

Thunder Bay 2010:  
Cutting-Edge Technology and the Hunt for Lake Huron's Lost Ships

## Shipwreck Mystery

(adapted from the PHAEDRA 2006 Expedition)

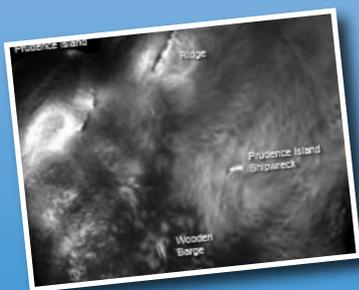


Image captions/credits on Page 2.

# lesson plan

### Focus

Marine archaeology

### Grade Level

7-8 (Earth Science/Social Studies)

### Focus Question

How can marine archaeologists use historical and archaeological data to draw inferences about shipwrecks?

### Learning Objectives

- Students will draw inferences about a shipwreck given information on the location and characteristics of artifacts from the wreck.
- Students will explain at least three types of evidence that could support inferences about the use of maritime technology in the nineteenth century.

### Materials

- Copies of *Investigation of a Shipwreck Near Middle Island in Lake Huron*, one copy for each student group

### Audio-Visual Materials

- None

### Teaching Time

One 45-minute class period, plus time for student research

### Seating Arrangement

Groups of 3-4 students

### Maximum Number of Students

32

### Key Words

Lake Huron  
Thunder Bay  
Shipwreck  
Underwater archaeology  
Debris field  
Artifact

## Background Information

*NOTE: Explanations and procedures in this lesson are written at a level appropriate to professional educators. In presenting and discussing this material with students, educators may need to adapt the language and instructional approach to styles that are best suited to specific student groups.*

On the cold night of November 7, 1860, the two-masted schooner *Kyle Spangler* sped through Lake Huron headed for Buffalo with 15,000 bushels of corn. Suddenly, the schooner *Racine* appeared dead ahead and crashed directly into the *Spangler's* starboard bow between the cathead and knighthead. Ten minutes later, the both ships were headed to the bottom while the *Kyle Spangler's* crew floated in a small boat hoping for rescue. Those hopes were answered the next day. The *Racine* subsequently was raised by the wrecking tug *Oswego*, but the *Kyle Spangler* was not seen again for 143 years. In 2003, diver Stan Stock found the wreck sitting upright at a depth of 185 feet. In September 2008, the wreck was documented by the Thunder Bay National Marine Sanctuary with help from Stock and diver Tracy Xelowski.

The *Kyle Spangler* was neither the first nor the last ship to end its days at the bottom of Lake Huron. In fact, dense fog banks, violent storms, and rocky shorelines make the area surrounding Thunder Bay so hazardous that it has earned the nickname Shipwreck Alley. As a result, Thunder Bay represents one of the nation's most historically significant collections of shipwrecks. The Thunder Bay National Marine Sanctuary (TBNMS) was established in 2000 to protect this important cultural resource. The present boundaries of the TBNMS enclose 448 square miles that contain 40 known historic shipwrecks. Plans are well underway, however, to expand these boundaries to include 3,662 square miles (Figure 1). Archival records indicate that the expanded boundaries include more than 100 undiscovered shipwrecks which can provide unique opportunities for historians and archaeologists to study the maritime and cultural history of the Great Lakes region, as well as for recreational explorers. Finding the exact location of these shipwrecks is obviously essential to these kinds of uses, as well as to protecting these resources.

