

---

**Name of Organization:** Bad River Band of Lake Superior Chippewa

**Type of Organization:** Tribal Organization

**Contact Information:** Mr. Thomas Doolittle

Bad River Natural Resources

1 Maple Lane, P.O. Box 39

Odanah WI 54861

**Phone:** (715) 682 - 7123 **Extension:** 136

**Fax:** (715) 682 - 7118

**E-Mail:** dootommy@ncis.net

---

**Project Title:** Sea Lamprey Effects at Top Trophic and Watershed Scales

**Project Category:** Exotic Species

**Rank by Organization (if applicable):** 1

**Total Funding Requested (\$):** 96,750 **Project Duration:** 2 Years

**Abstract:**

Sea lamprey ammonocetes, transformers and adults will be collected from the Nemadji, Bad, Brule Rivers and Red Cliff Creek for mercury testing. Population estimates will be gathered from existing data from USFWS sea lamprey control. The mercury and population data will be used as a basis for determination of population limiting effects on higher order consumers (i.e. otter, bald eagle). Hard data on mercury food chain linkages will be determined for otter and bald eagles. River otter (*Lutra canadensis*) will be captured in the Bad River, Brule, Nemadji River, Red Cliff Creek watersheds and the Apostle Islands National Lakeshore. Mercury levels will be determined from live trapped animals with known territories, as well as from carcasses from trapped animals. Food habits, reproductive histories and morphological measures will be gathered to theorize or locate point sources of mercury in the food chain. Otter will be assessed for their roles as biosentinels for ecosystem health for the Lake Superior basin with applications for the Great Lakes St. Lawrence basin. The inherent differences between the Nemadji, Brule, Bad and Red Cliff Creek systems make an appropriate comparison between otter populations located near urban settings with known contamination (Nemadji) and populations living in relatively pristine conditions (Bad River). Similar to otter, bald eagles will be studied by sympatric methods. All mercury analysis on eagles will be from previously collected (1990-1999) feathers and blood archived by Wisconsin DNR. These studies will provide data for potential restoration measures and imperative decisions made for lamprey abatement, as well as further understanding limiting factors on otter and bald eagle populations basin-wide. Importantly, data and recommendations gathered through this work will provide a template for Great Lakes resource managers to make informed decisions from a regional perspective.

**Geographic Areas Affected by the Project**

**States:**

- |   |  |
|---|--|
| <input checked="" type="checkbox"/> Illinois  | <input checked="" type="checkbox"/> New York     |
| <input checked="" type="checkbox"/> Indiana   | <input checked="" type="checkbox"/> Pennsylvania |
| <input checked="" type="checkbox"/> Michigan  | <input checked="" type="checkbox"/> Wisconsin    |
| <input checked="" type="checkbox"/> Minnesota | <input checked="" type="checkbox"/> Ohio         |

**Lakes:**

- |  |   |
|--|---|
| <input checked="" type="checkbox"/> Superior | <input checked="" type="checkbox"/> Erie    |
| <input checked="" type="checkbox"/> Huron    | <input checked="" type="checkbox"/> Ontario |
| <input checked="" type="checkbox"/> Michigan | <input type="checkbox"/> All Lakes          |

**Geographic Initiatives:**

- |  |                                  |                                     |                                      |   |
|--|----------------------------------|-------------------------------------|--------------------------------------|---|
| <input type="checkbox"/> Greater Chicago | <input type="checkbox"/> NE Ohio | <input type="checkbox"/> NW Indiana | <input type="checkbox"/> SE Michigan | <input type="checkbox"/> Lake St. Clair |
|--|----------------------------------|-------------------------------------|--------------------------------------|---|

**Primary Affected Area of Concern:** Not Applicable

**Other Affected Areas of Concern:**

***For Habitat Projects Only:***

**Primary Affected Biodiversity Investment Area:** All BIAs

**Other Affected Biodiversity Investment Areas:**

**Problem Statement:**

Resource managers and the public will soon need to make decisions about the feasibility of placing a low head barrier dam (or some alternative) in the Bad River and other rivers to abate the spread of lamprey and subsequently mercury into interior watersheds and to minimize chemical treatments. There are other management considerations such as the Apostle Islands National Lakeshore have an open trapping season on otter, but have no knowledge of otter population levels. The assessment of otter population health in the basin will indicate emmigration potentials to the Apostle Islands and influence a resource management decision in the Lakeshore. Resource managers need to know whether mercury is limiting otter and bald eagle reproductive potentials in the Lake Superior basin. The Lake Superior basin may be a breeding sink for river otter and bald eagle, and little data on river otter in the Great Lakes has been collected and published.

