

SB-EDLP-002-2007

Grade Level: 5-12
Time Required: 1-2 hrs

Disciplines:

Biology
Geography
Geology
Marine Science
Marine Policy

Materials Needed:

• 4 Maps and Background
Information included here

Optional Materials:

• Access to Internet for additional resources and technical information



Even small vessels can cause significant damage if they hit a whale. Collisions between a large ship and whale will probably result in the animal's death.

Photo Credits: Injured whale (above) and Tanker and whales (at right) by WCNE (SBNMS file photos); taken under NOAA Fisheries Permit # 981-1701-00.



GERRY E. STUDDS
STELLWAGEN BANK
NATIONAL MARINE SANCTUARY

Collision Course

Using Scientific Data to Support Marine Policy to Protect Whales from Ship Strikes



Objectives:

- To be able to compare and contrast data from various sources.
- To analyze a problem and develop a potential solution using scientific data.
- To be able to work together in decision-making groups.
- To understand issues related to marine mammal protection.

Background:

One of the major reasons why Stellwagen Bank was designated as a National Marine Sanctuary in 1992 was because of the large numbers of whales that regularly visit the area. Many of these whales come to feed on masses of small schooling fish -- primarily sand lance (pencil-thin fish that bury themselves in the sand for protection). Of particular importance in this group, are the endangered humpback whales -- the acrobats among cetaceans and the whale watcher's favorite subject. Fin whales (or finbacks), another endangered species, and minke whales, along with Atlantic white-sided dolphins are also commonly seen feeding on these schooling fish.

The critically endangered North Atlantic right whale (with less than 400 remaining in the population) also visits the waters in and around the sanctuary. This species of cetacean feeds on zooplankton, preferring small shrimp-like crustaceans called "copepods" (with *Calanus finmarchicus* serving as the species of choice).

Over the years, even before the sanctuary was designated, whale researchers and whale watchers had been compiling sightings of these whales. This information became an important tool for research, resource protection, policy development and management once the sanctuary was established.

Using data from the Provincetown Center for Coastal Studies, the Whale Center of New England in Gloucester and the Right Whale Consortium, the sanctuary was able to build a 25-year database of over a quarter of a million whale sightings. The resulting maps show which specific parts of the sanctuary have higher historic sightings of whales.

Shipping Lanes to Boston

Although whale watching vessels and research vessels ply the waters of the sanctuary from spring to fall, other types of ships cross the sanctuary on a regular, and year-round, basis. Cargo ships, oil and LNG tankers, cruise liners, and other large vessels travel through all parts of the sanctuary, but with the greatest concentration using the Travel Separation Scheme (TSS), also known as the Boston shipping lanes. These lanes were delineated well before the creation of the sanctuary, and were established by the International Maritime Organization (a part of the United Nations). The route, marked on all navigation charts, passes directly through the southern portion of the sanctuary, in a region with a high degree of whale sightings. Shipping lanes are placed in areas with depths well below the draft of large vessels, and usually in the most direct path to the major port, as additional at-sea time means additional costs to the industry.

Shifting the Shipping Lanes Activity

Sanctuary managers and marine mammal resource protection specialists have decided that, in the interest of reducing ship strikes, the shipping lanes should be moved. Based on the background material presented above and the maps on the next page, develop a plan for a new Traffic Separation Scheme.

Sanctuary staff worked closely with cetacean researchers, the National Marine Fisheries Service, the U.S. Coast Guard, and the shipping industry in developing a plan. In this activity, you will work in groups, with individuals representing the sanctuary, whale scientists, the Coast Guard, the LNG companies, and the shipping industry, to develop new shipping lanes that will reduce potential interactions between ships and whales.

Procedure:

- 1. Set up groups of 5-6 individuals and assign roles.**
- 2. Work independently to analyze maps and develop ideas for a new Traffic Separation Scheme.**
- 3. Come together to discuss problems and possible solutions.**
- 4. Map out a route and write a justification for the plan using the best scientific data.**
- 5. Have a spokesperson for your group present your plan to the International Maritime Organization (the entire class).**

Dangerous Crossings

According to whale researchers and resource managers, ship strikes and entanglement in fishing gear are two of the major causes of whale mortality. In 2006, of the six observed right whale carcasses, four deaths were attributed to ship strikes, one to entanglement, and one was unknown. The sanctuary region over the years has become a hot spot for ship strikes, due to the high concentration of both ships and whales. Sanctuary staff believe that reducing ship strikes is a key objective in fulfilling the sanctuary goal of resource protection, and in complying with the Endangered Species Act and the Marine Mammal Protection Act.

