

Final Report: Great Lakes Maritime Transportation K-12 Education Program for Teachers, Students, & Communities (Year 1: January 15-September 30, 2006)

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Project Summary

This project addressed the GLMRI Focus Area of K-12 public education and outreach programs. The project conducted two one-week teacher institutes in summer 2006, developed an interactive online web module for students, a *K-12 Maritime Transportation Education website* and a K-12 teaching trunk. A total of 21 K-12 teachers attended the two teacher institutes. They were extremely enthused about their experience and are now excited to teach about Great Lakes shipping in their classrooms. Thousands of students and others in the Great Lakes basin and nationwide will be reached in the coming months and years via the new lessons developed by the teacher participants, or by interacting online with actual photos and real-world challenges of Great Lakes maritime transportation through an interactive web module, website, and teaching trunk. The project was coordinated by Joan Schumaker Chadde, education program coordinator for the Western Upper Peninsula Center for Science, Mathematics and Environmental Education at Michigan Technological University.

Implementation of Project Goals & Objectives

1) Conducted two week-long *Great Lakes Maritime Transportation Summer Teacher Institutes*.

Week I took place in western Lake Superior from July 24-28, where nine participants visited sites in Duluth, Superior, and Minnesota’s north shore. Week II took place in Michigan’s eastern Upper Peninsula from July 30-August 4 where 14 participants visited sites in Marquette, Munising, Whitefish Point, Sault Ste. Marie, Fayette, and Escanaba. Both institutes addressed maritime history, Great Lakes shipping routes, ports, and cargoes; and required teachers to develop two maritime transportation lessons that could be implemented in their math, social studies, language arts, and/or science classes. A summary of the 2006 teacher institute recruitment publicity, the two one-week teacher institute agendas, a list of what teachers believe K-12 students need to know about Great Lakes shipping *after* attending the two institutes, and a list of lessons developed by participating teachers is contained in Appendices A-D.

It was decided to conduct two institutes, rather than the one six-day institute originally proposed in the initial proposal, in order to comfortably visit the many interesting shipping-related sites in both Duluth-Superior and in the eastern Upper Peninsula of Michigan. Institute participants were able to visit a variety of typically inaccessible sites and interact directly with ship captains, industry personnel, port authorities, city planners, and government agencies (Duluth Seaway Port Authority, U.S. Army Corps, U.S. Coast Guard, Duluth Maritime Museum, Northern Great

Lakes Visitor Center, Marquette city planning and economic development office, Whitefish Point Lighthouse and Museum, and the Soo Locks).

Teacher participants were able to earn two graduate credits from Michigan Technological University for their work before, during, and after each Institute. They developed nearly 40 lesson plans that will be posted on the *K-12 Maritime Transportation Education website*. The best lessons will become part of the *Great Lakes Maritime Transportation Educators Guide* proposed for development in Year 2. One institute participant developed draft text for a potential children's book, "*F is for Freighter: An ABC book of Great Lakes Shipping*." Opportunities for publishing the book will be explored.

Institute participants paid a total of \$250 for the 5-day institute which included all lodging and transportation expenses, 2 MTU graduate credits, most meals, and entrance fees. In addition, participants received informational packets, NOAA Great Lakes map, and a CD of the presentations made by most presenters, and photos.

Recruitment for the 2007 teacher institute has already begun and will incorporate suggestions received from 2006 participants who recommended making presentations at science and social studies conferences in Michigan, Wisconsin, and Minnesota, as well as, articles in professional organizations' newsletters, and their word of mouth contacts to colleagues.

2) Developed web module on Great Lakes Maritime Transportation. <http://techalive.mtu.edu/glmri/index.htm>

The development of this interactive web module was coordinated by Dr. Marty Auer, Professor of Civil & Environmental Engineering at Michigan Technological University, who cost-shared his time. The content of the module was developed by MTU graduate student, Heidi Steudel, and animations were provided by Sue Hill. Some of the topics to be included are: comparing Great Lakes shipping to alternate transportation systems, shipping routes, cargoes, lock systems, and more, etc. The web module will be beta-tested by students before being finalized. The module is hosted on the Michigan Tech Alive website (<http://techalive.mtu.edu/glmri/index.htm>) but will be linked from the GLMRI website.

3) Developed new K-12 Maritime Transportation Education website
http://wupcenter.mtu.edu/education/great_lakes_maritime/index.htm

This new website will serve as a resource for educators. The website is hosted on the Western U.P. Center for Science, Mathematics and Environmental Education's website at Michigan Technological University and will be linked to GLMRI's website. The website will serve as a clearinghouse for teaching resources. Lessons developed by teacher participants in the summer institutes, links, photos, powerpoint presentations, a *Did You Know Quiz on Great Lakes Shipping* (see Appendix F), glossary of shipping terms (see Appendix G), and descriptions of suggested shipping-related field trip destinations are just some of the items to be included on the website that will be helpful to both formal and non-formal educators. Maritime experts and organizations are also invited to make contributions to the website.

4) Developed a Great Lakes Maritime Transportation teaching trunk

The trunk is designed for upper elementary and middle school classrooms and provides a wide variety of resources for teaching about Great Lakes shipping, including sample cargo, such as iron ore (taconite) pellets, coal, salt, limestone, sand; models of "lakers;" a 12'x14' cloth floor map of the Great Lakes watershed showing major shipping ports, ten children's books, ten videos, and a half-dozen curricula on Great Lakes shipping. The trunk may be checked out for two week periods and will be shipped via UPS. Interested educators may contact Loret Roberts at the Western U.P. Center for Science, Mathematics and Environmental Education (Tel: 906-482-0331 or loret@copperisd.org) to reserve the trunk. Borrowers are responsible for returning the trunk. After piloting the trunk for one year, we will make modifications to enhance its usefulness to teachers, and funding can be sought to replicate the trunk for use throughout MI, WI, and MN. In Michigan, the trunks can be disseminated by the network of 33 math/science centers throughout the state. A list of trunk resources is included in Appendix E of this report.

Evaluation Measures and Results

To evaluate overall project success, several evaluation measures were gathered. Teacher participants completed a course evaluation following each summer institute that will be used to improve future institutes. Significant findings from the teacher institute evaluation form are listed below.

(1) The pre-course reading, *Great Lakes Marine Transportation System* white paper prepared for the Midwest Freight Corridor Study by Dr. Richard Stewart, co-director of the Great Lakes Maritime Research Institute, was considered extremely helpful by all participants.

