

Project Title: Brook Trout Population Evaluation in Otter Creek

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Abstract: *Brook trout are native to Lake Michigan and many of its tributaries, in addition to other Great Lakes. It is known that some brook trout populations exhibit migratory behaviors where juvenile fish leave Great Lakes tributaries to spend most of their adult life growing exceptionally large in the open waters of Lake Michigan and other Great Lakes only to return to their natal streams to spawn. Historically, it is known that anadromous brook trout commonly referred to as “coasters” were relatively abundant in nearshore waters of northern Lakes Michigan and Huron in addition to Lake Superior. These populations not only provided valuable recreational and subsistence fishing opportunities, they promoted genetic diversity and vigor to Great Lakes brook trout populations. Little is known what populations, if any, exist in Lake Michigan that still exhibit this behavior. Otter Creek in Benzie County is known to have large brook trout residing within meters of Lake Michigan. It is not clear whether this population possesses a migratory element. The Grand Traverse Band is proposing to investigate the population of brook trout in Otter Creek to document the size and habits of this population and determine whether individuals exhibit anadromy through tracking movement using radio telemetry. Additionally, we propose to compare genetic material of Otter Creek brook trout to other local inland populations and Nipigon strains of brook trout to evaluate differences and similarities. These studies are proposed for to begin the fall of 2007 and continue through the fall of 2009.*

Statement of Issue: Through the development of a Joint Strategic Management Plan of Great Lakes Fisheries, fish community objectives have been defined for each of the Great Lakes. Consistent with each Lakes’ community objectives are the inclusion of goals to re-establish, enhance, protect and preserve native stocks of fish. Brook trout *Salvelinus fontinalis* are native to the northern Great Lakes region and continue to exist in many tributaries to Lakes Superior, Michigan and Huron. Further, the Great Lakes Fishery Commission has published a brook trout rehabilitation plan for Lake Superior (Newman *et al.* 2003). A comparable document would be valuable for Lakes Michigan and Huron.

Populations of lake run brook trout often referred to as “coasters” are known to currently migrate in and out of a small number of Lake Superior tributaries. Several studies have documented habitat use and anadromous tendencies of coaster brook trout in Lake Superior (Newman *et al.*

1999; and 2005). Coaster brook trout were once present in measurable numbers and highly sought after in many locales of northern Lake Michigan as they were elsewhere throughout the northern Great Lakes in the mid to late 1900's. These fisheries were arguably more valuable than their landlocked counterparts as they provided ample sportfishing and subsistence opportunities for anglers and likely promoted the genetic diversity and vigor through dispersal and straying from natal streams. Anecdotal accounts report relatively productive shoal and nearshore hook and line fisheries in Grand Traverse Bay. Other anecdotal information suggests historically there were naturally reproducing anadromous brook trout populations along the north shore of Lake Michigan; and that large brook trout, commonly referred to by anglers as "native trout", are periodically taken along the shores of Lake Michigan near Ludington. Newspaper articles from the early 1900's have reported that sightings of brook trout schools were a fairly common occurrence in the south end of Grand Traverse Bay as well as near other tributaries to Lake Michigan. Habitat destruction, interspecific competition and over-harvest are suspected to have been the principle reasons coaster brook trout declined significantly in the Great Lakes.

In an attempt to enhance declining Grand Traverse Bay brook trout fisheries the MDNR began stocking efforts in the 1960's and continued through the late 1980's, but met with very limited success. Since that time there have been very few accounts of brook trout in Grand Traverse Bay or elsewhere in Lake Michigan. While little is known about why these fisheries failed to succeed, there are indications that inappropriate stocking site selection and/or over-fishing may have been a significant factor(s). Because stocking programs may have targeted areas (sites) where spawning and nursery habitats were unsuitable or absent, such programs would not have promoted natural reproduction. Further, it is unclear whether some populations of resident stream brook trout persisting in close proximity to Lake Michigan may still maintain, at least to a minor degree, an anadromous element; and it continues to be debated what mechanisms (genetics, density, physiology, etc.) contribute to life history differences between "resident" and "lake run" brook trout. Brook trout are one of only two salmonid species native to the Great Lakes. The Grand Traverse Band is a strong advocate of the rehabilitation, protection and promotion of native species in the Great Lakes and recognizes both the ecological and intrinsic values of providing viable populations of these species for future generations.

