Living with an Infestation:
Update on Zebra Mussels in Manitoba

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Manitoba

Outline

- Aquatic Invasive Species
- Zebra Mussel Detection
- Rapid Response
- Treatment Options
- Post Treatment
- Moving Forward

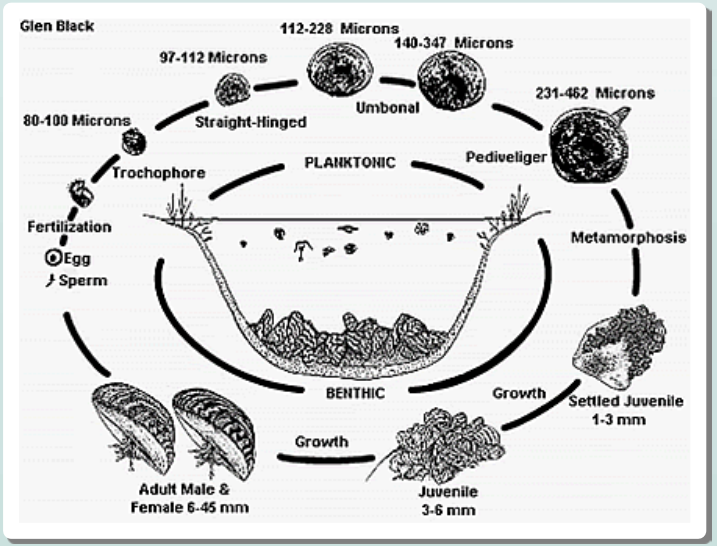
Aquatic Invasive Species (AIS)

- **A**quatic **I**nvasive **S**pecies
- Plants, animals, parasites, and diseases that are not native to an area.
- Require an aquatic habitat for at least part of their life cycle but do not necessarily live in entirely in water.
- Introduced either intentionally or accidentally.
- Out-compete native species for resources.
- Ecological, social, economic and health impacts.




Zebra Mussels

- D-shaped shells
- Adults usually 1-3 cm long (range 0.6-4.5 cm)
- Females can produce up to one million eggs per year
- Eggs and free-floating, microscopic larvae (veligers) disperse by water currents and human-based vectors (watercraft)
- After 2-3 weeks, the veligers start setting their shell, attach to substrate and grow.



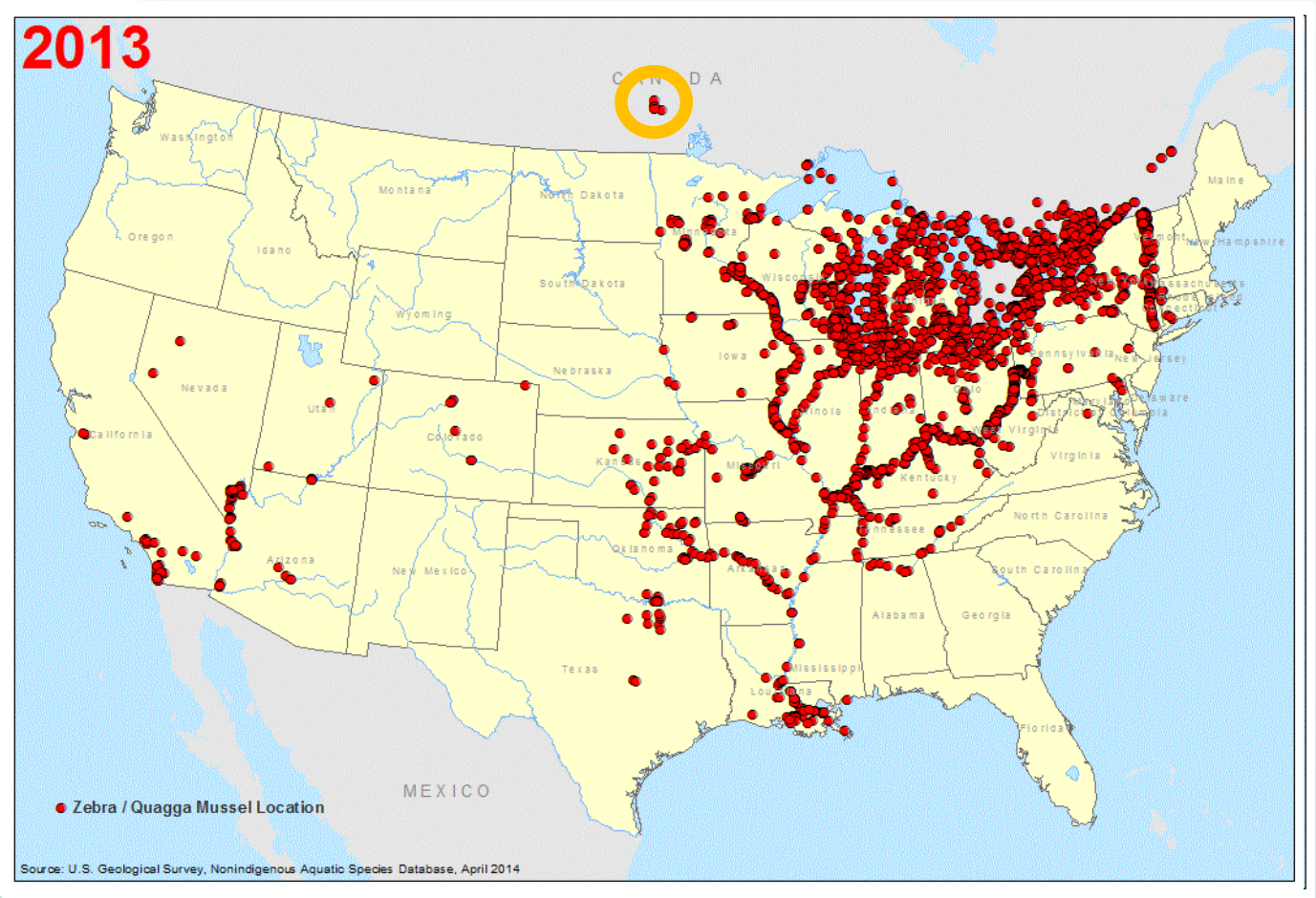
Zebra Mussel Impacts

- Ecological
  - Water clarity, aquatic vegetation, toxic algal blooms, fish populations, native mussel populations.
- Industry and Water Supply
  - Water flow, impair facilities, clog pipes and trash screens, disrupt water supply to homes and industry.
- Recreational
  - Sharp shells, drag, foul motors, sport fishing opportunities.
- Economic
  - Maintenance cost for power generation, water treatment plants, water delivery infrastructure.
  - Impact cost of food and utilities, native fisheries, tourism, waterfront property values.

