SAVE OUR SEAS

Developed by:
Maria Brown-Babcock

Compiled by:
Shelley Taylor

Edited by:
Rose Bierce
Kathy O'Hara

Artwork by:
Candice Brown

Special Thanks for Their Assistance:
Candice Brown
Jil Zilligen

Funded by:
Kraft General Foods
Lucky Stores, Inc.
Pepsi
National Oceanic and Atmospheric Administration
Richard and Rhoda Goldman Fund
The San Francisco Foundation
True North Foundation

Center for Marine Conservation
312 Sutter Street, Suite 606
San Francisco, CA 94108
(415) 391-6204

California Coastal Commission
45 Fremont Street, Suite 2000
San Francisco, CA 94105
(415) 904-5200

Save Our Seas is an interdisciplinary marine debris curriculum anthology produced by the Center for Marine Conservation and the California Coastal Commission for grades K-12.

The Center for Marine Conservation is a national non-profit organization dedicated to the health and protection of marine wildlife and their habitat. The California Coastal Commission is the state agency responsible for education and long term planning and management to protect the California coast and its resources.

For more information about the *Save Our Seas* education program, to participate in a training workshop, or to order additional copies of this curriculum, please contact the Center for Marine Conservation, 312 Sutter Street, Suite 606, San Francisco, CA 94108 (415) 391-6204 or the California Coastal Commission, Adopt-A-Beach Program, 45 Fremont Street, Suite 2000, San Francisco, CA 94105 (415) 904-5400.

Cover art by Robert Giusti.
Cover composition by Foote, Cone & Belding.

Save Our Seas is printed on recycled paper with soy based ink.

TABLE OF CONTENTS

ACKNOWLEDGMENTS

The California Marine Debris Steering Committee's Education Subcommittee was central to the development of *Save Our Seas*. Our thanks for their dedication and hard work.

Chair

Jack Liebster, California Coastal Commission

Members

Maria Brown-Babcock, Center for Marine Conservation
Joan Cardellino, State Coastal Conservancy
Robert Caughlan, Surfrider Foundation
Theresa Creech, Keep California Beautiful, Inc.
Ellen Faurot Daniels, Friends of the Sea Otter
Fritz Dern, Pacific Energy and Resources Center
Dru Devlin, The Tarlton Foundation
Dave Dixon, Dept. of Parks and Recreation
Jonna Engel, Sea Center
Brenda Goeden, Heal the Bay
Leslie Grella, The Marine Mammal Center
Linda Hagelin, Southwest Marine Educators
Todd Jacobs, Channel lslands National Marine Sanctuary
Martha Kauffman, Coastal Resources Center
David Lederer, Heal the Bay
Suzanne Marr, US Environmental Protection Agency
Natalie Schaefer
Cheri Fraga Shaw, Department of Conservation, Division of Recycling
Jill Shinkle, California Aquatic Science Education Consortium (CASEC)
Angie Wulfow, Gulf of the Farallones National Marine Sanctuary
Jil Zilligen, Center for Marine Conservation

The following individuals reviewed the curriculum for multi-cultural sensitivity:

Tom Ahn, Youth in Action, San Francisco Conservation Corps
Mary Dillard, Environmental Careers Organization
Running-Grass, Three Circles Center for Multi-Cultural Environmental Education
Alicia Sheppeck, Urban Habitat, Earth Island Institute

The following individuals were instrumental in testing the curriculum:

Candice Brown, California Coastal Commission
Jil Zilligen, Center for Marine Conservation
Emil Fogarino and his Washington High School marine biology class
Ann Henderson and her Golden Gate Elementary 1st grade class
Kathleen Nardina and her Fruitvale Elementary School 5th grade class
Martha Quenon and her Albany Middle School 8th grade science classes

The following individuals provided feedback on draft versions of the curriculum and/or field tested lessons with their students:

JoAnn Betty, Tres Condados Girl Scout Troop
Candice Brown, California Coastal Commission
Susan Chiesa, Howell Road School
Dana DeKoven, Marine Fish and Invertebrate Museum
Luis Dimapilis, California Coastal Commission
Anne Hempel, South Land Park Montessori
Johnathan London, Pacific Energy and Resources Center
Julie Milas, Point Reyes National Seashore
Hecate Rosewood, Live Oak School
Cherie Williams, Seattle Aquarium
Larry Wong, Seven Trees School
Jil Zilligen, Center for Marine Conservation

PREFACE

Marine debris has been identified as a significant national marine pollution problem. It adversely impacts wildlife, aesthetics, navigation, coastal economies, and environmental quality. Although marine debris is part of the much larger solid waste problem, efforts to reduce marine debris can contribute significantly to solving the overall problem.

In August 1989, the Center for Marine Conservation created a California Marine Debris Steering Committee with 60 representatives from federal, state, and local government; industry; citizen groups; scientists; educators; and individuals. The Steering Committee developed the *California Marine Debris Action Plan*, which outlines 22 recommendations to eliminate marine debris.

The Steering Committee's Education Subcommittee, chaired by the California Coastal Commission, identified education in the schools as its highest priority. The Subcommittee gathered and reviewed all available marine debris activities and curricula. After reviewing the materials, the Subcommittee chose some of the best marine debris activities and adapted them and then developed additional activities for middle and high school students. *Save Our Seas* is the result of two years of revising and testing marine debris activities. The *Save Our Seas* education program consists of a curriculum anthology, teacher training workshops, and a marine debris newsletter.

The goal of Education Subcommittee and the *Save Our Seas* marine debris education program is to educate the general public about marine debris and empower students to become part of the solution.

INTRODUCTION

The ocean is the largest life-sustaining resource on our planet. Its health is basic to our survival, for life on land would probably cease to exist without life in the ocean. Some scientists believe life began in the ocean approximately three and a half billion years ago. By geological time standards, life on land is fairly recent, beginning around four hundred million years ago. So for nine-tenths of the Earth's existence there was no life on land.

The ocean covers approximately 70% of the Earth's surface and is home to more than 90% of all living things. No other ecosystem comes close to matching the diversity of life in the ocean. The ocean is so diverse that we actually know very little about the system and what lives in its depths. More is probably known about outer space than our very own ocean. It is a fascinating place full of secrets to be discovered and mysteries to solve.

The more we learn about the ocean, the more we understand our dependence on a healthy, productive ocean environment. The ocean not only provides recreational opportunities, but is also a significant source of human food. The ocean generates oxygen — four times as much oxygen as green plants on land — and regulates the global climate.

If all life in the ocean should cease to exist, then animal life on land would only exist in extremely small numbers — if at all. For a healthy existence on land, we must take care of the life-giving ocean — for our existence depends on the ocean. Our survival is connected to the survival of the ocean. Hence the harm we do to the ocean, we are ultimately doing to ourselves.

In recent years the world has witnessed the demise of the health of the ocean from such activities as oil spills, over-fishing, and garbage washing onto uninhabited islands. In the past five years, the United States has witnessed garbage barges looking for a place to off-load, medical waste washing onto popular sunbathing beaches, and wildlife strangled by carelessly tossed six-pack rings. We are taking for granted the resource that gives us life and are treating the ocean as if it were a garbage dump — a place for unwanted trash — instead of a place that supplies us with food, water, and oxygen. But for every cloud there is a silver lining. Our silver lining is that something can be done to stop the tide of trash.

People are joining across the nation and around the world to pick up the trash littering the world's coastlines. Every year thousands of people volunteer each fall for the annual Coastal Cleanup. Volunteers spend three hours picking up trash and recording what they find on specially designed data cards. The data cards are sent to the Center for Marine Conservation and entered into the International Marine Debris Data Base. The information from the data cards is analyzed to identify the types and amounts of trash littering the coastline and to determine the possible sources. This information is used to create solutions to the problem of marine debris.

Picking up the trash, however, is only part of the solution. We also need to educate people about the larger solid waste issue. The United States has become a "throw away" society. Disposable items and excess packaging are thrown into the trash can. The trash can is conveniently emptied into the city garbage truck and whisked away to the landfill. But what happens once the landfill is full? Do we transfer all of our trash to floating barges to roam the sea? Part of the answer lies in reducing the amount of trash we generate, reusing materials, and recycling. The marine debris curriculum addresses these issues.

Now it is up to you and your students to use this book and join the effort to end marine debris!

Maria Brown-Babcock

Maria Brown-Babcock
Director, Pacific Marine Debris Program
Center for Marine Conservation

HOW TO USE THIS BOOK

Organization of the Materials

Save Our Seas is divided into four units: grades K-3, 4-6, 7-8, and 9-12. Each unit addresses why we should care about the marine environment, the marine debris problem, and how individuals can be part of the solution. The curriculum also bridges the gap between marine debris and the larger solid waste issue.

The K-6 section integrate multiple subjects including science, math, geography, social science, language arts, and art. The 7-12 section was developed specifically for science classes, yet still manages to integrate social issues. Secondary level students learn field methods and techniques while analyzing the marine debris problem. Participation in a waterway or beach cleanup is encouraged in each unit.

The curriculum is designed to encourage students to think about the complexity of environmental problems and assess the information available before making decisions. The activities take a hands-on approach to current environmental issues and are designed to help students make personal choices and realize the individual's potential to create positive and effective changes in society. Each unit concludes with a "real life" success story about what students of all ages are doing to protect our Earth.

Organization of Each Activity

Each activity includes recommended grade level, major subjects from which the concepts are drawn, major concepts covered in the activity based on the California Department of Education's curriculum frameworks, skills, estimated duration, setting (indoors or outdoors), and key vocabulary.

Each activity also includes the objective(s) of the activity, the method employed, background information for the instructor, materials needed, step-by-step procedures, suggested means of assessing the students' comprehension of the material, at-home learning activities, extension activities, and the original source of the activity or information.

Many of the activities begin with a proverb about the ocean. We suggest you begin each activity discussing the proverb, and what the ocean symbolizes to that particular culture. Emphasize that the ocean unites cultures around the world.

Appendices

The Appendices include handouts required in multiple activities, a play about marine debris that can be used as an extension activity, a list of resources that includes agencies and organizations referred to in one or more of the activities and other available marine debris materials, and a glossary.

And Beyond

The Center for Marine Conservation and the California Coastal Commission would like to keep in touch with everyone involved in the *Save Our Seas* education program. If you have any suggestions, additional information, or need assistance, please contact us.

Also, if your class is interested in becoming pen pals with other students involved in tackling marine debris in the United States or around the world, please contact the Center for Marine Conservation, 312 Sutter Street, Suite 606, San Francisco, CA 94108 (415) 391-6204.

We would like to hear about your students' success stories in the fight to end marine debris, so send us your stories about how you helped SAVE OUR SEAS!

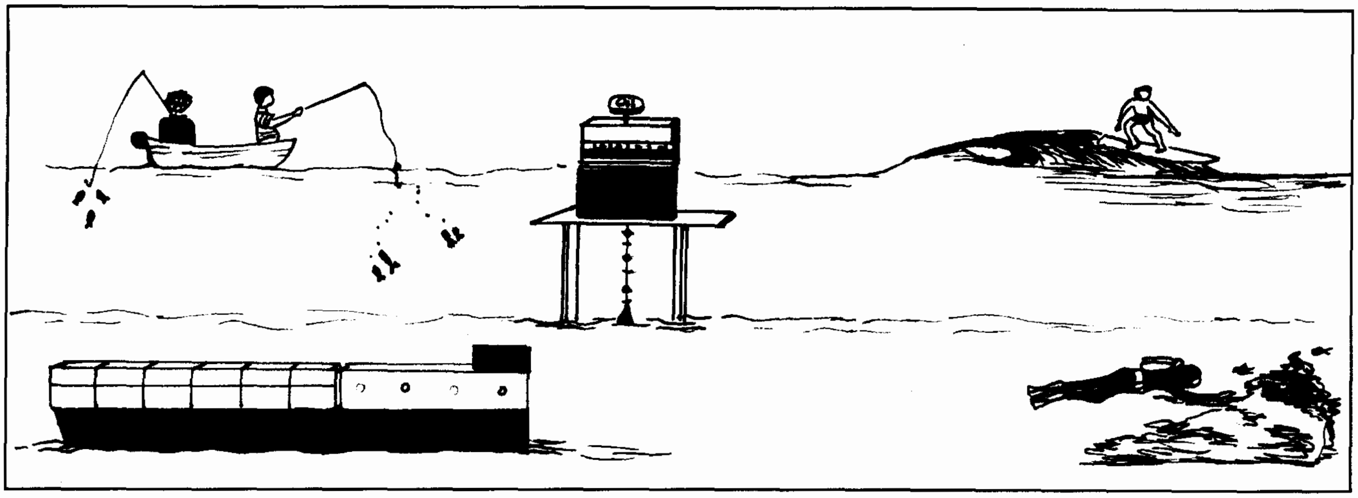
ACTIVITIES BY SUBJECT

Activities at a Glance	Art	Geography	Language Arts	Mathematics	Science	Social Science
Grades K-3						
Sandcastles and Sunburns	•	•	•		•	
Marine Debris: It Can Be Deadly				•	•	•
Trash: It's Everywhere!	•				•	•
The Storm Drain Connection	•				•	•
Adopt-A-Beach Cleanup			•	•	•	•
Take-Home Recycling Kit	•		•			•
Grades 4-6						
Wildlife and Marine Debris					•	•
What is MARPOL?		•	•			•
Getting the Message Out	•					•
Record Keeping				•	•	
What Happened?			•			•
Grades 7-8						
Web of Life					•	•
Too Much Trash!				•	•	•
Marine Debris Survey				•	•	•
Packaging Your Product	•				•	•
Stenciling Storm Drains					•	•
Recycling in Your School	•	•			•	•
Grades 9-12						
Marine Debris: Sources and Impact					•	•
Searching Out Nonpoint Sources of Pollution					•	•
Consider the Connections					•	
A Scientific Beach Cleanup				•	•	
Beach Cleanup Results				•	•	
Marine Debris Task Force		•			•	•

SAVE OUR SEAS

Grades K-3

SANDCASTLES AND SUNBURNS



"Drops from rivulets put together form the ocean." Japanese proverb

★★★★★★★★★★★★★★★★★★★★★★★★★★★★★★★★★★★★★★★
Age: Grades K-3
Subjects: Geography, Science, Art, Language Arts
Conceptual Framework: Science Framework: A healthy individual understands and interacts with the environment; living things and systems demonstrate a structure/function relationship; the Earth, within its universe, is constantly changing.
History-Social Science Framework: Develop location skills and understanding.
Visual and Performing Arts Framework: The arts are important in the education of all students to provide for balanced learning and to develop the full potential of their minds; the arts provide the sensory and perceptual input essential to the development of nonverbal communication.
English-Language Arts Framework: Linking personal experiences and prior knowledge provides opportunities for building language skills and recognizing common background experiences.
Skills: communicating, comparing, constructing, identifying, observing, visualizing, writing
Duration: 30 minutes (Part 1); 20 minutes (Part 2); 20 minutes (Part 3)
Setting: indoors
Key Vocabulary: Earth, planet, water, ocean, beach
★★★★★★★★★★★★★★★★★★★★★★★★★★★★★★★★★★★★★★★

Objectives: Students will be able to: 1) perceive the Earth as a water planet, label the oceans of the world, and establish a relationship between where the students live and the proximity of the ocean; 2) identify the many ways that they use and value the marine environment; and 3) establish a connection between the students' lives and the marine environment.

Method: Students imagine the life-giving ocean, and then color and label the oceans on a map. The students also locate where they live in relation to the ocean. Students pantomime their favorite beach activity and then create either a class collage or an individual beach book that shows people using the beach in various ways.

Background: Why is the ocean so important to those of us living on land? The ocean covers more than 70% of the Earth, and is similar to a giant pot of soup full of creatures floating in every teaspoon. Tiny, tiny plants called phytoplankton live in the top layer of the ocean and produce four times as much oxygen and food as do land plants. Phytoplankton is the main food source for many organisms that live in the ocean. Why is this important to humans? More than half the world's population depends on fish as its main protein source. Both life in the water and on land depend on phytoplankton for survival.

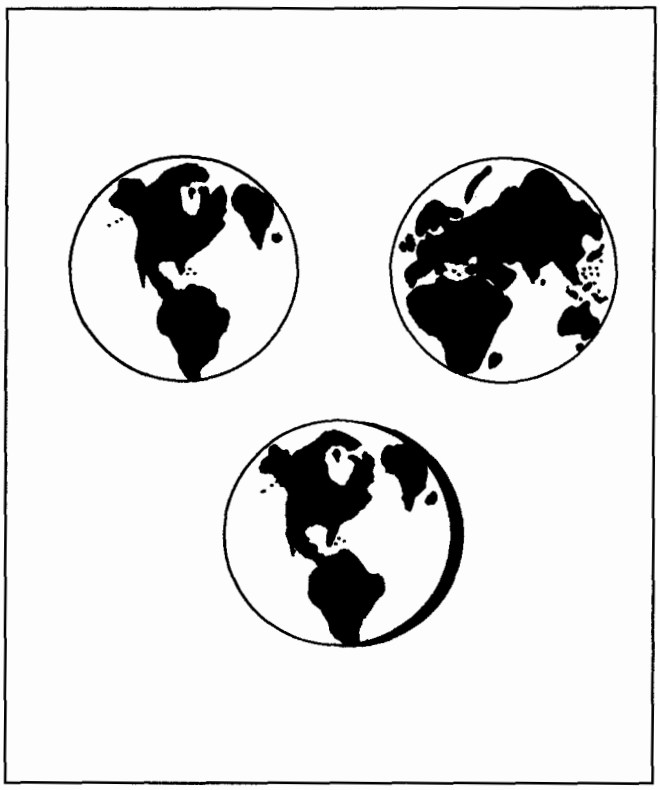
The closest that many of us get to this wonderful, life-giving ocean is by visiting the beach. Beaches are the simplest, most direct, and least expensive access to the marine environment. However, the sheer number of people who visit the beach and use the ocean during the year can greatly increase the volume of debris left behind — debris that greatly endangers the life of this environment. The Save Our Seas Marine Debris Education Program has been created to give students a chance to learn more about the marine environment while also learning how to care for it.

This particular activity uses guided imagery and requires students to create mental pictures of the marine environment. Studies have shown that using imagery can enhance a person's capacity to remember concepts, words, names, and ideas. Students will begin forming mental images of the ocean and begin understanding the connection

between the ocean and their lives.

Materials: World map (see Appendix C), crayons or coloring pencils, picture magazines, glue, scissors (one pair per student), butcher paper or construction paper.

Procedure:
PART 1: Color and Label Oceans on a World Map
1. Begin this activity with a lesson about the Earth as the water planet using a globe or a map of the world. Include in the lesson the significance of the ocean to all life on earth.
2. Hand out two paper plates and a copy of the world map to each student. Have the students cut out the continents of the world and paste them onto the back side of the paper plates. Next have them color the empty space blue and label the following oceans: Atlantic, Pacific, Arctic, Indian, and Southern (Antarctic). Staple or tape the paper plates together to form a modified globe. Have them locate where they live on the map with a red X.



3. Discuss with the students the proximity of the ocean. Ask the students if they have ever been to the beach and/or seen the ocean. Have the students describe what the ocean was like (sight, sound, touch, smell). What did they do when they visited the ocean? Do their parents visit the beach or ocean? Do they like to fish? Do they eat fish for dinner? Where does the fish come from? Where did the fish live?

PART 2: Student Pantomimes
1. Begin this activity by asking your students to close their eyes and visualize themselves at the beach: the sand is wet and cool and squishes between their toes; they hear the waves pounding on the shore and the gulls screeching overhead. What are they doing at the beach? (They may be swimming, having a picnic, body surfing, building a sandcastle, sailing, looking at shells, playing frisbee, taking pictures, and so on.) Wait a few minutes for the students to review their images. Then have each student (or a few of the students depending on the size of the class) pantomime what they were doing at the beach. Have the class guess what the student is acting out. Hold a brief discussion on why these activities are popular at the beach and why people have different ideas about what to do on a beach.
2. Now brainstorm with your students about the various people who use the beach (for example, tourists, fishers, Native Americans, park rangers, etc.). Many different cultures all around the world use the ocean. Look at the world map. Point out that the oceans unify the continents of the world. Ask your students to imagine that they become each of these people (one at a time): What is it that they're doing at the beach? Are they using the beach for food? for shelter? for fun?

PART 3: Beach Book or Class Collage
1. Have students cut pictures out of the magazines showing people using the beach. Bigger pictures will work better for a large class collage; small pictures can be used to make a "Beach Book" or album. Decorate one of the class walls with the pictures.

Assessment:
Have students draw a picture of the ocean and write their own beach book or a story about the class collage.

At-Home Learning:
1. Ask parents to help their children find a picture of a marine animal in a book or magazine, or on a calendar. Parents and students can discuss how that particular animal gets its food and moves. Ask students to bring in the picture, if possible, and to be prepared to tell something about the animal.
2. Ask parents to explain to their children how their family uses the ocean and why the ocean is important. How did their ancestors use the ocean?

Ask the students to share with the class what they learned at home.

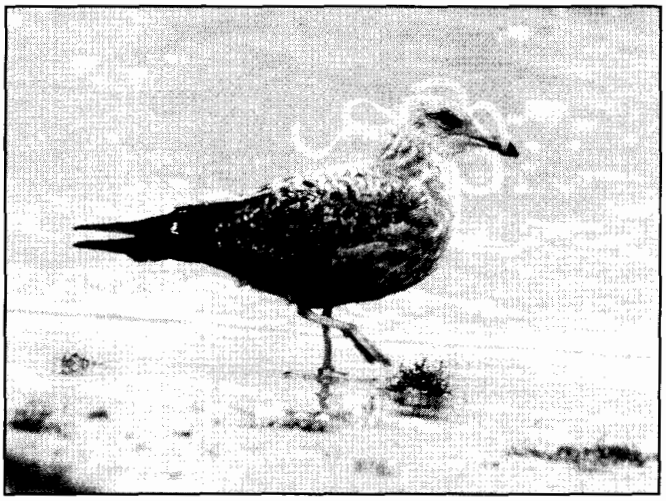
Extensions:
1. Read aloud poems and stories inspired by the beach and have students write their own poems about the beach.

Source of Activity:
Adapted from "Adopt-A-Beach School Education Program" — a collaborative project produced by the California Coastal Commission, the Tarlton Foundation, and the San Francisco Recycling Program. The proverb came from *Japanese Proverbs and Sayings* by Daniel Crump Buchanan, University of Oklahoma Press: Norman, OK (1965).

Guided Imagery Tips

1. Ask the students to lay aside all materials and to sit in a comfortable position with their eyes closed.
2. Wait until the room is quiet and then begin reading or speaking in a slow steady voice allowing enough time for your students to create mental pictures.
3. Allow time for your students to review their images, then ask your students to open their eyes.
4. Begin discussing the student's images.
5. Remember their are no mistakes in mental images.

MARINE DEBRIS: IT CAN BE DEADLY



"The sea and the air are common to all." proverb

★★

Age: Grades K-3

Subjects: Science, Math, Social Science

Conceptual Framework: Science Framework: Respect for nature develops from understanding how nature works; living things and systems demonstrate a structure-function relationship; life is diverse; humans affect the ocean ecosystem (adapted).

Mathematics Framework: Physical materials, pictures, and diagrams are related to mathematical ideas; mathematics are used to draw logical conclusions; collecting, organizing, and describing data is important for understanding and solving problems.

History-Social Science Framework: Understanding human and environmental interactions.

Skills: applying, computing, predicting (grades K-1); applying, comparing, computing (grades 2-3)

Duration: 40-50 minutes (games for K-1); 60 minutes (game for 2-3)

Setting: indoors

Key Vocabulary: marine, debris, sea lion, sea turtle

★★

Objectives: Students will be able to: 1) experience in a simulated setting the negative effects that plastics, in particular, can have on the feeding activities and health of marine animals; and 2) consider the effects of plastic debris in the oceans and on the beaches from an animal's perspective.

Method: Younger students (grades K-1) play two different games: one demonstrates an animal's entanglement in marine debris while the other demonstrates ingestion of marine debris. Older students (grades 2-3) play a game that simulates the negative effects plastic trash can have on the feeding and survival of marine animals.

Background: Long ago, finding a sunken box of gold coins was a deep sea treasure, but today people realize that the sea itself is a treasure, full of life to discover. Scientists believe that life began in the sea, and that millions of different organisms have evolved over billions of years. A tremendous variety of life flourishes in the sea. In fact, it is estimated that nine out of every ten organisms on Earth live in the ocean.

Animal life in the ocean can be divided into two categories: vertebrates, animals with backbones, and invertebrates, animals without backbones. Invertebrates include animals such as oysters, crabs, periwinkles, jellyfish, and octopuses which are believed to be the most intelligent animal of this category. Vertebrates include all fishes, sea turtles, and marine mammals such as whales, dolphins, seals, and walruses. The fish in the sea delight the imagination with a variety of colors, shapes, and life styles. Sea turtles are reptiles that swim in the oceans; the female sea turtle leaves the ocean only to crawl on shore to lay her eggs in a sandy nest. Seals are marine mammals that inhabit all the world's oceans, from the polar areas of Antarctica and Alaska to the beaches of Hawaii. The ocean is also home for whales, the largest creatures to live on this planet. Scientists have been fascinated by the highly developed communication systems used by these mammals and hope to one day understand more about the clicks, whistles, and songs emitted by the giants of the sea.

All these animals can be harmed by plastic litter. Marine mammals, birds, and fish can become tangled in plastic fishing line, plastic strapping bands, six-pack rings, or other plastic trash that ends up in the oceans. Once tangled, they spend

energy trying to get free, may become sick or weak, and even die. Certain marine animals also mistake plastic trash for food and eat it. Many animals have difficulty digesting plastic, so the plastic remains in the animal's stomach causing a feeling of fullness. The animal, feeling satiated, stops eating and eventually starves to death.

This deadly trash is known as marine debris. It is trash found in the ocean or along its shores. Its source can be classified as either "ocean-based" or "land-based," depending on where it enters the water. Ocean-based debris is waste disposed of in the ocean by ships. Land-based debris, on the other hand, is debris that blows, washes, or is discharged into the water from land.

Materials: Pictures of marine wildlife (attached). For grades K-1: one rubber band for each child; a tray or shoe box for every three children; plastic foam pieces (from packaging, beanbag chairs, or potting soil) — 1/2 cup per tray; bird seed, white beans, or popcorn — 1 1/2 cups per tray; and a spoon and cup per child. For grades 2-3: tape; multi-colored beads or any other small multi-colored items; a "calorie chart" and "score card" (see attached).

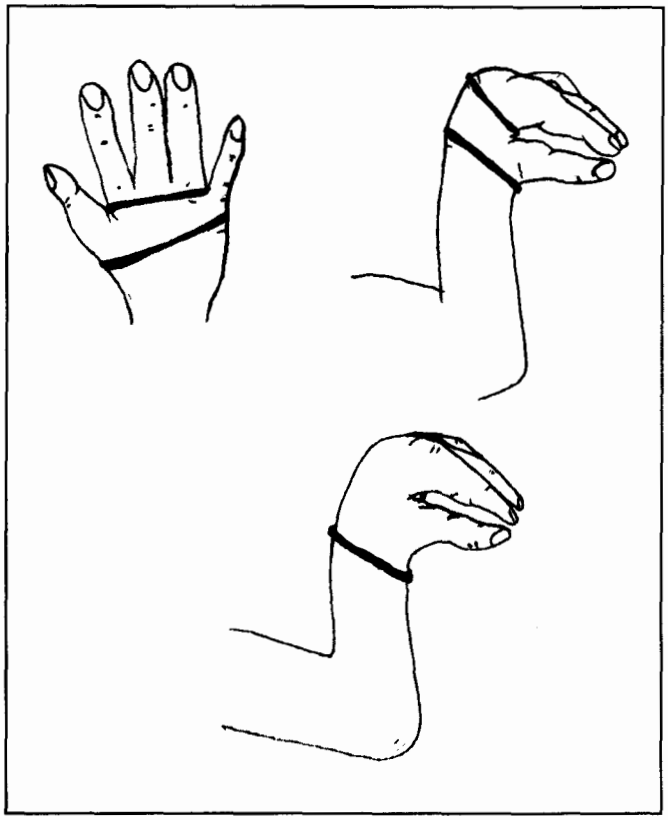
Procedure:

PART 1: Before playing the games that follow, talk about "who's who" in the marine environment with supporting pictures of the various animals. (You may want to use the pictures brought by the students as part of the At-Home Learning from "Sandcastles and Sunburns.")

PART 2: Grades K-1

"Getting Out of a Bind" is a simple activity that teaches empathy for wildlife by simulating an animal's entanglement in plastic litter. The procedure is as follows:

1. Use a volunteer to demonstrate. Put a rubber band around the back of his or her hand, catching the thumb and little finger (see diagram). Have the child try to remove the rubber band without using the other hand or teeth or rubbing it against something.
2. Hand out rubber bands for everyone to try. Tell each child to pretend his or her hand and arm is a gull entangled in plastic. For example, the hand is its head, the fingers its beak and the forearm its neck. Cup elbow with free hand. Place rubber band around the "beak" or "neck." Allow children only 30 seconds to free themselves. No helpers!
3. Is everyone successful in untangling themselves? Many animals don't get free, of course, and starve, strangle, or suffocate.
4. Discuss the following with the children: What plastics or other material could the rubber band represent in a natural setting (fishing line, plastic six-pack rings, fishing net, packing straps)? How could an animal get into a situation in which fishing line, strapping bands, six-pack rings, or a net would entangle it? (By swimming into plastic accidentally. Also, a bird might eat the bait on a fishing line, then become entangled or take the line back to a nest of vulnerable babies.) Some students might have rubbed their hand against the table to remove the band. In the marine environment, what would animals rub their heads against? Probably a rock. What would happen to an animal that rubbed its head against a rock until the band came off?



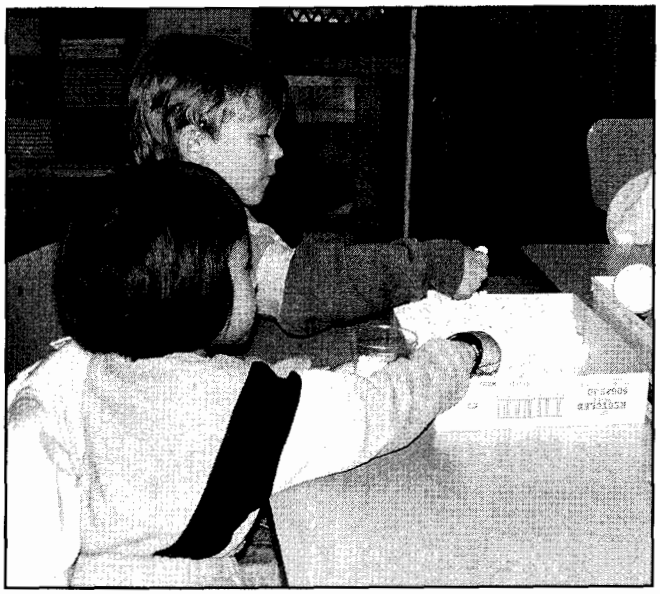
PART 3: Grades K-1

"The Early Bird Gets the . . . Plastic?"

This activity helps children understand how animals can mistake plastic for food.

1. The object of this game is to collect as much food as possible in the time allotted. Because of the collection method and the short time allowed, some plastic will be gathered also.
2. In each tray, mix plastic pieces with bird seed or popcorn. Have three children "feed" at each tray for 30 seconds, using their spoons as beaks. Each child should place the spoonfuls of food into his or

her cup or "stomach." When time's up, the children will examine their cups for real food and plastic. Help the children count and record the pieces in two columns on a sheet of paper.
3. Have the students return the plastic pieces to their cups and begin the feeding exercise again. Continue the exercise until the birds' stomachs are full of plastic and they don't feel like eating anymore.



4. Ask the children what they think will happen to birds that eat plastic. (Since plastic is difficult to digest, it can build up in the birds' stomachs taking the place of real food. The birds feel satiated, gradually stop eating, and slowly starve.)

PART 2: Grades 2-3
"The Feeding Game: A Simulation of the Perils of Plastics"
This game simulates the negative effects plastic trash can have on the feeding and survival of marine animals. Through several rounds of play, players collect colored beads that represent the food of marine animals. In the first round, the players determine the number of calories their animal needs to stay alive. In the subsequent rounds, the players are physically hindered in some way from gathering food in their normal way.

Round #1:
1. Read the second to the last paragraph of the background information aloud to the group, and explain that they will be playing a game that simulates the way animals can be harmed by plastic debris in the ocean.
2. Remove all of one color of beads from the bag (e.g., all the white beads) and set them aside for later.
3. Have the players stand along one wall or on the side of the playing area. Designate an equal number of the players as sea lions, gulls, sea turtles, and salmon. Pin or tape a picture of the corresponding animal on the front of each student. Tell the players that they will soon find out how much they need to eat each week in order to stay alive.
4. Explain that one round of the game represents a week of feeding and that when the round begins they should collect as much food as they can in 30 seconds. Warn them to move safely and not to run into other players.
5. Scatter two handfuls of beads around room (approximately 6-10 per player). Say "Go!" and then 30 seconds later call out "Stop!" The players should return to their positions along the wall with the beads they have collected.
6. Players should then count the number of beads they collected and calculate the "calories" by color according to the chart (attached). Each player's total is the number of calories required by their marine animal each week and is the amount they will need to collect in the following rounds in order to stay alive. Have each player, one by one, call out the number of calories they will require in the following rounds and enter their names and the calories they gathered under Round #1 on the score card.

Round # 2:
1. Collect the beads from the players, scatter them again, and explain the following:

The sea lions were curious about something they saw floating in the water and got tangled in a plastic strap. To symbolize this, the players who are sea lions must crouch down, grab their ankles with their hands, and waddle in this position, instead of walking or running, during the next round of play. (They can still use their hands to pick the beads up).

The fish swam into a six-pack ring and got stuck. To symbolize this, the players who are fish must keep their little fingers clasped together behind their backs at all times during the next round of play, even while picking up the beads.

The sea turtles tried to eat a plastic bag, which got caught in their throats, so now it is very hard to swallow anything else. To symbolize this, the players who are sea turtles must put one hand around their throat and may only use their free hand to pick

up AND hold their beads once they've collected them.

The gulls' feet got caught in plastic fishing line that was left on the beach. To symbolize this, the players who are gulls must hop on one foot during the next round.

2. Just before beginning the second round of play, designate one or two of each type of animal and tell them that they were lucky enough to have recovered from ingesting or becoming entangled in the plastic trash, and can play the round unhindered. Then circle the Y or N on the score card to indicate which players are or are not impaired.
3. Call out the beginning and end of the 30-second feeding period. Players should again return to the sidelines and calculate their calories according to the calorie chart. Enter the number of calories each player collected under Round 2 on the score card. Compare and discuss the differences between calories collected in Rounds 1 and 2 for the hindered and unhindered animals.

Round # 3:
1. Collect the beads from all players, this time quietly adding the white beads that had been previously removed. Scatter them again in preparation for the final round.
2. Tell the players who were hindered last round that they remain hindered by the plastic debris, and those who were unhindered remain so as well.
3. Call out the beginning and ending of the 30-second period.
4. Players should return to the sidelines and calculate their calories. Explain that the white beads represent plastic pieces that have no nutritional value, but instead the animal wasted energy finding and foraging on the plastic items. For each white bead collected, each player must subtract 10 calories. Enter the number of calories each player collected under Round 3 on the score card.

Discussion — Discuss which players did and did not meet their caloric requirements. Find out if any of the hindered players improved their collection rate in the third round. If any did, explain that this may be due to them growing accustomed to their hindrance. Explain that entangled sea animals could also become accustomed to their hindrance, but that they may also weaken and die.

Assessment:
Ask your students what kinds of trash represent a danger to marine animals, either through ingestion or entanglement. Where does this trash come from? Have students glue the trash from the entanglement and ingestion activities onto the class collage made the previous day.

Extensions:
1. Watch the Center for Marine Conservation's *Marine Debris and Entanglement* slide show, which illustrates hazardous effects of marine debris on wildlife (see Appendix I: Resources). After the slide show have the class brainstorm solutions to the marine debris problem. Highlight the actions individuals can take.
2. Plan a trip to a local aquarium to see the animals they have been portraying.

Source of Activity:
"Getting Out of a Bind" and "The Early Bird Gets the . . . Plastic?" is from the University of North Carolina Sea Grant's "Ripples: A Big Sweep Elementary Activity Guide." "The Feeding Game: A Simulation of the Perils of Plastics" is from the California Aquatic Science Education Consortium's "Plastic Eliminators." Proverb from *A World Treasury of Proverbs in 25 Languages* by Henry Davidoff, Random House: New York, NY (1946).

