

Boston Harbor Islands

A National Park Area



America's Oldest Light Station: Boston Light

Teacher's Guide

Developed by staff from the National Park Service,
United States Coast Guard, and U.S. Coast Guard Auxiliary

Boston Harbor Islands Partnership, 2006

America's Oldest Light Station: Boston Light
Boston Harbor Islands national park area Curriculum Unit

Grade Level: Grades 5- 9

Description

Since its beginning in 1716, to the present day, Boston Light on Little Brewster Island has provided guidance and protection for mariners sailing into Boston Harbor. This unit will guide teachers and students through an interdisciplinary study of the evolution of lighthouses, maritime commerce, lifesaving, and the United States Coast Guard. In addition to background information on the development of Boston Lighthouse and lighthouse technology, the unit offers ideas on pre and post visit activities and advice on visiting Boston Light on Little Brewster Island.

Boston Harbor is an "estuary" system where the salt water of Massachusetts Bay mixes with fresh water from three rivers: the Charles, the Mystic, and the Neponset. The harbor shores include six of Boston's neighborhoods (East Boston, Charlestown, North End, Fort Point, South Boston, and Dorchester) and seven other municipalities: Hull, Hingham, Weymouth, Quincy, Chelsea, Revere, and Winthrop. Although it has extensive development on its edge, the estuary provides valuable habitat for wildlife, a nursery for marine organisms, water filtration, and flood control.

The Inner Harbor includes the mouths of the Charles and Mystic rivers, Chelsea Creek, and the port of Boston; the Outer Harbor includes the three bays of Dorchester, Quincy, and Hingham and the mouth of the Neponset River. Combined, the Inner and Outer harbors comprise approximately 50 square miles and are bounded by 180 miles of shoreline.

Boston Harbor, a continuously working harbor since the mid 17th century, and the islands have undergone significant physical transformation over the last 300 years. Both human actions and natural forces have caused this change. Many people are aware of the dramatic expansion of the Shawmut Peninsula by filling tidal land over the centuries to create what is now the city of Boston. However, most people are not aware of similar changes to current and former harbor islands. Natural forces significantly eroded Sheep and Hangman islands to mere outcroppings. Causeways and land bridges were constructed to connect Worlds End, Deer, and Nut islands to the mainland, as well as other former islands such as the end of what is now a section of the town of Hull and the Castle Island extension in South Boston. A modern vehicle bridge was constructed for Long Island. Massive landfills connected Wood, Noddles, Apple, and Governors islands for East Boston and Logan Airport. Today's metamorphosis is the dramatic construction of Spectacle Island with material from the central artery highway tunnel through Boston known as the "Big Dig," and the creation of the Boston Harbor Islands national park area in 1996, which brought 34 islands and peninsulas together to be managed and protected. Today's visitor to the islands may get the sense of permanence. However, people and nature have had a dramatic impact on the geography of this resource over a relatively short period of time.

Key Concepts

Navigation, Technology, Environment, Natural History, Cultural History, Weather

Theme

Students exploring Boston Light will discover the evolution of lighthouse technology, the daily life of the lighthouse keeper, and the development of the country's lifesaving service and US Coast Guard. As the last remaining lighthouse station still staffed by the USCG, students will gain an understanding of its continuing role today as a central aids- to- navigation and weather station for Boston Harbor.

Essential Questions to Guide Student Inquiry

- Why was the establishment of Boston Light on Little Brewster Island important to the development of the port of Boston and Massachusetts?
- How has technology played a role in how the lighthouse station operates?

Learning Objectives

Habits of Mind Goals:

- Students will recognize connections between their community and the societal, cultural, and natural resources of the Boston Harbor Islands.
- Students will gain a respect for the differences between land use of the islands and in the city.
- Students will understand the role of the USCG and USCG Aux. and identify ways that they can become stewards to help protect Boston Light in the future.

Skill Goals:

- Students will develop skills in mapping, modeling, and navigation.
- Students will gain skills in scientific testing and measuring.
- Students will be able to give examples of ways that information on weather is measured and recorded.

Content Goals:

- Students will be able to identify Boston Light as the first lighthouse station in the country and the last remaining station staffed by the USCG.
- Students will be able to recall one story about the life and experience of a lighthouse family living on Little Brewster.
- Students will be able to explain the basic mechanics of the lighthouse and lens technology.

