

SURROUNDEDBY

Michigan Sea Grant works with partners for a sustainable future

Notes from the Director...

As Michiganders, we proudly describe our origin in the Great Lakes state. It is hard to envision Michigan without including the Great Lakes' role in our quality of life, recreation, tourism, economy, industry, and transportation.



Sea Grant is a program of the National Oceanic and Atmospheric Administration in the U.S. Department of Commerce. As such, we focus not only on the application of science to the environment, but also to the economy. According to a 2009 Sea Grant study, approximately \$62 billion in wages came from jobs related to the Great Lakes, which produced about 15 percent of all jobs and 23 percent of all payroll in Michigan. Clearly, the Great Lakes are an economic engine to be cherished by all of our citizens. This economy must continue in a sustainable manner so future generations can also benefit from the value we find in the Great Lakes.

Michigan Sea Grant has always looked at economic aspects of the coastal environment. There has been a long-standing effort to improve commercial fisheries and aquaculture through programs such as the Seafood HACCP—a program certifying the quality of

seafood — as well as through fisheries workshops and other activities that promote knowledge of the Great Lakes and their role in commercial fishing and aquaculture. Sea Grant has helped encourage tourism through sport fishing, fishing tournaments, charter fishing, and expansion of water and birding trails. We have helped coastal communities thrive and become more financially sustainable through their harbors, working waterfronts, and historical heritage sites. All of these have helped local communities understand and use their unique resources for a sustainable economy and a high quality of life.

This issue of *Upwellings* focuses on the economic impacts of some of Michigan Sea Grant's projects. All of these efforts rely on a large number of people who do research and outreach from local to state to national levels to further understanding and development of coastal resources.

I am proud of the fact that Michigan Sea Grant works today as one family in making this happen, not only involving combined efforts from our staff at the University of Michigan and Michigan State University, but scientists from other universities and agencies, as well as stakeholders in local communities and governments.

In Michigan, we are exceedingly fortunate to be surrounded by 20 percent of the world's surface freshwater, which is still in excellent condition and contributes not only to our economy, but to our quality of life and the future of our children. It is through programs that link youth education, stakeholder involvement, and science that these resources can be sustained into the future. I encourage you to look at the following projects as ways Sea Grant has functioned to make those connections and help shape the Great Lakes environment of the future.



The Heart of Michigan Sea Grant

At Michigan Sea Grant, we love to brag about the Great Lakes. These astonishing lakes and their connecting rivers make up the planet's largest body of fresh water. They provide drinking water for millions of people, span an international border, sustain billions of dollars of economic activity every year — and they are stunningly beautiful.

That's why we have been working diligently since 1969 to help people around Michigan understand and love the Great Lakes. We leverage our broad network of partner organizations to:

- Support and coordinate
 research projects at Michigan
 universities to help answer
 pressing questions about issues
 affecting coastal ecosystems and
 communities.
- Act as honest brokers of information, putting research findings into the hands of regulators, scientists, policy makers, and community members who can use the data to make informed decisions about their interactions with the Great Lakes.
- Host classroom activities, workshops, lectures, camps, and field trips that connect students and adults with our state's marvelous freshwater seas.

Interested in joining us? Get in touch with your regional Michigan Sea Grant Extension educator (see map on back cover) for volunteer opportunities or events near you. \blacksquare



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SHORING UP MICHIGAN'S SMALL HARBORS

THE GOAL: Identify the barriers preventing small harbors from becoming economically, socially, and environmentally sustainable.

Michigan is home to more than 80 public marinas and harbors, managed by state, county, or local governments. They are part of a boating culture that draws \$2.4 billion in economic activity to the state each year. Even so, with increasingly scarce state and federal funding, public facilities face

TURBULENT TIMES

plenty of challenges.

Michigan's harbor towns have weathered many storms in the last few decades. Factors such as fluctuating water levels and seismic shifts in the state's economy have left some harbor communities struggling to adjust.

But that's not the end of the story. Tourist dollars are returning to Michigan after the financial recession, and there is a growing interest in dining and outdoor recreation opportunities in towns along the state's coasts. Public harbors typically occupy prime waterfront real estate and could function as vital drivers for flagging local economies if bolstered with the right amenities.

A new state mandate also requires state-funded boating facilities to develop five-year management plans, so the time is ripe for managers to think carefully about the long-term future of their harbors.

The Sustainable Small Harbors project, funded by Michigan Sea Grant and a host of partners, aims to assist coastal communities in their planning efforts.

The project has enabled several coastal communities with public harbors to do in-depth self-assessments, uncovering strengths and weaknesses related to their waterfront assets. Participants brainstormed what they want their town's twenty-year future to look like and developed concrete ideas for projects that could help that future become a reality. In the past year, some towns involved in the project have already parlayed these insights into dollars and cents.

