



The Guide

leading you to the best that
Northeast Michigan has to offer

Invaders

Combating Aquatic Invasives

Plastic Pollution

Great Lakes Issues in the Classroom

Citizen Science in the Schools

Educational Opportunities for Students

Connecting to our Sanctuary

Shipwrecks, Science, & History



PROTECTING THE GREAT LAKES AND NATURAL RESOURCES OF NORTHEAST MICHIGAN
THROUGH HANDS-ON, PLACE-BASED EDUCATION IN AND WITH THE COMMUNITY.

The Guide

a note from the publisher



By Scott Nunn
publisher

The Guide is a proud partner of the Northeast Michigan Great Lakes Stewardship Initiative, and the publisher of this Special Edition.

A locally owned publication, The Guide's sole existence is to promote Northeast Michigan and all the wonders within.

Without partnerships with organizations like NEMIGLSI, Huron Pines and many others we couldn't ensure the protection of the assets that we live here

to enjoy, and others come here experience.

With its pristine waters, renowned rivers and lakes, and rolling landscapes Northeast Michigan is a prize worth protecting.

In a region sparse in population, partnerships are of the utmost importance to achieve the goal of making the world a better place for tomorrow.

Within these pages you will see highlights of conservation and education programs that have occurred across Northeast Michigan.

These programs are a prime example of place-based education. They showcase the benefits of getting youth out of the classroom and taking them into the fields, and streams or into the real-world if you will.

Aside each story you will

see a graphic advertisement showcasing one of NEMIGLSI's partners. Without these partners these important and educational projects would not have been possible.

You will also see schools mentioned within these stories, as these are, after all, examples of place-based education. Without the support of these educators, parents and students, this work also would not have been done.

It is important that you take a moment when reading these stories and consider what would happen without volunteer organization, businesses and government agencies working together.

Working together, anything is possible.

The Guide would like to take a moment to thank each and every partner within these pages, and

those we may have forgotten.

We also want to thank the schools and educators for looking outside the box and seeing the value these lessons presented to their students. These lessons cannot be applied to standardized tests.

We want to thank and applaud the students that got their hands dirty and their feet wet to learn invaluable lessons from these wonderful programs.

We want to thank the AmeriCorps volunteers past and present that work with these schools and organizations.

Lastly, we want to thank Brandon Schroeder for sharing in the dream for Northeast Michigan and the hope for a better tomorrow.

Without you, the aforementioned partners, our region would suffer greatly. 🙏

FEATURES

- 4 What's in YOUR Watershed?
- 6 Fisheries in the Classroom
- 8 Invaders
- 10 Plastic Pollution
- 12 Is Your School a Green School?
- 14 Rethinking the School Yard
- 16 Beyond the Cutting Board
- 20 Citizen Science in the Classroom
- 22 Adopt a Beach
- 24 Monarch Watch
- 26 Vernal Pool Patrol
- 28 Endangered Species
- 30 Invasives
- 32 Two Schools, Two Parks & a Too Cool Language Arts Project
- 34 Connecting to our Sanctuary

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What's in YOUR Watershed?



By Daniel Moffatt, Helen-Ann Cordes, and Meaghan Gass

Surrounded by rivers, lakes and streams, and so close to Lake Huron, Northeast Michigan teachers and community leaders understand the value of their resource-rich region. To connect student learning with the invaluable surrounding natural resources, they worked together to secure funding to get students outdoors and their feet wet. For instance, the Our River, Our Future grant successfully funded meaningful watershed education experiences for students in the Thunder Bay River and other Northeast Michigan watersheds through the national NOAA Bay-Watershed Education and Training (B-WET) Program. Flowing naturally with local resource issues of water quality, recreational and commercial fishing, aquatic invasive species and more, the B-WET grant supported teachers in both preexisting and newly developed place-based education projects.

The B-WET grant has helped provide meaningful watershed education experiences for many students and teachers throughout Northeast Michigan. Stepping out of their classroom to conduct water stewardship projects has allowed students to connect on a deeper level with their communities. The goal: engage students in meaningful watershed experiences through place-based education.

One grant beneficiary was the Thunder Bay River Watershed Project – where students research real ecological problems caused by invasive species in their local watershed. The B-WET program, in partnership with Alpena Shipwreck Tours and with instructional assistance from the regional Math and Science Center and 4-H Youth Programs, provided scientific testing materials for 20 classrooms within the Thunder Bay River watershed, allowing more than 800 students to experience shipboard learning on Lake Huron aboard the glass-bottom boat, *Lady Michigan*. By engaging young people in

Connecting students to our rivers, lakes, and streams...

meaningful exploration of their local watershed, this project demonstrates that students can play critical leadership roles in the region they call home.

While on Lake Huron, students learn about maritime heritage by observing historic shipwrecks and viewing modern ships in the bay. They conduct research on Lake Huron to determine what is found below the surface using ROVs (remotely operated vehicles). On shore, the students study shipwrecks and monitor area beaches. Through the Alliance for the Great Lakes Adopt-a-Beach™ program, students monitor water quality and lake current, count wildlife, and pick-up and tally litter items. The collected data is added to an online database through the Alliance for the Great Lakes.

For water quality monitoring, students analyze both biotic (living) and abiotic (non-living) indicators. Biotic indicators include macroinvertebrates, animals without a backbone that are visible to the naked eye. Some macroinvertebrates are more sensitive to pollution than others, and as a result, they are used as a biological indicator of water quality. By counting the collected aquatic organisms, students are able to assign a water quality score to each river site based on what organisms they found. Abiotic indicators are chemicals (i.e. dissolved oxygen, ammonia, nitrates, pH, etc.) found in the water. The student-collected data from both the water chemical tests and identified macroinvertebrates are then added to the Great Lakes FieldScope Database. This information contributes to their community by providing data from various sites throughout their watershed – much of which have never been studied before – to community partners, agencies and stakeholders.

Additionally, students connect to their watershed by monitoring invasive species, like Rusty Crayfish and Zebra Mussels. They study how these invaders impact the watershed. For instance, students work with community partners, like US Fish & Wildlife Service, to understand population densities and the locations of Zebra Mussels in the river. Knowing each mussel alone filters one liter of water per day, they applied math and science to understand how nutrients are filtered out of the river instead of flowing into the Lake Huron food web to benefit the Great Lakes fishery.

To support educators and these educational watershed experiences, the NEMIGLSI hosts a Lake Huron Place-Based Education Summer



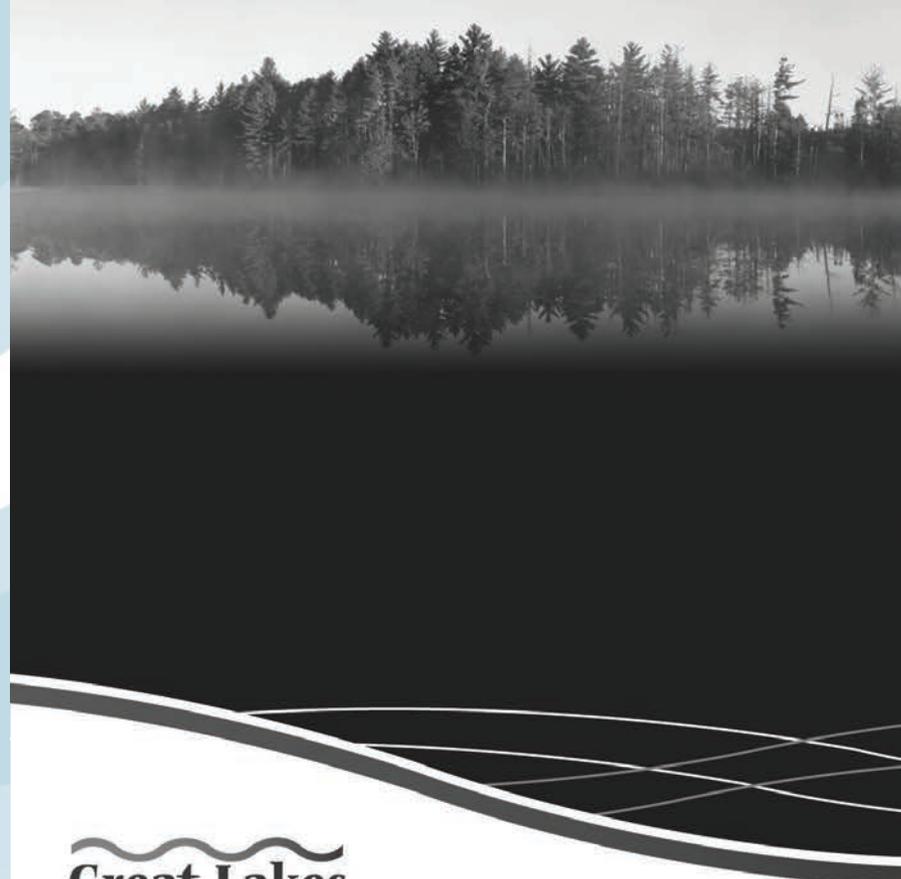
ways to launch different place-based education projects in their own classroom. This opportunity has also been extended to educators from the GLSI regional hubs in the Flint and Detroit-areas furthering the development of Great Lakes stewards across Michigan.

By connecting students, educators, and community partners with shared watershed experiences, a network of Great Lakes stewards is growing across Northeast Michigan. Beyond the NEMIGLSI network, other GLSI regional hubs facilitate place-based education inquiries to develop active stewards of the Great Lakes. With funding from the Great Lakes Fishery Trust, the GLSI and its regional hubs connect about 50,000 Michigan students to their local community and environment each year. Using hands-on, experiential learning, these students understand the importance of our Great Lakes and knowing what is in our watershed.

Teacher Institute. Funded by the the Center for Great Lakes Literacy, Michigan Sea Grant, and GLSI, this summer professional development opportunity helps teachers make connections to hands-on inquiries that meet Michigan's education expectations while increasing their understanding of the Great Lakes. They also network with community partners and explore

Great Lakes Literacy Principles

- The Great Lakes, bodies of fresh water with many features, are connected to each other and to the world ocean.
- Natural forces formed the Great Lakes; the lakes continue to shape the features of their watershed.
- The Great Lakes influence local and regional weather and climate.
- Water made Earth habitable; fresh water sustains life on land.
- The Great Lakes support a broad diversity of life and ecosystems.
- The Great Lakes and humans in their watersheds are inextricably interconnected.
- Much remains to be learned about the Great Lakes.
- The Great Lakes are socially, economically, and environmentally significant to the region, the nation, and the planet.



