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EXAMINING THE ROLE OF DOMESTIC SHIPPING IN THE SPREAD OF NONINDIGENOUS SPECIES

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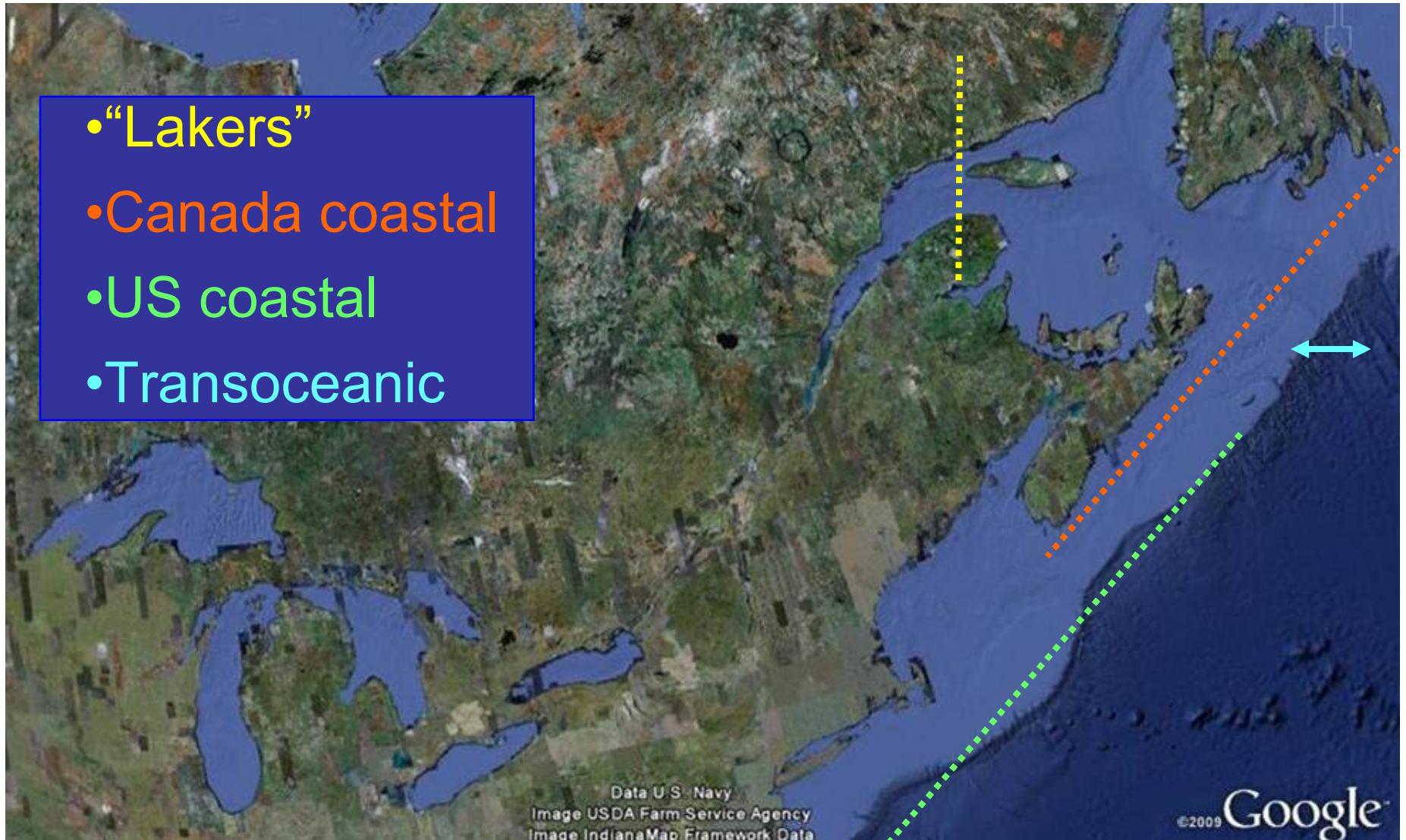
Great Lakes Ballast Water Management