PROJECT PARTNERS

Lawrence Technological University

Michigan Sea Grant

Rogers City

Au Gres

Baltimore

Michigan Department of Environmental Quality's Office of the Great Lakes

Michigan Department of Natural Resources

Michigan State Housing Development Authority Additional partner support:

Environmental Consulting and Technology

Veritas Economic Consulting

David L. Knight, LLC

Edgewater Resources

FORMING PARTNERSHIPS TO SEEK SOLUTIONS

Case-study

Communities

Pentwater

The Sustainable Small Harbors project was launched in 2014 as an integrated assessment — a type of research venture designed to draw together existing data into an overarching analysis of a given issue. The goal is to identify the barriers preventing small harbors from becoming economically, socially, and environmentally sustainable.

The project has been spearheaded by Don Carpenter of Lawrence Technological University. Funding came primarily from Michigan Sea Grant and multiple state agencies (see box for full list of project partners). An additional grant from the State of Michigan helped expand the project beyond its initial two-year run.

This co-funding model effectively leverages public dollars to benefit Michigan communities in an unprecedented level of partnership among Michigan Sea Grant and its state and university partners.

ELEVATING COMMUNITY VOICES

To complement the integrated assessment, the project team developed a series of case studies featuring small harbor towns from around the state. In 2015 and 2016, the project team visited the six case-study communities (see map) and facilitated in-depth visioning sessions to help community members develop and prioritize meaningful ways to make their waterfronts more environmentally, financially, and socially sustainable. The team was able to provide these highly interactive, public input-driven workshops, or "charrettes" — typically valued at tens of thousands of dollars — at no direct cost to the communities.

The Rogers City Marina was a focal point of the community's discussion about the future of its waterfront.

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What happens during a charrette?

The Sustainable Small Harbors project team visits a community three times: a one-day orientation visit, the main three-day design charrette, and a final one-day visit a month or two later. During the charrette, the project team sets up a design studio where designers and architects illustrate and electronically render images for visions identified by the community. The community provides a public space to welcome participants in an iterative series of public input events. Attendees engage with fellow community members to sketch on large-scale maps, use color-coded stickers to vote on options, and participate in several feedback loops to ensure the project team is accurately reflecting a consensus vision.



• Barriers

• Weaknesses































3 DAYS: DESIGN CHARRETTE

- Public input workshop
- Open house: Selecting a preferred option Public "work in progress" session

1 DAY: FINAL PRESENTATION

- Presentation to city/village council
- Updated graphics
- Final report





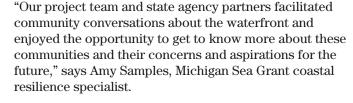










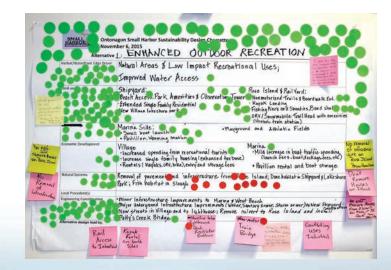


These brainstorming sessions typically involved three separate visits from the project team, which consisted of project lead Don Carpenter and representatives from Michigan Sea Grant and state agencies.

Before the team arrived in town, they already had worked with community leaders to gather information about the area's demographics, city planning documents, and waterfront set-up. The initial one-day visit included a preliminary visioning meeting that introduced community members to the Sustainable Small Harbors project and guided participants through a selfassessment of the factors that made their waterfronts more or less attractive to residents and visitors alike.

The second visit, a three-day design charrette, invited the public to refine concepts from the original meeting. The concepts were developed into three alternative designs reflecting unique futures for the waterfront. Through a "dot voting" process (see example on right), participants were encouraged to weigh in on potential development options gleaned during the first visit.

Participants reflected on improving access to public harbors or potential avenues for transforming underperforming facilities. They weighed designs featuring combinations of street redesigns, new bike trails, pocket parks, kayak rentals, boat ramps, wheelchair-accessible restrooms, and other potential upgrades that could boost the community's waterfront appeal. Upgrades that earned the highest participant support were compiled into a final series of design sketches and conceptual images, which the team presented at the end of the charrette.

















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Find the guidebook and more information about the project at sustainablesmallharbors.org



During the final one-day visit a few months later, the team presented a report to the city or village council. The report included potential funding sources, such as federal or state grants, foundations, and local champions, which the community and council could draw upon to launch the phased projects proposed in the final designs.

TURNING VISION INTO ACTION

In several cases, the charrettes galvanized community leaders to seek funding opportunities to support the designs prioritized by charrette participants. Community leaders have now leveraged the charrette designs to seek more than \$3 million in grant funds to support proposed harbor projects.

In 2015, the city of New Baltimore used the charrette designs to become finalists for a \$2.85 million grant from the Michigan Natural Resources Trust Fund. The funds are intended for the purchase of the private Schmid Marina on Lake St. Clair, which would be opened for public use. The city will use additional funds from a different grant to upgrade the marina facilities for handicap use. The Michigan Natural Resources Trust Fund has called the project "a rare opportunity for the city to obtain a site to provide public recreation, conservation, and environmental stewardship at a location in populous [southeast] Michigan.

