OUTREACH

THE MARINE ENVIRONMENT

Issue 49: The Marine Environment (Part 1)

Issue 50: The Marine Environment (Part 2)

Issue 51: The Marine Environment (Part 3)

New York University WCS UNEP TVE WWF

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Peace Corps
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June 1997
R0106

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The materials in OUTREACH packs may be used for **non-commercial, educational purposes in low-income countries.** Use the material as you wish:
ADOPT all or part of the materials for inclusion in articles, activities and programmes;
ADAPT materials to make them have local relevance;
ADD materials to existing articles and programmes to complement local interest with more general interest.

Write for more information to contributing organisations or those listed in resource sections.

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Who can use OUTREACH packs

The OUTREACH packs are supplied free-of-charge to 'multipliers' in low-income countries. 'Multipliers' are people who can pass on the environment and health messages to a wider audience. They include:

* *newspaper journalists* who can use the materials:
  - as 'fillers' in newspapers and magazines;
  - in articles;
  - in a series of articles;
  - in special editions, especially in children's health and environment newspaper supplements and magazines.
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  - as 'spots' between programmes;
  - in reports;
  - in a series of programmes on a specific issue;
  - in a special programme devoted to a particular topic;
  - as background information for interviews with local experts on environment and health issues.
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  - to inform their own networks;
  - as background information for programmes;
  - for meetings and activities with women; farmers; scouts, girl guides and other youth groups; community groups and leaders;
  - in environment and health campaigns;
  - in training workshops.
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  - for background information for their own classes;
  - for classroom activities;
  - in teacher training workshops;
  - on field trips and in laboratories;
  - in curriculum development.

What you can do for OUTREACH

We need feedback on the packs. How useful is this material? How can we make it better? Are there special topics you need? Please let us know. Please send us material to which you have added OUTREACH materials. We can pass it on to others to help them in their projects.

We also want to hear about the projects you are working on, and see the materials you produce. We would like to pass on your information and ideas to others in the OUTREACH Network. Please write to: **Dr. James Connor, OUTREACH Director, Teaching & Learning Center, 200 East Building, 239 Greene Street, New York University, New York NY 10003, USA** or **Mr. Richard Lumbe, OUTREACH Co-ordinator, Information & Public Affairs, UNEP, P.O.Box 30552, Nairobi, KENYA**

OUTREACH INFORMATION PACKS

(*All are available in English, Those so marked are translated into* **a** - Arabic, **c** - Chinese, **f** - French, **p** - Portuguese, **s** - Spanish)

1 -- *26 out of print*					
27 Trees and fuelwood (1)		**c**	**f**	**p**	
28 Trees and fuelwood (2)		**c**	**f**	**p**	
29 *Trees and fuelwood (3)*		**c**	**f**	**p**	
30 Pests and pesticides (1)				**p**	**s**
31 Pests and pesticides (2)				**p**	**s**
32 *Pests and pesticides (3)*				**p**	**s**
33 Wetlands (1)	**a**			**p**	**s**
34 Wetlands (2)	**a**			**p**	**s**
35 *Wetlands (3)*	**a**			**p**	**s**
36 Immunization (1)	**a**				
37 Immunization (2)	**a**				
38 Women - health & environment (1)				**p**	
39 Women - health & environment (2)				**p**	
40 Women - health & environment (3)				**p**	
41 - *45 out of print*					
46 Tropical rainforests (1)				**p**	**s**
47 Tropical rainforests (2)				**p**	**s**
48 Tropical rainforests (3)				**p**	**s**
49 The marine environment (1)				**p**	**s**
50 The marine environment (2)				**p**	**s**
51 The marine environment (3)				**p**	**s**
52 AIDS (1)					
53 AIDS (2)					
54 AIDS (3)					
55 Weather					**s**
56 The changing atmosphere (1) the "Greenhouse effect"		**c**			**s**
57 The changing atmosphere (2) the "Greenhouse effect"		**c**			**s**
58 The changing atmosphere (3) the Ozone layer					**s**
59 The changing atmosphere (4) acid rain and air pollution					**s**
60 Endangered species (1) Introduction	**a**		**f**	**p**	**s**
61 Endangered species (2) Threats to survival	**a**			**p**	**s**
62 Endangered species (3) Wildlife trade	**a**	**c**		**p**	**s**
63 Endangered species (4) Saving wildlife	**a**	**c**		**p**	**s**
64 Drugs (1) Medical drugs		**c**		**p**	
65 Drugs (2) Drug abuse		**c**		**p**	
66 Drugs (3) Herbal medicine				**p**	
67 Crops (1) Seeds and plants	**a**			**p**	**s**
68 Crops (2) The garden environment	**a**			**p**	**s**
69 Crops (3) Farm work	**a**			**p**	**s**
70 Crops (4) After the harvest	**a**			**p**	**s**
71 Crops (5) Farming issues				**p**	**s**
72 see Learning-By-Doing leaflet series "Gardening" part 1					
73 see Learning-By-Doing leaflet series "Gardening" part 2					
74 Appropriate Technology (1) Introduction	**a**			**p**	**s**
75 Appropriate Technology (2) Education	**a**				**s**
76 Appropriate Technology (3) Water	**a**		**f**		**s**
77 Appropriate Technology (4) Health	**a**		**f**	**p**	**s**
78 Appropriate Technology (5) Shelter	**a**				**s**
79 Appropriate Technology (6) Food & Fisheries	**a**				**s**
80 Appropriate Technology (7) Solar energy	**a**		**f**	**p**	**s**
81 Appropriate Technology (8) Biomass Energy			**f**	**p**	**s**
82 Appropriate Technology (9) Wind and Water Energy	**a**		**f**		
83 Appropriate Technology (10) Stoves			**f**		
84 Appropriate Technology (11) Transportation			**f**		
Special issue "All About OUTREACH"					
85 see Learning-By-Doing leaflet series "Inventing and Simple Machines"					
86 see Learning-By-Doing leaflet series "Water Technologies"					
87 see Learning-By-Doing leaflet series " Health Technologies"					
88 see Learning-By-Doing leaflet series "Building Technologies"					
89 not in print					
90 Growing Up					
91 Waste (1) Global Problems, Local Solutions			**f**		**s**
92 Waste (2) Conserving Natural Resources					
93 Waste (3) Recycling					
94 Waste (4) What to do about Hazardous Waste					
95 see Learning-By-Doing leaflet series "Waste and Recycling"					
96 Children in Especially Difficult Circumstances (1) Working and street children			**f**		
97 Children in Especially Difficult Circumstances (2) Children affected by catastrophes			**f**		
98 Indigenous Peoples (1)					
99 Indigenous Peoples (2)					
100 Land degradation (1) Soil Basics					
101 Land degradation (2) Causes and consequences					
102 *Land degradation (3) Some agricultural solutions*					

LEARNING-BY-DOING LEAFLET SERIES

Gardening (1)	**a**	**f**	**p**	**s**
Gardening (2)	**a**	**f**	**p**	**s**
Inventing and Simple Machines				
Appropriate Water Technologies				
Appropriate Health Technologies				
Appropriate Building Technologies				
Waste and recycling				**s**

OUTREACH 49

CONTENTS:

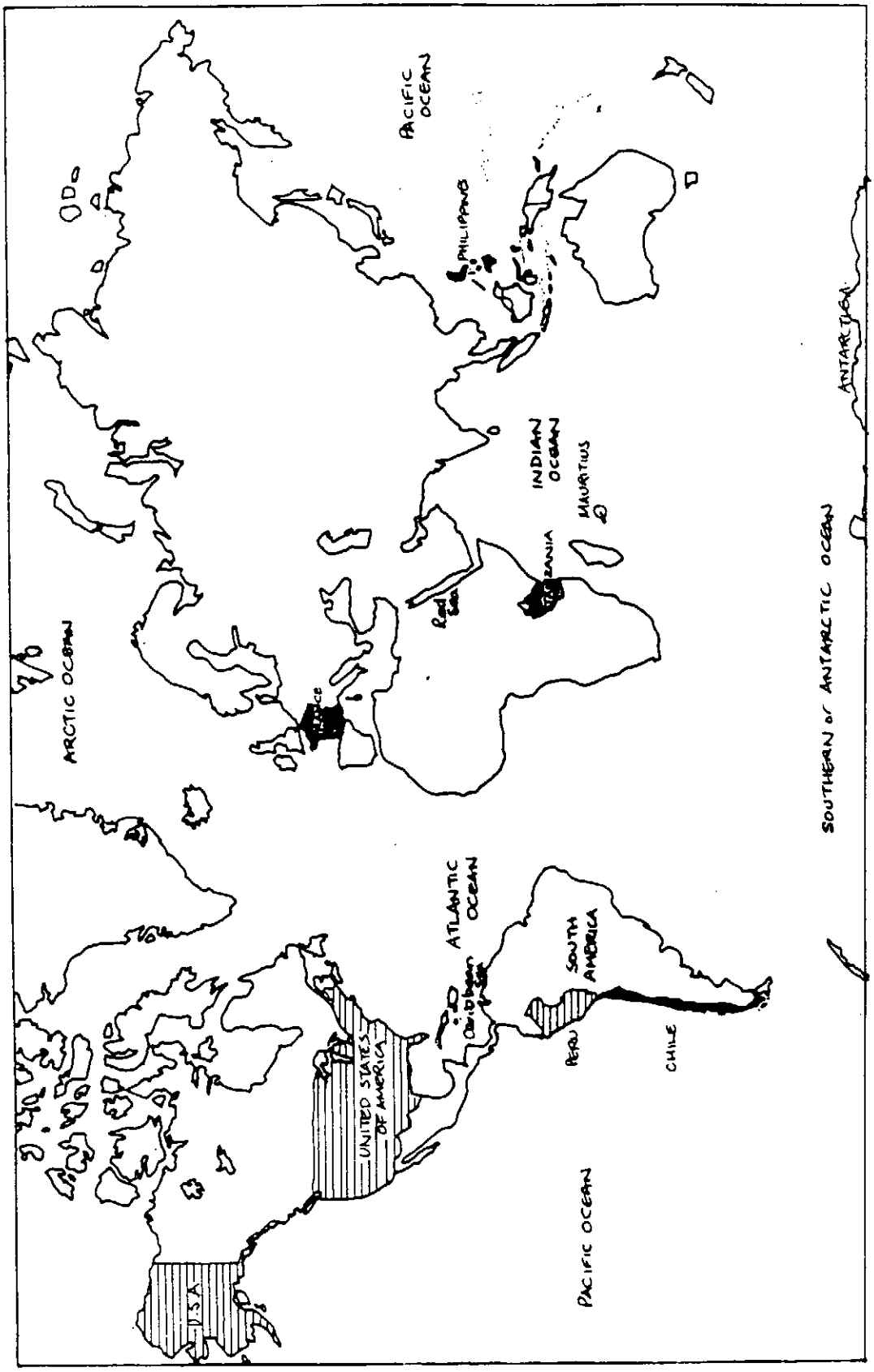
Using the chart below, you can see at glance which fields of interest are touched upon in this OUTREACH pack.
Letters in the chart indicate the following:
a - articles b - stories c - activities and games
d - teachers'/parents' page e - resources

Topic		General	Africa	Asia	Middle East	Latin America & the Caribbean	Deserts	Forests	Wetlands	Oceans	Mountains	Grasslands
Land	(L)		a									
Water	(Wa)	c								abe		
Atmosphere	(A)											
Wildlife	(Wi)	a	a	b						acde		
People	(P)											
Human Habitation	(Ha)											
Health and Sanitation	(He)	c										
Food and Nutrition	(F&N)											
Energy	(E)									a		

Reading levels:
I = for young children aged 8 - 10 years
II = for schoolchildren aged 11 - 13 and adults with basic literacy skills
III = for teachers and/or people with a secondary education

LOCATION MAP

The map below shows the location of places mentioned in OUTREACH issue no. 49:



OCEAN FACTS

UNESCO COURIER
UNESCO
7, place de Fontenoy,
75700 Paris
FRANCE

WWF-UK
Panda House,
Weyside Park, Godalming,
Surrey GU7 1XR
ENGLAND

The following facts are taken from:
Project OCEANS by WWF-UK and "Blue Planet" by Howard Brabyn published in the UNESCO COURIER (February 1986).
If this information is reproduced, please give credit to the sources.

These facts are useful background notes for teachers, or they may form the basis of cartoons/illustrations in children's magazines.

Here are some amazing facts about the ocean:

* Of all the planets of the solar system only the earth, as far as we can tell, has rain, rivers and oceans. To be strictly accurate we should say "ocean" since what people call the Pacific, Atlantic, Indian, Arctic and Antarctic oceans form one single body of salt water from which the continents emerge like islands.

* The ocean has a volume of 1,370 million cubic kilometres and a surface area of 361 million square kilometres.

* The ocean accounts for 98.8% of all water to be found on and around the earth. The remainder is made up of ice (1.2%), water in rivers and lakes (0.002%) and the atmosphere (0.0008%).

* A great number of chemicals are dissolved in ocean water. In fact, sea water contains all the natural elements that make up the minerals in the earth's crust. The most common of these elements are chlorine (55%) and sodium (31%) which combine in the ocean to form sodium chloride - common table salt. Of all the substances found in sea water only sodium chloride, magnesium and bromine are at present being extracted in significant amounts. The other resource which increasingly is being taken from sea water is water itself - fresh water. Rising demand for fresh water and improvements in technology are making desalted water competitive in ever larger areas of the world.

* There are two rather curious parallels between sea water and the liquids of the human body. The ocean covers 70% of the surface of the globe, and 70% of the human body consists of water. A comparison of the composition of sea water and human body fluids shows that the proportions of the elements are largely the same.

* Ocean water is not as uniform is it appears. Variations occur between one region and another - both vertically and horizontally It is only in the top 150 metres or so that sunlight penetrates and the water is warmed by its heat. Below this upper layer the

temperature drops very sharply. In the open ocean the amount of salt in the water varies only a little: on average there are 35 parts of salt to 1000 parts of water. However, the amount of salt in the water does change with depth and distance from the equator. Sea water is most salty near the surface at about 30 degrees north and south of the equator.

* The wind, the heat of the sun and the rotation of the earth together power the mighty ocean currents, moving huge volumes of water in giant whirlpool motions that rotate clockwise in the northern hemisphere and anti-clockwise in the southern hemisphere. These currents move staggering amounts of water. For example, it is estimated that the Gulf Stream, an "ocean river" some 80 kilometres wide and 450 metres deep, propels more than 4,000 million tons of water a minute.

* Cold water is heavier than warm water because it contracts when it cools (though it does expand when it solidifies as ice) and so becomes more dense. Salt also makes water heavy. Great slow currents are made in the deep ocean because of differences in the heaviness (density) of water masses. Cold surface water in polar regions becomes dense and sinks to the sea bed. This is replaced by warmer water from surrounding areas which in turn sinks as it gets colder. The cold water spreads very slowly towards the equator underneath the warm top layer which is heated by the sun and which moves in the opposite direction.

* Beneath the ocean lies a landscape just as dramatic as any found on dry land. In many places around the continents, the land gradually slopes under the water. This land is called the continental shelf. Continental shelves extend from the tideline to a depth of some 200 metres. These shelves range from as little as 16 kilometres wide to as much as 1250 kilometres. Beyond the continental shelves, the land slopes more steeply to the ocean floor (called the abyss) which is, on average, 3,790 metres below sea level. Flat regions, called abyssal plains, may be found in many areas of the ocean. Great mountains rise from the bottom of the ocean. Many are volcanoes. Some break through the surface and form islands. A mountain chain, called the midocean ridge, runs through every major part of the ocean. It is the longest mountain chain on earth. A large crack, a rift valley, runs down the middle of the ridge. The deepest parts of the ocean are usually near the continents and are called trenches. The point of maximum depth of the ocean is to be found in the Mariana Trench, between the islands of Guam and Yap, some 11,000 metres below the surface of the Pacific. If Mount Everest were to be placed in the Trench, its summit would be about 2 kilometres below the ocean surface.

* The sea bed contains great mineral wealth: heavy metals, diamonds, sand, oyster shell and gravel, manganese, phosphorite, coal, iron ore, oil, gas, sulphur, and potash. At present, 90% of all minerals (by value) taken from the ocean are oil and gas. As recovery techniques improve, more and more minerals will be taken from the sea bed.

* Scientists estimate that 70% of atmospheric oxygen is supplied by planktonic organisms. (Source: Global Tomorrow Coalition)

* The ocean is a great provider of food to eat. Over the past ten years or so the total catch from the sea has averaged 71 million tons per year, (see OUTREACH issue 51, page 4). However, present fishing methods are inefficient. Certain species are overfished to the point where they are in danger of complete extinction. Yet there are other species that are equally valuable as a source of protein but are not fished. It has been estimated that with efficient harvesting of all the fish in the sea, the ocean could provide a sustained yield of around 2,000 million tons of food each year.

* One third of global fish harvest goes into animal feed supplements, such as fishmeal. (Source: Global Tomorrow Coalition)

* Only in a few places in the world is it economic to harness the energy locked up in the world's tides, (see OUTREACH issue 50 page 3 for more on tides). One large tidal power plant has been built - at La Rance in France - but there are thought to be only about 24 potential tidal power sites in the world. Scientists are also studying ways of collecting energy from the bobbing motion of the waves. There are several experimental machines working. The largest scale use of the sea as a power source may be the eventual harnessing of the temperature differences at various depths in tropical seas by means of a heat exchanger, but there is a long way to go in developing this idea.

* Two-thirds of the human population lives in 1/3 of the world's land adjacent to coasts. 85% of ocean pollution derives from human activities on land - agricultural run-off, urban sewage and waste products from industry, nuclear reactors and oil refineries. 90% of these pollutants remain in coastal waters, which are by far the most biologically productive sector of the ocean. For instance, the mangrove ecosystem is more than 20 times as productive as the open ocean. (Source: Global Tomorrow Coalition)

UNEP News, UNEP Information Service, P.O.Box 30552, Nairobi, KENYA

Here are some reports from UNEP News, September/October 1987:

Goat culling saves threatened species in Mauritius

A conservation programme, which involved the eradication of goats and rabbits, has given threatened flora and fauna on a tropical island a new lease of life. Round Island off the north coast of Mauritius is the habitat of several rare species of birds, snakes, lizards, geckos and a unique type of palm tree. All were threatened by goats and rabbits which were ravaging the vegetation and disrupting the food chain. A marked regeneration of plant life had been noted since the eradication, said conservator of forests, Abdool Owadally, on 1 July. A similar campaign was launched in the Seychelles to protect rare wildlife on the Aldabra Atoll.

from: Reuter, 1 July 1987

Tanzania soil erosion scheme is success

A Federal Republic of Germany-sponsored scheme to curb soil erosion in Tanzania has attracted support from the local Wasambaa people. The aim of the Soil Erosion Control and Agroforestry Project was to change the traditional agriculture and livestock-raising habits of the people of the Lushoto district, as these were largely blamed for soil erosion and deforestation in the area. People were encouraged to keep cattle in stalls instead of herding them and grass for fodder and trees were planted in contours. The success of the scheme was reflected in the eagerness of farmers to participate. In one season, 300 kilometres of land was planted.

from: Sunday Times, Kenya,
21 June 1987

Ocean pastures

WWF-UK
Panda House, Weyside Park,
Godalming, Surrey GU7 1XR
ENGLAND

This article is from: Project Oceans, a wallchart from the series, Natural Regions of the World produced by World Wildlife Fund-UK.
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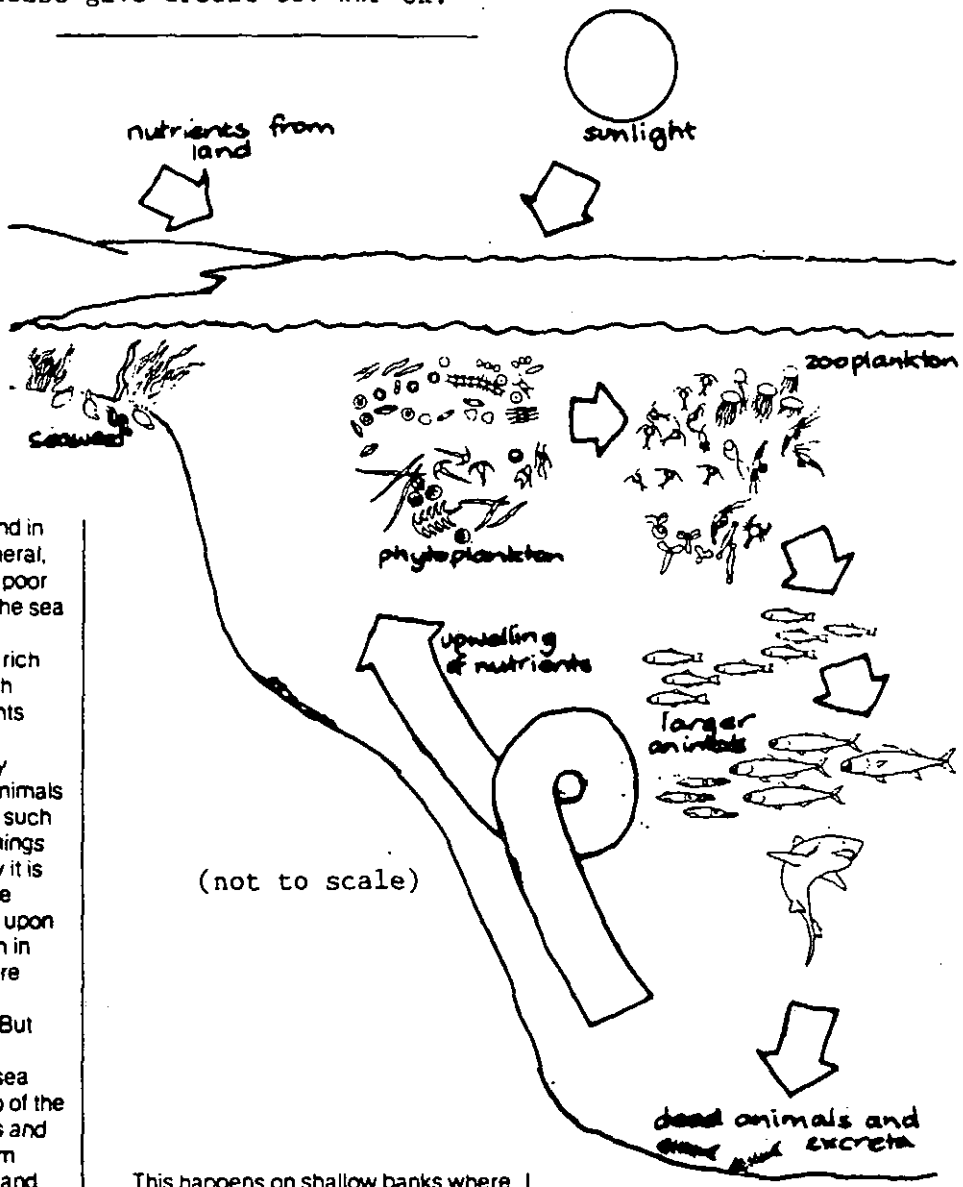

In some places the sea is blue and in some places the sea is green. In general, the places where the sea is blue are poor in marine life and the places where the sea is green are most rich in marine life.

The green places are green and rich because these waters are murky with plant life. It is upon these minute plants that larger living things depend. For example, phytoplankton are eaten by small animals, zooplankton. These animals in turn are eaten by larger creatures such as the whale. When different living things depend upon one another in this way it is called a food chain. And so as marine animals depend directly or indirectly upon phytoplankton it is in those areas rich in plant life that most marine animals are found.

All plants need sunlight to grow. But another essential for plant growth is fertilizer. Fertilizers for plants in the sea are known as 'nutrient' salts and two of the most important nutrients are nitrates and phosphates. Nutrient salts come from decomposing bodies or dead plants and animals which have drifted down to the bottom of the oceans.

The sunlight that marine plants need is at the top of the water, but most of the available 'fertilizers' are near the bottom. Plants can thrive only when these two essentials come together.

This happens on shallow banks where sunlight reaches down to the bottom of the water. It can also happen when wind and temperature changes stir up the water and mix it from top to bottom. This occurs when two currents meet or when a current reaches a land mass. Water is drawn from deep down to the surface carrying with it fresh nutrients into the sunlit waters. The regions of great upwellings of nutrients such as those off the Peruvian coast, are the sites of the great fisheries.

TEACHERS'/PARENTS' PAGE

PLANKTON BODIES

UNC Sea Grant College Program,
Box 8605
N.C. State University
Raleigh, NC 27695-8605
U.S.A.

The activity below is from:
North Carolina Marine Education Manual Unit 3: Coastal Ecology by Lundie Maudlin (UNC Sea Grant College Program) and Dirk Frankenberg (Marine Science Curriculum, UNC, Chapel Hill) (August 1978). This publication was sponsored by the Office of Sea Grant, NOAA, U.S. Dept. of Commerce and the North Carolina Dept. of Administration.

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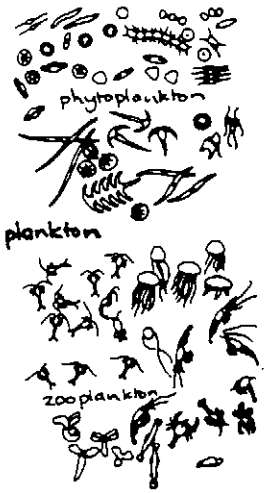
Objective: To investigate how shape/surface area effect ability to float in order to understand how plankton maintain their position in the water column.

Teacher Preparation: Several jars or trays full of water; miscellaneous pieces of paper, metal, cloth, cardboard, glue and a timer (vegetable oil, optional)

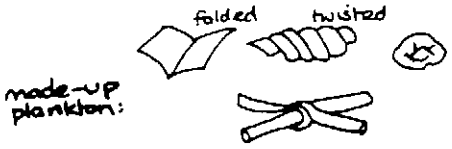
Procedure:



1. Look at some pictures of plankton and observe their shapes. Discuss some of their modifications for floating.
2. Experiment with one type of material, e.g. paper, aluminum foil. Twist, glue, bend into different shapes and test its floating ability. (Avoid the structure being held up by water surface tension by wetting it completely.) Measure the time it takes for different shapes of the same material to sink to the bottom.
3. Some plankton produce oil and store it in their bodies. Try folding your material so it will hold a teaspoon of oil. How does this affect floatation?

Discussion:

1. What shapes enabled your material to float the longest?
2. Why are waves and surface currents important in keeping plankton afloat?
3. Why is it important for plankton, especially phytoplankton, to stay in the upper layers of the water column.



KILLER WHALES

National Wildlife Federation,
1412 Sixteenth Street, N.W.
Washington, D.C. 20036
U.S.A.

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Copyright 1988 by the National Wildlife Federation. Reprinted from the July 1988 issue of Ranger Rick magazine, with permission of the publisher, the National Wildlife Federation.

They prowl the seas, catching fish and snatching seals. But are they vicious, cruel killers? Read on and find out.

KILLER WHALES—what a frightening name! You might think these big mammals attack and kill everything that comes near them, including people.

But we now know that killer whales are ferocious only toward their prey. They kill for food, not out of meanness.

Scientists don't know why, but killer whales don't seem to think of people as food. Divers who study them can even swim nearby without being afraid. That's why some people think *orca* is a better name for these whales. Orca comes from their scientific name and doesn't make them sound so scary. But whichever name *you* use, remember the whales *aren't* vicious, cruel killers.

KILLER COMPARISONS

It's easy to tell a killer whale from other whales. It has beautiful black and white patches on its body, topped by a triangular fin that may be taller than you are.

A male killer whale may grow to be as long as a school bus. But that isn't even one third the size of a blue whale, which is the world's largest animal.

Killer whales are small compared to many other whales. But they have something most bigger whales don't have—large, sharp teeth and powerful jaws. Killers are also among the fastest-swimming whales. Sometimes they zip through the water nearly as fast as a race horse can run!

Every ocean of the world has killer whales. Many live near Antarctica.

CAPTIVE KILLERS

Some people capture killer whales and keep them in tanks in marine parks. The keepers at the parks train the whales to put on shows for big crowds of people.

The park owners say that people learn to care about whales when they see them up close. But some experts say that it isn't good for these large, active wild animals to be kept in tanks in marine parks. They say these whales probably get bored or even depressed in captivity and would be better off in the wild.

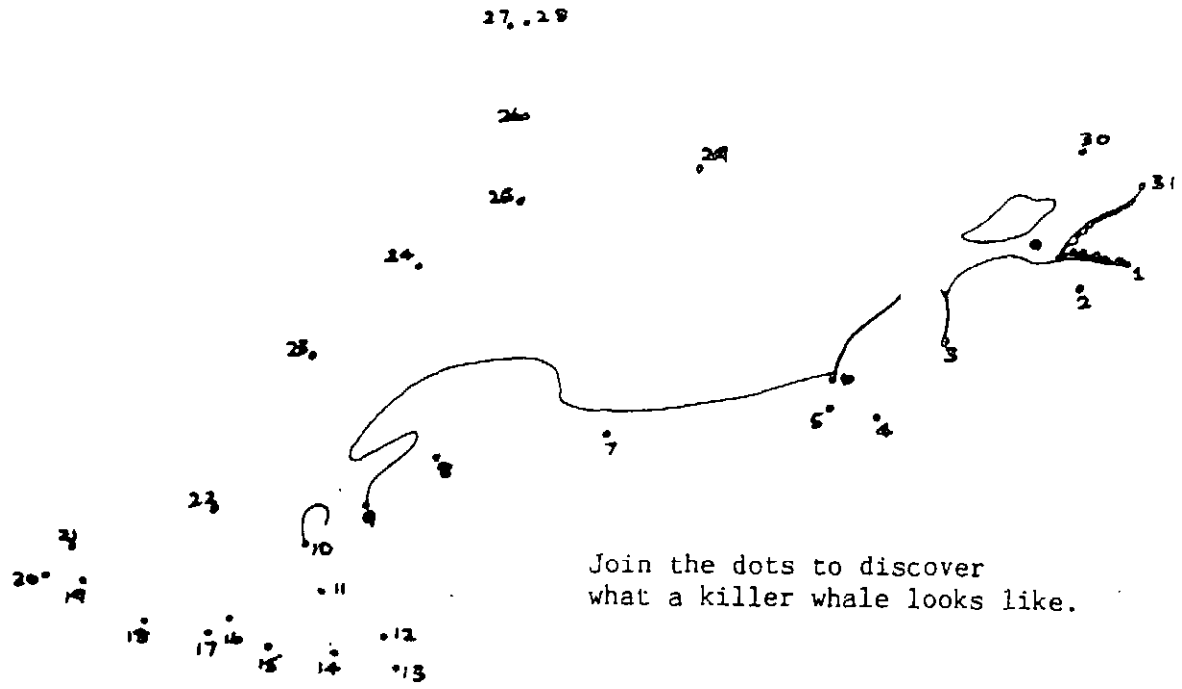
Many scientists study wild killer whales without catching them. They're learning where the whales go, what they eat, and how they behave toward each other. And they're trying to discover what the whales' amazing calls mean.

KILLER CALLS

Killer whales "talk" to each other with many different sounds. They trumpet, sing, whistle, and roar. These calls help the whales recognize others from their own *pod*, or group. Scientists can even tell one pod from another by the different sounds each pod makes.

A young killer whale probably learns to make the sounds of its pod by copying the adults. When older whales talk to their calves, they may be teaching them important "whale lessons."

A killer whale in trouble sends out a call for help that can be heard for miles underwater. Scientists have discovered that whales



Join the dots to discover what a killer whale looks like.

can hear another whale's cry at least 10 miles (16 km) away!

A whale also uses sound to help it "see" deep in the ocean where there is very little light. This is called *echolocation* (EK-oh-lo-KAY-shun). The whale sends out high squeals or clicking noises. The sounds bounce, or echo, off an object in the distance: a rock, a boat, or maybe a fish. When the sounds bounce back, the whale can tell how far away an object is by how long the sounds take to get back. It can probably even tell what the object is.

KILLERS' COMMUNITIES

Killer whale pods are made up of family members: mothers and their young, grandmothers, aunts, uncles, and cousins. The oldest female in the pod is the leader. The others learn many important things by following her example. Scientists think the females in a pod stay together for life.

When there is trouble, members of a pod help each other. If one is hurt or sick, others will lift it to the surface so it can breathe.

Pod members play together too. They dive, leap, and chase each other. Often they rub against one another. This may help them get rid of dead skin. But they also seem to enjoy just touching.

KILLER CALVES

A newborn killer whale calf is longer than a tall person and weighs around 400 pounds (180 kg). That's some baby! Very soon after it is born, the calf swims to the surface. Its mother stays by its side as it takes its first breath.

The calf has to get the right rhythm of blowing and breathing. Otherwise it may choke and sputter just as people do when they're learning to swim. It moves along underwater, holding its breath. Then it rises to the surface so that its nostril, called a *blowhole*, is above water. This blowhole is on top of its head, right above both eyes. The calf pushes the air from its lungs out of the blowhole. Usually there is a little pool of water on top of the blowhole. The water explodes into a fountain of tiny droplets when the whale forces the air out of its lungs. Then it quickly takes another breath through its blowhole.