Pathways for spreading AIS

- Inter-connecting waterways.
- Un-cleaned fishing equipment and gear.
- Release of live bait.
- Live food trade.
- Internet sales.
- Float planes.
- Legal and illegal introductions.
- Migration of wildlife.
- Release of aquarium or water garden, water, pets or plants.
- **Overland movement of recreational watercraft and water-based equipment.**

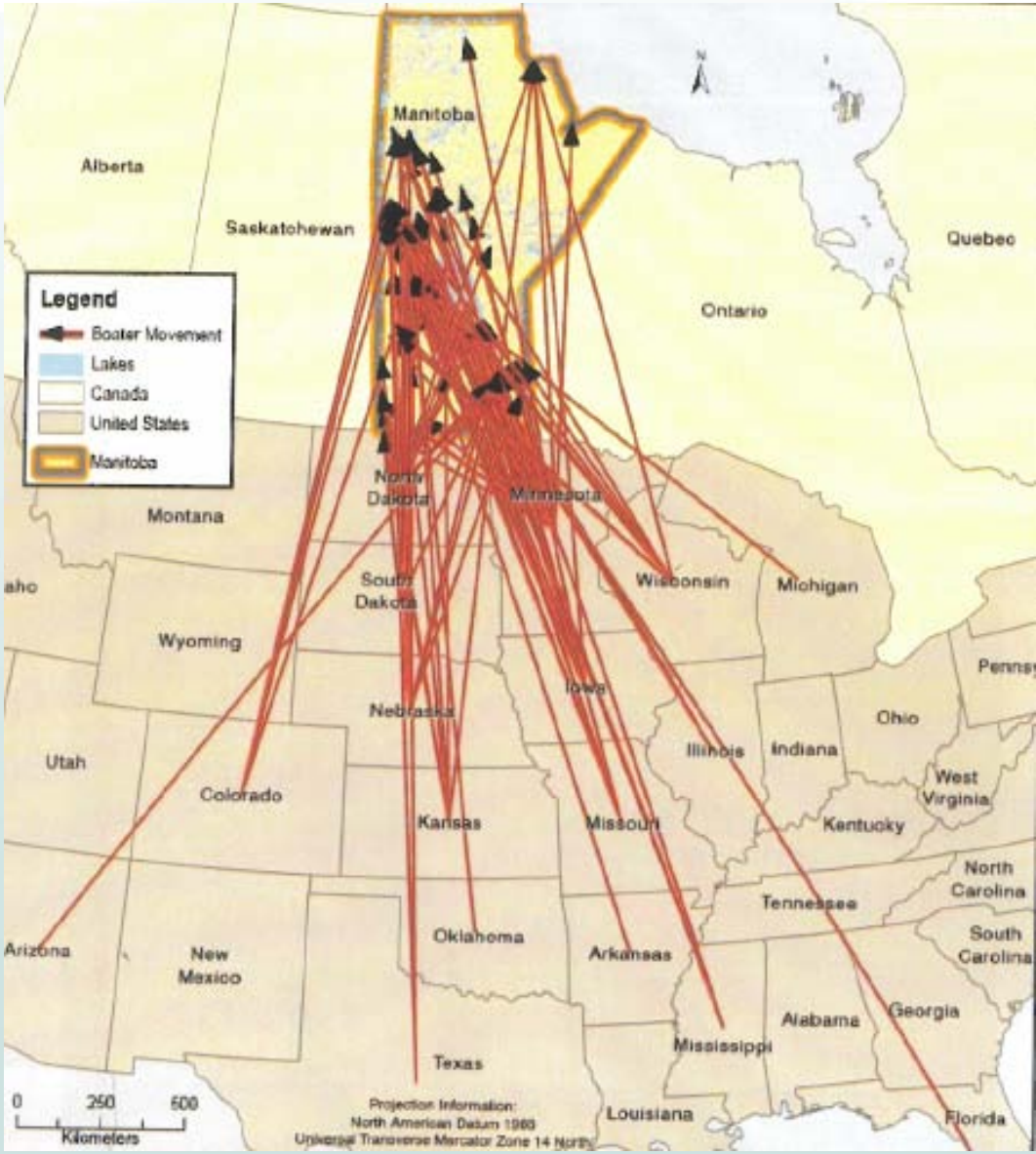
Timeline showing the invasion of Zebra and Quagga mussels across the U.S. in 1986.



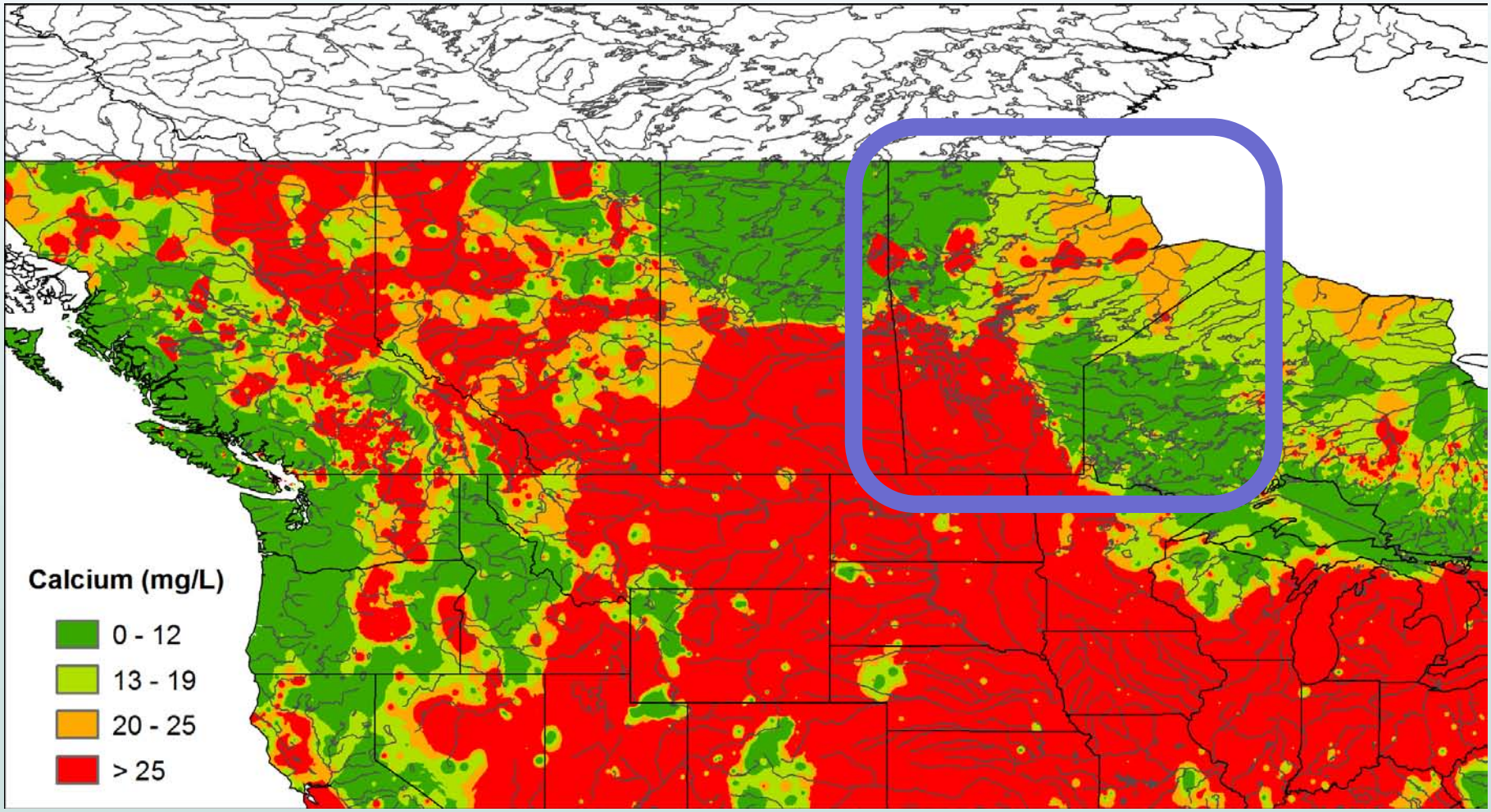
Timeline showing the invasion of Zebra and Quagga mussels across the U.S. in 2013.

