Chapter 6

Habitat, Terrestrial Wildlife and Aquatic Communities Progress Reports

Lake Superior Lakewide Management Plan
2006

Chapter 6 Contents

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6.0 ABOUT THE CHAPTER

The Habitat, Aquatic, and Terrestrial Wildlife Committees of the Binational Program have cooperated to compile this progress report. This chapter highlights the actions taken to restore and protect fish, wildlife, and their habitats in the Lake Superior Basin since the release of the LaMP 2004 Progress Report. The LaMP 2004 contained separate descriptions of the work in each of these areas, but the committees have combined efforts in recognition of the interconnected nature of the ecosystems in Lake Superior and its basin. These committees are part of an historic and unique collaborative endeavor by Lake Superior resource managers to protect, maintain, and restore aquatic and terrestrial wildlife, and high-quality habitat sites in the Lake Superior Basin and the ecological processes that sustain them. The committees are comprised of technical personnel from federal, state, provincial, and tribal natural resource agencies. A list of the members of each committee can be found at the end of this chapter.

Another product of the three committees working jointly is a single chapter that consolidates and replaces four chapters of the LaMP 2000. As suggested in comments from the public and as directed by the Lake Superior Task Force and Work Group, the Habitat, Aquatic, Terrestrial Wildlife, and Invasive Species chapters of the LaMP 2000 were consolidated into one chapter. The resulting document presents information on the characteristics, status, and trends of living natural resources in the Lake Superior Basin in a coordinated fashion. In accordance with the "three ring binder" approach to the LaMP, users should replace Chapters 6, 7, 8, and 10 of the LaMP 2000 with this consolidated chapter (new Chapter 6). Readers can find the consolidated chapter on the new Habitat/Terrestrial Wildlife committees' website, http://www.fs.fed.us/twcc/. For a CD copy of the consolidated chapter, please contact the co-chairs of the Habitat Committee, whose contact information can be found at the above web address.

6.1 ACCOMPLISHMENTS/PROGRESS

The following chapter recognizes many accomplishments over the past two years; however, readers should note that these are not all of the actions that have been taken to restore and protect the basin. The committees are tracking projects completed in furtherance of the LaMP; these represent a sample of projects completed in the past two years. The format of this chapter contains sections discussing broad, watershed scale projects, updates on native and non-native species efforts, and outreach and education initiatives (see Chapter 2 for additional outreach efforts).

6.1.1 Watershed Initiatives/Protection/Restoration

This section presents updates on initiatives to protect or restore the ecological health of the Lake Superior watershed.

Important Habitat in the Lake Superior Basin. Developing and maintaining an inventory of important habitat sites in the basin has been a key charge of the Lake Superior Binational Program since its inception. The map "Important Habitat Conditions in the Lake Superior Basin" was included in the LaMP 2000 as a revision to the original Important Habitat Map published in 1996. The Habitat Committee has recently undertaken a second revision to the map and its accompanying habitat site information databases. This effort will include reviewing the map and attempting to gather additional information about the sites already listed, and contacting state, federal, and tribal agencies to identify additional sites that are not currently on the map. In addition, the information gathered will be incorporated into the Site Explorer kiosks that are located at six sites around the basin.

Watercourse Stewardship Project. The ecological health of Lake Superior is determined in large part by the health of its tributary streams. These watercourses support resident and anadromous fish species, sustain healthy native animal and plant populations, provide wildlife corridors, and at the same time, contribute nutrient and sediment loads to Lake Superior. One way to determine the health of Lake Superior using these water systems is to adopt environmental indicators. Benthic invertebrates, one such indicator, respond to ecosystem changes faster than other members of the aquatic community. Trends and changes in aquatic invertebrate populations and community structure can serve as indicators of short-term, action-required stresses that may ultimately influence the aquatic community of Lake Superior.

The Watercourse Stewardship project is a joint endeavor between the Superior Workgroup and the Forum. To date, the project has established Regional Reference Values for benthic macro-invertebrate communities in 15 local, "healthy" Lake Superior tributary streams that can be used to determine the biological health of selected sites in areas that are believed to be impaired. Ten additional reference sites have been selected between Nipigon and Sault Ste. Marie in order to expand this project to other AOCs along the north shore of Lake Superior.

The stewardship component involves public education and the creation of a user-friendly stream monitoring program (i.e., Citizen's Guide to Monitoring Water Quality) that will enable the general public to sample stream communities to determine local water quality conditions. Community-based monitoring programs provide an essential early-warning system that identifies critical problem areas. To that end, the over-arching goal of this project is to facilitate citizen-driven protection and stewardship of streams and rivers along the north shore of Lake Superior with a long-term objective of improving water quality and fish habitat.

Lake Superior National Marine Conservation Area. In October 2002, the Government of Canada announced an action plan to create ten new national parks and five new national marine conservation areas over five years. The national marine conservation area of Canada (NMCA) in Lake Superior will be the first marine conservation area to be created under this plan.

National marine conservation areas are part of the Parks Canada family of protected areas. They consist of highly protected zones surrounded by cooperatively managed multiple-use areas where activities such as commercial fishing, shipping, and traditional uses continue. The guiding management principle is ecologically sustainable use. Dumping, mining, oil and gas exploration and extraction are prohibited throughout an NMCA.

More than 70 species of fish inhabit the near-pristine waters, including lake herring, walleye, yellow perch, lake whitefish, lake trout, and brook trout. Ring-billed and herring gulls, cormorants, great blue heron, and white pelican feed in these waters. All but the latter use island habitats for breeding during the late spring and early summer.

The signature of an agreement in principle confirms the intent of the governments of Canada and Ontario to work toward the establishment of an NMCA in Lake Superior. Negotiation of a comprehensive final agreement will now proceed, guided by the understandings set out in the agreement in principle.

At the same time, consultations with First Nations in the region will continue to reach a shared understanding regarding their future role in the management and operation of the NMCA, the economic opportunities it will create for Aboriginal communities, and the protection of cultural resources. Local people and First Nations will be actively engaged as stewards of the NMCA.

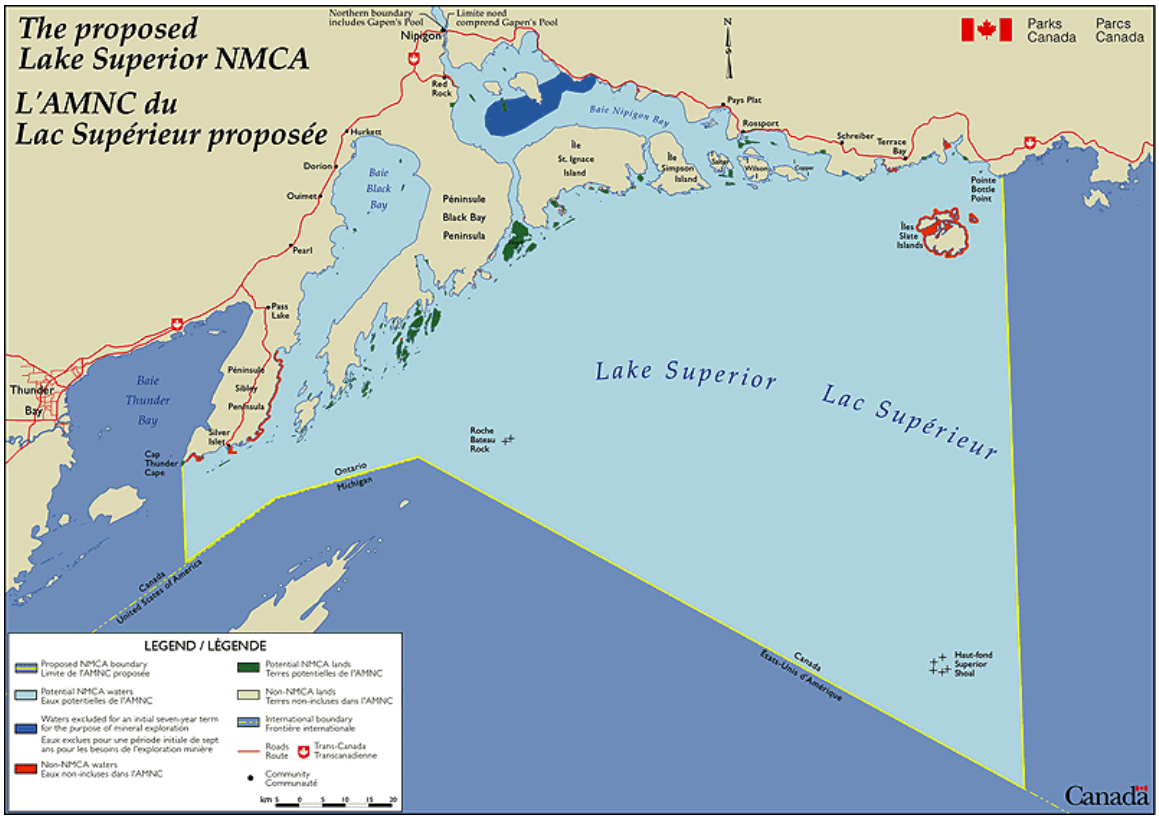

Figure 1. Proposed Lake Superior National Marine Conservation Area. Photo Credit: Parks Canada.

The proposed NMCA would extend from Thunder Cape at the tip of Sleeping Giant Provincial Park in the west, to Bottle Point just east of Terrace Bay, and out to the Canada-U.S. border. It would include the waters of Black Bay and Nipigon Bay, and encompass just over 10,000 square kilometres of lakebed as well as the overlying waters, along with a number of islands, shoals, and some of the mainland. When it is ultimately created, the NMCA in Lake Superior will

become Canada's largest national marine conservation area, and the first to be established under the *Canada National Marine Conservation Areas Act*, which became law in June 2002.

Lake Superior Coastal Wetland Initiative. The North American Wetland Conservation Act Partner Team is a unique partnership supported by many local agencies and organizations and the North American Wetland Conservation Act Program. The six-year project is nearing completion. The project brings together the U.S. Fish and Wildlife Service; U.S. Natural Resources Conservation Service; WDNR; Ashland, Bayfield, Douglas, and Iron County Land Conservation Departments; The Nature Conservancy; Sigurd Olson Environmental Institute; Ducks Unlimited; and the Red Cliff and Bad River Bands of Lake Superior Chippewa Indian Tribes to protect and restore coastal and inland wetland communities in Wisconsin's Lake Superior Basin. The overall goal is to protect coastal wetlands in the area by working with willing partners to acquire land, purchase easements, and restore habitat on private lands. Over 5,000 acres of habitat have been positively affected through the project.

Watershed Habitat Rehabilitation. Progress is being made basinwide in the effort to construct and restore road-stream crossings to benefit passage of aquatic organisms, protect stream and riparian habitat, and ensure roadway integrity. COA has supported tributary habitat restoration for native fish species on Clearwater Creek and the Montreal River in Ontario and investigations into habitat supply and fish population status on the White, Michipicoten, and Montreal Rivers. Minnesota DNR surveyed road crossings in portions of streams accessible to migratory fish to determine if and what type of maintenance might be required to allow for fish passage during both spring and fall spawning runs.

Training workshops for installation of fish friendly culverts and other road-stream crossing structures were held in the Lake Superior Basin in Ashland and Grandview, Wisconsin. These workshops involved 96 individuals representing seven town governments and more than a dozen natural resource agencies.

The Bad River Watershed Association recently inventoried all road-stream crossings in the watershed and is working with local, state, and federal government agencies to obtain grants to help repair crossings impeding fish passage or contributing sediment to streams (http://www.badriverwatershed.org). Recently developed educational and training videos, CD's, and web sites are available for local government and road department officials as well as the general public. For more information visit http://www.fws.gov/midwest/Fisheries/streamcrossings/index.htm.

Wetlands Consortium Update. The Consortium's purpose is to design an implementable, long-term program to monitor Great Lakes coastal wetlands. This is being accomplished through the development of indicators to assess the condition of Great Lakes coastal wetlands. The indicators were selected through the State of the Lakes Ecosystem Conference (SOLEC) process. The Consortium will provide scientific support for this monitoring program; create a database that is publicly accessible; recruit the leadership required to implement the long-term monitoring program; and develop a network of funders and agencies who will support the Great Lakes coastal wetlands monitoring program.

