Feasibility and Efficacy of Three Methods of Zebra Mussel Larvae Detection in Lake Winnipeg

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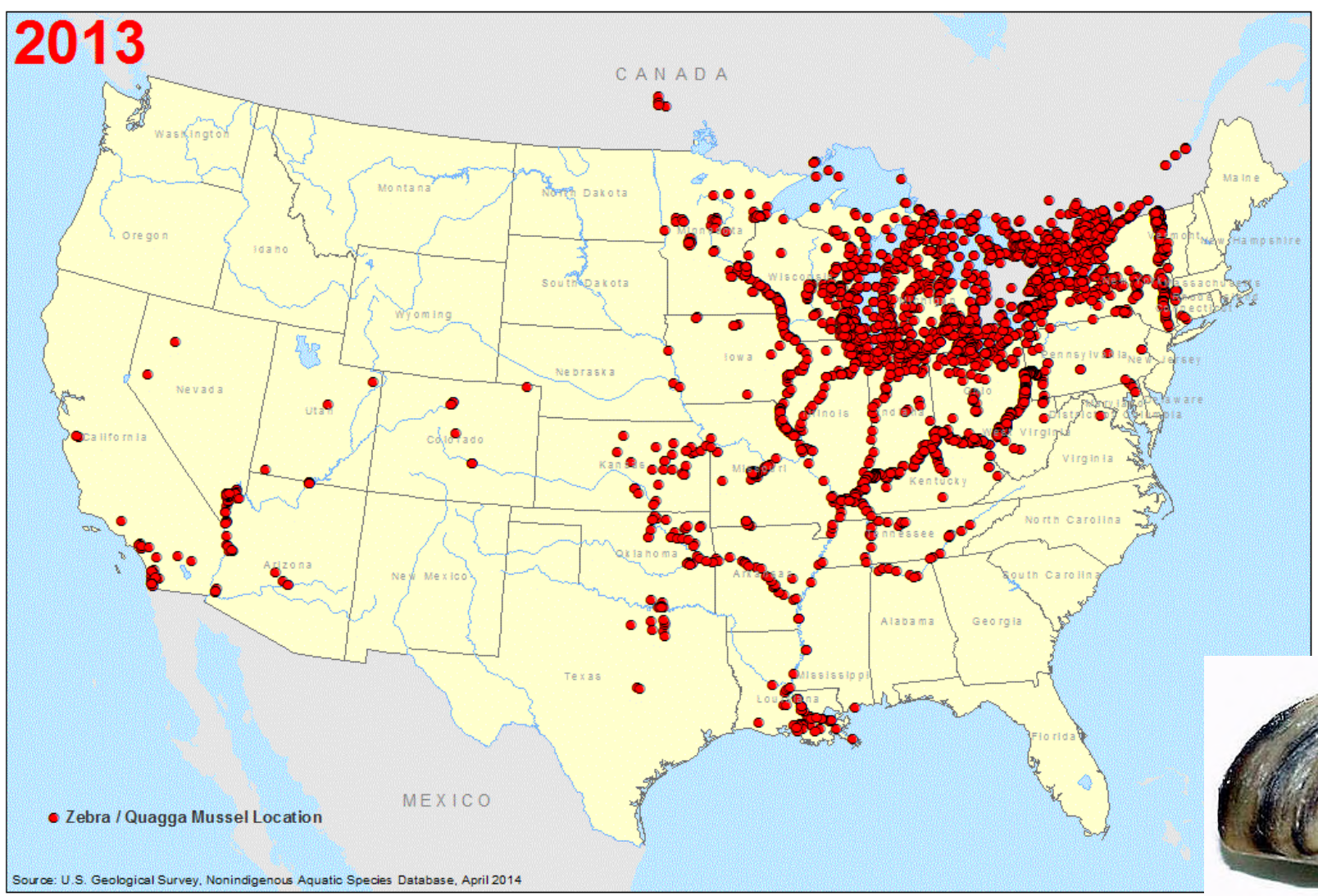
GLIER, University of Windsor

Dreissena spread



USGS (2016)

Lake Winnipeg

- Manitoba
- Two basins
- Zebra mussels
  - 2013 detected in south basin
  - 1 veliger reported in the north basin in October 2015
- Low abundance throughout

Janusz (2015), personal communication

Project goals

- Detection of zebra mussels in Lake Winnipeg
- Comparison of methods of detection

