

Buffalo Reef Task Force

AUGUST 2020 - Newsletter

www.Michigan.gov/BuffaloReef

Protecting Lake Superior fish spawning habitat off Michigan's Keweenaw Peninsula



A Buffalo Reef Task Force public meeting in Lake Linden in 2018 is shown. (Michigan DNR photo)

Marching forward in a time of pandemic

This newsletter – part of the Buffalo Reef Task Force's outreach to stakeholders – includes a recap of events of the past year and a look forward to task force activities planned to protect Buffalo Reef. We hope you'll especially like hearing about the role that *otoliths* (a new word for most of us too) can play in understanding what's happening to the reef.

The task force had penciled in two summer dates for public outreach meetings and COVID-19 erased them both. As a result, we're providing this newsletter as a temporary substitute for a face-to-face meeting. We're always interested in your ideas for protecting the reef AND for maintaining a dialogue. Please feel free share your thoughts on these subjects anytime via email to: Pepinj@michigan.gov.

Recent activities: The following timeline details task force events over the past year. Most activities are described in greater detail in news releases, found at www.Michigan.gov/BuffaloReef.

2019

August – Task force chooses top three alternatives for protecting Buffalo Reef; U.S. Army Corps of Engineers assembles engineers and scientists to flesh out the proposals.

September – U.S. Army Corps of Engineers contractor completes dredging of Grand Traverse Harbor and an area of the beach and Lake Superior north of the harbor.



A contractor working for the U.S. Army Corps of Engineers dredging the Grand Traverse Harbor in August 2019. (Michigan DNR photo)

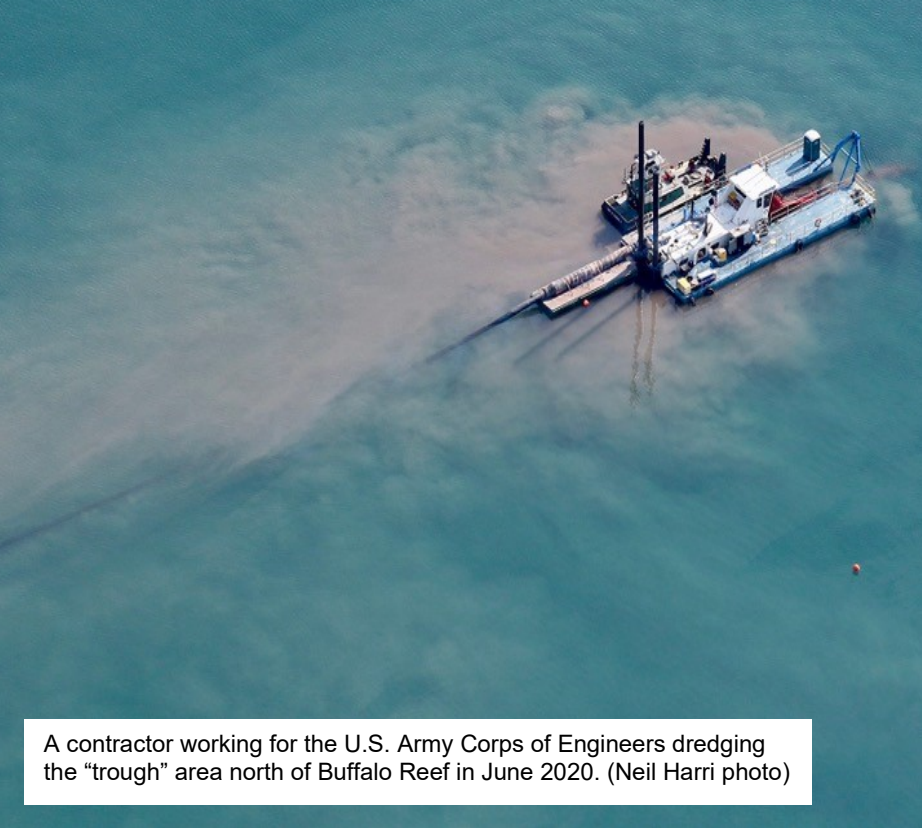
October/November – U.S. Geological Survey inserts telemetry tags into lake whitefish and lake trout to determine where they're laying eggs on the reef. Lake trout eggs are hatched and reared in aquariums containing varying amounts of stamp sands. Growth, survival and behavior are observed.