Officials in Au Gres plan to use the charrette designs to market the city as a "silent watersport-friendly" destination for paddlers, anglers, and other groups. Au Gres also won a \$30,000 grant from the Saginaw Chippewa Indian Tribe to renovate the formerly state-owned Au Gres Mooring Facility — one of the main ideas that came out of the city's charrette process. Additionally, city officials plan to incorporate some of the charrette designs into their next master plan.

In Ontonagon, the charrette process prompted a revitalization of the Downtown Development Authority in early 2016. The Authority maintained momentum on

several projects highlighted in the charrette designs, such as proposed improvements to local trails.

SPREADING THE WORD TO NEW COMMUNITIES

The Sustainable Small Harbors team hopes other communities can benefit from these examples.

"This project compiled best practices for coastal communities in regard to place-making strategies, smart waterfront growth, and tools that will allow communities to optimize their waterfronts and downtown connections to the water for local businesses, residents, and tourists," says Mark Breederland, Michigan Sea Grant Extension educator based in Traverse City.

Findings from the integrated assessment — along with the case studies and takeaways from an economic analysis of the multiple ways small harbors add economic value to communities — have been captured in the *Sustainable Small Harbors Tools and Tactics Guidebook*. The guidebook identifies the various stages of developing a strategy for harbor sustainability and serves as a tool for managers or officials seeking to do this kind of planning in their own communities.

"St. Ignace, Rogers City, and the other communities served as proof-of-concept case studies for the project, allowing city staff and volunteers a chance to review and provide direct input for the final *Sustainable Small Harbors Tools and Tactics Guidebook*," says Michigan Sea Grant's Amy Samples.

"The guidebook is a resource to assist communities with harbor-specific planning," she explains. It describes the importance of carefully planning for the long-term future of small public harbors, conveys best practices gleaned from the case-study communities, and provides resources for communities that want to walk through their own visioning process.

— Geneva Langeland

Five research projects launch with Michigan Sea Grant's support

Rain gardens, weather buoys, and a lesser-known Lake Michigan fish all feature in the latest round of research projects funded by Michigan Sea Grant. Every two years, Michigan Sea Grant supports a wide variety of research projects led by teams based at Michigan universities. Five projects were chosen for the 2016-18 funding cycle. Together, they will receive \$1.1 million in research funding over 2 years.

"The response to the request for proposals was excellent," says Jim Diana, Michigan Sea Grant director. "I am happy to see our partners from local, state, and federal management agencies represented in these projects and am impressed by the innovative ways the research teams seek to address some very challenging coastal resource management and policy issues."

The 2016-18 projects include traditional and graduate student research. They reflect Michigan Sea Grant's continued support for cross-disciplinary partnerships and integrated assessment.

"These projects tackle, in creative ways, key issues affecting the Great Lakes and coastal communities," says Catherine Riseng, Michigan Sea Grant research program manager.

The 2016-18 project line-up includes:

1. Many Michigan communities are interested in using plant-centric green infrastructure to supplement traditional stormwater management components, such as storm drains, sewer pipes, and wastewater treatment plants. Don Carpenter, a professor of civil engineering at Lawrence Tech University, is spearheading efforts to assess barriers to large-scale green infrastructure implementation and offer strategies for overcoming them.

- 2. New opportunities are rising to restore Lake Michigan ciscoes, once a dominant food and prey fish in the lake. Sara Adlerstein, a University of Michigan associate research scientist, is leading an interdisciplinary team in helping cisco restoration stakeholders identify a path forward.
- 3. Michael Moore, a professor of environmental economics at University of Michigan, is assessing the potential ways that restoring environmentally degraded water bodies might affect the composition and economic well-being of surrounding neighborhoods.
- 4. Acoustic cameras that capture images using sound waves have been deployed in several northern Michigan rivers to detect migrating fish. Erin McCann, a graduate student fellow at Central Michigan University, is developing a computer program that can process these images and distinguish between invasive sea lamprey and native rainbow trout.
- 5. Angela Yu, a graduate student fellow at Michigan Technological University, is using satellite imagery, buoys, field data, weather conditions, and river flow patterns to characterize the effects of the Detroit River on algal bloom formation in western Lake Erie.

For more information about these projects or the upcoming 2018-2020 funding cycle, visit: *michiganseagrant.org/research*.

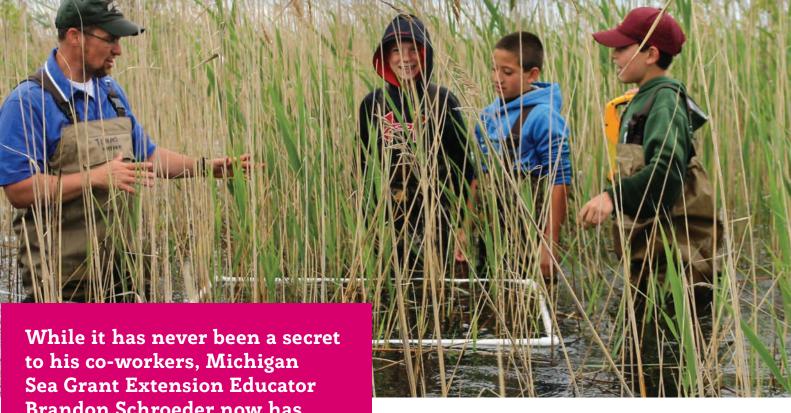
— Geneva Langeland

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2017 Informal Science Educator of the Year

BRANDON SCHROEDER



to his co-workers, Michigan
Sea Grant Extension Educator
Brandon Schroeder now has
proof of his exceptional science
stewardship teaching abilities to
hang on his wall.