This project is premised on the recognized need to assess the health of Great Lakes coastal wetlands, which are an integral part of the Great Lakes basin ecosystem. Coastal wetlands have critically important ecological values and functions, yet there are currently few basinwide data available for assessing their ecological health.

As described above, the Great Lakes Coastal Wetlands Consortium is developing a long-term Great Lakes coastal wetlands monitoring program. In a complementary effort, the Great Lakes Environmental Indicators (GLEI) research project (described below) is an effort to develop indicators for Great Lakes coastal habitats which assess habitat condition and point to causes of impairment.

Great Lakes Environmental Indicators Project Update. The US EPA funded a five-year major competitive research grant (2001-2006) to the University of Minnesota, Duluth to develop a new generation of environmental indicators for coastal regions of the U.S. Great Lakes. The project focused on the coastal and nearshore zone for the entire U.S. portion of the Great Lakes, from Lake Ontario to Lake Superior. The project included over 27 scientists in a consortium of 10 universities and was a cooperative agreement with US EPA's Mid-Continent Ecology (MED) Division in Duluth.

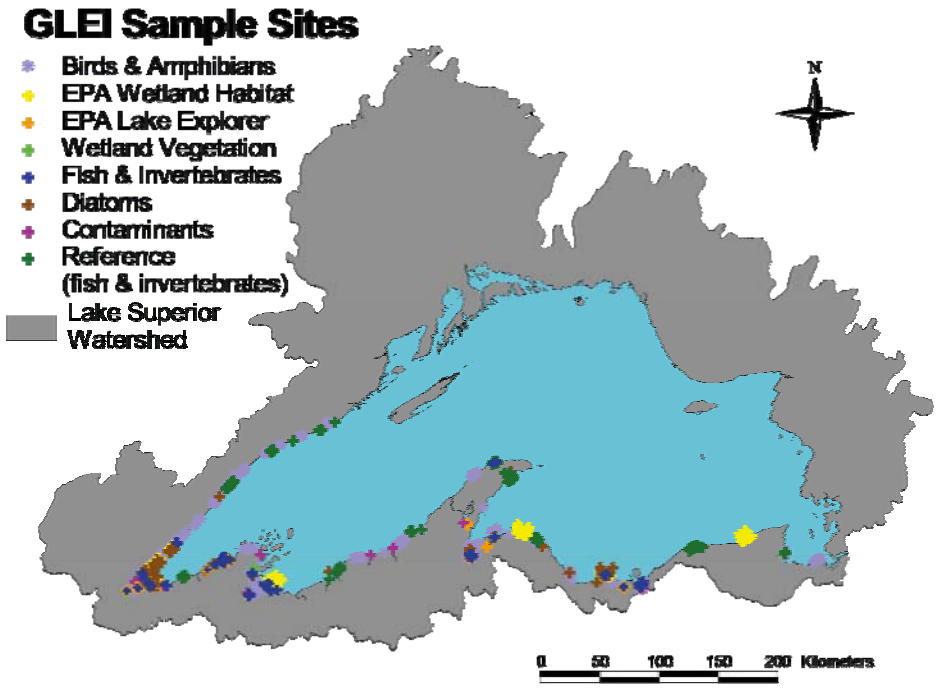

Figure 2. GLEI Sample Sites. Source: Natural Resource Research Institute, Duluth, MN.

The project has just concluded, and a final report will be completed in April 2006. This summary focuses on the results for the Lake Superior relative to the other U.S. Great Lakes coastal regions. The goal of the project was to develop indicators that both estimated ecological condition and suggested plausible causes of ecosystem degradation. The project consisted of measuring eight major responses, each with different sampling methodologies and sample size requirements. These indicators included populations of amphibians, birds, diatoms, fish, macroinvertebrates, and wetland plant communities. In addition, contamination due to polycyclic aromatic hydrocarbons (PAHs) and land cover in the U.S. Lake Superior Basin were characterized.

Field sampling was completed with a random stratified design which incorporated over 200 stressor variables among six major categories: agriculture, atmospheric deposition, land cover-land use, human population densities, point source pollution, and shoreline modification. The entire U.S. coastal region was subdivided into two major ecological provinces and further subdivided into 762 "segment sheds." Segment sheds represented a combination of the coastline and the watershed. Field sampling was completed primarily in 2002 and 2003, while the landscape characterization was completed for 1992 and compared with 2001 to determine land use change. More than 100 sites in Lake Superior were sampled, especially wetland ecosystems and high energy shorelines. The number of sites sampled in the Lake Superior coastal region for the various components were the following: 110 sites for birds, 12 sites for PAH contamination, 40 sites for diatoms, 32 sites for fish and macroinvertebrates, and 25 sites for wetland vegetation. In addition, US EPA-MED sampled more than 15 sites as well as extensive regions of the near-shore zone in the western portion of Lake Superior.

The preliminary results indicate that agriculture and population density had major influences on the indicator responses for all of the components studied. Strong signals in birds, diatoms, fish, and macroinvertebrates were observed in areas where either agriculture was predominant in the landscape or where human population densities were greatest. Considerable variation in the responses was exemplified at different spatial scales and many at surprisingly large scales. PAH contamination was found in several of the major areas of industrial activity such as in the St. Louis River of MN and near Ashland, WI. Land use change in the Lake Superior Basin was not as extensive as was found in the southern and eastern portions of the U.S. Great Lakes Basin; however, there was some conversion of forested areas to urbanized, residential areas within the basin.

In general, the Lake Superior Basin and near shore areas, as indicated from the biological responses measured, were in relatively good condition compared with many portions of the southern and eastern U.S. Great Lakes coast. However, many wetland and high energy shores had conditions that were approaching the highly degraded regions of the southern and eastern U.S. Great Lakes areas. A hierarchical framework will be developed to link responses with specific stressors in the coastal region. These data provide some of the most extensive and comprehensive sampling ever completed for a substantial portion of the U.S. Lake Superior coastal region. These data also provide a solid baseline that will allow comparisons to be made with future changes in coastal resources and potentially provide a mechanism to track further degradation or improvements in the health of the coastal region of Lake Superior. Further information on GLEI is available and more will be forthcoming (see http://glei.nrri.umn.edu).

The Nature Conservancy Issues Binational Conservation Blueprint for the Great Lakes. The Nature Conservancy and the Nature Conservancy of Canada have jointly developed a Binational Conservation Blueprint for Coordinated Action. The blueprint includes a map of the Great Lakes Basin identifying more than 500 sites as priorities for conservation. These include forests, coastlines, islands, wetlands, rivers, and inland lakes. Sites identified in the Lake Superior Basin include the Manitou River in Minnesota, the Chequamegon Bay watershed in Wisconsin, the Keweenaw south shore and bluffs in Michigan, the Black Bay peninsula, and Goulais Bay in Ontario. The Conservation Blueprint and the map can be found on the web at http://nature.org/wherewework/northamerica/greatlakes/resources/art11461.html.

Upper Peninsula Land Protected. A large tract of Upper Peninsula land, most of which is in the Lake Superior drainage basin, will be protected under a plan with federal, state, and private backing. The Northern Great Lakes Forest Project will protect more than 271,000 acres in the Upper Peninsula through a working forest easement on 248,000 acres with the State of Michigan and The Forestland Group, and through an acquisition by The Nature Conservancy of 23,338 acres in the Two Hearted River watershed (see Figure 3). The total cost of the project is nearly $58 million.

Highlights of the project include:

- More than 300 natural lakes, including 74 lakes larger than 10 acres;
- 192 miles of Class I trout streams, including the Two Hearted River (a state-designated Michigan Natural River) and the Presque Isle River (a federally designated National Wild and Scenic River), as well as over 324 miles of additional riparian habitat along major rivers and tributaries (roughly 516 miles total);
- More than 31 miles of land bordering Pictured Rocks National Lakeshore, including 20,000 acres of adjacent buffer;
- Roughly 10,000 acres of buffer and inholdings to Tahquamenon Falls State Park;
- Roughly 10,000 acres of buffer and inholdings to Porcupine Mountains Wilderness State Park;
- More than 52,000 acres of wetlands;
- Habitat for state and federal endangered species, including bald eagle, common loon, osprey, gray wolf, and a host of state-listed plant species and communities;
- Approximately 50,000 acres of watershed protection and buffer lands adjacent to Seney National Wildlife Refuge;
- 23,338 acres of adjacent land and inholdings to The Nature Conservancy's existing nature preserve in the Big Two Hearted River watershed.
- Important natural features like unique old-growth hemlock gorges, and high-elevation peatland-forest ecosystems;
- 30,000 acres of adjacent buffer and inholdings to Hiawatha National Forest;
- 27,000 acres of adjacent buffer and inholdings to Ottawa National Forest; and
- Approximately 100,000 acres of adjacent buffer and inholdings to various state forests.

For more information see
http://nature.org/wherewework/northamerica/states/michigan/slideshows/sld196.html.

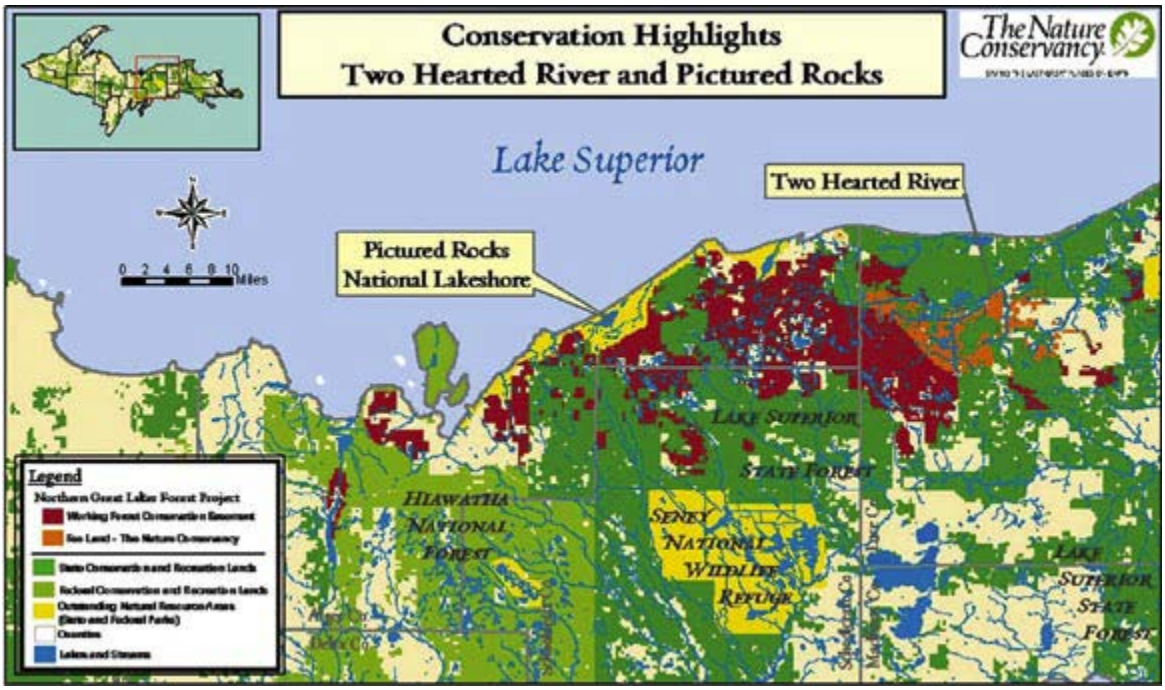

Figure 3. This map shows the lands included in the Northern Great Lakes Forest Project, which involves protecting more than 271,000 acres in the Upper Peninsula. The $57.9 million agreement, spearheaded by The Nature Conservancy, received some financial backing in President Bush's proposed 2007 budget (AP Photo/The Nature Conservancy).

The Wisconsin Lake Superior Basin Partner Team was originally formed in 1998 by the WDNR to help implement the Lake Superior Binational Program in Wisconsin. The Partner Team is a unique consortium of stakeholders who created a watershed health initiative to address erosion and sedimentation, which is the leading cause of water quality and habitat impairments in the Wisconsin portion of the basin. In 2005 the Partner Team received a grant from the Great Lakes Commission to conduct a pilot project for watershed planning and management in the basin. The Marengo River watershed, which is part of the Bad River watershed, was selected by the Team as the pilot location because of the variety of land uses, issues, and governmental bodies. In addition to a strategy for the Marengo River watershed, the project will result in a model watershed planning guidance document that can be used by other organizations in Wisconsin for watershed planning in the Lake Superior Basin.

