

Slowing the lake to lake spread of aquatic invasive species by recreational boaters

By:

John Rothlisberger- *Center for Aquatic Conservation, University of Notre Dame*

Lindsay Chadderton-*TNC Great Lakes Program*

Reuben Keller- *Center for Aquatic Conservation, University of Notre Dame*

Mark Fedora- *USDA Forest Service, Eastern Region, Ottawa National Forest*

Mark Drew- *Center for Aquatic Conservation, University of Notre Dame*

Joanna McNulty- *Center for Aquatic Conservation, University of Notre Dame*

David Lodge- *Center for Aquatic Conservation, University of Notre Dame*



Acknowledgements

The research was funded by the Great Lakes Protection Fund. Sheila Kennedy and S-K Environmental, Inc. (<http://s-k-enviro.com>) provided the portable boat washer used in this research . We would like to thanks Ted Ritter for his advice and for critically reviewing this document along with Phil Moy. Thanks also to Watersmeet Township for local support of our survey teams.

August 2008:

<http://aquacon.nd.edu/>

Slowing the lake to lake spread of aquatic invasive species by recreational boaters

Recreational boaters play a major role in the spread of aquatic invasive species (AIS) to inland waters in the Great Lakes region. AIS are transferred on hulls, fishing gear, anchor lines, in live wells, bilge water, and bait buckets. Recreational boaters have likely introduced spiny water flea, zebra mussels, rusty crayfish and Eurasian milfoil to inland lakes across the Great Lakes region. More recently the disease Viral Hemorrhagic Septicemia (VHS) has begun to spread into inland lakes, most likely moved around with contaminated bait and/or live well/bilge water.

Efforts to prevent the spread of AIS are underway at many levels and include public awareness and education campaigns (signage, brochures), boat inspections, cleaning stations, and survey and control or eradication programs for some aquatic weeds (see <http://www.uwsp.edu/cnr/uwexlakes/cbcw/>). This document describes the results of recent research conducted by scientists at the University of Notre Dame (UND) designed to identify the most efficient ways for individuals, lake association, or other groups to use available resources to slow the spread of AIS.

Cleaning boats makes a difference

Diligent visual inspections and hand removal can effectively remove invasive aquatic plants like Eurasian water milfoil from boats (Table 1). However neither this technique nor low-pressure washing is as effective on small-bodied organisms that are difficult to see with the naked eye (e.g. spiny waterflea, young zebra mussels). High pressure washing will remove almost all of these organisms from boat hulls, equipment and trailers, including seeds of invasive plants and mud that may contain these and other pests or pathogens like the fish disease VHS. Therefore, where small-bodied organisms are a concern, pressure washing should be used in conjunction with visual inspections and hand removal. Other recommended practices that should be followed but were not assessed in this study are included below,

- *Drain water from your boat, motor, bilge, live wells, and bait containers between lakes.*
- *Let boat dry in the sun for five days OR wash your boat with hot (104°F water)*
- *Do not move live fish from one waterbody to another.*
- *Dispose of leftover bait in the trash, not in the water or on land.*
- *Buy certified VHS clean bait from a local dealer or catch your own and use it to fish the lake or river from which you caught it.*

Controlling the source

For an invasion to occur, a species must be transported from an invaded lake to an uninvaded lake. Because there are fewer invaded than uninvaded lakes, it makes sense to concentrate management efforts at those lakes that are most likely to act as invasion sources.

UND analyses have shown that two factors make a lake particularly likely to act as an invasion source. First, the more invasive species in a lake, the more likely it is to 'donate' organisms to another lake and cause a new invasion. Second, lakes that are more frequently

visited by boaters have a greater chance of being the source of new invasions because there are simply more boats on which invaders can hitchhike. Lakes that pose the greatest risk of causing invasions, those with a large number of both AIS and boaters, are referred to as ‘super-spreaders’ because of their strong role in expanding the range of invaders. UND scientists have shown that preventing transport of AIS away from these ‘super-spreader’ lakes can make the greatest difference in slowing the spread of AIS.

