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# Biological Inventory for Conservation of Great Lakes Islands: 2002 Inventory and Final Report



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## Executive Summary

In 1998, Michigan Natural Features Inventory (MNFI) initiated a multi-year project to conduct biological inventories for the conservation of Great Lakes islands. The fundamental goal of this project was to systematically examine selected Great Lakes islands, compile comprehensive information on natural features and significant biodiversity areas, and then convey this information in the most useful form for landowner education and conservation planning purposes.

In 2002 MNFI completed a fifth and final year of inventory and conservation outreach. Inventories focused on surveys of Bois Blanc Island and several islands in the Les Cheneaux chain, the latter including Marquette, La Salle, Little La Salle, and Government islands. A conservation outreach workshop was presented on Bois Blanc Island, followed by a massasauga workshop and a field trip to selected natural community sites, with an emphasis on shoreline habitats. An analysis of the five-year project was completed, summarizing the results of biological inventories, natural features digitizing, identification of biodiversity areas, and conclusions regarding conservation outreach workshops.

**Animal Surveys:** Inventories were conducted on Bois Blanc Island for massasauga and Hine's emerald dragonfly, and on Marquette Island in the Les Cheneaux for Hine's emerald dragonfly. Bois Blanc Island comprises the northernmost edge of the range for eastern massasauga in Michigan, and is an important site for this federal candidate species. Three distinct massasauga occurrences were tracked prior to the island status survey. Following the inventory, these occurrences were merged into a single one, based on occurrence specifications and the fact that the island was concluded to provide a single, contiguous expanse of suitable habitat. Hine's emerald surveys on Bois Blanc Island resulted in the identification of two new occurrences for this federal and state endangered dragonfly, yet failed to reconfirm a previously known occurrence on Snake Island. Hine's emerald surveys in potential habitats on

Marquette Island did not result in the identification of occurrences, although several areas of potential habitat remain for future examination.

**Plant Surveys:** Rare plant surveys resulted in the documentation of five new rare plant occurrences and the updating of nine previously known occurrences. New occurrences identified for Bois Blanc Island included the federal and state threatened Houghton's goldenrod, beauty sedge, Lake Huron tansy, and limestone oak fern, the latter constituting the first known record for the island. Updated Bois Blanc records included occurrences for the federal and state threatened Pitcher's thistle, Lake Huron tansy, the federal and state threatened dwarf lake iris, butterwort, and pale Indian plantain. In the Les Cheneaux islands, we discovered a new record for Houghton's goldenrod and updated previously known occurrences of dwarf lake iris and Houghton's goldenrod.

**Natural Community Surveys:** Natural community inventories resulted in the identification of five new high quality occurrences and significantly updated information for three previously documented community occurrences. On Bois Blanc Island, new occurrences were identified for northern fen, rich conifer swamp, wooded dune and swale, and boreal forest, with an update compiled for a previously known occurrence of mesic northern forest. In the Les Cheneaux islands, a new occurrence of northern fen was documented for Marquette Island, with an update obtained for boreal forest on Government and La Salle islands.

**Conservation Outreach:** A series of conservation outreach workshops were prepared and held for Bois Blanc Island, building upon the format and approach developed for similar workshops on Beaver and Drummond islands. Conservation outreach was initiated with a multi-disciplinary evening presentation for residents and visitors, consisting of an overview of MNFI and the services we provide, the significance of Great Lakes islands and shorelines, and the results of biological surveys

on Bois Blanc Island. The agenda included introductions and an interactive exercise (“crayon your community”) during which the audience formed break-out groups and generated maps indicating the attributes that define Bois Blanc Island as unique. These attributes were later summarized and grouped into categories. The most important category was determined to be natural features, followed by historic features, cultural features, and then commercial features.

The next day a snake workshop was presented by a herpetoculturist from Potter Park Zoo, who provided extensive information on the biology and natural history of massasaugas, followed by an opportunity that enabled attendees to touch a live captive snake partially exposed within a demonstration tube. Conservation outreach concluded with a field trip to selected island sites, including a stop to view a common tern nesting area, a red-shouldered hawk calling area, and lastly, the shoreline communities and several rare plant species in the vicinity of the Snake Island Natural Area along the east shore of Bois Blanc.

**Identification of Significant Biodiversity Areas:** Significant biodiversity areas for Bois Blanc Island included Point Catosh, Point Detachee, Central Cedar Swamp, the Packard Point region, and Snake Island. New biodiversity areas for the Les Cheneaux islands included Meridian fen (Marquette Island), Government Island (forested with a high quality occurrence of boreal forest), and expanded areas of La Salle Island forested with boreal forest.

**Project Summary:** A collective total of 50 natural community, rare animal, and rare plant elements were identified during 1998-2002 surveys, of which nearly one-third are classified as globally rare or rarer. Biological inventories resulted in the documentation of a collective total of 216 natural community, rare animal, and rare plant occurrences, of which 115 (54%) were new and 101 (47%) were updated occurrences.

For natural communities, there were 41 new occurrences and 21 updated. For rare animals, there were 38 new occurrences and 13 updated, and for rare plants there were 36 new occurrences and 67 updates. Digitization of natural features for the islands covered during this study resulted in the processing of approximately 460 occurrences, representing nearly 4% of the statewide database. Ninety-four significant biodiversity areas were identified, the majority (40) occurring in the Beaver Island archipelago, with 24 areas identified for Drummond Island and 16 for Bois Blanc Island.

Conservation outreach workshops were conducted for Beaver Island, Drummond Island, and Bois Blanc Island. The original goal of conservation outreach was to test what types and levels of information are desired by island communities. After working with partners and community leaders, the goal of conservation outreach became less focused on testing which information is desired and more focused on designing effective methods to convey our information. Despite distinct differences between the three islands targeted for outreach, the results of interactive workshops were very similar. Natural features were the most highly valued attributes for all three islands. Sites identified by MNFI as significant were almost identical to the sites most valued by each island community. Several noteworthy insights were drawn from conservation outreach efforts. Up-to-date ecological surveys appear to be an excellent tool giving MNFI credibility within local communities otherwise unaware of our program. Secondly, each island tended to have at least one dedicated individual who played an integral role in development of the workshops. And third, conservation groups with an established presence were critical in identifying and contacting community leaders to enlist their assistance in the development of workshops.

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## Introduction

This progress report presents the results of year five of a five-year project to conduct systematic inventories of selected Great Lakes islands followed by targeted conservation planning workshops for island residents and other stakeholders. As emphasized previously (Penskar et al. 1999), a considerable portion of the biological diversity unique to the Great Lakes region is found on islands. In her overview of the biodiversity of Great Lakes islands, Soule (1993) stated that “nowhere else does the combination of vast, interconnected, mid-continental bodies of freshwater and such a number and variety of islands occur.” The nearly 600 islands contained within Michigan’s borders comprise a critically important part of this freshwater landscape, owing to their richness and variation in geography, geological origin, indigenous and non-indigenous human history, and biodiversity.

For more than two decades Michigan Natural Features Inventory (MNFI) has surveyed numerous natural communities and rare species found on or allied with Great Lakes islands. This extensive work was described in part by Soule (1993) and was detailed in previous years’ progress reports (Penskar et al. 1999, 2000, 2001, and 2002). Conducting comprehensive biological inventories on Great Lakes islands is both timely and crucial to the conservation of biodiversity, as reflected in the findings and recommendations of The State of the Great Lakes Island Report (Vigmostad 1999). This report comprises the proceedings of a 1996 U.S.-Canada Great Lakes islands workshop convened by the Great Lakes Island Project (Department of Resource Development, Michigan State

University) to determine the state of Great Lakes islands and elucidate potential conservation strategies. Among the three fundamental findings of the workshop was a recommendation for governments and other entities to support island conservation, and to that end, to base conservation planning on sound scientific information. Comprehensive biological inventories are thus essential for building the strong base of scientific knowledge upon which effective land use planning and conservation strategies are dependent.

In this final report on our efforts, we provide the results of biological inventories conducted on Bois Blanc Island and in the Les Cheneaux islands, in addition to an account of a conservation outreach workshop presented on Bois Blanc Island, the third such workshop carried out during the course of this project. As in the four prior progress reports, important biodiversity areas are briefly highlighted for this year’s target islands, in addition to a compilation of significant biodiversity areas identified for all islands assessed from 1998-2002. We also provide a summary of the extensive digitizing work completed for converting all island natural feature occurrences into spatial data for management within MNFI’s Geographic Information System (GIS). Lastly, an extensive summary and analysis of the five-year project is presented. We include suggestions for future biological inventories and conservation strategies for the many Great Lakes islands in Michigan that remain to be thoroughly surveyed, which we believe to be a necessary prelude to effective land use planning and conservation efforts.

## Organization of Report

This report has been organized according to the various components of the project: biological inventories and site summaries, the results of conservation outreach efforts, identification of significant biodiversity areas, and a summary of the project including suggestions for future efforts.

Biological inventories in year 2002 consisted of the following types: 1) animal surveys, focusing on the status of the federal candidate eastern massasauga on Bois Blanc Island and surveys for the federal endangered Hine’s emerald dragonfly on Bois Blanc Island and selected areas in the Les Cheneaux islands, 2)

plant surveys, targeting Great Lakes shoreline endemics, alvar, cliff and other limestone bedrock sites, and the identification of intact coastal and interior habitats, and 3) natural community surveys, emphasizing the delineation and assessment of high quality natural communities, with an emphasis on Great Lakes marsh and other shoreline communities, as well as interior communities such as boreal forest, mesic northern forest, and conifer swamps. Methods, results, and discussion are provided separately for each of the aforementioned components. Survey results are followed by site summaries for significant areas covered in

botanical and natural community inventories. A summary of the island digitizing work is provided, followed by a section with a detailed account of the conservation outreach workshop prepared and given for Bois Blanc Island residents and other stakeholders. The report then follows with an assessment of significant biodiversity areas for 2002, followed by a five-year summary of significant areas identified during the term of the project. The report concludes with a brief analysis of the project and suggestions for future biological inventories and conservation planning efforts.

### The Study Areas

The study sites for the fifth year of island inventory consisted of Bois Blanc Island and selected areas in the Les Cheneaux islands, all of which lie in northern Lake Huron, Mackinac County, in the eastern Upper Peninsula (Figure 1). Bois Blanc Island, a large and biologically significant island just east of the Straits of Mackinac, is the largest island within the Straits region, comprising nearly 24,000 acres in land area and approximately 36 miles (60 km) of shoreline. A significant portion of Bois Blanc Island consists of state land that lies within Mackinaw State Forest.

The Les Cheneaux islands lie in the vicinity of Hessel and Cedarville, approximately 20 miles (32 km) northeast of the Straits. The islands are largely private with the exception of

Government Island, which is within the Hiawatha National Forest. Marquette Island is the largest island within the Les Cheneaux group, covering approximately 4400 acres and 29 miles (46 km) of shoreline in the western portion of the island group. La Salle Island lies immediately east of Little La Salle Island and Marquette Island, covering approximately 1030 acres in land area with about 9 miles (15 km) of shoreline. Little La Salle Island, which lies along the southwest edge of La Salle Island, comprises about 270 acres in land area with just over 4 miles (7 km) of shoreline. Lastly, Government Island, the easternmost island inventoried in the Les Cheneaux archipelago, covers approximately 225 acres in land area and has about 3 miles (5 km) of shoreline.

### Methods for Animal Surveys

Animal surveys in 2002 focused on conducting inventories for the federally and state endangered Hine's emerald dragonfly (*Somatochlora hineana*) and the federal candidate and state special concern eastern massasauga (*Sistrurus catenatus catenatus*) on Bois Blanc Island. Surveys for the Hine's emerald dragonfly also were conducted in the Les Cheneaux islands. These inventories focused on documenting previously known and new occurrences of these two species to better determine their status and distribution on Bois

Blanc and/or the Les Cheneaux islands as well as regionally and statewide. Surveys for the Hine's emerald dragonfly and eastern massasauga were previously conducted on Bois Blanc Island by MNFI in 1999 and/or 2000 (Penskar et al. 2000, Penskar et al. 2001).

The MNFI Biological and Conservation Database (BCD) was consulted for known occurrences of these two rare animal species associated with Bois Blanc Island. Information on these species was gathered by consulting expert zoologists and wildlife biologists,

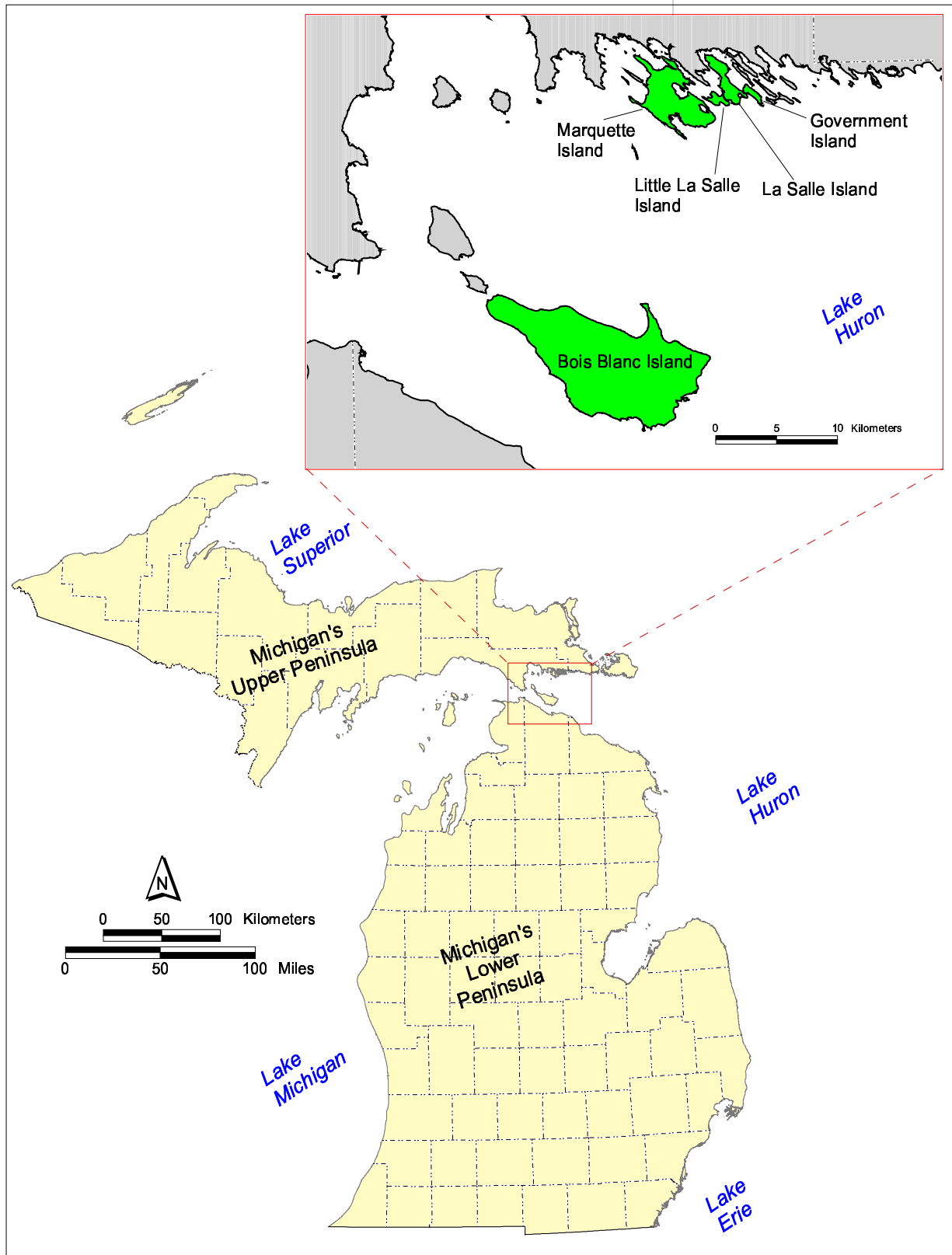


Figure 1. The study areas in northern Lake Huron.

pertinent unpublished reports, and a variety of published sources. Survey sites for each target species or group were selected based upon historical occurrence records, air photo interpretation, landcover maps, and by consulting with individuals knowledgeable about the island's flora and fauna. MNFI ecologists and botanists also assisted in identifying potential survey sites based on their site inventories.

