TEACHING GREAT LAKES SCIENCE

Lessons & Data Sets

USER GUIDE

Teaching Great Lakes Science lessons provide formal and informal educators with resources to effectively teach Great Lakes concepts. Topics include biological sciences, technology, beach safety, engineering, and applied mathematics. These lessons are aligned with Next Generation Science Standards and have been tested in classrooms across Michigan for users in grades 4-12. This user guide will explain the layout and resources available in the Teaching Great Lakes Science suite of lessons.

greatlakeslessons.com

About

This guide will help teachers incorporate *Teaching Great Lakes Science* material into their classrooms. We hope formal and informal educators can utilize our resources in the way best fit for their audience.

Each of the *Teaching Great Lakes Science* lessons, activities, data sets and teacher resources have been written and reviewed by education specialists. Using this guide, teachers will be able to use these educational resources in ways which work best for them.

All lessons, activities, data sets, teacher tools on guided inquiry and other supplemental information are freely available at the *Teaching Great Lakes Science* homepage:

> www.GreatLakesLessons.com

Teachers can use this guide to:
- Become familiar with *Teaching Great Lakes Science* resources before using them in the classroom.
- Follow step-by-step examples for creating and assessing lessons using these resources.
- Learn how to tailor lessons and activities to best fit your audience.

Funding Acknowledgement

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Introduction

Before exploring the various activities and lessons within the *Teaching Great Lakes Science* lessons portal, teachers and practitioners should be familiar with some of the building blocks that create their foundation.

Great Lakes Literacy

Helping students become stewards of the Great Lakes is important to the sustainability of our region. To achieve this goal through *Teaching Great Lakes Science* lessons, students must become Great Lakes literate by developing an understanding of how they influence, and are influenced by, Great Lakes processes. These lessons align with the Great Lakes Literacy Principles below:

Great Lakes Literacy Principles:
1. The Great Lakes are connected to each other and to the world's oceans.
2. Natural forces formed the Great Lakes; the Lakes continue to shape the features of their watershed.
3. The Great Lakes influence local and regional weather and climate.
4. Water makes Earth habitable; fresh water sustains life on land.
5. The Great Lakes support a broad diversity of life and ecosystems.
6. The Great Lakes and humans in their watersheds are inextricably interconnected.
7. Much remains to be learned about the Great Lakes.
8. The Great Lakes are socially, economically, and environmentally significant to the region, the nation and the planet.

Michigan Sea Grant produces curriculum resources, publications and other tools which include a rich geographic context, enabling students to become better connected to the Great Lakes. Michigan Sea Grant's resources strive to develop a Great Lakes-literate public by addressing the Great Lakes Literacy Principles. Our resources promote Great Lakes literacy among the community of educators, scientists, students and citizens residing within and around the Great Lakes region.

A Great Lakes Literate Person:
- Understands the essential principles and fundamental concepts about the characteristics, functioning and value of the Great Lakes.
- Can communicate accurately about the Great Lakes' influence on systems and people in and beyond their watershed.
- Is able to make informed and responsible decisions regarding the Great Lakes and the resources of their watershed.

Content and Structure

Each *Teaching Great Lakes Science* lesson consists of a summary, learning objectives and a detailed overview of the subject being explored. At the end of most lessons are links to the applicable activities that demonstrate and apply the concepts presented within the lesson. Topics include:
- Fish
- Food Webs

- Great Lakes & You
- Invasive Species
- Water Properties
- Water Quality & Quantity
- Weather & Climate Change

Data Sets
Data sets include background information and real data collected around the Great Lakes region. The background sections offer suggestions on how the data can be used as launching pad to design data-centered projects and analyses.

Teacher Tools
The *Teacher Tools* section contain useful tools for applying lessons and activities in the classroom. Resources include helpful charting and graphing tips, a glossary of key terms, tip sheets and resources for helping developing inquiry-based questions.

Next Generation Science Standards
All lessons are lined with the performance expectations from the Next Generation Science Standards (NGSS). To learn more about how the lessons align with the NGSS and what practices, crosscutting concepts and disciplinary core ideas the lessons align with, follow the specific link located below the performance expectations PDF in each lesson. Visit www.nextgenscience.org/ for more information.

