



Invasive Species Program 2015

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 and the traditional lifeways they sustain.

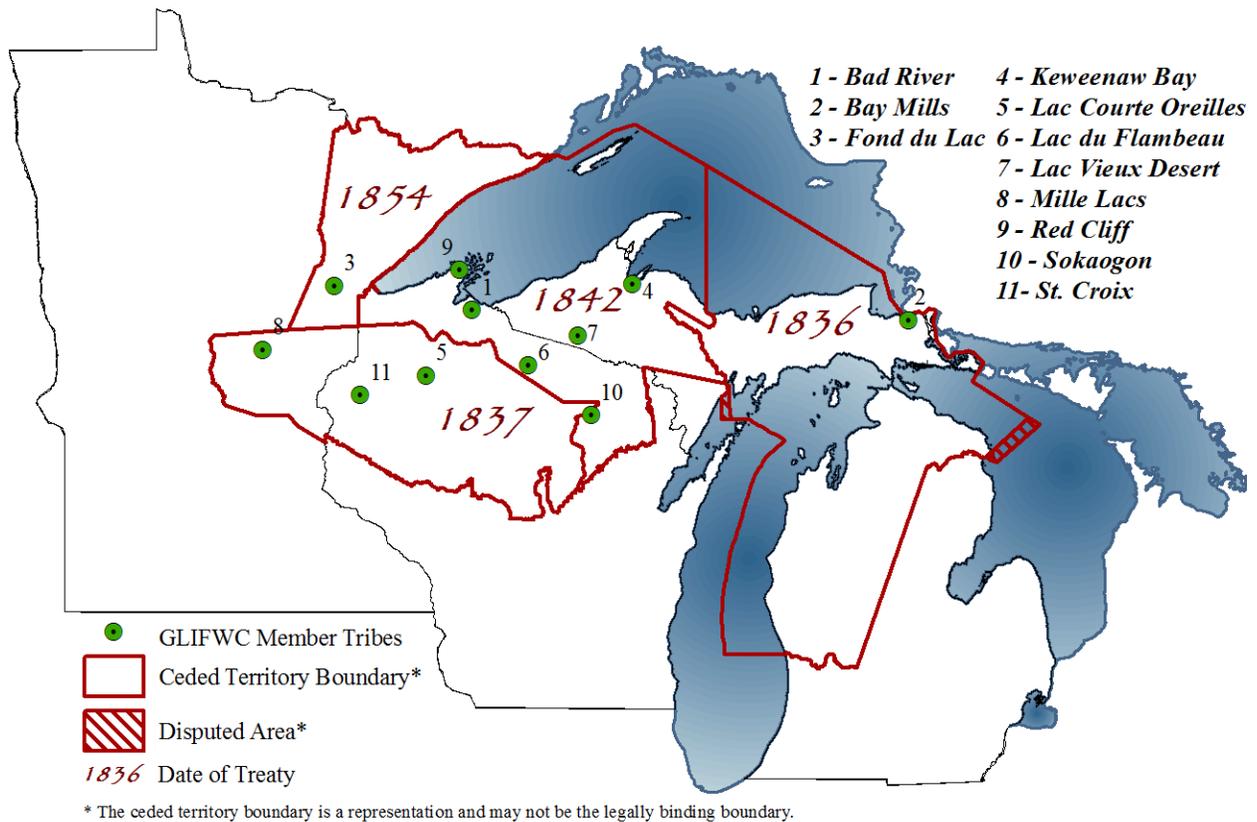


Figure 1. Location of GLIFWC member tribes and ceded territories.

This report summarizes the activities undertaken by GLIFWC staff during 2015 to address the spread of invasive species in the ceded territories. GLIFWC's invasive species program consists of 1) prevention, 2) early detection rapid response, 3) control and management, 4) research, and 5) coordination of these activities with cooperating tribes, government agencies and groups to maximize the efficient use of limited resources.

ACKNOWLEDGMENTS

The Great Lakes Indian Fish and Wildlife Commission acknowledges the following 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
 - Invasive Species Program
 - Great Lakes Restoration Initiative (GLRI) Tribal AIS

- U.S. Fish and Wildlife Service (USFWS)
 - Great Lakes Restoration Initiative (GLRI) Tribal AIS
 - Wisconsin State ANS Plan
 - St. Croix Interstate ANS Plan

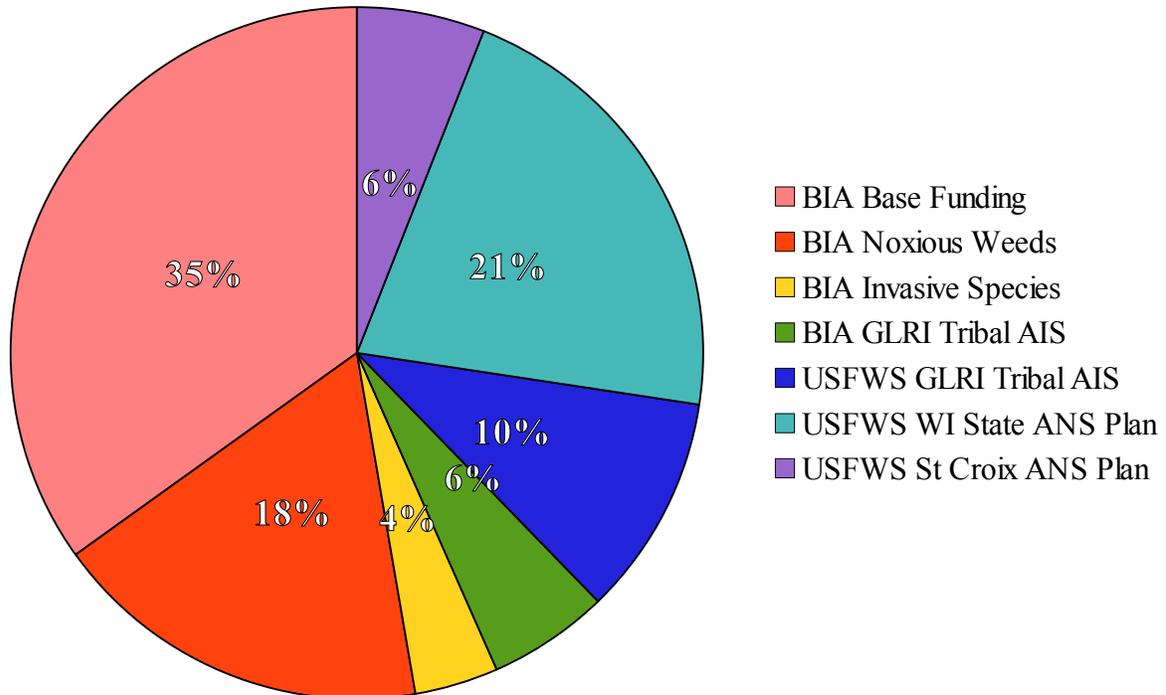


Figure 2. Funding sources for GLIFWC's Invasive Species Program in 2015.

PREVENTION

Introduction

The most effective approach to combat the spread of invasive species is to prevent their initial establishment. Because the vast majority of invasive species introductions can be attributed to human activities, effective prevention efforts depend on an informed public. A variety of education, outreach, and training materials are needed to alert a diverse public to the threats posed by invasive species and the actions required to prevent their spread.

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, stickers, 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 (glifwc.org/invasives) and quarterly newsletter - *Mazina 'igan*.

Accomplishments

Mazina 'igan Articles

GLIFWC's newsletter features articles on invasive species. Topics covered in 2015 included:

- “Before leaving & before launching inspect everything” side panel illustrating important areas to inspect on boats and trailers for AIS – Spring/Summer 2015 (glifwc.org/publications/mazinaigan/Summer2015/)
- “Protecting manoomin: Monitoring aquatic invasive plant permits” by Lisa David – Spring/Summer 2015 (glifwc.org/publications/mazinaigan/Summer2015/)
- “Confronting the threat of forest invasives” by Steve Garske – Fall 2015 (glifwc.org/publications/mazinaigan/Fall2015/)
- “Phragmites, purple loosestrife & leafy spurge focus of invasive species program” by Miles Falck – Fall 2015

Events, Presentations and Other Outreach Activities

Activities in 2015 included:

- Presented information at GLIFWC's creel clerk meeting on AIS and prevention measures tribal members can take during spring harvest.
 - Pocket size cards were distributed with permits during spring spearing & netting season to educate tribal harvesters on steps to prevent the spread of AIS including how to clean equipment and specific tribal AIS regulations.
 - Fish measuring stickers with AIS prevention and tribal regulation information were distributed at tribal registration stations and GLIFWC events.

