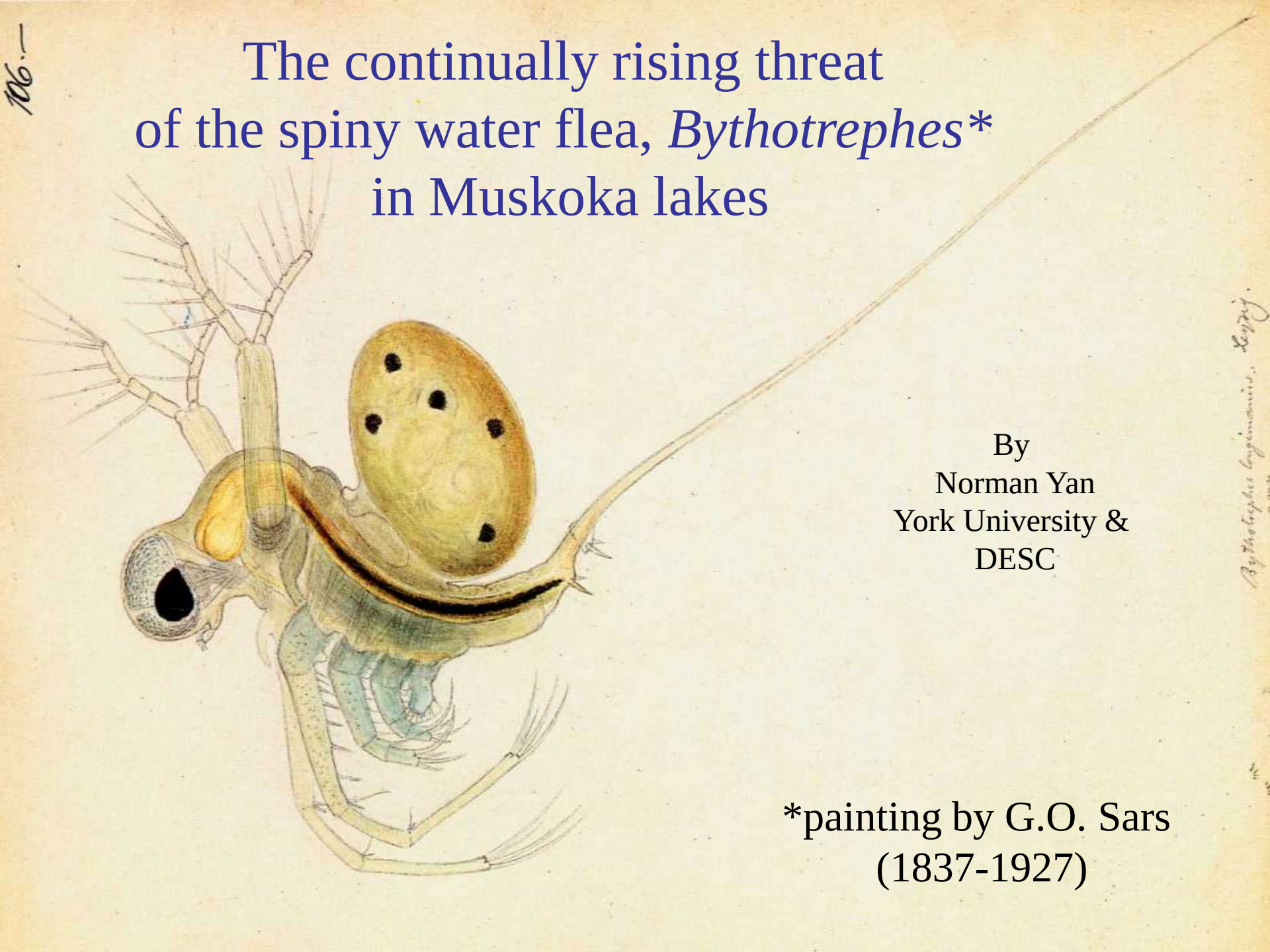
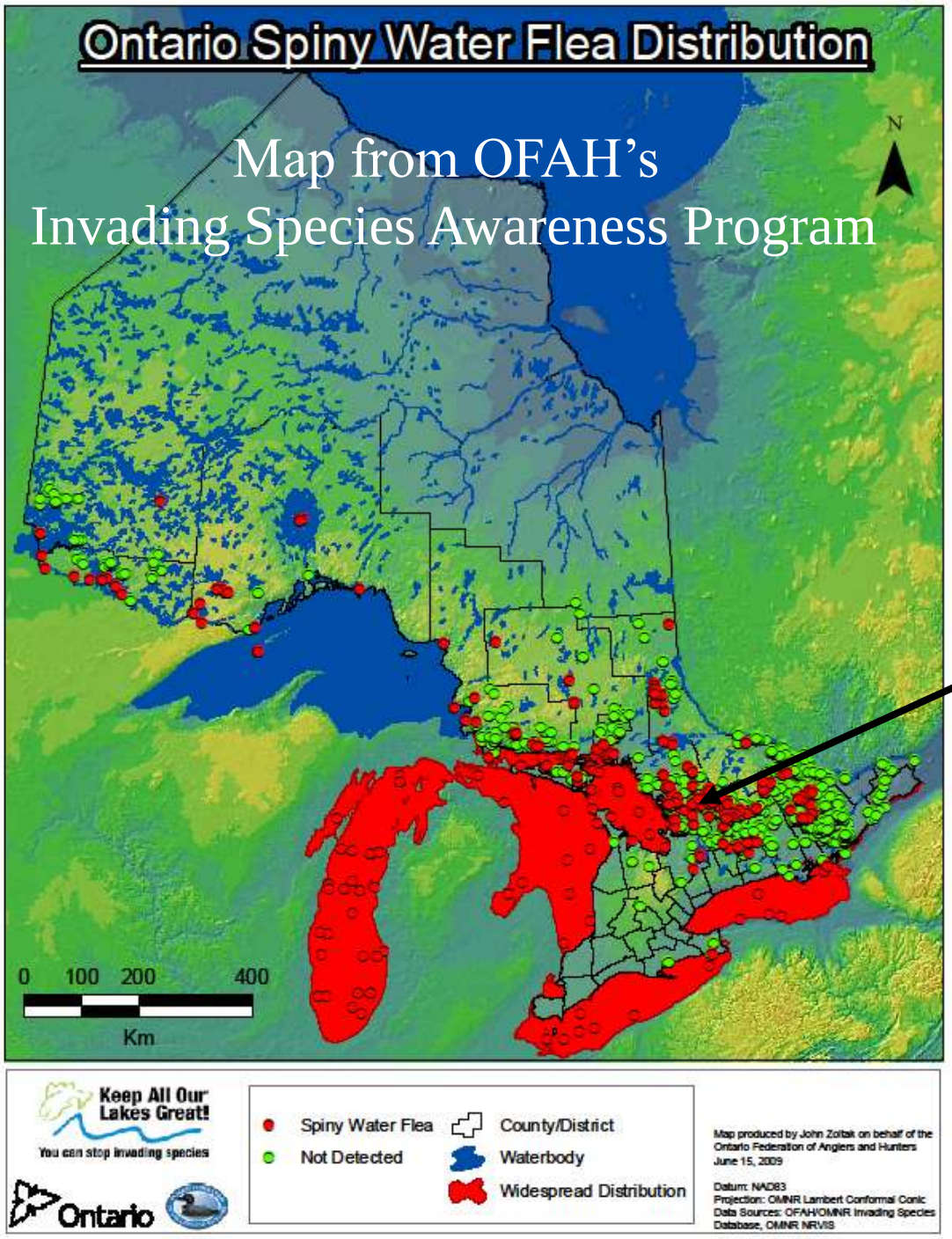
The continually rising threat of the spiny water flea, *Bythotrephes** in Muskoka lakes