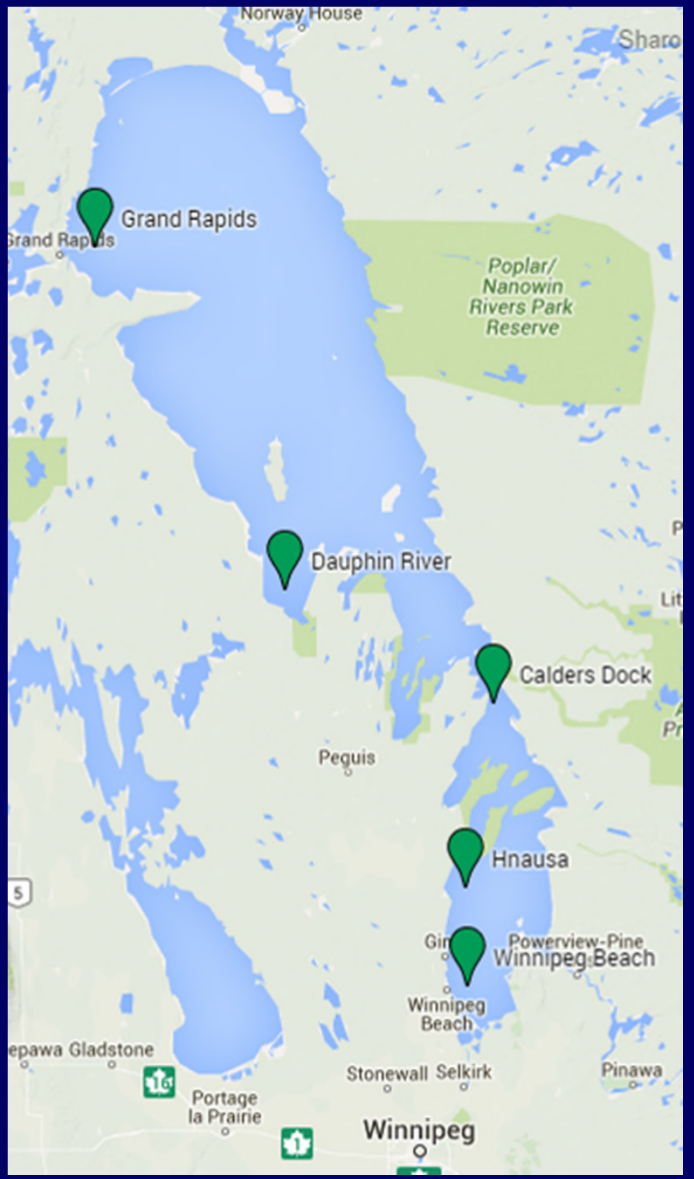
Null Hypotheses

- Increased sampling intensity does not change probability of detection of NIS
- No difference in detection success in the south and north basin
- Different methods of detection would result in the same success rates

Methods

- July 2015

- Sampling sites
  - Grand Rapids
  - Dauphin River
  - Calder's Dock
  - Hnausa
  - Winnipeg Beach



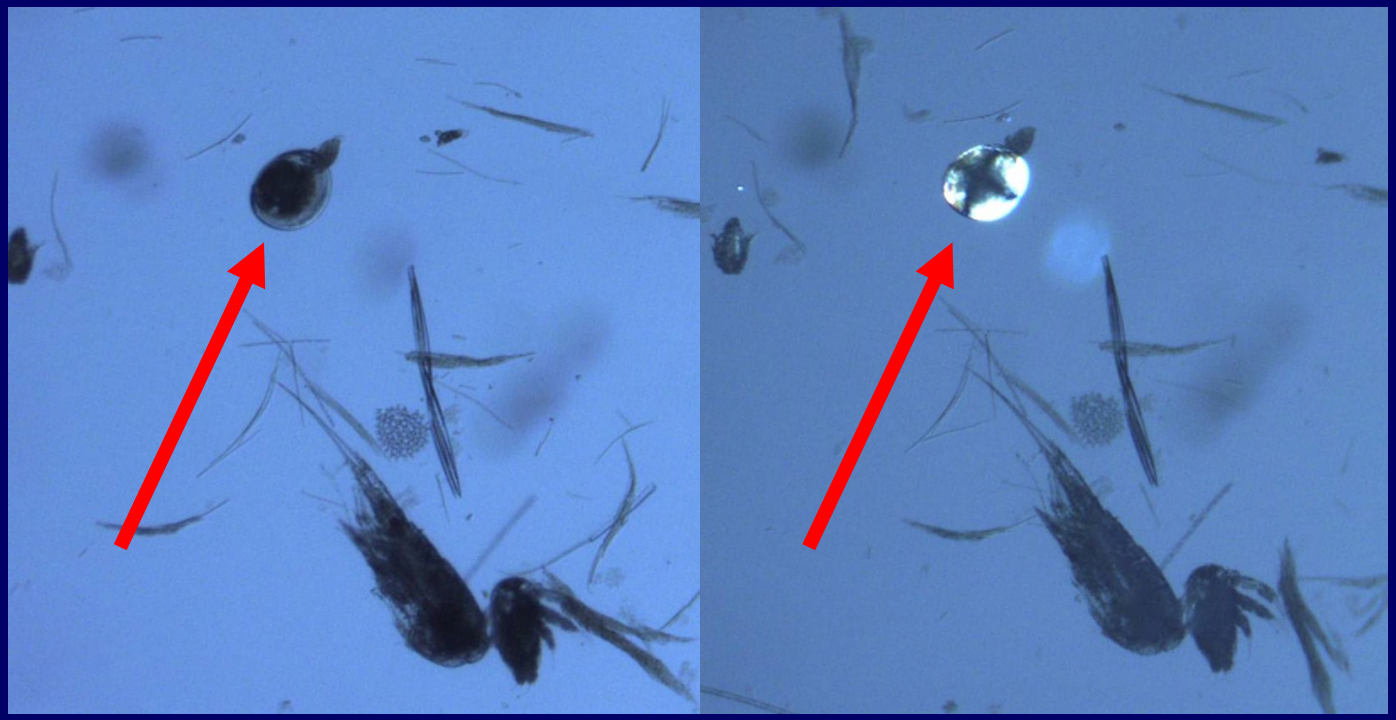
Methods

- 100 plankton tows at each site
  - 64µm plankton nets
- Plankton collected and stored in 95% ethanol
- Filtered out plankton larger than 300µm
- Concentrated into 50mL