Water Basins

- On the receiving end of many watersheds
- Lake Winnipeg alone receives water from **4 provinces** & **4 states**
- **120** AIS in Mississippi Basin
- **200** AIS in Great Lakes Basin
- Large number of watercraft coming to Manitoba
- Until the Zebra Mussel invasion, Manitoba had 15 aquatic invasive species: spiny waterflea and rusty crayfish among those.

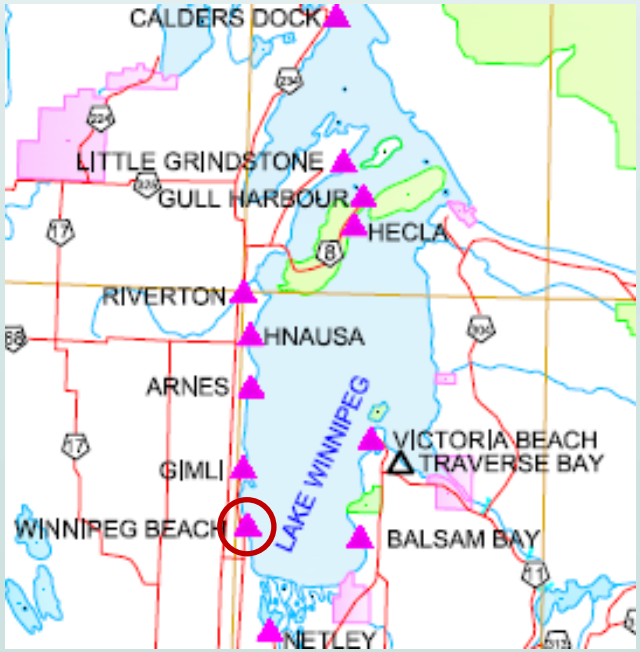


Will Zebra Mussels survive and thrive in Manitoba?



Zebra Mussel Reported

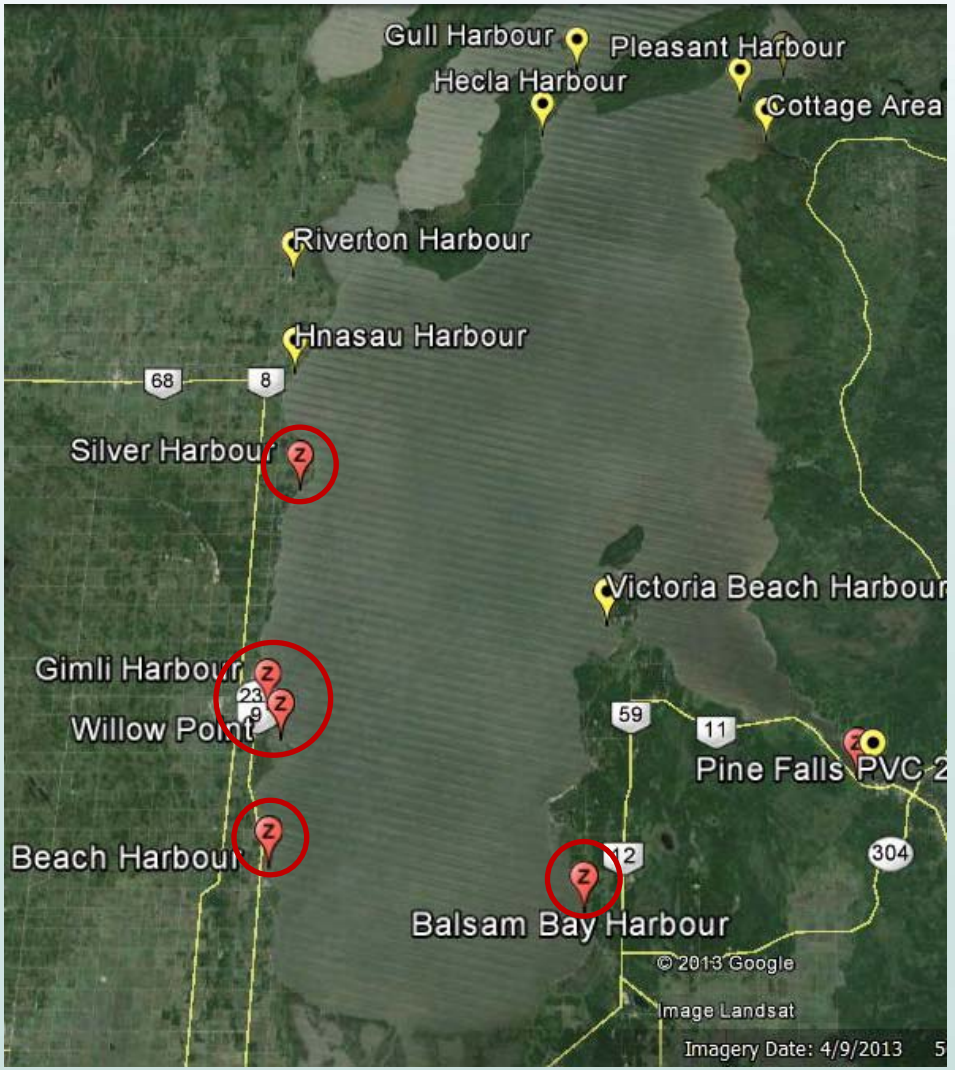
- **October 11, 2013** suspect zebra mussel report received.
- Mussel was confirmed to be a zebra mussel.
- Mussel was attached to a recreational watercraft moored at Boundary Creek Marina located in the south basin of Lake Winnipeg on the west side
- The underside of docks were inspected and additional zebra mussels were found.