A field schedule was developed based on prior Michigan observation and collection dates for each animal group or species and the extent of suitable habitat. Survey techniques varied

according to species groups, and are described in the following sections. Incidental observations of listed species which have been designated under the federal Endangered Species Act and/or state endangered species legislation as endangered or threatened were noted by all project staff when encountered. Special concern species also were recorded. Data from all sightings of listed animal species were recorded on MNFI field forms, including numbers of individuals observed and the location, extent and quality of occupied habitat. Location information was obtained using a Global Positioning System (GPS) unit. These data were then entered into the statewide BCD.

### *Justification for Animal Target Selections*

Previous animal surveys conducted on Bois Blanc Island by MNFI in 1999 and 2000 focused on assessing the richness and abundance of Neotropical migratory and breeding birds and documenting occurrences of other rare birds, invertebrates and reptiles (Penskar et al. 2000, Penskar et al. 2001). These included the federally and state endangered piping plover (*Charadrius melodus*), the state threatened common loon (*Gavia immer*), the state threatened red-shouldered hawk (*Buteo lineatus*), wetland birds, the state threatened Lake Huron locust (*Trimerotropis huroniana*), the Hine's emerald dragonfly and the eastern massasauga. Although these surveys failed to document the Hine's emerald dragonfly and eastern massasauga on Bois Blanc Island, other researchers or island residents had reported observations of these two species, and extensive suitable habitat for both species appeared to be present on the island. Thus, additional surveys for the Hine's emerald dragonfly and eastern massasauga were warranted.

The Hine's emerald dragonfly is an extremely rare dragonfly that was listed as federally endangered in January 1995 (DOI 1995). This species is currently known from northern Michigan, northeastern Illinois, Door County in northeastern Wisconsin, and one site in the Missouri Ozarks (Cuthrell 1999). Historically, the species was known to occur in

three areas of Ohio, and from one site in Indiana. In addition, one specimen was collected in northern Alabama. The Hine's emerald dragonfly was first documented in Michigan in 1997. Since this time, three distinct populations have been found in Michigan in the Upper Peninsula, northern Lake Huron (Bois Blanc Island), and along the northern Lower Peninsula shoreline. The Hine's emerald dragonfly is thought to be restricted to wetland habitats characterized by thin soils over dolomite bedrock with marshes, seeps, and sedge meadows (U.S. Fish and Wildlife Service 1999).

The eastern massasauga is currently listed as a species of special concern in Michigan, and became a candidate for federal listing in 1999 (USFWS 1999). The decline of this species is primarily due to habitat loss and degradation as well as widespread human persecution. These snakes occupy a variety of open and forested wetland habitats adjacent to open uplands, and can use both habitat types at different times of the year (Harding 1997). Michigan appears to be the last U.S. stronghold for this species relative to other states within its range (Szymanski 1998). Thus, conservation and recovery efforts in Michigan are particularly crucial for ensuring the long-term viability of this species. In the past, eastern massasaugas were reportedly common on Bois Blanc Island. This population is disjunct from other Lower Peninsula

populations, and is at the northern limit of their range in the state. The Snake Island wetland complex, a small peninsula that is a designated State Natural Area on the eastern edge of Bois

Blanc Island, is thought to provide one of the more important habitats for massasaugas on the island (Taylor 1995).

### *Reptiles*

Meander surveys were conducted for eastern massasaugas by walking through appropriate habitats on Bois Blanc Island during 4-8 August 2002. A variety of habitats were surveyed, including a northern fen community located along the southern shore of the island (east of the ferry dock), the wetlands within the Snake Island Nature Study Area, the sedge meadow adjacent to East Twin Lake, a northern fen/sedge meadow complex north of West Twin Lake, the wetland margins on the east side of Thompson Lake and north side of Deer Lake, a cedar swamp/mesic northern forest complex in the

island interior east of Lime Kiln Point Road, and a northern fen community at Point Catosh (Figure 2). Roadside surveys also were conducted along Bob-Lo Drive, Fire Tower Road (also known as Central Drive), Lime Kiln Point Road and Bible Road (Figure 2). These surveys consisted of driving the roads during the day and in the evening (i.e., from 6-10 pm) and looking for snakes crossing the road. Photographs were taken and specimens of dead snakes were collected to verify observations whenever possible.

### *Insects*

Meander surveys were conducted for the Hine's emerald dragonfly by walking through suitable habitat during the appropriate time of year on Bois Blanc Island during 22-24 and 27-31 July 2002, and on Marquette Island in the Les Cheneaux region on 2 August 2002. Survey sites on Bois Blanc Island included the wetlands within the wooded dune and swale complex in the Snake Island/Mud Lake Nature Study Area, along the east shore of East Twin Lake, along the north shore of Lake Mary and Deer Lake, and along the shoreline between Point Catosh and Point Detachee (Figure 2). Surveys on

Marquette Island were conducted along the north shore of Voight Bay and the south shore of Duck Bay on land owned by The Nature Conservancy and/or the State of Michigan (Figure 3). Adult dragonflies in the genus *Somatochlora* were caught with an aerial net, identified, and then released. Specimens of the Hine's emerald dragonfly were also photographed and then released unharmed. In addition, close-focusing binoculars were used to observe dragonflies that were perched higher up in the trees and those that were flying over the open water.

## **Results of Animal Surveys**

### *Reptiles*

Four eastern massasaugas were observed at different locations during targeted meander and roadside surveys on Bois Blanc Island in early August. Two live snakes were observed crossing Bob-Lo Drive within 0.5 mile east of the ferry dock and on Fire Tower Road or Central Drive near the gravel pit. One massasauga was found just west of the boat launch area at Thompson Lake. A fourth snake was found dead on Lime

Kiln Point Road south of the Bois Blanc Landing Field. This specimen was collected and deposited in the University of Michigan Museum of Zoology's amphibian and reptile collection. The habitats in the vicinity of these observations included wooded dune and swale, northern fen, cedar swamp or rich conifer swamp, and mesic northern forest.

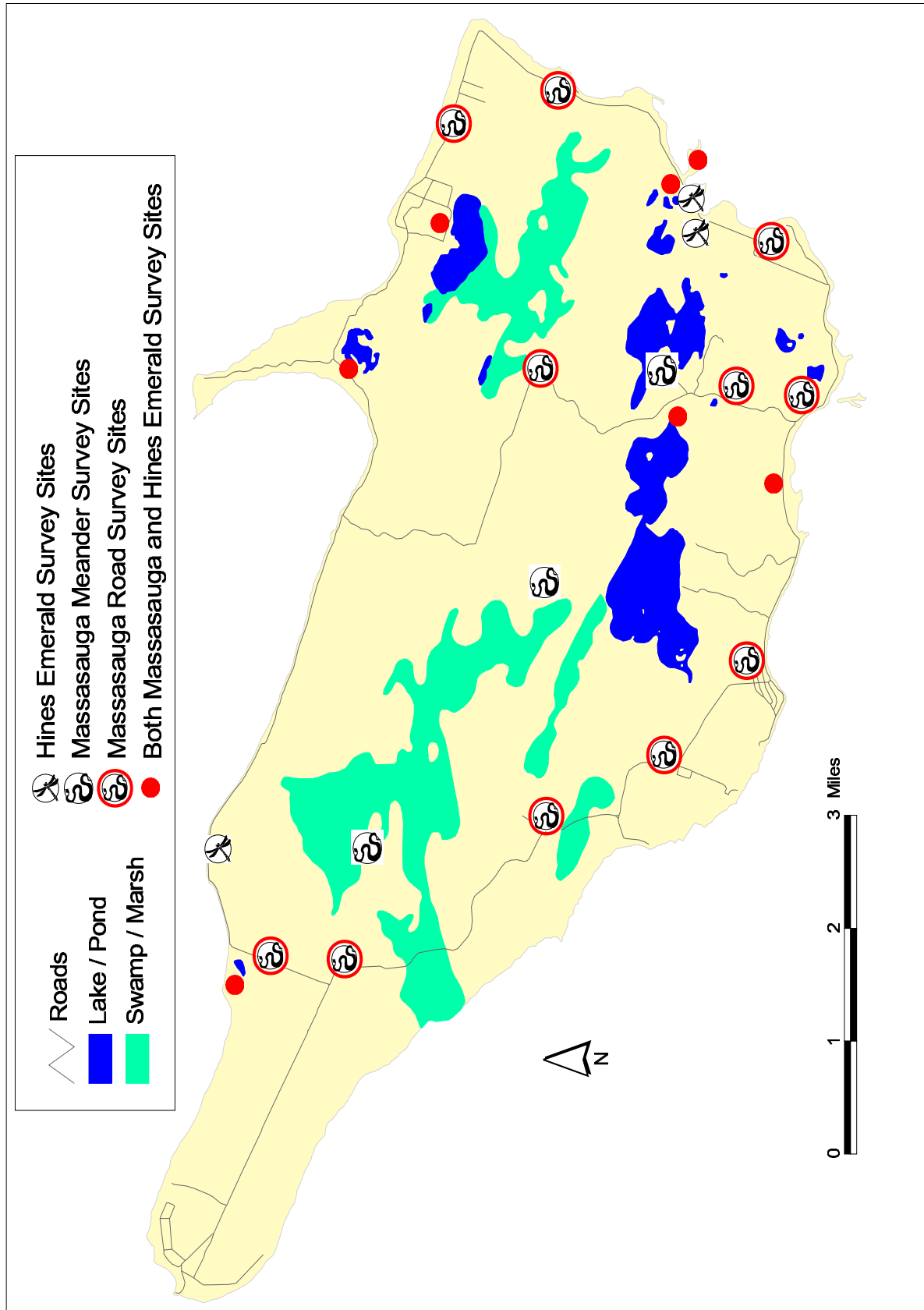


Figure 2. Massasauga and Hine's emerald survey sites on Bois Blanc Island.

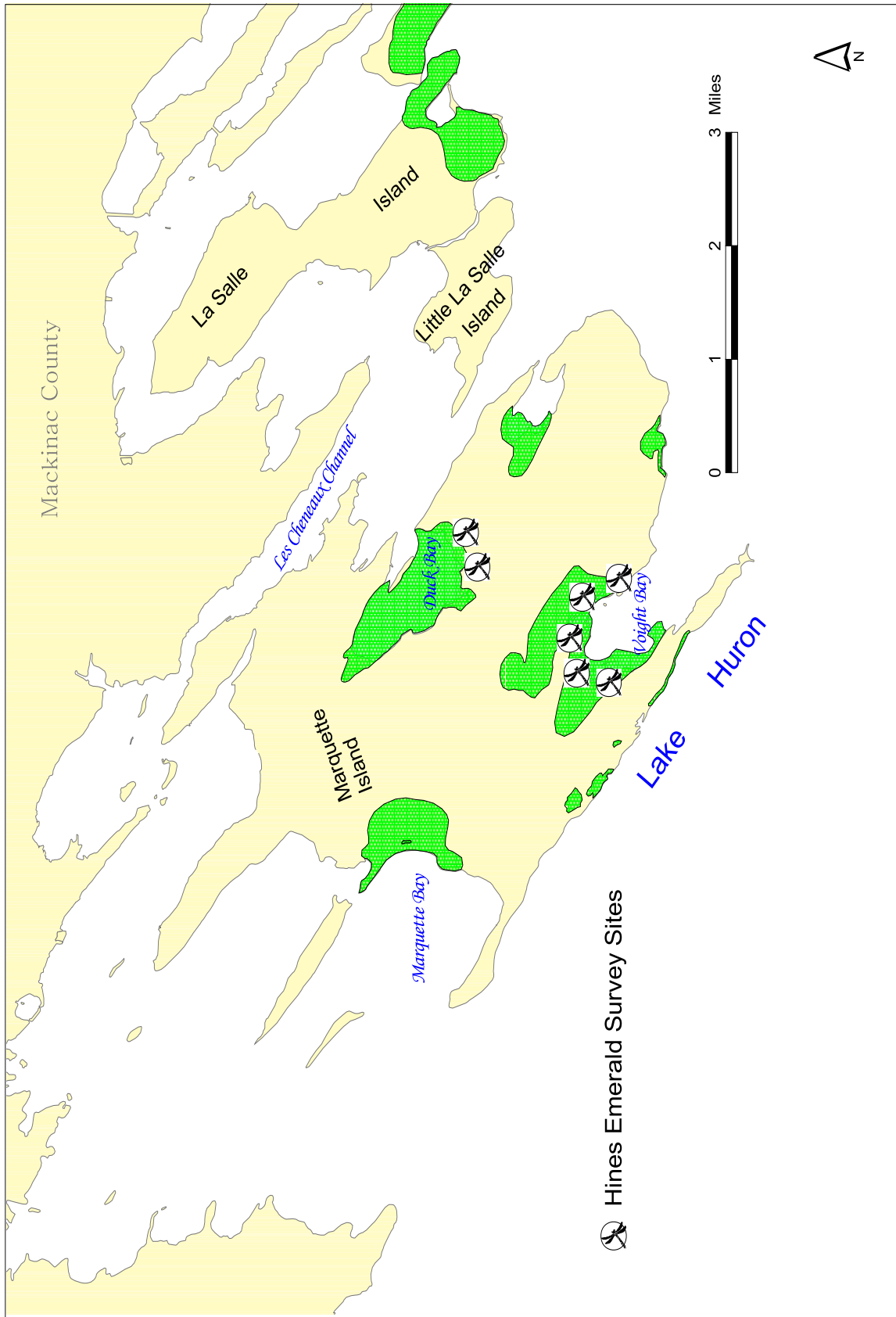


Figure 3. Hine's emerald survey sites on Marquette Island, Les Cheneaux chain; green areas indicate natural community boundaries, which are Great Lakes marsh complexes in Hine's sampling sites.



MNFI staff documented five additional observations of eastern massasaugas in late July 2002 during Hine's emerald dragonfly and rare plant and natural community surveys. These included observations of massasaugas on Bob-Lo Drive east of the ferry dock, on Fire Tower Road north of the intersection with Bob-Lo Drive, in the Snake Island Nature Study Area, and along the northwest shore of Deer Lake. The snake observed at Deer Lake was possibly a gravid female because of its size (i.e., very thick-bodied, M. Smar pers. comm.).

Several Bois Blanc Island residents and visitors knowledgeable about massasaugas also reported observations of the snake from numerous additional locations on the island in 2002 and within the past 30 years. These locations include the following: Bob-Lo Drive between Packard Point and Rosie Point, Mud Lake Nature Study Area, wetlands west of Walkers Point, Lafayette Point, the north shore of Lake Mary, McCrae Road, forested habitats north of the West Twin Lake, forested habitat within 0.5 mile of Bob-Lo Drive along the north shore of the island west of McCrea Bay, Bible Road and Lime Kiln Point Road between Pointe Aux Pins and the landing field. According to

knowledgeable island residents and number of massasauga reports, locations at which massasaugas have been frequently encountered include Snake Island, Bob-Lo Drive and adjacent wetlands within 1.0 mile east of the ferry dock, Bob-Lo Drive between Packard and Rosie points, Lake Thompson and Lime Kiln Point Road between Pointe Aux Pins and the landing field.

Prior to this study, three eastern massasauga occurrences had been documented in MNFI's statewide database (BCD) for Bois Blanc Island. These occurrences were located at Snake Island, north of West Twin Lake and along Bob-Lo Drive east of the ferry dock. Element occurrence specifications recently developed by the Natural Heritage Network stipulate that observations of eastern massasaugas separated by 1.0 kilometer (0.6 mile) of unsuitable habitat or 5 kilometers (3.1 miles) of suitable habitat should be designated as separate occurrence records. Given that most of the island is considered suitable habitat at this time and that the locations of all massasauga reports to date are separated by less than 5 kilometers, all massasauga observations on Bois Blanc Island have been merged into one element occurrence record.

### *Insects*

Surveys conducted for the Hine's emerald dragonfly on Bois Blanc Island documented two new occurrences but failed to reconfirm a previously known occurrence at Snake Island. New occurrences of this species were documented in northern fens along Point Detachee and the eastern shore of East Twin Lake. Other emerald dragonflies also were observed at both these sites. Large emerald dragonflies with potential to be Hine's emerald dragonflies were observed in flight in the Snake Island/Mud Lake wooded dune and swale complex. However, these dragonflies could not be successfully netted, and identification of these individuals could not be confirmed. Suitable habitat appeared to still be available at this site. Two other areas surveyed appeared to have suitable habitat and potential for the Hine's emerald dragonfly. These include the northern

fen habitat south of Bob-Lo Drive east of the ferry dock and along the west shore of Deer Lake.

