

ENHANCING ENFORCEMENT

The Logistics and Science needed for an effective
regulatory program

GREAT LAKES PANEL

MILWAUKEE – June 2008

Chris Wiley

DFO / TC

Ballast Water Management

- New Regulations by US Seaway – include Canadian requirements for sediments (NOBOB's)
- Increased physical sampling by both Seaways
- Increased numbers of tanks by the USCG
- Logistics by TC Quebec
- Effectiveness confirmed by DFO Biological Analysis of Random Tanks

Daily Coordination

Cheers, Inspectors to check if BW tanks number on BWRF matches tanks number on BWM plan -- Updated CD -09 June 08

Couleur Ship's name IMO number CTC Montreal (marron) CTC Québec Bleu Seaways green CTC Rimouski et Sept-Iles Black-general info colour

KWINTEBANK 9234288 18 june PAT 0641 dr 7.9 m BWRF flushed OK R.Reford 514- 845-5201 from Aalborg- Oxelosund then Valleyfield -Cleveland-Chicago-Duluth SLS to test all tanks. First tripper

DUTCH RUNNER 8712075 18 june Montreal s. B-7 2147 dr 4.5m BWRF to follow Echo Freight 514-299-4858 514-333-3380 from Europe trades TCMS to test all tanks- clear for domestic runs and go for 27 question-

FEDERAL MATTAWA 9315537 18 june Lock St Lam 2111 dr 8 m BWRF 46 flushed R.Reford 514- 845-5201 from Antwerp=Bremen then Hamilton-Cleveland-Burns Harbor- Thunder Bay 2nd tripper SLS to test 18 tanks if missed will request CTC Toronto

SICHEM EVA 8517073 june Montreal dr 8.7m BWRF historic for non transoceanic OK test at arrival would confirm MTL MARINE 450-646-3448 from Gulf of Mexico trades then Sarnia SLS to test all tanks only and check voyages ans ballast w. historic (Missed in Port-Alfred)

VICTORIA 9290074 21 june Quebec Early dr. 7.3m BWRF 1220 exch & flushed 2nd tripper NAVITRANS 514-845-4595 from Szczecin- Bremen then Montreal-Hamilton - Burns Harbor TCMS to test all tanks only

SEA FORCE 9322102 21 June PAT or ?- 2204 dr 7.4m First tripper BWRF flushed MTL Marine 450-646-3448 from Amsterdam-Antwerp then Nanticoke SLS to test 15 tanks

FEDERAL SETO 9267209 20 june MTL s.46 2348 dr 10.96m BWRF 45 flush FEDNAV 514-878-6453 from Balboa then ??? more to follow

BELUGA FLIRTATION 9358034 23 june PAT 1027 dr 5.35m BWRF to follow MONTSHIP 514-286-4611 from then GL More to follow SLS to test All tanks and go for 27 questions FIRST TRIPPER

APOLLON 9146821 23 June MTL dr:10.67 BWRF more to follow Gresco from Panama then ??? more to follow

NON Great Lakes Related

ENEREGY PRIDE 9278052 16 june Qbc 0417 dr ?? bwrfl no flush 2 ports-Stated No-De-Ballast in Canada New ship OCEANIC TANKER 418-833-3633 from New Jersey-Bayonne Perth Amboy then Montreal TCMS to provide cd & info during First tanker visit

EMINE 8222575 QBC 19 June 0929 anchorage Quebec BWRF flushed dr: 10.2 COLLEY MOTORSHIPS LTD 514 939 2366 from Yuzhnyy then ?? TCQC to test 27 tanks, BTE 27 questions

F.D. JACQUES GRAUBART 9362243 -19 june Quebec 0832 dr BWRF flush MCA 514-694-3707 from Gdansk then ?? First tripper . TC-QBC to test all tanks Plus 27 questions

FEDERAL SETO 9267209 20 june MTL s.46 2348 dr 10.96m BWRF 45 flush FEDNAV 514-878-6453 from Balboa then ??? more to follow

Daily Follow up

INFO ON PAST TRAFFIC - and FOLLOW-UP

DONE BY SLS UMIAVUT 8801591 16 june MTL s. 72 today 16 june dr 7.8m BWRf 416 excch- flushed Montship 514-286-4611 from *Gemlik- Gibraltar then Oshawa, Valleyfield* SLS to test all tanks -Had retentions at two trips in 2007

DONE BY SLS IRMA 9180396 16 june PAT since 1330 dr 7.1m BWMF 75 flushed Inchcape 514 861 1216 from *Klaipeda- Ijmuiden then Cleveland* SLS to test all tanks.

DONE BY TC FEDERAL MAAS 9118135 16 june Contrecoeur 2022 dr 9.7m BWRf 51 flushed FEDNAV 514-878-6453 from *Frederickstad - Riga BR* then ?????? For info TC To test all tanks

CAMILLA DESGAGNES 8100595 08 june Montreal s. 25 Being tested by LL 2318 dr 5. m BWRf exchanged & flushed LADEN 514-284-4202 from *Conakry-Ceuta then domestic* TCMS to test all 19 tanks- Open manholes if necessary- see if Ballast water management is effective and go for 27 Questionnaire- Clear all tanks prior domestic trades More to follow -meeting with management planned

DONE ok SLS - YM SATURN 9362136 13 june MTL s. 72 - 2310 dtr 7.0 BWRf FT 280 MTL MAR 450-646-3448 from *Le Havre -Antwerp then Sarnia* SLS to test all 14 tanks and go for 27 question- Request TC if needed

DONE BY SLS - ASIABORG 9333553 15 june Direct to Lock 1217 dr 7 m BWRf 4401 exchanged R. Reford 514- 845-5201 ext 1500 from *Bilbao- El Ferrol then Duluth* TCMS to test all tanks 2nd tripper

WATERWISE OK Doc wise to improve -meeting with management planned -- ANNA DESGAGNES 68000507 16 june MTL s. 25 0158 BWRf 3833 exchanged LADEN 514-284-4202 from *Huston -St-Petersburg then Cote Ste-Cat* TC to test 16 tanks go for 27 question for UPDATES- cleared ok waterwise