The Michigan Science Teachers Association (MSTA) has chosen Brandon as its 2017 Informal Science Educator of the Year. MSTA is a state chapter of the National Science Teachers Association, one of the largest science teacher organizations in the United States. Its mission is to stimulate, support, and provide leadership for the improvement of science education throughout Michigan.

Brandon serves as Michigan Sea Grant Extension educator for northern Lake Huron coastal communities. In addition to his valuable work involving fisheries science, biodiversity conservation, sustainable coastal tourism, and working with communities to apply science-based knowledge to address Great Lakes issues, Brandon is a passionate proponent of science education and Great Lakes literacy. The work he has been doing for years aligns perfectly to Michigan's new K-12 science standards — another benefit for teachers learning and working with Brandon.

As part of the Northeast Michigan Great Lakes Stewardship Initiative (NEMIGLSI), a regional place-based stewardship education initiative, Brandon works with area schools to foster school-community partnerships by providing professional development for educators and supporting youth in implementing stewardship projects. Alongside Great Lakes scientists and natural resource professionals, Brandon works with youth who are applying environmental science, technology, engineering, and math (E-STEM) learning to help conserve Lake Huron's biodiversity, map threatened and endangered species habitats, monitor vernal pool wetlands, manage invasive species, investigate marine debris, and more. Since 2009, nearly 19,000 students have engaged as Great Lakes stewards, E-STEM learners, and valued community leaders through NEMIGLSI, which Brandon helped launch.

In addition, Brandon provides program leadership for Michigan State University Extension's statewide 4-H Great Lakes and Natural Resources Camp, a youth leadership camp and Michigan State University Pre-College Program recognized nationally for conservation education excellence and science program best practices.









Brandon doesn't reserve his enthusiasm for just students. He currently serves on the Great Lakes Sea Grant Network's Center for Great Lakes Literacy team, which fosters connections between Great Lakes scientists and the educational community. Brandon co-coordinates two intensive opportunities for Michigan educators — a shoreside Lake Huron Place-Based Education Summer Teacher Institute and a shipboard Lake Huron Science Exploration with teachers aboard the EPA *R/V Lake Guardian* research vessel.

According to MSTA, Brandon was chosen for his "unique and extraordinary accomplishments, active leadership, scholarly contributions, and direct and substantial contributions to the improvement of non-school-based science education over a significant period of time."

Awards are formally presented during the annual MSTA conference, held this year in March. "It's a great honor to be recognized by MSTA," Brandon says. "It is an honor that also recognizes our great partnerships with communities, schools, educators, and youth."

In 2015, Michigan Sea Grant's Steve Stewart, senior Extension educator in Southeast Michigan, also received MSTA's Informal Science Educator of the Year award. The recognition of their peers illustrates how Michigan Sea Grant Extension educators are held in high regard.

Joining Brandon on stage this year will be another award winner with ties to Michigan Sea Grant. Alpena elementary schoolteacher Bob Thomson (above), who works with Brandon on many projects, has been named MSTA's Elementary Science Teacher of the Year.

Bob Thomson's class has been a long-term partner with Michigan State University Extension and Michigan Sea Grant through the NEMIGLSI network and the Center for Great Lakes Literacy. Locally, Bob's class has been instrumental in establishing the Thunder Bay Watershed Project — where students engage in watershed science and studies. Through their projects, his students are collaborating with Michigan Sea Grant and other partners to address significant issues in the region, such as water quality, invasive species, biodiversity conservation, and marine debris in the Great Lakes.

A leader beyond his school walls, Bob Thomson's place-based stewardship education model has inspired school administrators and other area educators. He and Brandon have both been instrumental in helping Michigan Sea Grant foster a growing network of partners committed to connecting youth with the Great Lakes and natural resources.

— Cindy Hudson



Michigan Sea Grant's Elliot Nelson wears many hats. He is a new dad, a dedicated birder, an Extension educator, and without a doubt — an Upper Peninsula cheerleader.

"No matter what season it is, you find something fun to do up here. Whether it's skiing, snowmobiling, fly fishing in our streams, salmon fishing, or birding — there is always a new adventure to pursue," says Elliot. And since joining Michigan Sea Grant in May 2016, he hasn't wasted any time jumping into those adventures.

Elliot has been working to build connections with stakeholders throughout the community. He sees a strong role for Michigan Sea Grant in continuing to engage people with local natural resources and help them connect with the world around them.