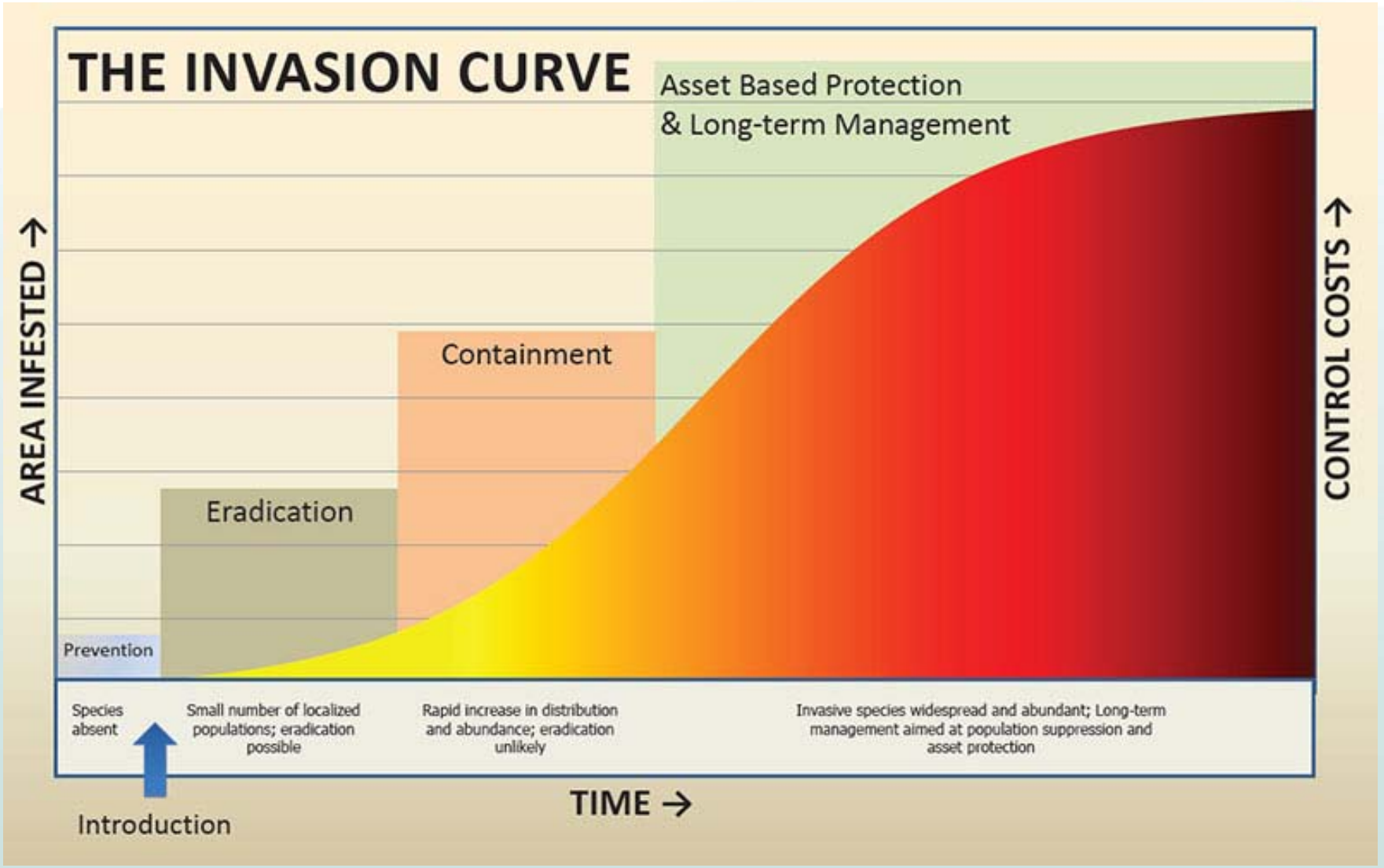


Map: Small Craft Harbours

How Did We Respond?

- Department implemented Locke *et al.*'s Rapid Response Framework.
- Established a Science Advisory Committee comprised of government and external experts.
- Results from data collected in the fall determined this was an early stage of infestation largely contained to four harbours: Gimli Harbour, Boundary Creek Marina/Winnipeg Beach Harbour and Balsam Bay Harbour.

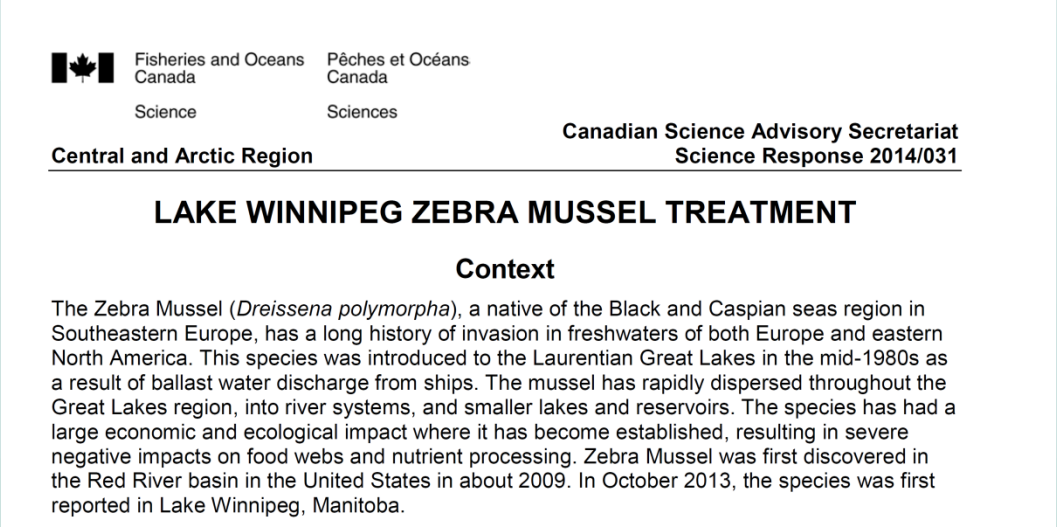




Generalized invasion curve showing actions appropriate to each stage. Prevention is the first defence for invasive species. After prevention, eradication and containment (early detection and rapid response, EDRR) is most successful, cost-effective, and least damaging means of invasive species control. Once invasions are widespread, significant long-term management costs are aimed at protecting key assets and suppressing established populations. (Figure from North American Invasive Species Network, http://naisn.org/information/).

Treatment Options Considered for Lake Winnipeg

- No Action
- Physical Treatments: hand picking; re-suspending sediments; de-watering the harbours
- Biological Treatments: Zequanox
- Chemical Treatments: Reducing pH; Copper Sulphate; Chlorine; Potash



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Science | Sciences

Central and Arctic Region

Canadian Science Advisory Secretariat
Science Response 2014/031

LAKE WINNIPEG ZEBRA MUSSEL TREATMENT

Context

The Zebra Mussel (*Dreissena polymorpha*), a native of the Black and Caspian seas region in Southeastern Europe, has a long history of invasion in freshwaters of both Europe and eastern North America. This species was introduced to the Laurentian Great Lakes in the mid-1980s as a result of ballast water discharge from ships. The mussel has rapidly dispersed throughout the Great Lakes region, into river systems, and smaller lakes and reservoirs. The species has had a large economic and ecological impact where it has become established, resulting in severe negative impacts on food webs and nutrient processing. Zebra Mussel was first discovered in the Red River basin in the United States in about 2009. In October 2013, the species was first reported in Lake Winnipeg, Manitoba.

Recommended Treatment - Potash

WHY?

- Economic, ecological and social cost of doing nothing – not an option.
- Potash selected for a number of reasons:
  - Known to be 100% effective.
  - Considered the most environmentally benign option – potassium at concentrations of 100ppm K+ toxic to mussels but not finfish or any other aquatic organisms/wildlife. No human health risk.
  - Had been used successfully elsewhere (Virginia).
  - Affordable and logistically achievable within the tight timeframe.
- Objective of the treatment: at minimum, apply downward pressure on the Zebra Mussel population and reduce the spread of Zebra Mussels from the harbours.

HOW?

- Apply muriate of potash (Potassium Chloride) at a concentration of 100 ppm K+ between ice break up and before water temps reach 10^0C.

WHO?

- ASI Group Ltd - Ontario

So many things needed to be completed before treatment and the 2014 open water season - many things were happening concurrently!

