

Ripples of Change: Need for Vigilance

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a place of mind

THE UNIVERSITY OF BRITISH COLUMBIA

PHSA Laboratories

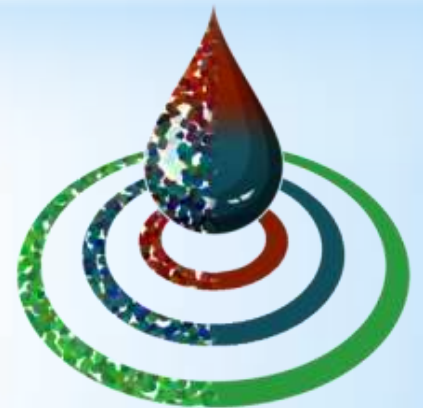
Public Health Microbiology & Reference Laboratory



BC Centre for Disease Control

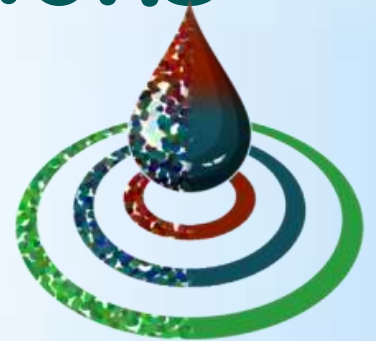
Questions

- ☐ Secure?
- ☐ Threats?
- ☐ Priorities?



Perspective

- ☐ Public health
- ☐ Water quality
- ☐ Waterborne infections



Secure?



- ☐ Depends
- ☐ Assess needs
- ☐ Public health

Threats?



- ❑ **Waterborne infections**
 - ✓ Primary concern (WHO, 2011)
 - ✓ Fecal contamination
 - ✓ All types of pathogens



Threats?

☐ Pathogens change

- ✓ Bacteria important historically
- ✓ New bacteria emerged
- ✓ Parasites came to fore
- ✓ Don't forget viruses



Threats?

☐ Monitored well?

- ✓ Weather
- ✓ Surveillance
- ✓ Testing



Current Test Limitations

“The most significant problems associated with pathogen measurement are the **lag time** involved in testing and... the **large number of false results**... The absence of *E. coli* does not assure the absence of more resistant fecal pathogens...”

*The Honourable Dennis R. O'Connor
Walkerton Inquiry Commissioner*

Current Tests

Filtration of sample then putting filtered membrane on culture media (grow bacteria)



Incubate cultures then cultures examined by lab tech for bacterial growth



Better Tools: Role of Metagenomics

“DNA analysis offers promise for the future”
Walkerton Inquiry Report

We need **better tests**

- ☐ Water quality test: Is fecal pollution present?
- ☐ New markers: Detect all types of microbes?
- ☐ Pollution attribution: Which species is the cause?

Genome Canada Study



Some Current Team Work

UBC

Patrick Tang
Judith Isaac-Renton
Natalie Prystajeky
Jennifer Gardy
Curtis Suttle
Robert Holt
Karen Bakker
Leila Harris
Natalie Henrich
Bev Holmes
Andre Marziali
Robert Brunham

SFU

Fiona Brinkman

Univ. of Sask.