SHARING HIS LOVE OF BIRDS

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Elliot has already been hard at work and was key in helping create an interactive online winter birding trail map that highlights opportunities in the eastern Upper Peninsula to enjoy great birding, even in winter (see "Michigan's trail movement keeps growing" on page 19). Interesting winter birds include a number of finch species, but many birders — beginners and the experienced alike — come in search of a snowy owl sighting. Visitors from Canada, surrounding

states, and all over Michigan head to this popular area and help generate tourism dollars for the local economy.

Elliot has lent his expertise to several birding tour groups and has also worked with Michigan Audubon and other organizations to host a bird trail networking conference. He hopes the conference will encourage Michigan groups to coordinate activities and develop a statewide plan to promote Michigan birding.

GETTING STUDENTS OUTSIDE

A former high school science teacher, Elliot also plans to work with partners to offer public programs that introduce upper elementary and middle school students to paddling, fishing, water quality, and watershed restoration activities. In addition, he plans to encourage place-based K-12 stewardship education in the St. Marys watershed. Through these projects, he will support teachers in their efforts to get students outside and engaged in hands-on stewardship and science learning opportunities.

AQUACULTURE INITIATIVES

"There is a large and growing sector interested in aquaponics and recirculating systems for food production," Elliot says. He believes hosting community workshops and supporting research and development surrounding sound operations and effective business models will allow communities to determine how they want to harness these possibilities for food security and economic growth.

Elliot has been involved in organizing the Aquaculture Challenge Program for high school classes from around Michigan. The one-day workshop at Lake Superior State University (LSSU) in Sault Ste. Marie explores the potential, as well as the impact, of aquaculture on the food system. The integrative learning curriculum, which meets Michigan science standards, includes building an aquaponics system that functions biologically and cycles efficiently, developing a water quality monitoring protocol, programming water sensors, and creating a business plan.

Elliot is working with LSSU and area community colleges to develop and implement an aquaculture technician certification program. The two-year certification program is slated for fall 2017, allowing a new generation to explore low-impact, sustainable aquaculture opportunities.

In a complementary effort, Elliot is working with the Michigan Department of Agriculture and Rural Development and the Michigan Aquaculture Association to develop a GAAMP, or Generally Accepted Agricultural Management Practice, for siting aquaculture operations. GAAMPs are written by the state to provide guidance and standards based on sound science for effective agricultural practices with low environmental impacts. This new GAAMP will provide guidance and standards for appropriate locations of aquaculture operations, taking into account environmental, social, and economic factors.

SHARING THE LATEST RESEARCH

One of Michigan Sea Grant's signature event series is the Great Lakes Fisheries Workshops, held throughout the state each year. The workshops bring communities together with fisheries research and management partners to discuss research findings, management updates, and fishing trends. Attendees have an opportunity to weigh in on important management issues. The Lake Superior Fishery Workshop, which Elliot is helping organize, is planned for May 2017, in Marquette, and will provide updates on the state of the local fishery, as well as baitfish monitoring and invasive species control measures.

Adventure can be found in any of the Upper Peninsula's roughly 30 major watersheds, but Elliot notes that "few watersheds have a management plan in place, and even fewer have watershed councils to guide and promote conservation and management." Operating on a watershed basis allows for the consideration of all activities and all land areas that affect the health and function of a particular river or lake as a whole. Elliot is taking an active role in helping these councils get up and running.

"Developing partnerships and working together for the good of our communities and our natural resources is one of my main goals," says Elliot. "I think the Upper Peninsula is one of the most beautiful places in the world, and I am very passionate about helping the communities in this area thrive economically, but at the same time ensuring we are being good stewards of this wonderful resource."

— Kate Bailey, Cindy Hudson

KEEP ON ROCKIN'

A new spawning reef in the Detroit River marks 15 years of habitat restoration work



Construction was completed last fall on the newest fish-spawning reef in the Detroit River. The reef — actually a complex of 3 small reefs — is situated in about 20 feet of water off Belle Isle near downtown Detroit.

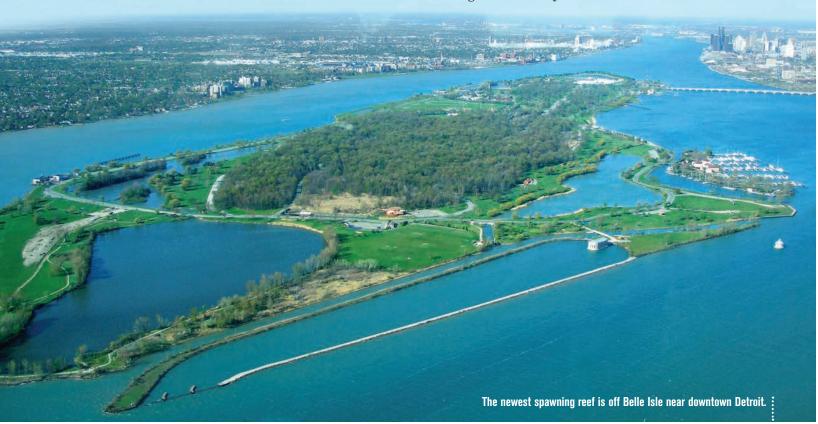
These deceptively simple piles of limestone rock are in fact the result of intensive study, input from a broad range of experts and stakeholders, and more than 10 years of reef-building trial and error.