Wisconsin Lake Superior Watershed Health Initiatives. Watersheds in Wisconsin's Lake Superior Basin are unusual, with "flashy" streams cut deep into layers of clay and sand that form ravines and high slumping banks. Over the last 150 years, logging, forest fires, agriculture, drainage, and road construction have changed the watersheds. These changes, combined with the tight clay soils, make water run off the land rapidly. The increased flow carves at streambanks and bluffs, which accelerates erosion and degrades fish habitat.

To help address watershed issues and stream flow dynamics, the WDNR funded several projects with USGS to collect information on the North Fish Creek, Bark River, Sioux River, Whittlesey

Creek, and the Cranberry River. The USGS verified that the power of flood events is presently twice that of the pre-settlement era. These flood events changed the character of some stream sections and even destroyed middle and lower river historical spawning reaches. This greatly affected brook trout reproduction and reduced their potential future success in Bayfield peninsula streams. The other larger salmonids, although still limited, are better able to utilize this damaged habitat. Study results suggest that we need to develop strategies to "slow the flow" or reduce the speed that snowmelt and rainfall events drain off the land. Results also suggested the need to concentrate on watershed areas upstream of critical spawning and rearing reaches.

For more than 50 years, there have been many attempts to reduce erosion and sedimentation problems associated with the red clay-like till soils of Wisconsin's Lake Superior Basin. The primary focus in the past has been on mechanical stabilization. Recently, the agencies' focus has changed to watershed processes that contribute to excess runoff and peak stream flow.

Comparative Analysis of Sub-watersheds in the Wisconsin Portion of the Lake Superior Basin. This project was completed in 2005 through efforts of the WDNR, Wisconsin Coastal Management Program, and the Ashland Bayfield Douglas and Iron County Land Conservation Department. Research by USDA-Forest Service Research Hydrologist Sandy Verry has shown that sub-watersheds that have more than 60 percent of their area in either open field or forest clearcuts which are less than 15 years old deliver accelerated surface runoff to the streams and thus greatly increase the velocity and volume of episodic stream flows.

This project identified the location of sub-watersheds which are above the threshold of open land and young clearcuts in order to coordinate forest and land management activities. The project mapped open land and clearcuts over the last 16 years using satellite imagery and GIS technology. Results were presented to over 70 resource managers attending the *Clean Water and Healthy Watersheds: Wisconsin Lake Superior Basin Watershed Mapping Workshops* held in Ashland, Wisconsin, in March 2005.

Lake Superior Basin Plan. As part of our effort to strategically target key watersheds, the Minnesota Pollution Control Agency (MPCA) completed a watershed assessment for all 435 minor watersheds in its portion of the Lake Superior Basin. This assessment, which is based on an adapted version of the U.S. Forest Service's East-wide Watershed Assessment Protocol, is used to generate a cumulative score for each watershed based on 19 condition and vulnerability parameters. These parameters, which are outlined in the plan, include land use, population and road density, recreational pressure and percent of the riparian corridor in forest or wetland. The assessment has a significant habitat component, including a focus on watersheds that serve as entry points for exotic plant and animal species that arrive from Lake Superior or through overland routes. The Watershed Assessment has also been used to select a pilot watershed for the development of a pro-active strategy for watershed protection.

Sucker River Pilot Project. The Sucker River Watershed was selected as a pilot project for the development and employment of a watershed protection approach. The MPCA and the US EPA provided support for the project as part of a slate of innovative pollution prevention initiatives. Approximately $35,000 was provided to the South St. Louis County Soil and Water Conservation Service District to provide staff support to the project. The project was unique in

that it was one of the few attempts by any agency to intervene prior to the identification of a serious water quality issue. It also utilizes a new approach to watershed projects, focusing very heavily on community-based social marketing techniques and quantifiable outcomes.

City of Sault Ste. Marie, Ontario, Plans to Protect Upland Aquifers. The City of Sault Ste. Marie, Ontario, has approved new zoning rules designed to protect aquifer recharge zones in the foothills of the Canadian Shield above the city. Studies of the aquifers beneath the city indicated that the gravelly soils of the recharge zone are very vulnerable to leaching of pollution which could possibly contaminate the city's drinking water supply. The new zoning laws are also designed to protect remaining habitat on the city's edge. The new zoning ordinances include restrictions on the storage of fuels and chemicals, restrictions on severing current land parcels, and new rules regarding the discharge of storm water. The stormwater on site must be collected, stored, and treated or properly disposed of in order to remove contaminants before the stormwater is allowed to enter into the ground or exit the property. See http://www.city.sault-ste-marie.on.ca/eng/plan/ZoningByLaw/plan_zmain.htm.

Figure 4. Stream feeding into the St. Marys River. Photo Credit: Mike Ripley, CORA.

Sault Michigan Planning for Cleaner Urban Creeks. Sault Ste. Marie, Michigan, citizens and agencies, with the help of the Chippewa/East Mackinac Conservation District, are taking part in a planning process to protect and restore water quality in urban creeks that flow through the city. The St. Marys River is actually a connecting channel between Lake Superior and Lake Huron and is one of 43 areas of concern (AOCs) in the Great Lakes. In the past 15 years, great progress has been made to reduce point source pollution in the St. Marys River, and now there will be efforts to control non-point source pollution.

The Sault Ste. Marie Area Watershed Project is a non-point source pollution planning project that attempts to address water quality issues, identify pollution sources, and construct a plan to reduce those sources within Sault city limits. The Sault Project will encompass several small "sub-watersheds" of the St. Marys River that course through the city, including Ashmun Creek, Mission Creek, Seymour Creek, and the rest of the city limits area east to Frechette Creek. The rationale for the project is to create awareness about non-point source pollution, the effect that pollution has on aquatic resources, and land management that can benefit water quality. When complete, these efforts should lead to improvements to beneficial uses such as fish and wildlife habitat, water quality, and aesthetics.

Lake Superior Tributary Fish Habitat Rehabilitation. Seventeen Lake Superior tributaries covering 11.7 river miles have been improved through 2005 as part of a WDNR fish crew's

Figure 5. Stakeholders take a tour of the urban creeks in Sault Ste. Marie, Michigan. The group will be helping to develop a plan to protect and restore watersheds which flow into the St. Marys River. Photo Credit: Chippewa/East Mackinac Conservation District.

effort to maintain and improve habitat to sustain naturally reproducing populations of trout and salmon, including native brook trout. The effort involved removing sand, tag alder trees, beaver dams, and woody debris from trout and salmon spawning grounds to expose the rocks, large logs, and gravel that had been buried for more than a century.

Inland Aquatic Resources Update. Fish population surveys were conducted annually on 10-15 lakes and 2-3 streams within Minnesota's Lake Superior Basin. The Forest Service conducted restoration projects on 2,300 acres of inland lake and 53 miles of inland stream habitat, some of which is located in the Lake Superior watershed. In addition, eight watershed assessments were performed.

Wildlife Habitat Enhancements. Between 2004 and 2006, the U.S. Forest Service restored or enhanced 2600 acres of wildlife habitat in forests wholly or partly within the Lake Superior Basin. In these same forests, 750 acres of endangered or threatened species habitat were restored or enhanced, 200 acres of land were treated for noxious weeds, and soil/water resource improvements were made on another 125 acres.

St. Louis River Habitat Assessment. The Minnesota DNR, 1854 Authority, and Fond du Lac have cooperated in a St. Louis River assessment. The purpose of the assessment was to collect physical, chemical, and biological information necessary to implement management plans and/or special designations by the Minnesota DNR. This was a two-phase assessment. Phase I included identifying and mapping the physical characteristics of the river. Information gathered included GPS locations of stream features, channel width, river depth, and water temperature. Phase II consisted of establishing stations and collecting water quality information, invertebrates, and fish.

Lake Superior State University Takes Snapshot of Ecosystem Health. Nine faculty and staff and 25 students from Lake Superior State University's School of Biological Science and Department of Chemistry and Environmental Science are involved in a three-year $715,000 project to determine the health of the St. Marys River. The study, entitled "Biotic Integrity and Habitat Assessment within the St. Marys River Area of Concern," is designed to determine the health of the ecosystem in this river that connects Lake Superior to Lake Huron. The study looks at coastal marshes to determine the status of habitat and the wildlife that use it. The researchers

have been collecting biological samples and performing chemical analysis of samples taken from the water and bottomlands.

6.1.2 Native Species Rehabilitation/Protection

The following section describes progress in efforts to rehabilitate or protect native species in the Lake Superior Basin.

Herptile Monitoring Work in Progress. Reptiles and amphibians have been identified as a critical group of species to be monitored by the State of the Lake Ecosystem Conference and the LaMP 2000. Herptiles are sensitive to anthropogenic perturbations and chemical contaminants, and many species are in decline worldwide. Lake Superior is at the northern edge of the natural range of many herptile species, and thus changes in their abundance in the basin may be indicative of pending environmental changes elsewhere. They may also be particularly useful for monitoring in Areas of Concern to document progress in remediation and restoration.

In 2002, the Terrestrial Wildlife Committee commissioned a report by Gary Casper, Herpetologist for the Milwaukee Public Museum, to describe the status of herptiles in the Lake Superior Basin. In 2003, a herptile workshop was held in conjunction with the Society for Conservation Biology meeting in Duluth. To continue the development of a basin monitoring program, a joint United States/Canadian herptile monitoring project was funded in 2005.

Figure 6. Wood Turtle. Photo Credit: http://www.glfc.cfs.nrcan.gc.ca/landscape/herp_e.html.

Steve Hecnar, from Lakehead University in Ontario, and Gary Casper will lead the project which will develop and field test a basinwide amphibian and reptile monitoring program and data repository process. This will be done by selecting representative sampling sites in the Canadian and U.S. portions of the Lake Superior Basin. Components of the project include sampling site selection, intensive surveys, database development, and statistical analyses. The statistical analyses will utilize a proportion of area occupied model capable of incorporating data from existing monitoring programs in order to achieve basinwide analysis.

Results will be applicable throughout the Lake Superior Basin for use in amphibian and reptile habitat protection and restoration. The project will allow researchers to monitor 21 herptile species and determine trends in species occupancy. The ability to detect species declines or increases will have direct bearing on both aquatic and terrestrial habitat management for these species within the basin's forests, grasslands, wetlands, lakes, and streams.

Lake Superior Prey Fish Monitoring. Researchers at the University of Minnesota Duluth, U.S. Geological Survey (USGS), and partner Lake Superior fishery agencies completed year three of a four year project to develop methodology for a pelagic prey fish monitoring program for Lake Superior. Objectives of the project were to estimate the density and biomass of prey fish in Lake Superior, to determine the level of effort and budget needed, and to identify and

calibrate acoustic target strength for different prey species. Accurate estimates of forage fish biomass are critical to help agencies manage self-sustaining predator populations, primarily lake trout, and to better understand and predict ecosystem dynamics. Researchers have found that using a combination of trawl surveys and acoustics provides the best estimate of prey biomass and better coverage of the complex and spatially variable nature over the vast expanse of Lake Superior. In addition, through annual sampling in one area of the lake, they are also increasing their knowledge of annual variability in prey density. The same hydroacoustic technology was employed to assess the status of lake herring in Thunder Bay and Black Bay, Ontario, and the Apostle Islands, Wisconsin, during the 2005 fall spawning season.

Lake Superior's Lower Food Web. Last year, natural resource agencies conducted the most extensive biological sampling effort on Lake Superior in history. Six agencies from the U.S. and Canada coordinated efforts and shared resources to collect samples of organisms from microscopic plankton to fish in an effort to gain a thorough understanding of Lake Superior's lower food web. The six agencies with large research vessel and/or lower food web sampling equipment included Environment Canada, Department of Fisheries and Oceans, Ontario Ministry of Natural Resources, US EPA, WDNR, and USGS.

