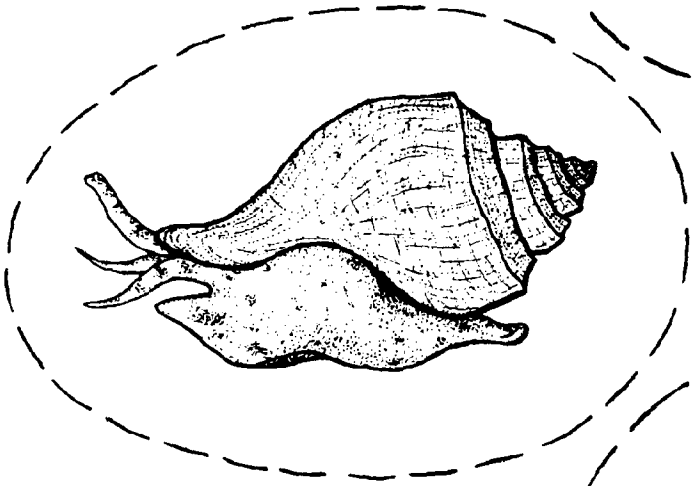
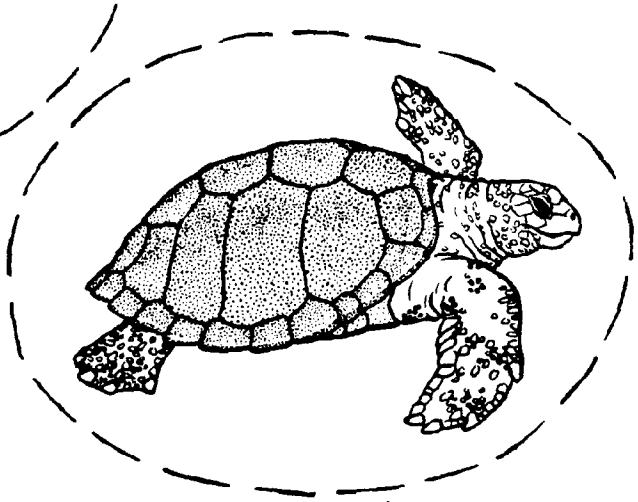


