PEARLS

TEACHER'S GUIDE

http://www.amnh.org/exhibitions/pearls

AMERICAN MUSEUM OF NATURAL HISTORY

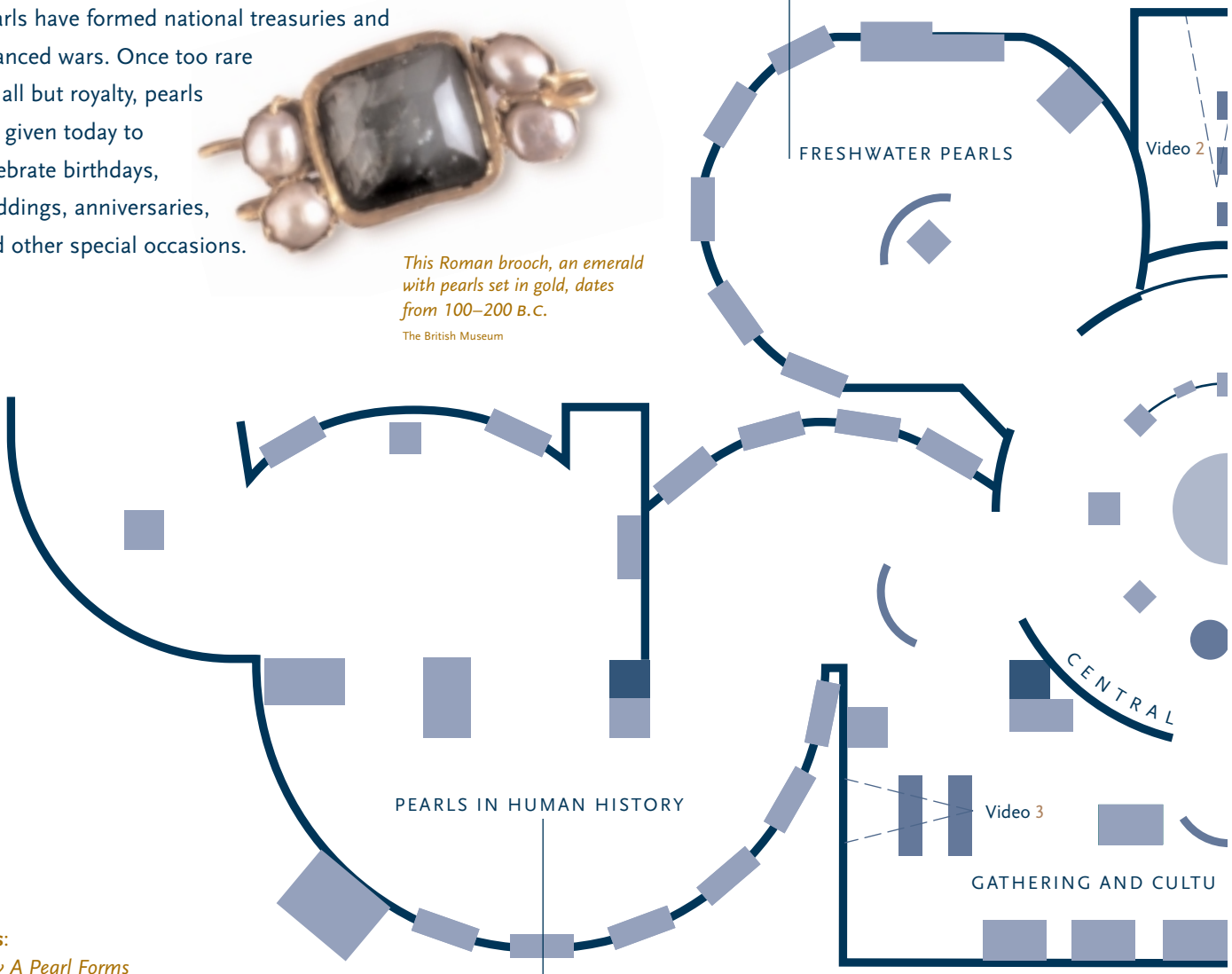
OVERVIEW

Pearls are among the world's most coveted gemstones. From the Roman Empire and Renaissance Europe to imperial China, India, and Russia to ancient North America, they have been treasured, sought, traded, bought, and eaten. Arriving in finished condition from their biological source, saltwater pearl oysters and freshwater pearl mussels, have fascinated both scientists and society. Pearls have formed national treasuries and financed wars. Once too rare for all but royalty, pearls are given today to celebrate birthdays, weddings, anniversaries, and other special occasions.