A Place for Research

In addition to the wealth of whale sightings data, the sanctuary has become a focal point for other studies. The U.S. Geological Survey chose the sanctuary as the site for a major seafloor mapping project. Using multibeam and side scan sonar systems, video and still imaging and sediment sampling, scientists have not only been able to map the sanctuary's bathymetry, but have also located specific seafloor habitats. The three major types are mud/silt, sand, and gravel. Each of these habitats supports distinct arrays of marine species, such as cod on boulder ridges and gravel beds and sand lance on the sandy banks.

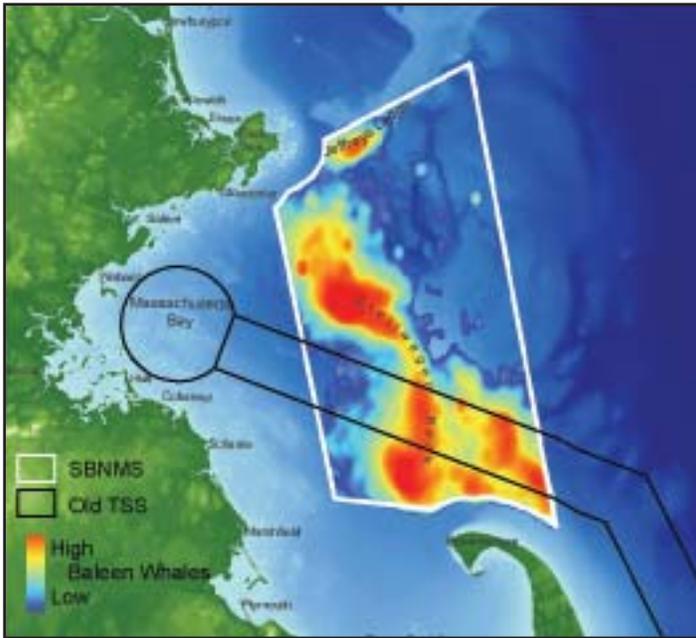
Other Important Information

Computer models by physical oceanographers show that plankton in Massachusetts Bay can be pushed by prevailing currents and collect in Cape Cod Bay and the southern section of the sanctuary.

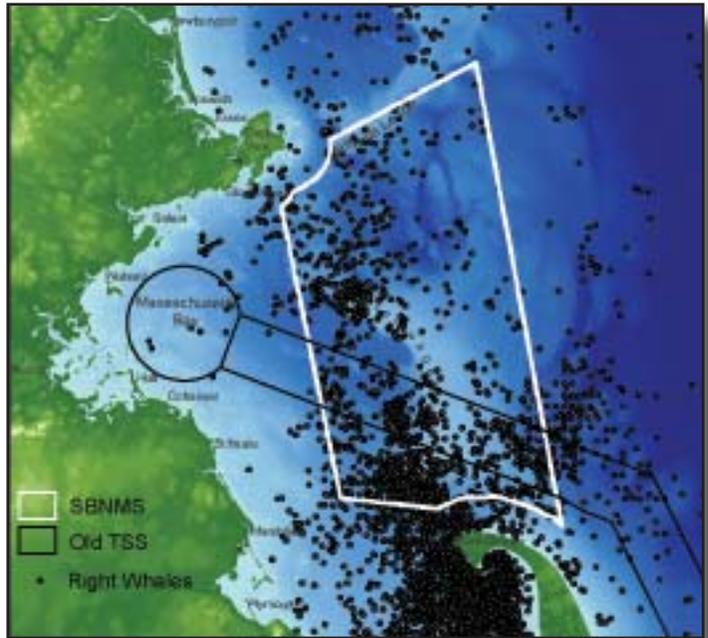
The waters of Massachusetts Bay are used for various purposes. The Mass Bay Disposal Site for clean dredge materials is just to the west of the sanctuary boundary in Stellwagen Basin. The MWRA outfall pipe is located nine miles east of Boston in Massachusetts Bay. Two liquid natural gas (LNG) companies applied for and had permits approved for the creation of offshore LNG ports in Massachusetts Bay, in an area west of the sanctuary, outside of the state boundary, and north of the old TSS. Because of the massive damage that an accident or terrorist attack to a LNG tanker could cause, the Coast Guard requires a one-mile exclusion zone around the terminals.