Surveys for the Hine's emerald dragonfly on Marquette Island in the Les Cheneaux islands failed to document new populations of this species. However, extensive, high-quality suitable habitat appeared to be available along the north shore of Voight Bay, particularly on lands owned by The Nature Conservancy. This area is comprised of wooded dune and swale habitat, cobble beach with vegetated seeps, sedge meadow with scattered cedar and tamarack, and large expanses of marly fen. Despite the abundance of high quality habitat, only a few potential emerald dragonflies were observed during surveys. The state-owned land along the south end of Duck Bay contained dense sedge meadow that graded into emergent



cattail marsh. This area did not look like suitable Hine's emerald dragonfly habitat. However, an

emerald dragonfly was observed patrolling the sedge meadow, but was not netted and identified.

### *Discussion of Animal Surveys*

#### *Reptiles*

Results from the eastern massasauga surveys in 2002 were encouraging. A total of nine observations of eastern massasaugas was documented by MNFI surveyors over a three-week period during late July and early August. During two of these weeks, massasaugas were observed almost every day at different locations on the island. Island residents and visitors reported additional observations of massasaugas during this same time period. This frequency of massasauga observations has rarely been documented recently elsewhere in the state (Y. Lee pers. comm.). These snakes are quite cryptic and generally difficult to detect even during the most optimal conditions for inventory. Some residents on the island commented anecdotally that more massasaugas had been encountered in 2002 than in previous years.

A lack of observations of massasaugas during earlier MNFI surveys in 1999 and 2000 may be due to the timing of the surveys. Surveys in 1999 and 2000 were conducted in May and June, whereas 2002 surveys were conducted in August. Spring (i.e., usually April and May) is considered an optimal time for massasauga surveys as snakes emerge from hibernation sites and spend a lot of time basking before dispersing from these sites (Casper et al. 2001). Massasaugas also have been found to hibernate communally (i.e., several snakes in the same area). Thus, spring surveys could lead to identification of clusters of snakes at these hibernation sites. Surveys conducted in late summer (i.e., late July – August) may also be productive as males move around to find females during the mating season and gravid females spend a significant amount of time basking during the gestation and birthing period (Casper et al. 2001). Earlier massasauga surveys on Bois Blanc Island in May and June, which were conducted when MNFI zoologists were also performing bird surveys, may have occurred

after the spring emergence when snakes had already dispersed from their hibernation sites. Also, interestingly, reports or observations of massasaugas in northern Michigan are generally more common in the summer, whereas reports of massasaugas in southern Michigan are usually more common in the spring.

Overall, the results from the massasauga surveys not only confirm recent reports of this snake from island residents and visitors but also indicate a persistent and potentially robust population on Bois Blanc Island. This population is particularly significant for several reasons. It is one of only three known island populations of the eastern massasauga, and represents the northernmost limit of the species' range in Michigan. This island population also may represent a unique contribution to the species' genetic diversity in the state and across its range. However, the long-term viability of this population remains very uncertain.

Suitable habitat for the massasauga is abundant on Bois Blanc Island with a good juxtaposition of wetland and upland sites. Thus, habitat availability is likely not a limiting factor and the island has the potential to support a healthy population of the eastern massasauga. The primary threats to this species on the island appear to be road mortality and human persecution. Island residents have reported observing numerous snakes killed on the main roads of the island over the past twenty or more years. Additionally, residents have admitted killing large numbers of snakes over the years. It is unknown whether the effects of inbreeding have had an impact on eastern massasaugas on the island.

Initiating a research study that would provide a realistic estimate of the population of eastern massasaugas and knowledge of their distribution on the island would be very useful. The use of mark-recapture technique, and

especially DNA analysis and radio telemetry to count individual snakes, determine genetic differentiation, assess snake movement, and identify key habitats (e.g. hibernacula, basking sites, and maternity or gestation sites) would provide a good foundation for guiding management decisions on the island. Over the past eight years, this type of research has been conducted in Killbear Provincial Park in Ontario, and as a result, much has been learned about the population size, distribution, and behavior of the massasauga in that area. This information has been used to design and implement a successful public education program as well (Parent 2000).

Clearly, protection and management of suitable habitat and a change in people's attitudes and actions toward the eastern massasauga are crucial for ensuring the long-term viability of this species. One of the most important elements of a successful conservation and recovery program for this species is public outreach and education. Public education is needed to promote a better understanding of the species' status, life history, role in ecosystems, and minimal threat to human safety. This improved understanding will cultivate tolerance and positive attitudes toward the eastern massasauga and help the general public find ways to co-exist with the snake. Public and private land managers and others that impact massasauga habitat also need to be educated on the species' habitat needs, the presence or potential for massasaugas on their property, and the potential impacts of management practices on the snake. Most importantly, public education and outreach are needed to generate long-term, local community support for the conservation and recovery of the eastern massasauga.

The discovery of new occurrences of the Hine's emerald dragonfly on Bois Blanc Island was very exciting, and demonstrated the potential for finding new populations of this species as additional surveys for this species are conducted. More surveys are needed on Bois

In 2002, MNFI made progress in initiating and developing local community support for conservation of this species on Bois Blanc Island. During massasauga surveys, several island residents were contacted to obtain information on massasauga sightings. One seasonal resident volunteered and assisted with massasauga surveys on the island for a day. This individual is very interested in the snake, and has offered to serve as a local contact for the island community to compile, confirm, and respond to massasauga sightings. This could entail talking with landowners, educating them about the snake to minimize the potential for adverse impacts to this species, and moving the snake off-site if needed. A similar program has been in place in Ontario for a number of years, and has been very effective (Parent 2000). The Bois Blanc Island volunteer also has offered to help with inventory and research efforts such as radio-telemetry or a mark-recapture study. Effort should be made to follow up with this potential local assistance. MNFI may be conducting additional surveys for the eastern massasauga on Bois Blanc Island in 2003, and if so, will contact this individual.

The educational workshop on eastern massasaugas that was conducted on the island in August also helped generate interest in the snake, provided important information on its biology and ecology, and demonstrated how residents can safely and easily move snakes off-site if necessary. This workshop hopefully will help facilitate local community support for conservation of this important massasauga population. Efforts to generate and facilitate long-term, local community support for conservation and recovery of this snake on Bois Blanc Island should be continued.

### *Insects*

Blanc Island to determine this species status and distribution on the island, and population size and use of particular sites (e.g., breeding areas, foraging areas, etc.). Potential exists for documenting additional occurrences of or locations for this species on the island, given the

difficulty in surveying for invertebrates, especially for such high-flying and deft aerialists as dragonflies. Several areas with suitable habitat at which Hine's emerald dragonflies had not been documented in 2002 warrant further survey. These include the Snake Island/Mud Lake habitat complex, shallow wetlands along Deer Lake, and northern fen habitats along Bob-Lo Drive east of the ferry dock, between Point Catosh and Point Detachee, and north of West Twin Lake.

Potential also exists for documenting new populations of the Hine's emerald dragonfly in the Les Cheneaux islands. The north shore of Voight Bay on Marquette Island appears to contain extensive, high-quality suitable habitat for Hine's emerald dragonflies, particularly the lands owned by The Nature Conservancy.

Habitat conditions at Voight Bay may not have been ideal during the 2002 surveys. The island was very wet, and the marl flats were flooded with 15-30 centimeters (6-12 inches) of water due to heavy rains during the previous two days. Few emerald dragonflies were observed during surveys, despite abundance of suitable habitat. The sedge meadow and fen habitats in this area appear very similar to habitat occupied by Hine's emerald dragonflies at another known site, Thompson's Harbor State Park. The north shore of Voight Bay should be considered a priority for additional survey work. Other areas with northern fen habitat also were documented on Marquette Island and should be surveyed in the future. Future surveys also should expand to other areas with suitable habitat in the Les Cheneaux region.

### Methods for Plant Surveys

Prior to field surveys on Bois Blanc Island and in the Les Cheneaux islands, the statewide Biological and Conservation Database (BCD) was examined for previously identified element occurrences. Data compiled from island surveys in 1998 and 1999 (Penskar et al. 2000, Penskar et al. 1999), which included portions of Bois Blanc and Les Cheneaux islands, was also reviewed in order to identify information gaps. MNFI staff ecologists were also consulted for recommendations regarding particular natural features and specific survey sites familiar to them. All of this information was compiled and studied to delineate data gaps and other areas deemed to have the highest merit for inventory based on the relatively limited time allocated for field investigations.

Bois Blanc Island was assessed briefly in 1999 in collaboration with a staff ecologist to examine interior mesic forest areas. Prior to the 2002 field season, the island was examined via infrared aerial photos as well as digital orthophotos by a staff ecologist and botanist to delineate large, intact sites. We focused on such areas as wooded dune and swale complexes, extensive interior swamps, coastal dunes, and northern fens. A dedicated natural area near MacRae Bay, occurring within the peninsula

terminating in Lighthouse Point, was highlighted for survey in order to examine and more accurately map the boundary of a delineated old-growth mesic forest. This area was also identified via aerial photos as likely to contain a high quality boreal forest of strong merit for recognition and mapping, a community that had not been previously distinguished. In addition to the aforementioned areas, several stretches of shoreline were identified for potential field survey, based on the need to more systematically assess the status of somewhat dated to historical species records.

As in several previous island and Great Lakes shoreline studies (Penskar et al. 2002, Penskar et al. 2001, Penskar et al. 2000, Penskar et al. 1997, and Penskar et al. 1993), our high priority targets were Great Lakes endemic species such as dwarf lake iris (*Iris lacustris*), Houghton's goldenrod (*Solidago houghtonii*), Pitcher's thistle (*Cirsium pitcheri*), and Michigan monkey-flower (*Mimulus glabratus* var. *michiganensis*), all of which are federal and state listed. Additional target taxa included such well known coastal rarities as Lake Huron tansy (*Tanacetum huronense*), calypso orchid (*Calypso bulbosa*), English sundew (*Drosera anglica*), butterwort (*Pinguicula vulgaris*), Alaska orchid

(*Piperia unalascensis*), ram's head orchid (*Cypripedium arietinum*), pinedrops (*Pterospora andromedea*), and several other potential species known in this region of the state. These taxa are strongly associated with shoreline areas, where they occur in such natural communities as open dunes, coastal rich conifer swamp, bedrock beach, alvar (limestone pavement lakeshore), cedar glades, northern fen, boreal forest, and wooded dune and swale complexes.

Within the Les Cheneaux islands, emphasis was placed largely on areas not covered during previous field visits (Penskar et al. 1999). In contrast to previous inventory work, surveys were scheduled for late August, in order to target high priority species such as Houghton's goldenrod which cannot be identified earlier in the growth season. Marquette Island, the largest island with the Les Cheneaux archipelago, contained several sites known to require inventory based on past surveys, including shoreline and interior fens. Similar sites, as well as boreal forests, rich conifer swamps, and bedrock beaches were identified for survey on Little La Salle, La Salle, and Government Island. In addition to the species noted above, we surveyed for such rarities as climbing fumitory (*Adlumia fungosa*), bulrush sedge (*Carex scirpoidea*), and yellow pitcher-plant (*Sarracenia purpurea* f. *heterophylla*), among others.

As for all prior island inventories, simultaneous efforts were made to delineate notable or qualifying natural community occurrences. This was done both to identify significant potential rare plant habitats as well as

to conduct a preliminary assessment for high quality community remnants for subsequent evaluation and possible transcription by MNFI ecologists. All plant inventories were conducted in collaboration with the project's community ecologist, who provided the primary evaluation of potential natural community occurrences and also assisted in rare plant surveys.

The specific botanical survey methods, which essentially consisted of meander searches, closely follow those used during the previous three years of island inventories. These have been presented in detail by Penskar et al. (1999) and thus will not be presented again here. Because most of the field inventories were conducted jointly with a staff ecologist, aerial photo interpretation and site selection were completed in collaboration and thus not duplicated. Sites were thus highlighted for field inventory based on their potential for both natural community and rare plant occurrences.

One significant difference from work conducted in previous years was the full-time use of hand-held global positioning system (GPS) units. Site locations, where appropriate, were recorded on Garmin 12XL GPS units, which could be effectively employed in both forested and non-forested habitats. Waypoints recorded during field surveys were subsequently downloaded by information management staff and converted to GIS shapefiles, from which precise locations were subsequently digitized and mapped. The preparation of shapefiles also assisted the project botanist and ecologist in plotting precise field locations during data processing and transcription.

### Results of Plant Surveys

Botanists and ecologists jointly conducted rare plant and natural community surveys, and therefore the results of these surveys are combined in Table 1. Natural community results are discussed more thoroughly in the community section below. Five new rare plant occurrences were collectively documented from four sites during our surveys, consisting of one occurrence of state threatened *Gymnocarpium robertianum* (limestone oak fern), two occurrences of federal

and state threatened *Solidago houghtonii* (Houghton's goldenrod), one occurrence of state special concern *Carex concinna* (beauty sedge), and one occurrence of state threatened *Tanacetum huronense* (Lake Huron tansy).

In addition to the discovery of new occurrences, we identified nine previously known rare plant occurrences over a total of five sites. These consisted up two occurrences for federal and state threatened *Cirsium pitcheri*

**Table 1. Rare plant and natural community sites inventoried during 2002 surveys of Bois Blanc Island and Les Cheneaux islands (Mackinac County)<sup>1</sup>.**

Site name	Known occurrences relocated and updated	New occurrences documented
<b>Bois Blanc Island</b>		
Central Cedar Swamp		Rich conifer swamp
Lighthouse Point	Mesic northern forest	Boreal forest
Packard Point	<i>Cirsium pitcheri</i> <i>Tanacetum huronense</i>	
Point Catosh Swales	<i>Iris lacustris</i>	Wooded dune and swale complex <i>Gymnocarpium robertianum</i>
Point Detachee Fen	<i>Pinguicula vulgaris</i>	Northern fen <i>Solidago houghtonii</i>
Snake Island	<i>Cacalia plantaginea</i> <i>Cirsium pitcheri</i>	<i>Carex concinna</i> <i>Tanacetum huronense</i>
<b>Les Cheneaux Islands</b>		
Government Island	Boreal forest	
La Salle Island	Boreal forest	
Meridian Fen-Marquette Isl.	<i>Iris lacustris</i>	Northern fen <i>Solidago houghtonii</i>
Voight Bay-Marquette Isl.	<i>Solidago houghtonii</i> <i>Iris lacustris</i>	

<sup>1</sup> Global and state ranks, as well as federal and state listing status as appropriate are provided in Appendix I.

(Pitcher's thistle), three occurrences of federal and state threatened *Iris lacustris* (dwarf lake iris), one occurrence of *Tanacetum huronense*, one occurrence of state special concern *Cacalia plantaginea* (pale Indian plantain), one occurrence of state special concern *Pinguicula vulgaris* (butterwort), and one occurrence of

*Solidago houghtonii*. Significant new status information was obtained for these sites, including more detailed data on spatial extent, population and site condition, artificial and natural disturbances, and potential threats to occurrences such as off-road-vehicle (ORV) traffic and the presence of invasive exotic plants.

### Discussion of Plant Surveys

The richness and diversity of the rare biota of islands is revealed to some extent by the ability to discover new rare plant occurrences during necessarily limited surveys. Unlike natural community inventories, which provide much broader time periods for adequate searching and characterization, rare plants require targeting within considerably narrower time frames. Ideally, botanical surveys should take place at a minimum of three times during a field season to capture the peak blooming and/or fruiting periods for early, mid, and late season species. Even within this ideal scenario, carefully chosen periods must be selected, and species could easily be missed owing to local climatic influences that may significantly retard or advance growth and flowering. It is thus notable that rare plant occurrences have been steadily catalogued on islands during our inventories despite the inherent time restrictions of the project and the fact that previous surveys (by MNFI and others) have occurred.

Bois Blanc Island, by far the largest island of the five surveyed in 2002, logically produced the majority of rare plant information, including three of five new occurrences tallied and five of eight known occurrences updated. Although Bois Blanc is inhabited and contains roads and trails, it is exceptionally large and many areas cannot be easily accessed. Owing to the diversity of habitats and natural communities present, and considering the setting of the island, a number of rare species are to be expected. Dwarf lake iris (*Iris lacustris*), a well known rarity in the Straits region, forms large colonies along virtually the entire periphery of the island, including within rights-of-way (ROW) of active roads. This species also occurs in many variously sized patches inland, where clones

remain in former (post-glacial) shoreline areas. Relatively small colonies of Pitcher's thistle (*Cirsium pitcheri*) persist on small foredunes along the southern and eastern shores, where our surveys updated occurrences not assessed in several decades, such as the Packard Point and eastern shore 1938 record. Interestingly, two new rare plant occurrences were identified in one of the most well known sites on the island, within and near the small peninsula known as Snake Island, a dedicated State Natural Area. A small colony of beauty sedge (*Carex concinna*) was found at the base of the peninsula, whereas a new record for Lake Huron tansy (*Tanacetum huronense*) was identified along dunes immediately south of this site.

