



Invasive Species Program 2006

by

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EXECUTIVE SUMMARY

The Great Lakes Indian Fish and Wildlife Commission (GLIFWC) is an organization exercising delegated authority from 11 federally recognized Ojibwe tribes in Minnesota, Wisconsin, and Michigan (Figure 1). These tribes retain hunting, fishing, and gathering rights in the territories ceded to the United States through various treaties. The degradation of native ecosystems by invasive species poses a serious threat to the continued exercise of these rights.

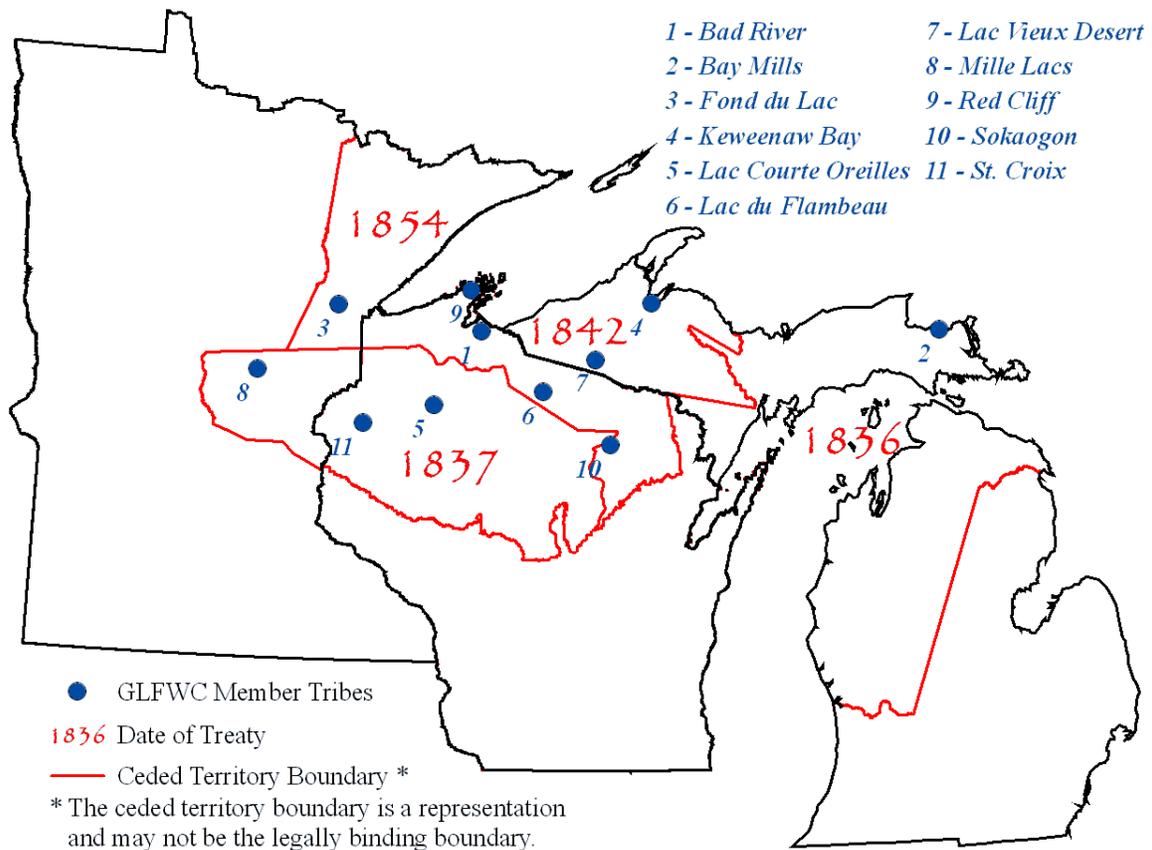


Figure 1. Location of GLIFWC member tribes and ceded territories.

Invasive species are considered by many biologists to be the second most important cause of biodiversity loss and species extinction worldwide, behind habitat destruction (OTA 1993, Wilcove *et al.* 1998, Enserink 1999). Wilcove *et al.* (1998) estimated that 57% of plants on the endangered species list are there at least in part because of invasive species. Besides physical displacement of native flora and fauna, invasive species can alter fire frequency, hydrologic

properties, soil chemistry, and the physical and trophic structure of entire ecosystems (Walker and Smith 1997, Westbrooks 1998). This report summarizes the activities undertaken by GLIFWC staff during 2006 to address the spread of invasive species in the ceded territories. Taxonomic nomenclature cited in this report complies with the Integrated Taxonomic Information System (www.itis.gov).

GLIFWC's invasive species program consists of four comprehensive elements – education outreach, inventory and monitoring, control, and evaluation. Each of these elements is coordinated with local cooperators to maximize the efficient use of limited resources.

GLIFWC's noxious weed program started in 1988 with a pilot project to control purple loosestrife (*Lythrum salicaria*) in Fish Creek sloughs near Ashland, WI (Gilbert and Parisien 1989). This project has grown to include annual control efforts for purple loosestrife and leafy spurge (*Euphorbia esula*) populations throughout the Bad River - Chequamegon Bay watershed.

In 2001, GLIFWC initiated annual surveys for terrestrial invasive species (TIS) in an effort to assess the relative threat of the many non-native plants that have become established in the region and prioritize them for management (Falck and Garske 2002, Falck and Garske 2003). This effort continued in 2006 with additional cooperation and funding from the Wisconsin DNR Division of Forestry (Garske and Falck 2007).

In 2004, GLIFWC initiated annual surveys for aquatic invasive species (AIS) as part of its invasive species program (Garske and Falck 2005). These surveys are coordinated with surveys conducted by Wisconsin DNR staff and target waters with high visitation rates. The surveys look for invasive aquatic plants and animals, including zebra mussels (*Dreissena polymorpha*) spiny water fleas (*Bythotrephes cederstroemi*) and rusty crayfish (*Orconectes rusticus*).

GLIFWC's educational outreach efforts center around its web site (www.glifwc.org/invasives) which provides basic information on invasive species and provides access to a regional GIS database (www.glifwc-maps.org) of invasive species survey efforts, distribution records and control efforts. In addition, GLIFWC distributes and develops print material to raise awareness of invasive species issues. In 2006, GLIFWC worked with the Wisconsin Coastal Management Program and Discover Mediaworks to produce a special episode of Discover Wisconsin devoted to Aquatic Invasive Species, their impacts, and how to prevent their spread.

Because non-native invasive plants disperse widely across the landscape and administrative boundaries, it is advantageous to work cooperatively with adjacent landowners towards common objectives. GLIFWC strives to coordinate its invasive species activities with local and regional cooperators by providing information on its website and participating in several forums to coordinate and guide invasive species management efforts.

ACKNOWLEDGMENTS

The Great Lakes Indian Fish and Wildlife Commission acknowledges the following government agencies for their financial support of GLIFWC's invasive species program. The BIA continues to provide the foundation for developing new partnerships and leveraging additional resources for invasive species management (Figure 2). The activities summarized in this report were funded by:

- ◆ Bureau of Indian Affairs (BIA)
 - GLIFWC's base funding
 - Noxious Weed Program
 - Supplemental Funding
- ◆ U.S. Fish and Wildlife Service (USFWS)
 - Wisconsin AIS State Management Plan (WIS)
- ◆ Wisconsin Department of Administration
 - Wisconsin Coastal Management Program (WCMP)
- ◆ Wisconsin Department of Natural Resources (WDNR)
 - Division of Forestry

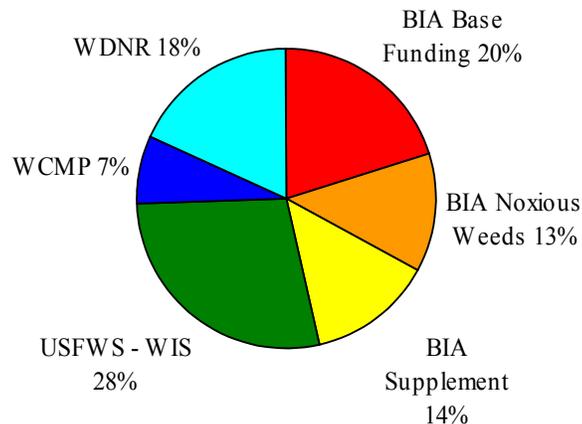


Figure 2. Funding sources for GLIFWC's Invasive Species Program in 2006.

