ocean explorer
oceanexplorer.noaa.gov

Exploring Alaska's Seamounts

# Biological Communities of Alaska Seamounts

## Focus
Biological communities on seamounts

## Grade Level
7-8

## Focus Questions
Do biological communities on seamounts become less similar as the distance between seamounts increases?

## Learning Objectives
Students will be able to infer why biological communities on seamounts are likely to contain unique or endemic species.

Students will be able to calculate an index of similarity between two biological communities given species occurrence data.

Students will be able to make inferences about reproductive strategies in species that are endemic to seamounts.

Students will be able to explain the implications of endemic species on seamounts to conservation and extinction of these species.

## Additional Information for Teachers of Deaf Students
In addition to the words listed as Key Words, the following words should be part of the list.
Productivity
Habitats
Microbial
Invertebrates
Commercial trawl fishing
Deepsea coral reefs
Endemic

The words listed as Key Words should be introduced prior to the activity. There are no formal signs in American Sign Language for any of these words and many are difficult to lipread. If some of this information has not already been covered in your class, you may need to add an additional class period to teach vocabulary and teach some of the Background Information to the students prior to the activity.

This is a very visual activity and represents the concept well to the students.

An excellent evaluation for the activity is to collect and review the graphs that the students made as part of the activity. Another evaluation tool would be to use the "Me" connection activity.

## Materials
- ❒ "Seamount Species Checklist," one for each group of students
- ❒ "Gulf of Alaska Seamounts" map, one for each group of students
- ❒ Dividers or rulers to measure distance between seamounts

## Audio/Visual Materials
None

## Teaching Time

One 45-minute period

## Seating Arrangement

Groups of two to four students

## Maximum Number of Students

24

## Key Words

Seamount
Endemic
Extinction
Coefficient of community
Biological community

## Background Information

Seamounts are undersea mountains that rise from the ocean floor, often with heights of 3,000 m (10,000 ft) or more. Compared to the surrounding ocean waters, seamounts have high biological productivity, and provide habitats for a variety of plant, animal, and microbial species. Numerous seamounts have been discovered in the Gulf of Alaska. Many of these seamounts occur in long chains that parallel the west coast of the U.S. and Canada. One of the longest chains, known as the Axial-Cobb-Eikelberg-Patton chain, is being intensively studied by the Ocean Exploration 2002 Gulf of Alaska Expedition.

Because seamounts are often isolated from large land masses as well as from each other, many biologists believe that they are likely to find new species on unexplored seamounts. In fact, a single research cruise to explore Australian seamounts collected 259 species of invertebrates, about a third of which were new to science, and up to 40% of these new species are thought to occur only on seamounts in the region. Unfortunately, seamount habitats are easily damaged by commercial trawl fishing. At the First International Symposium on Deep Sea Corals (August, 2000), scientists warned that more than half of the world's deep-sea coral reefs have been destroyed, and some believe that destruction of deep-sea corals by bottom trawlers is responsible for the decline of major fisheries, such as cod. Seamounts in the Gulf of Alaska appear to be relatively undisturbed, but their biological inhabitants have not been thoroughly studied and may include unique species found nowhere else in the world. Characterizing the living communities on these seamounts is one of the major objectives of biological investigations on the 2002 Gulf of Alaska Expedition. If these communities contain unique species, what should be done to protect them from possible extinction? Are the biological communities on seamounts sufficiently similar that protecting one or two seamounts would be sufficient, or is every seamount different? How similar are biological communities on Alaskan seamounts? Do these communities become less similar as the distance between seamounts increases?

## Learning Procedure

NOTE: This activity uses a hypothetical data set. While these species have actually been found on Cobb Seamount, their presence (or absence) on other seamounts has not been confirmed. The technique of comparing communities with the coefficient of community can be used for actual data from the Gulf of Alaska Expedition as this information becomes available.

1. Explain that seamounts are the remains of underwater volcanoes, and that they are islands of productivity compared to the surrounding environment. Although seamounts have not been extensively explored, expeditions to seamounts often report many species that are new to science and many that appear to be endemic to a particular group of seamounts. An unresolved question is whether the biological communities on seamounts that are far apart are less similar that those that are closer together.

2. Distribute the "Seamount Species Checklist" and "Gulf of Alaska Seamounts" map. Assign each group one pair of seamounts to compare.

Students should calculate the coefficient of community for each pair of seamounts using the formula C = 2a/(b + c), where C is the coefficient of community, a is the number of species in common to both seamounts, b is the total number of species found on one of the seamounts, and c is the total number of species found on the other seamount. Students should also measure the distance between their seamounts.