The Great Lakes Fishery Trust (GLFT) provides funding to enhance, protect, and rehabilitate Great Lakes fishery resources. Since 1998, the GLFT has granted over \$55 million to academic institutions, government agencies, nonprofit organizations, and tribal governments through investments in three broad categories: access to the Great Lakes fishery, ecosystem health and sustainable fish populations, and Great Lakes stewardship.

More information about the GLFT is available online at www.glft.org.

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Fisheries in the Classroom

By Brandon Schroeder, Daniel Moffatt, and Meaghan Gass

Raising fish in the classroom to learn about life cycles, water quality and more!

Lake Sturgeon

Did you know Lake Sturgeon coexisted with dinosaurs and have lived in the Great Lakes for thousands of years? Alpena, Cheboygan, Inland Lakes and Onaway School students, along with other students across Northeast Michigan, have been learning about this prehistoric fish through an opportunity to host living sturgeon in their classrooms. This unique project teaches students about this state-threatened fish while allowing them to actively participate with scientists in sturgeon research and restoration efforts locally.

The classes partner with the Michigan Department of Natural Resources (DNR), Michigan State University, and Sturgeon for Tomorrow for this experience. The Sturgeon in the Classroom project allows students to learn about fish biology, connect fish with aquatic habitat needs, and explore conservation issues that threaten this rare species.

With sturgeon, students complete feedings and tank maintenance while observing a fish that is growing – nearly 2 inches per month – and offering different behaviors every day. Frozen bloodworms are the diet of choice for the young Lake Sturgeon that can grow from 4 inches to 18 inches over a period of seven months. Not a bad start for a fish that may grow to reach 6-8 feet and 200-300 pounds or more in its lifetime!

Coordinating with the local Sturgeon for Tomorrow chapter, teachers and students share their classroom learning with students in the school and individuals across their community. For instance, Cheboygan Middle School students developed outreach materials for the Black Lake Sturgeon Shivaree, a fundraiser for the Lake Sturgeon hatchery, habitat conservation, research, and outreach. Additionally, Ella White students worked with Michigan Sea Grant to create a new poster line of Lake Huron's indigenous fish, portraying these native species as cartoon superheroes.

Near the end of the school year, the sturgeon is chipped by researchers with a tracking identification tag, and then, the fish are released. This tagging allows future students to stay connected to the fish

since with each recapture they will be notified with the location and an update of its growth and health.

Lake Trout

As part of the Thunder Bay Reef Restoration Project, Ella White 5th graders raise Lake Trout in the classroom. In the fall semester, they receive Lake Trout eggs. Throughout the school year, these fish grow allowing the students to learn about life cycles, and in the spring, they release Lake Trout fry on the artificial reef in Thunder Bay, Lake Huron. With Great Lakes scientists, they are studying Great Lakes ecosystems, fish habitat issues, life cycles, all while taking care of the fish.

To release the fish on the reef, the students engineered and built ROVs (remotely operated vehicles) in cooperation with Thunder Bay National Marine Sanctuary. They also used a 3-D printer to produce a system (adapting a plastic pop bottle) to release their young lake trout to their underwater reef habitats. This class, with lead teacher, Bob Thomson, raises project funds from grants and online charity sources like DonorsChoose.org.

Chinook Salmon

From fall to spring, students raise, care, and maintain Chinook Salmon in the classroom. They receive salmon eggs from Michigan DNR, and throughout the school year, they see the fish grow from egg to hatchling to smolt. Through this project, they learn about life cycles and habitat needs, and in the spring semester, the fish are released into the local watershed allowing these students to improve fish populations.

Moreover, while the Chinook Salmon is not native to this area, they were introduced and subsequently naturalized to reduce invasive Alewife fish populations. Currently, they are included in the Joint Strategic Plan for Management of Great Lakes Fisheries, and this fish serves as a biological indicator for the health of our rivers, which serve as spawning sites. Through this project, students learn about the importance of



monitoring water quality in order to support fishery life. Prior to the fish release, students monitor the water quality by analyzing living and non-living indicators.

Salmon in the Classroom involves many teachers across the NEMIGLSI network – including Alcona Elementary, Onaway High School, Oscoda Area School, Rogers City Middle School, and Inland Lakes Elementary. This great opportunity connects student learning across the region while learning more about fisheries. Some educators and their classrooms – like Rogers City teacher, Holly Wirgau, and Inland Lakes teacher, Jennifer VanDaele – have been involved with this project for over ten years. Onaway students also educate younger grades about the fish including its biology and habitat needs to further connect their school to our fisheries.

Through these different fisheries in the classroom projects, students connect with area scientists to help with restoration and stocking projects, and they learn the needs and characteristics of the fish. They also increase community awareness about our fisheries.

This hands-on learning activity allows students to connect to their area watersheds while benefiting their local community and environment. Together, involved students, teachers, and community partners create a network of fishery stewards.

Overall, these projects exemplify place-based stewardship education since students are learning about their local watershed and fish species while improving local fisheries.



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INVADERS

By Brandon Schroeder, Daniel Moffatt, and Helen-Ann Cordes

Combatting aquatic invasive species — carrying out real-world data collection and sharing possible solutions.

Aquatic invasive species (AIS) are a growing environmental concern and a seemingly never ending issue for our Great Lakes waterways. These invaders impact the ecological health of Great Lakes and cost our coastal communities millions of dollars a year in lost tourism and fishery resources.

These impacts are felt widely among Northeast Michigan and coastal Lake Huron communities. Students from Sanborn Elementary in Ossineke and Ella White Elementary in Alpena, however, are not intimidated by the magnitude of this issue. These Alpena Public School students are tackling this problem through scientific research and public education accomplished through their Thunder Bay River Watershed Projects. Students at Sanborn and Ella White investigate these issues through collaboration with community partners such as Michigan Sea Grant, US Fish & Wildlife Service (USFWS), Michigan Department of Natural Resources Fisheries, and the NOAA Thunder Bay National Marine Sanctuary (TBNMS).

Sanborn students and teachers monitor water quality and improve the health of their local river. Supported by the

Northeast Michigan Great Lakes Stewardship Initiative network, this place-based educational experience also involves researching real-world ecological problems (and possible solutions) caused by invasive species in our local watershed. They hope to understand how invasive species affect the health of the watershed by disrupting the natural aquatic ecosystem and food web.

The high-profile invasion of the Great Lakes by Zebra and Quagga Mussels (first arriving in the mid-1980s) was a natural place to begin research and benefit from the support of area agencies already working on this problem. In a short time, these mussels have arguably caused some of the most dramatic ecological changes in our local freshwater resources, resulting in economically costly consequences to our communities. Students started by monitoring zebra mussel populations in their very own Thunder Bay River watershed. They worked with USFWS to understand population locations and densities in the river. Knowing that each individual mussel filters one liter of water per day, students applied science and math to quantify their findings and understand how

nutrients are being filtered out of the river rather than flowing into the Lake Huron food web.

At Ella White Elementary, students are also engaging in water quality monitoring and investigating invasives through their partnership with various organizations and agencies. This partnership has allowed students to dive deeper in their studies of invasive species and lead them to the Rusty Crayfish. Lead teacher, Bob Thomson, stated, “The hard work is worth it when you see a student in the river with a huge smile saying, “Thank you.”

By studying a Michigan State University-led crayfish survey conducted in the 1970s, the team discovered how far the invasive crayfish have spread, displacing native crayfish species throughout their watershed in just the past 30 years. Each year, students spend multiple days on local waters capturing, measuring and counting crayfish to document the spread of this invasive species and look for areas where

native crayfish still remain. Using this capture, mark and recapture method, the team apply their research and math skills to estimate Rusty Crayfish populations in certain stretches of the Thunder Bay River. They then can calculate an estimated population size of these invaders in the river.

With fisheries researchers from Michigan DNR, students identified Smallmouth Bass as

GREAT LAKES MOST UNWANTED AQUATIC INVASIVE SPECIES

RUSTY CRAYFISH
Orconectes rusticus

Description: The rusty crayfish is an invasive crayfish species with a thick exoskeleton (shell over its body) and oversized claws. They can thrive in a diversity of aquatic habitats like rivers, lakes and ponds with sand, silt or rocky bottoms, but prefer small, fast-flowing streams. They are dark reddish-brown, grow 3 to 6 inches long, and are most easily identified by a dark, rusty colored spot found on each side of the carapace (main body segment).

Written with Kayla Bandini and Jada Schatz, Students at Sanborn Elementary, Alpena Public Schools.

OUTSTANDING FEATURES AND BEHAVIOR

- Underwater Lawn Mowers:** Rusty crayfish destroy aquatic plant beds. They change habitat by grazing on and eliminating aquatic plants, which takes shelter and food sources away from other species.
- Invasive Bullies:** The rusty crayfish are aggressive and will force native crayfish from their fishing areas. When hydrated, they assume a "limp-up" position to back down potential predators and to prevent getting eaten.
- Big Appetites:** The rusty crayfish eats a diversity of food, and research suggests they eat more food (up to twice as much) than other crayfish, reducing food available for other animals.
- Habitat Hitters:** The invasive crayfish affect fish populations by eating fish eggs, reducing invertebrate prey available for fish, and destroying habitat (lots of aquatic plants) that fish use during their life cycle.

THE FUGITIVE'S STORY

Expert opinions vary, but rusty crayfish likely arrived in Michigan waters in the early 1930s. They are native to the Ohio River Valley region (not far from Michigan), but are considered non-native invaders to the Great Lakes basin. They were very likely introduced to Great Lakes waters by the bait bucket — it is suspected that anglers using the rusty crayfish as bait may have

unintentionally introduced them to the basin. The invasive crayfish began to reproduce, hybridize with local species (reproduce with other related species), and have now spread to local waters throughout the state and the region.