octopus



whelk



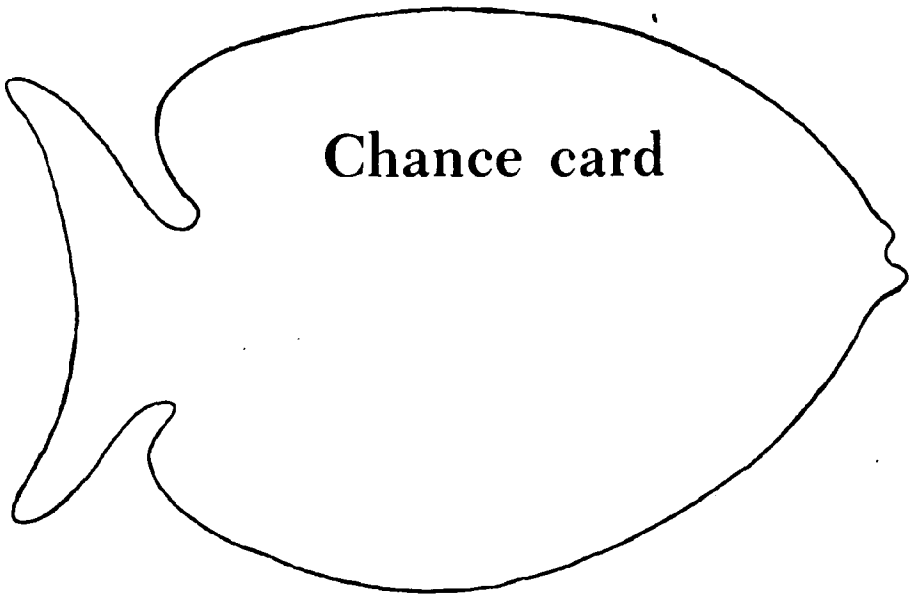
sea turtle

APPENDIX II

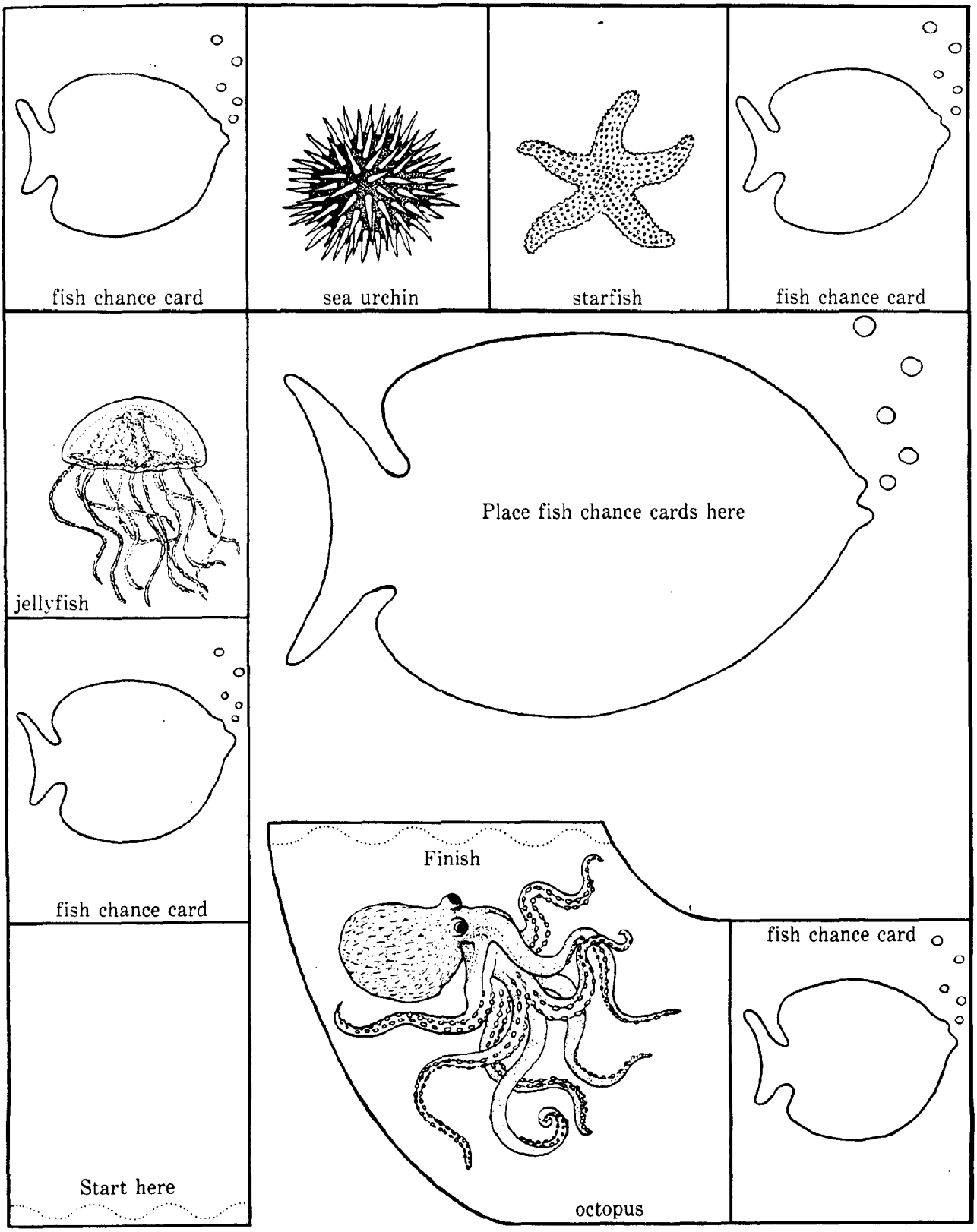
Game board for Caper Eight

Chance directions

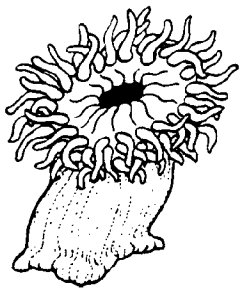
1. Move to the animal with a jelly-like body and long stinging tentacles.
2. Move to the animal that lives within two seashells.
3. Caught in seaweed, lose next turn.
4. Stopped to watch a school of porpoises, go back two spaces.
5. Chased by a shark, move ahead five spaces.
6. Move to the animal that has a blowhole.
7. Move to the animal that wraps its tail around seaweed.
8. Move to the animal that has dangerous jaws.
9. Move to the animal that looks like a flower.
10. Move to the animal that is long and thin.
11. Move to the animal that has eight legs and two claws.
12. Move to the animal that is a spiny ball.
13. Move to the animal that has five arms.
14. Move to the animal that has eight tentacles with suckers.
15. Move to the animal that can fly.
16. Move to the animal that has four flipper-like legs.



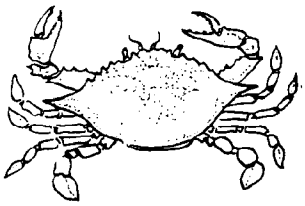
Chance card pattern. Duplicate 16 times and paste 1 set of directions to each card.



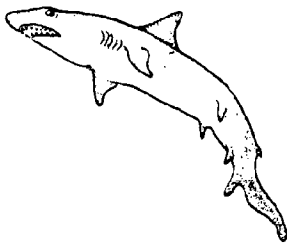
Duplicate each half of game board and tape together.