AQUATIC INVASIVE SPECIES INVENTORIES IN THE CEDED TERRITORIES

Since the early 1800s, at least 183 (GLERL 2006) species of fish, plants, invertebrates, algae, and pathogens have been introduced into the riparian and aquatic habitats of the Great Lakes. Many of these organisms have since invaded inland lakes and rivers in the ceded territory, and others are poised to do so. The most destructive of these invasives have caused major environmental and economic impacts - the economic cost of zebra mussels alone has been estimated at \$100 million since its introduction (Pimentel *et al.* 2000).

GLIFWC staff surveyed select ceded territory waters in 2006 to 1) assess and document the scope of the problem, 2) detect small populations of the worst invasives before they become large, environmentally damaging populations, and 3) prioritize education and management efforts.

METHODS

In 2006, 25 lakes were chosen for survey in coordination with the Wisconsin Department of Natural Resources (WDNR) and targeted lakes with high visitation rates (Table 1, Figure 3). Oxbow and Little Oxbow Lakes in Iron County were surveyed for Eurasian water milfoil only, following its detection upstream in Long Lake. An effort was made to visit each lake twice during the summer to increase the chances of detecting zebra mussel veligers and plants with varying phenologies.

Surveys targeted the most likely areas for introductions. Boat landings were a high priority. All public and some private boat landings on each lake were surveyed. Shorelines, shallow water areas, pier supports, rocks, floating fragments and beach debris were inspected at the landings for invasive plants and animals.

Surveys also focused on inlets, outlets, shallow or protected bays, wetland areas, disturbed areas, and developed shorelines or shorelines in close proximity to roads. Shorelines were typically surveyed from the outer edge of the littoral zone from a slow-moving boat, checking any suspicious looking patches of vegetation including submerged, emergent, and riparian plants. The area was also surveyed for invasive animals or evidence of these animals.

The most ecologically destructive aquatic invasive species threatening ceded territory waters were categorized as “priority” species (Table 2) and were documented at each site where they were detected. Other aquatic invasive species considered less invasive, or so common as to be impractical to delineate, along with some terrestrial invasive species were simply recorded as “present” or “absent” on each lake (Table 3).

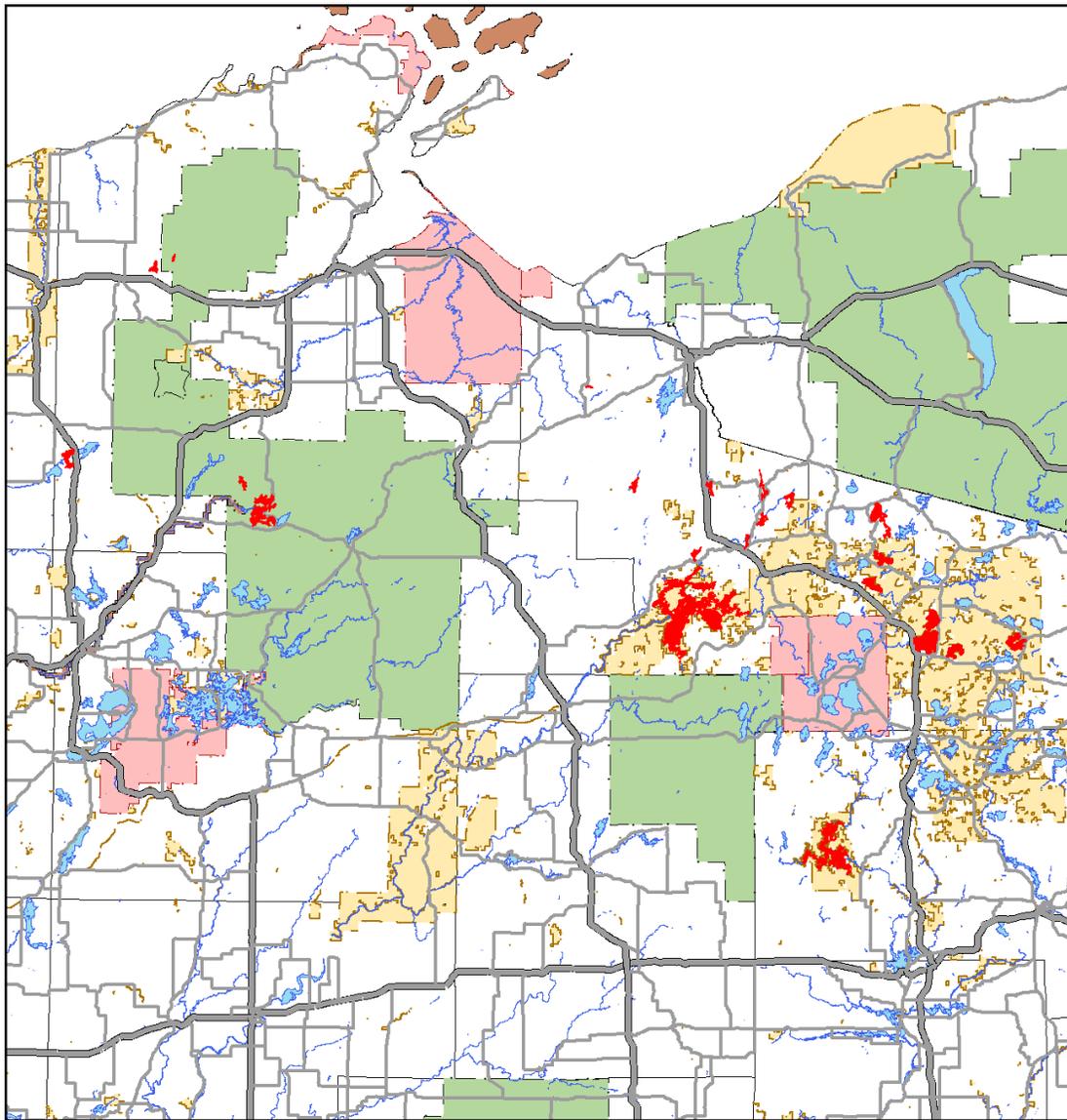
Table 1. Lakes surveyed by GLIFWC for aquatic invasive species in 2006.

County	Lake Name	WBIC	Acres	State	Dates Surveyed
Bayfield	Bladder	2756200	84.1	WI	8/15
	Diamond	2897100	322.4	WI	8/15
	Long	2767100	279.6	WI	7/5, 8/21
	Middle Eau Claire	2742100	829.8	WI	7/6, 8/16
	Namekagon	2732600	2607.2	WI	7/5, 8/17
Iron	Echo	2301800	205.1	WI	6/22, 6/29, 8/3
	Fisher	2307300	441.2	WI	6/22, 8/2
	Island	2945500	344.2	WI	6/14, 7/27
	Lake of the Falls	2298300	296.9	WI	6/26, 8/7
	Little Oxbow*	2302300	81.9	WI	6/21
	Long	2303500	370.1	WI	6/15, 6/20, 8/1
	Oxbow*	2302400	17.1	WI	6/21
	Pine	2949200	299.6	WI	6/13, 7/31
	Saxon Falls Flowage [†]	2941100	67.8	WI/MI	6/13, 7/27
	Spider	2306300	358.7	WI	6/21, 8/3
	Trude	2295200	785.7	WI	6/27, 8/8
	Turtle Flambeau Flowage [†]	2294900	12942.3	WI	6/28, 8/9
	Weber	2909000	64.7	WI	6/12, 6/19, 7/24
	Oneida	Willow Reservoir	1528300	4217.1	WI
Vilas	Averill [‡]	2956700	67.7	WI	8/23
	Big	2334700	827.1	WI	7/13, 8/24
	Big Muskellunge	1835300	897.4	WI	7/12, 8/30
	Island	2334400	865.2	WI	7/10, 7/11, 8/22
	Presque Isle	2956500	1165.1	WI	7/11, 7/12, 8/23
	Star	1593100	1219.2	WI	8/10, 8/31
	Trout	2331600	3864.2	WI	7/17, 7/18, 8/28
	Van Vliet [‡]	2956800	230.0	WI	8/23

* These lakes were surveyed for Eurasian water milfoil *only*, after detecting it upstream in Long Lake, Iron County, WI.

† These lakes were previously sampled, vegetation surveys were conducted near boat landings only.

‡ These lakes were not sampled for water fleas or zebra mussels, because they are connected to Presque Isle Lake.



