Unit I The Channel Islands National Marine Sanctuary (CINMS)

On the cutting edge...
Personnel at the Channel Islands National Marine Sanctuary, Channel Islands National Park, and University of California, Santa Barbara are on the cutting edge of science. They are using the latest technologies to monitor the habitats found within the sanctuary. They are using a variety of monitoring techniques to collect baseline data about the status of marine resources. These data sets can then be used to better manage and protect the sanctuary.

Introduction to the CINMS

Lesson Objectives: Students will be able to do the following:
• Name the islands surrounded by the sanctuary
• Describe the factors contributing to the rich biodiversity of this area
• Compare and contrast “plumes” and “blooms”

Key concepts: national marine sanctuaries, Sustainable Seas Expeditions, Deepworker, oceanographic processes, sediment plumes, phytoplankton blooms

CINMS Overview

National Marine Sanctuaries are marine areas that have been designated for special protection because of their rich biological and/or cultural resources. The National Marine Sanctuaries Program (NMSP), administered by the National Oceanic and Atmospheric Administration (NOAA), within the Department of Commerce was established in 1972 as a result of a growing awareness about the need to protect our ocean ecosystems. One of the contributing factors to the designation of the NMSP and eventual establishment of the Channel Islands National Marine Sanctuary was a 1969 oil well blowout off the coast of Santa Barbara, which released four million gallons of crude oil and killed thousands of marine organisms. This spill, perhaps more than any other environmental disaster, galvanized public opinion to protect our coasts and led to the creation of the Marine Protection, Research and Sanctuaries Act of 1972, under which the National Sanctuaries were first established. There are currently 13 national marine sanctuaries around the country. To learn more about these special places for scuba diving, sport fishing, and wildlife viewing log on to http://www.sanctuaries.noaa.gov/
The Channel Islands National Marine Sanctuary was established in 1980. This area was set aside to protect the diverse marine life, habitats, and cultural resources found in this region. The CINMS is located 22 nautical miles off the coast of Santa Barbara, California and encompasses 1252 square miles of ocean habitat. CINMS boundaries extend from mean high tide to six nautical miles offshore San Miguel, Santa Rosa, Santa Cruz, Anacapa, and Santa Barbara Islands. A fertile combination of warm and cool currents in this area results in a great variety of plants and animals including large nearshore forests of giant kelp, flourishing populations of cetaceans, pinnipeds, and marine birds. The secluded relatively undisturbed waters of the Sanctuary also provide full or part-time homes for several endangered species including blue, humpback, and sei whales, southern sea otters, the California brown pelican, and the California least tern. The primary goal of CINMS is to protect the marine life, habitats, and cultural resources within its boundaries. The sanctuary also allows multiple uses such as recreation, wildlife viewing, fishing and boating that are compatible with the goal of resource protection.

Physical oceanographic processes such as water movement and weather conditions help create the distinctive aquatic environments found in the CINMS. The waters on the northeastern margins of the northern Channel Islands are impacted by water flowing through the Santa Barbara Channel. Within the channel, cold water from the southern flowing California Current meets the warmer, northbound waters of the Southern California Countercurrent. This water movement creates a circular current in the channel. This swirling water picks up and carries nutrients throughout the system. These nutrients are food for animals that live within this area. They are also the raw materials for plants to use in the process of photosynthesis.

Weather conditions such as offshore winter winds create upwelling. This process brings nutrients to the top of the water. These are just two examples of how the natural balance
is continually changing within the
sanctuary. By preserving and
studying these systems, scientists
hope to learn more about the kelp
forests, rocky intertidal zones, and
seagrass meadows found within the
sanctuary.

The islands within the
sanctuary began to form
fourteen million years
ago. At this time the
Southern California
coast was going through
volcanic changes. The polar ice caps
were also changing. They had cycles
of freezing and thawing. These
events created the present day
California coastline. At the same
time, the underwater area that lies
between the California coast and the
Channel Islands was being formed.
This region, known as the
Continental Borderland, has some of
the most varied underwater
topography on Earth. Today
scientists think that the physical
movement of two tectonic plates
caus{ed} many of these underwater
features. As these plates converged
and sheared to the right, the sea
c{om}b{ot}tom began to push upward in a
series of ridges. In the last ice age
these ridges appeared above the
water level. They formed one big
is{land} known as Santarosae. As the
ice began to melt, the sea level rose.
This created the chain of islands
called the Channel Islands. Changes
in sea level also helped to form low
underwater ridges next to the islands
and deeper bowl shaped basins
further from shore. Some of these
basins are 1500 feet deep. Other
underwater landscape includes
seamounts that were once active
volcanoes, deep
canyons, and
steep slopes or
escarpments.
These areas are
home to abalone,
scallops, lobsters, rockfish, and
many other species.

Research within the Sanctuary

The Sanctuary has
developed many
partnerships to carry
out research within
the region. These
partnerships provide
cost effective ways to monitor the
marine resources and habitats within
the sanctuary. Detailed information
from these studies also helps
managers create regulations or
develop educational programs to
protect the natural resources within
the sanctuary.

