
THE CORAL REEF TEACHER'S GUIDE

LESSON PLANS FOR K-5:

- **What and Where are the Coral Reefs?**
- **Life on the Coral Reef**
- **Benefits, Threats, and Solutions**



The coral polyp at night with extended tentacles. (Photo: Jim Larson)

The Edible Coral Polyp

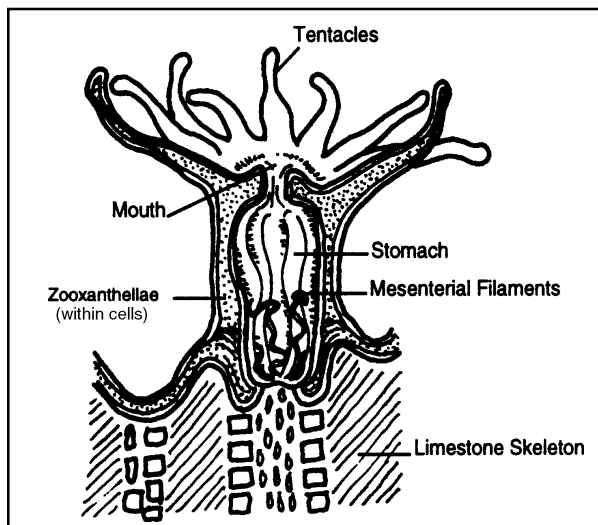
Objective: Students will review the parts of a coral polyp by building an edible coral polyp model.

Interdisciplinary Index: Science, Math, Language Arts

Vocabulary: coral, polyp, limestone, coral colony, coral reef, tentacles, zooxanthellae

Materials:

- white baking chocolate, candiquik mix, or cake frosting (1/2 ounce for each child)
- one marshmallow for each student (substitute: section of banana or strawberry)
- toothpicks
- red licorice (regular or whip): six two-inch strips for each child. If regular licorice is used, cut the pieces into small, thin strips.
- blue, red or green sprinkles
- heat source (microwave or hot plate) for melting candy coating only
- pan for candy coating
- paper plates



PRESENTATION:

You may want to prepare a model colony to show your students before they make their own.

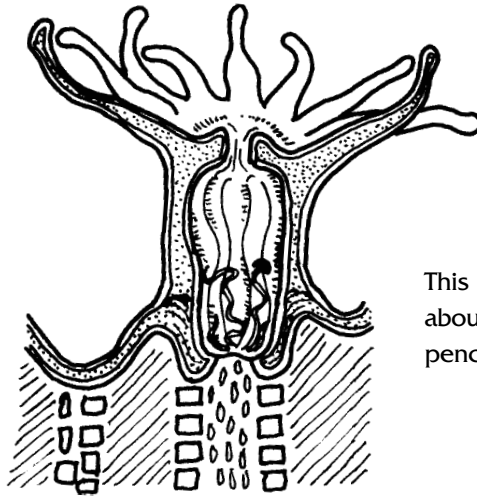
1. Group the students into pairs.
2. Give each pair of students a paper plate. The plate represents the limestone base to which the coral is attached.
3. Give each student a marshmallow on a toothpick and six strips of licorice. The marshmallow represents the polyp body and the licorice represents the tentacles.
4. Give each pair one ounce of melted candy coating from the heat source in a shallow container (the candy represents the limestone skeleton).
5. Have the students work together. Roll the sides of the marshmallow in the melted candy coating and stand the marshmallows on a paper plate. If the marshmallows are placed close enough together, they will attach to each other and resemble a coral colony.
6. Have the students insert six licorice strips around the top of the marshmallow. Children may want to use their toothpicks to help them poke the holes.
7. Slightly dampen the marshmallow with water and sprinkle it with the sprinkles. The sprinkles represent the zooxanthellae. Use only one color per polyp.
8. Discuss the edible polyp model. Explain what the marshmallow, the candy, the licorice, the sprinkles, and the plate represent.
9. Now have the students pretend that they are parrotfish or crown-of-thorns sea stars and eat their polyps. YUM!

Math: Students can count the number of tentacles on their polyp and multiply by the number of students in the class to find the total number of tentacles in the classroom coral colony.

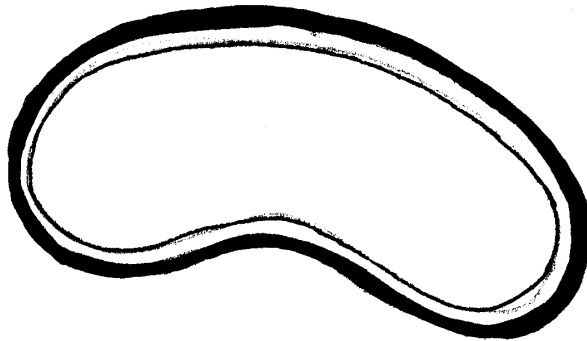
FOLLOW-UP/EXTENSION:

Students may want to write a story about their polyp or draw a diagram. Have them color the "I'm a Coral Polyp" Color Page.

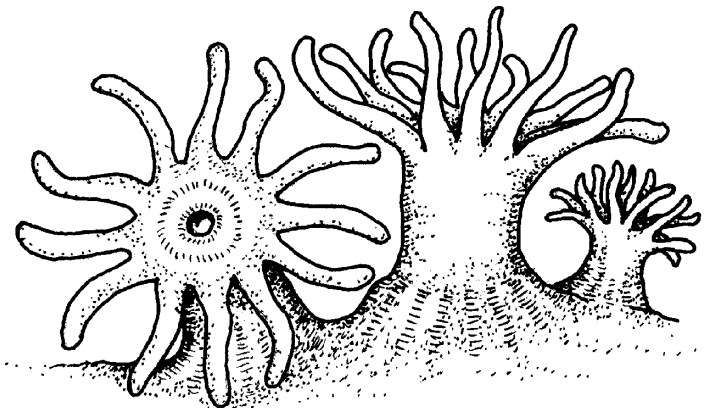
"I'M A CORAL POLYP" COLOR PAGE



This is a coral polyp. It is about the size of a common pencil eraser.



This is a microscopic plant called a zooxanthellae. It lives inside the coral polyp. The picture is greatly enlarged.



Coral polyps join together to make a coral colony. Coral colonies join together to make a coral reef.

Calcium Carbonate and Coral

Objective: Students will understand that coral skeletons are the basic structure of the coral reef, and that these skeletons are made of calcium carbonate, extracted by the polyps of hard corals from seawater to form limestone. They will use a vinegar test to identify calcium carbonate in objects in their classroom environment.

Interdisciplinary Index: Science, Language Arts

Vocabulary: limestone, skeleton, calcium carbonate

Materials:

- a limestone rock or shell
- two rocks other than limestone
- a piece of chalk
- pencil or other common object
- vinegar
- a dish for each specimen

PRESENTATION:

1. The basic element of the coral reef is the coral skeleton which is made of calcium carbonate extracted from seawater by the hard coral polyp to form a limestone base.
2. Explain that a test for calcium carbonate is to pour vinegar over an object and observe it. If the object bubbles and/or makes a fizzing sound, it probably contains calcium carbonate. (Note: sodium bicarbonate also bubbles with vinegar.)
3. Place the first two materials listed in separate dishes. Have the students tell you which ones they think contain calcium carbonate and why.
4. Perform the test, and identify the calcium carbonate object.
5. Have the students choose items from the room that they think might be made from calcium carbonate. If chalk is not chosen, the teacher should add it.
6. Place each of the selected items in a separate dish and pour vinegar over each one.
7. Observe which items cause the vinegar to bubble.
8. Discuss which items are made of calcium carbonate and contain the same material as coral skeletons. Since chalk is made of calcium carbonate, it will bubble.

FOLLOW-UP/EXTENSION:

Have the students write a description of what they observed. **Helpful hint:** If you cannot observe the bubbles, have students hold the container with the calcium carbonate object near their ears and they can hear the fizzing sound of the bubbles.

Where in the World are those Coral Reefs?

Objective: Students will distinguish the different types of coral reefs (fringing, barrier, atoll) and identify the areas of the world where tropical coral reefs occur.

Interdisciplinary Index: Science, Geography

Vocabulary: coral, coral reef, fringing reef, barrier reef, atoll, equator, tropics

Materials:

- globe or large world map
- **Reef Formation** handout and **Where in the World** handout for each student
- pencils, crayons or markers.

PRESENTATION:

1. Use map or globe to familiarize students with the continents, various islands, the equator, the belt of tropics (between the tropic of Cancer at 23°27'N and the tropic of Capricorn at 23°27'S).

Coral Reef Formation:

2. Explain that tropical coral reefs grow only in a special area approximately 20° north and 20° south of the equator called the tropics. Show the students the tropics on a large map. Explain that this is the part of the world where the water temperature is always warm. Explain that corals like warm shallow water and lots of sunlight since their plant partners, the zooxanthellae, need light to make food for the corals.
3. Pass out a **Where in the World** map and a **Reef Formation** handout to each student.
4. Explain that as the coral animals die, their skeletons become the base upon which new corals can grow. Tell them to turn to the **Reef Formations** handout.
5. Review the process of reef formation along a tropical island.
 - a) First, corals form a fringing reef along the edge of the island.

b) With time, the island sinks slightly so that water now separates the coral reef from the island. This is a barrier reef.

c) Eventually the island sinks completely, leaving a ring of small sandy islands and coral reefs around a central lagoon. This is an atoll.

6. Have the students color the fringing reef red, the barrier reef orange, the atoll purple, the island green, and the surrounding water blue.

Coral Reefs Around The World:

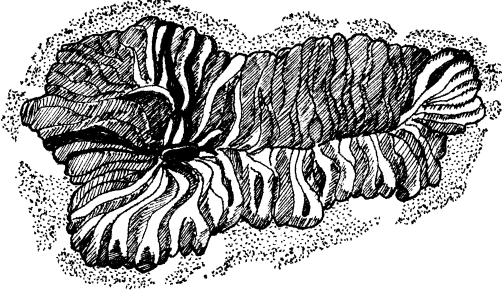
7. Use the **Where in the World** handout to review equator, tropics, continents, etc. Have students use the key to color in coral reefs, water, and land.
8. Locate the Great Barrier Reef and color it yellow. Explain that this is the largest structure built by living organisms on our planet. Tell them that it can even be seen from space.
9. Locate where the students live and mark it with a red dot.
10. Have students complete the "Find and Number" section by marking the locations on the map.
11. Review by asking students where most of the coral reefs occur in the world. Where are they located in relation to where the students live? Ask why they think there are no reefs at the North and South poles. Ask if any students have been to a coral reef. If so, ask them to locate it on the map. Do they know what kind of reef it was?

FOLLOW - UP / EXTENSION:

Have students draw their own reef formation (fringing, barrier, or atoll). Where would they locate it on the map? Have them describe what it looks like, both above and below the surface of the water. How did they get there? What are they doing? What is the water temperature? Is the water shallow and clear or murky and polluted? Why?

REEF FORMATIONS

The dotted areas represent coral.



- 1) This is a fringing reef where coral grows directly from the shoreline.



- 2) This is a barrier reef which is separated from shore by a lagoon.

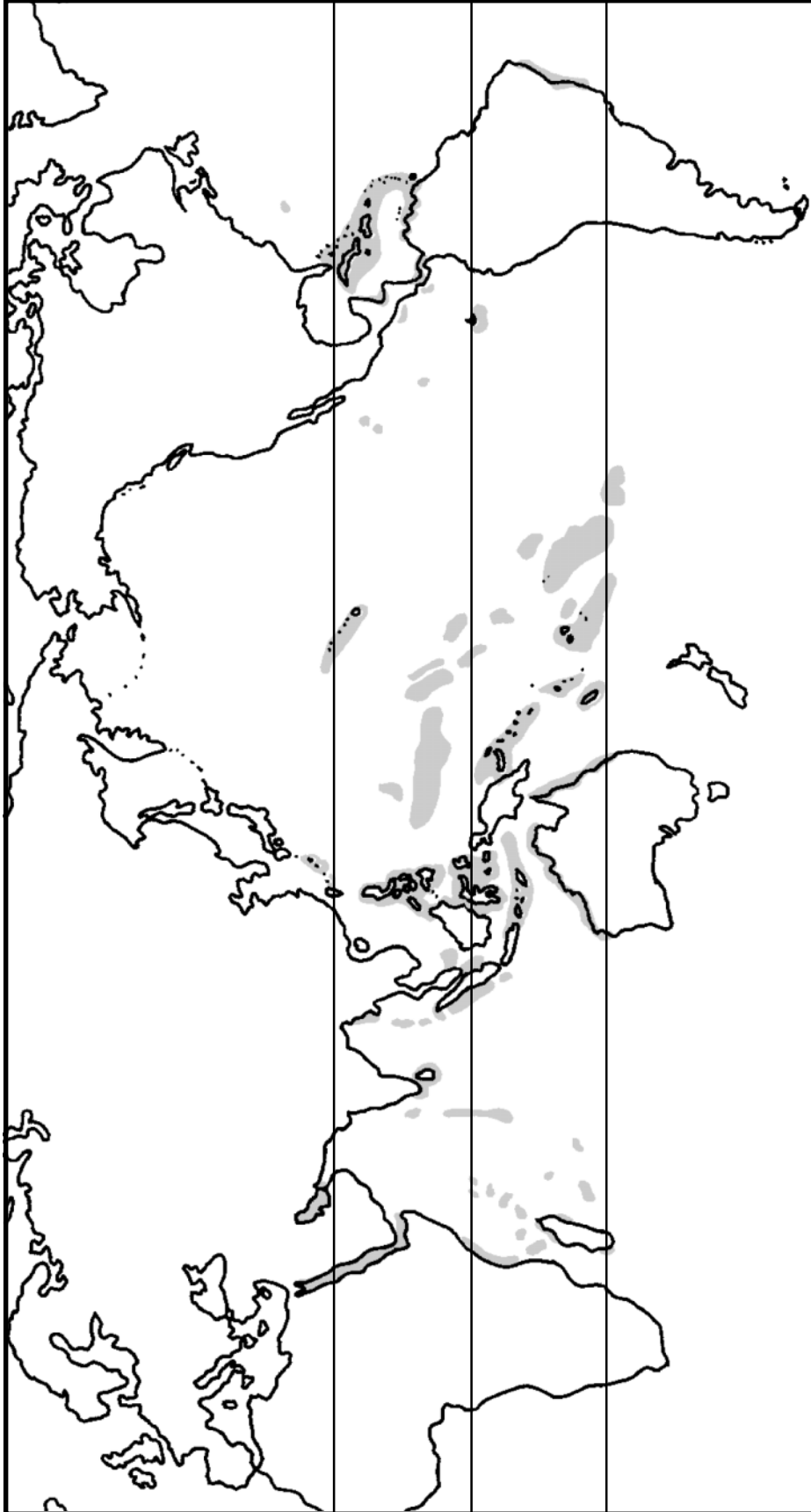
A barrier reef forms as the island sinks.