Janet Hill

NRC-PBI

Sean Hemmingsen

McGill University

Bartha Knoppers

Vural Ozdemir

Yann Joly

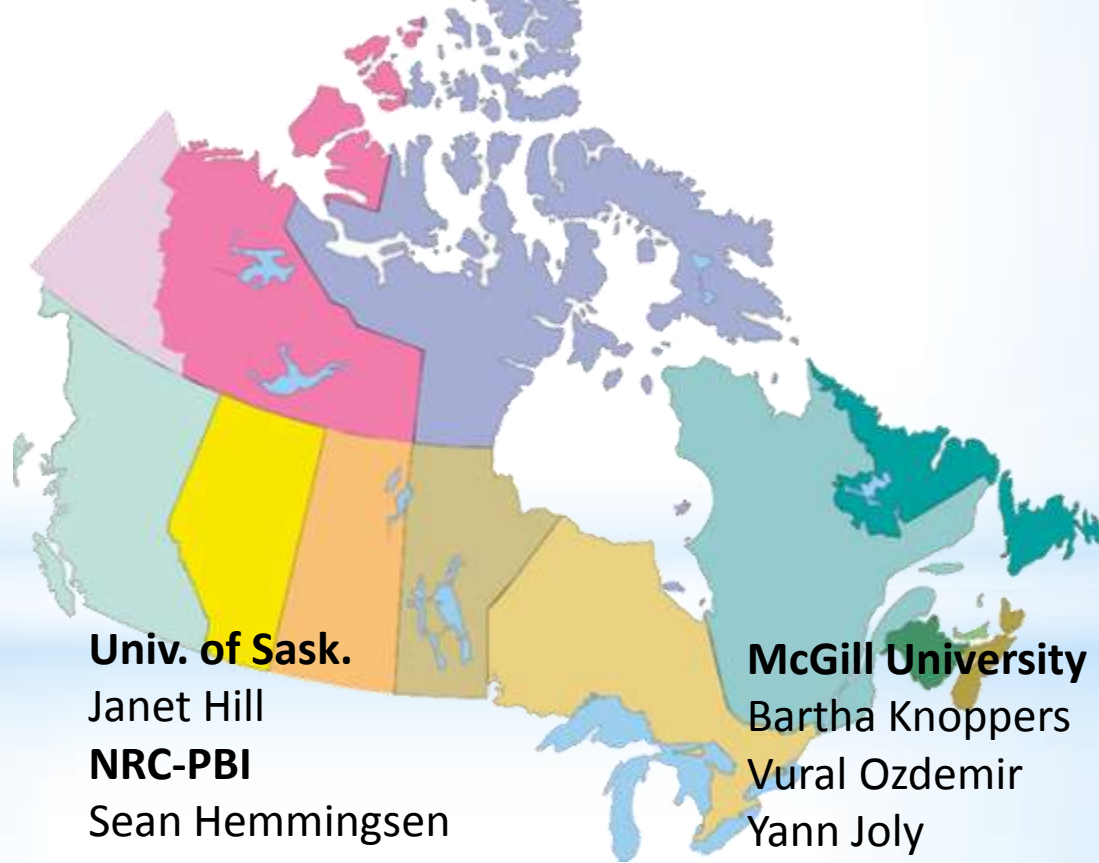
Collaborators

Hans Schreier, UBC

Kyle Garver, DFO

Timothy Lambert, MOH

Paul Hasselback, VIHA



These two things make metagenomics happen



✓ Next-generation DNA sequencers allow millions of pieces of DNA to read from a processed water sample.