-  2006 Aquatic Invasive Species Surveys
-  Secondary highway
-  Primary highway
-  Open water
-  Tribal
-  National Park Service
-  State
-  US Forest Service
-  Counties



0 10 20 Miles

Overview

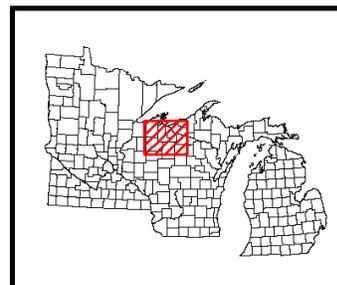


Figure 3. Lakes surveyed for aquatic invasive species in 2006.

Table 2. “Priority” species surveyed for in 2006 AIS surveys.

Scientific Name	Common Name	Detected
<i>Butomus umbellatus</i>	Flowering Rush	No
<i>Bythotrephes longimanus</i>	Spiny Waterflea	No
<i>Cercopagis pengoi</i>	Fishhook Waterflea	No
<i>Cirsium palustre</i>	Eurasian Marsh Thistle	Yes
<i>Dreissena bugensis</i>	Quagga Mussel	No
<i>Dreissena polymorpha</i>	Zebra Mussel	No
<i>Eichhornia crassipes</i>	Water Hyacinth	No
<i>Hydrilla verticillata</i>	Hydrilla	No
<i>Hydrocharis morsus-ranae</i>	European Frog-bit	No
<i>Iris pseudacorus</i>	Yellow Iris	Yes
<i>Lythrum salicaria</i>	Purple Loosestrife	Yes
<i>Myriophyllum spicatum</i>	Eurasian Water-milfoil	Yes
<i>Najas minor</i>	Brittle Naiad	No
<i>Nymphoides peltata</i>	Yellow Floating-heart	No
<i>Phragmites communis</i>	Common Reed (Eurasian)	No
<i>Pistia stratiotes</i>	Water Lettuce	No
<i>Potamogeton crispus</i>	Curly Pondweed	No
<i>Trapa natans</i>	Water Chestnut	No

The surveys also searched for and documented any evidence of the biological control agent *Galerucella* spp. wherever purple loosestrife was encountered. Rusty crayfish specimens were collected from lakes where they were previously undocumented, preserved in 95% ethanol and sent to the UW-Madison Center for Limnology. Voucher specimens were prepared for new invasive plant infestations and new county records. These specimens were sent to public herbaria along with a label providing the location and appropriate notes.

The presence of aquatic invasive species informational signs at boat landings was also recorded. This information will be compiled with data collected by GLIFWC’s fishery assessment crews and WDNR to identify boat landings lacking AIS informational signs.

Location and attribute data were recorded directly into a GIS spatial database using a handheld Trimble® GeoXM GPS receiver/data recorder running ESRI® ArcPad GIS software. ArcPad provided an integrated environment to display the real-time GPS location overlain on existing GIS layers such as lakes, local roads, and pre-existing invasive species data. Custom data entry forms were developed using ESRI® ArcPad Application Builder. The custom data

Table 3. Lower priority aquatic invasive species and terrestrial invasive species detected during 2006 AIS surveys.

Scientific Name	Common Name
<i>Berberis thunbergii</i>	Japanese Barberry
<i>Cipangopaludina chinensis</i>	Chinese Mysterysnail
<i>Euphorbia cyparissias</i>	Cypress Spurge
<i>Lonicera tatarica</i> , <i>L. morrowii</i> , <i>L. x bella</i>	Eurasian Bush Honeysuckles
<i>Mentha piperita</i> , <i>M. spicata</i> , <i>M. x gentilis</i>	Eurasian Mints
<i>Myosotis scorpioides</i>	Water Forget-me-not
<i>Orconectes rusticus</i>	Rusty Crayfish
<i>Phalaris arundinacea</i>	Reed Canary Grass
<i>Polygonum cuspidatum</i>	Japanese Knotweed
<i>Robinia psuedocacia</i>	Black Locust
<i>Salix fragilis</i> , <i>S. alba</i> , <i>S. x rubens</i>	White, Crack and Hybrid Willow
<i>Solanum dulcamara</i>	Bittersweet Nightshade
<i>Typha angustifolia</i> , <i>T. x glauca</i>	Narrow-leaf and Hybrid Cattail
<i>Viviparus georgianus</i>	Banded Mysterysnail

entry forms speeded data entry in the field and reduced the potential for error during data entry by providing standardized nomenclature, required fields, and drop-down menus.

Plankton nets were used to sample for zebra mussel veligers and spiny and fishhook water fleas. Vertical plankton tows were used to sample for zebra mussel veligers, following the protocols of Galarneau *et al.* (2005). Two 2-m tows were conducted for each sample site on oligotrophic lakes, one 2-m tow for mesotrophic lakes and one 1-m tow for eutrophic lakes. At each veliger sampling point, pH and temperature were measured using an YSI pH 100 pH/ORP/temperature meter. Readings were taken at a depth of 1 m and 4 m (or about 30 cm above the bottom, if the point was less than 4 m deep). This information was shared with researchers at UW-Madison Center for Limnology for use in modeling the spread of aquatic invasive species.

Horizontal plankton tows were used to sample for spiny and fishhook waterfleas, following the protocol of Johnson (2004). A suitably deep portion of the lake was chosen to sample and the net was towed through the water for approximately 100 m. This distance was estimated by towing the plankton net for 120 seconds at approximately 3 km/hour (Steve Galarneau, WDNR, pers. commun.). The water column was surveyed by allowing the net to sink as close to the bottom as possible and then slowly pulling the net back up.

The number of veliger and waterflea samples taken on each lake was based on lake size and available time. Typically at least one sample was taken near a busy boat landing and one or two additional samples in different bays or basins. An effort was made to sample at least three sites on larger lakes or lakes with multiple bays, however due to time constraints that was not always possible. One or two samples were taken on smaller lakes. Both types of samples were transferred to sample bottles, labeled and preserved with 95% alcohol at a ratio of 4 parts alcohol to 1 part sample. Samples were sent to the WDNR Service Center in Plymouth, Wisconsin for analysis.

After leaving each lake, the boat and all equipment were disinfected thoroughly. Plant fragments and other debris were removed by hand at the landing and the drain plug was pulled away from the landing to ensure water would not run into the lake. The boat, trailer, view scope and paddles were power washed using a high powered portable power washer and the boat motor was flushed with water. All equipment that came into contact with water including plankton nets, ropes, anchor, floats and depth finder were all soaked in vinegar for at least 20 minutes and rinsed.

RESULTS

A total of 231 invasive plant populations comprising 15 taxa were mapped in 2006 (Table 4). "Priority" species comprised 152 of the total plant records with purple loosestrife accounting for 49% (74 sites). Invasive animals (rusty crayfish, Chinese mysterysnail [*Cipangopaludina chinensis*] and banded mysterysnail (*Viviparius georgianus*)) were detected in 17 lakes (Table 4). Fifty-nine boat landings were surveyed for AIS and signage was documented at each landing. No waterfleas or zebra mussel veligers were detected in the samples collected during 2006.

DISCUSSION

During the surveys, three new Eurasian water-milfoil (EWM) infested lakes were detected. Two of the lakes, Weber and Long, were located in Iron County where no EWM had previously been documented in the county.

Weber Lake

Weber Lake is a small lake, approximately 65 acres, with one boat landing and a county park and campground. Whitecap Mountain Ski Resort and golf course borders the south side of the lake with a few scattered seasonal homes on the north side. A total of 16 Eurasian water-milfoil sites were located on the lake with the main concentration on the southeast side of the lake. Plants were fairly well established in the exposed, sandy beach area around the campground and park and around the boat landing. Two sites of single isolated plants were found on the west side of the lake. These plants were hand-pulled along with the plants around the boat landing to decrease the chance of someone transporting EWM. Floats were used to identify the location of EWM and were snorkeled to for hand pulling with the least amount of disturbance possible. Two

Table 4. Summary of aquatic invasive species detected in 2006.