Score Card — Number of Calories Gathered

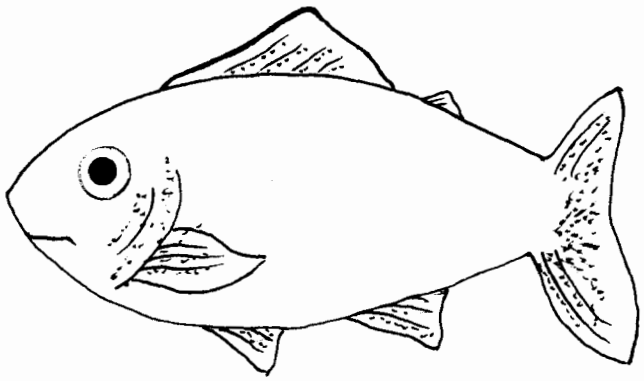
Player's Name	Animal	Round #1	Physically Impaired	Round #2	Round #3
			Y N		
			Y N		
			Y N		
			Y N		
			Y N		
			Y N		
			Y N		
			Y N		
			Y N		
			Y N		
			Y N		
			Y N		
			Y N		
			Y N		
			Y N		
			Y N		
			Y N		
			Y N		
			Y N		
			Y N		

Calorie Chart

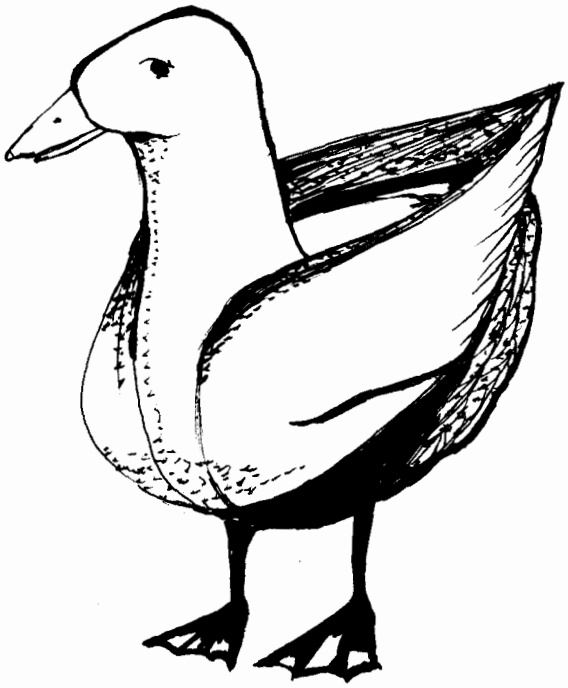
Each colored bead represents an item of food for a marine animal.

Each color of bead represents a different amount of calories.

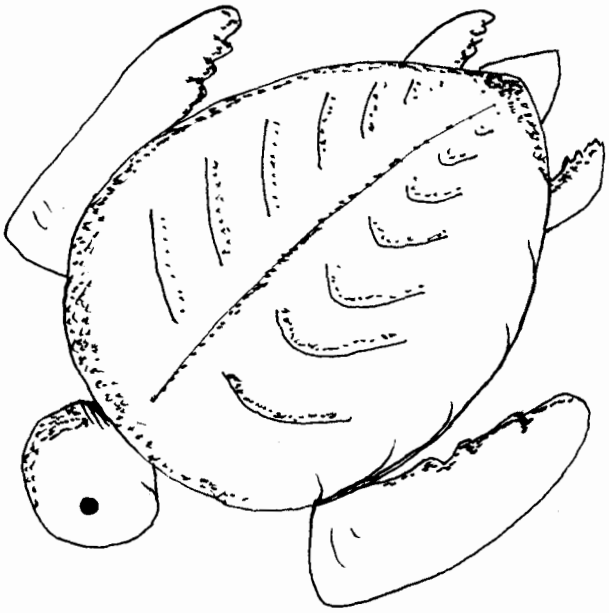
Color	Number of Calories
Yellow	3
Red	5
Green	10
Orange	20
_____	_____
_____	_____
_____	_____



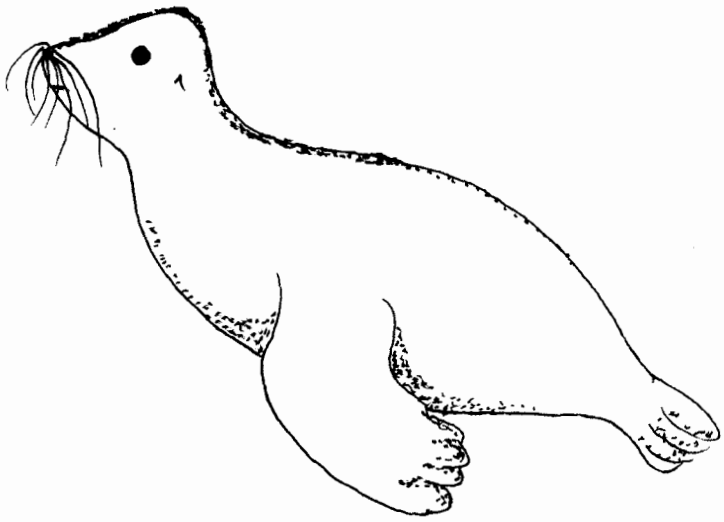
fish



gull

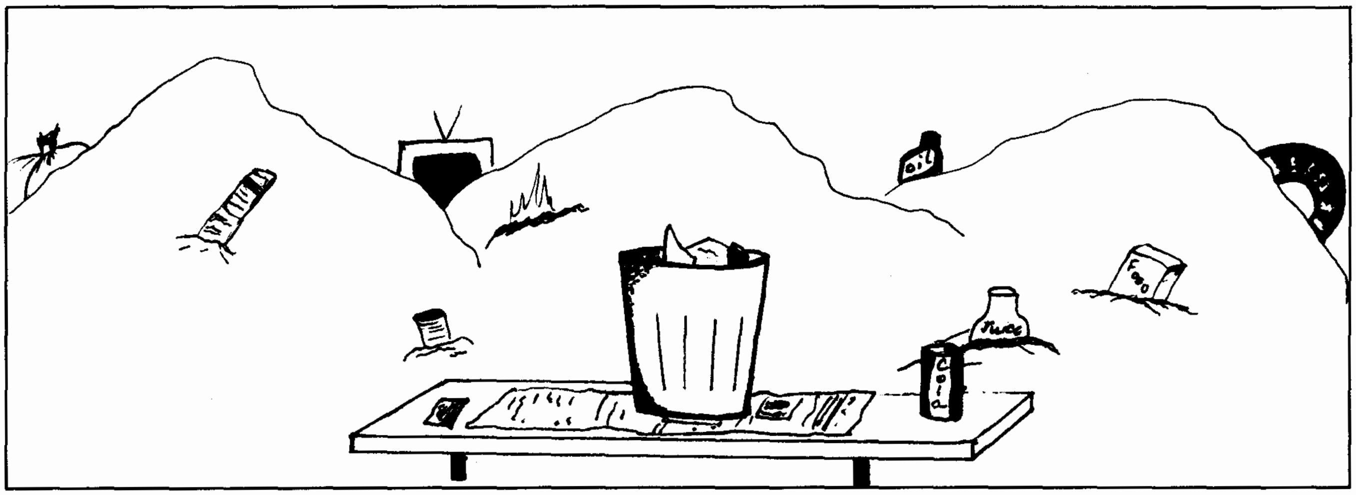


sea turtle



sea lion

TRASH: IT'S EVERYWHERE



★★

Age: Grades K-3

Subjects: Science, Math, Social Science, Art

Conceptual Framework: Living things get things they need from the environment; humans affect the ocean ecosystem (adapted)

Mathematics Framework: Objects can be classified and sorted using one or more attributes by observing similarities and differences, describing and recording relationships, and making generalizations.

History-Social Science Framework: Understanding human and environmental interactions.

Skills: applying, classifying, constructing, observing, group interaction, social participation, define, clarify, and draw conclusions

Duration: 15 minutes (part 1); 30 minutes (part 2);

Setting: indoors

Key Vocabulary: trash, landfill, recycle

★★

Objectives: Students will be able to: 1) understand that marine debris comes from people; 2) identify the various kinds of trash and discuss rethinking, recycling, reusing, and reducing as ways to lessen the amount of trash: and 3) create a class recycling center to demonstrate how they can play an important role in reducing waste.

Method: Students examine actual trash from a trash can (glass, paper, plastic, etc.) and classify whether it can be recycled, reused, or reduced. Students set up a recycling center in the classroom.

Background: It is important to remember that trash has the potential to become marine debris. Trash thrown in the street can eventually end up in the ocean.

What makes up our trash, and why is there so much of it? Trash is anything that is thrown away. Every day we throw out great quantities of valuable materials. Paper, which is often tossed out after only one use, can be reused in different ways and then recycled. Cans, glass bottles, and some plastics can be recycled and in some cases reused before recycling. Yet these items abound in our landfills.

In addition, one-third of our nation's trash by volume is packaging. Packaging is often composed of non-reusable or non-recyclable materials. Also, some packaging for consumer goods is much larger than the product it holds in order to attract attention and increase sales, and its disposal is filling our landfills at a staggering rate.

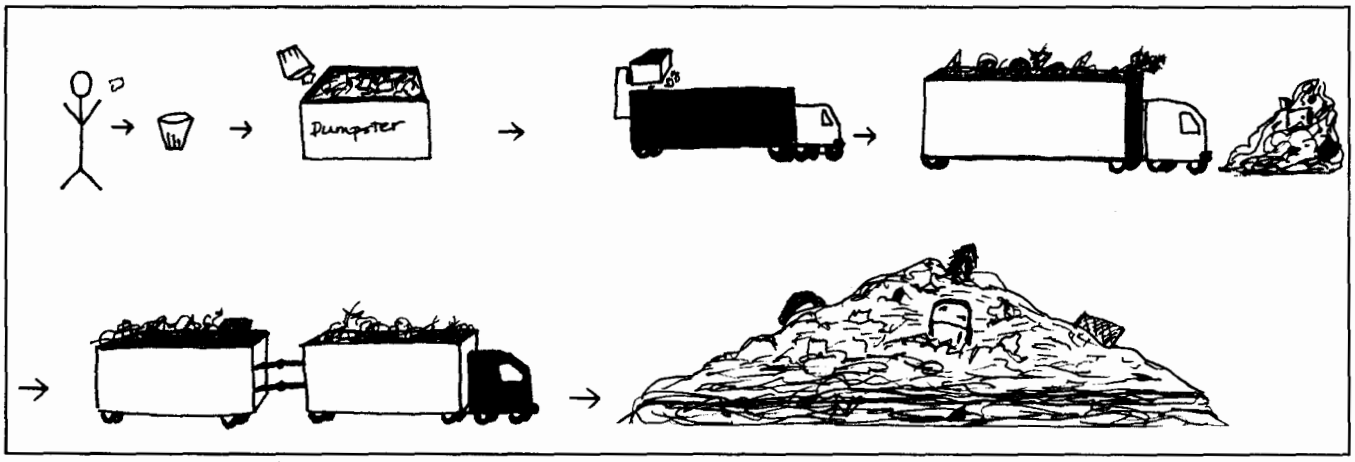
By becoming more aware of what we throw away, we can find ways to both reduce the amount of waste we produce, and decrease our consumption of natural resources. Items that are reusable and recyclable can be identified and removed from the waste stream. Recycling centers in many cities and towns are now equipped to accept cans, bottles, aluminum, paper, and some plastics. With an awareness of recyclable materials, students can easily reduce their contribution to the trash crisis by reusing, by selecting products that have the least amount of packaging and/or have been made from recycled materials, by buying recyclable items in place of non-recyclable items, and by recycling. The reuse and recycling of goods will result in the reduction of waste, and our nation will save valuable energy, resources, money, and land. At the same time, we will be protecting the ocean and its inhabitants from marine debris. By reducing the amount of trash we generate, we are reducing the amount of potential marine debris.

Materials: Table in front of class, a prepared waste-paper basket "from the teachers' room" full of trash including: lots of paper —white, color, glossy, newspaper; a paperboard box or two; a plastic 1 or 2 liter soda pop bottle; a glass pop bottle; a small glass jar; a paper cup; an aluminum can; aluminum foil; plastic grocery bag; paper grocery bag; a throw-away plastic toy. A copy of the "Three R's" (attached), a list of recycling centers in the area for each student, and curbside recycling information (if your community has this service).

Procedure:

PART 1: Class Discussion and Demonstration

1. Lead a class discussion regarding where trash comes from.
2. Bring in the prepared "teacher's room" wastepaper basket. Pull some newspapers out of it and cover the demonstration table with them. Tell the students that today we are going to investigate the trash from the teacher's room. Then, dramatically dump the contents of the wastepaper basket on the table.
3. Hold a brief discussion about how the trash is disposed of and where it goes. Diagram it on the board using simple sketches and arrows. For example: from teacher to wastepaper basket to school dumpster to garbage truck to the transfer station to semi-truck and trailer to the landfill site. Note that landfill sites are becoming overcrowded.
4. Now separate the paper out and put to one side of the pile. Point out how much there is and that it can be recycled to make new paper. Tell the students that paper makes up half of the trash sent to the landfill and that recycling will reduce overcrowding of landfills. Hold up samples of the paper pointing out sheets that have only been used on one side, pieces that are only used in part, newspapers that were used to cover the demonstration table. Ask the students if there is any way in which some of the paper could have been used over before it was thrown out. Consider note paper, scratch paper, art projects, homework, letters.
5. Tell them which centers in your area accept these recyclables. Ask if any of your students have already been to one of these centers. Finally, post information about nearby recycling centers in the classroom.
6. Now point out what is left — plastic bags, plastic toy, plastic wrap. Hold up the plastic toy, announce that you do not have any use for the toy and ask if anyone else has an idea for it. You can then give it to a student for a younger brother or sister. You can donate it to a local charity. Focus on the non-recyclables. Ask how the users of those items could have selected reusable or recyclable products in place of this trash (e.g., cloth bags used in place of plastic or paper, aluminum foil in place of plastic wrap, a thermos in place of a juice box, etc.). Brainstorm with your students.
7. Later in the unit the students will participate in a beach cleanup. Clearly identify the items that will be recycled during the cleanup: glass, aluminum cans, and plastic soda bottles. Keep the recyclables separate and take them to your neighborhood collection center. Return the "trash" to the wastepaper basket.
8. Hand out copies of the "Three R's." Explain to students that by purchasing items packaged in recycled materials, which if we recycle again, creates a loop in which minimum raw materials are necessary to package a product.
9. Can the students think of anything to add to the "Three R's?" Also hand out recycling center information and curbside recycling information (if your community has this service). Post the "Three R's" in the classroom.



PART 2: Create a Class Recycling Center

1. Have the class decorate and label four boxes for recycling materials in the class: metals, glass, paper, and newspaper.
2. Aluminum cans should be completely emptied, then crushed. A crushed can takes up much less space than an uncrushed can. Plus, aluminum is soft and crushes easily.
3. All the glass can be stored in one container. For safety reasons, please don't break the glass. Remember to wash out any food particles from glass jars or containers.
4. Separate classroom paper (which can be reused in the classroom) from newspaper. Newspaper should be stacked in paper grocery bags or tied depending on your recycler's preference.
5. When the recycling boxes are full take the recyclables to a community recycling center.

Assessment:

1. Have students list items that can be recycled.
2. Ask the students what the 3 R's stand for and have them give you examples.

At-Home Learning:

Have students bring an item from home to recycle.

Extensions:

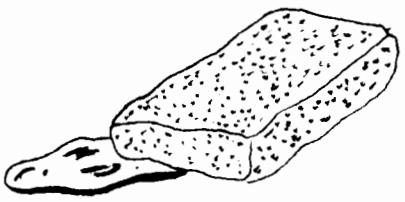
1. Conduct a litter walk on the school grounds or in the school neighborhood.
2. Many school cafeterias use and toss large quantities of polystyrene. Start a polystyrene recycling program at your school. (See Appendix I: Resources for details.)
3. Have your class visit the local landfill or transfer station to see where our trash goes. Combine this field trip with a tour of a recycling center near your school.

Source of Activity:

Adapted from the "Adopt-A-Beach School Education Program" — a collaborative project of the California Coastal Commission, the Tarlton Foundation, and the San Francisco Recycling Program.

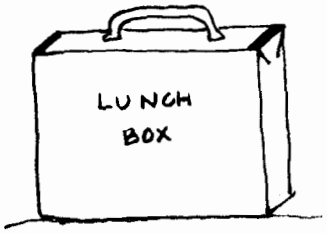
"Three R's"

Reduce:



Use a sponge instead of paper towels
Use a glass or plate instead of paper cups & plates
Write on both sides of paper
Buy products with less packaging
Buy products packaged in recycled materials

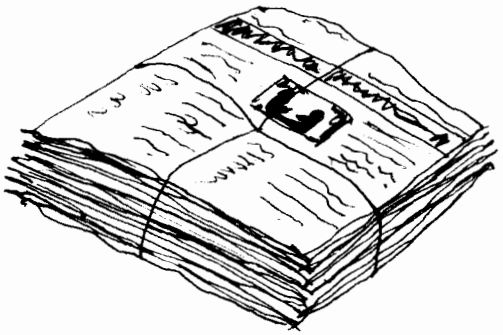
Reuse:



Use a lunch sack for more than one day
Bring lunch in reusable containers
Use containers for other uses (For example, a margarine tub can hold buttons, crayons, or game pieces)

Recycle:

Newspapers, bottles, plastics, aluminum cans, car batteries, paint, automotive fluids



THE STORM DRAIN CONNECTION

****
Age: Grades K-3
Subjects: Science, Social Studies, Art
Conceptual Framework: Science Framework: Humans affect the ocean ecosystem (adapted).
History and Social-Studies Framework: Develop locational skills and understanding; understanding human and environmental interaction.
Skills: describing, identifying, observing, predicting, mapping, defining, and clarifying problems
Duration: 50 minutes
Setting: indoors and outdoors
Key Vocabulary: *storm drain*
****

Objectives: Students will be able to: 1) understand that storm drains are connected to water systems and can become a significant source of marine debris; and 2) identify storm drains around their school and/or community.

Method: Students locate storm drains around their school and consider their function. Afterward, they color a diagram of a storm drain.

Background: In some old cities, the sewage system and the storm drain system are connected and together are called a combined sewer system. During heavy rains, the old systems are overwhelmed and usually both the storm water and sewage do not receive adequate treatment and are discharged into a local waterway.

Other cities have a sewer system made up of two different networks of pipes. One network handles sewage coming from sources such as kitchen sinks, toilets, and washing machines. These pipes carry waste materials to a larger network of pipes leading to a sewage treatment plant where sewage is separated into sludge (solid waste materials) and water. The sludge is compacted then landfilled, incinerated, or marketed as an environmentally beneficial product, while the water is discharged into a river or other nearby waterway free of any solid waste.

The other network of street gutters and pipes carries runoff storm water from streets to nearby bodies of water such as streams, rivers, and oceans. There is generally no screening process associated with this system, so litter that is carried into the pipes with storm water will also end up in the receiving body of water. These pipes are obviously designed to carry storm water runoff from one point to another and are not meant to transport street litter and other types of debris. Storm drains, then, are a source of marine debris to the extent that people use them as receptacles for inappropriate waste.

Materials: "Storm Drains as a Source of Marine Debris" (see attached diagram).

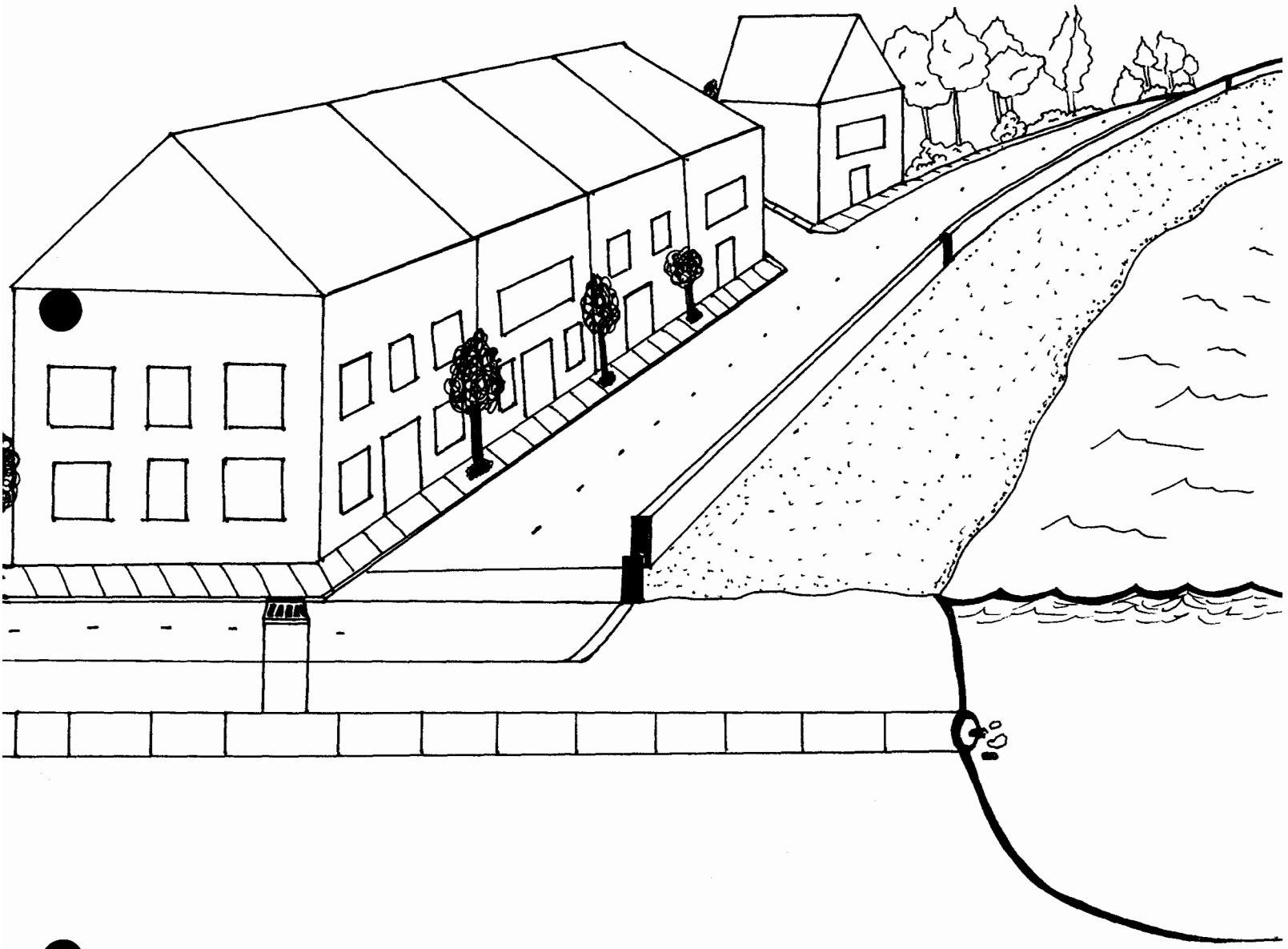
Procedure:

1. Take your class on a walk around the school. Identify and locate the storm drains with your students.
2. Have students give their own descriptions of what storm drains are designed to do. Pose questions that will help them formulate ideas on the function of storm drains and help them understand the connection that exists between storm drains and streams, rivers, etc.
3. Is there litter near the storm drain that you and your students have located? Can you look into the drain and see any trash? Have your students consider how the trash got there and what would happen to it over time, especially if it rained.
4. Back in the classroom, hand out copies of the storm drain diagram for your students to color.

Assessment:

Have your students diagram the path of litter from the street into the storm drain and eventually to a body of water.

Storm Drains as a Source of Marine Debris



ADOPT-A-BEACH CLEANUP

★★★★★★★★★★★★★★★★★★★★★★★★★★★★★★★★★★★★★★★

Age: K-3

Subjects: Science, Math, Social Studies, Language Arts

Conceptual Framework: Science Framework: Humans affect the ocean ecosystem; respect for nature develops from understanding how nature works; application of scientific knowledge changes the world.

Mathematics Framework: Collecting, organizing, and describing data is important for understanding and solving problems.

History-Social Science Framework: Understanding human and environmental interaction.

English-Language Arts Framework: Activities that extend content and meaning stimulate the development of higher-level thinking such as analysis, synthesis, and evaluation.

Skills: applying, classifying, computing, identifying, small group work, tabulating, writing, social participation skills, and judging information related to a problem

Duration: 2-4 weeks before the field trip to the beach (Part 1); 15 minutes (Part 2); 1-2 hours (Part 3); 30 minutes (Part 4)

Setting: outdoors and indoors

Key Vocabulary: data, litter

★★★★★★★★★★★★★★★★★★★★★★★★★★★★★★★★★★★★★★★

Objectives: Students will be able to: 1) demonstrate how they can play an important role in marine conservation by participating in a beach cleanup; and 2) tell the Center for Marine Conservation, California Coastal Commission, or an elected official about their experience.

Method: Students work in "buddy pairs" collecting trash on the beach (separating recyclables and non-recyclables as they go). Back in the classroom, students (depending on the grade level) write letters or draw pictures about their experience.

Background: It's time for a trip to the beach! Your students are now aware of the hazardous effects of marine debris on wildlife, as well as the different types of debris that exist and what is and isn't recyclable. Let's transform this new found awareness into action with a beach cleanup.

Remember to allow plenty of time for the students to play at the beach. You might want them to bring lunches and have a picnic. It is important for the students to enjoy being at the beach and develop an appreciation for the outdoors. The more fun they have, the more likely they are going to want to protect the ocean.

Finally, remember that the attitudes and practices that you, the teacher, display are important because much of what students learn about conservation is better "caught than taught." Please take nothing but trash from the beach. Please leave all life undisturbed, especially the dune grass. Dune grasses keep the beach from eroding and are extremely delicate. Share this saying with your students — "Take only pictures (and trash!), leave only footprints."

Good luck with your cleanup!

Materials: Trash bags for both recyclable and non-recyclable debris; your school's parental consent form, and "Students' Checklist" (see Appendix E) for each student; gloves; and a first aid kit.

Procedure:

PART 1: Organizing your cleanup

Two to Four Weeks Before the Cleanup

1. Contact your State Coastal Cleanup Coordinator, the Center for Marine Conservation (202) 429-5609, or in California the Coastal Commission for

Adopt-A-Beach information. Select a beach for your cleanup. The beach should be sand or gravel and known to collect litter.
2. Call the beach manager to get permission to conduct a beach cleanup. The beach manager may also have beach cleanup supplies for you to use.
3. Arrange for the trash to be collected after the cleanup. The beach manager may be able to arrange this for you.
4. Begin assembling the materials and support you need.
5. Arrange transportation to the beach.
6. Send the school's parental consent form home with the students to be signed and returned.

PART 2: The Morning of the Cleanup
1. Review the following safety information with the students:
   1) No one will be allowed in or near the water on the trip.
   2) Keep your eyes on the ocean —when close to the water don't turn your back on waves.
   3) Everyone must stay with their assigned group.
   4) Call an adult immediately if a dangerous item (syringe, metal drums, chemical containers, medical waste) or stranded animal is found.
   5) Dress warmly and in layers — the beach is usually cooler than inland areas.
   6) Let everyone know the trip will be cancelled in stormy weather.
2. Collect parental consent forms.
3. Check weather conditions at the beach.

PART 3: The Beach Cleanup
1. Divide the students into groups.
2. Pass out trash bags.
3. Begin picking up trash.
4. Allow time after the cleanup for the students to enjoy the clean beach.

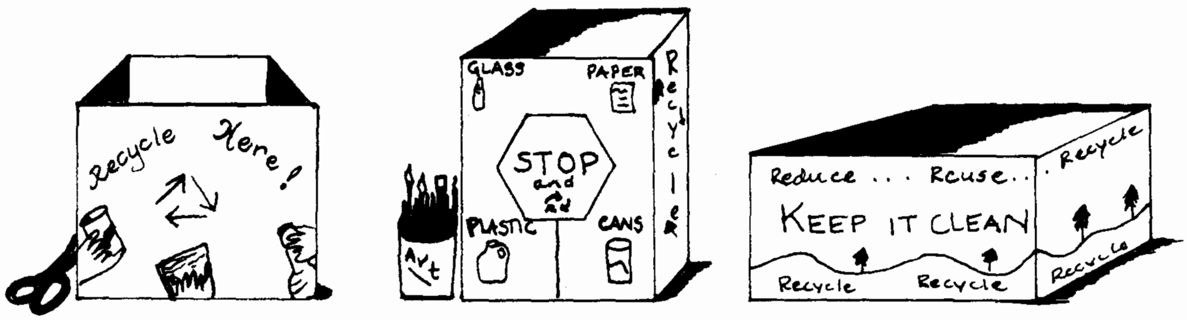
PART 4: After the Cleanup and Back in the Classroom
Lead a class discussion about the experience. Emphasize to the students that they helped eliminate deadly marine debris from the beach and that they are part of the solution to marine debris. Have the class discuss the following questions:
1. What kind of litter was most often found?
2. Do you think most of that litter was left here by people on the shore, or dumped from boats?
3. How many recyclable beverage containers did you find?
4. Was any of the litter found on the beach packaging material? (Cans, bottles, and candy wrappers are all packages.)
5. What could we ask law makers to do about the problem of pollution?
6. How does it make you feel to see the litter along our beach?
7. How does it make you feel to see the beach clean after your work?
8. What can each of us do to minimize the problem of ocean pollution?

Remove the trash from the class collage made in the previous activity to illustrate a pretty, clean beach that the students can be proud of.

Assessment:
Depending on the grade level, have the students write a class letter or have each student write a letter expressing what they saw and did at the beach. Send your letters to the Center for Marine Conservation or the California Coastal Commission's Adopt-A-Beach program. You may also want to send the letter to the city council or mayor.

Extensions:
1. Write a story about your findings from the beach cleanup for the school (or local) newspaper (See Appendix H: How To Be An Effective Grassroots Activist).
2. Make a display about marine debris for your school. Include some of the litter you found.
3. Create posters of marine debris and hang them in bait shops, marinas, or places that sell fishing licenses.

TAKE-HOME RECYCLING KIT



****

Age: Grades K-3
Subjects: Social Studies, Language Arts, Art
Conceptual Framework: History-Social Studies Framework: Understanding human and environmental interactions.

English-Language Arts Framework: Linking personal experiences and prior knowledge provide opportunities for building language skills and recognizing common background experiences.

Visual and Performing Arts Framework: The arts provide the sensory and perceptual input essential to the development of nonverbal and verbal communication; the arts can be used to vitalize and clarify concepts and skills in all curriculum areas.

Skills: applying, communicating, constructing, organizing, reading, small group work, defining, clarifying, and problem solving
Duration: 30 minutes (part 1); 60 minutes (part 2); time outside of class setting up the home recycling center
Setting: indoors
Key Vocabulary: recycling center

****

Objectives: Students will be able to: 1) help solve home and community waste problems by constructing a take-home recycling kit; and 2) explain to their families solid waste problems and solutions.

Method: Students assemble a take-home recycling kit and learn how to present their kits to their families.

Background: More than half of what we toss in the trash can is reusable or recyclable. The loss of natural resources and energy, along with the waste disposal costs, make source separation at home an important alternative.

Recycling at home is an excellent way to complete the Marine Debris School Education Program. It allows students to incorporate the concepts covered on marine science, conservation, and recycling into their own lives and gives them a chance to actively assert their own conservation commitment.

Materials: A medium to large cardboard box from students' homes; magazines for each student; marking pens, glue, scissors; a variety of colored construction papers (take as much paper as you can from the classroom recycling box to demonstrate reusing); a copy of "How to Recycle" for each student (see Appendix A).

Procedure:

PART 1: Assemble the "Take-Home Recycling Kit"

1. Have each student decorate their box. They may want to glue different colored sheets of construction paper to each side of the box.
2. Have students list on their box the items to be recycled: Glass, Paper, Aluminum, Tin, Plastic, and Newspaper.
3. Have the students cut up copies of "How to Recycle" and paste the pertinent information on the recycling box.
4. Using the magazines, cut out pictures of the different items that can be recycled and paste these pictures on the box below the corresponding heading.
5. Discuss with students how they might set up centers in their homes.
6. Have each student draw a floor plan of his or her home, marking places where the home center could be set up. Paste this plan on the back side of the box.

PART 2: Presenting the Kit

1. In preparation for teaching their families about recycling, have students in groups practice explaining their recycling kits.

Assessment:

Have each student present their recycling kit to the class.

At-Home Learning:

Have students present their recycling kits to their families. The next day have the students discuss their families' reactions to the recycling kit.

Extensions:

1. Discuss what other groups in the community the students might present the kit information to (neighbors, other family members, other classes in schools, PTA, school staff, chamber of commerce, city council, mayor, etc.)
2. Visit a recycling center, or have a recycler visit the class.

The Gift of Recycling

Name: Mollie Clarke
Age: 17
Grade: 12
Town: Camden, South Carolina

WHAT SHE DID

Summary

Mollie didn't know what to give her family members for Christmas. But the fact that they weren't recycling — even though she'd told them how it saves resources and helps cut pollution — gave her an idea.

Some relatives complained that it was too much trouble to get recycling bins that looked nice in their kitchens.

But Mollie was committed to recycling. So she came up with a novel way to solve the problem: Make recycling bins to give as gifts. "Then," she thought, "they won't have any excuses not to recycle."

Results

Mollie gave everyone handmade recycling bins, and they started recycling right away. "I encouraged them to help clean up our Earth and made it possible for them to do it," says Mollie. "Now I hope they'll spread their excitement and interest in recycling to others!"

SAVE OUR SEAS

Grades 4-6

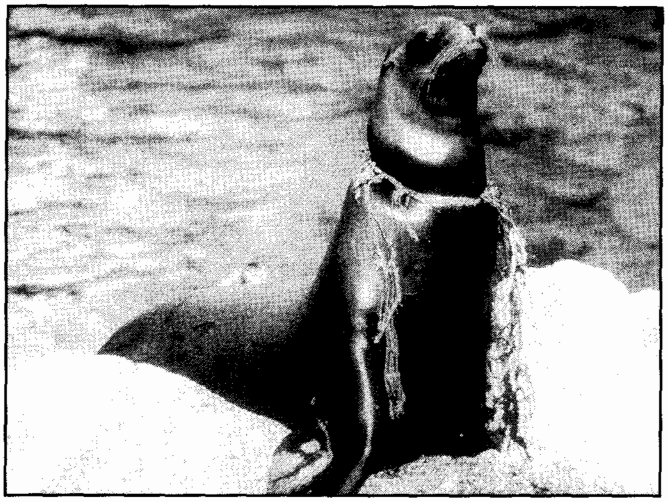
U.S.S. My School

The Center for Marine Conservation has created the **U.S.S. My School** curriculum to teach students about marine debris and legislation that prohibits the disposal of plastic trash at sea. This curriculum will help students understand the difficulties of storing trash on board a ship. This project requires students to store trash generated in the school cafeteria for a few days at school. Using problem solving and creative thinking skills the students will develop ways to minimize the amount of trash generated at school and will develop educational materials for other students at their school to promote these efforts. Ultimately, the lessons learned by this curriculum can be applied by students to minimize the amount of trash in their daily lives.

A great way to kick off the unit would be to organize a beach cleanup. By participating in a cleanup, the students will be able to witness first-hand the marine debris problem.

U.S.S. My School has been abridged to fit into the *Save Our Seas* 4-6 grades unit. If you are interested in receiving the complete 14-day curriculum, please contact the Center for Marine Conservation's headquarters at 1725 DeSales St., NW, Washington, D.C. 20036, (202) 429-5609.

WILDLIFE and MARINE DEBRIS



"The sea washes away all human ills." Greek proverb

****
Age: Grades 4-6
Subjects: Science, Social Science
Conceptual Framework: Science Framework: Life is diverse; respect for nature develops from understanding how nature works; components of ecosystems interact.
History-Social Science Framework: Understanding human and environmental interactions.
Skills: analyzing, communicating, comparing, describing, drawing, reading, research, small group work, writing
Duration: 50-60 minutes (part 1); 30 minutes (part 2)
Key Vocabulary: habitat, marine debris
****

Objectives: Students will be able to: 1) recognize a variety of marine animals; 2) identify various kinds of marine debris; 3) describe the hazardous effect of marine debris on marine wildlife; and 4) identify various occupations that require people to live and work at sea.

Method: Students watch either the Center for Marine Conservation's (CMC) *Marine Debris and Entanglement* slide show or *Trashing the Oceans* video detailing the effects of marine debris on marine wildlife. Students brainstorm about various jobs at sea, and identify marine debris generated by these occupations.

Background: Marine debris is litter or trash that is found underwater and on beaches. Any trash that is not properly discarded has the potential to become marine debris. Trash not only ends up in the ocean from illegal disposal of shipboard waste but also from land-based sources. Litter on the street is washed down storm drains when it rains. This trash can work its way into rivers and eventually empty into bays and oceans.

People have been throwing trash off ships for centuries, but materials that make up discarded vessel wastes have changed. Since the second half of this century, more and more products are made of plastic. Plastic trash does not sink or decompose at sea, thus increasing its visibility in oceans and on beaches. It is now virtually impossible to cross an ocean or go to a beach anywhere in the world without finding marine debris.