November – Michigan DNR's contractor removes a 30-foot-high cliff (175,000 cubic yards of stamp sands) from the water's edge at Gay. This cliff, composed of tailings from the Mohawk Mill, was eroding an average of 26 feet of material per year into Lake Superior.



A 30-foot-high bank of stamp sand deposits is being removed from the Lake Superior shoreline at Gay in November 2019. (Michigan DNR photo)

Fact: Buffalo Reef is a 2,200-acre natural cobble feature beneath the waters of Lake Superior, located off the eastern edge of the Keweenaw Peninsula, about 20 miles northeast of Houghton. The reef is important spawning habitat for lake trout and lake whitefish.



A contractor working for the U.S. Army Corps of Engineers dredging the “trough” area north of Buffalo Reef in June 2020. (Neil Harri photo)

2020
January – Michigan DNR’s contractor dredges 13,000 cubic yards of stamp sands from the Grand Traverse Harbor and another 32,000 cubic yards of material from the beach north of the harbor.
March – DNR’s funding for Buffalo Reef is frozen due to COVID-19 budget shortfalls.
June – U.S. Army Corps of Engineers contractor completes dredging 112,000 cubic yards of stamp sands from the “trough” in Lake Superior north, of Buffalo Reef.
 – Michigan Department of Transportation and Superior Stone and Aggregate sample stamp sand for potential use in road construction.
 – U.S. Army Corps of Engineers collects water and sediment samples for chemical and biological testing.

Planned activities

August/September 2020 – U.S. Geological Survey divers recover telemetry units from Buffalo Reef.
August 2020 to December 2021 – U.S. Army Corps of Engineers to develop 30% engineering plans, including costs, for the three top alternatives under consideration for protecting Buffalo Reef. These alternatives include building an in-lake barricade around the original stamp sand pile to contain it, disposing of stamp sand in a nearby landfill or hauling the material to mine tailings basins at the former White Pine Mine in Ontonagon County.
 – The extent and rate of dredging will continue to be refined as data is collected from the studies described in this timeline.

May 2021 – U.S. Geological Survey divers will collect fish eggs and fry (young fish) from Buffalo Reef for additional hatching experiments. Acoustical receivers will be redeployed.
Summer 2021 – U.S. Army Corps of Engineers contractor will obtain stamp sand boring samples from the beach and lake to determine the thickness of the deposited stamp sand, as well as its chemical and physical properties.
November 2021 – A camera will be installed at Grand Traverse Harbor to monitor waves and ice shove.
December 2021 – Solicit public input on which alternative management plan is best for protecting Buffalo Reef.