A killer whale calf drinks milk from its mother. But it doesn't get the milk by sucking on nipples, as most young mammals do. Instead, the milk comes out of slits on the mother's belly. Special muscles squirt the milk out of the slits

when the calf nudges its mother. The milk is forced right into the calf's mouth.

Killer whales spend a long time growing up and learning from others in the pod. They don't have their own calves until about age 14.

KILLERS' CRUNCHIES

Killer whales are big eaters. But they don't all eat the same food. Scientists have discovered that there are two types of killer whale. One type eats mostly fish. These fish-eaters travel in large pods of ten to fifty whales. The schools of fish they hunt for are often scattered far and wide. So the whales spread out until one of them spots a school of fish. Then it calls the others in its pod to join in the big meal.

The other type of whale eats sea mammals and birds such as penguins. They travel alone or in small pods of two to five whales. These mammal and bird eaters do not need to hunt in large groups to find prey. They also rarely make sounds. It's easier to sneak up on a mammal or penguin that way.

Penguins and seals often rest on small islands of ice floating in the ocean. But that doesn't save them from a killer whale. When a whale spots something to eat on the ice, it charges up and rests its belly on the edge of the ice. With the whale's weight pushing down on one side of the tiny ice island, the animal on it just slides right off into the water!

Sometimes an adult killer whale catches food for a calf. The male killer whale may swim close to shore, looking for food for a calf in his pod. The calf and its mother are probably waiting in deeper water. With a *splash* and a snatch, the male grabs a sea lion pup. He may keep the young sea lion alive for a while so he can show the calf how to kill an animal. That is just one of the many lessons a killer calf learns from other whales in its pod.

People hope to learn a lot more about these great sea creatures too. But one thing we already know for sure: Unless you're a fish or a seal, the scariest thing about a killer whale may be its name!

Written with the help of Michael Bigg, Barbara Steiner, Terry Tempest, and Brooke Williams.

GIANTS OF THE SEAS

WWF-UK,
Panda House, Weyside Park,
Godalming, Surrey GU7 1XR
ENGLAND

The information below is taken from:
Natural Regions of the World: Teachers' Notes produced by World Wildlife Fund-UK.
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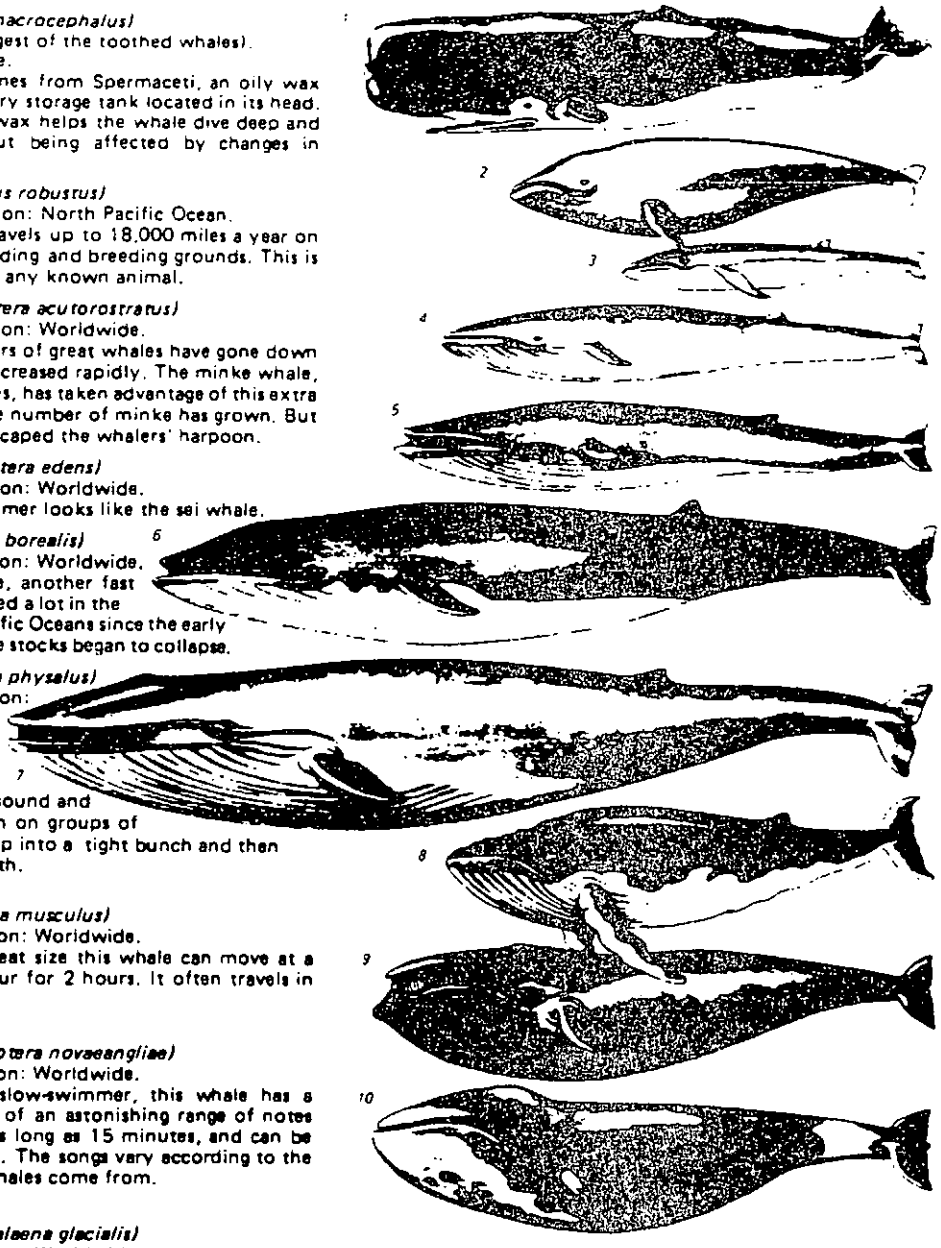
For many years whales were thought to be gigantic fish but because they give birth to live young which they suckle on milk it shows that they are mammals. Their ancestors were land-living creatures which started living in the sea some 100 million years ago. They are found in all oceans of the world.

The blue whale is the largest animal ever to live on the planet. It grows up to 31 metres long and weighs over 153 tonnes. To conjure up the right picture of this beast, its tongue is the size of an elephant, a small child could crawl with ease though its main blood vessel, and a full grown trout could swim comfortably through most of its blood vessels.

There are over 80 different kinds of whales, dolphins and porpoises, but they can be divided into two types, the toothed whales and the baleen whales. Toothed whales like the sperm whale, dolphins and porpoises feed on squids and a variety of fishes. Baleen whales, which include the larger whales such as the blue, Sei and fin whales, have horny curtains of plates instead of teeth. They use these to sieve from the water tiny floating shrimp-like creatures called krill which travel about in large shoals in the colder water of the Arctic and Antarctic seas. The huge baleen whales spend the summer months feeding on the krill in these waters. Then the whales travel vast distances to their winter breeding grounds in warmer seas.

(continue on the next page)

The great whales



1 Sperm Whale *(Pyseter macrocephalus)*
Type: Toothed (the largest of the toothed whales).
Distribution: Worldwide.
Features: Its name comes from Spermaceti, an oily wax found in an extraordinary storage tank located in its head. It is thought that this wax helps the whale dive deep and surface quickly without being affected by changes in water pressure.

2 Grey Whale *(Eschrichtius robustus)*
Type: Baleen. Distribution: North Pacific Ocean.
Features: This whale travels up to 18,000 miles a year on its journey between feeding and breeding grounds. This is the longest migration of any known animal.

3 Minke Whale *(Balaenoptera acutorostratus)*
Type: Baleen. Distribution: Worldwide.
Features: As the numbers of great whales have gone down their food of krill has increased rapidly. The minke whale, one of the smaller whales, has taken advantage of this extra food, and as a result the number of minke has grown. But these whales have not escaped the whalers' harpoon.

4 Brydes Whale *(Balaenoptera edens)*
Type: Baleen. Distribution: Worldwide.
Features: This fast swimmer looks like the sei whale.

5 Sei Whale *(Balaenoptera borealis)*
Type: Baleen. Distribution: Worldwide.
Features: The sei whale, another fast swimmer has been hunted a lot in the Antarctic and North Pacific Oceans since the early 1960's when the fin whale stocks began to collapse.

6 Fin Whale *(Balaenoptera physalus)*
Type: Baleen. Distribution: Worldwide.
Features: The fin whale is partial to eating fish like herring. The whale makes a low frequency sound and uses the echo to home in on groups of fish. It rounds the fish up into a tight bunch and then sucks them into its mouth.

7 Blue Whale *(Balaenoptera musculus)*
Type: Baleen. Distribution: Worldwide.
Features: Despite its great size this whale can move at a speed of 27 kms per hour for 2 hours. It often travels in groups of 2 or 3 animals.

8 Humpback Whale *(Megaptera novaeangliae)*
Type: Baleen. Distribution: Worldwide.
Features: A relatively slow-swimmer, this whale has a complex song made up of an astonishing range of notes and sounds which last as long as 15 minutes, and can be repeated time after time. The songs vary according to the seasons and where the whales come from.

9 Black Right Whale *(Eubalaena glacialis)*
Type: Baleen. Distribution: Worldwide.
Features: So-called because, swimming slowly and sluggishly, it was the right one (easiest) to kill of all the whales. It also floated when dead, unlike other whales, which sank when killed and were lost. This was the first whale brought near to extinction through hunting.

10 Bowhead Whale *(Balaena mysticetus)*
Type: Baleen. Distribution: Arctic Ocean.
Features: The bowhead whale is very like the right whale. This was one of the first whales to be killed until its numbers were so low it was no longer economic to hunt. It continues to be hunted by eskimos on a small scale.

30m 20m 10m 0

Since the whaling business developed over 100 years ago the numbers of whales left alive has fallen dramatically, and now most of the larger whales have been hunted to the very edge of extinction.

Whales are hunted because they provide a variety of useful products. oil for softening leather, making soap, crayons and lipsticks. meat for pet foods and bones and blood for making fertilizers and glue. And yet alternative substances now exist for all current uses of whale products.

The only hope for whales is to control whaling more strictly before they are killed off completely. The International Whaling Commission, under great pressure from conservation groups like WWF, has tried to limit the numbers of whales being killed.

Many of the larger whales have some formal protection, but much of this depends upon the goodwill of whaling nations to ensure that laws are followed. The main reason for the continued killing is that nobody owns or is responsible for the open sea. People can take its resources without worrying about the consequences.

(continue on the next page)

Here is a summary of the best estimates of present population sizes of commercially-exploited whales. The figures are from The Ecology of Whales and Dolphins by D. Gaskin (published Heinemann, 1982). Some of these figures are open to debate. The conservation status of the whales in also indicated:

	Present Population	Conservation Status
Sperm whale	above 567,800	■
Grey whale	7,000-15,000	■
Minke whale	113,000-646,780	
Bryde's whale	well in excess of 80,000	■
Sei whale	probably less than 130,000	■
Fin whale	probably substantially less than 88,000	■
Blue whale	7,000-13,000	●
Humpback whale	3,000-5,000	●
Black Right whale (all stocks)	3,500	●
Bowhead whale	2,500	●

Conservation status.

■ Rare or vulnerable ● Endangered.

DRAW A WHALE TO SCALE

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National Wildlife Federation, 1412 Sixteenth Street, N.W., Washington, D.C. 20036-2266, U.S.A.

Almost everyone is impressed with the sizes of whales. Try this short outdoor activity to help your kids visualize just how big the biggest species is.

Before the kids arrive on the day of the activity, measure off 100 feet (30 m) on a blacktop play area or parking lot. Then use chalk to draw the shape of a blue whale (see p.17) within that space so that it fills up the entire length. (Older kids might be able to draw the whale themselves.)

(continued on page 17)

MAKING A HYDROMETER

Education Department, National Aquarium in Baltimore,
Pier 3, 501 East Pratt Street,
Baltimore, MD 21202 U.S.A.

The activity below is taken from Maryland: Mountain to the Sea - a theme tour for grades 4-6 produced by the National Aquarium in Baltimore. The activity may be reproduced for educational purposes if credit is given to: National Aquarium in Baltimore.

A hydrometer is a sealed glass tube which is weighted at the bottom and has a scale on the stem. It measures the density of sea water, thereby indicating the amount of solid material dissolved in water. In this activity you will make a simple hydrometer and test the densities of different liquids.

MATERIALS NEEDED:

Plastic straws	Clear jars or large glasses
Modeling clay	Table salt
BB's, sand or small weights	Stirrer
Waterproof marker	Variety of liquids: syrup, soda,
Metric ruler	cooking oil, vinegar, soup, etc.

DIRECTIONS:

1. Plug the end of a plastic straw with clay.
2. Add enough BB's, sand or small weights for the straw to float upright in a container of water.
3. With a waterproof marker, mark the straw in half-centimeter units, showing the water level as 1. This will be the reference point for tap water.
4. Mix several salt solutions by dissolving different amounts of salt in several jars of water. Label jars according to the amount of salt dissolved. Float a hydrometer in each solution.

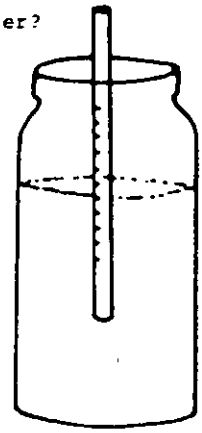
   It floats higher in which one?
5. Leave the hydrometer in a salt solution for several days. As the water evaporates, does the hydrometer float higher or lower?

   What does this tell you about the salinity?
6. Compare warm water with very cold water. The hydrometer floats higher in which one?

   Which is more dense, warm water or cold water?
7. Test the densities of other liquids. Float a hydrometer in jars or glasses of syrup, cooking oil, vinegar, soup, alcohol, mineral oil, soda, etc.

   How do they compare with the reading for tap water?
8. Look up hydrometer in a good dictionary. What does "hydro" mean?

   How does this make sense with what a hydrometer does?



ANSWER KEY

4. A hydrometer floats higher in the saltiest solution.
5. Higher; the salinity increases as the water evaporates.
6. It floats higher in cold water, which is denser than warm water.
8. Hydro-water, meter-measure.

ADVENTURES OF RANGER RICK by Elizabeth Athey

National Wildlife Federation,
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Washington, D.C. 20036
U.S.A.

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This story is about coral reef destruction in the Philippines. The story may be adapted to suit local circumstances. For example, the visitors to the Philippines may be more well-known creatures instead of Ranger Rick and his gang. Or the story can be adapted so that it describes the adventures of a group of young children.

"Canoe ahoy!" Ranger Rick shouted, pointing to a long, narrow boat in the distance.

"Do you think those people are out looking at all of these fantastic fish too?" Sammy Squirrel asked.

"Well, if they're not, they're missing a real treat," Scarlett Fox replied. The friends were visiting the Philippine Islands in the warm waters of the western Pacific Ocean. They had come to see the colorful fish that live in coral reefs around these islands. And they were having a great time.

Sammy leaned over the side of the boat and plunked his head down into the water. Through his swim mask he could see everything clearly. After only a moment or two, he got really excited. "I see angelfish and—hey!—there's a butterfly fish. It has eye patches that remind me of yours, Rick. It must be one of those *raccoon* butterfly fish I've heard about." Sammy chattered on, "Wow! Look at that fantastic clownfish ——"

"I'm staring at a *clown squirrel* right now," Rick interrupted. "You know you're supposed to be wearing a life jacket."

"Oh, c'mon, Rick," Sammy pleaded. "I'd *look* like a clown in that thing. Besides, the water is calm. There's no danger here—just crabs and shrimp and sea anemones and fish going about their business among the corals."

Rick thrust a life jacket at Sammy, but the squirrel stubbornly refused to take it.

"All those nuts you eat must have settled in your head instead of your stomach," Scarlett scolded. "It's nutty not to wear a life jacket."

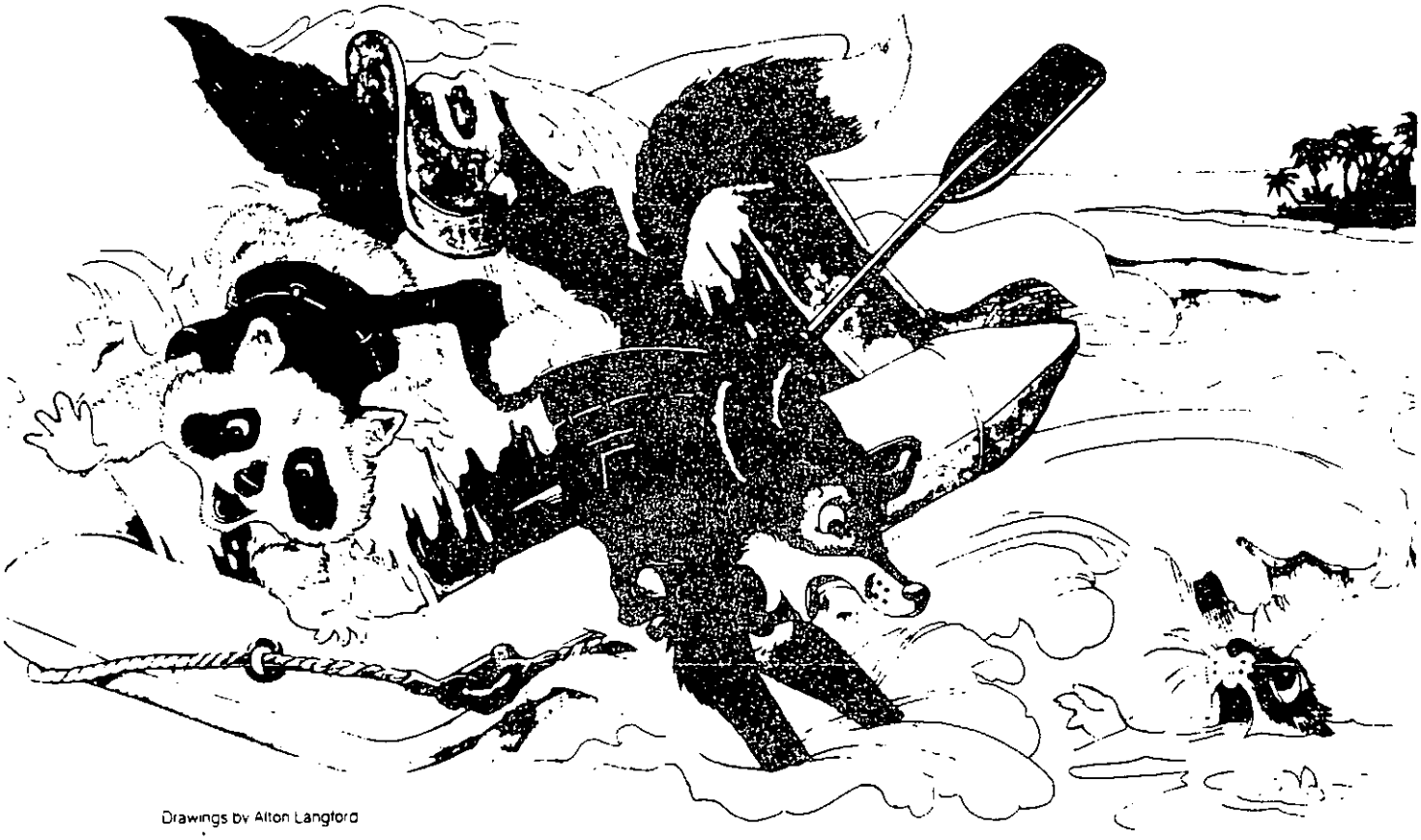
"Well, Sammy, I hope you'll change your mind later," Rick sighed.

Sammy continued to lean over the side of the boat. "I know corals are tiny, soft sea animals that build hard, stony homes around themselves. And I know that when these stony homes pile up on top of each other, they form coral reefs," he said seriously. "But I wonder: How long does it take to make a coral reef?"

"I'd guess about 3000 years to make a coral reef the size of a school bus," Scarlett answered. Then she continued to help Rick paddle closer to the canoe with the men in it. The men were facing the other way so they didn't see the quietly approaching boat.

Suddenly one of the men threw something into the water. Then . . . *BOOM!* There was a loud explosion. Water gushed up into the air, making lots of waves.

It all happened so fast that Sammy was still peering over the side when the first big wave hit. He teetered for a moment, and then he tumbled into the foaming sea.



Drawings by Alton Langford

"Squirrel overboard!" Scarlett screamed. At once both she and Rick leaned over and tried to catch Sammy's paw as he bobbed in the water. But the squirrel was out of reach. Desperate to save their friend, Scarlett and Rick leaned farther and farther out of the boat until . . . *splash!* Both Rick and Scarlett fell into the water headfirst. Now they too were struggling.

Sammy was so frightened that he lost his cool. Again and again he opened his mouth to scream. But every time he did, a wave slapped him in the face. Sputtering and coughing, he thought, *So this is what it's like to drown.*

At that moment Sammy felt something under his feet. It lifted him out of the water and said quite calmly, "Hold onto my back. I'll take you—and your friends—to that island." It was a dolphin. And in a few minutes it had also picked up Rick and Scarlett.

Safe in shallow water at last, Rick turned to the dolphin. "Thanks for rescuing us, whoever you are."

"You saved my life," Sammy said gratefully, spitting a piece of seaweed out of his mouth.

"Denise the Dolphin, at your service," the dolphin replied politely. "Glad to help."

"So-o-o glad you were here," Scarlett said. "I'm dyin' to know what that explosion was all about. Do you know?"

"I sure do, sad to say," Denise sputtered angrily. "It was some people from one of the larger islands. Sometimes they make bombs and set them off in the coral reefs."

"But why?" Scarlett asked.

"So they can catch fish," Denise answered. "Many of the people here are very poor. To make money, they sell small, colorful fish to traders. Then the traders sell the fish to pet shops. People all over the world buy them for their salt-water aquariums."

"But how can you *catch* fish with bombs?" Rick asked. "Don't bombs *kill* fish?"

"That's what makes me really mad," Denise muttered. "A bomb kills lots of fish. And it

often blasts off big chunks of the reefs where the fish live. But lots of the fish are only stunned by the explosion. And these stunned fish are easy for the divers to catch."

"Hey, everybody, look!" Scarlett exclaimed. "There's a boat headed this way. I wonder if it's another bomb-happy crew."

"I'll check it out," Denise said, swimming out to sea.

When she returned, Denise looked worried. "They're not bombers, but they're big trouble all right. They came out here last week. I watched them dive down into the water. Then I saw one of them squirt something from a bottle marked *cyanide poison* among the corals."

"What on earth for?" asked Sammy. "Seems like a dumb thing to do."

"They use cyanide for the same reason those other guys use bombs. The cyanide makes a lot of the fish dopey. And dopey fish are easy for the people to catch."

"But isn't cyanide awfully dangerous?" Scarlett asked.

"You'd better believe it!" Denise answered. "That's why there are laws against using it. Each year cyanide kills thousands of fish."

"That's *so* sad," Sammy said.

"You've got it," Denise frowned. "But fish going belly up isn't all that's sad. Cyanide kills corals too. And if all the corals die, there won't be any new coral reefs."

"We've got to do something," Rick said. "If people keep messing up the reefs, lots of fish and other sea creatures won't have a place to live or find food."

"You know," Sammy said thoughtfully, "Denise carried us to this island. And I'm sure we looked pretty weird too—all wet and draped with seaweed."

"You bet," Denise laughed.

"Well, Rick, if you feel real brave—and if you can hold your breath long enough—I have a plan," said the squirrel shyly. "*Surprise:* That's the key to my idea."

Sammy explained his plan to his friends, who thought it was risky but worth a try. When the divers anchored their boat in front of a nearby reef, Sammy whispered, "It's time to say *no* to those Poison People!"

The men dived into the water. One held a squirt bottle in his hand. The other held a plastic bag. When they were a few feet underwater, the men started to squirt their poison toward the reef.

It was at that moment both men felt something brush against their backs. They turned around and saw . . . a *monster!*

The monster was draped with seaweed. Its underside looked like a silver torpedo. Its topside was brown and gray, and it had four eyes. The monster darted up to the divers again and poked its claws near the men's faces.

Terrified, the divers dropped the bottle and the plastic bag. They just scrambled to the surface without looking back. Climbing into their canoe, they paddled away from the monster as fast as they could.

A few minutes later the monster surfaced near shore. Denise turned and asked, "You OK, Rick?"

"Sure am!" Rick exclaimed. "Sammy's plan worked! Me riding on Denise's back—and both of us covered with seaweed: We must have looked like a *very* scary creep from the deep."

"And—at least for today—lots of fish did *not* get poisoned," Scarlett crowed.

"And I finally did something right," Sammy happily announced. "I hope this makes up for all the trouble I caused when I was too stubborn to put on my life jacket."

"Promise you won't do a nutty thing like that again?" Scarlett asked.

"Of course I won't," Sammy said.

"Then I'll tell you what I think," Scarlett said. "I think you're a pearl of a squirrel."

FOOTNOTE: The new Philippine Government is trying to protect its coral reefs from bombs and cyanide. It wants to get this message across: If the reefs disappear, then the fish that live in the reefs will disappear too. And that would be too bad for everyone.

FINNY FUNNIES

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What sport might a fish enjoy?
BASSketball.

What vitamin do fish take to keep healthy?
Vitamin SEA.

When a fish gets hurt, who does it call for help?
The Rescue SQUID.

Who is the "Mr.Fix-it" fish?
The CARPenter.

- by Ellis Stewart and Mary Grace Dembeck.

Can you make up similar jokes about other fish you know?

TEACHERS'/PARENTS PAGE

PARTNER WANTED

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For many creatures in a coral reef, "you scratch my back and I'll scratch yours" is a way of life. Some living things in a coral reef depend on other living things in a very close relationship. This special relationship is a type of *symbiosis*. (Symbiosis means "living together.")

Before you begin, use the information in "Partners For Life" on page to go over each pair of reef buddies.

Here's a fun way to learn about coral reef partnerships. Make copies of the "want ads" below and pass them out to the kids. Have the kids try to identify which of the reef buddies might have placed each ad and which might have responded to each ad. To do this they should match up the "box numbers" for each ad. For example, the first ad (box 1) represents an ad that an anemone might place. It goes with the ad in box 4, which represents a clownfish's ad. The kids could write "box 1/box 4" for their answer. (See answers in margin.)

REEFS OF THE WORLD

Reef-building corals grow only where the water is warm (above 68° F), clear, and shallow enough for light to penetrate to the bottom. These conditions exist in tropical seas, generally around small islands and along the eastern shores of continents.

The largest and perhaps most well-known reef is the Great Barrier Reef, which stretches for over 1000 miles along the northeastern coastline of Australia. Other areas noted for their spectacular reefs are the Caribbean, the South Pacific, the Red Sea, and the Indian Ocean.

ANSWERS
Box 1 (sea anemone)
Box 4 (clownfish)

Box 2 (hermit crab)
Box 6 (sea anemone)

Box 3 (cleaner fish)
Box 7 (grouper)

Box 5 (pistol shrimp)
Box 8 (goby)

THE REEF WEEKLY

WANT ADS

Safe and secure place for rent. I'll take in anyone that can keep unwanted company away. Write only if you can stand my "stinging" personality.
Write: Coral Reef/Box 1

Seeking extra protection and a disguise. Willing to take on hitchhikers.
Write: Coral Reef/Box 2

Need a cleaning? Count on me! I'll keep you spotless and healthy in exchange for meals.
Write: Coral Reef/Box 3

Fish needs bodyguard and good home. (Not easily "stung.") Willing to help protect home from danger.
Write: Coral Reef/Box 4

Strong digger in need of a "watchdog." Bonus: Plenty of extra space in my burrow.
Write: Coral Reef/Box 5

Worried about safety? I can provide the added protection you need in exchange for a free ride around the reef.
Write: Coral Reef/Box 6

In search of a personal groomer. I have a "tough guy" image, but with the right partner, I'm gentle as a lamb. Write if you want to eat in peace.
Write: Coral Reef/Box 7

"Lookout" fish in search of a ready-made underground hideout. Lots of guard-duty experience.
Write: Coral Reef/Box 8

RESOURCES:

WET AND WILD: A MARINE EDUCATION CURRICULUM

Marine Education Program,
USC Sea Grant Institutional Program,
Institute for Marine & Coastal Studies,
University of Southern California,
Los Angeles, CA 90089-1231
U.S.A.

The bilingual (English and Spanish) curriculum materials called "Wet and Wild" were designed for students aged 5 to 12 years by a group of educators and the Education staff of the USC Sea Grant Program. The materials are not intended to serve as a textbook but as supplementary materials to be integrated into existing curricula.

The materials are multidisciplinary in nature as the designers recognised that science alone is not sufficient as a tool for teaching about the marine environment: the issues must be presented in their entirety. This, the designers felt, is most effectively accomplished when educators become comfortable with basic marine concepts and are able to weave the ocean into any or all of their classes as easily as they do land concepts.

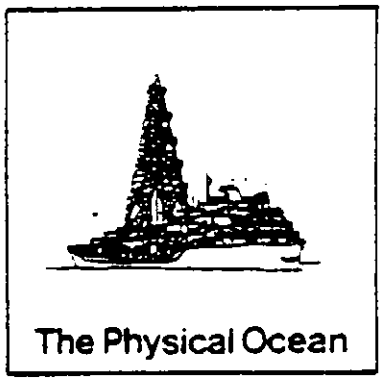
"Wet and Wild" materials are divided into six units. Each of the six units begins with a detailed introduction which covers enough basic information to make the teacher feel knowledgeable enough to apply any of the lesson plans in that section to his/her class with confidence.

Each unit contains approximately 25 multidisciplinary lesson plans which are "lively with enriching activities as they integrate the sea into all areas of academic endeavour". A detailed bibliography and research materials are also included in each unit.

The six units are as follows:

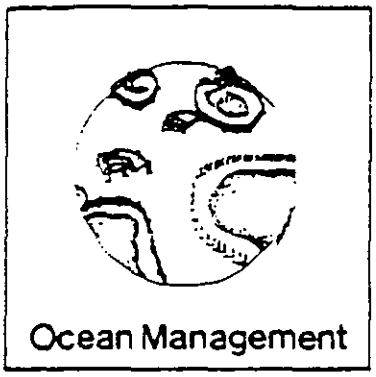
I. Physical Ocean
II. Ocean Management
III. Research
IV. The Biological Ocean
V. The Economic Sea
VI. Marine Ecology

A more detailed description of each unit follows, together with sample activites from Unit II. Ocean Management, and a price list for the materials.



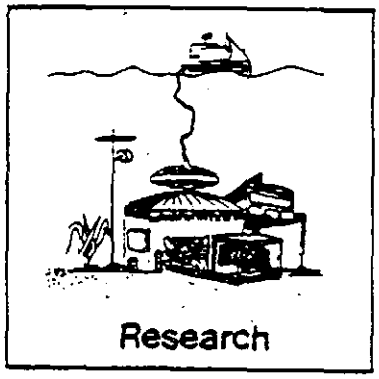
I. The Physical Ocean

Whether it is our weather, the spreading of the sea floor and earthquakes or the loss of property along coasts due to storm waves, the sea affects every one of us daily.



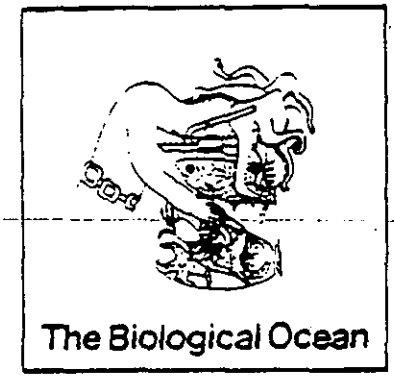
II. Ocean Management

Who owns the sea? Does it belong to us, them, everyone or no one? If we agree that the sea is the common heritage of mankind, who will decide how it is to be used and protected? This subject is particularly amenable to discussion groups, role playing and hypothetical problem solving situations.



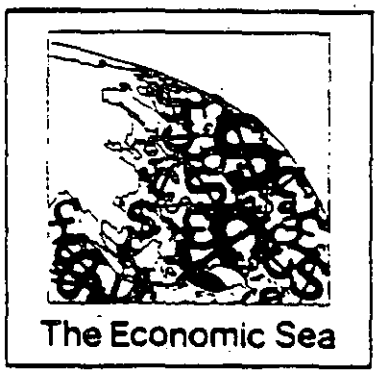
III. Research

Our knowledge of the sea has exploded during the last 100 years. Our surface and subsurface research systems, from satellites to underwater habitats and subs, attest to the creativity of man. But we are constantly astounded to learn that some of our latest discoveries have been common knowledge to less sophisticated people who live closely with the sea. Some of the most interesting literature of the sea is the stories and accounts of people working at the frontiers of ocean knowledge.