Some plastic products can cause harm to wildlife and vessels alike. Some seabirds eat plastic that resemble fish eggs and other food, causing them to die from starvation. Some turtles eat plastic bags, mistaking them for their favorite food, jellyfish, and die. Discarded fishing nets made of strong plastic materials continue to "ghost fish" — trapping marine mammals, sea turtles, birds, and fish. Boat engines and propellers are fouled by plastic bags, rope, and fishing line.

Certain items found as trash on the beach can be traced back to their marine users. These items are called "indicator items." Below are a few examples:

Indicator Items	Marine Source
Fishing net, fishing line, light sticks, salt bags, and buoys	Commercial fishers, recreational fishers
Wooden pallets, plastic strapping bands	Merchant ships, oil and gas industry workers
Hard hats, write-protection ring	Oil and gas industry workers
Vegetable sacks, plastic milk jugs, egg cartons	Merchant ships, commercial and recreational fishers, cruise lines, oil and gas industry

Materials: PART 1: CMC's *Marine Debris and Entanglement* slide show or *Trashing the Oceans* video (see Appendix I: Resources). PART 2: CMC data card (Appendix F) ; box of marine debris (you can go to a local beach and collect debris or collect trash that is listed on the data card); folders (letter-sized and two-pocket), plus notebook paper for each student's *U.S.S. My School* notebook.

Procedure:

PART 1: Let's Talk Marine Debris

1. Now introduce the words "marine debris" to your students. Break it down into "marine" and then "debris" to discuss its meaning.
2. Present either the slide show or the video on marine debris to your students.
3. Discuss the concepts of entanglement and ingestion that have been shown in the visual presentation.

PART 2: Living and Working at Sea

1. While making a list on the board, discuss different jobs at sea. Have students include the list in their *U.S.S. My School* notebooks.
2. Give each student a copy of the data card. Display a box of marine debris including some of the indicator items listed above. Present the items and have the students identify the item on the data card. Who is the source of the item? Have the students include the data card in their *U.S.S. My School* notebooks.
3. Pass out the attached word-search activity of occupations at sea.

Assessment:

Have your students make a list of why plastic trash in the ocean is harmful to people and animals to include in their *U.S.S. My School* notebook.

At-Home Learning:

Have students complete the word-search activity.

Extensions:

1. Organize a beach cleanup to experience what types of trash wash up or are left on beaches.
2. Have students research and write a report on one occupation that requires people to live and work at sea.

Source of Activity:

Greek proverb from *A World Treasury of Proverbs in 25 Languages* by Henry Davidoff, Random House: New York, NY (1946).

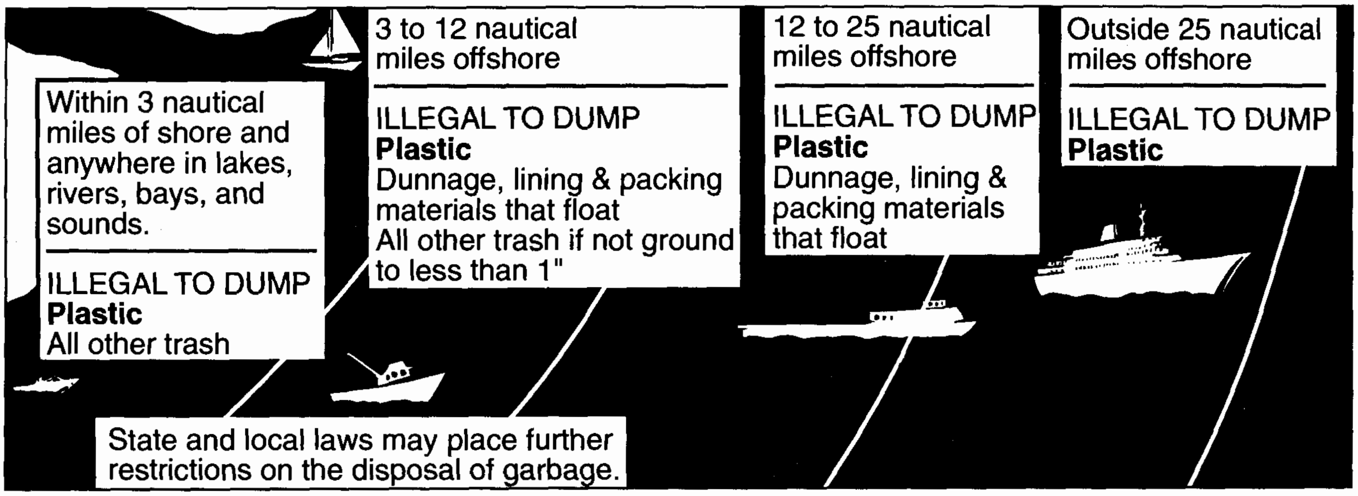
Word-Search

DIRECTIONS:
Complete the word-search below to find seven people who live and work at sea.

N C Y A E G K I O S M W Q H K U O
L E Q C W I E M B O E D F N B K E
C R D U S N A V Y C R E W M A N N
O R S W T F U B D E C A B F G K H
A D U F K E L C V M H S O W A X Z
S R D I C R B H J L A J A D F Y T
T I O F S M W M S E N W T U O P G
G B I S T E R S K D T F E E T S H
U K L E W S L T C I S O R H N B C
A O R W M E K I K S H K K A B G J
R H I U X F D B N A I F H J P H U
D P G D P I O P L E P F D W A N G
O O W S L S Z C W O C L I U B D M
F A O K Y H C Z K L A A Q A Z S E
F E R S W E R F G T P N P U E S P
I S K B H R K W D L T P S T H F T
C A E V F M H U O P A G N B A R D
E X R D F A H Y M J I K W L M I Q
R S D G J N L T Y H N A W Q V T N

BOATER
COAST GUARD OFFICER
CRUISELINE CAPTAIN
FISHERMAN
MERCHANT SHIP CAPTAIN
OIL RIG WORKER
U.S. NAVY CREWMAN

WHAT IS MARPOL?



****
Age: Grades 4-6
Subjects: Social Science, Geography, Language Arts
Conceptual Framework: History-Social Science Framework: Develop locational skills and understanding; understand human and environmental interaction; understand different groups have different interests and needs; understand basic economic problems confronting societies; understand what is required of citizens in a democracy.

English-Language Arts Framework: Providing opportunities for research, using source materials such as encyclopedias, magazines, and library books helps students discover their resourcefulness.
Skills: identifying, inferring, listing, research, writing
Duration: 60 minutes
Key Vocabulary: treaty, occupation, cargo
****

Objectives: Students will 1) learn about one solution to the marine debris problem; and 2) understand what it is like to hold trash on board a ship.

Method: Students learn about the law that regulates the dumping of trash at sea, and also locate countries party to the treaty on a world map. Then students pretend their classroom is a ship and the students are the crew. The students begin a waste characterization study of the ship's garbage.

Background: Annex V of the MARPOL (short for MARine POLlution) treaty is the newest legal tool to stop the dumping of plastic trash at sea. Annex V went into effect on December 31, 1988, and by 1992, 52 countries have agreed to abide by its requirements. Other sources of marine pollution are covered under MARPOL as outlined:

Annex I	Regulations for the prevention of pollution by oil
Annex II	Regulations for the control of pollution by noxious liquid substances carried in bulk (e.g. toxic chemicals)
Annex III	Regulations for the prevention of pollution by harmful substances carried in packaged forms
Annex IV	Regulations for the prevention of pollution by sewage
Annex V	Regulations for the prevention of pollution from garbage with focus on plastics

Annex V prohibits the disposal of all plastics into the ocean and requires that all vessels carry their plastic trash into port for proper disposal. The law that implements Annex V in the United States authorized the Coast Guard to write rules and regulations regarding the display of placards (see preceding page) to notify crew and passengers of the requirements of Annex V. It also requires each vessel to keep a log book describing their ship's garbage disposal activities. An entry in the log is required each time a vessel's garbage is off-loaded at a port, or incinerated on board. Large ports, marinas, private docks, and fish processing plants have to provide facilities for trash disposal.

Who must comply with this law? All ships, from rubber rafts to tankers, including:
- Crew boats that travel to and from oil rigs
- Commercial fishing vessels
- Recreational boaters
- Passenger cruise ships
- Ports, marinas, and private docks
- Fish processing facilities owners

- Oil and gas exploration workers
- Public vessels, including the Navy
- Merchant ships

All U.S. vessels must develop and use a ship-board waste management plan specifying how it plans to comply with the provisions of Annex V. In addition, while Annex V applies only to ships of countries that are signatory to the MARPOL Treaty, the law gives the Coast Guard additional authority to prosecute any vessel operator who dumps plastics within 200 miles of the U.S. coast. Violators caught dumping can be fined up to $500,000 and be imprisoned for up to six years.

Life on board a ship is very different from life on land. The main obstacle to overcome is space. There is very little extra space to store trash on a ship. The average person generates approximately three to five pounds of trash per day. Some ships could be at sea for a few months, serving meals four times a day. So storing plastic trash is a real challenge for the crew. Plastics that are contaminated with food begin to smell after a few days and attract pests.

The crew on board could reduce their waste by thinking about the five R's:

1. RETHINK the way they buy products and how they will dispose of them.
2. REUSE products in order to minimize waste.
3. REDUCE the amount of trash generated by purchasing items in bulk quantities or with minimal packaging.
4. RECYCLE products. If there is a continued demand for recycled products we will help to generate booming recycling business.
5. REMEMBER we all can make a difference in the ways our homes, cities, beaches, and oceans look. Remember to recycle, to reduce, and to be part of the solution, not part of the problem!

Materials: A couple of clear plastic bags, a copy of the world map (see Appendix C) and the list of countries that are signatory to MARPOL (attached) for each student.

Procedure:

PART 1: The MARPOL Treaty

1. Discuss with your students what MARPOL means and Annex V. Explain to them that many nations are working together to protect the world's oceans. In U.S. waters, the Coast Guard enforces the law.
2. Discuss how this law will change crew behavior, and ship-board practices of handling trash.
3. Hand out the world map and the list of countries party to MARPOL. Have the students label the world's oceans and then locate and label some of the countries party to MARPOL.

PART 2: *U.S.S. My School*

1. Discuss the "Five R's" — RETHINK, REUSE, REDUCE, RECYCLE, and REMEMBER — as they apply to shipboard solid waste management.
2. Then explain to the class that they are now on a ship and cannot easily dispose of their garbage. The students will need to collect all their garbage, except food waste, after lunch.
3. Choose two students to be lunch-time monitors who will collect the classroom's garbage from lunch. Give the monitors a clear plastic bag for the garbage. Every day during lunch the monitors will need to collect the class's garbage until the ship arrives back in port (at the end of the unit).

Assessment:

Have the students include their completed maps in their *U.S.S. My School* notebooks. Hand out a copy of the CMC MARPOL placard to each student. Have the students discuss the fines and penalties for dumping trash at sea as well as the role that the Coast Guard plays as the enforcing agency in U.S. waters. Have the students write a news report about their ship and its waste management program. Remind the students about using their Five R's.

Extension:

Invite someone from the Coast Guard to give a presentation about marine debris and MARPOL Annex V.

MARPOL

Countries that have signed Annex V of the MARPOL treaty (as of 1/93)

Algeria
Antigua and Barbuda
Australia
Austria
Bahamas Belgium
China
Colombia
Cote d'Ivoire
Croatia
Cyprus
Democratic People's Republic of Korea
Denmark
Ecuador
Egypt
Estonia
Finland
France
Gabon
Gambia
Germany
Greece
Hungary
Iceland
Italy
Jamaica
Kenya
Japan
Latvia
Lebanon
Lithuania
Luxembourg
Marshall Islands
Monaco
Netherlands
Norway
Oman
Panama
Peru
Poland
Portugal
Russian Federation
St. Vincent and the Grenadines
Slovenia
South Africa
Spain
Suriname
Sweden
Togo
Tunisia
Turkey
Tuvalu
United Kingdom
United States
Uruguay
Vanuatu
Yugoslavia

GETTING THE MESSAGE OUT

"If you wait patiently excellent weather will come for your sea journey." Japanese proverb

****
Age: Grades 4-6
Subjects: Social Science, Art
Conceptual Framework: History-Social Science Framework: Understanding what is required of citizens in a democracy.

Visual and Performing Arts: The arts are important in the education of all students to provide for balanced learning and to develop the full potential of their minds; the arts provide the sensory and perceptual input essential to the development of nonverbal and verbal communication; the arts can be used to vitalize and clarify concepts and skills in all curriculum areas.
Skills: analyzing, applying, communicating, constructing, organizing
Duration: 2 hours
Key Vocabulary: galley, solid waste
****

Objectives: Students will be able to: 1) understand that education is an important way to get the student "crew" to start the solid waste management program; 2) students will be able to select and carry out the educational methods by which to inform their "crew" and the student body about the new solid waste management program; and 3) consider various rewards for the "crew" for their cooperation with the new "galley waste procedures."

Method: Students discuss ways that other ships educate their crew in order to change their behavior as well as ways to reward their own "crew's" good solid waste management behavior. Students make informational signs to educate their school about marine debris.

Background: For a solid waste program to work it is necessary to have the cooperation of all of the crew. The participation of every individual is essential. Crew members must understand why it is important that they minimize their waste and sort their trash. They need to understand why trash in the ocean causes problems. Some shipping companies and the Navy educate their crews with informative videos and posters displayed on-board ship. Visits by the commanding officer to the crews also help them understand the new procedures and why they are necessary.

Materials: Marine debris posters such as the Navy poster "Don't Splash Navy Trash" (see Appendix I: Resources); a sheet of white unlined paper or poster board for each student; and felt tip pens or crayons.

Procedure:
PART 1: Changing Behavior by Educating
1. You can begin by showing the Navy video, *Plastic in the Ocean: More than a Litter Problem*, so students can visualize storing trash on a ship.
2. Discuss the ways the Navy informs their crews about the new procedures for handling solid waste. How does the message get out to the crew? How would the students educate their crew? Write the students' ideas on the board. Have your students include a list of the ideas in their *U.S.S. My School* notebooks.
3. Present a marine debris poster to display in class.

PART 2: Getting the Message Out
1. Make creative educational materials to educate the school about marine debris. Suggested ideas: posters, brochures, books, or announcements to read over the loud speaker.
2. Have each student present their idea to the class.
3. Educate the school (hang the posters and brochures in the school hallways, read announcements over the loud speaker, etc.)

PART 3: Rewarding the Crew
Now discuss how the students will keep the student body "crew" interested in the new program. How can they reward the crew for collecting lunch-time garbage in the "galley?" Select one idea.

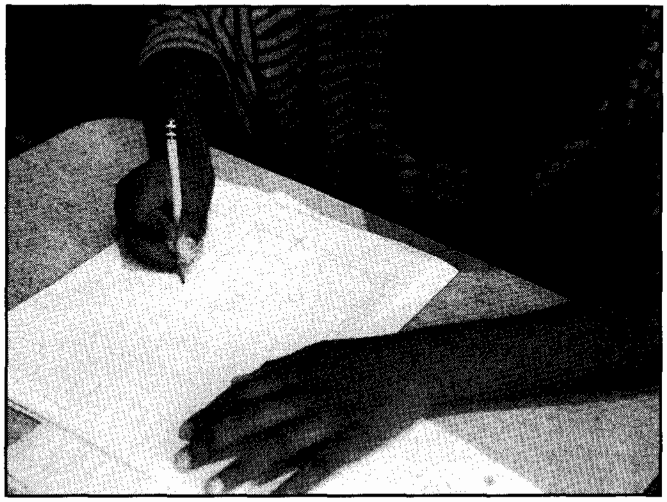
Assessment:
Have the students present their posters to the class and explain their drawings.

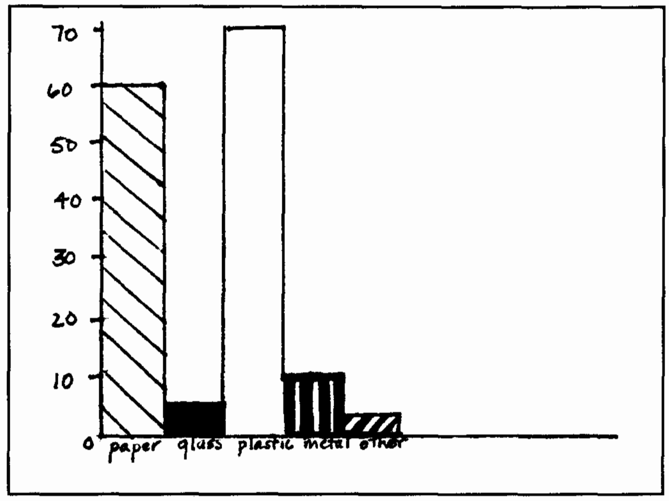
Extensions:
1. Invite a Navy officer to your classroom to explain what it is like to live on a ship and how they store

their garbage.
2. Visit a local port to look at the boats, and arrange a tour of a vessel.
3. Perform a play or puppet show about marine debris for the school (See Appendix D: "The Big Clam Shake").

Source of Activity:
The proverb came from *Japanese Proverbs and Sayings* by Daniel Crump Buchanan, University of Oklahoma Press: Norman, OK (1965).

RECORD KEEPING





****
Age: Grades 4-6
Subjects: Science, Math
Conceptual Framework: Science Framework: The application of scientific knowledge changes the world.
History-Social Science Framework: Understanding what is required of citizens in a democracy.
Mathematics Framework: Tables and graphs represent relationships.
Skills: analyzing, comparing, computing, evaluating, graphing (or charting), problem solving
Duration: 60 minutes
Key Vocabulary: data, polystyrene, percentage
****

Objectives: Students will be able to: 1) conclude their work in the "galley;" 2) record data in a useful format; and 3) consider how to reduce plastic trash.

Method: Students graph or chart the information that they gathered from collecting lunch-time trash. They also make a display of plastic items and substitutes for those items, and discuss how to reduce, reuse, or recycle plastic in their school cafeteria.

Background: One of the first steps taken by shipping companies and the United States Navy to reduce plastic trash was to conduct a shipboard inventory of plastic items used daily to determine the amount of garbage generated on a ship. This made it easier to substitute or even eliminate some plastic items. For example, plastic dry cleaning bags are no longer used and plastic sticks to stir coffee have been replaced with metal spoons. If the amount of plastic taken on board is reduced, then the amount of plastic waste will decrease.

Materials: The trash collected during lunch-time; graph paper; and plastic items and substitutes.

Procedure:
PART 1: Data Collection
In order for a crew to determine how much trash they generate on a cruise and determine what types of trash could be eliminated, the ship's crew had to conduct a waste characterization study. The students will do their own waste characterization study for their "ship."

1. Have the students write a purpose statement explaining why they collected their lunch-time garbage. Be sure to include space to label and categorize the results.
2. Divide the class into groups and have each group count some of the trash collected during lunch-time. Combine the results and have the students figure out how many plastic spoons, cups, trays, etc. are used during lunch each day, each week, and each month. Have your students make a graph or chart to visually present these totals. Discuss with your students the amounts that would be generated in five days, seven days, and thirty days.
3. Have your students develop graphs or charts showing the percentage or number of plastic, glass, metal, and paper items collected.
4. Compare these classroom "galley" totals to that of a crew of 5,000 on a Navy vessel eating breakfast, lunch, and dinner on a ship at sea.
5. Discuss the following with your students: What types and amounts of trash did the class collect? Did holding the "galley" trash take up a lot of space? Could some of the plastic items be replaced with

reusable items to reduce the amount of trash? (Have your students make a list of these substitutes.) What changes would need to occur if plastic items were replaced? Can some of the plastic items be recycled? (Have your students make a list of these changes.) Write a class conclusion to your waste characterization study.

PART 2:
Begin a display of disposable plastic items and substitutes. For example, display a foam coffee cup next to a ceramic mug. Display a plastic bag next to a reusable lunch container. Display a plastic spoon next to a metal spoon.

Assessment:
Have students list disposable items they use during lunch that could be replaced by reusable items. Have the students include their waste characterization study in their *U.S.S. My School* Notebook.

At-Home Learning:
Encourage all students to bring from home an example of a disposable plastic item and a substitute.

WHAT HAPPENED?

★★★★★★★★★★★★★★★★★★★★★★★★★★★★★★★★★★★★★★★
Age: Grades 4-6
Subjects: Social Science, Language Arts
Conceptual Framework: History-Social Science Framework: Understanding what is required of citizens in a democracy.
English-Language Arts: Activities that extend content and meaning stimulate the development of higher-level thinking such as analysis, synthesis, and evaluation.
Skills: analyzing, evaluating, reporting, writing
Duration: two 45 minute periods
★★★★★★★★★★★★★★★★★★★★★★★★★★★★★★★★★★★★★★★

Objectives: Students will be able to 1) prepare a summary of the results of the solid waste management project; 2) approach the school to adopt methods that will reduce cafeteria waste; 3) reward the "crew" for their cooperation; and 4) take pride in a project completed successfully.

Method: Students discuss what worked, what didn't, and why and then approach the school administration with suggested changes. Students reward the crew via the method selected in the activity "Getting the Message Out." Students also complete their *U.S.S. My School* notebooks with a certificate of appreciation presented to them by their teacher.

Materials: Certificate of appreciation (see attached).

Procedure:
PART 1:
1. Review and discuss with your students problems and successes of the program. What changes would they make in the cafeteria? Would they start a recycling program or request an item in the cafeteria be replaced with reusable items (e.g. replace plastic spoons with metal spoons)?
2. Have the students make a presentation to the cafeteria staff, the custodial staff, and the principal about suggested changes to the cafeteria, for example, replacing disposable items with reusable items (which in the long run should save money), or starting a recycling program to reduce the amount of trash generated (which could also possibly save the school money).
3. Have the students write and distribute thank-you notes to the cafeteria staff, the custodial staff, and the principal for considering their ideas.

PART 2:
1. As discussed in "Getting the Message Out," reward the "crew." Have a class party celebration! How about pizza?
2. Present the certificates of appreciation to the students.
3. Have them hand in their completed notebooks.
4. If you have taken photos of the project, have the film developed. Have your students label each picture for a *U.S.S. My School* photo album for the classroom.
6. Congratulations on a job well done!

Assessment:
Have the students write down their suggested changes to the cafeteria. Include in their *U.S.S. My School* notebook. Collect the *U.S.S. My School* notebooks.

Reading, Writing, & Recycling

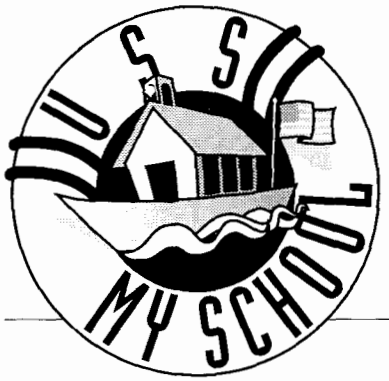
Name: Brady Landon Mann
Age: 9
Grade: 3
Town: Vancouver, Washington

WHAT HE DID

Summary
Brady had read about conservation and had started recycling at home. But at his school there was no recycling program. "I thought, man, at school, we're not doing anything," he says. "In my class, kids throw away about 8 pieces of paper a day, some with only a few marks on them." Brady didn't want to let things keep on going that way. He figured that even if he could get just his class recycling, it would help. So he wrote a letter to the school principal about starting a recycling program.

Results
According to Brady, "All classes now recycle white and colored paper." Kids also started a volunteer recycling effort to recycle milk cartons at the cafeteria. (Volunteers get "teddy bucks" — play money they can trade for toys.)

From *Kid Heroes of the Environment*, 1991. Published by EarthWorks Press, Berkeley, CA. Used with permission.



CERTIFICATE OF COMPLETION

THIS CERTIFICATE IS PRESENTED TO

_____

For successfully completing *USS My School* project.

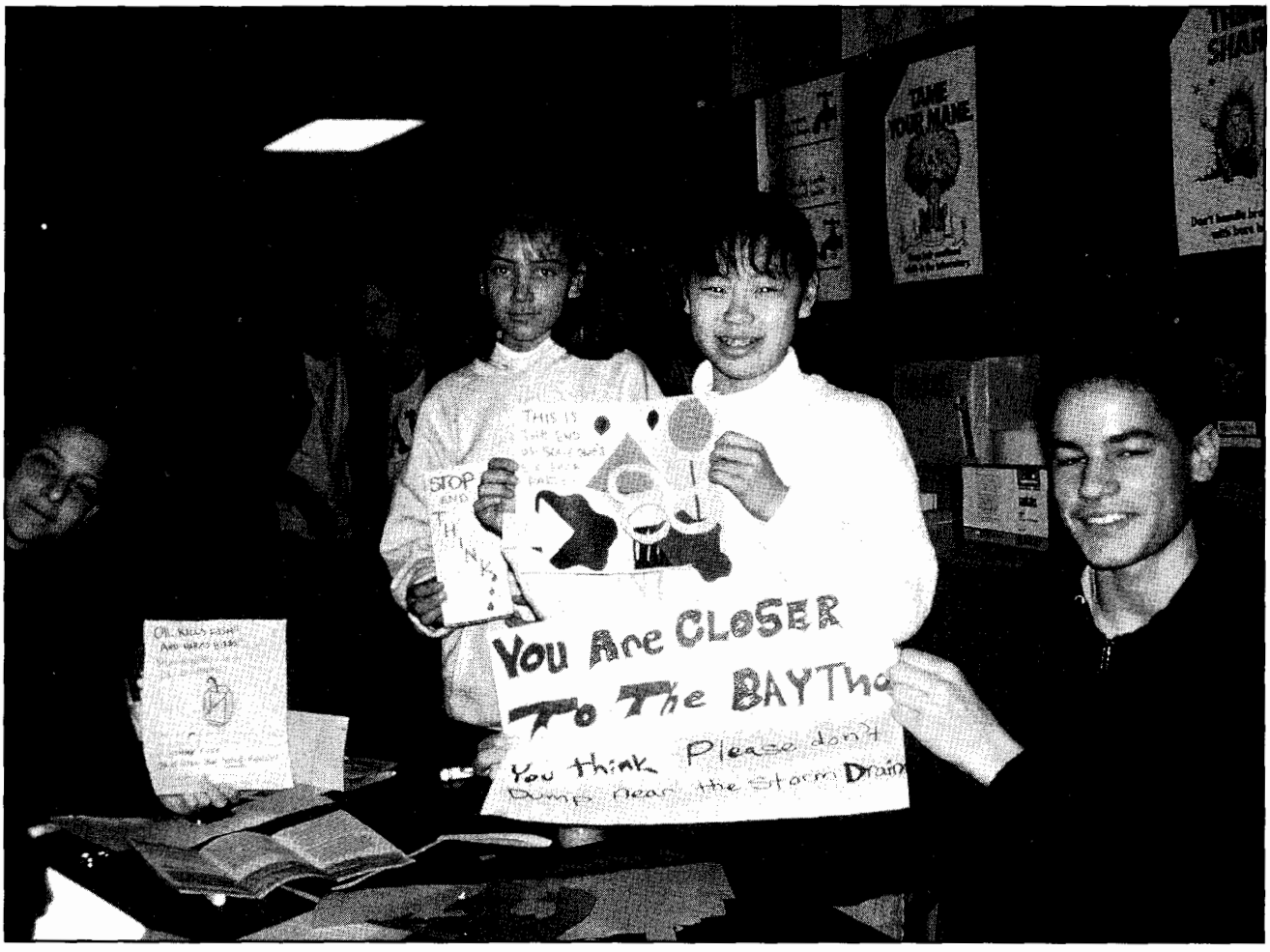
Given this _____ day of _____ 19____

Teacher _____

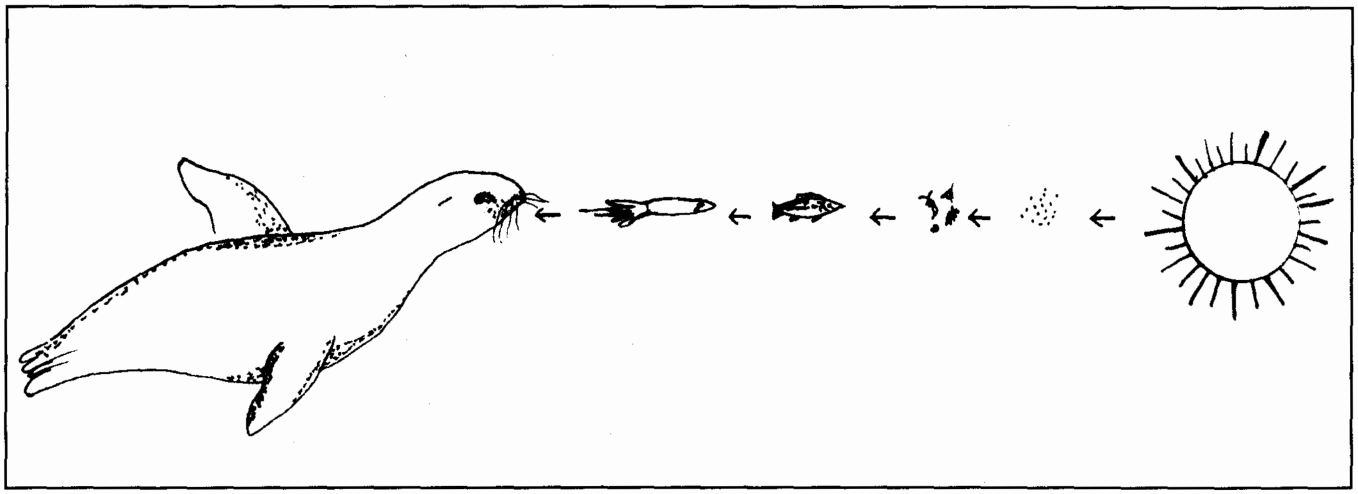
School _____

SAVE OUR SEAS

Grades 7-8



WEB OF LIFE



"Even the great dike of ten thousand feet may be crumbled by a single ant hole." Chinese proverb

****

Age: Grades 7-8
Subject: Science, Social Science
Conceptual Framework: Science Framework: Living things and systems demonstrate a structure/function relationship; Earth systems interact in cyclical patterns; respect for nature develops from understanding how nature works; life is diverse.
History-Social Science Framework: Understanding human and environmental interaction.
Skills: applying, communicating, comparing, inferring, observing, public speaking, reading, researching, writing
Duration: 50 minutes
Setting: indoors (may be done outdoors)
Key Vocabulary: photosynthesis, plankton, organism, entanglement, ingestion, inorganic

****

Objectives: Students will be able to: 1) understand that living organisms are interconnected either directly or indirectly with everything within their physical environment, and that the action of one organism or change in one physical factor can affect all other organisms within that habitat and eventually affect other habitats; and 2) discover that humans' careless use of the sandy beach habitat may adversely affect the entire food web.

Method: Students play a game that demonstrates the interconnections between sandy beach organisms, the roles they play within their habitat, and the hazardous effects of marine debris on these animals.

Background: In the late 1960's and early 1970's astronauts on the moon saw clearly what no one had observed so dramatically before — the Earth is a water planet — the interconnected waters of the oceans cover over 70% of the Earth's surface. The Pacific Ocean alone is 25% larger than all of the world's land surface combined. The oceans occupy an enormous volume of over 300 million cubic miles. The average depth of the ocean is over two miles, with the greatest known depth being just over seven miles in the Marianas Deep of the western Pacific. It is this very abundance of water that makes life possible and therefore, makes Earth different from all other planets.

Exactly how does the ocean enable the Earth to be uniquely life-bearing? By the process of photosynthesis. Phytoplankton, tiny one-celled plants, floating on the ocean's surface provide the basis for the web of life for water and land animals by making food from the sun's energy and generating oxygen. The following example illustrates a particular food chain: seals eat animals, such as squid; squid eat fish; the fish eat zooplankton; zooplankton eat other zooplankton and phytoplankton; phytoplankton are dependent upon inorganic nutrients brought to the surface by upwelling and the sun for energy to make their own food through photosynthesis. These interconnections can be shown in the form of a food chain where lines and arrows are drawn between predators and prey.

Food webs are often complex, with animals eating more than one prey item. When a particular prey becomes scarce, the predator may still survive by eating the alternate food item. Many food webs, however, are fragile, and the removal of even one link in the web may ultimately result in the collapse of the entire food web. Such a case may occur for the above example if upwelling does not take place one year (e.g. during El Niño). Without upwelling, the phytoplankton which is the base of the food

cannot "bloom," zooplankton cannot flourish, clams then cannot find enough to eat, and ultimately the shorebirds will have to concentrate on some other food item, move to another beach, forego reproduction that year, or starve.

Human hazards to marine life are also potentially disruptive to the food web. Pollution from oil spills may coat shorebirds, so that they are no longer able to keep warm. Silt from construction and agriculture carried downstream can smother small filter-feeding animals when it is brought back to shore by currents. Trash dumped by ships offshore and by people onshore can become deadly marine debris. For example, marine mammals, birds, and fish can become entangled in plastic fishing line, plastic strapping, six-pack rings, or other plastic trash. Once tangled, they may spend precious energy trying to get free, may become sick or weak, and even die. Certain marine animals can also mistake plastic debris for food, and die from eating it. Sea turtles mistake plastic bags for their favorite food, jellyfish, and birds mistake plastic pieces for fish eggs. All of these activities can disrupt the food web by removing a vital link in the complex structure of the ocean. Humans are responsible for this destruction wrought by marine debris and it is therefore up to us to bring the destruction to an end.

Why would the disruption of a marine food web matter to us? It matters because all of life on Earth is interconnected and to whatever extent we make it less possible for ocean life to flourish, we make it that much less possible for life on land — including ourselves —to flourish.

Materials: Masking tape or safety pins, ball of yarn, pictures of living creatures and "boobytrap" items, and actual items from the following "boobytraps"/trash list.

Living: Phytoplankton, zooplankton, mussels, sand dollar, sea star, sea anemone, anchovy, rays, people, sea turtles, barnacles, shore crabs, sandpiper, gulls, sea lions, harbor seals, jellyfish, kelp, salmon, and sharks.

"Boobytraps"/Trash: Plastic pieces/polystyrene, fishing line and nets, and plastic bags.

Procedure: Before beginning the game that follows discuss with your students the principle of "interconnections" and the role that the ocean plays in sustaining life on Earth. Photocopy the living creatures and boobytraps. You may want to photocopy the pictures onto card stock to make the copies stronger. Cut the photocopies into cards and laminate or cover with clear contact paper.

PART 1: Who Am I?

1. Write the list of living creatures on the board.
2. Review vocabulary words such as herbivore, scavenger, predator, etc. with the students. Discuss which groups of animals have backbones and which do not.
3. Have students sit in a circle on the floor and pair up with someone sitting next to them. Pass out a living creature card to each student.
4. Have the pairs of students play "20 Questions" by asking "yes" or "no" questions to try to guess who he/she might be. Sample questions might include "Am I an animal?" "Do I scavenge?" "Am I alive?" "Do I have a shell?" "Am I an herbivore?" "Do I have a backbone?" ("Who Am I?" can also be played with the entire group. In this case have the students enter the circle one at a time and have the other students in the circle take turns asking questions.) Also, more clues can be added to the front of the pictures to help the students guess.
5. After the students have asked 20 questions they may guess. Once the students have guessed, have them tape, pin, or string the pictures to their fronts and place a check by the name on the board list.

PART 2: Food Web Game

1. Discuss interdependence, food webs/chains and ways in which animals can be dependent on one another within their physical environment. Use examples given in "Background."
2. Have all of the students form a circle holding their pictures so that everyone can see them. Have the student highest on the food web start and give him or her the ball of yarn. Ask who or what they are dependent upon and have them throw the ball of yarn to the student holding that picture. The second student then throws the ball of yarn to someone holding a picture of something they are dependent on. Before they can toss the yarn to another student, they must be able to describe to the rest of the class how they are dependent on the pictured item to which they threw the yarn. (Example: The sea turtle says, "I depend on jellyfish for food.") Remind each student that they must hold onto a piece of the yarn before they toss it and the yarn should be held taut between links in the web.
3. When every student has had the yarn tossed to them at least once, the game can be stopped. The class has now formed a complex food web wherein everyone is connected directly or indirectly to each other and the physical environment.

