Oceans

Prior Knowledge

The student has

1. read and written numerals from one to 100
2. added and subtracted single- and double-digit numbers using manipulatives
3. classified objects according to various attributes
4. ordered by size and by length
5. worked with fractions such as 1/2, 1/5, 1/10.

Mathematics, Science and Language Objectives

Mathematics

The student will

1. explore the concept of percentage
2. measure length
3. multiply single-digit numbers as repeated addition, using arrays
4. record and graph data
5. classify objects
6. recognize and create patterns and similarities
7. read temperature on Fahrenheit and Celsius scales
8. explore symmetry
9. explore multiplication as a cross-product
10. explore division as repeated subtraction, separating into arrays
11. use denominate numbers (hours and minutes) to calculate time
12. compare numbers using subtraction or fractions.

Science

The student will

1. identify at least three main oceans
2. describe zones of salt water that vary in temperature, pressure and light intensity
3. identify and describe different environmental conditions in the oceans
4. identify and describe different types of ocean life
5. demonstrate and explain or draw the effects of salt water
6. illustrate and explain the tides
7. classify ocean life as plants and animals
8. have an understanding of the ocean floor, an assimilation of the different layers of the ocean
9. name and describe various resources and careers provided by

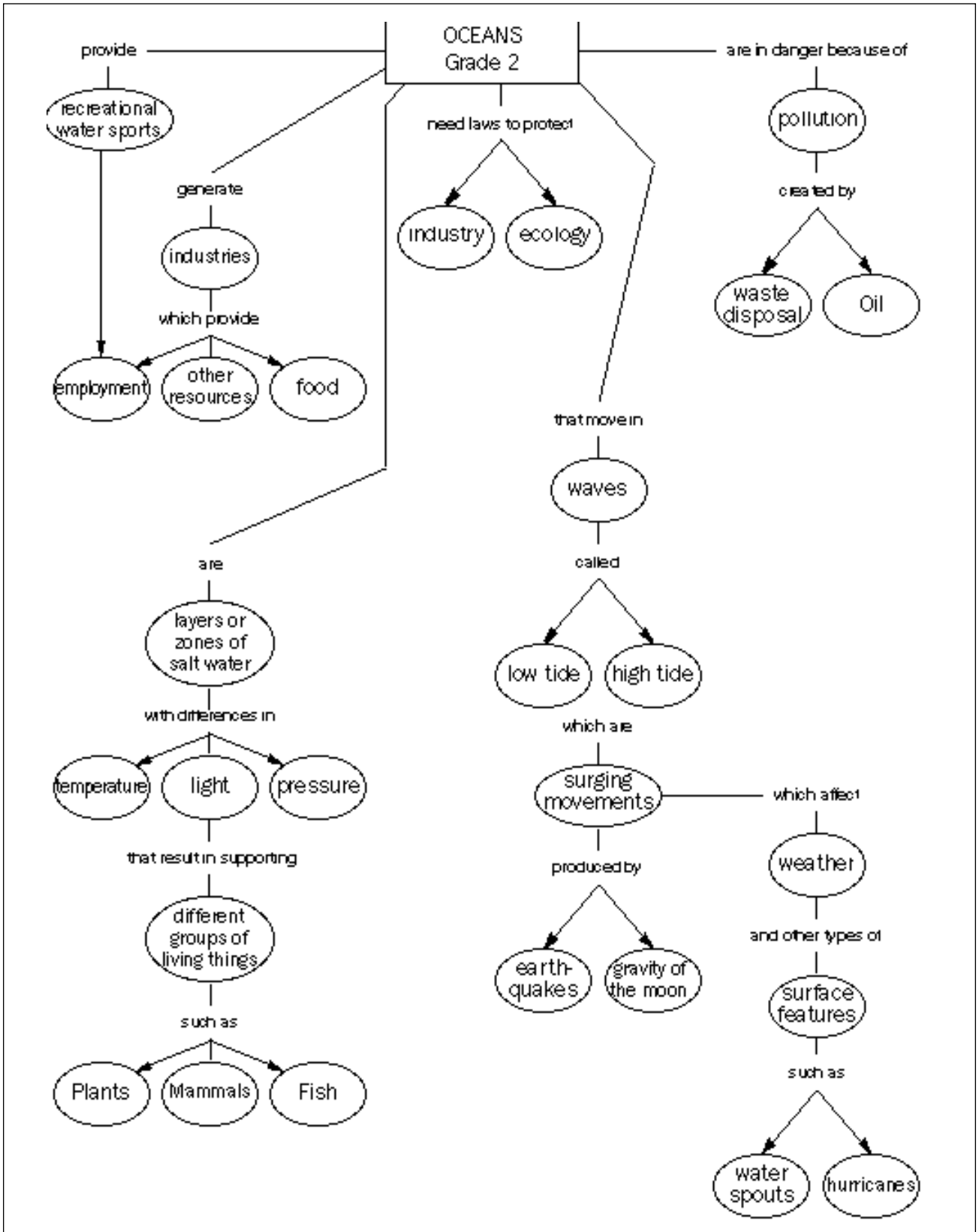
Language

The student will

1. respond to storytelling or oral language in verbal and/or nonverbal ways
2. listen to literature selections daily for personal enjoyment and language acquisition
3. employ active listening in a variety of situations
4. engage in pre-writing activities
5. write complete sentences
6. predict outcomes
7. explain observations.

V O C A B U L A R Y

recreation recreación	current corriente	river río	volcano volcán	beach playa
reef arrecife	depth profundidad	formation formación	canyon cañón	coastline costa litoral
estuary estuario	tide marea	energy energía	temperature temperatura	weather tiempo
gyre rotación	pollution contaminación	animal animal	plant planta	hurricane huracán
earthquake terremoto	gravity gravedad	salty salado	surf rompientes	boating pasear en barco
swim nadar	fish pescar	career carrera	instruments instrumento	migration migración
basin cuenca	waves olas	erosion eroción	light luz	
food source recurso alimenticio		food chain cadena alimenticia		continental margin margen continental
North Atlantic Atlántico del Norte		South Atlantic Atlántico del Sur		South Indian Indico del Sur
North Pacific Pacifíco del Norte		South Pacific Pacífico del Sur		ocean océano
history of oceans historia de los océanos				


OCEANS
Grade 2
provide
recreational water sports
generate
industries
which provide
employment
other resources
food
need laws to protect
industry
ecology
are in danger because of
pollution
created by
waste disposal
Oil
that move in
waves
called
low tide
high tide
which are
surging movements
which affect
weather
and other types of
surface features
such as
water spouts
hurricanes
produced by
earth-quakes
gravity of the moon
are
layers or zones of salt water
with differences in
temperature
light
pressure
that result in supporting
different groups of living things
such as
Plants
Mammals
Fish

C O N C E P T W E B

Teacher Background Information

Sea water contains salt, which will be left as a light-colored residue in the bottom of the pan after the water has evaporated. For those who do not live near the ocean, a sprinkling of salt in tap water will make a good substitute.

Most living things are fitted or adapted to live in a certain environment. Plants and animals found in a salt-water environment are unlikely to appear in fresh water.

Many different plants and animals live in the salt-water environment of the ocean. Yet even in an ocean environment there are differences between the shallow parts and the deep. Plants and animals that live in the shallow ocean are not usually found in the ocean's deeper parts.

When water is warmed, the heat causes the water molecules to move faster and farther apart. As the molecules move farther apart, the water becomes less dense. How dense a substance is tells how much mass is in a particular volume. Warm water, then, is less dense than cold water and so floats on it.

The oceans are salt-water environments. Lakes, streams, ponds and rivers have little or no salt in the water. These bodies of water are fresh-water environments. Would you expect to find the same plants and animals living in both fresh-water and salt-water environments?

Prior Preparation: Bring in two like plants at the beginning of the unit. The plants will serve in **Lesson 6.** Ask the students to place one of the plants in a window. They place the second plant in a closet or other place where it will get no light. At appropriate times, the students water both plants at the same time and with the same amount of water.

LESSON FOCUS

LESSON 1 *The Underwater World*

BIG IDEAS The oceans and seas on earth cover 7/10, or 70%, of its surface with salt water, creating an underwater world that is still largely unknown.

LESSON 2 *Ocean Mountains and Valleys*

BIG IDEAS The ocean floor is not smooth and it is not flat; great mountains and valleys cover it. Different combinations can be made using only a small number of things.

LESSON 3 *Waves, Tides and Currents*

BIG IDEAS The oceans' water surges as it travels in waves creating great currents; the rotation of the earth and the position of the moon cause low and high tides.

LESSON 4 *Layers of Salt Water*

BIG IDEAS The oceans exist as layers of salt water that vary in temperature, light intensity, pressure and currents. We can measure all these characteristics.

LESSON 5 *Oceans — A Different World*

BIG IDEAS Conditions in the ocean environment produce many different types of shore and underwater life.

LESSON 6 *Plants and Animals of the Abyss*

BIG IDEAS Life abounds in the ocean on the surface, in the thermocline and in the abyss. The largest mammals and the smallest one-celled protozoa and one-celled algae — all live in the ocean.

LESSON 7 *Oceans and Industries*

BIG IDEAS The oceans are important sources of food, employment and recreation.

LESSON 8 *Oceans and Pollution*

BIG IDEAS The oceans are in danger of increased pollution; we can protect them through awareness and laws.

OBJECTIVE GRID

Lessons	1	2	3	4	5	6	7	8
Mathematics Objectives								
1. explore the concept of percentage	•							
2. measure length	•			•				
3. multiply single-digit numbers as repeated addition, using arrays		•	•		•			
4. record and graph data	•	•				•	•	
5. classify objects	•	•			•	•	•	
6. recognize and create patterns and similarities	•	•			•		•	
7. read temperature on Fahrenheit and Celsius scales				•				
8. explore symmetry	•				•			
9. explore multiplication								•
10. explore division as repeated subtraction, separating into arrays			•		•			
11. use denominate numbers (hours and minutes) to calculate time			•					
12. compare numbers using subtraction or fractions	•							
Science Objectives								
1. identify at least 3 main oceans	•							
2. describe zones of salt water that vary in temperature, pressure and light intensity		•	•	•	•	•		
3. identify and describe different environmental conditions in the oceans			•	•	•	•	•	•
4. identify and describe different types of ocean life	•			•	•	•	•	•
5. demonstrate and explain or draw the effects of salt water	•				•			
6. illustrate and explain the tides			•					
7. classify ocean life as plants and animals	•				•	•	•	•
8. understand that the ocean floor is not flat, but has mountains and valleys		•		•		•	•	•

Lessons	1	2	3	4	5	6	7	8
9. name and describe various resources and careers provided by oceans						•	•	•
10. discuss how oceans are being polluted and list ways that will decrease future pollution								•
11. list and discuss at least 3 water recreation activities.							•	
Language Objectives								
1. respond to storytelling or oral languge in verbal and/or nonverbal ways	•	•	•	•	•	•	•	•
2. listen to literature selections daily for personal enjoyment and language acquisition	•	•	•	•	•	•	•	•
3. employ active listening in a variety of situations	•	•	•	•	•	•	•	•
4. engage in pre-writing activites	•	•	•	•	•	•	•	•
5. write complete sentences	•	•	•	•	•	•	•	•
6. predict outcomes	•	•	•	•	•	•	•	•
7. explain observations	•	•	•	•	•	•	•	•

LESSON 1

The Underwater World

BIG IDEAS The oceans and seas on earth cover 7/10 of its surface, or 70%, with salt water, creating an underwater world that is still largely unknown.

Whole Group Work

Materials

Book: **I Am the Ocean** by S. Marshak

World globe; books and encyclopedia; large bowl of salt water; a hot plate; blank world maps for students; four cups of salt water (two T. salt per cup); laminated pictures of seashells; metric and English rulers

Word tags: ocean, sea, underwater, Pacific, Atlantic, Indian, circumnavigate

Encountering the Idea

Today, we begin an adventure to discover what the largest part on our earth is! Ask those students who have been to the ocean to tell about their experiences of the ocean. What did they see? How did the water taste? What sea life did they see? (As the students tell their experiences, write relevant words on the chalkboard to use later in sentences for a class book on oceans.) Today, we will discover what an ocean is, where the ocean is located, the different names of oceans and interesting characteristics of oceans.

Read **I Am the Ocean**. After reading the book, students locate the oceans on a world globe and on their individual blank world maps.

Exploring the Idea

Pointing to the world globe tell students that the globe represents the earth. Show the parts of the globe that are land and those that are water. Tell the students that the earth can be seen from outer space as a **big blue marble** because there is so much water on the earth's surface that the blue color is visible from space. Water covers more than half of the earth's surface. There are three main bodies of water — **The Pacific Ocean, the Atlantic Ocean** and the **Indian Ocean.** Did you know that although we name different oceans — **Atlantic, Pacific, Indian, Arctic,** and **Antarctic** — these are actually all part of one ocean? We could travel around the world without touching land.