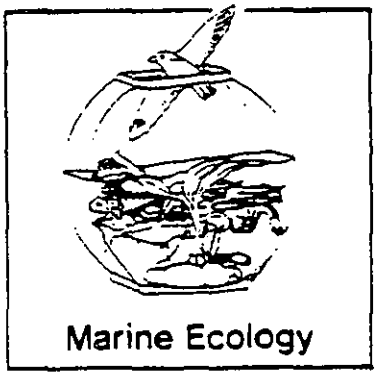
IV. The Biological Ocean

Life evolved in the sea and it is to the sea where we must look to find examples of the progression of life from simple to complex. There is no science fiction more bizarre than some of the animals without backbones. Their appearance, their ways of earning a living and caring for their young remind one of the creative potential of the evolutionary process. From another perspective we are awed and inspired by the marine mammals. In these magnificent creatures we see what we are not and possibly should be. Man's fascination with the dolphin is recorded in the historical literature or as myths and legends of every seafaring culture.



V. The Economic Sea

We have recently passed through a period of great enthusiasm regarding the sea and its resources. But anticipated riches from the sea and an expanding job market have not materialized. Living and nonliving resources are difficult and expensive to exploit. Farming the sea for food or drugs or exploiting its mineral resources is still the exception and not the rule. But other areas of ocean endeavor not usually considered by ocean enthusiasts are very important. These include military activities, shipping, and ocean recreation.



VI. Marine Ecology

All living communities on earth face the same basic problems of survival, whether they be a rainforest, a coral reef or one of our major cities. The sun's energy must be captured and resources must be exploited to maintain a healthy and functioning system. In nature there is no waste; everything must be recycled. Coral reefs for example farm on their roof tops, using the sewage, or waste of the coral animals, and passing it directly to plants which live within corals. This serves as nutrients for the plants to make food, which in turn helps the corals thrive. Likewise we should use our waste in agriculture. From the adaptations and relationships of marine organisms we have much to learn about the structure and functioning of communities.

Introduction

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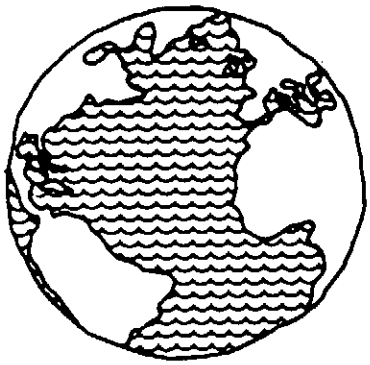
University of Southern California Sea Grant Program.

Who owns the sea?

As we look at a map of the earth, we see that the land has been divided up into many different parcels. Usually, each is given a different color. Each of these is a country or a state and each is owned by someone. But if we look at the earth from space, we see that these boundaries and colors are totally artificial. The earth is really a jewel of life and water suspended in space. What we have on this little spaceship is what we will always have in the future. We cannot get any more clean air, so we will have to manage this spaceship in a very sound way to ensure the health and welfare of our ecosystem.



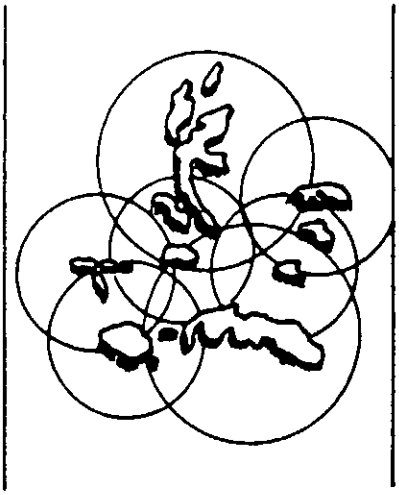
As we look at the sea, whether from space or on a map, we see that it is all one color. It has not been divided. There are a number of reasons for this. One is that the sea is a harsh environment. It has also been much less useful to us in the past than an equal area of land, and it is very difficult to defend.

But let's consider for a moment what the sea should be to us. As far back as 533 A.D., the Romans pondered this question stating, "Thus the following things are by natural law common to all—the air, the running water, the sea and consequently the shoreline." One thousand years later, Queen Elizabeth I said, "The use of the sea and air is common to all; neither can a title to the ocean belong to any people or private persons"; and again, over 400 years later in 1958, most of the nations of the world agreed that the sea ". . . is the common heritage of mankind and that it should benefit mankind as a whole." An important point made by these three statements is that the sea has been designated to belong to everybody. This is a very different concept than that of the sea belonging to nobody. If the sea belongs to nobody, there is no one responsible for its maintenance or well being and it is there for anybody to take and possess.

The following questions point to some of the problems that may occur. Do you want somebody else taking so many of your fish that they may soon be all gone? In addition to this, will you allow those people who take your fish to not share them with you? Do you want somebody to dump all their waste in your ocean? Do you want it polluted so much that the fish you catch cannot be eaten or that the whole life system dies? Do you want somebody to take your oil and your mineral resources and not share them with you? If we agree that you and I own the sea from the bottom to the surface, plus all the fish and whales and other resources between, what is the next step?

UNIT II: OCEAN MANAGEMENT

Introduction (continued)



Consider the possibility to each country that has a coastline extending its territorial boundaries 200 miles to sea. The ocean would be a maze of lines where each country was vying for a little more territory. There would be infinite conflicts as territorial lines and boundaries overlapped.

Consider a South Pacific island that is relatively small. It could be surrounded by a circle of territory over 125,000 miles in area. Think of all those straits and narrow passageways where ships of all nations normally pass. Could they be denied rights of passage? On the other hand, shouldn't a country have the right to deny foreign warships from passing too close?

The law of the sea and ocean management does not end as we reach the shore. In many situations, the problems become intensified as we consider the conflicting demands placed on coastlines and their resources. We know that coastlines are very important to ocean processes as well as to marine life. They are also very important to people. On most coastlines (where the water meets the land), there is a zone that is considered public property. Everyone owns it. Problems arise when people's access to the beach is denied because of private property.

Another example of conflicting demands and problems associated with the coastline situation is an estuary where people who own the surrounding land feel that they also own, or have been given rights to own, the water and marshland. In many cases, they want to develop that land; and in many cases, they are forced to develop it because of the taxing structure of the community. The question is, do you and I want that estuary to be filled for commercial or housing developments, or do we want it to be dredged into a harbor? Once the estuary is gone, the fishermen catch fewer fish; plus, a natural wildlife area and potential recreation area will be lost forever. On the other hand, if the harbor is built, there will be jobs and there will be income so that people can live better. One type of recreation will be replaced by boating and sailing.

Finally, how about the person who bought the land for development in the first place? Can we take his/her property away or prevent him/her from using it? Answers to these questions do not come easily. Our coastal states are wrestling with these problems by developing sound coastline management programs.

Let's consider two of the most fundamental and important questions relating to the ocean and its wise management. First, how do we make sure that resources are used properly without harming the earth's system; and secondly, how do we make sure everyone on earth gets to share the wealth from the sea? Most people believe that we need a world organization made of all individual governments—one in which all countries work together to decide how we should use the sea. In concept, this is a great idea; but there are over 160 different countries and each has a different idea as to how the sea should be managed. Small countries are afraid that the larger and richer ones will quickly take all the wealth from the sea and not share it with them. They are justified

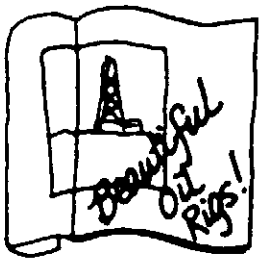
One need for international agreement:

EACH NATION HAS RECEIVED A 200-MILE EXTENSION OF ITS BORDERS. SUPPOSE THAT CANADA PASSES MORE

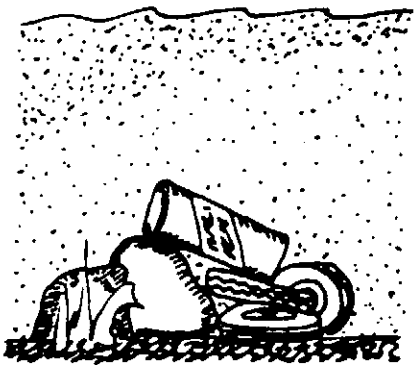
STRINGENT RESTRICTIONS THAN THE U.S. ON OIL TANKERS. HOW WILL CANADA REACT IF AN AMERICAN TANKER ON THE WAY FROM ALASKA TO SEATTLE DUMPS OIL ON CANADIAN BEACHES?

in this view—look what has happened in the past to the resources on land. On the other hand, large countries have fewer votes than the smaller countries and are afraid that the smaller countries will want so much that they will be prevented economically from exploiting the resource at all.

For example, the development of technology and research associated with exploiting manganese nodules on the deep sea floor is incredibly expensive; and the profit margin, if it comes at all, is going to be very low. It's likely that any other costs, such as those that would be required by a world-governing organization, would be enough to deter the investors and prevent industry from developing at all. In addition, we do not know all about the sea in terms of how many fish can be taken safely, how many harbors are too many, and what will happen if too much oil is spilled.



In answering questions such as these, we may have to look at the complete world as some states have begun to look at their coastlines; they proceed by compiling great lists of all the resources of the area, then give each resource a value of importance based on such things as the physical system, the biological system, and the importance to humans. There will be some areas that are very important as feeding and nursery grounds for marine life and other areas less important to nature. Logically, these other areas are where developments made by people should take place. Of course, there are many conflicts that must be resolved.



Sound management must be based on fact. Obtaining that factual knowledge and information is a very lengthy and expensive process. But based on this information, and realizing that we hope to continue living on earth for the indefinite future, we must decide what can and cannot be taken from the sea or put into it. Obtaining this kind of information and solving the difficult problems relating to ocean management and differing political viewpoints will take time and education.

Only through an ordered legal system can we resolve the many conflicts and difficulties relating to management of the ocean. For example, overfishing, pollution, the movement of war vessels, war, problems with fishing rights (such as the cod war off Iceland, problems with American tuna boats off South America), oil
drilling and oil spills, ships encroaching on other countries' territorial waters, ocean dumping, and many other potential problems must be faced now if we are to use and protect the sea for the future.

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UNIT II: OCEAN MANAGEMENT

Section A: Who Owns the Sea?

If you were to write a law for the sea . . .

Grades 4-6

Objective

The student will develop an understanding of the different perspectives countries have regarding ocean management and law of the sea.

Materials

Paper, pencil, chalkboard, and chalk.

Activity

The class will be divided into two groups, one group representing the United States—the rich, industrialized nation, and the other representing a number of small third-world countries, some of which have no ocean borders.

These groups will discuss and resolve the problems dealing with management and exploitation of deep sea bed minerals (oil, manganese nodules, and fishing). They must resolve the problems of pollution and territorial waters, including non-military rights of passage.

Finally, they will develop a system whereby the revenue gained from ocean exploitation will benefit all people on earth. Consider what it would do to the economic incentive in the United States to develop these resources. We will assume that only the United States has the capability of exploiting those resources; thus, if there is no incentive, they won't get developed and no one will benefit from the use of these resources for at least 10 to 20 years.

Procedure

1. Divide the class into two groups (as discussed above). Have each group elect a leader.
2. Make a list of the issues you must resolve on the chalkboard. Discuss the list with the class. (See discussion above; also refer to the introduction.)
3. Have each group meet privately first to decide what its position on each topic will be.

SOCIAL STUDIES •
DEBATE

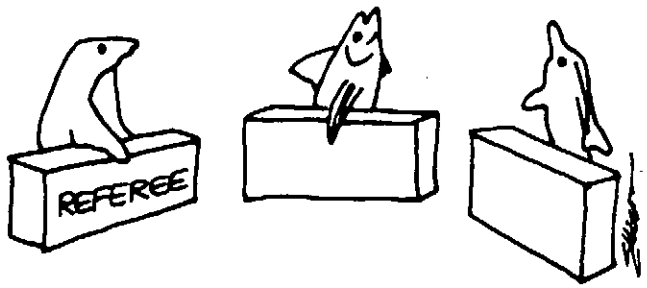
UNIT II: OCEAN MANAGEMENT

Section A: Who Owns the Sea?

Grades 4–6

Procedure (continued)

4. Have both groups meet. After discussing each side's positions, list each position on the board or on their papers.
5. Have each group meet privately to discuss the other side's positions and to formulate new ones for its own group.
6. Have the group meet together to negotiate and try to arrive at a consensus.
7. Have the groups write out an agreement and have each side sign it.



The tuna-porpoise debate.

GEOGRAPHY •
DEBATE

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UNIT II: OCEAN MANAGEMENT

Section C: Limits

How many fish can we take from the sea?

Grades 4-6

Objective

The student will learn that there must be limits on what can be taken if we are to protect any resource and ensure its perpetuation in time.

Materials

Paper to make 30 fish chips for each child (5 adult and 25 young). Cards marked as follows:

Disease—lose five young
Predators—lose ten young and two adults
Foreign fishermen—lose one adult
Warm water—lose five young and one adult
Bad current—lose five young
Rich nutrients and food increase—gain five young
Conservation—gain ten young
Competition with other fish—lose five young

Activity

Fishing Game

Each student begins with 30 fish chips (5 adults and 25 young). With this resource each player, in turn, picks one card from the pile, which will determine the fate of the fish chips.

After five turns each player then must decide how many fish chips can be sold to earn him/her a living and pay for his/her boat and how many must be kept for the future.

The future is the next round of five turns when each adult fish chip is changed into 15 young fish chips and each previous young becomes one adult. The more the student sells, the fewer he/she has for the future. If the student sells too much, there will be none for the future.

Fish Chips Value

Adults = $500
Young = $250

Grades 4-6

Activity (continued)

Each player begins with 5 adult and 25 young. One year = 5 turns. After that time, each adult fish chip becomes 15 young, and each young fish chip becomes one adult.

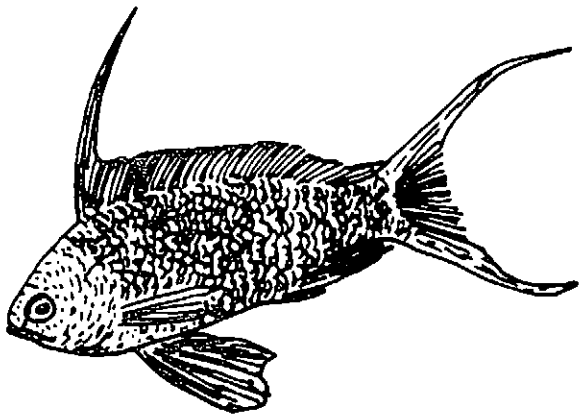
Example: Begin:	5 adults	25 young
Turn		
#1 predator	−2	−10
#2 nutrients		+ 5
#3 disease		− 5
#4 warm water	−1	− 5
#5 competition		− 5
	2 adults	5 young

You decide to sell as follows: 1 adult ($500 each) + 2 young ($250 each) = $1,000.

In addition, the remaining fish that you don't sell (1 adult + 3 young) convert to 15 young + 3 adults.

Summary

As the game proceeds, some fishermen will be wise and prudent managers, accumulating money and fish. Others, through bad management, will go out of business. Some will get rich quickly, but ultimately will have no fish left for the future. Chance is an important factor, and all fishermen must be cautious to stay in the game. No one wins, as such. Continuing to stay in business is reward enough because it is earning a living.



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UNIT II: OCEAN MANAGEMENT

Section C: Limits

Who owns the non-living resources?

Grades 4–6

Objective

The student will become aware of the complexities involved in ownership of the resources taken from the ocean.

Materials

3 × 5 cards, pencil, paper, and relevant current events.

Activity

Using 3 × 5 cards, have the class compose predicaments in which a landlocked country (and also a coastal country) might find itself. Write each predicament on a separate card. Try to write enough so that every student will have one. Some examples are listed on the following page.

Place the cards representing coastal countries on desks situated around the edge of the room. Place the landlocked countries on the remaining desks.

Students take their seats and each represents the country and predicament on the card that is on his/her desk. Each student, in turn, reads the predicament and gives a possible solution. Discussion will follow each presentation until a possible consensus is reached.

At the end (after the students "give and take" with each other), write out the acceptable agreement and have each student (country) sign. Using current newspaper clippings, etc., discuss how this game relates to happenings in everyday life.

Questions

How does this game relate to the real world? Do decisions like these really have to be made? What would better prepare you to make these important decisions for your country? Does the sea belong to everyone or no one? Can someone possess exclusive rights or claims to any area? (No.) *How would you be able to stake your claim? Who may exploit the area? Should there be production controls? If so, who would set the limits? How would you decide what the limits would be? What would this do to the "freedom of the seas" concept?*

SOCIAL STUDIES
GEOGRAPHY • WRITING

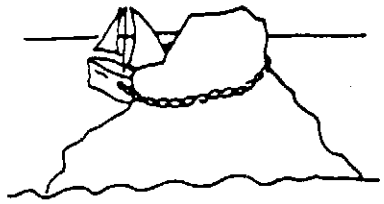
UNIT II: OCEAN MANAGEMENT

Section C: Limits

Grades 4-6

Examples of Predicaments

1. You have access to manganese nodules but only your neighbor has the present technology to extract them.
2. According to your calculations, you have a strong indication that there is a valuable "find" a few miles past your boundaries. What do you do? Tell your neighbor? Sneak it out? Work out a deal?
3. Your equipment for exploration is rudimentary. Your neighbor offers assistance for a percentage of the profits. How much would you agree to, if any at all?
4. You're a large, prosperous, coastal country with ever-increasing energy needs. Convince your poor, landlocked neighbor that you should get more energy.
5. You have the technology to extract valuable ores from the sea but only your coastal neighbor has access.
6. You've discovered oil by slant drilling from land, but you discover that it's on your coastal neighbor's property.
7. You are a poor landlocked country. Convince the more wealthy countries that you should be given an EQUAL share of the resources they exploit, since the ocean is to be used for "all nations."



An iceberg could be towed from Antarctica to Chile in 300 days. It would lose 86 percent of its water, but would still be worth $2.7 million when it got there. Since the trip would cost only $1.3 million, there is a nice profit to be made. Anybody got a long rope?

"Wet and Wild" costs as follows:

WET & WILD: Six Bilingual Supplementary Marine Curriculum Guides for Teachers, Grades K-6.

Six units, each in English and Spanish, contain introduction of background information for teachers, approximately 25 multidisciplinary lesson plans in each unit and a list of reference books and films. Published by the Evaluation, Dissemination and Assessment Center for Bilingual Education, California State University, Los Angeles.

UNIT 1: The Physical Ocean (Wet, Wild and Deep).
171 pp. (USCSG-ME-01-83)
_____X $8.00 = $_____

UNIT 2: Ocean Management (Who Owns the Sea?).
66 pp. (USCSG-ME-02-83)
_____X $6.00 = $_____

UNIT 3: Research (Innerspace Explorers).
146 pp. (USCSG-ME-03-83)
_____X $8.00 = $_____

UNIT 4: The Biological Ocean (Hello Down There!).
180 pp. (USCSG-ME-04-83)
_____X $20.00 = $_____

UNIT 5: The Economic Sea (Riches of the Sea).
150 pp. (USCSG-ME-05-83)
_____X $18.00 = $_____

UNIT 6: Marine Ecology (You Scratch My Back... I'll Scratch Yours).
188 pp. (USCSG-ME-06-83)
_____X $23.00 = $_____

COMPLETE SET (UNITS 1-6)
SAVE $8.00!
_____X $75.00 = $_____

A documentary and slide sets linked with "Wet and Wild" are also available:

Wet and Wild.

A 10-minute documentary on the marine studies classroom and field programs for visually impaired children. Serves as an inspiration for other groups to conduct similar programs. Video tape (in color and with sound) available in three sizes: 1/2" Beta II, 1/2" VHS and 3/4" U-matic. (USCSG-ME-08-82)
Prices available on request

continued/...

Dimensions of the Sea: Marine Education Slide With Narratives: Grades K-Graduate Level.

a. The Physical Ocean. (13 slides)	_____ x $11.00 =	$_____
b. Ocean Management. (15 slides)	_____ x $12.00 =	$_____
c. Ocean Research. (15 slides)	_____ x $12.00 =	$_____
d. The Biological Ocean. (22 slides)	_____ x $16.50 =	$_____
e. The Economic Sea. (27 slides)	_____ x $20.00 =	$_____
f. Marine Ecology. (44 slides)	_____ x $33.00 =	$_____
Complete Set, a-f. (136 slides)	_____ x $95.00 =	$_____

Each set contains 35mm color slides on the marine community and environment, accompanied by a written narrative which can be adapted by teachers to the appropriate grade level. (USCSG-ME-04-82) Order complete set and save 10%!

***Narrative available in either English or Spanish**
____English ____Spanish

Orders should be sent with payment to:

USC Sea Grant
Marine Education Program,
University Park
Los Angeles, CA 90089-1231
USA

CARTOONS FOR CHILD SURVIVAL

Here is a cartoon about child survival. It is the work of one of seventeen Asian cartoonists and graphic designers that attended a week-long workshop early in 1988. The workshop, run by UNICEF and the Press Foundation of Asia, recognised that creative talents of graphic artists should be utilised more often to get across child survival and development messages.

Can you design a poster that will encourage parents to have their children immunized?

JESUS 'JESS' ABRERA
PHILIPPINES

OUTREACH 50

CONTENTS:

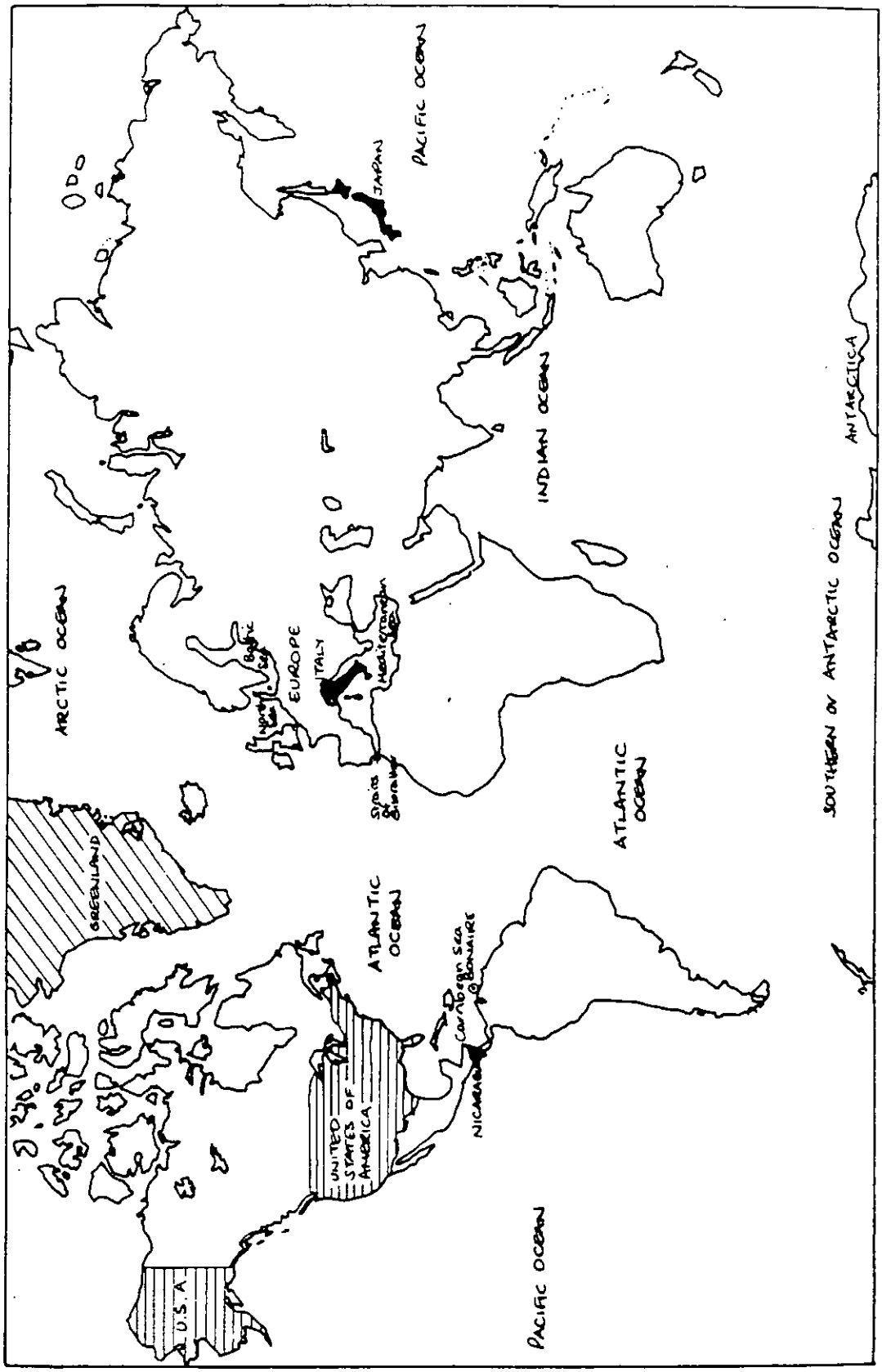
Using the chart below, you can see at glance which fields of interest are touched upon in this OUTREACH pack.
Letters in the chart indicate the following:
a - articles b - stories c - activities and games
d - teachers'/parents' page e - resources

Topic		General	Africa	Asia	Middle East	Latin America & the Caribbean	Deserts	Forests	Wetlands	Oceans	Mountains	Grasslands
Land	(L)											
Water	(Wa)	acd								acde		
Atmosphere	(A)											
Wildlife	(Wi)	ae								acde		
People	(P)									a		
Human Habitation	(Ha)											
Health and Sanitation	(He)									a		
Food and Nutrition	(F&N)											
Energy	(E)											

Reading levels:
I = for young children aged 8 - 10 years
II = for schoolchildren aged 11 - 13 and adults with basic literacy skills
III = for teachers and/or people with a secondary education

LOCATION MAP

The map below shows the location of places mentioned in OUTREACH issue no. 50:



ARTICLES ON MARINE AND COASTAL ENVIRONMENTS THAT HAVE APPEARED IN BACK ISSUES OF OUTREACH

	issue	page(s)
Drip the Drop: the journey of a drop of water through the water cycle	5	18-21
The "Tiger of the Sea" gets its teeth cleaned	16	21-23
Find the cleaner	16	24
A Wildlife message	16	25-26
Older than the Dinosaurs	17	4-5
Eyes that surprise	18	1-2
Turtles winning race against extinction	18	12
Background notes on green and olive ridley sea turtles	18	13-14
Now you see me, now you don't	18	20-21
Some mathematical puzzles on sea turtles	18	25
Coral reefs (part 1)	19	
Coral reefs (part 2)	20	
Caribbean nations curb over-fishing of queen conch	32	25-27
Wetlands (part 1) includes some general information on wetlands and coastal habitats	33	
Wetlands (part 2) focuses on mangrove swamps	34	
Puzzle: why people smoke fish	35	7
Fish smoking: the Chokor Smoker	35	8-15
Special issue: children's magazines on water	41	

OCEAN MOTIONS

Here are some notes on the movement of ocean waters. The article is based upon information from the following:
Ranger Rick's NatureScope: Diving into Oceans published by the National Wildlife Federation, USA (1988)
"The restless currents" and "Time and tides" from The UNESCO Courier, February, 1986.

The article provides useful background notes for teachers, and it includes various activities for children.
If reproduced, please credit sources.

The waters of the ocean never stop moving. We see the constant tumbling of waves along the shore and the quiet ebb of the tide. But less obvious are the great ocean currents - streams of water that flow over parts of the ocean in never-ending cycles.

(i) Ocean currents

Ocean currents are formed by a combination of three major forces - the heat of the sun, the rotation of the earth and winds that blow across the ocean's surface.

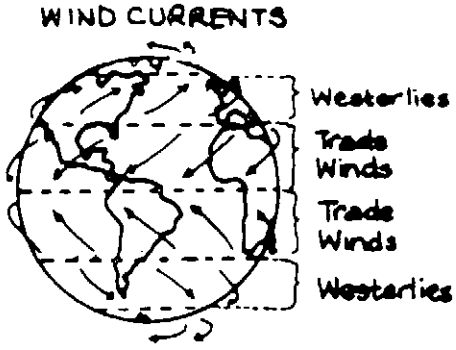
As the earth revolves around the sun, it rotates on its own axis in such a way that the direct rays of the sun strike the seas near the equator, heating them up much more than the polar seas. As the surface water at the equator heats up it expands. This raises the sea level at the equator ever so slightly but enough to create a "slope". The water at the equator, therefore, tends to run "downhill" towards the Poles.

Cold water is heavier than warm water, because water contracts as it cools. So the colder water of the polar regions sinks beneath the inflowing warm water from the equator and spreads slowly back along the bottom towards the equator.

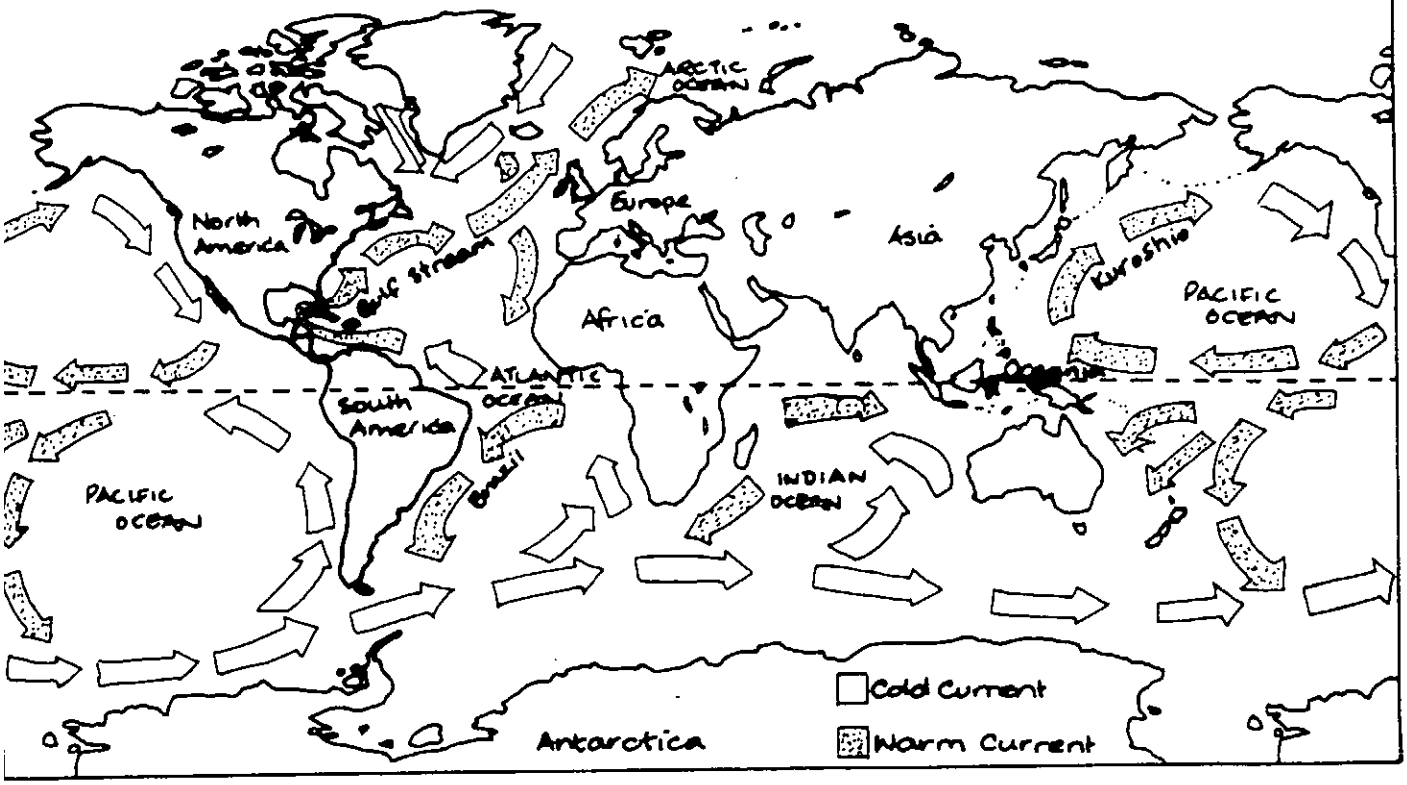
The rotation of the earth also has another curious effect on the waters of the ocean. Because of the earth's spin, the winds of the world are deflected as they blow. This is called the Coriolis Effect. In the northern hemisphere the winds are deflected to the right. And in the southern hemisphere the winds are deflected to the left.

Prevailing winds, too, have a major influence on currents. Prevailing winds are those that blow continuously in the same general direction. The most predictable prevailing winds in the Tropics are the Trade Winds, see diagram. These generally blow steadily from east to west towards the equator. But these winds are also affected by the Coriolis Effect which causes them to curve north and south away from the equator and to circle back in the higher latitudes, driving the surface waters before them from west to east.

In the middle latitudes the Westerlies drive the ocean currents west to east.



MAIN OCEAN CURRENTS



NOTE TO TEACHERS: Draw a new world map showing the position of the continents and the equator. Draw arrows that indicate the direction of ocean currents. Then invite students to colour in the cold and warm ocean currents, and to label the following: the equator, the names of the continents and oceans; two major currents, the Gulf Stream and the Kuroshio current.

