Unit I The Channel Islands National Marine Sanctuary (CINMS)

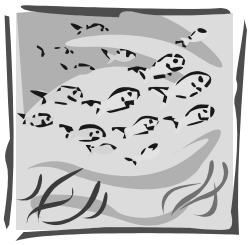
On the cutting edge…
Personnel at the Channel Islands National Marine Sanctuary, Channel Islands National Park, and University of California, Santa Barbara are on the cutting edge of science. They are using the latest technologies to monitor the habitats found within the sanctuary. They are using a variety 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

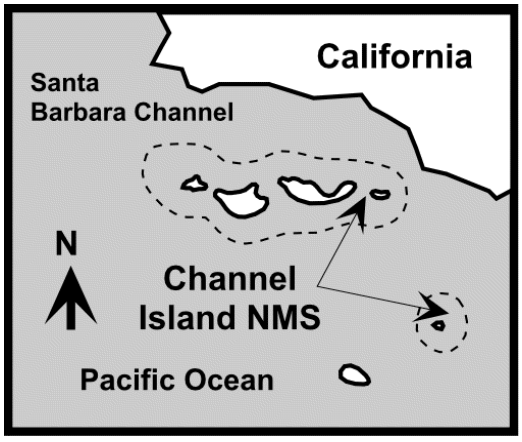
Lesson Objectives: Students will be able to do the following:
- Name the islands surrounded by the sanctuary
- Describe the factors contributing to the rich biodiversity of this area
- Compare and contrast “plumes” and “blooms”

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

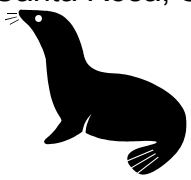
CINMS Overview



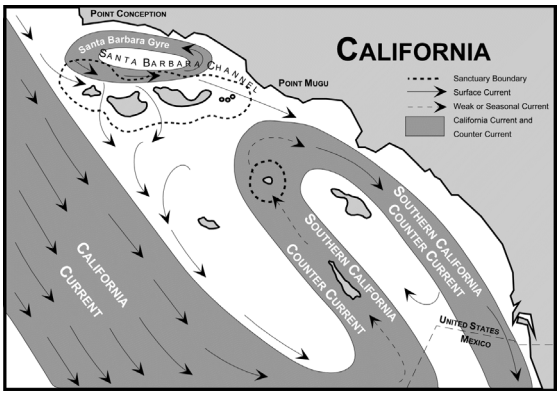
National Marine Sanctuaries are marine areas that have been designated for special protection because of their rich biological and/or cultural resources.
The National Marine Sanctuaries Program (NMSP), administered by the National Oceanic and Atmospheric Administration (NOAA), within the Department of 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.



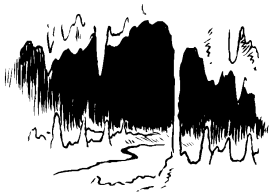
Physical oceanographic processes such as water movement and weather conditions help create the distinctive aquatic environments found in the CINMS. The waters on the northeastern margins of the northern Channel Islands are impacted by water flowing through the **Santa Barbara Channel**. Within the channel, 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** caused many of these underwater features. As these plates converged and sheared to the right, the sea bottom 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 island 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.



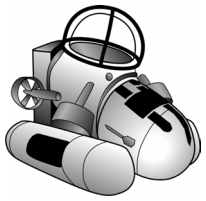
Research within the Sanctuary

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 five years. The purpose of the expeditions is to use a one person **submersible** to explore the deepwater 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.



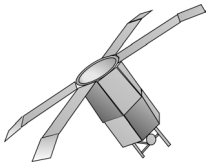
In addition to the SSE, the CINMS carries out its own research programs. These programs evaluate ecosystem health. (To learn more about research programs within the sanctuary log on to http://www.cinms.nos.noaa.gov/res.stm). Some examples of research projects supported by the sanctuary include sea bird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

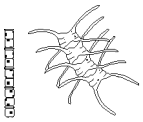
Life at Land Margins

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.



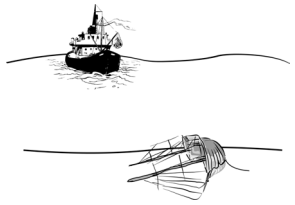
During the Plumes and Blooms project, research vessels collect water samples twice a month from several locations across the channel. The scientists measure water temperature, salinity, particulate **silica** levels, chlorophyll levels, and turbidity as a function of depth. Satellite pictures of the 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