By combining information on the distribution of five of the most damaging invasive species (zebra mussel, rusty crayfish, Eurasian watermilfoil, spiny waterflea and curly-leaf pondweed), and on boater traffic, researchers have identified which lakes in Wisconsin and the Michigan U.P. are potential ‘super-spreaders’. Super-spreaders include the Great Lakes and several inland lakes (see map below). Management efforts to prevent the departure of AIS from these lakes are likely to be very cost effective at reducing invasions throughout the region, including the lake about which you care the most.

Because these super-spreaders were identified using state-scale information, local knowledge will be important for guiding local management efforts. For example, just because there are no ‘super-spreaders’ in your region, it may still be possible to determine which lakes pose the greatest risk for AIS spread by considering the number of introduced invasive species and number of boaters at each lake near you.

Because many uninvaded lakes remain in the Great Lakes region, it is not possible to reliably predict which one will become invaded next. Therefore it is difficult to recommend lakes that should be singled out for protection from incoming species. This means that the most effective management option is to prevent the movement of invaders away from infested lakes. Possible exceptions might be un-invaded lakes that have very high value for wildlife or recreation – where these values could be irreversibly lost through an AIS introduction. In these cases, application of special protection measures against arriving species would be warranted. If individuals or lake associations took steps only to protect their lake from incoming invasions, such efforts would eventually be overwhelmed by an increasing number of invasive species from an increasing number of invaded lakes (because most lakes will remain unprotected). Thus, it is in everyone’s interest to prevent the departure of AIS from lakes that are already invaded, even if such lakes are at some distance from the lake about which you care the most. The most effective measures will be those taken to prevent the departure of AIS from already invaded waterways.

Slow the spread by focusing on high-risk boaters and behaviors

Recreational boaters comprise a diverse group that includes anglers, water skiers, charter boat operators, fishing guides, cruisers, sailing, house-boaters, pontoon boaters, small-boat commercial fishermen, personal watercraft users, and hunters. Each of these groups behaves differently and each activity poses a different potential for spreading aquatic invasive species. A recent UND survey of boaters in northern Wisconsin and the western U.P. found that most boaters fish the same small number of lakes. However, about 30% of boaters move among lakes, sometimes visiting multiple lakes in a single day. These highly mobile boaters also include those who frequent Great Lakes landings. This sort of boater should take extra precautions to prevent spread and should be especially targeted for education and inspection as they have a greater potential to spread AIS.

Fishing tournaments that attract boaters from outside the region also pose a high risk of introducing new species of AIS. Establishing mandatory inspection and cleaning of tournament boats as a condition of entry to all tournaments is a way to reduce the high risk posed by such events. Written materials distributed ahead of time to all entrants should mandate inspection and cleaning before practice fishing ahead of the tournament.

