

A calibrated ecosystem model to assess the ecotoxicological risk of endocrine disruptors in aquatic environments.

SETAC Europe

Basel, Switzerland

15 May, 2014

Ludwine Clouzot

M. Paterson, A. Dupuis, P. Blanchfield, M. Rennie,
K. Kidd and P.A. Vanrolleghem



Canada Research Chair
in Water Quality Modeling



Endocrine disruption

What happens at the ecosystem level?



**Joanne Parrott*



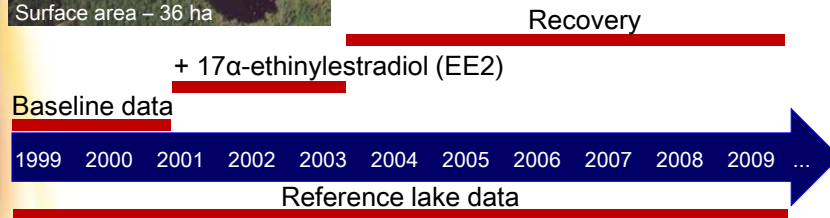
2



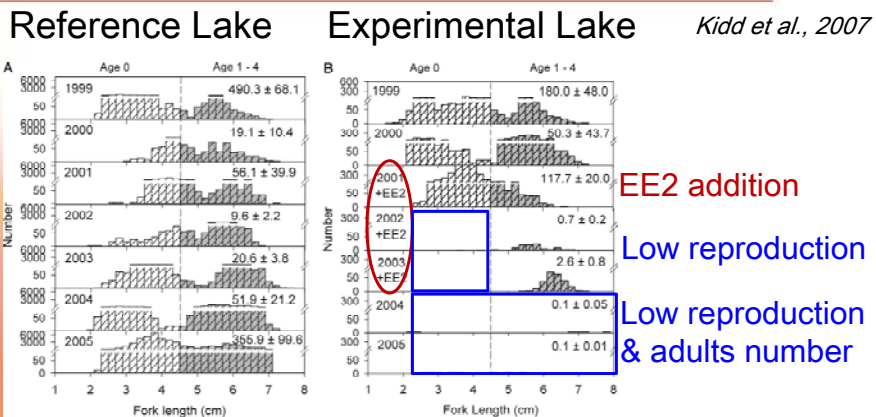
Experimental Lakes Area in Canada



Ecosystem study with EE2



EE2: Collapse of *fathead minnow*



Endocrine disruption in the other fish species

Endocrine disruption

Ecosystem experimental study:

- Just one shot

Ecosystem models:

- Required to better understand the impacts and to predict risk
- 0 ecosystem models found in the literature

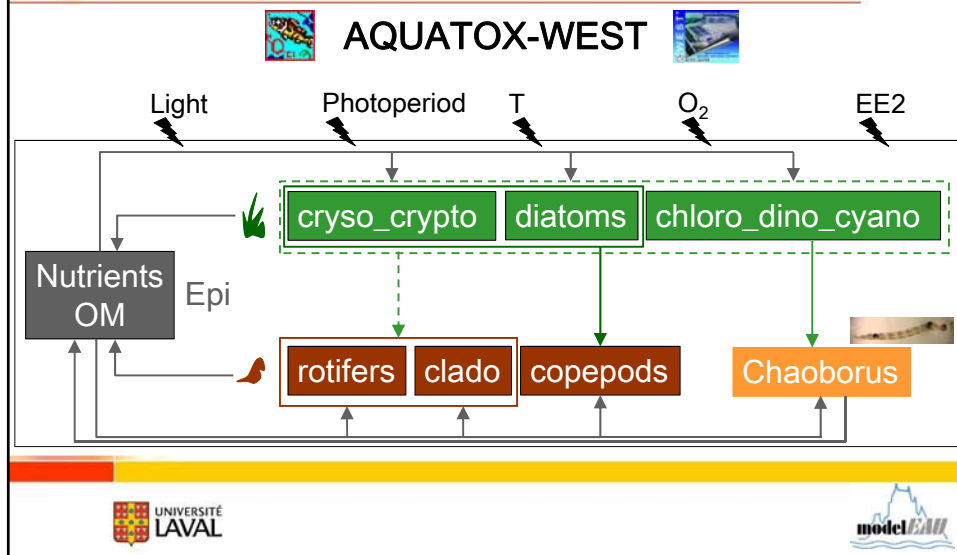
Objective of the study

- Developing an ecosystem model that could be used in assessing ecotoxicological risk of endocrine disrupters in aquatic environments