Internal approval **Regulatory Approvals** **Stakeholder Consultation**

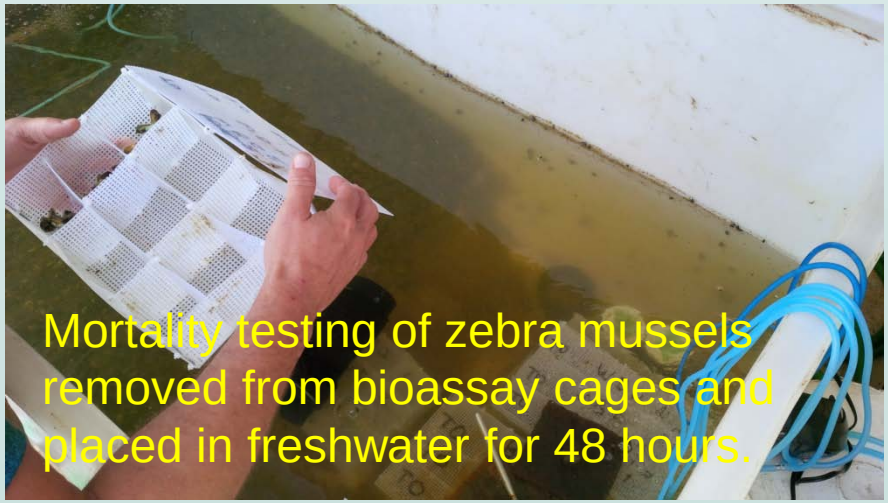
- Determine if potash could even be used and if so what approval was required. Hurdle: no product registered in Canada for open water use.
- Determine what other approvals were necessary, submit applications, prepare advertisements and signage.
- Prepare and advance internal documents requesting approval and funding to treat – along with other program components.
- Determine who we needed to consult with.
- Consult with stakeholders – tricky to be transparent when no internal approval or regulatory approvals in place.
- Prepare contract and work with consultant.
- Prepare Ministerial and public communication materials.
- Develop containment and monitoring plan and implement.

Zebra Mussel Eradication/Treatment

- Potash treatment of harbours began on May 21, 2014

- Treatment considered a success based on 100% mortality of zebra mussels in bioassay cages placed at various locations throughout each harbour.

- Unfortunately…



Monitoring Results 2014

Water samples:

- *M.V.* Namao veliger sampling (54 stations plus 6 near shore stations)
  - Summer = 3 positive samples
  - Fall = 10 positive samples

Artificial substrate and infrastructure:

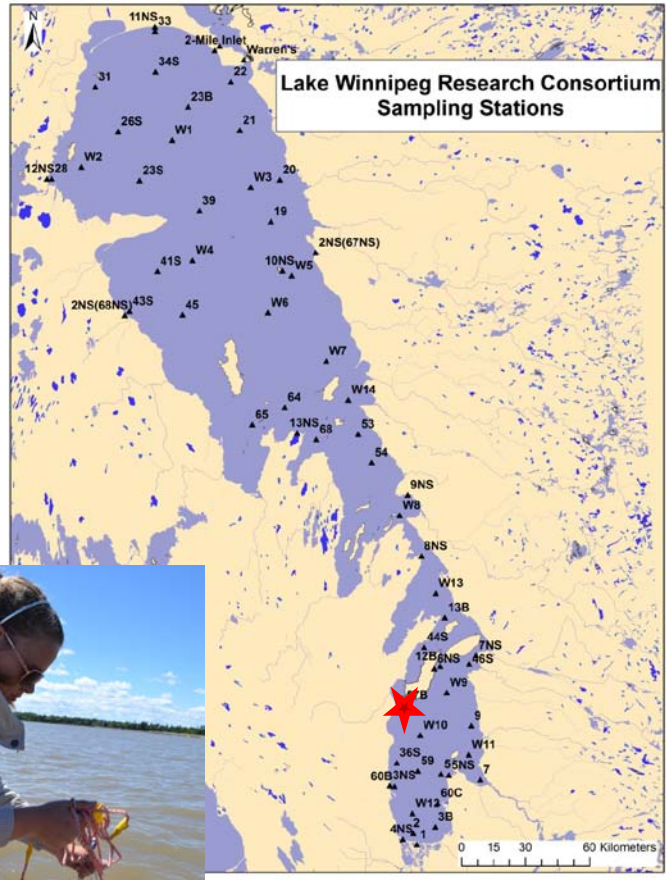
- Juveniles on samplers and docks
- Hnausa, Victoria Beach new detections

Navigational buoys:

- Icelandic River, Grand Beach

Good News

- No zebra mussel veligers, juveniles or adults reported from the channel (narrows) or the north basin.
- No reports from other waterbodies.



Zebra Mussel invasion timeline

Manitoba Zebra Mussel Timeline	
Oct. 2013	Found in south basin of Lake Winnipeg
Spring 2014	Harbour treatment
Spring 2015	South basin being invaded

Lake Winnipeg Monitoring

Objectives: To determine the magnitude and extent of Lake Winnipeg invasion and monitor other “at risk” water bodies.

Lake Winnipeg veliger results:

	2014		2015	
	Summer	Fall	Summer	Fall
# of Stns w veligers	3	10	15	24
Min # of veligers	1	3	1	1
Max # of veligers	7	25	772	2620
Avg # of veligers/ stn	3	10	92.5	371.7

Summer 2014 vs. Summer 2015: **100x** increase in veligers

Fall 2014 vs. Fall 2015: **1000x** increase in veligers

Lake Winnipeg Monitoring

- Found for the first time on samplers set in the channel in 2015
- Compared to last year densities (#/m^2) have increased substantially:

e.g. Gimli Harbour

2014 - .004/cm^2: 88/m^2;

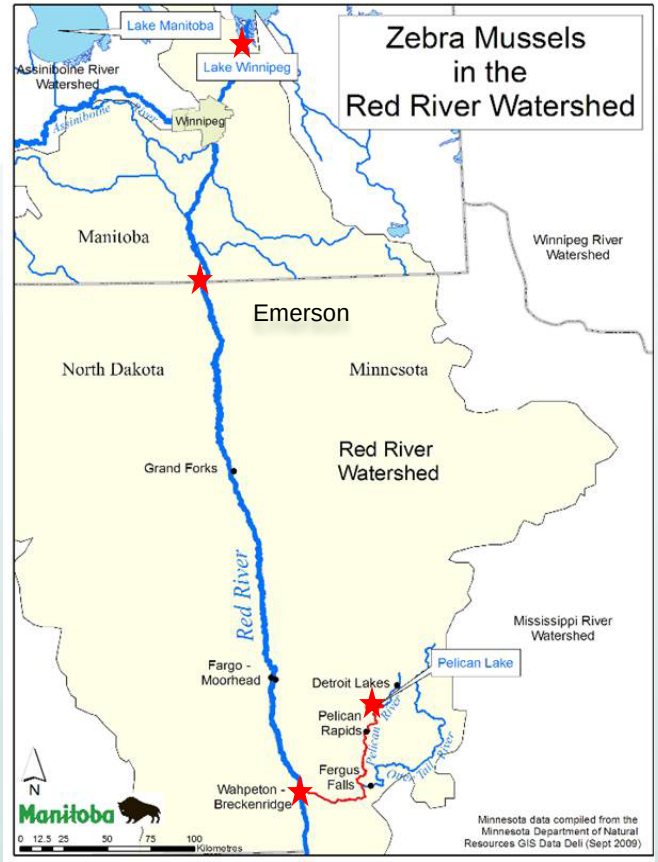
2015 – 11.1/cm^2: 100,887/m^2

- Reported along rock groins; attached to wood, native mussels, debris and washed up along the shoreline.
- Motors and hulls of watercraft moored in harbours covered with Zebra Mussels.