- 3) This is an atoll. Atolls form when the island sinks below the water, leaving a ring of small sandy islands and coral reefs around a central lagoon.

Color the fringing reef red, the barrier reef orange, the atoll purple, the land green, and the water blue.

WHERE IN THE WORLD ARE THOSE CORAL REEFS?



COLOR KEY TO THE MAP:

- Coral Reefs - Pink
- Great Barrier Reef - Yellow
- Water - Blue
- Land - Green
- Where You Live - Red

FIND AND NUMBER:

- | | | |
|---------------|-------------------|--|
| 1. Africa | 6. North America | 11. Pacific Ocean |
| 2. Asia | 7. South America | 12. Equator (0 degrees) |
| 3. Antarctica | 8. Arctic Ocean | 13. Tropic of Cancer (23°27' North) |
| 4. Australia | 9. Atlantic Ocean | 14. Tropic of Capricorn (23°27' South) |
| 5. Europe | 10. Indian Ocean | |

Tempting Tentacle Problems

Objective: The students will use basic math skills to solve word problems related to corals.

Interdisciplinary Index: Science, Math

Vocabulary: octocoral, soft coral, hard coral, polyp, tentacles, colony

Materials:

- a copy of the **Tempting Tentacle Problems** worksheet, one for each student or pair of students
- pencils
- markers, colored pencils, or crayons (optional)

PRESENTATION:

1. Review the terms octocoral, soft coral, hard coral, polyp, tentacles, and colony.
2. Remind the students that octocoral polyps (soft corals) have eight tentacles. Hard coral polyps have tentacles in multiples of six.
3. Have students work out the **Tempting Tentacle Problems** individually or in pairs.

FOLLOW-UP/EXTENSION:

Have students make up their own **Tempting Tentacle Problems!**

Have students draw a picture to go with each problem.

ANSWERS:

Grades 1-2:

1. 3 tentacles
2. 16 tentacles
3. 18 tentacles
4. 32 tentacles

Grades 3-5:

1. 360 tentacles
2. 16,000 tentacles
3. 1,620 tentacles
4. 18,000 tentacles

TEMPTING TENTACLE PROBLEMS

(GRADES 1-2)

REMEMBER! Soft coral polyps have eight tentacles.

Hard coral polyps in these problems have six tentacles.

For each problem, draw a picture to help you find the answer.

1. There was once a hard coral colony growing on a coral reef. A parrotfish came along and bit off three tentacles from one of the hard coral polyps. How many tentacles did that polyp have left?

2. Two soft coral polyps grew next to each other. How many tentacles did they have altogether?

3. A crown-of-thorns sea star ate almost a whole hard coral colony. Only three hard coral polyps were not eaten. How many tentacles did these three coral polyps have?

4. One day a soft coral grew four new coral polyps. How many tentacles did these new coral polyps have altogether?

NAME: _____

TEMPTING TENTACLE PROBLEMS

(GRADES 3-5)

**REMEMBER! Hard coral polyps have tentacles in multiples of six.
Soft coral polyps (octocorals) have eight tentacles.**

1. There was once an awesome colony of hard corals on a reef in the Pacific Ocean. Each coral polyp in the colony had 12 tentacles. A very hungry parrotfish swam up and quickly munched down 30 coral polyps. How many tentacles did the parrotfish munch if he ate every tentacle on the 30 polyps?

2. A beautiful soft coral swayed gracefully in the water. Along came a boat that dropped its anchor on the soft coral. Sadly, 2,000 coral polyps had their tentacles crushed. How many tentacles were crushed by the careless anchor?

3. A huge hurricane brought rains that smashed into a coral reef. Many corals were crushed by the storm. After the storm was over, only one hard coral with 150 polyps and one soft coral with 90 polyps survived. Each hard coral polyp that survived had six tentacles. If all the surviving hard and soft coral polyps have all of their tentacles, how many total tentacles survived the storm?

4. The crown-of-thorns sea star is a main predator on hard corals. One day a crown-of-thorns busily ate three colonies of hard coral. Each colony had 1,000 polyps. Each polyp had six tentacles. How many tentacles did the crown-of-thorns sea star eat?

NAME: _____

Coral Reef Zones Color Page and 3-D Mural

Objective: The students will be able to identify the following coral reef zones:

- a) Lagoon:
 - Beach
 - Mangroves
 - Patch Reef
 - Seagrass
- b) Reef Crest
- c) Reef Face:
 - Upper Zone
 - Lower Zone

They will also be able to name at least one life form found in each zone.

Interdisciplinary Index: Science, Language Arts

Vocabulary: coral reef zones, lagoon, reef crest, reef face, mangroves, beach, seagrass, patch reef, coral reef plants and animals

Materials:

For the Color Page:

- **Coral Reef Zones** handout for each student
- crayons, colored pencils, and/or markers

For the 3-D Mural:

- overhead projector
- transparency of **Coral Reef Zones** handout
- scissors
- glue
- tempera and watercolor paints
- paint brushes
- butcher paper (all colors)
- construction paper, tissue paper (optional)

PRESENTATION:

For the Coral Reef Zones Color Page:

1. Pass out a copy of the **Coral Reef Zones** to each student.

2. Provide each student with markers, crayons, or colored pencils.
3. Explain to the students that there are many parts to the coral reef, and that all of these parts are interconnected. We call the different parts “reef zones” (areas where different plants and animals live). Direct the student’s attention to each reef zone and have him/her add animals and plants and color in each zone as you discuss it.
 - a) The seaward facing slope of the reef is called the reef face. This is where life on the reef is most abundant. It is home to corals, fishes, sharks, turtles, and many other creatures.
 - b) The reef crest is the highest and shallowest part of the reef. At low tide, shallow pools of water form among the coral and are home to nudibranchs, marine snails, crabs, sea stars, worms and small fishes.
 - c) The lagoon is the protected body of shallow water between the beach and the reef. Many coral reef plants and animals live here on patch reefs and among the seagrass, like fish, lobsters, sea turtles, and small sharks. The seagrass serves as a nursery for young fish.
 - d) Mangroves grow in the area where the land meets the sea. Mangrove roots grow in the saltwater and serve as an important habitat for many marine animals.
 - e) Beaches are often formed from the breakdown of coral skeletons. Animals, such as sea turtles and certain birds, use the beaches to lay their eggs and build nests.
 - f) Tropical rainforests often border the beaches. These rainforests are the home of thousands of plants and animals, such as parrots, monkeys, fruit bats, and snakes. Protecting the tropical rainforests also helps to protect the coral reefs. When rainforests are cut down, the sediment that was once held down by the plants and tree roots washes into the water and out to the reefs where it smothers and kills the coral.
 - g) Have students draw a picture of their favorite coral reef creature in the box. You can use the **Sample Coral Reef Creature** as an example.

For the 3-D Coral Reef Zones Mural:

1. Make a transparency of the **Coral Reef Zones** handout.
2. Use an overhead projector to project the transparency onto white butcher paper (3 feet by 6 feet). Trace the **Coral Reef Zones** handout onto the paper, deleting the box and words.

(If you do not have an overhead projector, lightly trace the **Coral Reef Zones** handout onto the paper.)

3. Let the students work in groups of 6-8. This works well as a learning center activity. You will be creating three or four murals, depending upon the number of students in your class.
4. Have students use watercolors to paint in the water and sky.
5. Let other students use tempera to paint in the corals and other creatures on the sea floor.
6. Using brown butcher paper (or white paper painted brown), twist the paper into long strips that the students can form into mangrove roots and branches. Glue these onto the mural.
7. Have students design a coral reef creature of their choice on construction paper. The teacher can use the **Sample Coral Reef Creature** as an example. Color the creature. Place the colored sheet on top of a plain sheet of construction paper and cut both sheets out together into the shape of the creature. Have students glue the outlines of the creatures together, leaving an opening to stuff in newspaper. Stuff in the newspaper and completely glue the two sheets together. The finished creature should look 3-D, sort of like a pillow.
8. Let students put their finished creatures in the appropriate reef zones.

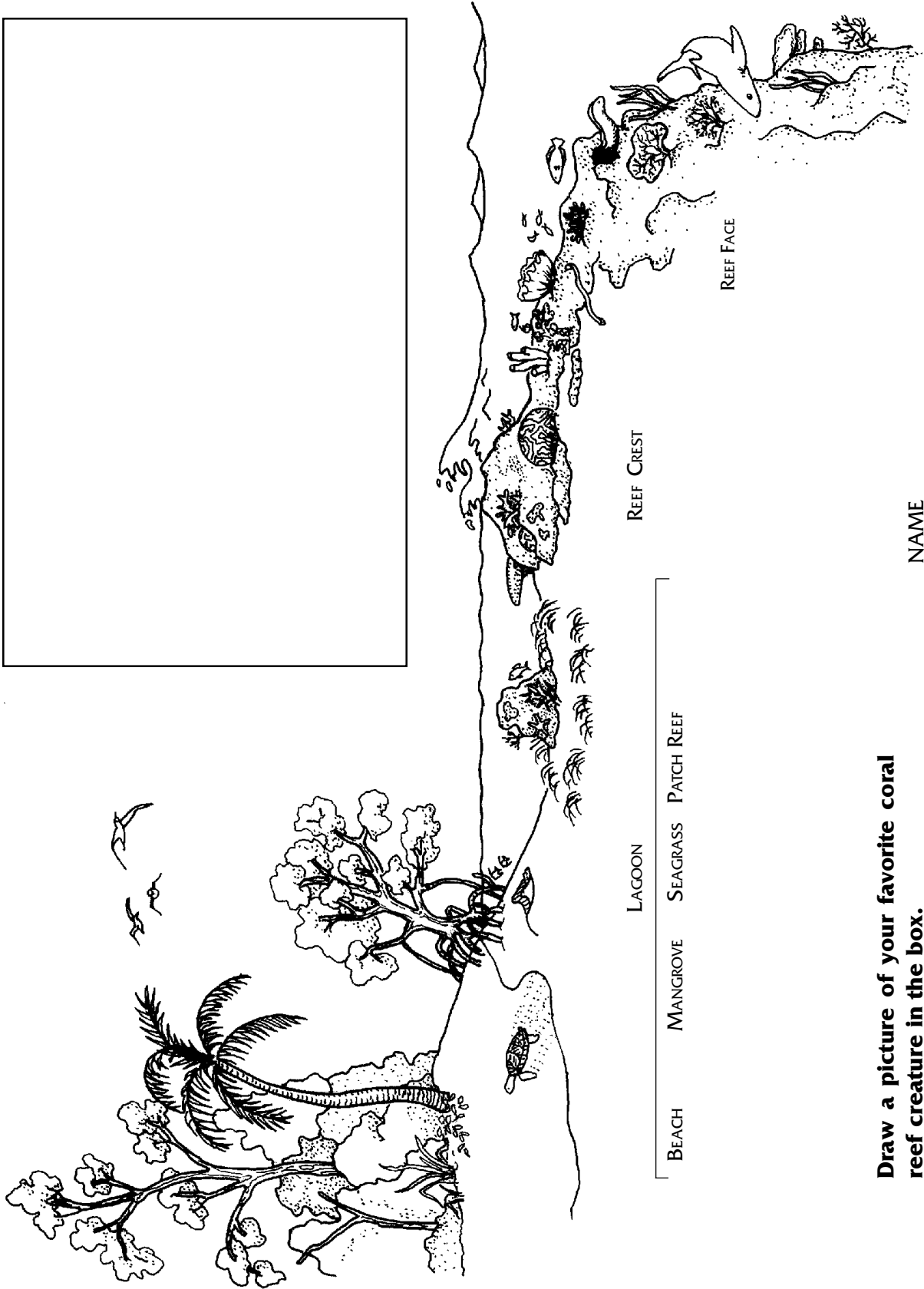
(Suggestion: You might want to assign different creatures to each student corresponding to different parts of the reef zone. For example, some students might make only young reef fishes that live among the mangrove roots. Other students might make fish that feed on corals. Other students may create worms and sea stars that live on the reef crest, etc.)