Explore Lessons and Activities

What goes into a Great Lakes lesson? What are the key elements that make our lessons and activities worth incorporating into your curriculum? Each lesson and activity includes:

- Clearly identified learning objectives
- Background information on expansive topics and concepts
- Hands-on learning activities

Michigan Sea Grant's teaching and learning resources, which are free and easy to download for the classroom, are found at www.GreatLakesLessons.com. To get started on the homepage, select the *Explore Lessons and Data* tab.
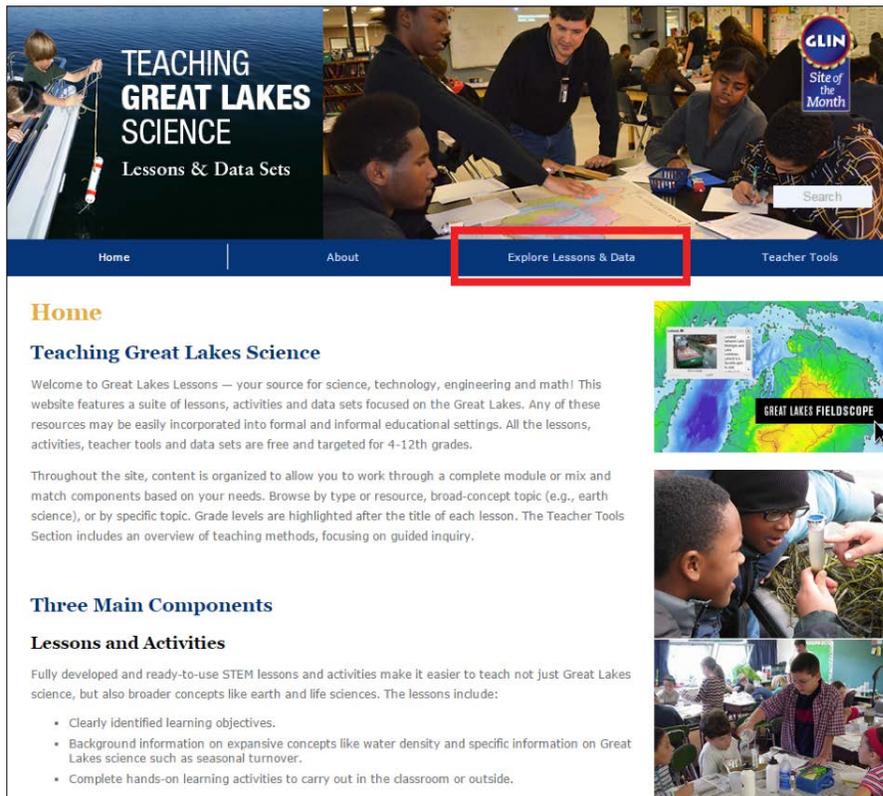

Figure 1: *Teaching Great Lakes Science* lessons homepage provides access to all of Michigan Sea Grant's teaching and learning resources.

How to Find a Lesson

To help users easily find the most applicable lesson, they are organized in multiple ways. Teachers can use the most relevant sorting tool to find the lesson that best suits their classroom and teaching needs.

Lesson Components

- **Introduction:** Each lesson begins with an introduction and explains the importance and relevance of the topic. It is critical for educators to understand the lesson beforehand in order to convey concepts to students.

- **Grade level:** The lesson will state the intended grade level, but lessons can be modified by the instructor to fit their intended audience. Modification is left to the discretion of the teacher or instructor.

- **Performance expectation:** Performance expectations come directly from the Next Generation Science Standards (NGSS) and align with the expected outcomes of the lesson. This makes it easy for educators to know which performance expectations students will have met upon completion of the lesson.

- **Objectives:** Each lesson contains a list of lesson objectives. These help define what students should gain from the lesson, and make it clear to the instructor what the learning objects are for each lesson.

- **Background:** The background sections will contain most of the information needed to teach the lesson. This section may include additional resources such as visual aids, diagrams or links to other resource which augment the lesson. This is helpful for both students and instructors.

Activities

Most lessons include a 50 minute activity for students to provide hands-on experience and strengthen concepts learned. For teachers with existing Great Lakes lessons, the activities are available for adaptation into their existing programs and lesson plans.

These activities provide valuable hands-on opportunities for students to explore Great Lakes concepts and engage in topics in greater depth. Each activity includes a summary, a list of resources needed to complete the activity, the estimate time of completion and free downloadable items. Materials include worksheets, worksheet keys, maps and diagrams. Step-by-step procedures needed to perform the activity are included, followed by discussion points to spur dialog and critical thinking.