Lake	County	High Priority				Lower Priority													
		Eurasian Marsh Thistle	Yellow Iris	Purple Loosestrife	Eurasian Water Milfoil	Rusty Crayfish	Japanese Barberry	Chinese Mysterysnail	Cypress Spurge	Eurasian Bush Honeysuckles	Eurasian Mints	Water Forget-me-not	Reed Canary Grass	Japanes Knotweed	Black Locust	Crack, White, & Hybrid Willows	Bittersweet Nightshade	Narrowleaf/Hybrid Cattail	Banded Mysterysnail
Bladder	Bayfield															✓			
Diamond	Bayfield						✓												
Long	Bayfield			✓							✓	✓				✓		✓	
Middle Eau Claire	Bayfield				✓						✓	✓		✓		✓		✓	
Namekagon	Bayfield																		
Echo	Iron								✓		✓	✓				✓		✓	✓
Fisher	Iron			✓			✓	✓			✓	✓							
Island	Iron											✓				✓			
Lake of the Falls	Iron										✓	✓						✓	
Long	Iron		✓		✓						✓	✓				✓		✓	
Pine	Iron					✓			✓			✓				✓			
Saxon Falls Flowage	Iron										✓	✓						✓	
Spider	Iron							✓				✓						✓	✓
Trude	Iron											✓				✓		✓	
Turtle Flambeau Flowage	Iron			✓															
Weber	Iron			✓	✓			✓				✓						✓	✓
Willow Reservoir	Oneida				✓			✓				✓				✓		✓	✓
Averill	Vilas																		
Big	Vilas			✓		✓					✓	✓						✓	✓
Big Muskellunge	Vilas	✓		✓							✓	✓				✓		✓	
Island	Vilas			✓		✓			✓		✓	✓		✓		✓		✓	✓
Presque Isle	Vilas					✓					✓	✓				✓		✓	
Star	Vilas			✓		✓		✓		✓	✓	✓				✓		✓	✓
Trout	Vilas			✓		✓		✓		✓	✓	✓				✓		✓	✓
Van Vliet	Vilas									✓				✓					

isolated purple loosestrife plants were also found on the lake.

WDNR was notified and currently there is no established lake association. Attempts are still being made to develop lake contacts for possible management and treatment. The boat landing was posted by staff from WDNR with decals for both Eurasian water-milfoil and purple loosestrife.

Long Lake

Long Lake in Iron County is a 370 acre lake with scattered development throughout the lake including homes and resorts with one public boat landing. This lake is located in the headwaters region of the Flambeau River and has great potential to infest numerous downstream water bodies. Eurasian water-milfoil was scattered as isolated plants or patches throughout the lake. Native plants were well established throughout the lake which may be why EWM was restricted to scattered plants instead of thick beds. Many EWM plants were isolated with various native aquatic plants surrounding the EWM. The largest population was approximately 100 plants in the small bay on the north end of the lake before the narrow channel to the far north end. No Eurasian water-milfoil was found north of the channel or near the public boat landing. There were two private landings which were not surveyed.

WDNR was notified and contacted the Long Lake Improvement Association. The boat landing was posted with decals and a map was sent to the association with EWM population locations and attribute information.

The lake association applied for and subsequently received a rapid response grant to do control work. Areas with EWM infestations were treated with 2,4-D on September 9th and 10th of 2006. Monitoring will commence in the spring of 2007 by trained volunteers to evaluate the effectiveness of the 2,4-D treatment.

Willow Flowage

Willow Flowage in Oneida County is a 6400 acre reservoir with over 73 miles of shoreline and a designated Scenic Waters Area. The flowage is surrounded by over 26,000 acres of state land and has 35 remote campsites, one campground and 7 boat landings. The areas with the highest Eurasian water-milfoil densities were concentrated between the two boat landings on Dam Road and in the bay just north of the two landings. Eurasian water-milfoil in the bay north of the two landings was matted up and estimated at over 1000 plants. Plants were scattered outside of the bay. Fisherman at the landing indicated the bay was a favorite fishing spot for many of the local fisherman and some regular visitors on the beach said they had been seeing fragments like EWM washing up at the landing for at least the past two years.

Isolated plants or small patches were found in a few bays on the east side of the flowage including North, Hilbert and Beavers Bays and in the bay east of the Willow Queen Cruise boat. In combination with the Northern Highlands State Forest survey, 34 out of 35 of the

campgrounds were surveyed for terrestrial and aquatic invasive species. Only one campsite (#2) was found to have one isolated EWM plant in the area where boats access the site.

As much of the flowage as possible was surveyed, but due to low water levels it was difficult to get into many of the bays or close to the shoreline. Surveys were coordinated with the WDNR, who provided an additional surveyor and boat for the northern and central portions of the flowage. WDNR posted all of the landings with EWM decals. The flowage manager was also contacted and provided with a GIS shapefile of infestation sites and site photos.

Purple loosestrife

Purple loosestrife was found on nine of the lakes surveyed. Three patches were found on Long Lake in Bayfield County. The local lake association was contacted and provided with maps and photos of the infestations. The lake association hand-pulled the plants and will continue to monitor these sites. The Turtle Flambeau Flowage manager was contacted about an infestation near one of the boat landings and was sending out a crew to treat the plants if they had not already treated the site. *Galerucella* spp. beetles were present on Star Lake in Vilas County in the northeast bay on the north side of the southern portion of Star Lake. Big Muskellunge in Vilas County was heavily infested in the southern portion of the lake and would be a good choice for biological control.

PURPLE LOOSESTRIFE CONTROL ACTIVITIES IN THE BAD RIVER - CHEQUAMEGON BAY WATERSHED

INTRODUCTION

Purple loosestrife is a perennial, herbaceous wetland plant native to Europe. It arrived in eastern North America in the early 1800's via plants brought by settlers, seeds carried within livestock, and in ballast soil carried by ships (Thompson *et al.* 1987). After its introduction, purple loosestrife quickly spread westward displacing native wetland plant communities. Its current distribution includes much of the U.S. and southern Canada.

Purple loosestrife can germinate in moist, exposed soils and tolerates a wide range of pH, nutrient, and light levels. Once established, seedlings can survive shallow flooding. The plant develops an impressive rootcrown and dense shoots that out-compete adjacent plant life. The stalks are square and commonly attain heights up to 2m on mature plants. The leaves are opposite each other and alternate at 90 degree angles along the stem. The distinctive flowering spike of purple loosestrife blooms from mid July through early September in the upper Great Lakes region.

Purple loosestrife degrades wetland habitats by out-competing native vegetation. On exposed substrates, purple loosestrife seeds germinate at such a high density that they out-compete native vegetation. The herbivores and pathogens that keep loosestrife from dominating European wetlands are absent in North America. This lack of natural enemies combined with prolific seed production gives purple loosestrife a substantial advantage over native vegetation. Diverse wetland plant communities can quickly be displaced by monotypic stands of purple loosestrife. Reductions in plant diversity translate into a loss of food and shelter for the numerous insect, amphibian, mammal, and bird species that depend on healthy wetlands for their survival.

METHODS

GLIFWC's integrated control efforts continued to focus on purple loosestrife within the Bad River/Chequamegon Bay watershed. Purple loosestrife populations within the Bad River - Chequamegon Bay watershed were inventoried in 1994, 1995, 1999, and 2000 (Gilbert *et al.* 1995, Edblom *et al.* 1995, Falck *et al.* 2000, Falck 2001). Since 2003, control crews have used hand-held GPS receivers to document the locations of purple loosestrife sites and control efforts. These data were used to prioritize effort and select control methods based on the areal extent of the site, number of plants, and the site's location within the watershed.

Small sites (< 0.5 acres) in upper reaches of the watershed were prioritized for chemical control. Depending on the hydrology of the site, control crews using back-pack sprayers applied either Glyphosate (Glypro®) or Triclopyr (Garlon 3A®) to purple loosestrife plants. Glyphosate was used on sites with standing water, while Triclopyr was used where standing water was

absent. Triclopyr has the advantage of being dicot-specific, allowing grasses and sedges to persist and re-colonize the site in a shorter time period. Chemical control efforts focused primarily on road rights-of-way between Mellen and Bayfield. Private properties were also treated after consent forms were signed by the landowner. Control crews mapped treated areas using a hand-held Trimble® GeoExplorer GPS receiver. Data on each site were also collected including an estimate of the number of plants, acreage class, herbicide used, and an estimate of the amount of herbicide applied.

Large sites (> 1 acre) in lower reaches of the watershed, sites with poor access, and sites where landowners have expressed a preference for biological control were given high priority for biological control. The release of *Galerucella* beetles (native to Europe) in the United States for biological control of purple loosestrife was approved by USDA - APHIS in 1992. In 2006, beetles were collected from locally established populations in late May or early June and transferred directly to new release sites. Release sites from prior years were visited in early June and again in late summer to ascertain overwinter survival, assess suitability of sites for collection of adults, and to take site photos documenting the effects of beetle herbivory.