9. Discuss the different reef zones and the interdependence of life in these zones.

FOLLOW-UP/EXTENSION:

1. Have students do reports on their creatures.
2. Have students look up more information on each of the coral reef zones and report to the class.

CORAL REEF ZONES



Draw a picture of your favorite coral reef creature in the box.

SAMPLE CORAL REEF CREATURE



Coral Reef Color Page and Mural

Objective: Students will study the abundant life of the coral reef by completing the color page and/or creating a mural.

Interdisciplinary Index: Art, Performing Arts, Language Arts

Vocabulary: coral reef, coral reef ecosystem, coral reef plants and animals

Materials:

For the Color Page:

- copies of **Coral Reef Color Page** handout (both sides) for each student
- crayons, color pencils, or markers
- construction paper
- glue

For the Mural:

- transparency of **Coral Reef Color Page**
- overhead projector
- white butcher paper, approximately 3 feet by 6 feet
- watercolors and tempera paint (option: crayons and/or markers)

- paint brushes
- **The Coral Forest: Diversity of Life on the Coral Reef** poster as a reference and color guide. (To order, refer to **Merchandise** information in the back.)

PRESENTATION:

For the Coral Reef Color Page:

1. Pass out a color page to each student.
2. Use the key on the back of the color page to identify the various coral reef plants and animals.
3. Remind students that all life in the coral reef is interrelated, and that the plants, animals, sand and rocks together make up the coral reef ecosystem. Discuss the role of various coral reef creatures pictured on the color page.
4. Have students color in the coral reef plants and animals. You can do this one at a time as you discuss them, or you can have some students color independently while others work on the mural. You can also enlarge different sections of the color page, have the students color them, then place them all together on the wall.

For the Coral Reef Mural:

This activity works best as a small group activity (6-8 children per mural). Use this as a learning center activity, or set up four separate murals that students can work on in small groups.



Coral Reef Mural, by students from Sea View Elementary School, Salton City, CA. (Photo: Joanne Hardesty)

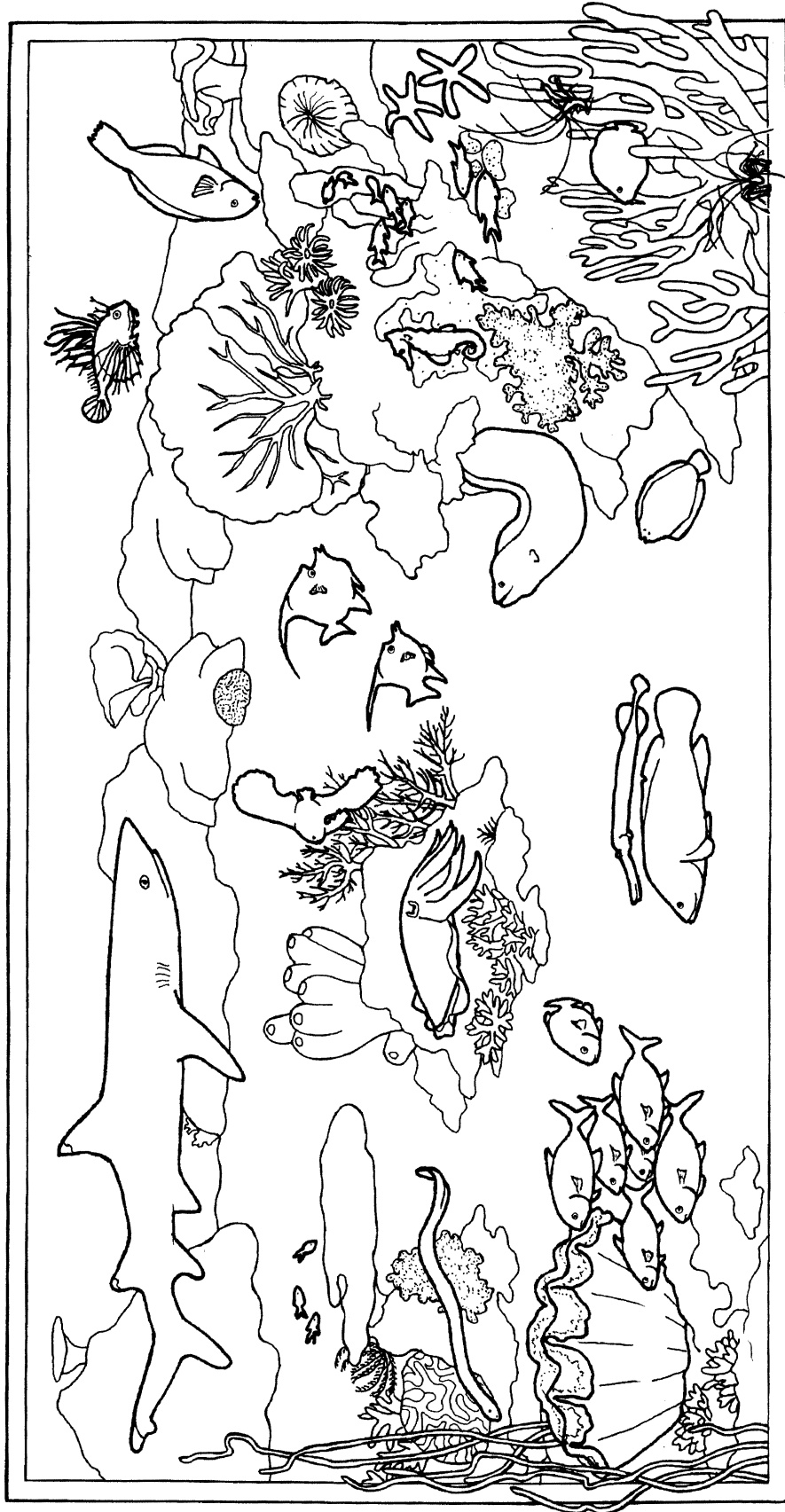
1. Make an overhead transparency of the **Coral Reef Color Page**.
2. Using an overhead projector, enlarge and trace the **Coral Reef Color Page** onto the 3 feet by 6 feet white butcher paper. (If you do not have an overhead projector, lightly sketch the **Coral Reef Color Page** onto the butcher paper.)
3. Give each student watercolors and/or tempera paint and paint brushes.
4. Have students paint in the background using light blue watercolor paints. This gives the mural an aquatic feeling. Show the students how to make wavy lines with the paints to create a sense of motion in the water. For a textured effect, try letting students use watercolor for smaller creatures and tempera for corals and larger creatures.
5. Display the mural(s) for everyone to see!

FOLLOW - UP/EXTENSION:

1. Glue completed color page/mural onto construction paper and let students cut up the color page/mural into a puzzle.
2. Have students work in partners, exchange puzzles, and reconstruct each other's puzzles.
3. Ask each student to choose one of the animals and act it out in front of the class. Have the class guess which animal it is.

CORAL REEF COLOR PAGE

THE CORAL FOREST: Diversity of Life on the Coral Reef



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NOTE: See next page for information and Key to the Illustration.

CORAL REEF COLOR PAGE

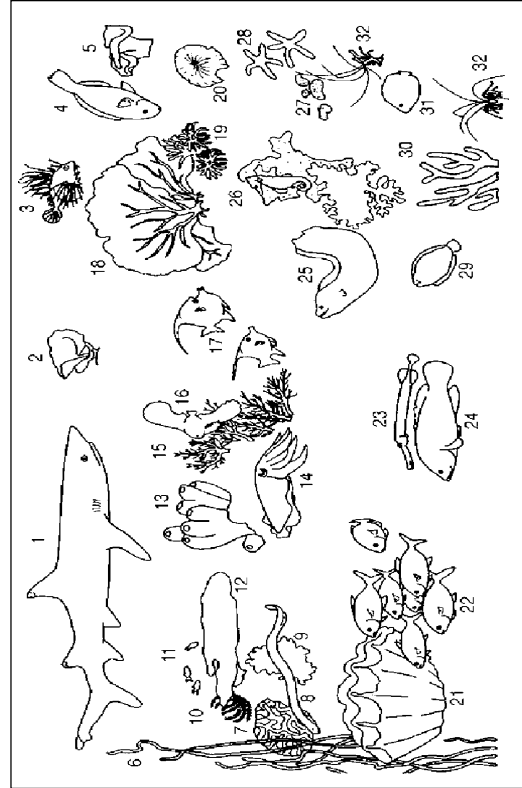
THE CORAL FOREST: Diversity of Life on the Coral Reef

Coral reefs were first formed more than 500 million years ago, and since that time they have successfully developed and supported a tremendous array of plant and animal life, earning them the name "rainforests of the sea." Today, reefs are found in 109 countries around the world; however, it is estimated that they are either destroyed or damaged by human activity in 93 of them. Like the rainforests, their survival is threatened. With the rainforests, they form an interrelated ecosystem whose health and balance is critical to ensure the biodiversity of species, protection of the coastlines, and an ongoing supply of food and medicinal resources. Enjoy the beauty of the coral reef, learn about its vast diversity of life, and help to preserve it for generations to come.

KEY TO THE ILLUSTRATION

Location: The Great Barrier Reef, Australia

Key Fact: The Great Barrier Reef is the largest structure built by living organisms on Earth, and it is the only living structure visible from outer space. Located along the northeast coast of Queensland, it is 1,240 miles (2,000 km) long and consists of more than 2,500 major reefs.



1. White tip reef shark
2. Lettuce coral
3. Butterfly cod (lionfish)
4. Parrotfish
5. Soft coral
6. Sea whips
7. Brain coral
8. Olive sea snake
9. Soft coral
10. Feather star
11. Damselfish
12. Plate coral
13. Vaseform sponge
14. Cuttlefish
15. Needle coral
16. Batfish (juvenile)
17. Moorish idol
18. Gorgonian fan coral
19. Sea anemone
20. Mushroom coral
21. Giant clam
22. Six-banded trevally
23. Trumpetfish
24. Coral cod
25. Yellowmargin moray eel
26. Spotted seahorse
27. Sponge
28. Blue sea star
29. Flowery flounder
30. Branching coral
31. Emperor angelfish (juvenile)
32. Banded coral shrimp

Coral Reef Life Cards

Objective: Students will learn about the various animals of the coral reef by using **Coral Reef Life Cards** in a series of games and exercises.

Interdisciplinary Index: Science, Language Arts, Art

Vocabulary: coral, coral reef, names of coral reef animals

Materials:

- copies of **Coral Reef Life Cards** for each student
- crayons or markers
- scissors
- construction paper
- glue

PRESENTATION:

Coral Reef Identification Game:

1. Copy one set of **Coral Reef Life Cards** for each student.
2. Cut out each **Coral Reef Life Card**.
3. Have students color the cards using crayons or markers.
4. Have each student hold up each card as you discuss a fact about the animal on the card. Refer to the following **Fact Sheet** for information.
5. When you are done, have each student hold up a picture of the animal that they like the best and discuss why they like it.

Coral Reef Memory Game:

Preparing for the Game:

1. Copy one set of **Coral Reef Life Cards** for each student.
2. Cut out each **Coral Reef Life Card**.
3. Glue the cards onto construction paper (optional).
4. Have students color the cards using crayons or markers.

Playing the Game:

1. Students put their cards together (two sets per two students).
2. Cards are shuffled face down and spread out in rows in front of the players.
3. Each player turns up two cards. If the cards match, the player keeps the pair and continues picking two cards at a time until he/she does not have a match. Unmatched cards are returned to their original positions in the row.
4. The game continues until all cards are matched.

CORAL REEF LIFE CARDS FACT SHEET

FOR USE BY THE TEACHER.

Blue Dash Butterflyfish - The butterflyfish is shaped like a thin pancake so that it can hide easily among the coral and be safe from predators. The blue dash butterflyfish is bright yellow with a blue streak on its body and a "fake eye" on its tail to confuse any predators that try to attack. The predator thinks that it is aiming for the head when in reality it is aiming for the tail, enabling the butterflyfish to swim forward quickly and escape.

Clown Triggerfish - The clown triggerfish is marked with large white polka dots which help to break up its outline and camouflage it against the reef. It is also very poisonous so predators do not try to eat it. The clown triggerfish attacks small reef animals, such as fish that hide in the sand and sea urchins, by blowing streams of water out of its mouth to uncover or overturn its prey.

Clownfish and Sea Anemone - The clownfish, a small orange damselfish often marked with one or two white stripes, has a symbiotic relationship with its partner, the sea anemone. The clownfish lives among the stinging tentacles of the anemone. The fish protects the anemone from being eaten by predators and drops bits of food into its mouth, and the anemone protects the clownfish with its poisonous tentacles.