3. Make a graph plotting the coefficient of community (y axis) against distance between seamounts (x axis). Have students describe the trend shown by the data (similarity decreases with increasing distance between seamounts). Lead a discussion of what these findings suggest about reproduction in seamount communities, and about the implications of these findings to the danger of extinction. Students should recognize that the data suggest that juveniles or larvae of many species are not easily exchanged between seamounts, and are either retained near the seamounts where they are produced, or do not survive long trips between seamounts. This finding means that species endemic to particular seamounts are extremely vulnerable to extinction, because a relatively localized event (for example, a few passes of a fishing trawler) could sweep away all individuals of these species, resulting in immediate extinction.

## The BRIDGE Connection

www.vims.edu/bridge/biology.html

## The "Me" Connection

Have students write a paragraph on why they should care about what happens to biological communities on seamounts, or have groups of students debate this question.

## Connections to Other Subjects

English/Language Arts, Geography, Mathematics

## Evaluation

If individual evaluations are desired, have students prepare written interpretations of the summarized data prior to leading a group discussion.

## Extensions

Have students visit http://oceanexplorer.noaa.gov to keep up to date with the latest Gulf of Alaska Expedition discoveries.

## Resources

http://oceanexplorer.noaa.gov – Follow the Gulf of Alaska Expedition daily as documentaries and discoveries are posted each day for your classroom use. A wealth of information can also be found at this site.

http://www.marine.csiro.au/PressReleasesfolder/98releases/5jun98.html – Information on seamount conservation issues in Tasmania, which are very similar to those concerning seamounts worldwide

http://www.sciencegems.com/earth2.html – Science education resources

http://www-sci.lib.uci.edu/HSG/Ref.html – References on just about everything

de Forges, B. R., J. A. Koslow, and G. C. B. Poore, 2000. Diversity and endemism of the benthic seamount fauna in the southwest Pacific. Nature 405:944-947. (The research report on which this activity is based)

## National Science Education Standards

**Content Standard A: Science as Inquiry**

- Abilities necessary to do scientific inquiry
- Understanding about scientific inquiry

**Content Standard F: Science in Personal and Social Perspectives**

- Populations, resources, and environments

## For More Information

Paula Keener-Chavis, National Education Coordinator/Marine Biologist
NOAA Office of Exploration
Hollings Marine Laboratory
331 Fort Johnson Road, Charleston SC 29412
843.762.8818
843.762.8737 (fax)
paula.keener-chavis@noaa.gov

## Acknowledgements

This lesson plan was produced by Mel Goodwin, PhD, The Harmony Project, Charleston, SC for the National Oceanic and Atmospheric Administration. If reproducing this lesson, please cite NOAA as the source, and provide the following URL:
http://oceanexplorer.noaa.gov

