Michigan Department of Natural Resources
Marquette Fisheries Research Station

2011/2012 Field Season Newsletter
April 2013

Produced by Dan Traynor

Mission

The mission of the Marquette Fisheries Research Station is to enhance stewardship, long-term health, and balance of Michigan's fisheries and aquatic resources through scientific data collection, analyses, syntheses, modeling, dissemination of results, consultation, and mentoring. We are committed to maintaining and developing our Great Lakes vessel program which is crucial to multi-agency, basin-wide efforts to understand, protect, and preserve Lake Superior, Michigan's most wondrous, immense, and valuable resource.

Research Station History

Marquette Fisheries Research Station (MFRS) was established in 1952 and is housed at the Marquette State Fish Hatchery. Marquette's Great Lakes station merged with the Marquette Fisheries Research Station in 1983 to form a single entity. Research station work includes studies on fish species, communities, and ecologies in Upper Peninsula rivers, streams, inland lakes, and the Great Lakes.

The Marquette Fisheries Research Station

Staffing

The Marquette Fisheries Research Station has a staff comprised of 3 biologists (Troy Zorn, Ed Baker, and Shawn Sitar), 2 technicians (Karen Sanford, Dan Traynor), 1 fisheries assistant (Greg Kleaver), 1 boat captain (Kevin Rathbun), 1 assistant boat captain (Chris Little), 1 station manager (Ed Baker), and 1 administrative support person (Penny Bacon).

Staff of Marquette Fisheries Research Station and Marquette State Fish Hatchery

<u>Active Studies:</u>

Lake Michigan Nearshore Fish Community Studies

Data for nearshore fish community studies is collected during fish assessment trawl and gill net surveys in Big and Little bays de Noc, and waters off the ports of Naubinway, Manistque, Cedar River, and Menominee. We use the data for multiple purposes including the following: to describe status

of fish populations in these waters and changes in abundance and species composition in the fish community over time; to track abundance and reproductive success of sport fish populations to guide fish management and walleye stocking activities; to provide information on yellow perch population trends for Lake Michigan wide summaries and analysis; and to obtain samples for collaborative studies with various universities, including Central Michigan University, University of Michigan, and Lake Superior State University. A typical year for this survey involves setting 600' gill nets at randomly chosen locations in Big Bay de Noc and Little Bay de Noc, Cedar River and Menominee in odd-numbered years, and sites at Naubinway and Manistique in even-numbered years. We also conduct 15-20 bottom trawls with a 12-foot wide trawl at each port to sample small, bottom-dwelling fish populations that are not readily collected by gill nets.

During recent nearshore fish community surveys MRFS staff gathered information to assess the contribution of hatchery-reared walleyes to 2004-2012 year classes of walleyes in Little and Big bays de Noc. As of 2012, we found that 76% of 2,250 juvenile walleyes examined from Little Bay de Noc were naturally produced (24% were of hatchery origin), and 64% of 865 juvenile walleyes in Big Bay de Noc were from natural reproduction (36% were of hatchery origin).

Measuring bottom trawl catch

Walleye Spawning Assessments

MFRS staff have been characterizing and estimating spawning runs of walleyes in rivers throughout the Upper Peninsula to provide baseline information and to identify factors influencing the potential of Michigan rivers for spawning walleyes. Recent surveys have included the Rapid, Whitefish, Ford, and Manistique rivers. In 2011 MFRS staff surveyed the Ford River, capturing and marking 2,691 walleyes, resulting in a preliminary estimate of 16,000 +/- 8,000 (2 standard errors) walleyes spawning in that river alone.

Walleye Tagging

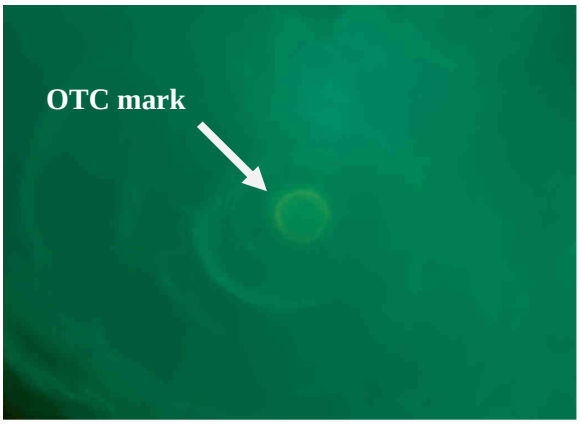
MFRS staff annually tag several hundred walleyes in Little Bay de Noc and rely on angler reports of tagged fish over time to assess walleye movements and the exploitation rate of the Little Bay de Noc walleye populations. If you catch a tagged fish please report it to us at http://www.michigandnr.com/taggedfish/.