One research partnership is with the
Sustainable Seas Expeditions (SSE).
The SSE is a national program that
began in 1998 and will continue for
d{o}v{e}r five years. The purpose of the
expeditions is to use a one person
submersible to explore the
depthwater habitats of the national
marine sanctuaries. SSE is a
partnership between the National
Geographic Society, the National
Oceanic and Atmospheric
Administration (NOAA), and the
Richard and Rhoda Goldman Fund.
To learn more about the goals of the expeditions log on to http://www.sustainableseas.noaa.gov/

The expeditions are headed by Dr. Sylvia Earle, the National Geographic Society’s Explorer-in-Residence. Dr. Earle and other researchers have been using DeepWorker as a research tool to explore underwater areas of the sanctuary. This one-person submersible is able to explore ocean depths up to 2,000 feet (600 meters). This technology allows scientists to pilot the submersible and collect their own data. Scientists can learn about the natural history of an area and record the types of plants and animals that live there using an onboard video camera. They can also use their experiences to help them plan new studies. All of the information collected can be used as a database for future ocean management and resource protection.

In addition to the SSE, the CINMS carries out its own research programs. These programs evaluate ecosystem health. (To learn more about research programs within the sanctuary log on to http://www.cinms.nos.noaa.gov/res.stm). Some examples of research projects supported by the sanctuary include sea bird monitoring, blue whale research, water quality monitoring, and Plumes and Blumes (described below).

In order to carry out such research, the CINMS operates two research vessels and an aircraft. The Sanctuary Aerial Monitoring and Spatial Analysis Program (SAMSAP) uses an airplane equipped with special data collection software. This plane conducts aerial surveys. It monitors boat traffic and marine mammal populations. The plane flies a predetermined inner and outer loop twice a week. Data collectors on board enter information into a computer program that automatically records the coordinates for each sighting. At the end of the survey, the computer program creates pictures of the data. These diagrams can be displayed over a basemap. Other layers of data can be added to give a more in-depth profile. This new technology is part of a Geographic Information System (GIS).

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**Life at Land Margins**

Aquatic habitats within the sanctuary are continually changing. Moving water carries nutrients and pollution. Strong winds cause larvae to be dispersed and help move water. Rainwater runoff changes the salinity and water turbidity. The amount of sunlight affects plant...
production and water temperature. As these changes take place, researchers have noticed that the color of the ocean also changes. Scientists from the University of California at Santa Barbara, NOAA researchers, and sanctuary personnel are interested in finding out the source of these color changes. They are using satellite imagery as one of the tools in their study.

Researchers are looking at two causes of color change: winter plumes and spring blooms. Plumes occur when winter rains wash sediment from streams and creeks into the channel. Sediment materials include sand, mud, clay, and debris. A small fraction of this sediment can stay suspended in the water column. Heavier particles settle to the bottom. This sediment can turn the water brown and can block sunlight. This in turn limits photosynthetic production. Fish may also be affected by fine particles. Blooms occur during the spring months due to increased nutrient concentrations and increased sunlight. These increases cause the primary producers of the sea called phytoplankton to grow and reproduce resulting in a population explosion or a bloom. For most phytoplankton blooms, the water turns green, as these organisms contain chlorophyll. Some unusual phytoplankton blooms change the ocean color to brown, yellow, and even orange. Scientists are recording their findings. They want to create a historical record. This will help them understand the controls on phytoplankton production for this region and to assess the effects of climate changes over time.

During the Plumes and Blooms project, research vessels collect water samples twice a month from several locations across the channel. The scientists measure water temperature, salinity, particulate silica levels, chlorophyll levels, and turbidity as a function of depth. Satellite pictures of the channel are also taken. These images of ocean surface properties are then compared to the onboard information. Researchers continue to repeat their experiments over long periods. This helps them pinpoint the sources of ocean color changes and learn how to use these changes to monitor marine resources from space.
Activity: Where’s the Wreck?

This is an introductory activity adapted from information located on the CINMS Shipwreck page. To complete a study of sanctuary shipwrecks online and have lots of fun go to http://www.cinms.nos.gov/shipwreck/shiphome.html

Shipwrecks are one of the cultural artifacts found within the Channel Islands National Marine Sanctuary (CINMS). These shipwrecks are interesting to study from several viewpoints. Historians can learn about past cultures. Scientists can learn about the oceanographic processes that caused the wrecks. Sanctuary managers can learn more about the impacts of humans on the environment.

Objectives: Students will be able to do the following:
1. Define latitude and longitude.
2. Explain how to locate points on a map.
3. Use information to plot shipwreck points on a map.

