Observing the Ocean

A series of activities that demonstrate how scientists study the ocean through modern technology

Objective
Students investigate the many uses of ocean observing systems and how the information is used.

National Science Education Standards:
K-12 Unifying Concepts and Processes
- Evidence, models, and explanation
- Form and function

9-12 A Science as Inquiry
- Abilities necessary to do scientific inquiry

9-12 C Life Science
- Interdependence of organisms
- Behavior of organisms

9-12 F Science in Personal and Social Perspectives
- Natural Resources

9-12 B Physical Science
- Motions and forces

9-12 D Earth and Space Science
- Energy in the earth system
- Origin and evolution of the earth system

9-12 E Science and Technology
- Understandings about science and technology

Observing the Ocean

Background

People have studied the ocean for a long time. In the past, our knowledge about the ocean came from measurements made from ships. Ocean observing systems now use many different types of technology, which sense the "pulse" of the ocean by collecting data continuously. This information is posted on the internet and allows scientists to quickly detect changes in the oceans. Being able to quickly see changes also allows scientists to understand why changes are happening, and even to predict them.

These systems include a variety of instruments that measure temperature, currents, wave height, salinity, and other parameters. Types of observing systems include satellites, which sense the ocean from far above, moored (stationary) buoys, which communicate information directly to land-based computers and are accessed via the Internet, and roving sensors (sonars), which can travel remotely through the water and radio information to receivers. You can access this exciting information to explore the effect of the ocean on climate and weather or locate sea creatures based on temperature, all through the eyes of ocean observing systems.

This activity includes a series of experiments that demonstrate what types of information ocean observing systems measure and how this information is used to predict physical and biological occurrences in coastal and ocean systems.

Part A. Introductory Activity: Globe Toss

Objective
Students will be able to demonstrate the fact that the ocean occupies over 70% of the Earth's surface.

Materials
16" Inflatable globe
Instructions with data table

Procedure
1. Inflate globe
2. With a partner toss the globe 10 times to each other. This means that each partner catches the globe 5 times for a total of 10.
3. On the table provided record how many fingers touch the ocean on each toss.

Toss #	**# Fingers in Ocean**
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
Total %	

Conclusion: What can you summarize from this activity?

Part B. Exploring Ocean Observing Systems

Objective
As an introduction to ocean observing systems, students will become familiar with ocean observing systems and the parameters they measure.

Materials
Computers with internet access
Data sheets with questions below

Procedure
1. Divide into teams and define each parameter below by using web resources. Then go to the Ocean Observing Systems using this website: www.ndbc.noaa.gov
Click on an area nearest you. Choose a buoy and click on it. Record below the most recent data for each parameter at the buoy you chose. If your buoy doesn't report on every parameter, click on other buoys to find one that does.

Wind speed, gusts and direction: Definition_____
_____
Data values:_____

Temperature: Air & water: Definition_____
_____
Data values:_____

Pressure: Atmospheric, tendency: Definition_____
_____
Data values:_____

Tides/Water level: Definition_____
_____
Data values:_____

Waves: Height, period, direction: Definition_____
_____
Data values:_____

2. Go to http://mddnr.chesapeakebay.net/eyesonthebay/index.cfm. Scroll down to the map of Chesapeake Bay and click on an orange buoy (these buoys measure data in real-time). Define each of the parameters below and record the most recent data values for each parameter.

Dissolved Oxygen Concentration: Definition_____
_____
Data values:_____

Salinity: Definition_____
_____
Data values:_____

Chlorophyll: Definition_____
_____
Data values:_____

3. Answer the questions below.

What is the ocean temperature off the coast nearest your home or your favorite ocean area?

What parameters were only available at a few buoys? Why do you think these parameters are not more widely measured?

Part C. Vertical Mixing

The purpose of the *field investigation* is to determine if water is mixed or stratified through vertical measurements of temperature, salinity and oxygen. In a companion *web-based activity*, these field data will be compared with those data from observing systems and an assessment will be made of the advantages and disadvantages of the two methods of data collection.

1. Field Trip

Objective
Students will be able to determine if the water is vertically mixed or stratified.

Materials
Boat
Oxygen, Temperature, Salinity meter with 30 meter cable
Data sheets
Computer with Internet connection

Procedure
1. Select a station in a body of water with a depth of at least 10 meters and record latitude and longitude. Observe weather conditions and record on data sheet.
2. Using the instrument that measures temperature, salinity and oxygen, lower the probe through the water column taking measurements at 1 meter intervals.
3. Record salinity/conductivity, temperature and oxygen in the data table below

Data Table for Vertical Mixing Field Trip

Station:_____

Latitude:_____
Longitude: _____
Weather: _____
Group: _____
Date: _____

Depth	Time	Temp (C)	Oxygen (mg/l)	Salinity

Questions and Conclusions

1. Was the water column mixed or stratified?

2. Explain your answer

2. Vertical mixing using Ocean Observing Systems

Objective
Students will investigate vertical mixing using data from the Ocean Observing Systems.