IVORY COAST 7042825 12 June 1200 PAT till 1900 dr 4m BWRf more to follow Redford 514- 842-5201 from ? to Toledo SLS to test all tanks and go for 27 question UPBOUND NO INFO

DONE SLS LOR OLYMPIC MELODY 8307674 MISSED by TC 09 june QBC 2353 dr 10.75m BWRf flushed Gresco- LOLA 418-692-2850 From *Puerto Questzal, Guatemala then Toronto*. First tripper . SLS to test all tanks Plus 27 questions

DONE SLS Retain # 4 dbs MUD- FEDERAL PIONEER 9190080 Thanks SLS Missed by TC 10 June Sorel 1721 dr 9.47m BWRf flush 60 Sorel Maritime from *Calais- Antwerp then Sorel, Burns harbor and Milwaukee*. TCMTL to test all 18 TKS

DONE LOR FROM SLS OCEAN PRIDE 9114969 08 june PAT 2004 dr 7.4m BWRf flushed MTL MAR 450-646-3448 from *Amsterdam-Rotterdam then Nanticoke - Sarnia* SLS to test all 14 tanks and go for 27 question- Request TC if needed

DONE SLS Retain 5 DB- P&S- MANDARIN 9239812 04 juin Sorel 0300 dr 8.22m BWRf flushed COLLEY 514- 939-2366 from *ImminghamGB Teesport UK then Detroit-Milwaukee-Chicago* First tripper SLS to test all tanks

Retain Apk SLS - MUNTEBORG 9179385 26 may PAT 1910 dr 7.4m BWRf 43 flushed R.Reford 514- 845-5201 from *Tahkoluoto Finld- Oxelosund Sw then Valleyfield-Cleveland- Chicago* SLS to test 27 tanks and go for 27 questions. First tripper.

Daily Contact with all Agencies

- PAT Boatman office 514-640-4970 cell. 514-217-0881 For Contrecoeur Ask agent to inform the Gate house and same for QIT Sorel
- When info is not available CAPITANERIE Port de Montreal 514- 283-7022
- USCG Field Contact Person ; Kent Hedberg - Travis Kelly - Scott Whited- Kerri Moran - Logan Brien cell. 315-323-4785 (4) & Massena Office 315-769-5483
- Canadian Seaway 450-672-4115 ext 2232 A.Desjardins ext 2306 or cell 514-233-0699 R,Dallaire ext 2238 or Cell. 514-916-0784 RG Côté ext 2256 or Cell 514-942-0443 Fax 450-672-8493
- US Seaway - Mr Terry Jordan cell. 613-361-0208 or Tom Rausch cell. 613-719-9310
- TCMS Montreal Sector - PIERRE PLAMONDON res. 450-922-7774 Office 514-496-2084 Cell. 514-214-4068 pager 1-(888)-500-7429 nip 552-4018
- *LINE LAROCHE is relieving P.Plamondon for coming days - L.L. At Res. 514-624--4600 Off 514-283-0574 Cell 514-231-7184 pager 514-338-9756*
- MTL Field Contact Person Montreal
- TCMS Quebec Sector for Field Persons - Agnes Tomsic 418-648-4749 res. 418-878-1521 or off general 418-648-3234 cell 418-670-3377 pager 1-800-253-5004 nip 150548
- Deficiency for StLawrence Seaway= vtc@sls.dot.gov fax 315-764--3250 questions 315-764-3290 Eisenhower Lock traffic Control
- RAA or TCMS senior officer on duty for off hours 1-800-363-4735 or 418-648-4366 the communication officer will guide you to TCMS senior on Duty 24/7- queraa1@innav.gc.ca
- Regional program Manager: Michel Boulianne bouliam@tc.gc.ca

Comparison since implementation

- 2005 – 147 Ships 2358 Tanks 89%
- 2006 – 255 Ships – 4886 Tanks 94%
- 2007 – 224 Ships G/L 4333 Tanks 96.5%
- 2007 – 77 Ships St L 1249 Tanks 60%
- 100% Entering G/L assessed
- Risk Assessment – Globallast
- 3.5% Retention Letters
- 8 opted for Brine Treatment
- 4 delayed

Road Salt Experiment

- In April 2007, an opportunistic road salt experiment was conducted on an operational ship
- The ship had exchanged its ballast en route to the Great Lakes from Paulsboro, New Jersey – but 5 tanks were below the 30 ppt requirement
- TC Inspectors approved treatment with road salt

