Fisheries Impact Review

Ojibway Power and Energy Group (OPEG)
Draft Environmental Report
Namakan River Hydro Development Project

David Caroffino, Ph.D.

1. Qualifications

I am a Fisheries Biologist for the Michigan Department of Natural Resources and Environment with specific expertise in lake sturgeon ecology, Tribal fisheries, and fisheries management. I obtained a Bachelor of Science in Fisheries and Wildlife Management from Lake Superior State University, a Master of Science in Conservation Biology from the University of Minnesota and a Ph. D in Fisheries from the University of Alaska Fairbanks. I have significant past experience and knowledge in the study and observation of both lake sturgeon and many other freshwater fish species.

A CurriculumVitae outlining my education and professional experience and qualifications is attached to this report.

2. Report Review

I have conducted a review of the Draft Environmental Report prepared by the Ojibway Power and Energy Group (OPEG) focusing on potential impacts to lake sturgeon. The report is based on my individual professional opinion, and its contents should not be considered a position, opinion, or statement from the State of Michigan or the Department of Natural Resources and Environment regarding this subject.

3. Findings

The proposed project could impact the lake sturgeon population within the Namakan River system in two ways:

a) barriers to connectivity of populations through movement of various life stages; and

b) habitat quality and quantity,

Each is discussed below.

a. Potential Impacts to Lake Sturgeon Migration

Potential Project Impacts: The proposed development plan could potentially impose barriers to current sturgeon movement in two areas: the back channel and High Falls itself. OPEG's consultants did not observe sturgeon moving into Bill Lake from the back channel. The OMNR report provided as an appendix to the Environmental Report, however, showed that the back

channel is an important movement corridor for lake sturgeon. Sturgeon were not observed moving upstream over High Falls, leaving the back channel as their only route. The genetics study completed by Amy Welsh confirmed the results of the telemetry study done by OMNR. The population of lake sturgeon in the Namakan River is not fragmented by barriers, and it constitutes one single biological population with gene flow throughout. In my opinion, if this population is to remain intact, movement must not be inhibited and the back channel must not be modified. A weir across the channel would negatively impact lake sturgeon and other fish that utilize the back channel for movement in this system.

Impacts on Downstream Fish Movement: The proposed project also has implications for fish moving downstream. Currently adult lake sturgeon move downstream over High Falls, as confirmed by OMNR telemetry studies. Adult lake sturgeon will be unable to move downstream at this location, and will be forced to find the back channel for downstream movement. If adult fish can no longer pass over the falls, which the Environmental Report acknowledges, this is a potential adverse impact which has not been addressed.

In addition, the study seems to ignore downstream movement of age-0 or other juvenile lake sturgeon. Telemetry studies have not been presented to confirm where juvenile lake sturgeon are moving downstream. In the absence of this information, experience indicates that lake sturgeon moving downstream take the path of least resistance, which would be over the falls or through the dam. The environmental report mentions barriers will be installed which prevent adult fish from entering the dam but allow larval fish to pass through; however, it does not mention a specific barrier size. The report lacks a sufficient discussion of potential impacts to juvenile fish movement.

Juvenile Mortality: No discussion is provided on potential impacts to juvenile sturgeon. Age-0 juvenile lake sturgeon will be moving downstream in the fall, and could be 18-26 cm in length. Passing through the dam could cause significant mortality on this life stage, which could have a large impact on the population. Early life mortality of lake sturgeon is high, the rate of which is reduced with both size and age. By the time age-0 juveniles are migrating downstream in the fall they have reached an age and size where they are no longer vulnerable to most natural sources of mortality that impact eggs, larvae, and early age-0 juveniles. If an additional mortality source is introduced to this life stage it will negatively influence the population. The solution to this problem is not simply to include barriers that prevent 18-cm fish from passing through the dam. Movement research on juvenile lake sturgeon has shown that some will move downstream throughout their first summer of life, at different sizes. A decision will have to be made about the size of the barrier to install with juvenile mortality in mind. The Environmental Report has ignored the age-0 and other juvenile life stages. It has focused strictly on adults and larval sturgeon, which is a significant omission.

