



Background Information and Suggested Classroom Activities on North Carolina Lighthouses

Background information

Only a few years ago, it was difficult to find information on the lighthouses of North Carolina. Fortunately there is now an abundance of information available about our lighthouses and exploring them in the twenty-first century can be a year's curriculum in itself! There are a number of excellent, accurate Internet sites on lighthouses and numerous pictures online. A good starting point to fill you in on the historical background of lighthouses is the webproject of the U.S. Coast Guard at <http://www.uscg.mil/history/articles/LighthouseCurriculum.pdf>.

For specific information about NC lighthouses, use the Outer Banks Lighthouse Society's website at <http://www.oblhs.org>. Facts on the NC lighthouses are based on original U.S. Lighthouse Service documents.

A unit of study on NC lighthouses is a great opportunity to tap your community resources for further information and enhanced experiences for your students. Ask a painter how the stripes were painted on Cape Hatteras. Ask an architect how bricklayers in the latter half of the nineteenth century made double round (conical) walls to make up the basic structure of our tall coastal lights. Do a demonstration on how Cape Hatteras was moved. The possibilities are endless.

There are three types of lighthouses world-wide: **ocean lights** like St. Georges Reef in California and Minots Ledge in Massachusetts; **coastal lights** like most of our NC lighthouses; **harbor and lake lights** like Ocracoke.

Lighthouses are landmarks that serve as directional signs for water borne traffic just like highway signs show the way on land. When traveling along the coast many years ago, there were no visible markers along the stretches of North Carolina's sandy, coastal shores. One section looked much the same as any others. There were no large rocks or big homes or churches atop hills to guide mariners. Lighthouses were the only way a mariner knew where he was and to steer away from the dangerous coastline including the shoaling sands of Diamond Shoals off Cape Hatteras and Frying Pan Shoals off Bald Head Island.

It is a myth that Cape Hatteras should have had a "diamond" pattern since Diamond Shoals is just offshore. According to U.S. Lighthouse Service records, Cape Hatteras correctly received black and white stripes, Bodie Island black and white bands, and Cape Lookout black and white "checkers" in 1873.

Bodie Island is pronounced "Body Island." It was first recorded in U.S. Lighthouse Service records as "Body's Island," perhaps for the original landowner's name but this has not been confirmed. Additionally, there is no proof to the legend that it received its name from the number of shipwrecked victims that washed ashore, though five ships wrecked while it was being built in 1872.

There were many women keepers of American lighthouses. We know of only one at Bodie Island and one at Cape Lookout, and we have little information on these two women. During the Civil War, most men were at war and women had to assume care of the lighthouses. Also, if a keeper died, the wife filled in. Taking care of a lighthouse was a team effort. Children were expected to complete chores including keeping the grass cut, polishing brass, filling the wood box by the warming and cook stoves, and doing anything else needed around a light station.

"Light station" refers to the lighthouse, keepers quarters, and all outbuildings such as storage sheds, whereas "lighthouse" refers to just the tower.

From 1789-1852 the "lighthouse service" was known as the U.S. Lighthouse Establishment; from 1852-1910 it was called the Light-House Board; from 1910-39 it was known as the Bureau of Lighthouses. Throughout the organization's documents, the terms are interchanged and the overall accepted name was the U.S. Lighthouse Service.

Did you know that America has built about 1,500 lighthouses, which includes lighthouses that were burned or replaced after the Civil War? At some sites, more than one lighthouse stood near the same point. For instance, the present tower at Bodie Island is the third tower to be near this site since 1848. Today, only about 600 lighthouses are standing and many of them are in desperate need of repair. Find a lighthouse and help care for it!

The following suggested activities are only a few ways to explore lighthouses with your students. Let them create ideas also--this is a fun unit of study from which all can learn. Note that you will see different numbers quoted for the height of the lighthouses. Until laser technology is used to measure all of them, exact measurements will not be available, but generally, the tall coastal lighthouses are about 160 feet tall with Cape Hatteras being the tallest at 198 feet. (It is the tallest lighthouse in North America and the second tallest in the world.) A quoted measurement may be referring to just the tower itself while another measurement may be the tower plus the height of the lantern room. Yet another quoted height may refer to the "focal plane" of the lighthouse (height from the base of the tower to the middle of the lantern room where the beam is emitted). Even the National Park Service lists the height of the Cape Hatteras Lighthouse as 193', 198' and even 208'! 198' is generally the accepted measurement.