The most notable record for Bois Blanc Island was the identification of a colony of limestone oak fern (*Gymnocarpium robertianum*), which was discovered in a large wooded dune and swale complex near Point Catosh on the north shore. This rare fern species, known primarily from rich conifer swamps in Michigan (Choberka and Penskar 2001), was specifically sought during our inventory, constituting the first such record for Bois Blanc and the first new rare plant species added to this island in nearly 25 years. While conducting a transect of this extensive complex, we encountered several small patches of *Iris lacustris* markedly inland, indicative of the distribution of such remnant colonies throughout the island.

Surveys in the Les Cheneaux islands were restricted to Marquette Island, La Salle Island, Little La Salle Island, and Government Island. Portions of Marquette Island were inventoried previously (Penskar et al. 2000), yet this largest island within the Les Cheneaux chain contained



several additional areas of merit for field visits. Aerial photo review indicated a large northern fen on the south shore, which was confirmed by field review and which also resulted in a new occurrence for *Solidago houghtonii*. Interior forests were examined while accessing delineated shoreline areas, resulting in the identification of several previously unknown colonies of *Iris lacustris*. Portions of a large, well known Great Lakes marsh complex within Voight Bay, which contained localized, unmapped patches of northern fen, were inventoried for a known occurrence of Houghton's goldenrod. This species was found and subsequently updated for areas not identified previously. We also sought such rare plant species as state special concern *Drosera anglica* (English sundew), a northern shoreline species which was not found despite dedicated searches of high potential habitat.

Relatively few inventory sites were identified for the much smaller Les Cheneaux islands. Portions of the southern shoreline of Little La Salle were briefly sampled, revealing little rare plant habitat, including some fen-like areas along the southeast shore and mixed forest along the southwest shore within property owned by The Nature Conservancy (TNC). A relatively small Great Lakes marsh in Muscallonge Bay, contiguous in part with TNC property, was also examined. No rare plant records were identified

for Little La Salle Island during our survey, which was completely traversed via kayak and point sampled. There are, however, previously known records for the island, including a site for *Iris lacustris* near Middle Entrance Point on private land (which was not accessed) adjacent to the aforementioned TNC tract, and a record for state threatened *Calypso bulbosa* (calypso orchid) near Arnold Point.

La Salle Island was also completely traversed via kayak, but this larger island was more intensively sampled along the shoreline and interior. Most of the southern shoreline was walked and examined, and a meander search was conducted within boreal forest. Fen-like areas along the shore were searched, in addition to a limited stretch of sand dunes, yet no rare plants were identified. In collaboration with the program ecologist, a previously identified occurrence of boreal forest was updated and more broadly delineated. Government Island was the last island surveyed in the Les Cheneauxs, and as for the La Salle islands, it was completely traversed along the shore via kayak. This island, which lies within the Hiawatha National Forest, contained boreal forest and shoreline fens. Examination of these habitats did not result in the identification of any rare plant species, including the shoreline fens that were carefully searched for *Solidago houghtonii*.

### Methods for Natural Community Surveys

Natural community surveys on Bois Blanc Island and in the Les Cheneaux islands were organized to provide additional information on several sites that had been identified during prior inventories (Penskar et al. 2000, 1999, Albert and Penskar 1993). Natural community surveys were conducted in coordination with rare plant surveys, occurring from July 22-26 for Bois Blanc Island and from August 5-9 in the Les Cheneaux islands. Preparation for the surveys involved conducting aerial photo interpretation, prioritizing inventory sites, and studying site records for potential and previously identified element occurrences. To assist in surveys of Bois Blanc Island, a large format map was

compiled in collaboration with MNFI's GIS analyst. This map was prepared by combining available digital orthophoto quadrangles, providing a large-scale map of the island for the delineation of potential survey areas and to guide field surveys. The map was also designed to assist in subsequent presentations to island residents as part of the conservation outreach workshop.

Site visits involved mapping the boundaries of each delineated natural community occurrence on topographic maps and collecting detailed biotic and abiotic data. Data collection included compiling comprehensive plant species lists with notations of relative abundance, describing

structural information for the vegetation layers in each plant community, and recording information on the landforms and soils that characterized the sites. Site-specific information was also gathered related to signs of past human disturbance and land-use activities. Insights into future protection and/or management activities if apparent during site visits were also recorded. High quality natural communities were defined according to the MNFI Natural Community Classification (MNFI 1989). Each natural

community occurrence was given a grade based on its relative quality, condition, and landscape context compared to other known occurrences within the state and Great Lakes region. Finally, information from field forms was transcribed and submitted for mapping and incorporation into the MNFI statewide database. During the process of data analysis and transcription, GPS waypoints obtained during field surveys were downloaded and used to help verify specific locations and community boundaries.

### Results of Natural Community Surveys

Natural community inventories resulted in the identification of five new high quality natural community occurrences and significantly updated information on three previously identified natural communities (Table 1). The majority of new occurrences were identified on Bois Blanc Island, including one new occurrence for rich conifer swamp, one new occurrence of boreal forest, one new occurrence of wooded dune and swale complex, and one new occurrence of northern fen (Figure 4). For the Les Cheneaux islands, one new occurrence of northern fen was documented, where it was identified on Marquette Island (Figure 5).

Updated natural communities included one mesic northern forest occurrence for Bois Blanc Island and one boreal forest occurrence for La

Salle and Government islands, where this occurrence was mapped as contiguous over these closely adjacent islands (Figures 4 and 5). As detailed in the previous section on plant surveys, the inventory of these natural communities resulted in several new rare plant occurrences and significant updates for previously known rare plant records.

In addition to obtaining information on natural communities and rare plant species, we compiled data on artificial disturbance features and the presence of invasive species where appropriate. In some cases the compilation of detailed species lists markedly improved the occurrence information for both rare plant and natural community occurrences alike.

### Discussion of Natural Community Surveys

For Bois Blanc Island, the most significant natural community identified was the B-ranked wooded dune and swale complex documented near Point Catosh (Figure 4). This natural community type is known throughout the Great Lakes, but was the first such occurrence for the island, where our survey of this site resulted in the identification of state threatened *Gymnocarpium robertianum* (limestone oak fern), also a new record for Bois Blanc. Another new natural community type identified for the island was an AB-ranked occurrence of rich conifer swamp (Central Cedar Swamp), which forms part of a series of extensive, wooded wetlands that cover much of the western portion

of Bois Blanc. On the northern shore of the island, a C-ranked occurrence of northern fen was found (Point Detachee Fen), consisting of a string of relatively small, pocketed openings paralleling and in close proximity to the shoreline. The assigned rank of this northern fen occurrence is largely due to its somewhat limited extent, although there is little artificial disturbance, the quality of the habitat and vegetation is very high, and it contained populations of *Pinguicula vulgaris* (butterwort), *Solidago houghtonii* (Houghton's goldenrod), and *Iris lacustris* (dwarf lake iris).

Elsewhere on Bois Blanc Island, an A-ranked occurrence of boreal forest was



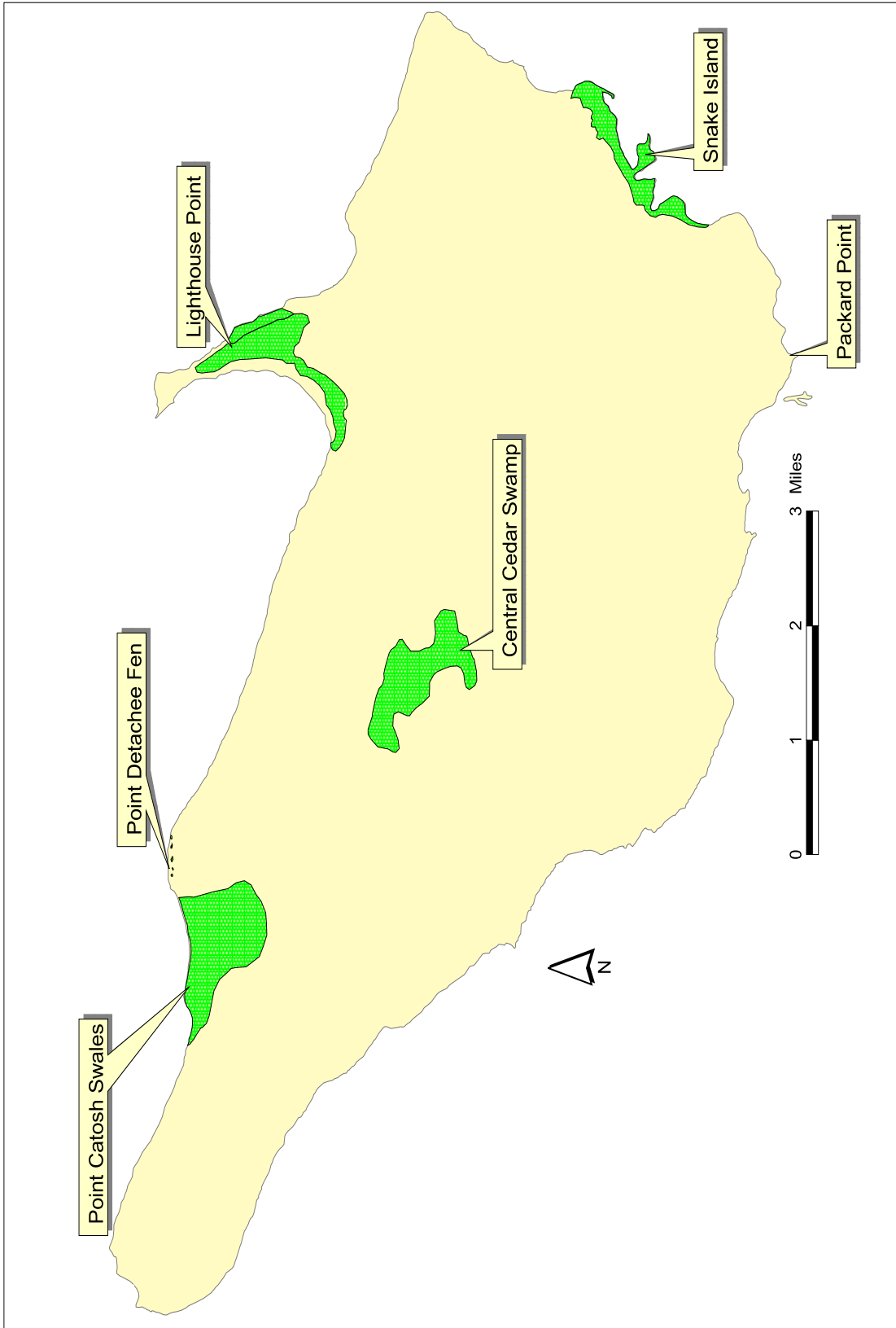


Figure 4. Principal plant and natural community survey sites on Bois Blanc Island.

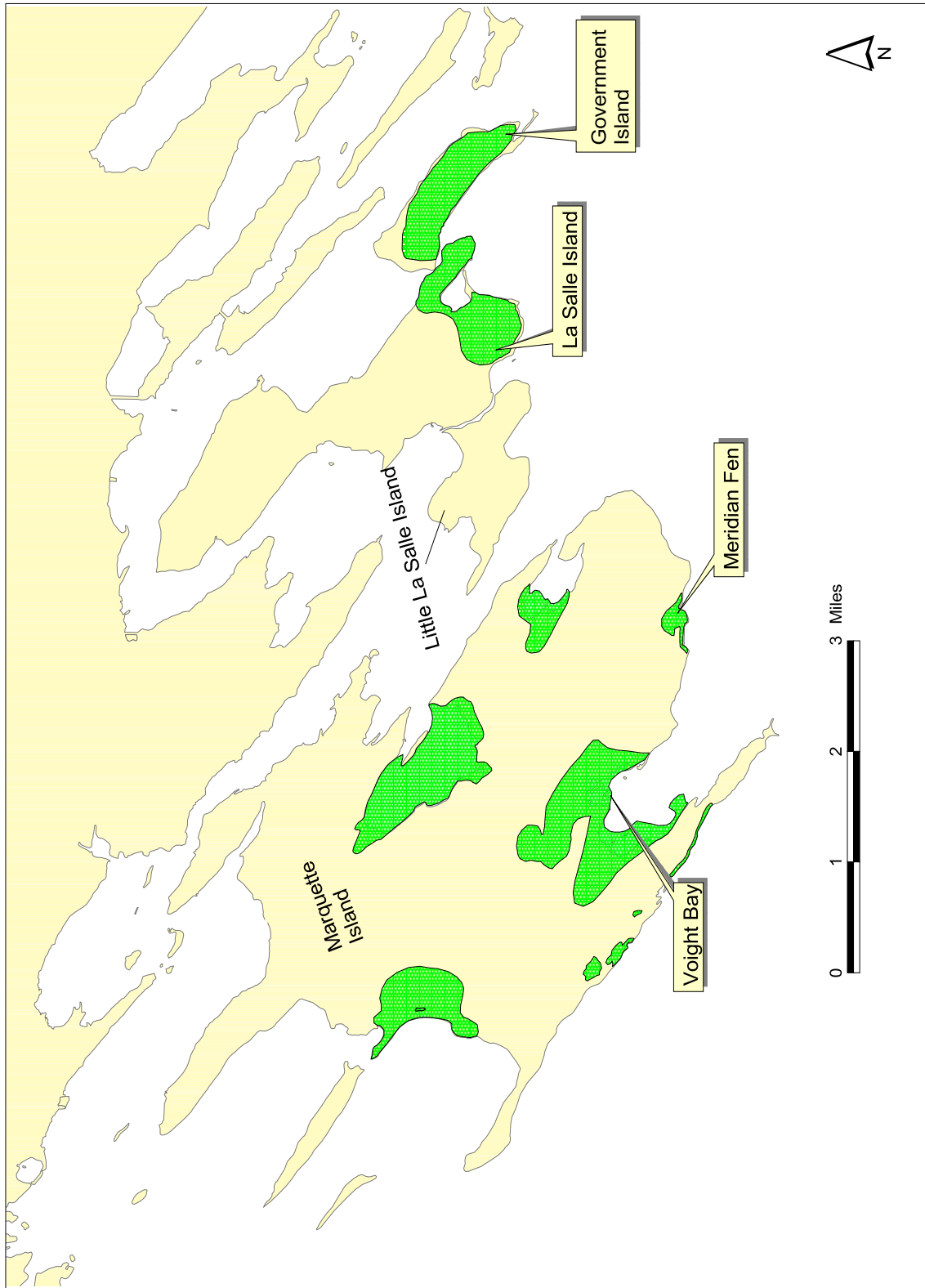


Figure 5. Principal plant and natural community survey sites in the Les Cheneaux islands.

delineated during survey of a well known, AB-ranked occurrence of mesic northern forest on the Lighthouse Point peninsula. This mesic northern forest site, which contains old-growth hardwoods dominated by *Acer saccharum* (sugar maple), lies within a state dedicated natural area. Inventory of the community and habitat boundaries of this site indicated strong merit in delineating a boreal forest community occurrence, dominated by *Thuja occidentalis* (northern white cedar), *Abies balsamea* (balsam fir), *Picea glauca* (white spruce), and also large individuals of *Pinus strobus* (white pine). Old-growth was also present within the boreal forest occurrence, where individuals of northern white cedar were cored with an increment borer and aged as more than 200 years old.

One new natural community occurrence was identified during our inventory of the Les Cheneaux islands. An AB-ranked occurrence of northern fen (Meridian Fen) was found along the south shore of Marquette Island, the largest island surveyed (Figure 5). The fen was found

to be of high quality, containing extensive marl flats, pools, and springs, and contained a previously unknown population of Houghton's goldenrod, which occurred throughout the site. A known, B-ranked boreal forest occurrence for La Salle Island was examined and found to be essentially contiguous with an extensive area of boreal forest that comprises much of Government Island. La Salle Island and Government islands are separated by an extremely narrow inlet, and thus the extent of this previously identified natural community was expanded to include the abutting tracts of this type for both islands. A Great Lakes marsh on the north side of Little La Salle Island, within Muscallonge Bay, was initially identified as a Great Lakes marsh occurrence, and a detailed survey and field forms were completed. The marsh, although of good quality, was later determined to be too small to meet the minimum size criterion for recognizing this natural community occurrence with respect to the statewide database.