PART 3: Environmental Boobytraps and Pitfalls

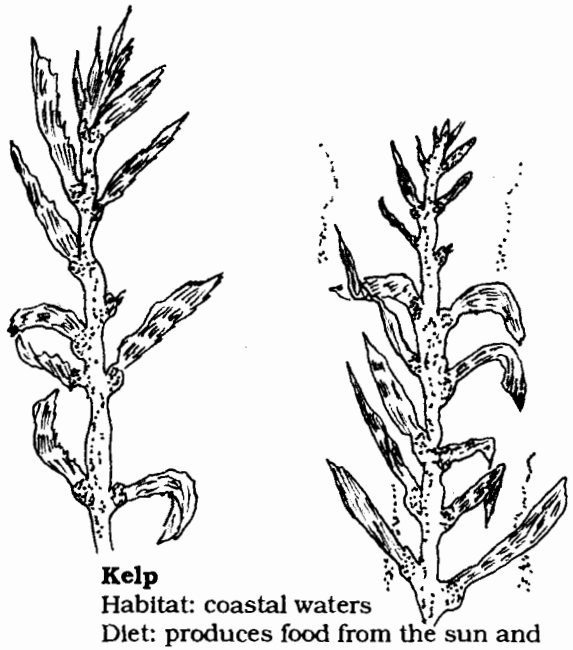
1. Now introduce the boobytrap cards into the game. Select only one boobytrap at a time. Give a

student holding either the jellyfish, salmon, crab, or kelp the corresponding boobytrap card as follows: Replace jellyfish card with plastic bag; fish card with fish entangled in a net; crab card with plastic pieces; drift kelp with fishing line.
2. Once a boobytrap card has been passed out, describe the corresponding scenario to the students as follows: The jellyfish now takes on its previously hidden form of a plastic bag, the sea turtles' favorite food. Thinking the jellyfish was a food item, the turtle actually swallowed a plastic bag and starved or choked to death; the sea lion was chasing a fish and did not see that the fish was caught in a net, the sea lion then became entangled in the net and drowned or strangled; birds feeding on crabs mistook the brightly colored plastic pieces for their food items, fed them to their chicks which then starved; gulls scavenging in the drift kelp became entangled in fishing line and then were unable to fly or eat.
3. The student connected to the boobytrap card (e.g. sea turtle connected to jellyfish/plastic bag boobytrap) must lift the piece of yarn above his or her head because s/he has been removed from the food web.
4. Then have the students raise their piece of yarn, one at a time, as they feel the pull in the yarn web.
5. After each student has raised his or her piece of the yarn, review interdependence and the importance of each creature to a healthy food web and how different animals might be affected by the loss of one species.

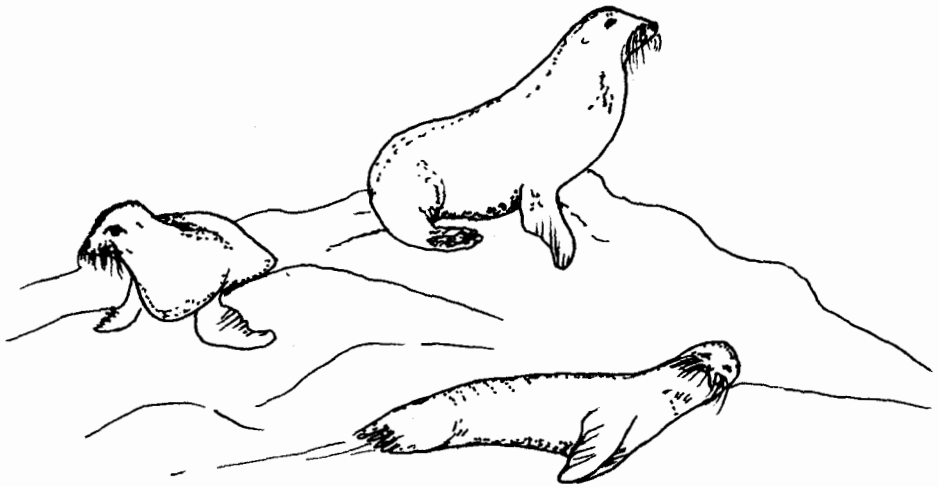
Assessment:
Discuss the following with the class:
1. What would happen to the sandy beach food web if each of the boobytrap cards were introduced?
2. What role(s) do people play in the sandy beach food web? Do people play only negative roles or are there some positive influences?
3. Why are our negligent actions out at sea (e.g., oil spills or dumping) of concern when studying the sandy beach habitat? (Answer: Currents transport substances dumped at sea over very long distances and both waves and currents deposit these materials on the beaches.)
4. What is the difference between food webs and food chains?
Give some terrestrial examples of each. How might these be interconnected with the sandy beach food webs?
5. Describe two different food chains found on the sandy beach. Do they overlap or are they independent of one another?

At-Home Learning:
1. Have the students choose a marine animal and use field guides or reference books to find out all they can about the animal. They should include in their report how marine debris is hazardous to their animal's health. Then have the students share what they learn with the class.
2. Also ask students to bring a piece of trash from home (trash that doesn't smell and is relatively clean) for tomorrow's activity.

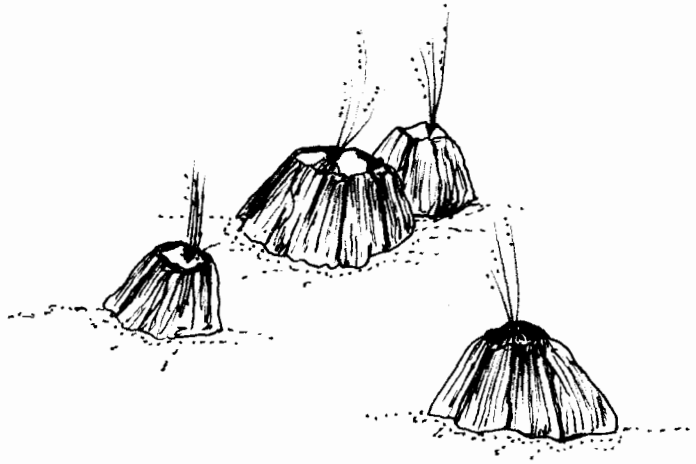
Source of the Activity:
Adapted from the "Adopt-A-Beach School Education Program" — a collaborative project produced by the California Coastal Commission, the Tarlton Foundation, and the San Francisco Recycling Program. The proverb came from *Wisdom of the Far East: A dictionary of proverbs, maxims, and famous classical phrases of the Chinese, Japanese, and Korean* by Young H. Yoo, Far Eastern Research and Publications Center, Washington D.C. (1972).



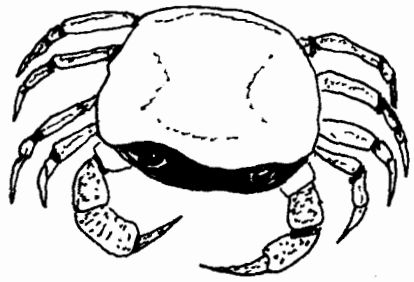
Kelp
Habitat: coastal waters
Diet: produces food from the sun and nutrients in the water



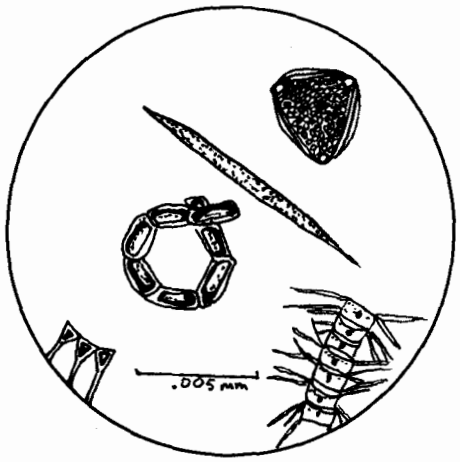
Sea Lions
Habitat: deep and coastal waters
Diet: squid, rockfish, small sharks, and rays



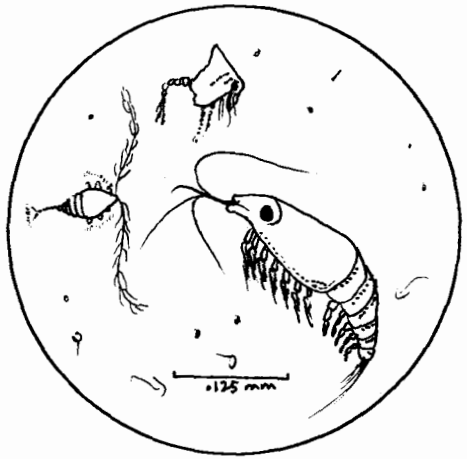
Barnacles
Habitat: attached to submerged surfaces such as rocks, in the ocean
Diet: zooplankton



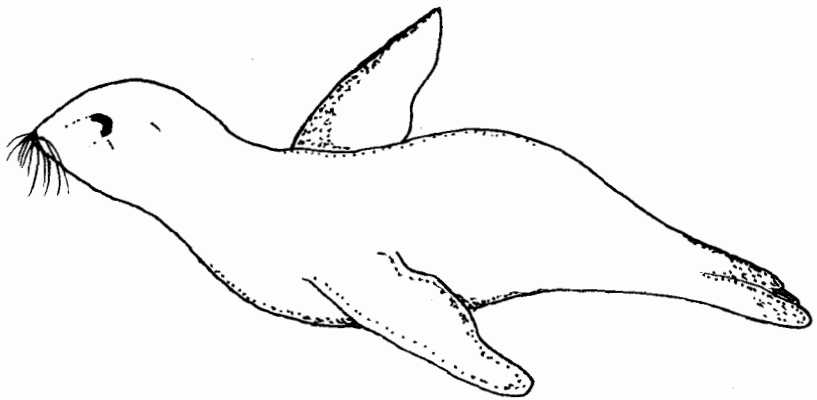
Shore Crabs
Habitat: tidal zones
Diet: decaying plant and animal matter



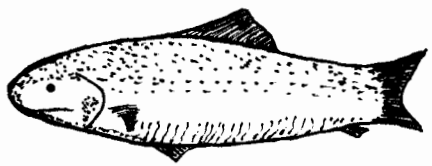
Phytoplankton
Habitat: floating in fresh or salt water
Diet: manufactures food from the sun and nutrients in the water



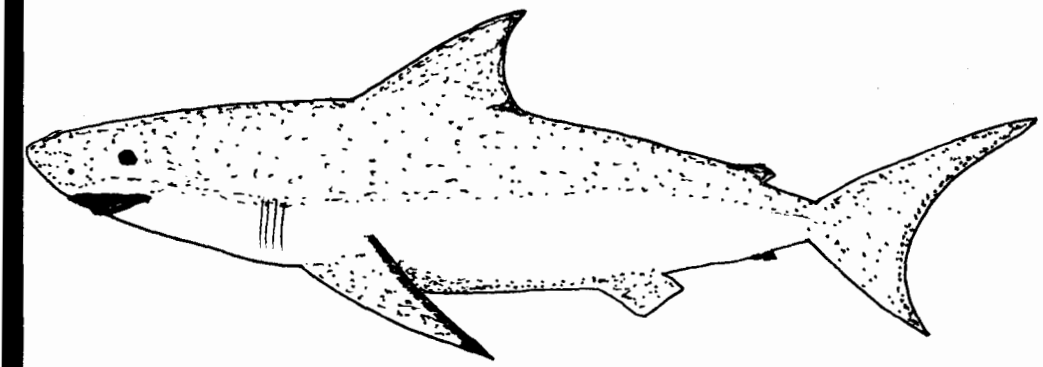
Zooplankton
Habitat: floating in fresh or salt water
Diet: phytoplankton and zooplankton



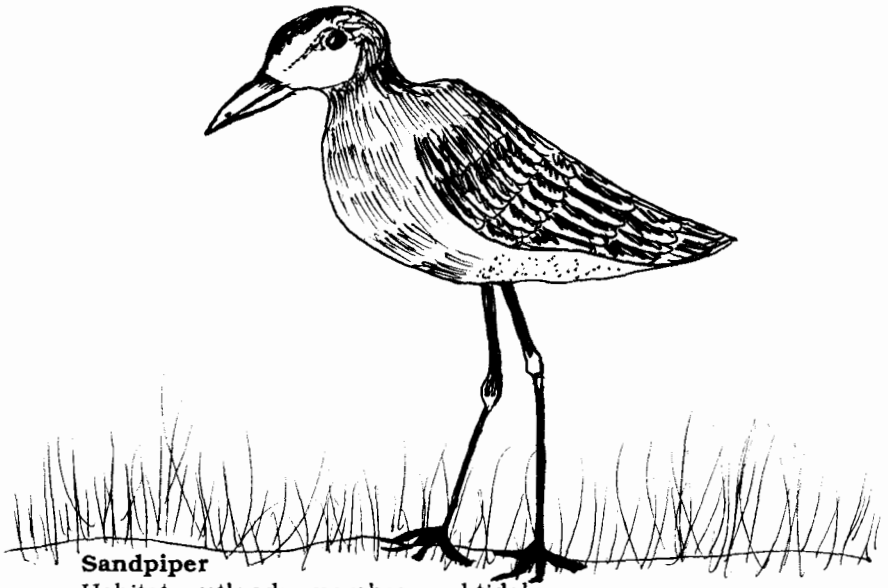
Seal
Habitat: coastal to deep waters
Diet: squid, rockfish, salmon, small sharks, and rays



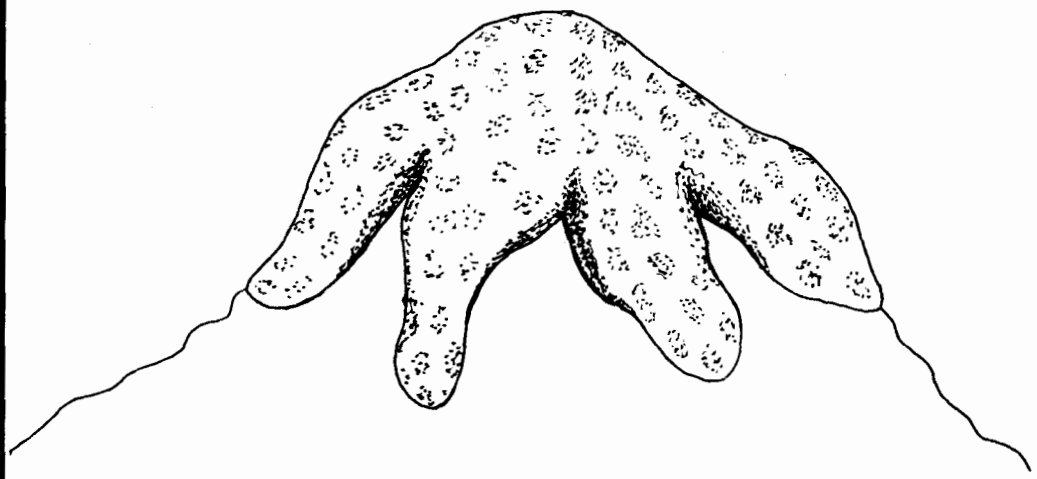
Anchovy
Habitat: coastal waters
Diet: phytoplankton and zooplankton



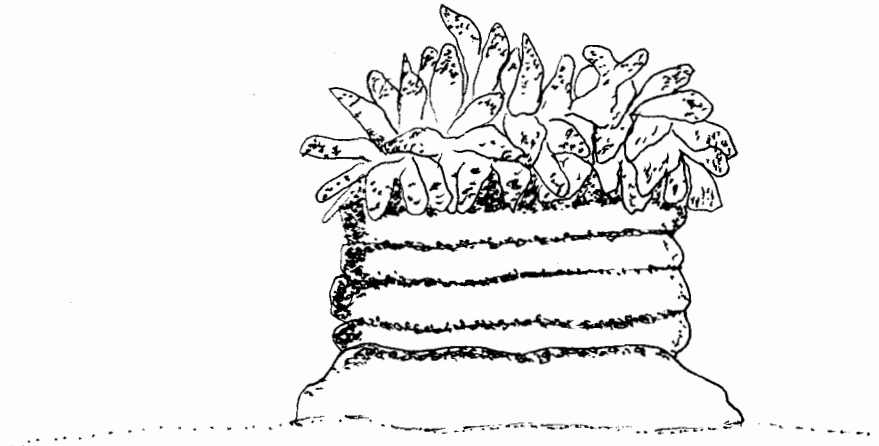
Shark
Habitat: Deep to coastal waters
Diet: Mackerel, rockfish, salmon, seals, and other mammals



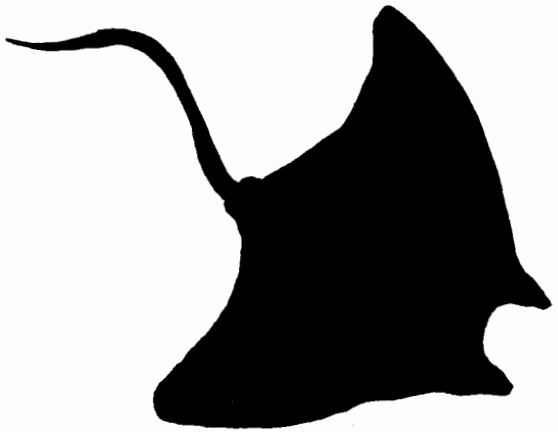
Sandpiper
Habitat: wetlands, marshes, and tidal zones
Diet: crabs, snails, and worms



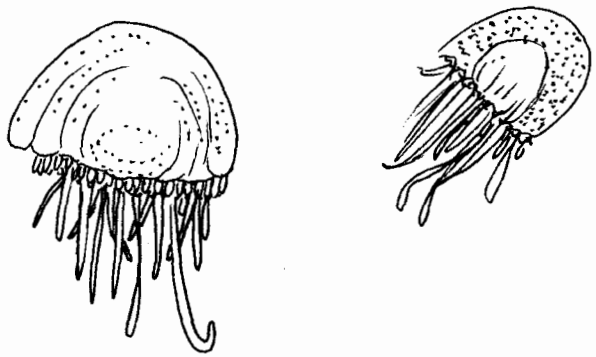
Sea Star
Habitat: Tidal waters and tidepools
Diet: Urchins, barnacles, and periwinkles



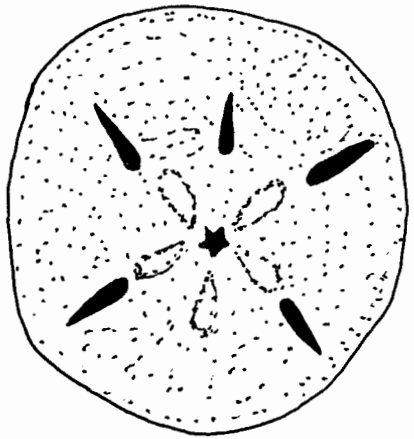
Sea Anemone
Habitat: tidal waters and tidepools
Diet: phytoplankton and zooplankton



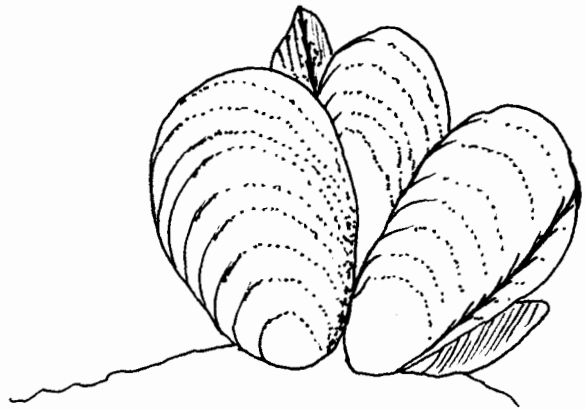
Ray
Habitat: sandy bottom of ocean
Diet: sea stars



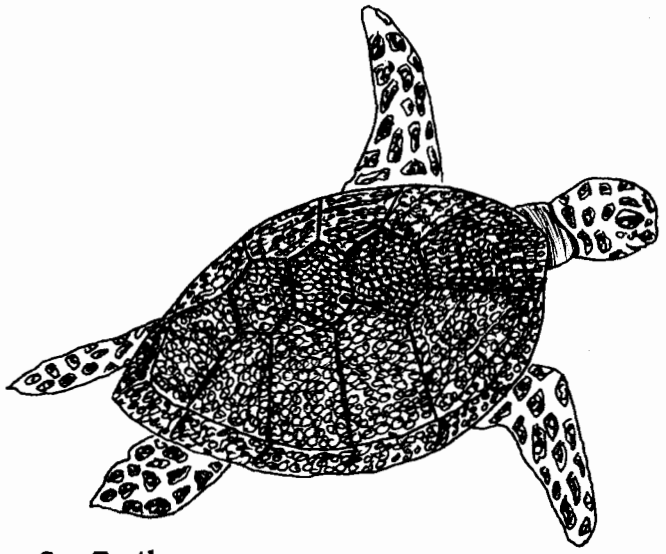
Jellyfish
Habitat: near shore waters
Diet: zooplankton and phytoplankton



Sand Dollar
Habitat: tidal waters and tidepools
Diet: phytoplankton

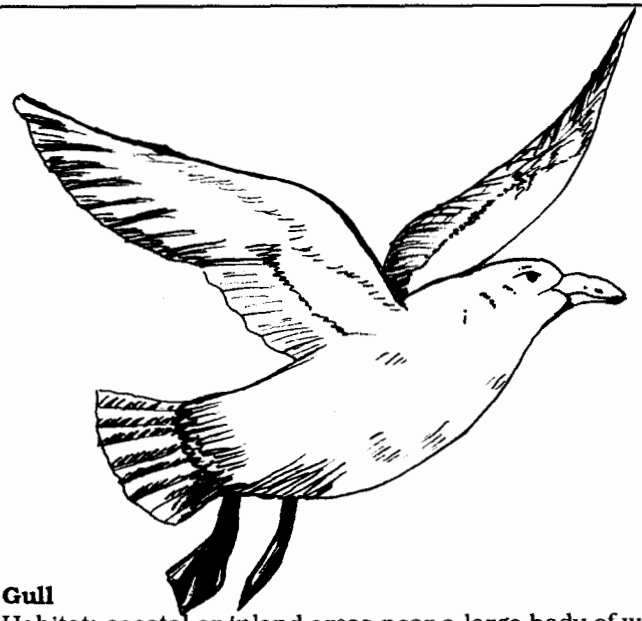


Mussels
Habitat: tidal waters and tidepools
Diet: zooplankton

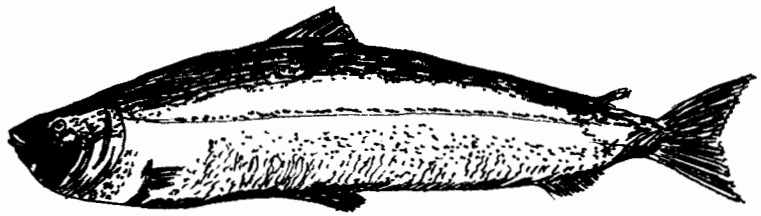


Sea Turtle
Habitat: near shore waters, usually tropical
Diet: jellyfish, algae, coral, and sponges

People
Habitat: land
Diet: shellfish, kelp, sea turtles, fish, crabs, jellyfish, sea anemones, etc.

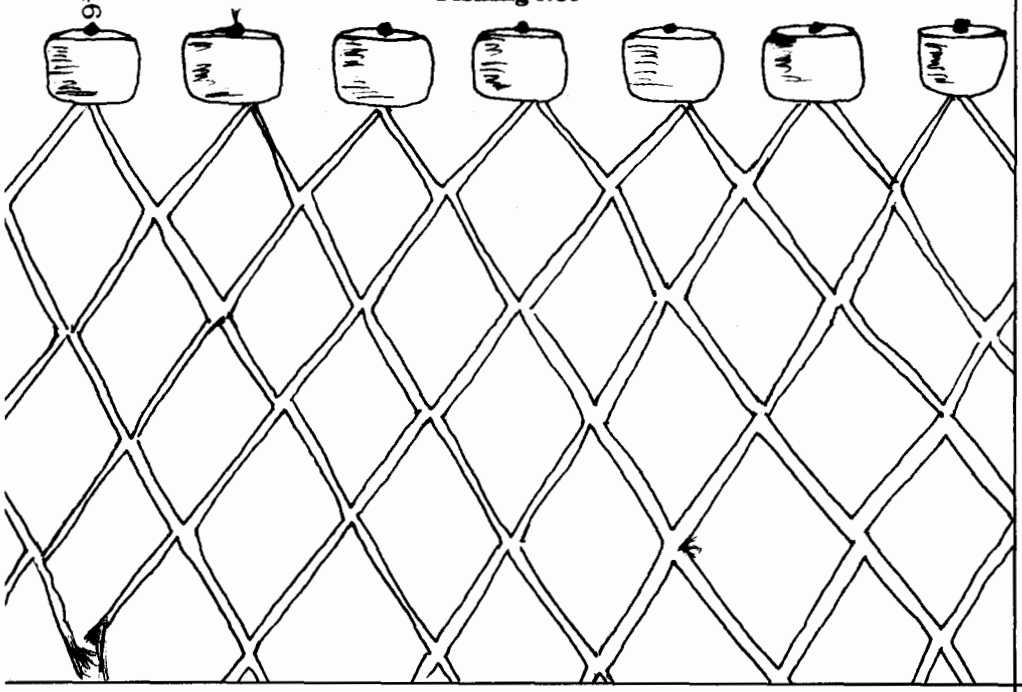


Gull
Habitat: coastal or inland areas near a large body of water
Diet: herring, anchovies, squid, and sardines



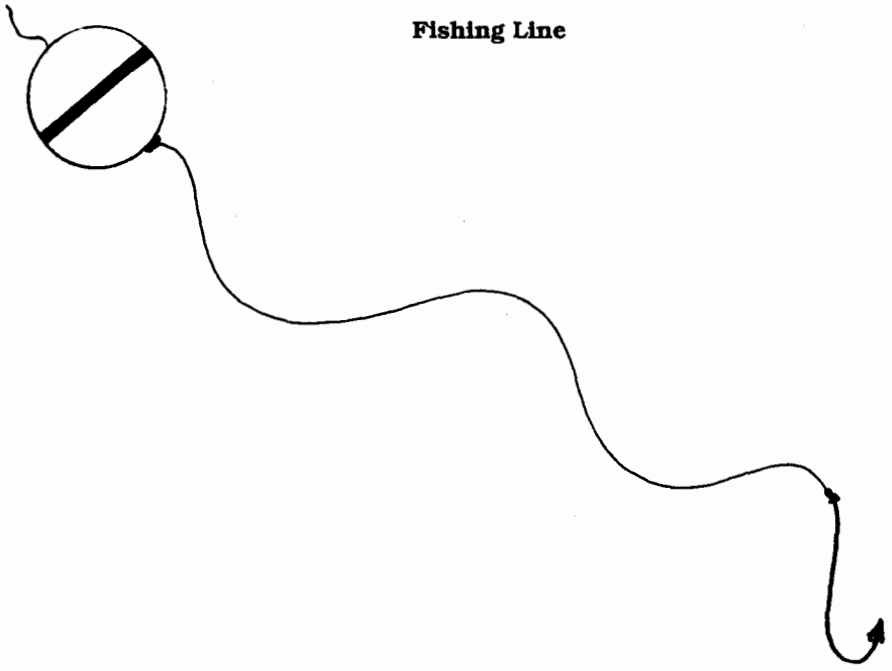
Salmon
Habitat: coastal waters and fresh water streams and rivers
Diet: squid, anchovy, rockfish, herring

Fishing Net

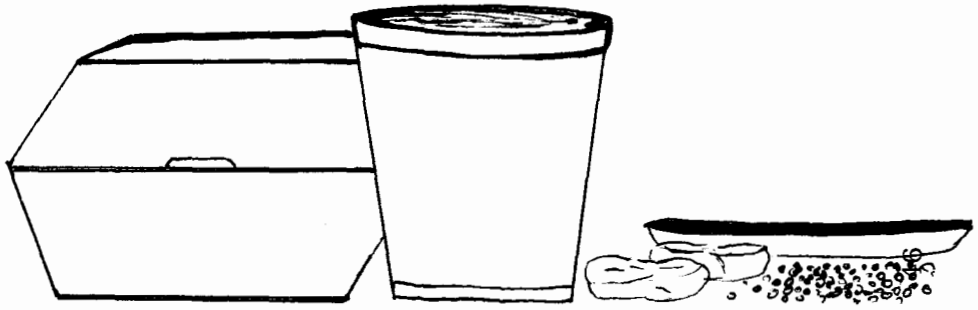


Plastic Bags

Fishing Line



Polystyrene/Plastic Pieces



TOO MUCH TRASH!

"However far the stream flows, it never forgets its source." Yoruba proverb

****
Age: Grades 7-8
Subjects: Science, Math, Social Science
Conceptual Framework: Science Framework: The application of scientific knowledge changes the world; humans affect the ocean ecosystem.

Mathematics Framework: Collecting, organizing, and describing data is important for understanding and solving problems.

History-Social Science Framework: Understanding what is required of citizens in a democracy.

Skills: applying, classifying, comparing, describing, evaluating, predicting, social participation skills
Duration: 50 minutes (parts 1 & 2); part 3 is an at-home activity followed by a short class discussion the next day
Setting: indoors
Key Vocabulary: solid waste, landfill, polystyrene, recycle
****

Objectives: Students will be able to: 1) perceive the immense quantity of solid waste that we generate and how this relates to the problems of burgeoning landfills and marine debris; 2) consider what happens to trash that is improperly discarded; and 3) discuss recycling, reusing, rethinking, and reducing as solutions to the solid waste problem as well as the problem of marine debris.

Method: Students participate in a trash/landfill activity that demonstrates the solid waste problem. Students also discuss the relationship between trash and storm drains. Finally, students discuss and apply the concepts of recycling, reducing, rethinking, and reusing to the trash that they have brought from home.

Background: Our trash is disposed of in landfills, which are limited in number and capacity. The landfills in the United States are filling up so rapidly that we face a serious landfill shortage in the next decade. Each man, woman, and child in this country now produces 3-7 pounds of trash per day. This massive amount of trash is collected by the garbage companies and taken to a transfer station where it is sorted, compacted, and loaded into large double rig trucks. From the transfer station it is driven to a landfill site. Ultimately, the cost of transporting and disposing of trash at the landfill is paid for by us.

It is important to remember that trash anywhere has the potential to become marine debris. People don't realize that trash they produce in their homes and communities can reach the ocean via streams, rivers, and other waterways. One way this occurs is via storm drains — storm water runoff flows into the street drains and then through pipes to the nearest body of water. Litter is inadvertently carried along with the water runoff. Marine debris also comes from more obvious sources, of course, such as littering while at the beach or on a boat.

What, then, makes up our trash and why is there so much of it? Trash is anything that is thrown away. Every day we throw out great quantities of valuable materials. Paper, which is often tossed out after only one use, makes up 34% of our municipal trash by volume. Yet paper can be reused in different ways and then recycled. Cans, glass, and some plastics can all be recycled and in some cases reused before recycling. Yet these items abound in our landfills. In addition, one-third of our nation's trash by volume is packaging. Packaging is often composed of non-reusable or non-

recyclable materials. Also, some packaging for consumer goods is much larger than the product it holds in order to attract attention and increase sales.

By becoming more aware of what we throw away, we can find ways to both reduce the amount of waste we produce and decrease our consumption of natural resources. Items that are reusable and recyclable can be identified and removed from the waste stream. Recycling centers in many cities and towns are now equipped to accept cans, bottles, aluminum, paper, and some plastics. With an awareness of recyclable materials, students can easily reduce their contribution to the trash crisis by reusing or giving items they no longer want to a local charity, by selecting products that have the least amount of packaging and/or have been made from recycled materials, by buying recyclable items in place of non-recyclable items, and by recycling. By rethinking about the types of products we buy and through the reuse and recycling of goods, our nation saves valuable energy, resources, money, and land. At the same time, we protect the ocean and its inhabitants from marine debris.

Materials: The day before this activity takes place, instruct your students to bring to class one piece of trash from their homes. You many also want to bring some trash that has the recycling symbol, so you can point out what the symbol looks like. Have an extra bag on hand so that recyclable trash can be collected separately and taken to a recycling center afterward.

Procedure:

PART 1: Trash/Landfill Demonstration

1. Now discuss trash. Americans throw away anywhere from 3-7 pounds of trash every day. Included in the trash are hazardous products such as motor oil, pesticides, household cleaners, solvents, and hobby supplies. Here are more statistics: the average American family produces about 100 pounds of trash every week. For every 10,000 tons of waste materials recycled, 32.6 jobs are supported, compared to only 6.46 jobs supported when this much waste is landfilled. Of the garbage Americans throw out, half could be recycled—enough to fill a football stadium from top to bottom every day. By volume the United States' municipal solid waste consists of 34% paper (mainly computer paper and telephone books), 14% food and yard waste, 12% metals, 2% glass, 20% plastics, and 18% other materials. At the 1991 National Beach Cleanup volunteers recorded the items collected during the cleanup of which 59% was plastic, 12% metal, 12% glass, 11% paper, 3% wood, 2% rubber, and 1% cloth. Plastic, the largest percentage of debris recorded, is also the most dangerous type of trash to wildlife.
2. Where does it all go when you throw it away? Have students describe what they think happens to the trash after they throw it away. Have any of them been to a landfill or transfer station? Diagram on the board where trash goes using simple sketches and arrows: from student to wastepaper basket to school dumpster to garbage truck to a transfer station to semi-truck and trailer to the landfill site.
3. What about trash that has not been properly disposed of? Where does litter on the street go, for example? Have your students ever seen litter near a storm drain, or have they looked down into a storm drain and seen trash? Have students give their own descriptions of what storm drains are designed to do. Now diagram a storm drain system on the board: from litterers to street to gutter to storm drain to pipes connecting to nearby waterways. In addition to trash, after a rain what else do your students think storm drains will carry to the nearest body of water (hazardous wastes such as motor oil, leftover paint, herbicides and pesticides from lawns and gardens, pet droppings)?

PART 2: The "Five R's:" Rethink, Reuse, Reduce, Recycle, and Remember

1. Display all the trash your students have brought on a table in the front of the class. Now discuss the possible alternatives to throwing away trash that will help to reduce the overcrowding in landfills as well as help with the problem of marine debris. As you discuss each alternative (rethink, reuse, reduce, and recycle), make a list of your students' suggestions to be posted in the classroom.
2. Begin with the concept of rethinking. Think about the product's packaging and how they will dispose of it before purchasing the product.
3. Now discuss reducing. This refers to the reduction of waste before it is even generated. Have your students apply this idea to the "display" trash. (For example: write on both sides of paper; use a refillable pen instead of a disposable pen; use a glass or plate instead of paper cups and plates; use a sponge instead of paper towels; use cloth bags instead of plastic or paper bags; use a thermos instead of a juice box; buy products in bulk quantities; buy products with less packaging; buy products packaged in recycled materials.)
4. Discuss the idea of reusing items before they are recycled or thrown out. What is reusable of the trash that is on "display?" (For example: use a lunch sack for more than one day; bring lunch in reusable containers; use containers, such as shoe boxes and margarine tubs, for other uses.)

5. Ask your students to define recycling (reusing waste to make new materials). What types of packaging on "display" are recyclable? (paper, glass, aluminum, tin, some plastics)
6. Do any of the cans or bottles have a redemption mark on them? (Explain to your students that some states have established bottle bills or redemption laws to promote recycling.) Have any of your students been to a recycling center?
7. Does any of the "display" trash have a recycling symbol? If not, show your students the recycling symbols. The three arrows of the symbol represent the three stages necessary to recycle materials: collect, remake, reuse. First the recyclable materials need to be collected, then sterilized and/or ground, melted, and reformed into a product, and finally reused again.
8. Divide the students into groups and have each group make a list of all the trash items on display. Next to each item have the group label the trash as disposable, recyclable, or reusable. Then have the students list alternative packaging options for the disposable items.
9. If your community has a curbside recycling program, obtain the information from your solid waste management agency and share it with your class.
10. Talk with your students about instituting these ideas in their homes. Will they rethink, reduce, reuse, recycle, and remember? Why or why not?
11. Clearly identify the kinds of trash that will be recycled during the beach cleanup: glass, aluminum, tin, and plastic soda bottles. You most likely will not be able to recycle paper, because paper tends to get too sandy and moist when it is left on the beach. Hand out copies of "How to Recycle" (see Appendix A) to each student. Save the trash for the "Packaging Your Product" activity later in the week.

PART 3: Review logistics for tomorrow's beach cleanup. Have each student prepare a hypothesis and purpose for the beach cleanup.

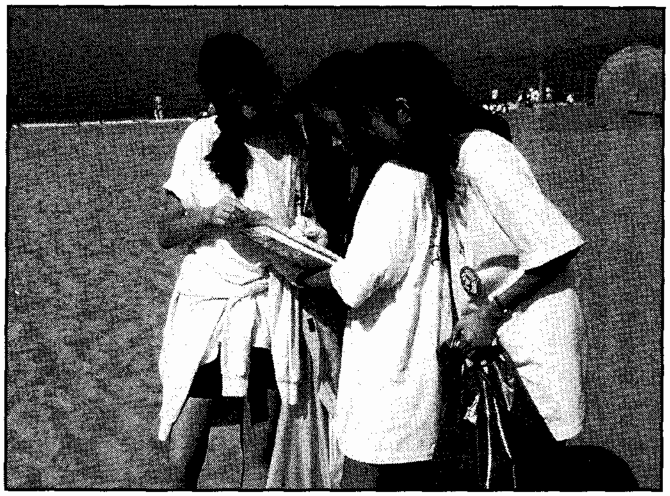
At-Home Learning:
In-Home Trash Survey
Have your students conduct a survey of their household trash cans. The students will record the types and amount of trash thrown out normally in one day, and then identify ways to reduce waste in their homes.
1. Have students itemize the trash on a tally sheet as reusable, recyclable, or throw-away (trash). For every item listed as reusable, include suggestions as to how it will be reused. For every item listed as trash, include suggestions as to what reusable or recyclable items could have been used in place of the trash item.
2. Have students compare their results with each other. Encourage students to implement some of their suggestions at home. Follow up by asking what worked for them. Was it easy? Did they find it difficult to change their habits? Did other members of the family cooperate? What was the most unusual thing they found in their trash?