THE PROBLEM

The invasive rusty crayfish outcompetes native crayfish and fish populations for habitat needs. Fish populations are being reduced by eating eggs and destroying fish nursery habitat. They have a voracious appetite and grow quickly. They are better able to avoid getting eaten by fish because of their larger claws, which they hold up in a defensive position when predators are near. Their thick exoskeletons also offer more protection.

They aggressively out-nest native crayfish from the best shelter or hiding spots. The rusty crayfish also alter habitat by trampling and removing native aquatic plants. They even eat down some invasive plants like Eurasian milfoil, which can be bad because milfoil can spread even more rapidly when cut or fragmented in this way.

WHAT'S BEING DONE

Education and awareness are important because communities may not understand differences in crayfish species and the problems caused by the rusty crayfish. Opportunities exist to educate the public about problems caused by this invasive. No chemicals are approved for crayfish control...

Some research suggests biological controls such as using smallmouth bass as natural predators, because they like to eat crayfish, could be effective. Some agencies and fishing clubs are advocating the catch and release of smallmouth bass to help bring their numbers under control, but nothing has yet been proven to permanently slow the spread of rusty crayfish.

WHAT YOU CAN DO

- Learn to identify rusty crayfish.
- Inspect and remove aquatic plants and animals from your boat, motor and trailer.
- Don't take or give water from live well, bilge and bait buckets before leaving the water access point.
- Dispose of unwanted live bait in the trash (NOT in or near water).
- Never transport or dump live fish or crayfish from one body of water to another.
- Report new sightings — call a U.S. Fish and Wildlife Service office or your state natural resources agency.

REMEMBER! KNOW THE RULES!

Specimens are needed to confirm sightings, but some jurisdictions prohibit possession of rusty crayfish and other invasive aquatic animals and plants. Others may restrict possession for specific uses only. Contact your local natural resources agency for guidance.

Sea Grant
www.misegreatlakes.edu/ds



and learn life skills such as problem solving, team-building, leadership, communication and civic engagement. In addition to posters and presentations, students continually apply writing and communication skills in support of Michigan Sea Grant's education and outreach efforts. They are partnering in the distribution of AIS educational materials, including the regional "Stop Aquatic Hitchhikers™" campaign and contributed much of the text on the "Lake Huron's Most Un-Wanted" poster for the Rusty Crayfish. Many of the Rusty Crayfish collected have been cast in acrylic blocks and are now used across the Great Lakes region as example specimens to teach others about the important environmental issue of aquatic invasive species.

a potential biological control for Rusty Crayfish. These fish feed voraciously on crayfish. A healthy smallmouth population could help control these invasives, as well as provide increased fishing opportunities for people who use the river. Students think this strategy could be a real solution and are communicating through

public service announcements to promote catch and release of Smallmouth Bass to help combat the problem. In partnership to this project, Sanborn fifth grade students have raised Smallmouth Bass fry in their classroom tanks to release in the Thunder Bay under the direction of DNR researchers. These Thunder Bay River Watershed Projects are a great

example of multidisciplinary learning among two schools. Not only do these projects engage these 3rd, 4th and 5th grade students in science, technology, engineering, and math (STEM), but also history, language arts, social studies and communication. Students must apply artistic creativity in designing their displays and presentations,



The Michigan state motto is a great reminder of two things Michiganders hold dear: the Great Lakes that literally shape our state and the beauty found within those peninsulas.



AT THE HEART OF THE GREAT LAKES

If you seek a pleasant peninsula, look about you.
— Michigan Motto

The Great Lakes and their connecting channels form the largest surface fresh water system on earth.

Michigan Sea Grant is at the heart of that system. We are dedicated to the protection and sustainable use of the Great Lakes and coastal resources.

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Plastic Pollution:

Great Lakes Issues in the Classroom

By Brandon Schroeder and Meaghan Gass

Have you ever wondered what aside from fish, resides in our Great Lakes? You may be surprised to learn that plastic is floating throughout the Great Lakes. This plastic pollution can weather and break down into smaller and smaller plastic fragments, also known as microplastics. These small pieces of plastic absorb pollutants (like the pesticide DDT), and when confused as food, they can be consumed by fish and birds resulting in harm. In general, marine debris is a growing issue and concern in our world's oceans but also here at home in our freshwater seas – the Great Lakes.

To better understand this issue, Alpena High School ninth grade chemistry students, in cooperation with Great Lakes scientists, are researching plastic pollution in Thunder Bay and Lake Huron. Using a surface trawl, a research net designed to sample plastic pollution, students have collected water samples onboard the glass bottom boat, *Lady Michigan*. Collecting data specific to local waters, these samples were taken back to the school chemistry lab, where they were analyzed. These samples are also sent to Dr. Sheri Mason, a chemistry professor at Fredonia State University in New York, who is a leading researcher of plastic pollution in the Great Lakes, and her team verifies the student results.

Expanding their research, these students have partnered with David Brooks, affiliated with the EarthWatch Institute and captain of the leading microplastic research vessel in the Great Lakes region, *Nancy K*. While onboard, a select group of Alpena High School students collected surface water samples and charted sample locations. The collected water samples are analyzed in the classroom as part of the students' chemistry class.

Alpena High School teacher, Melissa Smith, first developed the idea and opportunity for this student-led plastic pollution research opportunity during the 2013 Lake Huron Summer Place-Based Education Institute, a professional development opportunity facilitated by partners of the Northeast Michigan Great Lakes

Stewardship Initiative. Sponsored by the Sea Grant Center for Great Lakes Literacy (CGLL) and the Great Lakes Fishery Trust, this workshop connects educators with Great Lakes scientists with the goal of helping teachers engage students in locally relevant Great Lakes stewardship projects. At this professional development event, Smith first connected with Dr. Mason's microplastic research.

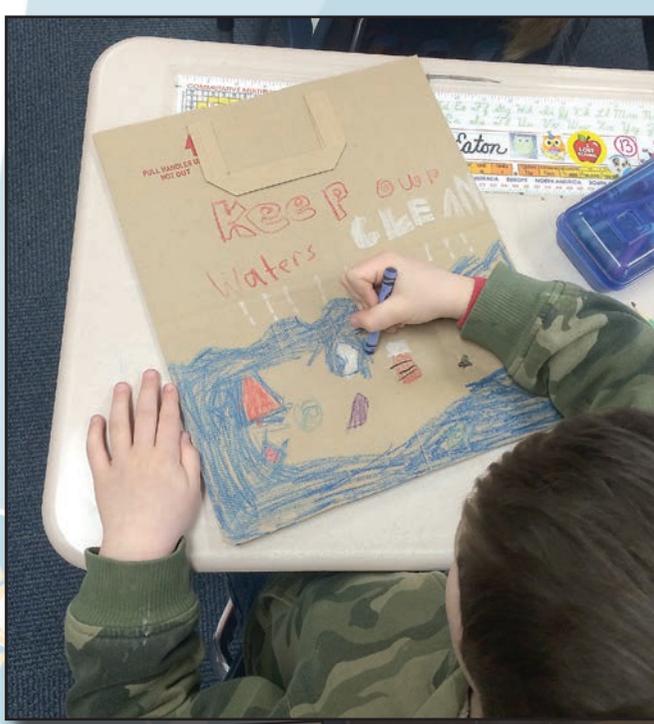


Gaining added experience and training, Melissa later participated in microplastic research first-hand while working alongside Dr. Mason on Lake Erie aboard the EPA research vessel – the *R/V Lake Guardian* - as part the Great Lakes Shipboard Science Program, another CGLL-sponsored learning opportunity for teachers. As a result, students are able to connect with leading scientists allowing them to learn more about potential careers in this field.

In addition to the inquiry at the high school level, area elementary students are also learning about the impact of marine debris in our Great Lakes and oceans and helping educate the public through the Northeast Michigan Earth Day Bag Project. In the classroom, students connected with community partners from Huron Pines AmeriCorps and Thunder Bay National Marine Sanctuary, who educated them about plastic

pollution, and following the lesson, students decorated paper grocery bags from local grocery stores with messages about marine debris and the 3Rs (Reduce, Reuse, Recycle). These bags are distributed to the public at area grocery stores on Earth Day, April 22nd.

This simple learning project allows students the opportunity to provide a great environmental service as well as the ability to take an active role in making a positive contribution to their community. Furthermore, the Northeast Michigan Earth Day Bag Project reflects a perfect example of place-based education in action. Place-based education is a hands-on learning approach that fosters stewardship projects allowing students to actively engage in and benefit their local community and environment. With this project, youth apply arts and science while learning and raising public awareness



about plastic pollution in the Great Lakes.

Students from All Saints School in Alpena are also raising

awareness about the dangers of single-use plastics with their place-based inquiries. After watching the film, *Bag It: Is your life too plastic?*, 7th and 8th graders decided to conduct an experiment in their lunch room. For one week, they tallied the number of single-use plastics each student used, and then they hosted an assembly where they educated the other grades about the dangers of plastic pollution. The following week, they launched school-wide single-use plastic reduction challenge, and again, they tracked the number of single-use plastics used by students. During the first week, students used about 1,500 single-use plastic items, but by the second week, this number dropped to 900 items!

By working with Great Lakes scientists and community partners, students are able to contribute scientific information about plastic pollution in Lake Huron while raising community awareness about marine debris in their local watershed. With this increased awareness, they develop as environmental stewards who understand how humans can impact their watershed.



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Is your school a "Green School?"

By Helen-Ann Cordes and Meaghan Gass

In Northeast Michigan, you may notice a new flag raised at local schools – a Green School flag! These flags distinguish Michigan Green Schools. In order to receive this distinction, schools must complete different activities in the following categories: the 3Rs (reduce, reuse, recycle); energy; environmental protection; and miscellaneous green activities. With more completed activities, schools gain different environmental stewardship designations including Green, Emerald, and Evergreen. The Michigan Green Schools program recognizes schools for their hard work and dedication to bettering their community and promoting environmental stewardship. These flags can now be seen at schools in Onaway, Alpena and Inland Lakes where students promote environmental stewardship through their place-based education inquiries.

At Onaway High School, Scott Steensma reinvented his classroom curriculum to put students in charge of their learning experience. Students integrate the environment and their local community into the classroom through their service-learning course, and their projects are focused in five areas: animals and habitat; fisheries and water quality; plants and forestry; recycling and energy; and technology and data. These projects allow students to make a difference in their school and community. As a byproduct of all

their hard work, Onaway Community Schools is now an Evergreen School. This status is the highest honor a school can receive from the Michigan Green Schools program!