### Site Summaries

As established in the format of several previous MNFI reports concerning coastal zone surveys, we provide here a description of our inventory areas. These brief site summaries are presented for significant inventory sites covered by MNFI botanists and community ecologists. The descriptions, however, do not cover all sites visited during island surveys, as many areas were accessed and traversed. Here we provide descriptions for sites in which the most substantive inventories were conducted.

#### *Bois Blanc Island Sites*

**Central Cedar Swamp.** Occurring within the center of Bois Blanc Island, this swamp is dominated by wetland conifers, principally northern white cedar (*Thuja occidentalis*), larch (*Larix laricina*), balsam fir (*Abies balsamea*), and black spruce (*Picea mariana*). This site was characterized by extremely diverse microtopographic variation, including numerous pools, hummocks, and many snags and blown down trees. Cored white cedar trees ranged to

approximately 175 years of age. Increasing water depth in areas indicated the presence and influence of beaver activity on the hydrology of this wooded wetland.

**Lighthouse Point.** Mesic northern forest of a well known state natural area was found to be bordered by an extensive coastal community of boreal forest dominated by northern white cedar, balsam fir, white spruce (*Picea glauca*), paper birch (*Betula papyrifera*), and hemlock (*Tsuga canadensis*). The boreal forest occurs along a gradual but marked slope down to the shore. Both forest types indicated heavy deer browsing activities, particularly on paper birch stump sprouts and young white cedar. Trees cored within the boreal forest ranged well over 200 years in age, with some ages estimated to be as much as 230 to nearly 250 years.

**Packard Point.** This site references the low open dunes community formed along the southeastern shores of the island, where it follows the shoreline adjacent to the heavily used gravel periphery road. The dunes are modest in

extent, and Pitcher's thistle (*Cirsium pitcheri*) and Lake Huron tansy (*Tanacetum huronense*) occur occasionally within these limited foredunes, and there are scattered vacation homes along the shore. The dunes include such characteristic species as little bluestem (*Andropogon scoparius*), common milkweed (*Asclepias syriaca*), harebell (*Campanula rotundifolia*), lance-leaved tickseed (*Coreopsis lanceolata*), and beach pea (*Lathyrus japonica*). Weeds include spotted knapweed (*Centaurea maculosa*), and white sweet clover (*Melilotus alba*).

**Point Catosh Swales.** The landscape between Point Catosh and Point Detachee on the north shore of the west end of the island comprises a moderately large wooded dune and swale complex, ranging inland about 0.75 miles. The site is a series of mostly open swales alternating with low cobblestone and former dune ridges that are forested largely with northern white cedar, white pine, white spruce, paper birch, hemlock, balsam poplar (*Populus balsamifera*), red pine (*Pinus resinosa*), and trembling aspen (*Populus tremuloides*). This community is very heterogeneous, with some larger upland rises dominated by hemlock and red pine and lower areas of white cedar swamp with larch, and black spruce with a dense ground layer of mosses, especially sphagnum moss. The first island record for limestone oak fern (*Gymnocarpium robertianum*) was found within this complex.

**Point Detachee Fen.** Approximately one mile east of Point Catosh, a series of small but botanically rich northern fens occurs adjacent to the shoreline. The localized openings, which are essentially interdunal depressions, have a marly substrate and are dominated primarily by graminoids. Rare plants present included dwarf lake iris (*Iris lacustris*), a previously known population of butterwort (*Pinguicula vulgaris*), and Houghton's goldenrod (*Solidago houghtonii*), which was new for this site. Characteristic plants of the fen included such species as pitcher-plant (*Sarracenia purpurea*), Labrador tea (*Ledum groenlandicum*), grass-of-Parnassus (*Parnassia glauca*), sedge (*Carex flava*), twig-rush (*Cladium mariscoides*), hair-

grass (*Deschampsia cespitosa*), Buxbaum's sedge (*Carex buxbaumii*), shrubby St. John's-wort (*Hypericum kalmianum*), and shrubby cinquefoil (*Potentilla fruticosa*).

**Snake Island.** Snake Island, which is actually contiguous with Bois Blanc via a narrow peninsula, is a small dedicated State Natural Area. A small foredune occurs along the shore on the south side of the peninsula, supporting a sparse colony of Pitcher's thistle. Additional rare species known for this site include Houghton's goldenrod, dwarf lake iris, pale Indian plantain (*Cacalia plantaginea*), and the species for which the island is reportedly named, eastern massasauga rattlesnake (*Sistrurus catenatus catenatus*). The Hine's emerald dragonfly (*Somatochloa hineana*) was discovered within the last three years in or near this site. A small colony of previously undocumented beauty sedge (*Carex concinna*) was discovered near the base of the peninsula during 2002 surveys. The peninsula and island are relatively unremarkable in the general character of the vegetation, yet the site comprises one of the island's richest sites for rare species diversity. Considered within the context of immediate shoreline area and the marly, fen-like swales of adjacent inland areas, this is one of the most significant biodiversity sites of the island.

#### *Les Cheneaux Islands*

**Government Island.** Among the few federal lands assessed during the island project (Harbor Island being the only other site), Government Island lies within the eastern portion of the Les Cheneaux chain, narrowly separated from La Salle Island by a small inlet. This island contains a tract of boreal forest that was inventoried and considered to be virtually contiguous with a previously identified community occurrence on La Salle Island. The forest is dominated by northern white cedar, white spruce, balsam fir, balsam poplar, occasional white pine, and red maple (*Acer rubrum*). A small area of potential northern fen was briefly inventoried on the southwest end of the island for rare species such as Houghton's goldenrod and butterwort.





**Plate 1. Eastern massasauga rattlesnake. Photo by Nancy J. Dickson.**

**Plate 2. Massasauga workshop with Theresa Moran and tubed captive snake. Photo by Yu Man Lee.**



**Plate 3. Dense rich conifer swamp within Point Catosh wooded dune and swale complex, Bois Blanc Island. Photo by Michael Penskar.**



**Plate 4. Old-growth cedars in boreal forest on Lighthouse Point peninsula, Bois Blanc Island. Photo by Michael Kost.**



**Plate 5. Northern fen swale with abundant pitcher-plant, Point Detachee, Bois Blanc Island. Photo by Michael Penskar.**

**Plate 6. Butterwort (*Pinguicula vulgaris*), Point Detachee fens, Bois Blanc Island. Photo by Michael Penskar.**





**Plate 7. South shore of Marquette Island, Les Cheneaux chain. Photo by Michael Penskar.**

**Plate 8. High quality northern fen with extensive marl beds, Marquette Island. Photo by Michael Penskar.**



**Plate 9. Northern fen, Marquette Island. Photo by Michael Penskar.**



**La Salle Island.** Accessed in previous island surveys to investigate the southern shore, La Salle Island was completely traversed on its periphery via kayak. Selected stops were made to determine if high quality potential habitat or rare species were present. Small fen-like areas were carefully meander-searched along the southern shore without success for rare species. A locally notable expanse of Great Lakes marsh found in Muscallonge Bay was recorded via field forms but later dropped from consideration for recognition as a natural community occurrence primarily based on its limited size. The inland shoreline area of the marsh, which lies within the island's Nature Conservancy tract, was also briefly surveyed, and no rare plant or communities were identified.

**Little La Salle Island.** This island is separated from La Salle Island by the Bosky Channel, a narrow but well used navigable inlet used by boaters. Brief point sampling on the periphery of the island indicated mixed hardwood and conifer forest, with localized areas of boreal forest. A small Great Lakes marsh occurs on the north side of the island in Muscallonge Bay between Arnold Point and Middle Entrance Point. Though later determined to be non-qualifying as a natural community occurrence based principally on size, the marsh is of good quality. Several distinct vegetation zones were present, including submergent marsh, emergent marsh, twig-rush dominant flats, northern fen, and transitional swamp forest. Dominant marsh species included threesquare (*Scirpus americanus*), hard-stemmed bulrush (*S. acutus*), twig-rush, sedge (*Carex lasiocarpa*), bluejoint grass (*Calamagrostis canadensis*), and spike-rush species (*Eleocharis* sp.).

**Meridian Fen-Marquette Island.**

Meridian fen is a fairly extensive but previously unknown northern fen that lies on the southern shore of Marquette Island. This AB-ranked fen contained a previously unknown occurrence of Houghton's goldenrod, and portions of a known occurrence of dwarf lake iris were identified along the margins of the fen. The fen had numerous, large marly pools and springs, and was diverse in microrelief. Characteristic plants

of this northern fen included such species as false asphodel (*Tofieldia glutinosa*), shrubby cinquefoil, northern white cedar, grass-of-Parnassus, hair grass, arrow-grass (*Triglochin maritimum*), bog goldenrod (*Solidago uliginosa*), Ohio goldenrod (*S. ohioensis*), bulrush (*Scirpus cespitosus*), white spruce, alder-leaved buckthorn (*Rhamnus alnifolia*), creeping juniper (*Juniperus horizontalis*), spike-rush (*Eleocharis rostellata*), twig-rush, and brown moss (*Scorpidium scorpioides*), the latter species a boreal moss especially indicative of alkaline conditions.

**Voight Bay-Marquette Island.** Voight Bay, long known for its large Great Lakes marsh occurrence, was explored along its periphery after aerial photo interpretation revealed the presence of potential northern fen habitat within this portion of the island. The Great Lakes marsh mapped for Voight Bay is actually a complex of community types, of which the marsh is the most dominant. The extent of the marsh, however, may change markedly from year to year following fluctuations in the cycle of Great Lakes water levels. The periphery of the marsh complex contains fen-like areas, which were explored for rare species such as Houghton's goldenrod (known for Voight Bay) and English sundew (*Drosera anglica*). Landward and northeast of the bay, distinct northern fen openings were identified. These openings were found to contain colonies of Houghton's goldenrod, extending the known occurrence for Voight Bay.



## Conservation Outreach for Bois Blanc Island

### *Background*

The conservation outreach portion of this year's project on Bois Blanc Island was built on the conservation outreach activities previously developed for the Beaver Island community during the summer of 1999 (Penskar et al. 2000) and the Drummond Island community during the fall of 2000 (Penskar et al. 2002). These workshops were designed to be interactive and open to the whole community. The goals of these workshops were to: 1) initiate community discussion about the natural resources and community character of the Islands, and 2) determine the natural features that island residents value most. Important outcomes of these workshops were recognizing the high value that these island communities place on natural features and obtaining several strong recommendations to protect these unique features. Some of the ideas that were generated included integrating this information into comprehensive master land-use plans and using

this knowledge to guide the development of sustainable ecotourism. The success of the Beaver Island and Drummond Island workshops provided a strong foundation for the design of the Bois Blanc Island workshop. For example, MNFI's goals for the Bois Blanc Island workshop reflected what was found to be the most meaningful to the Beaver island and Drummond Island residents, namely to: 1) initiate a discussion about the unique natural resources and community character of the island, 2) provide island residents with valuable biological and ecological information about the unique plants, animals and natural communities found on the island 3) determine the natural features which both residents and MNFI consider the most significant, and 4) provide an opportunity for interested residents to determine how to ensure the viability of these unique natural features in the long-term.

### *Preparation*

Preliminary planning began in the fall of 2001 after the Drummond Island workshop was completed and MNFI staff began to develop conservation outreach strategies for Bois Blanc Island. This island contains a large population of the federal and state threatened dwarf lake iris (*Iris lacustris*), and is considered one of the epicenters of this Great Lakes endemic plant. In addition, Bois Blanc also harbors the northernmost population of eastern massasauga rattlesnake (*Sistrurus c. catenatus*) in Michigan. Despite the relative global rarity of these species, both are considered problematic or controversial by many of the year-round residents. Dwarf lake iris is very abundant in many locations near the shoreline, thriving in many places now heavily platted for residential development. In addition, dwarf lake iris can respond positively to soil disturbances such as road grading or forest clearing. To the casual observer, dwarf lake iris appears to be more of a

weedy plant than one requiring state and federal protection. Similar to other areas in Michigan, the eastern massasauga rattlesnake, state listed as special concern and a federal candidate species, is perceived as a public threat and was historically persecuted by residents living on the island. Both species pose a significant challenge to the conservation community. Prior to conducting the workshop on Bois Blanc Island, MNFI staff gave thoughtful consideration to the best way to present information to the community about these species in view of the controversy surrounding them.

In the winter and spring of 2002, planning for conservation outreach efforts on Bois Blanc Island began in earnest. This planning was initiated by contacting The Nature Conservancy (TNC) Northern Lake Huron Bioreserve Director, Jesse Hadley. Jesse provided insights about educational programs conducted the previous summer by Leigh Bartoo, an

independent contractor who received funding from the MDNR Natural Heritage Grants program to promote outreach and awareness of the unique species of Bois Blanc Island in 2001. Jesse also helped to identify key island residents who might provide help in planning and promoting our workshops. In the spring several island residents were contacted who provided helpful suggestions regarding the best time and place to hold the workshops to attract the most island residents and visitors. They provided important contact information and by mid-spring the Township Firehall and conference room were reserved for August 8th and 9th. They identified key places on the island where informational flyers promoting the workshops could be posted. Finally they shared important insights about the issues and concerns that are on the minds of island residents and visitors regarding the natural resources of Bois Blanc Island. Many residents expressed strong negative feelings and misconceptions about the massasauga rattlesnake. It was decided that it would be important to provide island residents and visitors the opportunity to view and learn more about this much maligned animal in a safe setting. We decided on a two day workshop format with an evening educational presentation followed the next morning by a presentation on the massasauga rattlesnake with by a field trip to key places around the island to learn more about Bois Blanc's unique plants, animals and communities. Theresa Moran, a herpetoculturist, who is also an amphibian and reptile keeper and educator at the Potter Park Zoo in Lansing, was contacted and agreed to provide a workshop on the massasauga rattlesnake with live specimens. Information regarding current and past natural features data, landcover changes, landscape patterns, and distribution of known rare species and natural communities was reviewed and synthesized to prepare for the upcoming outreach workshop. Maps depicting this information were produced by the MNFI GIS Analyst, Helen Enander.

An article entitled "What makes Bois Blanc so special?" was submitted to the Bois Blanc Tatler, the local island newsletter, appearing in the June 2002 edition, which was also posted on

the island Web page. This article provided an overview of the surveys that MNFI scientists have conducted on Bois Blanc Island and invited people to join us for an interactive, two-day workshop to discuss the conservation of the natural features of Bois Blanc Island. The agenda for the first day of the workshop was developed, which included: 1) introduction and greetings, including an ice-breaker exercise ("list your favorite thing about Bois Blanc Island"), 2) a summary of MNFI and the significance of Great Lakes Islands, 3) an interactive exercise with break-out groups entitled "crayon your community", 4) an overview of unique natural communities and plants of Bois Blanc Island, 5) a summary of migratory and breeding bird surveys conducted on the island in 1999 and 2000, 6) an overview of rare reptiles and insects of Bois Blanc Island, and 7) a short discussion on possible next steps, which included information about related activities in nearby communities. The agenda for the second day was developed, which consisted of: 1) an educational presentation on the eastern massasauga rattlesnake with opportunities to view a live snake up close and 2) a field trip to select places on the island to view plants, animals and unique natural communities.

MNFI Conservation Planner, Daria Hyde, made a trip to Bois Blanc Island in July to promote the workshop, make arrangements for the presentation at the township firehall, and to plan the itinerary for the field trip.

Advertisements for the workshop were put up at key locations throughout the Island and on the ferry. Gary and Gail Wagner met with MNFI staff at the township firehall conference room to discuss the necessary arrangements for setting up for the evening presentation and providing an appropriate space for the massasauga workshop in the firehall barn. Daria drove to key places on the island that harbored unique natural communities, plants, and animals and secured permission for workshop participants to access these sites during the field trip.

The workshop, entitled "Bois Blanc Island's Unique Plants, Animals, and Natural Communities", was held on the evening of August 8th followed by a workshop on the

eastern massasauga rattlesnake the following morning. This was followed by a field trip to key places on the island to view plants and animals in selected natural communities. A total of 70 residents attended the workshop (40 on the first

evening, 30 the following morning, with 10 attending the field trip), and relationships were developed with key people in the community. (A copy of the workshop agenda is provided in Appendix II).

### *Presentation*

A variety of educational materials were provided at the evening workshop and included: 1) a bird list for Bois Blanc Island, 2) a list of rare natural features found on Bois Blanc Island, 3) abstracts for 10 of the rare plants, animals, and communities on the island, 4) reporting forms for rare species 5) MNFI brochures, and 6) Borne of the Wind dune ecology booklets. Three large wall-sized maps, showing element occurrences with digitized natural communities over a digital elevation layer, 1978 landcover, and circa 1800 vegetation, were displayed at the workshop and later provided to Bill Rutledge from the Bois Blanc Island Historical Society to be used as a resource for islanders.