Analysis

Conventional Microscopy

- Cross-polarized light microscopy
  - Entire sample analyzed and enumerated
  - Distinct shape



Frischer *et al*. (2012); Johnson (1995)

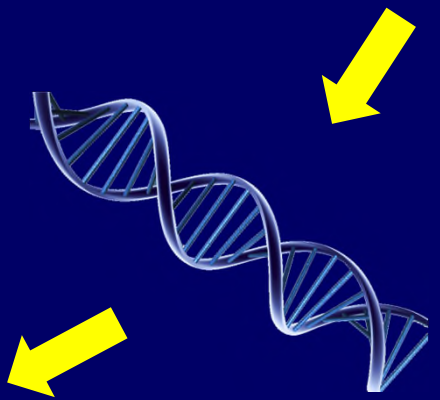
Flow Cytometry and Image Analysis

- Flow Cytometer And Microscopy (FlowCAM)
  - Fitted with XPL (cross-polarized lenses)
  - Subsample (3/50 of filtered)
  - Images of each particle is captured and stored for analysis

Fluid Imaging (2011)

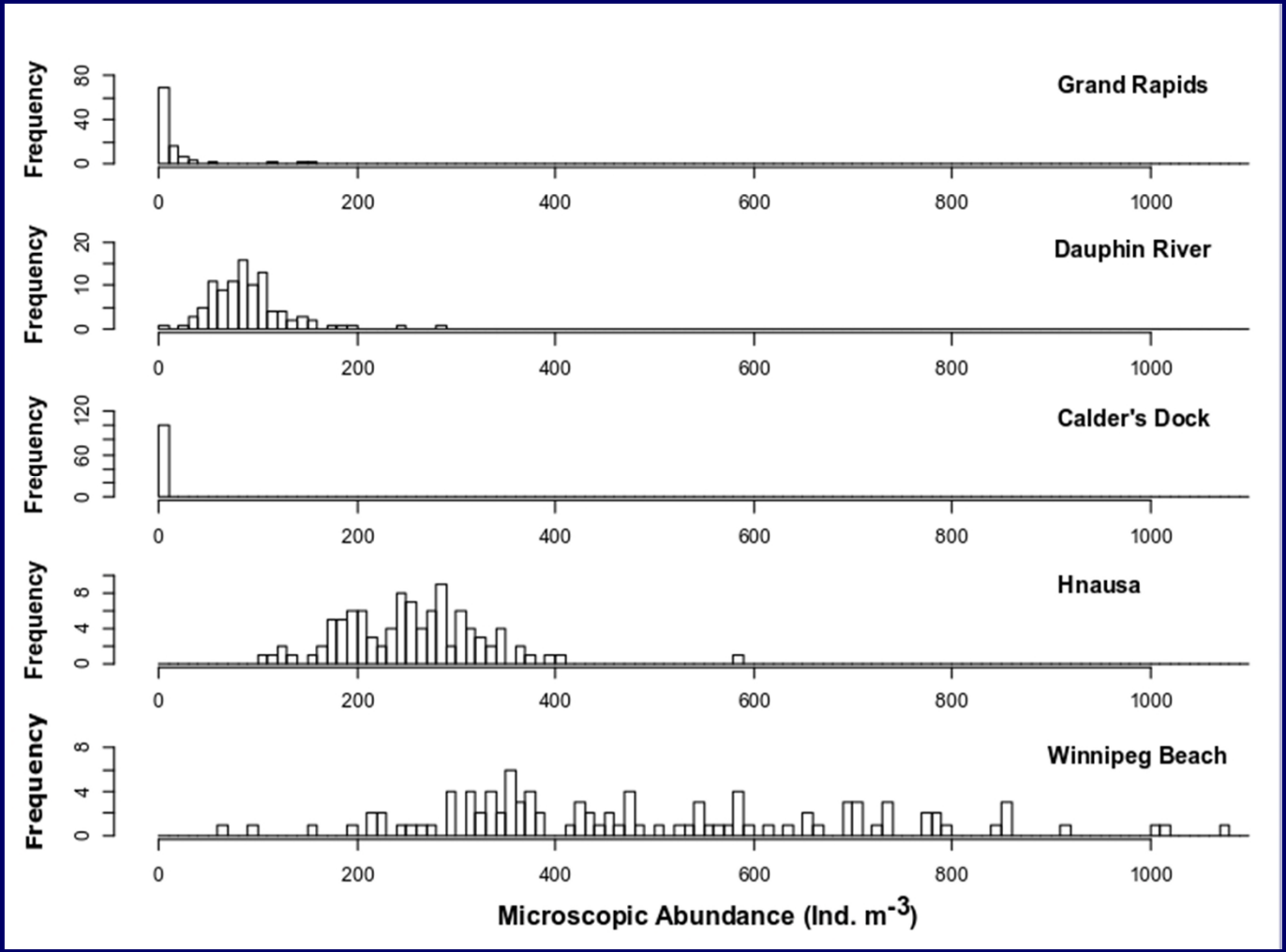
Environmental DNA (eDNA)