Photo courtesy of Dean Thorkelsson, Lake Agassiz Marine

Manitoba Zebra Mussel Timeline	
Oct. 2013	South basin of Lake Winnipeg
Spring 2014	Harbour treatment
Spring 2015	South basin being invaded
June 2015	Red River - Manitoba

Trigger for MB sampling: Red River water temp 10 – 12 ºC at Fargo/Grand Forks



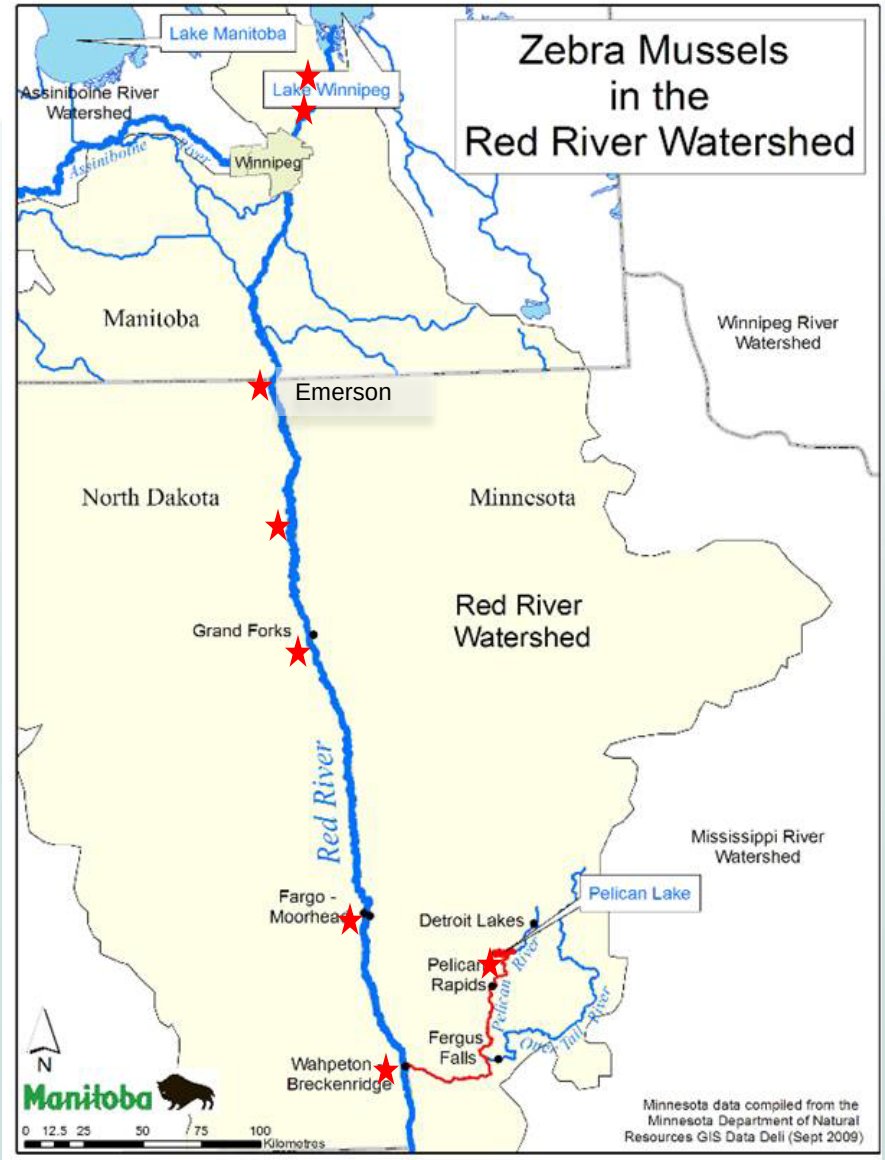
Red River Watershed

Zebra Mussels in the Red River: timeline

Location	Year
Pelican Lake, MN	2009
Wahpeton ND /Breckinridge MN	2010
Emerson MB	June 2015

Red River - Zebra Mussel Veligers (total count) Sampling Results.

	09-Jun	25-Jun	10-Jul	24-Jul	07-Aug	21-Aug	16-Sep	25-Sep
Emerson	**1220**	**712**	**9**	**0**	**2**	**2**	**2**	**4**
St. Vital Park	n/a	381	21	0	6	0	2	4
Selkirk Park	204	280	3	1	0	41	2	0



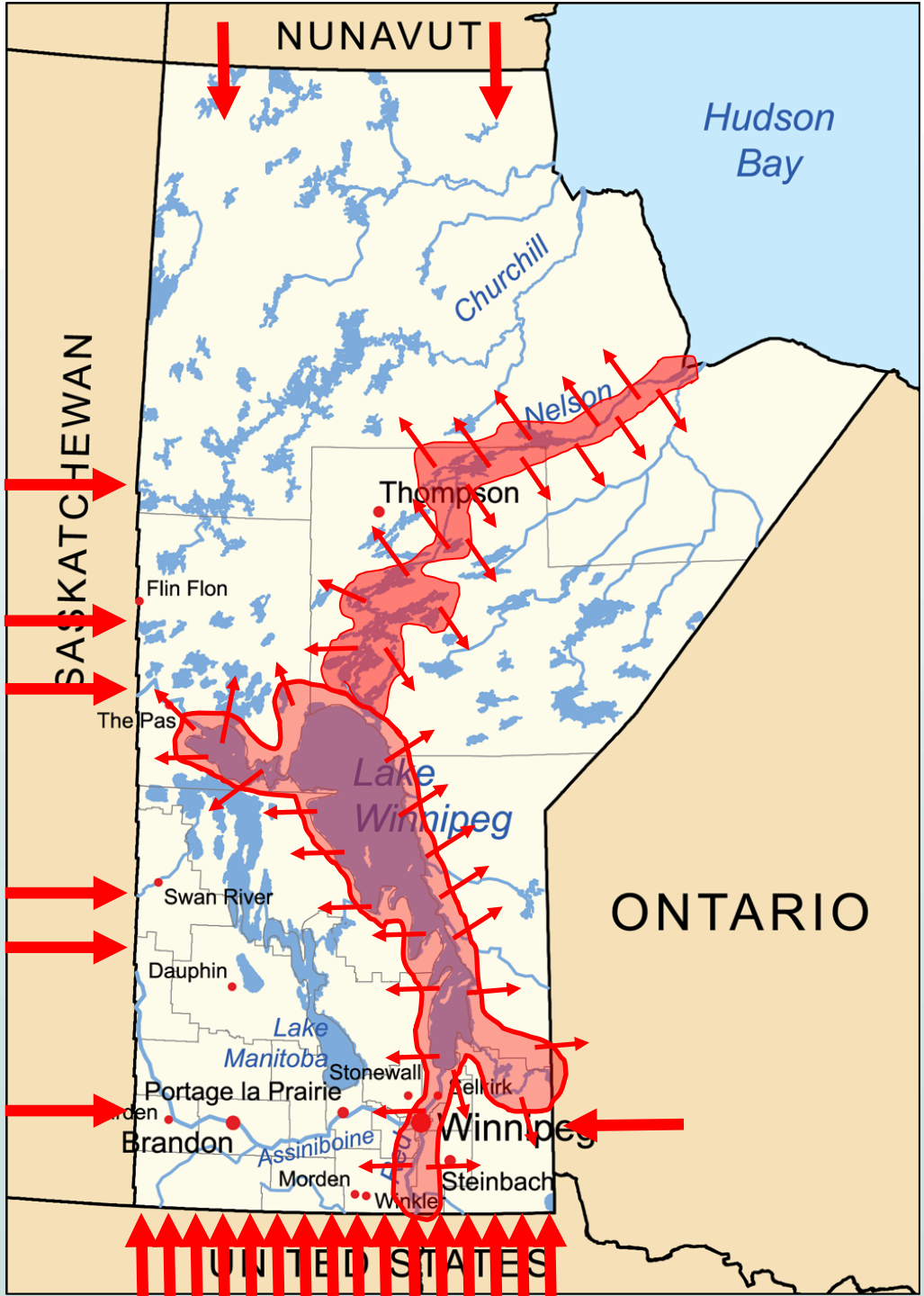
Zebra Mussels in the Red River: timeline