Impacts of Gene Flow: Inhibiting movement through the back channel and/or High Falls will negatively impact the population through restricted gene flow and recruitment. Gene flow will be unidirectional downstream if adult fish cannot reach upstream spawning habitat. The environmental report did not adequately describe the spawning habitat in the entire river, only near the proposed development. Other areas upstream of Bill Lake could be significantly contributing to the population as well, and cutting off these fish or spawning areas from the

population could lead to reduced effective population sizes and genetic diversity. If juvenile mortality is increased due to downstream movement through the dam, recruitment will be reduced. Also, if a large number of juveniles are currently produced upstream of Bill Lake and adults can no longer reach that spawning habitat, juvenile production and the future population will suffer.

Proposed Mitigation Measures: The Environmental Report presents no evidence of successful facilitation of lake sturgeon movement through engineered mitigation solutions. Traditional fish ladders and fish passage systems have not been widely utilized for lake sturgeon, due to their body size and poor leaping ability. To my knowledge, a passage system does not currently exist that has been shown to successfully pass all life stages of lake sturgeon without causing either incidental mortality or restricting movement compared to a natural system. Blocking off the back channel and relying on a fish passage structure poses a significant risk to the fish populations that rely on unobstructed movement through the channel. Such a system will have at best a short-term negative impact until designs can be adaptively modified to work and at worst, if a successful structure cannot be engineered, this will result in population fragmentation and the potential genetic and demographic degradation that follows.

b. Impacts of Habitat Quality and Quantity

Potential Impacts: In addition to the movement problems associated with the dam, the environmental report failed to adequately describe habitat quality and quantity. Sturgeon habitat is diverse; it includes spawning and incubation habitat, nursery habitat, and general habitat used by adults. The proposed project could significantly impact spawning and incubation habitat and nursery habitat. Spawning and incubation habitat includes both proper substrate and flow. Adult lake sturgeon will spawn on substrate from gravel to boulder; however, research has shown that large cobble substrate generally produces the highest survival of offspring. In most natural areas, lake sturgeon eggs will only survive and hatch if they settle into interstitial spaces below the surface of the substrate. These spaces must be large enough for eggs to settle into; however, they must be small enough to prevent interstitial predators from gaining easy access to the eggs. Such combinations are not normally possible with gravel or boulder substrate. In addition to substrate size, flow conditions also dictate survival. Constricted interstitial spaces will reduce flow and allowing sedimentation and suffocation of the eggs, while spaces too large may allow significant flows to scour eggs and flush them downstream.

Proposed Mitigation: Creating spawning habitat, as proposed in this report, upstream of the head of the back channel, may not be a successful strategy. If the wrong substrate is used, or flow conditions are not suitable for reproduction, the artificial habitat would either not be utilized by lake sturgeon, or not be successfully used. This may be the reason that some spawning areas that appeared to have sufficient substrate were not observed to be used during the evaluations by OPEG's consultants.

In order to provide a reasonable prospect for success, it is necessary to follow a procedure of constructing and monitoring the new habitat prior to commencing the construction of the project to evaluate whether or not the new habitat is sufficient for reproduction and will be used by the species of interest. No such approach is proposed here.

Because spawning habitat depends on flow conditions, the quantity and quality available varies annually. An area of heavy egg deposition in one year may be devoid of eggs the following year, because of a slight change in discharge. This is another danger of spawning habitat creation. Artificial habitat may be sufficient only in a handful of years, making successful reproduction sporadic. There is not a direct 1:1 trade off in terms of spawning habitat. One area cannot be traded for another, as quality due to flow rates may greatly differ. Neither is habitat quantity the largest concern. A small patch of habitat that has perfect substrate and flow conditions would be more successful than five times the amount of habitat with less favorable substrate and flow conditions. This appears to be a fundamental misunderstanding of OPEG's habitat mitigation strategies.