To help meet this need, in 2008 a remote sensing survey was undertaken in the northern portion of the proposed expansion area. This survey used a side scan sonar towed from a research vessel, as well as a conventional sonar system mounted on an autonomous underwater vehicle (AUV). The 2008 survey covered an area of about 100 square miles and located two new shipwrecks. The total proposed expansion area is much larger, though, so a third survey strategy is needed to efficiently cover large areas of deep water. As its name suggests, the Thunder Bay 2010: Cutting-Edge Technology and the Hunt for Lake Huron's Lost Ships Expedition will use state-of-the-art

### Images from Page 1 top to bottom:

Existing (yellow) and proposed (green) boundaries of the Thunder Bay National Marine Sanctuary. Locations of some known shipwrecks are indicated. Source: Thunder Bay National Marine Sanctuary

A crew in a support boat releases the line from the Naval Undersea Warfare Center (NUWC) REMUS 600 unmanned underwater vehicle equipped with the Integrated Precision Underwater Mapping (iPUMA) subsystem in Narragansett Bay during the Autonomous Vehicle Fest in May 2008.

<http://www.militaryaerospace.com/index/display/article-display/337291/articles/military-aerospace-electronics/volume-19/issue-8/features/special-report/swimming-robots.html>

This image was captured by iPUMA, a wide-swath forward-looking sonar used to identify possible targets. Here we see the two wrecks off Prudence Island, as well as features on the surrounding seafloor. To get a sense of scale, consider that the wooden barge is 120 feet long.

[http://oceanexplorer.noaa.gov/explorations/08aufvest/logs/summary/media/ipuma\\_s2\\_3\\_sonar.html](http://oceanexplorer.noaa.gov/explorations/08aufvest/logs/summary/media/ipuma_s2_3_sonar.html)

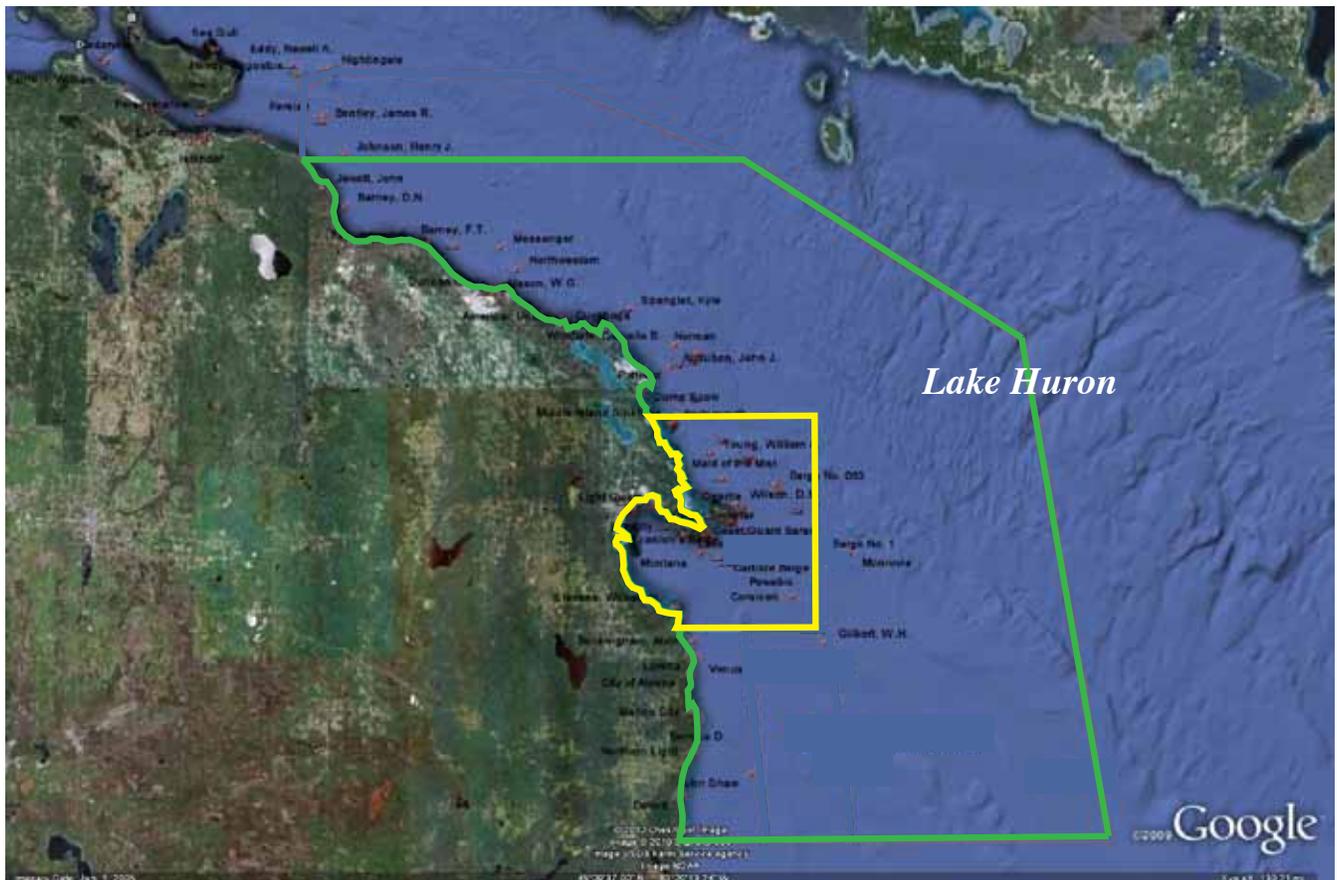
Once a shipwreck has been located on a sonar image, archaeologists don SCUBA gear to "ground truth" the discovery. Dives deeper than about 40 m require the use of special breathing mixtures containing helium, oxygen, and nitrogen to reduce some of the safety hazards that accompany breathing ordinary air during deep dives. Source: Thunder Bay National Marine Sanctuary