(2) Teachers identified the best dates for scheduling summer teacher institutes:

- Last 2 weeks of June - 2
- July - 9
- First 2 weeks of August - 5
- Last 2 weeks of August - 0

(3) Teachers identified useful incentives to encourage attendance at the institute? (17 responses)

- Dates were convenient - 9
- Inexpensive cost - 14
- Opportunity to earn credits - 12
- Topic of interest - 14 (Other: MTU classes are fun.)

(4) Teachers made suggestions for teacher recruitment for next summer's institute:

- Conference presentation - 3
- Word of mouth recruitment - 8
- Write an article for an education journal - 2
- Write an article for your school newsletter - 2
- Post info on your school's website - 3
- Write an article for an organizational newsletter - 1

Other evaluation comments:

- Keeping the quality high and cost low.
- You supplied everything we could ask for: grad credit, room and board, and free admission to very cool sites.
- Encourage teachers to bring colleagues from the same school district to the institute so they can work together after the institute.
- Presentations at annual state social studies conferences.
- Make these institute classes part of a "planned program" for State of Michigan teacher certification. The credits aren't that useful if you don't already have your permanent teacher certification.

(5) What teachers' enjoyed most about the institutes:

Overwhelmingly, teachers enjoyed the opportunity to see and do things that would typically not be accessible to them traveling on their own, i.e. industrial port facilities, Cleveland Cliffs iron ore mine, Army Corps of Engineers, Soo locks underground tour, and access to the experts and specialists. Specific responses from each week are shown below:

Week I:

- There are too many to name! The more hands-on, the more I enjoyed it.
- I am impressed with the wide variety of site explorations that included all the facets of the shipping industry from the arrival of goods by rail and the safety processes of the port to the shipping of those goods to other GL ports and global destinations. I was able to do this with my friend and meet a new network of professional friends.

- I loved being treated like an honored and important guest. We were privileged to see so many interesting sites in a way we would never have on our own. Teachers rarely are treated so well. Everyone was so interested in our ideas and input. It was a really good and positive experience.
- Being able to go to the port terminals and other sites like the lighthouse, instead of being lectured to in a classroom!
- Becoming aware of the transportation issue. Our sessions at the Duluth Port Authority were very interesting and helpful, and the Port Authority representative did a great job narrating the harbor tour.

Week 2:

- Whitefish Point (3)
- Touring the Cleveland Cliffs Mine and learning how iron-ore gets processed and shipped. (3)
- I also was fascinated by the Soo Locks tour (by the U.S. Army Corps) behind the scenes (8)
- As a history teacher, I enjoyed the Whitefish Point museum and Fayette. (2)
- The Army Corps of Engineers was awesome.
- Visiting many places where you normally couldn't go. i.e. Soo Locks tour, Coast Guard Facility tour, (Cleveland Cliffs) iron ore mine, personal presentations at Marquette, Escanaba
- Soo Locks Boat Tour (2)
- Walking under the Poe Lock!
- I liked all of it!
- Coast Guard facility Vessel Traffic Service (2)

(6) Ways to improve the content or schedule of the teacher institutes for next year.

Week 1:

- Provide time to reflect with other teachers in the institute. Lots of info has been given to us throughout the week and we need time to process it all!
- Include a daily roundtable discussion at the conclusion of each day with all members participating.
- A meeting site is a necessary component in building a community of the learners and professional collegiality. The meeting site would provide a gathering place to review, discuss, answer questions, or give direction to the entire group daily.
- Be sure to have a course overview at the beginning of the institute.
- Have internet access and a resource room available at UMD.

Week 2:

- Week 2 tied in nicely with the first week. I would not recommend taking one week without the other. However, doing both weeks really wore me out physically.
- Maybe state that the class is "Shipping and Industry" or "Transportation and Industry," as we did both.
- Start at 9 and end at 5 each day with discussions at 7:30-8:30 at breakfast and 6:30-7:30 at dinners. Discussions should count as class time. Keep focus on shipping. Eliminate Sault Edison/Pictured Rocks.
- Leave out the paper mill tour and try to get a tour of a limestone quarry at Gulliver or Cedarville in U.P.
- Build in small group discussion time, do not always require whole group time, build on journal reflection time, and build in lesson planning time. End by 9:00 pm daily!
- Start class on Sunday evening for course overview.

The following additional evaluation information will be gathered over the 2006-07 school year and will be included in Year Two's report:

- ◆ Teacher feedback following implementation of newly developed lessons in their classroom and the mastery of learning objectives by their students.
- ◆ Teachers' and students' assessment of the new interactive web module on Great Lakes shipping.
- ◆ Teachers feedback on the usefulness of the Great Lakes Maritime Transportation teaching trunk, and records on the frequency of its use and teachers' comments and suggestions.

Appendix A

Summary of Publicity & Recruitment for 2006 Summer Teacher Institutes

MICHIGAN

- ◆ Michigan Science Teachers' Association (MSTA) list-serve sue@ucia2.com
- ◆ Michigan *Building A Presence for Teachers* list-serve larwad@charter.net
- ◆ Email to 1,000+ past MTU teacher workshop/institute participants (2001-2006)
- ◆ Resource agencies & organizations: conservation districts, county extension offices
- ◆ Michigan DEQ statewide Environmental Education website <http://www.michigan.gov/deq/>
- ◆ U.P. Environmental Educators website
- ◆ Michigan Earth Science Teachers' Association (MESTA) website <http://www.mestarocks.org/>
- ◆ Michigan Math & Science Centers list-serve
- ◆ Michigan Project Wild list-serve elshoff@msue.msu.edu
- ◆ Michigan Project WET list-serve vailj@gvsu.edu
- ◆ Michigan Project Learning Tree list-serve kfischer@binderparkzoo.org
- ◆ Michigan Association of Environmental & Outdoor Educators (MAEOE) list-serve and online calendar
- ◆ Michigan Teacher Network list-serve for MI educational institutions and organizations
- ◆ NMU Seaborg Center list-serve of teachers

WISCONSIN

- ◆ Wisconsin Assn of Environmental Educators (WAE) wae@uwsp.edu and annual conference Oct. 25-27.
- ◆ Wisconsin Education Association Council (WEAC) <http://www.weac.org/>
- ◆ Wisconsin Center for Environmental Education - UW-Stevens Point www.uwsp.edu/cnr/leaf/sf
- ◆ Midwest Lakes Policy Center www.midwestlakes.org

MINNESOTA

- ◆ Minnesota SEEK website seek@moea.state.mn.us or mnseek.net
- ◆ University of Minnesota Duluth
- ◆ MN Association for Environmental Education meeinfo@naee.org
- ◆ Great Lakes Aquarium (Dave Schaeffer) education@glaquarium.org
- ◆ Minnesota Science Teachers Association (MnSTA)

REGIONAL

- ◆ Great Lakes States Seagrass coordinators: Jim Luebner, WI Seagrass; Cynthia Hagley & Marie Zhuikov, MN Seagrass, and Steve Stewart, MI Seagrass.