After looking at books on the oceans and world maps, the students work in small groups to plan and design a mural to show the three main oceans and the main continents surrounding them. After negotiating the plan and design, the students separate into specific task groups.

At the **Art Center,** students begin **Activity** — Ocean Mural.

At the **Social Science Center** (or where the large world globe is located), the students work in pairs to trace routes from Los Angeles around the world and back, without touching land.

At the **Science Center,** the students complete

1. **Activity** — Salt Water
2. **Activity** — Floating in Salt Water.

At the **Mathematics Center,** the students complete **Activity** — Looking at % (Percent).

Getting the Idea

Several of the student groups demonstrate to the class the routes they found to **circumnavigate** the earth without touching land. Students estimate which routes were longer and which routes appeared to be shorter.

The class discusses the amount of surface area covered by the oceans using the concept of percent.

1. What do we mean when we say "over 70% of the earth's surface is water? Yes, over 70 parts of every 100 parts of earth is water. Look at your percent grid. Show what 70% is on the grid.
2. Is 70% more that 1/2? How can you show this on your % (percent) grid?
3. What does it mean that the ocean holds 97% of the world's water? 97% means what? In what other way can you say the same thing?
4. What does it mean when we say that **2% of the earth]s water is ice in the polar caps?** How much is 2%? Show it on your % (percent) grid. Is it a lot or is it little?
5. What does it mean when we say that **only 1% of the earth's water is fresh** water? Draw this on your % (percent) grid.

Organizing the Idea

At the **Writing Center,** the students begin work on an illustrated class Big Book on oceans by listing interesting things they want to include in the book.

At the **Mathematics Center,** the students complete **Activity** — Ocean Mathematics.

Students work on their blank world maps. Working in groups, they color land brown and the ocean blue. Using the world globe and/or other reference materials as guides, they label the oceans and continents.

Applying the Idea

Predict what would happen if a ship traveled in fresh water and another one traveled in salt water. Would it make a difference in how much cargo (weight) each ship could carry?

Closure and Assessment

1. When you ordered the seashells by size (length) was the order of the seashell the same when you used centimeters as when you used inches? Explain to your partner why the order was the same.
2. Why does a seashell **measure** more in centimeters than in inches? Is the **length** of the sea shell the same whether you use inches or centimeters? What changes?
3. Pick a picture of a particular seashell, one of the longer pictures, and ask students to compare the length of the seashell to a particular student.

Oral Assessment

1. Name two oceans of the world.
2. In the experiment on ocean water, what did you see at the bottom of the pan after the water had evaporated?
3. What did the residue taste like?
4. Where did the residue come from?
5. What did this experiment tell you about ocean water?

Performance Assessment

The student traces two routes to circumnavigate the globe and gives reasons why one might or might not be shorter or longer.

Assess participation (frequency and quality of ideas) in the completion of a colored, labeled map of the world.

Written Assessment

Students list things contained in the ocean or that describe the ocean (**Writing Center).**

Students begin work on an illustrated class book on oceans: "I AM THE OCEAN." Students write a sentence describing the ocean or something living in the ocean.

List of Activities for this Lesson

▲ Ocean Mural

▲ Salt Water

▲ Floating in Salt Water

▲ Looking at % (Percent)

▲ Ocean Mathematics

ACTIVITY
Ocean Mural

Objective
The students create a mural of the ocean.

Note: The development of the mural is an ongoing project that the students complete in stages as they learn about the ocean. The planning and design phase may have to be completed after the students have gone through Lesson 3.

Materials
Book: **Swimmy** by L. Lionni
White butcher paper; scissors; colors; glue; magazines picture of ocean life; library books on oceans; films depicting ocean life; sponges

Procedures
1. The students, working in small groups, plan and design an ocean mural for their group.
2. The mural includes surface and undersea features containing life forms (plants as well as animals) found in each zone.
3. The mural includes, as a surface feature, illustrations of industries and employment opportunities that the oceans and their products have generated.
4. The study of the ocean is an important area of science — oceanography. The researchers are called **oceanographers.** People who study the life that exists in the ocean are **marine biologists.** Students can read about these careers and report to the class what they think is interesting about these careers. They may include ocean science activities in the mural.
5. As an optional activity, the students can create an individual ocean mural, using the same artistic style as L. Lionni or another style they find interesting.

ACTIVITY
Salt Water

Objective
The students say that sea water contains salt; fresh water does not contain salt.

Materials
Hot Plate; pan; small piece of wood; bowl with fresh water; sea water (or salt water)

Procedures
Put some of the sea water aside to use in the second part of the demonstration.

Tell students that you have put some sea water (or some water that is like sea water) on the pan that is on the hot plate. After the water has evaporated and the pan has cooled, ask the students to look at the bottom of the pan. What is it? Taste it and see. What do you think is in sea or ocean water? Have any of you tasted sea water?

Discussion
1. What is left at the bottom of the pan?
2. What do you think is in sea water? Does all water have salt in it?
3. Where do you suppose the salt comes from?
   - the land
   - coastal soil and rocks worn away by wind and rain
   - carried by rivers
   - shells and skeletons from sea animals
4. How long do you think it took to get so much salt into the ocean? (Hundreds of millions of years.)
5. Have any of you gone swimming in the ocean? Pause for student responses.
6. Put the piece of wood in the pan with fresh water in it. Mark the piece of wood on the water line. Now, put the same piece of wood in the pan with salt water. What do you see? Why is the wood floating higher in the sea water than it floated in fresh water?
7. If you have gone swimming in the ocean, you know that you can float more easily in salt water than in fresh or regular water. The salt in the water makes the water more **buoyant.** Salt water exerts more upward force than regular or fresh water to make something float.

ACTIVITY

Floating in Salt Water

Objective

The student says that things float higher in salt water than in water without salt.

Materials

Large bowl filled 3/4 with tap water; salt; unpainted block of wood

Procedures

1. Float a block of wood in the bowl of water.
2. Remove the block and mark it where the wood is wet.
3. Dry the block.
4. Add five spoonfuls of salt to the water. Stir until most of the salt disappears.
5. Float the block again and mark where the wood is wet.
7. Compare the two marks. In which type of water did the block float higher?

Discussion

What can you say happens when salt is added to the water?

Make and test a prediction:

1. Do you think you can put more weight on a ship if it is going to float in salt water than you can if the ship is going to float in fresh water?
2. Students develop and test a hypothesis to answer this question.
3. After the students work on the problem, they report to the class. The class develops a concensus regarding the answer to the question.

ACTIVITY
Looking at % (Percent)

Objective

The student writes a given % (percent) as a fraction with 100 as the denominator.

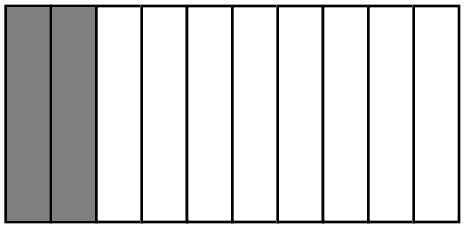
Materials

10 x 10 grids and areas separated into 10 equivalent areas (laminated); erasable markers

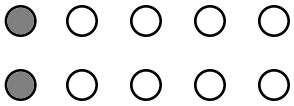
Procedures

1. Review meaning of a fraction as a part of a set and as part of an area.
2. Students show 3/10, 5/10, 1/10, 2/10 as shaded areas on the review grid.
3. Working in small groups, students show 70/100, 4/100, 25/100, 95/100 as shaded areas. They check each other's work.
4. Tell students that % (percent) shows a fraction with 100 as a denominator. Then 70% means 70/100 with 70 parts out of 100.
5. What do we mean when we say that 70% of the earth is water?

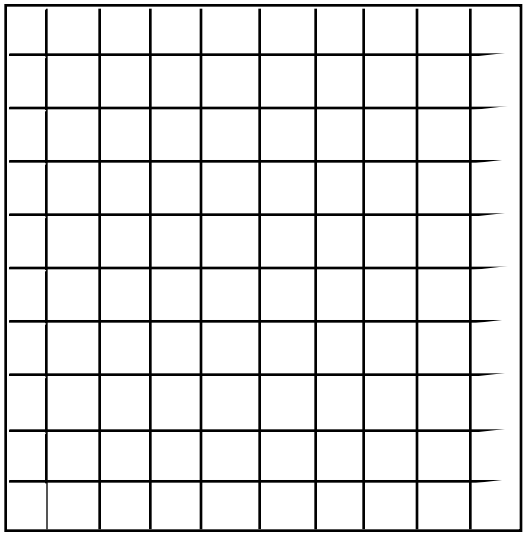
Review Grid



2/10



2/10



% grid

100

ACTIVITY
Ocean Mathematics

Objective

The students

1. categorize an object by size and shape and identify its line of symmetry, if it has one
2. use a nonstandard measure (a paper cutout drawing of a seashell) to measure his/her height
3. use a standard measure such as inches and/or centimeters and compare the measures.

Materials

Collection of various types of seashells or seashell pictures

Word tags: ellipse, cone, spiral, hexagon, cylinder, circular or circle, symmetry, symmetrical and other words students use to categorize the seashells

Procedures

1. The students describe each shell (at least seven of them) by size (measured in centimeters and/or inches), shape (using as many words to describe the shape as possible) and by symmetry.
2. The students select the categories they want for the seashells.
3. The students separate the seashells into the selected categories.
4. The students use a paper cutout of a shell to measure his/her own height.
5. The students measure their heights in inches and/or centimeters.
6. The students write word problems comparing the sizes and shapes of the various seashells. For example: How many centimeters longer is the elliptical shell than the cone shell?

   A spiral shell measures 12 centimeters but a cone measures four inches. Which is longer? How do you know? Can you compare two centimeters and four inches by putting the seashells side by side?
7. The students order the pictures by size, using centimeters and then using inches. They consider if the order is the same regardless of the unit used.

Discussion

1. Why are the measures in centimeters and inches different?
2. What is a standard unit of measure? A nonstandard unit?
3. What is an example of a nonstandard unit of measure?

LESSON 2

Ocean Mountains and Valleys

BIG IDEAS The ocean floor is not smooth and it is not flat; great mountains and valleys cover it. Different combinations can be made using only a small number of things.

Whole Group Work

Materials

Listed with activities

Encountering the Idea

We have been talking about the oceans on earth, the area they cover, and that they have salt water that is different from fresh water. Before we can begin to draw our mural, however, we need to know something about the bottom of the ocean, its floor. What do you think it looks like — the floor of the ocean? Is it smooth? Is it flat? What would you predict? Pause for student suggestions. Write the more plausible ones on a chart to use later.

Let's ask a different question. What does the surface on earth look like? Is it flat and smooth? No, it has valleys and mountains. Some of the mountains are very high. Some of the valleys are very deep. How were the mountains and valleys made? What caused some of the surface to rise and other parts to sink? We can look at some activities that will help us discover the answers to some of these questions.

Exploring the Idea

At the **Science Center,** students

1. complete **Activity** — Seaquakes
2. complete **Activity** — An Ocean Volcano
3. complete **Activity** — The Ocean Floor.

At the **Mathematics Center,** the students complete **Activity** — An Aquarium.

Getting the Idea

1. In your activity on an ocean aquarium, you designed several aquariums using different combinations of sea creatures, plants and ocean floors. Were you able to develop a strategy to help you find all the different designs? When we make sets by selecting different members out of several groups, these new sets are called **combinations.** When we have two creatures (octopus, dolphin), two plants (kelp, coral) and two floors (rocks, sand), we made eight **different combinations.** One group made this picture of all the combinations. The group leader gave this explanation:

There are three things that have to be chosen: the creatures, the plants and the floor, so first you select the creature, the plant and the floor: **O K R**. Next, you change only the floor: **O K S**. That's two designs. You do it again, but with a different plant. That makes four designs. You do it again, but this time change the creature. That makes eight.

This is their diagram:

O(ctopus)	K(elp)	R(ocks)
O	K	S(and)
O	C(oral)	R
O	C	S
D(olphin)	K	R
D	K	S
D	C	R
D	C	S

Another way to find all possible combinations where you can select from two or more sets is to use multiplication. Try to find out how you multiply to get the correct answer.

2. The idea that the ocean floor moves and changes was not an easy idea for many people, even geologists, to accept. But through the collection of data, scientists now accept the fact that the ocean floor is continuously moving and spreading in different directions. This spread causes the floor to be uneven, to have large mountains, valleys and basins.