Map 1. Great Lakes region, with Thunder Bay National Marine Sanctuary marked with a red dot.



US Army Corps of Engineers, Detroit District. From Wikipedia.

Figure 1. Existing (yellow) and proposed (green) boundaries of the Thunder Bay National Marine Sanctuary. Locations of some known shipwrecks are indicated. Source: Thunder Bay National Marine Sanctuary



technology that includes a sophisticated AUV carrying a one-of-a-kind precision sonar system to survey up to 200 square nautical miles in the proposed expansion area. Further investigation of shipwrecks located during the survey will be done by marine archaeologists using technical diving procedures. If particularly interesting wrecks are discovered, these “ground truthing” dives may be done during the Thunder Bay 2010 Expedition. Most of these investigations, however, will be done after the expedition’s conclusion.

### Learning Procedure

1. To prepare for this lesson:

(a) Review introductory essays for the Thunder Bay 2010: Cutting-Edge Technology and the Hunt for Lake Huron’s Lost Ships Expedition at <http://oceanexplorer.noaa.gov/10thunderbay/welcome.html>

(b) You may also want to review Web pages about the *Kyle Spangler*, “Schooner in the Sand” and *Queen Anne’s Revenge* at <http://thunderbay.noaa.gov/shipwrecks/spangler.html>, <http://www.hal.state.mi.us/mhc/museum/explore/museums/hismus/special/schooner/Default.htm>, and <http://www.qaronline.org/> respectively. Some elements from each of these Web sites have been incorporated into the list on the student handout, since a complete inventory of artifacts from the *Kyle Spangler* is not presently available.

(c) Review the video made by archaeologists investigating the *Kyle Spangler* linked from <http://thunderbay.noaa.gov/shipwrecks/spangler2.html> to decide whether you want to show this to students at the conclusion of the lesson.

2. Show students a map of the Great Lakes, and locate Lake Huron and Thunder Bay. Highlight “Shipwreck Alley” and briefly introduce the Thunder Bay 2010: Cutting-Edge Technology and the Hunt for Lake Huron’s Lost Ships Expedition. Discuss some of the reasons that archaeologists might want to find wrecked ships from the eighteenth or nineteenth century in the Great Lakes. Reasons may include obtaining new information about life early in our country’s history, learning more about technology in other times, and recovering valuable cargo and artifacts.