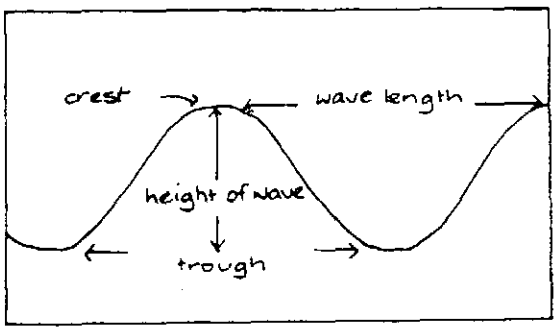
A combination of three forces - the heat of the sun, the Coriolis Effect and the prevailing winds - causes the ocean currents to circulate clockwise in the northern hemisphere and anti-clockwise in the southern hemisphere, see map.

(ii) Waves

Waves constantly cause ocean waters to rise and fall as they transfer energy from one part of the ocean to another. Waves are caused by wind, earthquakes or volcanic activity and by the gravitational* pull of the moon and sun.

Waves caused by wind are the most common. As the wind moves over the water, it pushes against the surface. This causes part of the water to rise. The wind then pushes the raised water and creates waves.

In an ocean wave, water moves up and down. There is no forward motion as with currents. See this for yourself. Tie a rope to a tree and, holding the loose end, move your hand up and down. The rope will go up and down, too, but the rope itself will not move forward.



Look at the diagram of a wave. There are two main parts: the crest and the trough. When a wave reaches land, its trough starts to drag on the bottom. This causes the lower part of the wave to slow down while the crest still moves quickly. The crest gets higher until it topples over, causing the wave to "break" on the shore. These breakers pitch water, as well as sand and other kinds of sediment, onto the beach. Waves also hit against cliffs on the coast. They chip away and break up parts of the rock.

As the wave moves back into the ocean, it goes under the waves coming in and carries material from the shore.

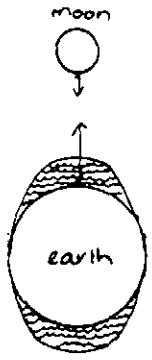
Tsunami

A tsunami (said: TSOO-nom-ee) is a giant ocean wave that starts when a sudden motion in the earth jolts and displaces the water in the ocean. Undersea earthquakes, coastal earthquakes and volcanic activity are the usual causes of tsunamis. Most tsunamis occur in the Pacific Ocean.

The height and speed of a tsunami are affected by the depth of water it is travelling through. Out in the middle of the ocean, a tsunami may be only 3 feet (90cms.) high. But when it reaches shore it may tower above land to a height of 100 feet (30 metres) or more.

(iii) Tides

Tides, the periodical rise and fall of the waters of the ocean, are caused by the gravitational* pull of the moon and sun. The gravitational* forces of the moon and sun are constantly pulling at the water, air and land on earth. Because the moon is much closer to the earth than is the sun, it exerts a much stronger pull.



When the moon is directly over any point in the ocean, it pulls water towards it causing it to "bulge out" towards the moon. This is called a tidal bulge. Where the bulge is greatest is high tide. As the moon circles the earth, it pulls the water in different part of the earth into high tides.

On the side of the earth opposite to this tidal bulge, the force generated by the rotation of the earth is greater than the attractive force of the moon. And so the water at this point tends to dome outwards, too. Thus high tides will occur at the same time on opposite sides of the earth, rather than a high tide on one side and a low tide on the other.

Low tides occur at points ninety degrees away because water is flowing away from these areas towards areas of high tides. In other words, there is a constant flow of water from every part of the ocean towards the points directly under or directly opposite the moon.

Every other week, tides are much higher or much lower than at other times. This is due to the relative positions of the earth, moon and sun. For example, at times of new and full moon, the earth, the moon and the sun are in a line,

and the sun and moon are pulling in the same direction. This causes the highest high tide, the spring tide, to occur. But when the moon and sun are at right angles to each other and are pulling against each other, then very small tides occur. These are called neap tides.

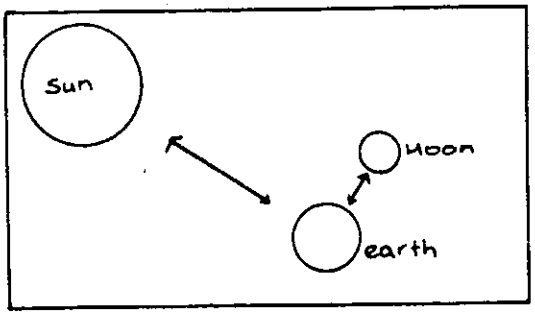
The rotation of the earth and moon and the size, shape and depth of ocean basins all have an effect upon tides. That is why in some places - such as along the Atlantic Ocean - there are two tides a day, yet the Mediteranean Sea doesn't have much tide action at all.

* Gravity is the force of attraction between all matter in the universe, including the earth, sun and moon. It holds everything on earth - including ocean waters - down to earth while everything on earth is also attracted by the sun and moon. This pull of gravity is an important part of producing tides.

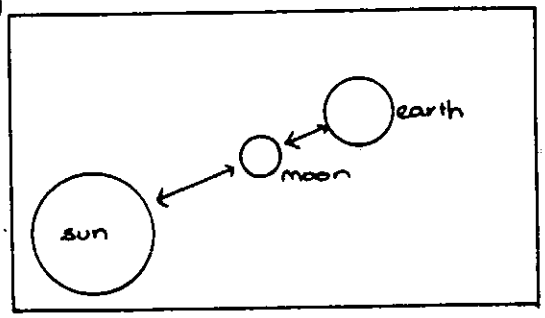
OCEAN MOTION QUIZ

1. Which is heavier, cold water or warm water?
2. Name three forces that cause ocean currents.
3. In which direction do currents generally flow in the southern hemisphere, clockwise or anti-clockwise?
4. What is the most common cause of waves?
5. Which direction do waves move:
   (a) up and down?
   (b) side-to-side?
   (c) forward?
6. What causes tides?
7. Look at the diagrams below. Which kind of tide occurs in situation (a) and in situation (b)? Try to draw the bulges of water.

(a)



(b)



Answers
1. cold water; 2. the sun's heat, the rotation of the earth and winds; 3. anti-clockwise; 4. winds; 5. (a) up and down; 6. The gravitational pull of the moon, and to a lesser extent, the sun; 7. (a) neap tide (b) spring tide.

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When hot and cold salt water meet

Here is an experiment which shows what happens when warm salt water is added to cold salt water, and vice versa. Before you try this experiment, can you predict what will happen? When you add warm salt water to cold salt water, will it float at the surface, sink to the bottom or mix together? When you add chilled salt water to warm salt water, will it float, sink or mix together? Now let's see if your predictions are right.

What you need:

4 containers;
a clear glass or plastic jar;
a measuring cup;
salt water solution;
canning salt;
hot water;
food colouring;
medicine dropper;
refrigerator.

What you do:

1. Pour 1 cup of the salt water into a container. This is solution A. Put solution A into the refrigerator for at least 2 hours to cool it down.
2. After 2 hours, pour 1 cup of hot water into another container. Add 1½ teaspoons of salt, and stir until all the salt has dissolved. This is solution B.
3. Into a third container, pour a small amount of solution B, add 4 or 5 drops of food colouring and stir well. This is solution C.
4. Fill the clear jar with about 2 inches of solution A. Then, using the medicine dropper, drop in about 20 drops of solution C. Watch what happens as coloured warm salt water drips into the cold salt water.
5. Clean out the clear jar.
6. Now reverse the experiment. Pour a small amount of solution A into the fourth container. Add 4 or 5 drops of food colouring, and stir well. This is solution D.
7. Fill the clear jar with 2 inches or so of solution B. Then drop in about 20 drops of solution D into the jar, using the dropper. Watch what happens as the coloured cold salt water drips into the warm salt water.

In each case what happens to the water? Were your predictions correct? What does this say about water currents? Based upon this experiment, where would you find the warmest water in the ocean - at the surface or close to the bottom?

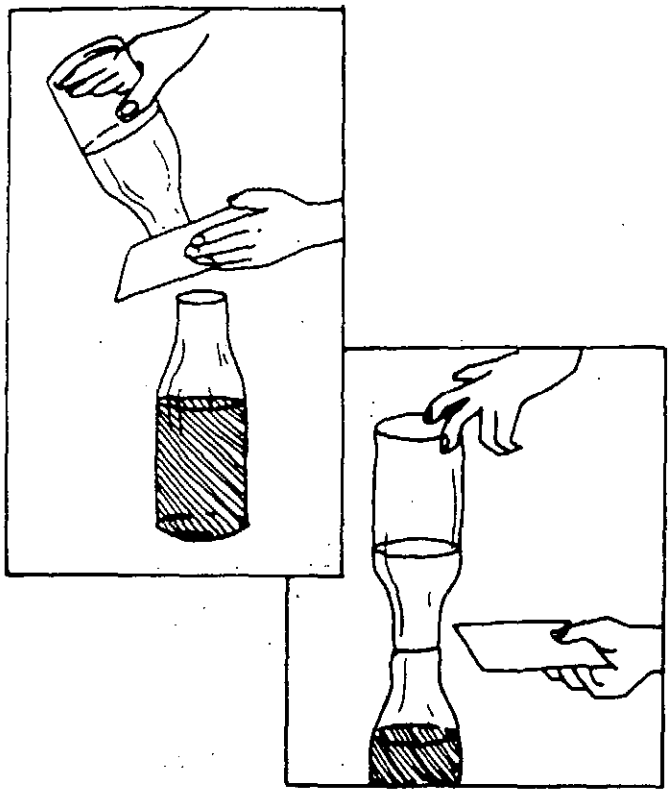
Perhaps, it is difficult to get all you need for the above experiment. It can be simplified a little.

Use 2 glass jars that are identical, if possible. (At least their mouths should match each other exactly.) Fill one jar with cold water, and fill the other with hot (boiled and then cooled a little) water. Colour the hot water with food colouring. Stir well.

Place a thin piece of cardboard over the mouth of the jar containing cold water. Hold the cardboard tightly over the top of the jar and carefully turn the jar upside down. Place it on top of the jar containing the hot water. Be sure the mouths of the jars are directly over each other. Slowly and carefully remove the cardboard.

What happens to the water? (The cold water will sink to the bottom of the bottom jar. The coloured water will then be distributed throughout both jars.)

Reverse the experiment by placing the coloured hot water on top of



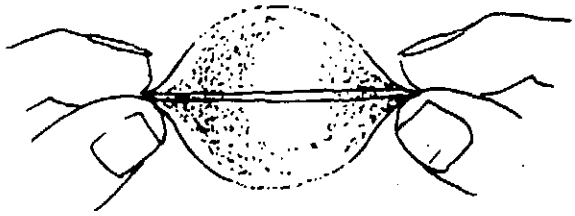
Making a tidal bulge

Try this exercise to help you understand how tides are formed.

What you need:
A ball of cotton;
A rubber band

What you do:

1. Wrap the rubber band around the ball of cotton. Make sure the band is just tight enough to fit but not too tight that it crushes the ball.
2. Using two hands, hold the opposite sides of the cotton ball. Pull the rubber band and a little cotton between your thumb and index finger of each hand. See how it changes the shape of the cotton ball. This is a little like the effect of the pull of the moon's gravity on earth.

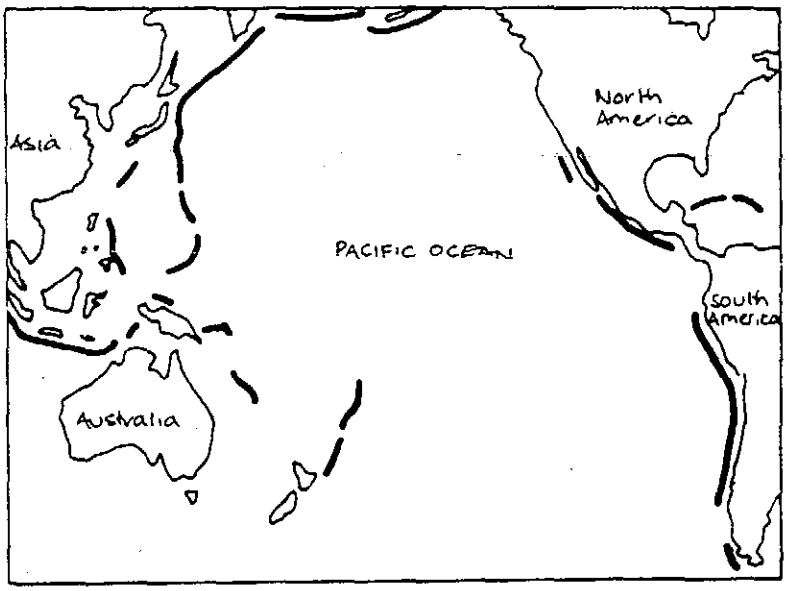


the jar containing the cold water. What happens to the water? (When hot water is placed on top of cold water, the two bottles will keep their original colour. The waters won't mix.)

The article below is taken from **Natural Regions of the World: Teachers' Notes** produced by **World Wildlife Fund-UK**. If reproduced, please give credit to **WWF-UK**. (WWF-UK, Panda House, Weyside Park, Godalming, Surrey GU7 1XR, ENGLAND.)

DUMPING IN OCEAN TRENCHES

Ocean trenches run like canyons across the deep sea bed. Some - like the Japan and Philippine trenches - reach depths of 6 miles or more (see map). The world's 22 ocean trenches, representing a small part of the total ocean area, are unique habitats. In these dark depths, where pressures are thousands of times greater than those on the surface, up to 60% of life forms in each separate trench are found nowhere else. Knowledge of trenches is sketchy. Yet they have been mooted as *dumping sites for highly* toxic chemical and radioactive waste, under the assumption that the deeper these substances go, *the less harmful* they will be. As trenches represent the point where continental 'plates' meet some believe the waste would be swallowed into the earth's core as one continental plate grinds over another. However, some scientists dispute this theory, claiming the waste would never reach the molten interior. Some conservation organisations are concerned that pollution would destroy a unique environment - even before its riches have been discovered.



Map - Ocean trenches in the Pacific Ocean

FROM LIGHT INTO DARKNESS

World Wildlife Fund-UK,
Panda House,
Weyside Park,
Godalming, Surrey GU7 1XR
ENGLAND

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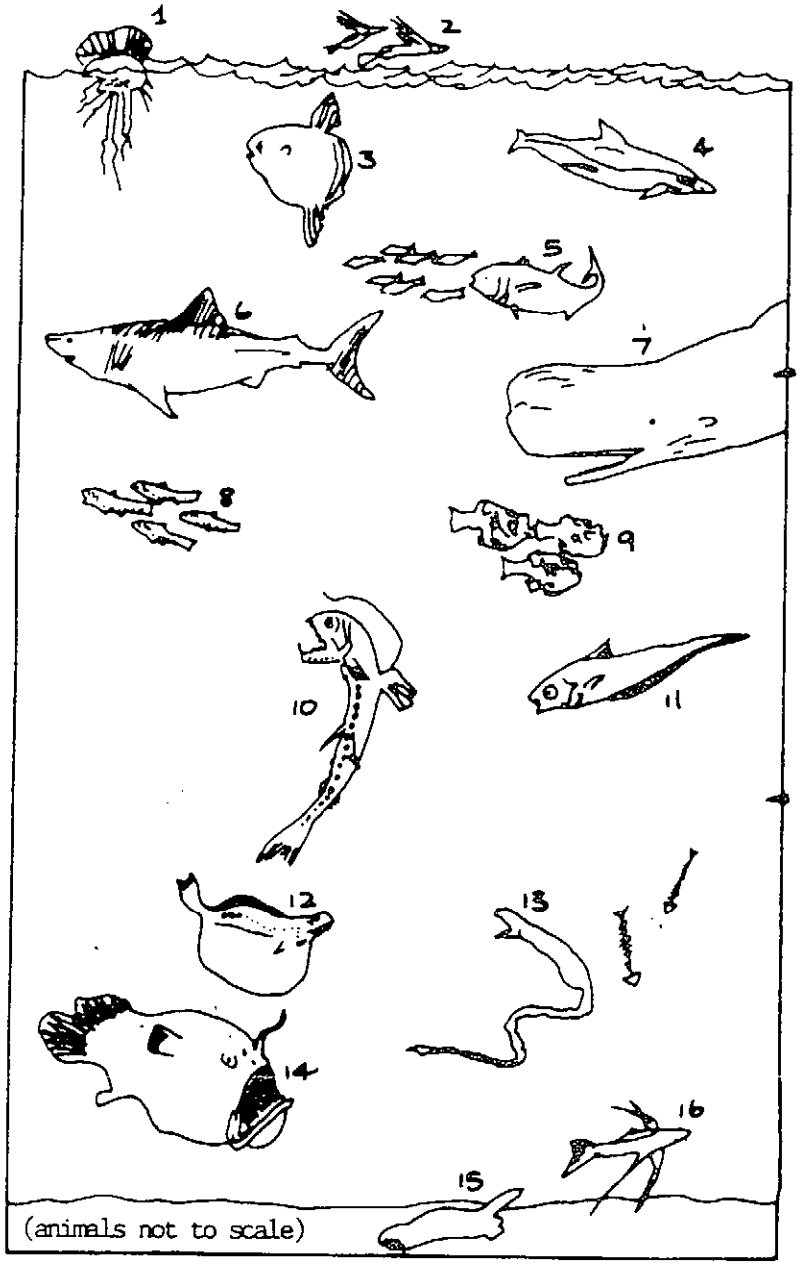

SUNLIT ZONE (EUPHOTIC ZONE)
Sunlight can pass down through ocean waters only to a depth of about 150 metres. This sunlight or Euphotic zone contains most of the minute green plants to be found in oceans. Living in the top layer too are animals which live on plants (herbivores). These are the smallest oceanic animals, the drifting zooplankton, and small fish which tend to travel in large groups or shoals in the wake of planktonic plants. This zone attracts many other fish and even the mighty whales which eat zooplankton and small fish. Sea dwelling mammals, like whales, seals and dolphins, can dive deep into the ocean, but are regularly found in the uppermost layer of the open ocean because they come to the surface to breathe.
The number of small fish in the euphotic zone increases at night. These fish travel up from the lower ocean at this time because they can avoid their predators more easily during the hours of darkness.

TWILIGHT ZONE (MESOPELAGIC ZONE)
Below the sunlit surface waters is the twilight world of the mesopelagic zone. This is the home of countless fish and larger invertebrates like squid, octopuses and prawns. In this zone the plant kingdom is represented only by bacteria and fungi. And so the inhabitants are mainly animals which feed upon other animals (carnivores). This region offers little shelter. To counter the threat of being hunted many creatures are speedy swimmers with streamline bodies to aid movement. Some have well developed sensory organs which detect approaching enemies, and others have stinging mechanisms with which to repel possible predators.

DARKNESS ZONE (ABYSSAL ZONE)
Beneath the twilight zone and below the reach of the main surface currents are great regions of permanent darkness. This deep sea or abyssal zone extends to the ocean floor and it represents about 90-95% of the oceans' depth.
Far from light, in near-freezing waters at extremely high pressures, animals depend upon a meagre diet of dead plants and animals (detritus) which drift down from the surface waters to settle on the ocean floor. This food supports relatively few scavenging animals, but the variety of abyssal creatures is remarkable. As yet in these largely unexplored depths more than 2,000 different and often weird-shaped animals have been discovered. The majority are 30cm or less in length and most swim with their large mouths always agape. Most deep-sea animals are dark coloured but have light producing organs. This light – the only light in the darkness – helps animals to communicate and attracts prey.

1. Portuguese man-of-war; 2. Flying fish; 3. Ocean sunfish; 4. Striped dolphin; 5. Bluefin tuna; 6. White shark; 7. Sperm whale; 8. Lantern fish; 9. Hatchet fish; 10. Viperfish; 11. Rattail fish; 12. Black swallower; 13. Gulper; 14. Angler fish; 15. Sea cucumber; 16. Tripod fish. (For a description of these sea creatures, turn to the next page.)

NOTES ON SEA CREATURES (see previous page)

National Wildlife Federation,
1412 Sixteenth Street, N.W.
Washington, D.C. 20036
U.S.A.

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1. **Portuguese man-of-war**
* purple body with long, purple and white tentacles;
* tentacles may be over 100 feet (about 30 metres) long;
* small fish are paralyzed by stinging tentacles, then eaten.

2. **Flying fish**
* doesn't really fly - gains speed as it swims, then leaps from water and glides;
* body is silver;
* about 9 inches (about 21 cms.) long.

3. **Ocean sunfish**
* about 15 feet (about 4.3 metres) and weighs more than a ton;
* body is grey or brown;
* eats jellyfish.

4. **Striped dolphin**
* eats small fish and squid;
* about 8 feet (about 2.3 metres) long;
* back is dark blue and belly is white.

5. **Bluefin tuna**
* usually swims in schools;
* about 14 feet (about 4 metres) long and weighs 1800 lbs. (about 810 kgs);
* back is blue-black, sides are silver-grey and belly is white.

6. **White shark**
* a large grey or brown fish with a white belly;
* feeds mainly on fish and marine mammals;
* sometimes hunts around the edges of kelp forests;
* has no natural enemies.

7. **Sperm whale**
* about 56 feet (about 16 metres) long and weighs about 43 tons;
* body is grey or black;
* may eat a ton of food a day;
* commonly dives to depths of more than 3000 feet (about 85 metres) in search of giant squid and other prey.

8. **Lantern shark**
* 2-3 inches (about 5-7cms.)
* swims closer to surface at night to feed on zooplankton;
* body is pale brown or grey and speckled with many lights.

9. Hatchet fish
* feeds on zooplankton and shrimp;
* 3 to 4 inches (7-9 cms.) long;
* sides of body are silvery, with lights along belly.

10. Viperfish
* jaws can open wide to catch large prey;
* about 8 to 10 inches (19-24 cms.) long;
* body is dark brown or black;
* single line of lights along sides of body:
* lighted lure helps to attract prey.

11. Rattail fish
* about 2½ feet (about 70 cms.) long;
* body is grey;
* feeds on lantern fish, shrimp and the remains of dead animals.

12. Black swallower
* about 6 inches (about 14 cms.) long;
* body is black;
* can swallow fish that are 8 to 10 inches (19-24 cms.) long;
* stomach stretches to hold large prey.

13. Gulper
* slender, eel-shaped body about 15 to 22 inches (35-53 cms.) long;
* body is velvet black;
* flattened head consisting of the mouth opening with teeth;
* feeds on invertebrates, especially crustaceans.

14. Angler fish
* about 3 to 6 inches (7-14 cms.) long;
* body is dark brown or black;
* eats fish, squid, zooplankton and worms;
* females have a light at the end of a stalk that helps them to attract prey and mates.

15. Sea cucumber
* about 1 foot (about 30 cms.) long;
* crawls over bottom, feeding on small bits of food;
* body is usually dark violet.

16. Tripod fish
* about 1 foot (30 cms.) long;
* body is dark brown;
* long, stiff fins help it to stand on soft bottom.

TEACHERS'/PARENTS' PAGE

DEEP SEA SHOW

UNC Sea Grant College Program,
Box 8605
N.C. State University
Raleigh, NC 27695-8605
U.S.A.

The activity below is from:
North Carolina Marine Education Manual Unit 3: Coastal Ecology by Lundie Maudlin (UNC Sea Grant College Program) and Dirk Frankenberg (Marine Science Curriculum, UNC, Chapel Hill) (August 1978). This publication was sponsored by the Office of Sea Grant, NOAA, U.S. Dept. of Commerce and the North Carolina Dept. of Administration.

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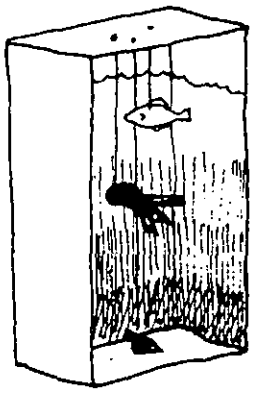
Objective: To allow for creativity in learning about nekton living in various depth of the ocean.

Teacher Preparation: This activity is more of a special project for a group of students. Materials can vary as to what is available. Basically a cardboard box of whatever you want from a refrigerator box to a produce box, construction paper, glue, scissors, string, paint, crayons.

Procedure: Turn the box on its side standing tall. Paint or paste in water color, light blue or green for surface, deeper blue near middle turning to black at the bottom. This gradation indicates absorption of light rays. Cut out models of fish and other creatures which inhabit different depths. Tie each to a string and suspend it from the top of the box at the suitable level. Some animals are capable of quite a bit of "vertical migration". You may wish to show this by pulling and lowering the animals to make your point. Squid, whales, and some crustaceans may migrate down to depths of 1000 m.



Discussion:

1. Why would most animals inhabit the upper levels of the ocean? (Most light allows most plants to grow providing food to other animals)

2. On what do deep animals feed? (This answer is still being studied by scientists. Many think deep animals depend on what drifts down to them. Some think food comes from organic molecules which clump up and become food sized particles)

3. Why are most mesopalagic animals luminescent? (To allow recognition of each other and of prey)

"JUST CALL ME LUCKY!"

by Willem Semeler, Age 11 as told to David F.Donavel

National Wildlife Federation,
1412 Sixteenth Street, N.W.
Washington, D.C 20036
U.S.A.

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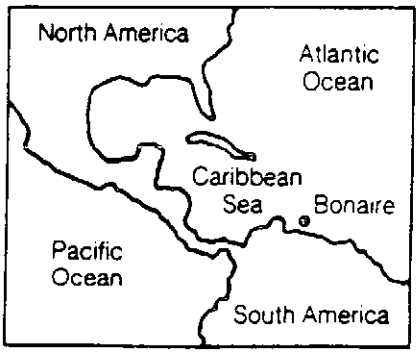
Here I am, feeling at home in the water.



When you see how I live, you'll probably say, "That Willem—he's so lucky!" And guess what . . . I'll agree with you for sure.

See all the diving gear I'm wearing? I go diving every day, year round. It's easy for me. I live on Bonaire, a little island in the Caribbean Sea. It's near the northern coast of South America, (See map).

Most of Bonaire is a desert, so we can't grow much food here. That didn't bother the people who settled here long ago. There were plenty of fish and conchs (KONKS) for them to catch in the coral reefs around Bonaire. (Conchs are delicious animals with large pink shells—the same ones people put to their ears to "hear the ocean.") Over the years, people took more and more conchs and fish from the water around our island.

Finally our government became worried that the conchs and some of our fish would

disappear for good. So they decided that the coral reefs and water around much of Bonaire would become an underwater park. That means that many kids like me who want to stay on Bonaire no longer grow up to be fishermen. We have to find new ways to make a living—and I did.

Tourists have come for years to see all the pink flamingoes that nest on Bonaire. Now they are starting to come because of the good diving around our coral reefs in the underwater park. But the tourists need someone to show them around. So instead of catching and selling fish and conchs, I'm learning to be a dive guide. I will lead visitors on dives and help them see living fish and other animals in our beautiful, clear waters.

Now you're probably saying, "Lucky Willem. He gets to dive every day, so he doesn't have to go to school." But that's not true. I *do* go to school and I like learning new things. I study math and reading and science just as you do. But I will also learn several languages besides our island language. I will learn to speak English better too. Then I'll be able to talk with almost anyone who comes to visit Bonaire and wants a dive guide.

Every day after school and on weekends I ride my bike from my house down to the beach. When I don't have a diving lesson, I snorkel in a shallow bay. I practice diving by spotting a little rock and then trying to bring it up.

My scuba diving lessons are more serious, but they're still fun. My teacher's name is Andre Nahr. Since I've been working with Andre, my diving has been getting much better. He also teaches me about what diving does to my body so I can dive safely. Then I'll be able to make sure others are diving safely too.

To be a good dive guide, I will have to know a lot. But most important, I must be completely at home in the water. That is one reason why

When we're underwater, Andre and I talk in sign language. Today we agree: everything's just perfect.

I swim almost every day.

I have to learn all about diving equipment too. I must be able to fill air tanks and care for diving gear. This gets a little complicated, so I have to pay close attention to Andre.

By now I know the names of many fish on the coral reef. (I can't wait to show the tourists my favorite big fish: the groupers and moray eels.) But I especially like discovering what the fish *do*.

It's amazing to watch the little "cleaner fish" at work. They eat lice and other harmful pests that cling to the bodies of bigger fish. After a good cleaning, the big fish are much healthier. And the cleaners are well fed.

Another thing I'm learning is that many kinds of coral are named for their shapes. In our seas we have brain coral, elkhorn coral, finger coral, and many more. The colorful coral reef formations are built from the skeletons of millions of tiny animals. And the reef they've built is home for many of the other sea animals I have to learn about: sea anemones, shrimps, crabs—well, I don't know all of them yet!

Sometimes I dive with my two uncles, Naro and Wicho. They are both dive guides in the underwater park, so I can learn from them too.

The first time we went diving together, I decided to play a trick on them. I hid behind a great big sponge. Then I watched them searching all over for me. They looked so worried it made me giggle! When I finally came out of hiding, they didn't think my trick was one bit funny. They made me promise *never* to hide from them again. I know now that to be safe, people should always stick with a buddy underwater.

Once in a while we take food along for the fish. Then the fish surround us like a group of puppies and take the food right out of our hands. But most of the time we just swim around and enjoy being in our underwater world.

On days when I don't have school, Naro and Wicho often take me with them and their guests on dive trips. Sometimes they let me steer the boat and help the visitors with their equipment.

It's neat to think that in a year I'll have my Junior Open-Water Diving Certificate. That means I'll have passed all the diving tests. But when I dive I'll still have to have someone with me who's at least 15. But when *I'm* 15, I'll be on my own. Then I'll help tourists see and understand the coral reef, just as my uncles do.

And maybe someday you'll take a trip to Bonaire and I'll show you around the reef. Then *for sure* you'll go home saying, "That Willem—what a lucky guy he is!"

Marine Mammal Crossword Puzzle

Center for Environmental Education,
1725 DeSales St., N.W.
Suite 500,
Washington, D.C. 20036
U.S.A.

National Aquarium in Baltimore,
501 East Pratt Street,
Baltimore, Maryland 21202
U.S.A.

The activity below is taken from: The Ocean: Consider the Connections published by the Center for Environmental Education, (1985). The activity appears in the publication courtesy of National Aquarium in Baltimore.

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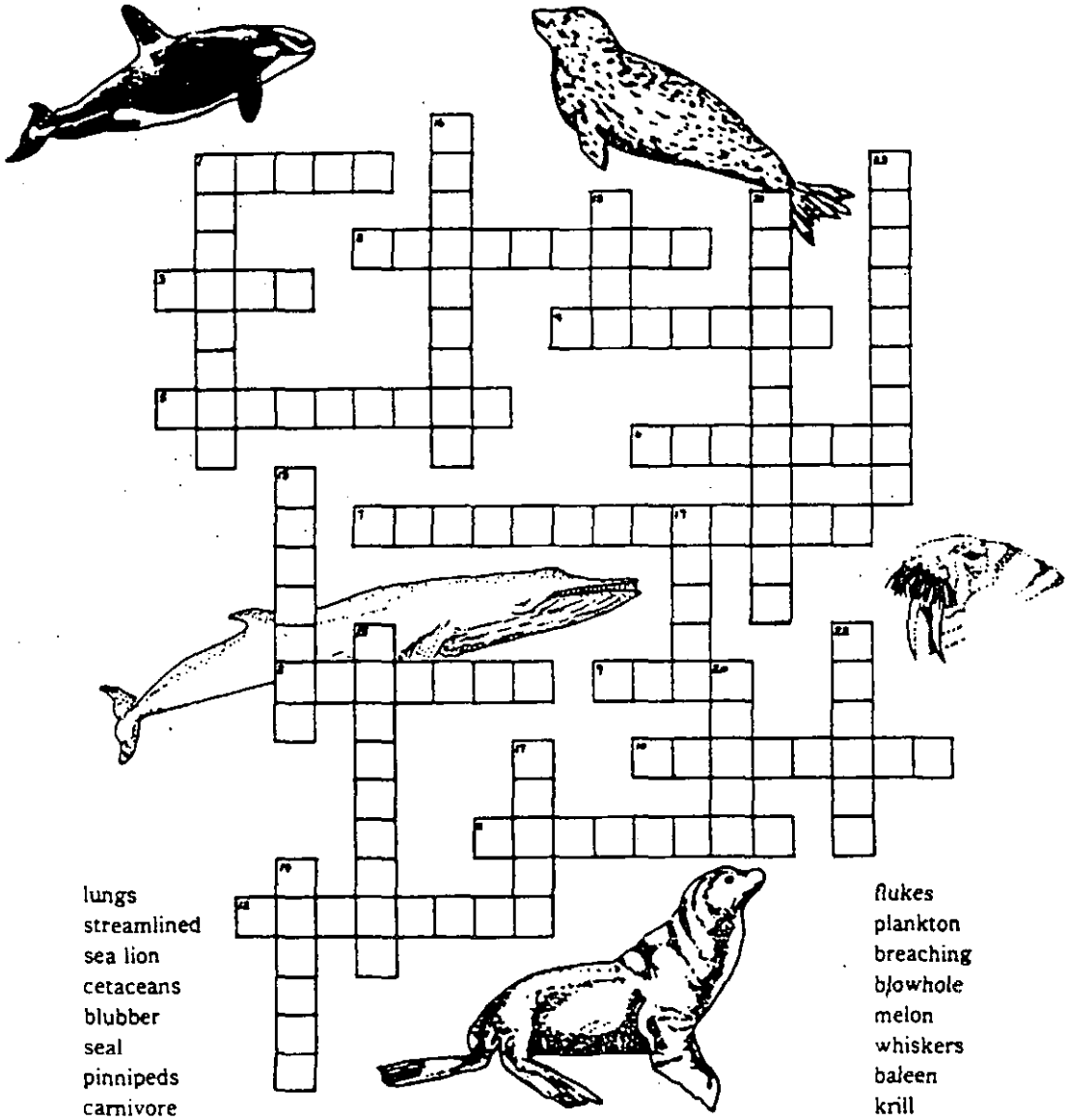


lungs
streamlined
sea lion
cetaceans
blubber
seal
pinnipeds
carnivore
herbivore
sonar
pods
sea otter

flukes
plankton
breaching
blowhole
melon
whiskers
baleen
krill
tusk
earflap
flipper
mammary glands

(Crossword clues are on the next page.)