How long do you think that it has taken for the ocean floor to develop the mountains and valleys it has? Scientists tell us that the earth plates on the ocean floor are moving at the average rate of six centimeters, about 2 1/2 inches, **per year.** This is the average growth rate of a person's fingernail. Can you imagine how long it will take for these plates to move to make a basin, or a trench? Scientists tell us that the ocean floor has been changing for over **130 million years.**

Now that we have some idea of what the ocean floor looks like, we can add these new features to our plans for our mural. We can also begin to design an ocean diorama.

Organizing the Idea

Students complete **Activity** — Ocean Diorama.

Applying the Idea

Many people like to look for and have found large treasures of gold, silver and precious gems in the Gulf of Mexico. Find the Gulf of Mexico on the world globe or on your world map. In your reference books read about the Gulf and hypothesize why people would have found gold in sunken ships on the Gulf floor.

Closure and Assessment

Oral Assessment

1. What does the ocean floor look like?
2. What do you like the best (or least) about what you have learned about the ocean floor?

Performance Assessment

1. Draw a picture illustrating the ocean floor. Label as many different things about the ocean floor as you can.
2. Show, with objects if you need to, as many different scenes as you can make in an aquarium if you put into it two types of fish, two kinds of plants and two types of seashells.

Written Assessment

The student selects one of the following activities:

1. Describe and illustrate the ocean floor as thoroughly as you can.
2. Describe and illustrate how the ocean floor has developed over time.
3. Write a paragraph about the ocean floor following the pattern:
   The most important thing about the ocean floor is _____, because _____.

List of Activities for this Lesson

▲ Seaquakes

▲ An Ocean Volcano

▲ The Ocean Floor

▲ An Ocean Aquarium

▲ Ocean Diorama

ACTIVITY
Seaquakes

Objective

The student understands that the ocean floor changes by describing the effects of **plates** of earth moving to cause cracks and hills, or valleys and mountains.

Materials

Playdough or clay molded into two flat surfaces, about 1/2 inch thick

Procedures

1. Place the two clay surfaces end to end and push together. Students make observations.
2. Remold the clay into two flat surfaces to simulate plates of earth.
3. Place the two surfaces one on top of the other. With the heel of your hand, press against the clay and observe.

Discussion

1. The two pieces of clay represent plates of earth. What happens when we push the two plates. Does it take a lot of force to push them together?
2. What makes the plates move together?
3. What happens to the earth's surface during an earthquake?
4. What happens to the ocean's floor during a seaquake?

Application

1. At the **Art Center,** draw what you imagine can happen on the ocean floor as the earth moves two plates together during an earthquake.
2. After you have drawn your ocean floor scene, share it with members of your group and design a scene of an earthquake on the ocean floor to include in your ocean mural.

ACTIVITY
An Ocean Volcano

Objective
Students say that volcanoes exist underwater and erupt in the same way as on the earth's surface.

Materials
Cardboard on which to place the clay volcano; clay to mold into a volcano shape; 20 inches of plastic or rubber tubing; puffed rice; pen or pencil

Procedures
1. Form the clay into a volcano shape and place on the cardboard.
2. Color the clay and cardboard to simulate the ocean floor around a volcano.
3. At the top of the volcano make a cone-shaped opening from the top to the bottom of the volcano.
4. Make a small tunnel the size of the tubing through the base of the cardboard and the volcano. This tunnel should connect with the cone-shaped opening at the top of the volcano.
5. Insert the tubing through the tunnel at the base of the volcano.
6. Pour the puffed rice into the cone-shaped opening at the top.
7. Blow air gently through the tubing to show a simulation of the magma that is getting ready to erupt, and then blow hard to show the effect of pressure from under the ocean floor on the pieces of rice.

Discussion
1. What did we learn about volcanoes from this demonstration?
2. What do the rice and the air that we blow through the tubing represent?
4. What do you think happens on the ocean floor when an ocean volcano erupts?
   - the water is very hot
   - magma erupts instead of the rice
   - the magma cools faster because it erupts into water instead of into air
   - other suggestions

ACTIVITY

The Ocean Floor

Objective

The students simulate and describe different layers of the ocean by using sand and pebbles in a jar of water.

Materials

Large glass jar for each student group; students bring the jars with lids
Different types of sand
Water
Seashells, different kinds, shapes, sizes

Procedures

Students work in small groups.

1. The students fill 1/3 of the jar with sand.
2. They place a few pebbles and seashells in the jar.
3. Fill the jar with water, and close the lid tightly.
4. The students shake the jars gently and thoroughly.
5. The containers sit on a shelf overnight.
6. On the following two days, the students observe the "ocean floor." They note the characteristics of the "ocean floor."
7. The students shake the jar every day and let it settle overnight for four to five days. Students describe the layers after the water has settled every day.
8. Is there a visible pattern to the way the layers settle?
9. If there is a pattern to the way the layers settle, make a rule about how the different layers settle.
10. The students shake the jar one more time to see if the rule they made applies to the results they get.

Assessment

1. Students describe their observations of the "ocean floor" in their journals.
2. The teacher asks:
   a. What does the floor look like?
   b. Are there different layers?
   c. Draw a picture of what you see.
3. Why do the layers settle in similar ways every time you shake the jar? (The heavier objects will drop faster to the bottom, while the lighter objects will settle on top.)
4. Students describe a volcano eruption and explain how it changes the ocean's floor.

ACTIVITY
An Ocean Aquarium

Objective
Students explore multiplication as a cross-product.

Materials
Set of five shapes of sea creatures (swordfish, shark, whale, dolphin and octopus)
Set of three types of ocean plants (kelp, seaweed and coral)
Three types of aquarium floors (rocks, clay and smooth sand)

Procedure
A decorator is designing an aquarium for a large building. The decorator can put only one type of sea animal, one type of sea plant and one type of floor in the aquarium. How many different aquariums can the decorator design? Tell your teacher or your friend how you know that number is correct.

1. Suppose the decorator has two types of sea creatures (octopus and dolphin), two types of plants (kelp and coral) and two types of floor (rough and smooth). How many **different** aquariums can the decorator design, using only one type of creature one type of plant and one type of floor for each acquarium? Draw at least four different ones. (eight possible combinations — (octopus, kelp, rough) is one; (octopus, kelp, smooth) is another; (octopus, coral, smooth) is another; (octopus, coral, rough), etc.
2. Suppose the decorator now has two types of sea creatures, three types of plants and three types of floor. How many different aquariums can be designed? Work with your group to see if you can develop a strategy to find all the possible designs without drawing them. (18 possible combinations: 3 x 3 x 2 = 18.)
3. What if the decorator now has four types of sea creatures, two types of plants and two types of floors? Use the strategy you used in Problem #2 above to see if it works on this problem. (4 x 2 x 2 = 16 combinations.)
4. In your journal, design, draw and color two or three different aquariums.
5. Write a story about one of the animals in your aquarium. Read it to your group, to your class or to your parents.

ACTIVITY

Ocean Diorama

Objective

The students create an ocean scene.

Materials

Shoe box; blue tempera paint; toothpicks; plastic wrap; pictures of sea animals; sand; small, colored rocks; weeds to resemble sea plants; dried flowers; small seashells

Procedures

1. Cut out one side of a shoe box (one of the long sides).
2. Color the bottom and three sides of the shoe box with blue tempera paint. Let it dry.
3. Draw or cut out pictures of sea animals.
4. Glue pictures of some of the sea animals on the inside of the shoe box.
5. Put the toothpicks through the top of the shoe box. Glue some sea animals on the inside of the box where the toothpicks are. These animals will appear to be swimming inside the box.
6. Glue sand, small pebbles and seashells on the bottom of the shoe box.
7. Glue dried weeds or flowers along the inside and bottom of the shoe box.
8. Glue small seashells and some rocks on the bottom of the inside of the shoe box.
9. Cover the cut-out side of the shoe box with plastic wrap.
10. The scene appears as three-dimensional with the fish or other sea animals glued to the toothpicks.

Each student briefly explains her/his ocean diorama to the class.

LESSON 3

Waves, Tides and Currents

BIG IDEAS The oceans' water surges as it travels in waves creating great currents; the rotation of the earth and the position of the moon cause low and high tides.

Materials

Book: **When the Tide Is Low** by S. Cole
Pie plate; Blow dryer; Pictures of ocean waves; World map showing currents
Word tags: wave, tide, current, ebb, crest, convection;

Encountering the Idea

Look at this picture of the ocean. What do you see? Waves — large ones, small ones, for many, many miles. The ocean is never still; it is always moving. When we began this unit we said that many of the earth's surface features, such as mountains and valleys, appear on the ocean floor also. On the earth's surface we have rivers — small and large. What would you guess? Are there rivers that run underwater? What do you think? What could make it possible? Today, we will discover what makes the ocean be in continuous motion.

Exploring the Idea

Waves: Let's start by making waves and observing their motion.

Activity — Making Waves, as below.

Materials

Pie plate filled with water

Procedures

1. Blow gently on the plate of water. Blow harder with the dryer, first on slow and then fast. Waves get bigger.
2. Students describe the effect the air has on the water.
3. Students hypothesize about the effect of wind on the ocean water.
4. Let the water in the plate become calm.
5. Place a small piece of wood (from the pencil sharpener) or some other small object that will float on the water.
6. Make waves by gently moving a hand back and forth in the water.
7. Students describe the action of the waves on the piece of wood.

Students complete **Activity** — Tides and the Moon, and **Activity** — Calculating High and Low Tides.

Now let's read **When the Tide Is Low.** Be thinking about what might cause the ocean to have tides — high and low.

Currents: At the **Science Center**, students complete **Activity** — Underwater Rivers.

Getting the Idea

From our activities, what idea did you get about what a wave is? (Pause for students to give their opinions. Ask the students to describe the motion. Is it only up and down? Back and forth? Ask students to wave their hands. Describe this motion.) **Waves** are the backward and forward **and** also up and down motion of water as it moves. When we blew on the water, it caused the water to surge in waves. The waves crested or peaked and then they died down, and ebbed and then began to crest again.

From our activities, what idea did you get about tides? **Tides** are the regular rhythm of the motion of the ocean. This motion is due to the presence of the moon and the sun. The attraction of the earth's and the moon's gravity is one of the causes of the tides.

From our activities, what idea did you get about what a current is? **Currents** are rivers flowing through the ocean. The two main causes of currents are the heat of the sun that warms the sea surface and generates strong, steady winds, and the cold heavy water that sinks and flows along the ocean floor. (Show map of currents.)

Organizing the Idea

At the **Art Center**, students
1. complete **Activity** — High and Low Tides
2. complete **Activity** — The Oceans' Currents, as below.

Materials

Blank world maps outlining the continents.

Procedures

1. Students look in reference books that depict the oceans warm and cold currents to locate five of the world's major surface circular current systems: the North Atlantic, South Atlantic, South Indian, North Pacific, and South Pacific.
2. The students draw and color the currents to show the cold and the warm currents.
3. The students draw arrows on the currents to show the direction of their motion.

At the **Writing Center,** the students list at least three important ocean currents, locate them on a world map, and describe and illustrate their routes.

At the **Language Center,** students analyze the words: current, convection, crest and peak. They compare the English words to the Spanish words **corriente,** which means "running"; **convección,** which means "move together"; **cresta,** which means "top"; and **pico,** which means "spike". The students look for other words in English and Spanish that, but for some spelling differences, have the same meaning — cognates.

Closure and Assessment

Oral Assessment

Name and describe three types of movement of ocean water.
Name and locate on a world map one of the important ocean currents.

Performance Assessment

Illustrate the motion of water as waves. Show two types of movement of the waves (back and forth, and up and down.)

Illustrate and label an ocean current.

Assess the level and quality of completion of the activities involving high/low tide scenes.

Written Assessment

Locate a continent and an ocean current. Describe and illustrate where that current would take you if you floated on it in a canoe.

Write a brief explanation of how the moon's gravity affects the ocean's water.

Fold a paper in half. On one side, draw an ocean beach and what you might see at high tide. On the other half, draw the same ocean beach and what you might see at low tide.

List of Activities for this Lesson

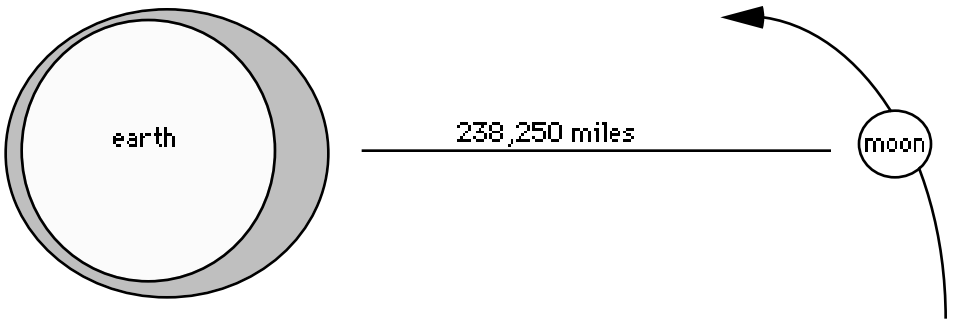
- ▲ Tides and the Moon
- ▲ Calculating High and Low Tides
- ▲ High and Low Tides
- ▲ Underwater Rivers
- ▲ Sea Square and Rectangles

Objective

The students explain verbally and/or with illustrations the action of the moon on the ocean to cause the tides.