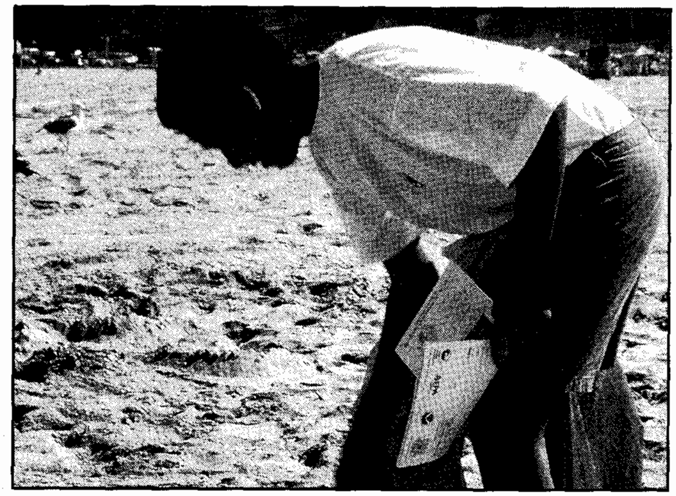
Extensions:
1. Watch the *Recycle This* video. The video promotes recycling through funny skits, songs, and game shows. You can show individual segments or the entire video. Students love it! (See Appendix I: Resources for details on ordering.)
2. Conduct a litter walk on the school grounds or in the school neighborhood.
3. Have the class visit the local landfill or transfer station to see where their trash goes. Combine the field trip with a tour of a recycling center near your school.
4. Do a class or individual research project on items that are advertised as degradable plastics. Do they degrade to a point where they essentially disappear? Do they break down into smaller and smaller pieces? Do they break down at all? Perform the following experiment: take various kinds of plastic to a nearby outdoor site where it will not be disturbed by people, be blown away by the wind, or harm wildlife. Set up an observation schedule for three months and note any changes in the various types of plastic; be particularly attentive to changes caused by sunlight, moisture, and temperature. How well did the plastic actually degrade? Is this the best disposal method for plastic trash compared to reducing/reusing/recycling?

The marine debris problem is essentially a litter problem. By making it socially acceptable to throw degradable plastics in the ocean, will that solve the marine debris problem? How fast do degradable plastics decompose? Is it fast enough so marine animals will not be harmed? Do degradable plastics decompose completely or do they degrade into smaller pieces? What about the ingestion problem? Do you think animals might mistake the degradable plastic for food?

Source of Activity:
Facts about garbage and recycling from the California Department of Conservation Division of Recycling's "Educator's Waste Management Resource and Activity Guide." The proverb is from *Quotations in Black* by Anita King, Greenwood Press: Westport, CT (1981).

MARINE DEBRIS SURVEY





****
Age: Grades 7-8
Subjects: Science, Math, Social Science
Conceptual Framework: Science Framework: Respect for nature develops form understanding how it works; living things and systems demonstrate a structure-function relationship; humans affect the ocean ecosystem.

Mathematics Framework: Physical materials, pictures, and diagrams are related to mathematical ideas; mathematics are used to draw logical conclusions; collecting, organizing, and describing data is important for understanding and solving problems.

History-Social Science Framework: Understanding what is required of citizens in a democracy.
Skills: analyzing, applying, classifying, computing, graphing (or charting), identifying, interpreting, small group work, social participation skills
Duration: Beach cleanup planning begins 4 weeks before the field trip to the beach; the actual cleanup requires 1-3 hours; part 2 requires a 50-minute class period the day following the cleanup.
Setting: outdoors and indoors
Key Vocabulary: sampling, data, transect
****

Objectives: Students will be able to: 1) demonstrate how they can play an important role in marine conservation by participating in a beach cleanup; and 2) conduct a survey of the debris on the beach.

Method: Students work in small groups collecting the trash off the beach (separating recyclables and non-recyclables as they go) and tallying the trash collected on data cards. In the next class period, the students summarize, graph, and discuss the significance of the data.

Background: It's time for a trip to the beach! Your students are now aware of the hazardous effects of marine debris on wildlife, as well as the different types of debris that exist, and what is and isn't recyclable. Let's transform this new found awareness into action with a beach cleanup and a marine debris survey. The beach cleanup will allow the students to participate in an immediate solution to the problem of marine debris while the survey will provide them with marine debris data to analyze. The activity will conclude with a discussion about the significance of the data.

During the Center for Marine Conservation's (CMC) annual International Coastal Cleanup volunteers go to the beach to pick up trash and record what they find on a specially designed data card. The information from the data cards is entered into the International Marine Debris Database and analyzed to determine the types and amounts of trash littering our beaches. This information helps identify the sources of the pollution, and inspire innovative programs and solutions. However, CMC only collects data from the annual beach cleanup that takes place each fall. If you plan on conducting your cleanup at another time of the year, we suggest that you still use the data card and analyze your results in the classroom in order to make a greater and more lasting impact on your students.

Materials: Trash bags for both recyclable and non-recyclable debris; "Beach Cleanup Data Card" and "A Guide to Good Data Collection" (see Appendix G), clip board and pencil for each buddy pair; your school's parental consent form and "Students' Checklist" (see Appendix E) for each student; and a first aid kit.

Procedure:

PART 1: Two Weeks Before the Cleanup

1. Select a beach for your cleanup. The beach should be sand or gravel and known to collect litter.
2. Call the beach manager to get permission to conduct a beach cleanup. The beach manager may also have beach cleanup supplies for you to use.
3. Arrange for the trash to be collected after the cleanup. The beach manager may be able to arrange this for you.
4. Begin assembling the materials and support you need.
5. Arrange transportation to the beach.
6. Send the school's parental consent form home with the students to be signed and returned.

PART 2: The Morning of the Cleanup

1. Review the following safety information with the students:
   1) No one will be allowed in or near the water on the trip.
   2) Keep your eyes on the ocean — when close to the water don't turn your back on waves.
   3) Everyone must stay with their assigned group.
   4) Call an adult immediately if a dangerous item (syringe, metal drums, chemical containers, medical waste) or stranded animal is found.
   5) Dress warmly and in layers — the beach is usually cooler than inland areas.
   6) Let everyone know the trip will be cancelled in stormy weather.
2. Collect parental consent forms.
3. Check weather conditions at the beach.

PART 3: At the Beach

1. Explain to the students that conducting a beach cleanup and recording data is similar to conducting a scientific experiment in the field.
2. Review the hypothesis and purpose of the beach cleanup that students prepared the day before.
3. Have the students divide into groups of 3 or 4 students. In each group, one student gets a data card, one student gets a recyclables bag, and the other students get trash bags. As the group walks down the beach and collects trash, the student with the data card records what they collect.

PART 4: Back in the Classroom

1. Have each group summarize their data into percentages by adding together the number of items in each category and dividing these numbers by the total number of items collected. Multiply by 100.
2. Have each group consider how to visually present their data. For example, some may want to create a pie chart while others may prefer to do a bar graph.
3. Have each group share their visual presentation with the class.
4. After the presentations, discuss the following with the students:
   1) How can the collected information be used?
   2) Why is it important to know the exact location of the debris and the date of the sampling?
   3) Where are the plastics coming from? Consider this for each kind of plastic debris.
   4) What about the other debris — is it being left by people on the beach, or is it being dumped from boats?
   5) What could we ask politicians to do about the problem of pollution?
   6) How does it make them feel to see the trash along the beach?
   7) How does it make them feel to see the beach clean after their work?
   8) What can each of us do to minimize the problem of ocean pollution?
5. Next have the students write a conclusion discussing the beach cleanup and their results.

Assessment:

Collect each student's beach cleanup report.

Extensions:

1. Write a story about your beach cleanup for the school or local newspaper.
2. Make a marine debris display for your school. Include some of the trash you found at the beach.
3. Present a slide show on the beach cleanup to your school or to other interested groups.
4. Design and conduct a survey of local boaters and fishers to find out how they handle their trash.
5. Design an informative handout or pamphlet about marine debris, using photographs if possible. Talk to boaters, fishers, and other marine users and give them your brochure.
6. Conduct studies of packaging. What kinds of packaging are polluting the sea? Are there alternatives to this packaging? Who puts warning labels on their packaging?
7. Ensure that all the local beaches and marinas have convenient, well-tended recyclable/trash containers. This can be an ongoing community service project. A local service group or the city may be willing to take on maintenance, if the students start the acquisition of the containers and set up the collection area.

PACKAGING YOUR PRODUCT

"The frog does not drink up the pond in which he lives." Indian proverb

****
Age: Grades 7-8
Subjects: Science, Social Science, Art
Conceptual Framework: Science Framework: Changing human needs and desires change the Earth.
History-Social Science Framework: Understanding what is required of citizens in a democracy.
Visual and Performing Arts: The arts can be used to vitalize and clarify concepts and skills.
Skills: observing, comparing, organizing, analyzing, relating, judging information related to a problem
Duration: 15 minutes (part 1); 60 minutes (part 2)
Setting: indoors
Key Vocabulary: packaging, natural resources, consumers, reusable
****

Objectives: Students will be able to: 1) define and clarify a problem by understanding that packaging contributes vast amounts of trash and is often wasteful of natural resources; 2) consider how packaging can either be avoided or redesigned to alleviate these concerns; 3) judge information related to the solid waste problem and distinguish between fact and opinion; and 4) attempt to solve a problem and draw conclusions.

Method: Students examine product packaging and identify various purposes served by the packaging. Students then rethink product packaging and design alternative packages that are less wasteful of resources and that minimize waste disposal problems.

Background: During the beach cleanup, a large portion of the trash the students collected was probably packaging waste. In previous activities we discussed the solid waste problem. Now make the connection between the solid waste problem and the marine debris problem. In the previous activities the students analyzed different types of trash. Now they can begin to tackle the marine debris as well as the solid waste problem by developing new or alternative types of packaging and by making consumer choices.

Manufacturers consider a number of factors when designing a package for their products. They prefer a package that most economically meets a number of requirements such as preservation of product quality, compliance with governmental regulations (Food and Drug Administration laws require that packaging for many products be designed to prevent spoiling and harmful tampering), appeal to the consumer, and promotion of their product.

Manufacturers know that consumers can be persuaded to buy a product if they are attracted to its package. Consumers look at the package size, shape, written messages, convenience of use, and color combinations to identify the product and select the one they want. In stores, packaging serves to advertise products and identify contents, and may be required to meet regulatory standards. During shipping, additional protective packaging is often required for ease of transport and product protection. Unfortunately, most packaging is disposable.

Discarded packaging is the single largest component of household waste. It makes up approximately one-third of the nation's trash, using up a major portion of our limited landfill space. The production of packaging alone uses tremendous amounts of valuable natural resources.

As consumers, we play an important role in determining the types of materials used in packaging. If we buy more of a product in a certain type of box, then the box stays. If we stop buying a product, the first thing to change is the package. We can influence types of materials used in packaging by buying products that are packaged properly but not excessively. It means considering the package when selecting products and avoiding those with excessive and disposable packaging. If we shop environmentally, manufacturers will need to respond by modifying their product's package to reflect these new concerns.

We can also voice our concerns about over packaging. The fast food industry is an example of how consumers effected business decisions. Consumers complained about the fast food industry's use of disposable and wasteful packaging and the industry reacted. McDonald's has stopped using foamed plastic hamburger containers, and now uses unbleached paper bags. Burger King paper bags contain post-consumer recycled paper. In turn, other fast food restaurants have also changed their packaging. We, as consumers, can help influence and change the type of materials used for and the method of packaging products.

Materials: a collection of packaged products such as pump toothpaste, lipstick, toy (unopened), laundry soap, disposable pens, and cereal box; some of the trash collected from the cleanup to display what types of packaging end up on the beach; some of the trash collected from the "Too Much Trash" activity; materials for design and construction of improved prototype packages (non-toxic markers, cardboard, newspaper, crayons, construction paper, white glue or paste, tape and/or staplers, and paperboard (old cereal boxes); and one copy per group of the "Packaging" handout (attached).

Procedure:

PART 1: Packaging Demonstration and Discussion

1. Describe various examples of packaging.
2. Ask the class for other examples of packaging. List the examples on the board. Discuss the list. Could less packaging be used?
3. Discuss alternative packaging methods for these items. Could the product be packaged in recyclable or reusable materials? Could the packaging be made from a renewable resource in place of a non-renewable resource?
4. Broaden the discussion to other products, such as newspaper or foamed plastic stuffed in a shipping box; milk bottles, paper milk cartons, and plastic milk jugs; candy boxes, candy wrappers, and plastic bags of candy; butcher paper or foamed plastic with plastic wrap for meats; toys in individual plastic hanger display cases and toys sold from a large container; fast food and canned food; foamed plastic and paper egg cartons, etc. Identify the most wasteful and the least.
5. Packaging makes up the largest single component of household solid waste. What will happen to packaging that is not reusable or recyclable? Can your students think of any products that do not require packaging?
6. Ask your students if they can think of any packaging that their families already reuse (shoe boxes, some plastic bags). How can they reuse or recycle other types of packaging after using the product? Can they think of ways to acquire less packaging when shopping?

PART 2: Packaging Study, Design, and Presentation

1. Divide students into groups and have them select an item from the trash display. Give each group a copy of the "Packaging" handout. Discuss the functions, benefits, and drawbacks of packaging including information on purposes, use of natural resources, recyclability, shelf life, biodegradability, disposal, and production of pollutants. Use products displayed in each category to illustrate your discussion. Ask someone from each group to identify one benefit and one drawback of the packaging for the products assigned to their group.
2. Supply each group with scratch paper — one to write on and several to sketch on. (When reusing paper it works well to have students draw an X across the used side of the paper and then turn it over and use the blank side.)
3. Ask each group to describe if it can be recycled and/or reused. For instance, an oatmeal box can be reused as a household container and then recycled to make paperboard. A glass bottle can be recycled to make new glass. Plastic-coated paperboard packages cannot be reused or recycled.
4. Have students answer the following questions: Why do they think the producer packaged the product this way? Is the product breakable? Will the product spoil? Do consumers need to see the inside of the package in order to decide to buy the product? Is the packaging necessary only during shipping (fruits and vegetables) or just until the product is purchased (plastic wrap on a cassette tape) or must it last until the product is used up (milk carton)? Is the packaging needed to protect the public from harm (child-proof bottle)? Is it lightweight for low cost shipping? Is the package designed for consumer convenience (individual instant soups)? Is the package bulky, making it more noticeable? Is the packaging material costly

or inexpensive? What are the most important purposes of the packaging (to protect the product from breaking, to keep the product sanitary)?
5. Have students design a package for their chosen product which is less wasteful of natural resources than the original package. Have them develop additional design specifications for the packaging such as whether the packaging will be reusable or recyclable. Have them describe what their package will be made of and what will be written on the outside. The package design should include information explaining how the consumer can reuse and/or recycle the package. And, it must serve all the important purposes of packaging for their chosen product. Allow time for students to create these new packages. Encourage creativity. Students can produce a three-dimensional model, a drawing, or a package label to illustrate their idea for improved packaging.

Assessment:
Ask students to present their prototype packaging to the class. Have them explain the reasoning behind their design.

At-Home Learning:
Have each student write a letter to the manufacturer of a poorly packaged product explaining that your class does not support the practice of over-packaging and make suggestions for better packaging. Write a second letter to the manufacturer of one of the products identified as having a better package and congratulate them on the packaging, explaining why your class preferred their package over the competitor. Mail the letters.

Extensions:
1. Conduct an informal survey of plastic packaging versus other packaging materials commonly used for commercial products. Visit one or more stores and look at the products on the shelves. Is plastic widely used? Which types of plastic are the most common? Are the amounts and types of packaging appropriate for the products? Evaluate a shelf of products for the appropriateness of the packaging used.
2. Make a display of alternative packaging. Have students bring examples of poorly packaged products and similar products in more appropriate packages (for example, a tiny bottle of shampoo and a large bottle of shampoo). Have the students write a short explanation of the benefits and drawbacks of the packaging on 3x5 cards to display next to each example.

Source of Activity:
Adapted from "A-Way With Waste: Second Edition," Washington State Department of Ecology. The proverb is from *Earth Speaks* by Steve Van Matre and Bill Weiler, Institute for Earth Education: Warrenville, IL (1983).

Packaging

Benefits of Packaging

Preservation of contents
Protects contents from damage
Sanitation
Safety
Identification of contents
Prevention of theft
Instructions for product use
Compliance with regulatory standards
Convenience

Drawbacks of Packaging

Disposable packaging is rapidly filling our landfills (we have fewer places to put all this garbage!)
Production of packaging consumes energy
Production of packaging often produces toxic wastes
Disposable packaging consumes and wastes our natural resources
Packaging can mislead consumers as to the quantity of a product
Packaging increases the cost of the product to the consumer
Some types of packaging if disposed of improperly endanger wildlife

Less Wasteful vs. More Wasteful

No packaging	Excessive packaging
Large quantity of product per package	Small quantity of product per packaging
Recycled paper products	New paper products
Recyclable plastic	Non-recyclable plastic
Recyclable material	Degradable material
Paper products	Plastic products
Recycled glass	New glass
Recycled aluminum	New aluminum
Recycled metals	New metals
Renewable resource	Non-renewable resource
Recyclable paper	Non-recyclable paper or paper difficult to recycle (glossy magazine, waxed paper, plastic coated paper)

STENCILING STORM DRAINS

"All water runs to the sea." proverb

****
Age: Grades 7-8
Subjects: Science, Social Science
Conceptual Framework: Science Framework: Humans affect the ocean ecosystem; respect for nature develops from understanding how nature works.
History-Social Science Framework: Understanding what is required of citizens in a democracy.
Skills: applying, identifying, observing
Duration: two 50-minute periods
Setting: outdoors
Key Vocabulary: source, storm drain
****

Objectives: Students will be able to: 1) understand that storm drains are connected to water systems and can be a significant source of marine debris; and 2) inform others in their community via a storm drain stencilling project.

Method: Students locate and stencil storm drains to make others aware that storm drains are connected to water systems and are not to be used as trash receptacles!

Background: Where did all the trash on the beach come from? As discussed in previous activities marine debris originates from many sources, and one of those sources is city storm drains. Many people are unaware that a connection exists between sewer systems and the marine environment. A community's sewer system is typically made up of two different networks of pipes. One network handles sewage coming from sources such as kitchen sinks, toilets, and washing machines. These pipes carry waste materials to a larger network of pipes leading to a sewage treatment plant where sewage is separated into sludge (solid waste materials) and water. The sludge is compacted, then landfilled, incinerated, or marketed as an environmentally beneficial product, while the leftover water is discharged into a river or other nearby waterway.

The other network of pipes carries runoff storm water from streets to nearby bodies of water such as streams, rivers, and oceans. There is generally no screening process associated with this system, so litter carried into the pipes with storm water runoff will also end up in the receiving bodies of water. These pipes are designed to carry storm water runoff from one point to another and are not meant to transport street litter and other types of debris.

In some communities (usually those with older sewer systems) the sewage system and the storm drain system are connected and together are called a combined sewer overflow or CSO. During storms, the volume of storm water entering the sewer system can exceed a sewage treatment plant's intake capacity causing a combined sewer overflow. When this occurs, an emergency overflow valve is activated and a certain amount of effluent, including sewage, bypasses the plant and is discharged into a river or other nearby waterway that will eventually run into the ocean. Thus, during periods of wet weather, there is a chance that untreated sewage, as well as litter carried in storm water, can enter the ocean. Because of possible sewage overflows and the release of inadequately treated sewage, citizens need to control the types of materials that enter the sewers by not using sinks, toilets, and storm drains as trash receptacles.

Storm drains and CSOs are significant sources

of marine debris. The concept that is most important to remember, however, is that these pipes were designed to carry storm water runoff and sewage from one point to another, not to transport street litter and other types of debris. It is essential to recognize then, that sewer systems and storm drains are a source of marine debris only to the extent in which people use them as receptacles for inappropriate waste.

Materials: For painting: stencils, paint that meets your state's standards, paint stir sticks, paint brushes (3") or environmentally approved spray paint (water-based, outdoor paint containing no CFCs), wet paint signs, masking tape, drop cloths. For the debris: data cards, pencils, clipboards, trash bags, gloves, broom. For cleaning up canned paint: newspaper and rags, coffee cans and lids, mineral spirits or paint thinner (small amount). A map of the city's storm drains from the Department of Public Works.

To obtain a storm drain stenciling kit or to find out if there is a storm drain stenciling project in your area contact:
Million Points of Blight
Center for Marine Conservation
306-A Buckroe Avenue
Hampton, VA 23664
(804) 851-6734

or in California contact:
Adopt-A-Beach
(415) 904-5214

Procedure: (To save yourself time contact either the Center for Marine Conservation or the California Coastal Commission Adopt-A-Beach program to find out if there is a storm drain stenciling program in your area. If there is an existing program a lot of the preparation might already be done.)

PART 1: Preparation
1. Obtain written permission from the county, town, or city department that maintains the storm drains in your community. This is usually the Public Works or the State Highway Department. Contact them with the following information 6-8 weeks before the project: who is involved in the project and who is supervising it; what you will be doing; the exact wording of the message you'll be stencilling; the particular area or neighborhood you would like to stencil; the dates of the project; rain dates; (it must be at least 50 degrees Fahrenheit and the pavement must be dry in order for the paint to dry); the date you need to hear back from them; and the purpose of your project.
2. If necessary, follow up with a letter or phone call to the department. If you are interested in stenciling on federally owned property or on private property, be sure to get permission from the appropriate federal authority or landowner.
3. Once you have permission for the project, fill out a Stencil Order Form and return it to CMC. Your order will be filled within five days of receipt and sent out via regular mail. Once your project is finished, you need to promptly send the borrowed stencils back so that CMC can send them out to another group.
4. Design a flyer to alert neighborhood residents to the project and educate them about non-point source pollution. Include information on when, where, and why you are doing the stenciling, as well as the name and phone number of the project leader. Politely request residents to move cars blocking storm drains.
5. Obtain necessary materials for the project.

PART 2: Mapping the storm drains
1. Pass out copies of a map of the city's storm drains. Locate the storm drains your class is going to stencil. Map the path of the storm drains to the receiving body of water.
2. Discuss what happens when trash or other pollutants, such as oil, paint, and pesticides, enter the storm drain.
3. Explain to the class that they are going to stencil storm drains to educate the community about storm drains and non-point source pollution.
4. Design a flyer to pass out to businesses and neighbors located near the storm drains your class is going to stencil.
5. Make each student responsible for delivering a certain number of the flyers.

PART 3: The Day of the Project
1. You will need two to three people per storm drain. The data collection and the cleaning and stenciling of the storm drain should take 10-20 minutes per drain.
2. If the participants in your project are youths, we recommend one adult chaperone per 4-6 youths, and at least one supervisor present with any group at a storm drain. Extra caution should be taken not to spill any paint!
3. Wear old clothes, and HAVE FUN!

PART 4: Data Collection and Painting
1. The Center for Marine Conservation (CMC) is building a national database with information on storm drain contaminants. Please mark the pollut-

ants you find at the storm drains on a data card, **before** you clean the area and paint the drain. Use one data card for the entire group of storm drains that you paint. Once you are finished with your painting project, be sure to send the card back to CMC.

This information will help us keep track of both the number of storm drains stenciled and the types of non-point source pollutants around our nation's storm drains.

2. Determine where you want to stencil on the storm drains. For storm grates you may want to put the stencil in front. For other types of storm drains you may want to stencil on the horizontal and vertical portion of the catch basin or to the right or left side of the drain.

Once you decide where you want to stencil, be consistent on all the storm drains you paint.

3. Brush clean or sweep the area where the stencil will be, and put garbage into trash bags.

4. Lay the stencil flat and have someone hold it firmly in place. Apply a small amount of paint to the ends of the paint brush bristles. Dabbing the paint brush on the surface rather than using long strokes will help reduce the possibility of paint getting under the stencil. Be careful not to drip any paint on the sidewalk, curb, or street. If using spray paint, use quick, even strokes about 6 inches from the stencil.

5. Tape a "wet paint" sign to your stencil and move on to the next storm drain.

PART 4: Cleanup

1. After the paint is dry, remove the "wet paint" signs from all the storm drains.

2. Clean brushes using a small amount of mineral spirits or paint thinner in a coffee can. Wipe brushes on clean newspaper. Repeat until brushes are clean. Put newspaper into trash bags.

3. Re-use the thinner or mineral spirits for another project: let it stand in the coffee can for about a day so that the solids settle to the bottom. Strain through cheesecloth and re-use the liquid. Wrap the solids in newspaper and discard in the trash.

4. Remember to send the data card to CMC, 306 A, Buckroe Ave., Hampton, VA, 23664.

Source of Activity:

The proverb is from *A Treasury of Proverbs in 25 Languages* by Henry Davidoff, Random House: New York, NY (1946).

STORM DRAIN DATA CARD

Only one data card needs to be filled out for the group of storm drains you stencil.

Name

Street Address

City/Town, State, Zip Code

Phone Number - work or home?

Number of Storm Drains Stenciled

Name of Group

Number of Participants

City/Town, State of Stenciling

Date of Stenciling

Center for Marine Conservation
July 1992

Please return completed data cards to:
"Million Points of Blight"
Center for Marine Conservation
306-A Buckroe Avenue
Hampton, VA 23664

Potential Non-Point Sources
Mark the number of storm drains you stencil near a:

Business District

Farm

Golf Course

Residential Area

Service Station

Shopping Center/ Parking Lot

Other

Additional observations

Non-Point Source Pollutants
Keep track of the items found within 6 feet of each side of the storm drains you stencil by making tick marks in the areas below:

Grass Clippings

Leaves

Motor Oil

Paint

Pet Wastes

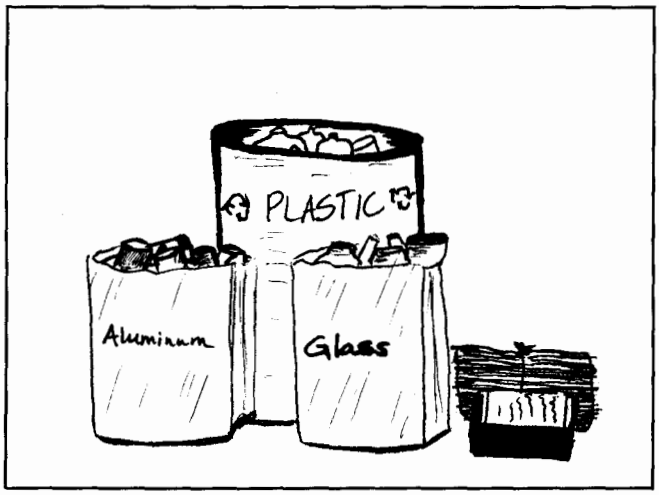
Street Litter/Plastics, including:

- Beverage bottles
- Beverage cans
- Caps/lids
- Cigarette butts
- Clothing/pieces
- Fast food containers

Street Litter/Plastics, cont.:

- Foam plastic pieces
- Newspaper/ magazines or pieces
- Paper bags/ wrappers
- Plastic or foam cups
- Plastic pieces
- Six-pack holders
- Straws
- Other

RECYCLING IN YOUR SCHOOL



"The water even from a great ocean comes from one drop at a time." Japanese proverb

★★

Age: Grades 7-8
Subjects: Science, Social Science, Language Arts, Art
Conceptual Framework: Science Framework: Application of scientific knowledge changes the world.

History-Social Science Framework: Understanding what is required of citizens in a democracy.

English-Language Arts Framework: Linking personal experiences and prior knowledge provides opportunities for building language skills and recognizing common background experiences.

Visual and Performing Arts Framework: The arts provide the sensory and perceptual input essential to the development of nonverbal and verbal communication; the arts can be used to vitalize and clarify concepts and skills.
Skills: analyzing, applying, communicating, evaluating, organizing, problem solving, group interaction
Duration: planning and start-up require 2-4 weeks; recycling requires 2 hours a week
Setting: indoors
Key Vocabulary: conserve

★★

Objectives: Students will be able to: 1) identify how they can be part of the solution to marine debris and establish a recycling program in their school; and 2) demonstrate how they can play an important role in reducing waste and conserving natural resources.

Method: Students identify objectives and goals of the recycling program; select an appropriate recycling program; prepare the school for recycling; and monitor the results of the program.

Background: Establishing a school recycling program allows students to incorporate the concepts covered on marine debris, conservation, and recycling into their own lives. At the same time, it gives students a chance to actively assert their own conservation commitment. A school-wide recycling program can accomplish the following: 1) develop an understanding of the importance of conserving resources through reducing consumption, reuse, and recycling; 2) provide an effective hands-on approach for environmental education and a model for life; 3) reduce school expenses by reducing consumption of paper products and reducing waste disposal costs; and 4) possibly generate a modest income for your school or student body.

Materials: Cardboard boxes, posters and signs, collection containers, and bins.

Procedure:

PART 1: Select a Recycling Team and Identify Goals and Objectives

1. The recycling team will assist the team leader with preparations and provide the people-power to run the program. Depending on the age or grade level, students can be in charge of some or most of the aspects of the program. The recycling team will require guidance from an adult to assure adequate day-to-day supervision of the program activities.
2. Before starting, the team should identify their primary purpose in organizing a school recycling program and set a goal. For example, if you want to earn money, then set a goal to earn $100.00 for a specified purpose. If you want to conserve limited resources, keep track of the petroleum saved by recycling plastics, or the energy saved by recycling aluminum. If you want to reduce garbage costs to the school, set a goal to reduce the volume of garbage by a set amount each month. Establish clear, attainable goals, and make them known to everyone from the start.

PART 2: Select a Recycling Program

The recycling team should choose a program designed to fulfill the primary objectives and goals outlined by the team. A little research is necessary to find the best recycling company for your needs. There are a number of recycling options open to your school:

1. Recycling collection service. This option provides relative convenience with moderate financial returns.
2. Deliver your own recyclables to a recycling center. This can be less convenient but provides greater financial return.

PART 3: Confirm Plans with the Administration

It is very important that you discuss and confirm

your plans with the school administration as well as with all others affected by the recycling program (the custodians, office staff, teaching staff, cafeteria staff, etc.). You will need to address the following:
1. What recycling company did you choose and why? You'll need to know how often recyclables will be removed from the school grounds, whether or not money will be earned, who is providing the bins, and where they will be stored.
2. Transportation to the recycling center. How will materials be removed from school grounds and by whom? The more convenient methods such as pick-ups at school are less profitable, but will still allow you to meet your non-monetary goals.
3. Storage of recyclables. How and where will the materials be stored? What will be done to assure cleanliness and safety?
4. Collecting recyclables. How many collection sites are needed, and where will they be located? How often will materials be consolidated into larger bins? Who will do this (recycling team, class monitors, custodians, etc.)?
5. Are janitors already recycling? Will you be taking from their reserve? How can you work together?

PART 4: Prepare Your School and Start Recycling
1. Your recycling team can do a lot to prepare your school for recycling. Advertise your goals, and announce the first collection day. Identify collection containers. Have students conduct short classroom presentations explaining the recycling procedures, create decorative cardboard boxes as classroom collection containers for paper, and make posters and signs for the school grounds to remind everyone to recycle.
2. Supervise the collection and consolidation of materials closely at the start. Give positive feedback to participants and remind teams of their responsibilities. Identify and resolve problems that arise as quickly as possible. Talk to school staff to assure smooth operations. Assist the operations until they blend in with other standard school procedures.

PART 5: Monitor Your Results
1. Have your recycling team record the accomplishments of your recycling program. Keep track of quantities recycled and the funds generated over expenses. These records can be used to document savings to the school resulting from reduced consumption, recycling sales, and reduction of garbage costs.
2. Use the data to rally additional support, to troubleshoot, and to give your students experience maintaining financial records.
3. If you are selling the recyclables to a recycling center, open an account for the money generated, and record how the money is spent. Celebrate and advertise your successes!

Extensions:
1. Do a waste characterization study at your school to find out what other items could be recycled. Identify ways to reduce waste production. Expand your present recycling program to include other things. For example, try setting up a compost pile to convert grass clippings and cafeteria wastes to soil.
2. Start a recycling club at your school to expand the recycling program into the community.
3. Look at what you and your school purchase, and identify where disposable or non-recyclable goods can be replaced by recyclable ones.

Source of Activity:
Adapted from the "Adopt-A-Beach School Education Program" — a collaborative project produced by the California Coastal Commission, the Tarlton Foundation, and the San Francisco Recycling Program. The proverb is from *Japanese Proverbs and Sayings* by Daniel Crump Buchanan, University of Oklahoma Press: Norman, OK (1965).

Adopt-A-Beach Goes Global

Name: Venice High School
Town: Venice, California

WHAT THEY DID

Summary

The students at Venice High School participate in the year-round California Adopt-A-Beach program, and their beach cleanup got them thinking about doing more for their school and their community. So they challenged another high school to a recycling contest.

Results

They enlisted beachfront merchants and businesses to save their recyclable containers for collection by the students. In a matter of weeks the students literally filled the classroom with more than 37,000 aluminum cans.

When cashing in their recyclables, the students decided to take their program one step further. The Venice High students took the proceeds and applied the money towards the purchase and protection of significant acreage of endangered Costa Rican rainforest.

SAVE OUR SEAS

Grades 9-12

MARINE DEBRIS: SOURCES AND IMPACT


"The fish trusts the water, and it is in the water that it is cooked." Haitian proverb

****
Age: Grades 9-12
Subjects: Science, Social Science
Conceptual Framework: Science Framework: Respect for nature develops from understanding how nature works; living things and systems demonstrate a structure/function relationship; humans affect the ocean ecosystem.
History-Social Science Framework: Understanding human and environmental interaction.
Skills: analyzing, evaluating, predicting, problem solving
Duration: 50 minutes
Setting: indoors
Key Vocabulary: marine debris, reduce, reuse, recycle
****

Objectives: Students will be able to: 1) understand what marine debris is and where it comes from; 2) describe the hazardous effects of marine debris on marine wildlife; and 3) consider solutions to the problem.

Method: Students watch the *Coastal Cleanup* slide presentation on marine debris and afterward discuss the various sources of marine debris. They also discuss waste reduction as one solution to the problem.

Background: Marine debris is trash found in the ocean or along its shores. Its source can be classified as either "ocean-based" or "land-based" depending on where it enters the water. Ocean-based debris is waste that is disposed of in the ocean by ships and petroleum rigs and platforms. The National Academy of Sciences estimates that ocean sources once dumped 14 billion pounds of garbage into the ocean every year. Contributors range from merchant, military, research, and commercial fishing vessels, to recreational vessels, offshore oil platforms, and supply vessels. Land-based debris, on the other hand, is debris that blows, washes, or is discharged into the water from land. Contributors include recreational beach-users, plastics manufacturers and transporters, inadequate sewage treatment operations, solid waste disposal activities, and illegal dumping. It is important to remember that land-based garbage has the potential to become marine debris. What people don't often realize is that garbage they produce in their homes and communities can reach the ocean, via sewer systems, streams, and rivers.

Besides the fact that trashy beaches and oceans look ugly, why should we be concerned with marine debris? Well for one reason, dirty beaches reduce tourism in the area and subsequently tourist revenue, so communities are forced to spend millions of dollars each year to clean their beaches. The cost of cleaning beaches increases every year. Marine debris is also dangerous to beach visitors and scuba divers. Beach visitors have required stitches from stepping on broken pieces of glass and metal buried in the sand, and scuba divers have become entangled in lost fishing gear.

But marine debris not only harms humans, it can be fatal to marine wildlife. Marine mammals, sea turtles, birds, and fish can become entangled in plastic fishing line, plastic strapping bands, six-pack rings, or other plastic trash. Once tangled, they may spend energy trying to get free, may become sick or weak, and even die. Certain marine animals can also mistake plastic debris for food, and die by ingesting it. Sea turtles mistake plastic bags for their favorite food, jellyfish, and birds mistake small pieces of plastic for fish eggs. Hu-

mans are responsible for this destruction wrought by marine debris and it is therefore up to us to bring the destruction to an end.

What can we as individuals do to help solve the hazardous problem of marine debris? The presentation mentions the obvious — participation in a beach cleanup. Other solutions include rethinking, reducing, reusing, and recycling trash (potential marine debris).

Materials: The Center for Marine Conservation's *Coastal Cleanup* slide show (see Appendix I: Resources) and one 3x5 card for each student.