Location	Year
Pelican Lake, MN	2009
Wahpeton ND /Breckinridge MN	2010
Emerson MB	June 2015
Fargo, Grand Forks, Dayton	July 2015
Lockport and Selkirk MB	August 2015
Along U.S. portion	Fall 2015

Red River Watershed

Zebra Mussel timeline	
Oct. 2013	South basin of Lake Winnipeg
Spring 2014	Harbour treatment
Spring 2015	South basin being invaded
June 2015	Red River
August 2015	Channel of Lake Winnipeg

Zebra Mussel timeline	
Oct. 2013	South basin of Lake Winnipeg
Spring 2014	Harbour treatment
Spring 2015	South basin being invaded
June 2015	Red River
August 2015	Channel of Lake Winnipeg
October 2015	North Basin of Lake Winnipeg Cedar Lake



Manitoba

CONTAINMENT PLAN FOCUS
Address key vectors of concern

Priorities:

1) Prevent/slow movement from invaded water bodies in Manitoba to other water bodies
   - MB SD Watercraft Inspection program, Enforcement & increased communications

2) Prevent introduction of AIS from outside province into MB
   - MB SD & Canadian Border Services Agency (CBSA) & communications

3) Prevent any other movement
   - Clean, drain, dry provisions of AIS regulation
   - Communication, education, and awareness

How?

- **Stronger Legislation**
  - New provincial AIS legislation
  - Federal AIS legislation

- **Containment Program**
  - Operating Watercraft Inspection Stations at “pinch points” to intercept highest volume of boater traffic.

- **Collaboration**
  - Western Provinces and Territory Aquatic Invasive Species Working Group
  - CBSA

Stronger Legislation

Federal AIS Regulations (came into force June 2015)

- Prohibits the importation, possession, transportation and release of aquatic invasive species in Canada.
- Prohibition to import Zebra or Quagga mussels into Western Canada and Invasive Carp into Canada
- Ability to use a deleterious substance to eradicate an AIS

New Provincial AIS Legislation under *The Water Protection Act*; proclaimed November 2, 2015

- Clean, Drain and Dry is now the law.
- Stopping at watercraft inspection stations is a legal requirement
- More than just watercraft…aircraft and ATVs
- Stricter measures in place when leaving areas with an AIS presence or where AIS will naturally move with water movements

AIS Legislation

General Provisions – apply when using ***any*** water body in Manitoba

WATERCRAFT & WATER-RELATED EQUIPMENT REQUIREMENTS:

- Before **PLACING** a watercraft/equipment into any water body you must ensure that it is free of AIS, aquatic plants and mud and drain all standing water on land so that it does not drain into a water body.

- When **REMOVING** a watercraft/equipment from a water body, you must inspect and remove all aquatic invasive species, aquatic plants; and drain all water before leaving the shore of the water body.

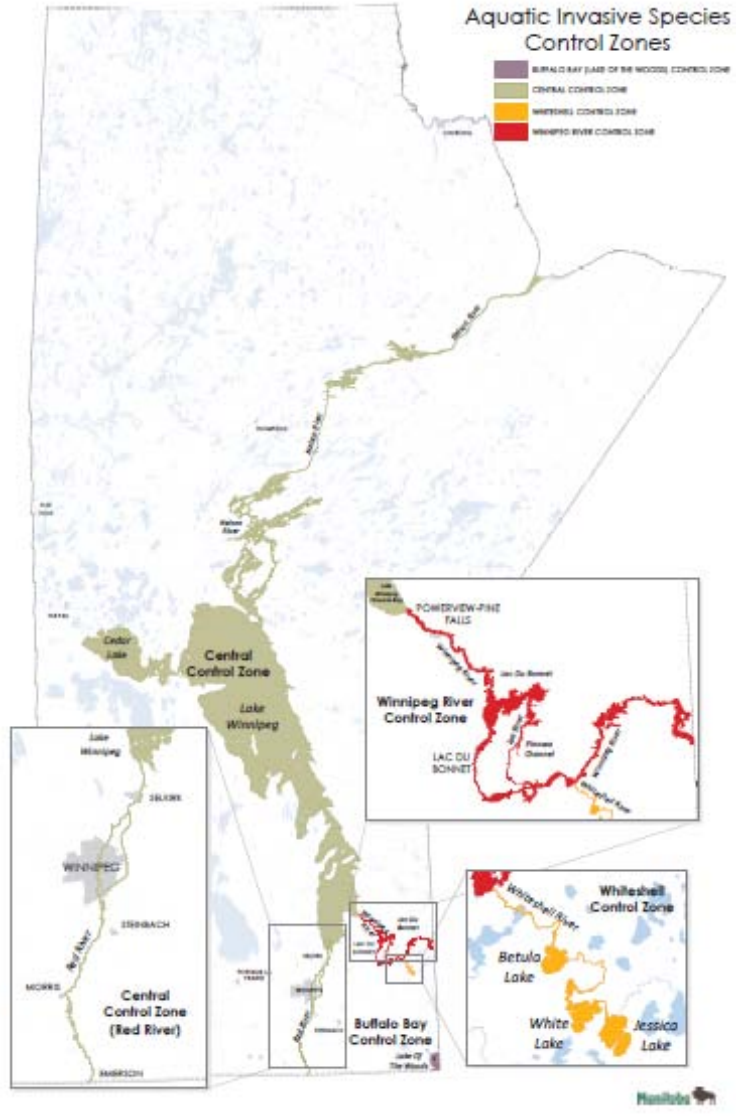
  - EXCEPTION: water removed from a water body in a water tank, water hauling equipment or water testing equipment.

- When **TRANSPORTING** watercraft overland, drain plugs and other valves or devices must be removed or left open to drain all the water AND ensure the motor vehicle and trailer are free of AIS and aquatic plants.