Briefly explain that most marine archeological investigations involve six major steps:

1. Research to provide the basic information needed for an overall project plan;
2. Search to locate the investigation’s target site;
3. Investigation which includes preparing detailed maps of the target site, and possibly excavation, recovery of artifacts, and other activities that provide useful information (this is the step that most people imagine when they think of “archeology”);

4. Post-Survey Research to analyze data collected during the Investigation step and “decode the clues” provided by physical evidence from the target site;
5. Cultural Resource Management, including preservation and storage of artifacts that may have been collected, as well as Cultural Resource Management plans to protect investigation sites from looters and souvenir hunters; and
6. Communication to make findings of the investigation available to other archaeologist and the general public; publication of results and interpretations is an essential part of every archeological project, and an archeological investigation has very little value without this step.

Ask students what kinds of clues archaeologists might use to identify a newly-discovered shipwreck. Emphasize the importance of shipping records and news reports of shipwrecks. These often include information about the approximate location in which a ship sunk, the size of the ship, how she was constructed, and what type of cargo was on board. These kinds of information can be used to locate a shipwreck, as well as to interpret artifacts from unidentified wrecks. Be sure students understand that artifacts are objects that were made, used, or changed by humans. Ask what types of artifacts might be recovered from a wreck. Their list should include pieces of the ships structure (masts, timbers, engines), items used to operate the ship (e.g., rigging, anchors, bells), weapons and armament, personal effects of crew and passengers, tools and navigation instruments, remnants of the ship’s cargo, and food and equipment used to feed people aboard.

Ask what information archaeologists might obtain from artifacts that would help them identify a newly-discovered shipwreck. The best clues, of course, are artifacts that are marked with the ship’s name (such as nameboards or ship’s bells) or registration numbers. Anything that helps establish the age of the ship, when she was sunk, or that matches objects known to have been aboard the vessel can help establish a wreck’s identity. Be sure students recognize that just because something is found on or near a shipwreck doesn’t necessarily prove that it came from the ship. Shipwreck sites are often “contaminated” by objects called intrusive materials that are carried to the wreck by ocean currents or dropped from vessels passing above.

3. Tell students that they are going to assume the roles of consulting marine archaeologists investigating a shipwreck found in near Middle Island in Lake Huron. Say that background research on shipwrecks in this area suggests that the wreck might be one of four ships. Their assignment is to analyze artifacts collected from sites near the ship, and draw inferences about the vessel and her most probable identity.

4. Provide each student group with copies of *Investigation of a Shipwreck Near Middle Island in Lake Huron*. Note that the artifact inventory is based on artifacts that have actually been recovered from wreck sites of nineteenth century ships in the Great Lakes. Students should first group the artifacts according to the area from which they were recovered. Students should study the artifacts found at each area, research the names of unfamiliar items, and develop inferences about the purpose of the vessel, the people who were aboard, and the most likely identity of the ship. Have each student group prepare a short report on their analyses, citing evidence from the debris field to support their conclusions.
5. Lead a discussion of students' results. Key points should include:
- Wood planks and masts establish that the vessel was constructed from wood, so this eliminates the *Norman* as a possibility.
  - Broken planks near the bow are consistent with a severe collision.
  - Deadeyes, rigging thimbles, and canvas sewing needles are consistent with the ship having been a sailing vessel.
  - Different styles of buttons and shoe buckles were recovered. Some of these were well-made and decorative, while others were roughly made from wood, bone, or leather. This variety suggests that some of the people aboard were relatively wealthy compared to others, such as the different economic status that probably existed between officers and seamen.
  - Barrels containing bones of various animals are probably the remains of food carried to feed people aboard the ship. Remind students that sailors who crewed the ship were doing very hard work in cold weather, and would have needed lots of food (preferably hot food) to keep going. At the same time, these ships sailed before the days of refrigeration, though canned goods may have been available (the first American canning factory opened in 1812). Salted and pickled meats were easily prepared and carried, often in barrels. Many foods were also commonly preserved in glass jars.
  - The empty barrels stencilled "J. M. Allen Salt Inspector" may provide a useful clue about when the ship sailed (and consequently, when she sank). Salt was an important commercial product, and it was the job of salt inspectors to certify the contents and weight of barrels containing this product. By examining public records, it may be possible to determine when and where J. M. Allen was a salt inspector, and this help pinpoint when the salt was carried about the wrecked ship. It's

not surprising that the barrels were empty, since any salt they contained would long since have dissolved in the lake water.