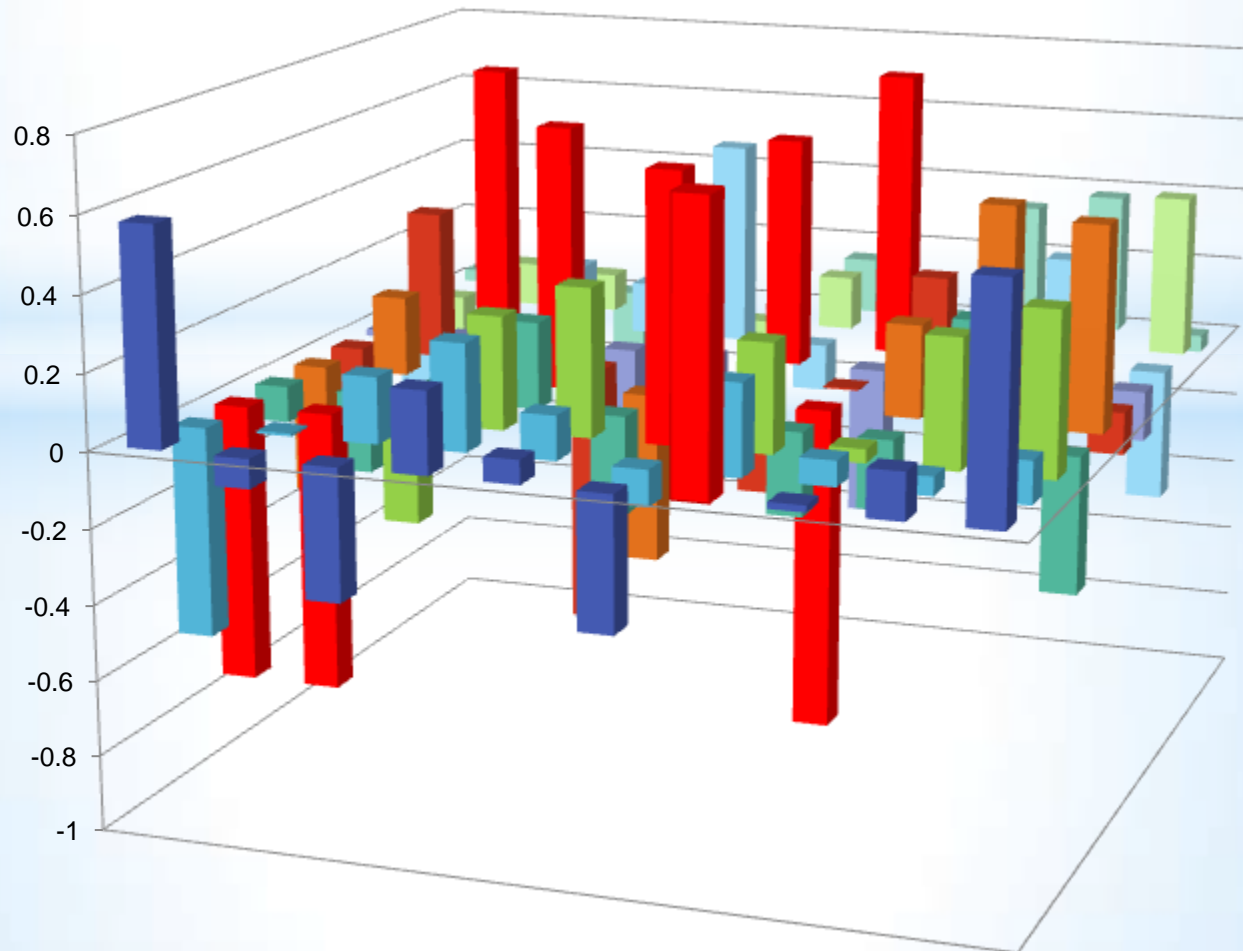


✓ Computational tools compare DNA in a sample and determine what microbes are there.

A detailed map of the Strait of Georgia region in British Columbia, Canada. The map shows the coastline of the strait, with numerous islands and peninsulas. Key locations labeled include Courtenay, Nanaimo, Port Alberni, and various smaller towns and villages. Water bodies like the Salish Sea and Powell Lake are also shown. The text "Will it work? What will we find?" is overlaid in a large, teal, sans-serif font across the center of the map. There are several red location pins on the map, one near Courtenay and another near Bowen Island. Highway markers for 19 and 99 are visible. In the bottom left corner, there is a small logo featuring a stylized globe with a red and blue flame-like shape above it, and the text "Kennedy Lake" below it.

Will it work?
What will we
find?

New Informative Biomarkers



Development of Tests



PCR Test to
Monitor
Microbial
Pollution



PCR Test for
Pollution
Attribution

Prototype kits validated with partners

**Faster, more useful, more cost-effective
monitoring**

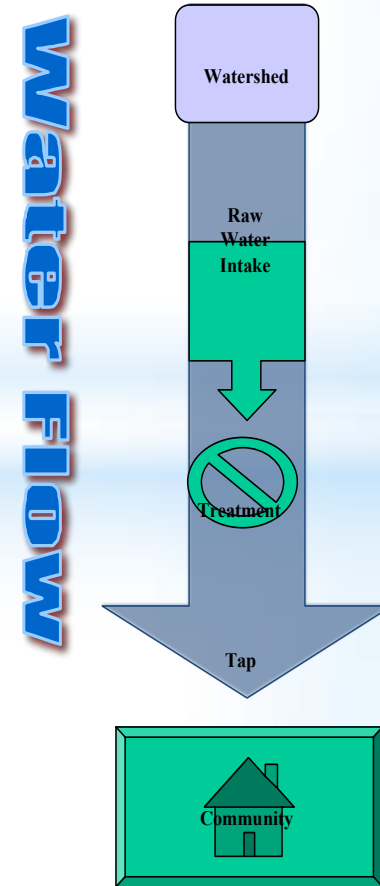
Threats?

- ❑ Framework complex
 - ✓ New model: Quality?
 - ✓ Multi-disciplinary possible?
 - ✓ Risk management focus?

Threats?



At tap

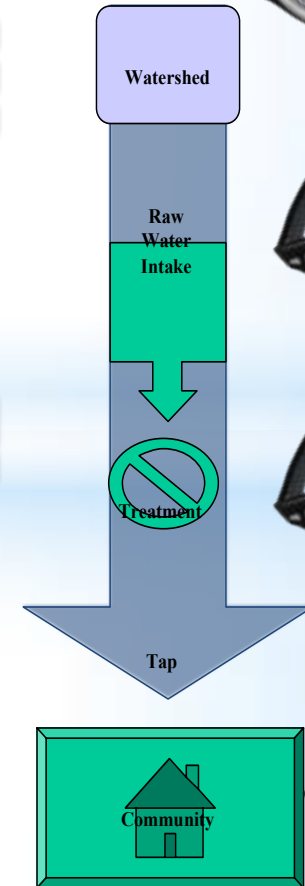


Threats?