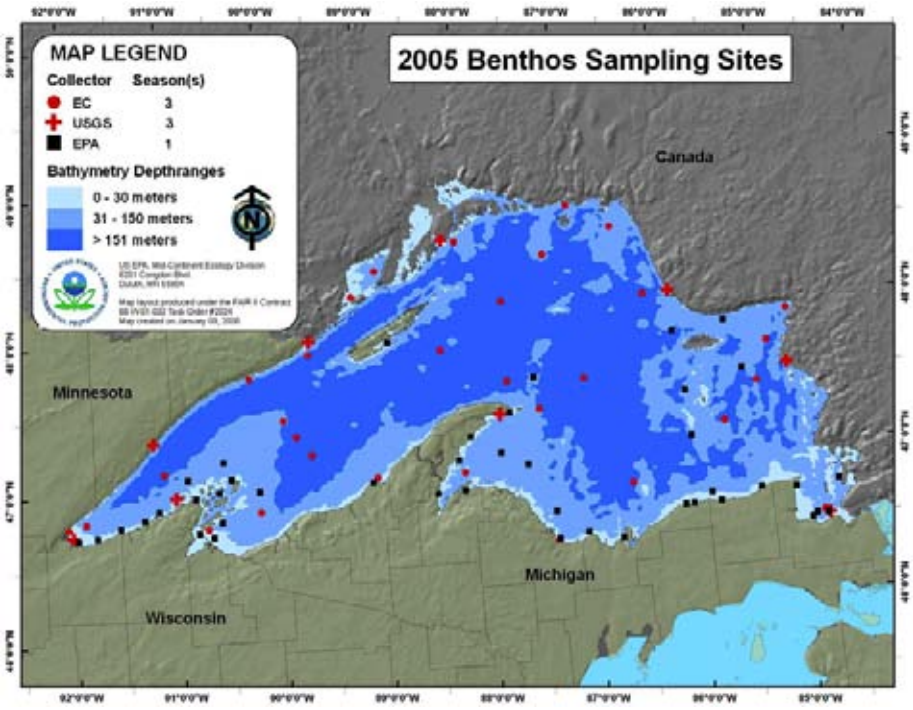

Figure 7. Locations and Depths of Zooplankton Samples Collected in 2005. Source: US EPA.

The survey components took place during spring, summer, and fall cruises. Objectives of the sampling were to describe seasonal biomass and abundance densities of phytoplankton, zooplankton, *Mysis* (tiny free swimming crustaceans), and *Diporeia* (tiny bottom dwelling crustaceans) across the lake, and to determine the production of these trophic levels if possible. Nearly 1,500 samples were collected which included 776 for zooplankton (animal plankton), 298 for *Mysis*, and 411 bottom samples. The range of locations and depths for zooplankton samples is shown in Figure 7. In addition, automated optical phytoplankton and zooplankton counters were towed by vessels and recorded data along transects totalling 1,000 km.

This collaborative and extensive sampling effort has resulted in significant progress toward understanding Lake Superior's food web. Many samples are being processed by various agencies; however, most zooplankton samples have yet to be processed. To complete the picture of the Lake Superior lower food level in a timely manner, additional funding is required to process these remaining samples.

There is a desire among agencies to establish a regular monitoring schedule for the lower food chain work. At one time, a rotating five-year cycle was mentioned whereby a focused effort would occur annually on each Great Lake. At this time, it is unclear whether agencies can commit to this type of long-term arrangement.

Lake Superior's Offshore Zooplankton Community 1998 to 2005

The US EPA's Great Lakes National Program Office has been monitoring the zooplankton populations of Lake Superior since 1992. Data collected from the past eight years during their spring and summer assessments of 19 deepwater stations (130 to 284 m) indicate that the offshore crustacean zooplankton community of Lake Superior is dominated numerically by the calanoid copepods *Diaptomus sicilis* and *Limnocalanus macrurus* and the cyclopoid *Diacyclops thomasi*. During the summer months, the cladocerans *Daphnia galeata mendotae* and *Holopedium gibberum* also appear in low numbers. Spring density of copepod adults and copepodites averages 1,100 organisms per m^3. Densities are higher in the summer (3,500 per m^3), primarily due to reproduction of diaptomid copepods. Crustacean zooplankton biomass increases from an average of 6.1 mg/m^3 in the spring to 12.5 mg/m^3 in late summer. During the past eight years, there has been relatively little change in the composition of the offshore zooplankton community of Lake Superior.

Fish production is closely linked to the availability of appropriately sized prey. The larvae of many planktivorous species are limited by the size of prey item they can swallow, which restricts them to feeding on small zooplankton during their first few months of life. As the fish grow, they switch to larger prey items. While the density of zooplankton in Lake Superior is low compared to that of the other Great Lakes, the size distribution pattern of the major species is appropriate to support the growth of planktivorous fish. The density of small (0.4 to 1.0 mm) cyclopoid copepods increases during the spring and summer months and is supplemented by the production of young diaptomids. While the density of the larger adult *Diaptomus sicilis* (1.5 mm) and *Limnocalanus macrurus* (2.5 mm) is lower, the larger individual sizes of these zooplanktons result in an increased biomass of prey for adult planktivores.

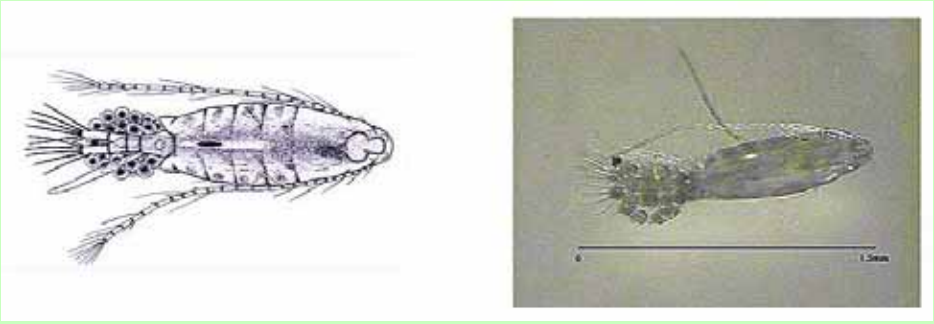

Figure 8. Adult *Diaptomus sicilis* (1.5 mm). Photo Credit: US EPA.

Status of Diporeia in Lake Superior

Over the past few decades, one of the most dramatic and enigmatic changes in the biotic community of the Great Lakes has been the decline of the deep-water amphipod *Diporeia spp*. This organism was once the dominant benthic taxa in offshore waters (> 30 m) of all the lakes. Recently, however, population declines have been documented in Lakes Michigan, Huron, Erie, and Ontario, and large areas in each of these lakes are now completely devoid of this organism (Dermott and Kerec 1997; Nalepa et al. 1998; Dermott 2001; Lozano et al. 2001; Nalepa et al. 2003).

Diporeia has long been considered a keystone species in the food web of offshore waters. It resides in the upper sediments and feeds on fresh organic material settled from the water column and, in turn, is fed upon by many fish species. Thus, it plays an important role in cycling energy from lower to upper trophic levels. Diporeia is high in lipids and therefore rich in calories, making it a valued food resource for fish. Recent changes in the condition, distribution, and abundances of several fish species have been attributed to the loss of this organism (Madenjian et al. 2003, Mohr and Nalepa 2005, Hondorp et al. 2005). One of the theories of the Diporeia decline relates to the appearance and spread of *Dreissena polymorpha* (zebra mussel) and *Dreissena bugensis* (quagga mussel). The observed declines in the lower lakes raise the question of whether similar declines may occur in Lake Superior.

Diporeia Trends in Lake Superior Unclear

A Great Lakes Diporeia workshop (Nalepa, et al. 2006) in the fall of 2005 brought together the multi-year survey findings of the following different surveyor groups: US EPA's Great Lakes National Program Office; US EPA's ORD-Duluth Mid-Continent Ecology Division; NOAA Great Lakes Environmental Research Laboratory; Dr. Mary Balcer, UW-Superior; and researchers at Michigan Technological University.

Evidence and discussion presented at the workshop suggest that zebra and quagga mussels may have a role in Diporeia decline in the other Great Lakes via food competition, toxic excretions, or mussel-caused environmental changes that increase susceptibility to disease, predation, pathogens, or oxygen levels in sediments. However, the absence of zebra mussels in deep offshore waters in western Superior suggests that the decline noted in this area may not be related to zebra mussels.

While the workshop concluded that a broad Diporeia decline in Lake Superior is not evident yet (not every study observed declines, see figure below), it recommended that agencies: 1) continue to monitor Diporeia, 2) combine datasets for analysis, and 3) examine the age structure in declining offshore populations to determine if Lake Superior is in the early stages of a decline similar to those reported in the other Great Lakes.

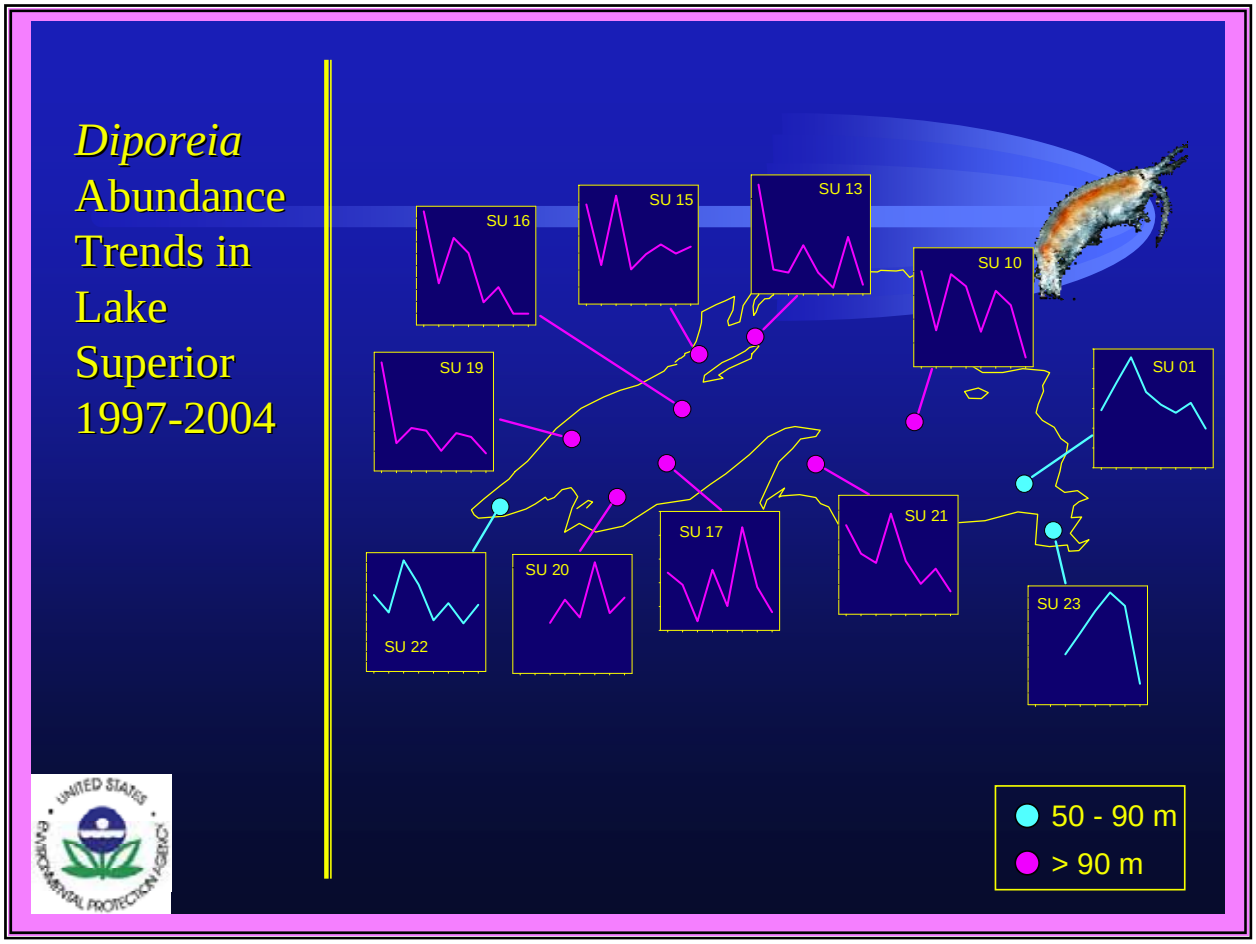

Figure 9. Diporeia Abundance Trends in Lake Superior 1997-2004. Source: David Rockwell, MS, US EPA; Mary Balcer, Ph.D., UW-Superior; Richard Barbiero, Ph.D., Grace Analytical Labs.