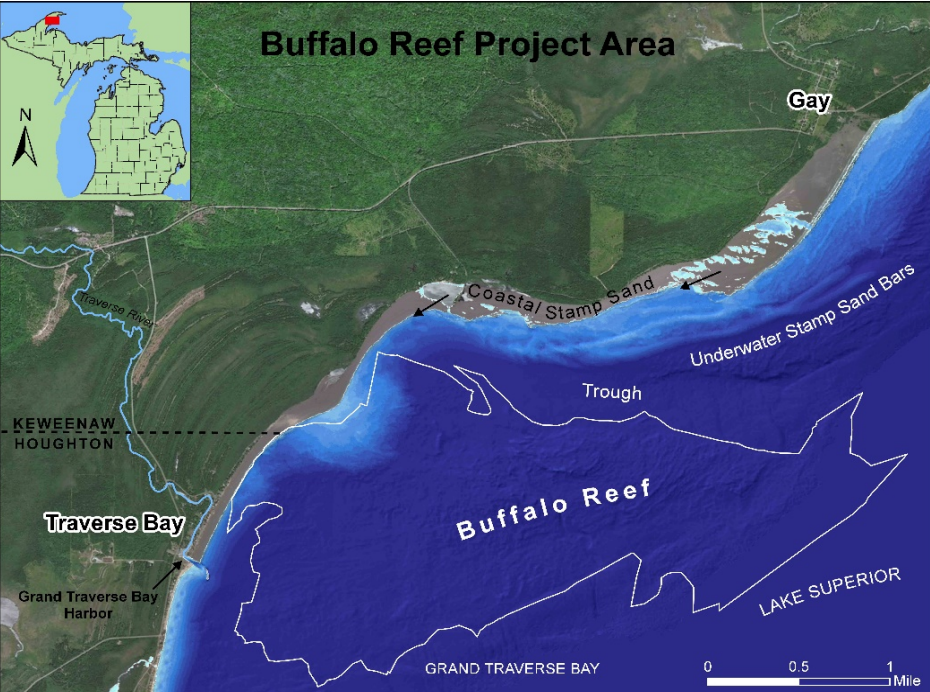
Potential Activities, pending funding

– Otolith and epigenetic work to determine fish production from Buffalo Reef.
 – Juvenile whitefish seining.
 – Ongoing removal of sand at Grand Traverse Harbor to prevent contamination of juvenile whitefish habitat south of the harbor, while

also keeping the harbor open for boating and preventing Traverse River flooding.
 – Sampling to track sand movement on and around the reef and impacts to the food chain.
 – Developing a model relating stamp sand contamination level to fish production from Buffalo Reef.



Steve Casey, senior engineer with Limno Tech of Ann Arbor, left, and Chris Korleski, director of the U.S. Environmental Protection Agency’s Great Lakes National Program office in Chicago, inspect stamp sands retrieved from the bottom of Lake Superior in August 2019. (Michigan DNR photo)



Real urgency involved

When the U.S. Environmental Protection Agency's Great Lakes National Program Office initiated the Buffalo Reef Task Force, it provided \$3.9 million for dredging stamp sand to slow the ongoing damage to Buffalo Reef and surrounding habitats.

U.S. Army Corps of Engineers contractors completed that work in June 2020 by removing 112,000 cubic yards of stamp sand from an ancient riverbed – the “trough” – in Lake Superior just north of Buffalo Reef.

For decades, stamp sand migrating southward across the bottom of Lake Superior was stopped at the trough. However, the western portion of the trough is full and overflowing onto Buffalo Reef.

By removing stamp sand from the trough, migrating sands will again temporarily be stopped.

Using the same idea, the U.S. Army Corps of Engineers removed sand from the Grand Traverse Harbor, nearby beach and Lake Superior in 2019 to prevent stamp sand from contaminating juvenile whitefish habitat south of the harbor.

However, the combination of high lake levels and vicious fall storms, powered by easterly winds, quickly undid this protection.

Fortunately, the State of Michigan had additional monies available to restore this protection through a wintertime dredging project.

The harbor area will require annual dredging to maintain protection of the juvenile whitefish habitat. The task force is seeking state and federal funding to support this work.