Boat wash facilities as a local long-term investment

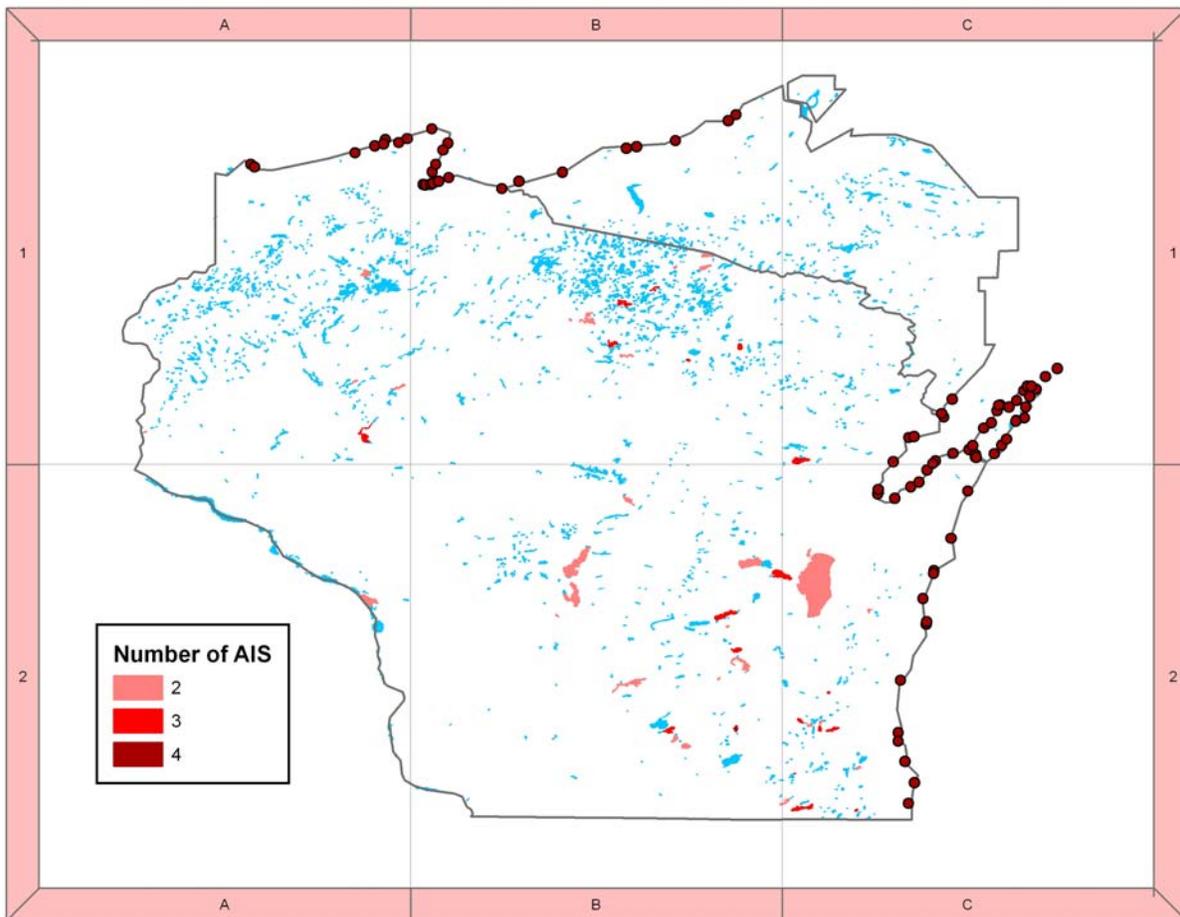
Pressure wash cleaning stations need not be at every waterway if the goal is to prevent the spread of invasive species from already invaded lakes, especially the super spreader lakes. Installing pressure washers at the most heavily used landings at already invaded waterways to clean departing boats, equipment and trailers will maximize the effectiveness of efforts to slow the spread of AIS. In addition, professional and commercial users who visit numerous lakes as part of their daily business should install and use such facilities as part of their normal daily routine. Finally, wash stations could be installed at key transit points (e.g. gas stations) to intercept boaters moving between lakes.

Important information for managers and lake associations on slowing the spread of aquatic invasive species