RESULTS

In 2006, GLIFWC staff treated 114 sites with herbicide. Figure 4 illustrates the distribution of chemical control efforts for purple loosestrife in 2006. With respect to biological control efforts, *Galerucella* beetles have established viable populations at all sites where they have been released since 2000. Site photos taken each year at the peak of blooming continue to demonstrate a consistent reduction in loosestrife flowering and seed production at these sites (Figures 5-7)

Because all of the largest sites within Bad River-Chequamegon Bay watershed already have established populations of *Galerucella* beetles, beetles were only released at one site in 2006, on the Bad River Indian Reservation, bringing the total number of biological control sites within the watershed to 64 (Figure 8). However, three days of field collections for *Galerucella* beetles were sponsored by GLIFWC and the Northwoods Cooperative Weed Management Area (NCWMA). Participants were led by GLIFWC staff to previously established biocontrol sites to collect beetles for loosestrife control efforts throughout northern Wisconsin. Participants included the Bad River Natural Resources Department, U.S. Forest Service, Wisconsin DNR, Friends of the St. Croix Headwaters, and the Iron River Lakes Association.

DISCUSSION

The use of biological controls has allowed GLIFWC's control crew to place greater emphasis on treating small satellite populations with herbicide before they become significant source populations (Figure 9). This strategy also reduces the amount of herbicide applied at any one site (Figure 10). The establishment of local *Galerucella* populations has eliminated the need



- 2006 Purple Loosestrife Herbicide Applications
- Bad River - Chequamegon Bay Watershed
- Secondary highway
- Primary highway
- Open water
- Tribal
- National Park Service
- State
- US Forest Service
- Counties



0 7 14 Miles

Overview



Figure 4. Purple loosestrife herbicide applications in 2006.

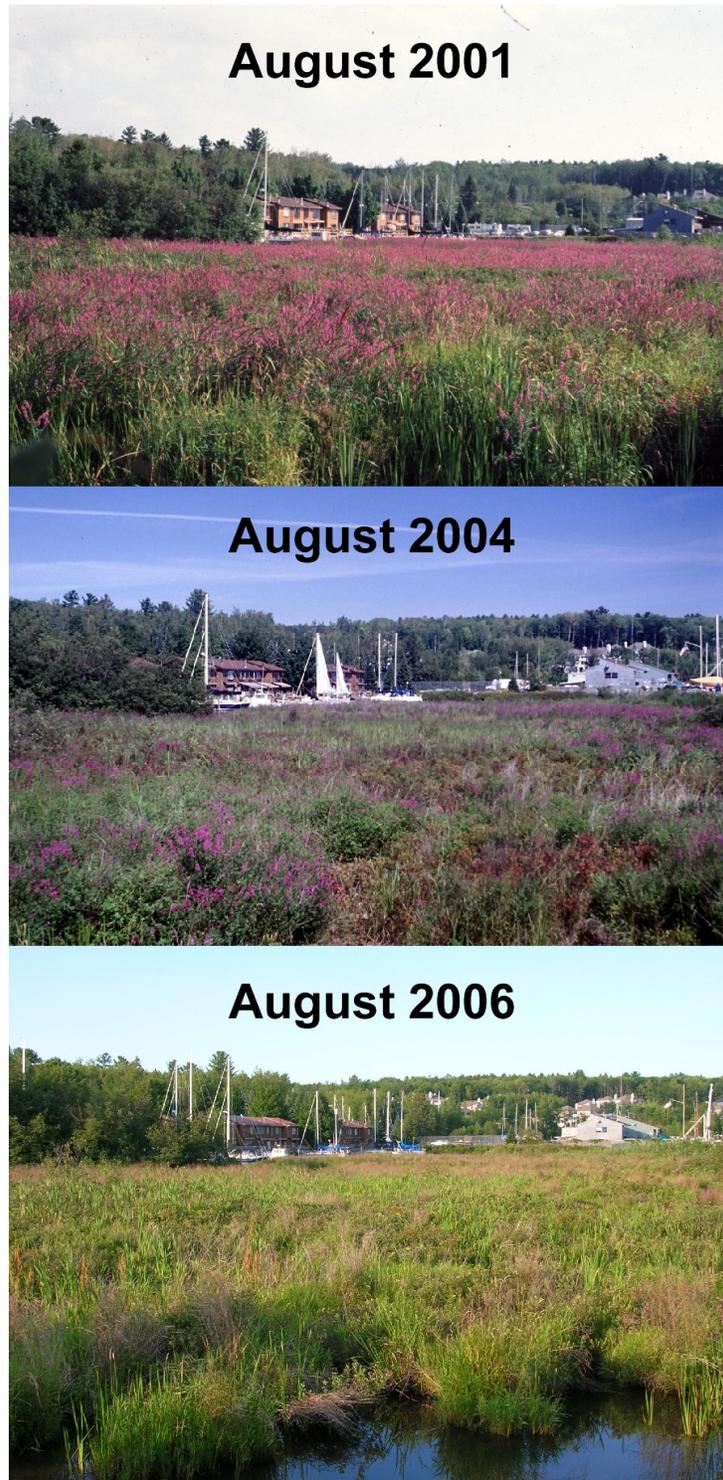


Figure 5. *Galerucella* release site near Bayfield, WI.