In 1998, otter with implant transmitters were followed to Bad River Falls (Bad River Reservation) and were observed to be feeding on spawning sea lamprey (*Pteromyzon marinus*). Mercury levels in muscle tissue were found to be high (1.33 ppm wet weight, whole body 2.7 ppm) in Lake Superior sea lamprey (USFWS, unpub. data, 1998). Since lamprey are anadromous, spawn and die there is a concern that lamprey transfer Hg at a watershed scale. In addition, 10 samples of otter fur from animals captured in the Bad River, Wisconsin were tested for mercury and were found to have a wet weight mean of 14 ppm. This order of biomagnification would not be expected unless there was a substantial mercury load associated with some facet of the food chain. However, it is not known whether the Lake Superior basin is a population sink for otter and whether mercury may be population limiting.

The Bad River Reservation has one of the highest nesting densities of bald eagles in the Great Lakes St. Lawrence basin. Great Lakes St. Lawrence eagle reproduction is still depressed in comparison to interior populations. Nesting eagles on the Bad River had notable lower nest success (N= 0.5 young/successful nest) than eagles nesting on the Lake Superior shoreline (N=2.0 young/successful nest). One observation was made in May 1998 of eagles feeding sea lamprey to newly hatched young. Bald eagles nest and feed on the Nemadji and on many other rivers with sea lamprey runs in the Great Lakes. To further the knowledge of food chain effects of mercury, further investigating sea lamprey (Hg) linkages and effects will provide imperative data to managers throughout the Lake Superior basin and other Great Lakes.

**Proposed Work Outcome:**

A. Lamprey Mercury Investigation

---

Sea lamprey ammocoetes, transformers and adults will be collected from the Nemadji, Brule, and Bad Rivers for mercury testing in known areas of eagle and otter foraging activity. Population estimates will be gathered from existing data (USFWS sea lamprey control). The mercury and population data will be used as a basis for determining effects on higher order consumers (i.e. otter, bald eagle). Hard data on mercury food chain linkages will be used to formulate recommendations to abate sea lamprey populations by barrier dam systems or other alternatives. However, there must be clear evidence that the mercury loads in lamprey compromise population stability of wildlife in the interior portions of the watersheds, prior to proposing alterations to major riverways.

#### B. River Otter and Bald Eagle Mercury Investigation

Otter will be trapped in three distinct ecological zones in the Bad River, Brule, Red Cliff Creek and Nemadji River watersheds located on the Wisconsin south shore of Lake Superior. They are: (1) coastal wetlands; (2) the lower Nemadji, Brule, Red Cliff Creek, White and Bad Rivers; and (3) headwater stream locations with no anadromous fish runs. In addition, there will be a control sample of otter trapped on Madeline, Stockton and Outer Islands within the Apostle Islands National Lakeshore, and above and below the low head barrier dam on the Brule River. Theoretically, the island control groups will illustrate contaminant sources relative to atmospheric deposition, the lower river sections will synthesize the Lake Superior food chain and point sources of anthropogenic toxins, while head water areas above barriers should have the least anthropogenic toxic effects and few Lake Superior food chain influences. Lastly, the Brule River above the low head dam will provide data on mercury levels in otter that are exposed to the anadromous fish from Lake Superior, but no sea lamprey.

Forty otter will be live trapped in the four study areas and the Apostle Islands National Lakeshore. Upon capture 20 otter will be affixed with implant transmitters. The transmitters will be necessary to determine home ranges and food habits of otter, and to model population densities. Hair samples will be collected from the discarded hair from the incision site for mercury analysis. Analysis for mercury will occur within 40 days from removal of the fat or hair from the otter. The implanted animals will then be replaced back into covered cages and once awake and apparently healthy they will be transported back to capture site and released. Hair will be taken from the remaining sample (N=20) to determine levels of mercury. They will be released at their capture site.