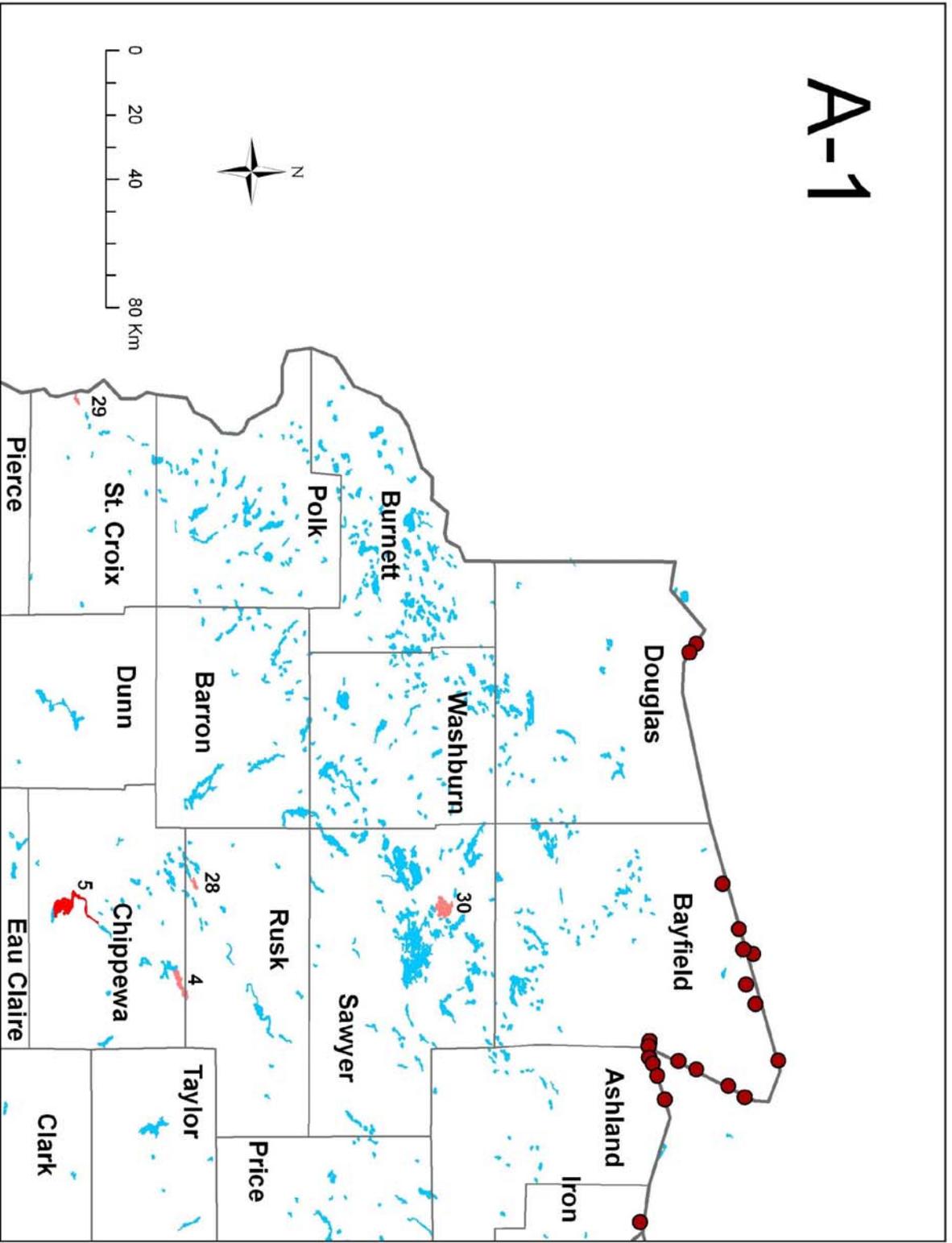
	Capital Expense	Annual Labor Costs	Efficacy (% reduction in AIS)	
			For vegetation	For small-bodied organisms
Inspection and hand-removal	\$25 (training by Clean Waters)	³ \$0- ⁴ \$12,800	87%	70%
Low pressure wash (unmanned) ⁷	\$50-\$200	\$0	63%	73%
Power wash station (self serve)	¹ \$300- ² \$35,000	\$0	85%	90%
Manned Power wash station	¹ \$300- ² \$35,000	\$0- ⁵ \$12,800	>85%	>90%

1. For a portable high pressure washer with no containment system--for use on outgoing boats at source (i.e., already invaded) lakes.
2. For a portable high pressure washer with filter and containment system to prevent incoming species..
3. Volunteers can be trained as boat inspectors
4. Assumes two paid inspectors 40 hrs/wk for 20 weeks (the same time period as Clean Boats/Clean Waters)
5. Manned power wash station with containment system would need at least two people to run. With training and experience we would expect on average a higher standard of cleaning and compliance
6. Garden hose with normal pressure without hand removal