The agenda for the main presentation covered three topics: 1) description of MNFI and the services we provide, 2) the significance of Great Lakes shorelines and islands, and 3) results of biological surveys for Bois Blanc Island. The significance of the Great Lakes shoreline and islands focused on important and interesting facts. For example, there are nearly 600 Great Lakes islands within Michigan's borders, and these islands harbor approximately 10% of the state's total known element occurrences tracked by MNFI. This section also included statistics about Bois Blanc Island such as its size, ownership, vegetation patterns, and landscape changes over time. For example, Bois Blanc Island is the largest island within the immediate Straits region, covering approximately 23,650 acres and comprising about 36 miles of shoreline. A significant portion (approximately 50%) of Bois Blanc Island consists of state land within Mackinaw State Forest. The third topic, biological surveys, included 1) a summary of the natural communities and rare plants occurring on the island, 2) results of migratory and breeding bird surveys with a comparison to other Great Lakes

islands, and 3) results of rare insect and snake surveys. The presentation ended with a map showing the most significant sites of the island, and a list of potential future survey targets (please refer to Appendix III for an example of the PowerPoint presentations). Similar to the Beaver Island and Drummond Island workshops, the areas MNFI identified as the most significant sites on Bois Blanc Island were nearly the same as those the islanders identified as important, including Snake Island, Twin Lakes, Lighthouse Peninsula, the entire shoreline of the island, and old-growth areas on west end and with Lighthouse Peninsula, as well as other historic and commercial features. One area that residents identified as important, which MNFI had not identified specifically, was Sand Bay. This area has historical element occurrences which should be revisited in the future, although a portion of this area was assessed in prior surveys for TNC (Albert and Penskar 1993).

The workshop ended with a brief discussion on potential next steps to follow the workshop. Because many of the workshop participants were visitors or seasonal residents and few year round residents were present, there was limited participation in this discussion, as those attending did not have specific ideas in mind for promoting the conservation of the island's resources. With only a few island leaders present, this discussion was only conceptual in nature; therefore few practical ideas emerged for potential next steps. Bill Rutledge agreed to distribute information from the workshop at the Historical Society and Gary and Gail Wagner agreed to provide information at the township offices.

The eastern massasauga workshop presented information on the status, biology, and ecology of this rare Midwestern snake. Theresa Moran provided a brief overview and then opened up

the session to questions from the participants. Workshop participants asked questions about topics such as the effects and treatment of a massasauga bite, how to care for a snake, the structure and biology of the rattle, and food and water requirements. Workshop participants then watched a video made by the Toronto Zoo on the biology, ecology, and conservation of the eastern massasauga. The video also showed how people could safely move a massasauga, if needed. Theresa Moran then took out one of her live, captive-bred massasaugas, showed the non-aggressive nature of the snake and its tendency to move away from the people and toward cover. She also demonstrated how to safely move a massasauga using a broom or garden tool and a paper grocery bag, as shown in the video. After

the demonstration, she put the head and upper two-thirds of the massasauga in a glass tube (i.e., “tubing” the snake), and then allowed workshop participants to touch the tail and lower body of the massasauga. She also answered questions during and after the demonstration. Moran also had available for participants various educational displays and materials on massasauga biology and conservation as well as materials on general herpetile conservation. Most of the workshop participants were seasonal residents and visitors with one year-round resident attending. Also, many, if not most, of the workshop participants were children, accompanied by their parents and/or grandparents.

### *Summary of Workshop Interactions*

We began the workshop by having participants introduce themselves and share some of the things they appreciated about Bois Blanc Island. The listed items included such things as the beach, wildlife, night sky, solitude and serenity, great views, and friendly people. Of the 40 items mentioned, the majority focused on natural features and resources. Others were categorized as cultural or recreational. Based on the results, Bois Blanc Island appears to be considered by most to be a very special place that people cherish and appreciate whether they visit once a year or live there year round.

The purpose of the interactive exercise entitled ‘crayon your community’ was to generate mental maps of the participant’s community, and list the things that define Bois Blanc Island as a unique place. Attendees were split into eight groups made up of four to six people each. At the end of the exercise, each break out group presented to the larger group and all items mentioned were broken into four categories: 1) commercial, 2) historic features,

3) natural features, and 4) cultural features. Similar to Beaver Island and Drummond Island, the natural features category, with 24 items (14 of which had more than one vote) contained the most items. Next in order of importance was historic features (10), followed by cultural and commercial features (four each). Of the items mentioned more than once, the lighthouse, its peninsula, and Snake Island were mentioned by all 8 groups. Bible Beach, Lime Kiln Point, and the island ferry were mentioned 7 times. Further analysis showed that items mentioned in the natural features category could be placed into three additional categories: 1) renewable resources, 2) elements, and 3) places. The element category, which had 13 items, was by far the largest category followed by places with 8 items. Only three items were included under renewable resources: maple trees and syrup, wild thimbleberries and raspberries, and fishing at Twin Lakes. (Please refer to Appendix IV for a list of the results).

## Identification of Significant Biodiversity Areas in 2002

The following consists of a brief overview of significant areas identified during 2002 surveys on Bois Blanc Island and within the Les Cheneaux island chain. These sites and others, such as important bird areas noted in previous surveys, are included within a cumulative project summary below.

For Bois Blanc Island, several new large sites were identified as significant biodiversity areas. An exemplary wooded dune and swale complex near Point Catosh was recorded as a new community element. This natural community also contained the first occurrence of the state threatened limestone oak fern (*Gymnocarpium robertianum*) recorded for the island. Exploration of portion of an expansive wooded wetland system occupying much of the central and western part of the island resulted in the identification of a rich conifer swamp (Central Cedar Swamp), which may be one of the most significant wetland complexes on the island. The well known old-growth and dedicated natural area within the base of Lighthouse Peninsula was found to abut a high quality of previously unidentified boreal forest. The boreal forest was found to contain old-growth conifers (e.g. northern white cedar, white pine), with some individual trees more than 200 years in age as indicated by core samples. Both

Packard Point and Snake Island, which are contiguous with respect to their shoreline communities, form one of the most significant areas on Bois Blanc Island. The dunes, fens, and swales of this region of the island support populations of nearly all of the Great Lakes endemic plant species (Pitcher's thistle, dwarf lake iris, Houghton's goldenrod) as well as several other rarities, in addition to rare animals such as the Hine's emerald dragonfly and eastern massasauga.

Notable sites in the Les Cheneaux islands include Meridian Fen, a large significant northern fen found on the south shore of Marquette Island, which was also found to contain a new population of Houghton's goldenrod. In addition to the well known Great Lakes marshes found in Duck, Peck, and Voight bays, respectively, Marquette Island has locally significant dunes, additional areas of northern fen considered to be of strong potential for Hine's emerald dragonfly (which has yet to be discovered in this island chain), and boreal forest. Lastly, a boreal forest occurrence identified in the southern portion of La Salle Island was found to be contiguous with similar forest covering much of the closely adjoining Government Island.

## Project Overview and Summary

### *Biological Inventories*

Biological inventories of islands from 1998-2002 resulted in the identification of a collective total of 50 natural community, rare plant, and rare animal elements. These were comprised of 13 natural community types, 23 rare plant species, and 14 rare animal species, as detailed in Appendix I. Sixteen of these elements (nearly one-third of those observed during surveys) are classified as globally rare or rarer according to element ranks maintained by NatureServe (see Appendix V for an explanation of global ranking criteria). By element type, the sixteen globally rare elements consisted of six natural community types, seven rare plant species, and three rare animal species. (See Appendix VI for a list of abstracts available via the MNFI web site.)

For the 50 natural community, rare plant, and rare animal elements identified during our surveys, a collective total of 216 occurrences were documented. Of this total, 101 (47%) were known occurrences relocated and updated and

115 (53%) consisted of new occurrences that were found (Table 2). Overall, a comparatively large number of element occurrences were identified, a significant percentage of which are globally rare. These results corroborate the highly disproportionate number of rare species and exemplary communities occurring on islands, as highlighted in Soule's 1993 biodiversity study. Soule noted that while islands represent slightly more than one-hundredth (ca. 420,800 acres) of the state's total land mass (ca. 36,000,000 acres), they supported about one-eleventh of the state's known element occurrences as of 1993. Soule further emphasized that even when the biologically rich Isle Royale archipelago was excluded, islands supported about seven times more occurrences than could be expected. Islands are clearly important reservoirs of Michigan and Great Lakes biodiversity as confirmed by our five-year inventory of high priority sites and archipelagos.

**Table 2. Grand summary of occurrences by element type for 1998-2002 island inventories.**

<b>Element Type</b>	<b>Number of occurrences relocated and updated</b>	<b>New occurrences documented</b>	<b>Total</b>
Natural communities	21	41	62
Rare animals	13	38	51
Rare plants	<u>67</u>	<u>36</u>	<u>103</u>
<b>Total</b>	<b>101</b>	<b>115</b>	<b>216</b>

### *Digitization of Natural Features Data*

As discussed and reviewed in all previous reports, a critical task of the island project has consisted of digitizing and preparing island natural features data for use within MNFI's Geographic Information System (GIS). As island surveys were systematically conducted from 1998-2002, field data and pre-existing data within our Biological and Conservation Database (BCD) were carefully reviewed and digitized. Digitizing occurrences of natural

features enables this information to be represented spatially, making it much more functional to a variety of users such as scientists, planners, consultants, and natural resource agencies, as well as private and public landowners.

A detailed description of digitizing and the natural heritage database system was provided with the 2001 progress report (Penskar et al. 2002). That description provided a display of



how natural features information is depicted and used within our spatial database. It also demonstrated how replacing circular buffers with digitized spatial extent changes the number of occurrences per legal survey section. The latter results in a more accurate portrayal of element occurrence extent that influences how these data can be used more efficiently by planners, environmental reviewers, and others.

Through 2001, a total of 430 occurrences were processed and digitized. With the new

element occurrences identified in 2002, in addition to the updating of previously known records, a grand total of 457 occurrences was tallied for digitizing from 1998-2002. This represents nearly 4% of the MNFI statewide natural features database, a proportion that can be expected to be maintained as islands continue to be inventoried.

### *Identification of Significant Biodiversity Areas*

Table 3 provides a cumulative summary of biodiversity areas identified during 1998-2002 island surveys. The table is largely a compilation of survey sites where natural features were documented during our surveys, including numerous bird survey sites identified as being important for Neotropical migratory species and/or as significant breeding areas. The list demonstrates a relatively high number of shoreline sites, which is to be expected considering that sand dunes and other shoreline communities support many of Michigan's Great Lakes endemics. Species such as Pitcher's thistle, dwarf lake iris, Houghton's goldenrod, Lake Huron tansy, Michigan monkey-flower, butterwort, Lake Huron locust, and a number of rare shorebirds such as piping plover, common tern, and caspian tern are found primarily along or in close proximity to Great Lakes shores. Not uncommonly, the shoreline natural community types comprise rare elements, including such habitats as alvar, limestone pavement lakeshore, Great Lakes marsh, open dunes, wooded dune and swale complexes, and northern fens. In many cases the aforementioned endemics and other rare plant

and animal species are often associated with these globally rare community types.

The majority of biodiversity areas (40 of 94) occur in the Beaver Island archipelago (Beaver, Garden, and Hog islands), with 24 areas identified for Drummond Island and 16 for Bois Blanc Island. As noted above, these areas are largely related to sites where substantive field assessments took place in 1998-2002, and are not intended to be definitive. Priority in field work was placed on examining significant inventory gaps with the highest potential for critical natural features, in addition to examining historical occurrences for similarly high priority elements. Beaver, Garden, and Hog Islands received fairly thorough and broad inventory coverage, whereas surveys on Bois Blanc and Drummond islands were necessarily targeted on very specific inventory gaps and elements based on previous MNFI surveys (see related discussion below under future efforts). Focusing on areas of the highest potential for critical natural features resulted in the delineation of the most significant sites. This emphasis also provided information useful in directing future biological inventories.

**Table 3. Significant Biodiversity Areas Identified during 1998-2002 Island Inventories.**

<b>Island/Biodiversity Area</b>	<b>Notable natural features</b>
<b>Beaver Island Archipelago</b>	
<i>Beaver Island</i>	
Appleby Point	One of two island sites for dwarf lake iris, ram's head orchid
Barney's Lake	Caspian tern, nesting common loons, osprey observed, rich bird diversity, aquatic species; known site for deepwater pondsnail
Bonnars Landing-McCauley Point	Open dunes with Lake Huron locust, Pitcher's thistle, Lake Huron tansy, Pumpell's brome grass
Cable Bay	Lake Huron locust, merlin, rich bird diversity, good quality open dunes, Pitcher's thistle, Lake Huron tansy
Cheyenne Point	Lake Huron locust, localized Pitcher's thistle
CMU Biostation	Historic Lake Huron locust population, small colony of ram's head orchid
Donegal Bay-Indian Point	Only site for Houghton's goldenrod; Pitcher's thistle, Lake Huron tansy, and butterwort also present
Donegal Bay-McCauley Point	Lake Huron locust, nesting piping plovers, rich bird diversity, Pitcher's thistle, Lake Huron tansy, butterwort
Egg Lake Bog	High diversity, high quality open bog
Font Lake	American bittern
Font Lake Old-growth	Small, remnant mesic northern forest, some potential for restoration
Fox Lake	Only island site for water plantain, reported site for deepwater pondsnail, adjacent open bog occurrence
French Bay	One of two island sites for dwarf lake iris; Pitcher's thistle and Lake Huron tansy present; known site for calypso orchid; well known scenic area
Greenes Bay-McFadden Point	High quality sand dune complex with Pitcher's thistle and Lake Huron tansy; known site for fascicled broom-rape; Lake Huron locust, merlin, historic piping plover nesting area
Greenes Lake	Common moorhen
Indian Point	Pitcher's thistle, Lake Huron tansy, butterwort
Iron Ore Bay	Locally extensive dune complex, Pitcher's thistle, Lake Huron tansy, known site for fascicled broom-rape; Lake Huron locust, merlin pair observed
Lake Geneserath Hemlocks	Remnant stand of old-growth hemlock in mesic northern forest, rich bird diversity
Letts Point	Pitcher's thistle, Lake Huron tansy
Little Sand Bay	Well known nature preserve, only extant island locality for Michigan monkey-flower, a state endemic; butterwort, Pitcher's thistle, Lake Huron tansy, Lake Huron locust, rich bird diversity
Lookout Point	Open dunes, Pitcher's thistle, Lake Huron tansy, Pumpell's brome grass, Lake Huron locust
Martin's Bluff	Locally significant mesic northern forest with remnant old-growth
Point La Par	Large, locally significant forest tract with two distinct community types
Sand Bay	Open dunes contiguous and intact despite shoreline development and significant seasonal use; large populations of Pitcher's thistle and Lake Huron tansy, limited artificial disturbance
Sandy Point North	Important bird migration site, rich bird diversity, Pitcher's thistle, Lake Huron tansy
Southwest Old-growth	Significant mesic northern forest old-growth remnant
St. James Harbor	Open dunes habitat with Pitcher's thistle, Lake Huron locust; former locality for Michigan monkey-flower
Wilke Airport	Merlin
<i>Garden Island</i>	
Garden Island Harbor	Locally significant Great Lakes marsh and northern wet meadow complex
Indian Harbor	Great Lakes marsh, osprey, rich bird diversity, good potential habitat for Houghton's goldenrod