For instance, through their recycling and energy-related projects, students installed alternative energy technology (like a wind turbine and solar panel). A former student successfully applied for a grant to secure funding for this technology. Thus, this project served as a source of student professional development.

With the amount of foot traffic passing through Onaway Schools, it is no surprise how much recyclable waste is created. After noticing this issue, students in the service-learning course launched a schoolwide recycling campaign. They created a new waste management system, and they instructed all grade levels on how the program would function and the importance of recycling. Now, students recycle about 2,000 pounds of recyclables every six weeks, totaling about 12,000 pounds recycled during a school year. Through these student-led projects, Onaway Schools serves as a recycling and renewable energy demonstration site – a model of sustainability within their own community.

In addition to supporting the school, the students explore opportunities to expand their projects to serve their

greater community. For instance, Steensma explains, "We are proud to have worked with the Onaway Garden Club and are attempting to develop working relationships with other organizations." Connecting with the Onaway Garden Club allows students to support their on-campus greenhouse with an area plant sale. These community connections extend student learning outside of classroom and give them an opportunity to make community change.

From these stewardship projects, Steensma's students are a tremendous

resource for their school and local community. In times when budgets are tight, these students use environmental stewardship programming as way to



Michigan Green Schools is a wonderfully symbiotic program to the NEMIGLSI. Both promote sustainability and resourceful, student-driven approaches for school and community learning across Michigan.

—Maureen Stine, Cheboygan-Otsego-Presque Isle Counties Michigan Green School Coordinator



cut operating costs for their school. For instance, because of the recycling program, less trash pickups are required weekly, and as a result, Onaway Schools save about \$2,000 per year.

In Alpena, Thunder Bay Junior High and ACES Academy are now certified Green Schools. At the junior high, students recycle and terracycle, a recycling program that upcycles materials (normally not recycled) into new products. Students focus their attention on ways to decrease their school's impact on the environment and overall waste. To kick off this effort, they started a school-wide campaign to install a reusable water bottle filling station at their school. With this water bottle filling station, students will be able to reuse water bottles and reduce their consumption of single-use plastic water bottles.

In addition to enhancing their school and learning atmosphere, students at Thunder Bay make their community a better place. With lead teacher, Cheryl Mack, 6th graders conduct Alliance of the Great Lakes Adopt-a-Beach™ clean-ups at different Alpena beaches. Other grades monitor the water quality of different sites in the Thunder Bay River watershed by analyzing biotic (living) and abiotic (non-living) indicators. Beyond making a difference in the community, components of these projects connect to classroom learning goals.

ACES Academy is no exception to the green work being done in Alpena.

Students guide their school's green initiative, and every year, they are challenged to enhance and add to existing projects. By being student-driven, they are empowered by their learning while addressing real-world issues.

For example, a major focus area for students has been updating their school's infrastructure. To reduce energy consumption, students replaced lights throughout their school with energy-efficient fluorescent bulbs. While lowering energy use, this effort also saves the school money. In another project students assessed their school building, including its insulation and infrastructure, to determine overall efficiency. Students are also involved in a paper recycling program at the high school, and to better their community, students annually clean up a site on the Thunder Bay River. While improving the site, they monitor the water quality by analyzing chemicals and macroinvertebrates found in the water.

Throughout Northeast Michigan, students are going green to better their school and community. Simultaneously, they improve their local environment. Whether it is promoting alternative energy, recycling, or cleaning up area beaches, these projects empower students and give them a sense of personal responsibility. Their work continues to translate into amazing products and experiences allowing the school, community, environment, and students to benefit. Everybody wins!



The mission of the Cheboygan-Otsego-Presque Isle Educational Service District is to maximize the learning and citizenship of all. We complete our mission by:

- Contributing educational leadership
- Facilitating sustainable evidence-based practices and services
- Providing development that involves member districts, this ESD and the entire community



Rethinking the School Yard

By Daniel Moffatt, Helen-Ann Cordes,
and Meaghan Gass

In 1934, public schools in Michigan started to teach conservation of our natural resources. Within twenty years, over 600 school forests were created, a number from state lands acquired during the depression era. Now eighty years later, four schools partnering with the Northeast Michigan Great Lakes Stewardship Initiative network are reaping the benefits of the historical deed.

JOHANNESBURG-LEWISTON

In Johannesburg-Lewiston, students in the environmental science and AP Biology classes are busy blazing a trail along a historic railroad grade that connects to a learning platform in the school's 40-acre parcel of natural forest, bog and grassland.

Due to a lack of trails, their forest area was largely inaccessible to classes and the public, which greatly limited the educational opportunities and community use of the site. Therefore, students partnered with the Otsego Conservation District for expertise on developing their forest management plan, which included the creation of trails and boardwalks throughout the site. Students

implement their forestry management plan and continue to make most of the decisions – from trail placement and interpretive design, to developing educational activities for younger students.

ALPENA

At Thunder Bay Junior High in Alpena, students are taking their classroom beyond the school walls and outside into their local school forest. Students are completing various trail improvement projects like building a bridge over a portion of Bagley Creek, which runs through the school forest. They are also leveling trails and spreading gravel and woodchips to make the trails more accessible to the public.

In Alpena, students use their school forest as an educational classroom throughout the school year. They complete projects and activities such as birding, forestry identification, water quality testing, and habitat restoration through invasive species removal. The school forest not only

serves as a resource for students but also for the local community. Cross country meets and recreation activities commonly occur in the area, which highlights the importance of managing this school and community resource.

ONAWAY

Onaway Area School is taking action in their school forest through developing a forest management plan in partnership with Martell Forestry and their local conservation district. Their current school forest of 180 acres has been largely unused due to a lack of development. Students are using their site management plan to help guide them in identifying areas of need and conducting an overall assessment of the property.

Three initial areas of focus have been identified by students including the development of cross country trails, habitat restoration through removal of invasive buckthorn on the property, and the creation of an outdoor pavilion to serve as an educational classroom. The development of their school forest will allow more students the opportunity to utilize this space, as well as the local community.



Students at Johannesburg-Lewiston Area Schools lay the decking to the school's learning platform in their wooded 40-acre parcel.

The main goal for the Johannesburg-Lewiston, Thunder Bay Junior High, and Onaway Area School's forests is to create a demonstration site where students and the community can see the importance of responsible land management while creating and maintaining healthy ecosystems.



Alcona High School FFA students host public demonstrations on the process of maple syrup making during the Maple Syrup Celebration Day.

ALCONA

For a “sweeter” product, let’s journey to Alcona Community Schools, where students use their school forest in a different way. Each winter, Alcona High School advanced agriscience students and Future Farmers of America members prepare for maple syrup season. In the school’s demonstration forest, students are responsible for identifying Sugar Maple trees. They tap the trees and hang bags or buckets to collect sap. They continually monitor them for sap collection.

Not only a hands-on learning opportunity on the school grounds, this project also serves as an educational facility for

the local community. Maple Syrup Celebration Day is one way students and FFA members educate the local community on the National FFA Organization and their maple syrup processing facility, the Sugar Shack. Through this event, students raise awareness among their community about this tasty product and the economic value of our northern woodlands.

On a guided tour by FFA members, you can see the syrup process from sap collection to bottling in the finishing room. The Alcona FFA Chapter is one of two in the state of Michigan that produce maple syrup which serves as their main source of income and fundraising.

Though over-harvesting and devastation of the land may have lead to granting these forests to schools, it has resulted in great opportunity today. All four schools are outstanding examples of how the land can be stewarded for good, and these exceptional sites serve as learning tools for both students and community members.



The AMA/Iosco Math Science Center is one of the 33 regional centers in the Michigan Math Science Centers Network. These centers provide leadership, curriculum support, professional development, and student services to educators in local school districts. The centers also serve as a resource clearinghouse for educational materials and information, and work to foster community involvement in the areas of mathematics and science. The Network supports the delivery of high quality mathematics and science education for the students of Michigan. The long-term mission of the Center is to foster systemic improvements in mathematics and science education.

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MSC Director & Math Specialist

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IOSCO

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Beyond the cutting board

By Daniel Moffatt,
Helen-Ann Cordes,
and Meaghan Gass

Industrial arts instructors in Northeast Michigan are engaging students in hands-on, place-based education in partnership with their local communities. Launched in 2013, this collaboration connects industrial arts instructors throughout Northeast Michigan to help foster place-based education in this specialized program. Through this regional network, Alcona, Alpena, Rogers City, and Inland Lakes industrial arts programs all jumped on board.

ALCONA

Industrial arts students at Alcona Community Schools are involved with place-based education through a variety of community-based projects. Through grants and fundraising, the program was able to purchase a CNC machine (computer-controlled cutting machine) for student and community projects. Use of this machine has allowed the Alcona Industrial Arts Program to broaden its reach and give students real work experience inside the classroom. Future goals include partnering with local businesses to have an internship program. This partnership would allow youth the opportunity to gain work experience at CNC shops while still in high school.



Other projects Alcona students are submersed in revolve around community enhancement. For instance, students built rustic furniture for Harrisville State Park, designed an educational kiosk for the elementary school's butterfly garden, and helped with infrastructure for the Alcona Community Garden.

ALPENA

In Alpena, industrial arts students are taking action to promote conservation and habitat restoration by helping to protect two local winter hibernacula for bats at Rockport State Park. When the Michigan Department of Natural Resources (DNR) Wildlife Division discovered Little Brown, Big Brown and Eastern Pipistrelle (or Tri-colored) bats using the hibernaculum, they knew something had to be done to protect the rare habitat. Further adding to the importance this preservation, the Little Brown and Eastern Pipistrelle are species of special concern in Michigan because of declining populations. In response to this issue, local students, 4-H members, and community members worked together to conserve the hibernacula and increase public awareness.



The two hibernacula are located in former quarry tunnels used to transport material during mining operations. The surge tunnels are almost 500 feet long, mostly buried in gravel, and have a single opening in which the bats - and even daring public - could enter. Restricting public access and maintaining safety was a priority. Alpena High School welding students and the Alpena Wildcat Welding 4-H Club were contacted to help protect the hibernacula. The gates allow bats to come and go freely, but they also block public access for safety concerns.