Mapping of Important Fish Habitat. Finding the relationship between habitat quantity and quality and fish production is an important quest as fisheries managers seek to put realistic expectations around how many fish Lake Superior can be expected to produce. By bouncing sound waves off the lake bottom and recording the strength of the return signal, the composition of the substrate can be determined. As sound waves are sent and received, location and water depth are simultaneously recorded, which allows scientists to create a geo-referenced map of the substrate. The final products of this acoustic mapping procedure are descriptions of current habitat conditions which will support decision making processes that seek to rehabilitate and sustain near shore fisheries. Our knowledge of what substrates (sand, clay, gravel, cobble) are present, in what surficial quantity, at what depth, and exactly where they are relative to other substrates or bottom features is slowly increasing.

The National Water Research Institute of Environment Canada and the USGS-Lake Superior Biological Station and others have applied their expertise in acoustic mapping surveys. Since 2002, 12 projects to map the distribution of substrates in specific areas of Lake Superior have been completed. Recent projects have addressed lake sturgeon, brook trout, walleye, and lake

trout habitat in near shore and tributary sites around the lake. Sea Lamprey Control is also mapping tributary and lentic habitat (11 sites) of sea lamprey larvae to improve control efforts. The mapped details will contribute to a large-scale Lake Superior GIS mapping exercise supported by the Great Lakes Fishery Commission that is underway to synthesize all available habitat information into a user-friendly product for resource managers working in the Lake Superior Basin.

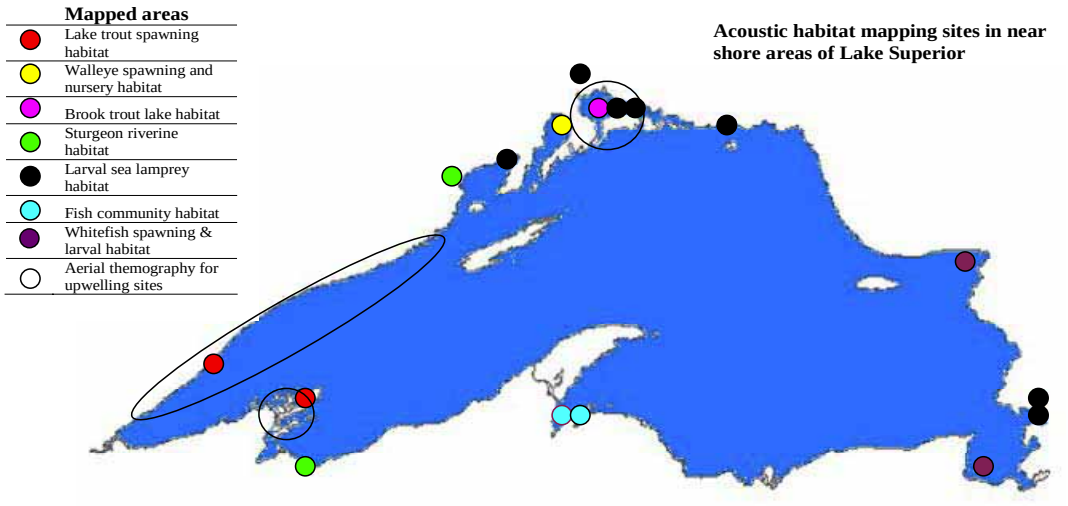

Figure 10. Acoustic Habitat Mapping Sites in Near Shore Areas of Lake Superior. Source: Aquatic Committee Co-chairs.

Individual Species Activities

Peregrine Falcon Update. The recovery of the peregrine falcon in North America has been called one of the most successful wildlife conservation projects in history. In a collaborative binational effort, non-profit organizations teamed with agencies and volunteers to recover populations of this dynamic bird of prey. In level flight, the normal speed for peregrine falcons is about 40 to 55 miles per hour. In a dive they can attain speeds in excess of 200 miles per hour as they attack their prey. The peregrine falcon was nearly extirpated in most of North America after World War II. The cause of the bird's decline was accumulation of organochlorine pesticides such as DDT in birds' tissues, which resulted in eggshell thinning and breakage during incubation. The pesticide DDT was banned in Canada in 1970 and in the United States in 1972. As a result of the ban, eggshell thinning subsided and the population recovered to the point that the species was delisted from the *Endangered Species Act* in the United States. The peregrine falcon remains designated as "Threatened" under the *Species At Risk Act* in Canada.

The Lake Superior Basin is home to the majority of known peregrine falcon nest sites and territories in Ontario. In 2005, Ontario conducted intensive nest and territory searches as part of a five-year national peregrine falcon survey in Canada. The Lake Superior Basin effort was coordinated by the Thunder Bay Field Naturalists in conjunction with the Ontario Ministry of Natural Resources (OMNR) and many volunteers. Survey results indicate a continued recovery of falcon numbers, with 43 active territories being located in the basin (56.6 percent of the

provincial total). This is up from 31 territories recorded during the 2000 Ontario survey. A minimum of 79 chicks were fledged in the basin during 2005, the highest number recorded to date. Of these, 47 chicks were banded, bringing the total number of chicks banded on the Ontario side of the basin over 10 years to 319.

Within the U.S. portion of the Lake Superior Basin, 15 pairs of peregrine falcons nested in 2005. Twelve pairs nested in Minnesota, 3 pairs in Michigan, and none in Wisconsin. A minimum of 26 chicks were fledged in the U.S. basin during 2005, and of these a total of 6 were banded.

Figure 11. Peregrine in Flight. Photo Credit: USFWS.

Lynx Update. The Superior National Forest is continuing to perform National Lynx Detection Surveys and is initiating snow-track protocols. Lynx DNA collection studies implemented in 2002 show that a minimum of 42 individual lynx genotypes exist within the state, and this is likely a small proportion of the actual numbers of lynx in the State of Minnesota this year. Lynx DNA collection efforts will continue.

Figure 12. Lynx Kitten. Photo Credit: http://www.nrri.umn.edu/lynx/index.html.

The Natural Resources Research Institute, University of Minnesota, Duluth, in conjunction with the Superior National Forest and U.S. Fish and Wildlife Service, initiated a radio tracking project for lynx in Minnesota in 2003. Twenty-five different adult and yearling lynx have been radio-collared as of 2005. The radioed animals consist of 11 males and 14 females. Box traps are used to capture the lynx.

Researchers have located multiple dens and kittens. In 2004 and 2005 there were 23 lynx kittens individually identified at den sites. Observers have documented that at least 14 of the kittens born during the two year period survived the most precarious first few months of life and were doing well going into their first winter. If all goes well, these young lynx could have litters of their own in the spring of 2006.

Figure 13. 10-Month-old Lynx Kitten in the Snow. Photo Credit: http://www.nrri.umn.edu/lynx/index.html.

Native Species Rehabilitation. Since the publication by the Great Lakes Fishery Commission of lakewide rehabilitation plans for lake trout, brook trout, lake sturgeon, and walleye (http://www.glfc.org), fisheries management agencies around the lake have continued efforts to protect and re-establish these four species in habitats where they were once common.

Lake Trout. One of the greatest success stories for the Great Lakes is the rehabilitation of lake trout populations in Lake Superior that resulted from stocking, sea lamprey control, and fishery harvest regulations. Currently, self-sustaining lake trout populations are present in most areas of Lake Superior. To ensure the long-term sustainability of lake trout stocks in the face of continued recreational and commercial fishing, fishery managers must accurately estimate the maximum level of mortality that populations can withstand without overexploitation/depletion.

Researchers at the University of Wisconsin–Stevens Point are working with WDNR to develop a model that will estimate the maximum sustainable total annual mortality rate for lake trout and minimize the risk of overexploitation. They have developed a model of an age-structured population of lake trout to mimic the real population. Previously developed statistical catch-at-age and stock-recruitment models to estimate abundance, recruitment, natural mortality, fishing mortality, gear selectivity, and catchability of lake trout in Wisconsin waters of Lake Superior were updated with the most recent WDNR data. Natural mortality was modeled as a combination of a fixed base rate and a density-dependent sea lamprey induced mortality rate. Recruitment was simulated as a density-dependent function of adult lake trout abundance. Lastly, various commercial and recreational harvest allocations were modeled to account for different patterns of selectivity between large-mesh gill nets, the predominant commercial fishing method, and angling, the predominant recreational fishing method. The model will help predict effects of different levels of commercial and recreational fishing mortality on the

population. The results of the simulations will be analyzed to estimate the extinction risk, the time to extinction, and the maximum sustainable harvest rate for the fishing mortality rates.

The model is currently designed for the eastern Wisconsin waters of Lake Superior, and is expected to be used by WDNR to predict how lake trout populations will react to various allocations of commercial and recreational fishing mortality and to estimate the maximum sustainable level of lake trout mortality. The model may ultimately be used by fishery managers throughout Lake Superior.

Brook Trout. *Supporting Management Actions* – Ontario, Wisconsin, and Michigan set new regulations for coaster brook trout in Lake Superior since 2003. Coaster brook trout regulations in the lake are now similar for all jurisdictions on Lake Superior. Ontario's regulations included tributaries to Lake Superior. These regulation changes are intended to protect brook trout through maturity and multiple spawning seasons in hopes of increasing reproductive success and fish abundance in the lake and its tributaries. Coasters at Isle Royale, Michigan, are fully protected through catch and release only regulations.

WDNR Bark River Brook Trout Experiment

This experiment attempts to increase brook trout abundance so that some fish will again enter Lake Superior and become coasters. It includes seeking ways to improve watershed health that restores in-stream conditions, habitat improvement at critical spawning sites, beaver control, restrictive angling regulations and monitoring population changes.

Figure 14. A crew surveys eroding stream banks. Photo Credit: WDNR.

WDNR and U.S. Fish and Wildlife Service completed the Wisconsin Lake Superior Brook Trout Plan in summer 2005. The plan's goal is "to protect and improve the self-sustaining brook trout populations and their habitat in Wisconsin's Lake Superior Basin, and attempt to rehabilitate or establish several populations that exhibit life history diversity (both stream resident and migratory "coaster" life history types). The plan can be read at http://www.fws.gov/midwest/ashland/pdf/Restorecoasterbrooktrout.pdf. The success of this plan will depend on a long-term commitment to manage watersheds to protect and restore tributary habitat. See the Watershed Initiatives section for more information on implementation activities.

Rehabilitation Activities – Rehabilitation for brook trout has followed several pathways: 1) engagement of researchers and local communities in the dissemination of information; 2) establishment of conservative fishing regulations lakewide, as described above; 3) continuance of monitoring, assessment, and research of brook trout in the lake and tributary habitats; and 4) habitat restoration.

In Ontario, Canada Ontario Agreement (COA) funding supported five coaster brook trout monitoring, assessment, and research initiatives. Projects include: identifying the range of coasters in 15 streams that had historic populations, collecting information on the timing and frequency of out-migration from tributaries, linking riverine habitats with production of coaster brook trout in the Nipigon Bay watershed, and aerial infrared photography surveys to identify areas of groundwater upwelling or springs which are potential coaster spawning sites in the Nipigon Bay area.

Figure 15. Coaster Brook Trout. Photo Credit: Ontario Ministry of Natural Resources.

The U.S. Fish and Wildlife Service and the Minnesota DNR have contracted to utilize aerial infrared photography to identify significant ground water contributions to tributaries and along the Lake Superior shoreline of Wisconsin and Minnesota. Survey work continues to determine the presence, relative abundance, and biological characteristics of coasters in many areas of Lake Superior, including numerous rivers in Michigan, Wisconsin, and Minnesota, and in streams and nearshore waters of the Keweenaw Bay Indian Community and Red Cliff Indian Reservation and Isle Royale. Stocking and evaluation of stocked fish are underway on the Grand Portage Band, Red Cliff Band, and Keweenaw Bay Indian Community Reservations, as well as in several streams in Michigan and one in Wisconsin.

Figure 16. Impaired Habitat at a Stream Crossing. Photo Credit: Ontario Ministry of Natural Resources.