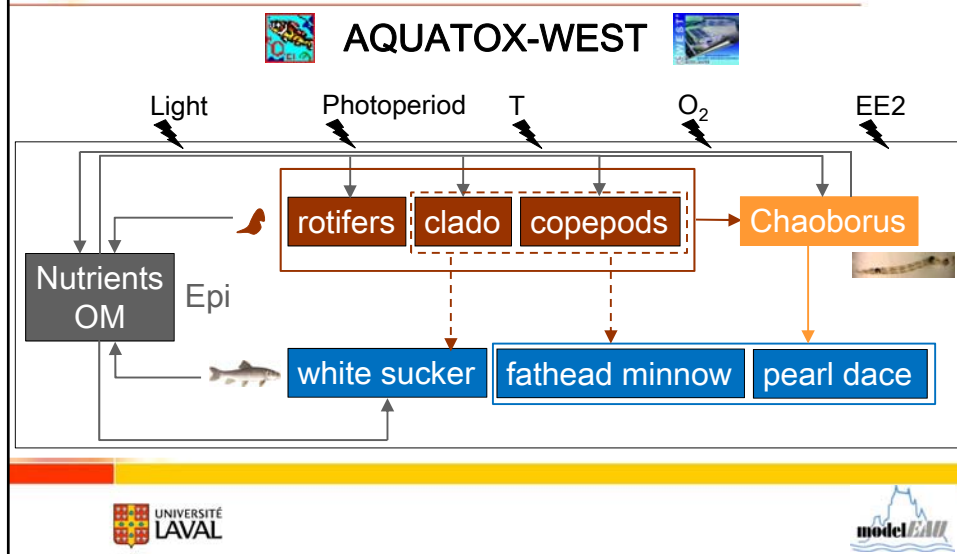


**Joanne Parrott*

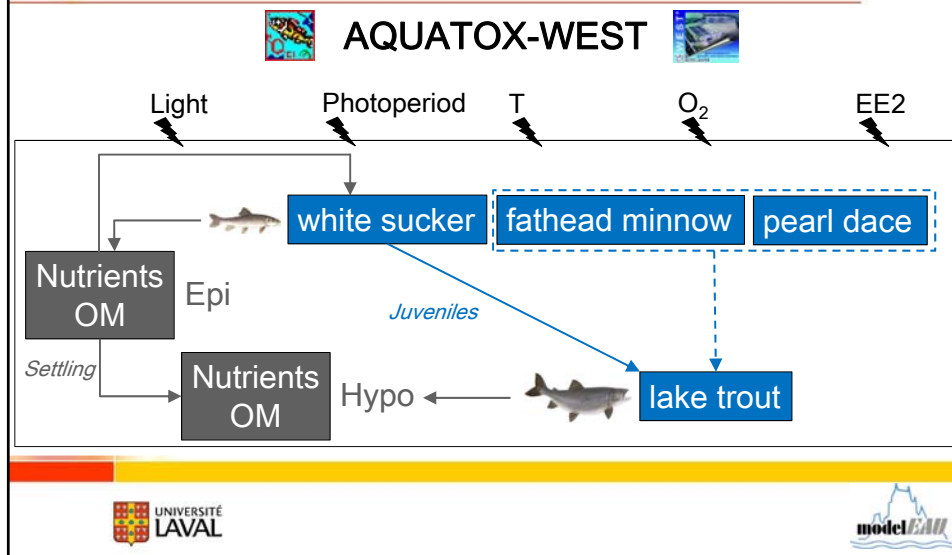
Ecosystem model: Object-oriented



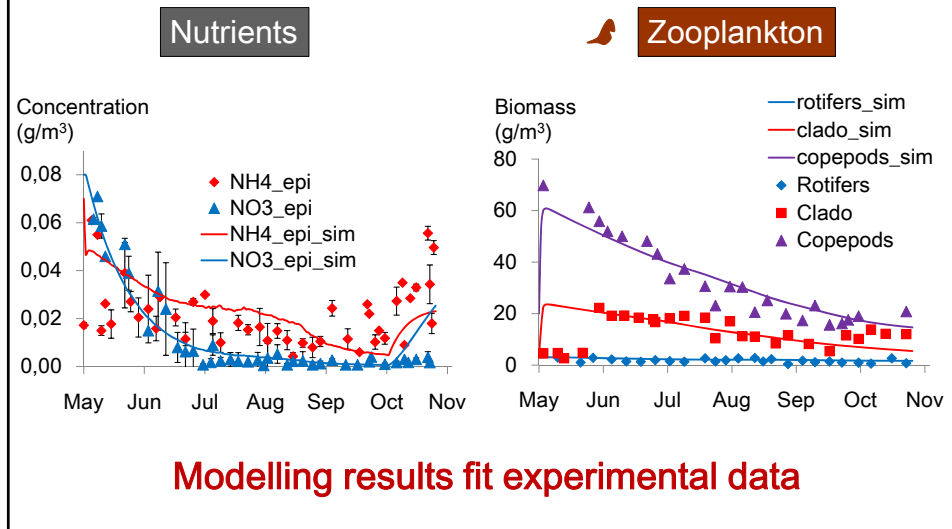
Ecosystem model: Object-oriented



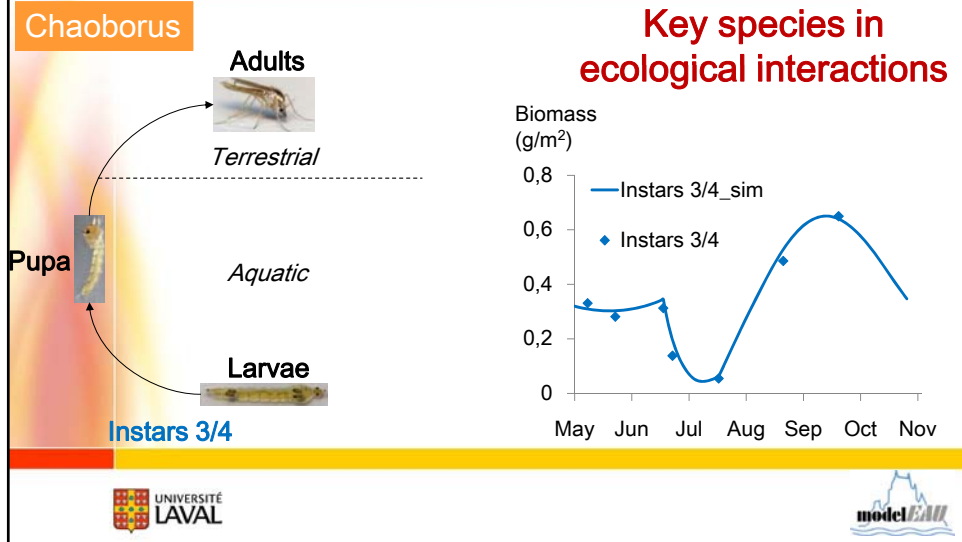
Ecosystem model: Object-oriented