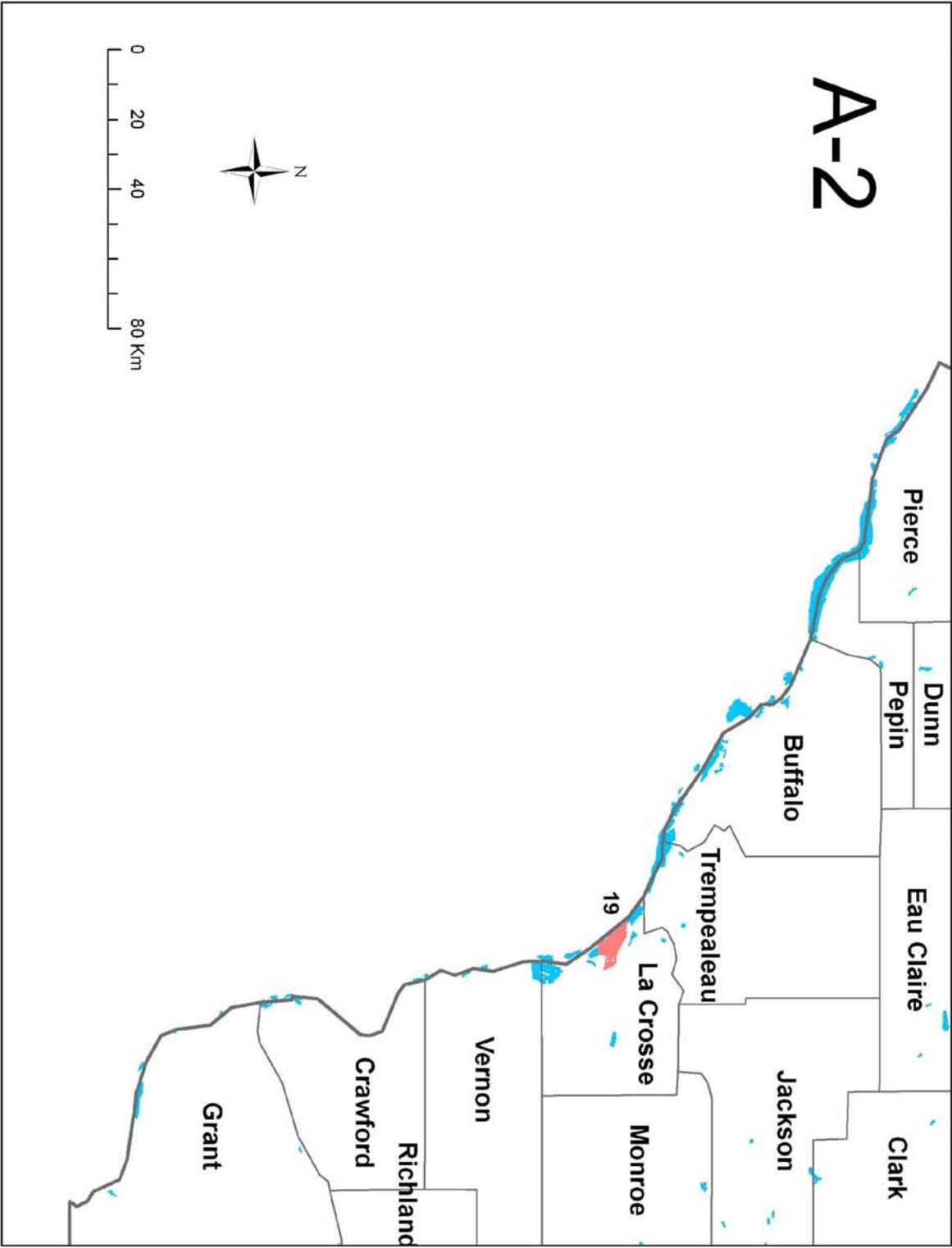
Maps identify Wisconsin-western Upper Peninsula of Michigan lakes (in red) that have a combination of many invasive species and high boater traffic. These lakes are probably “super spreaders;” that is, these lakes are much more likely than other lakes to be the source of new invasions in other lakes. Therefore, preventing invasive species from leaving these lakes on boats would reap benefits for all the lakes in this region. [Note; *Red dots on maps are Great Lakes boat landings that are likely to be a major source of invasive species for inland lakes due to the high numbers of introduced species present*]. Refer to last table for the names of the numbered lakes and list of known aquatic invasive species.