Minnesota DNR has surveyed road crossings in portions of tributaries to Lake Superior that are accessible to coasters to determine if and what type of maintenance might be required to allow for fish passage during both spring and fall spawning runs. Projects targeted at restoring fish passage and limiting impairments to habitat are underway in all States. Trout Unlimited has coordinated a multi-partner project on five streams tributary to Lake Superior in the Bayfield Peninsula of Wisconsin to improve fish passage at road crossings or culverts, restore stream bank and bluff stability, reduce peak flow during heavy snowmelt and rainfall events, and stabilize in-stream habitat for potadromous species.

Walleye. OMNR's efforts to rehabilitate the largest walleye stock in Lake Superior (Black Bay stock) continue with the development of a Black Bay Walleye Stocking and Assessment Plan. Supporting work has included creation of a genetic profile of remnant and historical walleye stocks, hydro-acoustic mapping to examine historical Black Bay walleye habitat, and stocking of 100,000 fingerlings in 2004 and 200,000 in 2005. Discussion with Sea Lamprey Control and others is underway to determine the fate of the timber dam on the Black Sturgeon River, which has blocked spawning migration up the river for decades.

Walleye assessments to determine spawning populations' size and characteristics are conducted by WDNR and Minnesota DNR in the St. Louis River, Minnesota-Wisconsin, in the Kakagon River, Wisconsin, by the Bad River Band, and by Michigan DNR in numerous Lake Superior tributaries. In Michigan, abundance data is being related to the amount and quality of habitat.

To help address the Lake Superior Walleye Rehabilitation Plan (http://www.glfc.org/lakecom/lsc/lschome.php#pub) objective for the Bad River, Wisconsin, walleye population, the Bad River Band has stocked 500,000 fingerlings and 4 million fry since 2004.

The Great Lakes Indian Fish and Wildlife Commission has completed studies of contaminants in walleye and lake sturgeon in Lake Superior.

Lake Sturgeon. Investigation into the status of lake sturgeon in Lake Superior has covered 15 of the 22 known historic spawning rivers. This work has occurred or is in progress in the Kaministiquia, Black Sturgeon, Nipigon, Pic system, White (Ontario), Batchawana, Chippewa, and Goulais Rivers in Ontario, the Bad and White (Wisconsin) Rivers, and Chequamegon Bay in Wisconsin, the St. Louis River, Minnesota/Wisconsin, the Pigeon River, Minnesota-Ontario, and the Sturgeon and Ontonagon Rivers, and Portage Lake in Michigan. Lake sturgeon status (spawning activity, recruitment, movement) in seven of the rivers has been completed, and genetic profiles for each population have identified the relatedness and tributary fidelity of these populations.

Figure 17. Sturgeon Population Assessment. Photo Credit: Ontario Ministry of Natural Resources.

Figure 18. Fluctuating Water Levels May Strand Spawning Sturgeon. Photo Credit: Ontario Ministry of Natural Resources.

Habitat related work includes assessing the impacts of hydro power generation strategies on habitat and reproductive success through examination of river habitats and sturgeon behaviour associated with current and proposed hydro power generation on the Kaministiquia River, in Ontario. A multi-year agreement with Ontario Power Generation has been implemented to study these impacts (water levels and flow rates) on sturgeon habitat and reproductive success and behaviour.

Mapping and description of lake sturgeon habitat in the lower Bad River, Wisconsin, and Kaministiquia River were completed and will support studies of habitat preferences of juvenile sturgeon. Habitat preference of stocked sturgeon is being studied in the Ontonagon River, Michigan.

In 2004, the second of three planned Great Lakes Lake Sturgeon Coordination Meetings was held. Sturgeon researchers and managers from around the Great Lakes Basin continue to assess sturgeon status and communicate rehabilitation progress and to plan and coordinate next steps through this venue.

Juvenile Lake Sturgeon Habitat Research Project. The Grand Portage Band received funding and is working with the 1854 Authority, U.S. Fish and Wildlife Service, Fond du Lac Band, Minnesota DNR, and the U.S. Geological Survey to investigate habitat use of young lake sturgeon in the St. Louis River and presence of lake sturgeon in the Pigeon River. Lake sturgeon have been captured and tagged with a combination radio/acoustic transmitter and will be tracked for one year. This information will allow managers to identify, protect, and/or rehabilitate critical habitats utilized by juvenile lake sturgeon.

6.1.3 Nuisance Species Developments/Efforts

Many Great Lakes researchers and managers consider invasive exotic species the single most important and immediate threat to Great Lakes ecosystems and their food webs. The following section describes accomplishments related to prevention and control of invasive species.

Developing a Landscape-Scale Invasive Free Zone. The goal of this long-term project, initiated in 2005, is to create an invasive-free zone by eliminating non-native invasive terrestrial and emergent aquatic plants on the Whittlesey Creek National Wildlife Refuge, associated

Viruses; bacteria; parasites; red, green, & brown algae; phytoplankton; zooplankton; amphipods; oligochaetes; snails; flatworm; mussels; fish

Source: Great Lakes Aquatic Nonindigenous Species List, NOAA

Ballast Water Regulation in Michigan

To prevent any new aquatic invasive species entering the Great Lakes through Michigan's ports via ballast water discharge from ships (the primary pathway historically), Michigan enacted legislation in 2005 requiring all oceangoing vessels engaging in port operations in the state to obtain a permit from the Department of Environmental Quality (MDEQ). In addition, the legislation required the MDEQ to facilitate formation of a Great Lakes Aquatic Nuisance Species coalition and to seek agreements with other states in the Great Lakes to implement on a basinwide basis water pollution laws that prohibit the discharge of aquatic nuisance species from oceangoing vessels. The MDEQ is finalizing the permit and facilitating the Coalition in 2006, toward a January 1, 2007 implementation date.

Michigan Public Act 33 of 2005 reads: "Beginning January 1, 2007, all oceangoing vessels engaging in port operations in this state shall obtain a permit from the department. The department shall issue a permit for an oceangoing vessel only if the applicant can demonstrate that the oceangoing vessel will not discharge aquatic nuisance species or if the oceangoing vessel discharges ballast water or other waste or waste effluent, that the operator of the vessel will utilize environmentally sound technology and methods, as determined by the department, that can be used to prevent the discharge of aquatic nuisance species. "

A general permit for port operations in Michigan by ocean-going vessels is under development by the MDEQ-Water Bureau in 2006. Extensive public consultation and consultation with other states is occurring on the permit. The permit will apply to all ocean-going vessels that a) engage in port operations in Michigan and do not discharge aquatic nuisance species into the waters of the state; b) discharge ballast water treated by one or more of the ballast water treatment methods determined by the MDEQ to be adequate treatment; and c) have not been determined by the MDEQ to need an individual permit. Treated ballast water will be authorized to be discharged from ocean-going vessels specified in individual certificates of coverage under the general permit. Ocean-going vessels will need a permit for port operations in Michigan starting January 1, 2007, to protect Michigan from new aquatic invasive species.

private lands, and adjacent U.S. Forest Service property at the Northern Great Lakes Visitor Center (720 acres in total). Native plant communities will also be restored. Monitoring via chronological GPS mapping and GIS analysis, photo-point imagery, and plant species density ratings will document treatment and restoration success.

Thus far, twenty-one species have been identified and mapped on approximately 600 acres. Mapping will be completed in 2006, and treatment and restoration plans will be developed. In addition, control has been initiated on nine species, and the University of Wisconsin-Extension is working on interpretive planning. Invasive species control and habitat restoration will continue and be expanded as funding allows.

Project partners include numerous private landowners, National Park Service Great Lakes Network Office-Exotic Plants Management Team, U.S. Forest Service, Great Lakes Indian Fish and Wildlife Commission, Northland College and Sigurd Olson Environmental Institute, WDNR, and the University of Wisconsin-Extension.

Aquatic Invasive Species. Most invasive organisms that have entered Lake Superior have originated from marine and estuarine environments in Europe and Asia. They have arrived here by various human transport systems, primarily ship ballast water. The exchange of ship ballast water in Great Lakes waters remains a serious concern. This includes ships entering the Great Lakes with no ballast water on board (NOBOB), as the sludge in their ballast tanks can hold organisms which may be discharged with ballast water that they may take on and exchange in the Great Lakes system. The Superior Work Group continues to encourage adherence to best management practices to reduce the risk of exotic species introduction.

All Lake Superior ports are at risk of receiving aquatic nuisance species (ANS) if vessels discharge the contents of ballast tanks while in or near the port. In Ontario, the imminent re-establishment of interlake ship traffic between Michipicoten Bay and the lower lakes puts the bay's aquatic ecosystem under threat. Presently Superior Aggregates Ltd., a company owned by Carlo Companies, a U.S. road-building contractor, is seeking permits to continue developing an aggregate extraction operation on the backshore area adjacent to Michipicoten Harbour. The company has stated its intent to ship the aggregate by lake carrier to lower lakes ports. The Superior Work Group has communicated its concerns to the company and offered suggestions to eliminate the potential transfer of non-native organisms between lakes.

Recently an addition was made to the list of known aquatic invasive species in the Lake Superior Basin. In December 2005, an adult Chinese mitten crab was found on a Thunder Bay hydro plant water intake screen. These crabs have successfully established themselves in marine coastal areas in North America and Europe and use both salt and fresh water habitats to complete their life cycles. They have not adapted to a wholly fresh water environment in other areas and are not expected

Figure 19. Adult Chinese mitten crab found on a Thunder Bay hydro plant water intake screen. Photo credit: Ontario Ministry of Natural Resources.

to do so in the Great Lakes. This discovery re-emphasizes the risks associated with ballast water exchange within the Great Lakes.

Nuisance species that continue to expand their range in Lake Superior include the fish Eurasian ruffe and round goby, and the spiny water flea (*Bythotrephes longimanus*). Ruffe have spread from the point of first discovery in Duluth, Minnesota, along the south shore of the lake and into local tributaries as far east as Marquette Harbour, Michigan. An isolated population is also being monitored in Thunder Bay, Ontario. The round goby is known to be established in Duluth-Superior Harbour, Minnesota/Wisconsin, and Thunder Bay Harbour, Ontario; recently it was found in the Amnicon River, Wisconsin. Michigan has detected round goby in the live bait purchase of at least one angler in the Upper Peninsula. Zebra mussels remain locally associated with multiple harbours and nearby embayments.

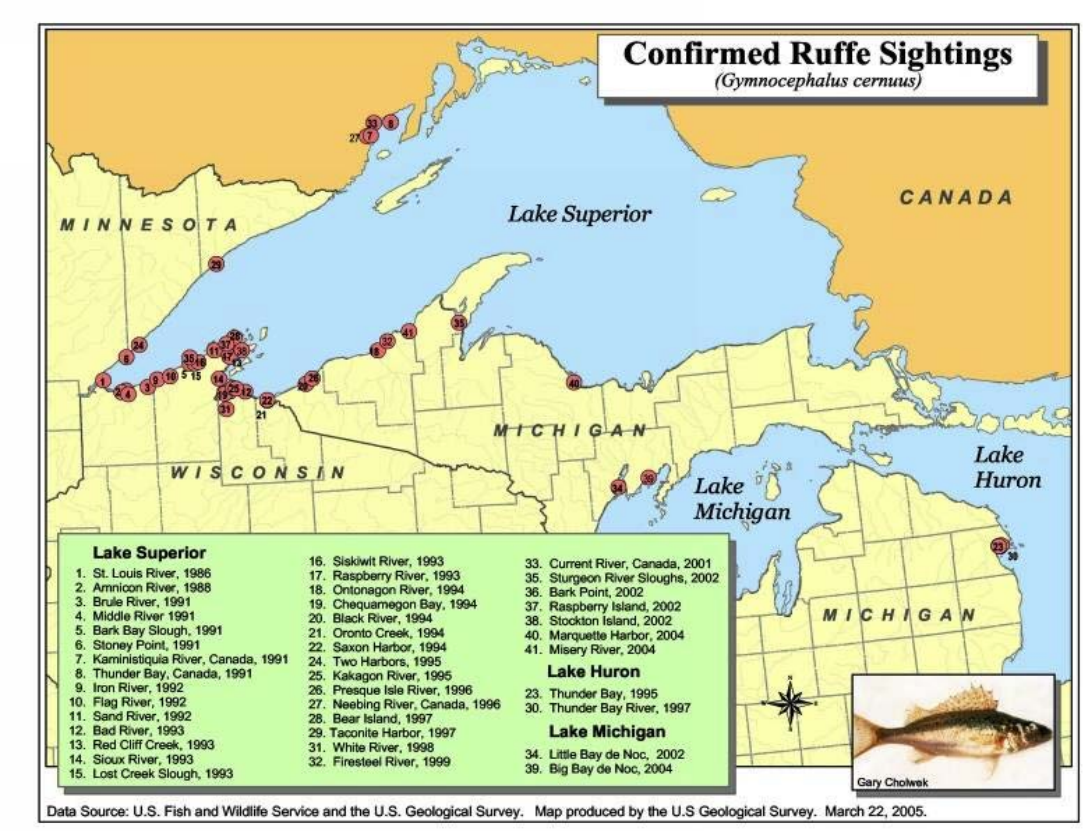

Figure 20. Confirmed Ruffe Sightings in the Great Lakes. Photo Credit: USFWS and USGS.