c. Other Study Deficiencies

Because OPEG's consultants could not quantitatively sample eggs, they attempted to address the quality of spawning habitat by comparing the relative numbers of fry/larvae captured during drift netting. This method of assessing spawning habitat quality by larval collections is flawed for the following reasons. Larvae captured cannot be assigned to a specific spawning site. They may have originated from immediately upstream of the drift nets, or from a greater distance upstream and captured during their downstream movement. Flow conditions also significantly impact the results of netting, and any differences in flow between sites could preclude conclusions. In addition, larvae do not drift equally in the water column either vertically or horizontally, so absent from the entire river being blocked off with drift nets, relative catches at multiple sites cannot be compared. In my opinion, the larval catches of lake sturgeon by the consultants indicate that sturgeon naturally spawn in this system and nothing more. The end result is that the quality of spawning habitat in different areas of the lake/river system was not adequately evaluated.

Nursery habitat is also important to juvenile lake sturgeon. Typically after hatching and yolk-sac absorption larval sturgeon drift downstream and eventually settle out of the water column over soft sand substrates in lotic environments. They feed on invertebrates and plankton that are both in the substrate and those that drift downstream. Although some age-0 juveniles continue to move downstream throughout the summer, most remain in lotic nursery areas during their first summer of life. As water temperatures decline in the fall, age-0 juveniles move downstream to lentic areas, possibly seeking warmer water for overwintering. As previously mentioned, this development could impact the movement of these age-0 juveniles, but equally important, the Environmental Report does not identify areas of nursery habitat. I can only conclude that the habitat and movements of juvenile lake sturgeon remain unknown in this system. Continuing with a development project without fully understanding the habitat use and requirements of all life stages could result in harm to the population that would not be detected for many years, due to the longevity of lake sturgeon.

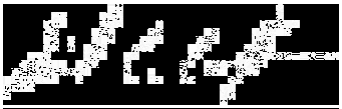
Little attention has been focused on the other fish species present in this river/lake system. Fall walleye index netting was completed in Little Eva Lake and Bill Lake and some significant differences were found. The population in Bill Lake showed signs of stress, whereas the population in Little Eva Lake appeared overall to be healthy. Why is there a discrepancy

between the two? Is there a habitat or forage difference that would contribute? Are these really two separate populations or is there movement between them? Is the movement seasonal or year round? None of these questions were answered for this species, but if the impact of this development project is to be adequately assessed, these questions need to be answered. Likewise, little information was provided for northern pike, whitefish, or other species. The paucity of information presented for these species leads me to believe their populations are not fully understood nor are the potential impacts of the proposed development on their sustainability.

4. Conclusions and Recommendations

In my opinion, the environmental report lacked sufficient detail to demonstrate that this project will not cause significant harm to lake sturgeon. The entire history of lake sturgeon in North America clearly demonstrates that dams negatively impact migratory fish, particularly lake sturgeon. Crucial aspects of sturgeon life history and ecology have not been explored and are not understood for this population. As such, sufficient information has not been presented to convince me that this development will change the course of history concerning lake sturgeon and hydroelectric development projects. As further evidence of this, it is noted that the word "anticipates" is used frequently in the mitigation sections of this report. OPEG anticipates that there will be no negative impacts, or OPEG anticipates that this will be a benefit, etc. Anticipation carries with it risk. The degree of risk and whether or not such risk is warranted depends on the quality and quantity of information gathered and the consequence of being wrong. My overall impression from this environmental report is that information quality and quantity are lacking. The consequence of damaging one of the few remaining populations of a threatened species may not be worth the risk that exists due to this incomplete information.

The Environmental Report fails to adequately assess the impacts of the proposed development. However, by focusing on mitigation, the report implicitly acknowledges that the project will adversely impact the population and habitat of lake sturgeon, a fish species at risk. By failing to present sufficient information to fully assess the impacts, the proponent is not in a position to develop viable mitigation measures or demonstrate that there will be no adverse effects on a threatened species. In my opinion, this project should not proceed without substantial additional study leading to a full understanding of all life stages of the fish species and populations affected by the proposed development. Once this information is obtained, a new impact assessment must be completed to adequately determine if the inherent risk is worth the potential reward.