- The coin found beneath the mainmast is another important clue, and in this case almost definitely establishes the identity of the ship. It is a long-standing maritime tradition to place a coin beneath the mast when a ship is constructed. The tradition is thought to be derived from the Roman custom of placing a coin in the mouth of a dead person to pay Charon, the boatman who ferried the souls of the dead across the River Styx to Hades (you may want to suggest that students research the origin of this custom for extra credit or personal interest). Since the date on the coin is 1857, it could not have been available to builders of the *John J. Audubon* or *Defiance*, since they were sunk in 1854 (unless the coin is counterfeit...). Since the *Norman* was a steam-powered steel vessel, the unidentified shipwreck is most likely the *Kyle Spangler*.
  - The inscription on the bible cover is consistent with the wreck being the *Kyle Spangler*, since the full inscription could have been "Schooner Kyle SpangLER."
  - The golf ball, soft drink bottle, nylon fishing line, and plastic oil container are obviously much more modern than other artifacts and should be considered intrusive materials.
  - Closer study of some artifacts might yield additional clues. Glass items, in particular, often have markings and styles of manufacturing that are associated with particular places and periods of time.
  - Students may comment upon the absence of any information about the wreck's cargo. In the case of wheat and corn, this might be because the cargo has decayed or been consumed by lake animals (though the deep, cold waters of Lake Huron are known to have preserved very old agricultural cargo in some shipwrecks). Railroad iron carried about the *John J. Audubon* should still be present, unless it has been removed by unreported salvage operations (illegal removal of artifacts is a common problem, and is one reason that people who discover wrecks do not always reveal their exact location).
6. Following the class discussion, you may want to read the paragraph about the end of the *Kyle Spangler* (Background, above) and possibly show video or still images of the *Kyle Spangler* from <http://thunderbay.noaa.gov/shipwrecks/spangler2.html>. Students will probably notice that the masts of the ship are still in place. If they ask why the worksheet indicates that they are broken off, say that

this was imagined so that the coin beneath the mainmast could be discovered. They may also note that the ship's nameboard was in place and legible when the wreck was first discovered. This fact, along with cargo information, was omitted from the worksheet to make things a bit more challenging!

### The BRIDGE Connection

[www.vims.edu/bridge/archive1200.html/](http://www.vims.edu/bridge/archive1200.html/) – Information, activities and links about shipwrecks and marine archaeology.

### The "Me" Connection

Have students write a brief essay describing why investigation of ancient shipwrecks are (or are not) worth the time, money, and risk involved, and how such investigations might affect their lives personally.

### Connections to Other Subjects

English/Language Arts, Social Studies, History, Physical Science

### Assessment

Student analyses, reports, and class discussions offer opportunities for assessment.

### Extensions

Have students investigate the "Schooner in the Sand" and *Queen Anne's Revenge* shipwrecks (<http://www.hal.state.mi.us/mhc/museum/explore/museums/hismus/special/schooner/Default.htm>, and <http://www.qaronline.org/> respectively).

### Other Relevant Lesson Plans from NOAA's Office of Ocean Exploration and Research

#### I, Robot, Can Do That!

(11 pages, 315 kb) (from the Thunder Bay 2008 Expedition)  
<http://oceanexplorer.noaa.gov/explorations/08thunderbay/background/edu/media/robot.pdf>

Focus: Underwater Robotic Vehicles for Scientific Exploration (Physical Science/Life Science)

In this activity, students will be able to describe and contrast at least three types of underwater robots used for scientific explorations, discuss the advantages and disadvantages of using underwater robots in scientific explorations, and identify robotic vehicles best suited to carry out certain tasks.