This Roman brooch, an emerald with pearls set in gold, dates from 100–200 B.C.

The British Museum

Objects: The surrounding cases focus on individual freshwater species, such as the Cockscomb Pearl Mussel (*Cristaria plicate*) and the Triangle Shell Pearl Mussel (*Hyriopsis cumingii*) of China accompanied by jewelry and decorative objects made from their pearls.



Videos:

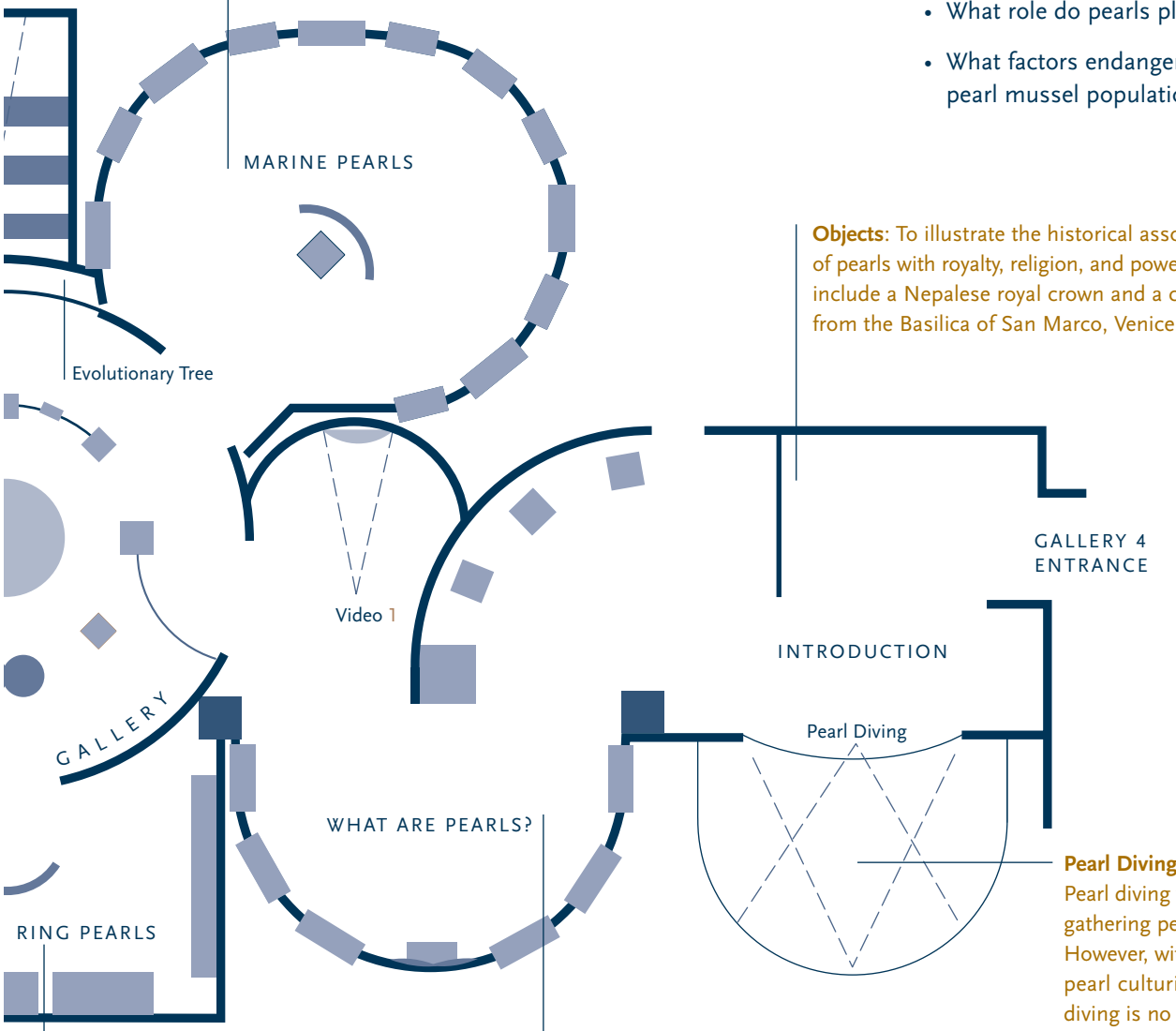
1. *How A Pearl Forms*
   Animation showing how a mollusk makes a pearl.
2. *Freshwater Mussels: The Secret Heart of the Cultural Pearl*
   At the center of most cultured pearls is a bead crafted from the ground-up shells of American freshwater mussels. This video takes a closer look at this natural resource.
3. *Culturing Pearls in Japan*
   This video follows the carefully monitored life cycle of oysters on a Japanese pearl farm. Central to the video is the pearl culturing procedure, called nucleation, followed by a 3D animation that reveals what goes on inside an oyster as it produces a cultured pearl.