For the first two weeks all study animals will be monitored daily to insure their safety. Subsequently, each animal will be located by ground or aerial surveillance on a random schedule until the transmitter fails or the animal dies. Home ranges and territories will be ascertained, and direct observations will be gathered to note some behaviors. A Global Positioning System (GPS) reading will be taken from the air on the animals and the location plotted on a digital 7.5 minute USGS quadrangle, while ground surveillance will be done by computerized GPS triangulation. The triangulation method is a new technology developed by Bad River Natural Resources staff to lessen error on standard triangulation methods and to save time.

Hair and liver samples from otter trapped in the Lake Superior basin and a sample of trapped otter from interior areas will be analyzed for mercury. Food habits will be determined by analyzing stomach contents from trapped carcasses (N=100) provided by trappers in each watershed and by scat collected from otter within the territories of the radioed study groups. Dens will be located and kit production will be noted. A formal necropsy taking morphological measures and determining reproductive histories will be completed on each carcass. Food items that are dominant in otter diets will be analyzed for mercury to determine other potential sources of mercury in the food chain.

The differences between the three ecological zones in the Bad, Brule, Red Cliff Creek, Nemadji River watersheds and the Apostle Islands will be used to compare habitat uses by otter, reproduction rates, data on food habits, home range and territory, population estimates and relative mercury burdens. This watershed approach will provide methods applicable to monitoring basin-wide, such as otter toilet counts.

Similar to otter, bald eagles will be studied in three distinct ecological zones in the Bad River, Brule, Red Cliff Creek and Nemadji River watersheds located on the Wisconsin south shore of Lake Superior. They are: (1) coastal wetlands; (2) the lower Nemadji, Brule, Red Cliff Creek, White and Bad Rivers; and (3) headwater stream locations with no anadromous fish runs. In addition, there will be a control sample of bald eagles studied on Stockton and Outer Islands within the Apostle Islands National Lakeshore and the upstream of the low head barrier dam on the Brule River.

Mercury in bald eagles will be determined by the analysis of juvenile breast feathers and blood. The actual data collection on eagles will be from pre-existing collection (1990-1999) of eaglet breast feathers and blood archived by the Wisconsin

---

---

Department of Natural Resources. Data will be compared from nests exposed to lamprey, and those above impoundments that are not influenced by lamprey or anadromous fish from Lake Superior.

Food habits have been extensively studied on the Apostle Islands and other locations in Wisconsin. Collections of prey remains below nests and review of the literature will provide adequate food habits data. Again similar to otter, prey items that make up the largest proportion of the eagles diet in the Lake Superior basin will be tested for mercury.

Outcomes (Long Term)

1. Determine trends in population and health of otter and eagles in the Bad, Brule, Red Cliff Creek Raspberry and Nemadji River watersheds.
2. Measure mercury burdens and biotic pathways in the Bad River, Brule, Red Cliff Creek, and Nemadji River otter and eagles.
3. Define food habits of otter and eagles in the Bad, Brule, Red Cliff Creek, and Nemadji River watersheds.
4. Review restoration potential in the Bad, Brule, Red Cliff Creek and Nemadji River for otter and eagles and the fitness of the system for fish consumption.
5. Provide recommendations for maintenance of otter and eagle in the system and provide recommendations for the abatement of sea lamprey in the Lake Superior basin relative to mercury transfer through the food chain.
6. Provide a scientific opinion by modeling effects of mercury at top trophic levels relative to sea lamprey spawning at basin-wide scales.

---

<b>Project Milestones:</b>	<b>Dates:</b>
Initiate trapping and tracking	10/2000
Collect samples, Hg analysis	04/2001
Lamprey collections, breeding suvey	07/2001
Food habits, breeding results	10/2002
Hg Analysis round 2	04/2002
Necropsies, habitat evaluations	07/2002
Collate data and peer review	10/2002
Project End,final report	10/2002

---

Project Addresses Environmental Justice

**If So, Description of How:**

The Bad River and Red Cliff Bands of Lake Superior Chippewa Indians are Federally recognized Indian Tribes whose reservations are located on the south shore of Lake Superior. The bands use fish and other aquatic resources for subsistence purposes, and the environmental quality of regional fisheries has a direct effect on the health of it's peoples. The cultural ties to the river otter and bald eagle by the Anishinabeg are strong, as well as the peoples knowledge on the otters and eagle habits. Like the Anishinabeg, otter and eagle are closely tied to the aquatic food chain, and can indicate potential environmental problems that may affect tribes in the Lake Superior basin.