NATIONAL

- North American Assn for Environmental Education national conference in St. Paul, MN, Oct. 11-14, 2006

Appendix B

Great Lakes Maritime Transportation Teacher Institute Week 1: July 24-28, 2006 (west end of Lake Superior)

Monday, July 24 – Houghton, MI to Duluth, MN

8 am (EST) – Meet at Michigan Tech University in Houghton (Wadsworth Hall)
8:30 am – Load van and depart.
10 am (CST) - **Northern Great Lakes Visitor Center** in Ashland, WI
Noon - Course overview, course requirements, and schedule
2 pm - Tour **Coast Guard facility** in Duluth
5:30 pm – Dinner
7-9 pm - **Lake Superior Maritime Visitor Center & Museum**

Tuesday, July 25 – Duluth, MN

8:30 am - Overview of Shipping on the Great Lakes by **Duluth Port Authority**
11:30-2 pm – **Duluth-Superior Harbor Tour** & lunch aboard *Vista Queen* from Barker’s Island in Superior, WI
3-4:30 pm – Tour of **S.S. William A. Irvin** freighter and museum
5:30-6:30 pm Dinner
7-9 pm – visit Great Lakes Aquarium

Wed., July 26 – Duluth & Two Harbors, MN

9:00 am – **Canadian National ore docks** in Two Harbors
10:30 am - *Edna G.* tugboat tour
Noon – Lunch
2-5 pm - **Split Rock lighthouse** tour
6:30 pm Dinner

Thursday, July 27 – Superior, WI

9-11:30 am - **Midwest Energy Coal transition point**
Noon - Lunch
2-4 p.m. - Tour **Burlington Northern Santa Fe No. 5 Taconite Facility** (BNSF Ore Docks) in Superior, WI
4:30 – 6:00 pm – *Balancing Social, Economic and Environmental Aspects of Shipping on the Great Lakes* by
Dr. Stewart, co-director, GLMRI
7-9 pm – Banquet

Friday, July 28 – Duluth, MN to Houghton, MI

9-11:30 am (CST) – Tour of **Lake Superior Warehousing Co.** and **Murphy Oil** in Duluth
Noon – Lunch & group discussion:

- *What are the “big ideas” regarding Great Lakes shipping that your students need to know?*
- *How can you best interest and effectively teach these “big ideas” to your students?*

12:30 pm (CST) - depart for Houghton, class ends
5 pm – arrive Houghton

Appendix B

Great Lakes Maritime Transportation Teacher Institute Week 2: Monday-Friday, July 31-Aug. 4, 2006 (eastern U.P. Michigan)

Monday, July 31 (Houghton to Munising, MI)

- 8:00 am – Meet at Wadsworth Residence Hall at Michigan Tech in Houghton
- 8:30 am – Depart MTU
- 10:30 am – Tour **Cleveland Cliffs’ Tilden Iron Mine & Taconite facility** with Dale Hemmila, District Mgr.
- 1:30 pm – Lunch in Harbor Park (Marquette)
- 2 pm – Overview of **City of Marquette’s Harbor & Economic Development Plan** with:
 - Fred Stonehouse, historian, author & Chair of Marquette’s Harbor Advisory Committee
 - Sandy Gayk, Director of Community Development for the City of Marquette
- 6:15 pm – **Pictured Rocks National Park Boat Tour** & group discussion
- 9:00 pm – Course overview, schedule, and course requirements
- 10:00 pm - Overnight at Sunset Motel on Munising Bay

Tuesday, August 1 (Munising to Sault Ste Marie, MI)

- 7:30 am – Breakfast
- 9 am – Depart Munising
- 11 am - **Whitefish Pt Shipwreck Museum**
- Noon - Lunch
- 1 pm – Drive to Sault Ste. Marie
- 2:45-5 pm - **Soo Locks Boat tour**
- 6:00 pm – Dinner & group discussion
- 7:30 pm - **Soo Locks Visitor Center** (on your own)
- 9 pm – Overnight at (Ramada) Ojibway Hotel in Sault Ste. Marie, MI

Wednesday, August 2 (Sault Ste Marie, MI)

- 8:00 am – **U.S. Army Corps of Engineers tour of Soo Locks** (water levels, dredging, lock operation, homeland security) with Al Klein, Area Engineer
- 10:00 - **U.S. Coast Guard Vessel Traffic Service**
- Noon – Lunch
- 1 pm – Tour **Edison Sault Electric Co. low-head hydroelectric plant & power canal**
- 2 pm – Tour of **Valley Camp freighter museum**
- 3 pm – Tour on your own: **Tower of History Lookout and River of History Museum**
- 7 pm – Dinner on your own
- 9 pm – Overnight at (Ramada) Ojibway Hotel in Sault Ste. Marie, MI

Thursday, August 3 (Sault Ste Marie, MI to Escanaba)

- 8:30-10:00 am - Tour of **St. Mary’s Paper Mill** in Sault Ste. Marie, ON
- Noon – Lunch & drive 2.5 hrs to Fayette State Park
- 3 pm – Tour of historic **Fayette State Park** (former iron smelting site)
- 6 pm – Drive to Escanaba
- 7 pm – Dinner & group discussion
- 9 pm - Overnight at House of Ludington Hotel in Escanaba

Friday, August 4 (Escanaba to Houghton, MI)

- 8:00 am ***Economics of Great Lakes Shipping*** by Capt. Mark Phillips, Great Lakes Maritime Academy
- 10:30 am - ***City of Escanaba Port Expansion plan & harbor tour*** by Doug Terry, Escanaba City Manager
- Noon – Lunch & group discussion:
 - o *What are the “big ideas” regarding Great Lakes shipping that your students need to know?*
 - o *How can you best interest and effectively teach these “big ideas” to your students?*
- 2:00 pm – Course ends. Depart for Marquette & Houghton.