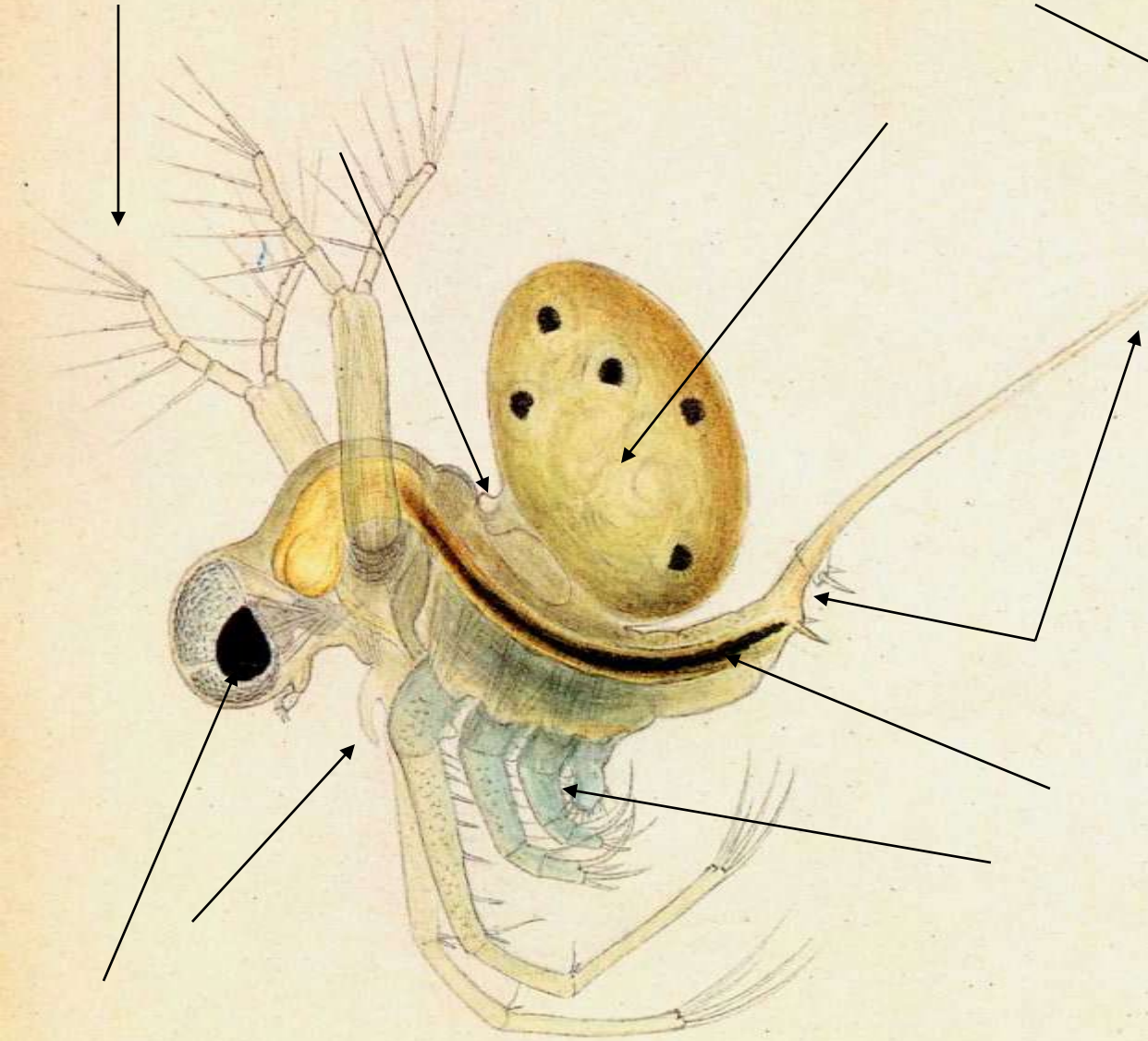
By
Norman Yan
York University &
DESC

*painting by G.O. Sars (1837-1927)


Ontario Spiny Water Flea Distribution
Map from OFAH's
Invading Species Awareness Program
N
0 100 200 400
Km
Keep All Our Lakes Great!
You can stop invading species
Ontario
Spiny Water Flea
Not Detected
County/District
Waterbody
Widespread Distribution
Map produced by John Zoltak on behalf of the Ontario Federation of Anglers and Hunters
June 15, 2009
Datum: NAD83
Projection: OMNR Lambert Conformal Conic
Data Sources: OFAH/OMNR Invading Species Database, OMNR NRVIS

