Activity Summary
In this activity, students investigate the incredible biodiversity that exists in estuarine environments. They begin by exploring the Rookery Bay National Estuarine Research Reserve (NERR) using Google Maps. Students then produce an estuary biodiversity concept map and individual organism profile that becomes part of an estuary wildlife exhibit.

Learning Objectives
Students will be able to:
1. Describe the physical and biological components of habitats that exist as part of an estuary.
2. Explain the relationships between primary producers, consumers, and secondary consumers.
3. Describe some adaptations of living organisms to the changing conditions within an estuary.
4. Explain why biodiversity is important and worth preserving in an estuary.

Grade Levels
9-12

Teaching Time
4 (55 minute) class sessions + homework

Organization of the Activity
This activity consists of 3 parts which help deepen understanding of estuarine systems:
- Investigating Habitats in an Estuary
- Biodiversity in an Estuary
- Portrait of Life in an Estuary

Background
This activity introduces students to the amazing biodiversity of an estuarine environment, focusing on the habitats in the Rookery Bay National Estuarine Research Reserve (RBNERR). The reserve is located at the northern end of the Ten
Preparation

- Bookmark Google Maps on your classroom computer(s) or computer lab machines.
- Arrange for students to access the Internet and/or other resources on organisms. For example, the University of Michigan Museum of Zoology’s Animal Diversity Web site: http://animaldiversity.ummz.umich.edu/site/index.html
- Obtain the poster paper for the concept maps in Part 2 and the poster board for the students’ organism profiles in Part 3.
- Make copies of the Student Readings and Student Worksheets.
- If feasible, assign the Student Reading—Introduction to Rookery Bay NERR and Student Reading—Biodiversity in an Estuary before beginning the activity, as preparation for Part 1.

Materials

Students

- Need to work in a computer lab or have access to a computer
- Copy of Student Reading Introduction to Rookery Bay NERR
- Copy Student Reading Biodiversity in an Estuary
- Copy of Student Worksheet Biodiversity in an Estuary
- Copy of Student Worksheets Biodiversity Concept Map and Portrait of Life in an Estuary

Teachers

- large sheets of poster paper (for Part 2)
- large pieces of poster board (for Part 3)

Equipment:

- Computer lab or
- Computer and Projector
Procedure

Part 1 — Investigating Habitats in an Estuary

1. This activity begins with a virtual exploration of Rookery Bay. Show students their starting point (Rookery Bay National Estuarine Research Reserve; 26° 01' 30.55 N, 81° 43' 54.20 W) in Google Maps.

2. Handout Student Readings: Introduction to Rookery Bay NERR and Biodiversity in an Estuary. Read in small groups. Discuss student readings as a class.

3. In the same small groups have them complete Part 1 of the Student Worksheet—Biodiversity in an Estuary using Google Maps on the computer. (Worksheet is three pages.)

4. Discuss why the images seem to change, particularly the color and resolution of some of the images.

5. Review and discuss the Part 1 tasks and questions.

Part 2 — Biodiversity in an Estuary

1. Have students read the introduction in the Student Worksheet—Biodiversity Concept Map, which describes concept maps. If students are unfamiliar with concept maps, consider drawing a sample concept map on a general topic, such as your school.

2. Divide the class into teams, distribute the large paper, and explain that they will produce a large concept map that underscores the biodiversity and the interrelationships of organisms in the dynamic estuarine environment.

3. Have the student teams create their Rookery Bay concept maps, starting with a box that has “Rookery Bay Reserve” and following the instructions and complete the questions on Page 2 of the Student Worksheet—Biodiversity Concept Map.

4. When students are done with their concept maps, attach the maps to a board or wall and have a discussion on the similarities and differences between the various maps.

National Science Education Standards

Content Standard A: Science as Inquiry
A3. Use technology and mathematics to improve investigations and communications.
A4. Formulate and revise scientific explanations using logic and evidence.
A6. Communicate and defend a scientific argument.

Content Standard B: Physical Science
B6. Interactions of energy and matter

Content Standard C: Life Science
C4. The interdependence of organisms
C5. Matter, energy, and organization in living systems

Content Standard F: Science in Personal and Social Perspectives
F3. Natural Resources
F4. Environmental quality
F5. Natural and human-induced hazards
F6. Science and technology in local, national, and global challenges
Part 3 — Portrait of Life in an Estuary

1. Assign or have students select one organism from an estuary to study in detail. You can have students draw the name of an organism out of a bowl (proverbial hat…) or you can have them choose one organism that they would like to focus on.

2. Have students complete Student Worksheet—Portrait of Life in an Estuary and produce a poster on their organism.

3. When students finish their posters, create a class exhibit to serve as a viewing area and post students’ work.

4. Allow students sufficient time to circulate and read all the class posters.

5. Lead a discussion of the importance of biodiversity, using examples where low biodiversity was problematic, and review the tasks and questions of Part 3.

Check for Understanding

1. Use the concept maps from Part 2 as an assessment of student understanding of the relationships between habitats, characteristics of the habitats, and the species that inhabit the estuary.

   A simple way to do this is to give 1 point for each link on the concept map between two of the three variables. Then, award 2 points for each double link (two lines that reveal a relationship). Add 3 points for complex interrelationships in the concept map (3 or more lines coming from one box). Establish a class scale based on the total points given for each poster.

2. Evaluate the Wildlife Exhibit posters as a summative performance assessment for this activity.

3. Have a discussion with students after the Wildlife Exhibit viewing has ended. Ask students:

   - Which animals or plants in Rookery Bay are endangered?
   - What conditions in the estuary have caused populations of each of the endangered species to decline?
   - Are any actions being taken or projects underway to protect the remaining population and support its recovery?

Optional Extension Inquiries

Ask for permission to take samples of plants native to the estuary region and have student teams compile a pressed sample book. Have students organize their field collection by creating a multi-stage classification and a dichotomous key for the samples they collected.
1a. Describe the estuary features and landforms you saw as you examined the Florida coast.

**Answer:** Students should mention bays, inlets, wetlands, barrier beaches, and others.

1b. List the types of habitats you identified in the Rookery Bay National Estuarine Research Reserve.

**Answer:** Upland forests, mangrove forest, salt marsh, and tidal flats habitats are evident.

2. Were there any animal species that were not linked to another with at least one arrow?

**Answer:** Each species should have at least one connection to another species and most will have more than one.

3a. Which animals or plants in Rookery Bay are endangered?

**Answer:** The Florida manatee is endangered. A rare and endangered species list for Rookery Bay can be found at [www.dep.state.fl.us/coastal/sites/rookery/species.htm](http://www.dep.state.fl.us/coastal/sites/rookery/species.htm).

3b. Choose one of the endangered animals and find out what conditions have caused its populations to decline. Are any actions being taken or projects underway to protect the remaining population and support its recovery?

**Answer:** Student answers will vary.