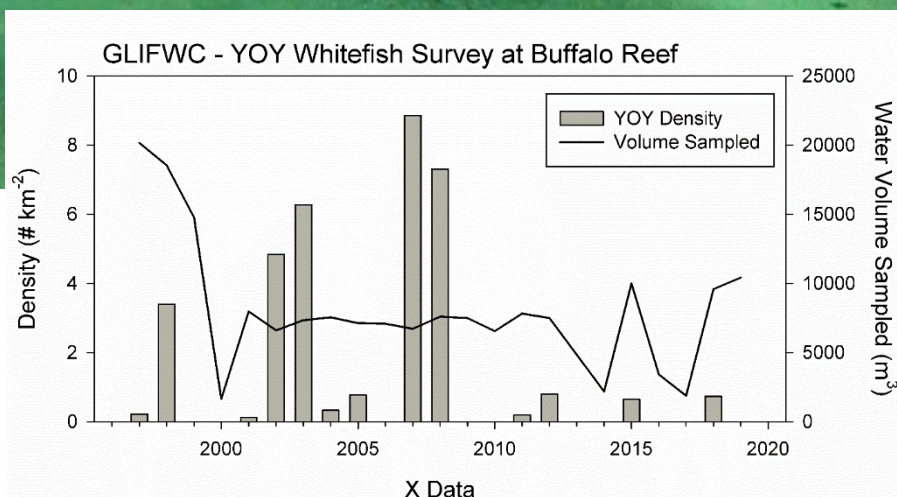
There is real urgency here. The Great Lakes Indian Fish and Wildlife Commission has been seining (netting) annually south of the harbor for juvenile whitefish (young of year) since 2006.

While this effort isn't definitive, it indicates that juvenile whitefish production may be greatly reduced since 2008. The otolith work described elsewhere in the newsletter provides a more definitive look at this critical issue.

Bing definition of otolith: *Each of three small oval calcareous bodies in the inner ear of vertebrates, involved in sensing gravity and movement.*

Historical context: Over the past roughly 100 years, historic copper mine tailings from the Wolverine and Mohawk mines – called stamp sands – were deposited at a milling site along Lake Superior, located in the community of Gay in Keweenaw County. Since that time, the stamp sands have been moved by winds and waves south down the shoreline roughly 5 miles, inundating natural sand beaches and threatening to cover fish spawning habitat and recruitment areas.

An underwater photo shows how stamp sands have covered cobbled fish spawning habitat on the bottom of Lake Superior. (Michigan Technological University photo)





A view from Lake Superior of the Grand Traverse Harbor shows natural sand beach at the left of the photograph and dark, stamp sands covered, beach to the north, at right. (Michigan DNR photo)

State of Michigan appropriation efforts detailed

In 2018, the State of Michigan made a one-time appropriation of \$3 million to the Department of Natural Resources to assist in the protection of Buffalo Reef. The intent of the appropriation was to utilize state resources, contracts and grants to offer some short-term protection for the reef, while efforts were ongoing to develop and fund a long-term solution to the stamp sand issue.

overtopping the harbor's north wall. With each significant storm on Lake Superior, the migrating stamp sands encroach, threatening use of the harbor and native white sand beach to the south. This is an ongoing issue that will require regular dredging and excavation of stamp sands.

In 2019, the Great Lakes Fishery Commission worked with staff from the U.S. Geological Survey and the Great Lakes Indian Fish and Wildlife Commission to improve understanding of how fish use Buffalo Reef and the surrounding area.



Dr. Charles Kerfoot of Michigan Technological University leads a group touring the stamp sands along the Lake Superior shoreline in 2019. (Michigan DNR photo)

This project employs acoustic telemetry to monitor use of the reef by adult lake trout and whitefish, as well as assess the effect of stamp sands on growth and survival of early life stages of these fish.

In 2019, Michigan Technological University analyzed samples from various sites in Grand Traverse Bay to determine the percentage of stamp sands versus native substrates. The information from this project will be coupled with other data (e.g. LIDAR and depth cores) to improve the overall understanding of stamp sands distribution and movement.

In March 2020, Gov. Gretchen Whitmer issued Executive Directive 2020-03 in response to revenue shortfalls resulting from the COVID-19 pandemic. All expenditures

and work associated with the state's appropriation were put on hold. This resulted in a halt to a project designed to analyze the physical, chemical and ecological characteristics of the stamp sands on shore and in Lake Superior. Fortunately, the Army Corps was able to secure funds to ensure that this project continues in 2021.