In 2001, a small group of natural resource managers and scientists from multiple agencies and organizations,

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facilitated by Michigan Sea Grant, joined forces with the goal of restoring spawning habitat for lake sturgeon in the Detroit-St. Clair River System. It took three years of planning and searching for funding, but in 2004, the first reef, also off of Belle Isle, went into the river.

"Native fishes, and especially sturgeon, were our target from the beginning," says Jennifer Read, director of the University of Michigan Water Center and principal investigator on the project. "Sturgeon are charismatic, and there was thought that lack of spawning habitat was hindering their recovery."



Sturgeon need rocky crevices in cold, fast-flowing water in which to lay their eggs. The St. Clair and Detroit rivers used to have this perfect combination and were spawning locations for sturgeon from throughout Lake Huron and Lake Erie. Efforts to make the rivers more suitable for shipping around the turn of the last century removed much of the rocky river bottom, piling it into islands and dumping it onto the shoreline.

Consequently, populations of sturgeon and many other fish species that rely on that rocky habitat suffered. Current sturgeon populations are estimated to be one percent of historical levels.

Habitat loss was not the only pressure put on sturgeon. They were intensively fished and the waters they swam in polluted. But fishing for sturgeon has been heavily curtailed and water quality improved by legislative mandate. Studies suggest that high-quality habitat is the remaining limiting factor to the rebound of these iconic fish.

The spawning reef restoration group, still made up of many of the members that initiated it, hopes this newest reef will adequately mimic historical habitat and be irresistible to sturgeon, walleye, and other native species looking for a place to lay their eggs.

They have reason to be optimistic. Since 2004, six reef projects have been constructed at three locations in the Detroit River and three in the St. Clair River. Comparison of fish-capture and egg data from before and after reef restoration found spawning by 16 native fish species, including lake sturgeon, on 5 of the 6 reefs. At least 14 other native species, including northern madtom that is listed as endangered in Michigan, are using the reefs in other ways.

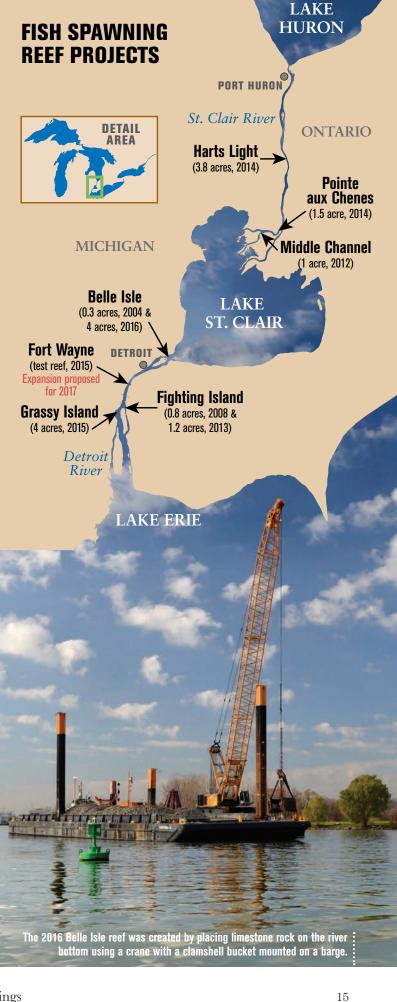
This new Belle Isle reef will augment with limestone one of the first reefs created by the restoration team. That reef was made in part from coal cinders provided by DTE Energy. The new reef will expand the original from 0.28 to 4 acres.

DTE is an active partner in the projects. The energy group recently loaned its dive team to survey proposed reef sites for endangered native mussels and has made available shorefront property to house the limestone used for constructing the reefs. This partnership is representative of the restoration team's ethos, where partners have distinct roles and decisions are shared even though no formal agreement has been signed.

ADAPT OR PERISH

Central to the group's success is adaptive management, a philosophy that seeks to learn from previous experiences — mistakes as well as successes — and achieve consensus among experts and stakeholders.

"An adaptive management strategy emerged organically," says Read, who started with the team when she was assistant director at Michigan Sea Grant in 2001. "We wanted to understand and monitor conditions prior to and



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after restoration. We also wanted to apply what we learned from one reef to the next. Why start from zero every time?"

The group recently published an overview of some of the hard-won lessons about reef construction and adaptive management. They hope the report, entitled *Science in Action: Lessons Learned from Fish Spawning Habitat Restoration in the St. Clair and Detroit Rivers*, will be used by other teams embarking upon spawning reef restoration activities.

Some of those lessons involve how reefs should be monitored and assessed. Partners at the U.S. Geological Survey had to work out the best way to place egg mats — sticky "welcome-mat" shaped squares that eggs adhere to — and larvae nets in order to determine if reefs are being used for spawning and by what species.