- Presented information on the use of phragmites in waste water treatment facilities in the Wisconsin portion of the Lake Superior basin to Lake Superior Freshwater Folk meeting, Duluth, MN (January 7, 2015).
- Presented information on waste water treatment facilities using phragmites in the Chequamegon Bay of Lake Superior to the Great Lake Phragmites Advisory Committee (February 13, 2015).
- Presented the status of non-native phragmites in the Lower St. Louis River at the St. Louis River Summit, Superior, WI (March 31, 2015).
- Updated GLIFWC staff's disinfection protocol to prevent the spread of aquatic invasive species in GLIFWC's management activities (March 2015).
- Presented the status of non-native phragmites in Chequamegon Bay at the Chequamegon Bay Research Symposium, Ashland, WI (April 14, 2015).
- Held event for *Mashkisibi* (Bad River) Boys and Girls Club to learn about invasive species and hand pull garlic mustard along the Bad River floodplain and organized the 7th annual GLIFWC staff invasive species field day (May 6, 2015).

invasives.glifwc.org

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.

EARLY DETECTION RAPID RESPONSE (EDRR)

Eradicating or containing invasive species is more feasible and cost effective when populations are at a pioneer stage of infestation. GLIFWC staff have conducted annual invasive species surveys since 1995 and have documented over 10,000 occurrences for several hundred species of invasive organisms throughout the ceded territories. This information provides a baseline to determine if newly detected occurrences are early detections, and whether rapid response efforts are warranted. Early detections by GLIFWC staff have led to successful rapid response control efforts for curly-leaf pondweed, Eurasian water-milfoil, garlic mustard, knotweed, phragmites, purple loosestrife, and teasel.

AQUATIC INVASIVE SPECIES

Introduction

Since the early 1800s, 185 species of fish, plants, invertebrates, algae and pathogens have been introduced into riparian and aquatic habitats of the Great Lakes basin (USGS 2012). 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 (Pimentel *et al.* 2005).

GLIFWC staff surveyed select ceded territory waters in 2015 to 1) assess and document the scope of the problem, 2) detect small populations of the most ecologically disruptive invasive species before they become large, environmentally damaging populations, and 3) prioritize education and management efforts.

Methods

In 2015, GLIFWC staff surveyed 31 waterbodies in northern Wisconsin and Michigan. Twenty-six lakes were surveyed for aquatic invasive species (AIS), two lakes were surveyed for water fleas, and environmental DNA samples were collected from three lakes (Figure 3, Table 1). Lakes surveyed for AIS were chosen in coordination with management partners including tribal, state, county and other local partners. Surveys targeted lakes important to the tribes for *ogaa* (walleye) and *manoomin* (wild rice) harvest, as well as high-risk lakes with high visitation rates or lakes in close proximity to infested waters.

Lakes surveyed for AIS were visited once during the season and were surveyed for all invasive plants and animals. Qualitative surveys for invasive species were conducted on each lake by observing the littoral zone from the water's surface. The survey was conducted by slowly driving a boat back and forth between the shoreline and the outer edge of the littoral zone. Surveys focused on submergent, emergent and shoreline plants. These areas were also inspected for invasive animals or evidence of their presence. Surveys strived to cover as much of the shoreline (including island shorelines) as possible.

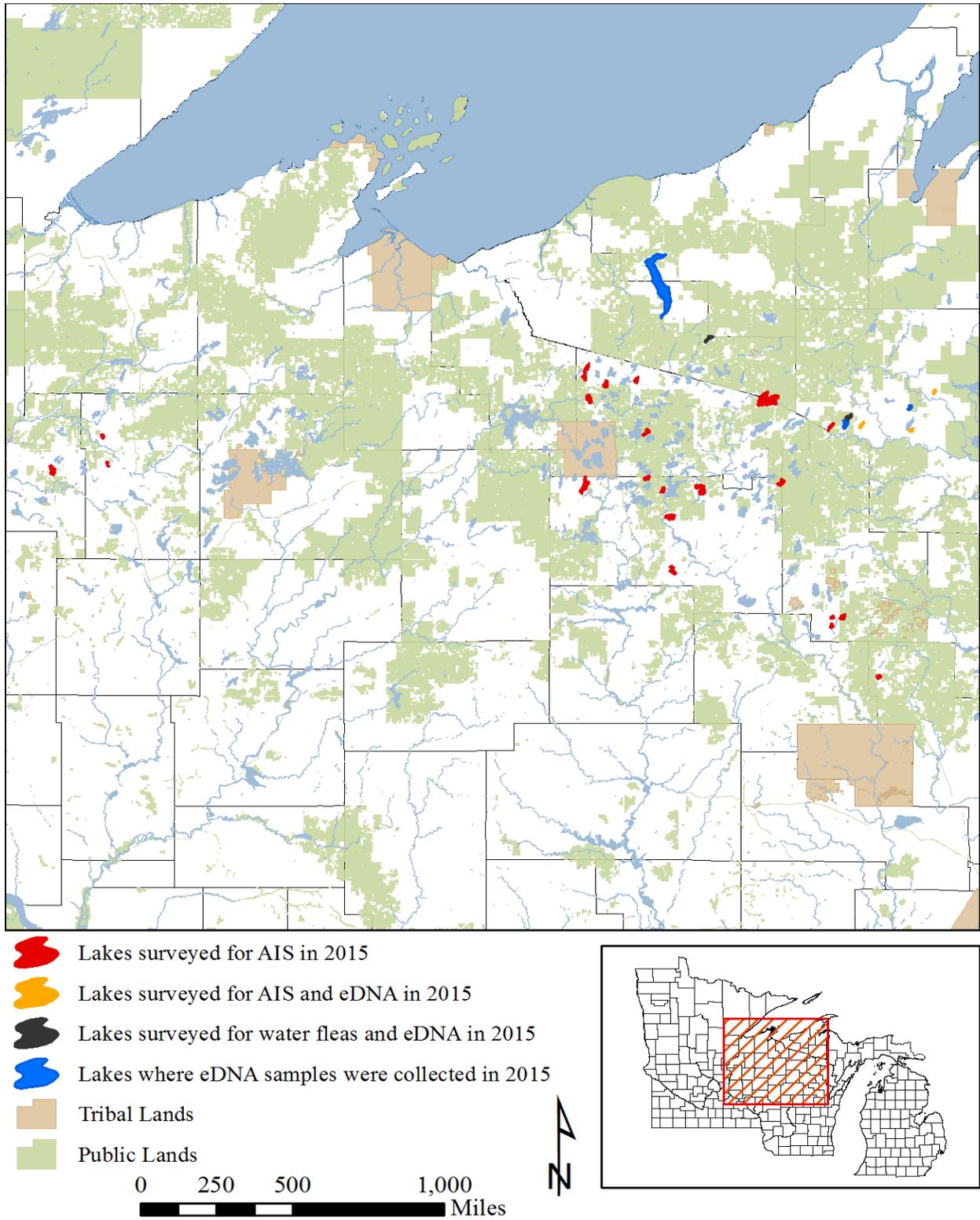


Figure 3. Lakes surveyed in 2015 for aquatic invasive species detection and management.

Table 1. Lakes surveyed for aquatic invasive species in 2015.

State	County	Waterbody	WBIC	Acres	Survey Type	Dates Surveyed	Number of Samples		
							Veliger	Waterflea	
MI	Gogebic	Beatons Lake ^a	27-622	330	water fleas, eDNA	8/31		3	
		Gogebic, Ontonogon	Lake Gogebic	27-966	13380	eDNA	8/20		
			Brule Lake	36-192	250	All AIS taxa	9/1	2	1
			Emily Lake	36-363	320	eDNA	8/19		
			Hagerman Lake	36-190	584	eDNA	8/20		
	Iron	Indian Lake ^a	36-138	196	All AIS taxa	8/19		2	
		Lake Ottawa	36-417	551	eDNA, water fleas, veligers	8/20, 9/1	3	3	
		Stanley Lake	36-173	310	All AIS taxa	8/19	3	3	
		Swan Lake	36-307	165	All AIS taxa	8/18	3	2	
MI, WI	Gogebic, Vilas	Lac Vieux Desert ^b	1631900	4300	Eurasian water-milfoil, curly pondweed	6/23-25, 8/31			
WI	Bumett	Sand Lake	2495100	962	All AIS taxa	7/21-22	3	3	
		Jungle Lake	377900	182	All AIS taxa	7/9	1	1	
	Forest	Lily Lake	376900	211	All AIS taxa	7/8	2	1	
		Roberts Lake	378400	414	All AIS taxa	7/7-8	3	3	
	Oconto	Boot Lake	418700	235	All AIS taxa	7/7	3	2	
		Carrol Lake	1544800	352	All AIS taxa	8/3	3	3	
		Crescent Lake	1564200	612	All AIS taxa	7/15	3	3	
		Dam Lake ^a	1596900	744	All AIS taxa	7/28-30		3	
	Oneida	Gilmore Lake ^a	1589300	301	All AIS taxa	7/15-16		2	
		Sand Lake ^a	1597000	540	All AIS taxa	7/28-29		3	
		Squirrel Lake	1536300	1317	All AIS taxa	8/4-5	3	3	
		Two Sisters Lake ^a	1588200	719	All AIS taxa	7/13-14		3	
	Oneida, Forest	Sevenmile Lake ^a	1605800	503	All AIS taxa	7/27-28		3	
		Allequash Lake ^a	2332400	426	All AIS taxa	8/5		2	
		Lynx Lake ^a	2954500	339	All AIS taxa	8/13, 8/17		3	
	Vilas	North Turtle Lake	2310400	369	All AIS taxa	8/11		3	
		Papoose Lake	2328700	428	All AIS taxa	8/12	3	3	
		Rest Lake ^a	2327500	608	All AIS taxa	8/6, 8/10		3	
		South Turtle Lake ^a	2310200	454	All AIS taxa	8/11		3	
	Washburn	Dunn Lake	2709800	193	All AIS taxa	7/22	3	3	
Washburn	Matthews Lake	2710800	263	All AIS taxa	7/20-21	3	2		
Total							41	69	

^a Lakes considered not suitable to sustain a zebra mussel population (aismartprevention.wisc.edu).