Procedure:

1. Begin this unit on marine debris by presenting the *Coastal Cleanup* slide show to your students.
2. After the visual presentation, discuss the sources of marine debris. The presentation focused mostly on the ocean-based sources. Ask your students how else marine debris reaches the ocean — what are some additional land-based sources? What happens to all the trash they throw away? Where is "away?" How can this trash become marine debris? What about litter that they see in the streets and on the school grounds? (Pipes connected to storm drains often carry runoff storm water from streets directly to nearby bodies of water such as streams, rivers, and oceans. Consequently, they transport street litter to the nearest body of water as well.)
3. Now discuss with your students how they can become part of the solution instead of part of the problem. Soon, they will be participating in a beach cleanup as part of a class activity. What can they do to decrease the amounts of debris ending up on the beach? Write the list of solutions on the blackboard. They can rethink purchasing a product that is poorly packaged, reduce, reuse, and recycle trash, and remember that we can all make a difference. What kinds of trash are recyclable? Do any of the students recycle regularly? What about non-recyclable trash? Can these items be reused or can our use of them be reduced? Can the students come up with ideas to add to the following "Waste Reduction" list?
   * Reduce: Use a sponge instead of paper towels; use metal utensils, a glass, or a plate instead of paper cups and plates and plastic utensils; write on both sides of paper; buy products with less packaging (one-third of our garbage is packaging).
   * Reuse: Use a lunch sack for more than one day; bring lunch in reusable containers; reuse bags from the store; use containers such as shoe boxes and margarine tubs for other uses.
   * Recycle: Newspapers, bottles, plastic, aluminum cans, car batteries, paint, automotive fluids. Complete the recycling loop and buy recycled products.
   * Remember: We all can make a difference!
4. Copy recycling information in Appendices A and B to hand out to your students.
5. Hand out 3x5 cards and ask the students to write one thing they will do to help reduce marine debris. Collect the cards and tell them the class will review the cards at the end of the week, and then at the end of the semester to see who implemented their task.

Assessment:

Have students write a one-page summary on the sources and effects of marine debris.

At-Home Learning:

Assign a marine debris article for the students to read (to order see Center for Marine Conservation in Appendix I: Resources).

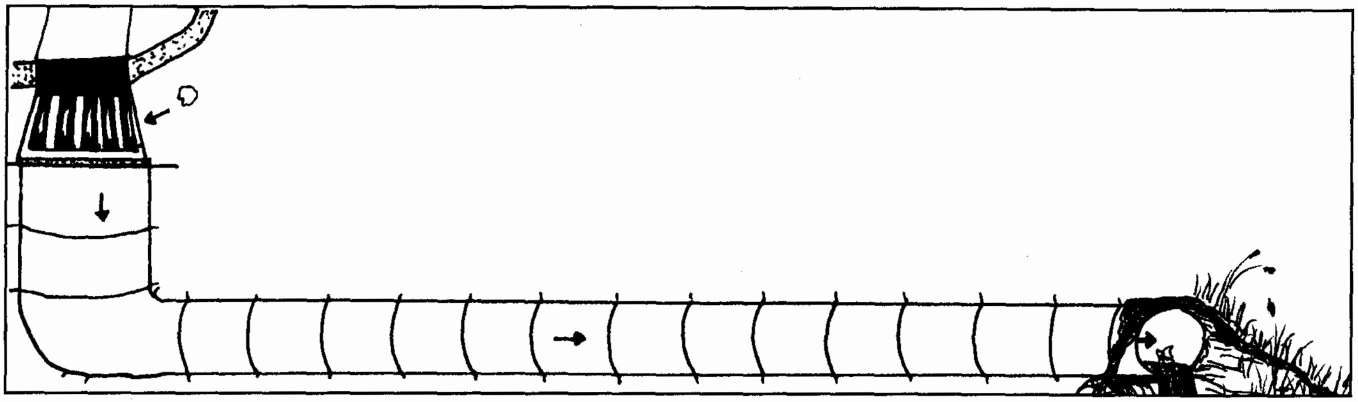
Extensions:

1. Design and conduct a survey of local boaters and fishers in order to find out how they handle their trash.
2. Design an informative handout or pamphlet about marine debris using photographs if possible. Talk to boaters, fishers, and other marine users.

Source of Activity:

The proverb is from *Quotations in Black* by Anita King, Greenwood Press: Westport, CT (1981).

SEARCHING OUT NONPOINT SOURCES OF POLLUTION



"The ocean is not choosy about a small stream." Japanese proverb

****

Ages: 9-12
Subjects: Science, Social Science
Conceptual Framework: Science Framework: Earth systems interact in cyclical patterns; respect for nature develops from understanding how nature works; humans affect the ocean ecosystem (adapted).

History-Social Science: Understanding human and environmental interaction.

Skills: analyzing, applying, classifying, comparing, evaluating, identifying, inferring, observing, problem solving
Duration: 50 minutes
Setting: indoors and outdoors
Vocabulary: point/nonpoint source pollution, runoff, sediment, pesticide, contamination, eutrophication, water quality, bioaccumulation, pathogens, carcinogenic

****

Objective: Students will be able to: 1) understand what nonpoint source pollution is and how it affects both water quality and water organisms; and 2) consider some solutions to the problem.

Method: Students study a local map to identify nonpoint sources of pollution, and discuss actions they can take as individuals to mitigate the problems caused by this pollution.

Background: Land-based marine pollution can either be from a "point source" or a "nonpoint source." Point source pollution originates from a specific place such as an oil refinery or a paper mill. Nonpoint source pollution, on the other hand, is contaminated runoff originating from an indefinite or undefined place, often a variety of places (e.g., farms, acid rain and airborne contaminants, and poor land development). The soot, dust, oil, animal wastes, litter (debris), sand, salt, and chemicals that constitute nonpoint source pollution often come from everyday activities such as fertilizing lawns, walking pets, changing motor oil, and driving. With each rainfall, pollutants from these activities are washed from lawns and streets into storm water drains that often lead directly to nearby bodies of water such as streams, rivers, and oceans.

While rarely visible, nonpoint source pollution is a chronic and ubiquitous form of coastal water contamination. The U.S. Environmental Protection Agency estimates that the primary cause of the pollutants in the ocean are not from point sources, but from various forms of runoff. The following table outlines examples of nonpoint source pollutants, their sources, and their effects.

Mitigating nonpoint source pollution is difficult, even if the multiple sources can be identified and located. Often solutions entail major changes in land-use practices at the local level and expensive methods to minimize runoff. However, nonpoint source pollution *does* offer individual citizens an ideal opportunity for combating marine pollution. By changing their everyday actions, individuals can help reduce the cumulative impact of nonpoint source pollution.

Materials: Local map of the community, and a map of the community's storm drain system from the Department of Public Works.

Procedure:

1. Have students identify the types of nonpoint source pollution that could be originating from their school and from the community. Pass out the "Examples of Nonpoint Source Pollution" handout

(attached). Study a local map to find areas where these types of pollution may originate. For example:

SCHOOL
* playground, football field (marine debris, fertilizers, pesticides)
* sewage system — restrooms, cafeteria, science classes (marine debris, excess nutrients, detergents, pathogens)
* parking lot (marine debris, heavy metals, oil)
* sidewalks and outdoor hallways (marine debris)

COMMUNITY
* farmland (sediments, excess nutrients, fertilizers, pesticides)
* construction sites (marine debris, sediments)
* residential areas (marine debris, fertilizers, pesticides, detergents)
* parking lots (marine debris, heavy metals, oil)
* parks (marine debris, fertilizers, pesticides)

2. Brainstorm with your students about actions they can take to reduce pollutants entering the marine environment. Here are some suggestions:
* Keep your car well maintained and free of leaks. Recycle used motor oil. Contact your state waste management agency for information.
* Do not pour chemicals down drains or toilets, because they may not be removed in sewage treatment and can end up contaminating coastal waters. Use non-hazardous alternatives whenever possible.
* Never dump chemicals on the ground or down storm drains because they might end up in the local stream, river, or bay.
* Properly dispose of trash in garbage cans. Litter can be carried by storm drains into local waterways.
* Walk pets in grassy areas or parks. Pet wastes on pavements can be carried into streams by storm water. Pick up after your pets.
* Don't dispose of leaves or grass clippings in your storm drain. Remember, storm drains usually lead to a body of water, and excess nutrients are a type of pollution. Instead, try composting yard waste.
* Landscape your yard to prevent runoff. Use as few pesticides as possible: try "natural" (non-toxic) approaches to pest control wherever possible and organic gardening techniques.

3. Pass out the "Safe Substitutes" handout.

Assessment:
Have the students map the types of nonpoint source pollution originating from their homes and list possible solutions.

Extensions:
1. Create a nonpoint source pollution display for your school and/or community.
2. Find out what types of pollutants your school is generating (e.g. detergents, pesticides, fertilizers). Educate the school staff about nonpoint source pollution and alternative products or methods of disposing of harmful chemicals.
3. Write to local or state representatives to find out what measures are being taken (or considered) at local and regional levels to address nonpoint source pollution.

Source of Activity:
Adapted from "Charting Our Course" — an activity guide produced by the State of Maine's Coastal Program. The proverb is from *Japanese Proverbs and Sayings* by Daniel Crump Buchanan, University of Oklahoma Press: Norman, OK (1965).

Watch out for these toxic ingredients

Degreasers: trichloroethylene (TCE), toluene, methylene chloride **Disinfectants:** o-phenylphenol, phenol chlorobenzene, diethylene glycol **Drain cleaners:** sodium hydroxide, potassium hydroxide, hydrochloric acid **Dry cleaning fluids:** TCE, perchloroethylene (PERC), 1,1,1-trichloroethane (TCA), naptha **Gasoline:** benzene, paradichlorobenzene **Oven cleaner:** methylene chloride, xylene, toluene, methyl ethyl ketone chloride, nitrobenzene **Spot removers or cleaning fluid:** carbon tetrachloride, 1,1,1-trichloroethane (TCA), trichloroethylene (TCE). perchloroethylene (tetrachloroethylene, PERC) **Toilet bowl deodorizer:** paradichlorobenzene **Upholstery cleaner:** TCE **Wood preservatives:** pentachlorophenols (PCPs), arsenic

Examples of Nonpoint Source Pollution

Pollutant Types	Sources	Effects
marine debris (plastics, glass, metals, wood)	runoff from roads, landfills, and parking lots into storm drains; sewer systems	can injure or kill marine life
sediments	construction sites; agricultural lands; logging areas; salt from roadway snow dumping sites	clouds water, decreases plant productivity; suffocates bottom-dwelling organisms
excess nutrients (e.g., lawn fertilizers, animal wastes, sewage)	livestock; gardens; lawns; sewage treatment systems; runoff from streets	prompts phytoplankton or algal blooms; causes eutrophication, depleted oxygen, and odor
acids, salts, heavy metals	runoff from roads, landfills, and parking lots; salt from roadway snow dumping sites	toxic to marine life and can bioaccumulate in organisms
organic chemicals (pesticides, oil, detergents, etc.)	forests, farmland; anti - fouling boat paints; homes(lawns); golf courses; sewage treatment systems; street runoff	toxic effects on wildlife and humans; possibly carcinogenic
pathogens (e.g., coliform bacteria)	municipal and boat sewage; animal wastes; leaking septic/sewer systems	causes typhoid, hepatitis, cholera, dysentery

Safe Substitutes

At Home

Air Fresheners
* For sink disposal odors, grind up used lemons
* For surface odors on utensils and chopping blocks, add a few drops of white vinegar to soapy water

Deodorizers
* For carpets, mix 1 part borax with 2 parts cornmeal; spread liberally, and vacuum after an hour.
* Sprinkle baking soda in the bottom of cat boxes and garbage cans

Dish Detergents
* Use mild, biodegradable, vegetable oil-based soap or detergent
* For dishwashers, choose a detergent with the lowest phosphate content

Disinfectants
* For disinfecting tasks, try 1/2 cup borax in 1 gallon hot water

Drain Openers
* Pour boiling water down the drain once a week
* For clogs, add a handful of baking soda and 1/2 cup of white vinegar to your drain; cover tightly and let sit 15 minutes while carbon dioxide bubbles work on clog; finish with 2 quarts boiling water; follow with a plunger
* For stubborn clogs, use a metal snake

Floor Cleaners
* For plain wood floors, use a damp mop with a mild vegetable oil soap and dry immediately
* For painted or varnished wood floors, combine 1 teaspoon of washing soda with a gallon of hot water. Rinse and dry immediately
* For vinyl floors, combine 1/4 cup white vinegar, 1/4 cup washing soda with 1 gallon of warm water, and mop
* For scuff marks on linoleum, scrub with toothpaste

Furniture Polish
* For finished wood, clean with a mild vegetable oil soap
* For unvarnished wood, polish with almond, walnut, or olive oil; be sure to remove excess oil
* Revitalize old furniture with linseed oil

Glass Cleaner
* Combine 1 quart water with 1/4 cup white vinegar

Laundry Detergent
* Avoid products containing phosphates and fabric softeners

Toilet Bowl Cleaners
* Combine 1/2 cup borax in 1 gallon of water for cleaning and disinfecting
* Clean frequently with baking soda

Tub and Sink Cleaners
* Use baking soda or a non-chlorinated scouring powder

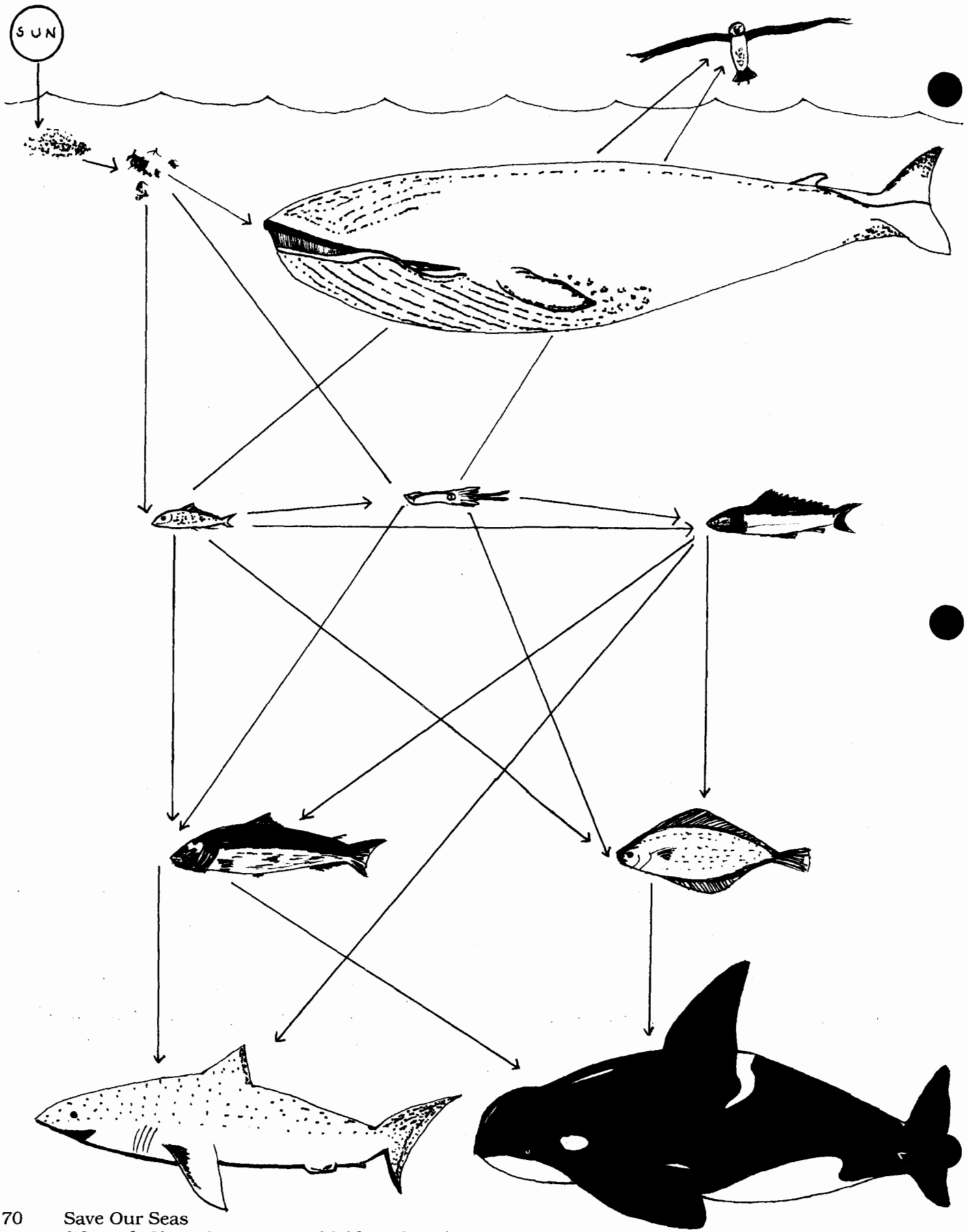
For the Garden

Garden Fertilizers
* Use materials from a compost pile
* Use organic soil additives such as peat moss, blood meal, bone meal, fish emulsion, manure, and seaweed

Garden Weed and Fungus Control
* For weeds, use less-toxic soap solutions/weed killers
* For fungus, use less-toxic sulfur-based fungicides
* To control powdery mildew on roses, spray both sides of rose leaves (in the morning, weekly) with a mixture of 2 tablespoons of mild liquid soap, 2/3 teaspoon baking soda, and 1 gallon water

Pest Control
* For outdoor ants, place boric acid in problem areas; For indoor ants and roaches, caulk entry points; Apply boric acid dust in cracks and insect walkways. Be sure it's inaccessible to children and pets (it's a mild poison to mammals)
* For garden aphids and mites, mix 1 tablespoon of liquid soap and 1 cup of vegetable oil; Add 1 teaspoon of mixture to a cup of water and spray. (Oil may harm vegetable plants in the cabbage family.)
* For caterpillars in the garden, apply products containing *Bacillus thuringiensis* to the leaves when caterpillars are eating
* For mosquitoes in the yard, burn citronella candles

Source: *Take Me Shopping; A Consumers Guide to Safer Alternatives for Household Hazardous Products* published by the Santa Clara County Hazardous Waste Management Program.



CONSIDER THE CONNECTIONS

****

Age: Grades 9-12
Subjects: Science
Conceptual Framework: Science Framework: Living things and systems demonstrate a structure/function relationship; Earth systems interact in cyclical patterns; life is diverse; respect for nature develops from understanding how nature works.
Skills: applying, reading, research, writing
Duration: 50 minutes
Setting: indoors
Key Vocabulary: abiotic, autotrophs, heterotrophs, ecosystem, primary producers, primary consumers, detritivores, trophic, food web

****

Objectives: Students will be able to: 1) understand the significance of food webs and the various roles involved in a food web; and 2) consider the concept of interconnectedness.

Method: Students construct a typical ocean food web, and then research a particular marine animal to find out its place in its "food web."

Background: Organisms within a community interact with each other and with the abiotic, nonliving, environment. In all instances, these interactions have two consequences: 1) a one-way flow of energy through autotrophs to heterotrophs which eat either autotrophs or other heterotrophs; and 2) a cycling of materials, which move from the abiotic environment through the bodies of living organisms and back to the abiotic environment.

The combination of biotic and abiotic components through which energy flows and materials cycle is known as an ecosystem. Taking a global view, the entire surface of the Earth can be seen as a single ecosystem. This view is useful when studying materials that circulate on a worldwide basis, such as carbon dioxide, oxygen, and water.

All ecosystems have at least three trophic levels: primary producers, which are usually plants or algae; primary consumers, which are usually animals; and detritivores, which are microorganisms that live on animal wastes and dead plant and animal tissues. The primary producers (the autotrophs) convert a small proportion of the sun's energy into chemical energy. The primary consumers (herbivores) eat the primary producers. A carnivore that eats the herbivore is a secondary consumer, and so on. About 10 percent of the energy transferred at each trophic level is stored in body tissue; of the remaining 90 percent, part is used in the metabolism of the organism and part is unassimilated. This unassimilated energy is ultimately utilized by detritivores.

The passage of energy from one organism to another takes place along a particular food chain — that is, a sequence of organisms related to one another as prey and predator. The first organism is eaten by the second, the second by the third, and so on, in a series of feeding levels, or trophic levels. In most ecosystems, food chains are linked together in complex food webs, with many branches and interconnections. Webs may involve more than 100 different species, with predators characteristically taking more than one type of prey, and each type of prey being exploited by several different species of predator. The relation of one species to others in its food web is an important function to its ecosystem.

The following is a simplified example of a marine food chain: shorebirds eat clams buried in the sand for food; clams eat phytoplankton and zooplankton which are brought to the beach by waves and currents; zooplankton eat other zooplankton and phytoplankton; phytoplankton are dependent upon inorganic nutrients (for raw materials) brought to the ocean's surface by upwelling and the sun for energy to make their own food through photosynthesis.

Many food webs are fragile, and the removal of even one link in the chain may ultimately result in the collapse of the entire food web. Such a case may occur for the above example if upwelling, the movement of deeper, nutrient-rich water to the surface, does not take place one year (e.g., during El Nino). Without upwelling, the phytoplankton at the base of the food web cannot "bloom," zooplankton cannot flourish, clams then cannot find enough to eat, and ultimately the shorebirds will have to concentrate on some other food item, move to another beach, forego reproduction that year, or starve.

Human made hazards are also potentially disruptive to the food web. Pollution from oil spills may block out the sun and disrupt photosynthesis in primary producers. Oil may coat shorebirds' feathers, making it more difficult for the birds to keep warm; and silt carried downstream from construction and agriculture can smother bottom-dwelling animals. These hazards could possibly remove a link in the food web and disrupt the entire web. Animals would have to search for other food sources, which would result in higher competition between species for food. Since less food is available, the animal populations affected would decrease

in numbers. What do you think would happen if there was an oil spill in endangered species' habitat? It could possibly lead to the collapse of the endangered species' population in that area. Why would the disruption and possible destruction of a marine food web matter to us? It matters because all of life on Earth is interconnected and to whatever extent we make it less possible for ocean life to flourish, we make it that much less possible for life on land — including ourselves — to flourish.

Materials: A set of the following materials for each group of four students: a sheet of 22" x 28" white poster board or paper, glue (preferably a glue stick), one black felt tip pen, one pair of scissors, one set of food web cutouts, and a copy of "Participants in the Ocean Food Web." Research materials on various marine animals.

Procedure:

PART 1: Making a Food Web

1. Discuss the significance of food webs and the various roles necessary to a food web (i.e. producers, primary consumers, secondary consumers, detritivores).
2. Divide participants into groups of four. Explain that each group will construct an ocean food web. They may use all or part of the cutouts provided. Participants should cut around each organism, it is not necessary to cut along the outline, the white border will provide extra support.
3. Pass out the poster board, a set of food web cutouts, glue, felt tip pens, and a copy of "Participants in the Ocean Food Web" to each group.
4. Have the students draw and label the ocean surface on the poster board.
5. Have the students arrange the cutouts on the poster board, using the reference material as a guide. Cutouts should then be glued down.
6. Connect the participants in the food web using lines and arrows. The point of the arrow should point to the consumer. Use the following lines:

———————— Direct food
— — — — — — Dead & decaying organisms
• • • • • • • • • • Nutrient return

PART 2: Class Discussion

1. How does the size of the organism generally relate to its position in the food web? Do you think there are any exceptions to this generalization? Why?
2. Have one group explain their food web construction to all of the groups. Do the other groups agree with the food web construction? Why or why not?
3. Simulate an artificial hazard, such as marine debris, entering the food web. What happens?

Assessment:

Have your students research and write a paper, about one page in length, on a particular marine animal. What role does the animal play in its food web? From the information learned in the previous activity, how can your animal be affected by marine debris? What are the consequences of marine debris to the food web?

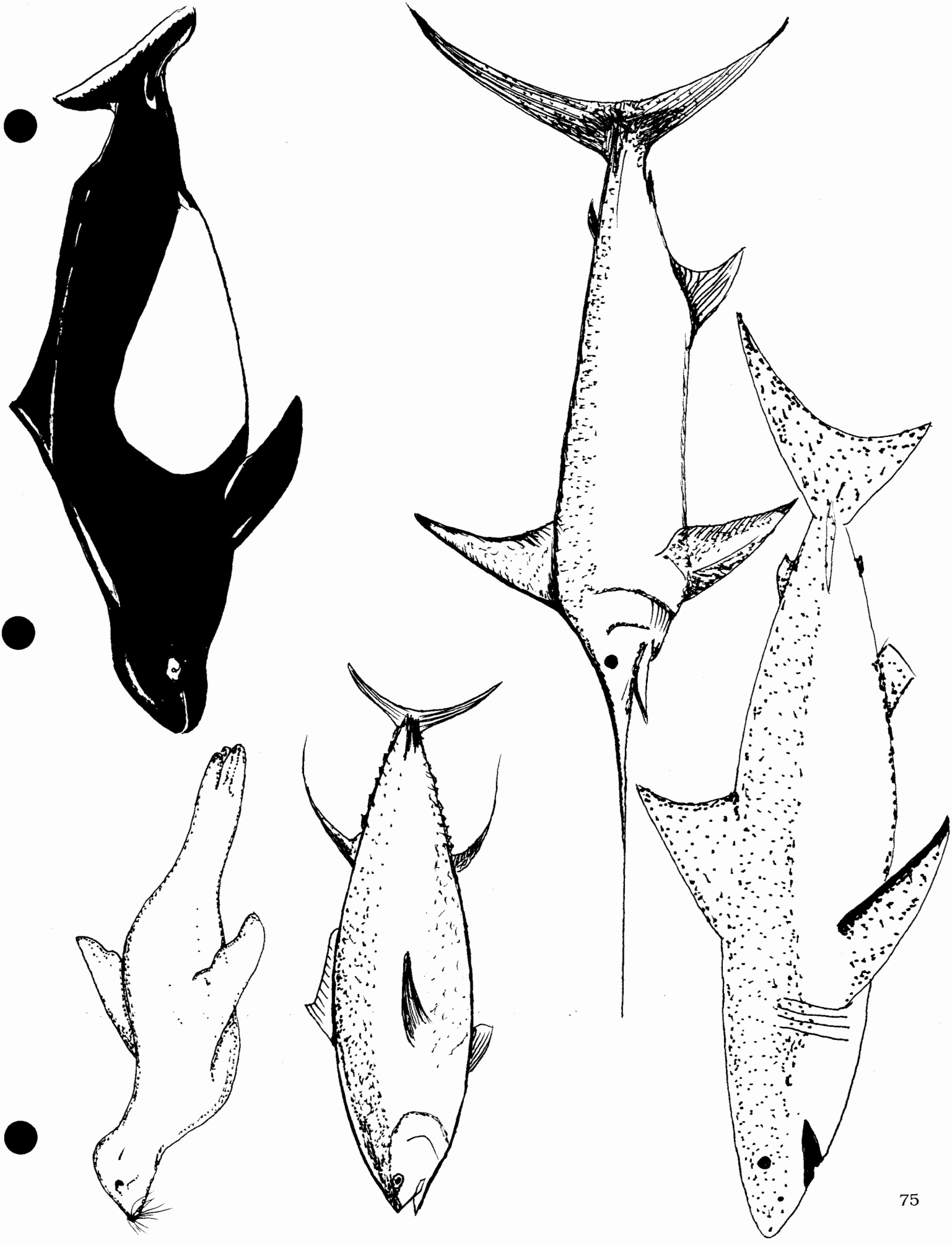
Source of the Activity:

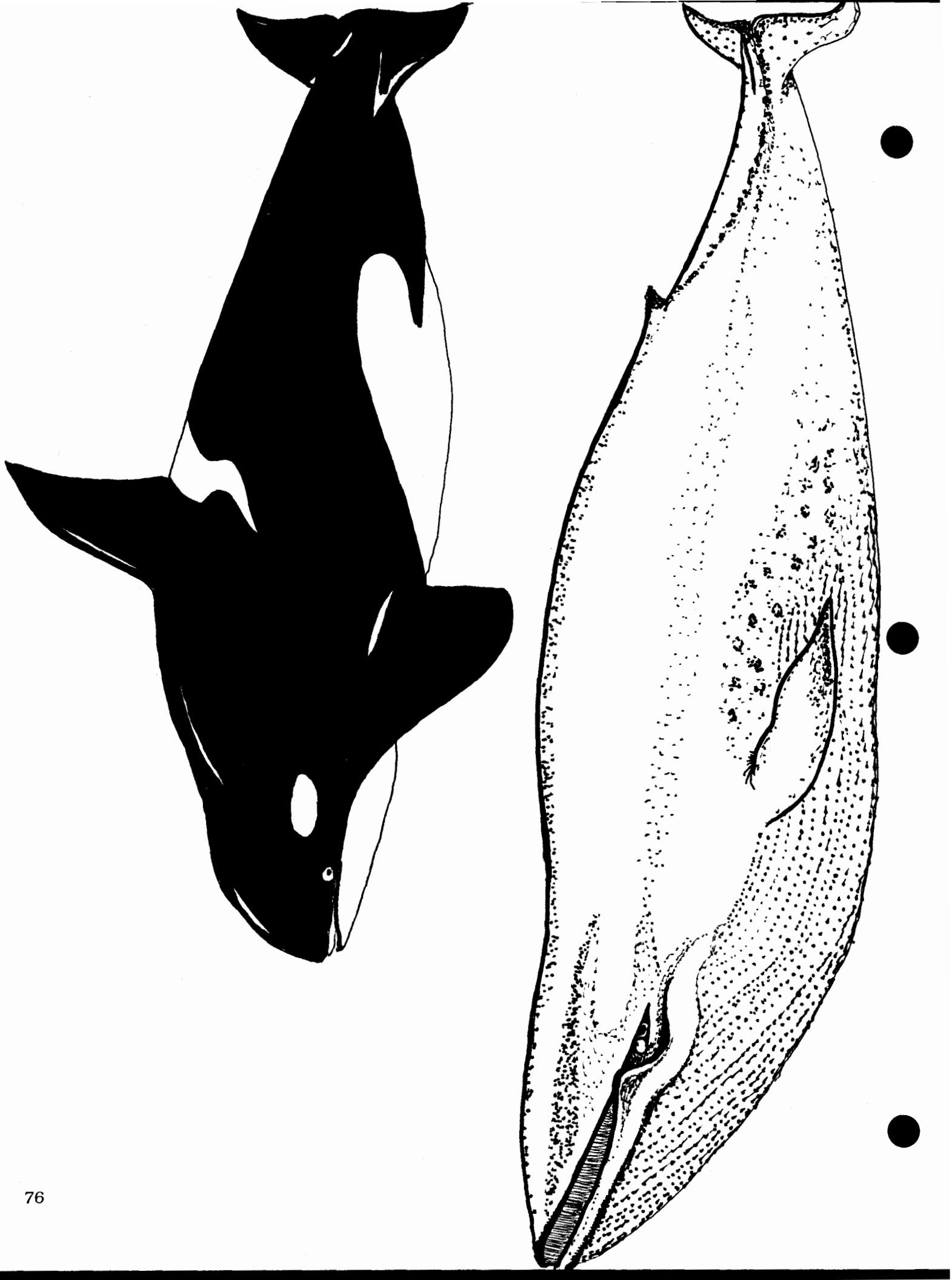
Adapted from the "Ocean Food Web" developed by W.S. Montgomery, 4-H Youth Advisor, University of California, 1985.

Some Participants in the Ocean Food Web

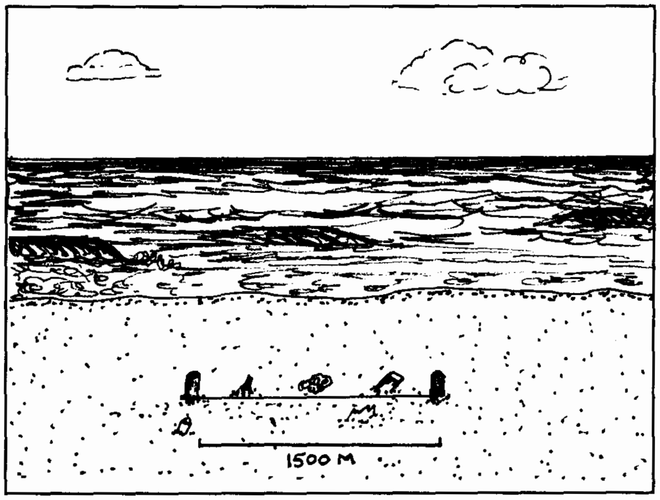
NAME	SIZE	IT EATS	EATEN BY
Anchovy	7 inches	plankton	porpoises, swordfish
Angler Fish	6-12 inches	squid and shrimp	mammals and other deep sea fish
Blue Whale	100 feet	krill	
Dall's Porpoise	7 feet	squid, herring, mackerel, and deep-water fish	sharks and killer whales
Gull	wingspan 3-4 feet	herring, anchovies, squid, and sardines	
Halibut	3-6 feet	anchovies, octopuses, other small fishes	sharks and mammals
Harbor Seal	5-6 feet	squid, rockfish, small sharks, and rays	sharks and killer whales
Killer Whale	20-30 feet	seals, sea lions, other cetaceans, fish, squid, and marine birds	
Mackerel	2 feet	anchovies, squid	porpoises, seals, yellowtail, sharks
Octopus	up to 3 feet	fish, clams, and crabs	sperm whale, tuna, swordfish, halibut
Pacific Herring	12 inches	plankton	most larger fish and mammals
Pelican	wingspan 7 feet	herring, anchovies, squid, and sardines	
Phytoplankton	microscopic	obtains food from the sun and nutrients in the water	
Rockfish	2 feet	smaller rockfish, sablefish, anchovies, lanternfish	toothed whales, porpoises, sea lions, sharks
Salmon	3 feet	squid, anchovies, rockfish, herring	seals, sea lions, sharks
Sardine	12 inches	plankton	sharks, pelicans, gulls, sea lions, porpoises
Shark	20-30 feet	mackerel, rockfish, salmon, seals, and other mammals	
Shrimp	1-2 inches	plankton	angler fish and porpoises
Squid	12 inches	small fish, shrimp, and smaller squid	many larger fish and mammals
Swordfish	12 feet	anchovies, squid, octopuses, mackerel, rockfish, deep sea fish	sharks and toothed whales
Yellowfin Tuna	5 feet	swimming crabs, anchovies, squid, sardines, mackerel, and other fish	sharks and toothed whales
Zooplankton	microscopic	phytoplankton and other zooplankton	filter feeders:clams, mullusks, etc.

0.10 mm
0.10 mm





A SCIENTIFIC BEACH CLEANUP



★★
Age: Grades 9-12
Subjects: Science, Math
Conceptual Framework: Science Framework: Humans affect ocean ecosystems; respect for nature develops from understanding how nature works.

Mathematics Framework: Collecting, organizing, and describing data is important for understanding and solving problems; mathematics are used to draw logical conclusions; physical material, pictures, and diagrams are related mathematical ideas.
Skills: applying, classifying, computing, hypothesizing, identifying, measuring, small group work
Duration: Beach cleanup planning begins 2 weeks before the field trip to the beach; parts 2 and 3 require 1-3 hours.
Setting: outdoors and indoors
Key Vocabulary: methodology, hypothesis
★★

Objectives: Students will be able to: 1) demonstrate how they can play an important role in marine conservation by participating in a beach cleanup; and 2) conduct the beach cleanup according to scientific method.

Method: Students discuss an hypothesis, purpose, and method in relation to the beach cleanup. At the beach, they will work in small groups collecting trash as they walk along a transect (separating recyclables and non-recyclables as they go) and tally the trash onto data cards. The trash is then calculated as to weight, quantity, area, and distance covered.

Background: Your students are now aware of the hazardous effects of marine debris on wildlife, as well as the different types of debris that exist and what is and isn't recyclable. Now it's time to transform this new found awareness into action with a beach cleanup that will be conducted in a scientific manner. The beach cleanup allows the students to participate in an immediate solution to the problem of marine debris; simultaneously, the students employ scientific methodology to analyze the problem of marine debris. They will form an hypothesis, decide on their purpose and follow a particular method. In the next activity they will finish their scientific study of marine debris by summarizing their results and making a final conclusion.

Why is data collection important? By collecting data, the students can begin to determine the types and amount of trash littering the beach. From this information, the students can also determine some possible sources of the debris. By determining what type of trash is littering the beach and possible sources, we can begin to develop solutions to the problem.

Materials: Trash bags for both recyclable and non-recyclable debris; "Beach Cleanup Data Card" and "A Guide to Good Data Collection" (see Appendix F and G); clip board and pencil for each small group; your school's parental consent form, and "Students' Checklist" (see Appendix E) for each student; first aid kit; bathroom scale; gloves; rope; stakes; tide chart; and a surveyor's map of the beach.

Procedure:
PART 1: Two Weeks Before the Cleanup
1. Select a beach for your cleanup. The beach should be sand or gravel and known to collect litter.
2. Call the beach manager to get permission to conduct a beach cleanup. The beach manager may also have beach cleanup supplies for you to use.
3. Arrange for the trash to be collected after the cleanup. The beach manager may be able to arrange this for you.
4. Begin assembling the materials and support you need.
5. Arrange transportation to the beach.
6. Send the school's parental consent form home with the students to be signed and returned.

PART 2: The Morning of the Cleanup
1. Review the following safety information with the students:
 1) No one will be allowed in or near the water on the trip.
 2) Keep your eyes on the ocean — when close to the water don't turn your back on waves.