- **PRIOR TO PLACING** water-related equipment into another water body it must be **completely dry** or **decontaminated** in accordance with Schedule B (dock, boat lift, trailer) or Schedule C (all other water-related equipment)

REMINDER – It is a illegal to possess, bring into MB, deposit or release, or transport AIS – dead, alive or any part of. Zebra Mussels are an AIS.

Provincial Control Zones



1) Central Control Zone (ZM & SWF)
Red River,
Lake Winnipeg,
Cedar Lake,
Nelson River

2) Whiteshell Control Zone (BA & SWF)
Betula Lake,
Jessica Lake,
White Lake,
Portion of the Whiteshell River between Jessica Lake and the Winnipeg River

3) Buffalo Bay (SWF)

4) Winnipeg River (SWF)

Regulations IN ADDITION to the general provisions for conveyances and water-related equipment operating in water bodies within a control zone.

Control Zone Provisions

WATERCRAFT & WATER-RELATED EQUIPMENT REQUIREMENTS:

Watercraft or water-related equipment **REMOVED** from a water body in a control zone must **NOT** be **PLACED** into another water body unless

- It has been **decontaminated** at a provincial control station;
- It has been **decontaminated** by a certified service provider (program not currently in place);
- It has been **decontaminated** in accordance with Schedule B (watercraft, dock, boat life, trailer) or Schedule C (all other water-related equipment) **AND** it is **completely dry** before it is placed into another water body.

COMPLETELY DRY means there is no detectable water on the equipment or the exterior or interior surfaces of the watercraft and no dampness can be felt on the equipment or on the interior of the watercraft.

THESE provisions do not apply when a watercraft travels directly from one water body to another water body without being removed from the water at any point.

AIS Reporting Requirement

- It is the law to report an AIS discovery to the AIS director as soon as practicable (1-877-867-2470)
- Take a picture, GPS coordinate, leave it where you found it unless otherwise instructed.
- Not required to report if found in a water body it is already known to be in (e.g. Zebra Mussels in Lake Winnipeg)

2015 Watercraft Inspection Program

Objective: *to contain the spread of Zebra Mussels from invaded waters and to prevent / slow the spread to other water bodies.*

Achieved by:

- Educating the public about the threat of AIS,
- Demonstrating to individuals the actions they must take to CLEAN, DRAIN, and DRY their watercraft and water-related equipment,
- Identifying and preventing the risk of AIS transfer through inspecting watercrafts and decontaminating when necessary.

Focus: Day-use boaters at high-traffic boat launches

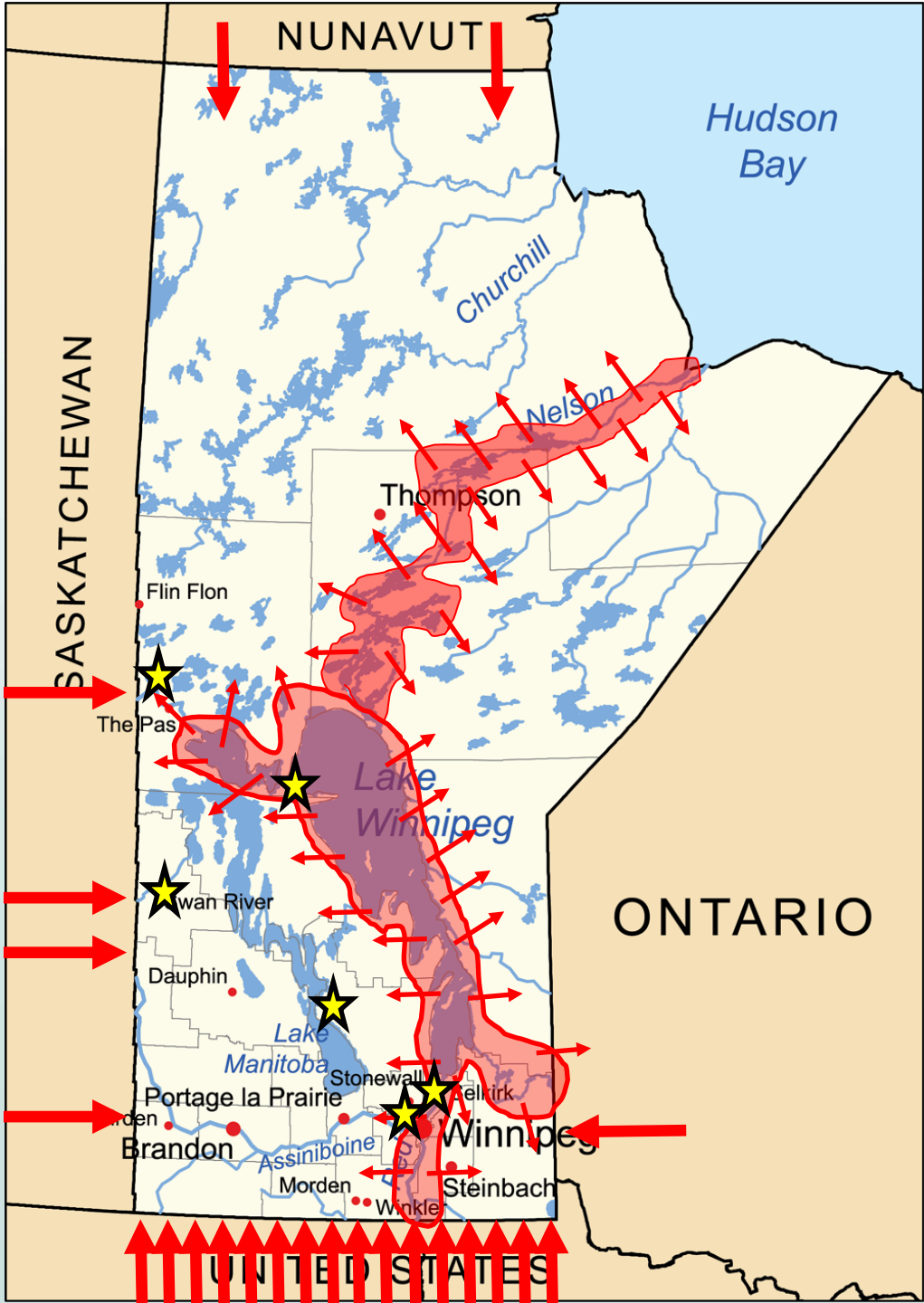
Completed:
4,260 watercraft inspections and
284 decontaminations

2016 Watercraft Inspection Program

Objective: *to contain the spread of Zebra Mussels from invaded waters and to prevent / slow the spread to other water bodies.*

What's new:

- Ministerial designating of watercraft inspectors
- Legal requirement for watercraft to yield to a watercraft inspection station.
- Conduct watercraft inspections at "pinch points" along key highway locations around Manitoba.
- Increase capacity within the regions to address the growing threat of AIS.
- New enforcement tools: decontamination and control orders.
- Seal program
- Control Zones
- General and special provisions



THANK YOU!

PREVENTION IS OUR BEST LINE OF DEFENCE

For more information, or to report an AIS sighting contact the Province of Manitoba's Aquatic Invasive Species (AIS) program:

Call: 1-87-STOP AIS-0

[1 (877) 867-2470]

or

Visit: Manitoba.ca/StopAIS