Appendix C

Great Lakes Maritime Transportation Teacher Institute

What students need to know about Great Lakes Maritime Transportation: A Summary of Participants' Responses following the 2006 Summer Teacher Institute

Economics

- What ships on the Great Lakes carry and why.
- How the cost, efficiency, and environmental impacts of Great Lakes shipping compares to other forms of transportation, such as rail and truck. (6)
- How natural resources are moved and used around the Great Lakes.
- How natural resources use and the regional and U.S. economy are dependent upon Great Lakes shipping. (3)
- The critical importance of the Poe lock (at the Soo locks) linking Lake Superior shipping to the lower Great Lakes.
- Connection between Great Lakes shipping and meeting global needs for goods.
- Gentrification of harbors and shipping can co-exist, i.e. Duluth
- How technological changes have affected harbor communities.
- That iron ore is shipped from northern MN and northern Michigan to Detroit, Gary, Cleveland, and other ports to make steel which we all use in our everyday lives.
- The variety of transportation systems used in the mining process.
- How technological advances in ship design, loading/unloading, navigation, and safety have helped Great Lakes shipping.
- The many and varied career opportunities related to Great Lakes shipping that are available, pay well, and require a variety of skills and post-secondary education/training.

Great Lakes Environmental Protection

- The role of ballast water management in helping to reduce invasive species entry and spread in the Great Lakes.
- How invasive species were introduced and spread throughout the Great Lakes, and control methods for reducing their impacts and their continued spread.
- That Great Lakes shipping is environmentally safe (good for the environment) and that U.S. Coast Guard and Army Corps of Engineers and shipping industry do a very good job of protecting our Great Lakes. (2)

Physical Science

- How locks work between two water bodies of different elevation, and why locks are important. (2)
- How physical principles of balance and momentum affect shipping.

History

- History of Great Lakes shipping from the fur trade, to the industrial revolution, to present-day shipping.
- How shipping has affected life in Michigan and other Great Lakes states.
- Great Lakes shipwreck stories, i.e. the Edmund Fitzgerald, so they understand the perils of the Great Lakes.

Great Lakes Geography

- Major shipping routes and ports on the Great Lakes from the St. Lawrence Seaway to Duluth.

Mathematics

- How mathematics is used in navigation.

Appendix D

Great Lakes Maritime Transportation Lessons for Gr. 3-12

(Mathematics, Language Arts/Reading, Social Studies, Science)

**Developed by Participants in the 2006 Great Lakes Maritime Transportation Summer Teacher Institute
sponsored by the Great Lakes Maritime Research Institute (www.glmri.org)**

1. Great Lakes Shipping Calamities & The Story of the Edmund Fitzgerald (4 lessons)
By Judi Vittito and Dan Kust, Northfield Middle School (MN)
2. How Will You Get Your Iron Ore to Market?
3. Boat Building 101: How Can a Ship Carry All That Cargo and Still Float?
4. Lighthouses: Guardians of Ships
5. Hazards of Shipping
By Craig Croone, Northfield Middle School (MN)
6. Shipping and the Lake Erie Water Snake
7. Lake Erie Water Snake and the Round Goby
By Lisa Bircher, East Palestine High School (OH)
8. How Is Iron Ore Mined?
9. How to Remodel a Harbor
By Kelly Bolen, Grosse Pointe Schools (MI)
10. Pellets, Ships & Cars
11. What Happened to Fayette?
By Susan Howey, Trombly Elementary, Grosse Pointe Schools (MI)
12. Great Lakes Geology and the Necessity of Locks
By Margaux Parino, Assabet Valley Collaborative Alternative High School (MA)
13. Ship to Shore Communication
14. Writing a Friendly Letter to the Ship's Crew
By Robert Palmer, Grosse Pointe Schools (MI)
15. Portage Canal Navigation
16. To Ship or Not to Ship: A Comparison of Transportation Costs in the Great Lakes Region
By Deb Zei, Chassell High School (MI)
17. Charting A Course
18. Great Lakes Topography from the Bottom Up
19. Great Lakes Shipping Card Game
20. The Life of A Laker Board Game
By Sarah Pregitzer, Grant Public Schools (MI)
21. Exploring Shipping Through the Ballad of the Edmund Fitzgerald
22. Comparing Costs: Maritime Shipping vs. Truck Transportation
23. Investigating Shipwreck Data
24. Exploring Great Lakes Folklore & Fables
By Debra L. Zolynsky, Kennedy Middle School (MI)

Appendix E

Great Lakes Maritime Transportation Teaching Trunk Resources (10/22/06)

Available to Great Lakes educators from
Western U.P. Center for Science, Mathematics and Environmental Education at Michigan Technological University
105 Dillman Hall Tel: (906) 487-3341 Email: jchadde@mtu.edu

CHILDREN'S LITERATURE

- Barker, Charles Ferguson. (2005). **The Day the Great Lakes Drained Away.** Grades 2-5
What would happen if the Great Lakes drained away? This unique children's book shows the interesting landscape that would be revealed if all the water in the Great Lakes was to suddenly disappear. This book educates children and adults about the geologic features under the Great Lakes, and reminds us never to take the Great Lakes for granted.
- Bergel, Colin. (2000). **Mail by the Pail.** Grades K-4
This book illustrates the mail delivery system for Great Lakes freighters. The J. W. Westcott Company operates the mailboat for the U.S. Postal Service marine post office in Detroit-the only mailboat that delivers mail to freighters while they are moving.
- Durbin, William. (2003). **Journal of Otto Peltonen: A Finnish Immigrant in Hibbing, MN, 1905.** Ages 12+
The story of a young Finnish boy and his family's experience working in the iron ore mines and growing up in a company town on the Minnesota Iron Range.
- Gibbons, Gail. (1992). **The Great St. Lawrence Seaway.** Ages 4-8 yrs.
Explains the history of this great trade route. Early French explorers and fur traders were halted by the treacherous rapids 500 miles upstream and eventually developed a system for carrying their trade canoes and cargoes around the dangerous stretches to the river beyond, leading into what became known as the Great Lakes. Ultimately, locks were built to do the lifting. The complexities of the lock system are clearly explained in a series of animated diagrams with just enough information for young readers
- Henry, Ragene. (2005). **Barefoot Boys of Fayette.** Grades 3-5
Students learn about the past in the small furnace town of Fayette in Michigan's Upper Peninsula in 1881 with a young boy and his friends.
- Hertel, Captain Robert. (1999) **The Edmund Fitzgerald: Lost With All Hands.** Grades 3-6 (8 copies)
A factual account describing the fate of the Edmund Fitzgerald, including Great Lakes geography, shipping, and theories as to why the ship sank. Also contains a simple maritime glossary.
- Holling, Holling Clancy. (1941). **Paddle to the Sea.** Grades 3-5
An Indian boy carves a wooden canoe and sets it into Lake Nipigon to watch it float away. The canoe spends four years on the water, being picked up by loggers, fishermen, and families before finally making it to the ocean. The canoe's adventures give children a sense of the wonders and diversity in the Great Lakes.
- Walker, Niki. (2003). **Life in an Anishinabe Camp.** Grades 3-5
Crabtree Publishing Company. www.crabtreebooks.com Follow the Anishnabe as they make a living in the Lake Superior land of Hiawatha...travel, children's lives, setting up camp, hunting and fishing, clothing, games, beliefs, working, and self-government.
- Wargin, Kathy Jo. (2003) **The Edmund Fitzgerald: The Song of the Bell.** Grades K-4
The giant ship leaves Superior, Wisconsin loaded with iron ore to make steel that will be used to build cars, but disaster is building as the storm clouds, known as the 'gales of November' gather... This is the story of what happened to the 29 sailors.