Materials:
- Writing instrument
- Copy of map
- Information from table

<table>
<thead>
<tr>
<th>SHIP</th>
<th>DATE LOST</th>
<th>CAUSE</th>
<th>CARGO</th>
<th>LATITUDE</th>
<th>LONGITUDE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adriatic</td>
<td>Dec. 1930</td>
<td>Collision with log</td>
<td>Fish (Sardines)</td>
<td>33° 23’ N</td>
<td>119° 06’ w</td>
</tr>
<tr>
<td>Chicasaw</td>
<td>Feb. 1962</td>
<td>Navigation</td>
<td>Toys</td>
<td>33° 53’ N</td>
<td>120° 07’ W</td>
</tr>
<tr>
<td>Comet</td>
<td>Aug. 1911</td>
<td>Faulty Chronometer</td>
<td>Lumber</td>
<td>34° 03’ N</td>
<td>120° 23’ W</td>
</tr>
<tr>
<td>Goldenhorn</td>
<td>Sept. 1892</td>
<td>NE currents, off course</td>
<td>Coal, bituminous</td>
<td>33° 58’ N</td>
<td>120° 13’ W</td>
</tr>
<tr>
<td>Lady Christine</td>
<td>Nov. 1997</td>
<td>Improper Lookout</td>
<td>None</td>
<td>34° 03’ N</td>
<td>120° 23’ W</td>
</tr>
<tr>
<td>Lotus</td>
<td>Sept. 1921</td>
<td>Fire</td>
<td>General</td>
<td>34° 00’ N</td>
<td>119° 11’ W</td>
</tr>
<tr>
<td>Winfield Scott No. 3</td>
<td>Dec. 1853</td>
<td>Navigation in fog</td>
<td>Gold Bullion and Mail</td>
<td>34° 01’ N</td>
<td>119° 23’ W</td>
</tr>
<tr>
<td>W T Co No. 3</td>
<td>July 1935</td>
<td>Unseaworthy</td>
<td>Film Crew</td>
<td>34° 01’ N</td>
<td>120° 27’ W</td>
</tr>
</tbody>
</table>
Procedure:
1. Review the following concepts: latitude, longitude, degrees, minutes, coordinates, and hemispheres. Have students practice plotting points using map coordinates.
2. Discuss the importance of studying shipwrecks. Some good questions to discuss may include the following:
   • How do people study shipwrecks?
   • Why do people study shipwrecks?
   • What can shipwrecks tell us about the past?
   • What type of scientific information might we learn from shipwrecks?
3. Explain that this activity will focus on some shipwrecks in the Channel Islands National Marine Sanctuary. Have students work individually or in groups.
4. Hand out a map to each student. Have the information on the table available to everyone.
5. Have students plot the locations of the eight shipwrecks on the map.
6. Have students answer the following questions:
   • What two shipwrecks have the same coordinates?
   • How many of the ships were named for people?
   • Do the shipwrecks tell us anything about life in the past?
   • Can you make any generalizations about the locations of the shipwrecks?
   • How many shipwrecks were caused by human error? How many shipwrecks were caused by technological problems? How many shipwrecks had environmental causes? Support your answers.
   • What other information might be helpful when trying to answer these questions?
7. Have students research information to help support or refute their answers. If you have internet access log on to http://www.cinms.nos.gov/shipwreck/shiphome.html Then click on “Database” to find more information about these shipwrecks.

Possible Extensions:
1. Have students research other shipwrecks and create a portfolio of information to show how these artifacts represent historical records that are useful today.
2. Have students research cultural artifacts in their community. Have them explain the societal, technological, and scientific impacts that result from the understanding gained by studying these artifacts.
Student Information: Visiting the Channel Islands Area

The Channel Islands National Marine Sanctuary is located off the coast of southern California. It includes the waters surrounding the five islands of Santa Barbara, Anacapa, Santa Cruz, Santa Rosa, and San Miguel. The Channel Islands National Park includes the land areas of these islands and shares control of their surrounding waters out to one nautical mile with the sanctuary.

Visitors can enjoy the natural beauty of the land and water environments found within this area. The endangered, brown pelican can be viewed in its only permanent California colony. Seals and sea lions can be seen in their colonies along the beaches of San Miguel Island. Visitors can also find more than thirty species of marine mammals within the waters including whales, dolphins, seals, and sea otters. Island visitors can look for interesting tidepool creatures including sea anemones and shore crabs. Divers can explore the rocky reefs or the kelp forests as they look for sponges and lobsters.

Visitors to this area can also learn about the Chumash or island people. The Chumash existed on the Channel Islands for at least 8,000 years (some archeologists estimate as long as 30,000 years). These people traveled the Santa Barbara Channel in plank canoes called “tomols”. The Chumash maintained active trade routes between the islands and the mainland. They produced shell beads to be used in their economy.

Shipwrecks can also be found in the waters surrounding the Channel Islands. These shipwrecks attract marine life and create beautiful spots for divers to explore. More than 100 shipwrecks have been discovered in the Channel Islands National Marine Sanctuary. Historic ships and archaeological sites are national treasures and are protected by law. No artifacts can be removed from these important cultural resources. We will all be able to enjoy these areas for years to come if we visit responsibly.