Little is known about the movements, habitat use and population condition of lake run (coaster) brook trout in Lake Michigan, though anecdotal accounts exist as to their persistence in these waters. Otter Creek is one of a very few (<5 in the northern lower Peninsula) small tributaries to Lake Michigan that contains a population of brook trout in close proximity to the mouth. It is located at T27N R15W Section 12 in Benzie County Michigan within the Sleeping Bear Dunes National Lakeshore.

Previous fishery surveys have documented a naturally reproducing brook trout population in Otter Creek, however it is not known conclusively whether this population contains any element migrating to and/or from Lake Michigan (anadromy). It has been shown that given the presence of groundwater upwellings, brook trout will spawn over woody debris, sand, and sandy silt substrates (Powers 1980, Curry and Noakes 1995). Gravel substrates are also known to be used by spawning brook trout in the presence or absence of upwellings. All of these habitat features exist in Otter Creek. The stream is considered unique, in that it appears that brook trout persist despite its direct migratory access to anadromous Pacific salmonids from Lake Michigan, which

typically out-compete brook trout in other systems. Given favorable temperatures, an exceptional forage base, and habitat characteristics coupled with the presence of a naturally reproducing brook trout population the potential exists for an extraordinary nearshore brook trout fishery. Accordingly, we are proposing further investigation be conducted to evaluate the existing brook trout population with respect to population size and health, migration patterns (anadromy) and genetics. Once evaluated, this stream appears to be potentially well suited for an enhancement program for lake run (coaster) brook trout. The U.S. Fish & Wildlife Service and Tribes elsewhere have strongly supported initiatives to enhance or reintroduce coaster brook trout into historic Great Lakes habitats.

Hypotheses to be tested:

- 1) Brook trout spawn successfully in Otter Creek and contribute significantly to the native fishery in Otter Creek.
- 2) Otter Creek brook trout are migratory between the stream and Lake Michigan.
- 3) No genetic difference exists between local “landlocked” populations of brook trout, Nipigon strain brook trout, and Otter Creek brook trout.

Related Objectives:

- 1) Describe fish community and relative contribution of brook trout in Otter Creek.
- 2) Determine whether brook trout migrate to and from Lake Michigan.
- 3) Locate and describe spawning sites for brook trout in Otter Creek.
- 4) Compare genetic profiles of Otter Creek brook trout to other local populations and Nipigon strain brook trout.

Methods and Work Schedule:

At least two methods have been used by investigators for monitoring movements of migratory salmonids. Passive Integrated Transponders (PIT) are small implants that do not require surgery, but do not emit a radio signal that is detectable at distance. Additionally, in order to establish a base station for detecting fish passage requires a substantial financial commitment. Radio telemetry was chosen for this study over the use of PIT technology for cost and applicability reasons. Specifically, we currently possess radio telemetry equipment and the use of PIT tags would not allow for location determination by pursuit in order to evaluate habitat use. Telemetry can allow for both monitoring movement and habitat use. Much of the methods for surgical procedures and telemetry are taken from comparable work by Newman *et al.* (1999 and 2005) and Summerfelt and Smith, 1990.

June to August 2007--Conduct brook trout population estimate, collect tissue samples, and radio transmitter implantation.

Fish will be captured using standard DC electrofishing equipment deployed from a tote-barge and canoes in addition to 0.91 x 1.8 m fyke nets placed near areas known to contain brook trout. The fyke nets will be set and checked daily where at least 25 cm of the heart and pot are above water to allow for any non-target species such as turtles to have access to the air. All trout

captured will be measured, scale samples taken for aging and tissue collected for genetic analysis (described below). A population estimate will be conducted using mark-recapture methods “with replacement”. Fin clips will be used to mark fish not implanted. Statistical analyses will likely use a variation of the Petersen index. All other fish captured will be identified to species, counted and released. At least two fishery surveys will occur between June and August.

