

Linking multiple stressors to adverse ecological responses across watersheds



The Kitchener and Waterloo Wastewater Treatment Plants are continuing to undergo major upgrades

Mark R. Servos

CRC in Water Quality Protection, Biology, UW

Wayne Parker

Professor, Civil and Environ. Eng., UW

Paul Craig

Assistant Professor, Biology, UW

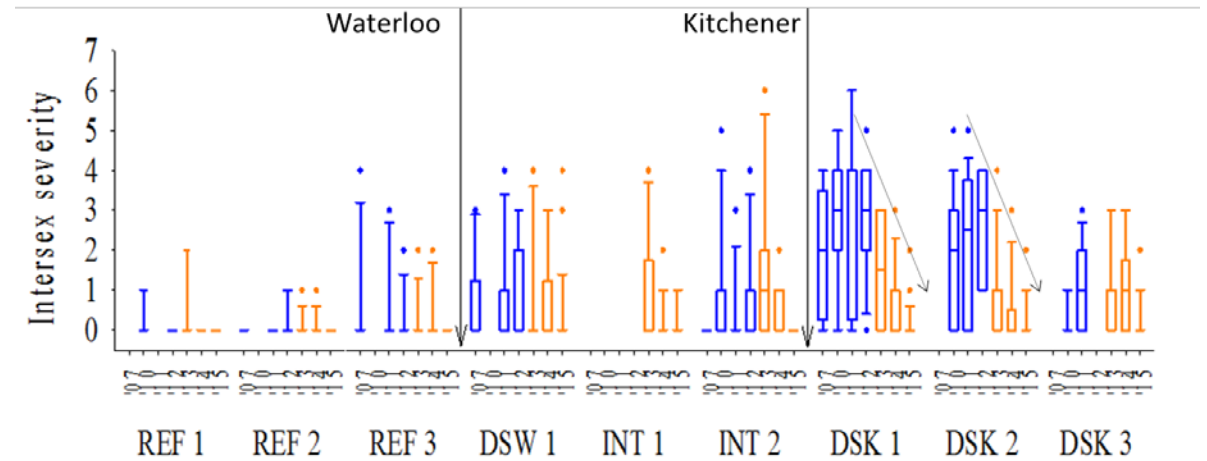
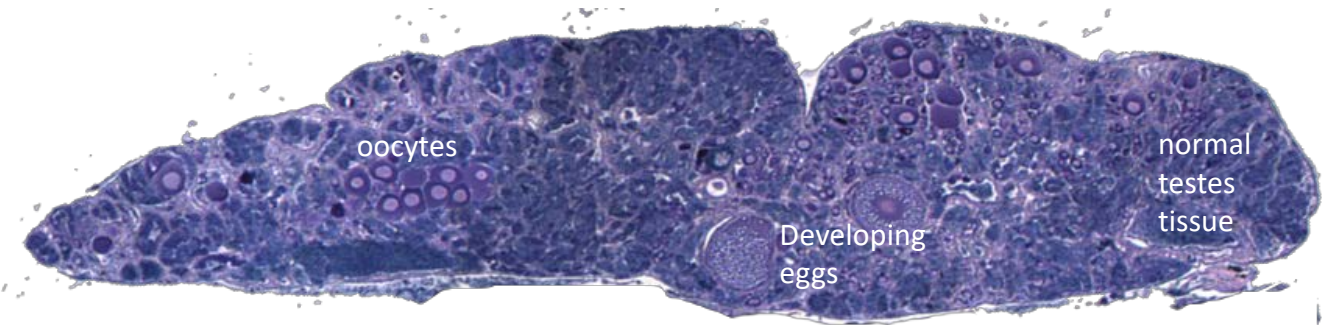


We have followed the environmental chemistry and effects in the Grand River since 2007

*Intersex (eggs in testes tissue) in rainbow darter has been associated with
poorly treated wastewater in the Grand River*