**Ping!**

(8 pages, 219 kb) (from the Aegean and Black Sea 2006 Expedition)  
[http://oceanexplorer.noaa.gov/explorations/06blacksea/background/edu/media/06blacksea\\_ping.pdf](http://oceanexplorer.noaa.gov/explorations/06blacksea/background/edu/media/06blacksea_ping.pdf)

Focus: Sidescan Sonar (Earth Science/Physical Science)

In this activity, students will describe sidescan sonar, compare and contrast side-scan sonar with other methods used to search for underwater objects, and make inferences about the topography of an unknown and invisible landscape based on systematic discontinuous measurements of surface relief.

**This Old Ship**

(9 pages, 272 kb) (from the PHAEDRA 2006 Expedition)  
[http://oceanexplorer.noaa.gov/explorations/06greece/background/edu/media/old\\_ship.pdf](http://oceanexplorer.noaa.gov/explorations/06greece/background/edu/media/old_ship.pdf)

Focus: Ancient and Prehistoric Shipwrecks

In this activity, students will be able to describe at least three types of artifacts that are typically recovered from ancient shipwrecks, explain the types of information that may be obtained from at least three types of artifacts that are typically recovered from ancient shipwrecks, and compare and contrast, in general terms, technological features of Neolithic, Bronze Age, Hellenistic, and Byzantine period ships.

**Paleo-Diving**

(12 pages, 552 Kb) (from the Exploring the Submerged New World 2009 Expedition)  
<http://oceanexplorer.noaa.gov/explorations/09newworld/background/edu/media/paleodiving.pdf>

Focus: Underwater Archaeology of Sinkholes (Physical Science/Archaeology)

In this activity, students will be able to explain how sinkholes are formed, why they may be associated with paleoamerican settlements, and how artifacts retrieved from sinkholes may be interpreted.

**Other Resources**

*The Web links below are provided for informational purposes only. Links outside of Ocean Explorer have been checked at the time of this page's publication, but the linking sites may become outdated or non-operational over time.*

<http://oceanexplorer.noaa.gov/10thunderbay/welcome.html> – Web site for the Thunder Bay 2010: Cutting-Edge Technology and the Hunt for Lake Huron's Lost Ships Expedition

<http://thunderbay.noaa.gov/welcome.html> – Web site for the Thunder Bay National Marine Sanctuary

Stein, Janis. 2009. Sunken Treasure. *Huron Shore* 2(1):26-28; available online at <http://view.digipage.net/?userpath=00000043/00008921/00042491/&page=28>

<http://celebrating200years.noaa.gov/edufun/book/welcome.html#book> - A free printable book for home and school use introduced in 2004 to celebrate the 200th anniversary of NOAA; nearly 200 pages of lessons focusing on the exploration, understanding, and protection of Earth as a whole system

<http://thunderbay.noaa.gov/welcome.html> – Links to Lesson Plans from the Thunder Bay National Marine Sanctuary; includes grades K - 2 Boat Builder Activity, grades 3 - 5 Photomosaic Activity, grades 3 - 5 Mapping Activity, grades 6+ Mapping Activities, Steamships and Energy Conversions, and Make Your Own Putt-Putt Boat

<http://thunderbay.noaa.gov/shipwrecks/spangler.html> – Web page from the Thunder Bay National Marine Sanctuary about the wreck of the *Kyle Spangler*

<http://www.hal.state.mi.us/mhc/museum/explore/museums/hismus/special/schooner/Default.htm> – Web site for the Michigan Historical Museum's Special Exhibit, "Schooner in the Sand: Unlocking the Secrets of a Great Lakes Shipwreck"

<http://www.qaronline.org/> – Web site about investigating a shipwreck that may be the pirate Blackbeard's *Queen Anne's Revenge*

<http://score.rims.k12.ca.us/activity/bubbles/> – Marine archaeology activity guide based on investigations of the wreck of a Spanish galleon; from the Schools of California Online Resources for Education Web site

Macaulay, D. 1993. *Ship*. Houghton Mifflin Company. Boston.