- BALLAST WATER EXCHANGE for full tanks required since 1993 (1989 voluntary)
- SALT WATER FLUSHING for residual ballast required since 2006 (2005 voluntary)

All arriving overseas vessels are required to conduct ballast water exchange/flushing, for all tanks, to achieve salinity ≥ 30 ppt



Shipping Pathways



Assessment of Domestic Ballast Water

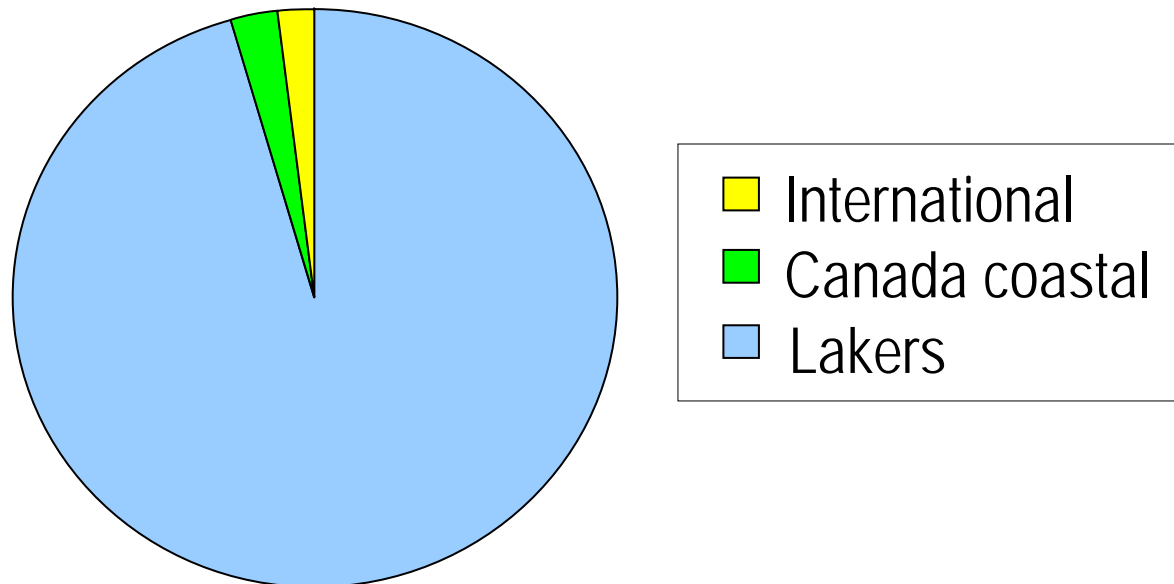
1. Ship Transit Studies
 - Port-specific analysis of vessel movements and ballast activity within the Great Lakes
2. Biological Sampling – Laker Ballast Water
 - Vessels in ballast, includes U.S. and Canadian fleet
3. Biological Sampling – St. Lawrence River
 - Vessels in ballast from SLR ports
 - Surveys of SLR ports



Laker Transit Study: Objectives

- 1) Quantify volume of ballast being transported
- 2) Determine top ports for ballast water uptake/discharge
- 3) Quantify ballast activities at potential ANS source ports:
 - Ports in the St. Lawrence Seaway
(marine ANS)
 - Ports receiving foreign/coastal ballast
(‘stepping stone’ invasions)