During fishery surveys small (<.1 gm) tissue samples will be collected for genetic profile comparisons. Genetic profiles will be developed through a cooperative agreement between the MDNR and MSU covering genetic work.

The first 13 brook trout greater than 280 mm will be retained temporarily for implantation of radio telemetry transmitters (telemetry described below). The fish will be placed in a livewell containing a 30 ppm concentration of clove oil to anesthetize the fish prior to surgery. When fish are sufficiently anesthetized (unresponsive to stimuli) they will be placed individually on moist sterile gauze pads covering a form fitted (cut-out) foam pad to secure the fish for surgery. Once secure, a surgical scalpel and blunt tipped scissors will be used to create a small incision about 15 mm long, down the midline of the belly, and approximately 30 mm behind the pectoral fins. The incision will be through the skin layer only, then will then be completed using blunt tipped hemostat to penetrate the muscle layer into the body cavity. The transmitter will then be inserted into the body cavity and secured using 2 or 3 sutures (4/0 monofilament) to close the incision with the antenna protruding. The last suture will also wrap around the antenna to help “lock” the antenna in place, prevent movement within the incision, and insure retention of the transmitter. Following surgery, fish will be placed into an aerated recovery tank until they are fully recovered (upright and actively swimming). Once fully recovered the fish will be returned to the stream.

September 2007 to October 2007—Habitat evaluation

Standard habitat evaluation techniques developed by the Grand Traverse Band will be used. Stream metrics measured will include depth profiles, gradient, substrate composition, woody debris abundance and frequency, discharge and other applicable features. Protocol available upon request. All measurements will be recorded on field forms for analysis.

September 2007 to December 2008—Monitor movements and evaluate whether anadromy is exhibited by members of this population.

Brook trout movements will be monitored using implanted radio transmitters monitored weekly by canoe, boat and on foot. Transmitters were selected to allow for at least one year of transmissions. Winter *et al.* (1978) recommends a transmitter weight of no more than 1.25% of the body weight of the fish. We will be using transmitters weighing 8 gm and will not implant fish weighing less than 650 gm. In order to maximize the life span of the transmitters and keep below our goal weight of 9 gm we selected duty cycle transmitters that will only transmit 12 hours per day for 3 days, off 4 days, then repeat. Under this duty cycle battery life is extended so these transmitters may be located for over 400 calendar days once deployed. The units will transmit unique frequencies ranging from 148.013 to 148.256 MHz, at a pulse rate and width of

35 ppm and 18 ms, respectively. They are manufactured by Advanced Telemetry Systems, Inc. Isanti, MN.

Locations will be taken at least once per week both within the stream by canoe and along the Lake Michigan Shoreline using a Telonics TR-2 Receiver with a Yagi type directional antenna. Transmitters will be located through pursuit or triangulation if necessary. If precise locations are achievable then GPS coordinates will be recorded along with a description of habitat.

Anadromy (migration out of the stream into Lake Michigan) will be evaluated using the methods described above and, if possible, an additional telemetry receiver/data logger base station will be remotely deployed at the mouth of Otter Creek to detect movement past the station into and out of Lake Michigan.

February 2009 - Prepare report and recommendations to determine the need for further study or feasibility of population enhancement.

Collections: No collections are planned for this project. Any inadvertent mortalities will be documented and preserved for placement into an appropriate repository.

Project Budget: A grant proposal has been submitted to the USFWS Coastal Program to help cover costs of setting up a data logging telemetry base station and other expenses. The project will still proceed regardless of grant success.

Budget	USFWS Coastal Program Requested (\$)	GTB Share In-Kind (\$)	Project TOTAL
Wages and Fringe	0	\$17,000 (500 hrs)	\$17,000
Fuel	500	0	\$500
Equipment	7500 (See Below)	\$2,500 (Radio Transmitters)	\$10,000
Supplies	1000	0	\$1,000
Total	\$9,000	\$19,500	\$28,500

(1) Radio telemetry receiver/data logger	\$4,000
(1) Waterproof Housing with data logger controller	\$950
(1) Solar panel for remote power	\$200
(1) Antenna switchbox and antenna	\$950
(4) Small mesh fyke nets	\$1,400

EQUIPMENT TOTAL	\$7,500
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*Additional in-kind will be provided by other tribes and MDNR, but are not estimable at this time.