<b>Island/Biodiversity Area</b>	<b>Notable natural features</b>
Jensen Harbor	Large northern fen and adjacent cedar forest, Houghton's goldenrod, butterwort
Jensen Harbor West	Pitcher's thistle, Lake Huron tansy, beauty sedge
Monatou-Sturgeon Bay	Great Lakes marsh with a northern fen component
Northcutt Bay	Limited dune habitat with Pitcher's thistle, beauty sedge, merlin observed
Red Oak Garden	Mesic northern forest remnant
Sweat Lodge Swale	Small but high quality northern fen with butterwort and English sundew
West Boreal Forest	Extensive boreal forest tract with old-growth
<b>Hog Island</b>	
Baldimore Bay Env. Area	State designated environmental area, Great Lakes marsh, northern fen, interdunal wetlands, common tern
Hog Island East Shoreline	Great Lakes marsh, small wooded dune and swale complexes, open dune, cobble beach, dwarf lake iris, Pitcher's thistle, Lake Huron locust
Hog Island North	Dry mesic northern forest, hardwood swamp
<b>Garden Peninsula Archipelago</b>	
<b>Poverty Island</b>	alvar, boreal forest, dry non-acid cliff, dwarf lake iris, beauty sedge, Richardson's sedge
<b>Little Summer Island</b>	Dry non-acid cliff, climbing fumitory, dwarf lake iris, bald eagle
<b>Summer Island</b>	Alvar, dwarf lake iris, Lake Huron tansy, slender cliff-brake, Richardson's sedge, beauty sedge, climbing fumitory
<b>Bois Blanc Island</b>	
Bois Blanc Airport West	Red-shouldered hawk territory
Central Cedar Swamp	Rich conifer swamp, portion of large wooded wetland complex
Central Drive Orchard	Red-shouldered hawk territory, rich bird diversity
Central Road East Fork	Red-shouldered hawk territory
Deer Lake	Bald eagle nest, eastern massasauga
Gull Island	Nesting common tern colony, Caspian tern
Lake Mary	Common loon, eastern massasauga
Lighthouse Point	Old-growth mesic northern forest, old-growth boreal forest, dwarf lake iris, rich bird diversity
Packard Point	Open dunes, Pitcher's thistle, Lake Huron locust, rich bird diversity
Point Catosh Swales	Wooded dune and swale complex, limestone oak fern, rich bird diversity
Point Detachee Fen	Northern fen, Houghton's goldenrod, butterwort, rich bird diversity
Snake Island	Dedicated state natural area, open dunes, cobble shore, and northern fen complex, eastern massasauga, Hine's emerald dragonfly, dwarf lake iris, Houghton's goldenrod, Pitcher's thistle, Lake Huron tansy, pale Indian plantain, beauty sedge
South Shore Fen	Eastern massasauga, rich bird diversity
Sucker Creek Swamp	Bald eagle nest
Thompson Lake	Common loons
Twin Lake Wetland	Red-shouldered hawk territory, American bittern, marsh wren
<b>Drummond Island</b>	
Barbed Point	Rich bird diversity
Big Shoal Cove	Alvar with several associated rare plant species, important bird migration site, important breeding bird site
Bruce Point Marsh	American bittern
Dickenson Lake	American bittern
Harbor Island Reef	Nesting common tern colony
Huron Bay	Alvar, Hill's thistle, bulrush sedge, purple cliff-brake, Richardson's sedge

<b>Island/Biodiversity Area</b>	<b>Notable natural features</b>
Huron Bay Road	Alvar, Hill's thistle, Richardson's sedge
Johnswood	Important bird migration site, Important breeding bird site
Marblehead Peninsula-East Shore	Extensive series of limestone/dolomite outcrops (dry non-acid cliff), only site in state for wall-rue fern; Alaskan orchid, pine-drops, and beauty sedge
Marl Lake	Important bird migration site, Important breeding bird site, American bittern
Maxton Plains East	Extensive alvar, Hill's thistle, flattened spike-rush, prairie dropseed, Richardson's sedge
Maxton Plains Meadow	Important breeding bird site
Maxton Plains Middle	Extensive alvar, bulrush sedge, Hill's thistle, flattened spike-rush, prairie dropseed, Richardson's sedge
Pigeon Cove Wildlife Flooding	Nesting northern harriers, American bittern
Potagannissing Bay Campground	Important bird migration site, Important breeding bird site
Potagannissing River Mouth	Nesting black tern colony
Potagannissing River Wildlife Flooding	American bittern
The Rock North	Small, remnant alvar opening with prairie dropseed and Richardson's sedge
Rabbit Bay	Nesting osprey
Scott's Marsh	Designated important bird stopover site for waterfowl; designated important breeding area for American bittern and LeConte's sparrow (TNC designation)
Sheep Ranch Road Wetland	Important breeding bird site
Shoal near Yacht Haven Marina	Nesting common tern colony
Snively Road	Nesting merlin
Warner's Cove	Important bird migration site
<b>Potagannissing Bay Islands</b>	
<b>Burnt Island</b>	High quality Great Lakes marsh, bald eagle nesting site
<b>Harbor Island</b>	Mesic northern forest with old-growth, Great Lakes marsh
<b>Les Cheneaux Archipelago</b>	
<b>Government Island</b>	High quality boreal forest contiguous with occurrence on La Salle Island
<b>La Salle Island</b>	High quality boreal forest, dwarf lake iris, calypso, beauty sedge
<b>Little La Salle Island</b>	Dwarf lake iris, calypso, Great Lakes marsh habitat present
<b>Marquette Island</b>	
Marquette Bay	Boreal forest, localized northern fen with beauty sedge
Marquette Southeast Peninsula	Dwarf lake iris, beauty sedge, localized areas of boreal forest and northern fen
Meridian Fen	High quality northern fen, dwarf lake iris, Houghton's goldenrod
Peck Bay	Great Lakes marsh, dwarf lake iris
Voight Bay	Great Lakes marsh complex, dwarf lake iris, Houghton's goldenrod
Voight Bay West	High quality northern fens, localized open dune with interdunal wetland, yellow pitcher-plant, beauty sedge; potential area for Houghton's goldenrod and Hine's emerald dragonfly

## *Conservation Outreach Summary and Conclusions*

Conservation outreach on Beaver, Drummond and Bois Blanc islands represents our effort to explore how natural features data can be optimally used by island residents and decision makers to improve awareness of island biodiversity and influence land-based decisions that impact the conservation of biodiversity. From our experience, we realize that the connection between scientific surveys and research and the day to day activities that occur in human communities throughout Michigan is often lacking. Not only are people often largely unaware of the unique natural features in their area, they are also unaware of how their decisions and actions can impact the long-term viability of rare species, high quality natural communities, and other significant natural features.

Originally, the goal of the conservation outreach portion of the project was to test what types and levels of natural resource related information are desired by island communities. The basic premise was that natural features related information is either not accessible to local communities or exists in a format that is not easily integrated into day to day decisions. While working with partners and community leaders to prepare for these workshops, however, the goal of conservation outreach became less focused on testing which information is desired by island communities and more focused on designing an effective method to convey the information. More specifically, the goal was to develop an effective method for: 1) sharing information with local residents and decision-makers about the unique natural features of their islands, 2) identifying natural areas and features that are highly valued by communities and recognized by MNFI as ecologically significant, and 3) catalyzing community-based efforts to conserve these unique natural areas and features.

Conservation outreach efforts on Beaver, Drummond, and Bois Blanc islands provided an opportunity to work within well-established human communities located in isolated and well-defined geographic spaces. All of these island communities are small and have a strong

sense of place. They are small enough that everyone has an opportunity to know everyone else, and all of these islands have several families with long histories on the island, some dating back four to five generations. Each island consists of seasonal and permanent residents. None of these islands can be reached by car, and they all offer ferryboat and airport services. The ferries that service Beaver and Bois Blanc Island operate nine months out of the year, while the Drummond Island ferry operates year round. All three islands also contain many high quality natural features and sites, as well as a relatively high percentage of public land.

There are also a few noteworthy differences. Beaver Island, which is located 32 miles from Charlevoix, is much more remote than Bois Blanc Island, which is 5 miles from Cheboygan, or Drummond Island, which is only 1 mile from mainland Detour Village. Drummond Island is the largest of the three islands, and more areas on Drummond are inaccessible. Beaver, Bois Blanc, and Drummond also differ in their respective geomorphology, and as a result, different natural communities, plants, and animals characterize each island. People on Beaver and Drummond Islands rely heavily on tourism as their primary source of employment and revenue, while this is not true for Bois Blanc Island residents. Another difference is that Drummond Island is generally marketed as a four-season "sportsman's paradise," whereas Beaver Island is marketed more as a summer destination for families with an emphasis on scenic views, sandy beaches, relaxation, and a friendly community. There is little active marketing of Bois Blanc Island as a tourist destination (even though tourism provides a small contribution to the island economy) except through a website hosted by the local real estate agent. Part of the reason for this may be that there few places to stay, with only one restaurant and store, and there are very few sandy beaches (most are cobble); moreover, the roads are dusty and unpaved and there are abundant black flies, mosquitoes, and no-see-ums on the island. The people that visit Bois Blanc love the island for

its ruggedness, relative remoteness, and solitude and for the most part want to keep it this way.

All of our workshops were designed to be interactive and community-based, with an emphasis on sharing information, rather than using an expert-based model that relies on a one-way exchange of data. The design of the workshops was largely the result of working closely with the Land Information Access Association (LIAA), as well as a few key members of the local community. The Drummond Island workshop was largely based on the success of the Beaver Island workshop, incorporating a few minor modifications. The primary difference in the Bois Blanc Island workshop was the addition of the massasauga rattlesnake workshop and a field trip to selected teaching sites the second day. These were very successful and were well received by the participants who attended them. Theresa Moran, the herpetologist who presented the snake workshop, is quite knowledgeable about massasaugas and proved to be a highly skilled public speaker. She helped to reduce people's fear, dispelled many common myths, and did an excellent job of raising awareness about the unique qualities of the eastern massasauga. It was very powerful, to the 30 participants who attended, to have the opportunity to not only safely view rattlesnakes but also to be able to touch the body and tail of a captive reared snake that was placed in a glass tube. People left this workshop with a heightened respect for this reptile as well as the factors that threaten its existence. In fact, of the eight workshop participants that turned in evaluations, all eight indicated they were very confident in knowing how to avoid snake bites after the workshop (mostly mildly confident with a few very confident before the workshop). Most importantly, all eight also felt they had a role to play in assisting in the conservation of this species after the workshop.

The following field trip, which was attended by 10 people, was also well received. It provided participants with an opportunity to visit different ecological communities and learn about the unique plants and animals that are associated with these special Great Lakes habitats. The field

trip gave people a chance to interact with MNFI's botanist and zoologist and learn about a variety of natural features, including northern fens, dwarf lake iris, Pitcher's thistle, pale Indian plantain, massasauga rattlesnake habitat, red-shouldered hawks, and common terns.

Another primary difference in the Bois Blanc Island workshop was that despite the fact that 40 people attended the workshop the first night and 30 the second day, there was minimal participation of key island leaders. Although island leaders were helpful in sharing information that was useful in planning the workshop, for various reasons they did not attend the workshops. Some were not on the island during the time that was suggested would be best to draw the most people. Two individuals in particular expressed strong negative feelings about massasauga rattlesnakes and were not interested in attending the workshop on the second day. One suggested that more people would attend a workshop on birds since there was a strong interest in bird-watching on the island. Even though these individuals were assured that during the workshop on the first night we would only discuss massasaugas briefly and that no live snakes would be present, they still did not attend. Perhaps with more resources MNFI could have provided a workshop on birds initially and followed up with a massasauga workshop the following year. It is difficult to gauge what if anything MNFI could have done differently to engage island leaders more fully to encourage their participation at the workshop. Overall, MNFI staff believes that the workshops were very well received and will provide a solid foundation for future collaboration regarding the conservation of Bois Blanc Island's natural resources.

Despite the fact that there are distinct differences between these islands (as mentioned above), the results of the interactive workshops were very similar. Natural features were highly valued on all of the islands. Items in the natural features category outnumbered items in other categories (cultural, historic, and commercial). Defined natural areas or landscapes, such as Iron Ore Bay on Beaver Island, Maxton Plains on Drummond Island, and Snake Island and the

Lighthouse Peninsula on Bois Blanc Island were an important part of each island's community identity and sense of place. Interestingly, the sites identified by MNFI as significant were almost identical to the sites most valued by each island community. This is not to imply that MNFI's data are unnecessary for identifying ecologically significant sites on an island. What it may demonstrate is that island residents have an appreciation for places that exhibit ecological integrity, intactness, and wildness. MNFI believes that these sites are important because of the global rarity and high quality of the plant communities found in these areas, and the associated rare plants and animals that they harbor. MNFI's information provides added value because it provides islanders with a better understanding of these unique natural features and supplies decision-makers with objective scientific knowledge that is meaningful to the local community and other stakeholders.

Upon reviewing the three island workshops, several insights can be drawn about the project. One of the more surprising insights was that up-

to-date ecological surveys, which are the foundation of this project, appear to be an excellent tool for giving MNFI staff credibility in local communities that were otherwise unaware of our program. Ecological surveys also helped engage the imagination of community leaders, which seemed to lead to greater local participation in the development of the workshops. Another important observation was that each island had at least one dedicated individual who played an integral part in the development of the workshops. Such individuals provided information about the best times, dates, and places for a workshop, contacted other community leaders, publicized the workshop, and basically served as a local liaison for MNFI. In addition, conservation groups with an established local presence, such as The Little Traverse Conservancy (LTC) and The Nature Conservancy's former Northern Lake Huron Bioserve office, were critical in identifying and contacting community leaders and enlisting their assistance in the development of the workshops.

### *Future Efforts and Recommendations*

Based on the clearly demonstrated biodiversity value of Great Lakes islands, continued biological inventories are strongly warranted. Of the 31 islands and island groups identified by Soule (1993) as high priority for inventory (based on analysis of Michigan's nearly 600 islands), 18 have now been substantively surveyed by MNFI. The majority of these islands were surveyed during 1998-2002 inventories, with the exception of the St. Martin islands (Mackinac County), Harsens and Dickinson islands (St. Clair County), and South Fox Island (Leelanau County), which were surveyed during the course of several other projects. Considerable work is thus required in order to attain adequate inventory coverage for the remaining islands or island complexes.

Notable sites in need of survey include: Sugar, Neebish, and Lime islands in the St. Mary's River (Chippewa County), Albany Island (Mackinac County), Thunder Bay, Crooked, and Middle islands in northern Lake Huron (Alpena

County), and North Fox in northern Lake Michigan (Leelanau County), the latter now owned by the State of Michigan. Additional survey is also needed to fully assess islands in Potagannissing Bay and Detour Passage, of which MNFI inventoried the two largest (Burnt Island and Harbor Island) of a complex of more than two dozen islands of significant size that are likely to support natural features.

An additional recommendation is that the entire list of Michigan islands should be carefully reexamined with regard to biological inventory needs and the identification of high priority survey sites. The statewide database of element occurrences has changed markedly since 1993, and the addition – as well as deletion – of tracked elements is likely to further influence survey areas. For example, the federal and state endangered Hine's emerald dragonfly was not known to occur in Michigan until 1997. It was then found by a USFWS surveyor on Bois Blanc Island and other areas in the Straits regions and



northern Lower Michigan. This species was subsequently identified as a target during island inventories as ecologists and botanists were able to assist in delineating potential habitat for this rare species.

We have also learned to focus on new inventory targets in addition to those emphasized by Soule. During the initiation of the project in 1998, Neotropical migrants were studied to elucidate how large islands function in supporting migratory bird species. It was then realized that it was necessary to go beyond tallying migrants to begin recording breeding bird populations, in order to more fully characterize the role of Great Lakes islands in supporting avian biodiversity. We believe that the incorporation of breeding bird surveys in island inventories will help to better define conservation needs and priorities.

An increased knowledge of specific islands through other projects will also influence the listing of island inventory priorities. Manitou Island, for instance, which lies four miles east of the tip of the Keweenaw Peninsula, was accessed during a statewide survey of bedrock shorelines (Albert et al. 1994). An intensive one-day survey of its shoreline resulted in the

identification of an exemplary bedrock natural community and numerous rare plant species. This island thus has strong merit for additional inventory by zoologists, and requires more thorough inventory by botanists and ecologists to fully catalogue its natural features. A review of island priorities, therefore, will undoubtedly result in the addition of several other sites.

Lastly, conservation outreach activities initiated through several island workshops and presentations can only be considered a first step toward effective conservation planning with local communities. An ongoing relationship, preferably through a local contact and/or a locally based conservation organization, is necessary in order to move forward with the information and biological data provided by MNFI. And finally, much as islands are known and valued for their varying degrees of physical isolation and scientific uniqueness, their human communities and culture are unique as well. The process of engaging these significant communities to conserve biodiversity may well provide important lessons in the broader application of conservation outreach throughout Michigan.

## Acknowledgements

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We would also like to thank Dave Kenaga for serving as project officer for the final year of this project, especially for his ever helpful administrative guidance and for taking the time to spend a day in the field to observe, discuss, and also participate in a day of surveys. It is relatively rare to have frequent contact with project officers, and rarer yet to have the opportunity to take them into the field and put them to work!