3) Everyone must stay with their assigned group.
4) Call an adult immediately if a dangerous item (syringe, metal drums, chemical containers, medical waste) or stranded animal is found.
5) Dress warmly and in layers — the beach is usually cooler than inland areas.
6) Let everyone know the trip will be cancelled in stormy weather.

2. Collect parental consent forms.
3. Check weather conditions at the beach.

PART 3: The Cleanup
Discuss the following steps of scientific methodology with your students:
1. Hypothesis — Have your students come up with an hypothesis that they'd like to test during their trip to the beach.
2. Purpose — Have your students determine the purpose of their scientific survey.
3. Method
Randomly select a stretch of shoreline:
1) Categorize the type of beach you have selected for your survey site (e.g. "major ocean exposure," "river influenced areas," or "harbor influenced area").
2) Define the area as relating to an oceanographic current system of interest or location to a major river discharge system.
3) Using a surveyor's map, measure each stretch of shoreline and divide them into equal units of one kilometer. Assign each kilometer a number. Randomly select one stretch of shoreline.
4) Divide the students into groups of 2, 3, or 4.
5) In your selected survey area, have each group randomly choose a center point for the survey area. Measure 750 meters to the right and 750 meters to the left of the center point to define the 1500 meter survey area.

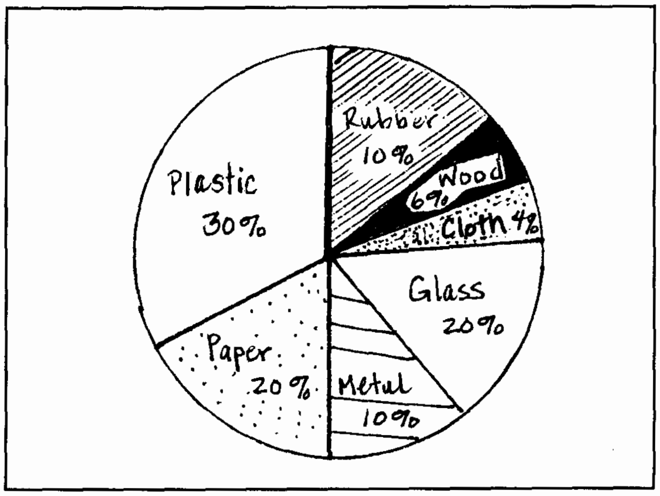
Measuring and marking the survey site:
1) Mark both ends of the survey area with temporary markers (flags or stakes).
2) Working in pairs, use a measuring tape or rope to create a transect line.

Collecting data:
1) Each group will walk along the transect (the survey line between the markers) and one person will collect the trash while the other student records what is being collected. Have the students collect and record all the trash an arms' distance from the transect line. Some groups should be sampling the high tide area, others the mid-tide area, and others the low tide area. Have them observe how the trash accumulates. For example, some parts of the beach may have more debris than other areas. This could be due to many factors, such as currents, wind patterns, storms, pattern of beach usage, and proximity of land pollution sources. The students may also notice that debris accumulates at different tidal levels.
2) After the trash has been collected have the students weigh the total amount of trash, and then divide the trash into categories and weigh each category. Compare weight vs. volume of trash. Many times we see statistics about how much garbage we generate in terms of weight and volume. Which form of measurement, weight or volume, would more accurately illustrate the percentage of trash collected?
3) Then have the students total the tally marks on their data cards.

Results — In the next activity, data will be summarized and graphed.
Conclusion — In the next activity, students will write a conclusion.
4. Recycle the recyclables collected.
5. Celebrate your excellent team work! Give three cheers for yourselves and take a last look at the amount of trash you collected in such a short time. If planned, have students wash and have lunch.

Extensions:
Your students can become involved in a national statistical sampling program with the Center for Marine Conservation and the U.S. Environmental Protection Agency. The purpose of the program is to determine whether there is a decrease in the amount of debris on our beaches, and whether the debris on the survey site is coming directly from the ocean or from other areas on the beach. If you are interested in making a year-round commitment to cleaner, safer beaches contact:
Statistical Sampling Program
Center for Marine Conservation
306-A Buckroe Avenue
Hampton, VA 23664
(804) 851-6734

BEACH CLEANUP RESULTS



****
Age: Grades 9-12
Subjects: Science, Math
Conceptual Framework: Science Framework: Humans affect ocean ecosystems; respect for nature develops from understanding how nature works.

Mathematics Framework: Collecting, organizing, and describing data is important for understanding and solving problems; mathematics are used to draw logical conclusions; physical material, pictures, and diagrams are related mathematical ideas.
Skills: analyzing, communicating, evaluating, graphing (or charting), interpreting, small group work
Duration: 50 minutes
Setting: indoors
Key Vocabulary: analyze, conclusion
****

Objective: Students will be able to complete the results and conclusion section of their scientific study on marine debris.

Method: Students will graph and discuss the results of the study and make a conclusion.

Background: Students conclude their scientific beach cleanup back in the classroom where they will analyze their results and make a conclusion to their original hypothesis. This activity ends with a classroom discussion as to the significance of the data they collected and analyzed.

Procedure:
1. Divide the students into their beach cleanup groups.
2. Have each group write up their results of the cleanup using graphs such as pie charts, line graphs, and/or bar graphs.
2. Have each group share their visual presentation with the class. What is the conclusion to their hypothesis?
3. After the presentations, discuss the following with the students:
   1) How can the information they collected be used to reduce marine debris?
   2) What is the importance of finding the weight, volume, area, and distance of the marine debris?
   3) Why is it important to know the exact location of the debris and the date of the sampling?
   4) Where does the trash accumulate?
   5) Where is the trash coming from? Do certain items indicate specific sources of debris? (For example, fishing nets represent the fishing industry and are an ocean-based source of marine debris.)
   6) Which items of debris are the most dangerous to marine wildlife?
   7) What could we ask city, county, and/or state agencies to do about the problem of pollution?
   8) How does it make them feel to see the trash along the beach?
   9) How does it make them feel to see the beach clean after their work?
   10) What can each of us do to minimize the problem of ocean pollution?

Assessment:
Collect the beach cleanup reports.

Extension:
1. Make a display of trash collected for the school or park where the cleanup was conducted.
2. Write a story about your beach cleanup for the school or local newspaper (See Appendix H: How To Be An Effective Grassroots Activist).

MARINE DEBRIS TASK FORCE

BRAINSTORMING TIPS

1. Don't Criticize Others
   They will lose their train of thought and stop generating ideas.
2. More is Better
   Write down as many ideas as you can. At this stage, don't worry about spelling, repetition, etc.
3. Connect Ideas When Possible
   If something someone says sparks a thought, say your idea. Connect parts of your ideas with theirs when possible.
4. Be Free Wheeling and Don't Be Afraid of Crazy Ideas
   A crazy idea now may seem plausible and original after more thought and research.

"A river moves a river on." Ghanaian proverb

****

Age: Grades 9-12
Subjects: Science, Social Science, Language Arts
Conceptual Framework: Science Framework: The application of scientific knowledge changes the world; humans affect the ocean ecosystem.
History-Social Science Framework: Understanding human and environmental interaction.
English-Language Arts Framework: Linking personal experiences and prior knowledge provide opportunities for building language skills and recognizing common background experiences.
Skills: analyzing, applying, communicating, describing, evaluating, organizing, problem solving, public speaking, small group work
Duration: 50 minutes (part 1); part 2 may require 2 to 3 class periods
Setting: indoors
Key Vocabulary: proposal, solutions, implement

****

Objectives: Students will be able to: 1) utilize a cooperative problem solving process designed to reduce marine debris; and 2) implement their solution.

Method: Students brainstorm ideas to reduce marine debris, analyze and evaluate the best ideas, and select the best one for actual implementation.

Background: Now the students will learn how scientific research and data collection can be used to develop solutions to environmental problems. Students will develop and try to implement solutions to the marine debris problem. No matter how young or old we are, all of us can make a difference!

Procedure:
PART 1: The Problem Solving Process
Using the "Brainstorming Tips" as a guide, begin the problem solving process: understanding the problem; brainstorming solutions; analyzing the suggestions; elaborating on the solutions; evaluating which solutions would be most effective; selecting the best solution.
1. Divide students into groups of four. Each group is a Marine Debris Task Force. Assign roles to Task Force members: recorder, discussion leader, spokesperson.
2. Tell the students they have been asked by the Governor to serve on a Task Force to recommend ways to reduce marine debris. Ask students to come up with solutions using the "Brainstorming Tips." Solutions should identify primary sources or types of debris collected during the beach cleanup and suggest ways to eliminate or reduce that type of debris on the beach. The recommendations could be as simple as initiating a letter writing campaign or as complex as working to get a law passed. For example, in Massachusetts students helped pass a law banning mass balloon releases.
3. Now have each group present their plan to the class. Ask for questions and comments and note ways their proposal could be improved.
4. Have the class select the best idea. Elaborate on the best solution — describe it clearly. Would graphs, charts, or time lines help?

PART 2: Going Beyond
1. Invite someone from the school administration

or community to class to help evaluate the Task Forces' proposed solutions.

2. Help the students implement the solution or send the recommendation to the appropriate city, county, or state agency. Consider the following for implementation: Which groups need to know about the proposal? Which groups will initially oppose it and how can their concerns be satisfied? What persuasive and educational techniques will be needed? Who will perform each task? Brainstorm tasks and draw up a plan of action with names, tasks, and dates.

Source of the Activity:
Adapted from the California Department of Conservation Division of Recycling's "Educator's Waste Management Resource and Activity Guide." The proverb is from *Quotations in Black* by Anita King, Greenwood Press: Westport, CT (1981).

A Recycling Program

Name: Laura-Beth Moore
Age: 12
Grade: 7
Town: Houston, Texas

WHAT SHE DID

Summary

On Earth Day 1990, Laura-Beth's school held a day-long recycling event, accepting materials from students' homes. When she saw how many bags of materials were brought in, she thought, "Why doesn't the city pick up these items from people's houses?"

She checked into the situation and found that the local garbage company was already picking up materials from people's houses in the neighborhood next to hers on a trial basis. But nobody was getting curbside recycling started in other areas.

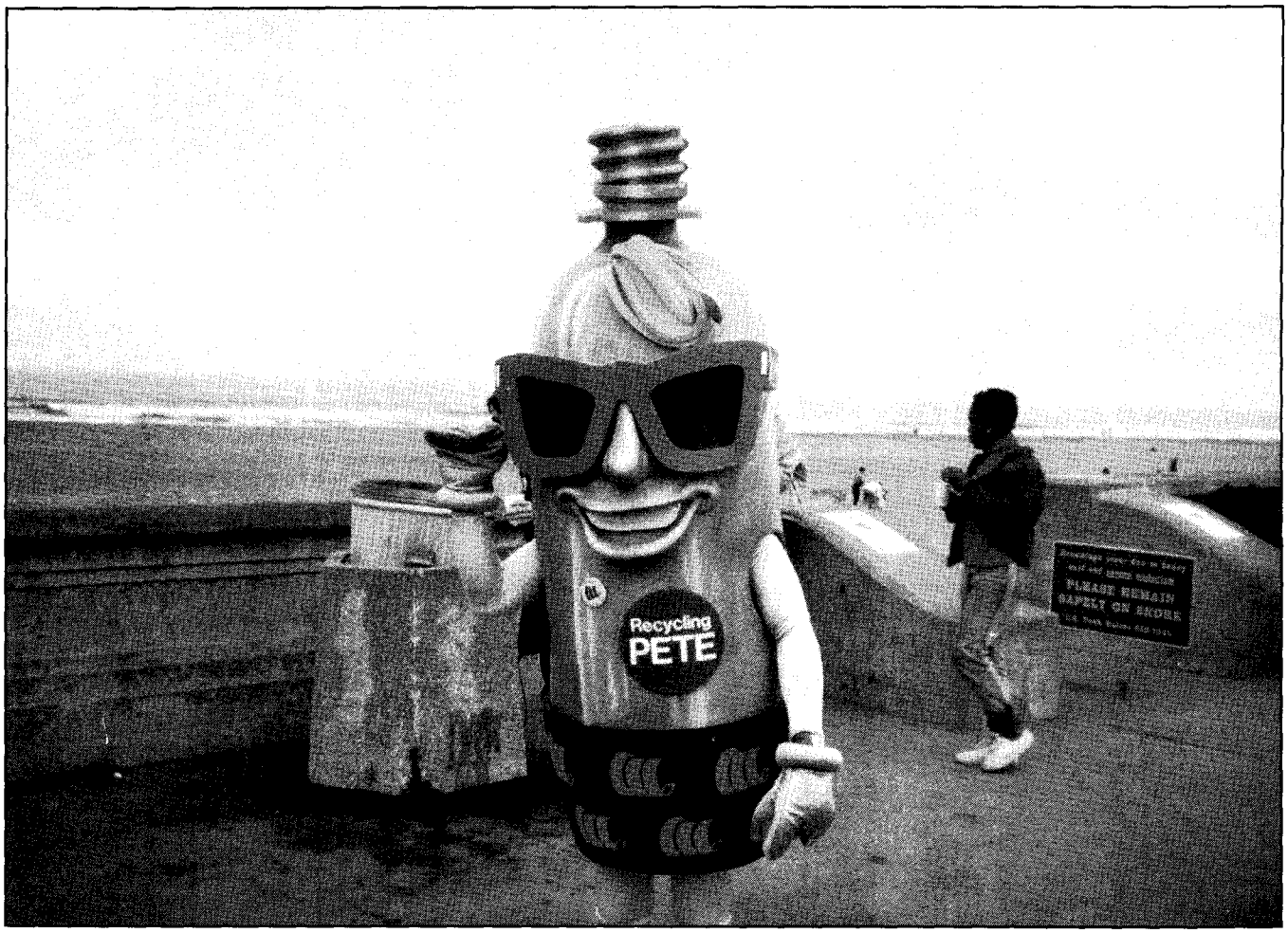
So Laura-Beth decided to start a neighborhood recycling effort. "I thought it was a great goal, and that it would be real easy," she says.

It wasn't. It took a year and a half to get a recycling program started.

Results

The program is now a success. Every month, neighbors drop off about 3 tons of materials at a central location. Then, on the first Saturday of each month, neighborhood volunteers take them to a recycling plant. The money earned is used to buy trees and flowers to plant in their area.

APPENDICES



A: HOW TO RECYCLE

How to Recycle Glass

As much as possible, buy returnable or reusable bottles. To prepare glass for recycling, do the following:

* Rinse glass - no need to remove labels.
* Check with recycler to see if it is necessary to remove all metal caps and rings.
* Separate glass containers by color, either at home or at the recycling center.

How to Recycle Paper

Newsprint:

* Stack newspaper in a fire-safe area.
* Check with recycler to see if newspapers should be tied in stacks, or placed in paper bags.

Other papers:

* Corrugated cardboard - Flatten for easy storage and transportation. Store in fire-safe area.
* High grades - (this is computer paper, tab cards, and ledger paper). Check to see what types of paper your recycler accepts.

How to Recycle Aluminum

* Rinse (you may wish to flatten to save storage and transportation space).
* Separate aluminum cans from other aluminum products; e.g. TV dinner trays and foil.

How to Recycle Tin Cans

(These are typical food cans: 1% tin, 99% steel.)

* Rinse and remove labels.
* Remove both ends and flatten.

How to Recycle Plastic

* Take off label.
* Rinse out bottles.
* Remove lids and caps.
* Check for plastic identification code on bottom of container. Most communities only recycle plastic number 1 and 2 (see proceeding page).

How to Recycle Other Materials

Call your State Waste Management Board or Department of Public Works for information on how to recycle oil, batteries, tires, paint, anti-freeze, appliances, etc.

How to Set Up Your Home Recycling Center

Setting up and maintaining your home recycling center can be a fast, easy process. Here are the basic steps for establishing your home recycling center:

* Find a convenient place in your home or apartment for the center. It does not take much room. The storage of glass, cans, and newspaper for a month usually takes a 3x3 foot area. The garage, a storage closet, corner of the kitchen, or under the sink are good places.
* Find sturdy containers to store materials. Four plastic buckets or paper boxes can be used: one for paper, one for cans, one for plastic, and one for glass.
* Locate your closest recycler. (Call your local recycling headquarters for help with this.) Find out the following: 1) If the recycling center is a donation or buy-back center; 2) What materials the center will take; 3) How you should prepare the recyclables before you bring them in (e.g., some recyclers require that cans be crushed before bringing them in).

Source of Information: California Department of Conservation Division of Recycling's "Educator's Waste Management Resource and Activity Guide."

B: PLASTICS RECYCLING

Plastics are becoming the most prevalent packaging materials—detergent bottles, food packaging, plastic bags—the list is endless. Some recycling centers are responding to the increased use of plastic packaging and have begun accepting plastic. The following list describes the different plastic types and their recycling codes which usually appear stamped on the bottom of plastic containers.

Polyethylene Terephthalate (PETE)
PETE has the properties of clarity, toughness, and barrier (the ability to maintain carbon dioxide). PETE is the fastest growing plastic used in household applications. The predominate use of PETE is to package soft drinks, but it is also used for some cooking oil bottles, liquor bottles, and peanut butter jars. PETE represents about 25% of the plastic bottle market.

Polyethylene (PE)
Polyethylene is the most widely used plastic in the household. PE is a family name which include specific plastics such as High Density Polyethylene (HDPE) and Low Density Polyethylene (LDPE).

HDPE is characterized by its stiffness, low cost, ease of forming and resistance to breakage. It represents over 50% of the plastic bottle market. HDPE has a variety of uses such as milk, water and juice bottles, bleach and detergent bottles, motor oil bottles, and margarine tubs.

LDPE is widely used in applications requiring clarity, inertness, processing ease, and moisture barrier. It's largest end use is for bags such as bread bags and trash bags.

Polyvinyl Chloride (PVC)

PVC is the most versatile of all plastics because of its blending capability. It can be used to manufacture products ranging from heavy walled pressure pipe to crystal-clear food packaging. PVC packages are used for window cleaners, some water and cooking oil bottles, and some detergent powders. PVC has the properties of good clarity and chemical resistance (which is important for holding household detergents and other harsh materials). PVC bottles make up less than 6% of plastic bottles typically found in the household.

Polypropylene (PP)

PP is a polymer with low specific gravity and good resistance to chemicals and fatigue. It has gained wide acceptance in applications ranging from fibers and films to food packaging such as screw-on caps and lids, yogurt and margarine tubs, syrup bottles, and straws.

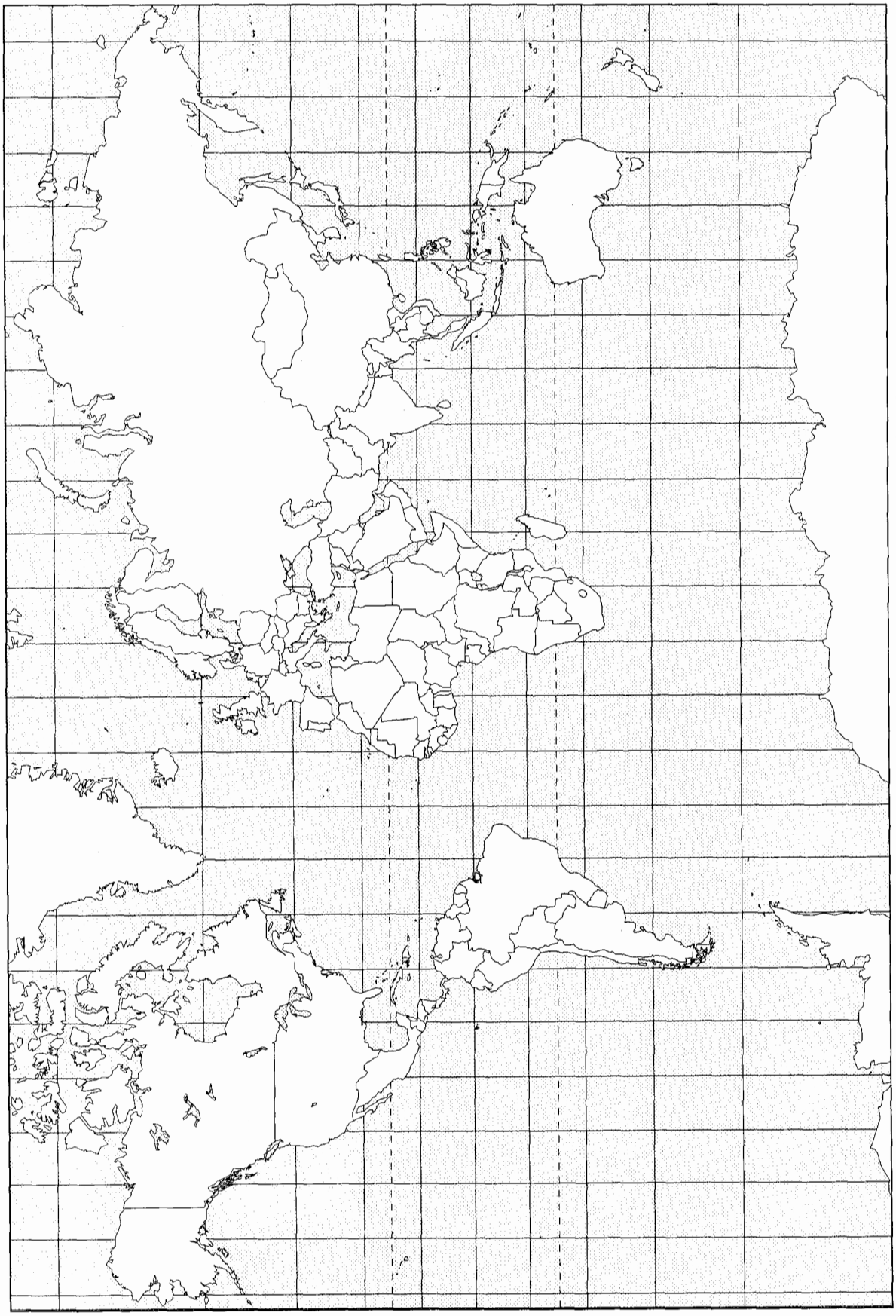
Polystyrene (PS)

PS is a versatile resin with a wide range of physical properties including clarity, ability to foam and relative ease of processing. It is the least used plastic for household packaging. Polystyrene can be found in a hard state or in the form of foam. Some typical applications of hard polystyrene are yogurt cups, hangers, salad take-out containers, and plastic utensils. Foam polystyrene is typically used for egg cartons, meat trays, and styrofoam coffee cups.

Other Plastics

These may include resins not mentioned above or containers made from more than one resin type. Included in this category are some squeezable syrup and catsup bottles and microwave food trays.

C: WORLD MAP



World Map

1. Label the oceans.
2. Locate several "MARPOL" countries.

D: THE BIG CLAM SHAKE

Objectives: Students will be able to: 1) tell others about the adverse effects of plastic on marine life; and 2) encourage them to partake in a beach cleanup as one possible solution to the problem of marine debris.

Method: Students perform a play or a puppet show involving various marine organisms, the hazardous effects of plastic debris on these organisms, and a beach cleanup as one of the possible solutions to the marine debris problem.

Materials: costumes or puppets representing the characters

CAST OF CHARACTERS:
Sammy the Sea Otter — our hero; a young, enthusiastic sea otter who is planning a "clam shake" party on the beach
Plastic Plague Monster — the villain; a cruel, relentless monster who wants to ruin Sammy's party
Squiggy the Squid — a slippery, but nice guy who is constantly being chased by whales, dolphins, and fish
Delia the Dolphin — a playful young dolphin who especially likes to chase squid
The Plankton Plethora (George, Ringo and John) — a group of tiny organisms who live in the ocean and are the base of the food chain; they have recently formed a band and plan to play at Sammy's party
Sally and Sander the Sea Birds — two gulls who live on the uninhabited island where Sammy is holding his party
Tomas the Sea Turtle — a wise, old sea turtle who has lived all over the world, and especially in the Gulf of Mexico, for over a hundred years
Orc the Orca — an orca whale (or "killer whale") who loves to surf
The Clams (Isadora, Raf and Jahmal) — a group of wild, clapping dancers who live in the intertidal zone

Scene 1: On a beach near the intertidal zone . . .

Sammy: Hi Clams! Guess what, I am going to have a beach party and I want you all to come. You can demonstrate your latest clapping clam dance.

Isadora Clam: Gee Sammy, that would be great!

Raf Clam: We could call it a "clam shake," since we move so well.

Jahmal Clam: But who will you invite, Sammy?

Sammy: Let's see . . . Squiggy the Squid and Delia the Dolphin are a lot of fun. The two are inseparable, especially since Delia's always chasing Squiggy and threatening to eat him. They both love parties, especially beach parties.

Isadora: How about the Sea Birds? They will fly by anyway, you have to invite Sally and Sander.

Raf: Besides, they live in a nest on the rocks above the beach.

Jahmal: Make sure you have a lot of fish for them to eat.

Sammy: Good idea. And Orc the killer surfing whale loves to snack on fish too, although he has also been known to eat squids, seals and, gee, sea otters as well . . . but he can bring some of his surfing music — he has every Beach Boys album in existence.

Isadora: Now Sammy, don't forget Tomas the Sea Turtle — just because he is over 100 years old and been to more beach parties than anyone — we can't forget him!

Sammy: You're definitely right. I'll bring some jellyfish donuts for him to eat — he loves jellyfish.

Raf: How about the Plankton Plethora? They formed a band with great music, and I would love to nibble on a few of them . . .

Sammy: The Plankton Plethora are definitely a part essential. They are the base of the food chain.

Jahmal: We could even do our clam shake to one of their songs!

Sammy: This will be a great party. Now I'll just swim out to the mid-ocean and find Delia the Dolphin, Squiggy the Squid, and Orc the Orca and drop off invitations. Then I'll look really hard and find a plankton so the Plankton Plethora will come.

Isadora: Then you can swim to shore and find the Sea Birds and Tomas the Giant Turtle. They will be

so excited!

Sammy: Bye Clams! See you in a little while at the beach! Get ready to shake!

Scene 2: The Plastic Plague Monster is angrily pacing the rocks above the beach, tossing plastic litter in every direction . . .

Plastic Plague Monster: Did you hear that? Did you?! Of all the double crossing, measly, scum of the sea things to do — have a party and not invite me. Me — the infamous, dirty rotten scoundrel they call the Plastic Plague Monster. Of all the nerve! That stupid Sammy the Sea Otter — I'll show him and his dumb friends what happens when you don't invite a crummy guy like me to a party. I'll make this one party they won't forget. If they don't want me, then I won't let them have any fun. Beware, Sammy the Sea Otter! (followed by evil laughter)

Scene 3: Delia the Dolphin is playfully chasing Squiggy the Squid all over the mid-ocean . . .

Squiggy: Look Delia, you've got to stop chasing me. You don't want to be late to Sammy's party, do you?

Delia: Oh Squiggy, you are no fun. Just a little bit longer, OK? Besides, dolphins are *supposed* to chase squid.

Squiggy: Why don't you go with the tunas, like all the other dolphins?

Delia: Because I like to chase you even more. Come on, I'll chase you to Sammy's party at the beach!

Squiggy: (out of breath) I guess I don't have much choice in the matter since you could eat me if I stop.

Plastic Plague Monster: (from above the sea) I'll start my revenge with this silly pair. Just when they least expect it, I'll throw this old fishing net someone left in the ocean right in their path. They may never even make it to Sammy's party! Ha ha ha ha ha. . .

Squiggy: Hey, a net, a net from above is sinking right towards us! Watch out Delia!

Delia: Squiggy, I can't avoid it! I can't get out of it — I'm trapped! Help, help me Squiggy!

Squiggy: Hang on, Delia, I'm too small to get you out, but we're pretty close to shore. I'll try to pull you to shore and get Sammy to help us. Don't worry, Delia, just try not to move too much and tangle yourself up even more. (Scene ends as Squiggy struggles to tow Delia to shore)

Scene 4: Orc the killer whale is riding a wave towards Sammy's party . . .

Orc: Dude, this is such a killer wave for a killer whale like myself! I bet I can take it all the way to the beach bash Sammy is throwing — what a cool sea otter. He really knows his music, having me bring my Beach Boys albums and inviting the Plankton Plethora to play. I've heard they are excellent!

Plankton Plethora (Ringo, George and John): Hey, thanks Orc!

Orc: (violently looking around and falling off his board) Hey, hey, where did that voice come from?

Ringo: Right here, to your left.

George: And here to your right.

John: And above and below you. (giggles)

Orc: All right, dudes, what's going down here? Where are you hiding and who is talking?

Ringo, George, and John: We're the Plankton Plethora, the band you were just raving about.

Orc: You?! I can't even see who you are! I thought the Plankton Plethora was a bunch of awesome seals or pelicans, not a bunch of little dudes I can't even see.

John: What do you think plankton are, Orc? Of course you can't see us. We're tiny — microscopic, in fact. We're all over the ocean and the base of the food chain. Without us you could never eat, Orc.

Orc: Whoa, dude, this is too much to comprehend. You little dudes can play music and supply food for other animals? That is so *awesome*. I think I'm even glad I lost that bodacious wave to meet you.

George: The feeling is mutual, Orc. Let's head over to Sammy's party. I can't wait to do our latest version of "Beach Blanket Baby!"

Ringo: Me either. All right. Yahoo . . .

Plastic Plague Monster: (from stage left) I'll give that

killer whale a real "killer," and knock out some of those plankton as well. If I toss this black plastic bag someone carelessly left for me in just the right direction, I can stop the whale and the stupid plankton. Those plankton need light to survive, like plants, so if I dump enough plastic I can end their disgusting musical career. (dumps a huge bag of plastic pollution right over the plankton and Orc)

John: Hey, who is blocking my sunlight? It is not night time yet, I need all the sun I can get!

George: Yeah, it's getting too dark!

Ringo: What's going on?

Orc: (coughing) I wish I could help you, little dudes (cough), but I'm having a hard time breathing (cough). Something is covering my blow hole (cough).

Ringo: I'll swim to shore while I still have the energy and find Sammy. He will save everyone.

Orc: Thanks little dude (cough). I'll try to (cough) swim towards shore.

Scene 5: On the rocks by the beach . . .

Sally the Sea Bird: (spoken excitedly) Say, Tomas, are you going to Sammy's party? It should be really fun, don't you think, Sander? I simply can't wait. I'm so excited!

Sander: We know you love a party, Tomas.

Tomas: (slowly like an old, old person) Well, kids, I must . . . say . . . a party is . . . definitely an event I do enjoy. I've been to many a party . . . Why, in my day . . .

Sally: I hate to cut you off, but we'd better get going so we're not late. You can tell us all about the parties you've been to when we get there, though.

Plastic Plague Monster: (from stage right) That is, if they *get* to the party. I'll place a deflated helium balloon some stupid person lost and put it in the old turtle's path. He'll mistake it for a jellyfish. Why, this may be that turtle's very last party ever . . ha, ha, ha — and as for those sea birds, I'll conveniently toss a six-pack ring in the ocean right above a tasty fish. The bird will dive and I will have a hole-in-one!

Tomas: (adjusting glasses) My, what a large jellyfish lying on the beach. It couldn't hurt to have a pre-party snack, could it? (gobble, gobble)

Sally: Hey Sander, there's a nice fish down there to your left. Would you like me to get it or would you like to do the honors?

Sander: I'll get it, Sally. Down I go. (He dives down, landing right into the six-pack ring) Sally (gasp), I've got something (argh) caught on my neck . . .

Sally: (anxiously and quickly) Oh no, oh dear, Sander, it's not coming off. Fly to shore and maybe Sammy can help us — it just won't come off. Oh no, oh dear . . .

Scene 6: At the beach . . .

Sammy: Well, everything is ready.

Isadora: And it looks simply marvelous!

Sammy: But where are all my guests? It's getting late, and they all said they would be here!

Raf: Don't worry, Sammy. No one would miss your party.

Plastic Plague Monster: (from above) Ahh — my plan is working perfectly. The "Clam Shake" may end up a "Clam Bake!"

Jahmal: Here comes that slippery squid. What's that he's pulling? (She scurries towards Squiggy)

Sammy: Why, it's Delia in a fish net — here, let me help!

Squiggy: Ahh — thanks Sammy. This is hard work. (He wipes sweat off his brow) You're almost there, Delia.

Sammy: There you go, Delia. Are you okay?

Delia: Just a little weak, that's all. Oh, it feels so nice to be able to move again. I just don't know where that drift net came from.

Sammy: Let's put it in its place — in the trash can.

Plastic Plague Monster: (from the lower left corner) Oh darn — the dumb dolphin got free — but the other guests are still in peril.

Ringo: Sammy ! Over here!

Sammy: Where's that voice coming from?

Ringo: Here, Sammy — under the potato chip bag!

Sammy: Say, is that you Ringo? It sounds like you, but I can't see you very well. How did you get under that bag and where's the rest of the group?

Ringo: We're right out there in the surf — see all that garbage? We're a bit stuck. Orc's there, too.

Sammy: Oh, my — we'd better hurry. (Sammy swims out to the water) Here, Orc, let me pull that bag off.

Orc: Ahh — thanks, Sammy. It's hard to breathe when plastic is covering my blow hole. (Sigh of relief)

John: Sammy ! Orc! Help—please!

Orc: No problem. Now that I've got my lungs again. You'll be jamming tunes again in minutes, little dudes.

Sammy: Just toss your trash in this garbage bag, Orc. The Plankton should be fine.

George: Thanks, Sammy. It's nice to see the sun again.

Sammy: Too bad we can't actually see you — but come to the beach—the party's waiting.

Plastic Plague Monster: (from the left-hand corner) Foiled again! That dumb sea otter is saving his party. But the sea birds and the old geezer aren't doing too well.

John, Ringo and George: We'll start tuning our instruments.

Isadora, Raf and Jahmal: We'll get ready to dance.

Delia: It's so great to be free again.

Orc: Tell me about it, dude.

Sally: (swooping down from the sky) Sammy, Sammy, Sammy! Help Sander—he's caught, trapped, hurt, sick—Help! Help! A six-pack ring!

Sammy: Relax, Sally, now tell me slowly. (Sander sickly lands on the beach) Oh, there you are, Sander! Oh, dear! More plastic pollution. It's just everywhere. Here, don't move about so much and I'll slip this ring off your neck.

Sander: Oh. (sigh) Thank you — I thought that was the end.

Sally: Oh thank you, Sammy! You're such a swell, such a nice sea otter! Oh thank you!

Sammy: Wow! We're all here, I think. I never knew the sea could hold so much trouble!

Isadora, Raf and Jahmal: But what about Tomas? Where's Tomas?

Sander: We just saw him behind those rocks a few minutes ago.

Plastic Plague Monster: (from the bottom) But they haven't seen him lately. Ha, ha, ha . . .

Sammy: Oh, no, what else could possibly go wrong?

Sally: We'd better hurry. I just know something is wrong. I know it — I can tell. Oh! (enter Tomas with a ribbon hanging from his mouth)

Tomas: Never . . . in . . . all . . . my . . . days . . . have . . . I felt this . . . bad. (sigh) Back . . . in . . . the Gulf . . . of Mexico . . .

Sammy: Oh Tomas, I think you swallowed a helium balloon!

Tomas: What's a . . . balloon? These . . . new fangled . . . inventions. Why . . .

Sally: Do something! Hurry, quick!

Sammy: Tomas, why don't you open your mouth and I'll try to pull it out.

Tomas: Young whippersnapper . . . I'll do no . . . such . . . thing.

Sammy: (yanks on ribbon and pulls balloon out) There you go, as good as new.

Tomas: I could never be as good as new. Why . . . my . . . I feel better. That ache — it's . . . it's gone.

Isadora: I don't understand it, Sammy. Why did everyone here have such a hard time getting here?! Plastic Plague Monster: (from above) Why? Why? I'll tell you—because you didn't invite me, that's why.

You invite your nice sea friends—but not an ugly monster like me!

Sander: Hey, look up there on those rocks! It's the Plastic Plague Monster!

Sammy: Of course! I should have known it all along. He's always causing trouble. And there is still so much litter everywhere—you could all get trapped or sick again. Why, I have a great idea! Let's make this a beach cleanup party. We can all pick up trash and still sing and dance.

Ringo: I dig that, man. That plastic stuff is bad for my musical career.

Orc: Dude! And my surfing is simply not cool with trash taking every killer wave instead of me. All right, a beach party! Yahoo!

Tomas: I do believe this is the first beach cleanup party I have every attended.

Sally: Sammy, you're simply swell.

Plankton Plethora: Hit it, Planktons. A one, two, three, four . . .

Plastic Plague Monster: (alone on the stage, frantically tossing trash) Foiled, foiled, foiled again. They have all managed to escape, dagnabit! If only there was more of me. But (hey, hey), you out there in the audience —maybe you could help. (ha, ha, ha) I could ruin all the beaches and oceans in the world with your help. It would be so wonderful — trash, litter, sick animals, EVERYWHERE. Oh, the possibilities are so disgusting it's overwhelming! (ha, ha, ha)

(The entire cast returns to the stage)

Isadora: What can be done to stop the Plastic Plague Monster?