"Over the years, we began developing better and better tools for monitoring lake sturgeon and other fish that spawn in similar ways," says Greg Kennedy, supervisory fishery biologist with USGS. Kennedy describes how his team's sampling techniques evolved from a system where divers manually placed egg collection devices on and near reefs to one that can be deployed and recovered by researchers who do not have diver support.

Similarly, the U.S. Fish and Wildlife Service developed methods for surveying adult fish on and near reefs. These include catching them on lines and in nets, using telemetry to monitor their movements, and adapting portable ultrasound units to help assess their sex and spawning readiness.

"Our knowledge of sturgeon movements and habitats has exploded ... thanks to this telemetry work," says Jim Boase, fish biologist with USFWS. "We now have a better understanding of how these fish move, where they spend their time, where they spend their winters."

POWER OF PARTNERSHIP

Other lessons speak to team creation and collaboration. Both Kennedy and Boase agree that working with the group toward a common goal, rather than working independently, has helped them move the state of their science forward.

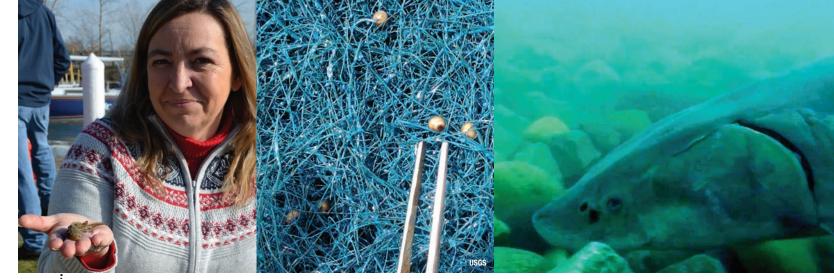
"Our collective impact has been much larger and has brought positive end results for each individual agency," says Boase, "rather than one agency taking full credit and trying to 'go it alone."

Michigan Sea Grant remains heavily involved as a partner. Mary Bohling, a Michigan Sea Grant Extension educator, has been an outreach contact for the effort since it began. Jim Diana, Michigan Sea Grant director, works with his students at the University of Michigan to better understand what happens to sturgeon larvae once they leave the reef.

"Since 2010, we have worked on locating where sturgeon larvae go after leaving the restored reefs," Diana says. "We thought it might be wetlands, but after extensive sampling, we were surprised to find that the juveniles prefer deep portions of the river — preferably with mucky bottom, moderate current, and the presence of a lot of benthic invertebrates."



Researchers found target fish species – lake sturgeon, walleye, and lake whitefish – prefer to spawn on rock beds with crevices that protect the eggs.



(Left to right) Michigan Sea Grant Extension Educator Mary Bohling holds a preserved juvenile sturgeon. Egg mats are used to assess how reefs are used by fish. A lake sturgeon visits a reef in the St. Clair River.

Diana's student, Joe Krieger, has extensively sampled the Detroit and St. Clair rivers looking for juvenile sturgeon. The restoration group will use a habitat model he and Diana created to inform placement of future reefs.

Other organizations that have been part of the restoration group since its inception include DTE Energy, Michigan Department of Natural Resources, and SmithGroup JJR.

New partners are brought on as needs arise. For example, one of the biggest problems the reefs face is sand settling into the gaps between the rocks where fish lay their eggs. The group recently engaged University of Michigan engineers to model hydrodynamics of the reef and look at how placement in the river and design might reduce infilling by silt and sand.

Using a wave tank and computer models, the group explored various designs — from wing-shaped towers to ramps — to determine what shapes and water velocities are best suited for reef construction. Their findings are being applied at Belle Isle and will be used in future reef construction and placement.

Its unique style, broad membership, and demonstrated successes have positioned the project well for funding. In addition to the time and resources committed by project partners, the effort has received funding from international federal, state, business, and non-profit sources. To date, more than \$10 million has been received to perform the work

ONE PART OF A LARGER EFFORT

The reefs' benefits to native fish species, including lake sturgeon, make them effective tools in the broader effort to restore the St. Clair-Detroit River System. The project team works closely with the St. Clair-Detroit River System (SCDRS) Initiative, a group that coordinates research and management efforts in the corridor. One of SCDRS' priorities is to remove the corridor from the Area of Concern (AOC) list.

In 1987, the St. Clair and Detroit rivers were listed as AOCs under the U.S.-Canada Great Lakes Water Quality Agreement. According to the U.S. Environmental Protection Agency, AOCs are regions that have experienced environmental degradation that impairs beneficial uses of that system. By helping restore native fish populations and habitat, reef restoration directly addresses beneficial use impairments, such as "degradation of fish and wildlife populations" and "loss of fish and wildlife habitat," that are listed as top concerns by both the U.S. and Canada.

"Reef restoration was identified as a priority project to address these impairments," says Bohling, who is also chair of the public advisory council for the Detroit River Area of Concern. "In the Detroit River, they were 1 of 10 projects that address those. Once those 10 are done, hopefully those 2 impairments can be removed and the area will be that much closer to being removed from the AOC list."