This grant would also assist in work related to a NRADA settlement where on June 30, 1992, a Burlington Northern train derailment near U.S. Highway 35, south of Superior, WI resulted in the release of approximately 30,000 gallons of "Aromatic Concentrates" to the Nemadji River, approximately 19 river miles upstream from Allouez Bay. Biologists from the U.S. Fish and Wildlife Service (Service), the Red Cliff Band and Bad River Band of the Lake Superior Chippewas, Wisconsin Department of Natural Resources (Department), and several universities gathered data on the effects of the spilled chemicals on the biota of the area. Both acute and chronic effects were documented between June 30 and July 8, 1992.

Project Addresses Education/Outreach

**If So, Description of How:**

Information on aspects of the study will be released to the popular media and through public meetings. Mobile displays will be prepared and housed at schools, the new Great Lakes Visitor Center, and Tribal facilities. A presentation on parts of study will be given at SOLEC and the study will be peer reviewed and published.

---

---

**Project Budget:**

	<b>Federal Share Requested (\$)</b>	<b>Applicant's Share (\$)</b>
<b>Personnel:</b>	20,000	25,000
<b>Fringe:</b>	2,500	3,750
<b>Travel:</b>	28,750	21,000
<b>Equipment:</b>	13,000	14,250
<b>Supplies:</b>	6,000	12,000
<b>Contracts:</b>	23,000	64,000
<b>Construction:</b>	0	0
<b>Other:</b>	0	0
<b>Total Direct Costs:</b>	93,250	140,000
<b>Indirect Costs:</b>	3,500	0
<b>Total:</b>	96,750	140,000
<b>Projected Income:</b>	96,750	140,000

---

**Funding by Other Organizations (Names, Amounts, Description of Commitments):**

In 1992, a settlement between Red Cliff and Bad River Tribes and Burlington Northern Railroad provided through a NRDA case \$140,000 for damages incurred to trust resources from a Benzine spill. A restoration plan has been developed with a mercury investigation component that is sympatric with this proposal. The restoration plan is in the final stages and will be placed in the federal register in April, 2000 for public comment and then to the Interior Committee for final approval. The initiation of the plan is likely late summer of 2000. The federal share requested through this grant application is imperative to initiate the field and analytical components to complete the job effectively and accurately. The National Park Service, Apostle Islands National Lakeshore is in the process in working on a MOU with the Tribe to determine population densities of otter within the Lakeshore. The tentative request from the Tribe is \$7,420.00.

---

**Description of Collaboration/Community Based Support:**

---

The National Park Service, Apostle Islands National Lakeshore (APIS), Great Lakes Indian Fish and Wildlife Commission (GLIFWC), United States Fish and Wildlife Service (USFWS) and the Wisconsin Department of Natural Resources (WDNR) would each be collaborators in the study.

Trapping within the areas of the upper watershed would be conducted by the Red Cliff and Bad River biologists, while Bad River would assist the National Park Service. USFWS would be advisoral on hair and tissue sample preparations and analysis.

The contact persons are:

Ervin Soulier, Natural Resources Manager, Bad River Natural Resources Department, Odanah, Wisconsin  
Thomas C.J. Doolittle (Project Coordinator) Wildlife Biologist, Bad River Natural Resources Department, Odanah, Wisconsin

Dr. Mike Meyer, Toxicologist, Wisconsin DNR, Rhinelander, Wisconsin

Julie Van Stappen, Supervisory Resource Management Specialist, Apostle Islands National Lakeshore, Bayfield, Wisconsin

Jonathan Gilbert, Wildlife Biologist, GLIFWC, Odanah, Wisconsin

Judy Pratt-Shelly, Red Cliff Environmental Specialist, Red Cliff, Wisconsin

Dr. Ken Stromborg, U.S. Fish and Wildlife Service, Green Bay, Wisconsin

Janet Smith, U.S. Fish and Wildlife Service, Green Bay, Wisconsin