sea anemone

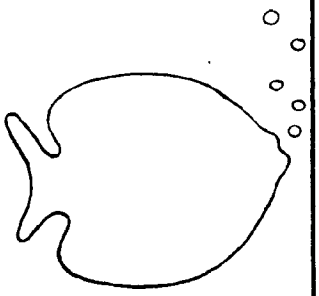


blue crab

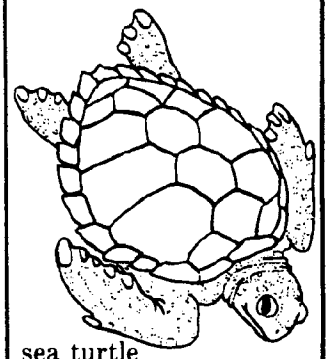


shark

gull

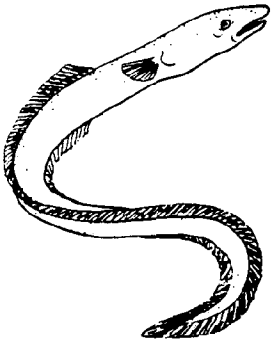


fish chance card



sea turtle

eel



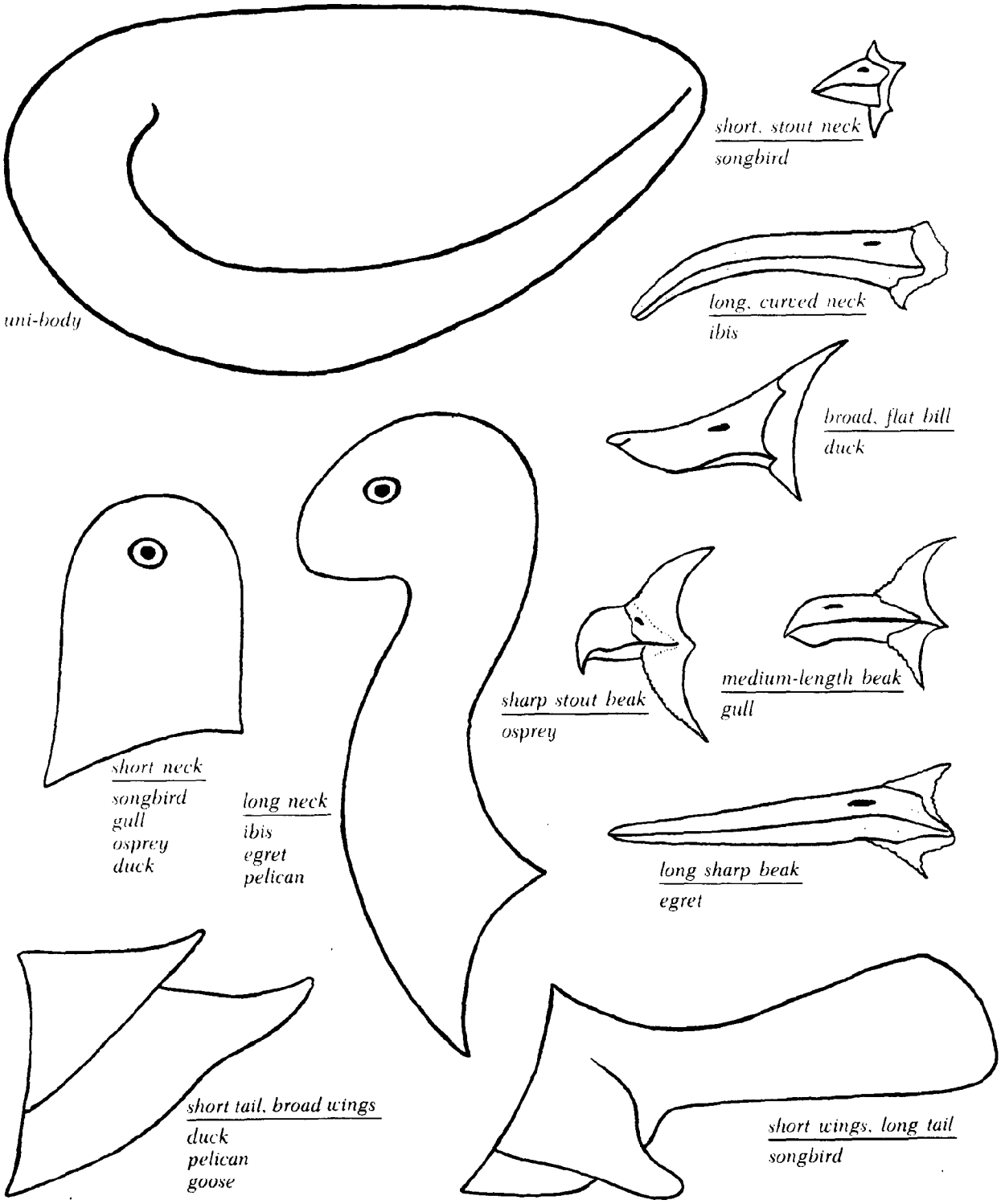
scallop

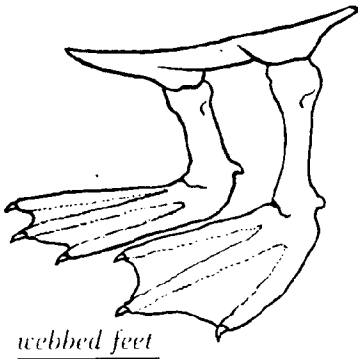
whale

sea horse

APPENDIX III

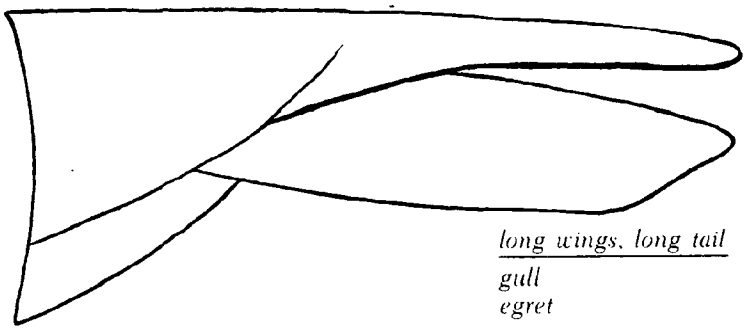
Bird pattern for Caper Ten





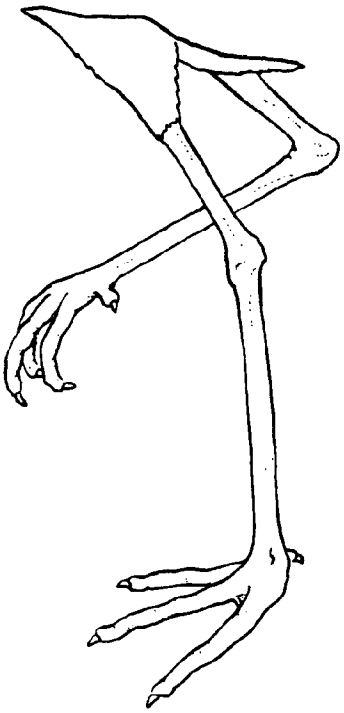
webbed feet

duck
gull
pelican



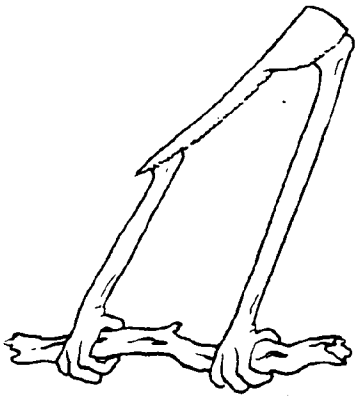
long wings, long tail