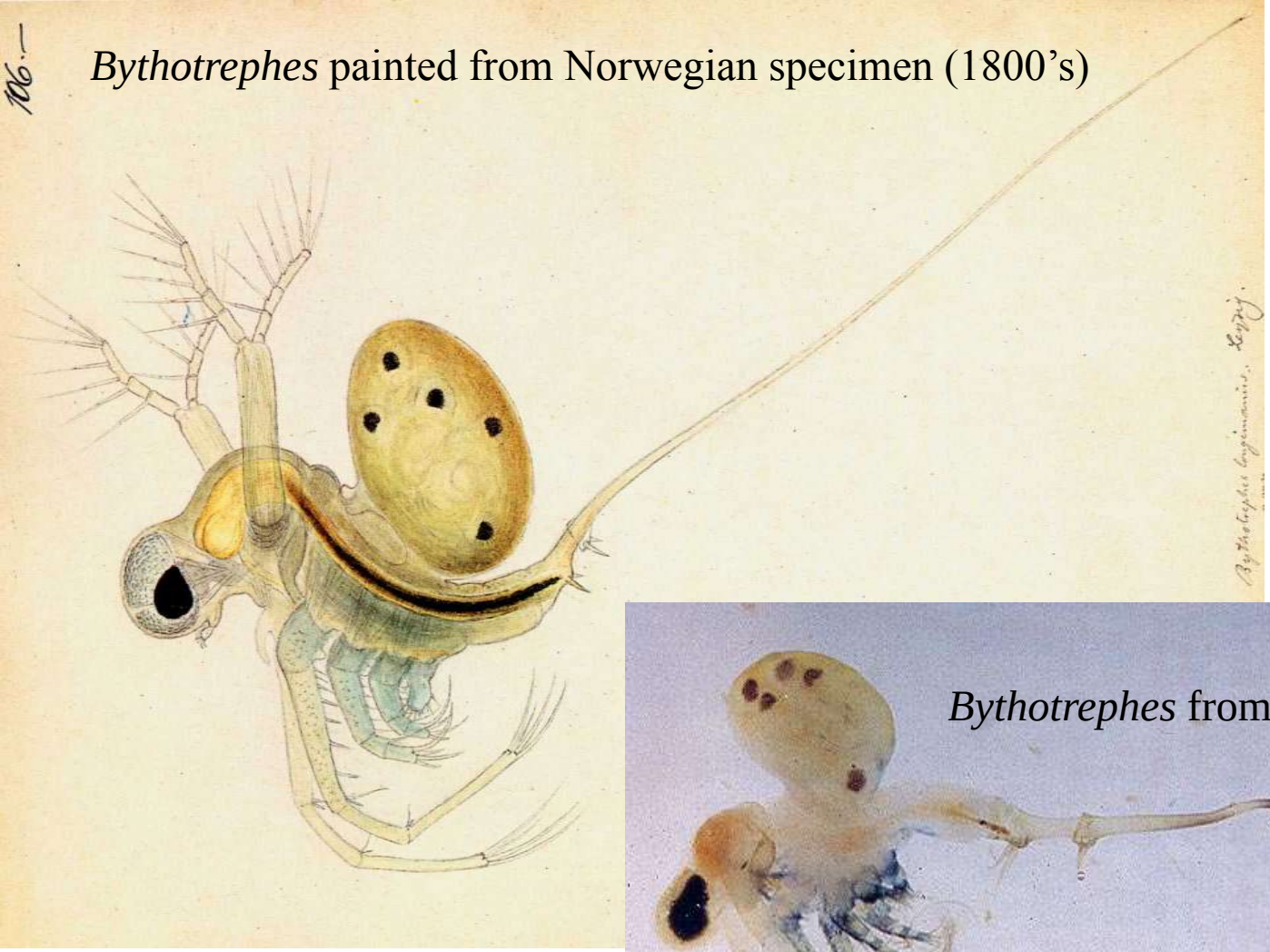
Bythotrephes

Introducing the invader using Sars' painting



It's a large, actively-hunting, visually-cued, coloured, cyclic parthenogen - a daytime predator of anything it can catch, and a cannibal. It is protected by its long, rigid "tail" from small fish. It is very fecund maturing in ~10 days and growing almost as rapidly as its prey. Given these traits, we should not be surprised if it changes communities it invades

Bythotrephes painted from Norwegian specimen (1800's)



Bythotrephes from Harp Lake, ON, in 1996

Photo by Bill O'Neill

What are the categories of threats to life in lakes?

- Changes in habitat quality
  - Changes in water chemistry, e.g. pollution
  - Changes in water physics – e.g. climatic warming, water flow alterations
- Direct intervention with living communities
  - Harvesting
  - **Introduction of non-indigenous species (NIS)**

When is a NIS a concern?

1. When it spreads rapidly
2. Has the capacity to change communities
3. In ways we don’t like, i.e. it causes damage, and
4. Is abundant enough to actually cause this damage

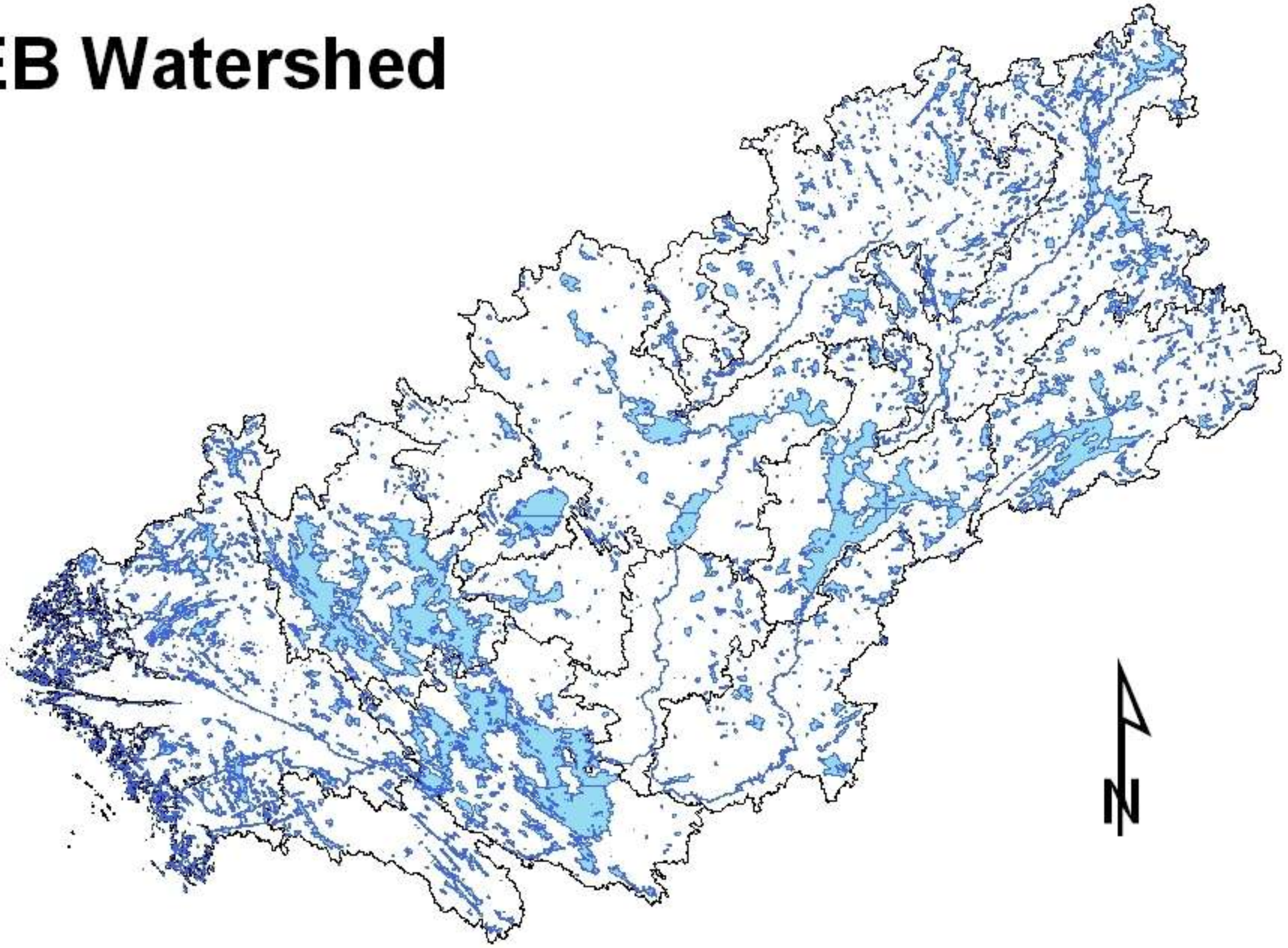
My Objectives

1. To prove that *Bythotrephes* is spreading rapidly in Muskoka
2. And has caused damage
3. To indicate what, if anything, we can do about it, given our current knowledge