Suggested classroom activities adaptable for all ages

***Explore the different types of lighthouses in NC:

- The octagonal (pre-federal) style of Bald Head Island (1817) is an example of an early light that was constructed before lighthouse designers realized that a round tower could be built higher and would stand better against wind and waves.
- The short, conical style of Ocracoke (1823) is a good example of the early federal style that showed improvement in design.
- The prototype tall coastal lighthouse at Cape Lookout (1859) was one of the first tall, double-brick-wall towers constructed to reach lofty heights. It was designed after the reorganization of the U.S. Lighthouse Service in 1852 that built America's lights with the finest materials available and installed Fresnel lenses in all the lighthouses.
- Post Civil War coastal lights with better stairs design are found at Cape Hatteras, Bodie Island, and Currituck Beach Lighthouses. The Outer Banks History Center in Manteo has architectural drawings of the NC lighthouses. For more information, call (252) 473-2655.
- The saltbox style of the river and sound lights were called "screw-pile" lighthouses because the wrought and cast iron legs or pilings on which one of these lighthouses was supported were tipped with cork-screw-like flanges. These pilings were turned or "screwed" into the soft ground of protected waters, such as bays and sounds where taller and heavier towers could not be supported by the soft, muddy bottoms. Most of these lights were built between the late 1820s and 1880s.
- The last lighthouse built in NC (and the next to last built in the U.S.) is the cylindrical Oak Island Lighthouse that is made of reinforced concrete.

***There are nine existing NC lighthouses. Can you name them all? Make a Bingo game or word find with the lighthouses names.

(Currituck Beach, Bodie Island, Cape Hatteras, Ocracoke, Cape Lookout, Bald Head Island, Oak Island, Price's Creek, and Roanoke River Lighthouses. Price's Creek is in ruins near Southport and the Roanoke River Light (3rd restoration) has been moved from its original location in 1955 to Edenton.) For more names, see the screw-piles, all but one no longer extant, on the map inside the NORTH CAROLINA LIGHTHOUSES booklet by Shelton-Roberts and Bruce Roberts. There are two reproduction lighthouses, Roanoke River Light (2d light) in Plymouth and Roanoke Marshes Light in Manteo.

***Draw an example of each type of NC lighthouse: short conical (Ocracoke); tall coastal (Currituck Beach, Bodie Island, Cape Hatteras, and Cape Lookout; pre-federal style (Bald Head Island); and screw-pile (any of the sound and river lights such as the Roanoke Marshes Screw-pile Lighthouse.)

***Draw the daymarks of Cape Hatteras, Currituck Beach, Bodie Island, and Cape Lookout Lighthouses. Note: the Currituck Beach Lighthouse was left its natural brick color as a daymark to distinguish it from the others.

***When you paint stripes like those on Cape Hatteras, then draw the stripes the opposite direction, look what happens at the intersection of the opposing stripe patterns! To which lighthouse does this daymark belong?

***Set up a display with items that the students collect with lighthouses on them including potato chip bags, Christmas ornaments, stamps, art, magazine articles, videos, bookmarks, travel brochures, etc.

***Start a bulletin board with a catchy title such as "Our Guiding Lights," and let it fill with students' art, writings, photographs, etc. as your unit progresses.

***Draw a large lighthouse, cut it into several pieces, and put a trivia question on the back of each piece. Divide students into small groups and allow them time to research their question. As each group answers/explains the answer to their question/topic, then let them try to piece the lighthouse together to "build" it.

***Design your own lighthouse and "daymark," the pattern/colors by which your lighthouse is identified to mariners.

***Locate on a map the exact locations of all NC lighthouses. Then, from the Internet, gather the names of several lighthouses around the country. Using a U.S. map, give the general locations of other lighthouses and allow students to pinpoint the location of each. If your students like this activity, then try several international lighthouses. One of the most famous is the Eddystone Lighthouse of England.