Walleye with jaw tag

Walleye Oxytetracycline Analysis

Walleyes are stocked in many of Michigan's waters and it is important for fisheries managers to quantify the contribution of these stocked fish to walleye populations. In many waters stocked walleyes are marked with oxytetracycline (OTC). OTC is an antibiotic drug which binds to bones and other calcified structures including otoliths (a small bone found in the head of fish).

When exposed to ultraviolet light OTC marks fluoresce, enabling detection of the chemical. To detect OTC marks MFRS personnel remove otoliths from captured fish, glue the otoliths to glass microscope slides, sand them flat to reveal a cross section, and examine them under a 200x microscope with ultraviolet light. An otolith containing an OTC mark will show a fluorescent ring near its center.



OTC positive walleye otolith examined under ultraviolet light and 200x magnification

Each year MFRS staff analyzes walleye OTC samples from lakes throughout the state as well as quality control samples from walleye rearing ponds. In 2011 MFRS staff analyzed 642 walleye OTC samples from 10 lakes and 194 walleye samples from rearing ponds. In 2012 MFRS staff analyzed 531 walleye OTC samples from 11 lakes and 185 walleye samples from rearing ponds.

State-wide River Fish Communities

Research biologist Troy Zorn has done extensive studies to develop tools that enable managers to better understand the types of conditions where the more common species of Michigan fishes (>65 species) occur and thrive. Using data from 100s to 1000s of fish and habitat surveys done throughout Michigan, we have developed models, some relatively simple (http://www.michigan.gov/documents/dnr/RR2091_362539_7.pdf) and others more complex (http://www.michigandnr.com/PUBLICATIONS/PDFS/ifr/ifrlibra/research/reports/2072rr.pdf), that describe preferred habitat conditions for common Michigan fish. This work demonstrated that river flow, water temperature, and stream size are very important predictors of a species' presence and abundance. Building on this work, we developed relationships between flow reduction and fish community response that are critical components of Michigan's water withdrawal laws and the Water Withdrawal Assessment Tool (WWAT), which identifies the potential effects of water withdrawal on any stream in Michigan. This work has spawned additional studies by universities and others interested in evaluating the WWAT, and the database has been useful in further research on the effects of increased storm flows on fish communities, as well as studies with Lake Superior State University on how the harshness of the stream environment favors fish with certain life history characteristics (e.g., longevity, reproductive behaviors, etc.).

Backpack shocking a small U.P. stream

The need for additional fish community surveys in central U.P. streams was noted in the water withdrawal modeling work, and the Marquette crew has conducted surveys on 5-8 streams each summer during the last several years to help fill the information gap. In summer 2011, we surveyed the following waters: Yellow Dog River, Big Garlic River, Le Vasseur Creek, Johnson Creek (near Au Train Basin), Laughing Whitefish River,

West Branch Whitefish River, and Silver Lead Creek. The following waters were surveyed in 2012: Green Creek, Little Brook, Little Dead River, Johnson Creek (near Big Bay), East Branch Chocolay River, and Dexter Creek.

Conducting stream survey (Dave Kenyon Photo)

Sand Trap Study

Characteristics of the stream bottom (substrate) are important to the persistence of many species of aquatic life. For example, 75 of 154 species of Michigan fishes reproduce on the substrate, and 71 of those 75 species spawn on gravel or coarser substrates. Thus, excessive deposition of sand in stream channels is detrimental to many Michigan fishes, most notably trout and salmon in our coldwater streams. In a study on Hunt Creek, a small trout stream in the northeastern Lower Peninsula, researchers found that continued excavations of several sediment basins (relatively short stretches of the channel that have been excavated to catch sand being transported downstream) improved channel habitat, increased coarse substrates, and restored trout populations to pre-impact levels. This led to widespread sediment basin construction in Michigan (over 250 sediment basins constructed), though very little evaluation has occurred. We conducted brief site visits to assess the long-term responses of streams to 65 sediment traps. Based on the data collected during these visits, we found little positive response in terms of depth, substrate, or channel stability changes, which calls into question the effectiveness of typical sediment basin construction and maintenance practices commonly-used throughout the state. This information will complement detailed, longer-term surveys to track the response of channels to sediment traps on 8 Michigan rivers. Data collection for the latter study was completed in 2012.