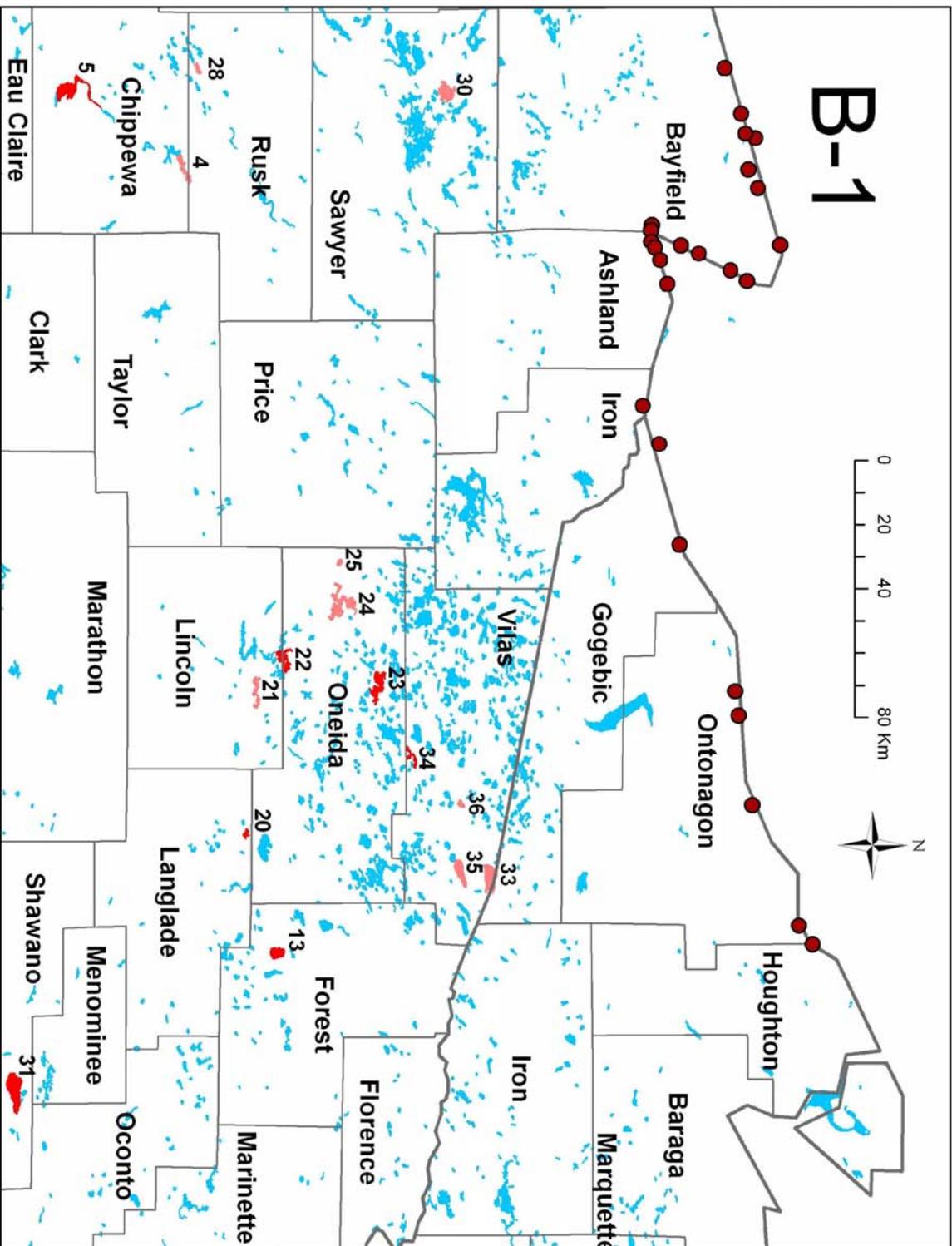
A-1