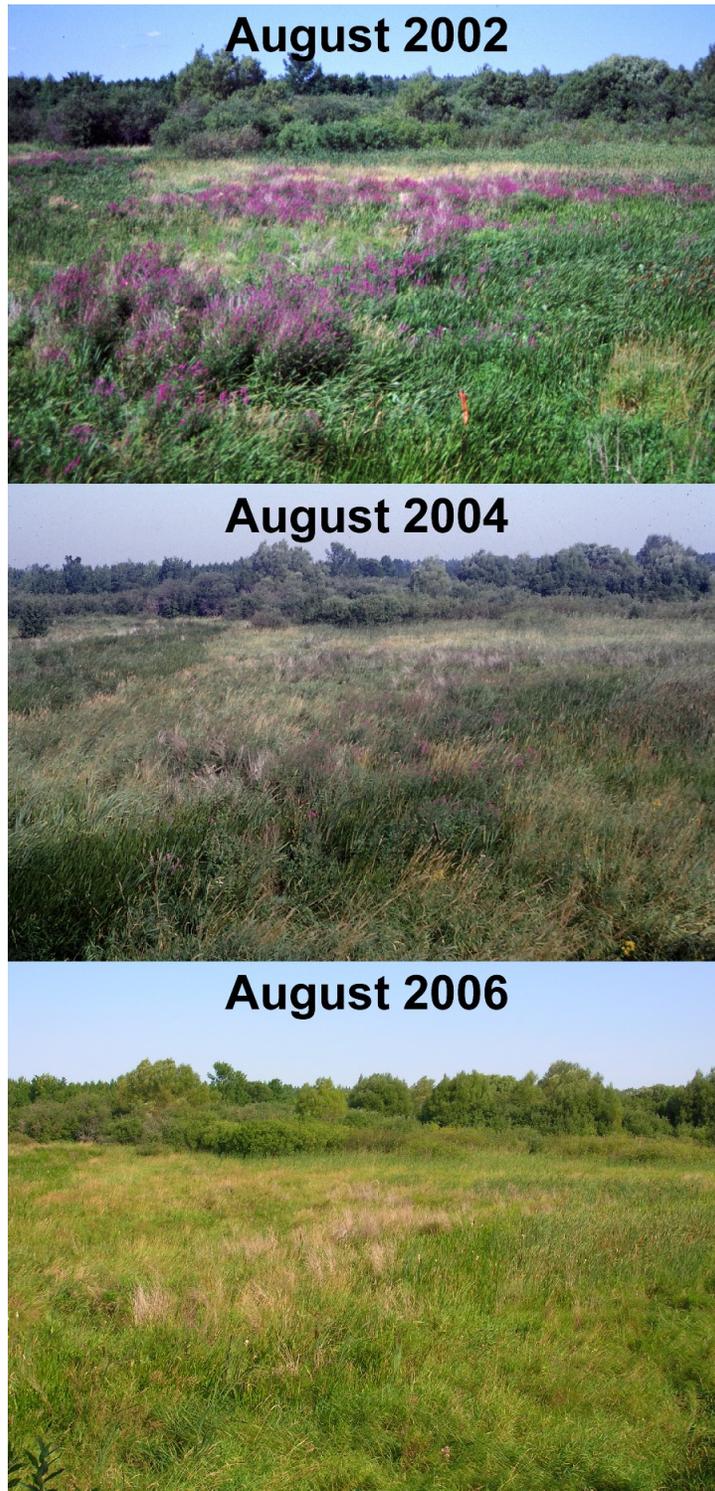
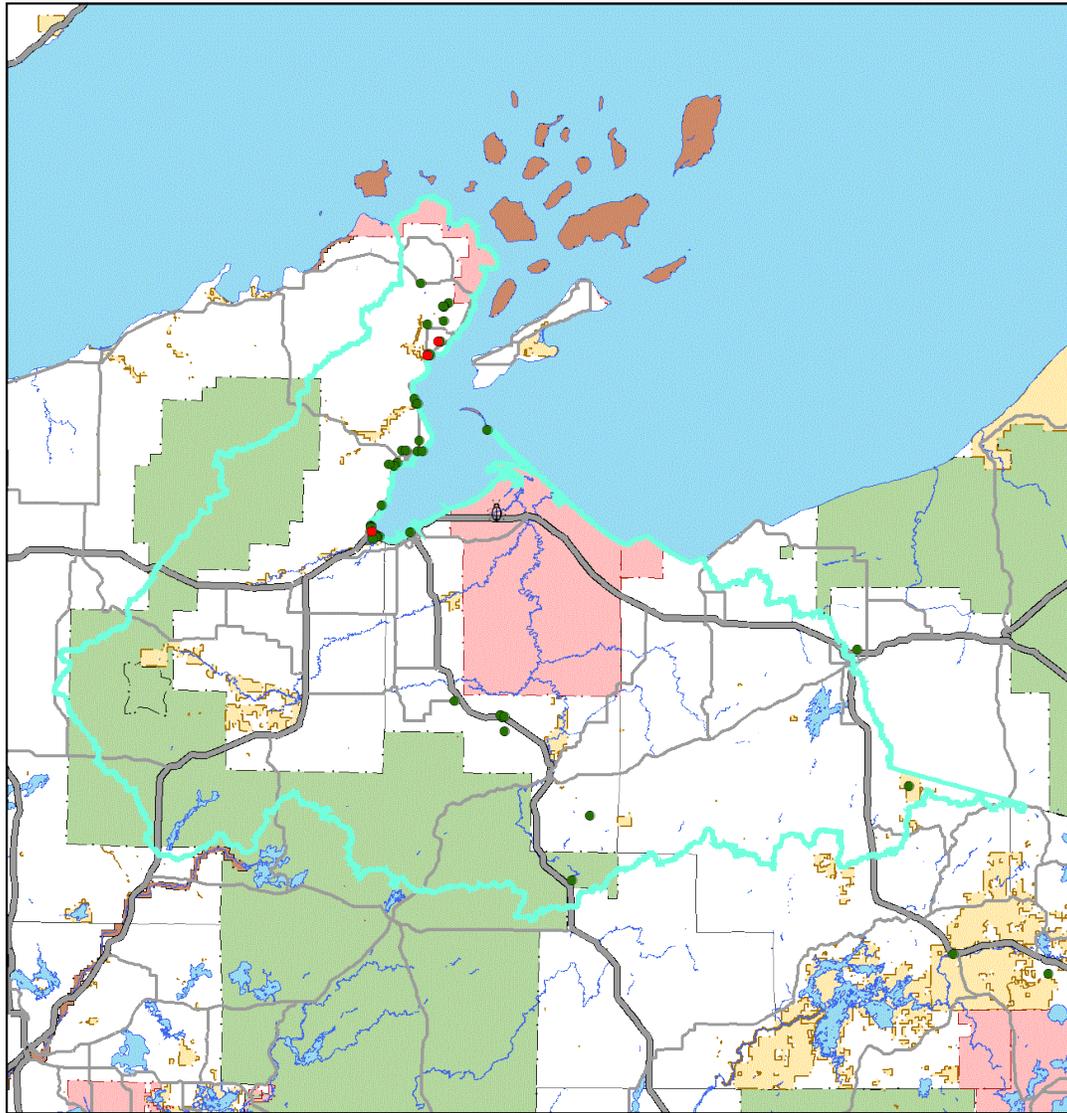


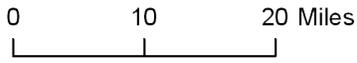
Figure 6. *Galerucella* release site near Whittlesey National Wildlife Refuge.



Figure 7. *Galerucella* release site in Ashland, WI.



- 2006 Galerucella Release Site
- 2006 Galerucella Collection Site
- Established Galerucella Site
- Bad River - Chequamegon Bay Watershed
- Secondary highway
- Primary highway
- Open water
- Tribal
- National Park Service
- State
- US Forest Service
- Counties



Overview

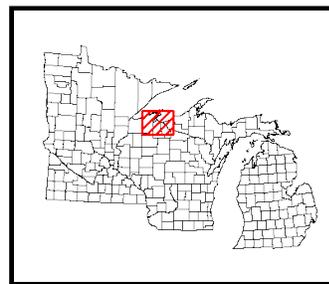


Figure 8. *Galerucella* sites within the Bad River – Chequamegon Bay watershed.

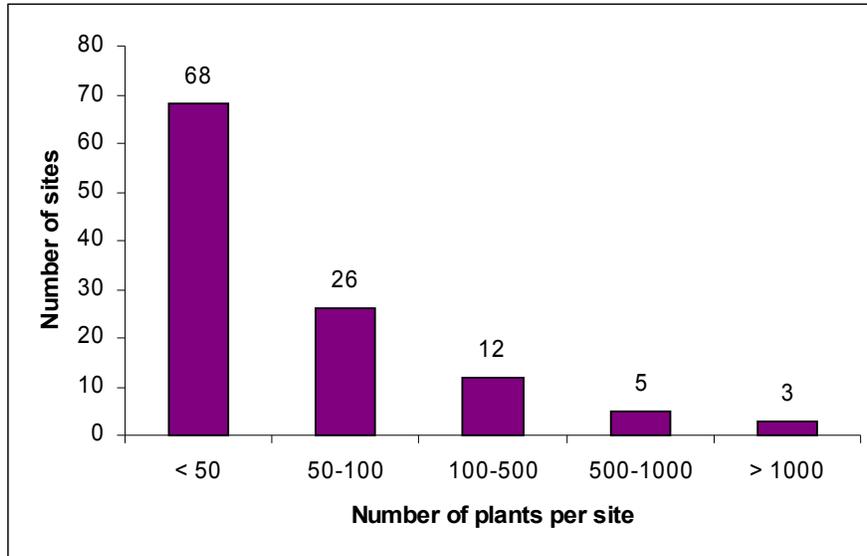


Figure 9. Abundance of purple loosestrife at sites treated in 2006.

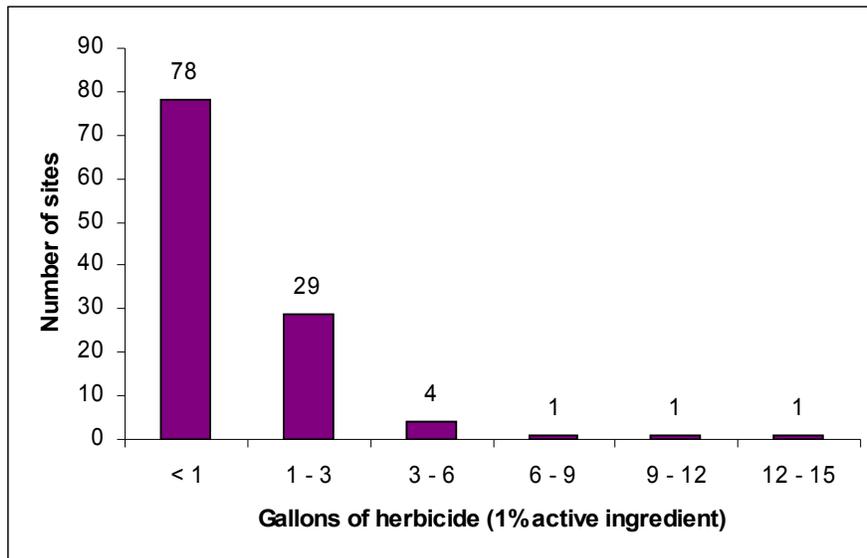


Figure 10. Amount of herbicide applied to purple loosestrife infestations in 2006.

for mass rearing, allowing beetles to be collected *en masse* from established sites and released at new sites in 2006. This has reduced the labor associated with this activity by approximately 70%. The field collection day sponsored by GLIFWC and NCWMA has also extended this benefit to cooperators outside of GLIFWC's focus watershed; three more collection days are planned for 2007.