1. Is *Bythotrephes* spreading rapidly?

YES

2EB Watershed



Universal Transverse Mercator
NAD83 Zone 17
NTDB 1:50 000

0 5 10 20
Kilometers

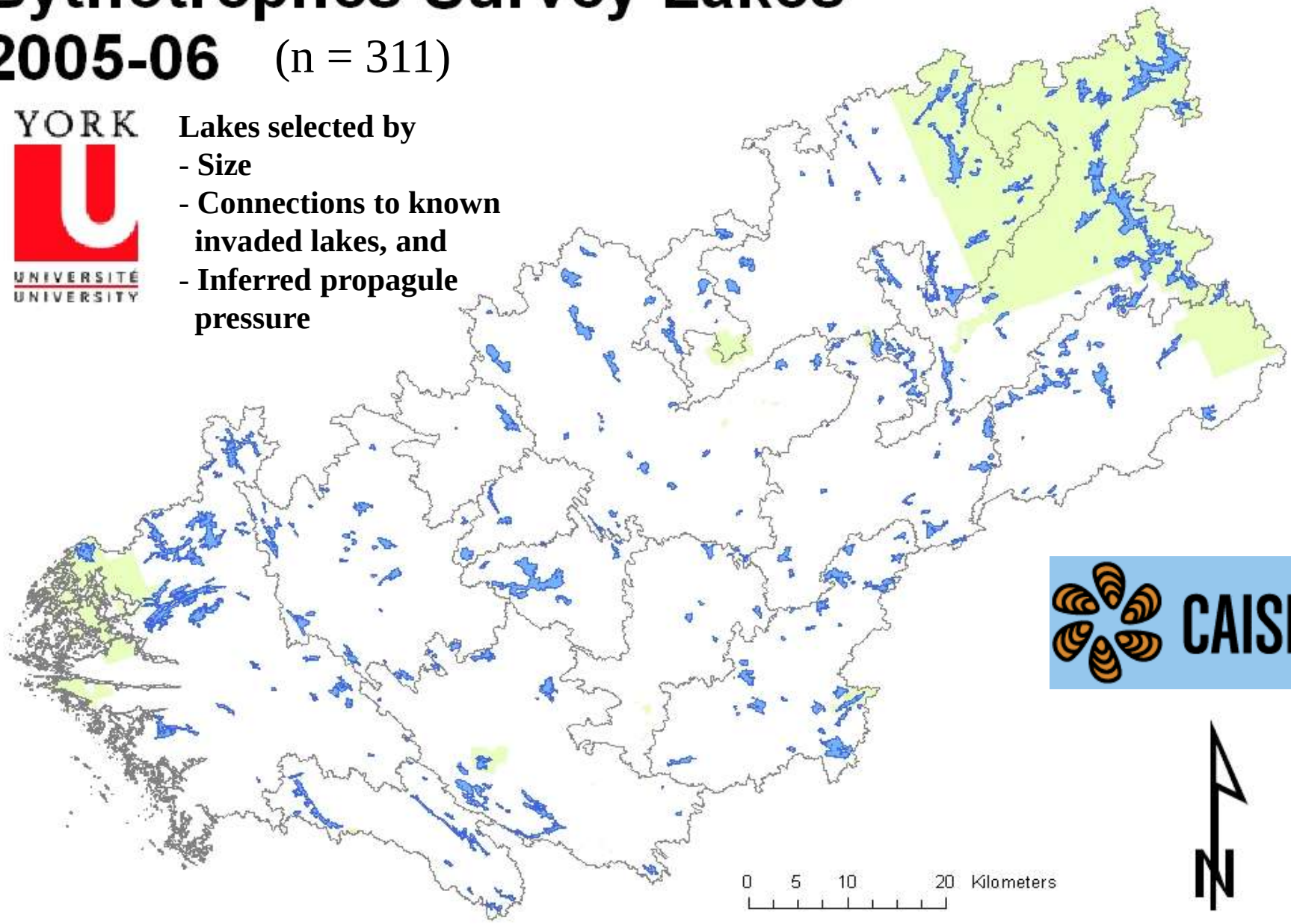
Waterbodies

2EB Boundary

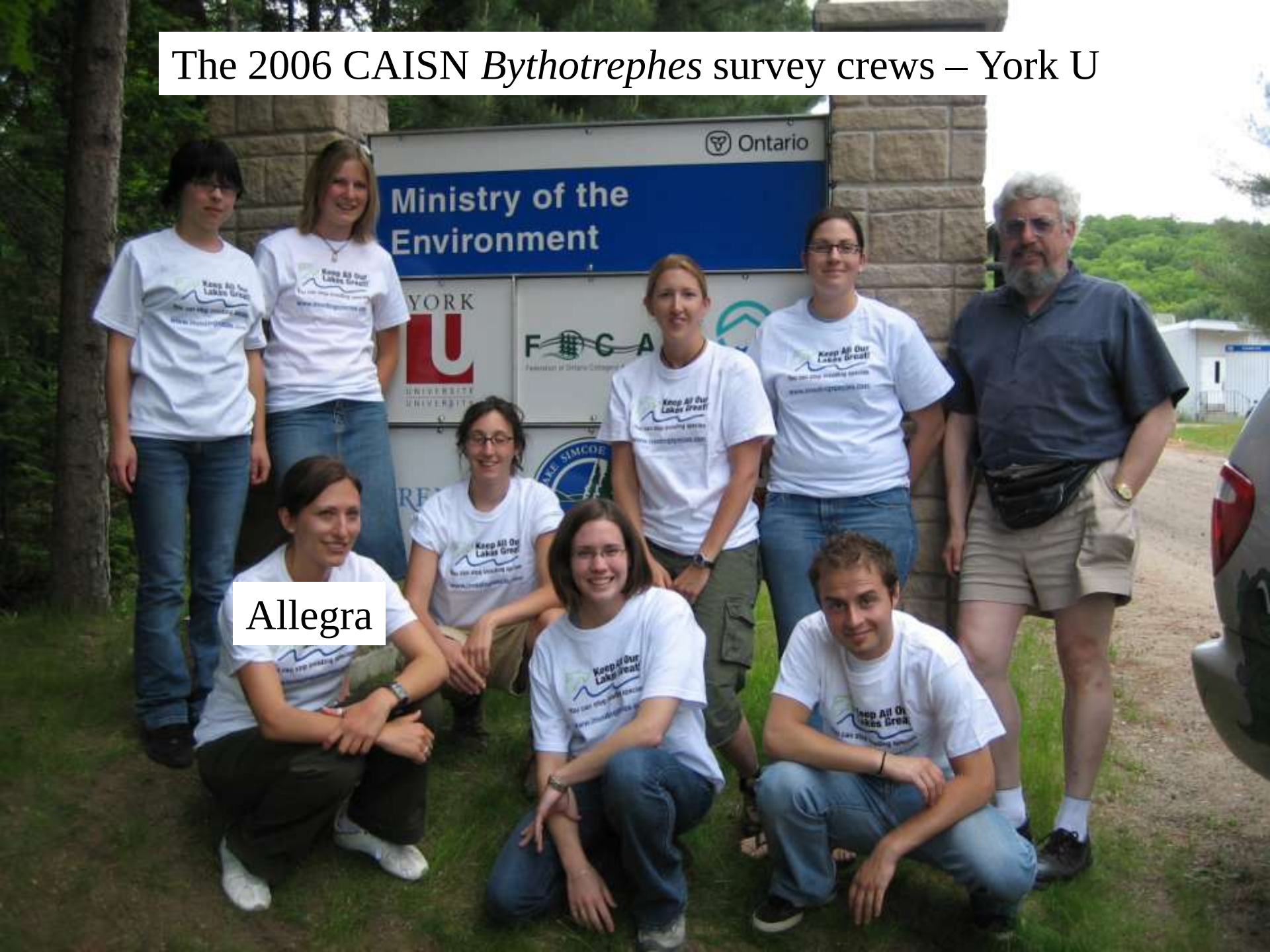
Bythotrephes Survey Lakes 2005-06 (n = 311)