Connections to Massachusetts State Standards

History and Social Science

Grade 5

1. Identify different ways of dating historical narratives (*17th century, seventeenth century, 1600s, colonial period*). (H)
2. Interpret timelines of events studied. (H)

4. Use maps and globes to identify absolute locations (latitude and longitude). (G)
7. Compare maps of the modern world with historical maps of the world before the Age of Exploration, and describe the changes in 16th and 17th century maps of the world. (G, H, E)
- 5.II. Explain the importance of maritime commerce in the development of the economy of colonial Massachusetts, using the services of historical societies and museums as needed. (H, E)

Grades 8- 12

USI.1. The Political and Intellectual Origins of the American Nation: the Revolution and the Constitution, 1763- 1789

USI.16. Describe the evolution of the role of the federal government, including public services, taxation, economic policy, foreign policy, and common defense. (H, C)

USI.27. Economic Growth in the North and South, 1800- 1860

Explain the importance of the Transportation Revolution of the 19th century (the building of canals, roads, bridges, turnpikes, steamboats, and railroads), including the stimulus it provided to the growth of a market economy. (H, E)

Mathematics

Grades 5- 6

6.M.2. Identify, measure, describe, classify, and construct various angles, triangles, and quadrilaterals.

6.M.3. Solve problems involving proportional relationships and units of measurement, e.g., same system unit conversions, scale models, maps, and speed.

6.P.7. Identify and describe relationships between two variables with a constant rate of change. Contrast these with relationships where the rate of change is not constant.

6.G.2. Identify three- dimensional shapes (e.g., cubes, prisms, spheres, cones, and pyramids) based on their properties, such as edges and faces.

Grades 9- 10

10.M.2. Given the formula, find the lateral area, surface area, and volume of prisms, pyramids, spheres, cylinders, and cones, e.g., find the volume of a sphere with a specified surface area.

G.M.2. Given the formula, find the lateral area, surface area, and volume of prisms, pyramids, spheres, cylinders, and cones, e.g., find the volume of a sphere with a specified surface area.

(10.M.2)

Science & Technology – Earth and Space Science

Grades 3- 5

6. Explain how air temperature, moisture, wind speed and direction, and precipitation make up the weather in a particular place and time.

7. Distinguish among the various forms of precipitation (rain, snow, sleet, and hail), making connections to the weather in a particular place and time.

8. Describe how global patterns such as the jet stream and water currents influence local weather in measurable terms such as temperature, wind direction and speed, and precipitation.

12. Give examples of how the surface of the earth changes due to slow processes such as erosion and weathering, and rapid processes such as landslides, volcanic eruptions, and earthquakes

Grades 9- 12

1.5. Explain how the transfer of energy through radiation, conduction, and convection contributes to global atmospheric processes, e.g., storms, winds.

- 1.8. Explain how the revolution of the earth and the inclination of the axis of the earth cause the earth's seasonal variations (equinoxes and solstices).
- 1.10. Describe the various conditions associated with frontal boundaries and cyclonic storms (e.g., thunderstorms, winter storms [nor'easters], hurricanes, and tornadoes) and their impact on human affairs, including storm preparations.
- 1.11. Explain the dynamics of oceanic currents, including upwelling, density, and deep water currents, the local Labrador Current and the Gulf Stream, and their relationship to global circulation within the marine environment and climate.
- 1.12. Describe the effects of longshore currents, storms, and artificial structures (e.g., jetties, sea walls) on coastal erosion in Massachusetts.
- 1.13. Explain what causes the tides and describe how they affect the coastal environment.
- 3.2. Describe how glaciers, gravity, wind, temperature changes, waves, and rivers cause weathering and erosion. Give examples of how the effects of these processes can be seen in our local environment.

Science & Technology – Physical Sciences

Grades 3- 5

4. Identify the basic forms of energy (light, sound, heat, electrical, and magnetic). Recognize that energy is the ability to cause motion or create change.
12. Recognize that light travels in a straight line until it strikes an object or travels from one medium to another, and that light can be reflected, refracted, and absorbed.

Grades 9- 12

- 1.3. Distinguish between, and solve problems involving, velocity, speed, and constant acceleration.
- 4.5. Interpret and be able to apply the laws of reflection and refraction (qualitatively) to all waves.
- 4.8. Explain the relationship between the speed of a wave (e.g., sound) and the medium it travels through.