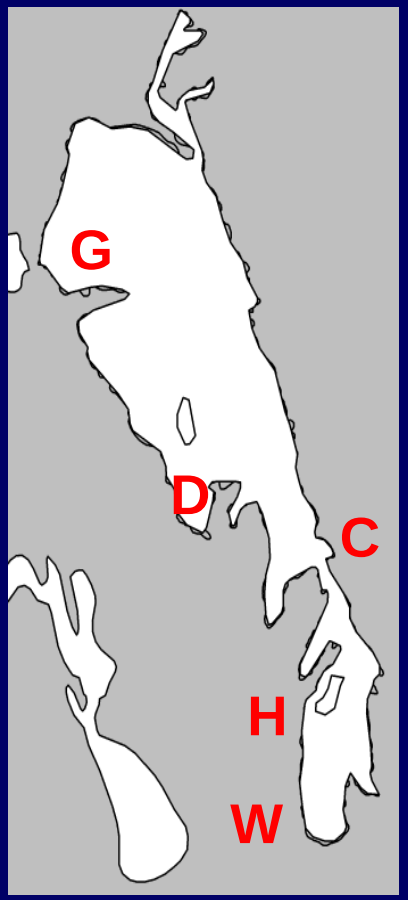
- DNA detection
  - Subsample (1/50) of filtered plankton
  - DNA extraction
  - PCR amplified with species-specific primers



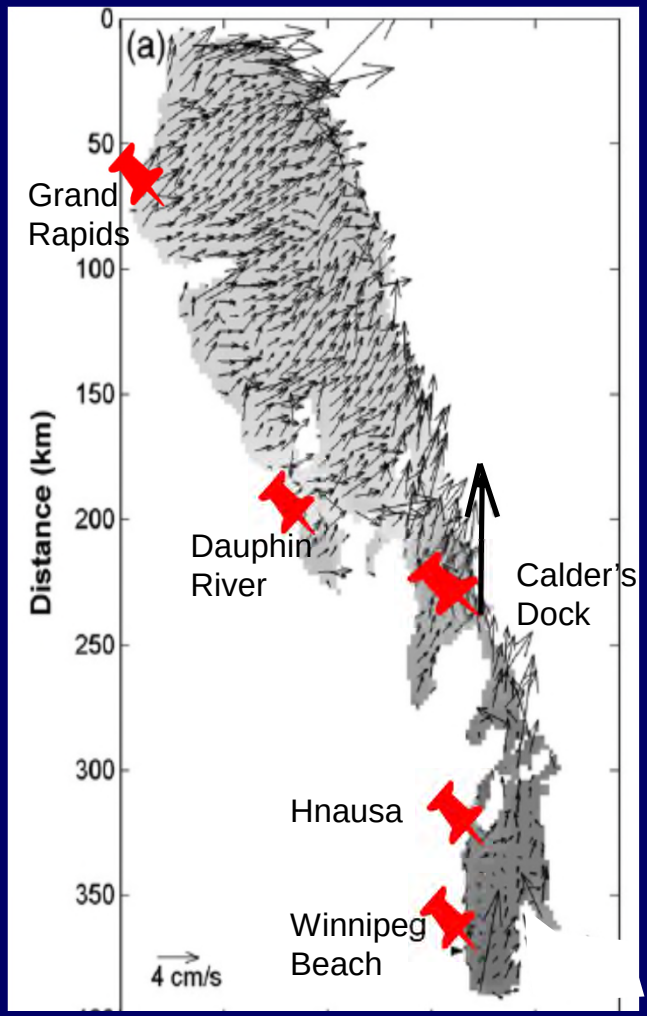
Egan *et al*. (2015)