YORK UNIVERSITÉ UNIVERSITY

Lakes selected by
- **Size**
- **Connections to known invaded lakes, and**
- **Inferred propagule pressure**

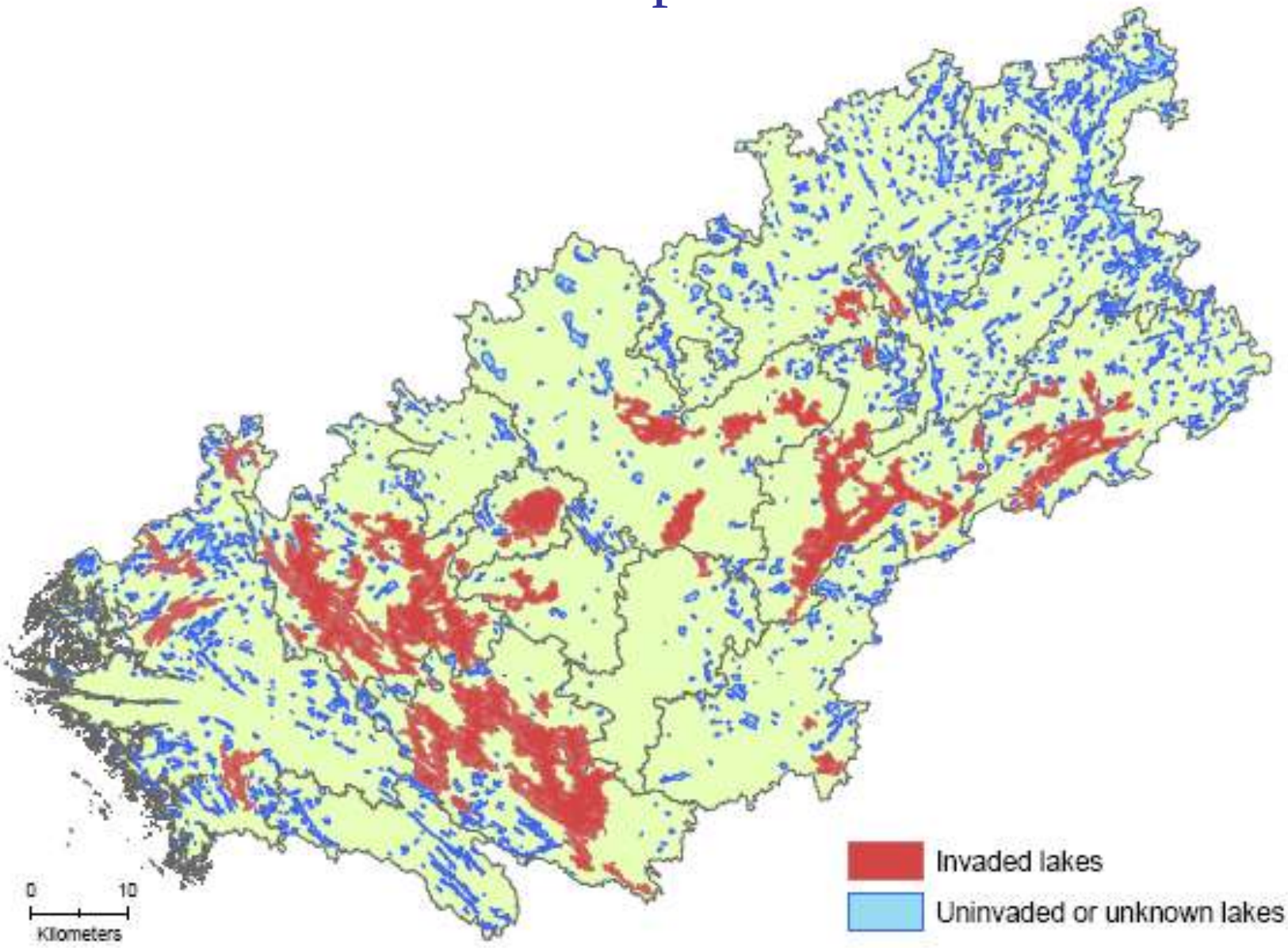


CAISN


The 2006 CAISN *Bythotrephes* survey crews – York U
Ontario
Ministry of the Environment
YORK
Allegra