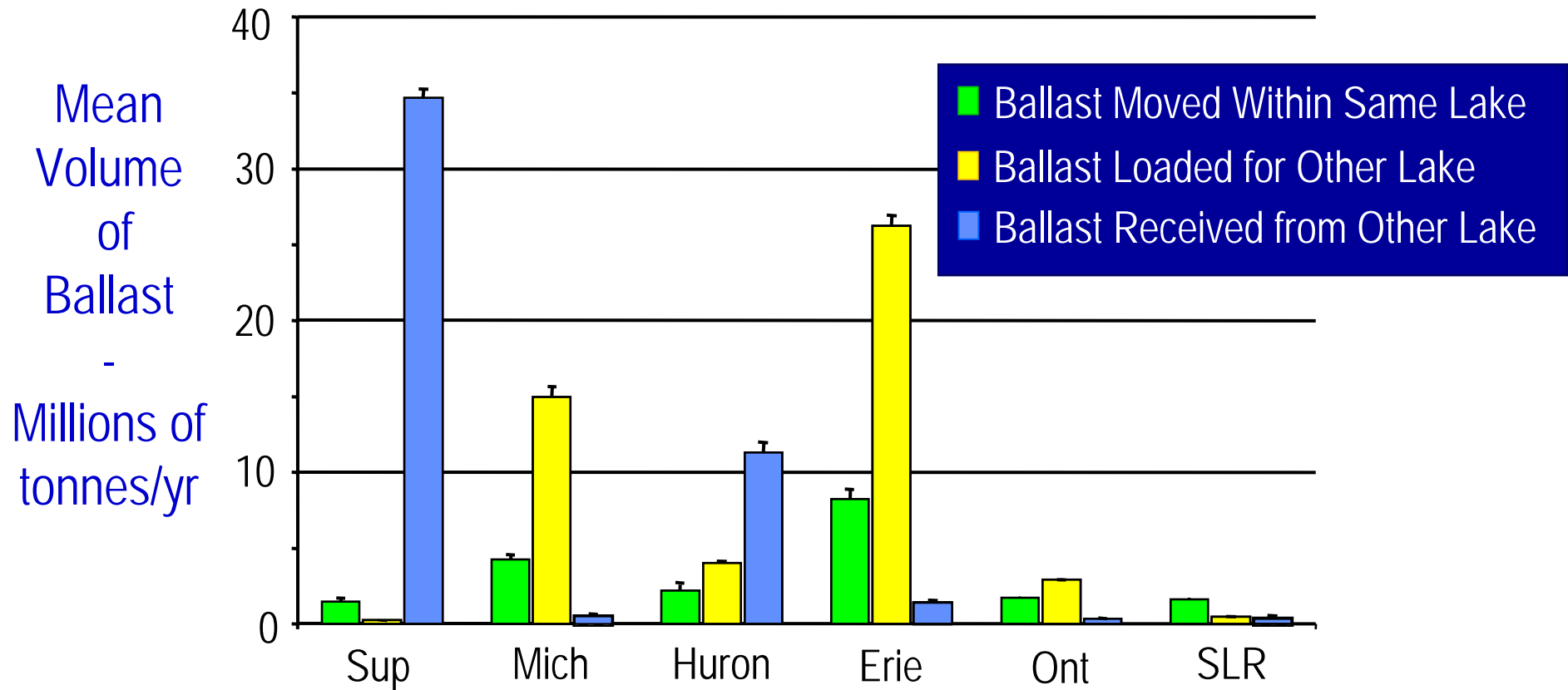
Great Lakes Ballast Water Discharge



Domestic vessels discharge 98% (72.6 million tonnes) of ballast water annually into Great Lakes ports.