Objects: One object of great historic significance, from the British Museum, is a pin from 300 B.C. that contains both a large marine pearl and a smaller pearl that may be from a freshwater mussel or from the Pinna shell of the Mediterranean. It is one of the oldest surviving pearl objects in the world and was excavated in the Temple of Aphrodite in Cyprus. Pearl ornaments from the Hopewell Culture, a North American Indian civilization that existed from 200 B.C. to A.D. 500 in the Ohio River valley, are on display.

Objects: Each display case is devoted to one type of marine mollusk, its pearls, and examples of cultured objects made from them. For example, the La Paz pearl oyster from the Gulf of California and a 17th century Spanish brooch.

As students tour the exhibition *Pearls*, they will investigate the following questions:

- What are the features of mollusks?
- What are the pearl-forming mollusks?
- How are pearls formed?
- What role do pearls play in human culture?
- What factors endanger pearl oyster and pearl mussel populations?



Objects: To illustrate the historical association of pearls with royalty, religion, and power, objects include a Nepalese royal crown and a chalice from the Basilica of San Marco, Venice.

Pearl Diving
Pearl diving was the traditional means of gathering pearls over the last four millennia. However, with the advent of commercial pearl culturing in the 20th century, pearl diving is no longer widely practiced.

Objects: Students can examine nacre-covered pearlfish, blister pearls formed around small crab, and a freshwater pearl formed around a snail shell. Scanning electron micrographs reveal the microstructure of pearls.

Objects: Historic artifacts in this section include experimental cultured pearls produced by Swedish naturalist Carl von Linne in 1740, who was knighted for his efforts. Another display illustrates how pearls are sorted and graded, how they are treated, and how they move from single pearls to hanks of similar pearls to matched pearls.

Prepare for the visit by conducting one or more of the following activities. Adjust the activities to fit the needs of your elementary, middle school and high school students.

What is a mollusk?

Materials: shells, pearl costume jewelry, mother-of-pearl buttons (collected by students or purchased at craft and bead stores).

Display the shells. Explain that these hard outer shells were once the homes of animals called mollusks. Ask students to share what they know about mollusks. Create a word web on the board and add students' responses. Stimulate discussion by asking the following questions:

- Where can you find mollusks?
  Fresh and salt water, and on land (land snails)
- How do mollusks feed?
  Most bivalves filter food particles from the water; many snails are predators on other invertebrates, or graze on plant life.
- Do mollusks move? How?
  Some move by means of a large muscular organ called a *foot*. Others remain attached to rocks and other surfaces throughout their lifetimes.
- Besides food, what products do mollusks produce?
  Pearls, mother-of pearl, cosmetics and medicine (from pearl powder)

Display mother-of-pearl and pearl jewelry to students. Explain that pearls are gems that are produced by mollusks that live in both salt and fresh water. Ask students to share what they know about pearls and add their responses to the word web.