^b Survey was designed to evaluate and guide Eurasian water-milfoil control efforts and monitor rate of curly pondweed spread.

Boat landings were the highest priority area for AIS surveys. All public and some private boat landings were surveyed. Shorelines, shallow water areas, pier supports, floating fragments, rocks and beach debris in the vicinity of the landings were inspected for invasive plants and animals. Rake tosses and D-net pulls were conducted at the main boat landing for five minutes. The material retrieved by each throw and pull was placed in a bin and inspected for invasive plants and animals.

The most ecologically disruptive aquatic invasive species with limited abundance and distribution in the ceded territories were classified as “priority species” (Table 2). Discrete patches of vegetation and locations where invertebrates were detected were considered “sites”. Species with low abundance where rapid response control efforts were deemed feasible were classified as “pioneer” populations and were recorded at each site they were detected within a waterbody. Aquatic invasive species that can not be easily quantified such as invertebrates or crustaceans, species that were abundant and widespread within the waterbody, and terrestrial invasive plants were classified as “present” and only their initial occurrence within a waterbody was documented.

If a “priority” invasive plant species was found on a lake where it was previously undocumented, a specimen was collected and notes on habitat and location were taken. Collections were sent to the Robert W. Freckmann Herbarium at the University of Wisconsin – Stevens Point. New observations of invasive snail species were collected and sent to UW-LaCrosse. Observations of *manoomin* and native populations of phragmites (*Phragmites australis* ssp. *americanus*) were also documented. Native phragmites location data were added to GLIFWC's database and shared with management partners.

Locations were mapped using a hand held GPS receiver. Attribute data for each site were entered directly into a GIS file format using ESRI's ArcPad software. ArcPad provided an integrated environment to display the current GPS location overlain on GIS layers including lakes and local roads.

Plankton nets were used to sample for zebra and quagga mussel veligers, spiny water fleas and fishhook water fleas. Vertical plankton tows were used to sample for zebra and quagga mussel veligers following Wisconsin DNR protocol (WDNR 2010). Veliger tows were only conducted on lakes that were suitable or borderline suitable to sustain a zebra or quagga mussel population. Lakes that do not have high enough calcium concentrations to sustain a zebra mussel population were not sampled for veligers. Lake suitability information was obtained from the University of Wisconsin Center for Limnology (see aissmartprevention.wisc.edu). Specific conductance was measured in the deepest basin of each lake at a depth of one meter using a YSI Model 30 meter to determine the current suitability of each lake. Lakes with a specific conductance reading of equal to or greater than 99uS are considered borderline or suitable and were sampled.

Table 2. "Priority" species surveyed for in 2015.

Scientific Name	Common Name
<u>Invertebrates</u>	
<i>Bithynia tentaculata</i>	Faucet snail
<i>Bythotrephes longimanus</i>	Spiny water flea
<i>Cercopagis pengoi</i>	Fishhook water flea
<i>Corbicula fluminea</i>	Asian clam
<i>Dreissena bugensis</i>	Quagga mussel
<i>Dreissena polymorpha</i>	Zebra mussel
<i>Potamopyrgus antipodarum</i>	New Zealand mudsnail
<i>Procambarus clarkii</i>	Red swamp crayfish
<u>Plants</u>	
<i>Butomus umbellatus</i>	Flowering rush
<i>Cabomba caroliniana</i>	Fanwort
<i>Callitriche stagnalis</i>	Pond water-starwort
<i>Crassula helmsii</i>	Australian swamp stonecrop
<i>Egeria densa</i>	Brazilian waterweed
<i>Eichhornia crassipes</i>	Water hyacinth
<i>Heracleum mantegazzianum</i>	Giant hogweed
<i>Hydrilla verticillata</i>	Hydrilla
<i>Hydrocharis morsus-ranae</i>	European frog-bit
<i>Myriophyllum aquaticum</i>	Parrot feather
<i>Myriophyllum spicatum</i>	Eurasian water-milfoil
<i>Najas minor</i>	Slender-leaved naiad
<i>Nymphoides pelata</i>	Yellow floating heart
<i>Phragmites australis</i> ssp. <i>australis</i>	Common reed (Eurasian)
<i>Pistia stratiotes</i>	Water lettuce
<i>Polygonum cuspidatum</i> , <i>P.sachalinense</i>	Japanese and giant knotweed
<i>Potamogeton crispus</i>	Curly pondweed
<i>Trapa natans</i>	Water chestnut

Horizontal plankton tows were used to sample for spiny and fishhook water fleas following the protocol of Johnson (2004). At each sampling point, the plankton net was towed through the water for 120 seconds at low speed. The water column was sampled by allowing the net to sink as close to the bottom as possible and then slowly pulling it back up.

For large lakes, three veliger and water flea samples were collected from each lake. On small or shallow lakes, only one or two samples were collected. Where feasible, at least one sample was collected near the main boat landing. The remaining samples were collected from the deepest basin, high visitation areas, other bays or basins, or the downwind side of the lake for veliger samples. Immediately after collection, veliger and water flea samples were condensed, transferred to sample bottles, labeled and preserved with 190 proof ethyl alcohol, at a ratio of four parts alcohol to one part plankton sample.

Veliger samples were sent to the WDNR Services Operations in Madison, Wisconsin for analysis. Water flea samples were examined by GLIFWC staff. Water flea samples were analyzed by taking five 10mL sub-samples from each sample collected in the field. Sub-samples were examined under a dissecting microscope for presence or absence of water fleas. The remainder of the sample was poured into a flat tray and visually inspected for water fleas. Water flea samples were also screened for the presence of bloody red shrimp, *Hemimysis anomala*, and another invasive water flea, *Daphnia lumholtzi*. All equipment was cleaned between lake samples.

Environmental DNA (eDNA) samples were collected from select Michigan lakes to assist with a Michigan State University research project for early detection of AIS. All samples were collected from approximately 1 foot below the water surface at the main boat landing. Twenty liters of lake water were collected with a filter funnel plus one additional liter of unfiltered lake water. Samples were labeled, froze and shipped to Michigan State University for analysis. Samples were analyzed for fishhook water flea, *Daphnia* (*Daphnia cristata*), rusty crayfish (*Orconectes rusticus*), sea lamprey (*Petromyzon marinus*), golden mussel (*Limnoperna fortunei*), quagga mussel, spiny water flea, hydrilla, zebra mussel, northern snakehead (*Channa argus*), killer shrimp (*Dikerogammarus villosus*), didymo or rock snot (*Didymosphenia geminata*), cylindro (*Cylindrospermopsis raciborskii*), Asian clam, New Zealand mudsnail, round goby (*Neogobius melanstomus*) and red swamp crayfish.

The boat, trailer and equipment were thoroughly disinfected after each survey was completed. Plant fragments and other debris were removed by hand or brush at the landing and the drain plug was removed in an area where the water would not run into the lake.

After leaving the lake, the washing location was chosen to ensure that the disinfection solution and rinse water would not run into storm water drains or other areas that might contaminate surface waters. The boat, trailer and all equipment that came into contact with the water (including plankton nets and cups, collection nets, ropes, weights, anchor and paddles) were sprayed with a 500 ppm bleach solution. After the appropriate contact time (10 minutes), the

boat, trailer and all equipment were thoroughly rinsed. The boat motor was flushed with tap water by using a flushing attachment (flush muffs) for approximately two minutes. Veliger sampling equipment was disinfected with the bleach solution, rinsed and soaked in vinegar for 20 minutes. The vinegar solution was used to dissolve any veliger remains, thus ensuring there were no false positives in subsequent samples. Lakes with known infestations of easily spread invasives (i.e. water fleas, zebra mussels) were surveyed at the end of each week, as an extra precaution to minimize the risk of spreading them.