Bailey *et al.* 2011

Domestic Ballast Transfers in the Great Lakes



Rup *et al.* 2010

Biological Sampling Study: Objectives

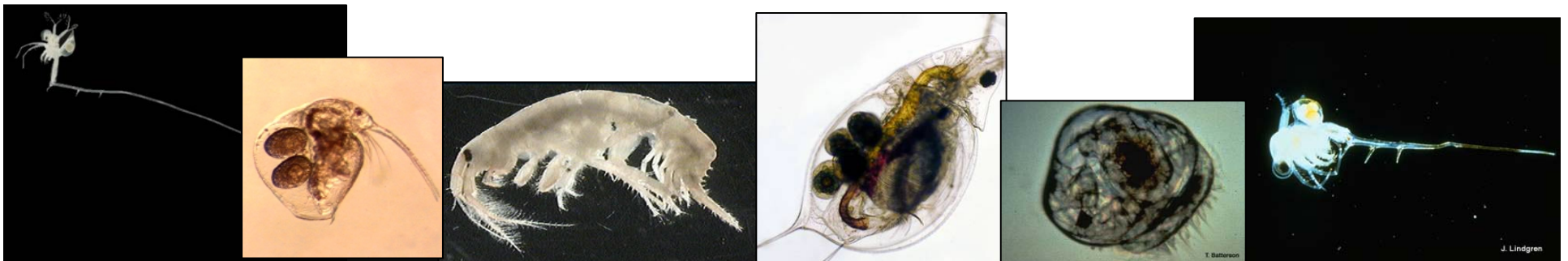


- 1) Determine density and diversity of taxa transported in domestic ballast water
- 2) Estimate level of risk
 - Propagule pressure
 - Tolerance
 - Impact