### **National Science Education Standards**

#### **Content Standard A: Science As Inquiry**

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

#### **Content Standard E: Science and Technology**

- Abilities of technological design

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

- Natural hazards
- Science and technology in society

## Ocean Literacy Essential Principles and Fundamental Concepts

### Essential Principle 2.

#### **The ocean and life in the ocean shape the features of the Earth.**

*Fundamental Concept Fundamental Concept b.* Sea level changes over time have expanded and contracted continental shelves, created and destroyed inland seas, and shaped the surface of land.

### Essential Principle 4.

#### **The ocean makes Earth habitable.**

*Fundamental Concept a.* Most of the oxygen in the atmosphere originally came from the activities of photosynthetic organisms in the ocean.

*Fundamental Concept b.* The first life is thought to have started in the ocean. The earliest evidence of life is found in the ocean.

### Essential Principle 6.

#### **The ocean and humans are inextricably interconnected.**

*Fundamental Concept d.* Much of the world's population lives in coastal areas.

*Fundamental Concept f.* Coastal regions are susceptible to natural hazards (such as tsunamis, hurricanes, cyclones, sea level change, and storm surges).

### Essential Principle 7.

#### **The ocean is largely unexplored.**

*Fundamental Concept a.* The ocean is the last and largest unexplored place on Earth—less than 5% of it has been explored. This is the great frontier for the next generation's explorers and researchers, where they will find great opportunities for inquiry and investigation.

*Fundamental Concept b.* Understanding the ocean is more than a matter of curiosity. Exploration, inquiry and study are required to better understand ocean systems and processes.

*Fundamental Concept d.* New technologies, sensors and tools are expanding our ability to explore the ocean. Ocean scientists are relying more and more on satellites, drifters, buoys, subsea observatories and unmanned submersibles.

### Send Us Your Feedback

We value your feedback on this lesson.

Please send your comments to:

[oceaneducation@noaa.gov](mailto:oceaneducation@noaa.gov)

### For More Information

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## Student Handout

### Investigation of a Shipwreck Near Middle Island in Lake Huron

Recreational divers have discovered the remains of a sunken wooden ship that appears to be quite old. Your background research has identified four ships that are believed to have sunk in or near this area. A marine archeological investigation has been launched to investigate the wreck, and a large number of artifacts have been recovered. As the artifacts were collected, their location on the wreck site was recorded using a grid system as shown in Figure 1. Your job is to analyze these artifacts and their locations to make inferences about the purpose of the vessel, what caused the vessel to sink, and the most likely identity of the ship.

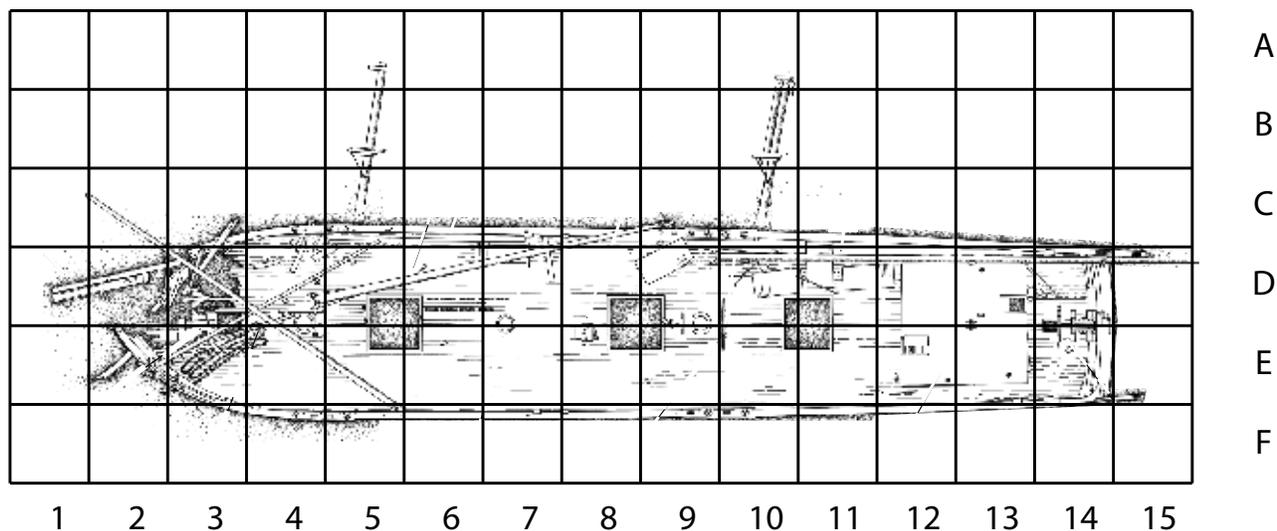
*John J. Audubon* – Brig, wood, 2-mast; sank October 20, 1854 following collision with schooner *Defiance*; cargo: railroad iron