***Research the first documented lighthouse, Pharos of Alexandria, Egypt. It was one of the Seven Wonders of the Ancient World. The connection of the name with the function became so strong that the word "Pharos" became the root of the word "lighthouse" in the French, Italian, Spanish and Romanian languages. (one site is <http://www.unmuseum.org/pharos.htm>)

***The Statue of Liberty was a lighthouse! Research this great American monument that was a gift from the country of France. The Statue of Liberty was placed upon a granite pedestal inside the courtyard of the star-shaped walls of Fort Wood (which had been completed for the War of 1812). The United States Light-House Board had responsibility for the operation of the Statue of Liberty until 1901. (one site for information is: http://www.greatbuildings.com/buildings/Statue_of_Liberty.html)

***What was a keeper's uniform like? What kind of tools did s/he use?

***Visit as many of the NC lighthouses as you can. Arrange a tour for your students through the resources listed at the end of this article. There are reproductions of the Roanoke Marshes Screw-pile in Manteo and the Roanoke River Screw-pile Lighthouses in Plymouth.

***Have the students to write about a keeper's duties. What do your students think it would be like to grow up at an isolated lighthouse like Bodie Island, Currituck Beach, etc? What would be a typical day for a keeper's son/daughter/pet? From the surviving keepers' children, now in their seventies and eighties, we learn about a time in the 1920s and 30s when there was little radio, no television, no electricity, no medical doctors nearby, no convenience stores, no running water, etc. What a different time! And yet these lighthouse children were very happy according to their oral histories.

***Research Augustin Jean Fresnel and his optic wonder, the Fresnel lens. Note: The reason for a lighthouse's existence was to get the light beam out to mariners as far seaward as possible. Two factors determine the reach of a beam: height of the lighthouse and the brightness of the light. The Fresnel lens increased the candlepower tens of thousands of times over earlier lamps with reflectors. The early lighthouses used candles; next, wicks that floated in oil, usually whale oil. Later, lamps were fitted with parabolic reflectors but were little better. In the early 1820s, Augustin Fresnel designed a lens based on the use of prisms. He positioned prisms into a giant beehive design and angled each prism so that all light from a central source was gathered and focused into an intense beam. His invention is eponymous with his name and still works in many lighthouses today. The ingenious design was easily converted from whale oil to kerosene lamps to electric light bulbs.

***Use a prism to show the reflection and intensification of a light.

***Study the Fresnel lens design. There is a small Fresnel lens on display at the Maritime Museum in Beaufort. The first order Fresnel lens can still be seen working in the Currituck Beach and Bodie Island Lighthouses. The first order Fresnel lens from Cape Hatteras Lighthouse can be seen at the Graveyard of the Atlantic Museum.

http://www.graveyardoftheatlantic.com/outer_banks_lighthouses.htm

The Cape Hatteras National Seashore offers more information about the Fresnel lens:

<http://www.nps.gov/caha/historyculture/fresnellens.htm>

The Old Baldy Foundation has purchased the heart of the Cape Fear lighthouse and is working on plans to display the lens. <http://www.outerbankslighthousesociety.org/news/news-old-baldy-cape-fear-lens.html>

There are only about a dozen of the large first order lenses still operating in the country. The protection of these lenses from being removed and sold is a must. The light is the soul of a lighthouse. (One site with illustration of the angles of prisms used in a Fresnel lens:

<http://www.seathelights.com/other/anatomy.html>)

***A lighthouse keeper, W. J. Tate, keeper of Currituck Sound Lights, assisted the Wright brothers in many ways during the period of their earliest flights at Kitty Hawk from 1900 to 1903. Keeper Tate at that time lived at Kitty Hawk, and he wrote many interesting recollections and documents concerning those now historic events.

For more information, see http://www.uscg.mil/history/faqs/Wright_Brothers.asp.

Lighthouses were also involved in aviation from 1927 until the early 1930s when the U.S. Lighthouse Service was responsible for lighting the landing fields on major routes across America! For an article on this subject, write the Outer Banks Lighthouse Society at P.O. Box 1005, Morehead City, NC 28557.

For more information on the Wright Brothers and the memorial, which was built as an intermediate landing field airway beacon, one site that is very informative and accurate on the Wright Brothers:

<http://ncpedia.org/aviation/wright-brothers>.

***All lighthouses have been automated today; family life at the lighthouses ended when the U.S. Coast Guard took over in 1939. But today, lighthouses are one of the top destinations for tourists.

Research the number of visitors to the NC lighthouses. Websites and phone numbers are listed at the end of this article. Interview people who visit lighthouses and ask them why they like going there.