Materials

Reference books for students to read about the tides
Sphere to simulate the earth
Sphere (smaller) to simulate the moon circling the earth
Large sphere to simulate the sun



Procedures

1. Students simulate the action of the moon around the earth, showing on which bodies of water the high and/or low tides would occur.
2. Then students simulate the action of the moon around the earth and the action of the earth around the sun to show where the highest of the high tides would occur. (When both the sun and the moon are in the same general direction, the pull of both will create the high tides.)
3. Students read about the tides in the reference books.
4. The students write and illustrate in their journals how the moon affects the tides.

ACTIVITY

Calculating High and Low Tides: Part 1

Objective

The student, given a table of times for high and low tides, uses the pattern to calculate future tides.

Materials

Tide chart, as below.

Procedures

1. Students look for patterns in the chart and develop strategies for predicting the time for the next high or low tide.
2. Students work in pairs or small groups to complete the chart shown below.

Schedule for Low and High Tides

	Sun.	**Mon.**	**Tues.**	**Wed.**	**Thur.**	**Fri.**	**Sat.**
Low Tide		2:37 1/2 a	3:27 1/2a				
High Tide	8:00 a	8:50 a	9:40 a				
Low Tide	2:12 1/2 p	3:02 1/2 p	3:52 1/2p				
High Tide	8:25 p	9:15 p	10:05 p				

3. Student groups compare the strategies they used and the times they calculated for the other days of the week.

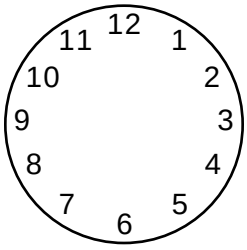
ACTIVITY

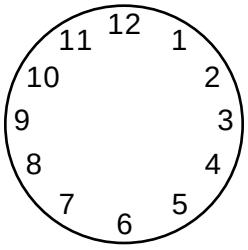
Calculating High and Low Tides: Part 2

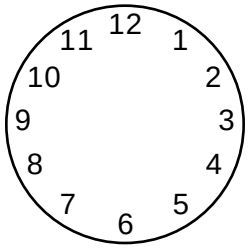
Application

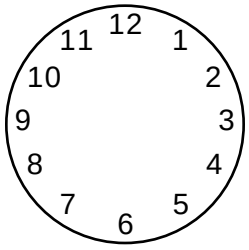
The students may want to use the clock faces to help them discover the patterns and calculate the times.

1. If you were the captain of a ship, would you leave the harbor when the tide is coming in or when the tide is going out? Explain why you chose one or the other. What time period would you choose to take your ship out on Wednesday?
2. Why would it be important for you to have an accurate schedule for the tides?









ACTIVITY
High and Low Tides

Activity 1

Objective

The students illustrate a high tide and a low tide.

Materials

White construction paper; pencil; crayons; markers

Procedure

1. Divide the paper into two sections, making both sides even.
2. Have children draw a nighttime picture showing a beach, the moon and water at a time of high tide.
3. On the second half of the paper, students draw a day picture showing the beach, the sun and water at a time of low tide.
4. Color pictures drawn.
5. Students display and explain a low tide picture and a high tide picture to their group or to the class.

Activity 2

Objective

The students illustrate a high tide and a low tide.

Materials

White construction paper; pencil; crayons; marker; blue or clear cellophane paper

Procedures

1. Using the construction paper, students draw a day beach scene, focusing on low tide characteristics.
2. Using the cellophane paper, draw or glue on a night beach scene, focusing on high tide characteristics.
3. Glue or staple, on the corresponding side of the paper, the moon and the sun.
4. Students do the illustration to resemble a book that shows both tides.
5. Students display and explain their drawing to their group or to the class.

ACTIVITY
Underwater Rivers

Objective
The student demonstrates and explains that cold water is heavier than warm water by constructing a model of the water currents that form underwater rivers in the ocean.

Materials
Two large transparent jars; two small bottles; ice water; water; red and blue food coloring

Procedures
1. Fill one large jar and one small bottle with ice water. Add enough blue coloring to the small bottle to color the water. Mix the color completely.
2. Fill the other large jar and small bottle with warm water. Add red food coloring to the small bottle to color it. Mix the color completely.
3. Hold the small bottle of blue ice water over the jar of warm water. Slowly pour the blue ice water into the jar of warm water. What happens to the cold water in the warm water?
4. Slowly pour the red warm water into the jar of ice water. What happens to the warm water in the cold water?

Discussion
After discussion, the students answer the questions in their journals. The students compare the density of ice water and warm water to explain ocean currents.

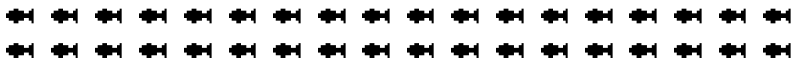
ACTIVITY
Sea Squares and Rectangles

Materials

Sea Squares by J.N. Hulme, placed in the **Reading Center** for students to read
Boxes of fish-shaped cheese crackers
Containers for the crackers, one container per group
Paper towels

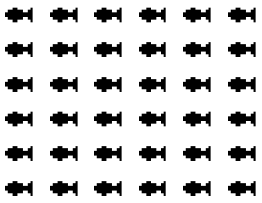
Procedures

1. Each pair of students receives a container with the same number of crackers (36).
2. Thirty-six fish by in pairs. How many pairs are there? The students make arrays with the crackers.
3. After separating the crackers, the students take turns telling each other what they did: 36 divided into groups of two make 18 groups of two each.
4. The students find out how many groups with three, then only four, then six, and then nine fish in each group they can make.
5. After each separation, the students take turns telling each other what they did.



36 fish in pairs are 18 pairs.

36 fish in groups of three are 12 groups



36 fish in groups of six are six groups

LESSON 4

Layers of Salt Water

BIG IDEAS The oceans exist as layers of salt water that vary in temperature, light intensity, pressure and currents. We can measure all of these characteristics.

Whole Group Work

Materials

Book: **The Magic School Bus on the Ocean Floor** by J. Cole
Copy of the diagram of three ocean layers below
Glass bowls; plastic tubing; pitchers; rubber bands; food coloring; balloons; pan; buckets; hot plate; flashlights; pieces of cheese cloth; poster board

Encountering the Idea

Today we are going to take a field trip to the ocean! Let's join Ms. Frizzle and her class as they take a special journey. Read **The Magic School Bus.**

We too are going to explore the different layers of the ocean. These layers of water are different, just like the layers of air on earth are different in temperature, pressure and light intensity. We are going to explore these conditions at three different layers:

- the shore or beach (at sea level)
- the surface or continental drift (up to 600 ft. deep)
- the floor or abyss (up to 20,000 ft. deep)

Exploring the Idea

Look at the diagram shown here. Before going to the learning centers, we are going to study the diagram to see what it tells us about the ocean layers. We will also make and record predictions about the conditions in these different layers of water. We will check them later.

	Temperature	Water Pressure	Light Intensity
Beach (surface) (0 to 1650 feet)	Depends on shore conditions, varying from 90 degrees F to below freezing at the poles.	Same as air pressure at sea level. At 33 ft. depth, pressure is twice pressure at sea level.	Sunlight penetrates to 3300 feet into the ocean; supports life in upper 650 feet only. From 130 to 650 feet depth is a twilight zone; only blue light remains.
Thermocline (3300 to 5000 feet)	Area of rapid changes; separates warm surface water from cold of the deep ocean.	The pressure increases from about 50 to over 200 times the pressure at sea level.	
Abyss (6500 to 13,000 feet)	Always cold; very close to temperature of the water at the poles.	In the deepest part of the ocean the pressure is over 1000 times the pressure at sea level	World of perpetual darkness where the only light is produced by organisms that generate **bioluminescence**

Where do you predict the water will be the warmest? Why? Where do you predict the pressure will be the greatest? Why? Where do you predict there will be the least amount of light? Why?

At the **Science Center**, students

1. complete **Activity** — Ocean Temperatures
2. complete **Activity** — Water: Pressure and Temperature
3. complete **Activity** — Water Pressure is a Force, as shown below. This is a teacher demonstration.

Materials

Empty, clean and dry can of duplicating fluid with tight-sealing lid, or some other can that is lightweight; hot plate to heat the can

Procedures

- Heat the can carefully, so as to drive out some air from the can as the air becomes warm.
- Remove the can from the hot plate. Immediately seal the can tightly.
- Students make observations and propose hypotheses about why the can was crushed.
- Students complete **Activity** — Light Intensity, as shown below.

Materials

Flashlight; pieces of gauze

Procedures

Turn on flashlight. Place one piece of cheesecloth over the light. Can light still shine through? Place another. How about now? Students describe what is happening.

Getting the Idea

Where do you suppose the salt found in seawater comes from?

- the land
- coastal soil and rocks worn away by wind and rain
- carried by rivers
- shells and skeletons from sea animals

It took hundreds of millions of years for the oceans to become as salty as they are.

Remember that warm water is lighter and has expanded, and cold water is heavier and more dense (closer together). Warmth makes water lighter, so it floats on top of the heavier, denser cold water. At what ocean depth will the temperature of the water change depending on surface climate and the season? (Close to the surface of the water.)

The deeper we go, the greater the water pressure. What happens to an object when it is under a great deal of pressure? Refer to the demonstration of the crushed can. After students have had an opportunity to express their ideas about what crushed the can, suggest to them that as the can cools, the outside air pressure, which is greater than the less-dense air pressure inside the can, will press in on all sides of the can and crush it. Tell students that if the object (can) were underwater under great pressure it would also be crushed. Both water and air can exert pressure, so it is the pressure, the weight, that crushes the can.

What did the experiment with the flashlight and cotton gauze suggest to you about the light intensity at the different depths of ocean water? How are the two notions — the layers of gauze and the layers of ocean water — alike? How are they different? Where will the least amount of light be in the ocean? (The floor.) Why? The sunlight is filtered out.

Organizing the Idea

Students use the diagram from **Exploring the Idea**, above, to complete the writing assignment.

At the **Writing Center**, the students describe the environmental conditions at each of the three levels. They focus on:

If I went swimming (or diving) on the (shore, on the surface, or close to the floor)

I would wear _____; I would see _____. I could only stay

_____ (hrs, min).

Students can add other ideas such as protective gear, radio contact with a ship, etc.

Applying the Idea

1. Look at the chart on the characteristics of ocean water. There are three general levels of water depth. There are also three things that affect ocean water that we studied — temperature, pressure and light intensity. How many boxes (classifications) will you have to make if you make combinations of three levels of depth and three characteristics? (nine.) (Refer to **Activity** — An Ocean Aquarium, Lesson 3.)
2. Suppose you are a marine biologist and want to build a laboratory on the ocean floor. Select an ocean (Atlantic, Pacific, other) and a floor depth to build your lab. How would you design it? What would it need? You may want to do research in some of your reference books before you answer the question. Make a drawing to illustrate your ideas.

Closure and Assessment

Oral Assessment

1. Describe the three layers of the sea.
2. Where is the coldest layer of water located in the ocean?
3. Is the coldest water in the ocean only at the North and South Poles? Explain your answer.
4. Are there underwater rivers in different ocean layers? Give your reasons for your answer.

Performance Assessment

Students draw and illustrate the layers of the ocean with a one-sentence description of temperature, pressure and light each.

Written Assessment

At the Writing Center, each student selects an ocean layer (or the ocean floor) he/she would most like to explore and explains why.

List of Activities for this Lesson

▲ Ocean Temperatures

▲ Water: Pressure and Temperature

ACTIVITY

Ocean Temperatures

Note: Since the lesson requires that students heat water on a hot plate, the teacher will need to supervise the activity at all times.

Objective

The student heats or cools water to the two extremes in temperature of the oceans' water, excluding the subfreezing temperatures of the polar regions.