Marine Mammal Crossword Puzzle /continued...

ACROSS

1. Some animals can guide themselves with _____ by emitting sound waves into the water which bounce off objects and return to them.
2. Seals, sea lions and walruses belong to a group of marine mammals called _____.
3. Cetaceans travel in small social groups called _____.
4. Most marine mammals have a thick, fatty layer of _____ under the skin to insulate them from the cold.
5. _____ is the term for any animal that eats plants.
6. A pinniped that propels itself with its front flippers and is very agile on land is the _____ _____.
7. The _____ _____ are structures found in female mammals that produce milk to feed the young.
8. One distinguishing characteristic of sea lions is the _____ _____, a small piece of skin that covers the ears.
9. The _____ of the walrus is really an enlarged canine tooth.
10. Like all mammals, whales do have hair in the form of _____ growing on their chins.
11. Cetaceans have a nostril or _____ on top of their heads that is used for breathing.
12. A collective term for tiny plants and animals found floating in the sea is _____.

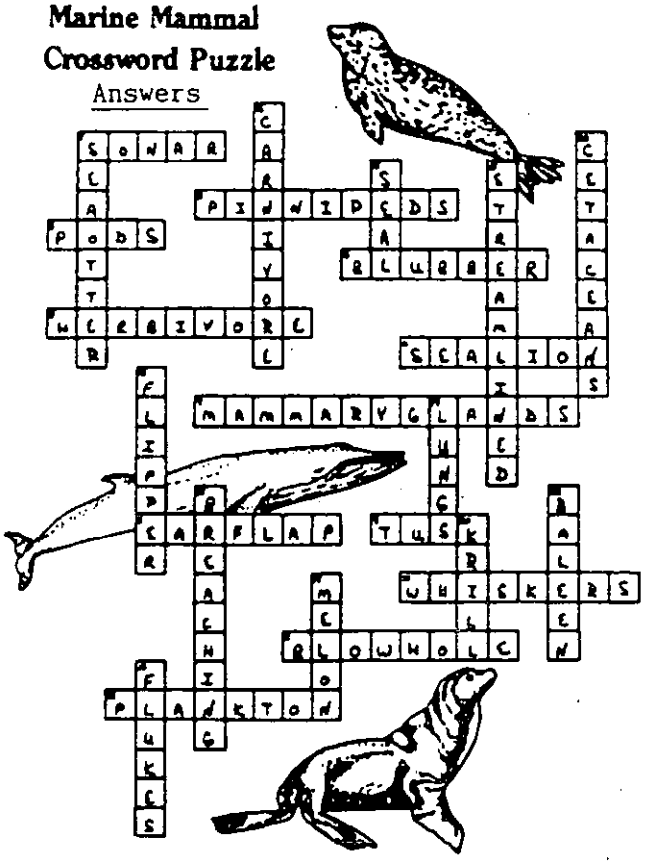
DOWN

1. A _____ _____ is a furry marine mammal that floats on its back while eating and may even use a rock as a tool.
13. The flattened forelimb of a marine mammal is called the _____.
14. Whales' tails are called _____.
15. A word that describes how whales sometimes leap out of the water and create a big splash is _____.
16. An animal that eats meat is called a _____.
17. A dolphin has a mass of fatty tissue in its forehead called the _____ through which sounds are projected.
18. A pinniped that propels itself with its hind flippers and is generally awkward on land is the _____.
19. Marine mammals, like all mammals, use _____ to breathe.
20. Baleen whales feed on small shrimp-like animals called _____.
21. Marine mammals have very _____ body shapes to cut down on resistance and allow them to move easily through the water.
22. Instead of teeth, some whales feed with sheets of fringed, horny material called _____.
23. Whales and dolphins belong to the group of marine mammals called _____.

Answers on the next page.

Marine Mammal Crossword Puzzle

Answers



The pollution of the oceans

United Nations Environment Programme (UNEP)
P.O. Box 30552,
Nairobi,
KENYA

The article below is taken from UNEP Environment Brief No.5: Cleaning up the Seas. If this article is reproduced, please give credit to UNEP.

Most of the world's waste ends up in the sea. Effluents from factories, farms and homes is dumped first into drains. From there, it flows— often untreated— into streams and rivers. The final step to the sea may take hours or months but the rubbish that finally spews out into the ocean— about 20 billion tonnes of it a year— moves but slowly. Most contaminants remain for years in coastal waters— and an estimated 90 percent of them never reach deep water. Instead, they stay close to shore, where they interfere with the most productive breeding grounds of fish and pollute even the fairest beaches.

For these reasons, the deep oceans are not thought yet to be seriously polluted— even though materials such as radioactive rubbish and toxic wastes are deliberately released into the sea or burned in mid-ocean. Coastal areas, by contrast, are already seriously polluted— from the Atlantic to the Pacific, and from the Caribbean to the Mediterranean.

The commonest evidence of this is the filth in which tourists are now condemned to swim on their favourite beaches. Sewage is often in abundant evidence. So are the diseases that accompany it. In 1973, many people in Naples, Italy, died from cholera poisoning, probably as a result of eating contaminated mussels. In the 1950s, thousands of Japanese were poisoned by mercury released by industry into tidal estuaries.

But it is not only tourists who suffer. More than two-thirds of the world's population live within 80 km

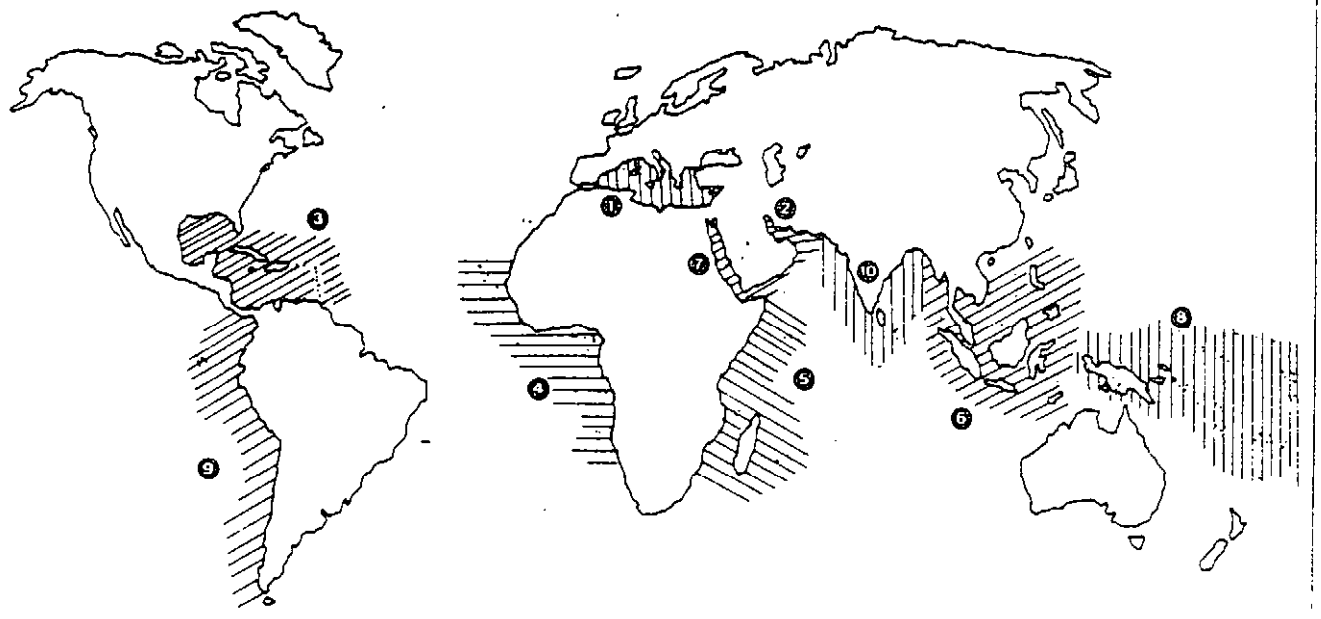
of a coast, and nearly half of the world's major cities are built on or near a tidal estuary. These facts are one reason why coastal waters have become so badly polluted. They are also one of the reasons why it matters so much: those who depend on the sea inevitably suffer when its quality deteriorates. For fishermen, things are particularly serious. Most of the world's 20,000 varieties of fish and 30,000 types of molluscs come from coastal waters. Worldwide, 90 percent of the fish catch is taken near the shore. Pollution is threatening that catch -- which provides much of the world's badly needed animal protein. Sludge from sewers has ruined many of the best shellfish beds in the United States, and in 1969 it was estimated that 70

How the seas are contaminated

(see map below for location of regional seas)

MAJOR SOURCES OF CONTAMINATION	Baltic	North Sea	Mediterranean	Kuwait Action Plan Region	West African areas	South African areas	Indian Ocean region	South-east Asian region	Japanese coastal waters	North American areas	Caribbean Sea	South-west Atlantic region	South-east Pacific region	Australian areas	New Zealand coastal waters
sewage	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
petroleum hydrocarbons (maritime transport)	●	●	●	●	●	●	●	●	●	●	●	●			
petroleum hydrocarbons (exploration and exploitation)		●		●	●			●		●	●	●	●		
petrochemical industry		●	●	●					●	●	●				
mining			●					●		●			●	●	
radioactive wastes	●	●	●				●		●	●		●			
food and beverage processing	●	●	●			●				●	●	●	●	●	●
metal industries		●	●		●				●	●		●			●
chemical industries	●	●	●						●	●					
pulp and paper manufacture	●				●					●			●	●	●
agricultural runoff (pesticides and fertilizer)			●		●		●	●		●					●
siltation from agriculture and coastal development						●	●	●			●				
sea-salt extraction							●				●				
thermal effluents						●	●		●	●	●	●			
dumping of sewage and dredge		●							●	●					

The Regional Seas



1. Mediterranean
2. Kuwait Action Plan Region
3. Wider Caribbean
4. West and Central Africa
5. Eastern Africa
6. East Asian Seas
7. Red Sea and Gulf of Aden
8. South Pacific
9. South-east Pacific
10. South Asian Seas

percent of the fish kills on the shores of that country were caused either by industrial waste or agricultural runoff that had been discharged into the sea.

About four-fifths of the pollution that enters the oceans comes from the land— mainly in the form of sewage, industrial waste and agricultural runoff. The other one-fifth comes from coastal mining, energy production and ocean-going vessels, much of it in the form of oil that is leaked, spilled, or shipwrecked. Tar balls and oil slicks can be found along most of the major shipping routes, even in mid-ocean; sometimes, levels of heavy metals in sea water are also higher along these routes. According to one estimate, between 0.05 and 0.1 percent of the sea's surface is covered with an oil film at any one time. While oil pollution has yet to leave any permanent scar on ocean ecology, wrecks such as those of the *Torrey Canyon*, the *Amoco Cadiz* and the *Ixtoc* have caused the deaths of thousands of sea birds, ruined many beaches and produced serious— if temporary— damage to oyster, mussel and other on-shore fishing operations.

All these effects tend to be worse in semi-enclosed seas such as the Baltic, the North Sea, the Mediterranean and the Gulf of Mexico. The average molecule of Mediterranean sea water, for example, tends to swill round for 80 years before escaping through the Straits of Gibraltar to the Atlantic. This means that the Mediterranean has a very limited ability to clean itself: it is still one of the world's dirtiest seas.

Pollution is also known to have reduced the populations of marine mammals in some ecological hot spots in the North and the Baltic Seas. Elsewhere in the world, certain marine ecosystems— notably mangrove swamps and coral reefs— have proved particularly vulnerable to some forms of pollution.

In its 1982 report called *The health of the oceans*, the Joint Group of Experts on the Scientific Aspects of Marine Pollution (GESAMP) identified a number of areas of potential and increasing concern. These included public health risks from micro-organisms and radioactive wastes, the toxic effects on man and other organisms of new chemicals and heavy metals, alteration of natural habitats as a result of energy production, and increased turbidity and disturbance of the sea bed from deep-sea mining. In addition, rising levels of carbon dioxide, produced mainly as fossil fuels are burnt, are now thought likely to lead to a warmer climate and rising sea levels sometime during the next century.

The GESAMP report, in effect, sounded the alarm on coastal pollution. It pointed out that although the threat was not in itself global, the combined effect of many local forms of pollution could become serious first on a regional and later on a global scale. The open sea, the main body of the ocean system, remains relatively healthy— but this does not mean that its extremities, such as estuaries and shallow waters, can be neglected. "Our warning," said the Chairman of the group investigating ocean pollution, "was that deterioration there, if allowed to progress, might affect the whole body."

RESOURCES:

The oceans: to learn more ...

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UNEP. 1984. UNEP Regional Seas and Studies No. 47.

UNEP. *The Health of the Oceans*. Nairobi, UNEP. 1982. UNEP Regional Seas and Studies No. 16.

Further information from:
OCA/PAC
UNEP
PO Box 30552
Nairobi
Kenya

Telephone: Nairobi 333930
Telex: 25164 UNEP RS

QUESTIONS AND ANSWERS ON THE HEALTH OF THE OCEANS

United Nations Environment Programme, (UNEP)
P.O.Box 30552,
Nairobi,
KENYA

The following questions and answers are excerpted from: The Vital Seas, Questions and Answers about the Health of the Oceans by Gunnar Kullenberg, published by UNEP, 1984.

These excerpts focus on sewage pollution, but the publication answers many more questions an ordinary person might ask about the marine environment and problems of marine pollution.

If these questions are reproduced, please credit the publication, author and publisher.

The oceans and seas are so huge - covering 70 per cent of the Earth's surface - why can't they swallow up all our wastes?

First one has to say that the oceans are capable of absorbing huge quantities and as such represent an important resource. But this capacity is certainly not infinite.

To understand what happens to wastes we need to look at the basic processes in the World Ocean, for that is what the seas are: seen from the Antarctic, the seas clearly form one main ocean with three branches into the Atlantic, Pacific and Indian Ocean regions.

Changes generally take place very slowly in the open seas. The huge size of the ocean enables it to disperse and dilute enormous amounts of material. But the deeper ocean waters interact with the surface and coastal waters extremely slowly since they move to the surface at an ocean-wide average rate of only a few metres a year. Winds, eddies and currents complicate this simple picture. But one implication is that any persistent contaminant which reaches the deep ocean layer could circulate there for hundreds, maybe thousands, of years.

How does this affect life in the ocean?

This situation carries with it the potential risk of a long-term build-up of toxic substances in the ocean. It also means that huge amounts of substances added to the seas near the surface will remain there, and that only the top 1 to 2 per cent of the upper ocean, the part where the waters are well-mixed, is available for diluting this material. This part of the open ocean, where the sun's rays penetrate, is where we find much of sea life, and especially its primary biological production (photosynthesis, the system by which plankton use sunlight to turn chemicals into food). A similar situation prevails for the coastal zone. Much of the material reaching coastal waters from land stays there because of physical, chemical and biological processes.

What are some pressures on coastal life?

In coastal regions, human settlements compete with many birds and species of wildlife which depend on coasts and estuaries for food and shelter. Tourism development and tourists can exact a high toll from the very amenities that attract the visitors - by increasing sewage loads, turning wildlife refuges into bathing beaches and burying marine habitats under brick and concrete. Irrigation works on the Nile and Indus have led to erosion of the coastal zone and a drastic decrease in regional fishing harvests.

In the intertidal zone, sewage can encourage species which are adapted to high nutrient levels, but it can also greatly reduce the diversity of species there. The impact on coral reefs, which contain an easily disturbed balance of a wide range of marine life, can be devastating. A large number of other human activities are also concentrated in the coastal zone simply because the resources we use are most commonly found or most easily exploited there: sand and gravel, metal mining, oil and gas exploitation, shipping and fishing. Much of the infrastructure - buildings, communications and construction works we need for these activities - is installed on the coast or offshore on the continental shelf, often leading to changes in transport patterns and erosion. All in all, the coastal zone is generally subject to a great deal of human interference, which at present is increasing globally.

You say the way we dispose of our wastes can affect our fishing resources. How does this come about, if much of the sewage includes nutrients?

Bacteria break down sewage, recyling its nutrient elements for the phytoplankton, by using dissolved oxygen in the water. An overload of sewage can starve fish and larger animal life in the sea of this oxygen, at the same time as it produces a quickly-rotting bloom of the sea's plants. Eventually the waters may be surrendered to bacteria and completely depleted of oxygen.

This has been a chronic problem since the beginning of the century in the bottom waters of the Baltic Sea, though there it has been exacerbated by the slow exchange of water between upper and lower levels. The conditions favour bacteria producing hydrogen sulfide (a gas that smells like rotten eggs). In less than half a century the bottom waters containing measurable amounts of this poisonous gas increased to 84,000 square kilometres in 1975. Today huge areas of the Baltic Sea bottom are oxygen free, but this may partly be due to the large amounts of organic material reaching the water from land-based sources. As a result of oxygen depletion, commercially-important fish died in massive numbers over thousands of square kilometres off the east coast of the United States in 1976. The plankton blooms can be toxic for humans, sometimes flaring up regularly in the same coastal spot.

Sewage dumping can also gradually alter the bottom or sea-floor sediments, making the ground uninhabitable for commercial shellfish, or anything more than a few

resistant species of worms. Tainting - or even the rumour that a particular stock is affected - can injure the reputation of a fishing area and harm sales. Unpleasant changes in colour and taste can be caused by a variety of contaminants. But metals such as zinc and copper in shellfish, and oil in fish and shellfish, are probably the most common.

There are ways of treating sewage chemically and biologically, though, to remove contaminants?

Outside the most advanced industrial countries, even drainage systems are rare, and confined for the most part to the prosperous sections of cities. Some 60 per cent of the islands in the Caribbean have few or no sewerage services. Less than 10 per cent of the total domestic waste in the Caribbean region receives treatment of any kind. Hardly 50 per cent of the 950 million people living in the 19 countries which border the Indian Ocean have sanitation arrangements. During low tide large coastal areas become very unpleasant, with high levels of faecal organisms.

But in fact, most places do not have to think of how to find the money for expensive chemical or biological treatment. Planning, proper siting and construction of waste pipes, together with a functioning management, control and monitoring system may be perfectly adequate.

As things stand today, what are the dangers?

Wastes are the major carriers of bacteria and viruses of diseases such as typhoid, cholera and dysentery. Sewage on beaches and in shallow waters can cause an offensive odour and for a tourist resort be economically disastrous.

But the possible health risk is a more important consideration. These organisms can survive sometimes for days in the sea and viruses can attach themselves to the animals on the bottom of the sea such as oysters and shellfish. Recent studies tend to support the assumption that bathing in sewage-contaminated water can result in disease, particularly where enteric diseases (illnesses of the gut) are common.

Climate and living conditions play a role, but typhoid is about 100 times more frequent in the Mediterranean than in northern Europe. Mussels contaminated through sewage discharges or releases of wastes from ships into illegal mussel beds is thought to have been the cause of an Italian cholera outbreak in the Seventies in which at least 19 people died.

Let us look now at some of GESAMP's* conclusions. We have to get rid of our wastes somewhere, so what do you propose about sewage?

The organic component of sewage is largely degradable - it is broken down and used by the creatures of the environment. So it cannot be regarded as a long-term contaminant if its

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* GESAMP stands for IMCO/FAO/UNESCO/WMO/WHO/IAEA/UN/UNEP Joint Group of Experts on the Scientific Aspects of Marine Pollution.

introduction to the sea is properly controlled. Birds are attracted to sewage disposal sites and clearly thrive there. Mobile marine organisms can avoid contaminated areas.

What do you mean by proper controls?

It is worth noting that full chemical and biological treatment of sewage - which is very expensive and rare outside the richest parts of the most industrialized nations - is not necessarily the optimal procedure. Often primary treatment, separating the sludge from liquid wastes, is enough. Secondary treatment, with chlorination, reduces bacteria. But viruses are less affected and long-lasting chlorinated organic compounds can be produced in larger quantities by such treatment.

Where deep water is available close to shore, disposal through long pipelines after reasonable, even minimal, treatment may be satisfactory. When disposal of sewage sludge at sea is planned, the wastes should not be dumped where water movements could transport them back to beaches or shellfish beds. Pipelines can be located at sites most likely to aid dispersal; they should be fitted with proper diffusers. The discharge can often be arranged to ensure tidal conditions achieve optimal dilution and dispersal. It is usually possible to treat sewage-affected shellfish so that there is no threat to human health, but the correct approach is to ensure that waste outfalls do not contaminate shellfish beds.

Fortunately, there is increasing awareness at local and national levels of the problem of sewage disposal. Various international conventions now potentially provide the means for controlling discharges and documenting indicators of effects to ensure there is no unacceptable risk to the marine ecosystem.

Shark

UNC Sea Grant College Program,
Box 8605
N.C. State University,
Raleigh, NC 27695-8605
U.S.A.

The activity below is from:
Coastal Capers: A Marine Education Primer written by Lundie Spence (UNC Sea Grant) and Vivian Barbee Cox. This is a UNC Sea Grant publication sponsored by the Office of Sea Grant, NOAA, U.S. Department of Commerce and the North Carolina Department of Administration.

If this activity is reproduced, please give credit to:
Lundie Spence and Vivian Barbee Cox/UNC Sea Grant Program.

Purpose

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

Vocabulary

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

Materials

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

Teacher background

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

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

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

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

Teacher preparation

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

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

Procedure

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

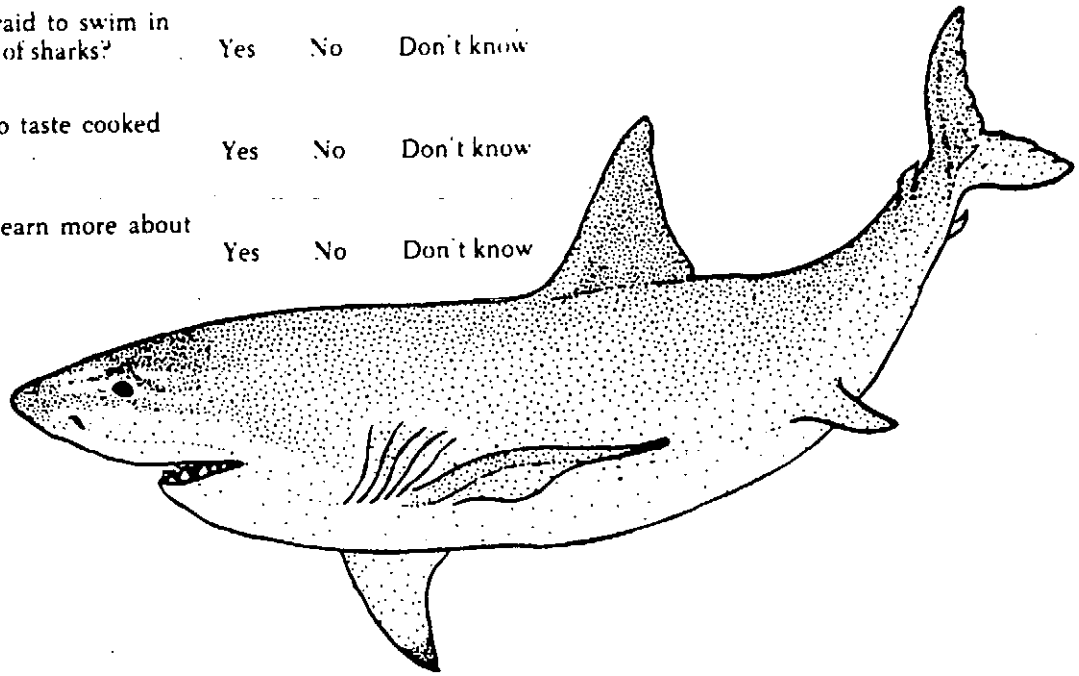
Use the survey form to test the students. Using an overhead projector, plot the results on the bar graph for the students to see. Explain to your class that they are going to investigate what other students think about sharks. Survey another class and plot the results on a bar graph.

Shark Survey

Grade _____

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

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



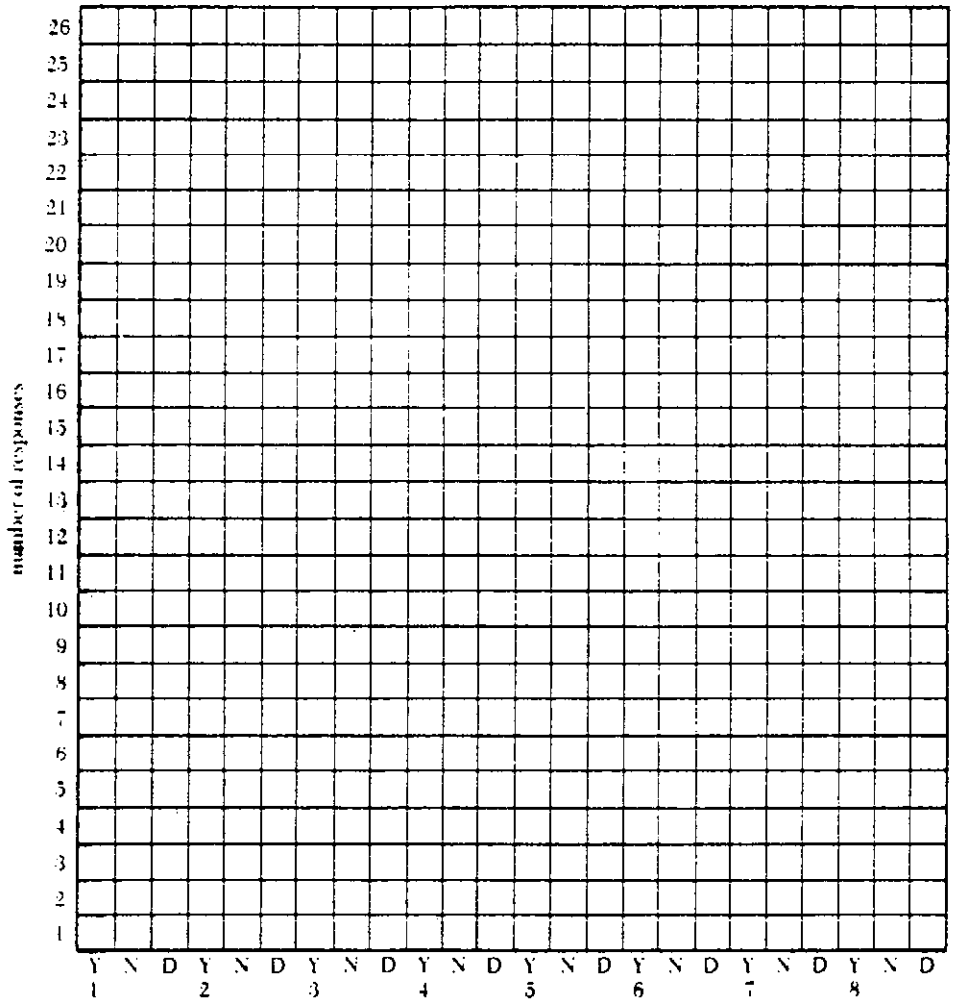
(Cover answers before photocopying.)

Answers:

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

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

Bar Graph for Tabulating the Results of the Survey



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

TEACHERS'/PARENTS' PAGE

Oil Spill Clean-up

Center for Environmental Education,
1725 DeSales St., N.W.
Suite 500,
Washington, D.C. 20036
U.S.A.

Smithsonian Environmental Research Center,
P.O.Box 28,
Edgewater MD 21037
U.S.A.

The activity below is taken from: The Ocean: Consider the Connections published by the Center for Environmental Education, (1985). The original source of this activity is Smithsonian Environmental Research Center.

This activity may be reproduced for non-profit, educational purposes if credit is given to both the sources above.

In this age of supertankers ferrying crude oil across the seas, there is always a chance of an accidental oil spill. When this occurs, what can be done? How can one protect the animal and plant life subjected to the oil spill? How can the spill be cleaned up?

Several clean-up methods have been developed. These involve containing the spill, adsorption of the oil, absorption, skimming, coagulating, and sinking of the oil. The method used depends on the type of oil spilled and where the spill occurred. Sometimes several of these methods are used on one spill. This activity compares various methods used in cleaning up an oil spill.

Find The Best Method To Clean Up An Oil Spill

MATERIALS

white plastic sinks
water
twigs and string to make a boom for containment
liquid detergent
sponge
soda straws
aquarium net
commercial sorbent
plastic trash bag
motor oil (used works best)
straw (not hay)
dirt or sand
styrofoam pieces
paper towels
kaolin (diatomous earth)

PROCEDURES

1. Tell the participants that they are an Environmental Protection team rushed to the site of a grounded tanker spilling oil. They are to use the best possible method to clean it up.

2. Divide the students into teams to study the various methods available. Prepare a large

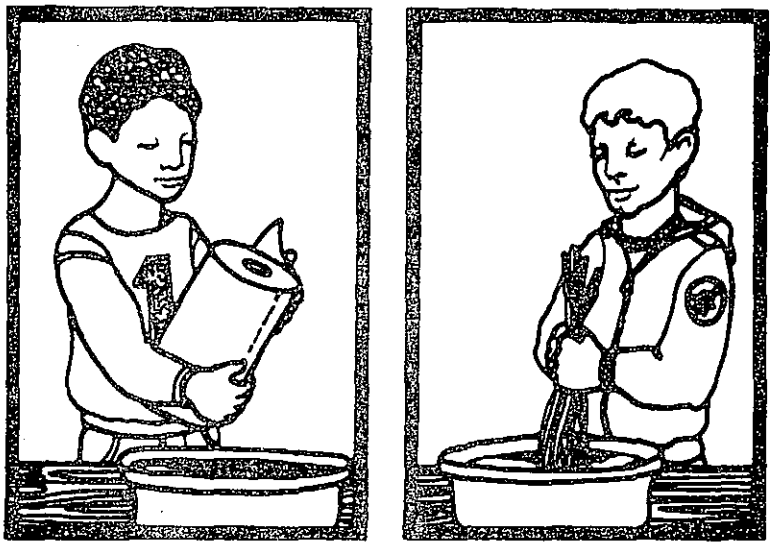
sheet of paper or blackboard as follows to record the results of the different methods used:

Method	What happened	Rating as to effectiveness (1-5)

3. Give the participants a white basin to fill with water and to which they add oil to create their own oil spill. If necessary, after each method is tried, more oil may be added. The used oily materials are to be placed into the plastic garbage bag. Tilt the sinks to make "waves." Observe to see if this changes the effectiveness of each clean-up method.

4. Some methods to try and rate as to their effectiveness.
   a) Straw—place on oil and remove
   b) Paper towel—place on oil and remove
   c) Styrofoam pieces—place on oil and remove
   d) Boom of twigs tied together—pulled across the spill, or place around spill to contain it
   e) Soda straw—blow bubbles under oil (a ring of bubbles will contain spill)
   f) Detergent—add a drop to spill to disperse oil.
   g) Sand sprinkled on surface of oil water
   h) Kaolin sprinkled on surface of oil water
   i) Commercial sorbent sprinkled on surface of oil water
   j) Aquarium net—scoop up oil
   k) Any additional methods suggested by participants

5. Using any one or all of the methods suggested, have the participants clean up the oil spill in their sink.



QUESTIONS

1. What method appeared to work best? Why?
2. Would the same method work for every spill?
3. Does the method have any bad effects on the environment?
4. How could an oil spill be prevented from spreading?
5. Who should be responsible for cleaning up a spill?
6. How might oil spills be prevented?

Courtesy of Smithsonian Environmental Research Center

Eighteen oil companies have collaborated to develop technology which has the capacity to clean up oil spills in seas not exceeding waves of four feet. This program is known as CLEAN SEAS. This footnote requested by the Year of the Ocean Foundation.

Bringing Up Baby

Amy Holm, Co-ordinator, Education Services,
Global Tomorrow Coalition,
25422 Trabuco Road, #105-440
El Toro, CA 92630-2797
U.S.A.

The activity below is taken from Marine and Coastal Resources, a Global Issue Education Packet produced by Global Tomorrow Coalition.