Damselfish - Damselfish come in many colors, from dull brown and gray to brilliant yellow and blue. They are found abundantly on the reef and are very territorial. Some species are "farmers", actively guarding and growing small patches of algae on an area of coral to serve as a food source.

Giant Clam - The giant clam has a symbiotic relationship with its zooxanthellae, enabling it to grow its own food in the tissue of its mantle. It can

reach more than 40 inches (1m) in length and weigh more than 1,000 pounds (453kg). Humans have destroyed populations of these clams in the Pacific, harvesting them for their meat and shells. Projects are now underway to farm giant clams and return them to the reefs.

Gray Reef Shark - The gray reef shark hunts for food along the coral reef during the night and rests in caves during the day. Sharks are powerful carnivores, hunting large and small marine animals including fish, crustaceans, and mollusks. Some of the larger species even hunt marine mammals, sea birds, sea turtles, and other sharks. Sharks have very sharp teeth, keen vision, and a highly-developed sense of smell. Although they are at the top of the food chain, most sharks are not dangerous to humans unless provoked.

Hard Coral - Hard coral builds reefs by secreting a hard external limestone skeleton. There are three types of hard (stony) corals: branching, massive and plate. Most hard coral polyps have tentacles in multiples of six and can be found individually or in colonies. During the daytime, the hard coral polyp retracts into its limestone base for protection but at night it comes out to feed on floating plankton.

Hawksbill Turtle - The hawksbill turtle is a species of sea turtle with its nose shaped like the sharp beak of a hawk. Most sea turtles are herbivores (vegetarians) feeding on seagrass. Many lay their eggs in nests on the beach. Sea turtles are endangered because many of them are caught and drowned in fishing nets each year, their eggs and flesh hunted for food, and their shells and skin used for ornament.

Lionfish - The lionfish has spectacular orange and white markings which help to camouflage it from predators, however the spines on its fins are highly poisonous. Lionfish are mostly stationary during the daytime but active at night, feeding primarily on crustaceans and small fish. Because of its beauty and uniqueness, it is often photographed by divers.

Mollusk - The mollusk is an animal with an unsegmented muscular "foot" that is protected by a

shell. This is a giant triton, the natural predator of the crown-of-thorns sea star which eats coral polyps. The triton has been overharvested for its meat and beautiful shell. Scientists believe that this might be one reason for the explosion in the crown-of-thorns population which has caused extensive damage to reefs in parts of Australia and the Philippines.

Moray Eel - The moray eel has a long muscular body that propels it through the water like a snake, and a large mouth with sharply pointed teeth. It hides in coral holes along the reef face where it waits for unsuspecting fish to come close enough to attack. It also eats mollusks and an occasional octopus. The moray eel is not dangerous to humans unless provoked.

Parrotfish - The parrotfish is often brightly colored with a hard beak that resembles a parrot's. It is an herbivore and uses its beak to attack the coral for food, scraping the limestone base to extract nutrition from the algae (zooxanthellae) in the coral polyps. The limestone base is digested along with the polyp, broken down in the stomach, then excreted as sand. The parrotfish is an important source of sand for tropical beaches.

Plankton: Zooplankton and Phytoplankton - Plankton consists of microscopic drifting animals (zooplankton) and microscopic drifting plants (phytoplankton) which are swept onto the reef face by upwelling currents from deeper parts of the ocean, supplying the reef life with easy access to food.

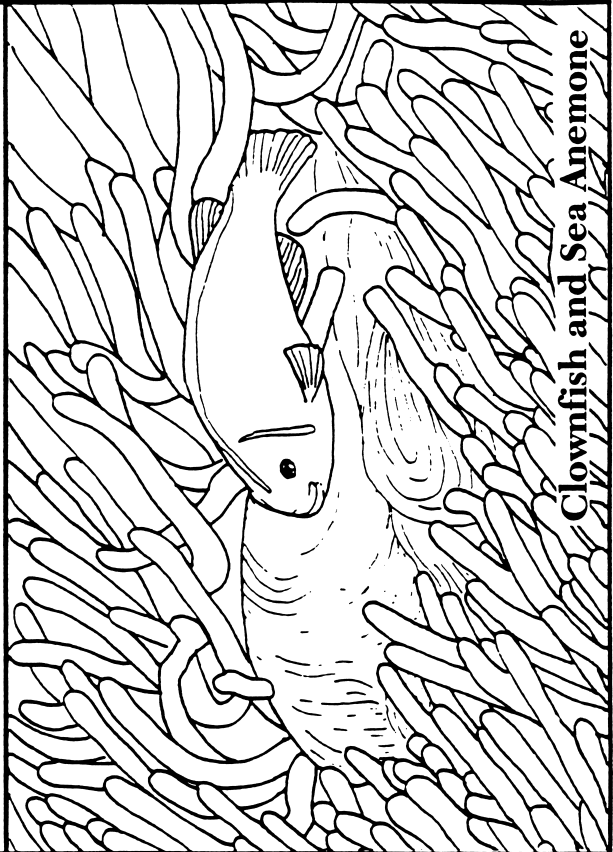
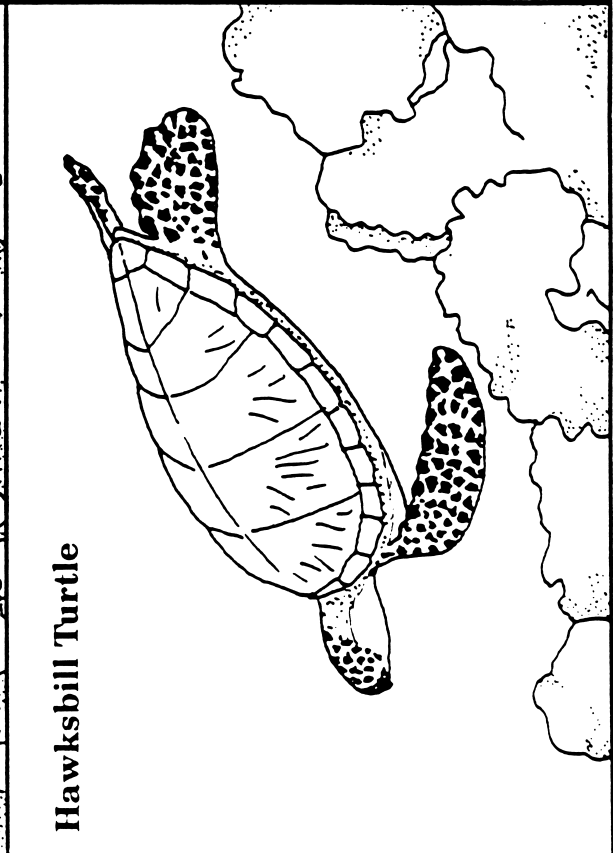
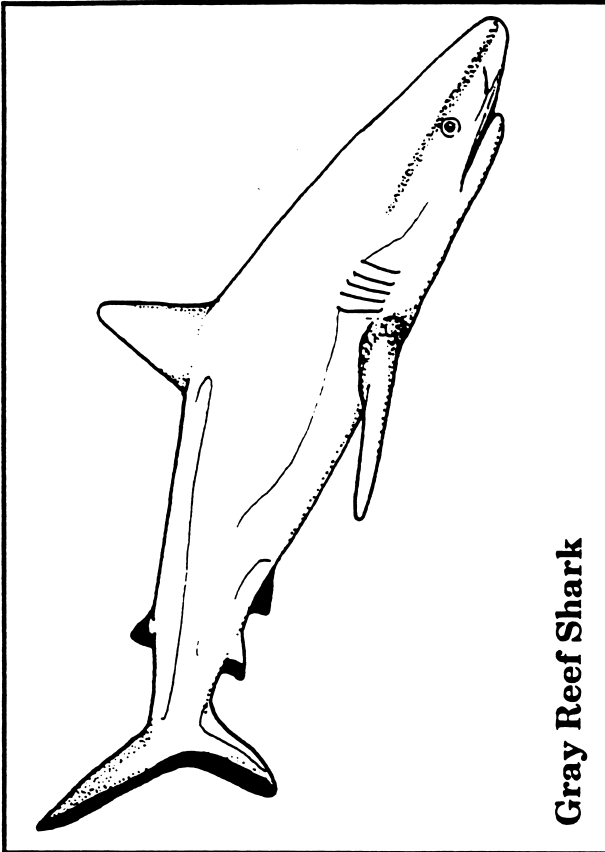
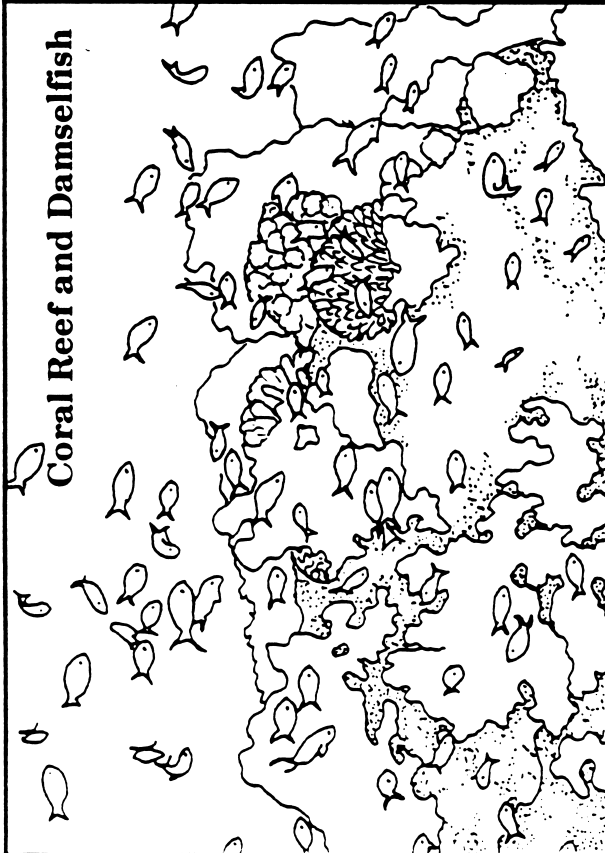
Sea Stars - Sea stars are characterized by radial symmetry wherein the body parts are repeated around a center, like the spokes of a wheel. They eat coral polyps and mollusks by wrapping their stomach and arms around the food. The crown-of-thorns sea star can be a threat to coral reefs because it eats the coral polyps, thereby killing the coral. If a sea star loses part of its body, it can grow the missing part back quickly.

Soft Coral - Soft corals do not build reefs. They secrete a flexible or soft skeleton which enables

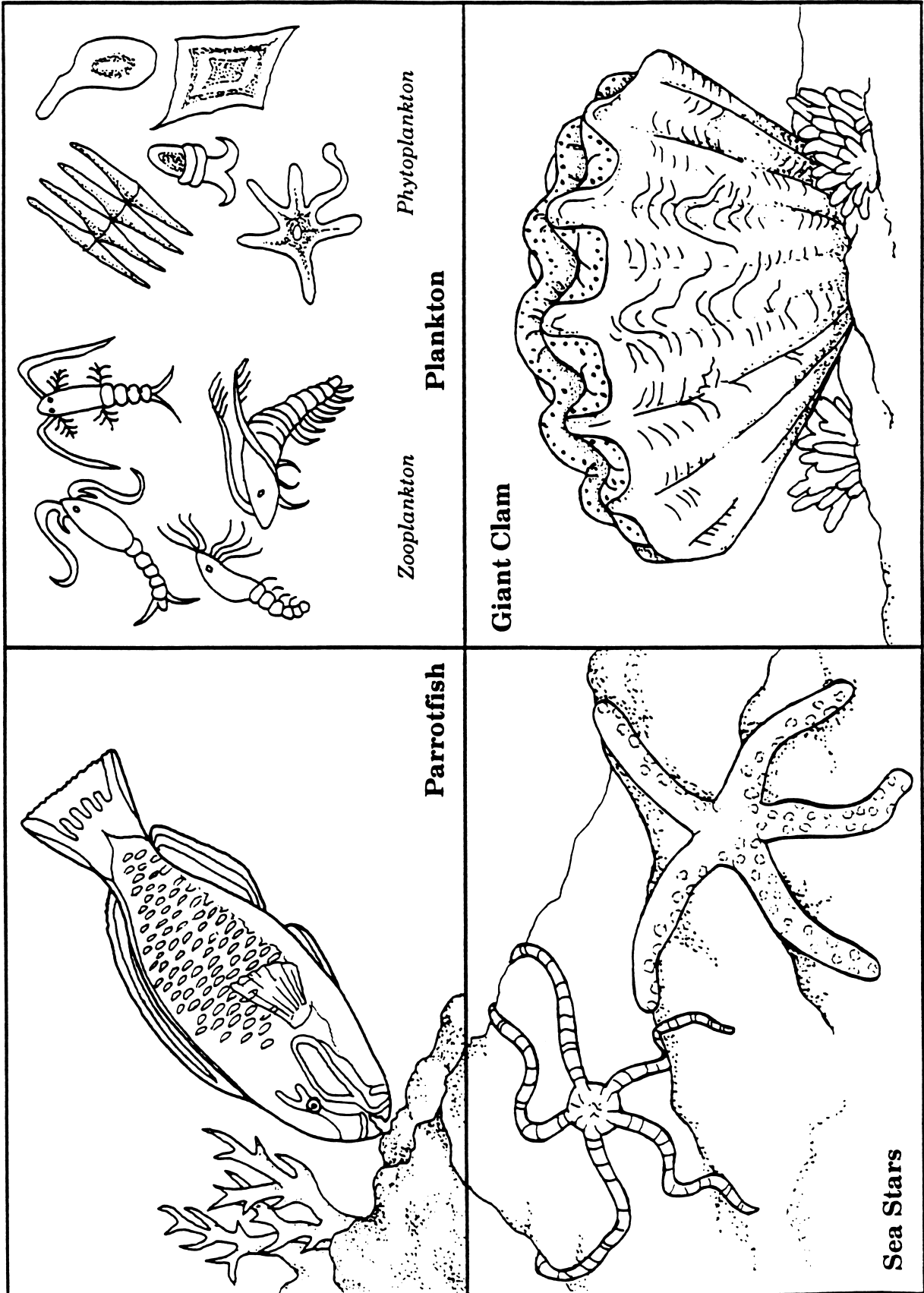
them to bend and sway in the water. They are also known as octocorals because each polyp has eight tentacles. Soft corals thrive in strong currents where they have access to lots of plankton. They also grow in dark caves and overhangs where hard coral cannot grow.