Sally: Well, we could start by throwing our trash away in garbage cans when we go to the beach.

Delia: And we could stop balloon launches so Tomas won't mistake the fallen balloons for jellyfish.

Sammy: And we could have more beach cleanup parties like this. Thanks for coming to my party!

Everyone: (everyone shouts out their own comment) Of course, we wouldn't miss it for the world — no more Plastic Plague Monster . . .

THE END.

Discussion Questions: Discussion can be led by instructors or by cast members.

1. Where is the trash on the beach and in the ocean coming from?

2. Have you ever seen trash left on the beach? How did it make you feel?

3. Do you think a sea otter would actually be able to remove plastic debris from other animals?

4. How can we teach people to stop littering?

5. What can you do as a class to stop plastic pollution?

"The Big Clam Shake'" was written by Sharon London for the Center for Marine Conservation.

E: STUDENTS' CHECKLIST

Clothing

___ Windbreaker/nylon wind shell or jacket
___ Sweater
___ Long Pants
___ Shorts/T-Shirt (for hot weather)
___ Sturdy Shoes
___ Gloves (gardening, dish, or disposable)
___ Hat (sun or wool depending on weather)

Other Items

___ 1-Quart Liquids
___ Sack lunch
___ Sunscreen
___ Sunglasses

Dressing for Success at a Beach Cleanup

Your beach cleanup will be a lot more fun if you have the right clothes and bring what you need. It is important to remember that it will always be colder along the water so bring additional warm clothes.

A Few Things to Remember

*Even summer can be cool at the beach, so it's important to be prepared.
*If the weather is especially cool, dressing in layers works well (e.g. long pants, turtleneck, sweater, jacket, windbreaker, and a hat).
*If you might get caught in the rain, be sure to wear wool or water-proof clothing, as it will keep you warm even when it's wet.
*Wear gloves and sturdy shoes when participating in a cleanup. Glass and other debris can be sharp.
*On hot/sunny days be sure to bring at least a quart of water, juice, or soft drinks. Working and playing in the sun can take a lot of energy; drinking fluids throughout the day can help you avoid getting overly tired or experiencing headaches.
*Be sure to bring sunscreen and use it.

F: BEACH CLEANUP DATA CARD

Thank you for completing this data card. Answer the questions and return to your area coordinator or to the address at the bottom of this card. This information will be used in the Center for Marine Conservation's National Marine Debris Database and Report to help develop solutions to stopping marine debris.

Name _____ Affiliation _____

Address _____ Occupation _____

City _____ State _____ Zip _____ Age: _____ Phone (____) _____

Today's Date: Month _____ Day _____ Year _____ Name of Coordinator _____

Zone Name/Location Cleaned _____ Nearest City _____

How did you hear about the cleanup? _____

Number of people working together on this data card _____ **Estimated distance of beach cleaned** _____

Number of bags filled _____

SAFETY TIPS

1. Do not go near any large drums.
2. Be careful with sharp objects and syringes.
3. Wear gloves.
4. Stay out of the dunes and natural areas.
5. Watch out for wildlife.
6. Don't lift anything too heavy.

WE WANT YOU TO BE SAFE

This form is designed for international use therefore not all listings may apply to your area.

Data collected since 1986 and analyzed by CMC has been used in reports, in testimony on Capitol Hill and at International Maritime Organization meetings in London to determine how plastic trash will be handled by ships at sea and at ports all around the world.

SOURCES OF DEBRIS. Please list all items with foreign labels (such as plastic bleach bottles Mexico) or other markings that indicate the item's origin (such as cruise line names, military indentification or debris with names and/or address of shipping/freighting or fishing companies, or oil/gas exploration activities.

Example: ABC Shipping Company	plastic strapping band

STRANDED AND/OR ENTANGLED ANIMALS (Please describe type of animal and type of entangling debris. Be as specific as you can.)

_____

_____

_____

What was the most peculiar item you collected? _____

Comments _____

_____

Thank you!

Please return this card to your area coordinator or mail it to:

CENTER FOR MARINE CONSERVATION
1725 DeSales Street, NW
Washington, DC 20036 U.S.A.

A Membership Organization

Center for Marine Conservation

Formerly Center for Environmental Education, Est. 1972

Printed on recycled paper, using soy-based ink.

ITEMS COLLECTED

You may find it helpful to work with a buddy as you clean the area, one of you picking up trash and the other taking notes. An easy way to keep track of the items you find is by making tick marks. The box is for total items; see sample below.

Example:
egg cartons 𝍸 𝍸 𝍸 I — TOTAL 16 — cups 𝍸 𝍸 𝍸 𝍸 II — TOTAL 22

PLASTIC

	Total number of items		Total number of items
bags:		fishing nets	
food bags/wrappers		hard hats	
salt		light sticks	
trash		pieces	
other bags		pipe thread protector	
bottles:		rope	
beverage, soda		sheeting	
bleach, cleaner		longer than 2 feet	
milk/water gal. jugs		2 feet or shorter	
oil, lube		6-pack holders	
other bottles		strapping bands	
buckets		straws	
caps, lids		syringes	
cigarette butts		tampon applicators	
cigarette lighters		toys	
cups, utentsils		vegetable sacks	
diapers		"write protection" rings	
fishing line		other plastic (specify)	
fishing lures, floats			

FOAMED PLASTIC

buoys		packaging material	
cups		pieces	
egg cartons		plates	
fast food containers		other foamed plastic (specify)	
meat trays			

FOLD ALONG THIS LINE

GLASS

bottles/jars:		fluorescent light tubes	
beverage bottles		light bulbs	
food jars		pieces	
other bottles/jars		other glass (specify)	

RUBBER

balloons		tires	
condoms		other rubber (specify)	
gloves			

METAL

bottle caps		55 gallon drums:	
cans:		rusty	
aerosol		new	
beverage		pieces	
food		pull tabs	
other		wire	
crab/lobster traps		other metal (specify)	

PAPER

bags		newspapers/magazines	
cardboard		pieces	
cartons		plates	
cups		other paper (specify)	

WOOD

(leave driftwood on the beach)

crab/lobster traps		pallets	
crates		other woods (specify)	
lumber pieces			

CLOTH

clothing/pieces

Remember to turn the card over and fill out your name and address and to record sources and entangled wildlife!

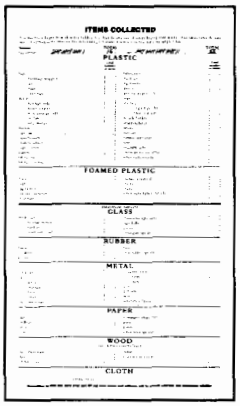
G: A GUIDE TO GOOD DATA COLLECTION

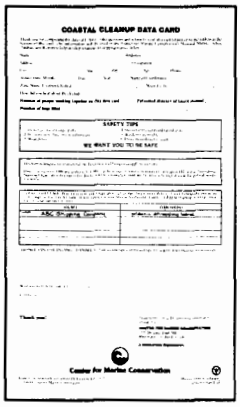
When you help at a coastal cleanup, you'll be asked not only to remove marine debris, but to record on Data Cards the kinds and amounts of trash you find.

The information on these cards will be used by the Center for Marine Conservation (CMC) in an international marine debris study to help policy makers on the state, federal and international levels develop solutions to ending the serious marine debris problems facing all coastal states.

Data collected since 1986 and analyzed by CMC has been used in reports, in testimony on Capitol Hill and at the International Maritime Organization meetings in London to determine how plastic trash will be handled by ships at sea and at ports all around the world.

DATA COUNTS!...YOUR HELP WILL MAKE A DIFFERENCE!





HELPFUL TIPS FOR DATA COLLECTORS:

1. Count items in groups of five like this //// and record the total in the box.
2. Do not write the words "Lots" or "Many". Only numbers of items can be put into the computer.
3. Stranded Animals: In this section, please list animals you find stranded or dead on the beach and, if possible, any entangling debris items.
4. Sources: In this section, please list foreign items found, country and any debris with identifiable markings, such as a company name.
5. Please leave natural items on the beach like driftwood, sea whip and seaweed. Avoid stepping on dune grass and plants. These things hold the sand and prevent erosion.
6. Work with a few people, have one person record the numbers while others collect and bag the trash.
7. Please return your data card to your area coordinator so that all your data will be added to the state and national totals.

THANK YOU for your help and interest in keeping the coast and ocean safe for all of us and for marine wildlife!

Center for Marine Conservation

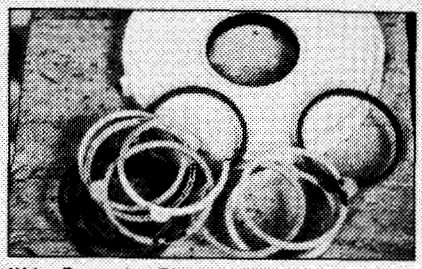
Return this card for future use

GUIDE TO MARINE DEBRIS

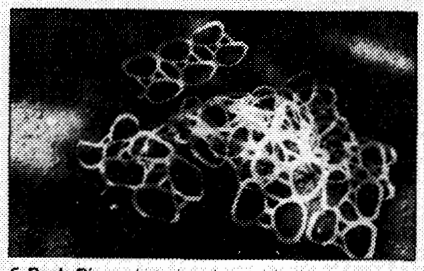
The best data recording can be done if you know what the items listed on your cards look like.

Here are some examples of unusual items you may find.

Light Sticks. *Listed under plastic, these clear plastic tubes about 6 inches long are mostly used by fishermen. When new, the liquid will glow in the dark and attract fish to baited hooks.*

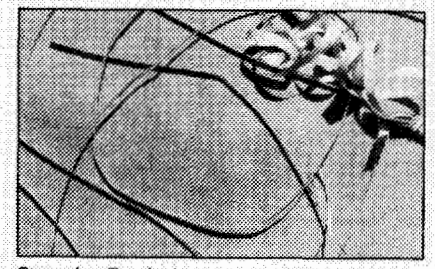


Write Protection Rings. *Listed under plastic, these are used on computer tapes on ships doing seismic testing.*

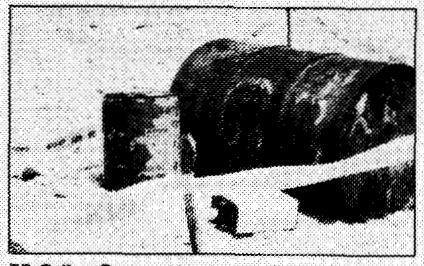


6-Pack Rings. *Listed under plastic, these items are used to hold cans.*

Wooden Pallets. *Listed under wood, these items are used to help stack and transport cargo.*



Strapping Bands. *Listed under plastic, these strong, narrow, light-weight plastic bands are used to bind materials and boxes.*



55 Gallon Drums. *Listed under metal, these drums could contain dangerous chemicals.* ***Do not go near a drum*** *because the vapor or liquid could hurt you.*

Vegetable Sacks. *Listed under plastic, these large mesh bags are used to hold bulk quantities of onions, potatoes, or fruit.*

Sea Whip. *This yellow, orange or purple colony of animals is long, thin and has a dark string-like core. This may look like wire or rope, but it is a natural item found from North Carolina to the Gulf of Mexico. Please leave this on the beach.*

FOR YOUR SAFETY

Do not approach any 55 gallon drums. They may contain dangerous liquids. Even the vapor could harm you. Leave the drum, but record it on your card.

Do not go into the dunes: snakes may be there.

Be very careful of broken glass and other sharp objects.

Wear gloves.

Don't lift anything heavy.

H: HOW TO BE AN EFFECTIVE GRASSROOTS ACTIVIST

Contact Your Representatives

Letters and phone calls from constituents can have a tremendous impact on the way city council members, county supervisors, mayors, and state and federal representatives vote on proposed legislation. Contrary to popular belief, your opinion does count. To ensure that your efforts are as effective as possible, try to follow these guidelines:

* Spell the representative's name correctly (e.g. Senator _____).
* Keep the letter brief and succinct. Focus on one topic only.
* Refer to the bill in question by title, if possible, briefly noting its general purpose.
* Avoid a form letter response by asking a specific question or two. To ensure that you receive a reply, remember to include a complete return address. If you are not satisfied with the reply, don't hesitate to write back.
* State your own views in your own words.
* Never threaten or appear over-emotional. A well-reasoned and thoughtful approach is more impressive and much more effective.
* Address your letters. Look in the phone book under the government pages for the phone number. Call and request the address — don't forget the zip code.
* If they act favorably on the issue, write back! Everyone appreciates a "thank-you" and it never hurts to remind your representative that you are paying attention to their record.

Increase Your Impact with a Letter to the Editor

Studies show that letters to the editor are among the most widely read features of American newspapers. A letter to the editor is an excellent way to express your opinions about marine conservation, interest your neighbors in the issue, report your beach cleanup results, and perhaps interest your paper in covering the story.

To increase the chances that your letter gets printed, here are a few suggestions from experts:

* Use a typewriter and double-space the lines. If you don't have a typewriter, be sure to print neatly.
* Plan your first sentence carefully. Try to refer to a previous article or letter that appeared in the same paper, if possible.
* Deal with only one topic in each letter, and present your ideas clearly and concisely.
* Use facts to support your argument—you are educating as well as advocating—and don't use sarcasm or hostile language.
* Appeal to readers' sense of fair play and justice. Challenge them to respond.
* Try to be practical and hopeful. People respond when they believe your cause has a chance of succeeding.
* Always supply your name and address. Editors are not likely to print letters that are not identified.

I: RESOURCES

Organizations

The following is a list of organizations and the marine debris related resources they offer. The list is not intended to be comprehensive, but a sampling of some additional resources you may need or want for the *Save Our Seas* activities.

Adopt-A-Stream Foundation
P.O. Box 5558
Everett, WA 98206
(206) 388-3487

Alaska Sea Grant College Program
Communications Office
University of Alaska
138 Irving II
Fairbanks, AK 99775-5040
(907) 474-7086

Amoco Foam Products Company
P.O. Box 566728
Atlanta, GA 30356-6013
1-800-637-3873

Bullfrog Films
P.O. Box 149
Oley, PA 19547
1-800-543-FROG

California Aquatic Science Education Consortium (CASEC)
Graduate School of Education
University of California
Santa Barbara, CA 93105
(805) 893-3102

California Coastal Commission
45 Fremont Street,
Suite 2000
San Francisco, CA 94105-2219
(415) 904-5200

Center for Marine Conservation
312 Sutter Street, Suite 606
San Francisco, CA 94108
(415) 391-6204

Channel Islands National Marine Sanctuary
735 State Street
Santa Barbara, CA 93101

Clean Ocean Action
P.O. Box 505
Sandy Hook Highlands, NJ 07732
(908) 872-0111

Educational Images Ltd.
P.O. Box 3456, West Side
Elmira, NY 14905
1-800-527-4264

Hawaii Marine Science Studies Program
Curriculum Research and Development Group
University of Hawaii at Manoa
1776 University Avenue
Honolulu, Hawaii 96822
(808) 948-6822
[On the U.S. mainland contact:
Dr. Frank W. Mattas, Director
Educational Merchandising & Consulting
1436 Spring Valley Drive
Roseville, CA 95661
(916) 782-3773]

Heal the Bay
1640 5th Street, #112
Santa Monica, CA 90401
(213) 394-4552 or General Info. 1-800-HEAL BAY

Izaak Walton League of America
1401 Wilson Boulevard,
Level B
Arlington, VA 22209
(703) 528-1818

Keep America Beautiful, Inc.
9 West Broad Street
Stamford, CT 06902
(203) 323-8987

Lawrence Hall of Science
University of California
Berkeley, CA 94720
(510) 642-5008

Maine Coastal Program
Station 38
State Planning Office
Augusta, ME 04333
(207) 289-3261

Mississippi/Alabama Sea Grant College Program
P.O. Box 7000
Ocean Springs, MS 39564-7000
(601) 896-3355

National Polystyrene Recycling Co.
1676 N. California Blvd.,
Suite 400
Walnut Creek, CA 94596
(510) 746-5262

National Wildlife Federation
Fisheries and Wildlife Section
1400 16th Street, N.W.
Washington, DC 20036
1-800-432-6564

Project WILD
P.O. Box 18060
Boulder, CO 80308-8060
(303) 444-2390

Puerto Rico Sea Grant College Program
Communications/Publications
RUM-UPR
P.O. Box 5000
Mayaguez, PR 00681-5000
(809) 832-4040

Rhode Island Sea Grant College Program
Communications Office
University of Rhode Island Bay Campus
Narranganset, RI 02882-1197
(401) 792-6800

Seattle Aquarium
Pier 59
Waterfront Park
Seattle, WA 98101
(206) 386-4339

Society of the Plastics Industry, Inc.
1275 K. Street, N.W.,
Suite 400
Washington, DC 20005
(202) 371-5200

Surfrider Foundation
122 S. El Camino Real, #67
San Clemente, CA 92672
(714) 492-8170

The Tarlton Foundation
50 Francisco Street, Suite 103
San Francisco, CA 94133
(415) 989-2810

Texas A & M University Sea Grant College Program at Galveston
P.O. Box 1675
Galveston, TX 77553-1675
(409) 762-4460

Texas Adopt-A-Beach Program
General Land Office
Stephen F. Austin Bldg., Rm. 620
1700 N. Congress
Austin, TX 78701
(512) 463-5052

Three Circles Center for Multi-Cultural Environmental Education
410 B Johnson Street
Sausalito, CA 94965
(415) 331-4540

U.S. Environmental Protection Agency
Public Information Center
PM-211B
401 M Street, S.W.
Washington, DC 20460

U.S. Navy
CINCANTFLT (Commander in Chief of U.S. Atlantic Fleet)
Norfolk, VA 23511-6001
[Contact: Commander Phil Pfeil, Shipboard Disposal and Hazardous Waste Division]
(804) 444-6852

University of North Carolina Sea Grant College Program
Box 8605
University of North Carolina
Raleigh, NC 27695-8605
(919) 737-2454

Washington Sea Grant College Program
Marine Advisory Services
3716 Brooklyn Avenue, N.E.
Seattle, WA 98105
(206) 543-6600

Washington State Department of Ecology
Waste Reduction, Recycling, and Litter Control Program
P.O. Box 47600
Olympia, WA 98504
(206) 459-6000

World Society for the Protection of Animals
P.O. Box 190
Boston, MA 02130
(617) 522-7000

Curricula and Teaching Aides

"Adventures of the Garbage Gremlin." (EPA/530-SW-90-024) **U.S. Environmental Protection Agency**. Comic book for grades 4-7 introduces students to the benefits of recycling.

"Aquatic Project WILD." **Project WILD**. Curriculum for grades K-12 contains lessons on aquatic environments and the impact of people on those environments. Only available through Project WILD workshops. Call Project WILD for information about the workshops and state workshop coordinators. Workshops are generally free of charge; accompanying printed materials are free.

"Charting Our Course." **Maine Coastal Program**. Activity guide for grades 6-12 focuses on water quality in the Gulf of Maine. Activities cover sources of marine pollution and could be adapted for use in other states.

"Directory of Coastal and Marine Educational Resources." **California Coastal Commission**. This directory provides a listing of San Francisco Bay Area organizations that provide information and resources on marine and coastal education.

"Directory of Marine and Coastal Educational Resources." **California Coastal Commission**. This directory provides a listing of organizations that provide information and resources on marine and coastal education in San Luis Obispo, Santa Barbara, and Ventura Counties.

"Don't Mess With Texas Beaches." **Texas Adopt-A-Beach Program**. Coloring book teaches children about marine debris and its harmful effects.

"Don't Teach Your Trash to Swim!" **Center for Marine Conservation**. A marine debris coloring book with an anti-litter theme in English or Spanish.

"Earth Notes." **U.S. Environmental Protection Agency**. Quarterly newsletter for teachers of grades K-6 presents ideas in environmental education.

"Environmental Education Materials for Teachers and Young People (Grades K-12)." **U.S. Environmental Protection Agency**. This publication provides a listing of environmental education curricula and other materials.

"Get the Drift." **Project WILD**. Educational packet for grades K-12 includes a teacher's guide, 4 posters and 6 activities on marine debris. Available for a small fee.

"Joey Saves the Day." **Texas Adopt-A-Beach Program**. A puppet show script for pre-kindergarten through grade 2 on how children can help the marine debris problem by participating in beach cleanups.

"Let's Reduce and Recycle: Curriculum for Solid Waste Awareness." (EPA/ 530-SW-90-005) **U.S. Environmental Protection Agency**. Curriculum for grades K-12 contains lessons and activities on solid waste generation and management.

"Marine Education: A Bibliography of Educational Materials Available from the Nation's Sea Grant College Programs." **Mississippi/Alabama Sea Grant College Program**. This publication provides a listing of curricula, publications, films, filmstrips and other educational materials from 29 Sea Grant College Programs across the country. Many of these materials are specific to marine debris. Available for a small fee.

"Plastic Debris in Puget Sound." **Seattle Aquarium**. Marine science curriculum for grades 4-6 introduces the plastic debris problem with solutions and activities. Available for a small fee.

"Plastic Eliminators." **California Aquatic Science Education Consortium**. Educational packet for grades 5-10 contains a leader's guide plus task cards and support materials for 14 separate activities dealing with the sources of plastic debris, its effect on marine animals and ways to help solve the problem.

"Plastics and Marine Debris: Solutions through Education." **Society of the Plastics Industry**. Teacher's guide explains how to minimize plastic marine debris by educating the public on how to properly dispose of such wastes.

"Plastics Recycling by the Numbers." **Keep America Beautiful, Inc**. K-6 activity guide focusing on plastic, the Plastic Container Coding System, and how to separate plastics for recycling. Free with purchase of "Waste in Place" (see following); $1 for individual copies.

"Pointless Pollution Packet." **Clean Ocean Action.** Education packet for grades 4-12 contains a series of fact cards, resource lists, and lessons on nonpoint source pollution.

"POOP Unit" (Protecting Our Ocean Planet). **Surfrider Foundation.** A junior high curriculum that traces the pathway of sewage, from humans through sewage infrastructure and treatment plants, to its final discharge in coastal waters.

"Preventing Marine Debris." **Channel Islands National Marine Sanctuary.** Activity guide for grades K-2 focuses on marine debris in the Channel Islands and includes beach cleanup information.

"Ranger Rick's NatureScope, Diving Into Oceans." (Volume 4, Number 2, Item No. 75042) **National Wildlife Federation.** Curriculum for grades K-7 contains lessons on ocean-related topics, including the impacts people have on oceans. Available for a small fee.

"Ranger Rick's NatureScope, Pollution: Problems & Solutions." (Item No. 75045) **National Wildlife Federation.** Curriculum for grades K-8 contains lessons on many aspects of pollution, including trash generation and wastes in aquatic environments. Available for a small fee.

"Ripples: A Big Sweep Elementary Activity Guide." **University of North Carolina Sea Grant College Program.** Activity guide about litter in our waterways and the problems it causes. Contains 16 illustrated activities that addresses wildlife entanglement and recycling. Available for a small fee.

"Save Our Streams." **Izaak Walton League of America.** Teacher's packet contains information on how to protect rivers and streams from debris and other pollution. Available for a small fee.

"School Recycling Programs: A Handbook for Educators." (EPA/SW-90-023) **U.S. Environmental Protection Agency.** Educator's handbook describes different options and step-by-step instructions for establishing a school recycling program.

Teacher's Recycling Kit and Polystyrene Recycling Poster. **Amoco Foam Products Co.** Kit for grades K-6 addresses the solid waste problem and recycling polystyrene in the school cafeteria.

"Turning the Tide on Trash." **U.S. Environmental Protection Agency.** Marine debris curriculum for grades 3-6 contains teaching activities on the sources and effects of marine debris as well as solutions to the problem.

"Waste in Place." **Keep America Beautiful, Inc.** Curriculum for grades K-6 contains over 30 teaching activities covering litter prevention, waste reduction, reuse, recycling and municipal waste management. $40.00 plus $5.00 shipping and handling.

"Waste: A Hidden Resource." **Keep America Beautiful, Inc.** Teaching activities for grades 7-12 encourage student investigation and decision-making on waste management and resources. $50.00 plus $5.00 shipping and handling. Computer software for this curriculum is also available for Apple IIe systems. $20.00 plus $2.00 shipping and handling.

"Water Pollution and Marine Debris." **Hawaii Marine Science Studies.** This is a complete topic excerpted from *The Fluid Earth: Physical Science and Technology of the Marine Environment* for grades 9-12 that focuses on sources and effects of pollution and debris in the ocean. Available for a small fee.

Publications

50 Simple Things Kids Can Do to Save the Earth. John Javan, The Earth Works Group. Andrews and McMeel, A Universal Press Syndicate Company, Kansas City, MO. This book describes 50 projects that children can do to help solve environmental problems, such as wildlife entanglement in plastics and cleaning up marine debris. Available at bookstores.

A Citizen's Guide to Plastics in the Ocean: More Than a Litter Problem. **Center for Marine Conservation.** Overview of the problems caused by plastic debris in the marine environment and how citizens and government officials are helping to reverse the trend of persistent marine debris. (143 pp.)

"Adopt-A-Beach Youth Group Program." **California Coastal Commission**. Booklet provides details on how to organize cleanups and ways for young people to get involved. (29 pp.)

Adopting a Stream: A Northwest Handbook. Steve Yates, **Adopt-A-Stream Foundation**. University of Washington Press, Seattle, WA. This book discusses the effects of people on the wildlife of a stream. Available from the Adopt-A-Stream Foundation for a small fee.

"Adopting a Wetland: A Northwest Guide." Steve Yates, **Adopt-A-Stream Foundation**. University of Washington Press, Seattle, WA. This booklet examines the impacts humans have on wetlands. Available from the Adopt-A-Stream Foundation for a small fee.

"All About Beach Cleanups: A Helpful Guide to Planning a Beach Cleanup." **Center for Marine Conservation**. Booklet about organizing a beach cleanup. (39 pp.)

"Coastal Connection." **Center for Marine Conservation**. Quarterly newsletter promotes beach cleanups and other activities to remove marine debris from the environment.

Kid Heroes of the Environment. Edited by Catherine Dee, The Earth Works Group. Earth Works Press, Berkeley, CA. This book gives examples of simple things real kids are doing to save the Earth. Available at bookstores.

Save the Earth: An Action Handbook for Kids. Betty Miles. Alfred A. Knopf, New York, NY. This book explains a wide variety of environmental problems and suggests ways children can help to solve those problems. It includes a section on water pollution and beach cleanups. Available at bookstores.

"Shipboard Solid Waste and Plastic Management." **U.S. Navy**. Booklet describes Navy initiatives to control the overboard disposal of plastic waste from U.S. Navy ships. (46 pp.)

The 1991 International Coastal Cleanup Results. **Center for Marine Conservation**. A detailed analysis of the 1991 International Beach Cleanup. (470 pp.)

"The U.S. Navy Combats Plastics." **U.S. Navy**. Booklet describes Navy initiatives to combat plastics in the marine environment. (7 pp.)

Brochures, Fact Sheets, Information Packets

"10 Tips for a Cleaner Beachfront." **Clean Ocean Action**. Pamphlet describes how beachgoers can reduce plastic marine debris.

"10 Tips for Boaters." **Clean Ocean Action**. Pamphlet describes how boaters can minimize marine debris.

"Adopt-A-Beach Questions & Answers." **California Coastal Commission**. Information on the year-round Adopt-A-Beach program.

"Coastweeks" information packet. **California Coastal Commission**. Includes activity ideas, response form, endorsement form, and a Coastweeks calendar.

"Everyone's Trash Hurts Someone Sometime." **Texas A & M Sea Grant College Program**. Brochure describes the problems of plastics in the ocean and contains information about MARPOL Annex V.

Informational packets are available for many different groups, including the general public, beach cleanup participants, beach cleanup organizers, teachers or other educators, elementary school students, recreational boaters or fishers, and press or media representatives. Packets are available from the **National Oceanic and Atmospheric Administration's (NOAA) Marine Debris Information Office through the Center for Marine Conservation**.

"Making Waves — Save Our Seas." **Clean Ocean Action** (COA). Pamphlet contains information about COA, ocean pollution, and how to help.

"Marine Debris Facts and Figures." **Center for Marine Conservation**. Report contains facts on sources of marine debris, its impacts on wildlife, and information on plastics with references included. (12 pp.)

"Our Water Planet is Becoming Polluted with Plastic Debris." **Center for Marine Conservation**. Brochure for the general public on the problems of marine debris.

"This Discarded Line is Done Fishing, But It's Not Done Killing." Center for Marine Conservation. Brochure contains information on marine debris for those involved in recreational fishing.

"Tossing This Trash Overboard Could Leave Death in Your Wake." **Center for Marine Conservation**. Brochure contains information on marine debris for recreational boaters.

"Trash Attack." **Clean Ocean Action**. Report describes a hands-on approach to waste reduction. (6 pp.)

"When It Rains, It Pours, Off the Streets and Into the Ocean." **Heal the Bay**. Brochure contains information about problems with storm drain runoff, precautions to take, and ways to help combat storm drain pollution.

"When It's Done Holding Your Ship's Garbage, It Could Hold Death for Some Marine Animals." **Center for Marine Conservation**. Brochure contains information on marine debris for those involved in commercial shipping.

Audiovisual Materials

"Coastal Cleanup." **Center for Marine Conservation**. Slide show details data collection techniques for beach cleanups and gives background information on the marine debris problem. $25.00 or free for a 5-week loan.

"Journey of the Blob." **Bullfrog Films**. A 10-minute film (in both video and film formats) about a boy who thinks about disposing of a green blob in a stream. Includes a study guide. Available for rent or sale.

"Marine Debris and Entanglement." **Center for Marine Conservation**. Slide show (15 minutes) containing 48 slides presents an overview of the problems associated with marine debris. $25.00 or free for 5-week loan.

"Mister Rogers' Recycling Video and Activity Book." **Keep America Beautiful** and the PBS series "Mister Rogers' Neighborhood" offer a 30-minute video and activity book to teach recycling to young children. The video features Mr. Rogers visiting a recycling center and demonstrating reuse of items, while the book leads children through the video and suggests simple activities. (Includes words and music to songs in video.) $19.95 for video; $1.50 for book.

"Ocean Pollution: What You Should Know." **Clean Ocean Action**. Slide show (45 minutes) presents an overview of ocean pollution issues and solutions.

"Plastic Waste at Sea." **U.S. Navy**. Video (15 minutes) on marine debris and refuse handling for Navy personnel.

"Plastic Waste Update." **U.S. Navy**. Video on update of plastic waste in the oceans and lessons learned on Navy ships.

"Protecting Our Waters." (No. 011-2112) **Educational Images Ltd.** Slide show containing 40 slides demonstrates the effects of pollution from sewage, solid wastes, industrial wastes and other sources on inland and coastal waters. Includes a guide and a cassette. Available for a small fee.

"Recycle This!" **National Polystyrene Recycling Company**. Music video introduces the solid waste problem and possible solutions.

"Respect the Beach." **Surfrider Foundation**. A beach ecology and water safety slide show.

"Trashing the Oceans." **Center for Marine Conservation**. Video (7 minutes) focuses on the marine debris problem and its effects. $10.00 or free for a 5-week loan.

"Troubled Waters: Plastics in the Marine Environment." **Center for Marine Conservation**. Video (28 minutes) focuses on the marine debris problem and its effects. $14.00 or free for 5-week loan.

Posters and Stickers

"180 Million Tons of Trash: What Can We Do With It?" **Keep America Beautiful**. Full-color poster depicts four disposal options, plus classroom activities demonstrating composting, waste-to-energy, sanitary landfilling, and paper recycling. $2.00 plus $1.50 shipping and handling.

"And You Thought You Were Just Killing A Few Beers." **World Society for the Protection of Animals**. Poster depicts a seabird strangled in a six-pack ring. $5.00.

"Problems in the Bag." **Heal the Bay**. Poster is about the coastal cleanup.

"Don't Splash Your Trash." **Washington State Department of Ecology**. Black and white poster showing boats dumping trash overboard into a sea full of marine life; can be colored.

"Don't Teach Your Trash to Swim." **Center for Marine Conservation**. Both poster and sticker depict a drawing of a fish entangled in a six-pack ring.

"I Hopes Ya Swabs Won't Be Throwin' No Plastics Overboard." **Center for Marine Conservation**. Cartoon poster with Popeye, Olive Oyl, Brutus and Wimpy describing the dangers of marine debris to wildlife and to boaters.

"Litter Is Not for the Birds." **Washington State Department of Ecology**. Black and white poster showing birds surrounded by trash. Can be colored.

"Marine Debris at Sea: Get a Grip On It." **Washington Sea Grant College Program**. Poster of an octopus picking up trash and putting it in a trash can.

"MARPOL Annex V." (SG-ED-05) **Alaska Sea Grant College Program**. Poster shows the Annex V regulations. Up to 25 free.

"No Hagamos de Nuestras Playas Un Vertedero." **Puerto Rico Sea Grant College Program**. Poster (translated — "Don't Make Our Beaches a Dumpsite).

"The Only Thing You Should Ever Leave On The Beach." **World Society for the Protection of Animals**. Poster depicts a beautiful beach with footprints. $5.00.

"Plastics Are Forever." **Rhode Island Sea Grant College Program**.

"Ride the Wave of the Future: Recycle Today!" **U.S. Environmental Protection Agency**. Colorful poster promotes recycling.

"Se Pana de un Playa, Adoptala." **Puerto Rico Sea Grant College Program**. Poster (translated — "Adopt-A-Beach").

"Sea Bird—See Bird Die." **Maine Coastal Program**. Poster depicts the hazards of marine debris.

"Silent Killers." **Clean Ocean Action**. Poster depicts the effects of plastics on wildlife.

"S.O.S.: Save Our Shores." **Maine Coastal Program**. Bumpersticker.

"Try Putting These on Before You Go Swimming." **Maine Coastal Program**. Picture of handcuffs at top of poster. Includes information on MARPOL Annex V.

"We Share the Sea." **U.S. Navy**. Poster depicts a pastel drawing of a seal amidst floating debris, looking at a polluting ship.

J: GLOSSARY

abiotic: non-living part of the environment, such as rocks, water, drift-wood
analyze: to examine
autotrophs: the primary producers that convert a small proportion of the sun's energy into chemical energy
behavior: the actions an organism performs
biotic: living
carcinogen: a cancer-causing substance
cargo: freight carried by a ship
conclusion: the outcome or results
conservation: to protect from loss
consumer: one who consumes; one who buys for personal use
contamination: to pollute
criteria: standards on which a judgement can be based
data: information organized for analysis and/or decision making
debris: scattered remains; trash
detritivores: organisms that live on dead and discarded organic matter
ecosystem: the organisms in a community and the associated non-living factors with which they interact
entangle: the state of being entwined in something that is difficult to escape from
eutrophication: the state of a body of water in which the increase of mineral and organic nutrients has reduced the dissolved oxygen, producing an environment that favors plant life over animal life.
fisher: one who fishes
food web: a set of interactions among organisms, including producers, herbivores, and carnivores, through which energy and materials move within a community or ecosystem
galley: the kitchen of a ship
habitat: the place in which individuals of a particular species can be found
herbicide: a substance used to kill plants
herbivores: animals that eat plants or other photosynthetic organisms to obtain food and energy
heterotroph: an organism that must feed on organic materials formed by other organisms in order to obtain energy
hypothesis: an assumption used as the basis for action
implement: the means used to achieve something
ingestion: to swallow
inorganic: non-living substance
landfill: where trash and garbage are disposed of
marine: living in salt water
marine debris: any manufactured material discarded accidentally or purposely in the marine environment
methodology: the procedures
natural resources: produced by nature, such as land, forests, minerals, water, and air
nonpoint source pollution: pollution in our water originating from many miscellaneous sources
ocean: the entire body of salt water that covers approximately 72% of the Earth's surface
occupation: profession; job
organic: pertaining to living things
organism: any living creature, either unicellular or multicellular
pathogens: any agents that cause disease, especially microorganisms such as bacteria and fungus
pesticide: a chemical used to kill pests, especially insects and rodents
photosynthesis: the conversion of light energy into chemical energy
plankton: small, mostly microscopic, aquatic and marine organisms found in the upper levels of the water where light is abundant. Phytoplankton are plant species and zooplankton are animal species
point source: pollution that can be traced back to specific sources
polystyrene: foamed plastic; styrofoam
primary consumers: heterotrophs that derive energy from living plants
primary producers: organisms that derive energy directly from the sun

proposal: a plan
recycling: the collection and reprocessing of manufactured materials for reuse either in the same form or as part of a different product
reduce: to lessen the amount
reuse: to use over again
sampling: a set of elements analyzed to estimate the characteristics
sediment: very fine particles of solid matter suspended in water or settling to the bottom of it
solution: the method or process of solving a problem
storm drain: a drain designed to carry away rainwater
transect: a crosswise division
treaty: a formal agreement between two or more nations
trophic level: a species' position in the food web or chain; its feeding level
upwelling: movement of deeper water to the surface; usually associated with regions of richer productivity owing to the higher nutrient content of deeper water