Proposed Work Outcomes/Products: A complete evaluation of the population status, migratory patterns, habitat use and genetic profile of Otter Creek brook trout. This evaluation will be used to develop recommendations on potential efforts to enhance the brook trout fishery in this tributary. Ultimately, if enhancement is considered and is successful, a coaster brook trout fishery will be re-established at a location historically identified as supporting such a fishery for both tribal and non-tribal people.

Literature Cited:

- Curry, R.A. and D.L.G. Noakes. 1995. Groundwater and the selection of spawning sites by brook trout (*Salvelinus fontinalis*). Canadian J. of Fish and Aquatic Sci. 52: 1733-1740.
- Newman, L.E., J.T. Johnson, R.G. Johnson, and R.J. Novitsky. 1999. Defining Habitat Use and Movement Patters of a Reintroduced Coaster Brook Trout Population in Lake Superior. Ashland Fishery Resources Office, Ashland, WI. 10 pp.
- Newman, L.E., R.B. Dubois and T.N. Halpern. (EDS). 2003. A brook trout rehabilitation plan for Lake Superior. Great Lakes Fish. Comm. Misc. Publ. 2003-03.
- Newman, L.E., J.R. Krajniak and H.R. Quinlan. 2005. Behavior and Habitat Use of Coaster Strain Brook Trout Stocked in Whittlesey Creek. Ashland Fishery Resources Office, Ashland, WI. 12 pp.
- Powers, G. 1980. The brook charr, *Salvelinus fontinalis*. Pages 141-203 in E.K. Balon [Ed.] Charrs – Salmonid fishes of the Genus *Salvelinus*. The Hague.
- Summerfelt, R.C. and L.S. Smith. 1990. Anesthesia, Surgery, and Related Techniques. Pages 213-261 in C.B. Shreck and P.B. Moyle, editors. Methods for Fish Biology. American Fisheries Society. Bethesda, Maryland.
- Winter, J.D., V.B. Kuechle, D.B. Sniff and J.R. Tester. 1978. Radio tracking freshwater fish. University of Minnesota, Agricultural Experiment Station. Miscellaneous Report 152. 18 pp.

Qualifications:

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| Brett Fessell | M.S. Fishery Management, University of Nebraska, 1995.
B.S. Fish and Wildlife Management, Lake Superior State University 1993.
Employed as Fish and Wildlife Biologist/Program Director, Grand Traverse Band, 12 years. |
| Tom Callison | B.S. Natural Resources Management, University of Missouri, 1986.
Employed as Biologist, Grand Traverse Band, 17 years. |
| Henry Bailey | Employed as Fish and Wildlife Technician, Grand Traverse Band, 3 years. |

Supporting Documents and Special Concerns:

- A. Safety – Grand Traverse Band employees will operate in compliance with OSHA standards in all aspects of this project.
- B. Access to study sites – No special requirements are necessary for access to study sites during project. Otter Creek will be accessed via canoe and on foot. Boat access will be gained at the Platte River boat launch.
- C. Use of mechanized and other equipment – Use of generator powered electrofishers in Otter Creek is necessary.
- D. Chemical use – No deleterious chemicals to be used.
- E. Ground disturbance – NA
- F. Animal Welfare – Standard fishery anesthesia, and aseptic surgical techniques to be employed. No laboratory studies requiring IACUC oversight.
- G. NPS assistance – Not necessary.
- H. Wilderness “minimum requirement” protocols – Use of generator powered electrofisher in Otter Creek is necessary. Exemption requested.
- I. **Collaboration/Community-based Support:** Collaborators to this study will include the Michigan Department of Natural Resources (MDNR). MDNR will provide genetic profile evaluations through a cooperative agreement with Michigan State University.