REFERENCES

Duluth Port Authority. 2005. **Pride of the Inland Seas** .

Describes the history of the port of Duluth. An additional 20 chapters that were not included in the book are available on Duluth Port Authority's website <<http://www.duluthport.com/>> .

Great Lakes Shipwreck Historical Society. 1998. **Whitefish Point Light Station 1849.**

Whitefish Point, Michigan has been known to native tribes, explorers, missionaries and mariners for centuries. Drawn by the bountiful fishing offered by Lake Superior, the Chippewa Indians used Whitefish Point as a meeting place. Early exploration of Lake Superior led to the discovery of valuable copper and iron ore deposits in the region. Their economic potential brought commercial vessel traffic that continues today. Whitefish Point marks a turning point for all shipping traffic entering or leaving Lake Superior. The Edmund Fitzgerald went down 17 miles NW of Whitefish Point on November 10, 1975.

Jauck, Autumn and Laura Pederson. 2005. **Pictured Rocks National Lakeshore: Exploring by Trail and Shoreline.**
A full-color photo book capturing the many moods of Lake Superior.

Lake Carriers Association. **U.S.-Flag Shipping on the Great Lakes** . (brochure).

Describes major cargoes and provides a useful map of shipping and receiving ports.

Marine Publishing Co. **Know Your Ships: Guide to Boat-Watching 2002.** www.knowyourships.com

Saint Lawrence Development Corporation. **The Great Lakes St. Lawrence Seaway System: Linking North America's Heartland to the World.** Describes pilotage, agents/stevedores, U.S. and Canadian port contacts, Seaway facts, cargoes and more.

Sivertson, Howard. 2001. **Schooners, Skiffs, and Steamships: Stories along Lake Superior's Water Trails.**

This book describes the many interesting watercraft used to carry people across Lake Superior. From the bark canoes and wooden schooners that transported the fur trade and the Mackinaw boats, skiffs and bateaux that worked her shores to the first side-wheel and propeller driven steamships that hauled passengers and freight, Lake Superior's early settlers relied on water transportation as a lifeline to civilization.

Soo Lock Boat Tours. 2005. **Locks & Ships.** Vol. 4.

Describes points of interest, histories of Sault Ste. Marie (Michigan & Ontario), lock and canal history in Sault Ste. Marie and St. Lawrence Seaway, historic lighthouses, charts and nautical terms, and more.

U.S. Environmental Protection Agency and Environment Canada. 1995. **Great Lakes Environmental Atlas**

Maps, history, environmental concerns, management, diagrams, fact sheets on the five Great Lakes.

VIDEOS

Aquatic Exotics (22:00 min.) Grades 4-8

Minnesota Department of Natural Resources – Exotic Species Management Program (1996)

Tel: 612-296-2835

Describes common exotic plant and animal species threatening the Great Lakes and suggests way to control their spread. For grades 4-8.

Barging into the 21st Century (1996) (8:48 min)

American Waterways Association

801 North Quincy Street, Suite 200, Arlington, VA 22203

Tel: 703-841-9300 <http://www.americanwaterways.com/>

Follows the tugboats, towboats, and barges which serve the waterborne commerce of the United States, enhancing the industry's ability to provide safe, efficient, and environmentally responsible transportation.

Intermodal Freight Transport <http://www.marad.dot.gov/index.html>.

Maritime Administration U.S. Department of Transportation
400 7th Street, SW Washington, D.C. 20590
Tel: 847-995-0122

To improve and strengthen the U.S. marine transportation system, including infrastructure, industry and labor, to meet the economic and security needs of the Nation. MARAD programs promote the development and maintenance of an adequate, well-balanced United States merchant marine sufficient to carry the Nation's domestic waterborne commerce and a substantial portion of its waterborne foreign commerce, and capable of service as a naval and military auxiliary in time of war or national emergency. MARAD also seeks to ensure that the United States maintains adequate shipbuilding and repair services, efficient ports, effective intermodal water and land transportation systems, and reserve shipping capacity for use in time of national emergency.

Living on the Edge: Great Lakes-St. Lawrence River Shoreline (25 minutes)
Army Corps of Engineers – Detroit District and the International Joint Commission

Perspective of a Vital Waterway: The Great Lakes ~ St. Lawrence Seaway System (21:38 minutes)
St. Lawrence Seaway Development Corporation

Tel: 1-800-785-2779 www.greatlakes-seaway.com

Beginning with the construction of the St. Lawrence Seaway in 1954 and the official opening in 1959, this bi-national project shared by Canada and the United States, was one of the top ten public works projects of the 20th century. This video captures the rich history, grandeur and diversification of this important waterway which includes channels, locks, rivers, and all five Great Lakes. Ocean-going freighters, bulk carriers, petroleum tankers, cruise ships, and pleasure craft all share in the convenience, efficiency and environmental benefits of one of the world's premiere inland waterways.

Rise and Fall of the Great Lakes. 1991. National Film Board of Canada (17 minutes)
Tel: 1-800-542-2164 Website: <http://www.nfb.ca/>.

A lesson in the geologic history of the Great Lakes. While the Great Lakes have had their ups and downs, nothing has been harder to take than present-day human impact. In the film, a lone canoeist lives through the changes over time—through Ice Age and flood—only to find himself trapped in a sea of 21st century scum.

Split Rock Light: Tribute to the Age of Steel (DVD) (22 minutes)
A story of the beacon that guided the ships along the rocky coast of Lake Superior's North Shore.

Tragedies in the Mist. 2004. Thunder Bay National Marine Sanctuary & Underwater Preserve, Alpena, MI
Thousands of vessels plied the Great Lakes for exploration, transportation, and trade. Many never reached their destinations. An area of Lake Huron known for extreme weather, treacherous waters, and dense fog has claimed over 200 ships. Today these sites are protected by the Thunder Bay National Marine Sanctuary and Underwater Preserve, allowing us to explore lost chapters of America's past.