*Defiance* – Schooner, wood, 2-mast; sank October 20, 1854 following collision with schooner *John J. Audubon*; cargo: wheat

*Norman* – Propeller ship, steel; sank May 30, 1895 after being rammed by lumber ship *Jack*; cargo: none

*Kyle Spangler* – Schooner, wood, 2-mast; sank November 7, 1860 following collision with schooner *Racine*; cargo: corn

Figure 1. Grid system for recording where items are found.



| Quantity | Item  | Grid Cell        |
|----------|---|------------------|
| 9        | wood planks, broken and detached from hull many nail holes; spacing of holes matches the distance between frames ("ribs") | C-2, C-3         |
| 1        | mast, wood, with prominent adze marks   | A-5, B-5, C-5    |
| 1        | mast, wood, with prominent adze marks   | A-10, B-10, C-10 |
| 1        | anchor & chain  | E-2              |
| 1        | steering gear   | D-14, E-14       |
| 1        | nylon fishing line  | E-7              |
| 3        | deadeyes  | F-9              |
| 7        | wrought iron hooks  | D-6, D-10        |
| 5        | rigging thimbles  | C-9              |
| 1        | glass oil chimney   | D-14             |
| 1        | bronze hand bell  | E-12             |
| 1        | pocketknife (inside cabin)  | E-13             |
| 4        | canvas sewing needles (inside cabin)  | E-13             |
| 1        | calipers (inside cabin)   | D-12             |
| 1        | brass binoculars (inside cabin)   | D-13             |
| 1        | plastic oil container   | B-7              |
| 1        | inkwell (inside cabin)  | E-12             |
| 1        | brass alarm clock (inside cabin)  | E-12             |
| 1        | sounding weight   | D-4              |
| 1        | soft drink bottle   | F-14             |
| 1        | liquor flask  | D-14             |
| 6        | barrels containing fish, cattle, and pig bones (inside cabin)   | D-13             |
| 11       | glass bottles   | D-8              |
| 14       | barrels, empty, marked with numbers and stencil "J. M. Allen Salt Inspector" (in cargo hold)                              | E-6              |
| 1        | overcoat, pewter buttons, decorative (inside cabin)   | D-12             |
| 3        | felt hats (inside cabin)  | D-12             |
| 2        | vests, bone buttons, rough (inside cabin)   | D-12             |
| 1        | suspenders (inside cabin)   | D-13             |
| 7        | shoes, leather buckles, rough (inside cabin)  | D-12             |
| 1        | rubber slicker (inside cabin)   | D-13             |
| 1        | woolen cap (inside cabin)   | D-13             |
| 1        | golf ball   | F-2              |
| 2        | clay pipes  | D-14             |
| 6        | boots, leather buckles, rough (inside cabin)  | D-12             |
| 1        | leather bible cover with lettering, mostly obscured; inscription begins with "SCH " and ends "ER" (inside cabin)          | E-12             |
| 1        | large copper penny found beneath the mainmast step, dated 1857  | D-9              |