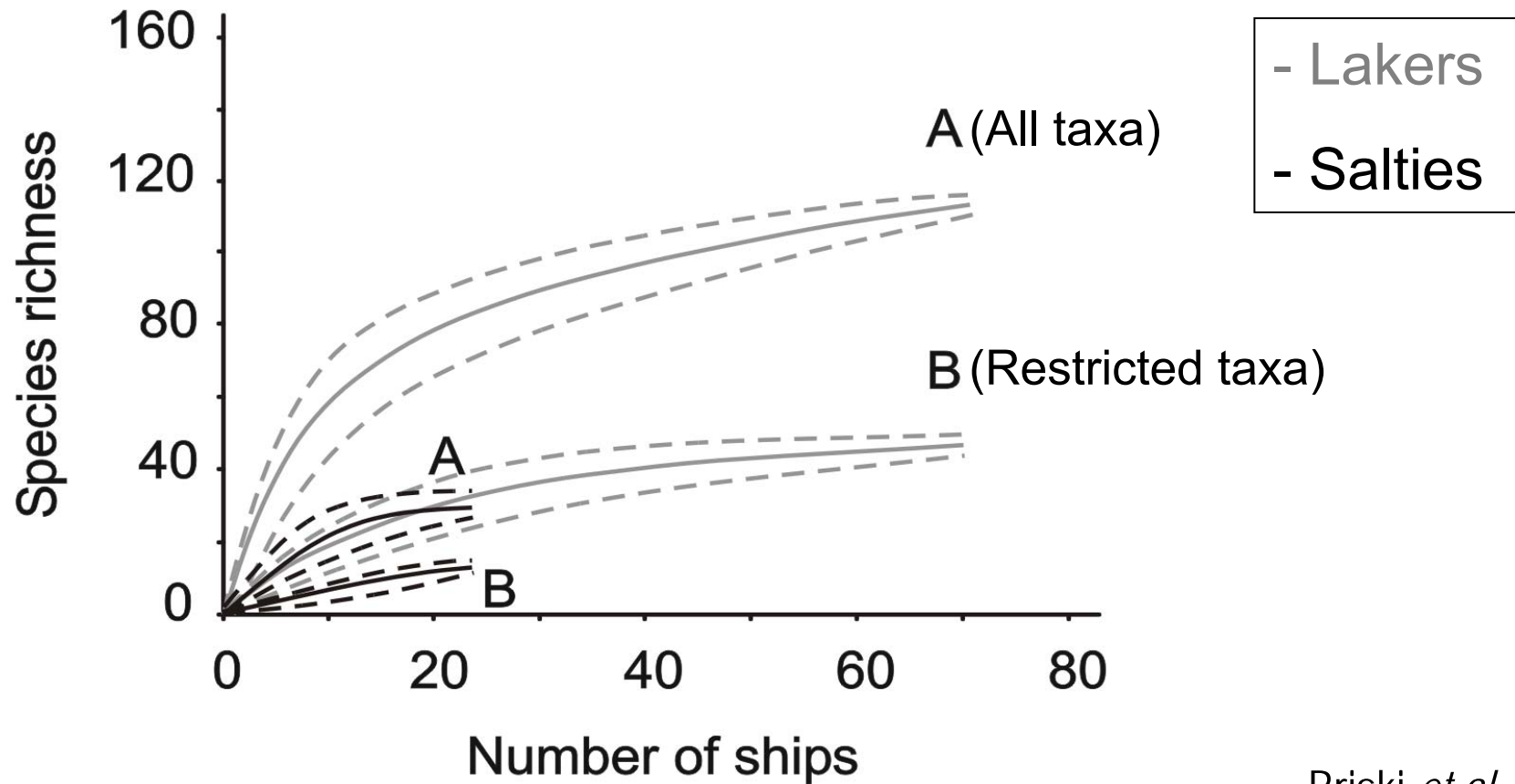
Biological Surveys: Lakers

- Plankton densities two magnitudes greater than for Salties
- Species richness three times greater than for Salties
- 89 species identified – 31 having restricted distribution and 8 NIS
- 99 'expansion' movements recorded