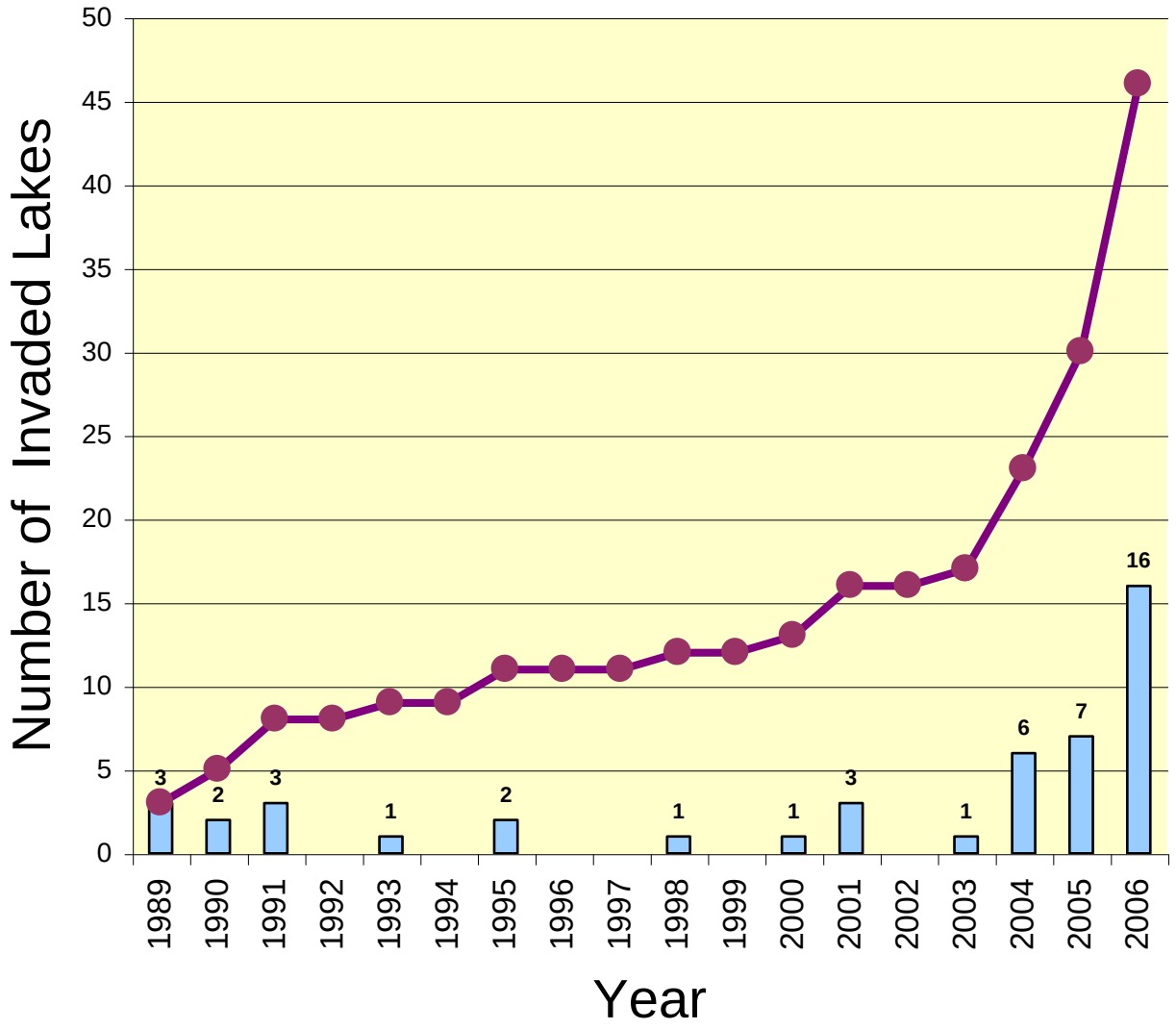

CANADIAN

The invasion is widespread in Muskoka



Map from Gertzen and Leung

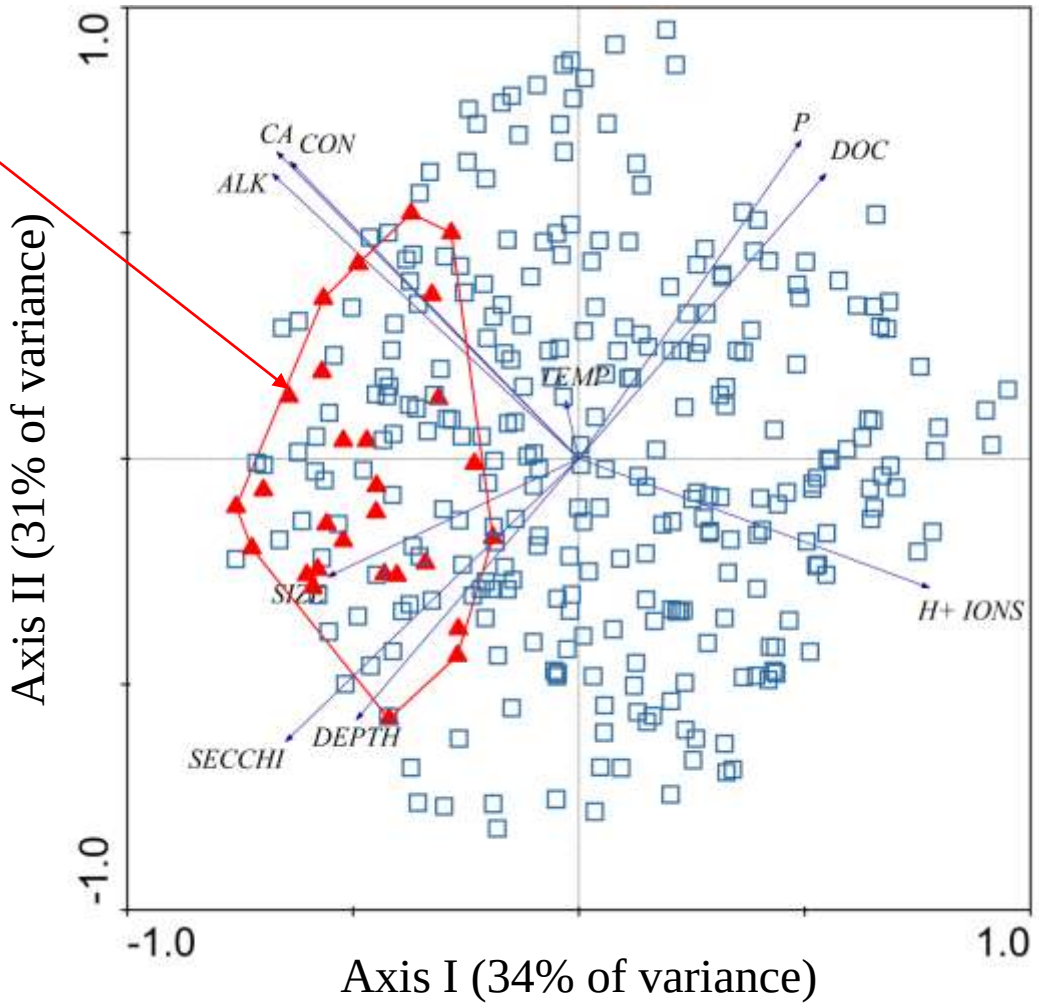
We doubled the number of known invasions in the area



Certain types of lakes are more likely to be invaded

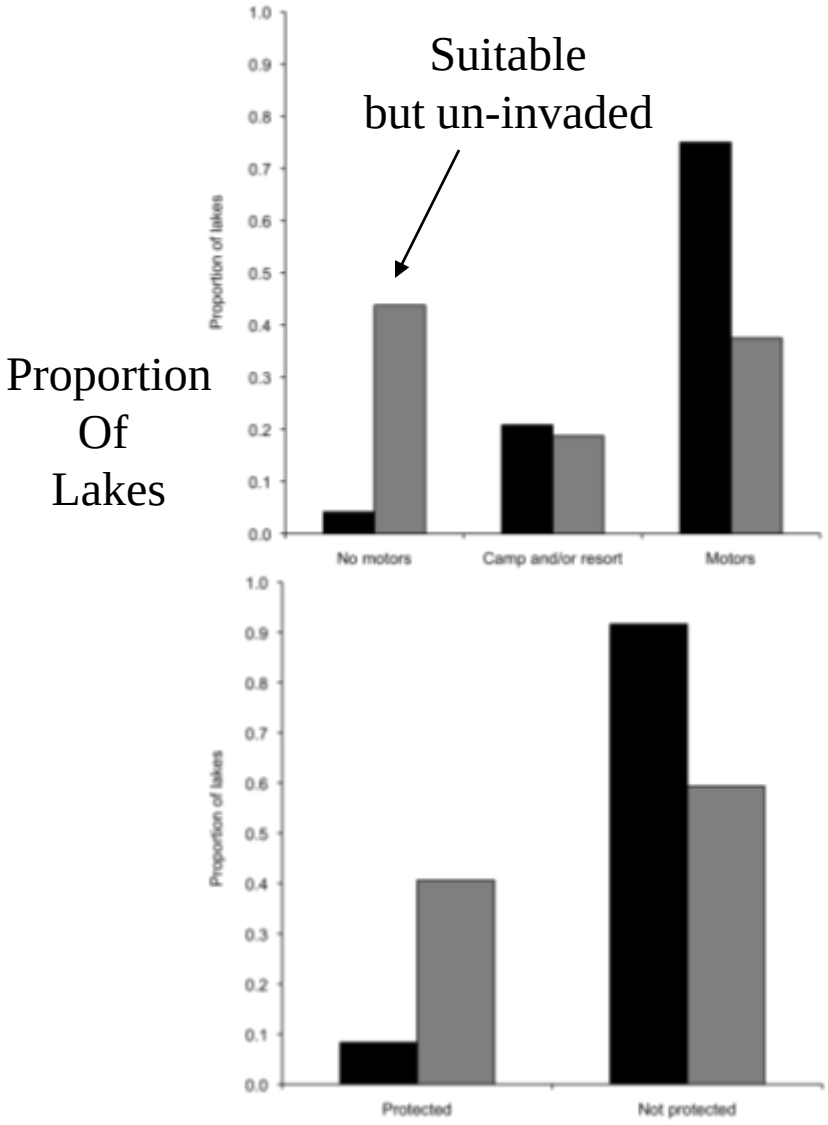
PCA on ranked physical chemistry of 311 lakes