A Vital Waterway – The Great Lakes St. Lawrence Seaway System (10:28 minutes)
St. Lawrence Seaway Development Corporation
Tel: 1-800-785-2779 www.greatlakes-seaway.com

This video captures the grandeur and economic importance of *The Great Lakes St. Lawrence Seaway System*--- its bustling ports, comprehensive marine transportation infrastructure, diverse intermodal transportation connections, and scenic vistas which all contribute to the making of North America's premier inland waterway.

Where Steel Begins (15:00 minutes) by the American Iron Ore Association (1991)
Available from Lake Carriers' Association, Suite 915, 614 W. Superior Ave., Cleveland, OH 44113-1383
Tel: 216-861-0592 Website: www.lcaships.com

Follow a hunk of iron ore, as it is mined and transformed into a taconite or a pelletized ball that is 60% iron, which then goes on to become the steel used in automobiles, rail lines, buildings, and many more of our everyday products. This video is a bit dated; may be easier to follow for younger audiences. Minnesota-based.

Steel Starts Here (12:00 minutes) by the Cleveland Cliffs, Inc. Michigan Operations (2005)

P.O. Box 2000, Ishpeming, MI 49849

Tel: 906-475-3400 Website: www.cleveland-cliffs.com

Follow a hunk of iron ore, as it is mined and transformed into a taconite or a pelletized ball that is 60% iron, which then goes on to become the steel used in automobiles, rail lines, buildings, and many more of our everyday products. This video is better for older students. Michigan-based.

HANDS-ON TEACHING SUPPLIES

Lake Superior Floor Map – this 12' x 15' cloth map which lays on the floor can be used to teach students of all ages (with shoes off!) about watersheds, Lake Superior geography, food chains, and much more. Includes laminated labels for states, countries, cities, and the Geography Concentration game found in *Lake Effects*, as well as the supplies for *Cooperative Cleanup*, an activity also described in *Lake Effects*.

Great Lakes Floor Map - this 15' x 20' cloth map which lays on the floor can be used to teach students of all ages (with shoes off!) about the Great Lakes watershed, shipping, geography, and much more. Includes laminated labels for states, countries, and the cities listed as shipping and receiving ports by the Lake Carriers' Association.

Samples of western, low-sulfur coal from the Powder River Basin of Wyoming and Montana

Samples of taconite iron pellets from Hibbing, MN

3 wooden ship models of “lakers” and a tugboat

52 playing cards of Great Lakes ships

40 Creature Cards from *Great Lakes in My World*

2" x 4" stamp of the Duluth Lift Bridge and a freighter entering the Port of Duluth

Inflatable globe

500 piece *Great Lakes Puzzle* 18" x 24"

More Legends of the Great Lakes CD (2001) by Carl Behrend. www.greatlakeslegends.com

Whatever Floats Your Boat – Designing Your Own Edmund Fitzgerald by Kathleen Sparling, Michigan Earth Science Teachers Association (MESTA). Contains a lesson, iron ore sample, and 5 cannisters of taconite pellets. In the lesson, student design an ore boat, build it, and test it using iron pellets (taconite), the cargo carried by the Edmund Fitzgerald. Student use charts of shipping routes and port cities to calculate distances and shipping time. Addresses math, social studies, and physical science curriculum benchmarks.

Weather or Not To Go by Kathleen Sparling, Michigan Earth Science Teachers Association (MESTA). In the lesson, students examine weather patterns, maps, and forecasts to determine whether it is safe to travel on the Great Lakes.

CURRICULUM MATERIALS

[*Exploring the Great Lakes: A Logbook of Adventures*](#) by Patricia Westfield and Nan Soper (2003)

A perfect guide for teaching about the Great Lakes. Includes information, activities, and reproducible worksheets on the Great Lakes, including geography, history, shipping and commerce, folklore, environmental issues, and a fold-out map of the lakes, along with mapping activities. A CD-ROM includes video selections of Niagara Falls, locks and

canals, ships, lighthouses, and much more. *Exploring the Great Lakes* leads young learners through the five themes of geography in a lively and relevant way, helping them link their new knowledge to their personal lives, as well as helping them understand the lakes' importance to the region and to the nation. Recommended for ages 8 and up. Spiral bound. 64 pages.

Global Change in the Great Lakes Scenarios (addresses 10 topics; Scenario #3 is on Great Lakes Shipping). (1991) by Rosanne Fortner. Ohio Sea Grant Education Program at Ohio State University. This series of short publications was designed to help people understand how global change may affect the Great Lakes region. Scenarios address: climate change models, effect on water resources, shipping, biological diversity, agriculture, air toxins, eutrophication, fish, recreation, and forests. The scenarios are written in terms the general public can understand, and their content has been reviewed by a panel of experts.

Great Lakes in My World

Alliance for the Great Lakes (Contact: Stephanie Smith <ssmith@greatlakes.org>, Alliance for the Great Lakes <http://www.greatlakes.org/> Tel: 312-939-0838). A collection of lessons related to the ecology and stewardship of the Great Lakes, includes 40 creature cards of Great Lakes plants and animals, natural and exotic.

Great Lakes Shipping: Earth Systems Education Activities for Great Lakes Schools. (1997) Edited by Rosanne Fortner. Ohio Seagrant (<http://www-ohiosg.osc.edu>). Provides eleven lessons related to shipping, world connections, cultures, Great Lakes triangle and canals in Ohio.

Lake Effects: The Lake Superior Curriculum Guide for Grades K-8 (1998)

The Lake Superior Center/Great Lakes Aquarium,
353 Harbor Drive Duluth, MN 55802

A collection of lessons related to the history, geography, management and stewardship of the Great Lakes and Lake Superior. To order, call: 218 740.3474 or view: <http://www.glaquarium.org/>.

Lake Rhymes – Folk Songs of the Great Lakes Region CD & Book by Lee and Joann Murdock. (2004)

This 18-song CD with 71 minutes of Lee Murdock performance includes a 146-page book containing musical scores for all 18 songs, plus over 70 historic photos, maps and illustrations. In addition, the book explains the stories behind each song, plus ideas for using the songs to teach history, English, music and geography. Ideal for those who interested in the Great Lakes maritime history or traditional folk music.

Life of the Lakes: The world's greatest fishery by Shari Dann, Michigan Sea Grant Extension and Michigan State Univ. Describes the life history of lake trout, their food web, past, present and future management.

Paddle to the Sea Curriculum Activities by Marcia Seager and Rosane Fortner of Ohio State University and teacher, Timothy Taylor of Muskingum County Schools. Contains 40 classroom activities that can be taught while reading the book. Activities are on Great Lakes geography, shipping (travel math, buoys, how locks work), lake ecosystems, and stewardship which can be taught in science, social studies, language arts, and math classes. Grades 2-6.