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EDUCATION

Doctor of Philosophy – Fisheries
University of Alaska Fairbanks – Fairbanks, Alaska (2009)
Dissertation title: *Early life history dynamics of lake sturgeon*

Master of Science – Conservation Biology
University of Minnesota – Saint Paul, Minnesota (2006)
Thesis title: *One year of parental hatchery experience reduces success of steelhead fry stocked into their naturalized environment*

Bachelor of Science [Honors] – Fisheries and Wildlife Management
Lake Superior State University – Sault Sainte Marie, Michigan (2004)
Thesis title: *Genetic influence of stocked walleye in the St. Marys River, Michigan*
Honors research: *Biological ethics at Lake Superior State University*

PROFESSIONAL EXPERIENCE

Fisheries Biologist
Michigan Department of Natural Resources and Environment, Charlevoix, Michigan
July 2008 – Present

- Worked as the Great Lakes Biologist for the Tribal Coordination Unit. Ensured the State of Michigan's compliance with the terms of the 2000 Consent Decree. Co-chaired an inter-agency modeling group that calculated annual harvest limits for lake trout and lake whitefish in treaty waters of the Great Lakes. Reviewed stocking, regulation, and assessment proposals made by State, Federal, and Tribal biologists. Monitored monthly catch and wholesale reports for Tribal and state-licensed commercial fishermen. Composed, compiled, and edited various annual reports for agency personnel and the general public.

Ph.D. Research Assistant
Purdue University, Department of Forestry and Natural Resources, West Lafayette, Indiana
University of Alaska Fairbanks, School of Fisheries and Ocean Sciences, Fairbanks, Alaska
April 2006 – July 2008

- Researched effects of early life mortality on year class strength and recruitment dynamics of lake sturgeon. Planned, implemented, and completed extensive field work. Supervised and directed activities of 12 field and laboratory technicians. Interacted and coordinated sampling with state and federal biologists as well as the general public. Composed semi-annual progress reports for funding agency. Guest lectured for FNR 545 Fisheries Management, and assisted with field laboratories for FNR 351 Aquatic Sampling Techniques.

M.S. Research Assistant
University of Minnesota, AquaGen Laboratory, Saint Paul, Minnesota
May 2004 – March 2006
- Used molecular markers to evaluate the success of fish stocking and management plans. Field collections and laboratory analysis of salmonids from fry through adult life stage. Contributed to annual Minnesota Department of Natural Resources Rainbow Trout Management Reports. Communicated research results and advised local interest group on steelhead management strategies. Served as teaching assistant for FW5601 – Fisheries Population Analysis during fall 2005, gave lectures, coordinated laboratory activities, and guided students in the analysis of fisheries sampling data.

Fisheries Technician – Aquatic Research Laboratory
Lake Superior State University, Sault Sainte Marie, Michigan
September 2001 – May 2003; September 2003 – April 2004
- Assisted with the rearing of Atlantic salmon and brook trout, including brood stock collection, disease treatment of larval and juvenile fish, fin clipping, fish aging, water quality monitoring, and plumbing. Provided tours of the facility, interacted with the general public. Conducted a lake sturgeon population survey and assisted with sea lamprey control efforts in the St. Marys River.

Fisheries Consultant
Hiawatha Sportsman's Club, Engadine, Michigan
August 2003 – April 2004
- Coordinated fisheries sampling activities between the Lake Superior State University Fish and Wildlife Club and Hiawatha Sportsman's Club. Activities included lake and stream surveys, water analysis, and winter oxygen profiles of private lakes.

State Worker – Hunt Creek Fisheries Research Station
Michigan Department of Natural Resources and Environment, Lewiston, Michigan
May 2003 – August 2003
- Gained extensive experience conducting mark-and-recapture population estimates in streams using barge electrofishing equipment, surveyed rivers to determine the effects of sediment traps on channel morphology, performed a longitudinal survey to determine slope of a two mile section of Hunt Creek, estimated stream discharge, assisted in data collection using the methods set forth in the MDNR's Stream Status and Trends Program.