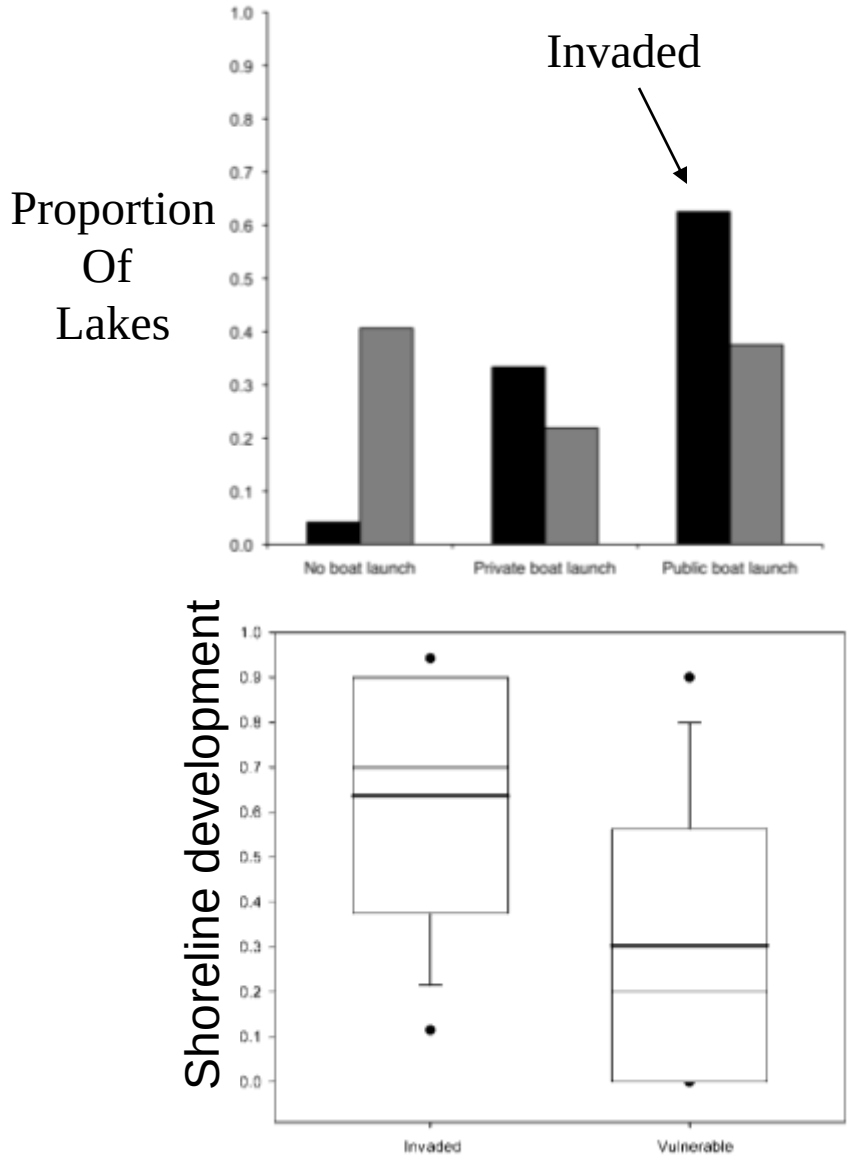
Invaded lakes



Weisz and Yan (2010)

It's human use that distinguishes invaded from un-invaded lakes with suitable habitat (Weisz & Yan 2010)?