Great Lakes Shipping: Did You Know Quiz

How many of the following questions can you answer correctly? Are you a:

Deck Hand = 25% correct (5 correct answers) *You're heading for a shipwreck!!*

First Mate = 50% correct (10 correct answers) *Get the books out and study up!*

Engineer = 75% correct (15 correct answers) *Good job!*

Captain = 100% correct (20 correct answers) *WOW!!*

1. A 1000-foot "laker" can hold enough iron pellets to make how many automobiles in the U.S.?
 - a. 500
 - b. 5,000
 - c. 15,000
 - d. 1 million

2. What percentage of the United State's iron ore used in steel production passes through the Poe lock at Sault Ste. Marie, Michigan?
 - i. 10%
 - ii. 25%
 - iii. 90%
 - iv. None

3. Which of the following make up "The Big Three" cargoes carried by U.S.–Flag lakers *in order of tonnage on the Great Lakes*?
 - i. Coal
 - ii. Stone
 - iii. Pelletized iron ore (taconite pellets)
 - iv. Salt
 - v. Grain
 - vi. Liquid bulk (oil and gasoline)

4. The "head of the lakes" refers to which city?
 - a. Chicago
 - b. Sault Ste. Marie
 - c. Montreal/Quebec
 - d. Duluth

5. In which year was the first lock constructed on the St. Mary's River to allow boat passage around the St. Mary's rapids?

1798

1850

1895

1959

6. What is "Operation Taconite" run by the Coast Guard at Sault Ste. Marie, Michigan?

7. What was the name of the first sailing vessel on the Great Lakes?

The Griffin *The Invincible* *Lady Elgin* *Mayflower*

8. Which President ordered the current Whitefish Point Lighthouse to be built?

9. Which of the Soo Locks is the longest and most used today?

10. Why did Mr. Carlson, the lighthouse keeper at Whitefish Point in 1918, have the assistant lighthouse keeper and his wife turned over to authorities?

11. When does a 1,000-foot laker hog, sag or list?

12. What does it mean when a large ocean-going vessel (saltie) must "swish and spit" just like you do when the dentist cleans your teeth?

- a. That all the crew have to go brush their teeth right away.
- b. It's time for the crew to wash the ship by "swishing" water over the deck and polishing it to a "spit" shine.
- c. The water in the ballast tanks needs to be exchanged, either saltwater for fresh, or freshwater for saltwater.

13. How many crew members does it take to load a 1000-foot laker with a full load?

1 10 20 50

14. Where is the bell from the Edmund Fitzgerald?

- a. At the bottom of Lake Superior
- b. At the bottom of Lake Michigan
- c. In the Mariners' Church in Detroit
- d. On display at the Great Lakes Shipwreck Museum at Whitefish Point in Michigan's Upper Peninsula.

15. What are the top 3 products *shipped through the Soo Locks each year*?
- a. Iron ore (taconite)
 - b. limestone
 - c. wheat
 - d. coal
 - e. salt
16. How many 1000-foot lakers does it take to transport the cargo carried by six 100-car trains or 2,308 trucks?
- a. One
 - b. Two
 - c. Three
 - d. Four
17. What is the total drop in elevation from Lake Superior to the Atlantic Ocean?
18. What is the drop in elevation between each of the Great Lakes?
- | | |
|--|-------|
| Lake Superior to Lake Huron | _____ |
| Lake Huron to Lake Erie | _____ |
| Lake Erie to Lake Ontario | _____ |
| Lake Ontario to Montreal (St. Lawrence Seaway) | _____ |
19. During which month has there been the greatest number of shipwrecks?
20. What is the total number of lives lost on the Great Lakes in shipping-related casualties in recorded history?
- 500 2,000 10,000 30,000 50,000

(Questions 1-10 and 16-20 by Joan Chadde; questions 11-13 by Katherine Roll; questions 14-16 by Lisa Bircher)

Great Lakes Shipping: Did You Know Quiz - ANSWERS

How many of the following questions can you answer correctly? Find out if you are a:

Deck Hand = 25% correct (5 correct answers) *You're heading for a shipwreck!!*

First Mate = 50% correct (10 correct answers) *Get the books out and study up!*

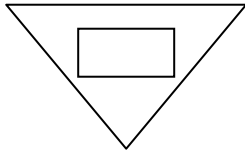
Engineer = 75% correct (15 correct answers) *Good job!*

Captain = 100% correct (20 correct answers) *WOW!!*

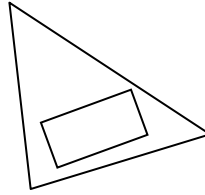
1. A 1000-foot "laker" can hold enough iron taconite pellets to make how many automobiles in the U.S.?
a. 15,000
2. What percentage of the United State's iron ore used in steel production passes through the Poe lock at Sault Ste. Marie, Michigan?
a. 90%
3. Which of the following make up "The Big Three" cargoes carried by U.S.-Flag *lakers* in order of tonnage on the Great Lakes?
 - i. **Coal = #3**
 - ii. **Stone = #2**
 - iii. **Pelletized iron ore (taconite pellets) = #1**
4. The "head of the lakes" refers to which city?
Duluth
5. In which year was the first lock constructed on the St. Mary's River to allow boat passage around the St. Mary's rapids? **1798 (can now be seen outside the St. Mary's Paper Company in Sault Ste Marie, ON)**
6. What is "Operation Taconite" run by the Coast Guard at Sault Ste. Marie, Michigan?
 - i. **The largest ice-breaking operation in the United States.**
7. What was the name of the first sailing vessel on the Great Lakes? **The Griffin (1679)**
8. Which President ordered the current Whitefish Point Lighthouse to be built? **President Lincoln**
9. Which of the Soo Lock is the longest and most used today? **Poe lock**
10. Why did Mr. Carlson, the lighthouse keeper at Whitefish Point in 1918, have the assistant lighthouse keeper and his wife (both German) turned over to authorities? **He overheard their plan to disable the Whitefish Point light in order to stop iron ore shipments through the Soo Locks that were aiding the United States' efforts in WW I !!**
11. When does a 1,000-foot "laker" hog, sag or list?

Answer: When it is improperly loaded. A 1,000 foot laker is much like a tippy canoe. It is essential that it be properly loaded with cargo to distribute the weight. It can "list" dangerously to one side and tip over, in much the same way a canoe would. Improper loading can also cause a vessel to "hog" creating a convex curve in the hull, or "sag" creating a concave curve in the hull.