Spotted Eagle Ray - The eagle ray is often found swimming gracefully along the perimeter of the reef face, either alone or in small groups. It has two wings or flaps and a long, hard tail with poisonous spines near the base. Its powerful jaws enable it to feed on mollusks, especially clams, mussels, and oysters. It is also hunted for food by native coastal people.

CORAL REEF LIFE CARDS



CORAL REEF LIFE CARDS

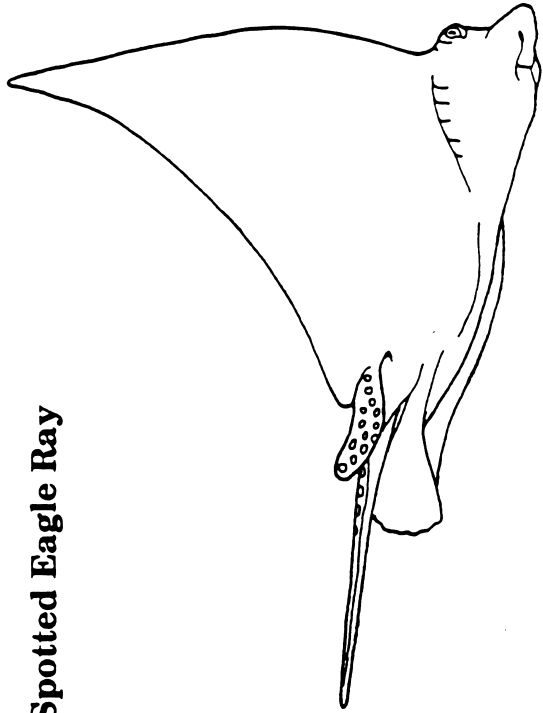


CORAL REEF LIFE CARDS

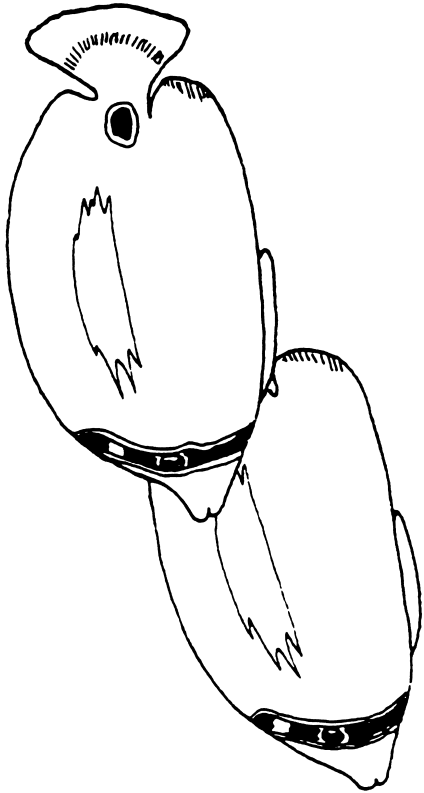
Mollusk



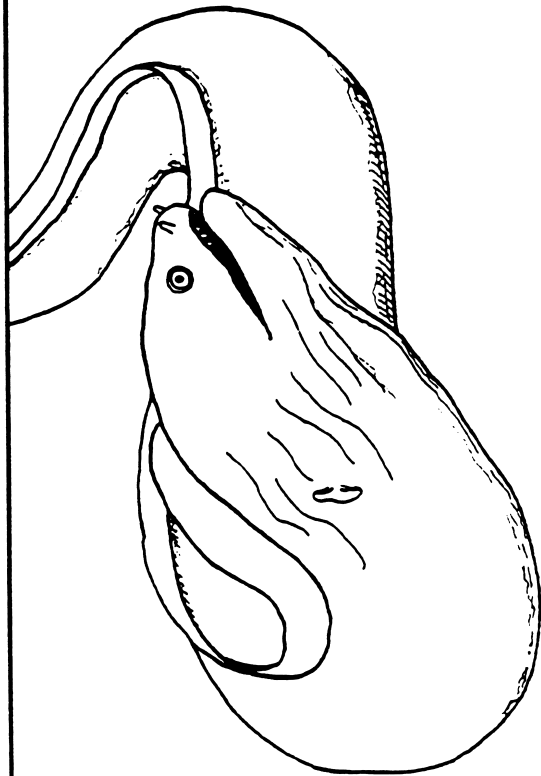
Spotted Eagle Ray



Blue Dash Butterflyfish

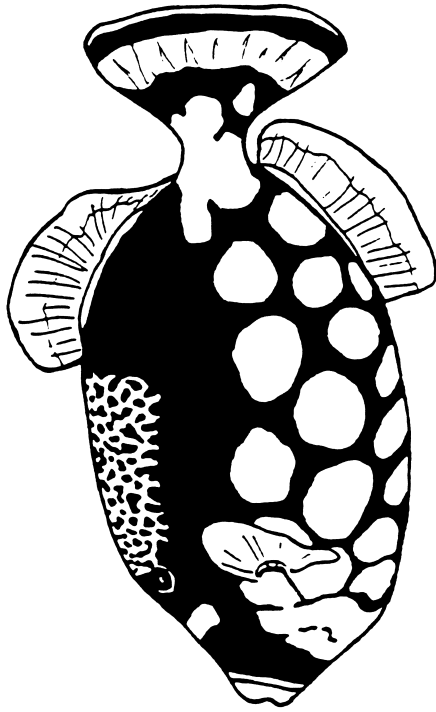


Moray Eel

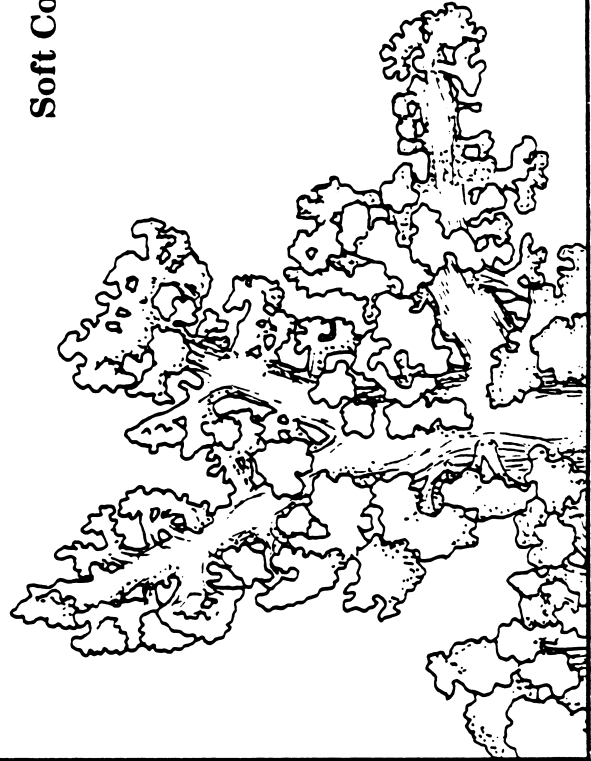


CORAL REEF LIFE CARDS

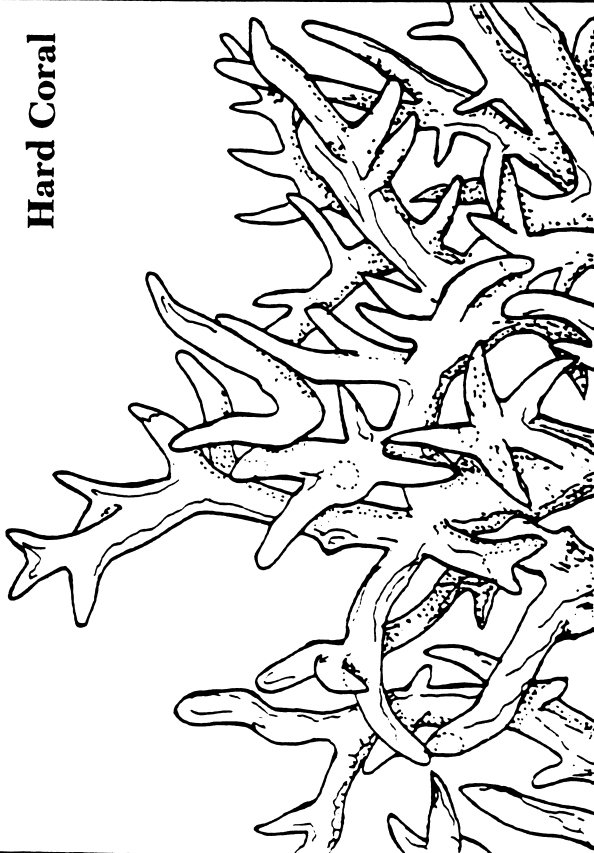
Clown Triggerfish



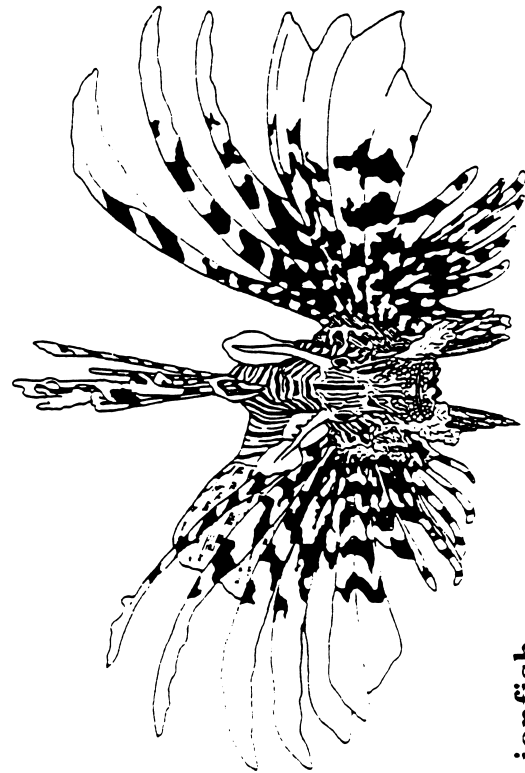
Soft Coral



Hard Coral



Lionfish



Coral Reef Poetry

Objective: Children will express the beauty of the coral reef using simple poetic formulas.

Interdisciplinary Index: Language Arts, Science, Art

Vocabulary: coral, coral reef, names of coral reef plants and animals

Materials:

- **Coral Reef Life Cards**
- paper
- pencils or pens
- poster board (optional)
- crayons

PRESENTATION:

1. Have students close their eyes and imagine that they are swimming among the creatures of the coral reef. AND/OR show the students the **REEF RELIEF Slide Presentation** or the videos listed in the **Resources** section of this **Guide**. AND/OR use the music side of the cassette tape that goes with **Baru Bay: Australia** by Bob Weir and Wendy Weir for aquatic inspiration.
2. Working as a whole class or in groups, let students discuss the underwater pictures evoked in their minds. Refer to the **Coral Reef Life Cards**. Then ask each student to contribute a word or short phrase to describe his/her thoughts. This "brainstorming" session is recorded on the chalkboard or a large piece of poster board for everyone to see.
3. Arrange students to work individually, in pairs, or in small groups.
4. Using words from the brainstorming session as well as additional words of their own choice, students will work individually or in groups to compose short poems. (See poem formulas on the following page.) Once the poems are complete, students should recopy the poems onto construction paper.

5. Each person in the group now adds a picture on the construction paper to illustrate the poem.
6. Each poem is now shared with the whole group.

POEM FORMULAS:

Haiku

First line of 5 syllables

Second line of 7 syllables

Third line of 5 syllables

Cinquain

First line — 1 word title

Second line — description of title in 2 words

Third line — 3 words that describe an action related to the title

Fourth line — 4 words that describe a feeling related to the title

Fifth line — 1 word that is a synonym of line 1 (means the same as the word in line 1).