Materials

Thermometer; rock salt; two glass jars; ice; test tube; dishwashing glove; hot plate; bowl with water; distilled water

Procedures

1. Using a hot plate and a water bath, heat the temperature of water in one jar to approximately 90˚ F. Students feel the water in the jar.
2. Using the ice to cool the water in the bowl, fill the other jar with ice and water and stir until the water reaches a temperature as close to freezing as possible. Again, the students feel the water in the jar to note the difference.
3. Have students put on a dishwashing glove (plastic, insulated) and again feel the hot and cold water.
4. Dissolve some of the rock salt into a bowl of water and ice. Put a test tube filled with distilled water (preferred) into the water bath. Take the temperature in seven to 10 minutes. The temperature should be at about 32˚ F or below. (Hold the test tube very still.) Students feel the water in the bath. Take the test tube out and tap it lightly. What happens?

Discussion

1. Since the water in the water bath was below 32˚ F, why didn't the water freeze? (The salt brings down the freezing temperature of water and supercools it. This freezing temperature is like an arctic temperatures.)
2. Students review the water temperature in the three layers of water in the ocean.
3. Tell the students that the water temperature in the **tropics** is normally warm, or average.
4. The temperature at the deepest parts of the ocean is approximately 30 to 34˚ F.
5. Tell students that the glove **insulates** the hands from cold or heat and is similar to what **scuba divers** wear when they go into the ocean.

ACTIVITY

Water: Pressure and Temperature

Objective

The students understand the effects of water pressure by stating a rule relating water depth and water pressure.

Materials

Large plastic container; masking tape; small balloon or rubber sheet

Procedure

1. Make three holes spaced evenly at the top, at the center and at the bottom of a large plastic container.
2. Place tape on the holes to prevent the water from draining out.
3. Fill the container to the top with water.
4. Remove the tape one piece at a time from the holes on the side of the container and let the flow run into the large pan.
5. Have students make observations about the streams flowing out of each hole by putting a hand in each stream to feel the pressure.
6. Cover the container top tightly with a balloon or rubber sheet. Press down into the container through the balloon. What happens?

Discussion

1. Where in the container is the water pressure strongest? How do you know at which level on the can the pressure is strongest?
2. Can students state a rule:
   The _____ the water, the _____ the water pressure.
3. Why do you suppose this rule is true? (Water has weight; the deeper the water the greater the weight, which is felt as pressure.)

Activity — Balloon Water Pressure

Materials

Balloons; rubber bands; plastic tubing; buckets

Procedures

1. Secure a balloon to plastic tubing with rubber bands. Blow up the balloon.
2. Deflate the balloon.
3. Now put the balloon that is still secured to the plastic tubing at the bottom of a bucket filled with water. Try to blow it up.

Discussion

1. Why could you not blow up the balloon when it was submerged in the water? (It is impossible because the water is pressing in on the balloon.)
2. What does this experiment tell us about water pressure in the different layers of ocean water?

Activity — Warm and Cold

Materials

Clear glass bowls; pitcher; food coloring; pan; hot plate

Procedures

Fill a glass bowl 3/4 full of cold water. Fill pitcher with hot (not boiling) water. Add a few drops of food coloring to the hot water. **Gently** pour the hot water down into the side of the bowl. Where does the hot water go?

Discussion

1. What happened to the hot water as we poured it into the bowl?
2. What happened to the cold water as we poured the hot water into the bowl?
3. What can we say about hot water and cold water when they come into contact, when they meet? (The cold, denser water goes to the bottom and the warm water, which is less dense, goes to the top.)
4. How does this experiment help us understand what happens in the ocean when a current of cold water meets a current of warm water?

LESSON 5

Oceans— A Different World

BIG IDEAS Conditions in the ocean environment produce many different types of shore and underwater life.

Whole Group Work

Materials

Book: **Monsters of the Deep** by N. Barrett, **Find Demi's Sea Creatures** by Demi and **Wonders of the Sea** by L. Sabin
Paper and crayons
A variety of pictures of plant and animal sea life
Word tags: adapt, bioluminescence

Encountering the Idea

We've talked about three different layers of water that make up the ocean. These layers differ in temperature, pressure, light and currents. You also know there are fish in the ocean. Name some of the sea creatures you know about. (Students name several: whales, sharks, etc.) Do you suppose there are plants that live in ocean water? Can you name some?

Exploring the Idea

Do you suppose that plants and animals can live in each of the zones of the ocean? We know that temperature, pressure and light are different in each of the layers. Does this matter to plants and animals? Yes. Let's discover how these different environments affect plants and animals. Study the nine different ocean environments described in the chart from **Lesson 4**, p. 33.

Read **Monsters of the Deep.** After discussing the characteristics of deep sea creatures and generating a word bank, students draw their own sea creatures and give them names.

Problem Solving Activity

Whole Group Activity

In **Lesson 4,** we learned that there are eight different environments in the ocean. In each category there is an environment that affects each of the living organisms — the animals and the plants — that live in it.

For each category, write descriptive words about the type of living organisms that could possibly live there. For example, in the abyss where there is no light, do you suppose there is animal life there? If so, what type? Where would you expect to find the most plant and animal life? Where would you expect to find the greatest **variety** of plant and animal life?

	Temperature	Water Pressure	Light Intensity
Beach (surface) (0 to 1650 feet)			
Thermocline (3300 to 5000 feet)			
Abyss (6500 to 13,000 feet)	No plant life because there is no light. Animal bodies float in currents. No eyes. Don't hunt food; grab what passes by. Food: pieces of dead animals falling to the ocean floor, food particles left by other animals.		

Getting the Idea

Read **Wonders of the Sea** by B. Sabin. Who can recall some of the names of the plants? Animals? Ask if the student is naming a plant or an animal. List under appropriate heading.

In the underwater environment, the most important factor is light and its absence, because living organisms cannot exist in the absence of light. Sunlight is the energy source that makes photosynthesis possible. It drives the food chain on which all animals depend.

Plants in the form of microscopic plankton and seaweed are at the center of this chain. They convert — like other plants — water and carbon dioxide into carbohydrates through photosynthesis. Carbohydrates are the basic ingredients that give organisms the "food" to grow and reproduce. In this food chain, the small plants are eaten by herbivorous animals, animals whose diets depends on plants. Then these animals are eaten by the carnivorous animals, animals that eat other animals.

The entire food web depends on the existence of solar energy that ceases to penetrate beyond 650 feet of water. When there is no light, there can be no plants and no production of food. All the creatures that live in the sea — from plankton to small jellyfish to sharks and whales — must be fed from the small amount of food that is produced in a very thin layer of sunlit water surface.

Although less aquatic life can exist in the abyss, as compared to the large numbers and the big size of some of the creatures living close to the surface of the ocean, the variety is nevertheless great. Since conditions on the ocean floor are very harsh, the creatures adapt in many different ways. For example, one fish, the tripod fish, has developed feet-like organs that help it walk on the ocean floor! Others have bodies that have developed into jelly-like sacks to withstand the water pressure and to float in the ocean currents, and these creatures grab food as it passes by. They do not exert more energy than they need to in order to survive.

Organizing the Idea

Do **Activity** — Salt on a Plant.
Do **Activity** — Fish Math.
Do **Activity** — Sea Creature Symmetry.

1. As students learn more about the ocean, they include the new ideas in the class mural. Before adding to the mural, they consult with their group members to ensure that everyone give suggests and participates.
2. At the **Writing Center**, students write and illustrate a paragraph about how they imagine life exists in the abyss. They are to think first about what the animals look like, if they need eyes, hearing or feeling organs, their outward coloring, what they eat, how they protect themselves from predators, and anything else the students may want to include. Before writing the students may want to look at pictures and do research on sea-bottom dwellers.

Applying the Idea

Fold a large piece of paper in half. Using various books and encyclopedias on ocean life, prepare a picture display of plants on one side and animals on the other side. Label the pictures with the names of the plants and animals. Use this information to add to your ocean mural.

Activity — Find Demi's Sea Creatures, as below.

Students read **Find Demi's Sea Creatures** by Demi. The students try to find the sea creatures in Demi's book. After the student-pairs find as many creatures as they can, they count them by twos, threes, or some other number they select. They compare with other student-pairs to see who has found the most creatures.

Closure and Assessment

Oral Assessment

Name one plant and one animal found in the ocean.

In the activity with the fish crackers,

1. how many groups of 10 did you have?
2. how many ones did you have?
3. what is the total number of fish crackers you had?

Performance Assessment

1. Illustrate and label the display of plants and animals.
2. Identify all sea creatures in **Find Demi's Sea Creature**
3. Draw favorite sea creature or plant in the sea creature's particular environment.

Written Assessment

1. If I could be any ocean plant or animal, I would be a(n) _____ because _____ (fill in). Illustrate.
2. If I lived in the abyss as an animal, I would (need, or not need) protective coloring because _____.

List of Activities for this Lesson

▲ Salt on a Plant

▲ Fish Math

▲ Sea Creature Symmetry

ACTIVITY
Salt on a Plant

Objective

Students explain and/or draw the effect of salt water on a lettuce leaf and on a spinach leaf.

Materials

Book: **Wonders of the Sea** by L. Sabin

Crisp lettuce leaves; two jars with covers; tap water with salt added; labels; fresh water; pencil; clear plastic cups; salt; spinach leaves; teaspoons

Procedures

1. Mix two teaspoons of salt into two cups of water. Pour this water into a jar marked SALT WATER.
2. Fill the jar marked FRESH WATER with some tap water.
3. Choose lettuce leaves with stiff white centers. Place one leaf in the fresh water and another in the salt water. Cover each jar with its lid and let stand overnight.
4. The next day, remove each leaf and feel it.
5. Students describe the leaves and compare.

Fill three cups 3/4 full with water. Measure one tsp. salt and stir in one cup. Measure two tsp. salt and stir in second cup. Leave the third cup plain. Place a spinach leaf in each cup. In 20 minutes, observe the spinach.

Discuss results: What happened to the spinach after 20 minutes? (Stayed firm in fresh water, and mushy or mushier in salt water.) What does this suggest? (Some plants and animals live better in salty water; others do not.)

ACTIVITY
Fish Math

Materials
Sheet of paper and pencil for each student
Place value chart
Box of fish crackers

Part 1

Objective
Students separate a set into groups of 10s and ones.

1. Students guess how many fish they can draw in a minute with their right hand. The "drawing" of the fish can simply be an open "8" drawn horizontally.
2. Students draw as many fish as they can in one minute (by the clock).
3. Stop after a minute and count the fish drawn. How many groups of 10? How many ones left over?
4. Write the number of 10s and ones on a place value chart.
5. Students tell what the number is.
6. If someone draws more than 100 fish, the students suggest what needs to be done to the place value chart after they have 10 10s.
7. The students now draw the fish with their left hand. They repeat the activities as with the right hand. The students compare the difference in number of fish drawn by the two hands. They discuss why this might happen.

Part 2

Objective
Students explore the concept of division as continued subtraction by grouping by twos, threes, fives and 10s.

1. Give each student group a handful of fish crackers.
2. Student predict how many there are in a handful.
3. The students group them by twos, threes, fives and 10s. The students put the leftover fish in a container so they won't include them.
4. Tell students that this is one example of division — grouping the members of a set by a given number. When they were grouping by twos, they were dividing by twos; when they were grouping by threes, they were dividing by threes, and so on.
5. The students group the crackers by fours and make a statement. Ex. three groups of four fish is 12 fish.
6. The students decide why they had to put the leftover fish in a container. Why did they not count those fish? (There weren't enough of them to make a group of twos, or threes, fours, etc., depending on the number by which they are grouping the fish.)

ACTIVITY

Sea Creature Symmetry

Objective

In this activity the students explore the concept of symmetry and create sea creatures.

Materials

Sheet of paper folded along the longer side for each student
Soft lead pencil for each student group
Crayons

Procedures

1. Each student writes his/her name in large letters along the fold of the sheet of paper with the soft lead pencil
2. After writing the name, students darken the writing with the soft lead pencil.
3. Fold the paper again so the pencil marks are on the inside of the fold.
4. Press the paper on the reverse side so the name transfers to the other half of the paper.
5. Students color the resulting figure they like to show a sea creature.
6. Students discuss the concept of symmetry and sea creature characteristics.

Assessment

1. Why are there two eyes, two ears, two legs, two arms in humans?
2. Is the nose symmetrical?
3. How many lines of symmetry does a fish have? A human?
4. How many lines of symmetry does your sea creature have?

LESSON 6

Plants and Animals of the Abyss

BIG IDEAS Life abounds on the surface, in the thermocline and in the abyss. The largest mammals and the smallest one-celled protozoa and one-celled algae — all live in the ocean.

Whole Group Work

Materials

Reference books on ocean life — plants and animals
Microscope for each student group
Slides of pond water containing algae and amoebas

Encountering the Idea

Today, we will begin our lesson by looking at slides of very small plants and very small animals. These plants and animals are so small that we have to use a microscope to see them.

