## Towards co-creation: engaging indigenous youth in monitoring stream health

#### Patricia Chow-Fraser Alana Tedeschi McMaster University, Dept of Biology

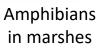
#### Urban-Rural Bio-monitoring and Assessment Network

- Citizen-science, long-term monitoring program
- Focused on wetlands, streams within Hamilton and Burlington region
- 2010-2013: 25-50 volunteers each year (May)
  - 25-30 wetlands and 8 streams

Biomonitoring & Assessment Network

- Volunteers mostly high school students and Mac undergrads and Niagara College diploma students
- 2014: Began a First Nations program for youth of the Saugeen Ojibway Nations in Bruce Peninsula







Marsh birds



Benthic invertebrates

## **Four Major Components**

Recruitment & training Field sampling Laboratory analyses Reporting to community





Biomonitoring &

- Contacted elders in the community and obtained permission from the two band councils
- Obtained permission from science teachers in high schools attended by the FN youth in the Bruce Peninsula
  - Wiarton
  - Lion's Head

#### **Recruitment and Training**



Urban-Rural Biomonitoring &

- Taught students about watersheds and land uses and how runoff from farm land can impact aquatic ecosystems
- Discussed the type of pollutants in runoff

#### **Recruitment and Training**



Urban-Rural Biomonitoring & Assessment Network

- Field Measurements
  - Conductivity
  - pH
  - Temperature
  - Dissolved oxygen
  - Turbidity
- Laboratory Nutrient Analysis
  - Nitrogen
  - Phosphorus
  - Chlorophyll



Mayflies, Stoneflies, Caddisflies

Increasing agriculture

beetle

Worms and midges



#### **Benthic invertebrates as indicators**







- Selected an appropriate watershed
- Signed up interested students to participate in field work
- Returned in May to do the sampling

#### Field sampling in May 2013 and 2014

# Physical characteristics

Benthos sampling

URBAN Urban-Bural Biomonitoring & Assessment Network



**Benthos sorting** 

Taught students how to use specialized equipment Water collection

#### Laboratory analyses at Mac during August



Urban-Rural Biomonitoring & Assessment Network



**Benthos identification** 



Chlorophyll analyses

#### Making sense of the data in workshop



 $\mathbf{RB}$ 

U

Urban-Rural Biomonitoring & Assessment Network









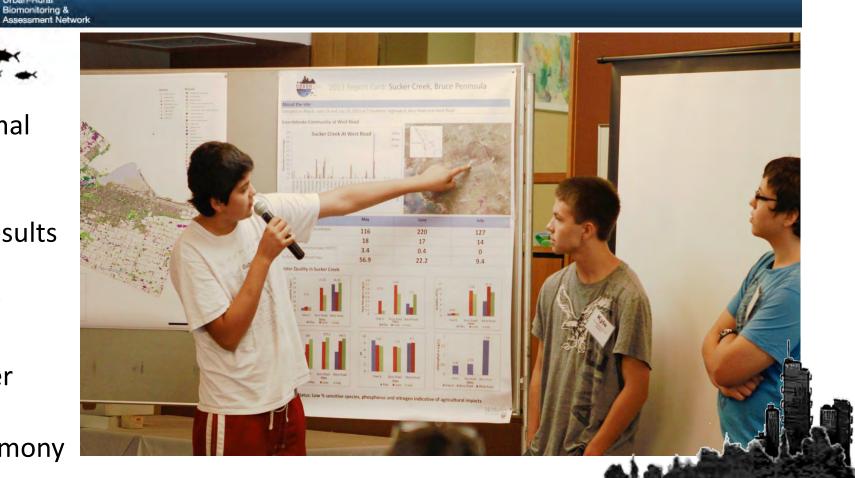


#### **Reporting results to community**

During formal reception, students reported results to elders in community

Urban-Rural

Clan mother conducted Water ceremony



#### Support of elders, family

Family members waited patiently









Really important to have the support of the family and elders

#### Saugeen Ojibway Nation

- **Danielle Price** (Saugeen First Nation)
- Jacob Ritchie (Saugeen First Nation)
- Noah Linklater (Chippewas of Nawash First Nation)
- Theron Solomon (Chippewas of Nawash First Nation)
- Jude McLeod (Chippewas of Nawash First Nation)
- Jessica Pedoniquotte (Chippewas of Nawash First Nation)
- Wade Kewageshig (Saugeen First Nation)