Measuring the effects of sand traps on stream channel morphology

Hunt Creek and Trout Studies

Research Biologist Troy Zorn has also been working with researchers in other areas of Michigan and the U.S. on finishing reports on several studies of coldwater fish populations. In one study, we evaluated the effects of introducing adfluvial rainbow trout (steelhead) on resident brown trout populations in a small coldwater stream. Such a thing might occur when a dam is removed or when fish passage capability is restored at a dam. We noted significant reductions in brown trout abundance, with significant reductions notable for all ages after age-1, due to reduced survival of age-0 brown trout which were competing against highly abundant age-0 steelhead. A DNR research report on this is in the final publication stages.

Steelhead captured in Gilchrist Creek

MDNR staff developed a model to assess the effect of summer flow reduction on the summer warming rate of Hunt Creek, and found that the rate at which the stream warms increases exponentially with the percentage of flow removed. This can have highly detrimental effects for trout and other coldwater fishes, in situations where stream temperatures are marginally suitable for trout and additional groundwater does not enter the channel to cool downstream reaches.

We also collaborated with Dr. Gary Grossman, a researcher at the University of Georgia, to examine which factors have caused the most significant changes in brook trout populations and reproduction in Hunt Creek over a 50-year period. His analysis documented the importance of density-dependent processes to brook trout populations. For example, when brook trout numbers were low, survival to the next year was high, and vice versa.

Brook trout captured in Hunt Creek

Assessment of Lake Trout Populations in Lake Superior

R/V Lake Char

This is the longest running study of the MFRS and is the primary project supported by the *R/V Lake Char*. This study provides key information to manage lake trout populations and provides data for statistical catch-at-age models that generate annual lake trout harvest quotas required by the 2000 Consent Decree of the 1836 Treaty of Washington. Every year the spring and summer lake trout gill net surveys are conducted between Black River Harbor and Grand Marais, taking about 40 sea-days from April through September. The crew collects standard biological data on lake trout such as length, weight, sex, maturity, sea lamprey wounding, and fat index. Otoliths and stomachs are also collected from the fish for analysis during the winter months. In 2011 the crew of the *R/V Lake Char* deployed 271,200 feet of gill net, capturing 5,735 fish. In 2012, 252,900 feet of net was set, catching 6,837 fish.

Removing fish from gillnets

During 2012, the *R/V Lake Char* conducted the triennial siscowet ("fat" strain of lake trout)-deepwater survey and set many nets in depths greater than 1,000 feet and even netted the deepest spot in the entire Great Lakes, 1,320 feet deep. Despite the great depth, siscowets and burbot were still captured by our nets.

A siscowet lake trout captured from a depth of 1,300 feet

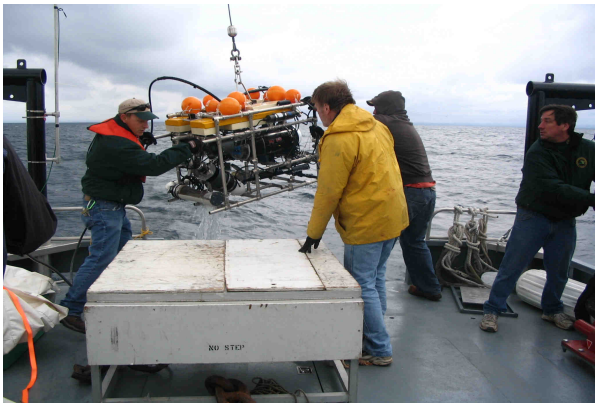
In 2011-12, the *R/V Lake Char* team also sampled a popular lake trout sport fishing destination - Stannard Rock - which is an offshore sea mount approximately 50 nautical miles north of Marquette. The team found lots of lean lake trout and even documented spring-spawning siscowet lake trout in about 500 ft of water off the reef. Tissue samples were collected from the Stannard Rock lake trout for genetic analysis by former MFRS state worker Andy Jasonowicz (now a University of Washington graduate student). During the past few years, the Lake Char crew has been working with Dr. Rick Goetz (Northwest Fisheries Science Center, NOAA, Seattle, WA) in collecting tissue from lake trout for genetic and reproductive profiling of the various lake trout forms in Lake Superior.