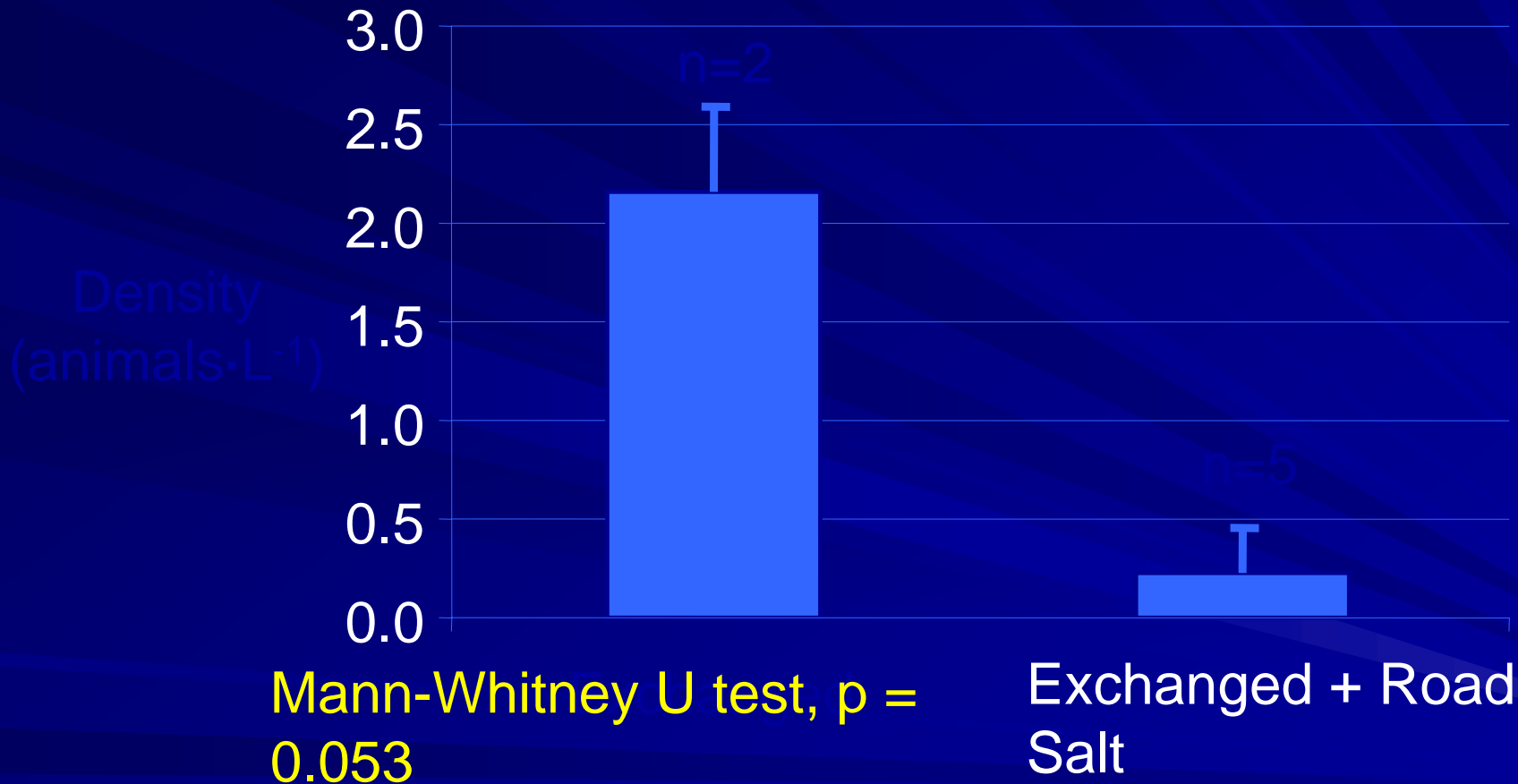


Road Salt Experiment



- 4-6 MT was added to each tank with desired goal of 40 ppt
- Road salt was left to dissolve on voyage from Montreal to Sarnia
- Biological samples were collected from the salt-treated tanks, plus two exchange-only tanks on arrival to Sarnia
- It was noted in Sarnia that the road salt had not completely dissolved

Biological Results



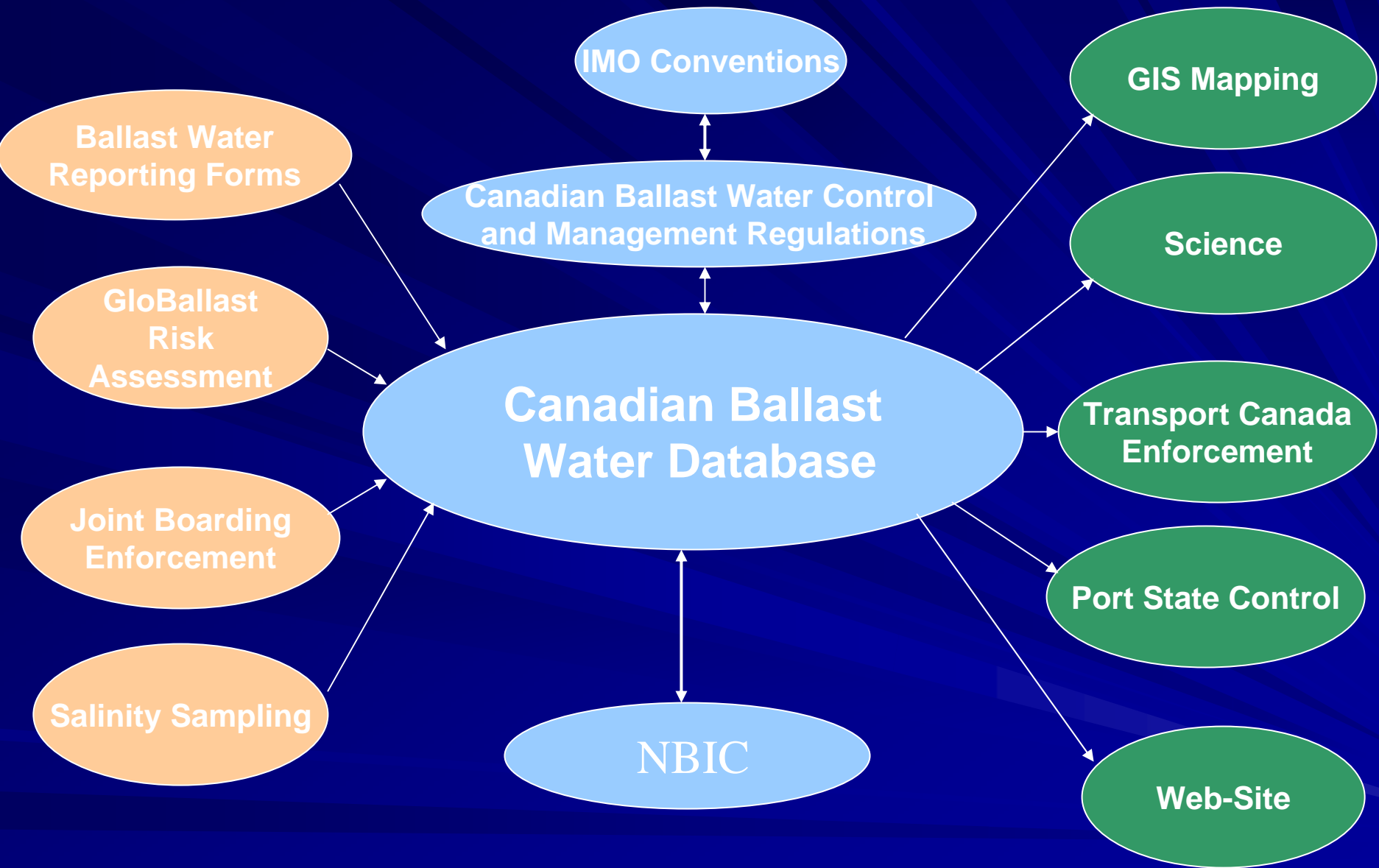
(Bailey & Wiley,
unpublished data)


What does it mean?