In addition to this amazing, community-driven project, Thunder Bay Junior High students built a bridge over Bagley Creek. From their hard work, other students and community members can now more easily access the school's Outdoor Environmental Learning Site. These projects continue to evolve today and serve as prime examples of how students can engage in real-world projects.

INLAND LAKES

Eager to incorporate place-based education projects in their classroom, Inland Lakes students looked for ways to give back to their local community. Identifying areas of concern was the first step. Students discovered the park, Hideaway, with





access to the Indian River in desperate need of repair. They worked to build a 100 foot long river boardwalk, signage, picnic area, and more. Ensuring the park was accessible to all was their first priority. The results – a new community park! Not only did students upgrade the existing park, they gave community members hope. Before their renovations, the park was largely unused due to a lack of accessibility and equipment to use.

Giving back to their local community and promoting ecotourism is just one aspect of the place-based education projects at Inland Lakes. Students also contribute to their school and community by enhancing their school forest. They built and designed signs for trail markers, and they created an outdoor classroom area with benches. This learning space provides students with an opportunity to learn outside their classroom.

ROGERS CITY

Industrial Arts students at Rogers City High School are taking action in their community through place-based education projects focused on habitat enhancement. Middle school students in Rogers City annually complete a threatened and endangered species project focused on Thompson's Harbor State Park. This project got high school industrial arts students thinking about how they could also support wildlife in the area.

As a result, the students partnered with the Michigan DNR to identify areas of concern at Thompson's Harbor State Park. The result – habitat enhancement! A plan was formed to increase the habitat of Blue Birds by building birdhouses to place throughout the park. To further add to the depth of the project, high school and middle school students partnered for an educational field day at the park. Together, they all learned more about threatened and endangered species, ecosystems, and habitats.

By enhancing student learning through these real-world connections with both their natural environment and community, these place-based education projects give industrial arts students professional skills while enhancing classroom learning.

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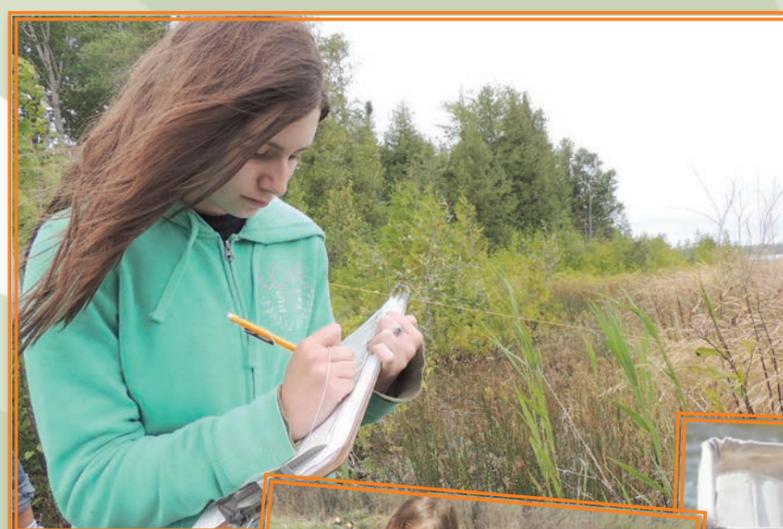
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Citizen science in schools: Education opportunities for students

by Brandon Schroeder and Tracy D'Augustino

Adopting beaches, tagging migrating monarch butterflies, and mapping habitats for endangered species are a just few of the hands-on ways in which teachers and students can get involved as citizen scientists. Immersing students in projects that enhance Northeast Michigan's woodlands and waterways, citizen scientist programs provide the perfect opportunity to expand learning beyond the classroom.

These citizen science opportunities afford students a chance to contribute to research, monitoring, and a better understanding of our valuable Great Lakes and natural resources. Many established citizen science efforts are teacher and community-friendly, designed with simple methods to report research and record findings.

A variety of individuals, community groups, and schools engage in citizen science partnerships. These programs offer fun and engaging scholarly opportunities for students of all ages to contribute to their community while exploring the local environment. Working with scientists, students add immeasurable value to the research of professionals who monitor habitats, track populations, and address questions about our environment. Connecting communities, schools, teachers, and students in citizen science activities offers a value well beyond science and data collection.

Citizen science can also serve as a place-based education experience where students contribute to meaningful environmental stewardship service. It exposes students to relevant conservation issues and career opportunities, and in their civic engagement experience, students can serve their communities as local environmental leaders. Most importantly, students can have fun and enjoy an outdoor experience while accomplishing their educational objectives.

The following citizen science opportunities are just a few examples open to student involvement. The established programs have proven attractive to teachers for both their ease in getting started and the learning experience they offer students:

- **Great Lakes Adopt-a-Beach™:** Middle school students from Alcona, Oscoda, and Thunder Bay Jr. High Schools hit Lake Huron's beaches with the Alliance for the Great Lakes. As part of this program, students lead an annual beach clean-up while collecting science-based data to assess beach health.
- **Great Lakes FieldScope:** Students from Au Gres-Sims Elementary collect and share water quality data from their local watershed, helping to pilot this citizen-science website supported by Michigan Sea Grant and National Geographic.
- **Monarch Watch:** Great Lakes coastlines serve as critical migratory corridors for birds, bats, and butterflies. By raising, tagging and releasing Monarch Butterflies into their schoolyard butterfly garden, Alcona elementary students contribute to this international citizen science effort.
- **Endangered Hine's Emerald Dragonfly Habitat Study:** As part of a coastal community science effort, Alcona County youth work with Michigan State University Extension Michigan Natural Features Inventory (MNFI), Michigan Department of Natural Resources (DNR), U.S. Fish and Wildlife Service, Huron Pines, and Michigan Sea Grant researchers to map Hine's Emerald Dragonfly habitats along the Lake Huron coastline.
- **Vernal Pool Patrol:** Youth across Northeast Michigan help the MNFI map and monitor vernal pools in the spring and fall. This citizen effort helps protect seasonal wetlands while learning about vernal pool ecology and the importance of biodiversity.
- **The Great Backyard Bird Count:** Learn to identify birds by color and call, and go on the search for birds in their habitats. Count birds with the National Audubon Society, Cornell Lab of Ornithology, and others—join the count with your local Audubon chapter and share your findings online.
- **Applying GIS and Smartphones for biodiversity conservation:** The National Geographic Great Nature project and the iNaturalist application allows students to contribute to biodiversity conservation while mapping and identifying native and rare species. In contrast, the Midwest Invasive Species Information Network aids the MNFI in the hunt for invasive species. Using technology, Northeast Michigan students learn about species, how to identify them, and map and submit findings to online monitoring databases.



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Citizen science involvement is a great launch point for communities, schools and teachers looking to leap into natural resource stewardship. Place-based education, as supported by the Great Lakes Fishery Trust's Great Lakes Stewardship Initiative (GLSI), allows students to engage in citizen science learning activities and make a difference in their communities by benefiting their local environments.

Citizen science opportunities are a great way to involve communities, schools, teachers, and students in science and the study of Michigan's Great Lakes and natural resources. Place-based education offers a framework by which students can contribute to these meaningful, real-world environmental stewardship efforts through learning and leadership.

ADOPT A BEACH

By Brandon Schroeder, Tracy D'Augustino, Daniel Moffatt, Zoe Rae Rote, Helen-Ann Cordes, and Meaghan Gass through Community Partnerships

a·dopt, *v.* **1:** to take by choice into a relationship; **5:** to sponsor the care and maintenance of

In Northeast Michigan, students connect to their natural environment and Great Lakes through place-based education inquiries that also have a benefit for their local community. Adopting local beaches is an example of these projects. Through the Alliance for the Great Lakes Adopt-a-Beach™ Program, students improve Lake Huron shoreline habitats while removing beach debris. More than a beach cleanup, students also observe and test various condition of beach and water health to identify potential issues and monitor changes.

Adopt-a-Beach™ is the Alliance for the Great Lakes' premier volunteer program, using the Great Lakes – a rich, living ecosystem in its own right – as the starting point for instruction while emphasizing hands-on, inquiry-based, real-world learning. The goal of the Adopt-a-Beach™ service-learning program is to move beyond cleaning up the coastlines to stopping debris and pollution from ever being a problem.

To accomplish this objective, Adopt-a-Beach™ teams remove debris and record what kinds of debris they find. These litter categories include: smoking related, plastic, glass, paper, metal,



and other. They also conduct beach observations and science-based testing to determine potential pollution problems. This information is entered into an online system that can be accessed by schools, volunteers, and the general public allowing them to better understand pollution concerns on area beaches.

Starting in 2012, Thunder Bay Jr. High students and lead teacher, Cheryl Mack, have adopted their city beaches while launching into studies focused on Lake Huron shoreline habitats. They monitor several public beaches and coastal wetland areas in Alpena, along a one and one-half mile stretch

ecosystems. For instance, with the help of community partners,

of the U.S. 23 Heritage Route, including Bay View Park, Thomson Park, Blair Street Park and Pier, Starlite Beach and Mich-e-ke-wis Park. Through their learning, this student effort fosters valuable school and community partnership while benefiting their school and Lake Huron

students picked up close to 10,000 cigarette butts on area beaches. By removing these items, the students are helping keep marine debris out of Lake Huron.

The students also work on finding solutions for some of the issues that arose during the cleanup. “Students were absolutely shocked at how much cigarette litter they discovered at the beaches,” Mack said. “This concern prompted a student group to present the data to our local city council and propose some ideas that could be implemented at area beaches. As a class, students

“ We collected garbage, took water samples and looked at how many and what type of animals were out there. [It's important] so you can help your environment and keep it clean for the future.

-TBJH 6th grader

The best part of this project is helping my community, the environment and getting to work outside of our classroom for a day.

-Oscoda 7th grader



are also working on interpretive signs, posters and public services announcements about dangers of cigarette litter to the coastal ecosystem and the need for proper disposal methods.”