Briski *et al.* 2012

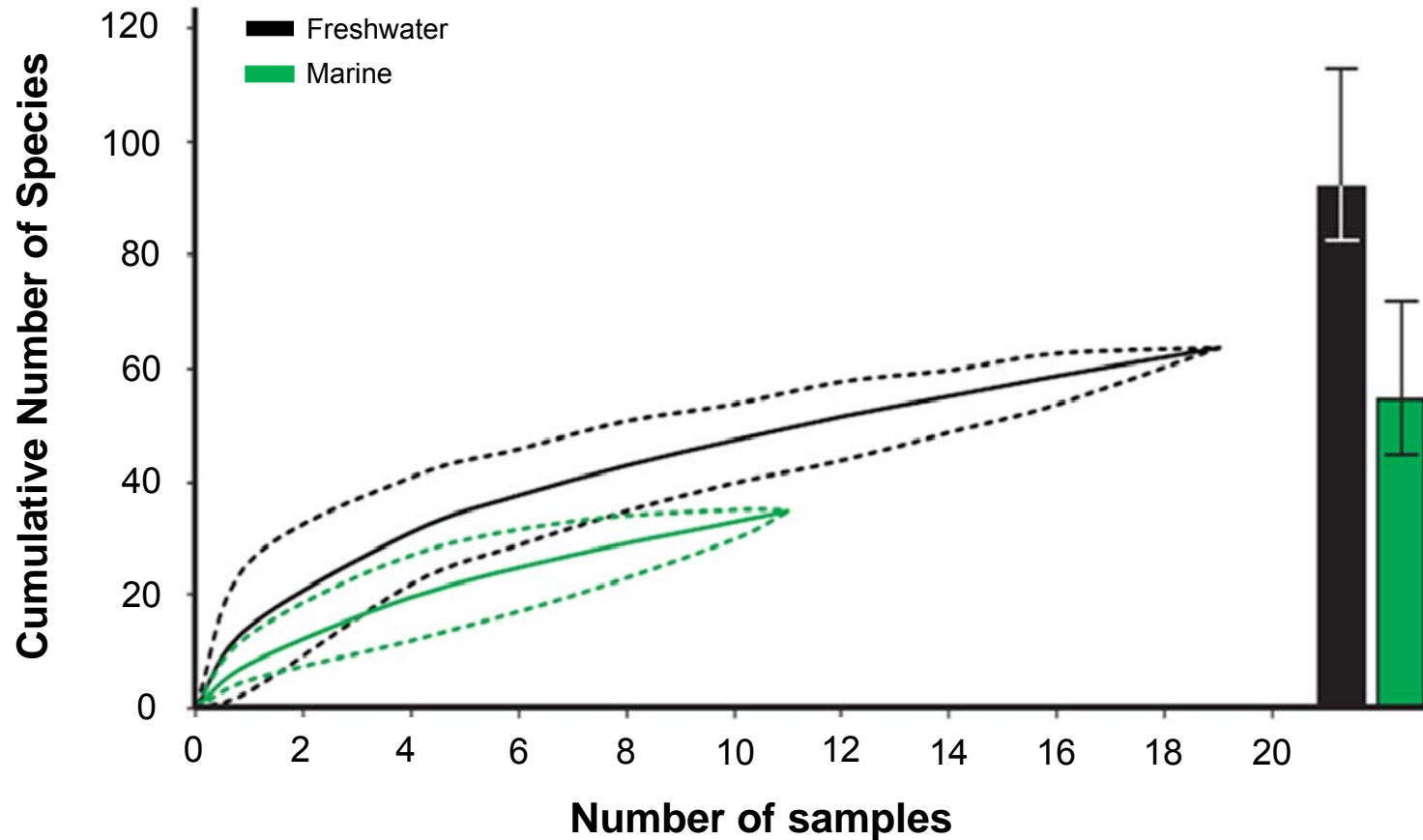


Projections for Great Lakes Ballast



Briski *et al.* 2012

Projections for SLR Ballast

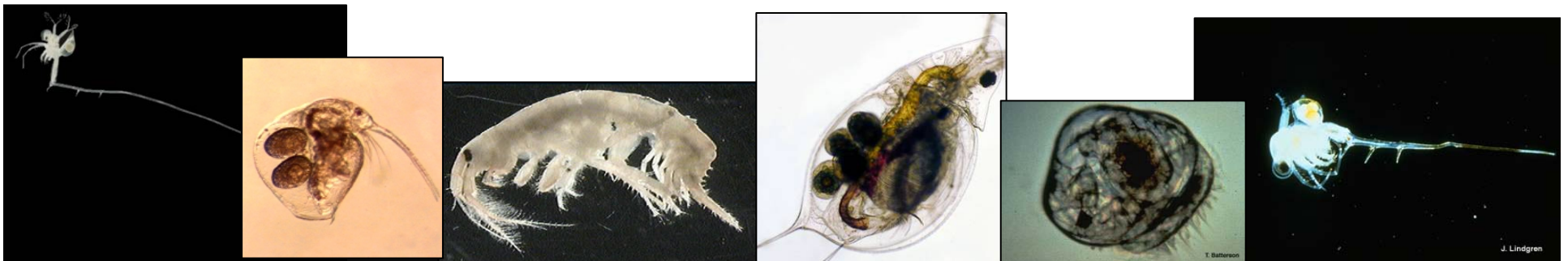


Adebayo *et al.* in review

Biological Surveys: SLR Ballast

- 78 zooplankton species identified – 13 marine spp. not found in GL
- 6 freshwater samples contained 'marine' species
- NIS present in 90% of samples
- Abundance of NIS significantly greater than for Salties
- Montréal, Sorel, Tracy and Trois Rivières appear highest risk

Adebayo *et al.* in review



Intra-regional ballast transfers

- Biological surveys consistently indicate domestic ballast water carries higher density and diversity of plankton
- Frequently more NIS than transoceanic ballast
- Inverse relationship observed between voyage length and survival of plankton during transit
- Facilitates 'stepping stone' transfers of established NIS or 'restricted' native species

(Lawrence & Cordell 2010; Simkanin et al. 2010; Briski et al. 2012)

Next Steps



- Synthesis of scientific data into national biological risk assessment
- Evaluate management strategies (treatment systems)
- Examine relative importance of other vectors and pathways
- Monitoring, and rapid response preparedness (?)

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