Procedure
1. From your computer, go to http://www.gomoos.org/data/recent.html?platform=A01
2. Click an observing buoy and then click the link under "Current Conditions" called "All Data From This Station." Make sure your buoy is reporting salinity and temperature from at least 3 different depths. If not, find another one that does.
3. Record your observations for salinity and temperature at the surface, at a middle depth, and at the deepest depth shown:

Salinity

Depth_____m Salinity (psu) _____

Depth_____m Salinity (psu) _____

Depth_____m Salinity (psu) _____

Depth_____m Water temperature (°C) _____

Depth_____m Water temperature (°C) _____

Depth_____m Water temperature (°C) _____

Questions and Conclusions: Comparison of field data to real time data available from Observing Systems.

1. Which method of data acquisition provided a more comprehensive view of vertical mixing/stratification at the time of sampling?

2. Which method provided a better long-term analysis of mixing/stratification over time?

3. Which method would you use if…

   … You wanted to know if the water in the estuary was stratified at a certain depth?

   …You wanted to predict if there was going to be a turn-over event in the river?

   …You wanted to see if there might be a fish kill caused by low oxygen bottom waters?

Part D. Where do the Critters live?

Any aspect of the physical environment that affects living organisms is called a "physical factor". Aquatic organisms are greatly affected by various physical factors such as temperature, salinity, dissolved oxygen, depth, and several others. In the open and coastal ocean, temperature can be a strong determinate of animal distribution. This web-based activity uses ocean temperatures to determine the distribution of marine organisms.

Objective
Students will investigate the influence of ocean temperature on marine organism distribution.

Materials
Computers with internet access
Data sheet below

Procedure
1. Go to the following website: http://www.ndbc.noaa.gov to locate water temperatures at several offshore sites from Maine to Florida and record below.

Location	Temperature ^{0}C
Maine	_____
New York	_____
Virginia	_____
South Carolina	_____
Florida (Miami)	_____
Chesapeake Bay	_____

2. The table below describes the optimal temperature ranges for these marine organisms. Using the data from the above table, determine the potential location of the organism.

Organism name	Optimal temperature (^{0}C)	Potential location
White Perch	10-30	_____
Silverside	3-31	_____
Striped bass	18-23	_____
American Lobster	8-14	_____

Florida (spiny) Lobster	22-26	_____
Eelgrass	0-25	_____
Widgeon Grass	5-30	_____

3. Answer the following questions:

Which organisms would you expect to find in Chesapeake Bay at this time?

Which organisms would you expect to find in Maine at this time?

List the organisms that might live anywhere from Maine to Florida to California?

Explain how these organisms can live in many different locations.

Application to Climate Change

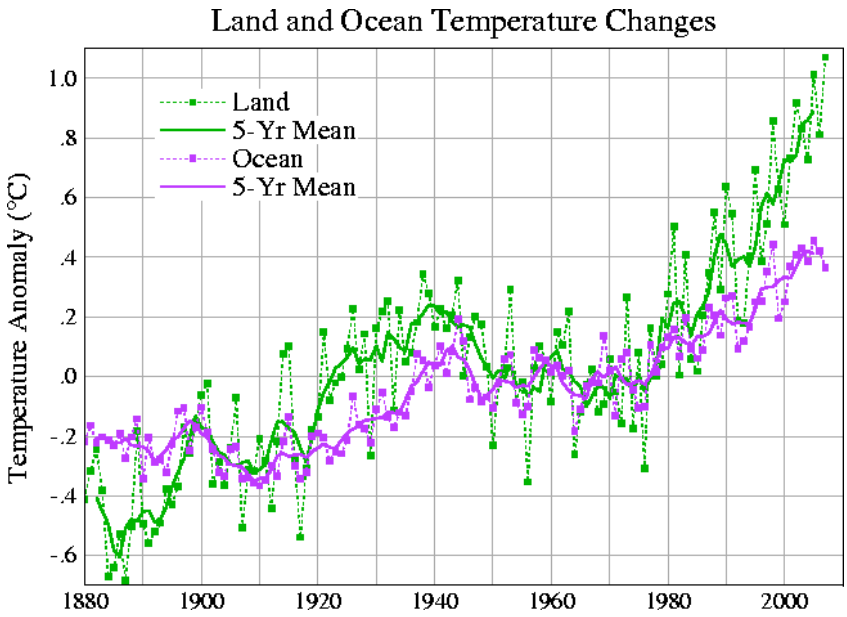
Study the graph below, which shows the changes (anomaly is the temperature above or below the average temperature) in land and ocean temperature from 1880 to present. Use the graph to determine the rate of change of ocean temperature over the past 50 years.

Rate of ocean temperature change:_____

If this rate of change remains the same, predict the change in temperature in the next 50 years and 100 years.

Temperature change in 50 years:_____

Temperature change in 100 years:_____



http://data.giss.nasa.gov/gistemp/graphs/Fig.A4.lrg.gif

Questions:

Describe how the rise in ocean temperature will affect the habitat for marine organisms.

Explain how these changes in ocean temperatures will affect our marine resources.