Global Tomorrow Coalition is a national alliance of organizations and individuals comprising over six million Americans which is committed to the belief that better public understanding of worldwide trends in population, resources, environment and development is needed to enable the United States and other nations to act today to ensure a more sustainable future. For further information about the education packets on global issues, see OUTREACH issue 46 page 30.

If the activity below is reproduced, please give credit to:
Global Tomorrow Coalition.

By studying data and a graph depicting the effect of pollution on animal species in a coastal wetlands habitat, students will learn about coastal areas and their importance as nurseries for marine species (35 minutes).

CONCEPT:
Coastal areas serve a unique purpose for marine life.

OBJECTIVES:
(1) Define habitats.
(2) Identify types of coastal wetland habitats.
(3) Define pollution.
(4) List (5) types of pollution.
(5) Define birth and death rates.
(6) Discuss (3) effects of wetlands destruction on people.
(7) Identify (5) ways of preventing pollution in coastal wetlands.

SUBJECT	SKILLS
• Mathematics	• graphs
• Social Science	• listing
• Natural Science	• application

MATERIALS
• Data Sheets*
• pens/pencils • blackboard

PREPARATION:
1. Copy Data Sheets.

PROCEDURE:
1. Define habitat. Coastal wetland habitats are areas that are flooded by water so frequently that the water determines the types of plants and animals that live there. These habitats are called fresh water marshes, salt water marshes, mud flats, mangrove swamps, or estuaries. All of the habitats have the same quality: they are places where fresh water from the land meets salt water from the sea.

Explain the role of coastal wetlands as nurseries for many wildlife species, because they are protected from the ocean waves, rich in nutrients, and safe from ocean predators.

2. Define pollution. Brainstorm and list types of pollution, which can damage the coastal wetland habitat. What effects can pollution have on the animal species that hatch or raise their young in the wetlands nursery?

3. Distribute the data sheet to the students. Define birth and death rate. Ask the students to study and explain what is happening to the animal population in the different periods. Point out that the death rate increases rapidly, owing to the rise of infant mortality in the total population.

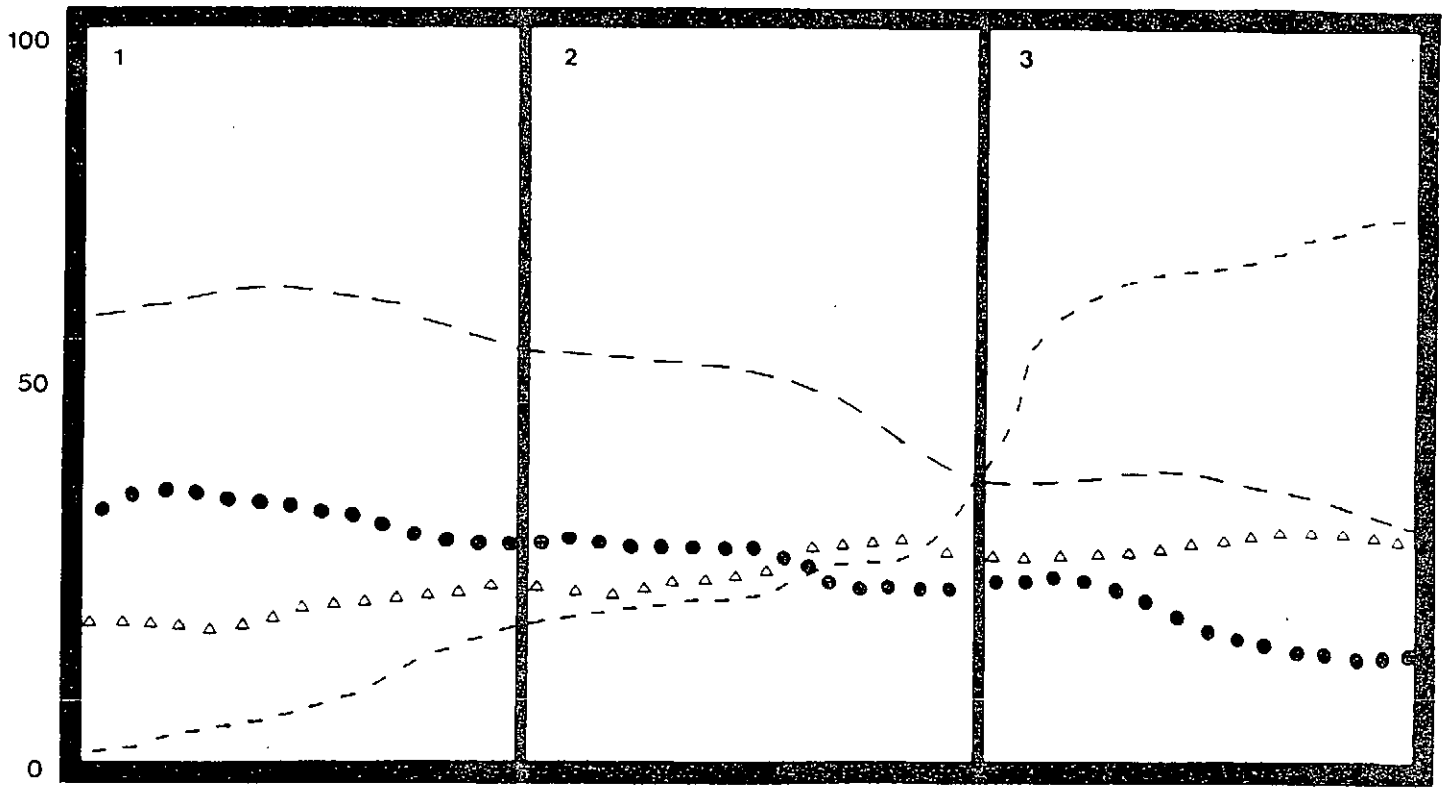
CONCLUSION:

1. Discuss the effects of polluted coastal wetlands on people. For instance, what happens to people if they consume fish from polluted waters? What happens to the fisherman who depend on the wetland nurseries to restock the fish and shellfish populations?

2. Identify ways of preventing the pollution of coastal wetlands and preserving these habitats.

Data Sheet

EFFECTS OF POLLUTION ON ANIMAL POPULATIONS



TOTAL NUMBER IN POPULATION — — —

NUMBER OF BIRTHS ●●●

TOTAL AMOUNT OF POLLUTION - - -

NUMBER OF DEATHS △ △ △

EDUCATIONAL RESOURCES:

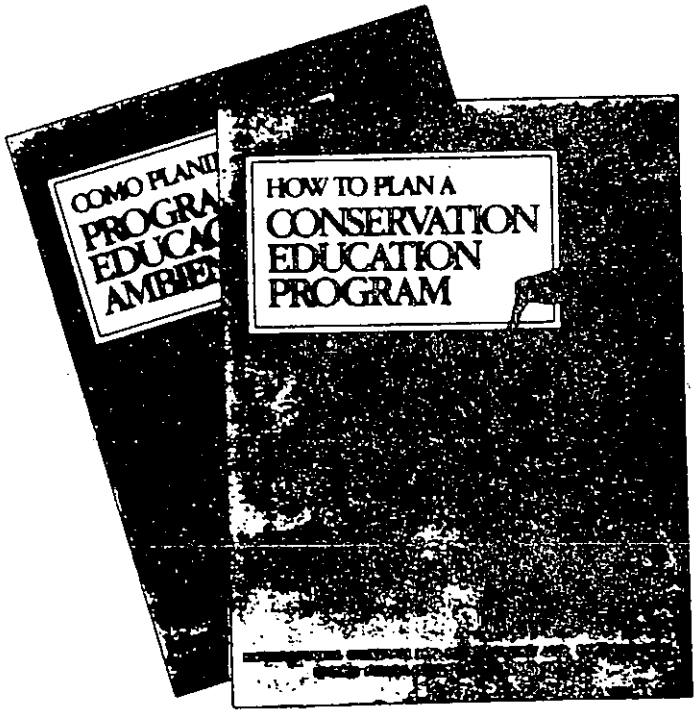
HOW TO PLAN A CONSERVATION EDUCATION PROGRAM

David S. Wood and Diane Walton Wood

Earthscan,
International Institute for Environment and Development,
1717 Massachusetts Avenue, N.W.
Washington, D.C. 20036
U.S.A.

How to Plan a Conservation Education Program outlines five basic steps that must be followed if conservation education programs are to be effective. Conservation educators can use this manual to design programs that have significant environmental impact and that match the people's concerns and traditions. By employing the techniques described in this manual, the commitment, energy, and creativity of conservation educators around the world can be applied effectively to encourage the wise management of the planet's environment.

IIED collaborated with the U.S. Fish and Wildlife Service's International Affairs Office to publish this manual.



47pp.
b/w illustrations, diagrams,
available in Spanish, 1987.
212 x 275mm, 8 1/2" x 11".
FREE

OUTREACH 51

CONTENTS:

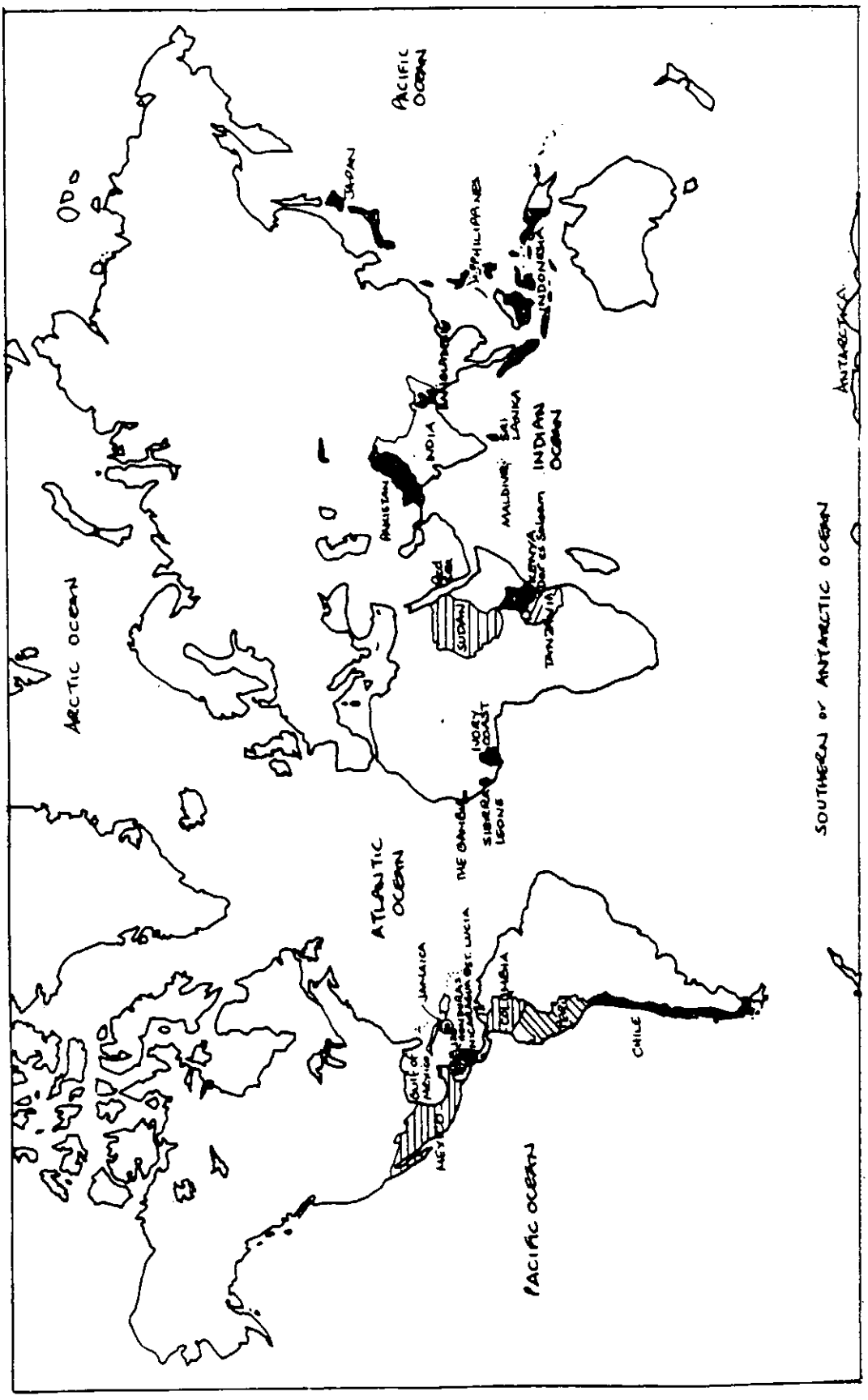
Using the chart below, you can see at glance which fields of interest are touched upon in this OUTREACH pack.
Letters in the chart indicate the following:
a - articles b - stories c - activities and games
d - teachers'/parents' page e - resources

Topic		General	Africa	Asia	Middle East	Latin America & the Caribbean	Deserts	Forests	Wetlands	Oceans	Mountains	Grasslands
Land	(L)											
Water	(Wa)									ae		
Atmosphere	(A)											
Wildlife	(Wi)	bcd				bc				abcde		
People	(P)											
Human Habitation	(Ha)											
Health and Sanitation	(He)									a		
Food and Nutrition	(F&N)	e								ae		
Energy	(E)											

Reading levels:
I = for young children aged 8 - 10 years
II = for schoolchildren aged 11 - 13 and adults with basic literacy skills
III = for teachers and/or people with a secondary education

LOCATION MAP

The map below shows the location of places mentioned in OUTREACH issue no. 51:



ARTICLES ON MARINE AND COASTAL ENVIRONMENTS THAT HAVE APPEARED IN BACK ISSUES OF OUTREACH

	issue	page(s)
Drip the Drop: the journey of a drop of water through the water cycle	5	18-21
The "Tiger of the Sea" gets its teeth cleaned	16	21-23
Find the cleaner	16	24
A Wildlife message	16	25-26
Older than the Dinosaurs	17	4-5
Eyes that surprise	18	1-2
Turtles winning race against extinction	18	12
Background notes on green and olive ridley sea turtles	18	13-14
Now you see me, now you don't	18	20-21
Some mathematical puzzles on sea turtles	18	25
Coral reefs (part 1)	19	
Coral reefs (part 2)	20	
Caribbean nations curb over-fishing of queen conch	32	25-27
Wetlands (part 1) includes some general information on wetlands and coastal habitats	33	
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Puzzle: why people smoke fish	35	7
Fish smoking: the Chokor Smoker	35	8-15
Special issue: children's magazines on water	41	

THE LIFE THE SEAS SUPPORT

WWF-UK,
Panda House,
Weyside Park, Godalming, Surrey GU7 1XR
ENGLAND

Here are some brief notes on how marine plants and animals are adapted to life in the ocean. This article is reprinted from Project OCEAN, a wallchart from the series, Natural Regions of the World produced by World Wildlife Fund-UK. If this article is reproduced, please credit WWF-UK.

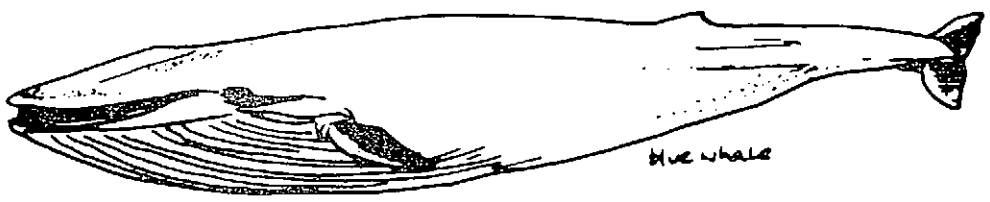
Natural Regions of the World comprises a set of wallcharts that each cover a major habitat: forests, wetlands, deserts, oceans, mountains and plains. The wallcharts, with an accompanying teacher's guide, is priced £3.00 plus package and postage from WWF-UK's Education Department.

To people, adapted as they are to life on land, the ocean may seem to be a hostile and dangerous place. Yet to marine inhabitants, the ocean offers many advantages over life on dry land. For instance, most surface waters have a seasonal temperature range of only 4.5°C or less, and in the depths of the open ocean the temperature, though cold, is virtually constant. This means that marine animals do not need a mechanism for controlling body temperature.

Cold and salt sea water is much more buoyant than air, and so it is not essential for marine animals to have strong skeletons and muscles to support their bodies. This is why many sea creatures have been able to develop strange and delicate shapes, often with soft bodies. These shapes would be impractical on land.

The buoyancy of water provides support for the largest animal that has ever lived: the huge bones and muscles of the **blue whale** (Balaenoptera musculus) would be incapable of supporting its 100 tonnes bulk if it were not buoyed up by water.

Water supports countless minute plants and animals. These are called **plankton** from the Greek word meaning 'floating', as they drift at the mercy of the ocean currents in the sunlit waters where they grow and multiply with great speed. The plants in the plankton are called **phytoplankton** and the animals are called **zooplankton**.



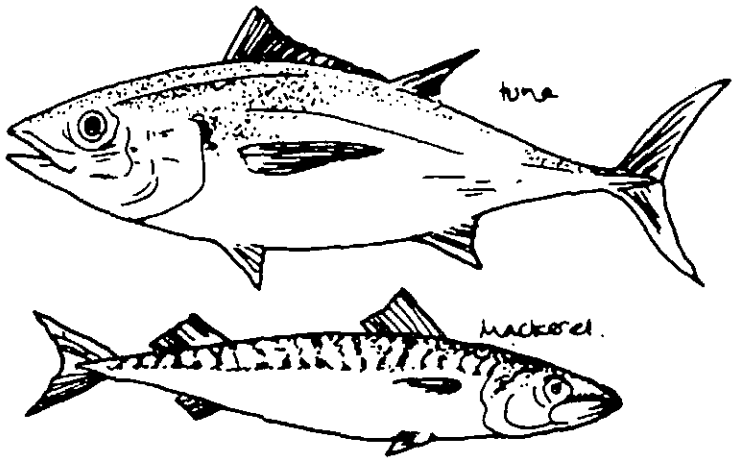
While the greatest percentage of salt water vegetation consists of the barely visible phytoplankton, fixed grasses and seaweeds may grow in shallow waters along the shore where sunlight reaches the sea bed. Seaweeds have a hold fast with which they cling onto rocks. Their slimy surfaces and plant stems make it difficult for the waves to grip and tear them from their moorings. It is not only marine plants that are affected by ocean currents. The coconut palm (Cocos nucifera), for example, relies on them for the dispersal of its fruits.

One of the largest zooplankton is the **Portuguese man-of-war** (Physalia physalis), a jellyfish which not only drifts with the currents, but also has a gas-filled bladder which keeps it floating on the surface.

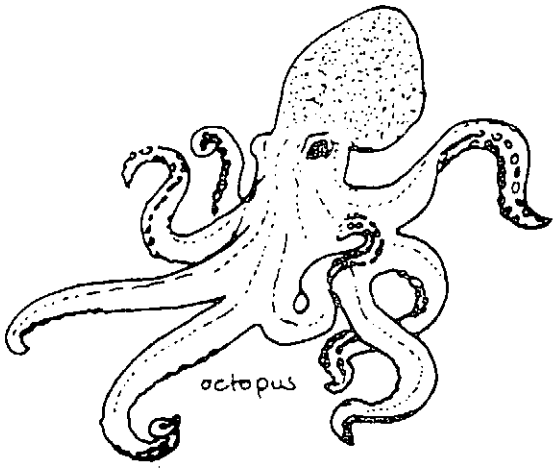
The body forms of sea creatures reflect their ways of life. High-speed fish such as **bluefin tuna** (Thunnus thynnus), **ocean bonito** (Katsuwonus pelamis), or **mackerel** (Scomber scomber) have marvellously streamlined bodies.

These fish belong to the group of fish which dominates the waters of the world: fish that have an internal bony skeleton. These fish have an air-filled pouch or swim bladder which serves to make the fish weightless at their various swimming depths. It also acts as a hearing aid. Other fish such as sharks do not have swim bladders and so would sink if they did not keep swimming.

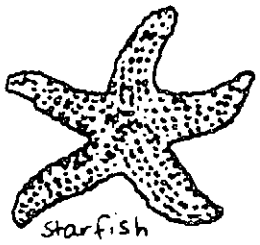
For some fish, the existence of a swim bladder has freed their body fins for all kinds of purposes. The armoured and stiff-bodied **sea horse** (Hippocampus guttulatus) holds its body upright and its back (dorsal) fin has become, in effect, a rear engine which - together with its whirling breast (pectoral) fin - enables the fish to make delicate and precise movements amongst the fronds of seaweed.



The common octopus (Octopus vulgaris) leads a very leisurely life among rocks and thick clumps of seaweed. It moves by pulsating a web of skin stretched out among



its tentacles. These long tentacles are armed with highly efficient horny suckers which reach out to capture its prey. The **common starfish** (Asterias rubens) is another bottom dweller. It crawls across rocks by means of tube feet on the underside of its body. It uses its tube feet to wrench open clams so as to feed on the flesh within.



The **walrus** (Odobenus rosmarus) and the **sea otter** (Enhydris lutris) also enjoy a meal of shellfish. As the walrus moves along in the water, its tusks stir up the sea bed and its lips and whiskers sort out the shellfish on which it feeds. The sea otter cracks open shellfish and sea urchins by hitting them on a flat rock which it balances on its belly as it drifts in the water.

Birds such as the **gannet** (Sula bassana) can dive for fish from high in the sky to deep into the sea. They are also able to spend long periods of time on the wing. Like the **wandering albatross** (Diomedea exulans) - which has a wing span of up to 3.6 metres - these birds can move forward without even flapping their wings. On stiff wings, these birds dive downwards into the turbulent air above the wave tops. Using the momentum of the dive and the wind currents over their outstretched wings, they can turn into the wind, climb and repeat the process.

As with many sea birds, some populations of **green turtle** (Chelonia mydas) migrate across the ocean to breed. While turtles live their lives out at sea, the mature females do return to their nesting beach to lay their eggs. This fact is sufficient to indicate turtles were originally land creatures.

The legs of the turtle form paddles with which the animal can 'fly' through the water at great speed. But the turtle must come up for air. Its hinged lower shell allows its chest to expand when the turtle takes a big gulp of air at the beginning of its dive. The blue whale also needs to come to the surface to breathe, but it has the ability to stay under the water without breathing for 50 minutes.

Sea mammals such as the whale, are warm-blooded animals and to reduce the heat loss from their bodies in cold water, they have layers of fat (blubber) beneath their hairless skins. The blubber may be up to 30cms. thick.

World fisheries face growing demand

The UNESCO Courier,
UNESCO,
7 place de Fontenoy,
75700 Paris
FRANCE

F.A.O.
Via delle Terme di Caracalla,
00100-Rome
ITALY

This article is taken from The UNESCO Courier, February, 1986.
It is excerpted from Fisheries Development in the 1980's by the Food and Agriculture Organization of the United Nations.

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Most traditionally acceptable species of fish are now fully exploited and many are over-exploited. As a result, the rapid growth in the world catch witnessed in the 1950s and 1960s has given way to a much slower rate of increase. The total catch has averaged around seventy-one million tonnes during the past decade, although the catch of food fish has continued to increase by about 1 per cent per annum. Excluding aquaculture, the final yield from currently exploited species is unlikely to be much more than 110 million tonnes. Production could eventually be increased above this limit, however, by catching so-called unconventional species such as the shrimp-like Atlantic krill, lantern fish, oceanic squid and small pelagic (open sea) fish.

Fisheries in many developing countries are already a vital source of food, employment and income. The changed circumstances of marine fisheries and advances in aquaculture and inland fisheries make it essential, however, to persuade countries accustomed to devoting the bulk of their national resources to agricultural development and the pursuit of industrialization that fisheries are also of considerable value to them.

Fisheries contribute about 6 per cent of the world supply of protein and about 24 per cent of its animal protein, if allowance is made for the use of fishmeal in animal feeds. On a regional basis, the percentage contribution of fish to animal protein in the diet is greatest in Asia. In southeast Asia, for example, 55 per cent of the animal protein consumed is derived from fish. In Africa, the figure is 19 per cent. Such regional statistics reveal little of the true contribution made by fish to food supplies in developing countries; in some communities, often the poorest, it may be the only source of "meat". This dependence on fish is made all the more important because the growth in demand, which is expected to double by the turn of the century, is likely to be greatest in the developing world.

It has been estimated that the fisheries provide employment, some of it part-time, for about sixteen million fishermen in developing countries. Many more people are engaged in associated activities, such as processing and marketing. The greater part of this work force is associated with small-scale or artisanal fisheries. Taking into account dependents, tens of millions in the Third World must rely completely, or in a major way, on fisheries for their livelihood. ■

THE STATE OF OUR OCEANS

The Editor,
THE SIREN,
OCA/PAC,
United Nations Environment Programme,
P.O.Box 30552,
Nairobi,
KENYA

The source of the information below is "The State of the Marine Environment 1988", fourteen reports on the health of our oceans, seas and coastal areas that appear in THE SIREN, No.36, April 1988. If this information is reproduced, please credit source.

THE SIREN is issued four times a year in English, French and Spanish, as an informal presentation of news from OCA/PAC, the Oceans and Coastal Areas Programme of the United Nations Environment Programme (UNEP). If you wish to receive THE SIREN free of charge, please write to the editor (address above).

The April 1988 issue of THE SIREN is a particularly important one because it includes - in "The State of the Marine Environment 1988" - a series of exclusive articles which outline the main problems of our oceans. Each article is based upon the findings of 15 task teams who, for the past year and a half, have met and worked to compile detailed reports on the state of the marine and coastal environments of the regional seas, see map.

The preparation of the regional reviews has been co-ordinated by UNEP, with technical assistance from IOC, FAO, and the regional secretariats of the Caribbean, Mediterranean, South Pacific and the S.E. Pacific action plans. Each report contains data and information from hundreds of scientists around the world, and consists of nine sections: introduction; characteristics of the region; marine contaminants; human activities affecting the sea; biological effects; prevention and control strategies; trends and forecasts, including climatic change effects; economics; a summary. They will be published in early 1989, under UNEP's Regional Seas Reports and Studies Series.

Did you know that....

* There are some 70 Mediterranean coastal cities with a population above 100,000 and, most of the time, the most polluted waters of the Mediterranean Sea are in the vicinity of these urban areas.

* The main public health problem arising from chemical pollution of the Mediterranean Sea is mercury poisoning from contaminated seafood.

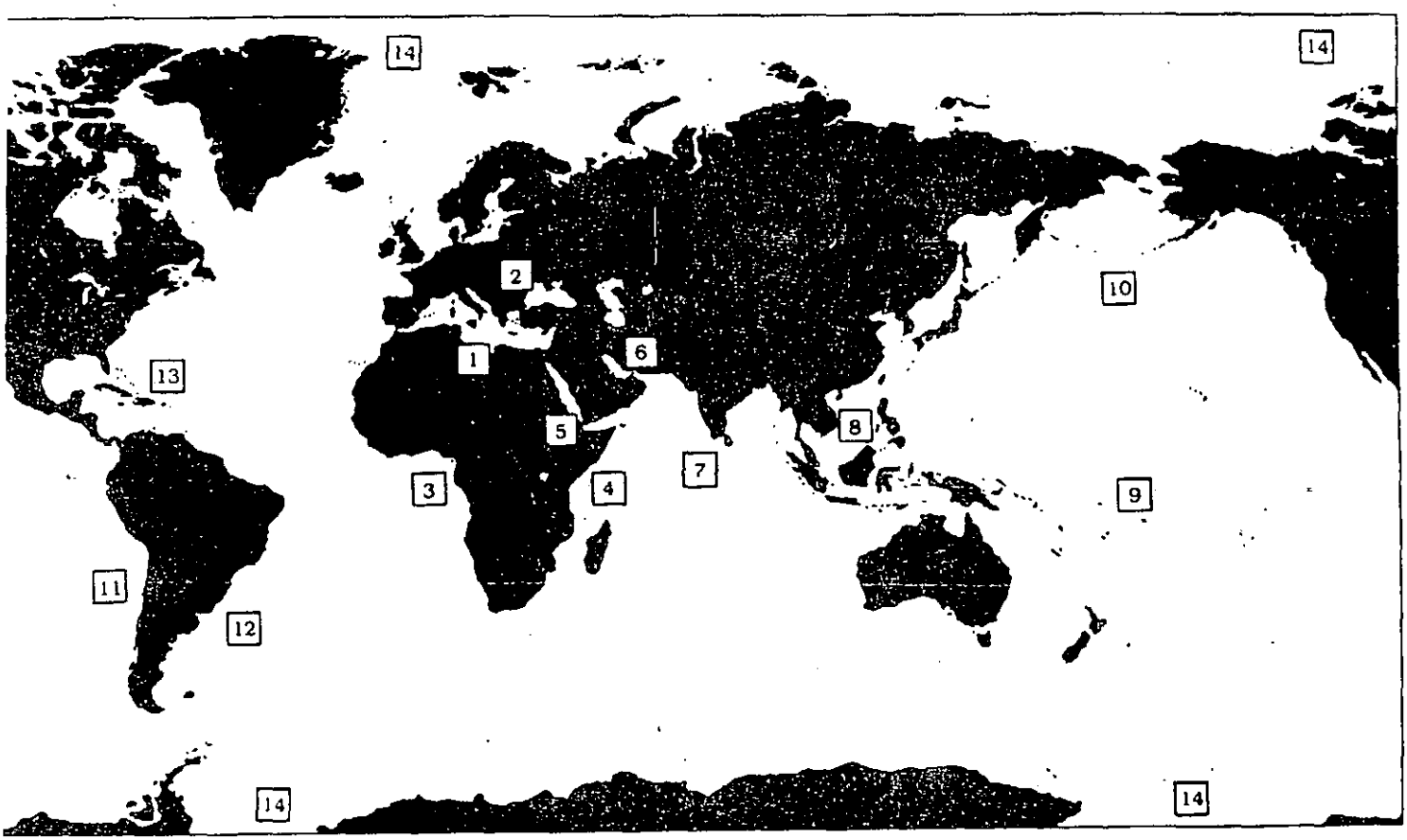
* A major problem in the sea off the coast of West and Central Africa is the pollution of coastal waters, especially lagoons, by sewage. For example, in the early 1970's, in Abidjan, Ivory Coast, the

volume of domestic sewage discharged each year into Ebrie Lagoon was equivalent to about 18% of the total lagoon volume. In 1988, the sewage situation of the region's seas seems to be no better.

* In the East African Regional seas area, there is a constant threat of oil pollution from oil tankers moving through the region on their way to Europe and America from the Middle East. A single oil spill off Dar es Salaam, Tanzania, in 1981 totally killed an area of mangroves and there are no signs of recovery after several years. Mangrove forests are also depleted in many areas due to over-cropping for firewood, charcoal and building materials.

* The Red Sea is the warmest and most saline body of water in the world's oceans. It contains a considerable number of species that are found only in its waters. Islands in the Red Sea support various rare plants and are the nesting grounds for 12 seabird species and 2 marine turtles. These islands were previously protected by their remoteness, but they are now attracting tourists.

* Many of the pollution problems of the Kuwait region arise from the extraction and transport of petroleum. There are over 25,000 tanker sightings in the Straits of Hormuz each year, and over 800 oil-producing wells are found on the seabed of the region. The oil is shipped from around 25 major oil terminals to destinations mostly in Europe and the Far East. Considering the size of the region, the input of oil into the sea through spillage from all



STATE OF THE MARINE ENVIRONMENT REGIONS
1. Mediterranean
2. Black Sea
3. West & Central Africa
4. Eastern Africa
5. Red Sea & Gulf of Aden
6. Kuwait Action Plan Rregion
7. South Asian Seas
8. East Asian Seas
9. South Pacific
10. North Pacific
11. South-East Pacific
12. South-West Atlantic
13. Caribbean & Gulf of Mexico
14. Polar Oceans

these activities is probably the largest in the world. Military activities in recent years have further magnified the problem. As a result, most of the beaches in the region are heavily contaminated with tar: concentrations of 1-30 kg per metre of beach are common.

* Approximately 240 million people in the South Asian Seas region are dependent on the bounties of the sea for their livelihood.

* Clean, plentiful, piped, drinking water is as yet a distant dream for one in two of the millions of people who crowd South Asia's Indian Ocean coastline from Pakistan and India to Bangladesh, including Sri Lanka and the Maldives. And sewage treatment in these areas is almost non-existent. All of Bangladesh's sewage, for example, flows out to sea or, through ground seepage, ends up in its two huge rivers, the Ganga and the Brahmaputra. High counts of coliform bacteria are found on India's beaches and in coastal waters as shown by Madras' contaminated shellfish.

* The wastes from coconut and rubber-based industries, food processing plants and paper mills have severely polluted waterways and coastal areas in Sri Lanka.

* 55,000 tonnes of pesticides are used in India each year; 11,000 tonnes are consumed in Pakistan, 3,000 tonnes in Bangladesh and 2,800 tonnes in Sri Lanka. It is commonly believed that about 25% of these ultimately end up in the sea, (although data on this issue is fragmented, and comprehensive research is needed).

* Of Indonesia's 2.5 million hectares of mangroves, 600,000 have already been converted, mainly into rice fields. By the year 1999, 100,000 hectares will be given over to shrimp farming and a further 500,000 hectares will become farmland.

