

Lesson 3: Tracking the Gentle Giants– Teacher’s Key

Teaching Note: In this module designed to be used with GeoMapApp, the lessons are designed to be used in order, and increase in skill and complexity from Lesson 1 through Lesson 5. Lesson 1, Exploring the Seafloor with GeoMapApp, and Lesson 2, Journey Across the Pacific, include exercises for introduction of skills and menu options. Lesson 3, Tracking the Gentle Giants, is designed to introduce students to working with real world data sets and using the scientific method. Lesson 4, Maps As Scientific Tools and Lesson 5, Marine Reserves, guide students into higher order thinking, include more conceptual exercises, and encourage the application of skills and concepts in decisions making using GeoMapApp as a tool. It is recommended that Lesson 1 and 2 be done before Lesson 3,4 and/or 5. This lesson and the 2 following will have fewer screen shots and detailed instructions, and require that students have gained some level of proficiency and confidence in using the basic GeoMapApp skills.

Question 1. Describe the location of the North Atlantic Right Whale. The North Atlantic Right Whale is found in the North Atlantic Ocean, off the East coast of North America. The whales appear to be found close to shore, over the continental shelf. Some whales were found in bays very close to the shoreline.

Question 2. Describe the location of the Bowhead Whale. The bowhead whales were found in Arctic waters north of Alaska. The whales are found in near shore waters, over the continental shelf.

Question 3. Describe the location of the Blue Whale. The blue whales were found in the Eastern Pacific, in waters off the coast of California and Baja California in North America.

Note: refer back to the introduction, and examine the range maps of each species.

Question 4. Why do you think the data only covers a small area compared to the range maps presented in the introduction of this lesson? Hint: Look at the dates of the data.

The data only covers a small area compared to the total range as presented in the introduction of this lesson because the tags were only on for a short period of time. The whales did move through the entire range of their possible habitats before the satellite tags stopped transmitting signals.

Question 5. How many months were researchers able to collect satellite data for each species? Fill in the table below. For geographic range, use the cursor and notice the latitude and longitude information that displays in the GeoMapApp window.

	Geographic Range	Temporal Range (dates of tagging data)
Right Whale	31.2° → 45.23° N -81.01° → -62.28°W	July 9, 2000 → Dec 15, 2000
Bowhead Whale	69.02° → 72.18° N -177.17° → -133.66° W	Sept 1, 1992 → Oct 5, 1992
Blue Whale94	27.94° → 38.40° N -126.95° → -114.67° W	Sept 13, 1994 → Oct 15, 1994
Blue Whale95	9.62° → 39.87° N -125.82° → -98.27° W	Aug 8, 1995 → Dec 8, 1995

Question 6. Based on these data sets, estimate which tagged whale species covered the largest geographic range? Bowhead whales covered more distance in terms of longitude, while Blue whales had the longest range in terms of latitude.

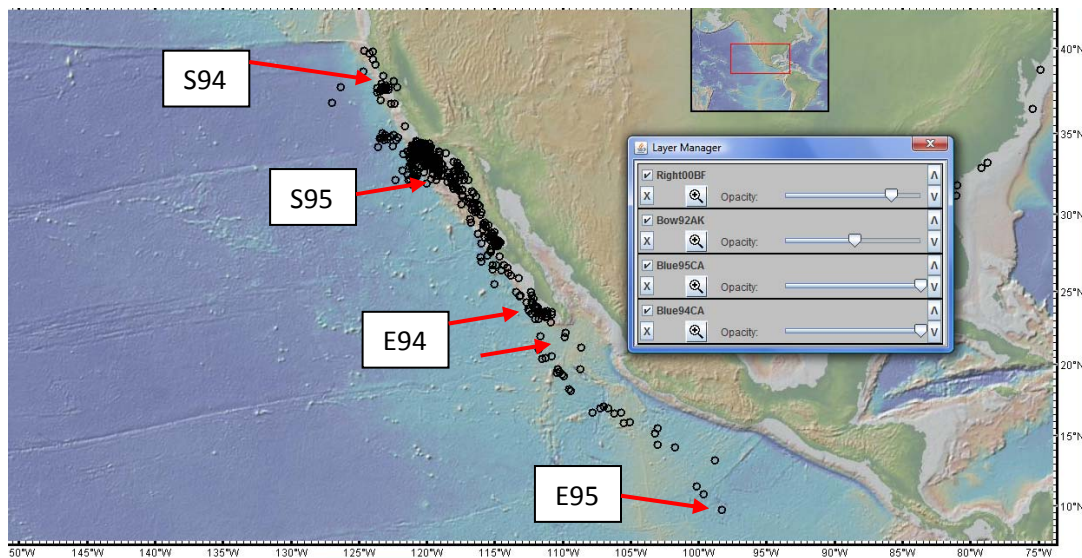
Question 7. How is temperature displayed visually on the map? Hint: What information does the color bar give you?