Diamante

This is a poem formed in the shape of a diamond.

noun
 adjective adjective
 participle participle participle
 noun noun noun noun
 participle participle participle
 adjective adjective
 noun

(Beginning and ending nouns are opposites; the four nouns in the middle are related to the beginning and ending nouns.)

FOLLOW-UP/EXTENSION:

1. Bind all poems into a big book. (See **Loads of Life Big Books**.)
2. Share poems with other classes.
3. Use the poems for choral reading.
4. Send poems to elected officials to inspire coral reef preservation.
5. Give each child a **Coral Reef Life Card** and have him/her write a poem about his/her plant or animal.

SAMPLE POETRY

By Students from Sea View School, California

HAIKU:

Coral reefs are neat
Attaching, swaying, living
Endangered species.

— Ryan Dominguez
Age 11

The clownfish is bright
He swims in anemone
He hunts in poison.

— Andrea Staley
Age 11

One coral two and
Ten corals twenty corals
More and more and more.

— Maria Hardesty
Age 11

CINQUAIN:

Coral
Big grand
Flowing growing playing
Bright living greeting feeling
Invertebrates.

— Andrea Staley
Age 11

Coral
So hard
Swishing washing singing
Lovely atoll reef home
Limestone.

— Kyle Dinsmoor
Age 10

DIAMANTE:

Sharks
Some big, some small
Chewing, killing, swimming
Gills, scaly skin, sharp teeth, dark eyes,
Listening, eating, fighting
Ancient, silent
Sharks.

— Ryan Dominguez
Age 11

Coral
Hard soft
Growing dying living
Fish oceans seaweed sharks
Multiplying growing breaking
Hard soft
Coral.

— Maria Hardesty
Age 11

Coral Reef Pop-Up Cards

Objective: Students will create pop-up cards of coral reef creatures and write coral reef messages/facts to share with friends.

Interdisciplinary Index: Science, Art, Language Arts

Vocabulary: coral reef, coral, coral reef plants and animals

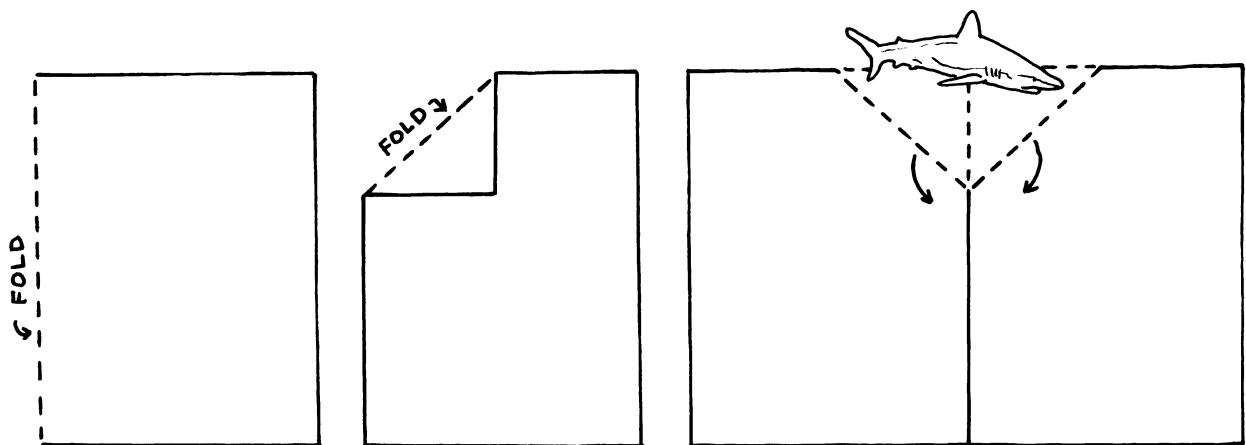
Materials:

- **Coral Reef Life Cards**, one card per student
- pencils
- crayons, colored pencils, markers
- scissors
- glue
- construction paper
- glitter, ribbons, buttons, other found materials (optional)

PRESENTATION:

Make a pop-up card before class so the students have a model to follow. Here is the basic pop-up pattern:

1. Fold card (8 1/2" x 11" works well) in half. Fold a triangle at the top corner, placing the fold 2 1/2" in from the top left corner.
2. Fold triangle towards you and away from you.
3. Open card and pull large triangle shape downward as you close the card. Reopen the card and lay flat on a table.
4. Cut out a **Coral Reef Life Card** and glue it between the left and right fold lines on the inside of the open card, as shown.
5. Fold and press the card down. Reopen.
6. Decorate the background to match the creature.
7. Add a catchy message to the front of the card. Example: What coral reef creature hunts at night? (open the card) A SHARK! (shark pops out).
8. Add an interesting creature fact to the front of the card. Have fun!



Coral Reef Connections

Objective: By taking on the roles of different coral reef animals, students will understand how animals in the coral reef ecosystem are interconnected.

Interdisciplinary Index: Science, Language Arts, Art

Vocabulary: names of coral reef animals

Materials:

- **Coral Reef Life Cards**, one card per student
- construction paper, all colors
- tissue paper (optional)
- glitter (optional)
- glue
- crayons
- scissors
- large ball of string
- one popsicle stick (or other stake, stick) per child

PRESENTATION:

Students will design a Coral Life Headband to wear while playing the **Coral Reef Connections** game.

Making the Headband:

1. Pass out a **Coral Reef Life Card** to each student. Explain that the student will use his/her imagination to create a headband to match his/her coral reef animal. One child should be chosen ahead of time to be the sun, and should create a headband to represent the sun.
2. Have each student color his/her **Coral Reef Life Card**.
3. Provide each student with a strip of construction paper, 1 1/2" x 24". Have the student measure the strip around his/her forehead to form a snugly-fitting band and glue the ends of the strip together.
4. Glue a **Coral Reef Life Card** onto the front of the headband.
5. Provide students with construction paper in colors to match their particular animal. Glitter and tissue paper are also fun to use if available. This activity works very well as a learning center where all supplies are readily available and the teacher monitors a small group of students at a time.
6. Tell the students that they are to decorate their headbands to match their animal card, so they feel like they are ready to become that animal. Explain that they will be speaking for the animal that they become. Once the headbands are finished, students are ready to play **Coral Reef Connections**.



Students from Sea View Elementary School, Salton City, CA, wearing Coral Life Headbands (Photo: Joanne Hardesty)

Playing the Game:

1. Have students put on their headbands.
2. Have them form a circle and sit down. Give each student a stake and have him/her either secure it firmly in the ground or hold the stake in his/her hand.
3. Have students look around the circle and think about how life in the circle is connected. Tell them that they have now become their animal, and they are to take turns passing a ball of string to an animal that they are connected to, saying the following:

I am a _____. I am connected to _____ because _____. (Example: "I am the Sun. I am connected to the Hard Coral because I give its zooxanthellae energy to make food." Then the Hard Coral might say, "I am the Hard Coral. I am connected to the Butterflyfish because I try to protect it from predators." Then the Butterflyfish might say, "I am the Butterflyfish. I am connected to the Shark because he eats me." And so on.) Model this with the students, and then explain that as they make a connection, they are to wrap the ball of string securely around their stake and then pass it on to the animal that they are connected to. Tell them that it is okay to have more than one connection to each animal. As the game progresses, encourage students to involve each animal in the circle. The teacher can refer to the **Coral Reef Sample Connections** to assist the students.

4. After students have played for some time, have them stop and discuss which animals seem to have the most connections. Discuss why this might be the case. If done carefully, the web can be lifted up and actually saved for some time. It is fun to bring in another class and share the completed web with them.

FOLLOW-UP/EXTENSION:

Have students write a play about **Coral Reef Connections**. They can wear their headbands as costumes for the performance.

CORAL REEF

SAMPLE CONNECTIONS

FOR USE BY THE TEACHER.

Sun - The sun is vital to the zooxanthellae in the hard coral and the giant clam for photosynthesis. Since hard coral forms the foundation of the coral reef, without sunlight coral reefs and all life dependent upon these reefs could not exist.

Blue Dash Butterflyfish - The butterflyfish uses camouflage for protection like the clown triggerfish and the lionfish. It can be eaten by the shark and the moray eel. Like the damsel fish and the lionfish, it hides among the hard coral to stay safe from predators.

Clown Triggerfish - The clown triggerfish uses camouflage for protection like the blue dash butterflyfish and the lionfish. It is also poisonous like the lionfish, the sea anemone, and the spotted eagle ray so predators won't eat it. It can be eaten by the shark.

Clownfish and Sea Anemone - The clownfish and sea anemone have a symbiotic relationship with each other, like the giant clam and its zooxanthellae. The clownfish can be eaten by the shark and the moray eel. Like the polyps of the hard coral and soft coral, the anemone is an invertebrate with tentacles and a mouth. The anemone uses poison for protection like the lionfish, the clown triggerfish, and the spotted eagle ray.

Damsel fish - Some damselfish farm algae on the hard coral. They also hide in its branches like the butterflyfish. It can be eaten by the shark and the moray eel.

Giant Clam - Like the clownfish and sea anemone, the giant clam has a symbiotic relationship with its zooxanthellae. Like the mollusk (giant triton) and the sea turtle, it has been overharvested by humans

for its meat and shell. Like the hard coral, it contains zooxanthellae in the tissue of its mantle. It also eats plankton like the hard coral, the soft coral, and the spotted eagle ray.

Gray Reef Shark - The gray reef shark hunts for food at night like the polyps of the soft coral and the hard coral. It can eat the butterflyfish, the clown triggerfish, the damsel fish, the clownfish, the lionfish, the parrotfish, the spotted eagle ray, and the moray eel. Some of the larger species hunt hawksbill turtles and other sharks. Sharks have sharp teeth like the moray eel, and like the moray eel, most sharks are not dangerous to humans unless provoked.

Hard Coral - Its polyps are eaten by the parrotfish and the crown-of-thorns sea star. Its branches protect the butterflyfish and the damsel fish from predators. The damsel fish farms algae on parts of it. It is an invertebrate with tentacles and a mouth like the soft coral and sea anemone. Its polyps come out to feed at night like the lionfish, the soft coral and the shark. Like the spotted eagle ray, the giant clam, and the polyps of the soft coral, it feeds on floating plankton. Like the giant clam, it contains zooxanthellae in its tissue which are dependent upon the sun for photosynthesis. Without the sun, there would be no coral reef and no reef life.

Hawksbill Turtle - Like the mollusk (giant triton) and the giant clam, it is protected by a shell and has been overharvested by humans for its meat and shell. Like the parrotfish, it is an herbivore (vegetarian). Like the gray reef shark and spotted eagle ray, it swims in the lagoon and along the reef face. Some sharks eat it.

Lionfish - The lionfish uses camouflage for protection like the clown triggerfish and the butterflyfish. It can be eaten by the shark and the moray eel. Like the damsel fish and the butterflyfish, it hides among the hard coral to stay safe from predators. Like the sea anemone, the clown triggerfish, and the spotted eagle ray, it is very poisonous. Like the gray reef shark and the polyps of the hard coral and soft coral, the lionfish is mostly stationary during the daytime but actively feeds at night.

Mollusk - The mollusk is protected by a shell like the giant clam and the sea turtle and like them, it has been overharvested by humans for its meat and shell. Some types of mollusks are eaten by sharks, moray eels, and sea stars. It uses its "foot" to move itself over hard coral.

Moray Eel - Like the shark, the moray eel has pointed teeth and is not dangerous to humans unless provoked. It can eat the butterflyfish, the damselfish, the clownfish, and the lionfish.

Parrotfish - The parrotfish eats the algae in the hard coral polyps. Like the hawksbill turtle, it is an herbivore. It can be eaten by the gray reef shark.

Plankton: Zooplankton and Phytoplankton - Plankton is eaten by the hard coral, the soft coral, and the spotted eagle ray.

Sea Stars - Sea stars eat hard coral polyps and mollusks.

Soft Coral - Soft coral polyps eat plankton. Like the gray reef shark, the lionfish, and the polyps of the hard coral, the soft coral polyps are nocturnal, actively feeding at night. Like the sea anemone and the hard coral polyps, the soft coral polyp is an invertebrate with tentacles and a mouth.

Spotted Eagle Ray - Like the hawksbill turtle and the gray reef shark, the eagle ray swims in the lagoon and along the perimeter of the reef face. Like the sea anemone, the clown triggerfish, and the lionfish, it is very poisonous. Like the polyps of the hard coral and the soft coral, it eats plankton. It can be eaten by the shark.

Loads of Life

Big Books to Share

Objective: The student will create coral reef stories to share using **Coral Reef Life Cards** as inspiration for characters.