Source-to-tap

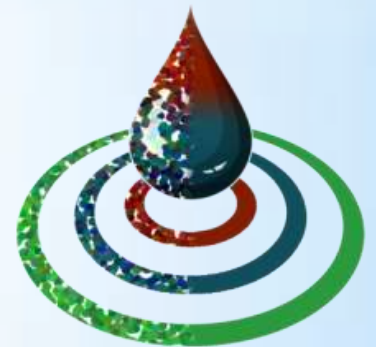
Water Flow



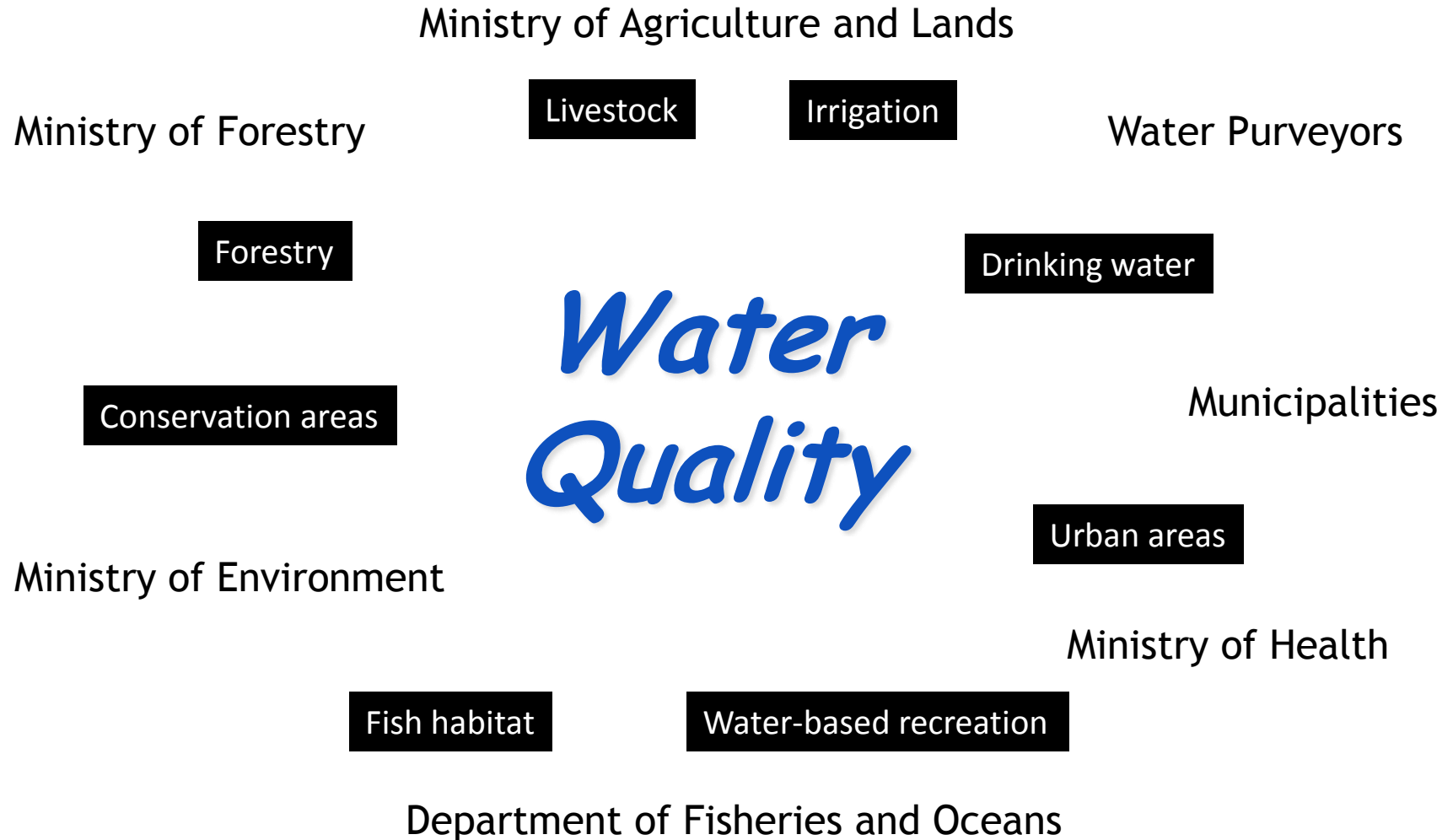
Threats?