- Preliminary results indicate that treatment with road salt, in either solid or liquid form, is more effective than ballast water exchange alone
- Treatment with brine/road salt could be utilized **immediately**, while IMO-approved technologies on ships are still years away
- Two year full scale program 2008 /09

Zebra mussel 1988







**Estimating probability of establishment
for parthenogenetic taxa
with small founding populations:**

**an assessment of the proposed
IMO ballast water treatment standards**

Sarah Bailey,
Antonio Velez-Espino, Marten Koops, Ora Johannsson
Fisheries and Oceans Canada

Chris Wiley
Transport Canada/Fisheries and Oceans Canada

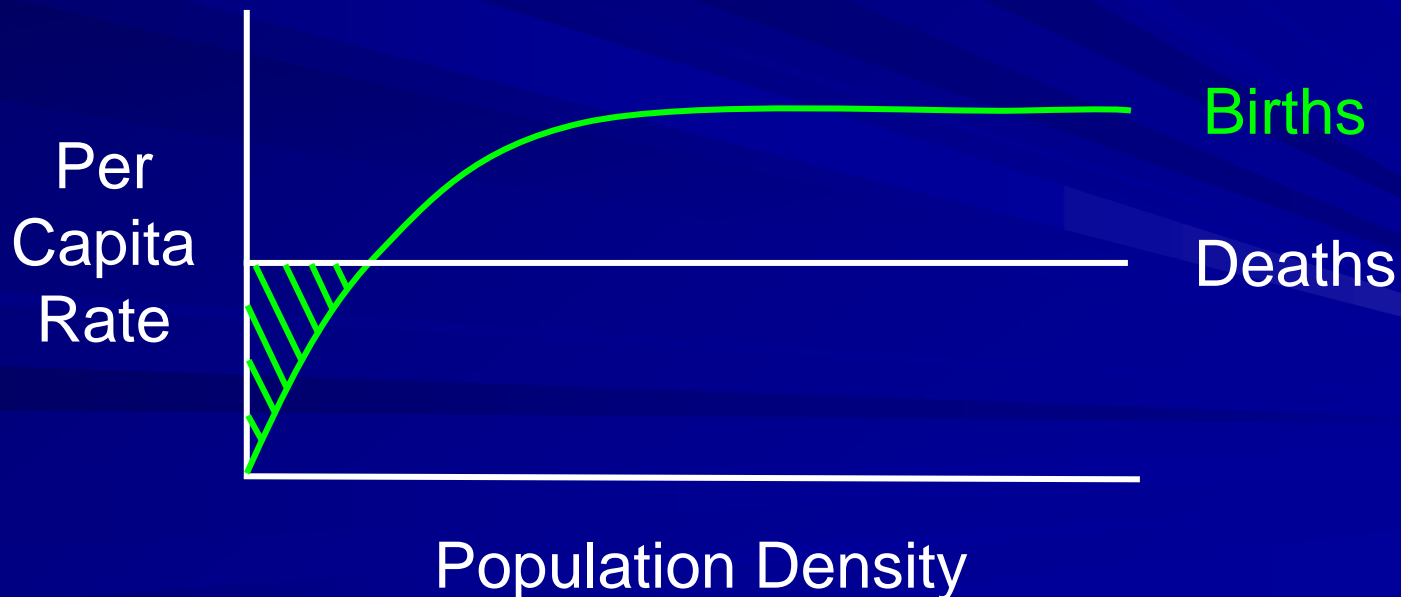
Theory Behind the Standards

Reduced Propagule Pressure:

- IMO standard estimated to be 10x lower than densities after BWE (Minton et al. 2005)

Density-dependent Demographics:

- Many taxa expected to have negative population growth at low population density



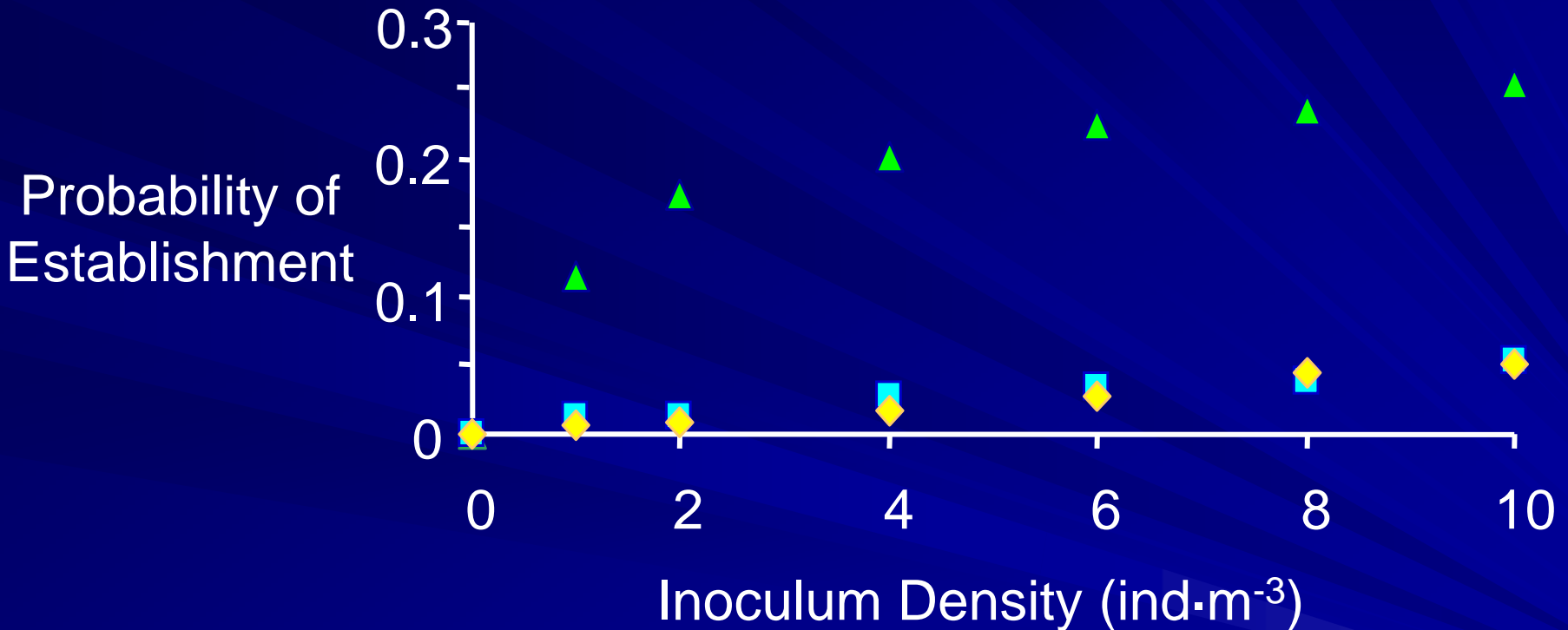
Mesocosm Experiments

Objective: to measure population growth rate of low density inocula in a favourable environment