To monitor fish community structure, fish community surveys were continued in Thunder Bay Harbour and four U.S. tributaries colonized by ruffe and other ANS. In April 2005, the University of Wisconsin-Extension sponsored an ANS awareness conference for lake associations and resort owners in northwest Wisconsin. Over 60 participants attended the conference near Cable, Wisconsin. In October 2005, the Great Lakes Indian Fish and Wildlife Commission hosted a conference to improve regional (MN, WI, MI) cooperation and collaboration among all organizations actively engaged in managing ANS in the upper Great

Lakes Basin. Educational materials (pocket guides, signage at boat landings, brochures, videos, etc.) continue to be produced by Sea Grant, Federation of Ontario Anglers and Hunters, and others. These materials are distributed throughout the Lake Superior Basin to help prevent the introduction and to control the spread of ANS.

Emerald Ash Borer Confirmed in Lake Superior Basin. The emerald ash borer (EAB) is a non-native beetle from Asia that invades and readily kills ash trees. In the Great Lakes region, that includes three common and important species: white, black, and green ash. EAB was first reported in the U.S. in 2002 in the Detroit and Windsor areas. However, surveys and research since that time indicate that the beetle has been present in Michigan for a much longer time, perhaps since the early 1990's. EAB has proven to be a tremendously effective tree killer, with estimates of 15 million dead trees at this time. Spread is a major concern, and numerous outlying populations have been located throughout the Lower Peninsula of Michigan, northwest Ohio, and in northeastern Indiana.

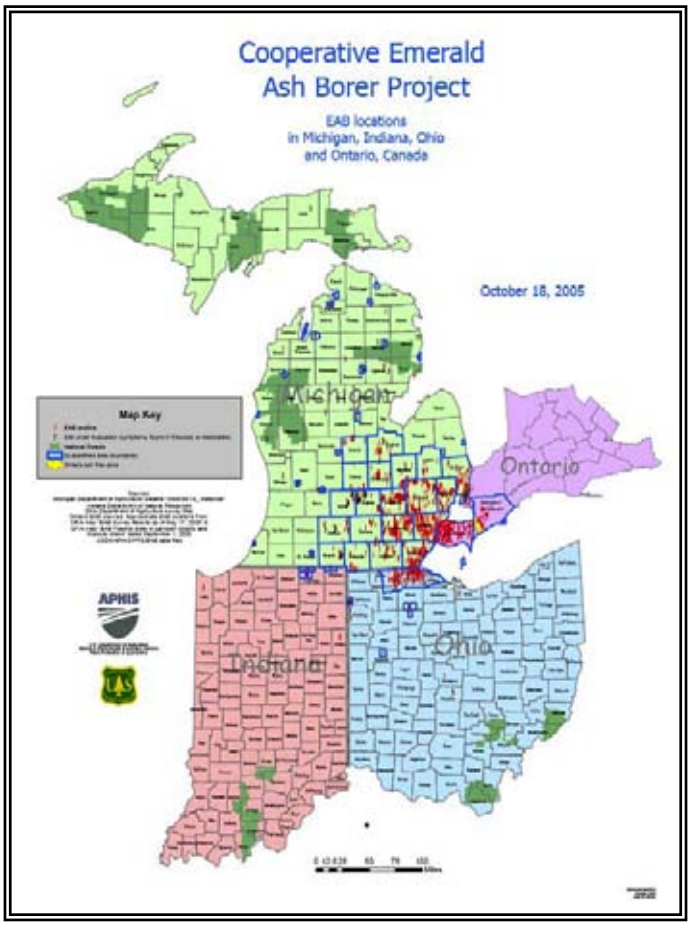

Figure 21. Emerald Ash Borer Locations. Photo Credit: USDA.

In September 2005, an introduction was also confirmed in Michigan's eastern Upper Peninsula within the Lake Superior Basin. Almost all of the outlying infestations have been traced back to firewood introductions from the original core area of southeast Michigan. Further surveys are underway, although a viable trap or attractant has not yet been discovered. This makes finding new introductions difficult. At this time, the overall program goal is to contain the infestation and eliminate the long distance spread of infested firewood. A number of agencies are evaluating tools that might be used to limit the movement of firewood. Managers hope that this will provide researchers time to develop viable management strategies.

Sea Lamprey Program. Sea lamprey management and control activities include laboratory experimentation of new control and management techniques. The program is committed to a number of different control techniques that support the integrated management (lampricide treatment, sterile male release, trapping, research into pheromone attractants) of sea lampreys in the Great Lakes. Adult lampreys are trapped annually in about 20 Lake Superior tributaries as a source for the Sterile Male Release program as well as to monitor success in suppressing sea lampreys in the lake. The Sea Lamprey Control program has added additional treatment efforts since 2001 to reduce sea lamprey abundance in the basin, and 23 streams and 3 lentic areas are targeted during 2006 for lampricide treatment in Lake Superior. The program is making significant progress towards determining what stream and lake habitats are important nursery areas for larval sea lamprey and therefore may make the biggest contributions to the adult parasitic stock in the lake. Acoustic habitat mapping to inventory key areas offshore of major sea lamprey producing tributaries has resulted in the treatment of several lentic areas since 2004, and this work continues. This work has saved additional thousands of pounds of lake trout, which significantly contributes to lake trout recovery in Lake Superior. Additionally, work is being directed at determining which streams contribute lampreys as survivors of stream lampricide treatments to target more treatment effort at likely sources where increased fish wounding has been reported.

6.1.4 Education/Outreach Initiatives

The following section discusses a few initiatives related to outreach and education efforts.

Wisconsin State, County, and Private Forest Certifications. In June 2005, Wisconsin received certification of sustainable management for privately owned, non-industrial forestland enrolled in the state Managed Forest Law (MFL). Forests owned by Wisconsin counties received certification in March 2005, and state-owned forests were certified in summer 2004. Nearly 5 million acres of forest are certified as sustainably managed in Wisconsin statewide. Forest certification is a process in which forest landowners undergo an audit of their practices by an independent third party organization.

The Great Wisconsin Birding and Nature Trail. This initiative will develop a mapped auto trail that will be statewide when complete. It is a project of the Wisconsin Bird Conservation Initiative, with leadership from the WDNR's Endangered Resources Program. The Wisconsin Department of Tourism produced a viewing guide for the Lake Superior and Northwoods region in 2004. For more information, visit www.wisconsinbirds.org/trail/overview.htm.

Bird's Eye View of Marquette County Shoreline on Central Lake Superior Watershed Partnership's Website. A Lake Superior "Aerial Shoreline Viewer" has been developed by the Central Lake Superior Watershed Partnership as part of a state funded coastal management effort. You can use the viewer to see the Lake Superior shoreline of Marquette County from an altitude of 500 feet or 1,000 feet. The Central Lake Superior Watershed Partnership worked with Benchmark GIS and the Bayfield County Land Records Department in the creation of this unique application, which is located at http://www.superiorwatersheds.org/shorelineviewer.asp.

6.2 CHALLENGES AND NEXT STEPS

The Habitat, Terrestrial Wildlife, and Aquatic committees have identified a number of challenges as we move forward in the implementation of the LaMP for Lake Superior. In general, all committees will continue to encourage projects by partner agencies and governments which further the objectives of the LaMP. All the agency partners are acting within their areas of jurisdiction with the good of the Lake Superior Basin in mind. Many of the committees' and partners' accomplishments are highlighted in this report. The committees will remain focused on forwarding the message, "complete all projects with the big lake in mind."

In the new LaMP Chapter 6, representing the consolidation of four chapters of the LaMP 2000, the committees identify five broad action areas: Information Gathering, Monitoring, Communication, Planning, and Stewardship. Taking effective actions in these areas can be said to represent the overall challenges to achieving a sustainable Lake Superior ecosystem that is a global model for resource management.

More specifically, active and continuous *information gathering* is required to help us understand and piece together the intricacies of the complex relationship between living organisms and their physical environment. *Monitoring* may take many forms and is ultimately designed to direct management activities and policy development. Monitoring of population trends (change, stability), or research-oriented monitoring to gain an understanding of the cause and effect of specific actions on species or habitats, or why a project was a success or failure, will provide sign posts to improve future management within the lake basin. Together these actions will provide insight and knowledge that can be communicated to governments, policy makers, planners, managers, and citizens of the basin. This will enable informed and effective *communication* about the links between land and resource use and ecosystem health with industry, business, landowners, and the public. Moving toward actively *planning* at a basinwide scale will assist in addressing the gaps in, and impediments to, sustainable resource management of land and water resources, help speak to the needs of today, and prepare us for future challenges. Finally, addressing *stewardship* needs will help foster the development of a healthy basin ecosystem that is resilient to perturbations from human activities and provides a broad range of sustainable benefits to its citizens. This category of active stewardship actions includes those "on-the-ground" activities that most directly impact the ecosystems that make up the basin.

The challenge of protecting and preserving Lake Superior and its basin require a long term approach by governments, industry, non-governmental organizations, and individuals. In 2004 the committees noted a number of significant needs that, if successfully addressed, would make important contributions to the LaMP goals related to the Lake Superior ecosystem and ultimately human health. While these needs remain, progress has been made on many of them.

Over the next two years, the committees and partner agencies have identified a number of steps that will help us begin to meet the needs and challenges described above. Future accomplishments continue to be dependent upon commitments by governments and other organizations, including individuals, to support the science, resource management, and legislative activities that will protect and restore the basin. During the 2006-2008 reporting

period, the committees will continue to support, resource, and seek funds and partners for presently occurring projects and issues, new projects, and emerging issues.

6.2.1 Information Gathering

- *Challenge: Map and quantify critical habitat for species of interest to management agencies.*

Next Step: Agencies will continue to conduct projects to describe, quantify, and map habitat (substrate and water depth) in areas of important fish habitat, as resources become available. Thus far, funding for these efforts has been piecemeal both in terms of location and species focus and is dependent upon individual agency interest and needs. A comprehensive lakewide effort would be of great benefit to generate information that will help agencies develop fish abundance goals based on the quantity of critical habitat throughout Lake Superior.

- *Challenge: Fund continued monitoring efforts for invasive species and fish community changes and status*.

Next Steps: 1) Support the continuance of research to examine the feasibility of using sea lamprey pheromones as an additional tool for control and management of sea lamprey; 2) Recommend that agencies attempt to develop protocols and obtain resources needed to monitor all areas of the lake that are at high risk (upper St. Marys River, all ports of call by lake carriers, baitfish harvesters) to aquatic nuisance species establishment; 3) Support proactive efforts to assess and describe fish community composition that will facilitate agencies ability to predict or evaluate changes due to introduced species.

- *Challenge: Prevent invasion and transport of non-native species within the Lake Superior Basin.*

Next Steps: 1) Continue educational and voluntary efforts to prevent introduction of aquatic nuisance species; 2) Identify and implement practices that reduce the potential for introduction of aquatic nuisance species, such as ballast water treatment or regulatory measures that prevent transport of species to or from Lake Superior.