During their presentation to the Alpena City Council, students emphasized their concern over the high number of cigarette butts found during the beach cleanups. The council members listened, and to the thrill of students, promised to install garbage cans at the public beaches managed by the City of Alpena. The students’ unexpected lesson in social activism was topped off when Alpena’s mayor visited their classroom. He discussed their findings and involvements, and the students were excited to meet such an important member of their community. Connecting with mayor gave further importance to Adopt-a-Beach™ cleanup empowering students to see how they can effect change in their community.

Joining the Adopt-a-Beach™ program in 2013, Oscoda Schools students also adopted the Au Sable Township Shoreline Park, a public beach just south of downtown Oscoda. Their research project gathers and monitors valuable water quality data, documents the status of coastal habitats, and improves the

public access shorelines of Oscoda.

Lead teacher, Mike Berenkowski, prepared for these projects at the annual Lake Huron Place-Based Education Summer Teacher Institute hosted by NEMIGLSI. He developed his educational plan to involve students in this school-community effort. He also gained training, connections to resources and partners, and valuable insights and lessons learned from other teachers engaged in similar projects.

Alcona Community Schools also joined the Adopt-a-Beach™ Program in 2013. With lead teacher, Christie Thomas, the students clean up part of the beach at Negwegon State Park. During this place-based inquiry, students also search for the habitat of federally-threatened Hine’s Emerald Dragonfly and Pitcher’s Thistle with community partners from Michigan Department of Natural Resources. This connection allows them to learn more about the importance of habitat protection for rare species.

By enhancing student learning through these real-world connections with both their natural environment and community, these place-based education projects give Alcona, Alpena, and Oscoda students a sense of place and ownership of their local waters and community.



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Monarch Watch: TRACKING BUTTERFLY MIGRATION

By Brandon Schroeder
and Meaghan Gass

Each fall, students migrate back to school just as monarchs - in transition from caterpillar to butterfly - prepare for their long migration south. This timeframe presents a colorful opportunity to witness one of the world's great migrations—that of the monarch butterfly. In Michigan, these widely recognized and beloved butterflies begin their roughly 3,000 mile journey south along the Great Lakes coastline to their wintering grounds in southern Mexico and Central America. Amazing to witness these butterflies also offer educational, recreational and coastal community tourism benefits while speaking to the importance of protecting coastal habitats critical to these wildlife migrations.

Monarch Butterflies embark upon this great migration every fall in order to roost over the winter, since they cannot survive in colder climates. In the spring, they return to the north over the span of multiple generations of butterflies. Throughout the course of a year, there are usually three to four generations of monarchs with varying lifespans. Overwintering Monarch Butterflies live about eight to nine months while the summer generations only live about three to five weeks!

In recent years, population levels for these ecologically invaluable pollinators have dropped immensely, causing serious concern for both biologists and butterfly lovers alike. To help monitor and track their migration, scientists are working with schools and community members to promote a citizen science tagging effort. This citizen science project led by Monarch Watch also offers a hands-on educational opportunity to learn about



monarch butterfly habitats, life cycles, and migratory patterns—while contributing to science.

Through this great project, students—and citizen scientists of all ages—learn how wildlife, habitat

stewardship, and Great Lakes habitats are connected across the world through butterflies. Students are contributing to this environmental stewardship effort by monitoring monarchs and their local habitats in collaboration with this program.

migration patterns

Turning the attention to their own schoolyard, students use their butterfly garden as a source of continuous learning, as well as for citizen science on a broader level. As part of the Science, Social Studies, and

Partner to this important project, students mark butterflies using a very small identifying sticker, and then they record data related to each butterfly. Following this tracking, the butterflies are released, and they continue their migration to Mexico. When the marked butterflies are recaptured, scientists can learn a great deal about survival, population health and

GET INVOLVED!

**“Conservation is a state of harmony
between men and land.”**

– Aldo Leopold



English Language Arts curriculum, students cover plant studies, animal habitats, and ecosystems. Expanding into communication and public awareness, students use this project as a source of inspiration for reading and writing. They also learn practical skills of communicating with partners through writing thank-you letters and informational pieces.

Supported through the Northeast Michigan Great Lakes Stewardship Initiative (NEMIGLSI), local students from Au Gres-Sims, Alcona, Alpena, All Saints, and the Alcona Preschool Co-op are contributing by helping scientists track the migration of Monarch Butterflies. Budding young scientists of Alcona Elementary School are exploring their schoolyard for milkweed habitats for monarch caterpillars, which offer a fun and educational experience for students. A firsthand exploration of life cycles, they are tracking their caterpillars' metamorphosis or transition into butterflies. Students tag and record data on each of their butterflies before releasing them into their schoolyard butterfly garden. The student-collected data will help Monarch Watch researchers monitor and study these local butterflies as they head south for the winter.

In addition to helping monitor the migration of Monarch Butterflies,

many schools have designed and built pollinator gardens that help support monarch habitats. A community partner to the NEMIGLSI, the US Fish and Wildlife Service, offers expertise and curriculum for educators to use in establishing a pollinator garden. Since monarch larvae's only food source is milkweed plants, viable habitat is an important consideration in increasing monarch population levels. Several of these participating schools also engaged their students in creating and maintaining schoolyard wildflower gardens that provide essential monarch habitat. By including milkweed in pollinator gardens, these students help support monarchs with a reliable food source, and it allows them to personally see the life cycle of a butterfly on their school's campus.

Chasing butterflies or rearing them in the classroom has been a fun way for students to start each school year and also provides a great science learning experience. The data these youth collect will help Monarch Watch researchers monitor butterfly populations and track their migrations as they head south for the winter. Through this great project, students—and citizen scientists of all ages—learn how wildlife, habitat stewardship, and Great Lakes habitats are connected across the world through butterflies.



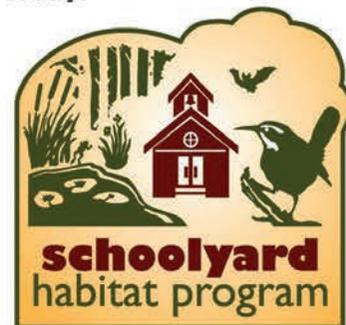
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Vernal Pool Patrol!

By Brandon Schroeder and Meaghan Gass

A spring walk in the woods may lead you to one of Michigan's more common but lesser known wetlands – a vernal pool. These seasonal or temporary wetlands are often small in nature yet significant in ecological value. Wet in the spring, vernal pools characteristically dry up as summer progresses. In fact, those exploring woodlands late in the summer may trek through a vernal pool without realizing they passed through this important wetland ecosystem.

As the snow of winter melts giving way to spring, these wetlands fill with water and explode with life. Scientists from the Michigan Natural Features Inventory (MNFI) and Michigan State University Extension (MSUE) study the ecology of these vernal pools during this small window of time each spring. It can be a challenge to visit large numbers of vernal pools each spring, when life is most active but before these seasonal wetlands dry up. Through the Vernal Pool Patrol Project, aimed at schools and youth, researchers call on our youngest citizen scientists to help collect and report data in these vernal pools across northern Michigan.

Little is known about vernal pools in Michigan. They are widely recognized among scientists for their important ecological value. Rich in biodiversity, vernal pools have been called the 'coral reefs' of our forests, home to some species that only exist in vernal pools. For example, Fairy Shrimp (tiny, bright orange crustaceans) only occur in vernal pools since their eggs have to dry and freeze before they can hatch each spring. Other species, such as the Wood Frog, Spotted Salamander and Blue Spotted Salamander, excel in vernal pools because these habitats

lack predatory fish that would eat their eggs and larvae. In addition, many plants grow within and around vernal pools and can provide clues that these pools were once full of water even during their dry phase. In the northeast U.S., vernal pools are home to some 550-700 species of plants and animals, including many rare species. These ecologically rich wetlands also function to improve water quality, help recharge ground water, store water, provide flood control, and serve as nutrient sinks (where organic matter collects and decomposes).

To increase understanding of this complex issue, MNFI hosts professional development opportunities for educators allowing them to involve their students as Vernal Pool Patrol partners. This place-based stewardship education training connected teachers with MNFI

scientists to learn about vernal pool ecology, exploring firsthand the biodiversity of plants and animals living within vernal pools. A great professional learning opportunity for educators supported by the Northeast Michigan Great Lakes Stewardship Initiative (NEMIGLSI) and Grand Traverse Stewardship Initiative (GTSI) networks, including U.S. Fish and Wildlife Service, Huron Pines, 4-H Youth Programs, and Michigan Sea Grant, among other partners.

Funded by Great Lakes Fisheries Trust, the MNFI will work with schools, where students gather valuable data to help MNFI monitor these unique wetland ecosystems. With this project, students apply science and technology, math, reading, writing, and more to complete their investigations. They discover the

importance of teamwork, organization, and observation needed to accomplish these types of field studies. In service of science and their communities, students collect, analyze, and report data to the MNFI to populate a statewide vernal pool monitoring database. Overall, this project allows students to learn more about their local environment while raising awareness and appreciation toward these small, seasonal, yet ecologically important vernal pools in their local communities.

Schools across northern Michigan have helped pilot this new citizen science project with outdoor investigations each spring and fall. Students from Roscommon School venture into the woods with their teachers alongside MNFI scientists and MSUE educators to explore and



Michigan Natural Features Inventory



gather data from their local vernal pools. Chemistry students from Gaylord High School research vernal pool ecology as part of their class, and they are mapping and visiting several potential vernal pool habitats in their school's local nature area. The 6th, 7th, and 8th graders from Au Gres-Sims and high schoolers from Onaway School are also investigating area vernal pools. While collecting data, they discover and assess wildlife in their local pools. In Harbor Springs and in connection with the GTSI, 8th graders and the Little Traverse Conservancy work together to learn more about vernal pools. Outside of school, the Alcona 4-H Environmental Stewards

Club identify vernal pools in the coastal Negwegon State Park. During their investigation, they even found Fairy Shrimp – a signature species of vernal pools.

Spring is the time when vernal pools come to life, and also a time when students grow excited to get out of the classroom and outside to explore. The Vernal Pool Project offers these young scientists an amazing hands-on learning experience exploring their local wetlands. In partnership with MNFI, these youth are helping scientists and their communities to better understand and care for vernal pools across northern Michigan.