Conduct one or more of the following small-group activities:

Classification

Provide groups with about 20 assorted mollusk shells which can be easily gathered or bought. Have students develop a classification system for the different shell types (snails [univalves], clams [bivalves], tusk shells, chitons, and cephalopods). Note that classification equally relies on the soft tissue. Identifying and classifying seashells provides a reference point for classification and comparison.

Students can visit the **Seashell Virtual Web Gallery** at *http://www.amnh.org/resources/pearls*. The on-line activity introduces students to the diversity of marine animals, oysters, and pearls through comparison activities.

The Chemical Composition of Shells

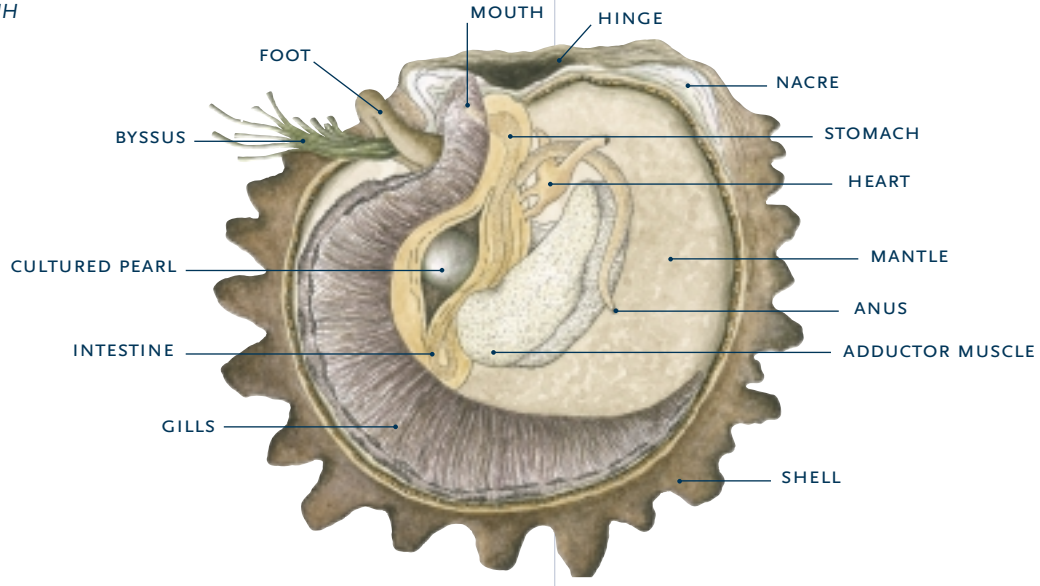
Provide groups with several shells from different species of mollusks, a file or sandpaper, and some vinegar. Instruct students to scrape away part of the shell, put a few drops of vinegar on that spot and observe what happens. The shell's composition is calcium carbonate. When the shell comes in contact with the vinegar (an acid), carbon dioxide is released and a fizzing action occurs. In *Pearls* students will discover which famous female ruler knew this fact.

What are the Organs of a Mollusk?

Purchase fresh clams, mussels, or scallops still in the shell (squid and octopus are also members of the mollusk phylum–a squid will have an internal shell that might make interesting comparison with the bivalves). Provide groups with several different mollusks. Have them open the shells and identify the major organs and their function. You may provide students with the diagram of the mollusk shown on this page.