Microscopy: Abundance



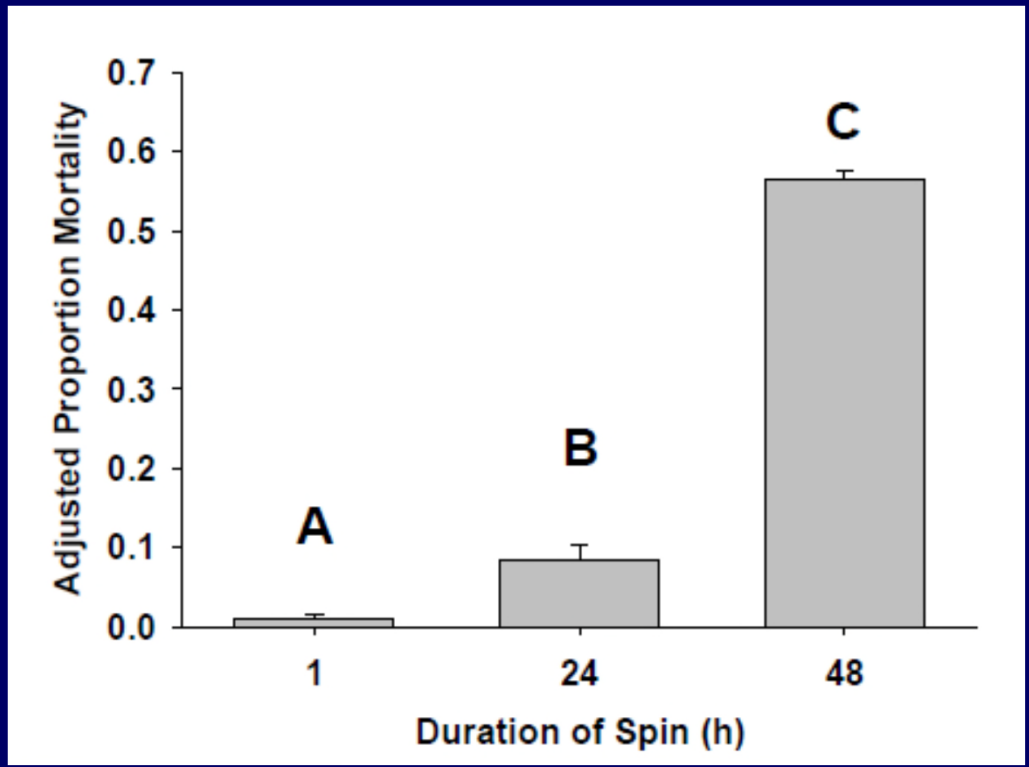


Flow Rate



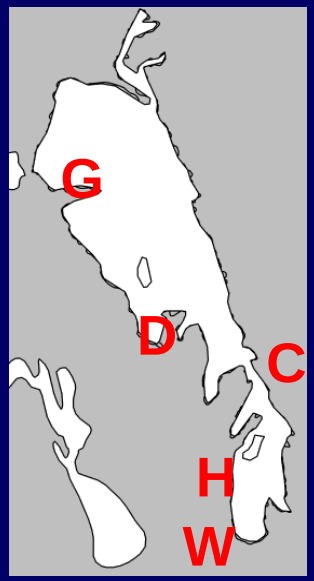
Zhao *et al*. (2012)