The spending freeze also halted a contract to ship 20,000 tons of stamp sands to Hancock where potential industrial users will transport them for a beneficial use pilot project. Given that the State of Michigan is experiencing a severe revenue shortfall for fiscal year 2021, it is uncertain whether the remaining funds appropriated for Buffalo Reef will be available for intended projects, such as developing a long-term management plan for protecting the reef, additional emergency dredging or beneficial use pilot studies.

The appropriation has allowed for the completion of several projects that have addressed critical problems. In 2019, contractors relocated 175,000 cubic yards of stamp sands from a cliff, on the original Mohawk mill pile, that was perched over Lake Superior. The stamp sands were relocated to a more inland area where they will not erode back into Lake Superior and pose a threat to Buffalo Reef.

After the U.S. Army Corps of Engineers dredged the Grand Traverse Harbor in 2019, by the end of the year it was again blocked by stamp sands. Thus, in January 2020, funds from the appropriation were spent to dredge the harbor and relocate an additional 32,000 cubic yards from the adjacent beach ridge

Studying the fish of Buffalo Reef

As coastal currents transport stamp sands southward along the shoreline of Grand Traverse Bay and onto Buffalo Reef, fine sand – which may contain trace amounts of heavy metals, such as copper – is covering the reef surface and filling the gaps between rocks that provide important protection for lake trout and lake whitefish eggs.

A team of researchers from the Great Lakes Indian Fish and Wildlife Commission, Michigan Department of Natural Resources, Michigan State University, Michigan Technological University and the U.S. Geological Survey is studying the potential effect of stamp sand encroachment on Buffalo Reef to past, present and future generations of lake trout and lake whitefish.

The study has two main objectives: 1.) identify where lake trout and lake whitefish are spawning on Buffalo Reef and 2.) determine potential effects of the stamp sands on spawning success.

The study will inform future mitigation and restoration efforts for Buffalo Reef.

To achieve the first objective, the research team surgically implanted 50 lake trout and 50 whitefish with telemetry tags (Fig. 1A and 1B). These tags emit a low-power, uniquely coded “ping” that is detected by an array of acoustic telemetry receivers (underwater computers) deployed on Buffalo and Traverse Island reefs.

Receiver locations are marked by a surface float (Fig. 1C) and their configuration covers the entire expanse of Buffalo and Grand Traverse reefs, allowing the team to pinpoint (within a few feet of accuracy) where tagged fish (Fig. 1D) are spawning. These spawning locations will be related to the distribution of stamp sands on Buffalo Reef.

All data collected on receivers will be uploaded to the Great Lakes Acoustic Telemetry Observation System (<https://glatos.glos.us/>) network, the central database for acoustic telemetry studies in the Great Lakes. Working through the GLATOS network will allow the research team to learn when their tagged fish move out of the study area and inform other researchers when their fish are detected along the eastern side of the Keweenaw Peninsula.

The second objective is being addressed using a combination of controlled laboratory experiments and fieldwork to assess how residual copper and other heavy metals in stamp sand might affect the early life stages (eggs and larval fish) of lake trout and lake whitefish.

Using the new laboratory facilities at the U.S. Geological Survey’s Hammond Bay Biological Station, each winter, fertilized eggs (Fig. 2A) are incubated

The cobble-bottomed fish spawning habitat beneath Lake Superior is shown. (Michigan Technological University)