Results

A total of 183 invasive species sites comprising 24 taxa were documented in 2015. “Priority” species accounted for 61 of the sites (33%, Table 3). A total of 41 zebra mussel veliger and 69 water flea plankton samples were collected during 2015. No zebra or quagga mussel veligers, spiny or fishhook water fleas or other aquatic invasive species were detected in any of the samples. Two new plant records were vouchered and sent to the UW-Stevens Point Freckmann Herbarium. Voucher snail samples from one lake were collected and sent to UW-LaCrosse. Eight eDNA samples were collected and sent to Michigan State University. One eDNA sample from Indian Lake tested positive for sea lamprey. Table 3 provides a summary of invasive species detections for each lake. Native phragmites (*Phragmites australis* ssp. *americanus*) was documented on four of the lakes surveyed.

Discussion

Early detection of invasive species before they become large, environmentally damaging populations makes eradication more likely and reduces the amount of effort required for effective control. Three lakes with small, pioneer infestations of “priority” species were detected by GLIFWC staff (Table 3). Eurasian water-milfoil was detected on Roberts Lake at low levels. Occurrence data for this site were shared with management partners and follow up surveys and planning of future management efforts were initiated by the local lake association. One patch of non-native Phragmites was found on the shoreline of Swan Lake. Occurrence data were shared with the Upper Peninsula Resource Conservation and Development Council for future control efforts. One floating fragment of curly pondweed was found on Rest Lake. No rooted plants were found and the North Lakeland Discovery Center plans to survey the lake in the spring of 2016. A new occurrence of curly pondweed was detected on Gilmore Lake, however, the population was well established and beyond the window for effective rapid response. Three lakes had small, pioneer populations of lower priority species that are more widespread. Eurasian marsh thistle was found on Jungle Lake and purple loosestrife was found on Carrol and Rest lakes. Even though these species are widespread, data on these locations were shared with management partners for potential management on a smaller, lake level scale.

The positive eDNA detection was for sea lamprey on Indian Lake in Michigan. Due to the low number of positive reactions (1 out of 6), it is either a false positive or at a very low concentration and further sampling would be needed to confirm the detection.

Table 3. Summary of aquatic invasive species detected in 2015.

State	County	Lake	Species											
			<i>Bellamy chinensis</i>	<i>Cirsium palustre</i>	<i>Iris pseudacorus</i>	<i>Lythrum salicaria</i>	<i>Myriophyllum spicatum</i> ^f	<i>Orconectes rusticus</i>	<i>Potamogeton crispus</i> ^s	<i>Phragmites australis australis</i> ^s	<i>Typha spp.</i>	<i>Viviparus georgianus</i>	Total invasive taxa detected	Native Phragmites
MI	Iron	Brule Lake	X	X ^{bc}				X					3	
	Iron	Indian Lake	X ^b										1	
	Iron	Stanley Lake	X ^b					X ^b		X			3	
	Iron	Swan Lake						X ^b		P ^b			2	
WI	Burnett	Sand Lake	X								X ^b		2	X
	Forest	Jungle Lake		P ^b								X	2	
	Forest	Lily Lake						X					1	
	Forest	Roberts Lake	X	X			P ^{bd}	X				X	5	
	Oconto	Boot Lake		X ^b				X			X ^b	X	4	
	Oneida	Carrol Lake	X				P ^b	X				X	4	
	Oneida	Crescent Lake		X ^b	X	X	X	X					5	
	Oneida	Dam Lake	X					X			X ^b		3	
	Oneida	Gilmore Lake	X						X ^{bd}		X		3	
	Oneida	Sand Lake	X			X	X	X					4	
	Oneida	Squirrel Lake	X		X	X		X			X ^b		5	X
	Oneida	Two Sisters Lake	X					X				X	3	
	Oneida, Forest	Sevenmile Lake						X			X ^b		2	
	Vilas	Allequash Lake	X			X ^b					X ^b	X ^{bc}	4	
	Vilas	Lynx Lake											0	
	Vilas	North Turtle Lake						X					1	
	Vilas	Papoose Lake			X ^e			X					2	
	Vilas	Rest Lake	X	X ^{bc}	P ^b			X	P ^{bf}		X ^b	X	7	
	Vilas	South Turtle Lake				X		X				X	3	
	Washburn	Dunn Lake	X			X					X		3	
Washburn	Matthews Lake	X								X ^b		2	X	
		Total	12	7	5	8	3	17	2	1	11	8	3	

X = Present

P = Pioneer

^a Priority species

^b Previously undocumented

^c Voucher sent to UW-LaCrosse

^d Voucher sent to UW-Stevens Point Freckmann herbarium

^e Plants found past blooming stage

^f Floating fragment, no rooted plants observed

PHRAGMITES

Introduction

Phragmites australis ssp. *australis* is a clonal wetland grass. Both a native (ssp. *americanus*) and a non-native (ssp. *australis*) subspecies of phragmites are present in North America. *Phragmites australis* ssp. *australis* is extremely invasive, growing in moist habitats and waters up to 1 meter deep as well as floating mats in deeper water. Phragmites can grow to heights of 6 meters, and densities of 200 stems per square meter. Phragmites can quickly establish dense clonal stands.

Phragmites spreads primarily by underground roots and overland runners, which can grow up to 16 feet per year. Long distance dispersal occurs via floating root fragments and wind-borne or floating seeds. Phragmites out-competes native wetland vegetation forming dense monotypic stands. Phragmites also alters hydrology and fire frequency and intensity.

Non-native phragmites poses a serious environmental risk to the freshwater estuaries of Lake Superior and inland *manoomin* (wild rice) waters. Phragmites is already common along the Lake Michigan shoreline, however it is not common in the Wisconsin and Michigan portion of the Lake Superior watershed. Considering the current limited distribution and abundance of phragmites in the Lake Superior watershed and the potential loss of coastal estuaries and nearshore open waters, phragmites is a high priority for control efforts before it spreads further and becomes too widespread to manage effectively.

Several small populations of phragmites were detected and treated in 2013 along the western shoreline of Chequamegon Bay near wastewater treatment plants (WWTPs) in Red Cliff, Bayfield, and Washburn. Continued surveillance and follow-up treatments will be required until these seed sources are removed. GLIFWC is actively engaged with all three communities and the permitting agencies to develop alternative species or facilities to remove these phragmites seed sources from the landscape.

Surveys conducted in 2014 detected 70 occurrences of non-native phragmites at a pioneer stage within the St. Louis River Estuary along the border of Minnesota and Wisconsin. Response planning was initiated in the fall of 2014, with initial treatment occurring in 2015.

Additional surveillance was conducted in 2015 to continue assessment of the current distribution and abundance of phragmites in Lake Superior estuaries in Wisconsin and Minnesota, and to verify reports from prior years that lack identification to the subspecies level.

Methods

Surveys:

GLIFWC staff surveyed roadsides and areas near prior phragmites reports where the subspecies was unknown. Locations of previously reported sites and herbaria specimens were acquired from

Wisconsin DNR, 1854 Treaty Authority and other cooperating agencies. Roadsides with unverified phragmites reports were targeted for surveys. Reports near *manoomin* waters were a priority for surveillance. Roadside rights-of-way were surveyed by driving slowly, surveying both sides of the road.

Control: Sites treated along Chequamegon Bay in 2013 and 2014 were monitored and follow up treatments were applied where necessary. GLIFWC crews cut and disposed of phragmites seed heads if present, then applied imazapyr (Habitat®) herbicide with back-pack sprayers.

All native and non-native phragmites locations were recorded wherever they were encountered. Hand-held computers with GPS receivers and GIS software were used to document the locations of phragmites sites and control efforts. Data collected for each site included location, an estimate of the number of plants, acreage class, type of herbicide used, and an estimate of the amount of herbicide applied.