The content source is listed at the bottom to allow teachers to learn more about data sources and provide further exploration.

Data

Teaching Great Lakes Science data are adapted from real Great Lakes data sets. They are customized by Michigan Sea Grant for use in the classroom. Data used in these lessons have been collated and condensed for ease of use by professionals, and tested by teachers in the classroom. Links to primary data sources are contained within each lesson.

Data sets are available independently of the lessons to accommodate teachers who wish to use them for their own lessons. To view a list of data sets, select *All Data Sets* under the *Explore Lessons & Data* tab. In the *All Data Sets* section, data sets are listed in alphabetical order, similar

to the *All Lessons* organization. Background information and related resources are provided for some data sets.

All Data Sets

- Physical Characteristics of the Great Lakes
- Hydrology of the Great Lakes
    - Background: Hydrology of the Great Lakes
    - Research Methods: Hydrology of the Great Lakes

- Storm's Effect on Lake Erie
    - Research Methods: Storms and Lake Erie

- The Storm that Sunk the Edmund Fitzgerald
- Underwater Sinkholes in Lake Huron
- Snow and Ice Conditions in the Great Lakes

Figure 2. Data sets are simplified for use by teachers, and available separately from the *Teaching Great Lakes Science* lessons for adaptation into other lessons and activities.

Data are contained within Microsoft Excel spreadsheets and are accompanied by specific questions, which complement the lessons or can be adopted for use with other lessons. These questions are provided to guide a classroom discussion and facilitate a better understanding and use of data sets in answering scientific research questions.

Additional Resources

Additional resources are provided to help apply lessons and activities to the classroom, and are applicable to many teaching settings. They include:

- Charting and graphing tips
- Glossary of common terms
- Guided inquiry
- Great Lakes FieldScope

These additional resources are found under the *Teacher Tools* tab located on the *Teaching Great Lakes Science* homepage.

Charting and Graphing Tips

Before creating a graph or chart, questions following the guided inquiry process (explained below) should be developed. Review the general characteristics of the data, such as correlation and distribution. Afterward, teachers will be able to decide which type of graph to use. Next, consider what relationships or comparisons are you interested in making.

Decide which type of graph would best illustrate the data, such as line, bar or scatter. Guidance is located in *Charting and Graphing Tips* under *Teacher Tools*.

Students should be reminded to always label axes, include units and keep graphs as simple as possible. Graphs are figures, and when included within a document they should be labeled as such. They should have clearly written captions. Figures and their captions should be able to be

interpreted independently of the document. Table captions go on top of the table, and figure captions go on the bottom. An easy mnemonic to remember this is, "Figure-floor, table-top." Other tips and advice are included in the *Charting and Graphing Tips* section.

Guided Inquiry

Guided inquiry, a process important at all grade levels, requires students to engage in higher-level thinking skills, such as summarization, analysis and evaluation. *Teaching Great Lakes Science lessons* follow the guided inquiry process. Guided inquiry provides educators with methods that support student learning, by providing real-world data in a classroom-friendly format. By using data sets from working scientists, students focus their efforts on analysis and evaluation. Guided inquiry steps, support and further resources are provided under *Teacher Tools*.

Great Lakes FieldScope

Great Lakes FieldScope is a partnership program created by Michigan Sea Grant, Great Lakes Observing System and National Geographic. It can be incorporated into any lesson where investigating spatial data in the Great Lakes is a key objective. Great Lakes FieldScope is an online tool built for exploring, sharing and analyzing real-world data sets, including observations from students and scientists studying the world around them. Great Lakes FieldScope contains data sets that can be used to answer questions presented in the lessons and activities. Users can use FieldScope to investigate questions that address real-world issues related to water quality in the Great Lakes. For a more detailed how to guide, please review *An Introductory Guide to Great Lakes FieldScope*.

Summary

This guide provides a roadmap to the *Teaching Great Lakes Science Lessons*, but teachers should explore the website thoroughly to familiarize themselves with the various resources available. The lessons, activities and data sets are intended to boost the Great Lakes Literacy of students within and outside of the Great Lakes region. Questions and feedback are welcomed and should be directed to msgeducation@umich.edu.