LEAFY SPURGE CONTROL ACTIVITIES IN THE BAD RIVER-CHEQUAMEGON BAY WATERSHED

INTRODUCTION

Leafy spurge is a perennial herb native to Eurasia. It was first recorded in North America from Massachusetts in 1827. It is thought to have arrived in contaminated seed. By the early 1900's, leafy spurge had spread as far west as North Dakota.

Leafy spurge thrives in open, sunny habitats. The plant reaches heights of up to 1 meter, though they are often shorter on poor sites. The plants bloom in late May and early June, producing clusters of inconspicuous flowers subtended by yellow bracts. The seed capsules of leafy spurge open explosively, dispersing seeds up to 15 feet. The seeds are often carried further by water, wildlife, and heavy equipment. Leafy spurge also spreads vegetatively, allowing the plant to dominate a site. The extensive root system of leafy spurge can penetrate as far as 15 feet underground.

Leafy spurge displaces native vegetation in open habitats including prairies, pine barrens, pastures, abandoned fields, and roadsides. It is especially dominant on dry or nutrient poor sites where its extensive root system and lack of natural enemies give it a substantial advantage over native vegetation. Because leafy spurge is unpalatable to cattle and deer, it can cause significant economic and ecological impacts.

Pine barrens habitats in northwestern Wisconsin are unique habitats that are especially vulnerable to the threats posed by leafy spurge. These areas provide habitat for a wide range of wildlife, as well as gathering and hunting opportunities for tribal members.

METHODS

GLIFWC staff evaluated the ecological threats and feasibility of control for over 300 non-native plants within Ashland and Bayfield counties in 2001 (Falck and Garske 2002, Falck and Garske 2003). Baseline distribution and abundance data were collected from the field and compiled with information on ecological impacts and control options from peer-reviewed literature and other sources. The resulting database was used to rank species into four management categories according to each plant's relative abundance, ecological impact, and feasibility for control. The results indicated that leafy spurge posed the greatest threat to local habitats, while its relatively low abundance and wide range of control options made it feasible to contain and control.

GLIFWC initiated chemical control for leafy spurge in the fall of 2003 using imazapic (Plateau®) herbicide applied with backpack sprayers. Herbicide was applied in the fall when plants were senescing and drawing energy reserves back into their roots for the winter. Herbicide

was applied until a hard freeze damaged or killed the shoots, preventing uptake by the plants. Shoot damage was monitored by checking for the presence of milky sap in broken stems.

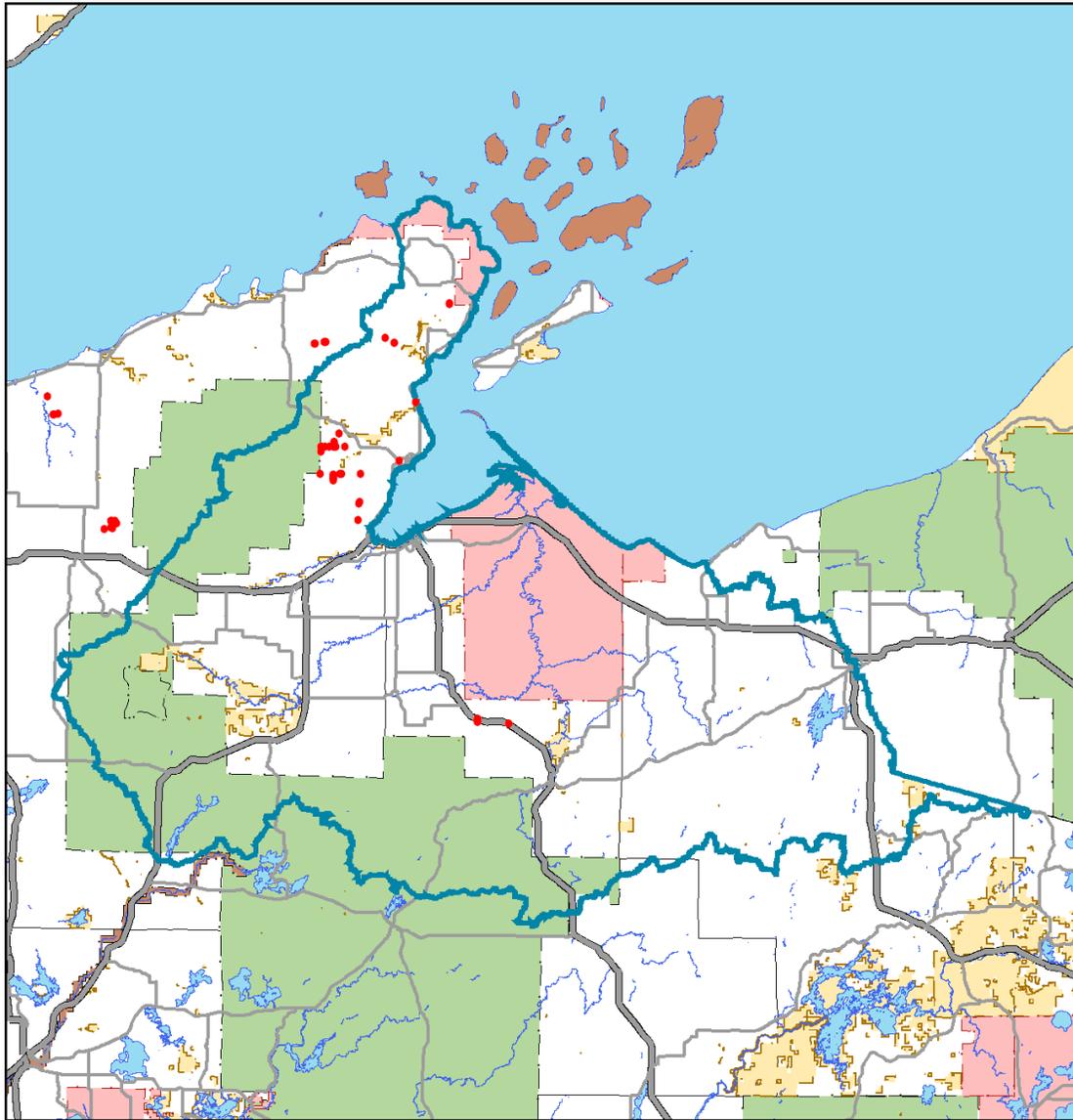
RESULTS

In 2006, GLIFWC staff treated 55 sites with herbicide. Figure 11 illustrates the distribution of chemical control efforts for leafy spurge in 2006.

Road rights-of-way on the eastern edge of the Moquah Barrens near Washburn, WI comprised the core area of local leafy spurge populations and provided a massive seed source for dispersal via road maintenance activities such as mowing and grading. Private properties were also treated after consent forms were signed by the landowner. Control efforts in 2006 continued to expand the area treated annually and focused on smaller satellite populations to prevent them from becoming large source populations (Figure 11). GLIFWC staff also participated in two workdays sponsored by the Northwoods Cooperative Weed Management Area to treat several large infestations on private lands, providing herbicide, backpack sprayers, and assistance with herbicide application (Figure 12). Participants also included private landowners, the National Park Service Exotic Plant Management Team and US Forest Service.

DISCUSSION

Unlike purple loosestrife, nearly ½ of the leafy spurge sites treated consisted of over 1,000 plants (Figure 13). Consequently, the amount of herbicide applied at each site was also considerably more relative to purple loosestrife control efforts (Figure 14). Although biological controls have been released in the area by private landowners, their impacts have yet to be realized.



- 2006 Leafy Spurge Herbicide Applications
- Bad River - Chequamegon Bay Watershed
- Secondary highway
- Primary highway
- Open water
- Tribal
- National Park Service
- State
- US Forest Service
- Counties



0 7 14 Miles

Overview

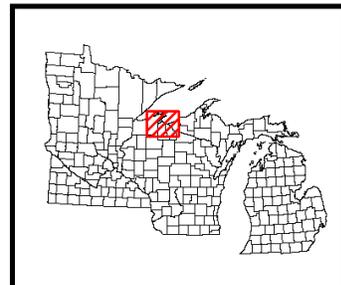


Figure 11. Leafy spurge herbicide applications in 2006.