HONORS/AWARDS
- Andrews Doctoral Fellowship Award (2006-2007)
- Best Student Paper Award (2006) for: One year of parental hatchery experience reduces success of steelhead fry stocked into their naturalized environment. Caroffino, D.C., L.M. Miller, A.R. Kapuscinski, and J.J. Ostazeski, Annual meeting of the Minnesota Chapter of the American Fisheries Society, Brainerd, MN.
- Janice Fenske Memorial Award Finalist (2005) Midwest Fish and Wildlife Conference
- National Dean's List (2003 – Present) for academic achievement at the University of Minnesota and Lake Superior State University
- Best Student Paper Award (2005) for: Genetic influence of stocked walleye in the St. Marys River. Caroffino, D.C. and B.I. Evans, Great Lakes Research Consortium, Syracuse, NY.

- Saginaw Bay Walleye Club Scholarship (2002 – 2005) Bay City, MI
- Dean's List (2000 – 2004) Lake Superior State University
- Fisheries and Wildlife Student of the Year (2003-2004) Lake Superior State University
- Fletcher Scholarship (2000 – 2004) Lake Superior State University
- Gil Gleason Fisheries Scholarship (2003 – 2004) Lake Superior State University
- Honors Program Graduate (2004) Lake Superior State University
- Valedictorian Scholarship (2000 – 2004) Lake Superior State University
- Alpha Chi Honors Society (Inducted 2003)
- Mason County Fin and Feather Club Scholarship (2002) Ludington, MI

PROFESSIONAL MEMBERSHIPS

- American Fisheries Society (2003 – Present)
- Michigan Chapter of the American Fisheries Society (2003 – 2006, 2009 – Present)
- Sigma Xi, Scientific Research Society (2004 – 2008)
- Minnesota Chapter of the American Fisheries Society (2004 – 2006)

CERTIFICATIONS/PROFESSIONAL TRAINING

- Facilitative Leadership Training, Michigan State University Extension – Roscommon, MI (2009)
- USFWS Bear Safety Training – Fairbanks, AK (2008)
- USFWS Boater Safety Training – Fairbanks, AK (2008)
- Certified Associate Fisheries Biologist – American Fisheries Society (2008)
- Certified Open Water Scuba Diver, PADI Certification Training (2005)
- American Fisheries Society Techniques for Estimating Fish Populations (2005)
- Saginaw Bay Power Squadron, Boaters Safety Training (1996)

PUBLICATIONS

- Caroffino, D.C., T.M. Sutton, R.F. Elliott, and M.C. Donofrio. In Review. Predation on early life stages of lake sturgeon in the Peshtigo River, Wisconsin. Transactions of the American Fisheries Society.
- Caroffino, D.C., B.I. Evans, and A. Mwai. In Review. Population genetics of walleye and yellow perch in the St. Marys River. Journal of Great Lakes Research, St. Marys River Special Issue.
- Caroffino, D.C., T.M. Sutton, R.F. Elliott, and M.C. Donofrio. In Press. Early life stage mortality rates of lake sturgeon in the Peshtigo River, Wisconsin. North American Journal of Fisheries Management.
- Caroffino, D.C., T.M. Sutton, and M.S. Lindberg. 2009. Abundance and movement patterns of age-0 juvenile lake sturgeon in the Peshtigo River, Wisconsin. Environmental Biology of Fishes 86:411-422.
- Caroffino, D.C., T.M. Sutton, and D.J. Daugherty. 2009. Assessment of the vertical distribution of larval lake sturgeon drift in the Peshtigo River, Wisconsin, USA. Journal of Applied Ichthyology 25(Suppl. 2):14-17.
- Caroffino, D.C., L.M. Miller, A.R. Kapuscinski, and J.J. Ostazeski. 2008. One year of parental hatchery experience reduces success of steelhead fry stocked into their naturalized environment. Canadian Journal of Fisheries and Aquatic Sciences 65:309-318.