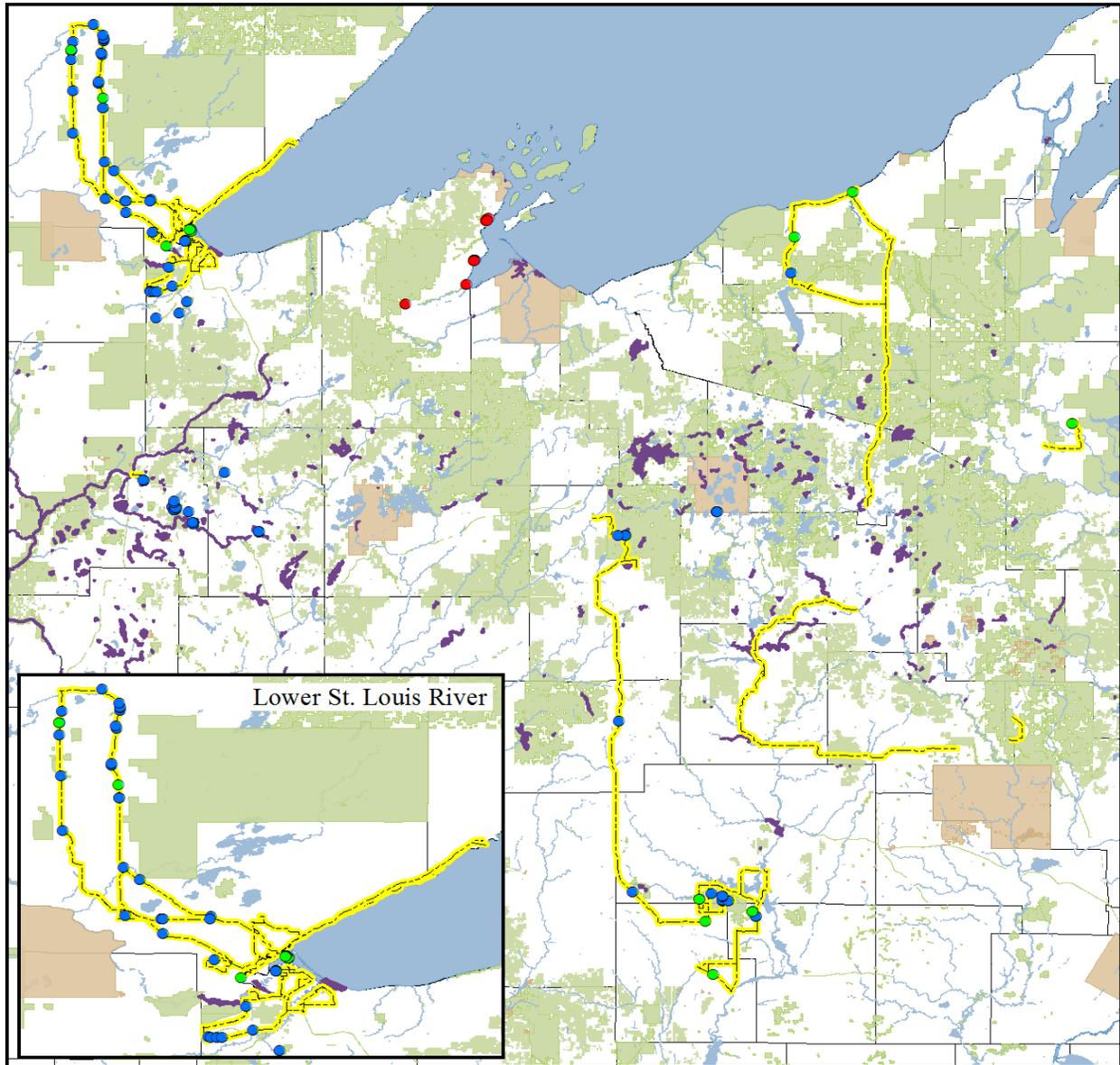
Results

Thirty-five non-native phragmites sites were detected in 2013 and 2014 by GLIFWC in the Chequamegon Bay region. All of these sites were monitored and treated if regrowth was evident in 2015. Ten of the 35 sites received follow-up treatment in 2015 (Figure 4). Figures 5 and 6 illustrate the abundance of phragmites at each site treated and the amount of herbicide used at each site from 2013-2015.

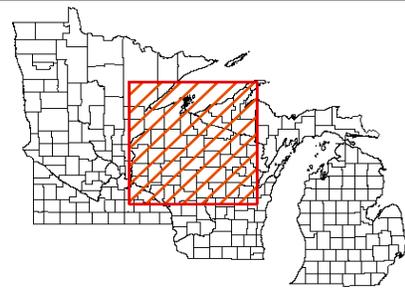
Over 850 miles of roadsides were surveyed in 2015 for phragmites (Figure 4). A total of 16 non-native phragmites occurrences and 75 native phragmites occurrences were detected (Figure 4). Eight phragmites reports were ground-truthed. Four reports were the non-native subspecies and three reports were the native subspecies of phragmites. No phragmites was detected at one of the previously reported sites. For non-native phragmites, eight of the sites detected in 2015 were in St. Louis County in Minnesota and will be treated in 2016. Three of the sites were detected in the Upper Peninsula of Michigan and will be treated in 2016 by GLIFWC or the Upper Peninsula RC&D. The other five locations were around Mead Wildlife Area in the southern portion of the ceded territories and were treated in 2015 by Wisconsin DNR.

GLIFWC staff continued to work cooperatively to manage non-native phragmites along the St. Louis River Estuary. Staff helped initiate and facilitate Wisconsin DNR control efforts on the Wisconsin side of the St. Louis River in 2015. GLIFWC staff were also instrumental in the creation of a new partnership with the Minnesota DNR, 1854 Treaty Authority, Fond du Lac Band, and St. Louis River Alliance to plan and conduct phragmites control efforts on the Minnesota side of the St. Louis River Estuary. GLIFWC staff are members of the technical advisory team overseeing the planning and management activities.

All phragmites occurrences that have been verified as either native or non-native were published online to coordinate appropriate responses (invasives.glifwc.org/phragmites) among management partners.



- 2015 Phragmites Herbicide Applications
- Non-native Phragmites Occurrences
- Native Phragmites Occurrences
- 2015 Phragmites Survey Route
- Manoomin Waterbodies
- Tribal Lands
- Public Lands



0 250 500 1,000 Miles

Figure 4. Distribution of *Phragmites* surveys and control efforts in 2015.

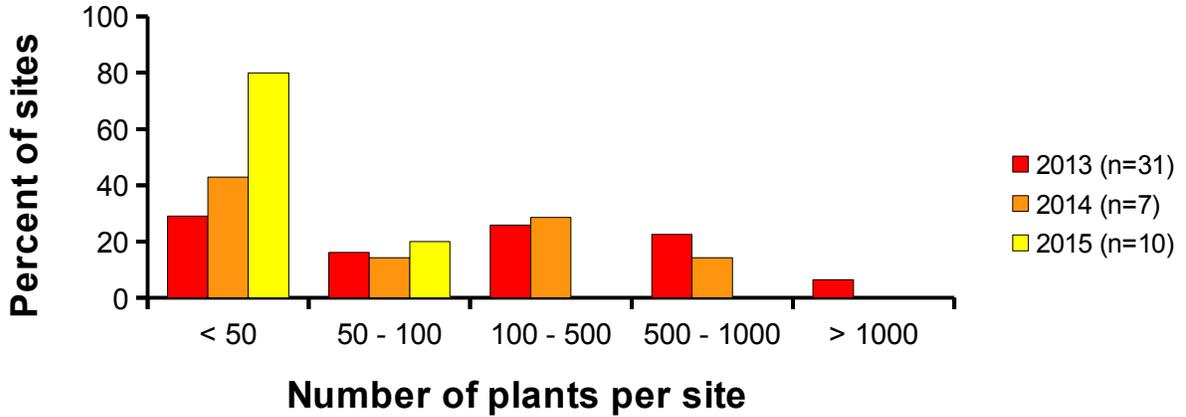


Figure 5. Abundance of non-native phragmites at sites treated in 2013-2015.

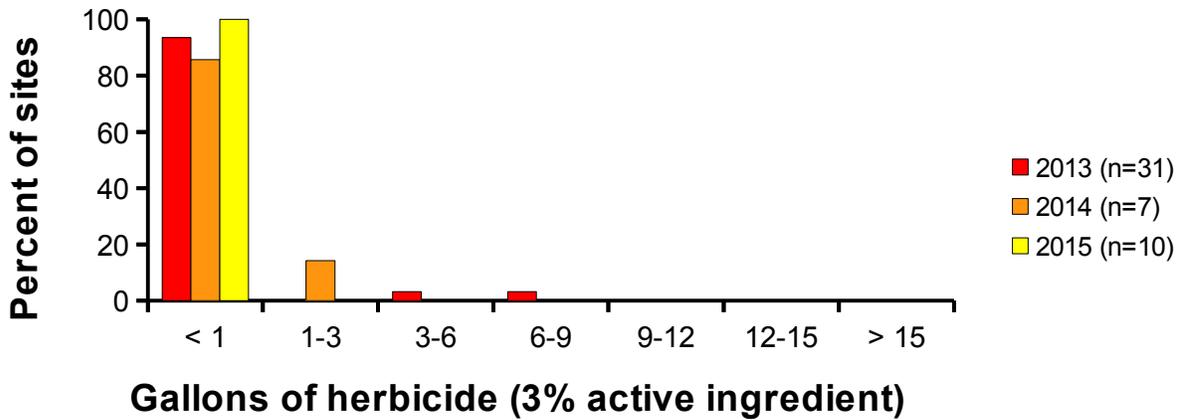


Figure 6. Amount of herbicide mix applied to non-native phragmites sites treated in 2013-2015.

CONTROL AND MANAGEMENT

When invasive species become established, the most effective action may be to prevent their spread or minimize their impacts through control measures. Integrated pest management (IPM) uses the most effective method or combination of methods while taking into consideration the cumulative environmental impacts. Methods may include manual, chemical and biological control.

LEAFY SPURGE

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, blooms in late May and early June, and produces 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 vehicles. 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 (e.g. *miinan* - blueberries) and hunting (e.g. *waawaashkeshi* – white-tailed deer) opportunities for tribal members.