The ocean temperature range from -2° to 35°C. The cooler temperatures are displayed with blue and green colors, and the warmer temperatures are displayed with red and orange colors.

Question 8. Where are warmer ocean waters located? Around the world near the equator.

Question 9. Where are cooler ocean waters located? Towards the poles.

Question 10. What was the last date of data collected in 1995? Approximately how many months was data collected on blue whales in this year? December 8, 1995. 4 months.



Question 11. Label the map above with an “S94” near the start date for the BlueWhale94 data and an “E94” near the end data point for the BlueWhale94 data. Do the same using “S95” and “E95” for start and end points of the blue whale data collected in 1995.

Question 12. What range of temperatures did the blue whales travel through?

15° - 28° C. From light blue colors to orange.

Question 13. Using the scientific method and the data you have examined, propose a hypothesis about blue whale migratory movements and possible reasons for them.

Answers will vary. Check for understanding of the scientific method, especially the hypothesis, or question and the logic to support or discard the hypothesis.

Question 14. What are the units of primary productivity? mg/m³

Question 15. What range of primary productivity is found in the world’s oceans?

.01 – 60 mg/m³.

Question 16. What is the mission of the NEO? Welcome to NEO -- NASA Earth Observations. Our mission is to help you picture climate change and environmental changes happening on our home planet. Here you can search for and retrieve satellite images of Earth. Download them; export them to GoogleEarth; perform basic analysis. Tracking regional and global changes around the world just got easier!

Question 17. Use the Ocean-Chlorophyll Concentration Scale Bar and describe the pattern of Primary Productivity around the world. Describe the general patterns of relative concentrations (use the terms equator, polar regions, near shore, open ocean).

The highest concentrations of primary productivity are found near the polar regions, in near shore waters. Lower concentrations are found near the equator and in open ocean basins.

Question 18. Are Right Whales found in areas of high or low chlorophyll concentrations?
High.

Question 19. Describe the chlorophyll concentrations (primary productivity) in the Right Whale habitat. Hint: Notice that there are areas of high productivity (orange and red pixels). Where are these areas located? The Right Whales are found in shallow, near shore waters, near the areas of highest productivity, orange and red pixels. The clusters of data seem to correlate with the darker oranges and reds in the chlorophyll concentration image.

Question 20. Examine the blue whale data. Describe the range of chlorophyll concentrations in the areas where blue whales traveled. The blue whales are found in areas of medium to high primary productivity. Some of the data points were in green pixels, but the majority were located in the orange and red pixels, indicating the whales stayed or moved within areas of high primary productivity and chlorophyll concentration.

Question 21. Examine the bowhead whale data. Describe the range of chlorophyll concentrations in the areas where bowhead whales traveled. The bowhead whales also had a considerable number of locations in areas of high productivity, but unlike the blue or North Atlantic right whale, the bowheads seemed to travel out into areas of relatively low primary productivity. This could correlate with tracking during migrations towards breeding and calving grounds, which typically have lower productivity levels.