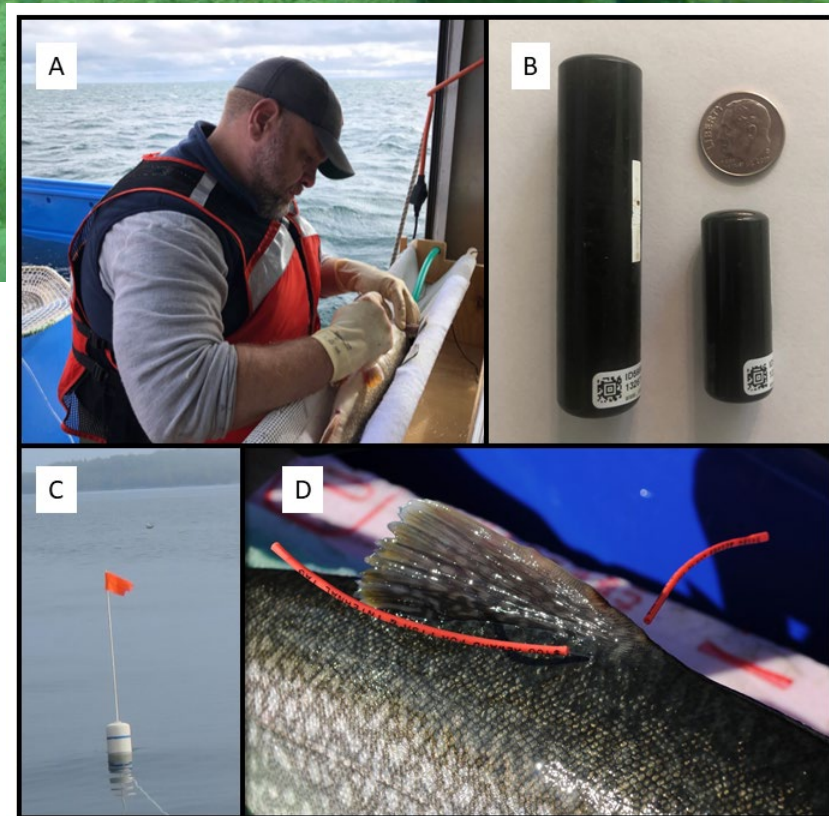


Fig. 1(A) Dr. Mike Lowe of the U.S. Geological Survey surgically implants an acoustic tag into an adult lake trout at Buffalo Reef (Tom Binder, MSU photo). (B) V16 (left) and V13 tags that are surgically implanted into lake trout and lake whitefish, respectively. The relative size of each tag is indicated by the dime in upper right-hand corner (Mike Lowe, U.S. Geological Survey photo). (C) Surface float marking the location of a receiver at Traverse Island (Brad Buechel, U.S. Geological Survey photo). (D) External tags on an adult lake trout indicate that this fish has been implanted surgically with an acoustic tag. On each external tag is contact information so fisheries biologists can arrange the return of the tag for future use in another lake trout (Tom Binder, MSU photo).

Historic benchmark: In October 1933, the stamp mill at Gay was being scrapped by dealers who bought the building and the machinery. By this time, the stamp sands piled in and at Lake Superior extended the shoreline of Sherman Township a mile into the lake.

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Studying the fish of Buffalo Reef (cont'd)

over increasing concentrations of stamp sand in experimental aquariums. Yolk sac consumption, larval growth rate and individual behavior (response to predators and prey capture success) is measured weekly after hatching (Fig. 2B).

Beginning next spring, lake trout and lake whitefish egg distribution and viability, as well as larval fish survival and growth, will be monitored on the two spawning reefs using a combination of divers, remotely operated vehicles and fry (young fish) emergence traps.

In addition, a subsample of the eggs and larvae from these studies will be used by researchers at Michigan Tech to quantify genetic adaptations related to stamp sand concentration. Work on this phase of the project began last winter and is scheduled to run through 2023.

Lastly, the Buffalo Reef Task Force, through funds provided by the Great Lakes Restoration Initiative, is supporting a new project starting in 2021.

This project would expand the scope of the juvenile fish monitoring programs conducted by tribal fisheries biologists by sampling more frequently and incorporating additional spawning reefs throughout Keweenaw Bay.

This regional, multi-reef comparison will use the abundance, diet and body condition of juvenile fish to better understand how stamp sand impacts the number of lake trout and lake whitefish that move from Buffalo Reef to adjacent nursery areas and, ultimately, grow to become part of the fishery.

A priority task for this research is the identification of natural markers found in fish “ear stones” (otoliths) and genetics that can be used to accurately estimate the contribution of Buffalo Reef to the fishery.