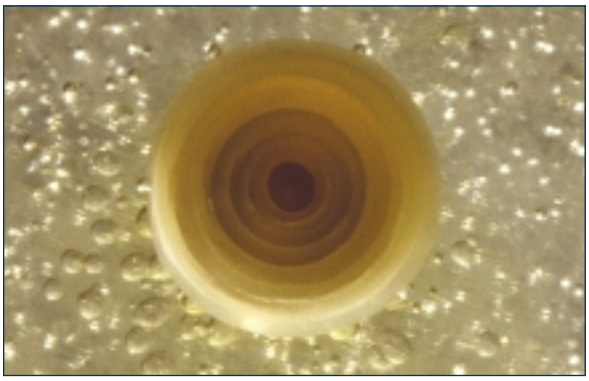
Cross-section of a Pearl Oyster

Illustration/AMNH



The Culture of Pearls

Hold a class discussion about pearls. Call on students to share what they know about pearls: where they come from, how they are produced, and their role in history and our culture. Ask students to discuss why they think people value pearls. Then ask which pearls are more valuable—cultured pearls or natural pearls. Kokichi Mikimoto was the first to develop modern techniques to culture pearls in Japan by inserting a bead nucleus in the mantle tissue (the nucleus is a small shell ball made from the shell of a Mississippi River mussel). Tell students they will examine several pearls and determine which is natural and which is cultured.



D. Finnin/AMNH Photo Studio

A cross-section of a pearl reveals changes in the physiology of the mollusk and its environment.

Cultured vs. Natural

Provide groups with a cultured pearl, a natural pearl, a penlight, and a magnifying glass. They will first examine the drill holes with the magnifying glass. In a cultured pearl there is a distinct line between the bead nucleus and the layer of conchiolin (the mortar which cements the layers of nacreous mother-of-pearl crystals). If students can identify this line, then the pearl is cultured. Students may also examine the pearls with a penlight. They should view the pearl from several different directions while holding a strong light in direct contact with it, slowly moving it around the pearl surface. If viewed in this manner, it is sometimes possible to see dark, parallel lines from the bead nucleus showing through the nacre.

Researching Pearls

Have students work in small groups to research and report on one topic related to pearls. Topics include:

- pearls in folklore, myths, and literature
- pearls in art
- pearl jewelry
- history of the pearl industry

Have groups present their completed reports or projects to the class. Tell students they will learn more about the culture of pearls when they visit *Pearls*.

Cultivating and Harvesting Pearls

Display a diagram of a pearl oyster or draw a simplified diagram on the chalkboard. Students should learn that pearls form within oysters and certain other mollusks when foreign material such as food, worms, fish, or crabs, invades the mantle (the lining that produces the shell). The foreign matter causes irritation and, in response, the mollusk coats the foreign invader with nacre, a liquid substance that hardens. Over several years the nacre builds up to form a pearl. Throughout history people have harvested oyster beds looking for pearls. Over time some were over-harvested and this resulted in the beds dying out.

Tell students that although pearl production is successful, there are certain factors that threaten the ecology of mollusks. Discuss with students what effect pollution, loss of habitat, natural diseases, and competition from introduced species might have on oyster and mussel populations. Discuss what factors might contribute to good oyster growth.

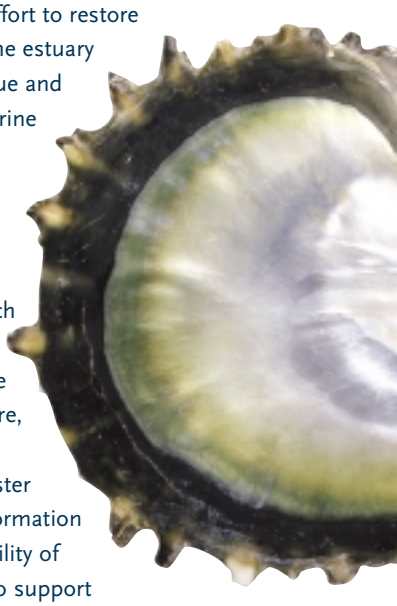
Have students research one of the following areas:

- The geography of oysters: Where have pearl oysters been traditionally found? What factors would contribute to oyster growth?
- What role do U.S. fresh-water mussels play in Japan's cultured pearl industry? How might the decline of fresh-water mussels affect Japan's pearl industry?