When the shipping lanes to Boston were established, they were set at two miles wide for both inbound and outbound lanes with a one-mile wide separation alley between the lanes. Use of this Traffic Separation Scheme is highly recommended but not officially required by the U.S. Government and the IMO.

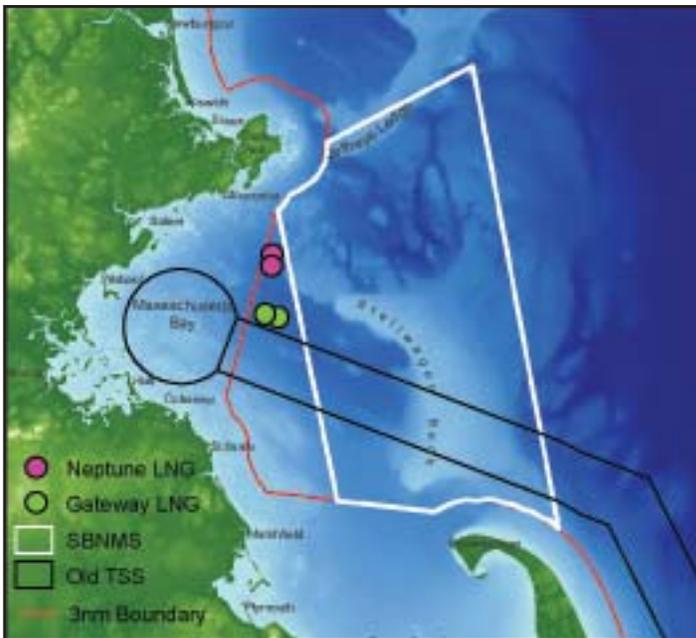
Shifting the Shipping Lanes Activity Maps



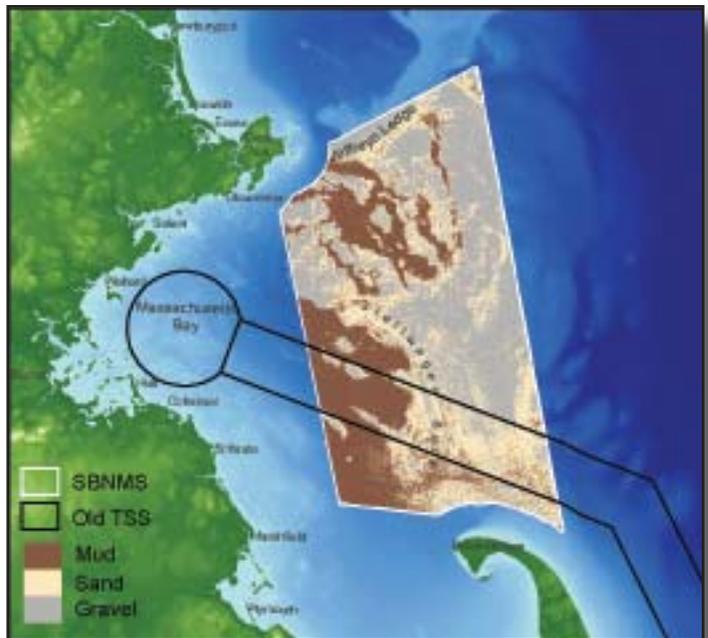
Density of Baleen Whale Sightings over 25 Years