* A growing concern for South Pacific atolls is the future climatic change (the greenhouse effect) which, if leading to some predicted sea-level rise, will result in the complete destruction of Kiribati, Tuvalu and the Marshall islands and substantial loss of many other islands.

* The use of the Pacific as a waste dumping site for both nuclear material and chemical wastes will be a future concern of all Pacific island states.

* A major problem in the North Pacific is marine debris, particularly persistent plastics. Drift nets used for squid fishing on the high seas is a great potential hazard, too. It is estimated that during the summer squid fishing season there may be as many as 1,700 drift net vessels in the North Pacific on any one day, with 30,000 kilometres of drift net, seven metres deep, floating freely on the high seas. If only 1% of these drift nets were to be discarded or lost, there would be 300 kilometres of drift net floating in the water entangling marine mammals, seabirds and sea turtles.

* Pollution by effluents from industrial mines is a problem which occurs in certain coastal areas of Peru and Chile where large quantities of tailings and residues reach the sea. Each year in Peru, for instance, over 43 million cubic metres of mining wastes are directly discharged into the sea. A further 61 million cubic metres of mining waste is indirectly discharged into the sea each year. Mining discharges are responsible for disturbances of rocky intertidal flora and fauna, and the loss of variety of marine life on sandy seabeds.

* Many large population centres located on coastal regions of the Caribbean and the Gulf of Mexico discharge raw sewage directly into bays, estuaries, coastal lagoons or rivers. Less than 10% of a total estimated regional population of 170 million have any sewage treatment. Industrial effluents and urban runoff also flow into the sea untreated in most countries of the region, which lead to loss of coastal habitats and fishery resources.

* Pesticides in runoff into the Caribbean Sea have been responsible for fish kills in coastal waters of Colombia and Jamaica.

* The biological balance of the Antarctic circumpolar ocean has already been affected by fishing and whale hunting. Some species of fish in the Atlantic sector have been overfished and need protection. The hunting of the great whales brought their stocks down to very low levels, and the subsequent increase in their main food source, the Antarctic krill, allowed other animals such as the crab-eating seals, the southern fur seal and penguins to increase in number.

* The major threats to the Antarctic Ocean and its ecosystem are probably changes in the atmosphere. For example, increasing carbon dioxide levels might cause a melting of the continental ice that may elevate sea levels.

A STORY ABOUT A GREEN TURTLE

Maria Grech,
Forestry and Lands Department,
Ministry of Agriculture, Lands, Fisheries and Co-operatives,
P.O.Box 892,
Castries,
St. Lucia
WEST INDIES

The story below is reprinted from Bush Talk April 1988. Bush Talk is a monthly publication written by Maria Grech and published by the Forestry and Lands Department of St. Lucia's Ministry of Agriculture. Bush Talk is intended to be an educational aid to help promote conservation of the natural resources of St. Lucia.

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Reprinted with permission from the April 1988 issue of Bush Talk written by Maria Grech, and published by the Forestry and Lands Dept. of the Ministry of Agriculture, St. Lucia. Copyright 1988 by Maria Grech.

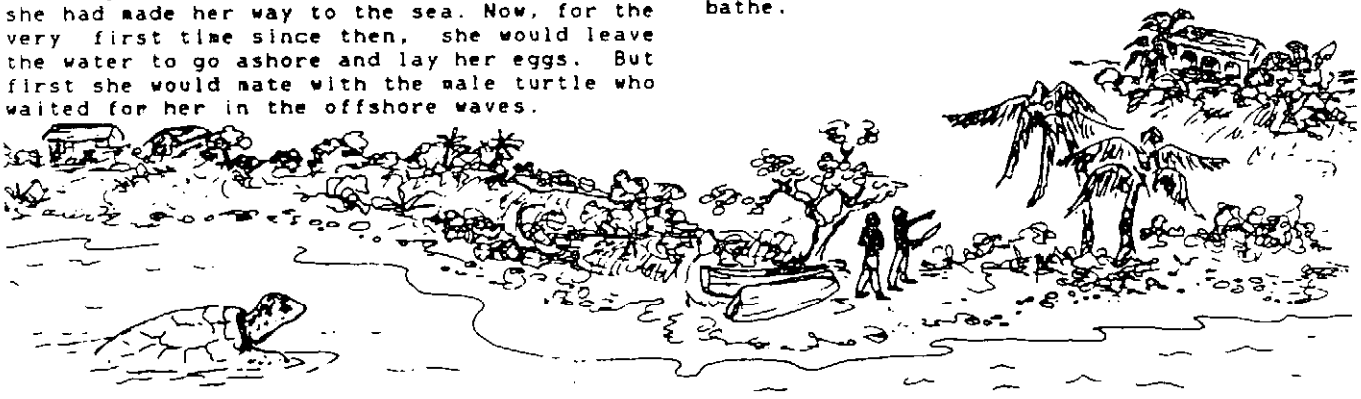
1. The Green turtle

Far out in the blue waters of the Caribbean Sea, swam a lone female turtle. She was many miles from shore, heading toward the western coast of the island of Saint Lucia. She had only seen the beach she was heading for once in her six years of life. Instinct was guiding her back to it. An instinct stronger than anything she had ever felt before.

On and on she swam, going down often into the cool water to wet her body and escape the brightness and the heat of the sun. Later, when the sun set and the air grew cooler, she floated half-sleeping, on the surface of the sea. But not for long. She knew that she was close to land. The clouds ahead and the new scents carried to her by the light wind told her so. The beach where she was going to land was the same one where she had hatched, small and helpless, so many years ago! From there she had made her way to the sea. Now, for the very first time since then, she would leave the water to go ashore and lay her eggs. But first she would mate with the male turtle who waited for her in the offshore waves.

It was dark before she came close enough to see the spray-topped, curving waves rolling up the sand ahead. The sky was clear and full of stars. In the East, above the outline of the hills, hung the golden disc of the full moon. Its light cast strong shadows on the beach. Shadows of the rocks and the few scattered palms. Shadows of the upturned fishing boats pulled high above the waterline. Shadows of the two men who stood silent, their backs toward the sea, smoking.

The beach had changed with the passing years. At one time the sands had been fringed with mangrove swamp and human footprints were hardly ever seen. Now there was a small road coming almost to the waters edge and on the hills around the bay were several houses. On the ground beneath the bush and all along the back of the beach was garbage left there by the people who came to picnic and to bathe.



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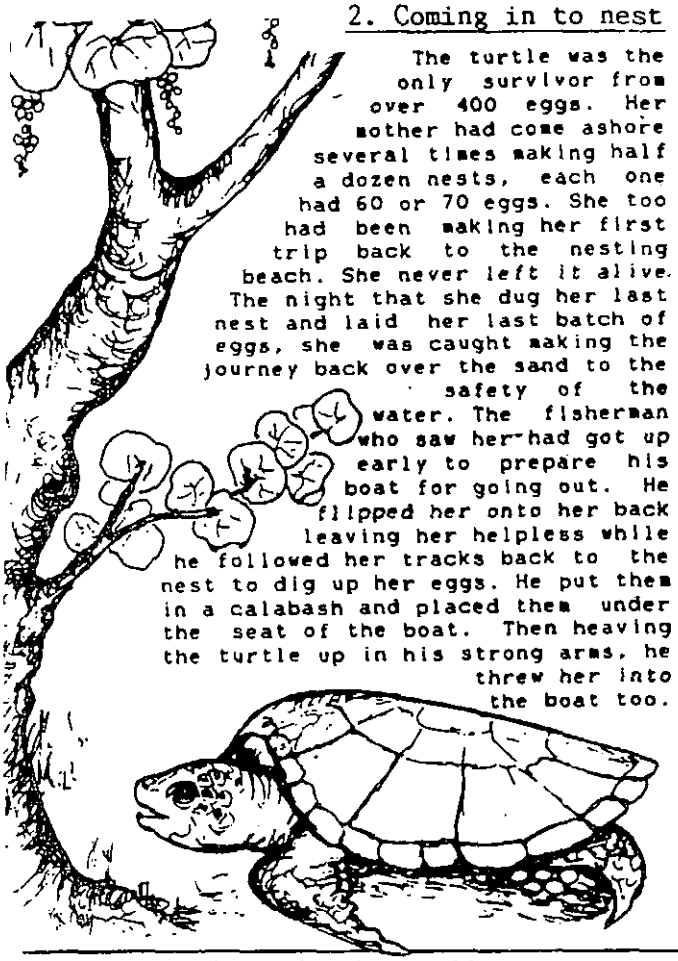
2. Coming in to nest



The turtle was the only survivor from over 400 eggs. Her mother had come ashore several times making half a dozen nests, each one had 60 or 70 eggs. She too had been making her first trip back to the nesting beach. She never left it alive. The night that she dug her last nest and laid her last batch of eggs, she was caught making the journey back over the sand to the safety of the water. The fisherman who saw her had got up early to prepare his boat for going out. He flipped her onto her back leaving her helpless while he followed her tracks back to the nest to dig up her eggs. He put them in a calabash and placed them under the seat of the boat. Then heaving the turtle up in his strong arms, he threw her into the boat too.

Out in the ocean the young female was still swimming toward the shore. She did not know that the development of the coastal areas had destroyed most of the turtles nesting habitat. Even if some of her eggs did hatch, her young ones would probably never be able to return.

She coasted in on a wave that left her stranded halfway up the narrow beach. The weight of her body and her clumsiness now that she was on land, confused her. She swung her head from side to side looking at this new world. Then with deep sighs and heavy breathing she started to heave herself forward.

She chose a spot under the branches of a Sea Grape tree. Its leaves made a canopy over her head and she paused there for several minutes to recover her breath. Then, before she began to dig her nest, she made a hollow in the sand for her body. Settling herself into it she used her back flippers to dig down under her tail until there was a deep hole. Then she started to lay her eggs.

The shadows on the beach grew darker and shorter as the moon rose higher in the sky. Bats flicked in and out of the palm trees. Small crabs scuttled here and there, only visible when they moved and their legs threw up little puffs of sand. A rat came down from the lower branches of an Almond tree and scampered toward the heap of garbage left by the daytime visitors. Two cigarette ends curved red as they were thrown away, then fell in a scattering of bright sparks on the ground. The men, their backs still turned to the sea, moved quietly away through the bush in the direction of one of the houses.

3. Dogs, crabs and other robbers

By the time the turtle finished there were more than eighty eggs in the hole. She was very weary. Her body was covered with sand thrown up by her flippers and from her eyes ran a clear mucus that looked exactly like tears. But, tired as she was, she still had to cover up the nest. She smoothed and brushed the sand over the eggs until she was satisfied that the spot had been properly camouflaged. Only then did she drag her land-clumsy body seaward. Her return journey left a trail as large and obvious as that of a tank. Out in the bay her mate waited. He was bigger and much heavier than she was. But however long he lived, he would never go back on shore.

From the direction of one of the houses, dogs began to bark. Lights came on and a voice called out, then a figure appeared on the balcony cutting the darkness with the beam of a flashlight. Soon the two men could be seen creeping out of the bush below. They kept in the darker shadows as they crossed the beach toward the tree. They sat there not speaking but looking up now and then at the house. The lights had all gone out except for a dim glimmer coming from an inside room. The dogs, apart from an occasional grumble were silent.

In the light of the match the two faces were dark and angry. The dogs and the the watchful householder had spoiled their plans and they sat there trying to decide whether they should try somewhere else. Then one of them noticed the many strange marks that rippled the sand in front of him. He got up and started to stab at the sand around his feet with the cutlass he carried. After about a dozen jabs its point came up dripping a thick sticky substance and within seconds he had uncovered the turtles nest. Tearing open the papery shells, both men sucked out the contents hardly stopping to take breath. When they had eaten their fill they scooped up the remainder and put them in their hats before they moved away.

The turtle came ashore three more times during her laying period, scattering her nests and her eggs across the beach. One was dug up by a playful dog chasing a crab. The eggs were broken and left scattered about to be eaten by rats and ants and crabs. The other two nests remained undisturbed. By the time the eggs were due to hatch, the female turtle was many miles away on her journey back to the feeding grounds. She would stay there for the next two or three years. She would never see her offspring, never know how many - or how few - had survived.

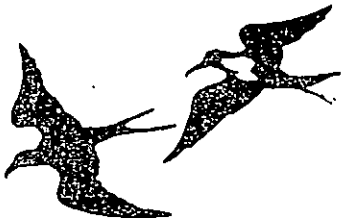
(continued on the next page)

4. Down to the sea

The afternoon was bright and hot and at the end of the beach a group of young boys shrieked and splashed in the shallow water. Overhead, a gathering of Frigate birds appeared, gliding on enormous, black wings. What had brought them to this spot? There were no fish jumping in the bay and anyway they seemed to be more interested in the land than the water. It was soon easy to see why. The sand at the top of the beach was erupting.

Out from it burst small black creatures still struggling to free themselves from the scraps of eggshell that clung to their bodies. The baby turtles had hatched, and the Frigate birds had moved in for the kill. It was almost exactly two months since the female turtle had left the beach.

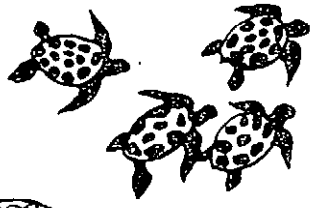
The boys left their game and wandered along to see what the birds were after. They watched as they wheeled in to dive and grab at the small scurrying things on the beach. The turtles, their shells still soft, were no more than a mouthful for the huge birds. They hardly took time to swallow one hatchling before they were back for another. The boys ran to join in the fun.

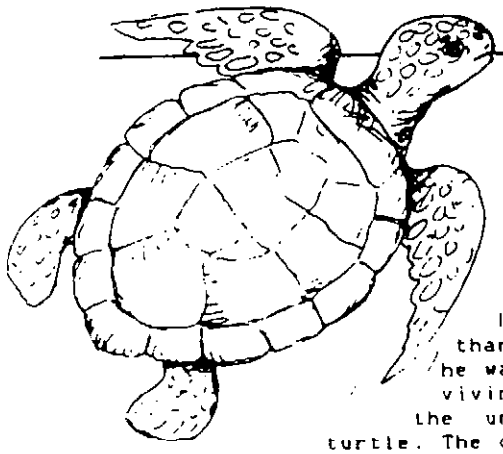


Picking up the baby turtles they threw them onto the weed-covered rocks. They threw them at the birds. they threw them at each other so that they fell broken and dying onto the hot sand.

By the time the birds were tired of eating and the boys were getting bored with their destructive game the sun was already edging toward the horizon. On the beach lay many sun-dried bodies. In the sea swam just a handful of survivors.

Their journey down to the sea had been a horrifying experience. Now feeling cool and comfortable in their new environment they made the mistake of thinking they were safe. They were wrong! Ahead of them lay the open sea but the way was barred by the sharp teeth of dozens of fishy predators. As if on a signal, they moved in for their share. The turtles were helpless. Unprotected and unarmed forced on by their instinct, most of them died. Their few hours of life had been a confusion of happenings. All of them unpleasant.

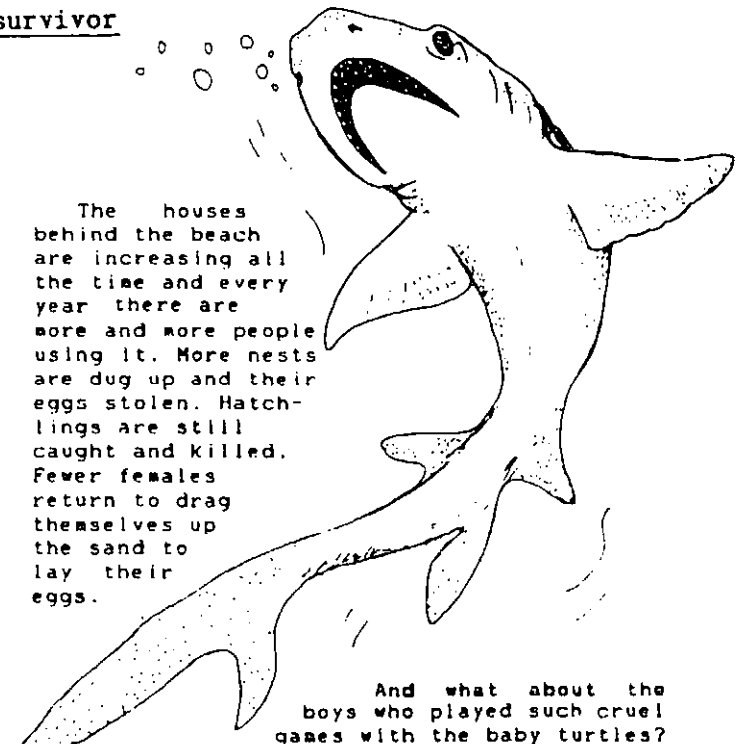




5. The lonely survivor

A year passed and hundreds of miles away from the beach where the turtles had hatched, a lonely male swam lazily through the sea. Hardly any bigger than a dinner plate, he was the only surviving offspring of the unfortunate female turtle. The only living proof of her long journey south and her many trips ashore to lay her eggs.

Only a handful of hatchlings had managed to make their way out to the ocean beyond the little bay. First there were the birds, then the fearsome barricade of fish. Later there were more and bigger fish, and fishermen and fishing nets. There seemed to be no end to it. In the twelve months since the eggs had hatched the number of survivors gradually got less and less. Now only this one lonely creature remained. Eventually he would find himself at the feeding grounds where his mother had gone before him. But it would be still another four or five years before he himself was mature enough to mate. Then he would return to the beach where he had first breathed air. He would swim around offshore waiting for the females who came there to nest and lay their eggs.



The houses behind the beach are increasing all the time and every year there are more and more people using it. More nests are dug up and their eggs stolen. Hatchlings are still caught and killed. Fewer females return to drag themselves up the sand to lay their eggs.

And what about the boys who played such cruel games with the baby turtles? When they are grown up with families of their own, will their children be able to see turtles in their natural habitat? Will they remember then, when it is too late, the part they played in helping them to disappear?

(continued on the next page)

THESE GENTLE CREATURES WILL DISAPPEAR FROM OUR PLANET FOREVER IF MAN DOES NOT COME TO THEIR RESCUE

TAKING THE ENVIRONMENT INTO SUDAN'S SCHOOLS

UNEP News
Information Service,
United Nations Environment Programme,
P.O.Box 30552,
Nairobi,
KENYA

Bit by bit the curricula taught in Sudan's primary and secondary schools and universities are being "environmentalized".

The method being used is novel. The education ministry has sponsored a number of curriculum developers in preparing MA theses which, once approved, can be used as teaching guides. One of the areas of study being promoted is how to integrate environmental concerns into various subject syllabuses.

One of the researchers is biology teacher Elradia Bab Alla Mutwali. Ms. Mutwali's thesis is on incorporating environmental considerations into Sudan's primary school science teaching. How not to let land degrade will be the central message of the new course in a mostly arid, drought-prone country.

As part of her research, Ms. Mutwali visited the United Nations Environment Programme in Nairobi. On this trip, which was sponsored by the Regional Office for Africa and the Desertification Control Programme Activity Centre, Ms. Mutwali was able to have access to desertification control experts and to a wealth of reference material. She was also able to tap Kenyan experience in introducing environmental education, both in syllabus planning and in training people to teach them.

Sudan is one of the countries selected for UNEP's "concentration" of efforts and for special attention until such time as environmental reform within the country has developed its own momentum.

Source: UNEP News, No.14

The *Arribada* / *La Arribada*

Sea Turtle Rescue Fund,
Center for Environmental Education,
1725 DeSales St., N.W.
Suite 500,
Washington, D.C. 20036
U.S.A.

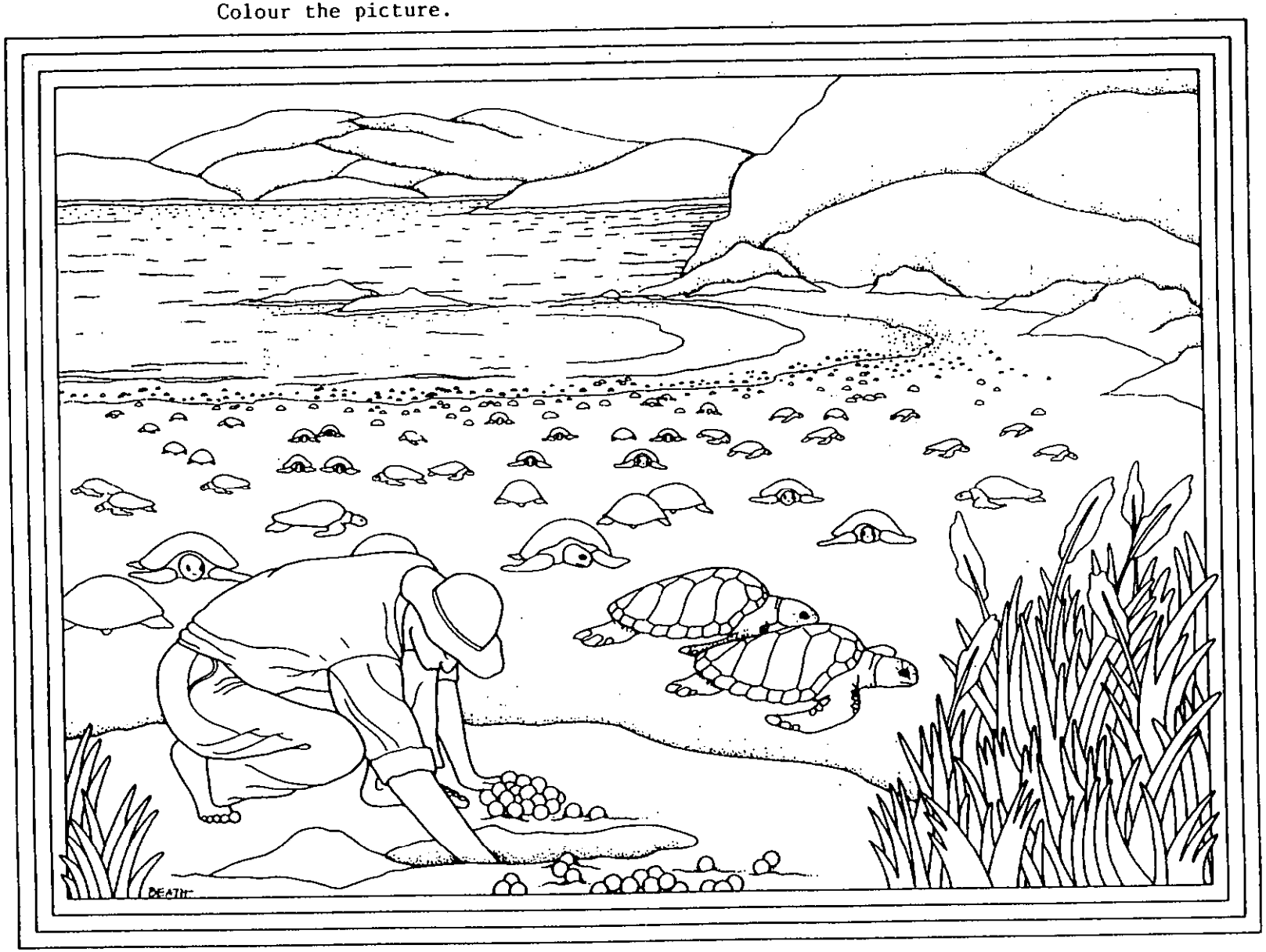
The text below and the colouring exercise on the next page are taken from:
Sea Turtles/Las Tortugas Marinas Coloring Book illustrated by Mary Beath and written by Francine Jacobs (Published by the Center for Environmental Education, 1981)

This material may be reproduced for educational purposes, but credit must be given to Mary Beath and Francine Jacobs/Sea Turtle Rescue Fund - CEE.

The word, *arribada,* means arrival in Spanish. It describes one of the most spectacular events in nature, the arrival of masses of ridley sea turtles at a nesting beach. Unlike other sea turtles that nest alone, ridleys come ashore together to nest. The Atlantic ridley, also known as the Kemp's Ridley, is the smallest sea turtle; it is gray, weighs less than one hundred pounds, and is very lively and difficult to handle. Once many thousands of them could be seen at *arribada,* coming ashore on the northeast coast of Mexico. But people like to eat sea turtle eggs. So poachers steal them from their nests and sell them to markets, leaving few ridleys to hatch. The Atlantic ridleys are disappearing. The government of Mexico is trying to save them. It sends marines to the beach at *arribada* to protect the turtles and their eggs. But so many eggs have already been taken that the Atlantic ridleys are still dying out.

La arribada toma su nombre de uno de los sucesos más espectaculares de la naturaleza: la llegada en masa de las tortugas loras o de las golfinas a la playa en que han de hacer sus nidos. En forma distinta a las demás tortugas marinas, que anidan individualmente, estas tortugas vienen a la playa todas juntas para hacerlo. La golfina es la más pequeña de las tortugas marinas; es grisácea, pesa menos de 45 kilogramos y es muy vivaz y, por lo tanto, difícil de manejar. Tiempo atrás se podían ver miles de ellas en la arribada, cuando llegaban ala costa del noreste de México. Pero los huevos de tortuga son un manjar muy apreciado por la gente. Los cazadores furtivos roban los huevos de los nidos para venderlos en el mercado, dejando así muy pocos para incubar. Las tortugas golfinas están desapareciendo. El gobierno de México está empeñado en un esfuerzo para salvarlas: durante la arribada envía la infantería de marina a la playa para que proteja las tortugas y sus huevos. Sin embargo, en el pasado se han sustraído tantos huevos de las nidadas que las tortugas golfinas todavía están en peligro de extinción.

This picture shows the arrival of ridley sea turtles at a nesting beach.
Colour the picture.



Sea Turtles? Or Turtle Products? / *Tortugas Marinas . . . O Productos de Tortuga?*

Sea Turtle Rescue Fund,
Center for Environmental Education,
1725 DeSales St., N.W.
Suite 500,
Washington, D.C. 20036
U.S.A.

The text below and the colouring exercise on the next page are taken from:
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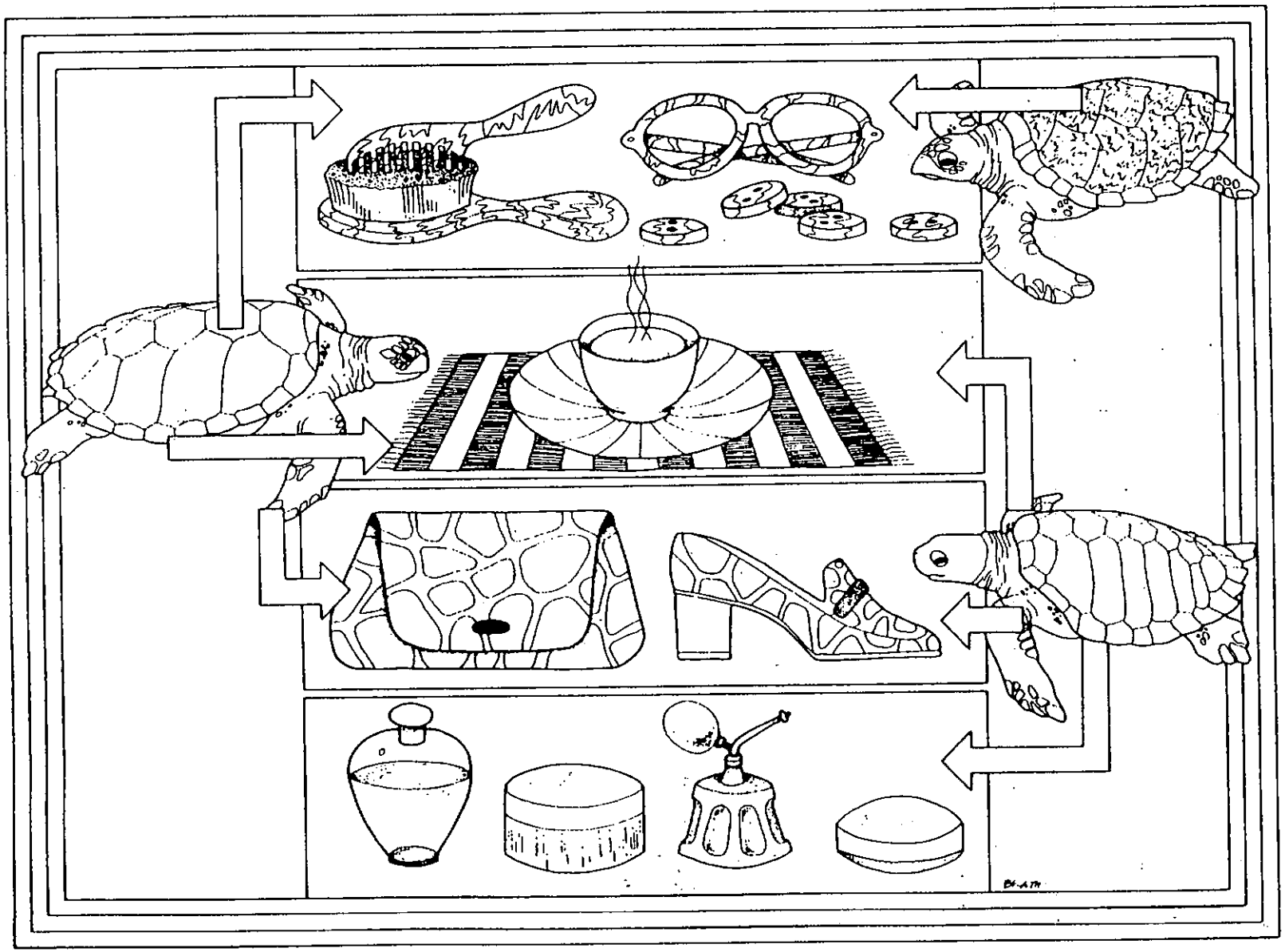
The sea turtle is disappearing. And once it is gone, it will be gone forever. One reason it is disappearing is because people use parts of turtles for food or, more often, to make different products. The hawksbill is prized for its carapace to make tortoiseshell combs, brush handles, eyeglass frames, buttons, hair clips, and jewelry. Hawksbill and green turtles are killed so they can be stuffed and hung on walls as decorations. Green turtles are slaughtered for their meat and in order to make turtle soup. The skin from the neck and flippers of greens and olive ridleys is made into leather for purses and shoes. Fat from turtle bodies is used in soaps and makeup creams. Instead of using plentiful resources for these products, the world's few remaining sea turtles are taken.

Las tortugas marinas están en vías de extinción. Y, una vez que esto suceda, habrán desaparecido para siempre. Una de las razones por las que están extinguiéndose es la gran variedad de productos que se obtienen de ellas, incluyendo los alimenticios. La tortuga carey es apreciada por su caparazón con el cual se fabrican peines, mangos de cepillos, armazones de anteojos, botones, peinetas y joyas. Estas tortugas y las verdes se disecan para decorar paredes. Las verdes son también apreciadas por su carne, así como para hacer sopa de tortuga. La piel del cuello y de las aletas de las tortugas loras y de las verdes se utiliza para hacer carteras y zapatos. La grasa que de ellas se obtiene se usa en jabones y cremas de maquillaje. En lugar de utilizar otros recursos más abundantes para fabricar estos productos, se están exterminando las pocas tortugas marinas que quedan en el mundo.

This picture shows the products made from some sea turtles. Colour the picture.



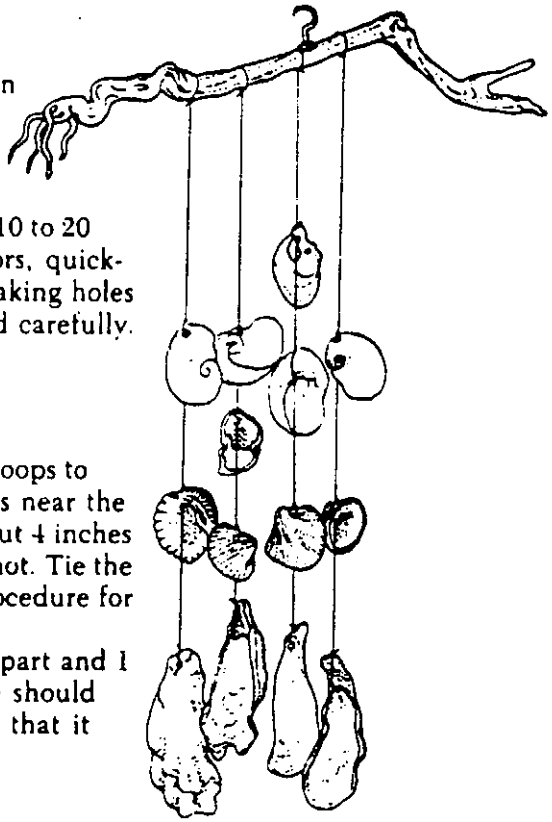
BLOWING IN THE WIND: A MOBILE WITH A SEA THEME

UNC Sea Grant College Program,
Box 8605
N.C. State University,
Raleigh, NC 27695-8605
U.S.A.

The activity below is from:
Coastal Capers: A Marine Education Primer written by Lundie Spence (UNC Sea Grant) and Vivian Barbee Cox. This is a UNC Sea Grant publication sponsored by the Office of Sea Grant, NOAA, U.S. Department of Commerce and the North Carolina Department of Administration.

