

Satellite Pursuit: Tracking Marine Mammals

Material adapted from:

[Monterey Bay Research Institute, EARTH: Satellite Tracking](#)

[OPB NOVA Teachers: Ocean Animal Emergency](#)

[Teach Engineering: Marine Animal Tracking](#)

Introduction:

Tagging and tracking marine animals can provide scientists with valuable information about animal location, migration, behavior, and physiology as well as conditions in ocean ecosystems. Several systems are currently being used to track marine mammals, including satellite/GPS tracking systems, radio navigation tracking systems, and bioacoustic tracking systems.

In this activity students will become familiar with satellite tracking procedures and use various tracking techniques to track each other's activities, as well as plot online marine mammal data.

Objectives:

Students will be able to:

- Describe how and why different marine mammals are tagged with tracking devices
- Describe different methods scientists use to track marine mammals
- Explain how animal habitats are mapped in the marine environment
- Collect, interpret and apply data related to the mapping of a marine habitat
- Draw conclusions about marine mammal behavior based on tracking data

Ocean Literacy Principles

These activities support:

- Essential Principle # 5: The ocean supports a great diversity of life & ecosystems
- Essential Principle # 7: The ocean is largely unexplored

Materials:

Notebooks/Writing Materials

Computers with Internet Access

Handouts/Transparencies:

Student Tracking Worksheet

Map of student tracking location (optional)

Diving into Research

Marine Mammal Tracking Data

Tracking Data Map

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Part A: Student Tracking

1. Introduce the topic of satellite tracking to the students. Divide the class into partner pairs and have each student “track” their partner for a specified period of time (e.g. one school day) or, if more appropriate, have the students track themselves. A map of the location (e.g. the school grounds) could also be provided to mark tracking locations. Decide what information is necessary or interesting to record on their Student Tracking Sheet. Encourage students to consider the following factors:
 - Time/Location
 - How often should readings be taken? Will this affect the “resolution” of the data?
 - How should students record location? (e.g. Latitude/Longitude, site description)
 - How specific should readings be?
 - Environmental conditions
 - How can temperature be measured, recorded or described?
 - What are the light conditions? (e.g. natural, artificial)
 - What are the audio conditions? (e.g. quiet, talking, TV)
 - If outside, how to measure, record or describe weather conditions?
 - Behaviors
 - Feeding
 - What is being eaten?
 - What was the food source?
 - How was the food consumed?
 - How much food was consumed?
 - How often does feeding occur?
 - Resting
 - What conditions are optimal for resting?
 - How long does each period of rest last?
 - Social interaction
 - What is the usual group size during interaction?
 - What is the gender mix?
 - Are there specific behaviors during interaction?
2. Discuss what types of units students may encounter during this study. Also discuss the problems associated with using different measurement methods and the importance of assigning units.
3. Once tracking is completed, have the students create a tracking map or other graphical representation of their data. Have the students discuss:
 - Any patterns that emerged in the data they collected
 - Difficulties they encountered in data collection
 - What conclusions can they draw about the tracking subject?

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- What this activity can tell us about the obstacles scientists must overcome to study pelagic (open ocean) marine mammals
- How technology can increase scientific ability to collect information about far-ranging ocean animals

Part B: Satellite Tracking

1. Divide the students into small groups and assign them to a computer with Internet access.
2. After viewing, explain that different types of tagging devices are used on a variety of marine animals, such as:
 - Cetaceans (Whales, dolphins & porpoises)
 - Pinnipeds (Seals, sea lions and walruses)
 - Sea Otters
 - Sea Turtles
 - Sharks
 - Fish

Which kind of tag is used depends on several factors, including the *range* of the animal being tracked and how much *time* the animal spends above water. Brainstorm with the class some of the data that might be collected from the different types of tags (e.g. location, diving behavior, swim velocity and ocean temperature).