How might people spread *Bythotrephes*

*Bythotrephes on downrigger line
from Lake Erie, photo by Andrea Jaeger

2. Has Bythotrephes caused damage?

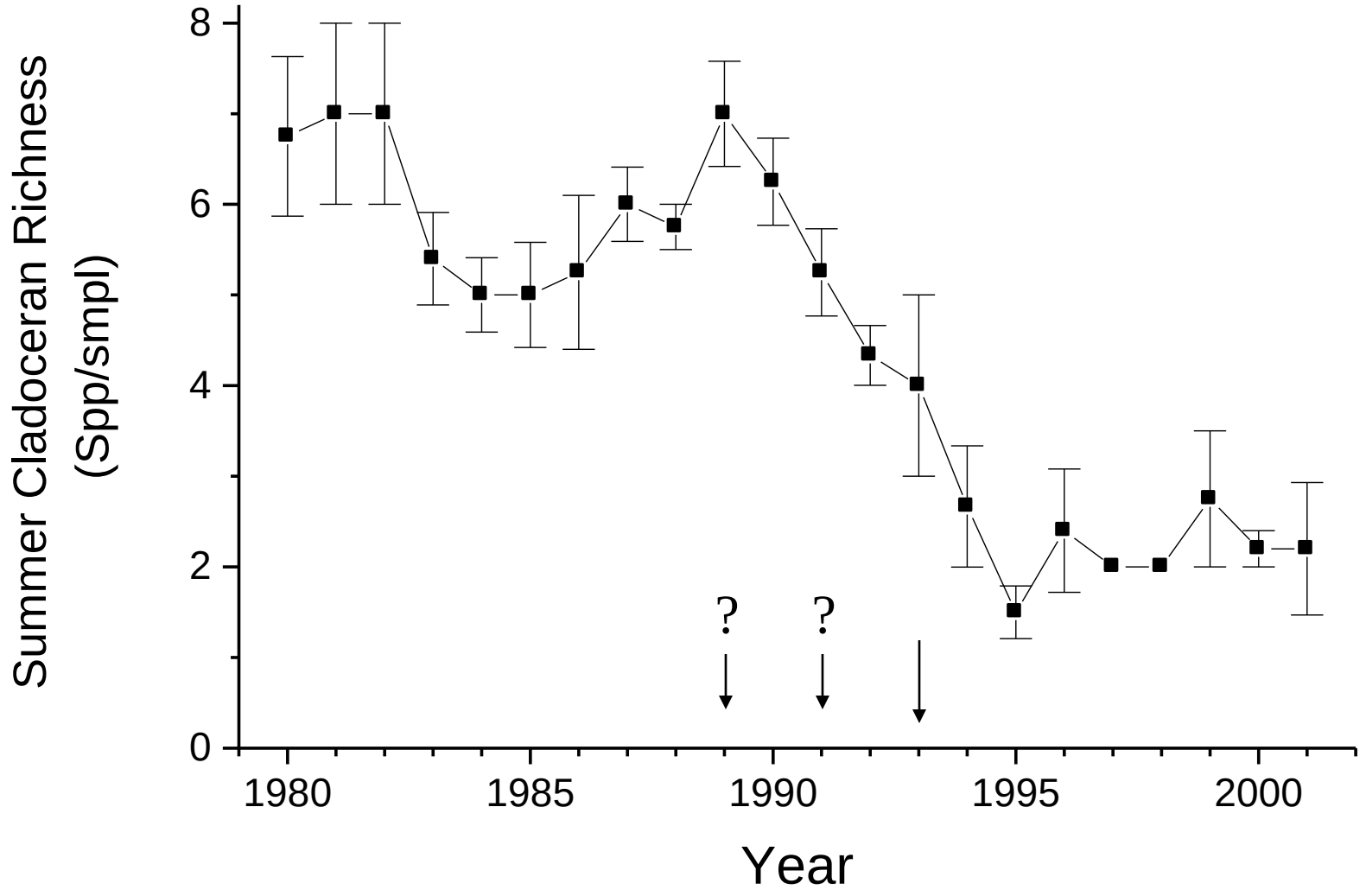
YES

What are the normal concerns?

- Direct threat to people
- Reduced fish growth or yield
- Increased contaminant levels in sport fish
- Reduced water clarity or quality
- **Loss in native biodiversity**

It has caused damage:

summer Cladoceran richness in Harp Lake, ON



*Yan et al. 2002, & unpub

Losses of native crustacean zooplankton species richness

sites	Comment	% loss	Source
Harp Lake	14 pre- vs. 12 post-invasion years	**19.2**	Yan et al. 02,08
30 lakes	13 ref. vs. 17 invaded	**22.9**	Boudreau & Yan 03
18 lakes	11 ref vs. 7 invaded	**24.8**	Palmer unpubl.
28 lakes	changes 1980s to 04_05	**15.3**	Palmer unpubl.
15 lakes	4 ref. vs. 11 invaded	**22.7**	Strecker et al. 08
Simcoe	5 ref. vs. 2 invaded years	**25**	Yan et al. unpubl.
Great Lakes	3-4 ref vs. 10-12 invaded years	**22-32**	Barbiero pers. comm
CAISN lakes	166 ref. vs. 20 invaded lakes	**14**	Yan, Cairns, et al. unpub.

average = 21.80%

Bythotrephes can be very abundant

Laurie Wesson's hand, Rainy River

D. Garton's hand, L. Erie

And it eats a lot, and drives prey into deeper, cooler waters reducing their growth

It can be very abundant!
Bythotrephes in a cisco stomach, L. Rosseau*

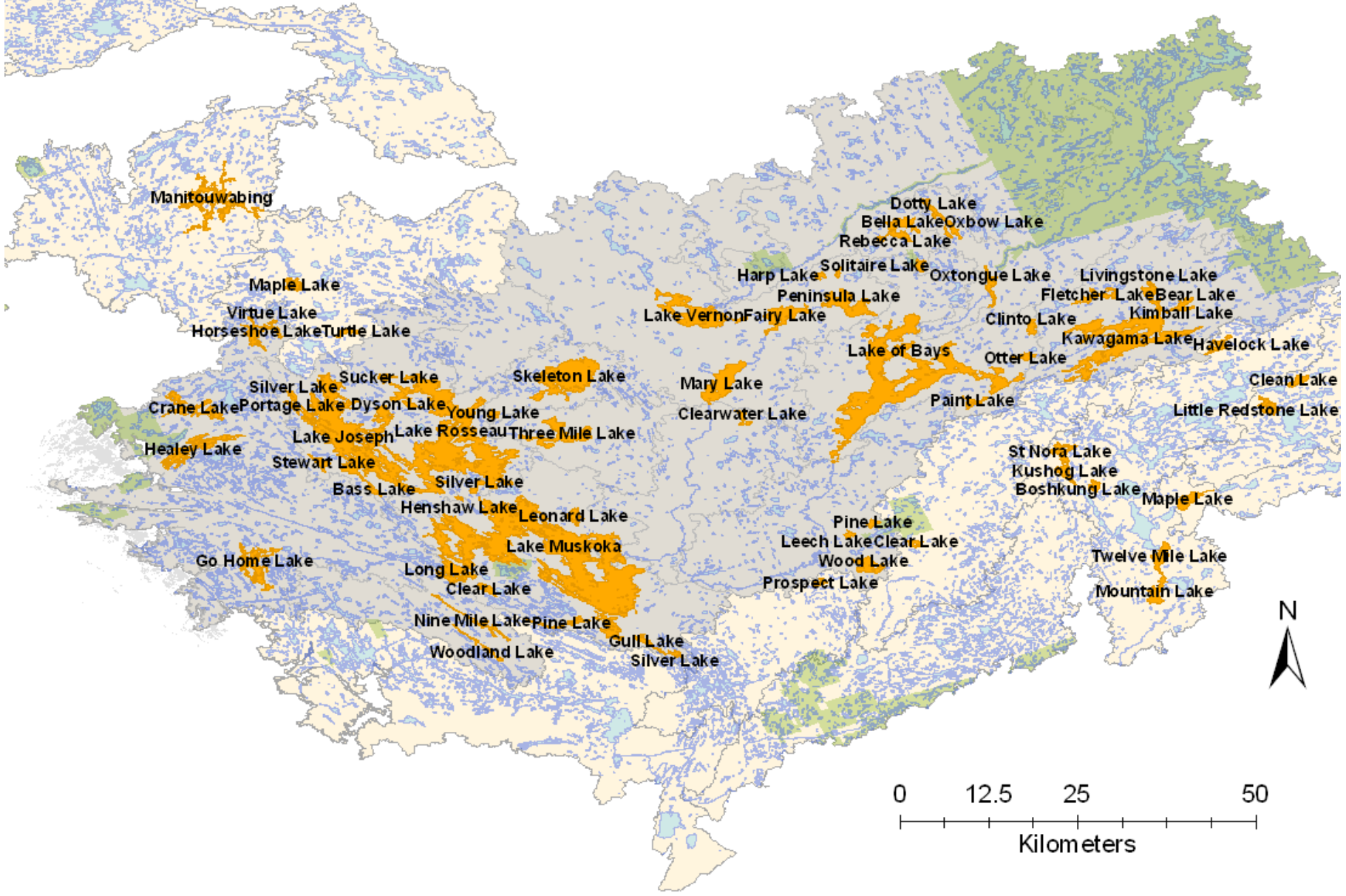
*photo by B. Clarke

3. What can be done?

- Can we slow the ongoing spread of *Bythotrephes*
  - Know where they are
  - Never move water between lakes, especially from known invaded lakes
  - Thoroughly dry all lines, ropes and gear for > ½ day
  - Never dump a bait bucket, even an "empty" one, into a lake
  - be careful about cleaning fish. Resting eggs can survive in fish digestive tracts.
  - Contact OFAH about potential sightings
- Can we eliminate known invasions?
  - We don't know, because no research has been done
  - If possible, it would not be easy

Lakes known to be invaded by Bythotrephes in study region (n=69)

by 2010. So far in 2011, we've found 5 new invasions



Acknowledgements

- NSERC
- MOE's DESC
- OFAH
- District of Muskoka
- CAISN