“... **source protection** planning must be carried out on an ecologically meaningful scale - that is, at the watershed level.”

*The Honourable Dennis R. O'Connor
Walkerton Inquiry Commissioner*

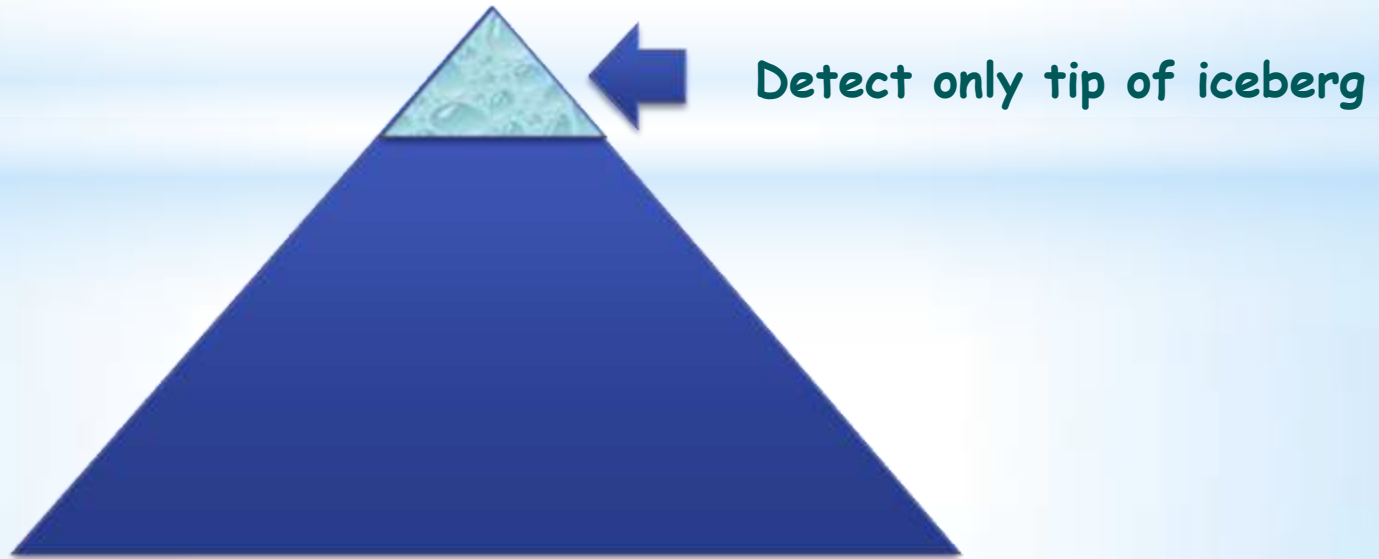


Watershed Stakeholders



Threats?

☐ Surveillance limitations



Threats?

- ☐ Waterborne infections
- ☐ Pathogens rapidly change
- ☐ Limitations of monitoring
- ☐ Focus is at tap
- ☐ Framework complex





Priorities?

- ☐ Immediate, ongoing
- ☐ Recurring themes?

Safe Drinking Water, Steve and Elizabeth Hrudey, IWA 2004

Priorities?

Recurring themes

-  Pathogens pose greatest threat
-  Use multiple barriers
-  Trouble preceded by change
-  Use a risk approach

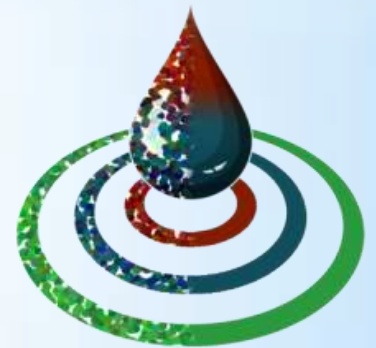
Safe Drinking Water, Steve and Elizabeth Hrudey, IWA 2004

Answers

- ☐ Secure? *Don't know*
- ☐ Threats? *Pollution*
- ☐ Priorities? *Define, improve, involve*

Questions...

Answers?



Applied Metagenomics of the Watershed Microbiome

(Genome Canada)

Phase I:
Metagenomic
Survey of
Watersheds

Phase II: Develop
PCR-Based
Quality and
Attribution Tests

Understanding stakeholder needs
Understanding regulatory framework