R/V Lake Char crew at Stannard Rock (left to right: Greg Kleaver, Shawn Sitar, Chris Little, Kevin Rathbun, Dan Traynor)

Location of Siscowet Spawning Site

In the fall of 2011, the *R/V Lake Char* crew conducted bioacoustics (50 nautical miles of transects) and ROV (remotely operated vehicle) surveys in collaboration with Dr. John Janssen and Rob Paddock of the Water Institute, University of Wisconsin-Milwaukee to seek out siscowet spawning grounds near Marquette. Based on the collection of near-spawning condition siscowets in a previous Great Lakes Fishery Commission (GLFC)-funded study that MFRS has collaborated on during 2006-2010, the research team planned a three-stage approach to document a siscowet spawning site, which has not been done before. The team first conducted bioacoustics seeking spawning aggregations of siscowets which could indicate spawning grounds. When potential spawning aggregations were observed during the bio-acoustic sampling, the Lake Char crew deployed gill nets in order to collect spawning-condition fish. Lastly, after reviewing results from stages 1 & 2, the research team deployed the ROV at candidate sites to try and collect siscowet eggs and visualize the substrate with the ROV camera and egg suction device. Unfortunately, we did not find any siscowet eggs where the ROV was deployed. We were only able to make a small number of dives with the ROV and didn't cover many

sites. However, what we observed with all sampling gear was promising, and hopefully a follow-up study can be funded to continue this work. The *R/V Lake Char* crew added to their skill-set experience in conducting night-time vessel operations including setting and lifting gill nets, which was new for the crew. Furthermore, the crew gained experience in anchoring in deep water and deploying scientific instrumentation that the vessel was designed to support.



Deploying ROV

Evaluation of Sub-lethal Effects of Sea Lamprey Parasitism on Lake Trout Reproductive Development

In 2011 the *R/V Lake Char* crew collected lake trout in the final year of a 2-year GLFC-funded study in collaboration with Dr. Cheryl Murphy of Michigan State University. The study had both field and laboratory components. The *R/V Lake Char* crew was tasked to collect mature lean and siscowet females prior to spawning and collect a vast array of biodata on the fish including: pituitary glands, livers, gonads, otoliths, blood, and fat meter measurements. New to the Lake Char crew was the use of the Fat Meter, which is a device that uses microwaves to measure fat content in live tissue.

Lake trout with multiple sea lamprey wounds

Hooking Mortality of Lake Trout in Lakes Superior and Huron

In early 2010, Shawn Sitar (Principal Investigator) and Jim Johnson (co-PI, Alpena Fisheries Research Station) embarked on a research study working with expert lake trout anglers and commercial trap net operators to measure hooking mortality in lake trout. The study is taking place in the Marquette area of Lake Superior and between Alpena and Greenbush in Lake Huron. There has only been one previous research study conducted in the upper Great Lakes that measured hooking mortality of lake trout, and that study reported about 15% mortality rate. There is concern among anglers and scientists that the previous rate may be conservative. The current study was designed to measure hooking mortality in the most realistic way possible by comparing fish actually released by anglers to those released from commercial trap nets (which serve as a control). This is done by tagging fish from both sources and then comparing the overall tag return rates. Previous research on trap-net released lake trout indicates little to no mortality. The earlier hooking mortality study had charter boats catch lake trout but fish were tethered on buoyed lines to assess mortality. Sample sizes in the earlier study were too small to permit estimation of mortality by season. There are reasons to believe mortality of

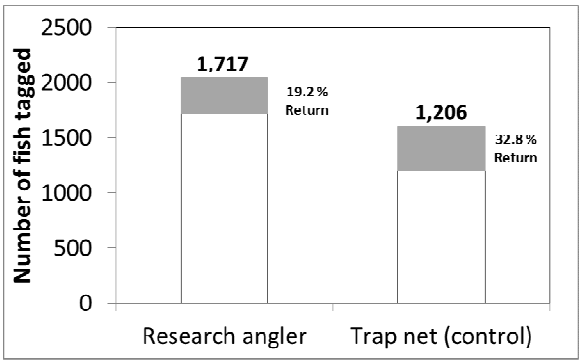
hooked and released lake trout is higher in summer than in spring or fall.

Recaptured lake trout with green cinch Floy tag from hooking mortality study

Seasoned lake trout anglers have been recruited from both study sites and have gone through specialized training to tag fish and record data using specialized equipment to minimize handling time. Important data recorded from each fish tagged include: length, depth and location of capture, any signs of bloating, play time, handling time, lamprey wounds, anatomical hooking location, and fishing method. Much of this data is recorded by a digital camera issued to each angler in order to minimize handling time. Upon release of the tagged fish, the angler also records the condition and whether gulls are present in the area of the fish. There are three tagging years planned with a goal of 1,200 lake trout tagged in each lake per year (600 angler-tagged and 600 trap-net tagged fish) followed by two more years of tag recoveries. Furthermore, as an incentive to maximize tag returns, there is a $10 reward for the return of tags used in this study.