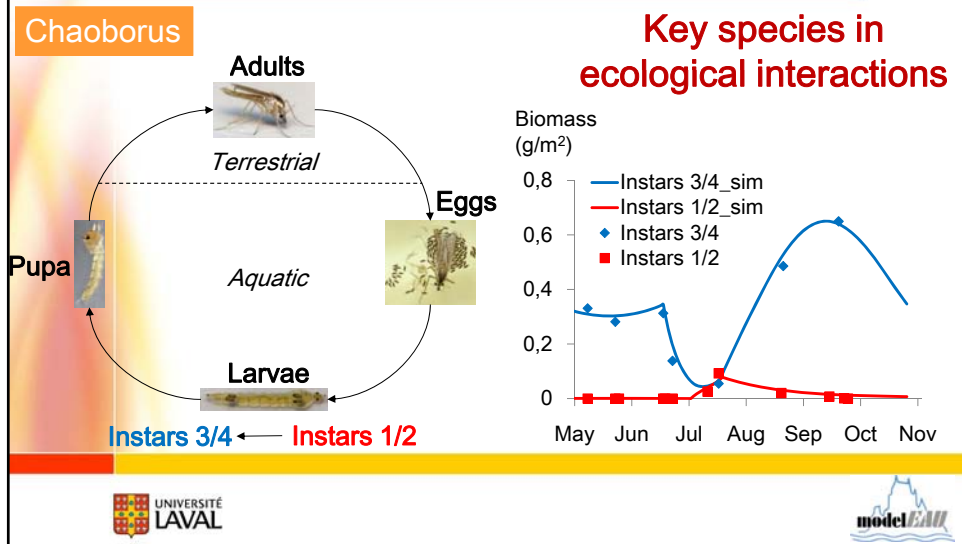
Modelling results: Calibration



Modelling results: Calibration



Modelling results: Calibration

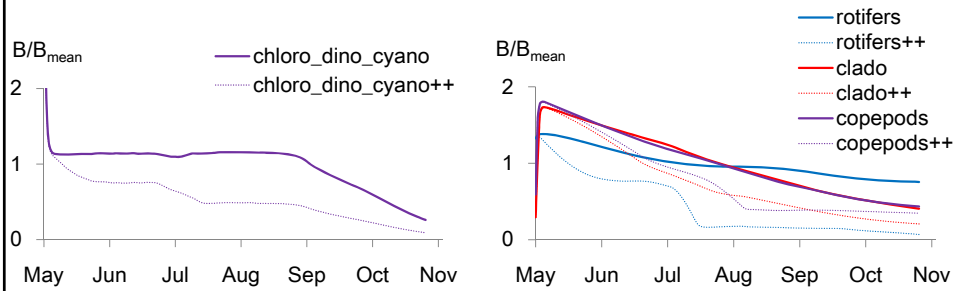


Modelling results: Sensitivity analysis



Chaoborus

Initial Biomass x5



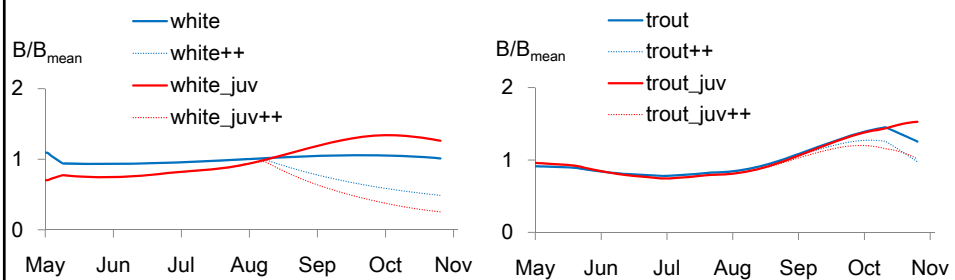