Methods

GLIFWC crews applied imazapic (Plateau®) herbicide to leafy spurge 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. An assortment of biological control organisms have been approved by USDA-APHIS for controlling leafy spurge. Three of these have been released at leafy spurge sites in Bayfield County – *Aphthona lacertosa*, *A. nigricutis* and *Oberea erythrocephala*.

Treated sites were mapped using a GPS receiver and GIS software. Attribute data collected for each site included an estimate of the number of plants, acreage class, type of control used (chemical or biological), and an estimate of the amount of control applied (amount of herbicide used or number of insects released).

Results

In 2015, GLIFWC staff treated 5 sites with herbicide. In addition, several thousand *Aphthona lacertosa* were collected by GLIFWC staff from a site at Douglas County Wildlife Area and released at one site in Gogebic County near the Wisconsin border. Figure 7 illustrates the distribution of chemical and biological control efforts for leafy spurge in 2015. Road rights-of-way on the eastern edge of the Moquah Barrens near Washburn, Wisconsin comprised the core area of local leafy spurge populations and have provided a massive seed source for dispersal via road maintenance activities such as mowing and grading. However, abundance at these sites in recent years has been greatly reduced.

Discussion

Annual control efforts have substantially reduced the abundance of leafy spurge, especially around the town of Washburn where efforts were focused in past years. Control efforts in 2015 were focused on sites which had not received as much attention in past years. Figure 8 illustrates a trend towards more small sites and fewer large sites for the period 2011-2014, and a slight increase in the size of sites treated in 2015 reflecting the change in focus area. As a consequence, the amount of herbicide used at each site also trended slightly upward in 2015 as opposed to the declines seen during the period 2011-2014 (Figure 9). Areas treated in the past with integrated control measures employing both biological and chemical control continue to exhibit reduced abundance of leafy spurge.

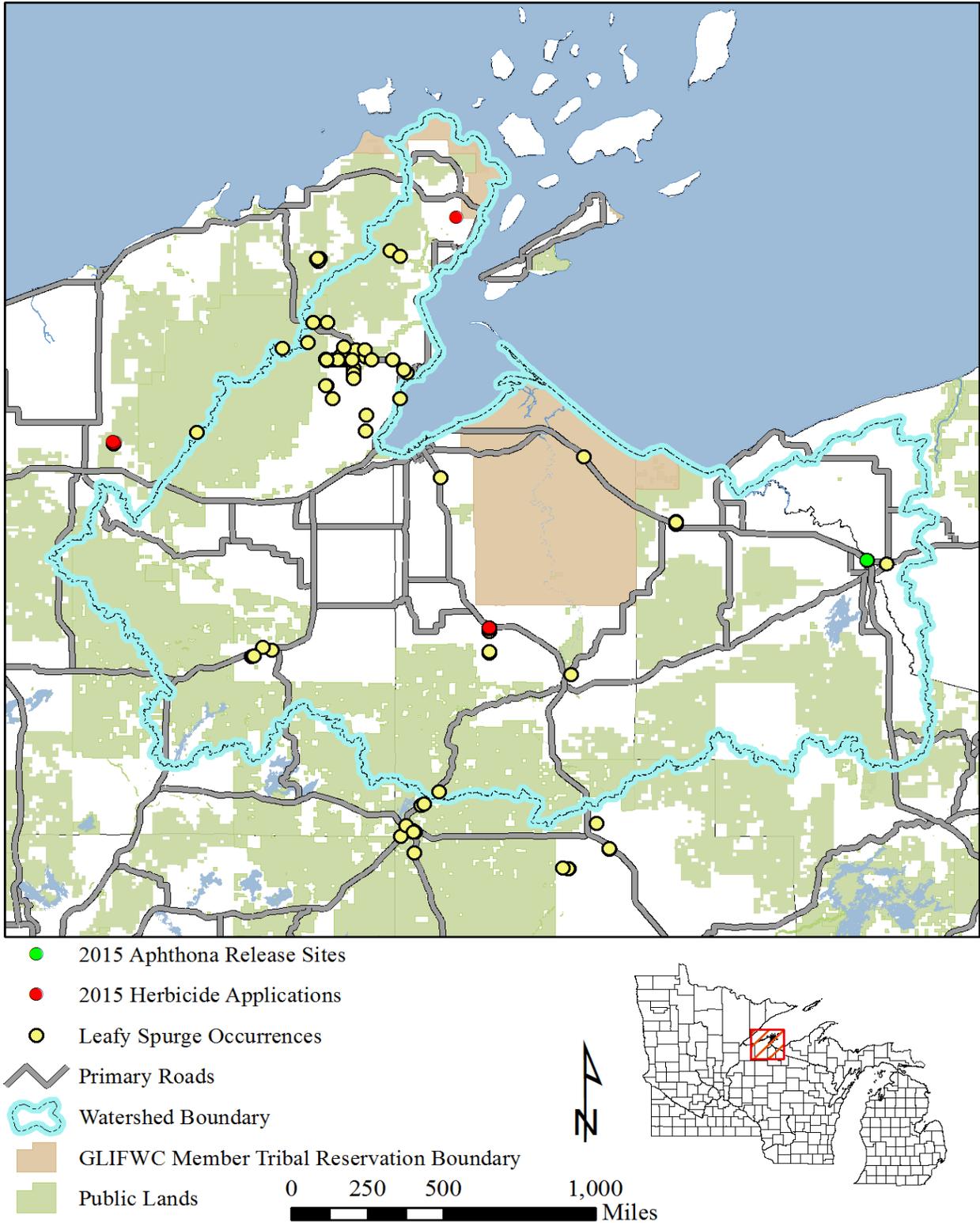


Figure 7. Distribution of leafy spurge integrated management efforts in 2015.

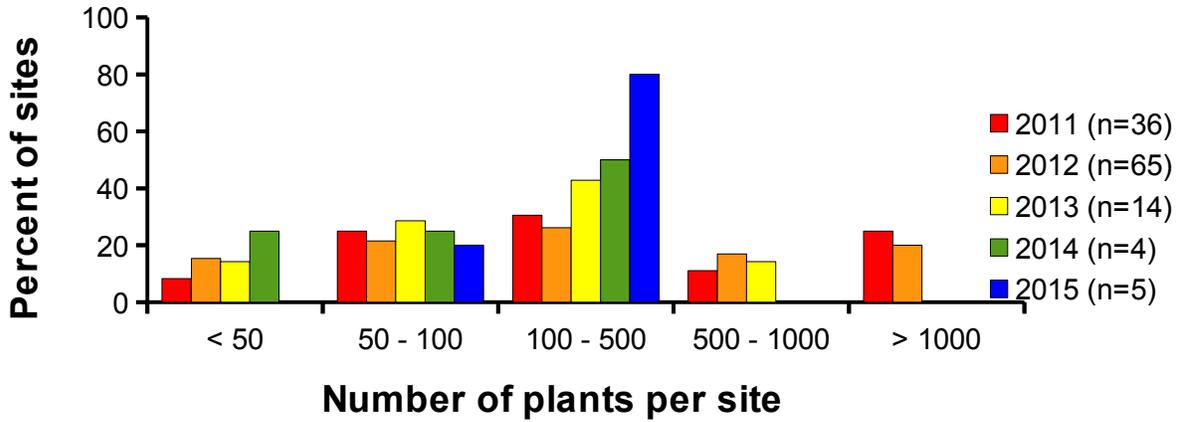


Figure 8. Abundance of leafy spurge at sites treated in 2011-2015.

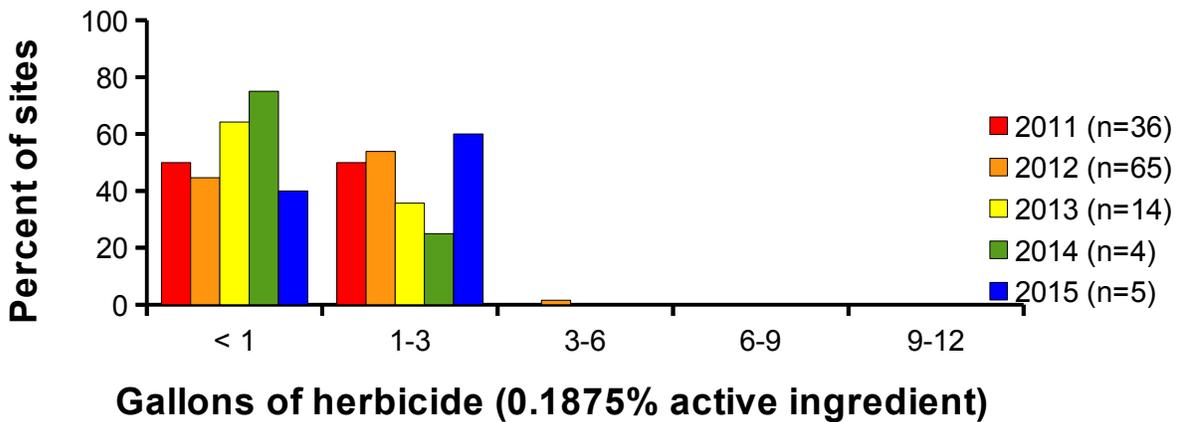


Figure 9. Amount of herbicide mix applied to leafy spurge sites treated in 2011-2015.