Interdisciplinary Index: Art, Language Arts, Science

Vocabulary: review names of coral reef animals

Materials:

- **Coral Reef Life Cards**, one per student
- white construction paper (12" x 18") — at least one sheet per student
- pencils, markers or crayons
- scissors
- glue

PRESENTATION:

1. Tell students that they will each be contributing one page to a big book about coral reef life.
2. Review the role of each of the coral reef animals pictured in the form of a guessing game. (Example: Who remembers how a parrotfish eats?) Please see **Background Information** for facts about coral reef animals.
3. Give each student one **Coral Reef Life Card**, one sheet of construction paper, drawing materials, scissors, and glue.
4. Have the student think of a caption to go along with his/her animal. The student then copies the caption neatly at the bottom of the page. (For younger students, the teacher may choose to copy the sentence onto the page for the child.)
5. Have the student plan a coral reef scene to go with the animal and its caption.
6. The student then cuts out the animal, glues it onto the paper, and draws a scene around it.
(Steps 4, 5, and 6 can be done in any order).
7. Once all students have finished their pages, the teacher or a student adds the title page. It is recommended that the covers be laminated.
8. Bind the book at the top, using either a book binding machine or punching three holes at the top of the book and lacing yarn or metal rings through the holes. This is an excellent way to create a number of big books for the class library.

FOLLOW - UP/EXTENSION:

Once you have created a big book together, try one or more of the following variations:

1. Have students work together in cooperative groups. Divide the animal cards evenly among the students and have them brainstorm a story using all the cards. Have one student act as a recorder to write down the story line. Each student creates the pages for his/her cards.

Have the group design a title page. Bind all pages together.
2. Each student can use all of the animal cards to create his/her own book.
3. Choose only one type of animal and have the students brainstorm a story with only one main character. (Example: **The Adventure of the Timid Sea Turtle.**)
4. The students can then take their big books to other classrooms to share. This works especially well when older students create the big books and share them with the younger grades.

Sample That Reef Life!

Objective: Students will sort out the different types of coral reef creatures (represented by “found” objects) and find the number of individuals of each type of creature.

Interdisciplinary Index: Science, Math, Language Arts

Vocabulary: spiny lobster, clownfish, angelfish, sea turtle, moray eel, shark, sample, endangered species

Materials:

- different types of small “found” objects, such as shells, pebbles, beans, bottle caps, seeds, etc.
- a large container for mixing objects
- paper
- pencils

PRESENTATION:

1. Teacher mixes found objects together in a large container.
2. Give each student (or pair of students) a large handful of the found objects. Explain that these objects represent a sample of the different kinds of animals that live on the coral reef (Reef 1).
3. Write the following chart on the board or a large sheet of paper for the class to see:

★ Animal	Found Object
* spiny lobster	bottle cap
clownfish	bean
angelfish	small rock
* sea turtle	shell
moray eel	seed
shark	small piece of wood

★ The teacher may substitute the marine life and found objects in her/his area for the animals and objects listed.

* Add only a few found objects to represent these species since they are endangered or threatened.

4. Have students sort out each type of object into separate piles.
5. Have each student count the different objects and make a chart like this one.

Reef 1: Kind of Animals Found	Number of Each Kind
spiny lobster	2
shark	5
clownfish	8
sea turtle	0
moray eel	2

6. Have student put a ★ next to the most abundant animal and an ⊗ next to the least abundant animal.
7. Discuss the findings. Ask students to explain why they think a certain animal might be more/less abundant on the reef. Introduce/review the concept of endangered species. How/why does this happen?
8. Gather up the found objects and repeat the activity. Tell students they are now taking a sample from a different reef (Reef 2). Students can then compare their two charts.
9. Older students can use their charts to write a story about the differences/similarities between the two reefs.

FOLLOW - UP/EXTENSION:

Have students create a bar graph or pie chart representing the number of individuals of each type of creature.

Careful With Your Plastics!

Objective: Students will identify plastic items that are often thrown away, and discuss how these items can be harmful to coral reef creatures. Students will discuss how these items should be recycled, reused, or reduced (used less).

Interdisciplinary Index: Science, Language Arts

Vocabulary: recycle, reuse, reduce, plastic, pollution, coral reef plants and animals

Materials:

- **Coral Reef Life Cards**
- plastic items (food containers, six-pack rings, grocery bags, plastic forks, fishing line, sandwich bags, etc.)
- **Plastics Worksheet**, one for each student

PRESENTATION:

1. Tell students that every day, people all over the world throw unwanted things (trash) on the ground and in the water. At sea, careless boaters often dump garbage over the side of the boat. People visiting the seashore sometimes leave piles of trash on the beach which can be swept into the ocean by wind and waves. In this way trash can end up on the coral reef and sea creatures can be killed when they try to eat it. For example, sea turtles think that plastic bags look like jellyfish, and eat the bags. Small sea creatures can become trapped in plastic containers dumped in the sea. Other animals become hopelessly tangled in nylon fishing lines and nets. Thousands of animals die each year when they are caught in plastic six-pack rings, causing them to be choked or cut.
2. Display the **Coral Reef Life Cards** in front of the class.
3. Have a sack with the plastic items listed above in it.

4. Have a student pull out a plastic item from the sack, and explain how it would harm one of the coral reef animals on display.
5. When you have gone through all of the plastic items, discuss how each of the items could be reused, recycled, or reduced (used less). Discuss alternatives to the disposable plastic items.

Examples:

- plastic grocery bags: use canvas bags instead to reduce plastic use
- plastic fork: use metal silverware, even when on vacation
- plastic six-pack ring: always cut up six-pack rings and dispose of properly
- plastic food containers: reuse for other things or recycle
- plastic sandwich bags: use reusable food containers instead

Encourage students to be creative at reusing plastic items!

6. Pass out the **Plastics Worksheet**. Have each student complete it and share his/her completed worksheet with the class.

FOLLOW-UP/EXTENSION:

Have students check the use and disposal of plastic items at their homes and report to the class.

PLASTICS WORKSHEET

Plastic trash can be very dangerous to coral reef creatures.

Draw a picture showing different plastic things that are sometimes thrown away at sea.

Choose one of the plastic items you just drew and show a coral reef creature in trouble because of that item.

Now draw a picture showing how you can reuse or recycle your plastic garbage so that it doesn't end up in the ocean!

Coral Reef Word Find

Objective: Students will review and become familiar with words related to the coral reefs in the **Benefits, Threats and Solutions** section of the **Background Information**.

Interdisciplinary Index: Language Arts, Science

Vocabulary: food, shelter, beach, tourism, medicine, hurricane, sediment, disease, cyanide, dynamite, pollution, boats, divers, extinct, endangered, cleanup, sustainable, sanctuary, conserve, education

Materials:

- A blank **Coral Reef Word Find**, one for each student
- pencils

PRESENTATION:

1. Review the vocabulary.
2. Tell students they are going to make their own **Word Find**.
3. Have students place the review words (one letter in each square) randomly across or down on the grid.
4. When all of the words have been placed on the grid, students will fill in the empty squares with letters.
5. Have students exchange **Word Finds** and solve.

FOLLOW-UP/EXTENSION:

Give each student another **Word Find** sheet as homework. The student can make a word find for a friend or relative to solve. Encourage students to add their own coral reef words.

CORAL REEF WORD FIND

NAME _____

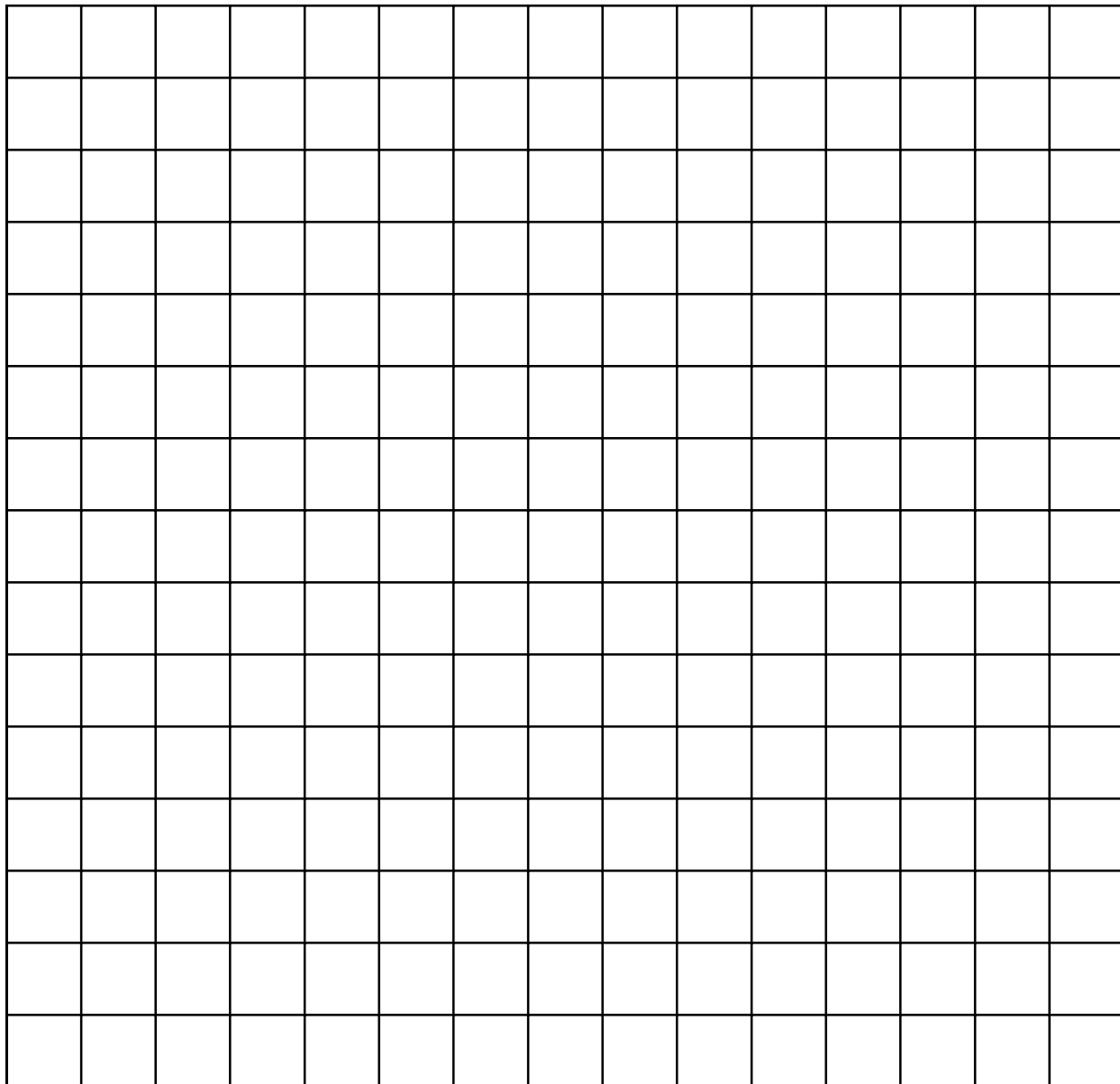
Use the words related to coral reef benefits, threats, and solutions to make a word search. See if someone else can solve your puzzle.

food
shelter
beach
tourism
medicine

hurricane
sediment
disease
cyanide
dynamite

pollution
boats
divers
extinct
endangered

cleanup
sustainable
sanctuary
conserve
education



Unsettling Sediments

Objective: Through experimentation, students will understand how the destruction of tropical rainforests can cause extra amounts of soil to be washed onto the coral reefs, resulting in damage to the reefs.

Interdisciplinary Index: Science, Language Arts

Vocabulary: sediment, coral reef, tropical rainforest, clear-cut

Materials:

- a clear, large jar
- water
- small, clear container filled with muddy water
- household sponges (you can use various colors of sponges to represent coral reefs)
- rock to weight down the sponges (option: if sponges are not available, rocks can be used instead).

PRESENTATION:

1. Tell the students that corals grow in very clear, clean water. Discuss rainforest vegetation. Explain that when it rains, the plant and tree roots help to hold the soil in place. When the forest and trees are cut down, the soil washes into the water and eventually reaches the coral reef. Coral polyps can survive if some soil washes on top of them and is then swept away by the current. However, when too much soil remains on the coral polyps, it smothers them. A whole coral reef can be killed in only a few weeks.
2. Cut several household sponges into various shapes resembling coral and place them on the bottom of a clear glass or plastic jar. Weight the sponges down with a rock, then fill the jar with water.
3. Tell students to imagine that the sponges are corals.

4. Ask students to imagine that they are in a tropical rainforest. Tell them that bulldozers are coming to cut the trees down. Have students make sounds of bulldozers and trees crashing to the ground.
5. Tell students that all of the trees have been clear-cut and that the soil is now exposed.
6. Have students imagine that a big rain storm comes in. Have them make the sounds of a storm.
7. Stop here and ask the students what they think will happen to the soil.
8. Explain that the rain washes the soil into the water and currents carry it out to the reef.
9. Pour the muddy water into the jar of clear water. Tell the students that this is sediment washing onto the coral reef because trees have been cut down.
10. Explain that when water loaded with extra sediment drifts onto the coral reef, the added dirt smothers the corals.
11. Watch the sediment spread throughout the jar.
12. Notice how the “corals” become covered with sediment. Imagine the polyps trying to survive with all of that dirt on top of them.

FOLLOW-UP/EXTENSION:

1. During the day, observe how the sediment settles onto the “coral reef”. Keep track of how long it takes for the water at the top to become clear.
2. Have students write a letter to a world leader explaining the importance of the tropical rainforests to the coral reefs based on this lesson. Younger students can draw a picture of corals being smothered by sediment.