Decrease of prey when chaoborus increase

Modelling results: Sensitivity analysis



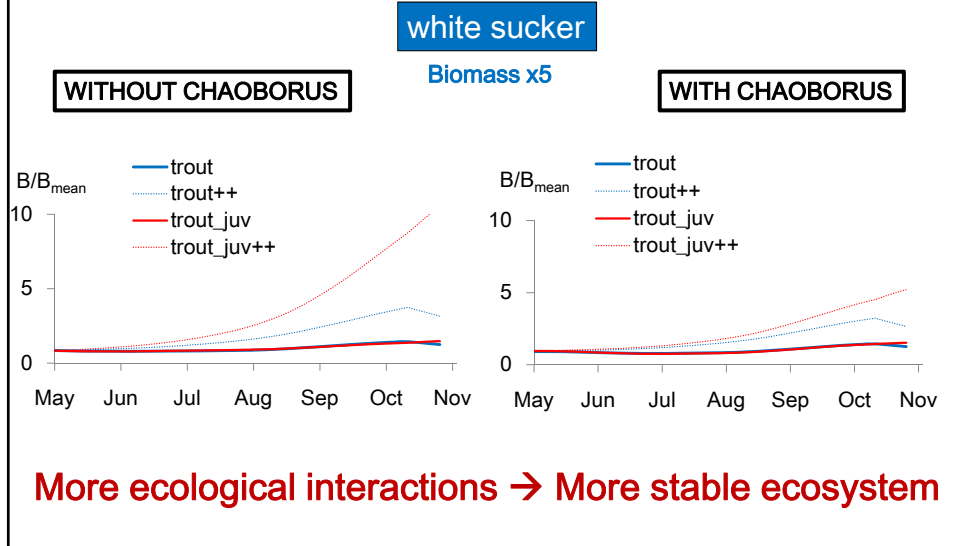
Chaoborus

Initial Biomass x5



Decrease of predators when food decreases

Modelling results: Sensitivity analysis



Modelling results: Conclusion

Calibration:

- Modelling results fit experimental data

Sensitivity analysis:

- Initial population x5 and ÷5 for each species
- Great consistency within the ecosystem
- Shows the potential of the model

EE2: Direct effects

Endocrine disruption

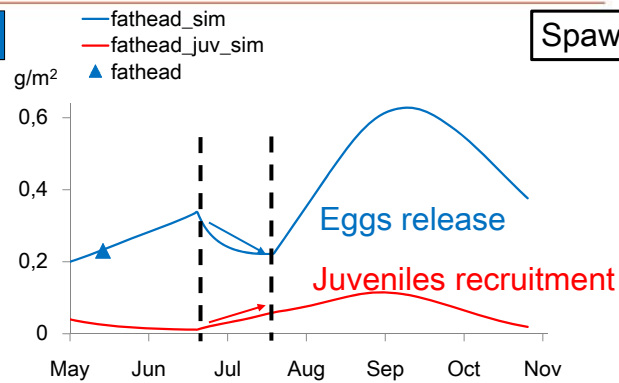
↘ Gamete production



↗ Fish mortality

EE2: Direct effects

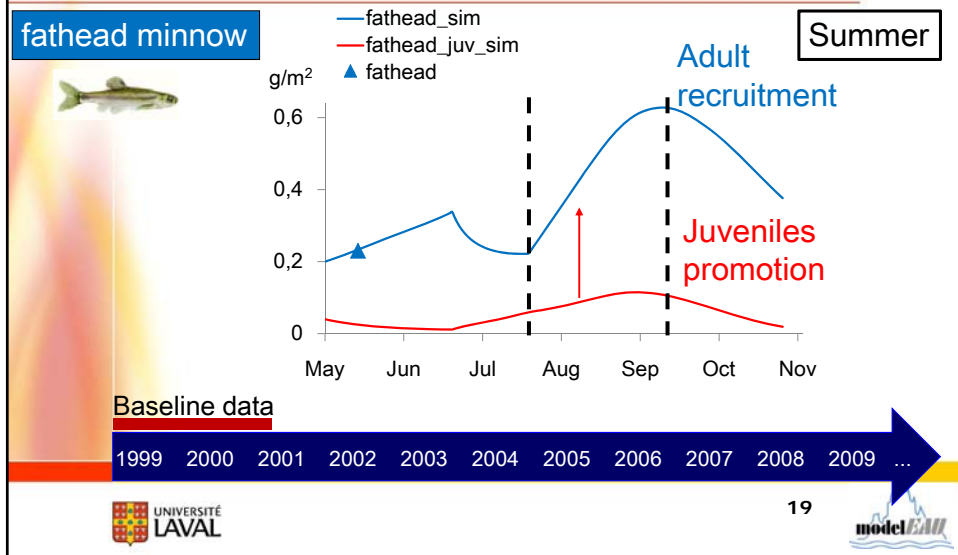
fathead minnow



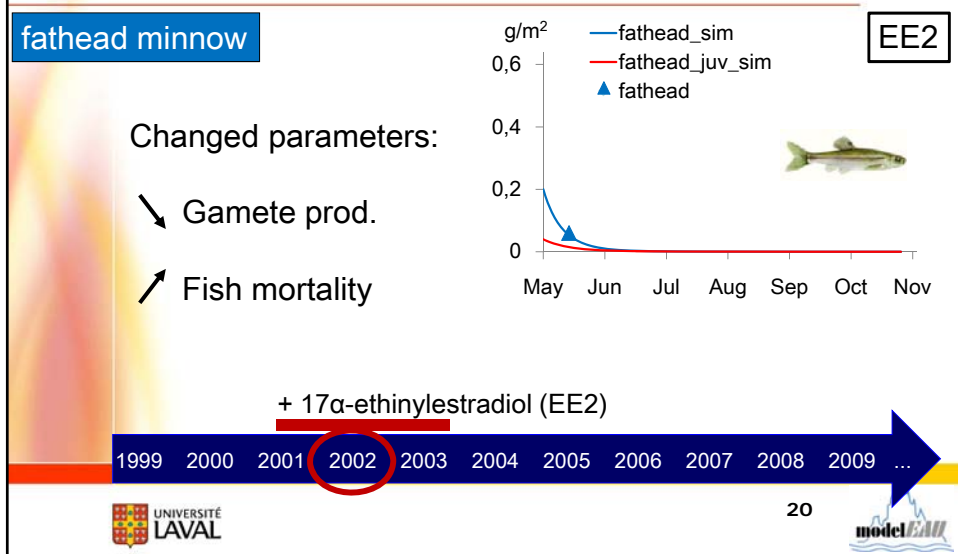
Baseline data

1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 ...