English Language Arts

Grades 5- 6:

- 9.4. Relate a literary work to information about its setting.
- 13.14. Identify and use knowledge of common graphic features (*charts, maps, diagrams, captions, illustrations*).
- 13.15. Identify and use knowledge of common organizational structures (*chronological order, logical order, cause and effect, classification schemes*).

Grades 9- 10:

- 9.6. Relate a literary work to primary source documents of its literary period or historical setting.

Historic Timeline Overview

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|-------|--|
| ~1500 | European lighthouses replace wood fires with coal fires and candles for illumination; coal is brighter, but candlelight is steadier. |
| <1800 | Throughout Americas, as elsewhere in the world, people light beacon fires to |

guide ships into harbors and to warn local populations of emergencies such as attack by sea. Two reports from the 1600s record signal fires on Little Brewster Island.

- 1713 Boston merchants petition the Massachusetts general court (the colonial legislature) to erect a lighthouse in Boston Harbor to direct ships arriving at night. Tower is built of stone, with wooden stairs and floors.
- 1716 General court appoints George Worthyake as keeper of Boston Light, paying him 50 pounds a year to keep a light burning from sunset to sunrise. The colony assesses fees on vessels using the harbor to offset the cost of lighthouse construction.
September 14: Worthyake lights Boston Light's beacon for the first time. Boston Light is believed to be the first lighthouse built in North America, possibly in the Americas generally. Ten other lights are built in British North America before the revolution; Sandy Hook (1764) is the only original structure to survive to the present day.
- 1718 Keeper Worthyake, his wife and daughter, Shadwell their slave, and a friend all drown when their boat capsizes near Little Brewster in November. Months later, Worthyake's replacement also drowns.
- 1719 Massachusetts pays for a cannon at Boston Light to serve as a fog signal. The cannon is not replaced with other technology until 1850.
- 1720 Fire damages the tower and causes cracks in the masonry walls. Other damage results from a severe 1723 storm and another fire in 1751.
- <1775 Despite earlier objections to lightning rods as acts of "vanity and irreligion" that "presume to avert the stroke of Heaven," a lightning rod is installed at Boston Light.
- 1775 In the face of British military takeover of Boston, American troops remove lamps from the tower and burn its interior to hinder British ships, then skirmish with British marines assigned to rebuild the interior.
- 1776 As the British fleet leaves Boston, it blows up the Boston Light tower, still standing after the patriot fire the previous year.
- 1783 The Massachusetts legislature pays 1400 pounds to rebuild Boston Light.
- 1781 The Argand lamp is developed in France, using a hollow wick and parabolic reflector for brighter, steadier, less smoky light.
- 1786 The Humane Society of Massachusetts is formed to save victims of shipwrecks.
- 1789 The ninth law of the U.S. Congress places all lighthouses in federal

government control, under the Treasury Department.

- 1789- 1820 Secretary of Treasury Alexander Hamilton administers lighthouses personally for a time, and early presidents personally approve construction of new lighthouses. Supervision of lighthouses passes back and forth between secretary of treasury and commissioner of revenue in this period.
- 1790 Massachusetts turns control of Boston Light over to central government, following new federal law.
- August 4: Legislation authorizes the U.S treasury to build 10 cutters to collect duties in American ports. This date is celebrated as the birthday of the U.S. Coast Guard, which will later combine cutter, lifesaving, and lighthouse services.
- 1807 Massachusetts Humane Society establishes a series of shoreline huts with surfboats and equipment that are used by volunteer crews to rescue shipwreck victims; one of the earliest sites is at Allerton Point in Hull, in view of Boston Light and the heavily used Lighthouse Channel.
- 1810 Winslow Lewis demonstrates an Argand- type lamp at Boston Light. Two years later, the US Lighthouse Service adopts it as its illumination standard.
- 1820- 52 All aids to navigation are placed under the purview of the fifth auditor of the treasury, Stephen Pleasanton. Pleasanton is a careful bureaucrat with no maritime experience, who is more concerned with keeping expenses down than with maintaining the most effective navigational aids. Lighthouses in this period are built and maintained according to the advice of Pleasanton's contacts in the field, making for individual character of lighthouses and widely varying quality of illumination and structures.
- 1822 Augustin Fresnel, a French physicist, perfects a magnifying lens and designs it in seven orders, or sizes. In the U.S., Stephen Pleasanton long refuses to install Fresnel lenses in lighthouses when they become available, citing their cost.
- 1844 Boston Light's wooden tower stair is replaced by an iron stairway, and English parabolic reflectors are installed for light. Seamen claim the new light is the best reflector- type light on the East Coast.
- 1847 Congress pays to equip volunteer life- saving groups like the Massachusetts Humane Society.
- 1851 Supervision of lighthouses moves from a treasury auditor to a Lighthouse Board, whose members have maritime experience. The board creates standards for lighthouse equipment and maintenance. Over time, the board moves selection of keepers from a patronage system into a civil service system.