- *Challenge: Provide ongoing support and maintenance of the geographic database and projects associated with the Lake Superior Decision Support System (LSDSS).*

Next Steps: This information is essential to the effective implementation of the LaMP, as it provides natural resource information to decision makers. One of the databases associated with the LSDSS contains information on important habitat conditions in the Lake Superior Basin and has been used to produce a map of important habitat in the basin. The Habitat Committee has recently undertaken a revision to the map and its accompanying habitat site information databases. This effort will include reviewing the map and attempting to gather additional information about the sites already listed as well as contacting state, federal, and tribal agencies to identify additional sites that are not currently on the map. In addition, the information gathered will be incorporated into the Site Explorer kiosks that are located at six sites around the

basin. This work will assist the committee in meeting another of the challenges identified in the LaMP 2004, to fill information gaps on the status and trends of habitat conditions in the Lake Superior Basin and develop management recommendations to protect and restore important habitat sites.

- *Challenge: Expand knowledge of inland and aquatic systems and the human induced perturbations that may have changed or limited their productivity.*

Next Step: 1) Identify contacts and consolidate information on inland aquatic resources to be reported for LaMP 2008; 2) Coordinate and develop partnerships among governmental agencies at all levels, and among local and regional road commissions, and secure resources needed to correct road crossings that are improperly functioning and limit the productivity of aquatic resources.

- *Challenge: Describe baseline aquatic conditions and restore aquatic habitat related to mine exploration, present sites and future development*. Mining exploration and interest in development in the basin is increasing. Resource management agencies lack baseline information on aquatic communities needed to adequately address environmental issues related to mine development or to evaluate changes that may occur if mines are constructed.

Next Steps: Encourage agencies to seek funding for information gathering activities that will provide baseline environmental conditions to address environmental issues related to mine development or to evaluate changes that may occur if mines are constructed.

6.2.2 Monitoring

- *Challenge: Establish agency support for and maintenance of long-term biota and habitat monitoring programs*.

Next Steps: Support the 2006 lower trophic level monitoring effort for Lake Superior and advocate for establishment of a long- term, partnership-based lower trophic level monitoring program. Two important monitoring program efforts (acoustic surveys for prey fish and lower trophic level surveys) have been designed and successfully tested. Agencies are now challenged in their ability to institutionalize these efforts as monitoring programs capable of establishing long term data sets. Diporeia monitoring by agencies should continue with combined analysis of all data sets to determine Diporeia status in near and off shore habitats in Lake Superior compared to the other Great Lakes.

Next Steps: Support the development and implementation of a partnership to develop a basinwide monitoring program for herptiles (see description of accomplishment related to herptiles in the Native Species Rehabilitation/Protection section, above).

Next Steps: The Terrestrial Wildlife Committee will focus on medium-sized carnivores (see "Medium-Sized Carnivore Monitoring" sidebar) and breeding bird monitoring.

Next Steps: Monitoring land use change is receiving growing attention in the Lake Superior Basin and nationwide. Land use change is the paramount issue affecting all natural resources, and decisions made today will effect fish and wildlife populations far into the future. As more habitat is lost to development, wildlife populations will most likely decline. The TWC and Habitat Committees propose the development of a method by which land use change can be monitored over time in order to track this issue as we work toward LaMP implementation.

Next Steps: The Great Lakes Environmental Indicators (GLEI) project has provided baseline information for a variety of wetland ecosystems and high energy shorelines in the U.S. Lake Superior coastal region. These efforts focused on many important biological communities, PAH contamination in sediments, and landscape characterization in the basin. Some efforts are moving forward to provide information for the Canadian portion of the coastal region as well. In order to make best use of the data that has been gathered, infrastructure needs to be developed to periodically monitor a suite of the parameters gathered as part of the GLEI effort. These data would provide the information necessary to inform managers as well as the public about whether coastal conditions are improving or declining. Moreover, an

Medium-Sized Carnivore Monitoring

Monitoring medium-sized carnivores is one of the monitoring goals of the Lake Superior LaMP. Yet this diverse group of mammals is comprised of secretive and often solitary species which are difficult to count. Thus, techniques to monitor medium-sized carnivores are usually labor intensive and expensive.

The integration of non-invasive survey techniques and molecular ecology may be able to solve some of these monitoring dilemmas. Pioneering work by Bronwyn Williams, graduate student at Michigan State University, developed a technique to monitor fishers and martens on the Ottawa National Forest within the Lake Superior Basin. This technique involves the use of a hair snare in which animals are enticed into a wooden structure on a tree with glue pads and bait inside. As the animal reaches for the bait it brushes against the glue pads and a few hairs are pulled out. These hairs can then be either field identified or sent to a genetics lab for positive identification.

This technique is now being applied as one of the first large-scale monitoring efforts in Wisconsin for American marten. This collaborative effort between USFS, GLIFWC and WDNR is designed to obtain distributional data on martens for northern Wisconsin, an area almost entirely in either the Lake Michigan or Lake Superior Basins. Jonathan Gilbert, GLIFWC wildlife biologist and the U.S. Co-Chair of the Wildlife Committee of Lake Superior, is leading the effort on behalf of the GLIFWC. He is hopeful that, if this technique works for martens in Wisconsin, it can be adapted for use in the Lake Superior Basin.

Figure 22. American Marten with Radio Collar. Photo Credit: John Wright, U.S. Forest Service.

appropriate infrastructure and monitoring design framework can help diagnose the causes of major ecosystem degradation in the Lake Superior coastal region. This would then allow appropriate management decisions to be made to curtail degradation and maintain or improve ecosystem health.

6.2.3 Communication

- *Challenge:* Educate the public on important habitat and ecological resources in the Lake Superior Basin by expanding the use of interactive information kiosks.

Next Steps: The Habitat Committee will maintain the current kiosk network and update information in the databases that support the kiosks. The update to the important habitat map will assist in this regard (see description of accomplishment in the Watershed Initiatives section, above).

- *Challenge:* Develop communication tools to present information, issues, and solutions related to the Lake Superior Basin ecosystem.

Next Steps: The Habitat and Terrestrial Wildlife Committees will maintain and update their joint web site. In addition, the Committees will work with the Communications Committee as appropriate to develop communication tools.

6.2.4 Planning

- *Challenge: Ensuring the maintenance of healthy aquatic communities on rivers with, and those identified for, hydro power development.*

Next steps: First steps have begun in Ontario with the participation of Ontario Power Generation in a five year study of the impacts of water flow and level on sturgeon in the Kaministiquia River. Other rivers under hydro power proposals or development need clarification of water use. The term “run of the river” does not yet have a shared definition by involved parties in Ontario. Planning by a multi-agency team continues for restoration of natural resource damages caused by the 2003 failure of two dams on the Dead River, Michigan. The Power Company decided to rebuild the dam at the Silver Lake reservoir; however, a decision has not yet been made for the Tourist Park dam

- *Challenge: Maintaining continued support for LaMP projects in order to accomplish LaMP goals will require continued effort by the LaMP to ensure governments keep the LaMP in the top priority of their funding targets.*

Next Steps: 1) Communicate the importance of the Canada-Ontario Agreement as a funding mechanism to achieve LaMP objectives to senior level managers in the Canadian federal and Ontario provincial government; 2) List the important U.S. funding sources and means to keep LaMP priorities at the top of granting lists.

6.2.5 Active Stewardship

- *Challenge: Preventing invasion and transport of non-native species within the Lake Superior Basin.*

The little to no progress that has been made on this most difficult challenge has managers and others exceedingly concerned. Ruffe have been transported to Marquette Harbour, round goby has made it into angler bait buckets in Michigan, a Chinese mitten crab was found in Thunder Bay Harbour, and the emerald ash borer has been confirmed in the Eastern Upper Peninsula of Michigan. Public, angler, and industry education is either not having an impact, is being actively ignored, or the response is perceived to be too costly to implement. The Sustainability Committee's community awareness survey noted that inconvenience was a significant reason for basin residents not making a greater effort to change negative environmental behaviour.

Next Steps: 1) Continue to monitor the expansion of existing invasive species and occurrence of new ones, and communicate findings to public, stakeholders, agencies, and industry, emphasising their roles for prevention and containment; 2) Establish contact with shipping and other industries whose activities are or may be contrary to the goals and objectives of the LaMP. Seek their voluntary compliance and use of mitigating actions to ensure no invasive species are introduced to presently uninfected areas.

- *Challenge: Continue to implement Rehabilitation Plans for lake sturgeon, walleye, lake trout, and brook trout and manage the prey base to support self-sustaining lake trout populations.*

Next Steps: 1) Continue to work with local communities and stakeholders to rehabilitate coaster brook trout, walleye, and sturgeon populations and manage the lake trout fishery to ensure stocks are self-sustaining; 2) Complete a report on the status of lake herring since the recovery of its top predator, lake trout.

- *Challenge: Protecting critical lake and tributary habitats.*

Next Steps in Ontario: 1) Ontario will continue to work with Parks Canada to ensure the details in the new Lake Superior National Marine Conservation Area management plan support LaMP goals and objectives; 2) Seek a means to protected lands, under development threat, which maintain critical ground water flows for coaster brook trout spawning in the area known as Gapen's Pool in the Nipigon River.

Next Steps in Wisconsin: A new Lake Superior Conservation Reserve Enhancement Program (CREP) in the Wisconsin Lake Superior Basin is a federal, state, and county partnership that will provide substantial financial incentives to land owners to establish forested riparian buffers along streams to reduce runoff. Previously, few Lake Superior Basin landowners qualified for this program because the land did not meet cropping history requirements. The new program expands eligibility to pasturing and hay production, which are more prevalent agricultural uses in the basin. The goal is to apply the CREP program to agricultural lands along 80 miles of streams in the Lake Superior Basin.

Hog Island Inlet Next Steps: In November 2005, the cleanup of Hog Island Inlet in the St. Louis River AOC was completed, the second contaminated sediment project under the U.S. *Great Lakes Legacy Act*. Because of its location, the 17-acre embayment off Superior Bay has excellent shallow water habitat potential now that contaminants have been removed. It is a quiet embayment surrounded by wetland near the high energy environment of Superior Bay and the entry to Lake Superior, which makes it an excellent stopping point for fish and birds and excellent nursery habitat for fish. Many agencies and local organizations are interested in a future habitat restoration project for the area. Restoration of this shallow bay habitat helps meet goals of the St. Louis River Habitat Plan (2002).

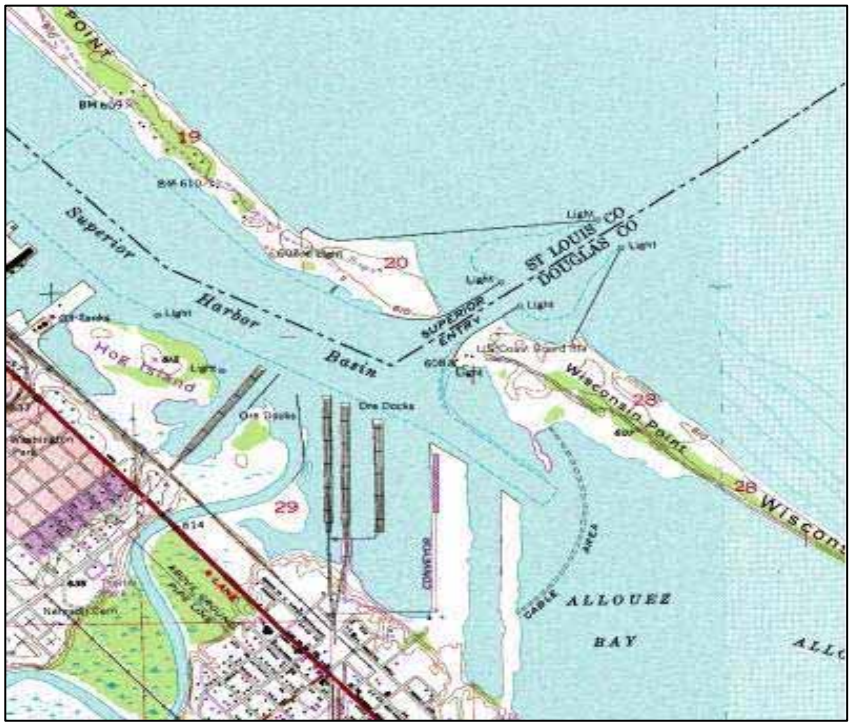

Figure 23. Map of Hog Island Inlet. Source: WDNR.

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