### **Co-creation of Indigenous Water Quality Tools**



Run a stream monitoring program at Six Nations

- Kawenni:io/Gaweni:yo Public School (KGPS) Elementary and Secondary School that offers Gayoghno (Cayuga) and Kanienkehaka (Mohawk) language immersion education for the Six Nations youth
- Run workshop for high school students and allow them to learn how to identify them using an English key; invite them to translate keys to either Cayuga or Mohawk (used to doing translations on other topics)
- Consult with elders and knowledge keepers to include relevant indigenous stories about insects/bugs

#### **Co-creation of Indigenous Water Quality Tools**



Produce a similar chart in Cayuga or Mohawk to be used in their curriculum

I.

Amphipoda (Scuds) Decapoda (Crayfish) Plecoptera (Stoneflies) (True Bugs) Chironomidae Hora and Dear Elice) (Lapidoptera (True Bugs) (Lapidoptera (True Bugs) (Crayfish) (Magaloptera (Truchoptera (Crayfish) (Crayfish) (Magaloptera (Trichoptera (Crayfish) (Crayfish) (Crayfish) (Crayfish) (Crayfish) (Crayfish) (Magaloptera (Crayfish) (Cray	Water Body Name:		Site #:	Replicate #:	Date (mm/dd/yyy	y) and Time:	
Circle Method: (Sub-sampling) Marchant Box / Teaspoon (Location) Field / Lab (Preservation) Live / Preserved (Magnification) Microscope / Unai Coelenterata Turbellaria (Flatworms) (Aquatic Earthworms) (Leeches) (Sow Bugs) (Clams + Muss (Hydras) (Flatworms) (Aquatic Earthworms) (Leeches) (Sow Bugs) (Clams + Muss (Clams + Muss (Clam	Organization:		Department		Address:		
Coelenterata (Hydras)       Turbellaria (Elátworms)       Nematoda (Roundworms)       Oligoskasta (Aquatic Earthworms)       Hirudnea (Leeches)       Isopoda (Sow Bugs)       Bixalvia (Clams + Muss         Amphipoda (Scuds)       Decapoda (Crayfish)       Hydrachnida (Mites)       Ephemeroptera (Mayflies)       Anisopfera (Dragorflies)       Zygoptera (Damselflics)         Plecoptera (Stoneflies)       Hemiptera (True Bugs)       Megaloptera (Fishflies, Alderflies)       Tichoptera (Cadisflies)       Lepidoptera (Aquatic Moths)       Gofcoptera (Beetles)       Gastropoda (Snails, limpts)         Chironomidae (Lucroandare and Dave Flier)       Culicidae (Claicate (Claicate (Chironomidae)       Culicidae (Claicate (Claicate (Claicate (Claicate (Cata)sflies)       Tipulidae (Tipulidae       Simulidae (Simulidae (Simulidae)	Contact:	Phone:	_ Phone: E-mail:		% picked for 100-count		# of vials:
(Hydras)       (Flatworms)       (Aquatic Earthworms)       (Leeches)       (Sow Bugs)       (Clams + Muss)         (Hydras)       (Flatworms)       (Aquatic Earthworms)       (Leeches)       (Sow Bugs)       (Clams + Muss)         (Hydras)       (Flatworms)       (Aquatic Earthworms)       (Leeches)       (Sow Bugs)       (Clams + Muss)         (Amphipoda       Decapoda       (Hydrachnida)       Ephemeroptera       Anisoptera       Zygoptera         (Scuds)       (Crayfish)       (Hydrachnida)       Ephemeroptera       (Mayflies)       (Damselflies)         Plecoptera       Hemiptera       Megaloptera       Trichoptera       Caddisflies)       Gastropoda         (Stoneflies)       (Trike Bugs)       (Clicidae       Clicidae       Clicidae       Tipulidae       Simulidae         (Horonomidae)       (Harono and Done Flico)       Clicidae       Ceratopogonidae       Tipulidae       Simulidae       Miser-Diptera	Circle Method: (Sub-sa	ampling) Marchant Box	/ Teaspoon (Locat	ion) Field / Lab (Pre	eservation) Live / Preser	ved (Magnification)	Microscope / Unaided