After the students have had an opportunity to look at the algae and other life forms on the slide, they make and record their observations in their journals. Discuss with them that although the animal and plant life they have been observing is from a fresh water pond, the life that we can see in a few drops of pond water is very similar to the microscopic life that exists in the ocean. We know that in order to survive, animals must have certain needs met. One need is food. All life needs food to survive. What do ocean plants and animals need to survive? Yes, they need food. Where do animals get their food? How do plants survive in the ocean? What do plants do on land to meet their food needs? (Pause for students to review needs — sunlight, carbon dioxide, water and minerals.) In today's activities we will discover how ocean plants and animal meet their survival needs.

Exploring the Idea

At the **Science Center**, students

1. complete **Activity** — Ocean Plants
2. complete **Activity** — Looking for Food in the Ocean
3. complete **Activity** — Ocean Life
4. complete **Activity** — Deep Sea Divers and Surface Swimmers
5. identify different living organisms found in the ocean and classify them as plants or animals, as shown below.

Materials

Magazines; scissors; glue; pencil; 11 x 14 construction paper

Procedures

1. Children look for pictures of ocean animals and plants in fishing magazines or reference books.

2. Cut out pictures or draw and illustrate if the pictures are in reference books.
3. Fold construction paper into two equal areas. Label the areas **animals** and **plants.**
4. The children glue pictures under the correct classification.
5. Children write the names of the animals or plants on the pictures.
6. The students look for ways the organisms have **adapted** to their environment.

Getting the Idea

All the food sources for both plants and animals on land come from plants. Plants use sunlight and chlorophyll to produce sugars and starch to use as foods. Animals eat plants for food, and some animals eat other animals as food. Thus, all our food energy, including that for humans, comes from plants. Where would you guess that the ocean produces food? Yes, plants also produce food for ocean life. In which of the eight zones we have studied, can plants grow? Only in those zones where sunlight can penetrate. Thus, plants can exist only on the surface waters or shallow marshes and ocean floors no deeper than several hundred feet, where light can penetrate.

Since all food develops on or very close to the surface waters, the amount of food produced by plants decreases with increasing water depth. Millions of animals as well as plant **plankton,** for example, inhabit the surface and mid-surface waters. The plankton serve as food for the smaller and larger fish and for mammals, such as the whales. Whales consume tons of the plankton to grow into their immense size and to exert the energy they do in swimming and hunting for prey. The larger fish are usually predators of the smaller ones. As the larger fish eat the smaller ones close to the surface, small leftover food particles drift downward into the lower depths. Animal life at these depths depends on the food that the surface swimmers leave over. In the abyss food is sparse and meals are infrequent.

Animal life, however, has adapted itself to the different environments in the ocean. For example, whales and walruses have large layers of fat to withstand the cold below-zero temperatures of the ocean depths. Others that live on the ocean floor have specialized bodies to withstand the water pressure — their bodies resemble jelly. They don't have strong swimming muscles and do not spend a lot of energy hunting their food. These dwellers of the abyss drift in the ocean currents waiting for the food to drift by. That food consists of dead animals and remnants or particles of food uneaten by the larger species and of feces of the surface dwellers. Thus, most deep-sea fishes have very large mouths, with large or specialized teeth, to take in large amounts of water that is they filter for food. Some animals use the low temperatures in the deep and a slow digestive rate to allow them to swallow fish that are longer than their own bodies. Others suck up mud from the ocean floor and sift it for particles of food. Life in the abyss is, indeed, harsh.

Applying the Idea

Do **Activity** — Seafood Math

At the **Writing Center**, each student group selects an ocean creature: octopus, jelly fish or sting ray. The students write a five to six sentence paragraph describing the creature and justifying why its body is gelatinous.

Closure and Assessment

Summarize the characteristics of the ocean mammals, fish and plants.

Oral Interviews

1. What is an ocean mammal? Name one ocean mammal.
2. What is a fish? Name one saltwater fish.
3. What is an ocean plant? Can an ocean plant make its own food through photosynthesis? Explain.
4. Can you name a plant that lives in sea water? (Sea weed, kelp)
5. Are there any plants in the ocean abyss? Why? Or why not?

Performance Assessment

Using pictures, students classify ocean mammals, fish and ocean plants.

Written

1. Write a brief description of a favorite living thing in the ocean.
2. List the characteristics of the ocean mammals.
3. At the **Writing Center**, the students describe and illustrate coral and say whether it is a plant or animal. They justify their answers.

List of Activities for this Lesson

▲ Ocean Life

▲ Deep Sea Divers and Surface Swimmers

▲ Ocean Plants

▲ Seafood Math

▲ Looking for Food in the Ocean

ACTIVITY
Ocean Life

Objective
The student describes and/or illustrates at least three different types of animals and at least two plants that live in the ocean.

Materials
Reference books on ocean life
Blank copy of the chart on ocean life for each student
Paper, markers and crayons for students to illustrate pictures

Procedures
1. Students use reference books and other books to locate examples of the various animals and plants listed in the chart below.
2. Students make illustrations in the various sections of a blank copy of the chart.

OCEAN LIFE

Migrating Fishes Migrate from fresh water to salt water or from salt water to fresh water to breed. Ex. carps, river eels, trouts	**Mollusks** Have soft one-segment bodies covered by a hard shell in one, 2, or 3 layers. Ex. oysters, clams, squids	**Other Aquatic Animals** Ex. frogs, turtles, coral
Marine Fishes Live in the ocean only. Ex. cods, haddocks, basses, sardines, tunas, sharks	**Aquatic Mammals** Mammals that live in the ocean. Ex. blue whales, porpoises, seals, walruses	**Aquatic Plants** Ex. brown seaweed, red seaweed
Crustaceans Have a hard shell. Ex. crabs, lobsters, krill, plankton crustaceans	**Sea Birds** In flight can snatch food, from surface; skip across the surface while snatching or catching prey; swim or dive to catch prey; dive into the water to pursue prey for some distance. Ex. skuas, petrels, penguins, pelicans, terns	

[1]Birds are included in the chart because they live off ocean food resources.

ACTIVITY
Deep Sea Divers and Surface Swimmers

Objective
Students describe how sea animals have adapted to being either deep sea divers and dwellers, or surface swimmers.

Materials
Reference books on the ocean
Pictures of scuba divers and their equipment
Pictures of human deep sea divers, diving bells and other equipment used in deep sea diving
Pictures of sea creatures that live on or close to the surface
Pictures of sea creatures that live in mid-depths of the sea and in the abyss

Procedure
1. After studying pictures of the divers, students describe and make a list on one side of a sheet of paper of the conditions deep-sea divers must plan for before going on a dive. (No light; near or below freezing temperature; water pressure of many pounds per square inch pressing on the body, if not protected; possible attack by Mako sharks.)
2. The students make a list on the other side of the sheet of paper of how the divers prepare to go into the deep. (Lights on top of their headgear; thermal wet suits; pressurized suits to withstand the water pressure; oxygen tanks.)
3. If the divers are going to great depths where the human body cannot withstand the pressure, even with pressurized suits, the divers go in diving bells, similar to navy submarines, that are especially constructed to withstand the water pressure.
4. The students compare and contrast deep-sea diving with scuba diving. How are the conditions alik? How are they different? The students make observations about the scuba divers and their equipment. (Have light near the surface; temperature is close to that of the shore and in the tropics can even be warm; don't need special suits. If they go deeper, divers may need oxygen tanks to stay underwater for a long time.)
5. Student groups design (show how it has adapted to the conditions of the surface, thermocline or the abyss) and illustrate an animal of the group's choice — fish, mammal or amphibian (can live in the water and on land) — either a **deep-sea diver** or a **surface swimmer.**
6. Students display their Aquatic Animals on the bulletin board.

ACTIVITY
Ocean Plants

Prior Preparation: Bring in two like plants at the beginning of the unit. Ask the students to place one of the plants in a window. They place the second plant in a closet, or other place where it will get not light. At appropriate times, the students water both plants at the same time and with the same amount of water.

Objective

The students describe the conditions that must occur for plants to exist and produce their own food.

Materials

The two plants for students to observe and describe
Chart describing the conditions that exist in the various ocean environments.

Procedures

1. Students review plant needs. (1. carbon dioxide, 2. water, 3. chlorophyll that the plant itself produces, 4. and solar energy required for the process of photosynthesis to produce sugar and other carbohydrates.)
2. What conditions are met in each of the ocean zones with different temperature, pressure and light conditions?
3. Where can plants survive?
4. Name some ocean plants and describe what they look like and where they live.
5. Design and illustrate your own plant. Display it on the bulletin board.

Note: All plant needs are met on the surface or close to the surface of the ocean. For example, water conditions are met: carbon dioxide is available, dissolved in the ocean water; solar energy is available up to the depth of the thermocline, since there is no light past a few hundred feet in ocean depth. Thus, at the surface and close to it, there is abundant plant and animal life. At depths greater than 700 feet, where light does not penetrate, there is no plant life. Animal life does, however, exist because the animals have adapted to those conditions.

On the surface and close to the surface, water temperature varies as the surrounding air temperature varies. Thus, plant and animal life lives within the temperature range from slightly below freezing at the poles and in the abyss, up to the warm tropical waters of the equator.

Plant life cannot survive where there is no light; consequently, plants do not have to adapt to the great water pressures of the abyss.

Objective

Students summarize on a bar graph information that they gather by counting; students compare numbers (cost) by using play money, place value charts or any other strategies they suggest.

Materials

Tuna in water; salmon; shrimp; crackers; paper plates; napkins

Procedure

1. Each student receives a small portion of three types of seafood on a cracker —

ACTIVITY
Looking for Food in the Ocean: Part 1

Objective

Students explain what a food web is and describe the ocean food web by making a whole group illustrated dictionary of important classes of aquatic life and their place in the food web.

Materials

Copy of a blank ocean food chart for each student

List of classes of aquatic life to begin the students' search: bacteria, plant plankton, animal plankton, sea cucumbers, crustaceans, mollusks, starfish; octopus; dolphins, whales, walruses, tuna, squid, glass sponge, tripod fish, turtles, any others they find and wish to include

Reference books for students to look at pictures of the various organisms that live in the sea and to read about the ocean food chain

Procedures

1. Students read about the various fish listed above and develop a food chain or web.
2. The students note that some of these animals live on the surface and can also be eaten by aquatic birds, thus being a part of a food web that includes creatures that do not live in the sea or in the water.
3. Students make a food web showing aquatic plants as the basis for the web. Without plants to make food, no life would be in the ocean. The students show, in a manner similar to Chart 2, the plankton, and other life that serves as food for the other species.
4. Point out that plankton are both plants and animals living and surviving together as a group. Individual members of the plankton may vary in size from microscopic to very large. Jellyfish can be up to one meter wide with tentacles extending over three meters. Plant plankton are microscopic and appear in such vast quantities that the ocean can appear green.