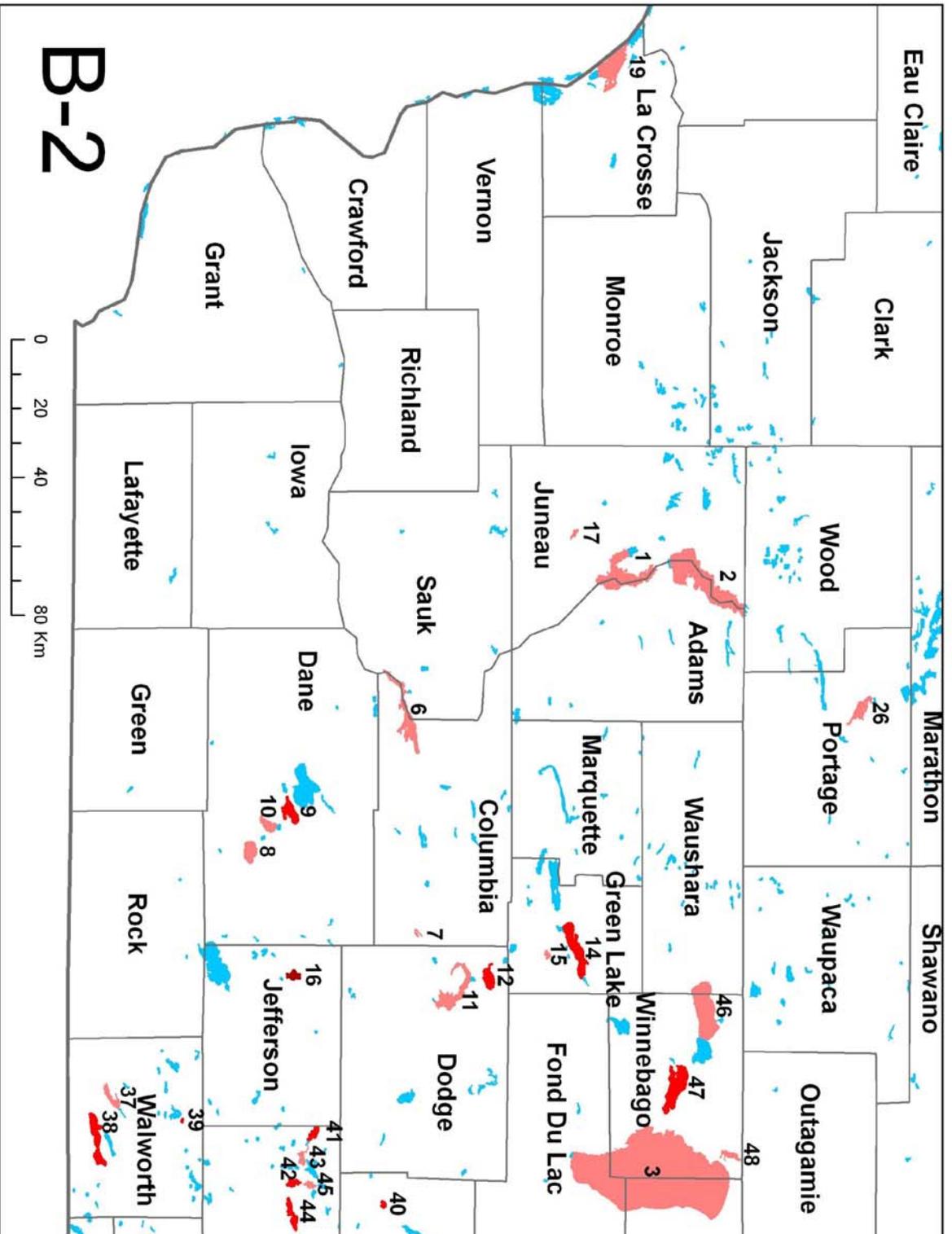


A-2