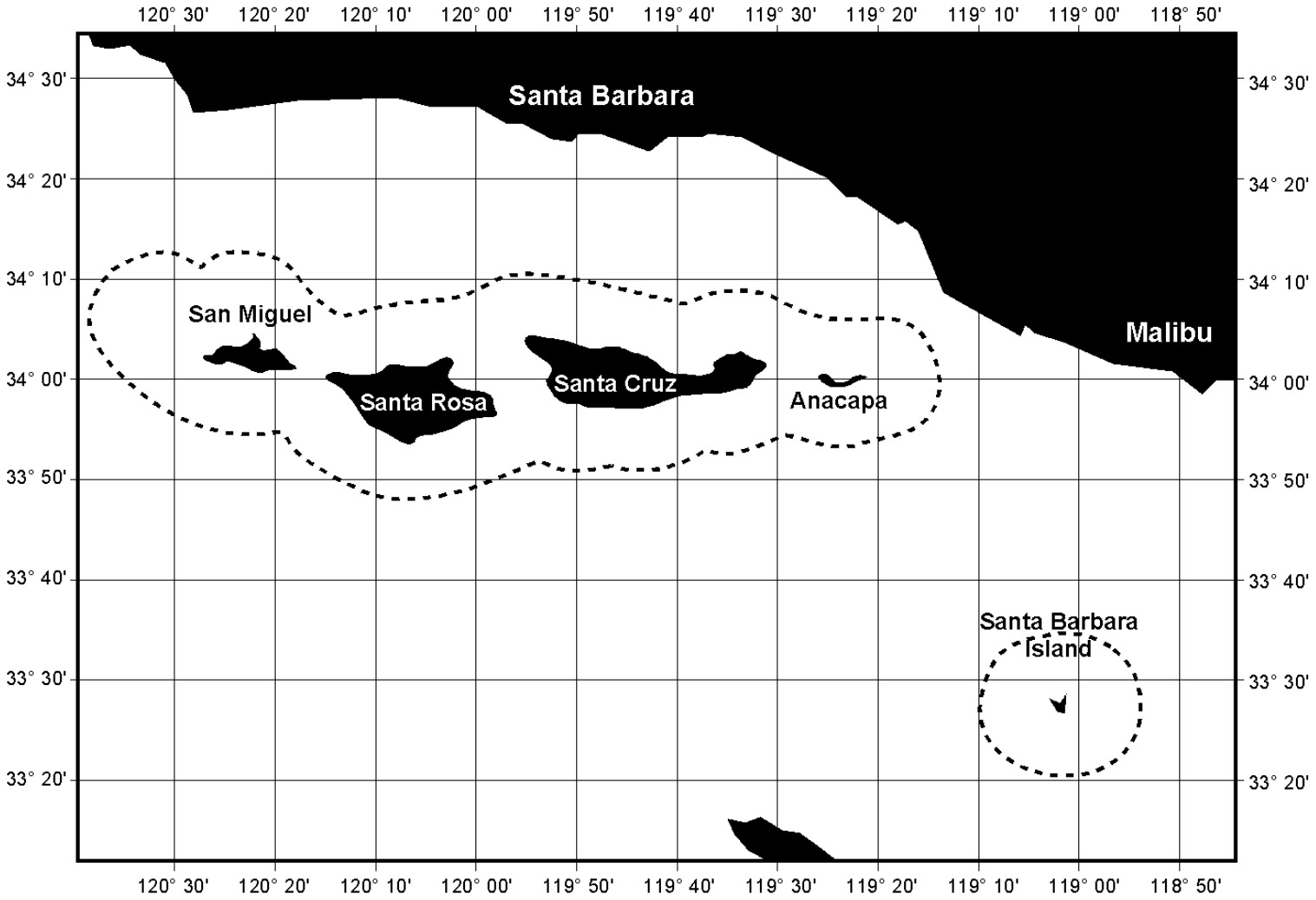
SHIP	DATE LOST	CAUSE	CARGO	LATITUDE	LONGITUDE
Adriatic	Dec. 1930	Collision with log	Fish (Sardines)	33° 23' N	119° 06' w
Chicasaw	Feb. 1962	Navigation	Toys	33° 53' N	120° 07' W
Comet	Aug. 1911	Faulty Chronometer	Lumber	34° 03' N	120° 23' W
Goldenhorn	Sept. 1892	NE currents, off course	Coal, bituminous	33° 58' N	120° 13' W
Lady Christine	Nov. 1997	Improper Lookout	None	34° 03' N	120° 23' W
Lotus	Sept. 1921	Fire	General	34° 00' N	119° 11' W
Winfield Scott	Dec. 1853	Navigation in fog	Gold Bullion and Mail	34° 01' N	119° 23' W
W T Co No. 3	July 1935	Unseaworthy	Film Crew	34° 01' N	120° 27' W

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.


120° 30'
120° 20'
120° 10'
120° 00'
119° 50'
119° 40'
119° 30'
119° 20'
119° 10'
119° 00'
118° 50'
34° 30'
34° 20'
34° 10'
34° 00'
33° 50'
33° 40'
33° 30'
33° 20'
Santa Barbara
Malibu
San Miguel
Santa Rosa
Santa Cruz
Anacapa
Santa Barbara Island

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.