- Six native Cladoceran taxa inoculated in large mesocosms ($\sim 5 \text{ m}^3$) at low densities
- 'Control' populations measured outside mesocosms
- Populations sampled every 3-4 days for 4 weeks

IMO Treatment Standard




Only three of six test species predicted to establish given inoculum density of 10 individuals·m⁻³

Conclusions

- 1 of 6 species had a moderate establishment probability (0.25-0.27) at IMO standard;
- 2 of 6 species had low establishment probabilities (0.04-0.05) at IMO density;
- 3 of 6 species were incapable of establishment given such low inocula;

The proposed IMO standard will be an improvement over BWE

Looking at Lakers: Domestic shipping as a vector for introduction or spread of aquatic nonindigenous species in the Great Lakes

A large black and red cargo ship is sailing on a body of water. The ship has a white superstructure with a prominent red funnel. The water is blue, and the sky is a clear blue with some light clouds. In the background, there are some buildings and trees along the shore.

Sarah Bailey^{1,4}, Michael Rup^{1,4}, Chris
Wiley^{1,2}, Mark Minton³, Whitman Miller³,
Gregory Ruiz³, Hugh MacIsaac⁴

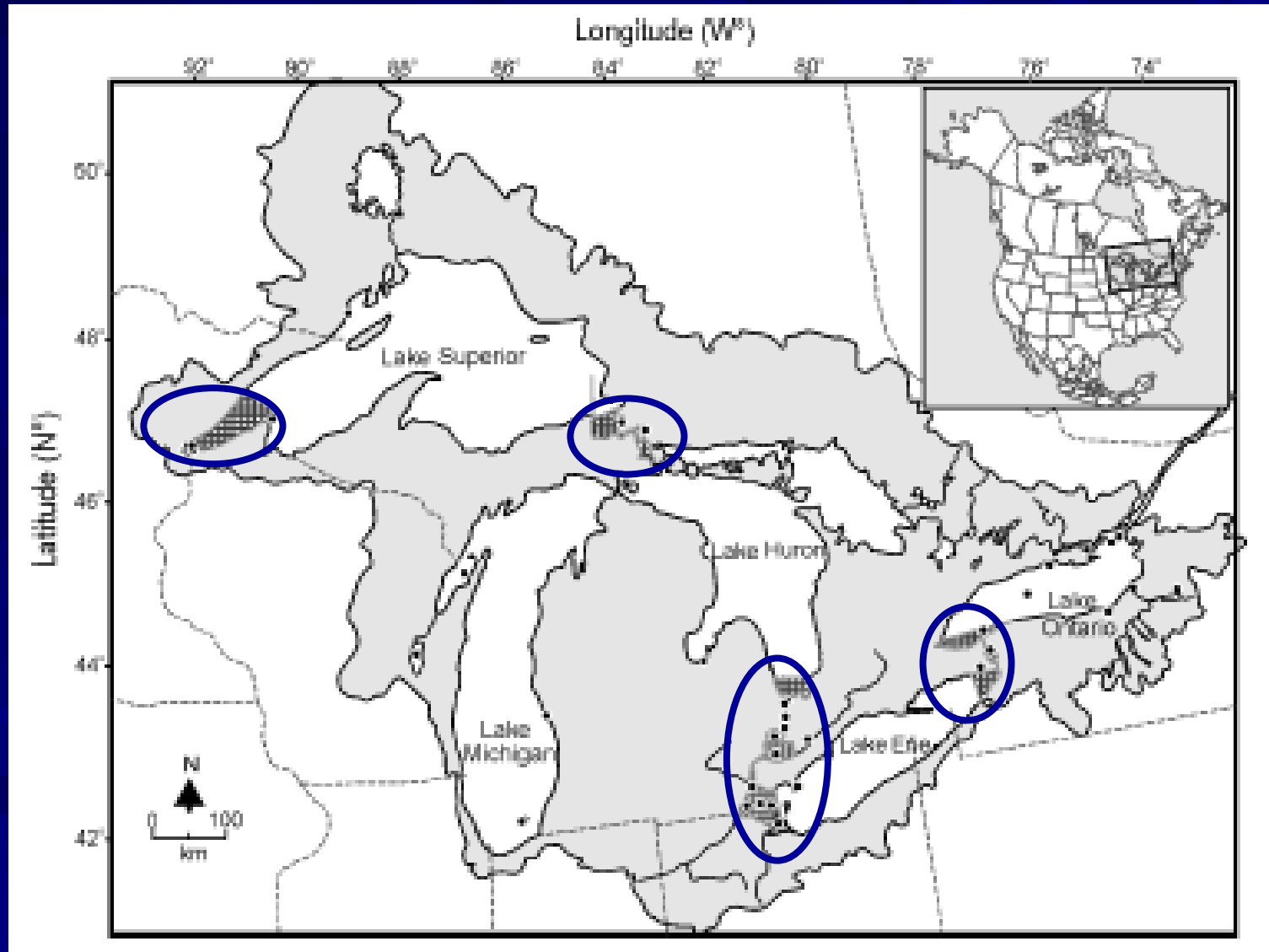
Project Goals

To determine if ballast water operations of 'Lakers' constitute a risk for introduction of ANS:

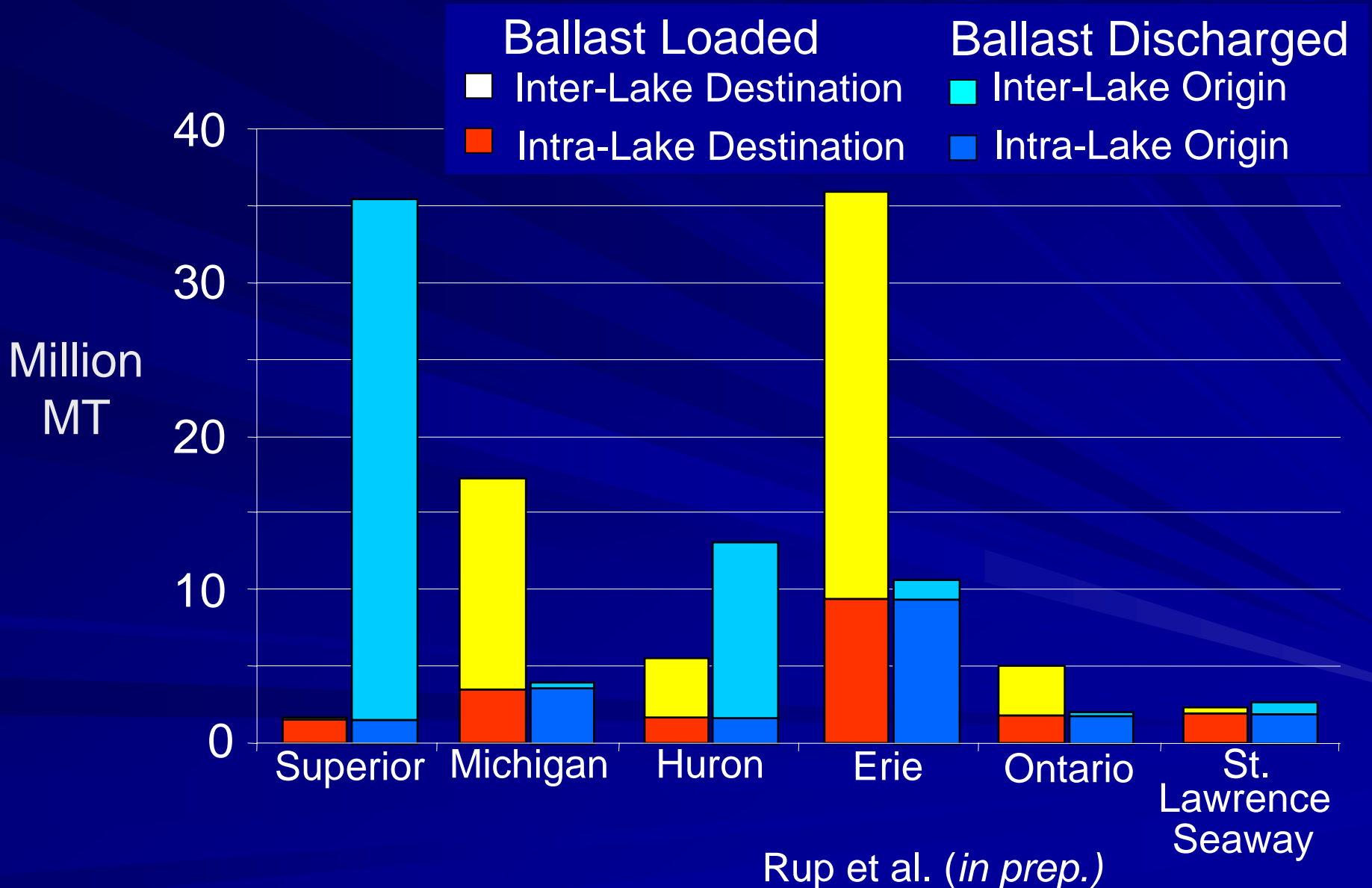


1. How much ballast water is being moved between domestic ports? (Laker transit study)
2. Are taxa being transported in domestic ballast water? (biological sampling study)