GREAT LAKES

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Endangered Species: Hine's Emerald Dragonfly and Pitcher's Thistle

By Brandon Schroeder, Tracy D'Augustino, and Meaghan Gass

Searching for the Endangered Hine's Emerald Dragonfly

Walking in the woods, wading in wetlands, and scouring Lake Huron beaches – what could be more fun for a kid (or adult) than a field trip exploring Negwegon State Park? Add Great Lakes scientists, an endangered dragonfly, and Alcona County youth committed to biodiversity conservation and the trip becomes that much more interesting.

Funded by the U.S. Fish and Wildlife Service (USFWS) Coastal Program through the Great Lakes Restoration

Initiative and our local Community Foundation for Northeast Michigan, this innovative project trains and engages community volunteers as citizen scientists. This effort led by Michigan Natural Features Inventory (MNFI) calls on community involvement to help protect the federally endangered Hine's Emerald Dragonfly and high quality natural habitats at Negwegon State Park along the Lake Huron coastline in Northeast Michigan.

In the summer, the Alcona 4-H environmental science club look for potential habitat for the Hine's Emerald Dragonfly with Friends of Negwegon State Park volunteers and the MNFI. Armed with global positioning system (GPS) units, a map of the park, muck boots and identification guides, they are also on the lookout for invasive species – such as Glossy Buckthorn and Narrow Leaved Cattails – threatening wetland habitats critical to this particular Dragonfly.

In the fall, science students from Alcona Community Schools and Alpena Community College's field biology class join this project. Alcona Schools students previously promoted stewardship of Negwegon State Park by helping create interpretive signage at the park. Now, as part of this school science learning experience, they hope to map endangered species, wetland habitats and problematic invaders.

Attention to the Hine's Emerald Dragonfly offers an opportunity to promote



Photo: David Cuthrell, Michigan Natural Features Inventory



Lake Huron biodiversity conservation of different species and their habitats. In the past, scientists documented adult Hine's Emerald Dragonflies in the park but have been unsure about the wetland habitats where adults lay their eggs and the larvae develop. Larvae generally spend three to five years in these wetlands, even inhabiting crayfish burrows during dryer seasons, before they emerge as adults. These traits make the wetlands critical to protect, but invasive species are threatening these important habitats.

Adding stewardship value in this citizen science effort, Alcona Community Schools students also had fun exploring the beach while conducting a beach trash clean-up, an annual event for this class. With Michigan Sea Grant experts, they searched the sandy dunes along the coastline for other rare species found in the park like the federally-threatened Pitcher's Thistle and state-threatened Lake Huron Locust. As with wetland habitats, invasive species also threaten their dunal habitats. Documenting these rare species, students improved their beach habitat by working with Friends of Negwegon State Park volunteers and local USFWS staff to remove invasive Spotted Knapweed.

Mapping Pitcher's Thistle with Great Lakes Scientists

Fourth graders from Au Gres-Sims School also launched a place-based inquiry related to threatened species with their teacher, Michael Fields. Adventuring to Charity Island in Saginaw Bay, they teamed up with Great Lakes scientists to map and identify the federally-threatened Pitcher's Thistle. They worked in partnership with Michigan State University Extension (MSUE), Michigan Natural Features Inventory (MNFI), Michigan Sea Grant, Huron Pines, USFWS and others in an effort to help promote Lake Huron biodiversity conservation on the island.



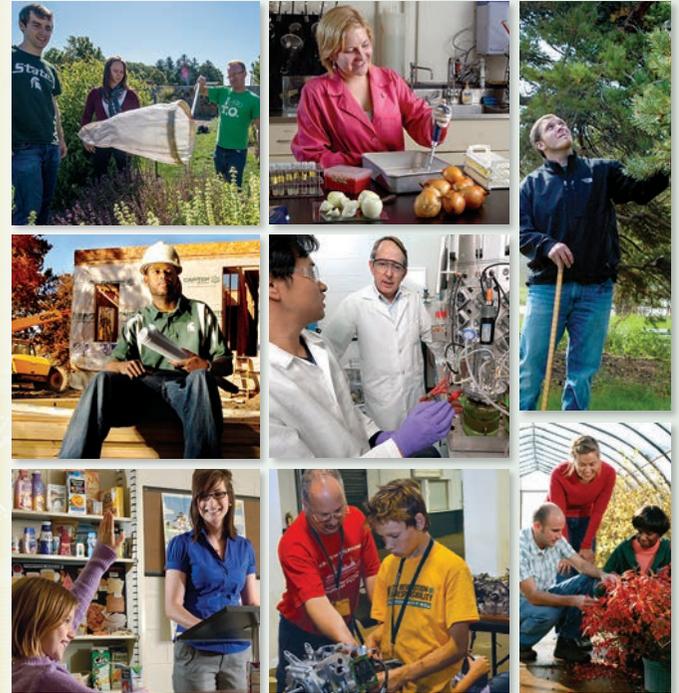
Toting clipboards and data sheets, identification charts and GPS units, these young scientists were ready to collect data for their research project. Local businesses, Charity Island Excursions and Brown's Landing charter services (operator of the boat, *Miss Charity Isle*), helped get students out to the island for their study. Once there, students were charged with counting, mapping and monitoring Pitcher's Thistle plant populations, which are known to inhabit the sandy dune areas of the island's coastline. They also collected data on Phragmites, an invasive plant species encroaching upon and threatening this very same coastal habitat.

Led by MNFI plant scientist, Phyllis Higman, and Michigan Sea Grant, students counted, aged, and mapped each plant they found. These plants included seedlings, small juveniles, large juveniles, and adults. Students also coordinated their study with USFWS, which both manages the majority of Charity Island as part of the Michigan Islands National Wildlife Refuge and has primary authority over Pitcher's Thistle. Prior to their visit, students were trained to take proper precautions to prevent unnecessary harm while conducting their study. They were also given permission to help collect some seeds from adult plants. These seeds will be cultivated by USFWS in support of future Pitcher's Thistle restoration efforts on the island.

Back in school after collecting their data in the field, the learning continued as students tabulated and summarized their findings, which was then shared with their many community research partners.

In Northeast Michigan, young citizen scientists help collect data for scientists working to map rare species, protect critical habitats and prevent invasive species threats. Through these invaluable place-based education experiences, they learn about Great Lakes science and careers, habitat stewardship and civic engagement in support of this project. In trade, the enthusiastic contributions of these students are valued by the community and scientists welcoming them as partner to this conservation effort.

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Invasives: Buckthorn, Garlic Mustard, and Phragmites

Across Northeast Michigan, students are learning how invasive plants impact local environments. These plants can take over ecosystems limiting habitat for native plants. Educators connect student learning using hands-on, place-based education. Students work with scientists to collect data about these invaders. They also connect with community partners to improve local areas by removing these invasive plants. Through their classroom learning, they are improving habitats – allowing their classroom studies to address a community need.

Buckthorn

In Alpena, Thunder Bay Junior High students take their coursework out of the classroom to explore and enhance their local community and its natural resources. As part of a team building exercise, students focus on the health of Bagley Creek, a tributary of the Thunder Bay River being choked by invasive buckthorn near the school campus. Native to Eurasia, buckthorn was introduced in North America during the 1880s as an ornamental plant, and it is a problem in wetlands across Northeast Michigan. In Alpena, it crowds out all other plant life and makes wetlands impassable.

Responding to this issue, junior high students, teachers, and community partners work together to manage the overgrown woody shrub and prepare to restore the creek with native plant species. This project allows the students to learn about forest ecology while improving the local environment. Connecting with the U.S. Fish & Wildlife Service, Michigan State University Extension, Huron Pines, Thunder Bay National Marine Sanctuary and other community partners, the students remove the buckthorn in the fall using saws and loppers. Lead teacher, Tim Pollard, employs a chainsaw to remove the larger buckthorn and treats the cut buckthorn with an herbicide. In the springtime, the students have a bonfire with the dried buckthorn. Beyond being a fun event, the bonfires are a tool to teach students about heat transfer (conduction, convection, and radiation).

In addition to their work removing buckthorn, the students also improve trails at the on-campus outdoor environmental learning site, and they even installed a bridge over Bagley Creek. These improvements make the site more accessible for both the school and local community members. Open to the public, this trail provides the perfect gateway for school-community partnerships.



A student removes invasive buckthorn from the Thunder Bay Jr. High Outdoor Education Site in order to restore the area.

Garlic Mustard

Oscoda Area Schools middle and high school students are working to combat Garlic Mustard, an invasive herb that is spread throughout much of the United States. This invader thrives in the northeast and midwest which makes northern Michigan the perfect habitat for this forest dweller. Native to Europe, Garlic Mustard (*Alliaria petiolata*) is usually found in the undergrowth of disturbed woodlots and forest edges. Recent studies have shown its ability to establish and spread to undisturbed areas. This factor makes the edges along the Au Sable River prime real estate for Garlic Mustard.

When students learned of this invader through a Garlic Mustard pull sponsored by Consumers Energy, they knew it was time to step up and take action in their local community. Working with community partners, including Huron Pines and the USDA Forest Service, students and Oscoda teachers participate in a Garlic Mustard pull each spring along the Au Sable River. In particular, students enjoyed being able to work alongside biologists and science experts to stop the spread of this invasive species. Overall, the students' service is a great example of a place-based education project connecting youth to their watershed and local community.



Students get up close and personal to a thick stand of invasive Phragmites at Mich-e-ke-wis Beach with partner Huron Pines.

Phragmites

Identified as an invasive plant, Phragmites (frag-MY-teez) is expanding into and negatively impacting Northeast Michigan coastal wetlands. The invasive reed, *Phragmites australis*, can take over coastal wetlands – where it competes with native plants species and degrades habitat for birds, reptiles, and amphibians. Now, it is the target of local management and control efforts. Students are connected to these efforts through their place-based education inquiries.

Connected to the Pitcher's Thistle citizen science project on Charity Island, Au Gres-Sims students investigated the density of Phragmites along the island's coastal zones. Supported by the Sea Grant Center for Great Lakes Literacy and the NEMIGLSI network, this opportunity connects students with Great Lakes scientists and community partners of the Charity Islands invasive Phragmites project led by Huron Pines. This partnership is aimed at managing and removing invasive species, namely Phragmites, currently threatening biodiversity on this island. At the end of summer, Huron Pines AmeriCorps members treated this invasive plant. In the fall, during the Au Gres-Sims School island visit, different community partners helped students evaluate densities of the plants found on the island by counting plant stems within a measured area. The school hopes to collect and monitor this same information annually, allowing them to return to the island in future years.