Have students discuss their findings in small groups.

Oyster Culturing in New York Harbor

NY/NJ Baykeeper is a group that runs the Raritan Bay Oyster Restoration Project. The group is in the process of restoring oysters to this estuary. Discuss with students how the culture of oysters contributes to the effort to restore the oyster reef population of the estuary because of their ecological value and to create a resurgence of a marine coastal industry.



Students may participate in an aquaculture program at the American Museum of Natural History (212-769-5169) in which they will grow oysters off piers and care for them for one year. They will monitor, measure, and clean them once a month. The data they collect about oyster growth will provide critical information about water quality and the ability of different areas of the estuary to support oyster growth.

Duplicate the **Student Observation Sheet** and distribute it to students. Read through the Sheet with them to identify the tasks involved as students visit each section of the exhibit. Point out that, besides written responses, students may also want to make drawings and diagrams. Students should bring along clipboards and additional sheets of paper for this purpose. Students may have their own questions about pearls. Suggest they write these down and look for the answers as they tour *Pearls*.

Elementary-school children may enjoy visiting the **Pearl Teaching Cart**. The cart provides hands-on, interactive learning activities. Students will learn about pearl oyster biology, which mollusks produce pearls, and how pearls are produced. They will investigate the manufacturing of pearl-buttons.

Related Museum Exhibitions

Your class may wish to visit other Museum exhibitions related to *Pearls* if time permits. You may wish to have your students conduct a scavenger hunt to discover how pearls and pearl products have been used by cultures around the world.

Hall of Pacific Peoples

In this Hall students can investigate how Pacific peoples used the pearl oyster.

- Pearl oysters used as money and Window Pane Oyster noisemaker (tinkler) are at the entrance to the Hall.
- Admiralty Island section: an uncut pearl oyster shell
- Solomon Island section: a Samoan headdress with mother-of-pearl disks

Hall of Asian Peoples

These items can be found in this Hall:

- Chinese Crafts Section: a mother-of-pearl inlaid box and pearl-decorated hair ornaments
- The Lure of Asia: mother-of-pearl inlaid table
- Music of Islam: *richak* musical instrument inlaid with mother-of-pearl
- Yemen Exhibition: Yemenite wedding dress with mother-of-pearl buttons
- The Islamic World: tobacco box inlaid with mother-of-pearl and pearl collecting and sorting tools from Oman
- Traditional Trade Routes of Asia: Pearls shown as luxury items aboard trade ships
- Tibetan Section: Headdress decorated with pearls

Black-lipped Pearl Oyster (pinctada margaritifera)

J. Beckett/AMNH Photo Studio

Hall of South American Peoples

Pacific Thorny Oyster and artifacts are displayed on the right as you enter the Hall.

Shell Corridor (1st floor of the Museum)

(Closed for renovation, January, 2002. It will be incorporated into the Hall of Ocean Life.)

The following oysters are on display: Black-lipped Pearl Oyster, Saddle Oyster, Hammer Oyster, Cockscomb Oyster, Foot Oyster, Atlantic Thorny Oyster, Pacific Thorny Oyster, and Eastern Oyster (with loose pearls).

Hall of Northwest Coast Indians

Students can see specimens of the small Pacific oyster in the Kwakiutl fishing gear exhibition. Numerous mother-of-pearl artifacts, all of abalone shell, can be seen in:

- Tsimshian nose, ear, and headdress ornaments
- Haida and Kwakiutl ceremonial regalia
- Tlingit earrings and headdress

Old New York

This exhibit features Peter Stuyvesant with Native American women bearing baskets of corn. The mortar in the wall of the fort was probably made by burning oyster shells from the world-famous oyster beds in the surrounding waters.

Morgan Memorial Hall of Gems

Students can observe in the display of pearls the variety in size, shape, and color of pearls as well as pearls forming in shells.

Hall of Ocean Life

(Closing for renovation, January, 2002, and will reopen midsummer, 2003.)