SCILINKS. Selected by Science Educators from NSTA

# Student Handout

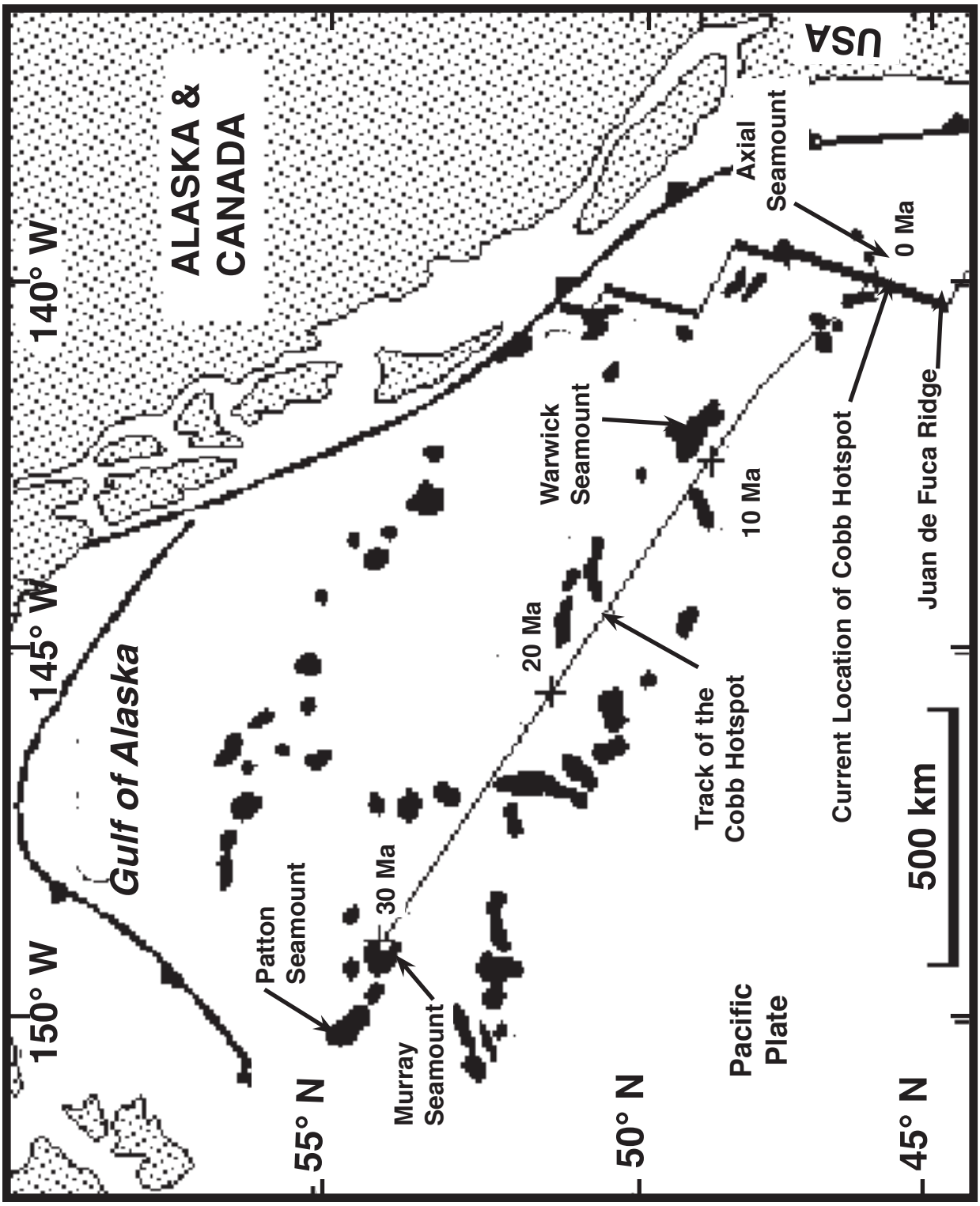
## Seamount Species Checklist

(based on Parker and Tunnicliffe, 1994)

| Phylum | Class | Species | Found on Seamount | | |
|---|---|---|---|---|---|
| | | | Patton | Warwick | Axial |
| Porifera | Desmospongiae | *Halichrondria panicea* | • | | • |
| Cnidaria | Hydrozoa | *Allopora verrilli* | | • | • |
| | Anthozoa | *Metridium senile* | • | | |
| | | *Corynactis californica* | • | • | • |
| Annelida | Polychaeta | *Crucigera zygophora* | | • | • |
| | | *Northria conchylega* | • | • | |
| | | *Phyllochaetopterus prolifica* | • | | |
| | | *Protula pacifica* | • | • | • |
| | | *Lumbrineris inflata* | | • | |
| Arthropoda | Amphipoda | *Caprella alaskana* | • | • | |
| | | *Caprella laeviuscula* | • | | |
| | | *Proboloides* sp. | • | • | • |
| | | *Micropleustes* sp. | | | • |
| | | *Parapleustes* sp. | • | • | |
| | | *Maera* sp. | • | • | |
| | Isopoda | *Ianiropsis tridens* | • | | • |
| | | *Munna uniquita* | • | • | |
| | | *Munna chromatocephala* | • | • | |
| | Tanaidacaea | *Leptochelia* sp. | | | • |
| | | *Paratanais* sp. | • | • | |
| | Malacostraca | *Chorilia longipes* | | • | • |
| | | *Oregonia gracilis* | • | • | |
| Mollusca | Gastropoda | *Margarites marginatus* | | • | • |
| | | *Calliostoma annulatum* | • | • | |
| | | *Calliostoma ligatum* | | • | • |
| | | *Diodora aspera* | • | | |
| | | *Searlisia dira* | • | • | • |
| | | *Granulina margaritula* | • | • | |
| | Bivalvia | *Crassodoma gigantea* | • | • | • |
| | | *Macoma balthica* | | • | • |
| | | *Modiolus modiolus* | • | • | |
| | | *Petricola pholadiformis* | • | • | |
| Brachiopoda | Articulata | *Platidia hornii* | • | | • |
| Bryozoa | Cyclostomata | *Bicrisia edwardsiana* | | | • |
| | | *Crisia occidentalis* | • | • | |
| | | *Filicrisia franciscana* | • | • | |
| | Cheilostomata | *Bugula* sp. | | | • |
| | | *Lyrula* sp. | • | | |
| Sipuncula | | *Phascolosoma agassize* | • | | |
| Echinodermata | Asteroidea | *Pycnopodia helianthiodes* | | | • |
| | | *Crossaster papposus* | • | • | |
| | | *Henricia sanguinolenta* | • | • | |
| | | *Henricia leviuscula* | • | | • |
| | | *Leptasterias hexactis* | • | • | • |
| | Crinoidea | *Florometra serratissima* | • | | |
| | Echinoidea | *Strongylocentrotus franciscanus* | • | • | |

## Student Handout

Gulf of Alaska Seamount Map




http://ridge.coas.oregonstate.edu/rkeller/seamounts.html

College of Oceanic and Atmospheric Sciences, Oregon State University