A fog bell replaces the cannon at Boston Light. This is in turn replaced by a

fog trumpet in 1872, then a steam siren in 1887.

- 1851- 67 Lighthouse Board seeks replacement for whale oil. Though a high- quality oil, its price has risen rapidly as whalers catch fewer sperm whales and growing industries demand the oil in greater amounts (1840: \$.55/gallon; 1855: \$2.25/gallon). Board introduces rapeseed, or colza oil (extracted from a plant grown widely in France, but not produced in large amounts in US), then a specially processed lard.
- 1851- 61 All US lighthouses are fitted with Fresnel lenses.
- 1859 A second- order Fresnel lens is installed at Boston Light, which increases visibility to 16 miles. The tower is raised to accommodate the lens. Also, in response to reports of cracks, the tower is strengthened with a brick lining. This is the only known rebuilding of the light's 1783 tower.
- 1871 U.S. Life- Saving Service is established under the Treasury Department.
- 1877- 85 Lighthouse Board introduces kerosene, called mineral oil, as lamp fuel at U.S. lighthouses. Vapor lamps appear 1904 onward (1913 at Boston).
- 1893- 95 MIT students experiment with fog signals that can be heard in the "ghost walk" on one side of Little Brewster Island.
- >1900 Lighthouse board experiments with electricity to power lighthouses. Conversion is slow because most lighthouses, not near electric cables, need generators.
- 1915 Life- Saving Service and Revenue Cutter Service are combined to form the United States Coast Guard, under the control of the Treasury Department.
- 1920- 40 Most U.S. lighthouses are converted to electricity. Electric power eliminates much of the nightly work of trimming wicks, cleaning soot, and filling oil lamps. As a result, fewer lighthouses have resident keepers. Keepers can instead visit some lights to maintain them.
- 1927 January: Frank Ponte, six- week- old son of first assistant keeper Frank Ponte, arrives with his mother Ruth on Little Brewster amidst much regional news coverage. His companions on the island are the two- year- old Maurice Babcock and a cat that Ruth Babcock adopted. Other keepers' children board and attend school on the mainland.
- 1932 April 11: Georgia Norwood is born on Little Brewster Island, one of the few children born at an offshore light station. National interest in her island childhood generates a novel and movie offers.
- 1939 U.S. Lighthouse Service becomes part of the U.S. Coast Guard.

- 1941 Boston Light's last civilian keepers end their work. Ralph Norwood, the second assistant keeper of Boston Light in the civilian Lighthouse Service, becomes the head keeper in the U.S. Coast Guard.
- 1941- 45 Coast Guard extinguishes Boston Light for coast security during World War II.
- 1948 Electric lamps replace kerosene at Boston Light (the island's houses continue to rely on coal and kerosene).
- 1960 The station's duplex house is razed and Coast Guard families relocate off Little Brewster Island. This ends the era of lighthouse families at Boston Light; the crew is now three men. Indoor plumbing and electricity are installed in the now shared keepers' house.
- With the exception of Boston Light, the Coast Guard begins automating light and fog signals at all lighthouses. By setting signals to turn on and off automatically, the service can eliminate resident keepers.
- 1962 Boston Light's cannon is relocated to the Coast Guard Academy in New London, CT; it is returned to Little Brewster in 1993.
- 1964 Boston Light is designated a National Historic Landmark by the U.S. Department of Interior, the first offshore lighthouse to be so designated.
- 1970 Boston Harbor Islands State Park is established, including Boston Light within its boundaries.
- 1989 In the face of Boston Light's imminent automation, Congress passes legislation requiring that the station be "forever manned" as a tribute to lightkeepers and American maritime history.
- 1995 Boston Harbor Islands National Park Area is established, including Boston Light within its boundaries.
- 1998 Boston Light is automated. The resident keepers no longer walk up the tower to turn the light on at sunset and off at sunrise; instead, the light remains on 24 hours a day.
- 2003 Aug 11th: The Coast Guard appoints Civilian Keeper, Sally Snowman as a full time lightkeeper for Boston Light and the first woman appointed to that duty.
- 2004 September 4th: Sammy, the official Coast Guard lighthouse dog since 1997 dies at the age of 14. One year old Samantha Anne (also a black lab) takes over dog duty on the island.