Since fisheries biologists have saved otoliths from previous years, this will enable researchers to calculate the present and past contribution that Buffalo Reef has made to the fishery.

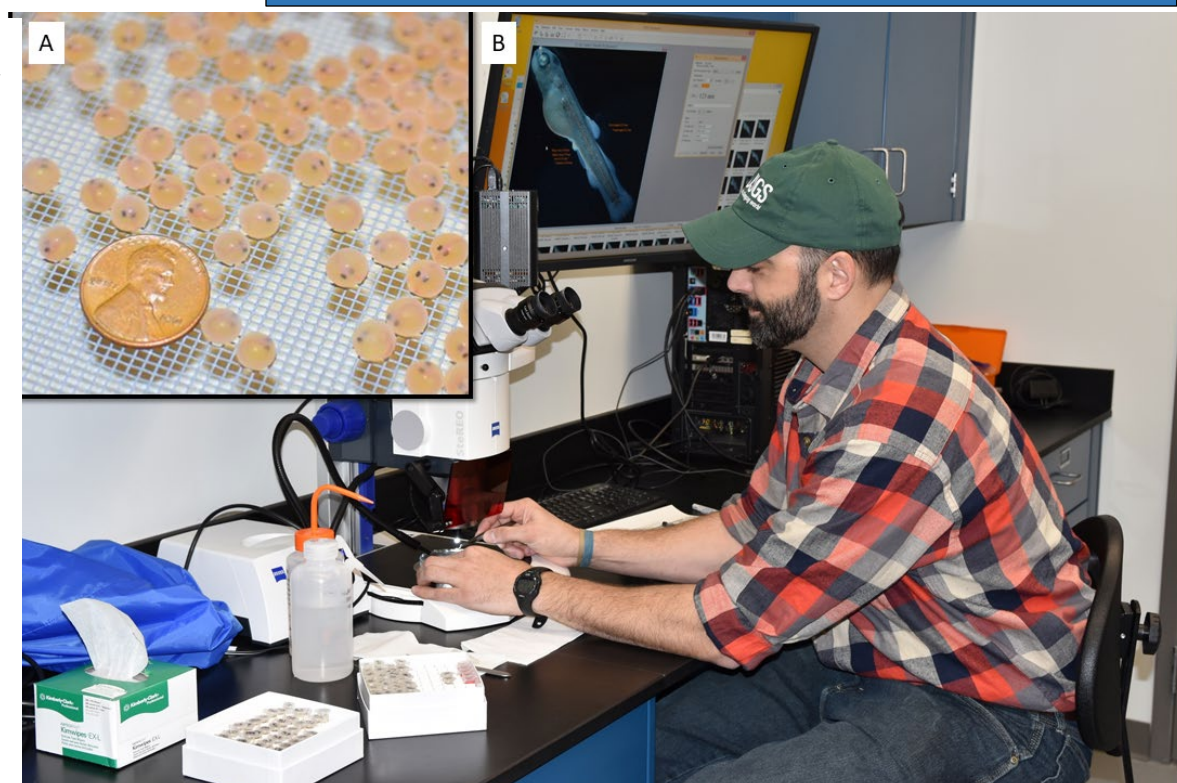


Fig. 2(A) Eyed-up” lake trout eggs waiting to be placed into experimental treatments. (B) Brad Buechel of the U.S. Geological Survey uses a digital imaging system at the Hammond Bay Biological Station to measure a larval lake trout (Andrea Miehl, Great Lakes Fisheries Commission photos).

Join the effort: To find more information, including Buffalo Reef Task Force reports, photos, news releases, a task force email sign-up portal and a link to a Michigan Technological University webpage on the effort to protect the reef and its valuable fish habitat, visit www.Michigan.gov/BuffaloReef.

For questions on this newsletter, contact editor John Pepin, deputy public information officer for the Michigan DNR, at pepin@michigan.gov or 906-226-1352