If this activity is reproduced, please give credit to:
Lundie Spence and Vivian Barbee Cox/UNC Sea Grant Program.

Wind chimes



Purpose

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

Materials

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

Procedure

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

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

TEACHERS'/PARENTS' PAGE

Wheel of Trouble

National Wildlife Federation,
1412 Sixteenth Street, N.W.
Washington, D.C. 20036-2266
U.S.A.

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Reprinted with permission from Ranger Rick's NatureScope, "Endangered Species: Wild and Rare", published by the National Wildlife Federation, copyright 1987.

Make a wheel that shows why some sea turtles are endangered.

Objective:
Explain why some sea turtles are endangered.

Ages:
Primary

Materials:
- ***pictures of sea turtles***
- ***pictures of land-dwelling turtles (optional)***
- ***copies of page***
- ***crayons or markers***
- ***lightweight paper plates at least 9" (23 cm) in diameter***
- ***scissors***
- ***glue***
- ***tape***
- ***construction paper (optional)***
- ***paper fasteners***

Subject:
Science

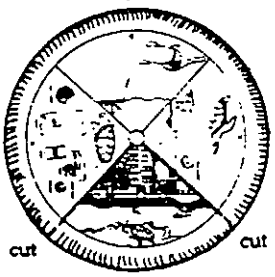
Many sea turtles are endangered for a lot of the same reasons that other species are in trouble, including overcollecting, habitat loss, and pollution. By using sea turtles as an example, younger children can learn about the variety of problems that affect many endangered species.

Before you begin, make eight triangular patterns, following the directions under "Getting Ready" below. Then start the activity by showing the kids pictures of sea turtles and talking about their natural history. (For general information about sea turtles, see "Turtle Talk" on page 20.)

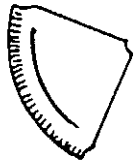
Now tell the kids that most sea turtles are endangered or threatened. Explain to the kids that they will be learning why these animals are in trouble by making a special "wheel of trouble." Then give each child a copy of page 21, two paper plates, scissors, glue, a paper fastener, and crayons or markers. Also hand out the triangular patterns you made earlier and tell the kids to share them. Then have them follow the directions to make a "wheel of trouble."

GETTING READY

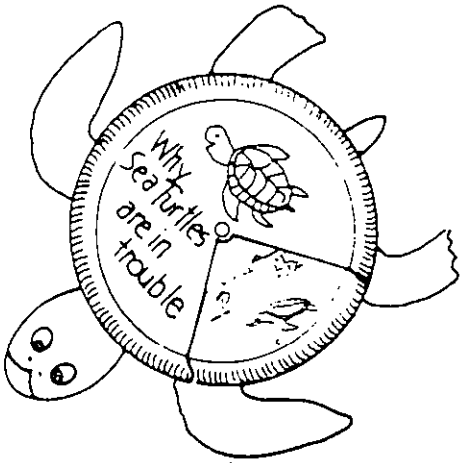
1. Cut out the circle on page 21 and tape it to the back of a paper plate. (Don't use too much tape because you will eventually be removing the circle.)
2. Cut out each segment, making sure you don't cut through the center circle or cut along the outer edge (see diagram). After cutting out each pattern, remove the paper pieces. (You will end up with four separate segments.)
3. Repeat this with another plate and Copycat Page. (Or use the pattern pieces to cut out four more segments from another plate.) Eight pattern pieces should be enough to get a group of 25 started.



each pattern piece should look like this:



finished wheel



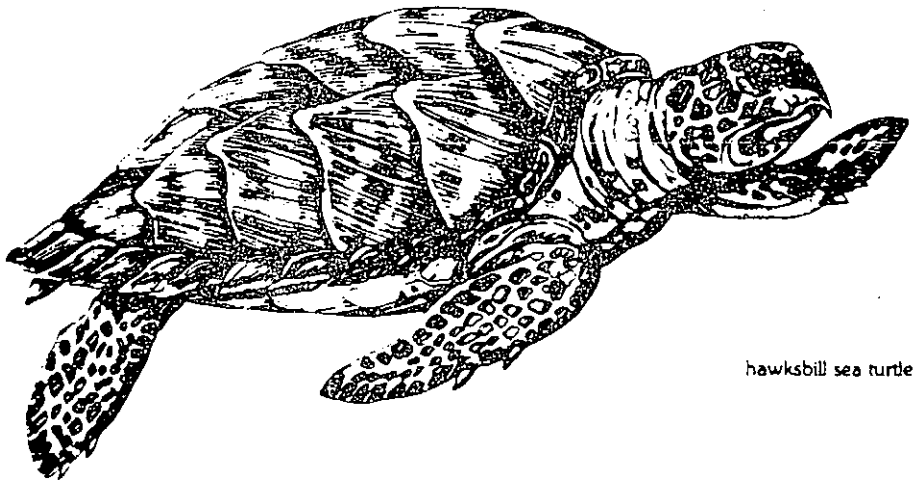
attach construction paper legs, head, and tail

HOW TO MAKE THE WHEEL OF TROUBLE

1. Color the pictures on the Copycat Page, then cut out the circle along the solid outer line.
2. Glue the circle on the back of a paper plate. (Tell the kids to use a *thin* layer of glue.) Set this plate aside.
3. Lay the triangular pattern on the back of the other paper plate so that the edge of the pattern meets the edge of the plate. Trace it and cut out the shape. (When one child finishes using a pattern piece, he or she can pass it on to someone else.)
4. Place the cut-out plate on top of the plate with the pictures and push a paper fastener through the center of both plates. (If you're using thick paper plates, you may have to first poke a hole through the plates with scissors or a pen.)

As the kids turn the top or bottom plate, each of the four pictures will appear in the cut-out space. Explain that these pictures illustrate the four major problems sea turtles face. Have the kids turn their wheels to picture A, then use the information under "Trouble for Turtles" to talk about each of the problems.

After your discussion, have the kids draw a picture of a sea turtle on their top plate and write the title "Why Sea Turtles Are in Trouble." You can also have the kids cut legs, a head, and a tail out of construction paper, and tape them to the bottom plate to make the wheel look like a turtle (see diagram).


hawksbill sea turtle

TROUBLE FOR TURTLES

A. Meat, shells, skin, and eggs: Overharvesting is a major problem for sea turtles. They are killed for their beautiful shells (which are made into jewelry), for their skin (which is tanned and used to make boots, belts, shoes, and bags), and for food (people eat their meat and eggs and use the cartilage to make soup).

B. Changing beaches: Development is another problem for sea turtles. In many areas, people have built homes, roads, motels, and other types of development on the beaches where sea turtles nest. Turtles don't usually lay their eggs in these built-up areas, but if they do, the hatchlings have problems. The young turtles hatch at night and instinctively head for the bright water of the ocean. But on developed beaches, the newly hatched turtles are mistakenly guided to the bright lights of buildings. These hatchlings often get hit by cars or eaten by birds, dogs, or raccoons, or they dry up in the sun.

C. Pollution: When plastic garbage is dumped into the oceans, it can cause big problems for many sea turtles. That's because turtles may mistake floating plastic bags for jellyfish and swallow them. They can't digest the plastic, and if it blocks a turtle's intestines or stomach, the animal will slowly starve.

Other forms of pollution, such as oil, tar, and poisonous chemicals released into the oceans, are also dangerous, especially for young turtles.

D. Fishing nets: Every year, some sea turtles drown when they are accidentally caught in shrimp nets. To help solve this problem, some shrimpers are now using a Turtle Excluder Device (TED) that fits inside shrimp nets and releases the trapped turtles.

Note: The five sea turtles listed below are all affected by these four problems. But some problems are more severe for certain species. For example, hawksbill turtles are overhunted for their shells and eggs. But because they live in areas where shrimp fishing is not a big business, they are rarely caught in fishing nets. For simplicity, we didn't include which problems affect each species.

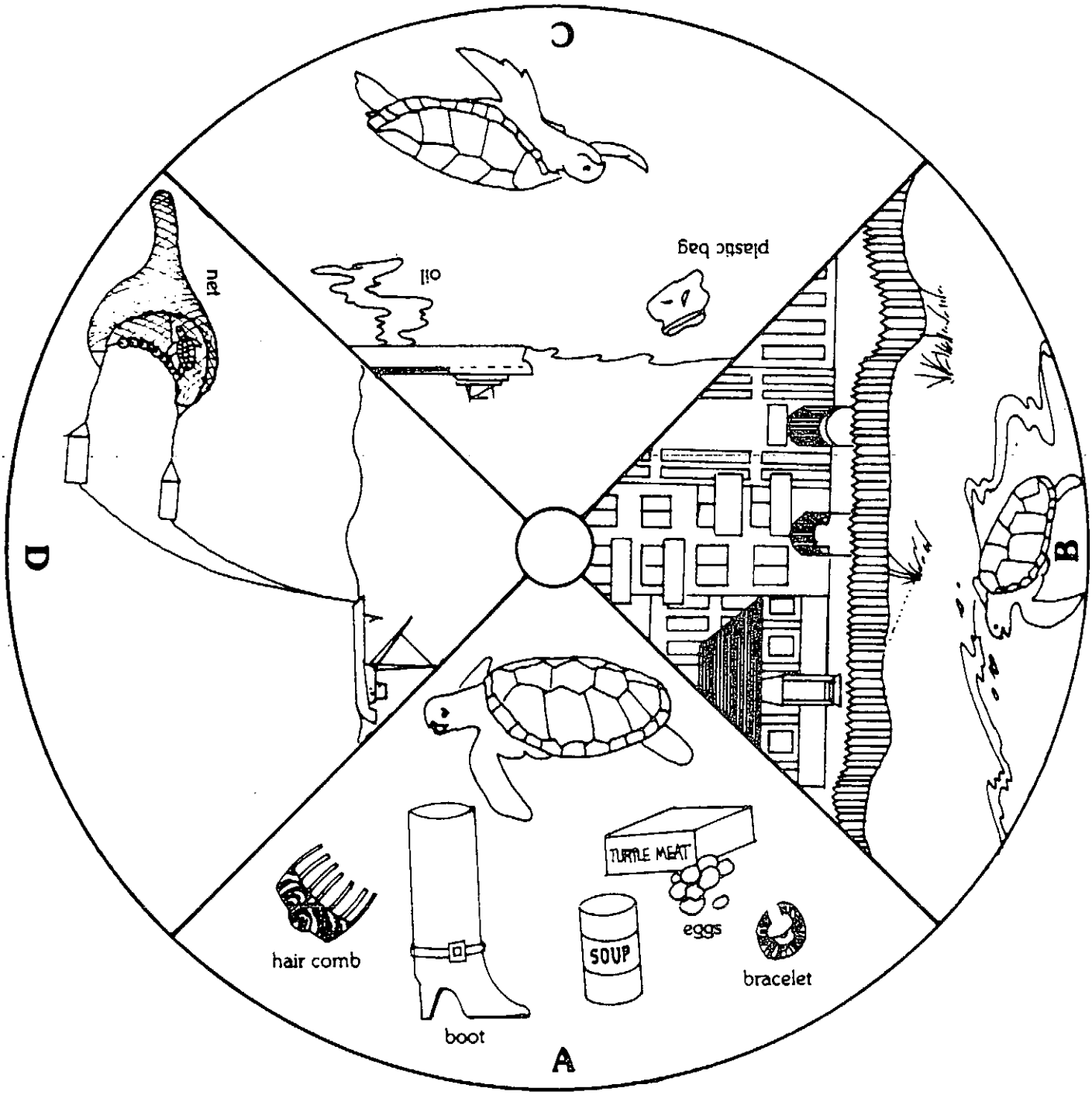
TURTLE TALK

The Kemp's ridley, Pacific ridley, loggerhead, green, and hawksbill sea turtles are all threatened or endangered. The following facts apply generally to these five turtles:

- live in warm oceans around the world
- eat jellyfish, sponges, crabs, fish, and/or plants, depending on the species
- size can range from 3 to 4 feet (.9–1.2 m) and weight can range from 100 to 350 pounds (45–158 kg)
- may live as many as 70 years
- have paddle-shaped flippers that help them move through the water and streamlined shells that reduce water resistance (compare to pictures of land turtles with high-domed shells and clawed feet)
- lay their eggs on sandy beaches; use their back flippers to dig deep holes in the sand where they lay up to 100 eggs
- eggs hatch in about two months
- many young turtles are eaten by birds, crabs, fish, and other predators
- adult turtles have only two enemies—sharks and people

COPYCAT PAGE

WHEEL OF TROUBLE



TEACHERS'/PARENTS' PAGE

NET GAIN, NET EFFECT

Project WILD,
Salina Star Route,
Boulder,
Colorado 80302
U.S.A.

This activity is reprinted from:
Aquatic Project WILD, an Aquatic Education Activity Guide. Project WILD is an interdisciplinary, supplementary environmental and conservation education program for young people ages between five and eighteen years.

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Objectives

Students will be able to: 1) describe the evolution of fishing from the techniques of early humans to contemporary times; and 2) interpret the possible effects of changes in technology on fish populations.

Method

Students conduct a simulation to explore the evolution of fishing and the effects of changing technology on fish populations.

Background

Fish supply the main source of protein for nearly half of the five billion people on the planet. Humans have been engaged in fish gathering since prehistoric times. Methods of catching fish probably started with humans wading into drying wetlands at the edges of large shallow lakes. There, with bare hands and clubs, they began the first uses of fish as a human food source. Later, new technologies were invented. Rock weirs or dams were built on streams and rivers. The fish were then trapped and speared in holding ponds. Eventually, baskets were fashioned that allowed fish to swim downstream into intricately woven baffles that prevented escape.

Following the use of spears and hooks to kill fish, the net was invented. It was the net that enabled fishing to move from small scale subsistence for the family or tribe to huge economic ventures.

As changes occurred, the net evolved in size, design, and effectiveness. There are a great variety of nets now available for catching different fish species in different situations. Gill nets, purse seines, trammel nets, and drift nets have all improved the fishers' catch rate. Yet these technologies have also introduced new problems such as impact on marine life not intended to be caught, size discrimination, over catching, and destruction of marine habitats.

Evidence of boats and rafts being used in fishing goes back to the stone age. The first revolution in boat design came when fishing boats shifted from dugouts to sailing vessels. The technology of sails did much to allow people fishing to extend both their range and catch. But nothing seems to have matched the revolution created by steam and later diesel-driven fishing fleets. These vessels could go rapidly to any spot in the

Age: Grades 3—6
Subjects: Science, Math
Skills: analysis, classification, comparing similarities and differences, computation, discussion, estimating, identification, inference, interpretation, kinesthetic concept development, matching, observation, psychomotor development, recognition
Duration: 30-60 minutes
Group Size: any
Setting: indoors or outdoors
Key Vocabulary: technology, fishing

oceanic world.

Nets combined with the range and manueverability of steam and diesel boats made it possible to catch larger and larger amounts of smaller and smaller fish. For commercial fishers, this creates a problem when mixed species are caught. Since most have a specific fish in mind to catch, the other species that are netted are caught inadvertently. Those fishing must cull the unwanted fish from their nets or sort them later. In either case, they are usually not returned to the sea.

Along with the technological changes in boats and nets, there has been a considerable change in other support fishing gear. Commercial fishers now routinely use complex sonar fish finders, radio communications, spotter aircraft, computerized navigational equipment, at-sea catch processing, and other similar sophisticated tools. Today, nearly fourteen million tons of sardines, herring, and anchovies are netted commercially each year. Approximately thirty-two million tons of other kinds of fish are caught annually. Japan, Russia, and China are the largest fishing nations of the world.

With the increasing sources of accessible fish, new markets were created. Today human consumption of fish for food is 35% of the total catch. The majority of fish are caught for fertilizer, oil, pet food, and fish meal to feed livestock. There are serious concerns about excessive fishing of some fish species.

For many fish species, the single most critical issue may be suitable habitat. Breeding grounds near shore are being lost at an alarming rate. Shoreline development, municipal and industrial waste, and offshore drilling are all contributing to the loss and the dangers. Because no one knows how many fish there are in the sea, it is difficult to know how many of the populations of species have changed.

It is clear, however, that many commercial fishers are reporting fewer and fewer fish in many traditional fishing sites. Non-commercial fishers are also reporting similar concerns in some places. Such concerns have led more countries to extend territorial limits and develop more stringent regulations for both freshwater and marine situations. Compliance and enforcement are problems for all nations. There are success stories, however. Some species seemed to have reached a balance between catch and reproduction rates. In some places, like the Great Lakes, species have been brought back into a dynamic balance after previous depletion of populations of fish by excessive unregulated fishing and pollution.

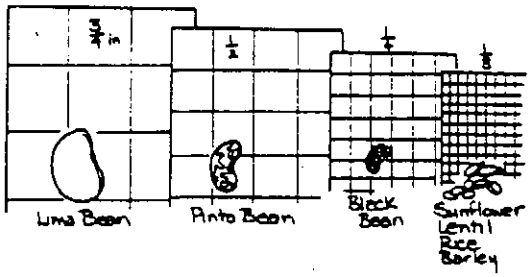
This activity focuses especially on some changes in fishing technology that have led to today's vast commercial fishing activities.

This activity does not address ethical questions related to the appropriateness or inappropriateness of catching fish for human uses. This dimension may be added at the professional discretion of the educator conducting the activity.

The major purpose of this activity is for students to acquire some understanding of the history of fishing and the effects of modern technologies on fish populations.

Materials

nets of differing mesh size (see table below); onion bags, potato bags, fruit bags, or netting from hardware store, plain cloth fabric for nets; a variety of dried beans and grains (one pound each of lima beans, pinto beans, black beans, lentils, rice); writing materials; four containers large and deep enough to hold ¼ of the beans and grains



Procedure

1. Prepare the "ocean" by mixing all the beans and grains. Then divide the mixture equally into the four containers. These will be the four "fishing grounds."

2. Ask the students to decide what each bean will represent for the purposes of this activity. Fish could be hypothetical or could represent actual fish that are common in your area. Each bean should represent a fish species. For example:

- Lima beans may become "Moonbean fish"
- Lentils may become "Red Snapper fish"
- Pinto beans may become "Wonderdot fish"

Make a chart matching the beans or grains with the fish they represent. Post the chart in front of the room or any place where it is easily visible to the students.

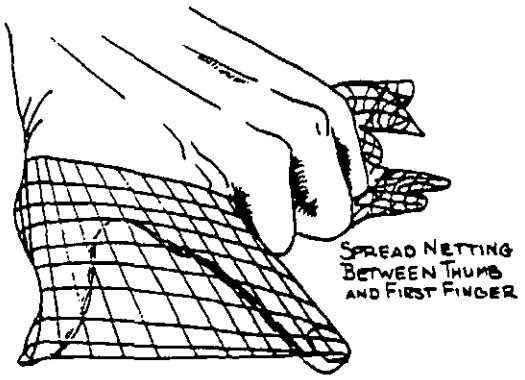
3. Divide the students up into four groups and ask each group to go to the fishing grounds (the containers of beans and grains).

4. Discuss how fish are caught. "If you fish, how do you catch fish? Have you seen people catch fish? How were they catching their fish? Could large numbers of fish be caught if all fish were

caught with rods or poles? What are some ways to catch large groups of fish at one time? (One way is with large nets as some commercial fishers do in the ocean.) What are some of the ways people used to catch fish? What are some of the ways people catch fish today?" After a general discussion of ways people fish, tell the students that they will now simulate the catching of fish using nets.

NOTE FOR TEACHERS OF OLDER STUDENTS: Have a general discussion about fishing. Who has been fishing, or seen people fishing? Has anyone ever seen people fishing commercially? What techniques did they use? Talk about how techniques for fishing have changed in some ways over time, and some have not.

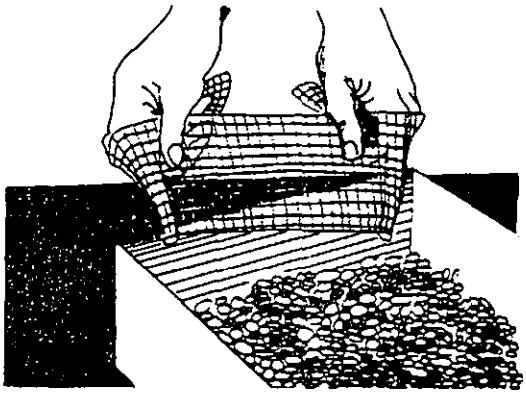
5. Next pass out the netting materials that you have. The net materials should be cut to be about four inches by six inches. The number of nets needed depends upon how many students share a net. One net for three students will work. With the coarse netting in hand, ask the students to "fish." They represent people who fish commercially. They are to use only one hand. They must hold the net so that the distance between their thumb and first finger is the catching area. Ask them each to make one pass with their nets through the fishing grounds. See the drawing below.



The worksheet shown below may be helpful.

NOTE FOR TEACHERS OF YOUNGER STUDENTS: Each time a "net" is used, you may want to demonstrate first for the students. When it is the students' turn, stress that they will be allowed to make only one pass into the "ocean." Show how to hold the net in your hand. Give each student a sheet of paper to represent their boat. Have them dump their "fish" into the boat. Count the number of each kind of fish caught. Record the numbers. Counting and estimating may both be used.

7. Next allow the students to use both hands. (See drawing below.) Make one pass through the "ocean." Repeat the fish count. Have the students repeat this process several times.



8. Discuss the results. Most likely, the students will have been more successful with the two-hand technique. Relate this to an improvement in technology. Using both hands rather than one may represent the shift from hand-powered boats and cast nets to trawlers.

9. Call the students' attention to the species they have netted. The smaller lentils and the rice often will slip through the netting and escape capture. The larger species—the limas and the pintos—are the most likely to have been caught. Ask them what they could do to catch more fish. Discuss possible options with them.

NETTING

		COARSE NET		FINE NET		COMMENTS
Number of Hands Used		1	2	1	2	
SPECIES	Lima Lunker					
	Pinto Porgies					
	Black Bass					
	Lentil Moonbeans					
	Rice Wrasses					

10. Next give them each a net with fine mesh (less than ¼ inch mesh). The net itself should again measure about four inches by six inches. If they have not already done so, ask them to return all the "fish" they caught earlier to the ocean containers so that they can try fishing with this new smaller-meshed net.
11. Tabulate as before and discuss the results.
12. OPTIONAL: Repeat with the nets of other size mesh, also cut to measure about four inches by six inches. Discuss.
13. Return all the fish to the ocean.
NOTE FOR TEACHERS OF YOUNGER STUDENTS: The activity may conclude with a discussion at this point. Ask the students to think and talk about what happens when the different kinds of nets are used. Is it good to let the smaller fish through the net? Why or why not? What might happen if people took all the fish from one part of the ocean? Which nets might be better to use in order to conserve the fish in our oceans? Why or why not?
OPTIONAL: Work with the students to construct a bar graph to show them the numbers of fish they caught using the different nets, and different techniques of netting.
14. Now announce a different perspective. Tell them that all the fish, beans through rice, are of the **same** species. Tell them that no fish can be caught that is smaller than the black bean species size. Any smaller fish that they catch will cost them a point. Tell them that a regulatory agency responsible for monitoring fishing practices will give them ten seconds to get rid of all undersized fish after each netting. Appoint two members of each fishing team to this regulatory agency.
15. Have the commercial fishers again use the fine mesh net (less than ¼ inch mesh) and make a catch. They have to empty the net onto the table and **one by one** return the undersized fish to the ocean. At the end of ten seconds, they must stop and the representatives of the regulatory agency will count the undersized fish that are still left and fine them one point for each one.
16. OPTIONAL: Discuss the economics involved. Can the people fishing afford to return all the undersized fish to the sea? What are their options? Should we release undersized fish? If yes, why? If no, why not?
17. Repeat with one of the larger mesh nets. Is there an advantage to letting the smaller fish get through the net over returning them by hand? Discuss how dolphins and sea turtles are often caught in nets. Point out how for the dolphins and sea turtles the problem is reversed. They are too large to escape.

NOTE: Efforts are being made to design, use, and enforce the use of nets and other fishing equipment that will reduce the loss of dolphins and sea turtles under these conditions.
18. Ask the students to summarize what they have learned. Review the general history of fishing, including how each new technological change may have affected fish populations. Consider possible impacts on fish habitats as well. Identify some of the potential tradeoffs related to changes in fishing technologies. Conclude with a discussion of how, if at all, the students think fishing technologies can be developed that minimize any potential long-term negative consequences to healthy fish populations and aquatic environments.

Extensions

1. Create an illustrated history of the fishing net.
2. Use nets of different sizes and try to catch aquatic organisms in a local pond or stream. Observe and record any differences in what the nets catch. Be extremely careful to return any animals to their habitat unharmed. NOTE: You must check regulations with your state's wildlife agency regarding net use, since in some areas it is against the law to use nets in local waters.
3. Investigate the current status of the problems surrounding the netting of tuna. How successful have efforts been to develop, use and enforce use of new nets and technologies to prevent the accidental netting of dolphins?
4. Who "owns" the fish in the sea? In streams? In lakes? In ponds? In other aquatic habitats? Who is responsible for conserving and protecting fish species?
5. Explore issues related to gill net use in the open ocean.
6. Find out about regulations on personal, non-commercial fishing in freshwater and marine environments.
7. Find out about regulations on commercial fishing in freshwater and marine environments.
8. Discuss the role of aquaculture (freshwater) and mariculture (marine) aquatic farming. How will this emerging field affect commercial fishing? What possible positive effects, if any, on fish populations and habitat might there be from a change to aquaculture? Mariculture? What possible negative effects, if any?
9. Learn about fishing in your state. What methods are most commonly used to catch fish in your state? Is there a commercial fishing industry in your state? If so, what regulations apply to commercial fishing in your state? Are they different, or similar, to the regulations for personal and recreational fishing?

FILM REVIEW

Television Trust for the Environment,
46 Charlotte Street,
London W1P 1LX
ENGLAND

The review below is taken from Moving Pictures Bulletin, issue 2, June 1988. Moving Pictures Bulletin is published quarterly by the Television Trust for the Environment. If this review is reproduced, please give credit to Television Trust for the Environment (TVE).

RIVAGES AMERS (The Promised Sea)

COUNTRY: France YEAR: 1988 LENGTH: 54'

LANGUAGE: French

PRODUCTION CO: Plein Champ with FR3 Thalassa, INA, CNRS Audiovisuel, CCFD, Terre des Hommes (France), Terre des Hommes (Switzerland), CNC, CEE, Ministry of Foreign Affairs, France

PRODUCER: Gerard Schmidt, Arnau Mandagaran.

DIRECTOR: Jerome Bouyer

DISTRIBUTOR: Plein Champ, Cap 125, 67 rue Robespierre, 93558 Montreux, France. Telex 48 516960

Less than 20 years ago the seas around the Philippines archipelago were rich fishing grounds, providing a good living for the fishermen who lived on their shores. Concessions by the Marcos regime to trawler operators based in Manila and Japan have led to overfishing — and today the traditional fishermen are being squeezed out, forced to sell whatever the factory trawlers leave to buy rice for their families. With shallow waters fished out, some in desperation resort to using cyanide or dynamite to bring deep water fish to the surface. Blasts have led to disfigurement and even blindness. Other fishermen have quit the sea altogether, to swell the slums or join the communist guerillas in the mountains. For those who remain there is the additional hazard of pirates who patrol the water, seizing boats and catches, and dispatching their owners. And there are large private, netted fishing enclosures put up by wealthy Filippino landowners who employ armed guards to see off boats that stray too close.

A way of life and a valuable resource are squandered for short-term gain. The fall-out — human misery and environmental poverty — is powerfully presented in this Plein Champ production.

HOW TO GET HOLD OF THE FILMS

The MOVING PICTURES BULLETIN is designed to inform subscribers how to get hold of films on development and environment issues.
TVE cannot supply you with these films (unless TVE is listed as the distributor). You must contact the distributor whose address is listed for each film keeping in mind the following points:

AVAILABILITY: Unless otherwise specified, the distributor deals with requests for both TV sales and non-theatric use (ie: showing the films to a non fee-paying audience). Some films may only be available for broadcast. Films available for non-theatric use are usually supplied on VHS cassettes which you can keep. Some films can be borrowed free of charge or hired for a small fee.

FORMATS: Most films are available on all video cassette formats. (U-Matic High Band, U-Matic Low Band, VHS and Betamax), and on 1" tape for broadcasters. Some films may also be available on 16mm. Always specify which format you require.

LANGUAGE VERSIONS: If the film is not available in your language, you can usually obtain an international version (i.e. sound without commentary) and a commentary script which can be translated. This enables you to dub the film into your own language.

RESOURCES:

CHILD ALIVE

World Immunization News (WIN)
The Task Force for Child Survival,
Carter Presidential Center,
One Copenhill
Atlanta, Georgia 30307
U.S.A.

The article below is taken from World Immunization News Vol.4, No.1 (January-February 1988). If this article is reproduced, please give credit to World Immunization News/The Task Force for Child Survival.

League of Red Cross and Red Crescent Societies

The CHILD ALIVE Program

In many areas of Africa, Asia, and Latin America, the effort to immunize children and mothers against vaccine-preventable diseases is being tackled by Red Cross and Red Crescent volunteers. Consider these examples:

- **Colombia.** In three barrios on the outskirts of Bogota, mothers clubs meet with the encouragement of the Colombia Red Cross to learn more about keeping children healthy. A midwife, who has been specially trained by the Red Cross, uses her respected place in the community to spread the word about the importance of immunization and the best ways to prevent and treat diarrhea. A puppet show, put on by Red Cross Youth, is helping children learn good health practices.
- **Honduras.** When its survey revealed very low immunization coverage among the children in a barrio on the outskirts of Tegucigalpa, a team of the Honduran Red Cross convinced a Ministry of Health mobile immunization unit to schedule a visit to the community. Red Cross volunteers helped with organization and follow-up. Immunization coverage was subsequently dramatically improved. The project has now been extended to a neighboring barrio.
- **Sudan.** In an effort to double the full immunization of children under 1 year old, Red Crescent volunteers are being trained on immunization and the vaccine-preventable diseases, methods of collecting relevant information, how to develop and spread health messages, and how to mobilize communities for health projects.

These projects and others in India, Kenya, Nicaragua, Sierra Leone, Somalia, Belize, and The Gambia are examples of the CHILD ALIVE program. It was created in 1984 by the Red Cross and Red Crescent Societies to stimulate and support those activities that decrease avoidable childhood sickness, disability, and death. Through such activities, the societies aim to increase and strengthen their capacity to help in other health projects, in both relief and development programs.

The societies are taking their commitment seriously, as evidenced by the fact that CHILD ALIVE was chosen as the theme for World Red Cross and Red Crescent Day in 1987. The national societies' important contributions were recognized by UNICEF in 1986 with the Maurice Pate Award for their "outstanding contribution to the survival and development of children through the CHILD ALIVE Programme."

Their projects all concern either diarrheal diseases or immunization. The primary thrust of CHILD ALIVE is to inform and motivate the community.

One way this is accomplished is by strengthening existing training programs (First Aid and Red Cross Youth) with information on diarrhea and immunization. Teaching modules on diarrhea and immunization have been developed. They are designed to be used at all levels of training, from youth volunteers to doctors and nurses. The 4-hour courses downplay lectures and emphasize role playing, demonstrations, and home visits.

pecial incentives, particularly for the outh groups, are badges and diplomas warded at the completion of a course.

HILD ALIVE has also produced a umber of model training materials nd can provide assistance with local daptation and translation. Although any materials are already available in nglish, Spanish, French, and Arabic, ne program urges communities to eld-test their materials to incorporate ocal idioms and concerns.

wo materials are worthy of special ote. One is the *CHILD ALIVE Newsetter*, (see Box 1).

econd are comic strips on diarrhea nd immunization, used for teaching nd discussion at home visits. (See igure). These are introduced by volnteers and handed out to families.

The singular aim of all such materials s to spread the basic messages on diarhea and immunization. These include nstructions for home management of cute diarrhea, the five signs of dehyration, and the five danger signs in a child with diarrhea, among others. The following is one of the basic messages for parents promoted by CHILD ALIVE on immunization:

1. It is up to parents to ask for immunization.
2. It is up to parents to take their children to be immunized on time.
3. Malnourished children should be immunized.
4. Sick children can be immunized.
5. Mild fever, local swelling, and pain often occur for 1 or 2 days after immunization. This is normal and is always less serious than the disease.
6. Children with other reactions should be taken to a clinic.

These basic messages are used in all the courses and given to all participants. They serve as a checklist and teaching aid for home visits.

Box 1

Child Alive Newsletter, a publication of the League of Red Cross and Red Crescent Societies, serves as a forum on CHILD ALIVE activities.

Some examples of subjects treated in last year's issues include: a report on a workshop on breastfeeding in Latin America; results of a study on whether soiled saris can be vehicles in transmitting diarhoea (they can), and youth volunteer work in Quibdo, Columbia, which led to almost a 25% increase in immunization coverage.

The publication is produced by the League of Red Cross and Red Crescent Societies, P.O.Box 372, 1211 Geneva 19, Switzerland.