Properly Loaded Ship



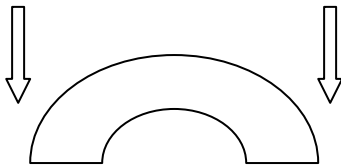
Listing Ship



HOGGING

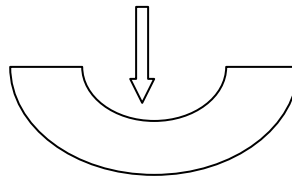
Load

Load



SAGGING

Load



12. What does it mean when a large ocean-going vessel (saltie) must “swish and spit” just like you do when the dentist cleans your teeth?

c. **The water in the ballast tanks needs to be exchanged, either saltwater for fresh, or freshwater for saltwater.** By exchanging fresh ballast water for saltwater in the ocean, an ocean-going vessel can almost completely avoid bringing non-native, invasive species from ocean ports to the Great Lakes.

13. How many crew members does it take to load a 1000-foot laker with a full load?

Answer: Just one! Due to advances in technology a large ship can be loaded by one crew member using remote control (self-loader and self-unloader).

14. Where is the bell from the Edmund Fitzgerald?

d. On display at the Great Lakes Shipwreck Museum at Whitefish Point in Michigan’s Upper Peninsula.

15. What are the top 3 products shipped through the Soo Locks each year?

- a. **Iron ore (taconite) = 74%**
- c. **wheat = 11%**
- d. **coal = 6%**

16. How many 1000-foot lakers does it take to carry the cargo carried by six 100-car trains (10,000-ton capacity each) or 2,308 (26-ton capacity) trucks?

a. One (a 1000-foot laker carries 60,000 tons)

17. What is the total drop in elevation from Lake Superior to the Atlantic Ocean?

Lake Superior is 640 feet above the Atlantic Ocean.

18. What is the drop in elevation between each of the Great Lakes?

Lake Superior to Lake Huron	<u>21 feet</u>
Lake Huron to Lake Erie	<u>12 feet</u>
Lake Erie to Lake Ontario	<u>326 feet</u>
Lake Ontario to Montreal	<u>224 feet</u>
(Totals 583 feet)	

19. During which month has there been the greatest number of shipwrecks?

From 1800-1975, 140 shipwrecks have occurred on the Great Lakes during the month of November; 40 were on Lake Superior and 38 were on Lake Huron.

20. What is the total number of lives lost on the Great Lakes in shipping-related casualties in recorded history? **30,000**

(Questions 1-10 and 16-20 by Joan Chadde; questions 11-13 by Katherine Roll; questions 14-16 by Lisa Bircher)

Appendix G

Great Lakes Maritime Shipping Vocabulary

Aft	Behind or back
Aid to navigation	Device that is external to the vessel whose purpose is to assist a navigator to determine position.
Ballast	Weight added to lower a ship in the water making it less top heavy when traveling without cargo. Fresh or salt water are most commonly used.
Beacon	Light to aid navigation.
Bearing	The direction to an object as measured from the boat.
Berth	A place where a ship anchors or ties up to a dock.
Bow	The front of the ship.
Broach	When a vessel rolls onto its side
Buoy	A floating object moored to the bottom to mark a channel to aid to navigation.
Cargo	Goods carried by a ship. General cargo is boxed, bagged, crated or on a pallet. Bulk cargo is loose---usually granular, such as grain, iron ore, taconite pellets, or coal.
Channel	The deeper part of a river or harbor for ships to pass through; a route between two bodies of water.
Chart	Nautical version of a highway road map.
Commodity	Anything that is bought and sold.
Course	Direction in which a boat is intended to be steered.
Danger signal on a ship	Five short toots.
Day beacon	Unlighted fixed aid to navigation.
Deck	Flat surface on the upper part of the ship where the crew and passengers can walk. Passenger ships have several decks, whereas a cargo ship (freighter) may have only one deck.
Dock	A long platform built next to the water as a landing place for ships.
Elevator	A building for storing grain.
Export	To send goods from one country for sale in another.

Foghorn	A horn blown during foggy weather to warn ships of danger.
Greenhouse gas	Gases in the atmosphere, including increased carbon dioxide, methane, ozone, and fluorocarbons that contribute to global warming and may result in greater evaporation from the Great Lakes.
Grounded	When a ship runs aground in shallow waters or on rocky outcrops.
Harbor	A place where ships may anchor.
Hatch	Doorway on a vessel. Hatchcovers are on the deck of a freighter where the vessel is loaded with cargo.
Head	Bathroom on a vessel.
Heading	The direction the boat is pointing.
Hogging	Improper loading can cause a vessel to “hog” creating a convex curve in the hull.
Hull	Lowermost portion of a ship floating partially submerged.
Import	To bring goods into one country from another.
Inter-modal transport	Moving cargo using more than one mode, such as truck, railway, ship, or plane.
Invasive species	Non-native species that are transported to a new area that typically have no natural predators (ex: zebra mussels).
Leg of a journey	Portion of a trip.
Lighthouses	Mark entrances to harbors, and warn ship captains where there are dangerous shallow waters or other obstructions.
Line	All ropes on a vessel are called lines.
Listing	Tipping to the side
Locks	A section of a waterway, in which gates are used to raise or lower the water level to allow ships to move between water bodies of different elevations.
Longshoreman	A person who works on the waterfront loading and unloading ships.
Maritime	Anything having to do with water bodies or the sea; nautical.
Maritime shipping	Transportation of cargo via waterways.
Natural resources	Useful materials found in nature

Radar	Radar helps ships find their way in the dark or in the fog.
Pilothouse	Enclosed structure on the deck of a ship from which it can be navigated.
Port	1. A city or town with a harbor for loading/unloading ships. 2. Left-hand side of a vessel, facing forward.
Quarry	Limestone and other stone used in construction and steel-making is mined from quarries and loaded into Great Lakes ships.
Range	Two visible objects in a line, or the distance to an object
Sagging	Improper loading can cause a vessel to “sag” creating a concave curve in the hull.
Shipping route	Route which a freighter travels from one port to another.
Shipping	Transportation of cargo via water, road, rail or airplane using a freighter, train, truck, or plane.
Starboard	The right-hand side of a vessel, facing forward.
Stern	Back of the ship
Taconite	Iron ore that is refined and formed into small marble-sized pellets
Ton	A unit of weight equivalent to 2,000 pounds.
Track	The path the boat has actually followed.
Tugboats	Help move ships around in harbors or rivers.
U.S. Coast Guard	Protects the Great Lakes in a variety of ways including environmental management (pollution spills, invasive species, etc.), security, navigation of foreign vessels, and search & rescue. Grand Haven, Michigan is Coast Guard City, U.S.A.
Vessel	A broad term for any watercraft.