PURPLE LOOSESTRIFE

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). 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 a large root crown and dense shoots that out-compete adjacent plant life. The stalks are square and commonly attain heights up to 2m on mature plants. 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 native plant diversity result in 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 in northern Wisconsin. Small sites (< 0.5 acres) in upper reaches of the watershed were prioritized for chemical control. Control crews applied triclopyr (Garlon 3A® or Renovate®) to purple loosestrife plants. Renovate® is approved for over-water use and was used on sites with standing water, while Garlon 3A® was used where standing water was absent. Triclopyr is dicot-specific, allowing grasses and sedges to persist and re-colonize sites in a shorter time period. Chemical control efforts focused primarily on road rights-of-way between Mellen and Bayfield, Wisconsin. Private properties were also treated after consent forms were signed by the landowner.

Large sites (> 1 acre) and sites with poor access were a 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. GLIFWC has been rearing and releasing *Galerucella* beetles and collecting and redistributing in the watershed since 2000. 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.

Treated sites were mapped using a GPS receiver and GIS software. Attribute data collected for each site included an estimate of the number of plants, acreage class, type of control used (chemical or biological), and an estimate of the amount of control applied (amount of herbicide used or number of insects released).

Results

In 2015, GLIFWC staff treated 80 purple loosestrife sites with herbicide. Figure 10 illustrates the distribution of chemical control efforts for purple loosestrife in 2015. Biological control efforts since 2000 have established over 60 *Galerucella* populations throughout the Bad River – Chequamegon Bay watershed and site visits continue to document their impacts (Figures 11-13).

Discussion

The use of biological controls has allowed GLIFWC's control crew to place greater emphasis on treating small populations with herbicide before they become significant source populations (Figure 14). This strategy also reduces the amount of herbicide applied at each site (Figure 15). Biological control has been effective in general throughout the watershed, although results vary with size, disturbance, native seed bed quality, weather, and wetness of the site.

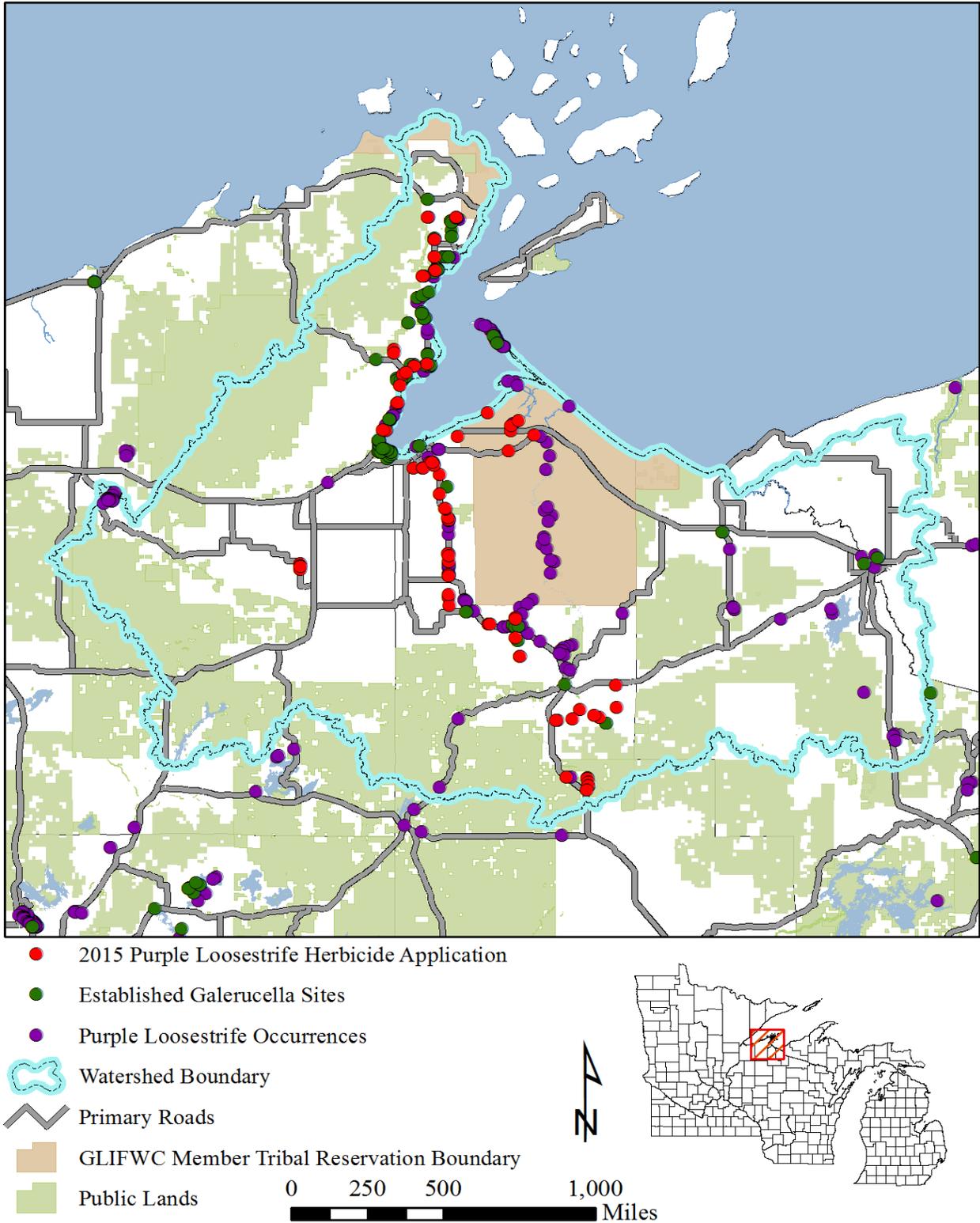


Figure 10. Distribution of purple loosestrife control efforts in 2015.



Figure 11. *Galerucella* release site west of Bayfield, WI.

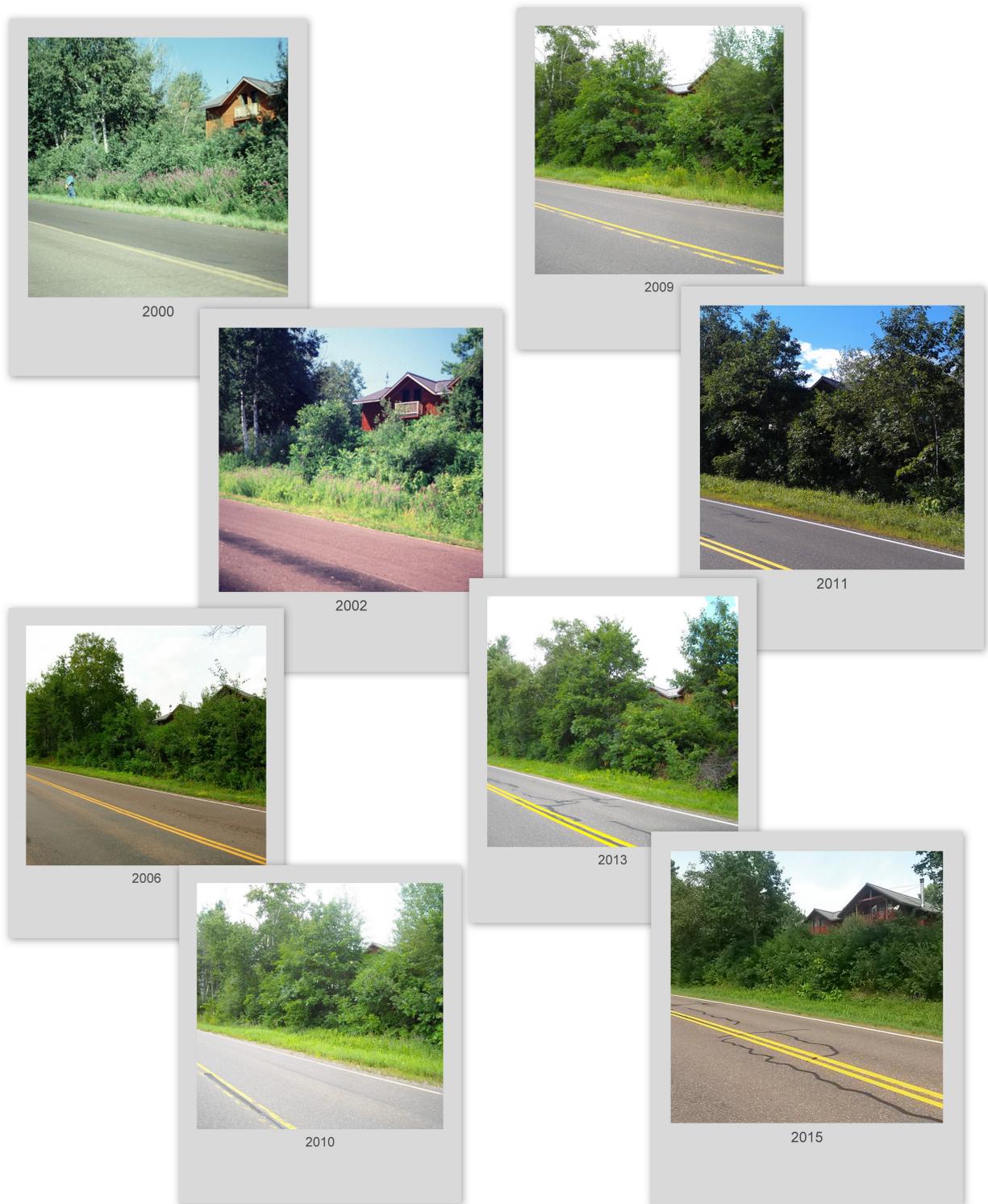


Figure 12. *Galerucella* release site south of Bayfield, WI.