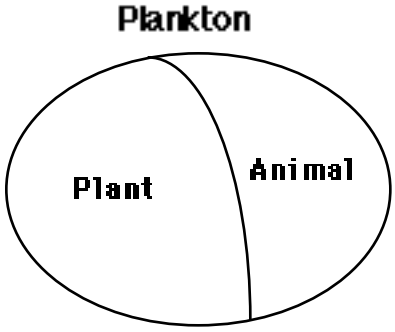
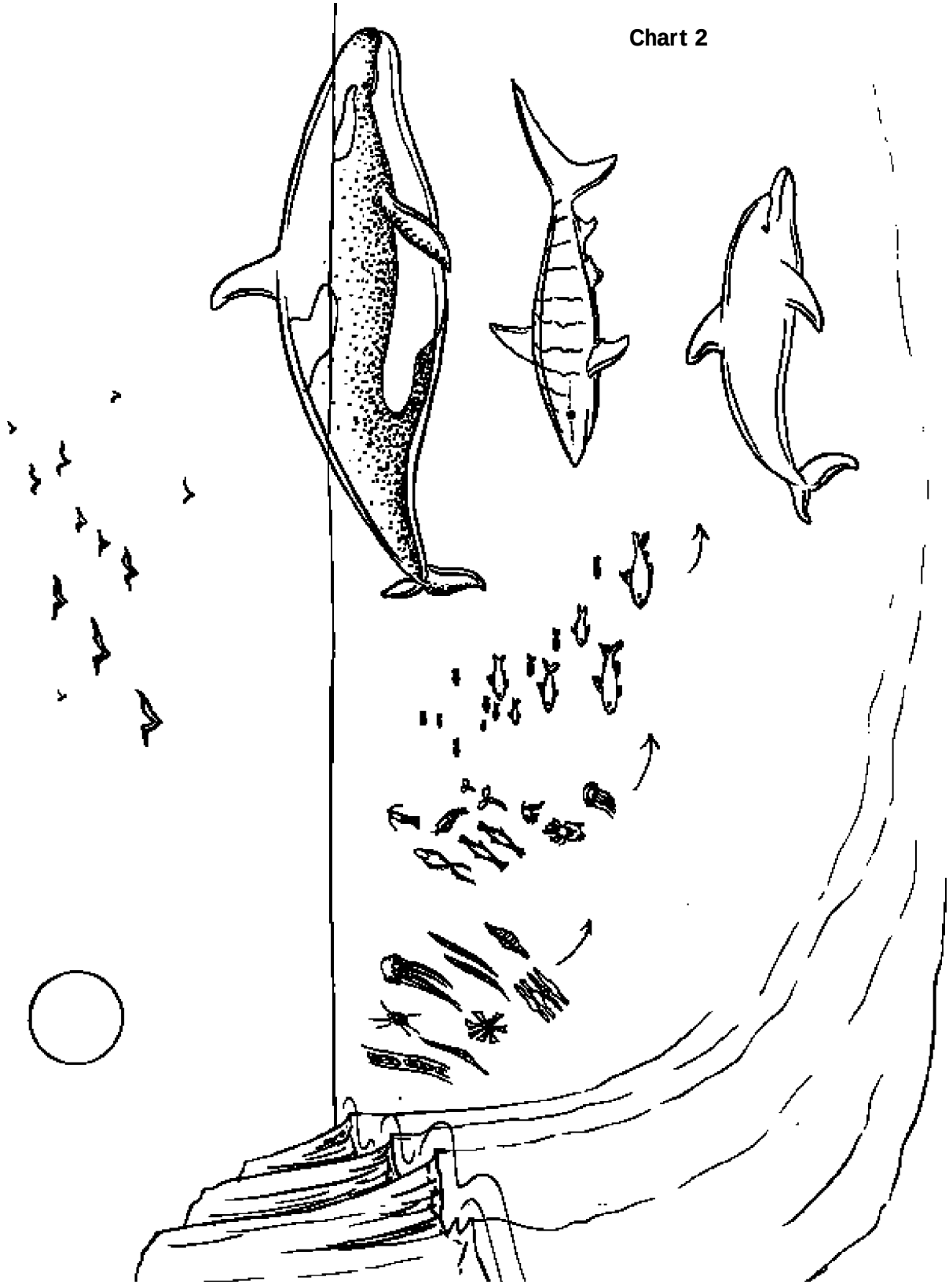


Chart 1

5. The main consumers of plant plankton are microscopic animals. The microscopic animals are the food of larger animals, such as whales, that consume vast quantities of the smaller animals. Thus, the Ocean Food Web is established.

ACTIVITY

Looking for Food in the Ocean: Part 2



LESSON 7

Oceans and Industries

BIG IDEAS The oceans are important sources of food, employment, and recreation.

Whole Group Work

Materials

Book: **I Can Be an Oceanographer** by P.P. Sipiera, **A First Look at Seashells** by M.E. Selsam and J. Hunt and other shell books

Butcher paper; canned tuna; canned salmon; rulers; canned shrimp; string; crackers; napkins; large collection of various seashells

Cards with name, pictures and length (in feet) of several sharks and whales

Encountering the Idea

The lesson begins in a whole class activity.

The ocean is a source of many things that are important to us. Oceans provide us with food, different jobs and even recreation. Let's begin today with a book that describes some of the careers you could choose that deal with the ocean. Read **I Can Be an Oceanographer**.

Let's list other different things we could do in and near the ocean. Solicit student responses. Include: snorkling, scuba diving, traveling on a cruise ship, deep sea fishing, sailing, sail boating, swimming, beach combing, sand castle building, surfing, agate collecting, clamming, crabbing.

Exploring the Idea

1. Before they go to the learning centers, in a whole class activity, the students take two surveys related to seafood as an important food for humans:
   - Do you like seafood? three categories: **Yes, No, A Little** The students count and record the number of people voting in the three categories.
   - How many times a week do you eat seafood? (Students can check at home for responses to this question and can include parents and others in the family.) After the students have collected the responses, they take them to the **Mathematics Center** to summarize and graph. The students select the type of graph they are to employ
     - pictograph, bar graph, or circular graph, etc.
2. **Activity** — Seashell Math, as below.

Materials

Collection of various shells (enough for four for each group)

A First Look at Seashells; Shell by A. Arthur; **Discovering Seashells** by D. Florian

Pictures of various recreational activities in and out of the water placed on display

Various books related to shells

Procedure

Read **A First Look at Seashells.** Students describe four shells by shape, size, pattern, type of animal body (soft, jelly-like, like an oyster) and other characteristics. Students separate the shells into univalve or bivalve shells. Students list the characteristics that made them choose a certain category. Students may use books to verify their choices.

Getting the Idea

1. Each child names a water sport she/he would like to participate in and discusses and names ways to spend leisure time at the ocean.
2. How many of you collect something? Solicit responses. Well, there are many fun and enjoyable things to do at the ocean; for example, we can collect seashells.

Organizing the Idea

1. On a chart list all the sea and ocean products the students can think of, such as food products like tuna, salmon, scallops, shrimp, oysters, clams, etc. List students' responses under "Food".
2. There are other ocean products such as salt, minerals, oil, pearls, diamonds, animal feed and fertilizer. For each of these resources an industry or a business has developed. Ask the students to read about industries connected with the ocean — fishing, mining salt and minerals, drilling for oil, diving for precious stones and precious metals, developing food for animals and fertilizer for plants.
3. Students list some of the jobs they read about in the story **I Can Be an Oceanographer.** Solicit responses — put on board under "Employment". Oceanographer, marine biologist, marine geologist, meteorologist who is a weather scientist. What other jobs can you think of? (Fishermen, shipping, cruises, resorts on shore, oil rigs.)

At the **Art Center**, the students

1. design and complete a display on various recreational activities that are related to or are part of the ocean.
2. include various recreational industries in their mural illustrations as they continue with **Activity** — Ocean Mural.

Applying the Idea

Do **Activity** — Measuring Sharks and Whales.

Closure and Assessment

Oral Assessment

Name two resources from the ocean.
Name three recreation activities.
What is your favorite water sport, and why is it your favorite?

Performance Assessment

Students draw a scene of a beach with sand. Students pretend they are going to the beach. They draw on the picture what they would do and what they would find.

Written Assessment

Students can:

Briefly write about an ocean career they might enjoy.
Write an advertisement for their favorite ocean activity.

List of Activities for this Lesson

▲ Ocean Mural (continuation)

▲ Measuring Sharks and Whales

ACTIVITY

Measuring Sharks and Whales

Objective

Student do something that marine biologists might do.

Materials

For each student group:
Rulers (ft.)
String
Display or cards with name, picture and length of several different kinds of sharks and whales

Procedures

1. From the information cards, the students select the shortest animal, the longest and the one in the middle.
2. Working in groups of three, students measure with string the length of the three sharks and/or whales.
3. Each student takes turns comparing his/her own the length with the length of each one of the whales or sharks, using any type of comparison they wish. (Ex. twice as long, 1/2 the length, or the same length, 10 inches longer, etc.).
4. Students compare their results and say why they selected a certain method of comparison and say what mathematical operation they used.

	Maria	Griselda	Jerry
Mako Shark			
White Whale			
Blue Whale			

LESSON 8

Oceans and Pollution

BIG IDEAS The oceans are in danger of increased pollution; we can protect them through awareness and laws.

Whole Group Work

Materials

Book: **Jack, the Seal and the Sea** by G. Aschenbrenner, **Sea Squares** by J.N. Hulme, **The Dying Sea** by M. Bright and **Polluting the Sea** by T. Hare
Resource to use: **50 Simple Things Kids Can Do to Save the Earth** by The Earth Works Group
Fish-shaped cheese crackers
Containers
Paper towels
Newspaper clippings on reports of oil spills and industrial and recreational pollution

Encountering the Idea

Children read newspaper clippings that report oil spills and industrial and recreational pollution. Assign each group of three or four students one article. Each group reports to the class about their article. The students propose and discuss suggestions to protect the ocean environment.

We have studied about the wonderful resources and food the ocean provides for us. What will happen if we don't take care of the ocean? Let's find out some things that harm our ocean and what the results can be. Read one of the suggested books.

Exploring the Idea

Use **The Dying Sea** and **Polluting the Sea** as references for the students to become aware of the conditions that cause pollution.

Play a game — Did You Know?

- 26,000 tons of plastic packaging are dumped at sea each year
- 690,000 plastic containers are dumped by the world's ships everyday.
- 3,000 miles of nylon drift nets are set each night
- 6 miles of fishing net are lost each night
- Everything we dump on land can eventually reach the ocean
- About 1/4 of all waste water is dumped into the ocean

At the **Art Center**, students draw a picture of how they think the sea will look in the future if this trend does not stop.

At the **Social Studies Center**, the students report on their newspaper articles and make a list of suggestions on a poster. Display the poster in and outside the classroom, in the hall.

Getting and Organizing the Idea

1. Students make a list of things that are threatening our oceans under the heading —- **OUR OCEAN IS DYING BECAUSE** List can include: disposal of toxic chemicals and garbage; overfishing; dredging; tourism (touching coral reefs); oil spills and disposal (car oil, for example, by ordinary citizens); disposal of sewage into rivers and oceans; industrial pollution.
2. As the students can see, humans behave in many ways that are harmful to the ocean. Let's see if we can think of some solutions. For each item listed above, the groups suggest different solutions. For example: Where will the garbage go? What will we do about the waste products from industry?
   Resource to use: **50 Simple Things Kids Can Do To Save the Earth.**
   - Don't throw litter on the beach.
   - When you visit the beach, take along a garbage bag to pick up trash.
   - Recycle plastics, glass, paper and aluminum; don't leave them on the beach.
   - Never throw fishing line into the ocean.
   - Cut up plastic container rings and dispose of them properly.
   - Take used oil to a recycling center. Don't pour it down the drain or in the gutter.

Applying the Idea

1. Students complete **Activity** — Ocean Multiplication.
2. Separate the class into four groups — The City Council, The Conservationists, B.I.G. Industrial Council, and the Citizens.
   The conservationists (Blue Ocean) go to the city council to complain that B.I.G. Industry is dumping its wastes into the ocean, killing the fish, seals and plants. The council passes a law that prohibits B.I.G.I. from dumping in the ocean. B.I.G.I. protests because the corporation will lose money if they have to take the waste somewhere to dispose of it. The industry will close and there will be fewer jobs. What should the citizens and the council do?

Closure and Assessment

Provide each group with a newspaper clipping related to ocean pollution.
Students also have available the list of suggestions they made to protect the ocean environment.

Oral Interviews

1. Name three forms of pollution.
2. What will be the result of our actions if we don't stop polluting the ocean and begin to clean it up?
3. Name one thing each person can do to help 1) stop pollution , and 2) clean up what has already been contaminated.

Performance Assessment

1. Draw a poster and list problems of and solutions to ocean pollution.
2. Make up a law to prevent ocean pollution and/or to clean up what has already been contaminated. Defend your law to your partner and/or to your teacher.

Written Assessment

1. Suppose you are a fish living in a polluted ocean. Describe your surroundings and how you feel. Illustrate what you see and how you feel.
2. Write a poem about a dying fish, seal or plant.

List of Activities for this Lesson

▲ Ocean Multiplication

ACTIVITY
Ocean Multiplication

Objective

The students develop a notion of multiplication as continued addition by 1) using a chart that shows a rate as partial sums and the product, and by 2) using an array that is a set of objects arranged in rows and columns.

Materials

For each student pair or student group: set of problems, paper and pencil to draw chart and counters to make arrays

> *An ocean current travels at the speed of six miles every hour. How far will the current carry garbage that was dumped in it, if the garbage travels at that same speed for five hours?*

Procedures

The students work in groups to solve the first problem. They report their results and the strategies they used. If the groups do not suggest the following strategies, present the strategies as additional ones that students can use.

1. Summarize the results by using a chart to show the partial sums each hour until the problem is solved.

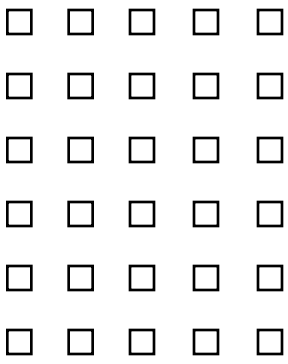
Distance Traveled Each Hour

One Hour	2 Hours	3 Hours	4 Hours	5 Hours	6 Hours

2. Give the students the second problem to solve.

> *A ship is losing fuel into the ocean at the rate of five tons each time it makes a round trip to its first assignment. How many tons will it lose in six trips?*

Instead of using a chart the students draw an array to show the five tons used each trip for six trips. For example, each square represents a ton.