There are many to thank for assistance in our surveys of Bois Blanc Island and the Les Cheneaux Islands, and especially for help in preparing and presenting a successful conservation outreach workshop on Bois Blanc Island. Yu Man Lee was ably assisted in massasauga surveys by John, Keenan, and Connor. Hine’s emerald surveys were conducted by Matt Smar, who also assisted by providing observations of rare plant populations. Plant and natural community surveys were greatly enhanced via the assistance of Marija

Andrijonas, who helped identify several rare plant populations and participated in natural community surveys on Bois Blanc Island as well as in the Les Cheneaux. The DNR Endangered Species Coordinator, Patrick Lederle, provided an excellent lead for potential Michigan monkey-flower habitat on Bois Blanc Island. Thanks to Gregg Dickerson (caretaker) and Deb Dawson (new owner) for their gracious accommodation of our staff at the South Shore Inn (the renovated former Boathouse Motel).

Numerous people helped us to prepare and conduct an extensive conservation outreach workshop on Bois Blanc Island. Jessie Hadley, the former director of TNC’s Northern Lake Huron Office, was a key contact for our workshop, providing names of island residents who were ultimately very helpful in the development of the outreach presentations. Jessie also was a key participant in our previous Drummond Island outreach workshop. We especially thank Gary and Gail Wagner for their warm hospitality in helping us with the room arrangements at the Township Fire Hall for the workshops. We are indebted to Dale Hoffman for providing us permission to visit his property during our field trip and for his wonderfully entertaining and informative rattlesnake stories from the island. We appreciate the willingness of Bill Heath, a biology teacher and summer Bois Blanc resident, who has volunteered to confirm, map, and record sightings of eastern massasauga so we can better understand its status and distribution. Thanks are also due to Bois Blanc islanders Donna Card, Susan Van Voorhees, Curt Van Voorhees, and Loren Gibbons for providing helpful information regarding the planning and development of the workshop. J. Bunker Clark included information about our workshop in the Bois Blanc Tattler newsletter, and Bill Rutledge of the Bois Blanc Island Historical Society kindly offered to distribute educational materials that we brought to the workshop. Finally, the conservation outreach effort was aided greatly by a superb snake workshop presented by Theresa Moran, who completely won over her audience with an excellent presentation and her

impressive knowledge of massasaugas and other snakes.

In this final year, it is important to acknowledge the contribution of several MNFI staff that participated in this project in previous years or otherwise influenced this project in significant ways. A seminal report by Judy Soule on the biodiversity of Michigan's Great Lakes islands was the touchstone for all of our efforts, and against which we measured the success of this project. Daria Hyde, who led conservation outreach efforts in 2002, designed and conducted three of four years of bird surveys. Jennifer Olson was also responsible for a significant portion of bird inventories, collaborating with Daria and completing them through 2001. Jen also recruited several volunteers (Jodi Spieles, Mike Petrucha, Kim Grveles, and Mark Ledebuhr) to assist in some of our bird work. Previous ecological surveys were conducted by former MNFI ecologists Rich Corner and MNFI Program Ecologist Dennis Albert. Phyllis Higman performed many of the plant surveys through the first three years of the project, and also provided the principal investigator with good advice on how to best summarize and present an abundant but potentially confusing array of data to our funders and other audiences. One year of aquatic

surveys were conducted by Reuben Goforth and his staff on Beaver Island. MNFI information management staff performed critical functions through all phases of this project, including digitizing work, general occurrence processing, map preparation, and assistance in the dreaded end phase of report production. Ed Schools, Rebecca Boehm, Michael Fashoway, and Helen Enander all provided abundant help in this regard, and were simply essential to the project. Joe VanderMuelen, of the Land Information Access Association (LIAA), assisted with the initial conservation outreach workshop on Beaver Island, helping to develop a model to build on for two subsequent efforts on Drummond and Bois Blanc islands.

As always, MNFI administrative staff supported this project in countless ways. We are especially indebted to Sue Ridge and Laraine Reynolds for the many tasks they undertake that enable us to conduct and accomplish our work. We also thank Lyn Scrimger and Judy Soule, MNFI budget specialist and Director, respectively, for important help in grant administration matters.

Much additional assistance was provided by individuals far too numerous to list again here, and thus we refer the reader to the 1999-2001 progress reports.

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## **Appendices**



## Appendix I

### Cumulative List of Natural Features Identified during 1998-2002 Island Inventories<sup>1</sup>

Element	Common Name	Global/State Rank	Federal/State Listing Status
<b>Natural Communities</b>			
Alvar	-	G2/S1	-
Bog	-	G4/S4	-
Boreal forest	-	GU/S3	-
Dry-mesic northern forest	-	G4/S3	-
Dry non-acid cliff	-	G4/S3	-
Great Lakes marsh	-	G3/S3	-
Hardwood-conifer swamp	-	G4/S3	-
Limestone pavement lakeshore	-	G3G4/S2	-
Mesic northern forest	-	G4/S4	-
Northern fen	-	G3/S3	-
Northern wet meadow	-	G4/S4	-
Open dune	-	G3/S3	-
Wooded dune and swale complex	-	G3/S3	-
<b>Rare Plant Species</b>			
<i>Adlumia fungosa</i>	climbing fumitory	G4/S3	SC
<i>Asplenium ruta-muraria</i>	wall rue	G5/S1	E
<i>Bromus pumpellianus</i>	Pumpelly's brome grass	G4G5T4/S2	T
<i>Carex concinna</i>	beauty sedge	G4G5/S3	SC
<i>Carex richardsonii</i>	Richardson's sedge	G4/S3S4	SC
<i>Carex scirpoidea</i>	bulrush sedge	G5/S2	T
<i>Cirsium hillii</i>	Hill's thistle	G3/S3	SC
<i>Cirsium pitcheri</i>	Pitcher's thistle	G3/S3	LT, T
<i>Cypripedium arietinum</i>	ram's head orchid	G3/S3	SC
<i>Drosera anglica</i>	English sundew	G5/S3	SC
<i>Eleocharis compressa</i>	flattened spike-rush	G4/S2	T
<i>Gymnocarpium robertianum</i>	limestone oak fern	G5/S2	T
<i>Iris lacustris</i>	dwarf lake iris	G3/S3	LT, T
<i>Littorella uniflora</i>	American shore-grass	G5/S2S3	SC
<i>Mimulus glabratus</i> var. <i>michiganensis</i>	Michigan monkey-flower	G5T1/S1	LE, E
<i>Pellaea atropurpurea</i>	purple cliff-brake	G5/S2	T
<i>Pinguicula vulgaris</i>	butterwort	G5/S2S3	SC
<i>Piperia unalascensis</i>	Alaskan orchid	G5/S2S3	SC
<i>Pterospora andromedea</i>	pinedrops	G5/S2	T
<i>Sarracenia purpurea</i> f. <i>heterophylla</i>	yellow pitcher-plant	G5T1T2Q/S1	T
<i>Solidago houghtonii</i>	Houghton's goldenrod	G3/S3	LT, T
<i>Sporobolus heterolepis</i>	prairie dropseed	G5/S3	SC
<i>Tanacetum huronense</i>	Lake Huron tansy	G4Q/S3	T

<sup>1</sup> G = Global Rank ("U" = Undetermined, "T" = Subspecies, "Q" = Taxonomy in question)  
 S = State Rank, LE = Federal Endangered, LT = Federal Threatened, C = Federal Candidate,  
 E = State endangered, T = state threatened, SC = State special concern

**Appendix I (continued)**

<b>Rare Animal Species</b>	<b>Common Name</b>	<b>Global/State Rank</b>	<b>Federal/State Listing Status</b>
<i>Botaurus lentiginosus</i>	American bittern	G4/S3S4	SC
<i>Buteo lineatus</i>	red-shouldered hawk	G5/S3S4	T
<i>Chlidonias niger</i>	black tern	G4/S3	SC
<i>Circus cyaneus</i>	northern harrier	G5/S3	SC
<i>Cistothorus palustris</i>	marsh wren	G5/S3S4	SC
<i>Falco peregrinus</i>	merlin	G5/S1S2	T
<i>Gallinula chloropus</i>	common moorhen	G5/S3	SC
<i>Gavia immer</i>	common loon	G5/S3S4	T
<i>Haliaeetus leucocephalus</i>	bald eagle	G4/S4	LT, T
<i>Pandion haliaetus</i>	osprey	G5/S4	T
<i>Sistrurus catenatus catenatus</i>	Eastern massasauga	G3G4T3T4/S3S4	C, SC
<i>Somatochlora hineana</i>	Hine's emerald dragonfly	G2G3/S1	LE, E
<i>Sterna hirundo</i>	common tern	G5/S2	T
<i>Trimerotropis huroniana</i>	Lake Huron locust	G2G3/S2S3	T

## Appendix II

### Agenda for Conservation Outreach Workshop

#### AGENDA

Thursday, August 8<sup>th</sup>

#### Bois Blanc Island's Unique Plants, Animals and Natural Communities

7:00-7:15pm	Introduction
7:15-7:30pm	Why are Michigan's Islands So Important?
7:30-8:00pm	Draw Your Island Exercise
8:00-8:10	Break
8:10-8:30pm	Unique Natural Communities and Plants of Bois Blanc
8:30-8:45pm	Birds of Bois Blanc Island
8:45-9:00 pm	Rare Reptiles and Insects of Bois Blanc Island
9:00pm	Discussion, Next Steps





## Appendix III

### Example of PowerPoint Presentation Given for Conservation Outreach Workshop on Bois Blanc Island.

### Agenda

- Who is the Michigan Natural Features Inventory?
- Significance of Great Lakes shoreline and Islands
- Results of biological surveys for Drummond Island



### The Natural Heritage Network

- A network of agencies whose charge is to collect sound scientific information
- 85 primary data centers:
  - all states
  - 6 Canadian provinces
  - 13 Latin American and Caribbean countries



### Who do we work for?

- Program of Michigan State University Extension operated cooperatively with the MI Department of Natural Resources.
- Funded by grants obtained from state agencies, federal agencies, and local governments, with core funding from the MDNR.

### Information Flow

- Gather
- Track
- Analyze
- Disseminate

.....information on endangered, threatened and special concern species, rare or exemplary natural communities, and other unique natural features.

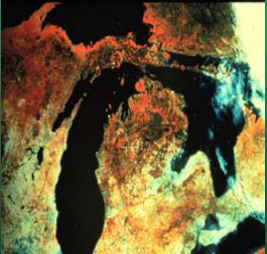


### Tracking Data

- Over 600 species of plants, animals, and invertebrates
- Over 60 natural communities
- Over 12,000 element occurrences



### Significance of Great Lakes Shorelines



## Appendix IV

### Results of Interactive Exercise, August 8,2002

#### Bois Blanc Island Community Workshop

*Things participants loved about Bois Blanc Island (round-robin- everyone contributed)*

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<b>Natural</b>	<b>Cultural</b>	<b>Recreational</b>	<b>Other</b>
Beach/water	History- lumber	Jet Skis	Everything
Biodiversity			Friendly people
Birds			Like the U.P.
Cedar trees			Part of U.S.
Crayfish			Quiet
Creek			Remote location
Deer			Solitude/serenity
Great view			Special
Natural beauty			Unique
Night sky			
Rattlesnakes			
Shoreline/view			
Tamarack trees			
Wildflowers			
Wildlife/critters			

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## Appendix V

### Global and State Element Ranking Criteria

#### GLOBAL RANKS

- G1** = critically imperiled globally because of extreme rarity (5 or fewer occurrences range-wide or very few remaining individuals or acres) or because of some factor(s) making it especially vulnerable to extinction.
- G2** = imperiled globally because of rarity (6 to 20 occurrences or few remaining individuals or acres) or because of some factor(s) making it very vulnerable to extinction throughout its range.
- G3** = either very rare and local throughout its range or found locally (even abundantly at some of its locations) in a restricted range (e.g. a single western state, a physiographic region in the East) or because of other factor(s) making it vulnerable to extinction throughout its range; in terms of occurrences, in the range of 21 to 100.
- G4** = apparently secure globally, though it may be quite rare in parts of its range, especially at the periphery.
- G5** = demonstrably secure globally, though it may be quite rare in parts of its range, especially at the periphery.
- GH** = of historical occurrence throughout its range, i.e. formerly part of the established biota, with the expectation that it may be rediscovered (e.g. Bachman's Warbler).
- GU** = possibly in peril range-wide, but status uncertain; need more information.
- GX** = believed to be extinct throughout its range (e.g. Passenger Pigeon) with virtually no likelihood that it will be rediscovered.

#### STATE RANKS

- S1** = critically imperiled in the state because of extreme rarity (5 or fewer occurrences or very few remaining individuals or acres) or because of some factor(s) making it especially vulnerable to extirpation in the state.
- S2** = imperiled in state because of rarity (6 to 20 occurrences or few remaining individuals or acres) or because of some factor(s) making it very vulnerable to extirpation from the state.
- S3** = rare or uncommon in state (on the order of 21 to 100 occurrences).
- S4** = apparently secure in state, with many occurrences.
- S5** = demonstrably secure in state and essentially ineradicable under present conditions.
- SA** = accidental in state, including species (usually birds or butterflies) recorded once or twice or only at very great intervals, hundreds or even thousands of miles outside their usual range.
- SE** = an exotic established in the state; may be native elsewhere in North America (e.g. house finch or catalpa in eastern states).
- SH** = of historical occurrence in state and suspected to be still extant.
- SN** = regularly occurring, usually migratory and typically nonbreeding species.
- SR** = reported from state, but without persuasive documentation which would provide a basis for either accepting or rejecting the report.
- SRF** = reported falsely (in error) from state but this error persisting in the literature.
- SU** = possibly in peril in state, but status uncertain; need more information.
- SX** = apparently extirpated from state.

## Appendix VI

### Abstracts Available on MNFI Web Site for Elements Identified During 1998-2002 Island Surveys

Element	Common Name	MNFI Abstract Available?
<b>Natural Communities</b>		
Alvar	-	Yes
Bog	-	
Boreal forest	-	
Dry-mesic northern forest	-	Yes
Dry non-acid cliff	-	
Great Lakes marsh	-	Yes
Hardwood-conifer swamp	-	
Limestone pavement lakeshore	-	Yes
Mesic northern forest	-	Yes
Northern fen	-	
Northern wet meadow	-	
Open dunes	-	Yes
Wooded dune and swale complex	-	Yes
<b>Rare Plant Species</b>		
<i>Adlumia fungosa</i>	climbing fumitory	
<i>Asplenium ruta-muraria</i>	wall rue	
<i>Bromus pumpellianus</i>	Pumpell's brome grass	Yes
<i>Carex concinna</i>	beauty sedge	
<i>Carex richardsonii</i>	Richardson's sedge	Yes
<i>Carex scirpoidea</i>	bulrush sedge	
<i>Cirsium hillii</i>	Hill's thistle	Yes
<i>Cirsium pitcheri</i>	Pitcher's thistle	Yes
<i>Cypripedium arietinum</i>	ram's head orchid	Yes
<i>Drosera anglica</i>	English sundew	Yes
<i>Eleocharis compressa</i>	flattened spike-rush	
<i>Gymnocarpium robertianum</i>	limestone oak fern	Yes
<i>Iris lacustris</i>	dwarf lake iris	Yes
<i>Littorella uniflora</i>	American shore-grass	
<i>Mimulus glabratus</i> var. <i>michiganensis</i>	Michigan monkey-flower	Yes
<i>Pellaea atropurpurea</i>	purple cliff-brake	
<i>Pinguicula vulgaris</i>	butterwort	
<i>Piperia unalascensis</i>	Alaskan orchid	
<i>Pterospora andromedea</i>	pinedrops	Yes
<i>Sarracenia purpurea</i> f. <i>heterophylla</i>	yellow pitcher-plant	Yes
<i>Solidago houghtonii</i>	Houghton's goldenrod	
<i>Sporobolus heterolepis</i>	prairie dropseed	Yes
<i>Tanacetum huronense</i>	Lake Huron tansy	Yes
<i>Botaurus lentiginosus</i>	American bittern	
<i>Buteo lineatus</i>	red-shouldered hawk	Yes
<i>Chlidonias niger</i>	black tern	Yes
<i>Circus cyaneus</i>	northern harrier	Yes
<i>Cistothorus palustris</i>	marsh wren	
<i>Falco columbarius</i>	merlin	Yes
<i>Gallinula chloropus</i>	common moorhen	
<i>Gavia immer</i>	common loon	
<i>Haliaeetus leucocephalus</i>	bald eagle	
<i>Pandion haliaetus</i>	osprey	
<i>Sistrurus catenatus catenatus</i>	Eastern massasauga	Yes
<i>Somatochlora hineana</i>	Hine's emerald dragonfly	Yes
<i>Sterna hirundo</i>	common tern	Yes
<i>Trimerotropis huroniana</i>	Lake Huron locust	Yes