Along the back wall, at the far right, is a diorama representing the sea floor of the enclosed lagoon of the coral atoll of Tongareva in the South Pacific. Two Tongarevan pearl divers are seen plunging down into a coral gorge. They can be seen detaching clusters of Black-lipped Pearl Oysters from the ocean bed.

D. Finnin/AMNH Photo Studio

This unusual collection of pearls highlights the variety of colors and shapes.

Pearls from AMNH, The Field Museum, Susan Hendrickson, Mastaloni Pearls, and Gayle Pollock Collections

Discuss the Museum Experience

Have students work in small groups to share their experiences at *Pearls*. Then, review with the class as a whole the information they recorded on their observation sheets. Ask students to share the single most interesting thing they learned at the exhibit. Find out if any of their questions from earlier class discussions were answered during their tour. If students have additional questions, use them as a reference point for further investigation.

Finding Solutions

Point out to students that at the Museum they learned about the factors that threaten pearl oyster and pearl mussel populations: pollution, loss of habitat, disease, and introduction of competitive species.

Have students work in groups to brainstorm ideas and formulate solutions for protecting pearl oysters and pearl mussels from these factors. Suggest students use the notes they took at the Museum, along with information they can gather at the Museum website to help them in their investigation. In preparing their reports, suggest groups use visual aids to illustrate the points they want to make. Groups should be prepared to answer any questions their classmates may have.

Create a Pearl Display

Have students share what they learned at *Pearls* by creating their own pearl display. Encourage students to illustrate their projects using maps, diagrams, photographs, drawings, comic strips, models, or other visual aids. Example project topics:

- a sequence diagram showing how pearls are formed
- a display showing the different kinds and colors of pearls
- an overview of the threats to pearl oyster and pearl mussel populations and the conservation measures being taken
- the ecology of pearl mussels (a look at pearl mussels as a keystone species)
- Columbus and pearls
- uses of pearls in Asian and Native American cultures
- pearls and social status

Have students present their completed projects to the class. Display the projects in the school hallway or school library.

Resources

Web Links

***Pearls*: The Exhibition, the AMNH exhibition website**
http://www.amnh.org/exhibitions/pearls

This site contains information about the exhibition, featuring the objects and curators, as well as the **Seashell Virtual Web Gallery** (*http://www.amnh.org/resources/pearls*), an interactive web-based classification activity for students.

Books

Abbot, R. Tucker. *Seashells of North America*. New York: Golden Press, 1968. (out-of-print, limited editions available)

Douglass, Jackie L. *Peterson's 1st Guide to Shells of North America*. Boston: Houghton Mifflin, 1998.

Farn, Alexander E. *Pearls: Natural, Cultured and Imitation*. Oxford: Butterworth-Heinemann Ltd., 1991.

Hackney, Ki, and Edkins, Diana. *People and Pearls: The Magic Endures*. New York: HarperCollins, 2000

Kunz, George Frederick, and Stevenson, Charles Hugh. *The Book of the Pearl: The History, Art, Science and Industry of the Queen of Gems*. Mineola, New York: Dover Publishers, 1993.

Landman, Neil H., Mikkelsen, Paula M., Bieler, Rüdiger, and Brown, Bennet. *Pearls: A Natural History*. New York: Harry N. Abrams, Inc, 2001.

Matlins, Antoinette Leonard. *The Pearl Book: The Definitive Buying Guide: How to Select, Buy, Care for & Enjoy Pearls*. Woodstock, VT: Gemstone Press, 1996.

Muller, Andy. *Cultured Pearls: The First Hundred Years*. Osaka: Golay Buchel Group, 1997.

Shirai, Shohei. *Pearls and Pearl Oysters of the World*. Okinawa: Marine Planning Company, 1994.

Ward, Fred. *Pearls*. Bethesda, MD: Gem Book Publishing, 1998.