Amphipoda (Scuds)       Decapoda (Crayfish)       Hydrachnida (Mites)       Ephemeroptera (Mayflies)       Anispptera (Dragouflies)       Zygoptera (Damsetflies)         Plecoptera (Stoneflies)       Hemiptera (Tribe Bugs)       Megaloptera (Fishflies, Alderflies)       Trichoptera (Caddisflies)       Lepidoptera (Aquatic Moths)       Gastropoda (Beetles)         Chironomidae       Tabanidae       Culicitae       Ceratopogonidae       Tipulidae       Simulidae         Chironomidae       Tabanidae       Culicitae       Ceratopogonidae       Tipulidae       Simulidae       Mise-Diptera							Bivalvia (Clams + Mussels
Amphipoda (Scuds) Decapoda (Grayfish) Hydrachnida (Mites) Ephemeroptera (Mayflies) Anispptera (Dragouffies) Zygoptera (Damselflies) Plecoptera (Stoneflies) Hemiptera (Stoneflies) (True Bugs) (Fishflies, Alderflies) (Caddisflies) (							
Plecopiera Hemiptera Megaloptera Trichoptera Ceratopogonidae Tipulidae Simulidae Mise-Diptera Culicidae Ceratopogonidae Tipulidae Simulidae Mise-Diptera Culicidae Mise-Diptera Culicidae Ceratopogonidae Tipulidae Simulidae Mise-Diptera Culicidae Ceratopogonidae Tipulidae Simulidae Mise-Diptera Culicidae Ceratopogonidae Tipulidae Simulidae Mise-Diptera Culicidae Mise-Diptera Culicidae Ceratopogonidae Tipulidae Simulidae Mise-Diptera Culicidae Ceratopogonidae Tipulidae Simulidae Mise-Diptera Culicidae Ceratopogonidae Tipulidae Simulidae Simulidae Mise-Diptera Culicidae Simulidae Sim			Hydrad	chnida Ephe		Anisoptera	
Plecoptera (Stoneflies) Hemiptera (True Bugs) Megaloptera (Fishflies, Alderflies) Caddisflies) (Caddisflies) Caddisflies) Caddisflies) Caddisflies) Caddisflies) Caddisflies Caddisflie							
Ceratopogonidae Inpundae (Plack Elica) Miscr-Dipte	Plecoptera						Gastropoda (Snails, limpets)
Ceratopogonidae Inpundae (Plack Elica) Misc-Dipte							
	S ) /T						Misc. Diptera (Misc. True Flie
		-			-		

#### Capacity building, sustainable

- Workshop will be fun in fall 2018, and students can sample stream in May 2019
- Water-quality sensors deployed in these streams along with biological (insects and algae) information can be used in report cards to assess stream health
- Students will learn to build their own sensors and deploy them in streams
- Enriched science curriculum for students and teachers; monitoring data for the community



#### **Our Primary Sponsor:**

#### **Other Sponsors:**



URBAN Staff:
Lyndsay Cartright
Maja Cvetkovic
Amanda Fracz
Julia Rutledge
Taylor Warrington

Graduate students:
James Marcaccio
John Paul Leblanc
Dan Weller

Undergrad students:
Nick Luymes
Rebecca Graves