gull
egret



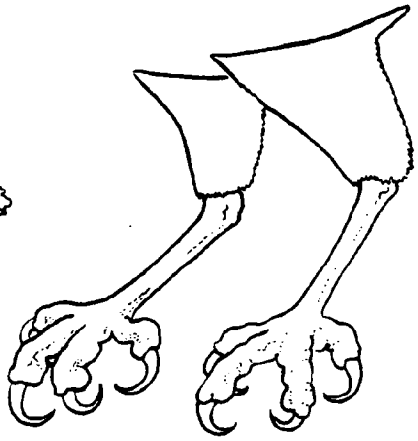
long slender legs

ibis
egret



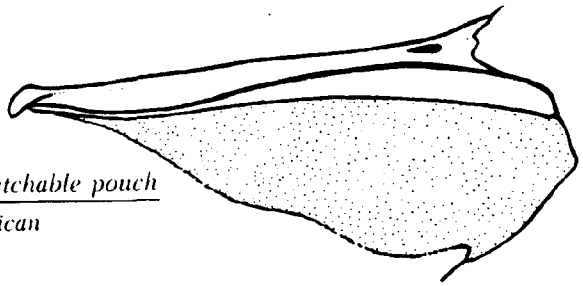
slender legs and toes

songbird



sharp talons

osprey

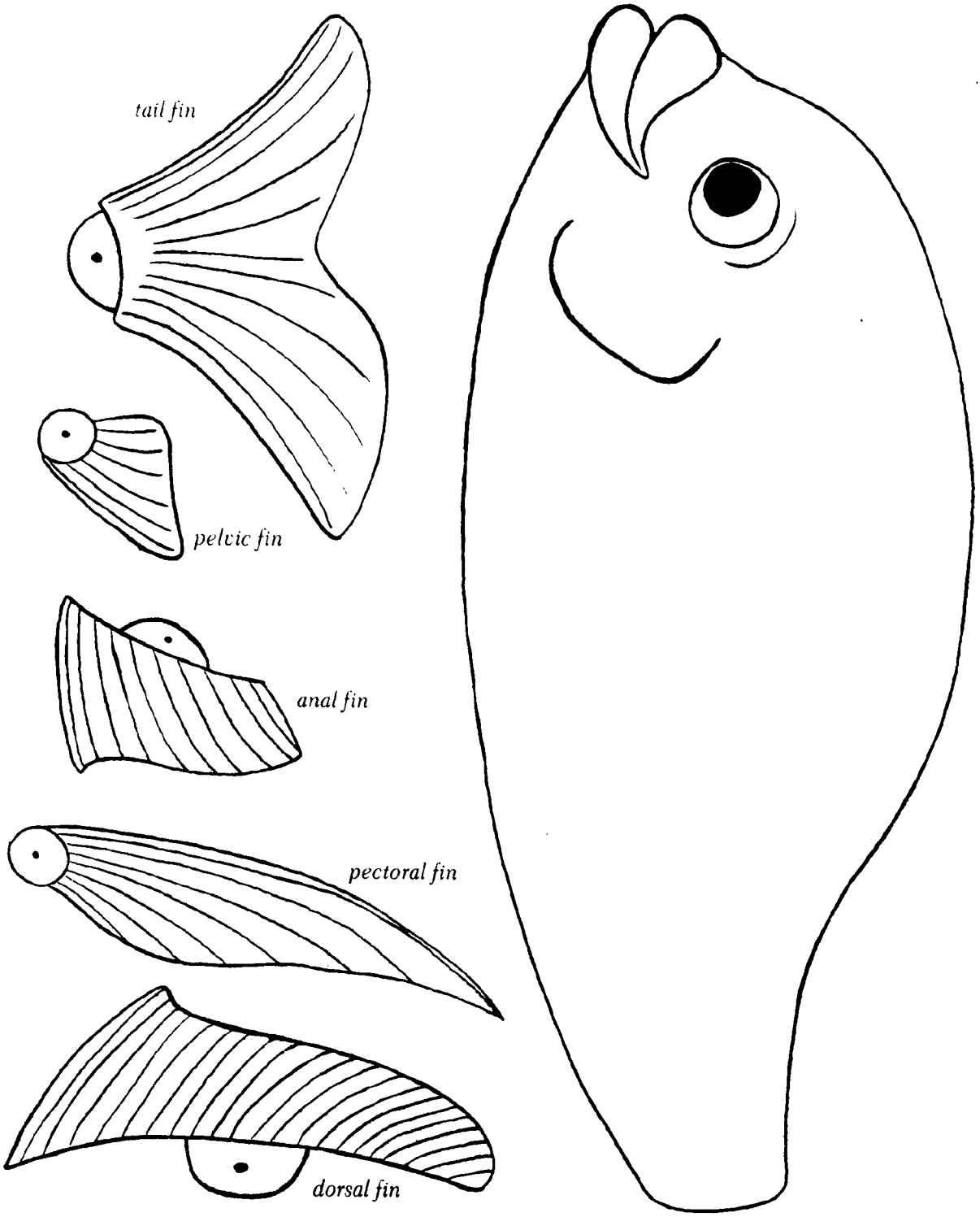


stretchable pouch

pelican

APPENDIX IV

Fish pattern for Caper Nineteen



ACKNOWLEDGEMENTS

Many educators in North Carolina and other states contributed suggestions and activities to *Coastal Capers*. Ann Charles-Craft of Wilmington, N.C., first recommended the idea. Judy Smith of Morehead City, N.C., critiqued the first set of activities for safety. Lindy Millman of Virginia Beach, Va., contributed "Now You See Me, Now You Don't" and "Clean Water." Dorothy Bjur of the University of Southern California Sea Grant contributed "Pin the fin on the fish." Cathy Conwell of the University of North Carolina at Charlotte and her graduate class in science methods reviewed the text. Wendy Allen of the Baruch Laboratories in Georgetown, S.C., critiqued the contents and instructional style.

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