3. Have the students watch the following videos to introduce them to the idea of satellite tagging:
 - [The Great Whale Trail: Tagging the Whales](#)
 - [Whale Tag](#)
 - [Tagging Elephant Seals](#)
4. Have the groups explore the [TOPP](#) website (Tagging of Pacific Predators). Direct them specifically to:
 - Interactive TOPP Predators [Tagging Map](#) (on homepage)
 - [About TOPP](#)
 - The different [TOPP Predators](#)
 - [TOPP Data](#) - Specifically click "[View the Live Data](#)" and explore the real time data sets
5. Distribute the Diving into Research handout. Assign each group one of the following animals to research:
 - California Sea Lion
 - Gray Whale
 - Harbor Seal
 - Northern Elephant Seal
 - Northern Fur Seal

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Students should research the following information about their group's animal:

- The animal's normal range and habitat.
- The animal's normal breeding season and breeding location.
- Whether the animal migrates, and, if so, its normal migratory route and season.
- How much time the animal spends in water versus on land
- How quickly the animal swims and/or how far it tends to travel in a day.

6. Direct students to the following Web sites to begin their research:

[Introduction to Marine Mammals](#) Web Site

[Marine Mammal Education](#) Web Site

[Pinniped Species Information Pages](#) Web Site

You may also have students visit additional sites or use other reference materials.

7. Inform the students they will now be plotting real data from a tagged marine mammal. Distribute the Marine Mammal Tracking Data handout, as well as the Tracking Data Map.
8. Have each group plot the data from the Tracking Data handout onto the Tracking Data Map. They should label each point with the corresponding date and draw a line connecting the points to show the path of the marine mammal over time.
9. After the groups have completed their maps, ask the class what they can conclude about the animal's behavior, based on its location over time:
 - a. The animal travels between Southern California and the Aleutian Islands in Alaska, starting in March and returning in July.
 - b. The animal spends most of its time in the deep ocean; however, it does spend time on land in two areas—San Miguel Island, California and Nikolski, Alaska.
 - c. The animal spends about a month (May) in one small area of the ocean off the Aleutian Islands.
 - d. The animal can move quickly, sometimes covering hundreds of miles in a few days.
10. Tell students they are now going to try to identify the animal that was tracked based on both the information from the map and the earlier research they conducted in groups. Using all the information they learned about the five types of animals, teams should determine which animal they think is represented by the data set.

(The animal represented in the data is the northern elephant seal.)

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11. To wrap up the session, ask each team to present its reasoning and conclusions. Discuss as a class any differences in the choices made by teams.
- Why do students think the animal traveled such a great distance? (*For food.*)
 - How do students' needs for food get met compared to what the northern elephant seal has to do to obtain food? (*Students have fairly easy availability to food of many varieties; the northern elephant seal has to travel long distances to find and catch its own food.*)

Extensions:

1. As an extension or alternative data set, have the students plot data for other animal species. [WhaleNet](#), as well as [TOPP Live Data](#) provides real-time data sets that students can explore and plot. Students can also create [online maps](#).

Example data sets:

- WhaleNet active Satellite Tags
http://whale.wheelock.edu/whalenet-stuff/stop_cover.html
 - TOPP Near Real Time Animal Tracks
http://las.pfeg.noaa.gov/TOPP_recent/TOPP_tracks060.html
2. Have the students design a marine mammal tag for an animal of their choice. Students should explain type of technology is needed for the tag based on the marine environment. In addition, the students should take into account how the tag will be attached to the animal and its possible effects.

Vocabulary:

Cetacean

An order of marine mammals that comprises whales, dolphins and porpoises. They have a streamlined hairless body, no hind limbs, a horizontal tail fin, and a blowhole on top of the head for breathing

Pinniped

An order of carnivorous aquatic mammals, comprising seals, sea lions and walrus. They are distinguished by their flipper-like limbs.

Latitude

The angular distance north or south of the earth's equator, measured in degrees along a meridian, as on a map or globe

Longitude

Angular distance on the earth's surface, measured east or west from the prime meridian at Greenwich, England, to the meridian passing through a position, expressed in degrees

Sensor Tags

Technology used to log data on a range of environmental and behavioral patterns

Spatial

Where an object or animal is located

Tracking

To observe or monitor the course of an animal