***Make a Power Point program on NC lighthouses; collect post cards to scan and draw images from the Internet.

***Make a trivia game about NC lighthouses. This could be a board game or a panel competition between teams.

***Make word finds with nautical and lighthouse terms.

***Make a crossword puzzle with nautical and lighthouse terms.

***Make a list of nautical glossary words to learn the meaning of and to illustrate. A suggested list is on the last page of the teacher's guide for K-4 (though the guide is certainly appropriate for even high school students) at

<http://www.uscg.mil/history/articles/LighthouseCurriculum.pdf>. This teacher's guide is provided by the U.S. Lighthouse Service and is part of the U.S. Coast Guard site. The concepts presented on lighthouses are well illustrated including tower types and Fresnel lens.

For your precocious students, consider this concept:

To figure the limits of visibility of a Fresnel lens (how far a first, second, third, fourth, fifth, or sixth order lens could cast a beam seaward with first order being the largest):

A nautical mile equals 1.15 statute miles

Square root of height of the lighthouse at the focal plane times 1.15 (considered the mariner's constant)

Add to the answer the square root of 15 times 1.15 (the average mariner is 15 feet above sea level)
The sum is the limits of visibility of the Fresnel lens within the lighthouse being considered.

Example:

Height of lighthouse at focal plane is 150 feet. The square root is $12.25 \times 1.15 = 14.09$

The square root of 15 is $3.87 \times 1.15 = 4.45$

Add the two products together: 14.09

$$\begin{array}{r} + 4.45 \\ \hline 18.54 \end{array}$$

Rounded at 19 nautical miles is the common distance given for the distance for a first-order Fresnel lens, the typical lens in a lighthouse 150+ feet tall.

If a mariner is closer to sealevel, the limits of visibility will be lower and if the mariner is on a larger ship and is sitting off the water at a greater height, the limits of visibility will be greater.

Source: *Mariner's Notebook* by Captain William P. Crawford, Master Mariner

Recommended websites and phone numbers

<http://www.currituckbeachlight.com> (Currituck Beach Lighthouse)
(252) 453-8152

<http://www.nps.gov/caha> (Bodie Island, Cape Hatteras and Ocracoke Lighthouses)
National Park Service headquarters Cape Hatteras Group (252) 473-2111
Buxton Visitors Center (252) 995-4474 Bodie Island Visitors Center (252) 441-5711

<http://www.nps.gov/caloc> (Cape Lookout Lighthouse)
Cape Lookout National Seashore Cape Headquarters is located on Harkers Island (252) 728-2250

<http://www.fptower.com/> (Frying Pan Shoals Light Station)

<http://www.oldbaldy.org/> (Old Baldy and Smith Island Museum) (910) 457-7481

<http://edentonlighthouse.org/> (Roanoke River Lighthouse 1886) (252) 482-7800
Roanoke River Lighthouse is located in Edenton.

<http://www.roanokeriverlighthouse.org/> (Roanoke River Lighthouse replica) (252) 217-2204
The replica of the second Roanoke River Lighthouse is located in Plymouth.

http://www.townofmanteo.com/index.asp?Type=B_BASIC&SEC={4948728C-E11D-44B2-A6D0-9CCBBFC5C09D} (Roanoke Marshes Lighthouse replica) (252) 473-2133
The replica of the Roanoke Marshes Lighthouse is located in Manteo.

<http://www.chicamacomico.net/index.htm> (Chicamacomico Life-Saving Station) (252) 987-1552

<http://www.oblhs.org> (all NC Lights)
Outer Banks Lighthouse Society, P.O. Box 1005, Morehead City, NC 28557

<http://www.uscg.mil/history/> The U.S. Coast Guard has built a tremendous website for information retrieval. See this site for information on lighthouses, tenders, a keeper's uniform, the U.S. Lifesaving Service (known as the "sister service" for the U.S. Lighthouse Service), the evolution of the lighthouse tower, and much more, including a teacher's guide for K-4. Just keep in mind that the coast guard took over the U.S. Lighthouse service's responsibilities and absorbed its history in 1939. The U.S. Lighthouse Service was the ninth act of Congress of the new nation in 1789. Today, the coast guard has many other responsibilities and is declaring most of American lighthouses surplus property, which are being transferred to qualifying entities who will take care of them. Recently, for example, Ocracoke and Bodie Island Lighthouses were transferred to the National Park Service in the Cape Hatteras National Seashore.