Figure 13. *Galerucella* release site south of Washburn, WI.

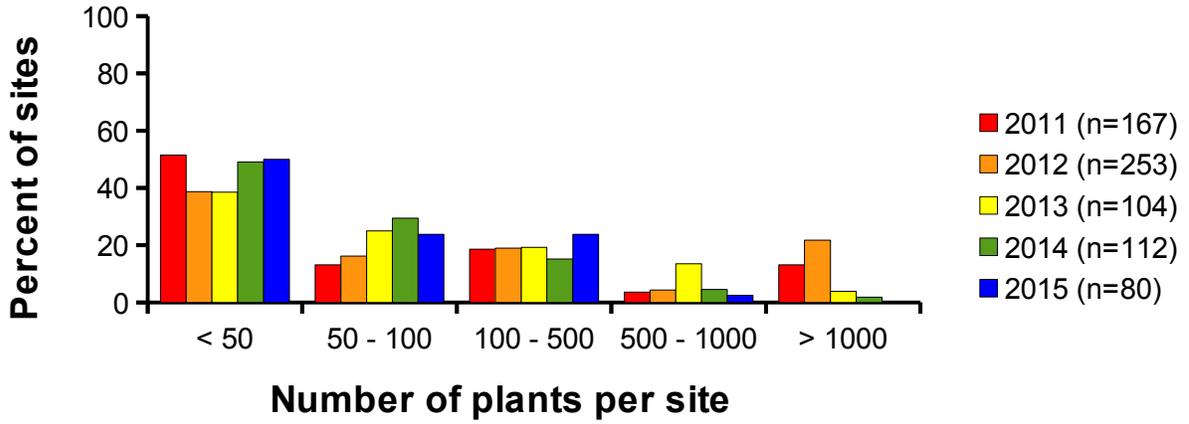


Figure 14. Abundance of purple loosestrife at sites treated in 2011-2015.

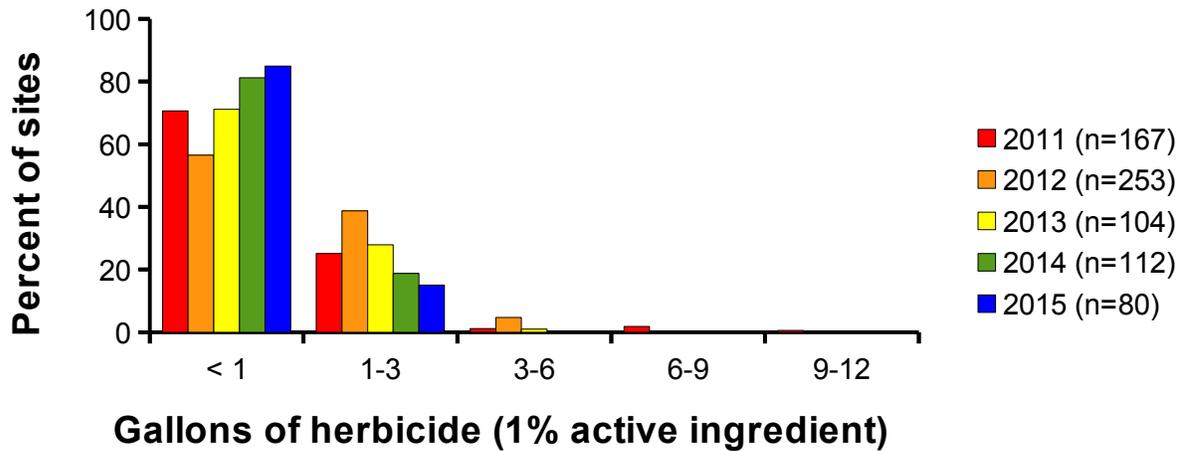


Figure 15. Amount of herbicide mix applied to purple loosestrife sites 2011-2015.

RESEARCH

Introduction

New invasive species continue to be introduced to ceded territory habitats and new management techniques are always being developed to reduce their spread. Research is required to address gaps in knowledge as they become evident, especially with respect to understanding potential impacts of invasive species and identifying or informing selection of cost-effective management actions.

Accomplishments

Activities in 2015 included:

- Staff attended a variety of conferences, webinars and workshops to continue to stay informed about new invasive species making their way to the ceded territories, new prevention and monitoring measures, research and new management techniques. Events that staff attended in 2015 included:
 - The Great Lakes Phragmites Collaborative webinar, “Phragmites and Fire”, January 15, 2015.
 - Herbicide updates workshop to stay up to date on the most efficient and new treatment options, March 18, 2015, Spooner, WI.
 - First aid and CPR training, March 26, 2015.
 - St. Louis River Summit, March 31-April 1, Superior, WI.
 - Great Lakes Phragmites Collaborative Advisory Council meetings, February 13 and October 20, 2015.
 - Chequamegon Bay Research Symposium, April 14, 2015, Ashland, WI.
 - The Stewardship Network webinar, “Practical Phragmites Control for Homeowners and Land Stewards”, June 10, 2015.
 - Wisconsin DNR's “AIS Monitoring – 5 Year Summary”, October 7, 2015.

COOPERATION AND COORDINATION

Introduction

Because invasive species disperse widely across the landscape and administrative boundaries, it is necessary to work cooperatively to achieve success. 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 activities with invasive species management partners to maximize the efficient use of limited resources. Management partners include Tribes, U.S. Forest Service, National Park Service, U.S. Fish and Wildlife Service, U.S. Army Corps of Engineers, state agencies, county governments, municipalities, universities, and non-government organizations.

Accomplishments

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

Northwoods Cooperative Weed Management Area (NCWMA): Formally established in 2006, NCWMA provides a forum to share information, collaborate on planning and cooperate on management activities in Douglas, Bayfield, Ashland, and Iron Counties in northern Wisconsin. In 2015, GLIFWC staff worked with the NCWMA partners to organize several garlic mustard control days and participated in knotweed control efforts in Iron County, WI. GLIFWC staff also assisted in developing a priority list of invasive species monitoring and control projects in the management area for 2016.

Wisconsin Headwaters Invasives Partnership (WHIP): Formally established in 2010, WHIP provides a forum to share information, collaborate on planning, and cooperate on management activities in Vilas and Oneida Counties in northern Wisconsin. GLIFWC has a history of surveying inland waters in Vilas and Oneida Counties for AIS and sharing the findings with WHIP partners.

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. Staff is working with partners to update this plan with an anticipated completion date in 2016.

Global Invasive Species Information Network (GISIN): GLIFWC staff participated on the standards committee to develop this standardized information exchange protocol for sharing invasive species information. An early adopter of the technology, GLIFWC's node of the Global Invasive Species Information Network (gisin.glifwc.org) can be used to query multiple databases simultaneously and browse the results via an interactive table or map.

Phragmites Management and Cooperation in the Lower St. Louis River Estuary: In 2014, GLIFWC staff facilitated a multi-agency meeting to share results from surveys and coordinate follow up monitoring and control efforts for non-native phragmites along the Lower St. Louis River. In 2015, GLIFWC staff continued to work cooperatively to manage non-native phragmites along the St. Louis River Estuary. Staff helped initiate and facilitate Wisconsin DNR control efforts on the Wisconsin side of the St. Louis River in 2015. GLIFWC staff were also instrumental in the creation of a new partnership with the Minnesota DNR, 1854 Treaty Authority, Fond du Lac Band, and St. Louis River Alliance to plan and conduct phragmites control efforts on the Minnesota side of the St. Louis River Estuary. GLIFWC staff are members of the technical advisory team overseeing the planning and management activities.

maps.glifwc.org: The goal of this project is to facilitate collaboration by providing a common communications infrastructure. maps.glifwc.org provides a portal for viewing invasive species distribution and management in the context of the ceded territories and other GIS layers relevant to GLIFWC's member tribes such as *manoomin* and *ogaa* waters.

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