Figure 12. GLIFWC staff contributed herbicide, equipment, and time to the “Leafy Spurge Workdays” organized by the Northwoods Cooperative Weed Management Area.

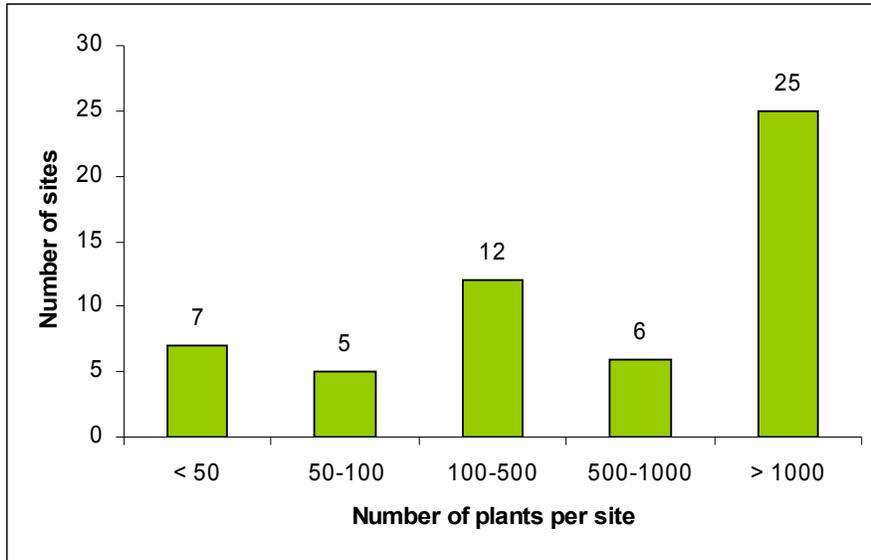


Figure 13. Abundance of leafy spurge at sites treated in 2006.

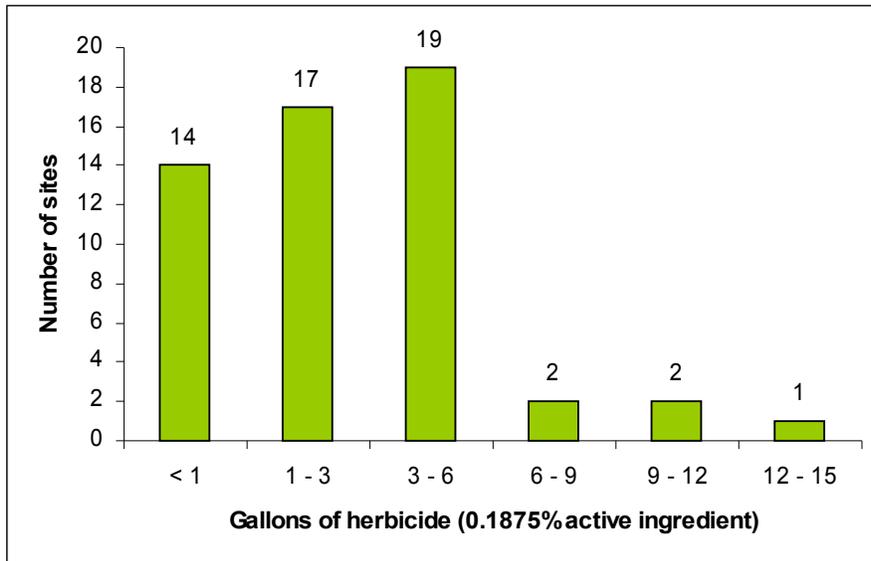


Illustration 14. Amount of herbicide applied to leafy spurge infestations in 2006

EDUCATION OUTREACH ACTIVITIES

INTRODUCTION

Because the vast majority of invasive species introductions can be attributed to human activities, effective prevention and control efforts depend on an informed public. Unfortunately, awareness of the ecological and economic impacts of invasive species among the general public is generally low (Colton and Alpert 1998). To help address this situation, GLIFWC initiated an educational outreach program in 1998 to raise public awareness of this important issue.

PROGRAM OVERVIEW

A suite of educational materials have been compiled and/or developed to reach a broad range of audiences. These materials include ID cards, brochures, slide and poster presentations, and videos. GLIFWC distributes educational material with the help of cooperating state and federal agencies throughout the ceded territories. Additional outreach is provided via GLIFWC's invasive species web site (www.glifwc.org/invasives) and quarterly newsletter - *Mazina'igan*.

ACCOMPLISHMENTS

Mazina'igan Feature Articles

Starting in 2004, each issue of GLIFWC's quarterly newsletter has featured an article on at least one invasive species issue. Topics covered in 2006 included Japanese knotweed, an overview of GLIFWC's Invasive Species Program and a progress report on biological control efforts for purple loosestrife.

Discover Wisconsin - *Maintaining Our Resource: Wisconsin Waterways*

A special episode of Discover Wisconsin - *Maintaining Our Resource: Wisconsin Waterways* - was produced in 2006 with funding from the Bureau of Indian Affairs and the Wisconsin Coastal Management Program. The episode featured a variety of lake user groups including fisherman, resort owners and scuba divers and highlighted the fact that aquatic invasive species affect nearly everyone, and everyone shares the responsibility to prevent their spread. The episode aired in June of 2006 and will be rebroadcast twice in the next two years.

WWW.GLIFWC.ORG/INVASIVES

GLIFWC's invasive species web site features species abstracts for many of the regions' invasive plants, photos that can be downloaded for educational purposes, GLIFWC reports, and links to interactive maps and other Internet resources on invasive species. In 2006, the site was updated with additional photos and many of the species abstracts were updated.

COORDINATION AND COOPERATION

INTRODUCTION

Because non-native invasive plants disperse widely across the landscape and administrative boundaries, it is advantageous to work cooperatively towards management and control objectives. In addition, the introduction and spread of new invasive species in the region continues to out-pace control activities, and is too much for any one agency to manage alone. GLIFWC strives to coordinate its invasive species activities with cooperating agencies, universities, non-governmental organizations, and the general public to maximize the efficient use of limited resources.

ACCOMPLISHMENTS

GLIFWC staff are actively engaged in several long-term initiatives that seek to enhance interagency cooperation and coordination of invasive species management and planning:

Northwoods Cooperative Weed Management Area (NCWMA): In 2006, an MOU establishing the Northwoods Cooperative Weed Management Area (NCWMA) was signed by GLIFWC and the rest of the NCWMA members. NCWMA provides a forum to share information, collaborate on planning and cooperate on management activities in northern Wisconsin.

St. Croix National Scenic Riverway Comprehensive Interstate Management Plan for the Prevention and Control of Aquatic Nuisance Species: Completed in March of 1998 in cooperation with the Lower St. Croix Management Commission, Minnesota Department of Natural Resources, Minnesota-Wisconsin Boundary Area Commission, National Park Service, Wisconsin Department of Natural Resources, U.S. Fish and Wildlife Service, and the Upper St. Croix Management Commission. This plan makes GLIFWC eligible for funding from the U.S. Fish and Wildlife Service to implement tasks identified in the plan and helps facilitate cooperation on AIS issues within the St. Croix watershed.

Wisconsin's Comprehensive Management Plan To Prevent Further Introductions and Control Existing Populations of Aquatic Invasive Species: Completed in cooperation with the Wisconsin Department of Natural Resources and UW-Extension in September of 2003, this plan makes GLIFWC eligible for funding from the U.S. Fish and Wildlife Service to implement tasks identified in the plan and helps facilitate cooperation with the WDNR on AIS issues.

Invasive Plant Association of Wisconsin - Science Committee: GLIFWC has contributed to invasive species prioritization, inventory and mapping, and information sharing initiatives undertaken by this group.

WWW.GLIFWC-MAPS.ORG

The goal of this project is to facilitate much of the collaborative work discussed above by providing a common communications infrastructure. GLIFWC compiles and shares information on invasive species distribution and management efforts throughout Minnesota, Wisconsin, and Michigan at www.glifwc-maps.org. This site received extensive database updates in the fall of 2006 and is now current as of the fall of 2006. Upgrades were also made to the site's help page, and pages were added to provide more information about the site, and links to similar websites around the country. A new tool was also added to allow display of glifwc-maps data layers in Google Earth.

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