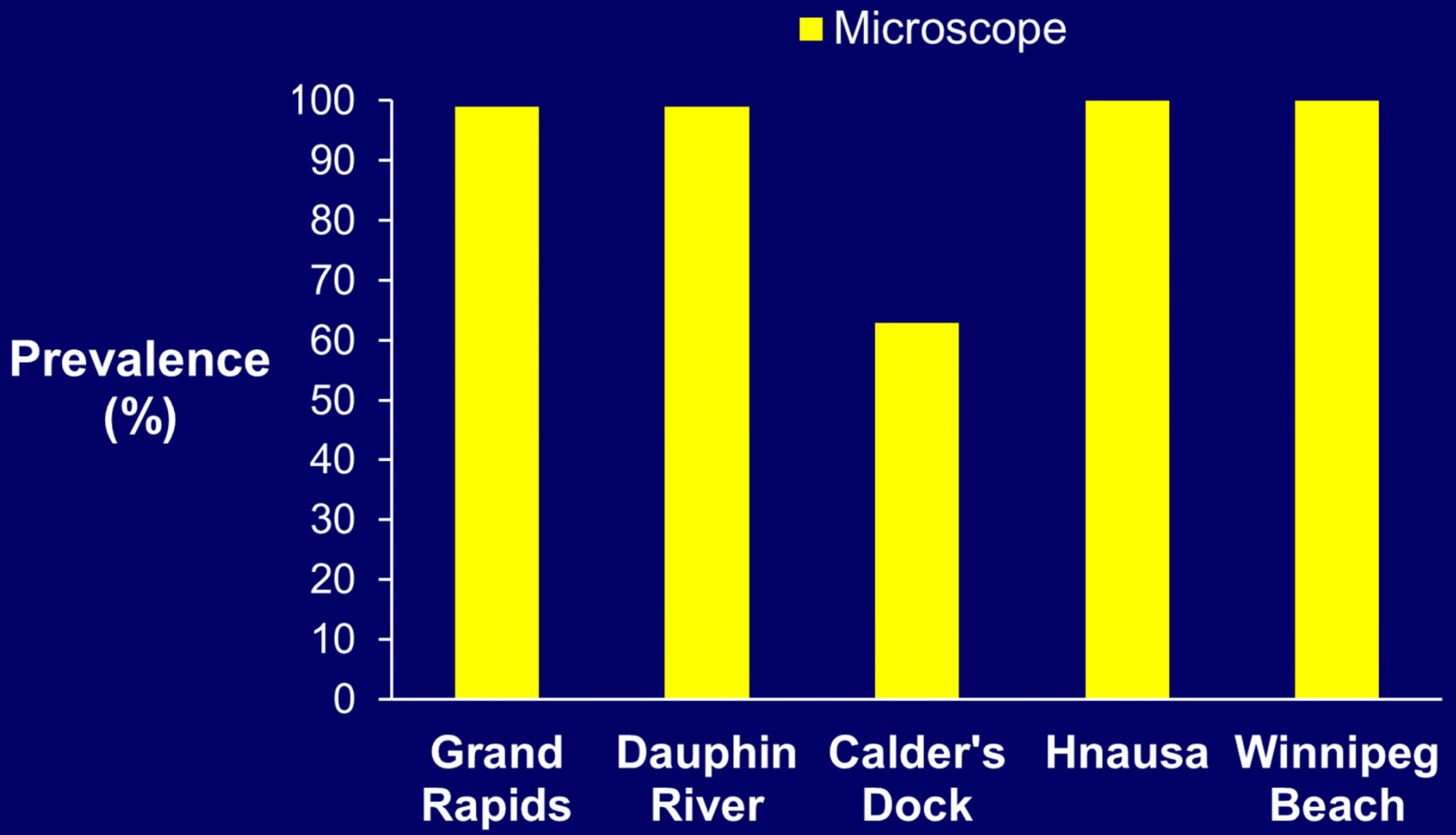
Increased Mortality



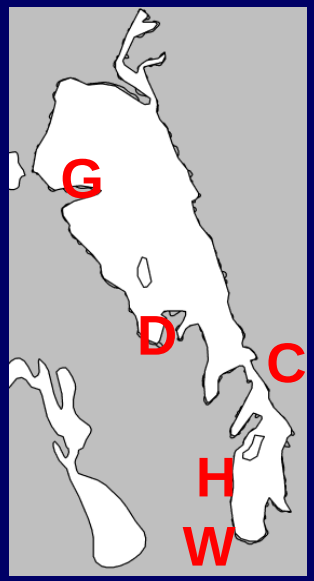
Horvath & Crane (2010)