All these exciting hands-on, place-based projects illustrate exactly how students, through their learning, are promoting environmental stewardship of their local natural resources. With each project, students learn while having fun and contributing to their community.

As a result, the community gains improved nature areas while increasing public awareness about the importance of protecting our valuable natural resources from invasive species.



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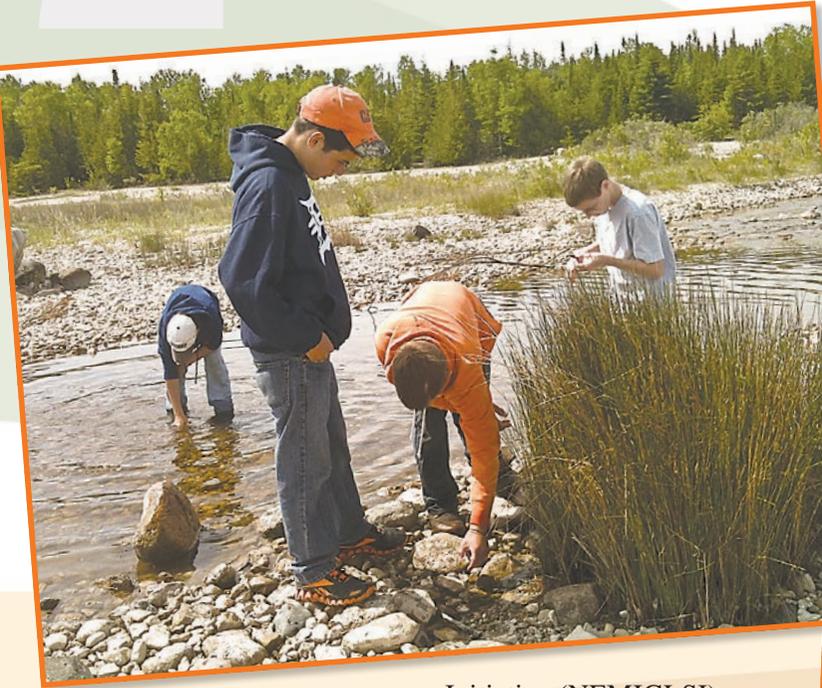
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TWO SCHOOLS, TWO COASTAL PARKS AND A TOO COOL LANGUAGE ARTS PROJECT

By Brandon Schroeder, Daniel Moffatt, and Helen-Ann Cordes

“What I liked about doing the project was that you got to explore a new animal, figure out what it does, find out a little bit more about it and learn how to protect it.”

– 7th Grader, Rogers City Middle School



When at Thompson’s Harbor State Park or Negwegon State Park, you are likely to meet teachers and students exploring. While Rogers City students visit Thompson’s Harbor and Alcona students visit Negwegon, both are trading their text books for hiking shoes. Through this exploration and learning, they are raising awareness and contributing to the stewardship of the amazing natural resources of these public lands.

Working in partnership with the Friends groups of each park, these students explore and write about the unique habitats home to threatened and endangered species found within these properties. Supported by the Michigan Department of Natural Resources, Michigan Sea Grant and other community partners through the Northeast Michigan Great Lakes Stewardship

Initiative (NEMIGLSI), these elementary and middle school students are trekking the shoreline and trails of Thompson’s Harbor and Negwegon State Parks. These budding researchers explore the biological diversity of coastal Lake Huron, woodland, and wetland habitats while looking for rare, threatened and endangered plants and animals. Aside from an amazing learning experience, the students also share what they have learned with others!

Learning alongside resource experts and Friends of Thompson’s Harbor State Park volunteers, Rogers City students experience Thompson’s Harbor State Park firsthand (and some for the first time) through multiple field trips



to explore the park. They investigate coastal dunes, limestone cobble shores, wetland marshes, and coastal fens, among the diversity of coastal habitats for which Thompson’s Harbor State Park is known. Reflecting on the field trips each year, students use their research to develop reports. Middle

school students select a rare species found in Presque Isle County to research and write a report profiling their species. Their completed research booklets include photos, species status details, and ecological information about the threatened or endangered species they studied.



Elementary students develop educational booklets featuring the places, plants, and animals they found to be most interesting and exciting during their visit. These booklets allow other park visitors to connect with area students and see the public land in a new light.

This project also enhances student learning. Rogers City Middle School teacher, Holly Wirgau, said, "It was such a positive experience for my science class. The educational benefits were phenomenal! They learned much in the course of the day, and because they were actually out in the field, they will retain their lessons."

Two counties to the south, another group of middle school students from Alcona Community Schools are launching a similar study of coastal habitats and rare species found locally within Negwegon State Park. This park is known for its sizeable and undisturbed dune and swale habitats abutting the Lake Huron coastline. Through the continued partnership with agency and university resource experts and Friends of Negwegon State Park, these students explore the park each school year. In complement to the work being done by youth in Rogers City, these Alcona students also research and write about these natural areas that characterize the ecological richness of Alcona County and Northeast

Michigan.

As part of a blended learning experience, Alcona and Rogers City students learn about the ecological and community values of the local natural resources and then select a rare species found locally to write a report. Among the many species, students have highlighted the federally protected Dwarf Lake Iris, Pitcher's Thistle, Hine's Emerald Dragonfly, and the Eastern Massasauga Rattlesnake. Applying science and writing skills, this project is a great opportunity for students to learn while raising awareness about these rare, local species.

Each year, both schools make a trip out to the state parks for further exploration and discovery surrounding the habitats, plants, and animals they write about. Through this experience students gain a better understanding of the ecological and community values that each park provides for Northeast Michigan. Today, they continue to work on sharing this valuable information through interpretive resources they are developing for park visitors and users. Increasing awareness and interest in these rare species may offer ecotourism development opportunities within the region while also promoting conservation of these important habitats and the biodiversity of life they support within the Lake Huron watershed.



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Connecting to our Sanctuary: Shipwrecks, Science, & History

By Brandon
Schroeder and
Daniel Moffatt

Mapping shipwrecks with marine archaeologists, researching Great Lakes fisheries of past and present, and building underwater remotely operated vehicles (ROVs) to explore what lies below Great Lakes waters are commonplace experiences for students enrolled Shipwreck Alley. This course offered at Alpena High School, Shipwreck Alley: Shipwrecks, Science, and the Marine Sanctuary engages students in local, hands-on Great Lakes science and history.

This one-of-a-kind course enriches student learning of Lake Huron natural resources and Great Lakes maritime heritage. Surrounded by the Thunder Bay National Marine Sanctuary (TBNMS), a federally protected area dedicated to the preservation of maritime history, students connect with area shipwrecks and maritime archaeologists. As an Earth Science elective, students also learn about geology and meteorology, Great Lakes ecology and environmental issues like invasive species. Their studies are brought to life through understanding how people and communities of Northeast Michigan are connected to the Great Lakes through history, economic issues, and maritime archaeology.

The class is founded on field-based experiences; in Alpena, locally relevant experiences for students in this class seem endless. The 4,300-square mile TBNMS protects one of America's best-preserved and nationally-significant collections of shipwrecks. To date, nearly 100 shipwrecks have been discovered within the sanctuary.

On any given day during the trimester, you may find students at Plaza Pool learning to snorkel while practicing underwater archaeological techniques. Students test skills through fun activities like underwater hockey! On another day, they could be visiting 40 Mile Point Lighthouse to investigate the shipwreck, *Joseph S. Fay*, which has been stranded there since 1905. On yet another field day, students could embark on the glass-bottom boat, *Lady*

Michigan, to deploy their built-in-class ROVs on historical wrecks in Thunder Bay, Lake Huron. Nearly all the field work is funded by grants and donations.

While designing the course, instructor John Caplis sought content guidance from the TBNMS staff. He also secured start-up funding from the Besser Foundation to launch his vision for this project. Kicking off in 2012,



the class has grown greatly and gained the interest of students and administrators alike! This course also received support through the NOAA Great Lakes Bay-Watershed Education Training (B-WET) program, and his class is an example of how humans and history can be woven together through watershed studies.

Expanding into new partnerships within the Northeast Michigan Great Lakes Stewardship Initiative (NEMIGLSI) network, the class connects with the Besser Museum and Michigan Sea Grant to collect



oral histories from commercial fishermen who worked on Lake Huron. According to Caplis, they hope to preserve these stories and learn more about the lives of these men and the health and history of the Great Lakes fishery. Documenting commercial fisheries history specific to northern Lake Huron, students will help create an interpretive exhibit for the *Katherine V* – a historic commercial fishing vessel that operated out of Rogers City and is now housed at the Besser Museum in Alpena. Through their research, they capture

a record of local history. To raise awareness about the value of our Great Lakes, they work to develop the outreach materials and exhibits of heritage in hopes of encouraging lifetime stewardship of the Lake Huron fishery.

Students learn about science, history, writing, and technology during these hands-on, multi-disciplinary learning experiences. The enthusiastic youth explore firsthand the wealth of careers connected with Great Lakes science. When they apply lessons learned

Because of this class, I became a volunteer at the Sanctuary. Then through that, I submitted an application to a program called Ocean for Life, which is a NOAA program [that] took place in California. So I got accepted to that and I went there this summer... I'm really interested in having a career path in marine archaeology or marine biology... It started all from this class, so that's really cool."

– Former Shipwreck Alley Student

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from experts, students find themselves equipped to take on real-world projects like the *Katherine V*, which is a valuable contribution to the mission and work of the Besser Museum.

This Alpena High class project demonstrates place-based education in action. Through their education, students contribute to their community

by enhancing maritime heritage studies and environmental stewardship of Northeast Michigan. Above all, the work of these students in their community – whether studying and mapping shipwrecks or interviewing commercial fisherman – generates great interest, awareness, educational opportunities and community pride.



Help support place-based education in northeast Michigan by donating to our NEMIGLSI Endowment.



Funding for the Northeast Michigan Great Lakes Stewardship Initiative is provided by the Great Lakes Fishery Trust. The mission of the Great Lakes Fishery Trust is to provide funding to enhance, protect, and rehabilitate Great Lakes fishery resources.



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