EE2: Direct effects

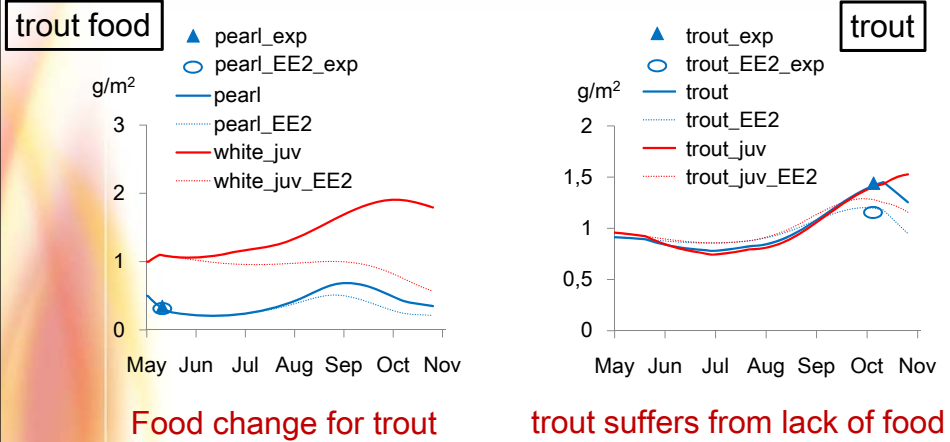


EE2: Direct effects

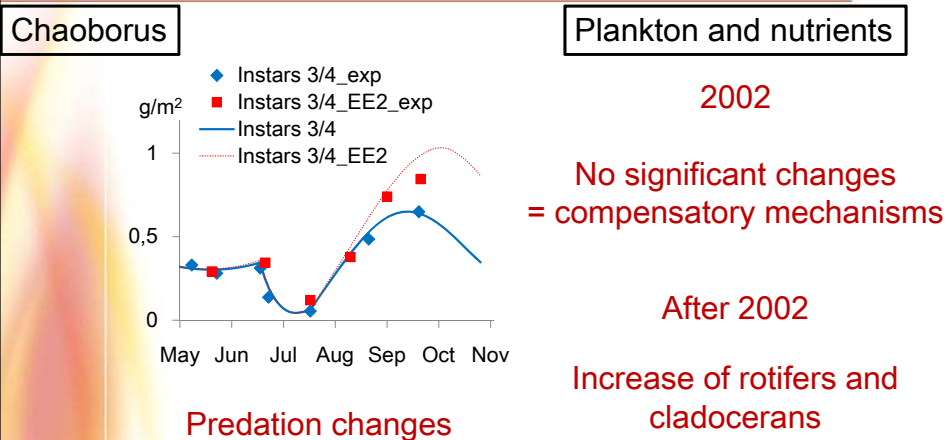


EE2: Indirect effects

Kidd et al., 2014



EE2: Indirect effects



Conclusion

Direct effects of EE2:

- Mainly on fathead minnow
- Pretty well understood

Indirect effects of EE2:

- Food web responses rarely studied
- Experimental data show some indirect effects
- More answers with the ecosystem model

Conclusion

Indirect effects of EE2 (bis):

- Competitive interactions = important ecosystem-level effect of endocrine disrupters
- Any significant changes in the plankton community = compensatory mechanisms

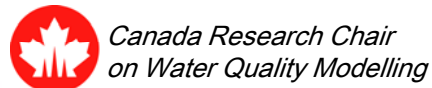
Perspectives

Long term simulation:

- Modify the model to run over a whole year
- Run the model from 1999 to 2005
- Use the model to predict the effects of longer EE2 exposures

Acknowledgement

Freshwater Institute
Welcome to the Freshwater Institute



For more questions: ludiwine.clouzot.1@ulaval.ca