MFRS staff extract important data from pictures taken by volunteer anglers

Although still early in the study, the preliminary results are very promising. As of March 2013, 2,923 lake trout have been tagged in Lake Superior, with 725 tags recovered. In Lake Huron, 2,042 lake trout were tagged with 203 tags returned. It is anticipated that findings from this study will provide fisheries managers a better understanding of the effects of catch and release of lake trout in the Great Lakes and will improve the effectiveness of fishing regulations.



Number of lake trout tagged and returned from Marquette study site as of March 2013

Voice Data Recording System

During the 2009 field season MFRS staff began implementing the use of a voice data recording system (VDRS) for data entry aboard the *R/V Lake Char*. During the 2011/12 field seasons the *R/V Lake Char* crew continued to use the VDR system and

data entry is now 99% paperless. MFRS staff have seen many advantages to using VDRS, including cost savings, decreased errors in data, and substantial time savings.

Processing fish using VDRS

After the initial cost of purchasing equipment the use of VDRS is practically free, eliminating the need to purchase expensive waterproof paper.

There are several steps in data entry where errors can occur. Errors can occur while measuring a specimen, voicing the measurements to a data recorder, recording the data on paper, and entering the data into a computer database. VDRS eliminates most errors because data is voiced directly into a computer database while the database is monitored on a laptop and LCD display. Potential data loss is prevented by using a voice recorder while processing fish, backing up the database on a flash drive at the end of each day, and backing up the voice recorder and flash drive on a server at the end of each week. In over 4 years no data loss has resulted from the use of the VDRS.

While the use of VDRS only saves a small amount of time while processing fish, it saves a substantial amount of post-processing time, eliminating the need for manual data entry and proofing. Prior to using VDRS, MFRS staff spent approximately 150 hours each year on data entry and proofing, which is now time we spend working on other projects. As a result of the continued success of the VDRS, other MDNR personnel, including those at the Charlevoix and Alpena Fisheries Research Stations, are adopting the system. Staff at the MFRS are also working on adopting the VDRS for other projects outside the *R/V Lake Char* (e.g., commercial fisheries monitoring).

Ghost Net

Staff at the MFRS often receive reports of abandoned or lost "ghost" gill nets in Lake Superior. Ghost nets are detrimental to fish and fishermen because they continue to entangle fish and fishing gear as they lay across the bottom of the lake. In May 2011 the *R/V Lake Char* crew removed 2,000 feet of monofilament ghost net from Lake Superior near South Entry and turned it over to law enforcement officers from the Great Lakes Indian Fish and Wildlife Commission.

Ghost net collected by the R/V Lake Char

Lake Trout Diet

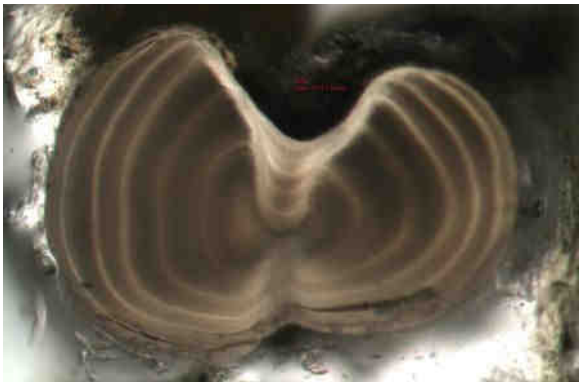
Analyzing lake trout diet is important for bioenergetics modeling and also for understanding changes in lake trout health and growth rates. In 2011 and 2012 MFRS staff analyzed the contents of 1,278 and 1,500 lake trout stomachs. Lake trout diet varied greatly depending on time and location of sampling, but common diet items

were rainbow smelt, ninespine stickleback, various coregonids (lake whitefish, round whitefish, bloater, kiyi, cisco), slimy and deepwater sculpin, burbot, mysis, troutperch, and terrestrial insects such as ants and flies. Unusual items found in lake trout diet have been rocks, iron ore pellets, fishing lures, latex gloves, barley, and miscellaneous bird parts.