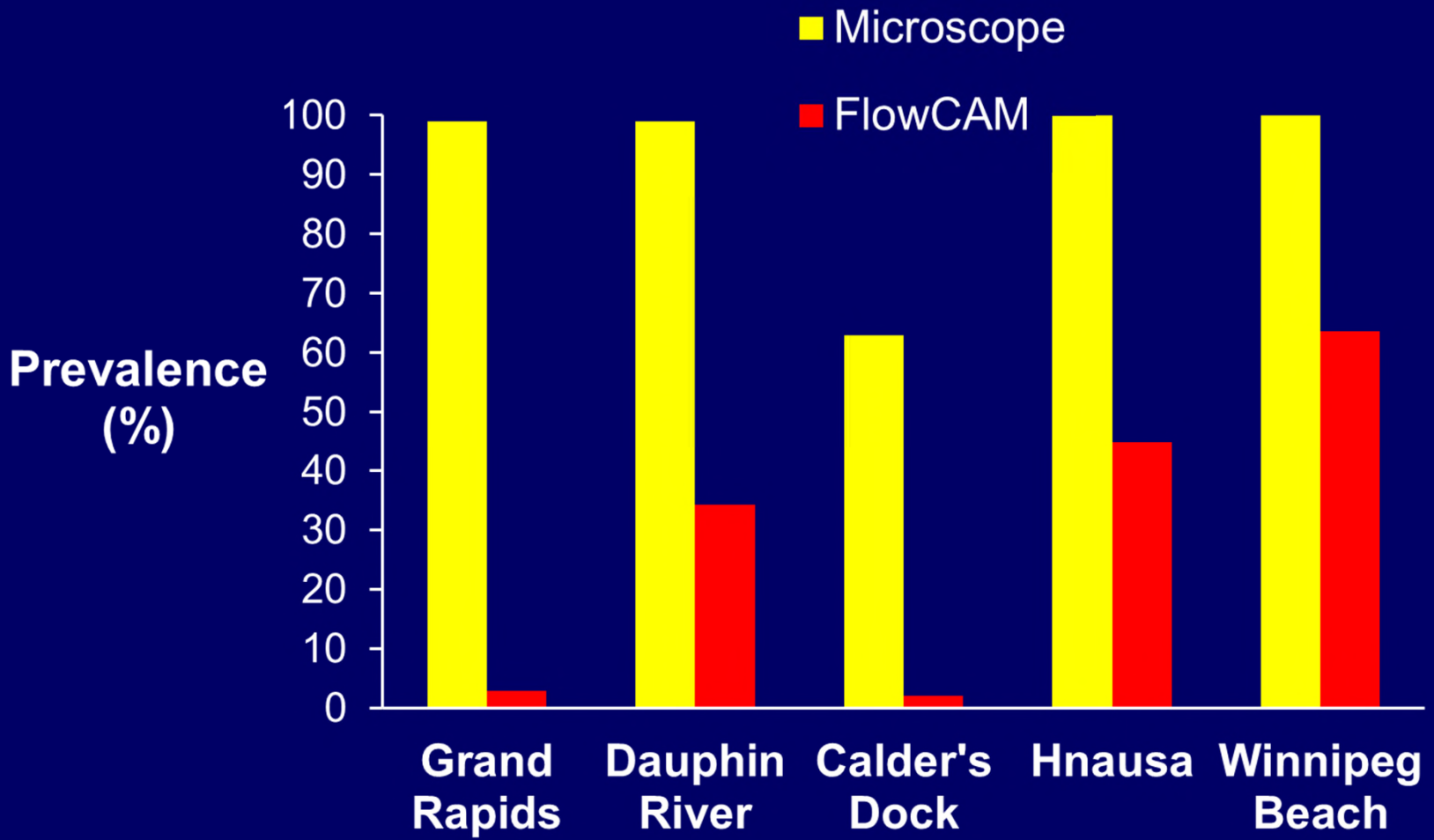
Veliger Prevalence in Samples





Veliger Prevalence in Samples





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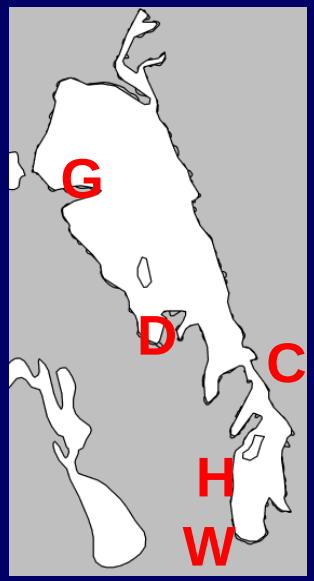
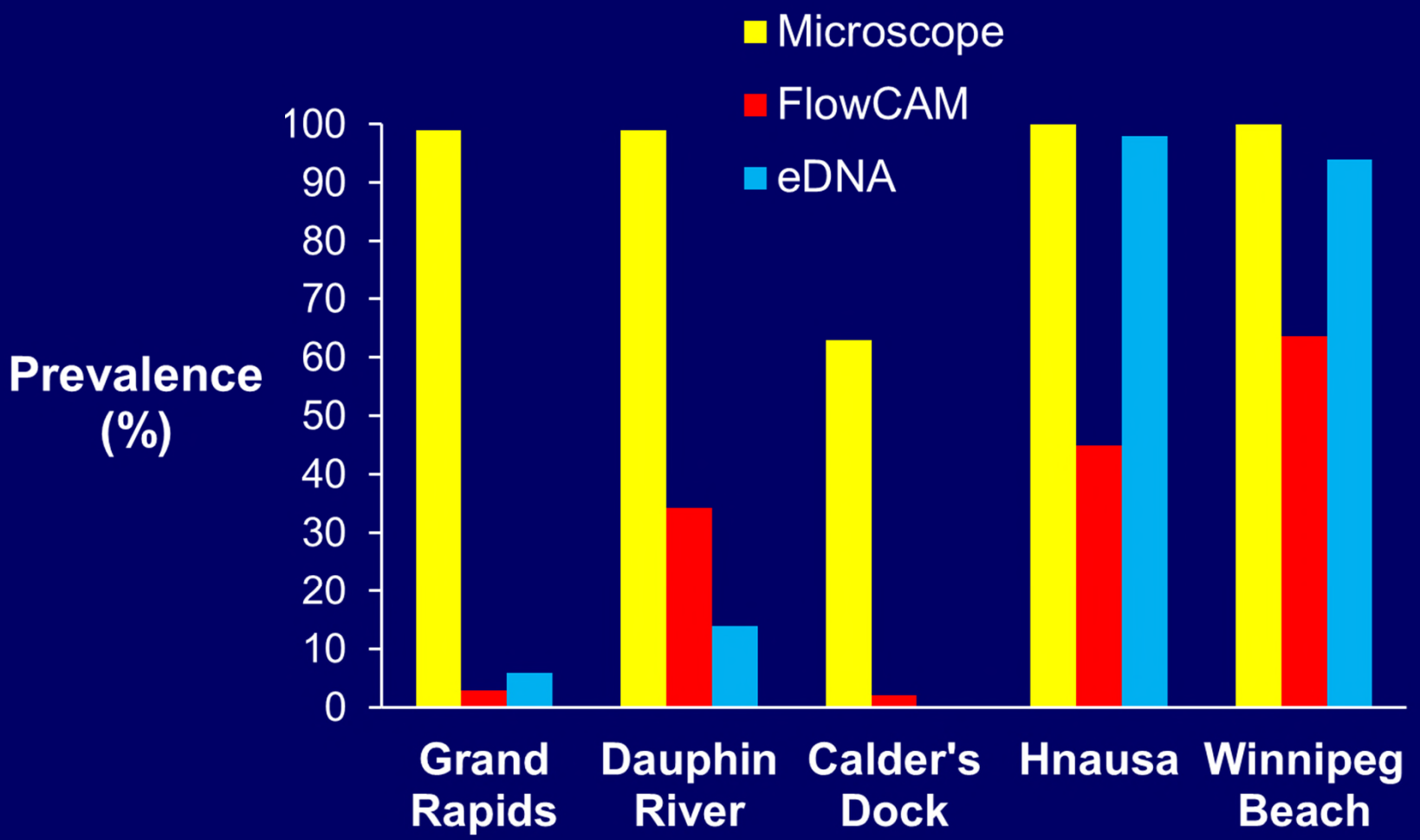
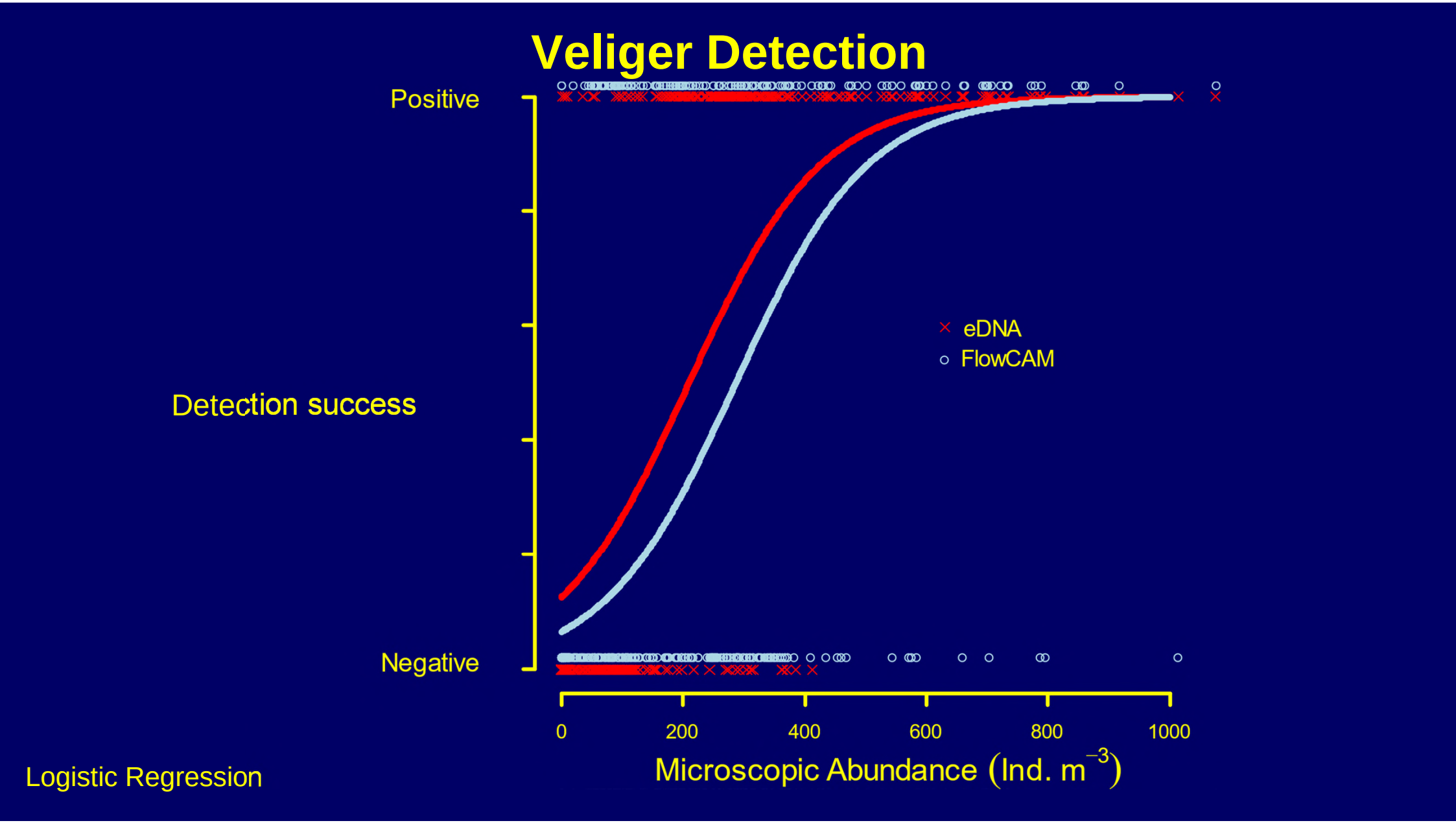




Veliger Detection



Logistic Regression

Cost and time

	Microscopy	FlowCAM	eDNA
Start up cost (CAD$)	10,441.60	81,499.73	5,835.00

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Cost per sample (CAD$)	7.90	6.78	1.87

Schlatter *et al*. (2015)

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	Microscopy	FlowCAM	eDNA
Start up cost (CAD$)	10,441.60	81,499.73	5,835.00
Cost per sample (CAD$)	7.90	6.78	1.87
Time (Hours)	198	167	24

Limitations

- Possible artifact of subsampling
- FlowCAM – volume restricted by time taken to process
- eDNA – volume restricted by equipment

Significance

- Changes in sampling strategy
- Detection methods
  - Microscopy mid-range in cost and longest time taken, but highest sensitivity
  - eDNA lowest cost and fastest - relatively high sensitivity

Acknowledgements

- Dr. Doug Haffner
- Dr. Aaron Fisk
- Dr Charles Ramcharan
- Colin van Overdijk
- MacIsaac Lab
- Heath Lab
- Joelle Pecz
- Jezel Gicole
- Taylor Haludek
- Ian MacIsaac
- Sarah-Jayne Collins

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