3. Students continue making arrays or using their own strategies to solve a variety of problems.

   One sea creature has four rows of teeth. How many teeth does the creature have if each row has 15 teeth?

   A coral (animal) secretes an external skeleton of limestone at the rate of about 1/2 inch per year. How long will it take the coral to grow to the length of two feet?

This problem lends itself to the use of a chart (since the English measure is a fraction) and to finding a pattern to use so the chart does not have to be large.

4. Students discuss the strategy their group used to solve the problem. The students write number sentences representing the solution to each problem, above.

   Ex. 6 + 6 + 6 + 6 + 6 = 30

5. The students rewrite each addition sentence as a multiplication sentence and practice reading it.

   Ex. 5 X 6 = 30

6. Students write in their journals a rule about when to use multiplication.
7. Students continue to solve problems written by second grade students in another school. They describe and discuss the strategies they used to get the answers.

   One monster shark can destroy seven boats in one day. How many boats can the monster destroy in one day, if it works twice as hard for that day?

   My sea creatures can migrate five times farther than sharks. If a shark migrated 800 miles in one week, how far did my sea creature migrate in one week?

U N I T A S S E S S M E N T

Oral Assessment

1. Using the ocean mural, the students answer the following questions:
   A. What animals live at the bottom of the ocean?
   B. What are some of the things you notice about ocean plants?
2. What causes the tides?
3. Name an ocean mammal.
4. What are the different layers on the ocean floor? Describe them.
5. Explain verbally (and the student may include illustrations) the effects of the moon's gravity on low and high tides.

Performance Assessment

1. On the ocean mural, students place pictures of plants and animals in their appropriate places.
2. Illustrate a high tide and a low tide.

Written Assessment

1. Write a short story about the ocean mural.
2. List the major characteristics of ocean mammals, fish and plants.
3. Write a short paragraph about what the beach would be like after a high tide recedes.
4. Write about a plan to prevent ocean pollution.
5. List ocean resources.
6. Write and illustrate a story about a water sport.

References

Annotated Children's Books

Arthur, A. (1989). *Eyewitness Books: Shell.* New York: Alfred A. Knopf.
Photographs and text examine different types of shells focusing on such aspects as how shells camouflage themselves and how they may be collected.

Aschenbrenner, G. A. (1988). *Jack, the seal, and the sea.* Englewood Cliffs, NJ: Silver Burdett Press.
Heartfelt story of a man who, after finding an ailing seal, can no longer ignore the sorry state of the world's seas.

Barrett, N. (1991). *Monsters of the deep. (*Picture Library). New York: Franklin Watts.
A look at predatory marine animals such as sharks, jellyfish, and octopi.

Bender, L. (1989). *First sight: Creatures of the deep.* New York: Gloucester Press.
Describes the strange and wonderful animals that inhabit the turlight world of the oceans' depths, including the viper fish, lantern fish, and the worm.

Bender, L. (1989). *First sight: Life on a coral reef.* New York: Gloucester Press.
Describes different kinds of coral and the various array of animals that inhabit coral reefs.

Bennett, D. (1989). *Water.* New York: Bantam Books.
Explains water and its uses. Colorful illustrations. Contains a review of facts.

Bombard, A. (1957). *Dr. Bombard goes to sea.* New York: Vanguard Press.
This book is a true story about how a person can survive at sea. Large illustrations of blue and white color. Higher level of interest for children.

Branwell. (1987). *The oceans.* New York: Franklin Watts.
Describes and explores various aspects of the ocean including currents, tides, ocean life, and ocean resources.

Bright, M. (1988). *The dying sea.* New York: Gloucester Press.
Examines various factors threatening our oceans including overfishing, dredging, and industrial pollutions.

Burton, M. (1970). *Los habitantes del mar.* Weidenfeld and Nicolson (Educational) Ltd. Ediciones Anaya, SA.
Da la historia de la exploración del mar. Describe plantas y animales que viven en el mar. Incluye un glosario para el segundo a tercer grado.

Burton, M. J. (1978). The Color Nature Library: *Sea life.* Westminister, MD: Crescent Books.
Color photographs of the hidden world of animals of the sea.

Coatsworth, E. (1960). *Lonely Maria.* New York: Pantheon Books.
Maria finds a way to entertain herself on a small island in the west Indies. She draws sand figures. This is a good story to discuss the tides.

Cole, J. (1992). *The magic school bus on the ocean floor.* New York: Scholastic.

Cole, S. (1985). *When the tide is low.* New York: Lothrop, Lee and Shepard Books.
This book is about the high and low tides of the ocean. Animals found on the beach after the tide receeds.

Croser, N., Sherwood. (1989). *Help.* Milwaukee: Gareth Stevens.
When Elephant, Lion, Monkey, and Beaver are shipwrecked on an island, each animal thinks he has the solution to being rescued.

Demi. (1991). *Find Demi's sea creatures: An aninal game book.* New York: Putnam & Grosset.
A game book introducing various sea creatures which must be located in the illustrations.

Domanska, J. (1971). *If all the seas were one sea.* New York: The Macmillan Company.
The illustrations are etchings. The volume contains very little printed text.

Editores, S.A. (1979). *Sinbad el marino.* Miami, FL: DDL Book, Inc.
Large, colorful illustrations. This book is about Sinbad's voyages. Great for reading enjoyment.

Editorial Molino. (1971). Mi Primera Biblioteca Básica. *Bajo el mar.* Barcelona: Author
Describe el mar a diferentes profundidades.

Editorial Molino. (1971). Mi Primera Biblioteca Básica. *El agua.* Barcelona: Author.
Explica como el agua de los mares se puede utilizar para el uso humano.

Editorial Molino. (1971). Mi Primera Biblioteca Básica. *Junto al mar.* Barcelona: Author.
Describe el mar y los animales que habitan las diferentes partes del mar.

Farber, N., & Livingston, M. C. (1987). *These small stones.* New York: Harper & Row, Publishers.
Poems about a snail, a crab, and beach stones.

Florian, D. (1986). *Discovering seashells.* New York: Charles Scribner's Sons.
An introduction to various kinds of seashells, where they can be found, and their inhabitants.

Gordon, S. (1985). *Now I know: Dolphins and porpoises.* Mahwah, NJ: Troll Associates.
The book is beautifully illustrated and easy to read. Children can read it independently.

Hare, T. (1991). *Save our earth: Polluting the sea.* New York: Gloucester Press.

Examines the benefits we reap from the oceans and the damage that oil spills, metal poisoning, and sewage dumping cause.

Hulme, J. N. (1991). *Sea squares.* New York: Walt Disney Book Publishing Group.
Rhyming text and illustrations of such sea animals as whales, gulls, clownfish, and seas provide opportunities to practice counting and squaring numbers from one to ten.

Javna, J. (1990). *50 simple things kids can do to save the earth.* New York: Andrews and McMeel.
Ideas for students to help save the earth including energy, animals, pollution, and recycling.

Lauber, P. (1991). *Great whales: The gentle giants.* New York: Henry Holt and Company.
This book has color illustrations along with black and white photographs. This book on whales includes a table of contents and an index. Children and teacher references.

Leonard, R., & Briscol, W. S. (1964). *Skipper the dolphin.* San Fransisco: Harr Wagner Publishing.
Short novel about a dolphin and its adventures with various illustrations.

Lionni, L. (1963). *Swimmy.* New York: Pantheon.
A little fish discovers a solution to the problem of big fish eating up his fellow fish.

MacDonald, G. (1946). *The little island.* Garden City, NY: Doubleday and Company.
Life on an island reveals how the earth is one piece of land under the sea.

Marshak, S. (1991). *I am the ocean.* New York: Arcade Publishing.

O'Neill, M. (1961). *Hailstones and halibut bones: Adventures in color.* Garden City, NJ: Doubleday & Company.
Large, colorful illustrations. Poems dealing with colors. Metaphors and similies.

Parker, S. (1990). *Eyewitness Books: Fish.* New York: Alfred A. Knopf.
A photo essay about the natural world of fish and their importance in human life.

Podendorf, I. (1982). *A new true book: Animals of sea and shore.* Chicago: Childrens Press.
Introduces creatures that inhabit the sea and shore. Animals with fur or shells, fins or legs, spiny skins or soft bodies.

Porter, K. (1986). *Life in the water.* The Animal Kingdom. New York: Schoolhouse Press.
Describes the various forms of animal life found in water and their characteristics.

Sabin, L. (1982). *Wonders of the sea.* Mahwah, NJ: Trolle Associates.

Selsam, M. E., & Hunt, J. (1983). *A first look at seashells.* New York: Walker and Company.
An introduction to seashells, explaining how they are classified and describes the differences that distinguish one shell from another.

Siberell, A. (1985). *Whale in the sky.* New York: E. P. Dutton.
This book is an Indian legend. Easy to read. Explains what Indians used to make totem poles.

Sipiera, P. P. (1987). *I can be an oceanographer.* Chicago: Children's Press.
Discusses the work oceanographers do as they study the ocean's depth.

Steele, P. (1986). *Life in the sea. Do you know about?* New York: Warwick Press.
A description of some of the animals found in the ocean and how they live.

Storin, D. (1980). *Oceans.* Columbus, OH: Xerox Education Publications.
Describes the ocean as a limited natural resource. Background knowledge to help citizens make sound decisions about the use of the oceans. Includes questions at the end of each chapter.

Waber, B. (1975). *I was all thumbs.* Boston: Houghton Mifflin Company.
Large illustrations about an octopus and its adventures.

Wheeler, A. C. (1988). *Discovering saltwater fish.* New York: Bookwright Press.
Describes and illustrates various saltwater fish.

Teacher References

Aschenbrenner, G. A. (1988). *Jack the seal and the sea.* Englewood Cliffs, NJ: Silver Burdett Press.

Morris, R. (1983). *Mysteries & Marvels of ocean life.* London: Usborne Publishing.

Nayer, J. (1992). *At your fingertip: Sea creatures.* McClanahan Books.

Oceans. Learning Center Catalog - 3rd grade. 1-800-334-0298

Oceans, Rocks, and Endangered Animals. (FS-7046)

Oceans. Thematic Units (Grades 2-3) (A Primary Whole Language Theme Unit). Instructional Fair.

Oceans. Thematic Unit (Intermediate). Westminister, CA: Teacher Created Materials, Inc.

Ranger Rick. Washington, D. C: National Wildlife Federation.

Reading Rainbow.

Tayntor, E., Erickson, P. A., & Kaufman, L. (1986). *Dive to the Coral Reefs: A New England acquarium book.* New York: Crown Publishers.

General References

Angell, M. (1976). *The fantastic variety of marine animals.* New York: The Bobbs-Merrill Company.
Uses a question and answer format to introduce animals that live in the sea.

Carter, K. J. (1982). *A new true book: Oceans.* Chicago: Childrens Press.
An introduction to the world's four largest bodies of salt water: the Atlantic, Pacific, Artic and Indian Oceans.

Craig, J. (1982). *Now I know: What's under the ocean.* Mahwah, NJ: Troll Associates.
Brief text and pictures introduce some animals and plants that live in the ocean.

Curran, E. (1985). *Life in the sea.* Mahwah, NJ: Troll Associates.
Introduces some of the animals and fishes that live in the ocean.

Lambert, D. (1984). *The oceans.* New York: The Bookwright Press.
Examines the ocean, waves, currents, and tides, and man and the ocean.

Lambert, D. (1988). *Our world: Seas and oceans.* Morristown, NJ: Silver Burdett Press.
Examine the world's oceans, their physical features, movements, plants and animal life, and relationship with humanity.

Lauber, P. (1991). *Great whales: The gentle giants.* New York: Henry Holt and Company.
Describes the characteristics and behaviors of different kinds of whales and discusses why they are threatened by extinction.

Martin, L. (1988). *The wildlife in danger series: Whales.* Vero Beach, FL: Rourke Enterprises.
Describes the 12 species of whales, threats to their existence and efforts of the World Wildlife Fund to save whales from extinction.

Russell, S. P. (1982). *What's under the sea?* Nashville: Abingdon.
Examines characteristics of the ocean, including the currents, tides, floor, and plant and animal life.

Schulz, C. M. (1980). *Snoopy's facts and fun book about seashores.* New York: Random House.
Snoopy and his friends explore many different things one can observe and do at the seashore.

Shale, D., & Coldrey, J. (1987). *The world of a jellyfish.* Milwaukee: Gareth Stevens.
Text and illustrations describe the physical characteristics, habits, and natural environment of the jellyfish.

Waters, J. F. (1979). *A jellyfish is not a fish.* New York: Thomas Y. Crowell.
Describes the general characteristics and functions of a variety of jellyfish with emphasis on the ones to avoid.