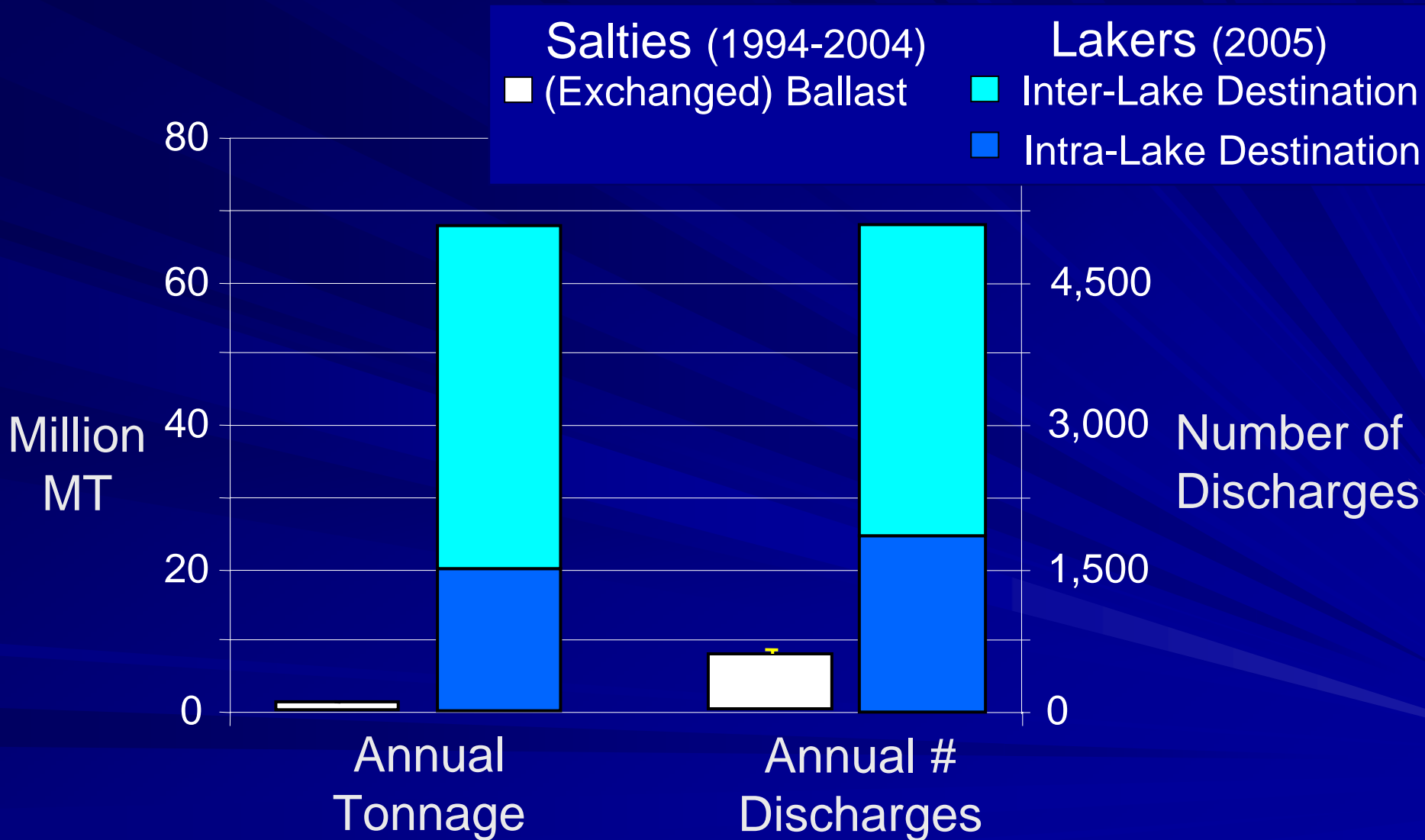
Invasion 'Hotspots' in the Great Lakes



Laker Ballast Transfers by Lake



Relative Discharges in the Great Lakes



Data from Sturtevant et al. (2007); Rup et al. (*in prep.*)

Top Laker Ballast Donor Ports

Port	Ballast (MT)	# of Ballast	
		Intakes	% Total (MT)
Detroit, Michigan	7,435,493	522	10.91%
Nanticoke, Ontario	6,095,311	272	8.94%
Gary, Indiana	4,035,966	122	5.92%
St. Clair, Michigan	3,831,702	97	5.62%
Indiana Harbor, Indiana	3,784,569	177	5.55%
Cleveland, Ohio	3,204,391	328	4.70%
Hamilton, Ontario	3,054,880	234	4.48%
Sault Ste-Marie, Ontario	2,287,837	231	3.36%

*hotspot region

If an ANS gets introduced to one of these ports (by any vector), it will likely spread to other locations. These ports will be important for prevention efforts.

Rup et al. (*in prep.*)

Top Laker Ballast Recipient Ports

Port	Ballast (MT)	# of Ballast Discharges	% Total (MT)
Superior-Duluth, Wisconsin-Minnesota	20,444,988	695	29.99%
Two Harbors, Minnesota	7,118,056	207	10.44%
Calcite, Michigan	3,331,165	290	4.89%
Marquette, Michigan	3,292,608	271	4.83%
Toledo, Ohio	2,606,047	206	3.82%
Stoneport, Michigan	2,375,589	201	3.48%
Great Lakes (remainder)	28,990,463	2856	42.53%

*hotspot region

If an ANS gets introduced to one of these ports (by any vector), it will likely spread to other locations. These ports will be important for monitoring efforts.

Rup et al. (*in prep.*)

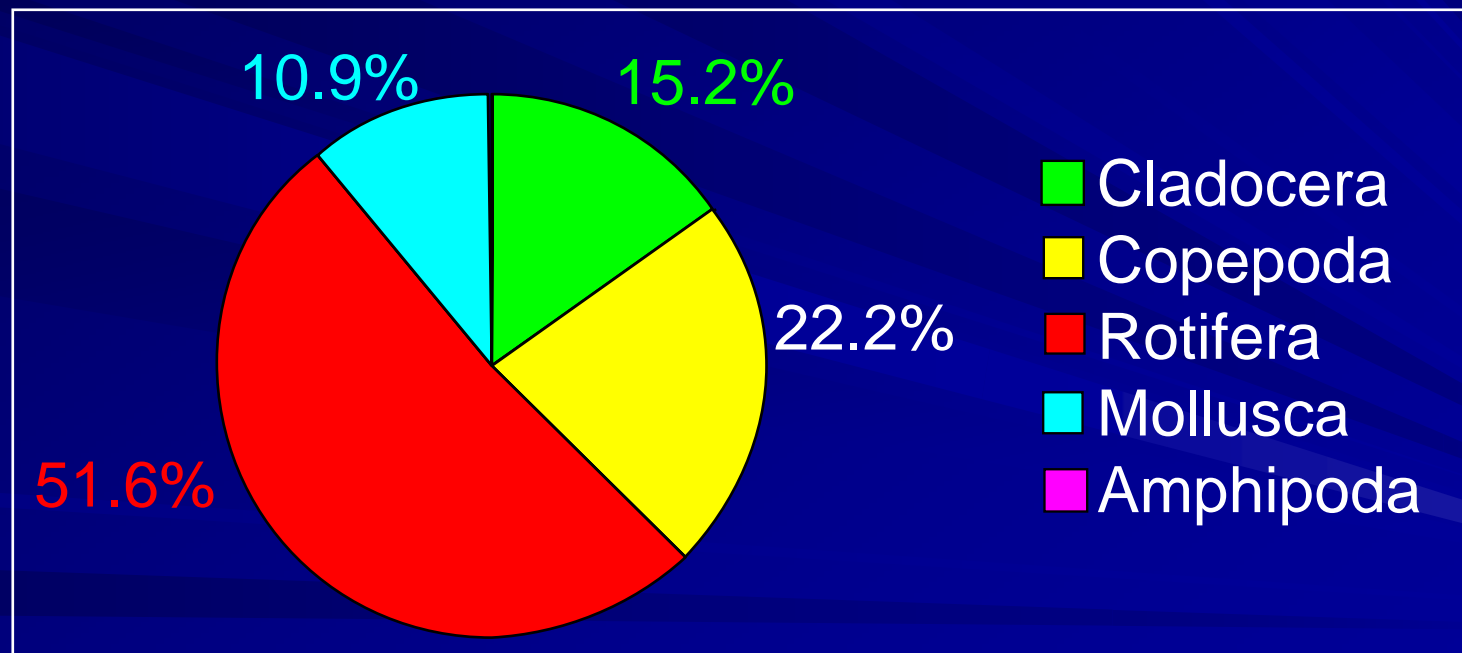
Biological Sampling Study: Objectives



- 1) Determine density and diversity of taxa transported in domestic ballast water
 - Zooplankton
 - Phytoplankton
 - Fish viruses
- 2) Determine presence of ANS
- 3) Document geographic movement of taxa with limited distribution