Brief suggested reading list on North Carolina's lighthouses

Booher, Mike and Lin Ezell. Out of Harm's Way: Moving America's Lighthouse. Eastwind Publishing, 2001.

Carr, Dawson. The Cape Hatteras Lighthouse: Sentinel of the Shoals. (Second edition) University of North Carolina Press, 2000.

Book devoted to the history of the lighthouse including the 1999 relocation.

Clifford, J. Candace and Mary Louise Clifford. Women Who Kept the Lights: An Illustrated History of Women Lighthouse Keepers. Cypress Communications, 2001.

This in-depth look at women lighthouse keepers is a classic; however, there are no NC keepers in the stories.

Corey, Cindy. Exploring the Lighthouses of North Carolina. Provincial Press, 1982.

DeWire, Elinor. The Lighthouse Activity Book. Sentinel Publications, 1995.

This is an activity book written for fifth grade level readers, but it is usable for oral reading with younger students or independent study for up to eighth graders.

Duffus, Kevin. The Lost Light: A Civil War Mystery. (Second edition) Looking Glass Productions, 2009.

Story of the Cape Hatteras Lighthouse 1854 Fresnel lens.

Hairr, John. North Carolina Lighthouses and Lifesaving Stations. Arcadia Publishing, 2004.

In the Images of America series, this is a photographic history.

Holland, F. Ross. Great American Lighthouses. Wiley, 1989.

This is a classic overview of most American light stations.

House, Katherine L. Lighthouses for Kids: History, Science, and Lore with 21 Activities. Chicago Review Press, 2008.

Jones, Ray and Bruce Roberts. American Lighthouses. (Second edition) Globe Pequot, 2002.

Has an in-depth introduction to the U.S. Lighthouse Service and now is the only complete guide to all U.S. lighthouses.

Jones, Ray and Bruce Roberts. Southeastern Lighthouses. Globe Pequot, 1998.

Maden, Mary. A Lighthouse Adventure. (Special Edition) Dog and Pony Enterprises, 2000.

For grades K-4, Petey and Tazz visit the Cape Hatteras Lighthouse. This special edition includes the 1999 move.

Shelton-Roberts, Cheryl and Bruce Roberts. Bodie Island Lighthouse: Its History & Restoration. Lighthouse Publications, 2010.

Shelton-Roberts, Cheryl (editor) . Hatteras Keepers: Oral and Family Histories. Outer Banks Lighthouse Society, 2001.

Family history researched by Sandra MacLean Clunies, certified genealogist.

Shelton-Roberts, Cheryl and Bruce Roberts. Lighthouse Families. Crane Hill Publishers, 1997.

This book contains a collection of stories, among which are three chapters from interviews with the last Keepers' children at the Cape Hatteras, Bodie Island, and Croatan Shoals Light Stations in North Carolina. These were some of the last children of the old U.S. Lighthouse Service Keepers who manned the lights before the U.S. Coast Guard took over the Lighthouse Service in 1939.

Shelton-Roberts, Cheryl and Bruce Roberts. Moving Hatteras: Relocating the Cape Hatteras to Safety. Lighthouse Publications, 1999 (updated through the move 2001.)

Shelton-Roberts, Cheryl and Bruce Roberts. North Carolina Lighthouses. Lighthouse Publications, 2000.

This is a 20-page full-color booklet on all of the tall coastal lights of North Carolina and the less well-known sound and river lights. The booklet features a color map of all of these lighthouses, driving directions, and in-depth history of the lighthouses based on a decade of research.

Shelton-Roberts, Cheryl and Bruce Roberts. North Carolina Lighthouses: Stories of History and Hope. Globe Pequot, 2011.

This is a comprehensive look at North Carolina lighthouses by the leading authorities on the subject.

Stick, David. North Carolina Lighthouses. North Carolina Division of Archives and History, 1980.

Tate, Suzanne. Holly from Hatteras: A Tale of Saving Lives. Nags Head Art, 1998.
For grades K-4.

Trumbauer, Lisa. Lighthouses of North America: Exploring Their History, Lore & Science. Williamson Books, 2007.

Yocum, Thomas, Bruce Roberts and Cheryl Shelton-Roberts. Cape Hatteras: America's Lighthouse. Cumberland House, 1999.