North Atlantic Right Whale Sightings for 25 Years



LNG Ports, State and Sanctuary Boundaries

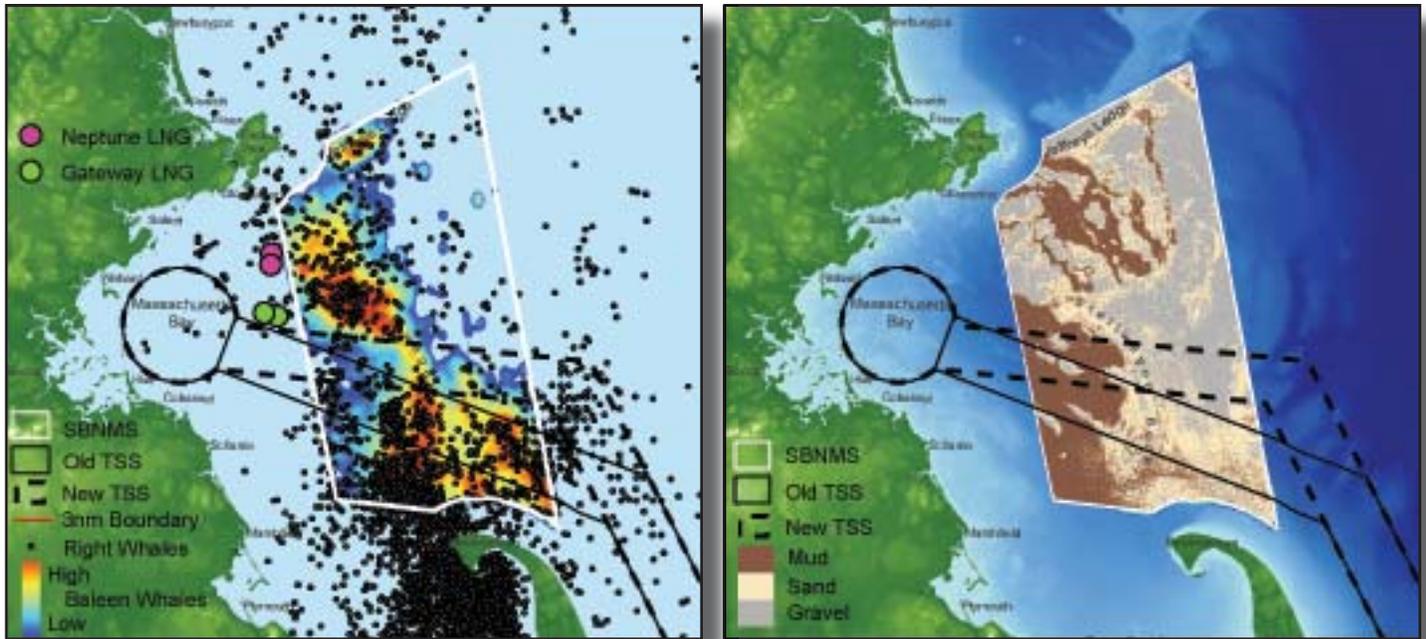


Sediment Characterization of Sanctuary Seafloor

Shifting the Shipping Lanes Stellwagen Bank National Marine Sanctuary Solution

Changing the location of officially sanctioned shipping lanes into and out of Boston is not something that can be done easily – the consequences affect not just American vessels but international commerce. Shipping lanes are assigned by the International Maritime Organization (IMO), a part of the United Nations.

In 2006, sanctuary scientists worked with whale researchers, the National Marine Fisheries Service, the U.S. Coast Guard and the shipping industry to develop a new Traffic Separation Scheme (the Boston shipping lanes) that would greatly reduce the risk of ship strikes on sanctuary whales. The proposal won overwhelming support at the November 2006 IMO meeting. As a result, a less dangerous course was adopted, and implemented on July 1, 2007.



Using a 35-year database of over a quarter of a million whale sightings from whale watch and whale research trips, sanctuary scientists showed that the heaviest concentrations of whales were located directly in the old shipping lanes. The probability of future sightings in these areas was substantiated by ecological studies. Most of the whales target sand lance, a small schooling fish, which prefers sandy sediments that predominate in the areas with the historically high whale sightings. The new lanes pass over an area that is mostly mud and gravel, unattractive to sand lance and therefore not likely to attract large numbers of whales. For North Atlantic right whales, which feed on small planktonic crustaceans, prevailing currents push their food into Cape Cod Bay and the southern portion of the sanctuary where the old lanes were located. The new TSS avoids the richer plankton areas according to the computer model.

To reduce the ship strike threat to great whales, the sanctuary proposed that the lanes be shifted a few miles northward into a low density area. However, the initial revision would have resulted in a conflict with the new LNG ports and their exclusion zones. After consulting with the Coast Guard, the sanctuary found that IMO had no specific requirement on lane width. By narrowing both the inbound and outbound lanes by one-half mile each (from two miles to one and a half miles wide each way) and keeping the one mile separation alley, the new Separation Scheme could avoid the LNG terminals and better avoid the areas with higher densities of whales. Calculations indicated that for most vessels, the change would only add a few minutes to transit times but would dramatically reduce the potential of a ship hitting a whale – 81% for all whales (humpback, fin, minke, northern right) and 58% for the critically endangered right whale.

Stellwagen Bank National Marine Sanctuary continues to support research projects that focus on whale behavior and distribution in an effort to better protect these fascinating creatures.