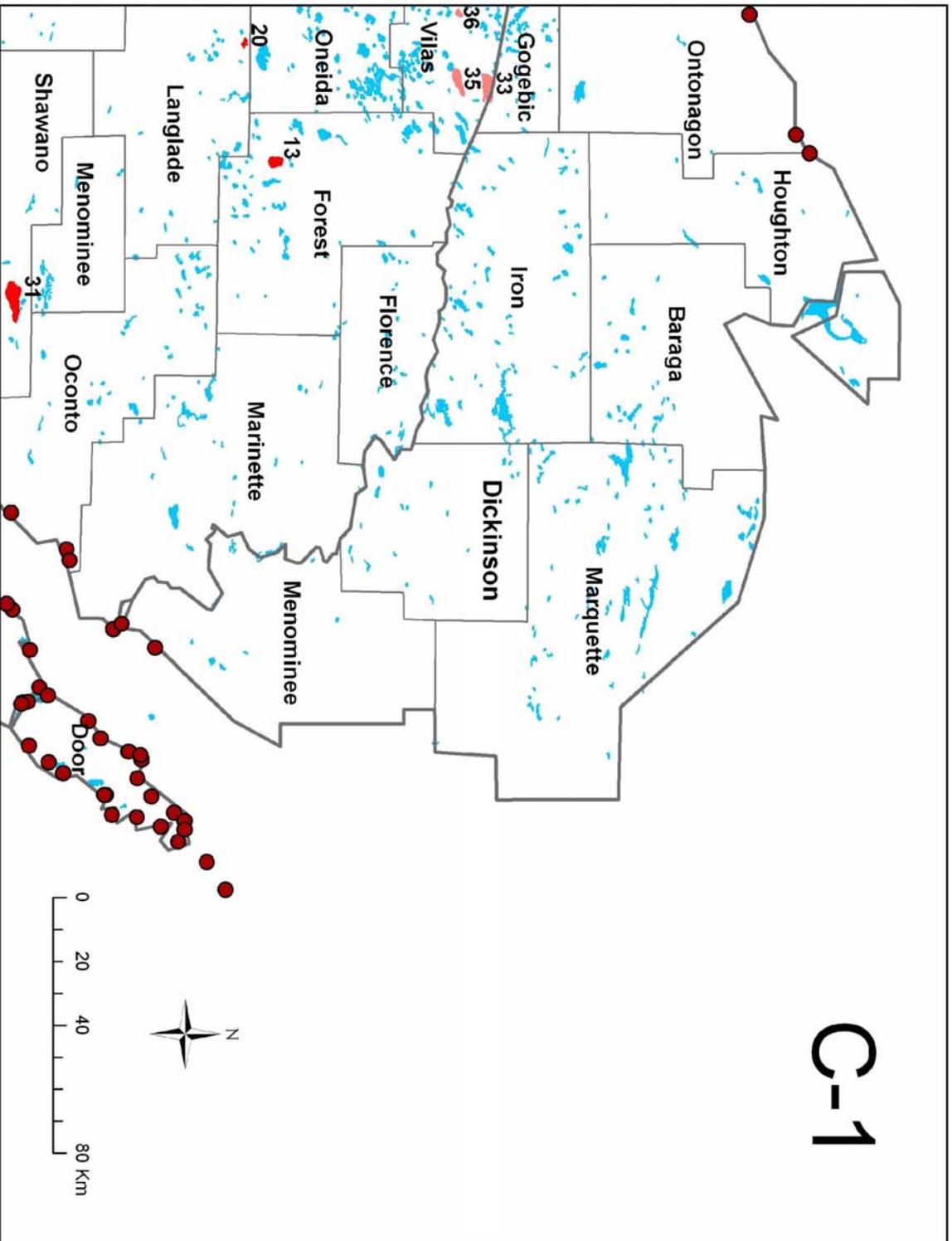


B-1





C-1



C-2