Rainbow Darter

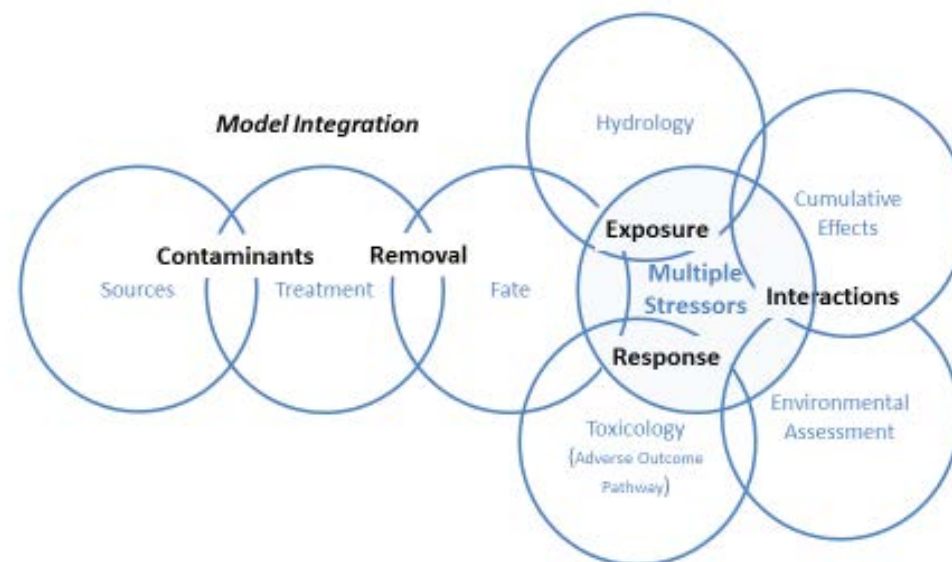


What does the project address?

Developing models to better predict the exposure and effects of cumulative stressors in watersheds

Objectives:

- To build models to describe the sources, treatment, and fate of emerging contaminants to better define exposure under different scenarios (e.g. treatment upgrades).
- To link the exposure predictions to adverse effects on key ecosystem components and biological responses.
- To explore metabolism as a more robust indicator of responses to multiple stressors.
- To better define and predict the interaction contaminants and environmental change (climate, land use, population growth, hydrology etc.).



Progress to date?

The project is based on more than a decade of field studies on wastewater in the Grand River (including upgrades).



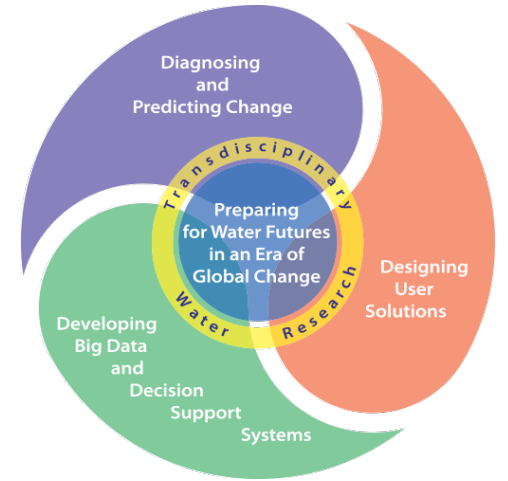
We have initiated development of:

1. A model to predict **inputs** of specific chemicals into treatment plants based on population and usage statistics.
2. A model to predict fate of contaminants during **treatment**
3. A **river** model (based on WASP) to predict spatial distribution of contaminants
4. Simple **effects** model to relate exposure to estrogens and intersex in fish.

Collaborations with other projects?

Potential linkages with other projects related to biodiversity and effects on ecosystems, for example:

- Lake Futures – Enhancing Adaptive Capacity and Resilience of Lakes and their Watersheds; Basu et al. especially the bioassessment components.
- ‘Omic’ and chemical fingerprinting methodologies using ultrahigh-resolution mass spectrometry for geochemistry and healthy waters; Jones et al. conducting assessments in watersheds.
- eDNA Project; Giesy et al.
- Northern Water Futures
- Linking stream network process models to robust data management systems for the purpose of land-use decision support
- Potential for collaboration with fate and sediment transport projects?



Core needs and contributions to the core?

Core:

- Forecasting and Modelling - potential to link models and concepts
- Knowledge Mobilization Team – assistance in structuring and delivery of KM
- Data Team – Management and access to watershed data, hydrology, etc.

Technical:

- Water Quality and Ecotoxicology Technician

Instrumentation:

- High Resolution Mass Spectrometry
- Water quality (especially Grand River)



*We have considerable water quality and biological data for the central Grand River that we can make available.
We also have analytical expertise and capacity in our labs.*

Reporting on key users and KM plan?



PARTNERS

Regional Municipality of Waterloo

City of Guelph

Grand River Conservation Authority

Ontario Ministry of Environment and Climate Change

Ontario Ministry of Natural Resources and Forestry

*Our partners have been very active and collaborative
Supporting a CRD Grant to continue collections*

Path Forward

- Recruiting HQP
- Developing and refining models
- Collecting and collating data to calibrate and test models
- Conducting experiments to test key assumptions and define parameters of the models
- Developing relationships between exposure to stressors and key biological endpoints



Global Water Futures
Solutions to Water Threats in an Era of Global Change