Videos

The Perfect Pearl, NOVA, WGBH, Boston Video, South Burlington, VT., www.wgbh.org

Eyewitness *Shell*, DK vision, http://www.dk.com

Additional Information

Cultured Pearl Information Center, 321 East 53rd St., New York, NY 10022

The Pearl Society, 623 Grove St., Evanston, IL 60201

South Sea Pearl Consortium Ltd., c/o Evins Communications Ltd., 635 Madison Ave., New York, NY 10036

World Pearl Organization, Japan Pearl Promotion Society, Shinju-kaikan, 3-6-15, Kyobashi, Chuo-ku, Tokyo, Japan 104

Pearl Journals, *Pearl Society Newsletter* (Published by the Pearl Society) 623 Grove St., Evanston, IL 60201

Pearl World LLC, 302 West Kaler Drive, Phoenix, Arizona 85021

THE NEW STANDARDS PERFORMANCE STANDARDS

The materials in this resource guide have been designed in accordance with the New Standards performance standards developed by the National Center on Education and the Economy and the University of Pittsburgh. The activities and Museum tour meet the following standards:

Elementary School

Life Science Concepts: Students will understand the characteristics of organisms, such as survival and environmental support; the relationship between structure and function; and variations in behavior. [S2a]

Scientific Connections and Applications: Students will understand the design world, such as development of agricultural techniques; and the viability of technological designs. [S4b]

Scientific Tools and Technologies: Students will acquire information from multiple sources, such as experimentation and print and non-print sources. [S6c]

Geography: Students will investigate how people depend on and modify the physical environment. [SS3]

Social Studies: Students will compare important events and accomplishments from different time periods in world history. [SS2]

Middle School

Life Science Concepts: Students will understand the structure and function in living systems, such as the cells, organs, tissues, organ systems, whole organisms, and ecosystems. [S2a]

Scientific Connections and Applications: Students will understand the impact of science, such as historical and contemporary contributions; and interactions between science and society. [S4e]

Scientific Tools and Technologies: Students will use technology and tools (such as traditional laboratory equipment, video, and computer aids) to observe and measure objects, organisms, and phenomena, directly, indirectly, and remotely. [S6a]

Geography: Students will present geographic information in a variety of formats, including maps, tables, graphs, charts, diagrams, and computer-generated models. [SS3]

Social Studies: Students will develop timelines by placing important events and developments in world history in their correct chronological order. [SS2]

High School

Life Science Concepts: Students will understand the interdependence of organisms such as conservation of matter; cooperation and competition among organisms in ecosystems; and human effects on the environment. [S2d]

Scientific Thinking: Students will use evidence from reliable sources to develop descriptions, explanations, and models; and make appropriate adjustments and improvements based on additional data or logical arguments. [S5c]

Scientific Communication: Students will represent data and results in multiple ways, such as numbers, tables, and graphs; drawings, diagrams, and artwork; and technical and creative writing; and select the most effective way to convey the scientific information. [S7a]

Scientific Investigation: Students will conduct a systematic observation, such as a field study. [S8b]

Geography: Students will explain how technological change affects people, places, and regions. [SS3]

Social Studies: Students will investigate key events and developments and major turning points in world history to identify the factors that brought about change and the long-term effects of these changes. [SS2]

Pearls is organized by the American Museum of Natural History in collaboration with The Field Museum, Chicago. The lead curator for the exhibition is Neil Landman, Curator, Division of Paleontology, American Museum of Natural History. Co-curators are Paula Mikkelsen, Assistant Curator, Division of Invertebrate Zoology, American Museum of Natural History; and Rüdiger Bieler, Associate Curator, Department of Zoology, and Bennet Bronson, Curator, Department of Anthropology, both of The Field Museum.

The *Pearls* exhibition is made possible through the generous support of Tasaki Shinju.

This guide was produced by the American Museum of Natural History, Department of Education.
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Cover: Photos: D. Finnin/AMNH Photo Studio; Muséum National d'Histoire Naturelle, Paris, AMNH photo; Rare Book Collection; Mr. and Mrs. R. Weatherly; Photo: Wartski, London; Pearls from AMNH, The Field Museum, Susan Hendrickson, Mastralomi Pearls, and Gayle Pollock Collections.