How You Can Help Reef Relief!

Objective: Students learn that there are many things that they can do to help preserve life on the coral reefs. They use their knowledge of anthropogenic threats to coral reefs to communicate their concerns to elected officials.

Interdisciplinary Index: Science, Language Arts, Political Science

Materials:

For the Direct Action Letter:

- a copy of the **Sample Direct Action Letter**, one per student
- pencils/pens
- paper

For the Artwork for the Reefs:

- a copy of the artwork page, one per student
- crayons, color pencils, or markers

PRESENTATION:

1. Choose one or more of the current threats to coral reefs and discuss with the students. Also, discuss the value of taking direct action as a way to protect the reefs. Review the **Sample Direct Action Letter**.
2. Based upon this information, ask the students to write a direct action letter and/or color the **Artwork for the Reefs** page. Students can also create their own page of coral reef art. Have them imagine that they are snorkeling or diving on a coral reef and describe or draw the scene around them. Is it beautiful? Is there pollution or damage?
3. Send the finished letters and/or artwork to elected officials. (Ask them to protect our coral reefs.) Then, wait and see if they respond.

Sending the direct action letters and artwork to elected

officials does have a tremendous impact. In California, it is estimated that for every person who writes a letter to a Senator, there are 5,000 other people who have not written letters but share the same view. Here are some addresses to get you started, along with the one on the sample letter.

Name
President of the United States
The White House
1600 Pennsylvania Ave. NW
Washington, DC 20500

Name
Vice President of the United States
United States Senate
Washington, DC 20510

Your Senator _____
United States Senate
Washington, DC 20510

Your Representative _____
U.S. House of Representatives
Washington, DC 20515

Name
Administrator
Environmental Protection Agency
401 M Street, SW
Washington, DC 30460

For specific information about current coral reef threats and whom to write, contact REEF RELIEF at tel: (305) 294-3100, fax: (305) 293-9515, e-mail: reef@bellsouth.net, or go to our web site:

<http://www.reefrelief.org>

SAMPLE DIRECT ACTION LETTER

Students can use any or all of the suggested sentences below to create their own direct action letters.

President
The White House
1600 Pennsylvania Avenue, N.W.
Washington, DC 20500

Dear Mr. President:

I am writing to ask you to please protect America's coral reefs in _____ (*Florida; Hawaii*). Coral reefs are important to people because _____ (*they protect shorelines from crashing waves; they are a source of medical treatments; they are beautiful places to study and enjoy*).

I have visited a coral reef in _____ (*location*). I saw _____ and _____ (*colorful coral and sponges; pretty fish; endangered turtles; sharks*). My favorite part was _____ (*seeing a funny-looking trunkfish; swimming with all the marine creatures; taking underwater pictures*).

I have never visited a coral reef, but I would like to one day. I can't wait to _____ (*see a shark; swim underwater with all the colorful fish; take underwater pictures*). I hope there will still be reefs to visit by then!

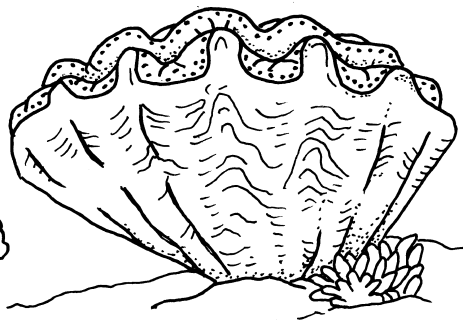
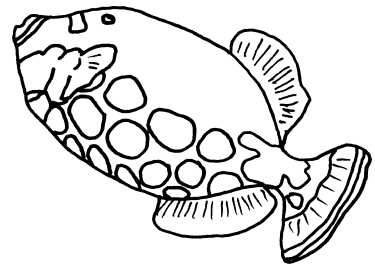
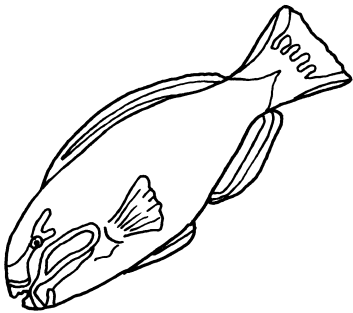
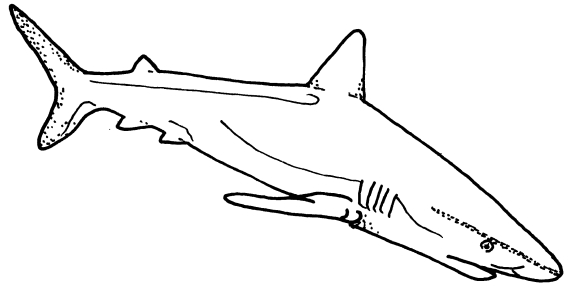
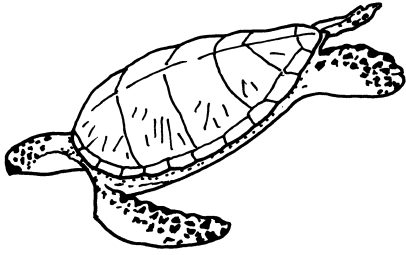
Many people make their living from coral reefs through _____ and _____ (*fishing; tourism*). Healthy reefs are important for their survival.

Thousands of different kinds of marine plants and animals depend on coral reefs for food and a safe place to live. But, _____, _____ and _____ are destroying coral reefs (*pollution; sewage; siltation from deforestation; development; careless boaters and divers*). Please do everything you can to stop the destruction. Please protect our environment and our coral reefs.

Sincerely,

Student's Name
Grade
Name of School
City, State

ARTWORK FOR THE REEFS



Student Assessment

Tell and Show What You Know

Objective: Students will review what they have learned about the coral reef by illustrating their knowledge and sharing it with others.

Interdisciplinary Index: Science, Language Arts, Art

Materials:

- writing paper or butcher paper for each student
- colored pencils, pens, crayons, and felt pens

PRESENTATION:

1. Have students fold paper into 4, 8, or 16 equal parts.
2. Tell students that they are to think of the 4, 8, or 16 most interesting things that they have learned about the coral reefs.
3. Have students draw or write down their thoughts in the 4, 8, or 16 parts of the paper.
4. Have students share their thoughts/pictures in small groups or with the class.
5. The finished product can be used as a mural.

FOLLOW-UP/EXTENSION:

Ask students to repeat the activity based on one of the following formats:

What would happen if...

What would you do if...

How I can help...

The 4, 8, 16 most interesting coral reef creatures are...

References for Children

BOOKS

Amos, William H. **Exploring the Seashore.** The National Geographic Society, 1984.

Alevizon, William. **A Sea Dreams Primer of Coral Reef Fish.** Melbourne Beach, Florida: Sea Dreams Publications, 1989.

Base, Graeme. **The Sign of the Seahorse.** New York: Harry N. Abrams, Inc.

Brown, Philip R. **Exploring Tidepools.** San Luis Obispo, California: EZ Nature Books, 1994.

Cole, Joanna. **The Magic School Bus on the Ocean Floor.** New York: Scholastic Inc., 1992.

Cooper, Jason. **Coral Reefs, The Sea.** Vero Beach, Florida: The Rourke Corporation, Inc., 1992.

DeCelles, K. M. "Coral." **Ranger Rick**, February 1995.

George, Michael. **Coral Reef.** Mankato, Minnesota: Creative Editions, Inc., 1992.

Heller, Ruth. **How to Hide an Octopus and Other Sea Creatures.** New York: Grossett & Dunlap.

Holing, Dwight. **Coral Reefs.** San Luis Obispo, California: Blake Publishing, 1990.

Jacobs, Francine. **Coral.** New York: G. P. Putnam's Sons, 1980.

Jacobs, Francine. **The Red Sea.** New York: William Morrow and Company, 1978.

Johnson, Sylvia A. **Coral Reefs.** Minneapolis, Minnesota: Lerner Publications Co., 1984.

Johnson, Rebecca B. **The Great Barrier Reef: A Living Laboratory.** Minneapolis, Minnesota: Lerner Publications Co., 1991.

Johnston, Damiar. **Make Your Own Coral Reef – Concept & Design.** New York: Lodestar Books.

Krinking, Kathy Walsh. "Coral Reefs and Islands." **Ranger Rick**, January 1995.

Maddern, Eric. **Curious Clownfish.** Boston, Massachusetts: Little, Brown and Company, 1990.

Mallory, Kenneth. **The Red Sea.** Boston, Massachusetts: New England Aquarium Books, 1991.

Muzik, Katy. **At Home in the Coral Reef.** Watertown, Massachusetts: Charlesbridge Publishing, 1992.

Sargent, William. **Night Reef.** New York: New England Aquarium Books, 1991.

Silcott, Phillip B. **Strange Animals of the Sea, A National Geographic Action Book.** National Geographic Society, 1987.

Soloff-Levy, Barbara. **How To Draw Sea Creatures.** Mahwah, New Jersey: Watermill Press, 1987.

Stec, RuthEllen. **Rescue the Reef: A Coloring Activities Book.** Birmingham, Michigan: RMS Publishers, 1993.

Tate, Suzanne. **Mary Manatee: A Tale of Sea Cows, and Tammy Turtle: A Tale of Saving Sea Turtles.** Nags Head Art, P.O. Box 88, Nags Head, NC 27959. (919) 441-7480.

Tayntor, Elizabeth, Paul Erickson, and Les Kaufman. **Dive to the Coral Reefs.** New York: Crown Publishers, Inc., 1986.

Taylor, Barbara. **Coral Reef.** New York: Dorling Kindersley, Inc., 1992.

Weir, Bob and Wendy Weir. **Baru Bay: Australia.** New York: Hyperion Books for Children, 1995.

Wright, Alexandra. **At Home in the Tide Pool.** Watertown, Massachusetts: Charlesbridge Publishing, 1992.

PUZZLES AND STAMPS

Life In the Coral Reefs. New York: Judy/Instructo, Simon & Shuster. 50 piece floor puzzle.

Life On a Coral Reef. National Geographic Society, (800-647-5463, Product no. 81154) 1994. 33 rubber stamps depicting marine life on a coral reef, sticker labels, and a washable blue ink pad.

Ocean World Puzzle. Hope, Arkansas: Fink & Co./EDUCA. 100 large size pieces with an illustrated guide to identify marine life.

VIDEOS AND SLIDES

Cities of Coral. Stamford, Connecticut: NOVA Video Library, 1975. (Footage of Caribbean coral reefs, available for rental at Blockbuster Videos.)

Coral Forest Slide Show. San Francisco: Coral Forest (415) 788-REEF; color slides with scripted presentation, one for K-5 and one for 6-12.

Coral Sea Dreaming—an Evolving Balance on Australia's Great Barrier Reef. Nashville, Tennessee: Small World Music (800-757-2277), 1993. 55 mins. (Excellent footage of the Great Barrier Reef without narrative. Outstanding for bilingual/multilingual classrooms.)

Dive to the Coral Reefs, A Reading Rainbow/PBS Home Video. New York: Lancit Media Productions., Ltd., 1992.

Life on the Reef. Nashville, Tennessee: Small World Music (800-757-2277), 1994. 53 mins. (Excellent narrated footage of life on the Great Barrier Reef, with incredible coverage of coral spawning.)

Bibliography

Alevizon, William S. **Caribbean Reef Ecology**. Houston, Texas: Pisces Books, 1994.

Reader's Digest Book of the Great Barrier Reef. New York: Reader's Digest Books, 1992.

Brower, Kenneth. "State of the Reef." **Audubon** 91(2), 1989.

Coral and Coral Reefs. Sea World Education Department, 1992.

Coral Reefs. Greenpeace Fact Sheet.

Gross, M. Grant. **Oceanography: A View Of The Earth**. Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1977.

Holing, Dwight. **Coral Reefs**. San Luis Obispo, California: Blake Publishing, 1990.

Jacobs, Francine. **The Red Sea**. New York: William Morrow and Company, 1978.

Johnson, Rebecca L. **The Great Barrier Reef, A Living Laboratory**. Minneapolis, Minnesota: Lerner Publications Company, 1991.

Kind Teacher. National Association for Humane and Environmental Education, 1993.

Richmond, Robert H. "Coral Reefs: Present Problems and Future Concerns Resulting from Anthropogenic Disturbance." **American Zoology** 33, 1993.

Sargent, William. **Night Reef**. New York: New England Aquarium Books, 1991.

Tayntor, Elizabeth, Paul Erickson, and Les Kaufman. **Dive to the Coral Reefs**. New York: Crown Publishers, Inc., 1986.

Ward, Fred. "Florida's Coral Reefs Are Imperiled." **National Geographic**, 178 (1) 1990.

Weber, Pewter. "It Comes Down to the Coasts." **World Watch**, March/April, 1994.

Wells, Sue and Nick Hanna. **The Greenpeace Book of Coral Reefs**. New York: Sterling Publishing Co., 1992.

Wilson, Roberta and James Q. Wilson. **Watching Fishes - Understanding Coral Reef Fish Behavior**. Houston, Texas: Pisces Books, 1992.