12 inch partially digested burbot, a common fish species found in lake trout diet

Fish Aging

A major component of most studies at the MFRS is the collection of aging structures. Biologists use age data to estimate fish abundance, mortality, and growth rates. These parameters are in turn used to set regulations and quotas for sport and commercially harvested fish species. Many calcified structures in fish can be aged, but scales, fin rays/spines, and otoliths are most common. Scales were historically the most popular structure for aging fish but we now predominately use otoliths and fin rays/spines because they produce more accurate ages.



Cross section of dorsal spine from 6 year old walleye

MFRS staff spend a significant amount of time each winter analyzing aging structures from the previous field season. In the winter of 2011 MFRS staff aged 6,938 fish, including 3,119 lake whitefish, 2,204 lake trout, 969 walleyes, 394 yellow perch, and 157 smallmouth bass. In 2012 MFRS staff aged 6,608 fish, including 3,391 lake whitefish, 1,983 lake trout, 397 walleyes, 428 yellow perch, and 261 smallmouth bass. Other species aged were burbot, northern pike, rainbow trout, brown trout, round whitefish, and Chinook salmon.

Net Repair

Each year MFRS staff repair or rebuild all gill nets to be used in the upcoming field season. In the winter of 2011 MFRS staff repaired 44,940 feet (8.5 miles) of net, including 39,900 feet of nylon multifilament and 5,040 feet of monofilament gill net. In 2012 MFRS staff repaired 40,600 feet (7.7 miles) of net, including 37,000 feet of nylon multifilament and 3,600 feet of monofilament gill net. MFRS staff also maintained two 12 foot head rope bottom trawls.

Commercial Lake Whitefish Monitoring

Pursuant to mandates in the 2000 Consent Decree (agreement between Michigan tribes, United States Department of Interior, and State of Michigan) staff from the MDNR monitor the commercial lake whitefish fishery in lakes Michigan, Huron, and Superior. Throughout the year staff from the MFRS collect fisheries information (such as effort and catch) and biological information (such as weight, length, age, and maturity) from commercial fishermen in Lake Superior and northern Lake Michigan. This information is used in statistical models to calculate the maximum number of fish which can be harvested from lake whitefish stocks in each lake whitefish management unit. In 2011 MFRS staff monitored five commercial lake whitefish operations on 17

occasions and collected biological data from 3,100 fish. In 2012 MFRS staff monitored five commercial lake whitefish operations on 19 occasions and collected biological data from 3,391 fish.

Commercially harvested lake whitefish

Lake Sturgeon Research

Lake sturgeon raised in the Whitefish River streamside rearing facility

Research Biologist Ed Baker has been studying lake sturgeon across the state and particularly in Black Lake (Cheboygan Co.) since 1997. Collaborative research at Black Lake has resulted in dramatic improvements in lake sturgeon management in the Great Lakes region. Research efforts have focused on lake sturgeon ecology, culture, genetics, reproduction, and early life history. Research at Black Lake benefits from a streamside hatchery that is the result of a partnership among the DNR, Michigan State University, and Tower-Kleber Ltd. Partnership. This facility is used to raise lake sturgeon for stocking into Black, Burt, and Mullet lakes for restoration in the Cheboygan River watershed and also to conduct basic and applied research on lake sturgeon ecology and culture practices.

Interior of Black River streamside hatchery

Research is also focused on reintroduction of lake sturgeon to waters they have been eliminated from. Small streamside rearing facilities are in operation on the Cedar, Whitefish, and Ontonagon rivers in the U.P. and are used to raise and stock lake sturgeon in these rivers. Early results are promising; stocked fish have been recaptured in the open waters of lakes Michigan and Superior and the fish are growing rapidly and appear to be doing well. Lake sturgeon restoration will be a long-term effort because it takes about 20 years for the fish to reach sexual maturity.

Streamside lake sturgeon hatchery on Cedar River

Salmon Trout River Brook Trout

Research is continuing on the Salmon Trout River coaster brook trout population in collaboration with Dr. Casey Huckins (Michigan Technological University). A new project was initiated in 2012 to evaluate an instream sand collector to protect coaster spawning habitat. The collector was installed upstream of a coaster spawning site in the Salmon Trout River that is heavily impacted by sand. The collector intercepts sand as it moves downstream and pumps it out of the river channel and up into the floodplain. The effectiveness of the collector will be evaluated over the next two years by monitoring sand deposition in the spawning habitat and quantifying the volume of sand removed from the river. Fish surveys will also continue in the river to evaluate whether coaster reproduction improves as a result of the sand removal.

Sand collector installed in the Salmon Trout River (Casey Huckins photo)

Contact Information

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