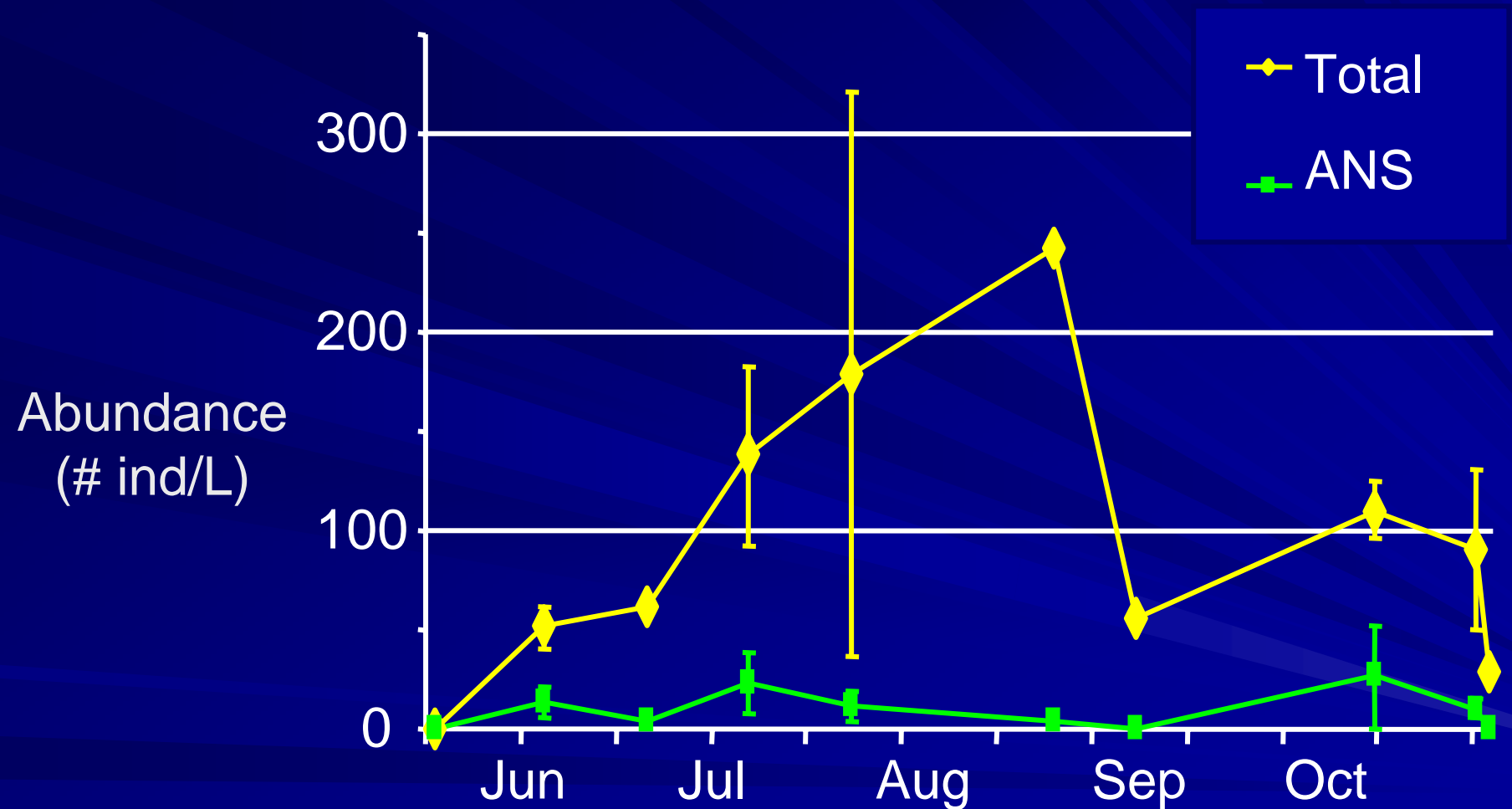
Preliminary Zooplankton Results

- 69 distinct taxa identified in Laker ballast
- Rotifers are most numerically abundant taxon
- 7 established ANS detected (at least 1 in 88% samples)



ANS comprise 11% cumulative zooplankton abundance

Zooplankton Density by Season



ANS abundance appears steady through time

Work Plan - 2008

- Ballast water sampling to continue – 50 more tank samples
 - Increase proportion of total fleet sampled
 - Increase proportion of US ships sampled
 - Broaden list of ballast water sources
 - Examine methodological differences (collection through hatch vs. sounding tube)



Centre of Expertise for Aquatic Risk Assessment

Species

Chinese Mitten Crab

Hemimysis anomala

Spiny rayed Fishes

Pathways in collaboration with OMNR

Bait

Aquarium Trade

Water Gardens

Live Food



- CEARA & CBS
- Live Food
- Comparison of one year of import invoices
- Hard copy to electronic database
- National Standard for conducting biological risk assessments for AIS



- Monitoring distribution Hemimysis
- Collaborative with OMNR / US agencies
- Lake Ontario, Erie, Huron
- Detroit, St Clair Rivers
- 2007 Identified in 4 additional location



- Higher Trophic AIS Monitoring
- Hamilton Harbour
- Great Lakes Tributaries – upstream spread of gobies
- Trent Severn – pathway for AIS spread
- Monitor established population of Corbicula



- Monitoring / Outreach
- Recreational Boating – awareness of AIS
- Direct to Live Bait End Use Survey (with OMNR & OFAH)
- Trade Shows, Direct Mailing to licensed anglers
- Availability of data for relative risk analysis