NEXT STEPS

Looking to the future, the restoration group has plans to build at least one more reef. A small test reef in the Detroit River near Fort Wayne has shown promise, with eggs found at the site and minimal infilling by sand since it was constructed in 2015. In addition, the group will continue monitoring reefs over the next few years to get a better idea of their impacts.

The group will also focus on sharing lessons they learned with others who are doing this kind of ecosystem restoration work. Team members are already working with other restoration projects in this system and elsewhere in the Great Lakes.

"We are excited about the way these projects have developed and the positive effects they seem to have on native fish species in these two rivers," Read says. "It's thrilling to be part of a growing revitalization of the region."

✓

— Rhett Register

16 Upwellings Upwellings



Great Lakes Fishery Workshops put anglers in the know

Fishing, whether for recreation or profit, makes an important In partnership with fisheries agencies and stakeholder contribution to Michigan's economy. According to the Michigan Department of Natural Resources (MDNR), there are 1.2 million recreational anglers who fish in the state's more than 11,000 lakes, 3,000 miles of Great Lakes shoreline and 20,000 miles of trout and salmon streams. The MDNR estimates that fishing generates 38,989 direct jobs and produces \$2.5 billion annually for the state's economy.

But fishing today is not the same as it was 10 or 15 years ago. Changes have occurred in the Great Lakes, and many favorite species do not exist in the numbers they once did. Where can you go to get up-to-date research and information about the status of Great Lakes fisheries? Smart anglers make sure to attend one of Michigan Sea Grant's annual Great Lakes Fishery Workshops.

organizations, Michigan Sea Grant brings communities together to learn about the latest research findings, lake management updates, and fishing trends. Several workshops are held between January and April at different locations around the state. They are open to the public and provide valuable information for anglers, charter captains, resource professionals, and other interested stakeholders. In addition, these workshops provide attendees with the chance to weigh in on important fisheries management issues.

Plan to attend a workshop, connect with other anglers, and learn about the latest research. Check the Michigan Sea Grant events calendar online or find the workshop page at bit.lu/1CbLaYS.

— Cindy Hudson



MICHIGAN'S TRAIL MOVEMENT

Outdoor recreation has always been a major part of the Michigan experience. Deer camp. Ice fishing at Houghton Lake's Tip-Up Town. Snowmobiling and skiing "up north" and in the Upper Peninsula. But changing climate patterns can make snowfall a little unpredictable for snowmobilers and skiers, and decreasing numbers of hunters and anglers mean fewer people in the woods or on the lakes. Many communities that have traditionally catered to these outdoor enthusiasts are also looking for ways to attract new visitors by taking advantage of their areas' other natural resources.

Trail networks offer a series of stops that connect users with unique regional resources, such as prime birding locations or fishing festivals. People engaging with these trails may boost local economies by spending additional money on food, lodging, or transportation in the area.

Hunters, anglers, birders, paddlers, and history buffs will all find something to enjoy in Michigan's growing trail systems.

BIRDING TRAILS

As Michigan Sea Grant Extension Educator Elliot Nelson has shown (see "Elliot Nelson brings enthusiasm to the eastern Upper Peninsula" on page 12), developing birding trails is a sure-fire way to attract new visitors. According to a U.S. Fish and Wildlife Service report, in 2011, there were 47 million birders 16 years of age and older in the United States — about 20 percent of the population. That's a lot of potential tourists. Check out several birding trails featured on the Michigan Audubon website — and the interactive online map Elliot helped develop — at michiganaudubon.org and northhuronbirding.com

WATER TRAILS

Water trails are also being touted as ways to help people connect to nature and hopefully add to local economies. Water trails are designed for people to follow a mapped route in a non-motorized craft, such as a kayak, canoe, or stand-up paddleboard. A comprehensive website identifies routes all over Michigan, including the Detroit Heritage River Trail and the Lake St. Clair Water Trail, both projects that Mary Bohling, a Michigan Sea Grant Extension educator, helped organize. Find details online at michiganwatertrails.org.

GREAT LAKES FISHERIES HERITAGE TRAIL

For history buffs, an ever-growing network of displays and museums called the Great Lakes Fisheries Heritage Trail (GLFHT) is a good reason to plan a road trip along the Great Lakes shoreline, stopping to visit these locations along the way. The GLFHT explores the past, present, and future of the lakes through the lens of fish and fishing. Brandon Schroeder, Mark Breederland, Ron Kinnunen, and Dan O'Keefe — all Michigan Sea Grant Extension educators — have organized and collaborated with many partners to create this trail around the state. Currently, the GLFHT includes museums and fisheries heritage exhibits, coastal fishing communities and historical sites, fisheries festivals and experiences, commercial fishing families, local fish markets, and related research and science centers throughout Michigan. An interactive map identifying each location and describing what visitors will find there is available online at wp.me/P2Wb84-1YX.

— Cindy Hudson



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