Suggested Student Activities

Activity 1) Pre- Visit - Introduction to the Boston Harbor Islands

Suggested Time: one 45 minute class

Materials Needed: An Interdisciplinary Guide for Teachers is available on the park website at: http://www.bostonislands.com/learn/learn_teach_guide.html. Activities include:

- Create a KWL chart to explore what students already know and what they want to know about the Boston Harbor Islands, civic and environmental responsibility, citizenship, and stewardship
- Examine maps and nautical charts of Boston Harbor from different time periods to understand the topographical changes in Boston and the harbor
- Create a scale model of an island in Boston Harbor to learn about the formation and geology of the islands
- Research the natural and cultural history of the individual islands in Boston Harbor and create a class timeline based on student findings

Activity 2) Pre- Visit – Participate in the [Farmers, Fishers and Facility Keepers PowerPoint Presentation](#). Additional Pre- Visit activities are described in individual curriculum alternatives.

Suggested Time: one 45 minute class

Materials Needed:

- PowerPoint projector and [Fishers, Farmers, and Facility Keepers PowerPoint](#)
- [Farmers, Fishers and Facility Keepers Worksheet](#)

Activity 3) Pre- Visit – Chart Making – Students will familiarize themselves with a chart of the Boston Harbor Islands but marking and coloring landmasses and navigational channel markers. There is a [Making Your Own Chart PowerPoint](#) available explaining the need for channels, what they do, and how they are designated.

Suggested Time: one 90 minute class

Materials Needed:

- PowerPoint projector and [Making Your Own Chart PowerPoint](#)
- Black and white [Boston Harbor Navigational Charts](#) photocopies
- Green and Red markers; Yellow highlighters (for coloring landmasses)
- Demonstration materials could include pictures of marker buoys and a toy boat floating in water to explain why channels are important.

Activity 4) Pre- Visit – Timeline Activity – Use events listed in the historic timeline to create an activity to familiarize students with significant events in the development of Boston Light.

Suggested Time: 30 minutes

Materials Needed:

- Historic Timeline Overview

Activity 5) Pre- Visit – Schoolyard Weather Observation

Suggested Time: 30 minutes

Materials Needed:

- [Weather Data Collection Worksheet](#)
- Thermometer

- Clock or watch
- Barometer
- Compass

Procedure: Using the Data Collection Worksheet and weather instruments go outside the school to record the weather. The Data Collection Worksheet is identical to the sheet used on the island so includes areas to record sea conditions. Students could either leave these sections blank or obtain data on sea conditions via the internet.

Activity 6) Field Visit – Visit Little Brewster Island/ Boston Light

Suggested Time: One school day (including travel time and time on the island)

Materials Needed:

- Class- made charts
- [Island Expedition Worksheet](#)
- [Boston Light Worksheet](#)
- Binoculars
- Compass

Procedure: Visiting Boston Light is by guided tour only. Arrangements can be made by calling the National Park Service Supervisory Park Ranger at the Boston Harbor Islands Park office 617- 223- 8666. During the two hour program on island the students explore four main themes through activity stations throughout the island. The themes cover, Navigation, Weather, Technology, and Life on the Island. Time is also allotted during the visit for a culminating activity and lunch.

Activity 7) Post- Visit – Read about a Boston Light Keeper’s family life.

Materials Needed:

- **First Light: Reminiscences of Storm Child** by Willie Emerson. East Boothbay, ME: Post Scripts, 1986. Recollections of life and work at Boston Light by Ralph and Josephine Norwood and their children, collected by a grandson.
- **A Lighthouse Family** by Harold Jennings. Orleans , MA: Lower Cape Publishing, 1989. Childhood reminiscences of a boy who grew up at Boston Light and Lovells Island; most of his recollections focus on Lovells , but one also gains a sense of lighthouse family life and the harbor’s lighthouse community.

Procedure: Read one of reminiscences about life as a lighthouse keeper family to gain a deeper understanding of life in Boston Harbor. Have students write a fictional journal entry as if they were a lightkeeper. The journal should describe their life and work on Little Brewster Island.