David C. Caroffino

PRESENTATIONS

- Caroffino, D.C., Graduate school and a career in Fisheries. Guest Lecture, Fundamentals of Natural Resources Management, Lake Superior State University, November 2009, Sault Ste. Marie, MI (invited)
- Caroffino, D.C., Steelhead management in Minnesota and early life history of lake sturgeon in Wisconsin. Guest Speaker, Fisheries and Wildlife Club Meeting, Lake Superior State University, November 2009, Sault Ste. Marie, MI (invited)
- Caroffino, D.C., T.M. Sutton, and D.J. Daugherty. Drift dynamics and abundance of lake sturgeon larvae in the Peshtigo River, Wisconsin, USA. Sturgeon Symposium at the 139th Annual Meeting of the American Fisheries Society, August 2008, Ottawa, Ontario, Canada (invited)
- Caroffino, D C. Growing, moving, and dying: juvenile lake sturgeon of the Peshtigo River, Wisconsin. School of Fisheries and Ocean Sciences Advisory Council Meeting, University of Alaska Fairbanks, April 2008, Fairbanks, AK (invited)
- Caroffino, D.C. Early-life dynamics of a Wisconsin lake sturgeon population. Freshwater Ecosystems Seminar, University of Alaska Fairbanks, February 2008, Fairbanks, AK (invited)
- Caroffino, D.C., T.M. Sutton, R.F. Elliott, and M.C. Donofrio. Mortality of lake sturgeon eggs and age-0 juveniles in the Peshtigo River, Wisconsin. Midwest Fish and Wildlife Conference, December 2007, Madison, WI
- Sutton, T.M., D.C. Caroffino, A.C. Benson, and R.F. Elliott. Early life-stage mortality and recruitment of lake sturgeon in a Great Lakes tributary. Annual Meeting of the American Fisheries Society, September 2007, San Francisco, CA
- Elliott, R.F., D.C. Caroffino, T.M. Sutton, and M. C. Donofrio. Early life-stages of lake sturgeon in the Peshtigo River, Wisconsin. Lake Michigan Technical Committee Meeting, July 2007, Marinette, WI
- Caroffino, D.C., T.M. Sutton, R.F. Elliott, E.A. Baker, and M.C. Donofrio. Abundance and mortality of lake sturgeon in the Peshtigo River Wisconsin. Great Lakes Lake Sturgeon Coordination Meeting, November 2006, Sault Ste. Marie, MI
- Caroffino, D.C., L.M. Miller, A.R. Kapuscinski, and J.J. Ostazeski. One year of parental hatchery experience reduces success of steelhead fry stocked into their naturalized environment. *Presented at the:*
  - -Annual meeting of the Minnesota Chapter of the American Fisheries Society, February 2006, Brainerd, MN
  - -Annual meeting of the Lake Superior Steelhead Association Board of Directors, December 2005, Duluth, MN (invited)
  - -Midwest Fish and Wildlife Conference, December 2005, Grand Rapids, MI
- Caroffino, D.C. and B.I. Evans. Genetic influence of stocked walleye in the St. Marys River. *Presented at the:*
  - -Annual Meeting of the Great Lakes Research Consortium, March 2005, Syracuse, NY
  - -Soo Area Sportsman's Club membership meeting, April 2004, Sault Ste. Marie, MI (invited)
  - -St. Marys River Fisheries Task Group meeting, March 2004, Sault Ste. Marie, MI (invited)
  - -Saginaw Bay Walleye Club, membership meeting, March 2004, Bay City, MI (invited)
  - -Annual Meeting of the Michigan Chapter of the American Fisheries Society, February 2004, Marinette, WI (poster)
- Caroffino, D.C, and B.I. Evans. Assessment of walleye in the St. Marys River through DNA analysis. National Collegiate Honors Conference, November 2003, Chicago, IL (poster)