



# The Impact of Norovirus on Baynes Sound

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# Why care about the oyster industry in Baynes Sound?



# What is norovirus

- > 1 million Canadians experience foodborne illness linked to norovirus each year.
- dsRNA virus (49 genotypes with 10 genogroups)
- 10 – 100 virions can cause disease.
- Norovirus can remain infectious in water for several months.
- Oysters are filter feeders.
- Known reservoirs are humans and oysters.



British Columbia

## **2 B.C. oyster farms closed after norovirus outbreak**

40 cases of gastrointestinal disease linked to eating the shellfish raw

CBC News · Posted: Apr 09, 2018 10:30 AM PT | Last Updated: April 9, 2018





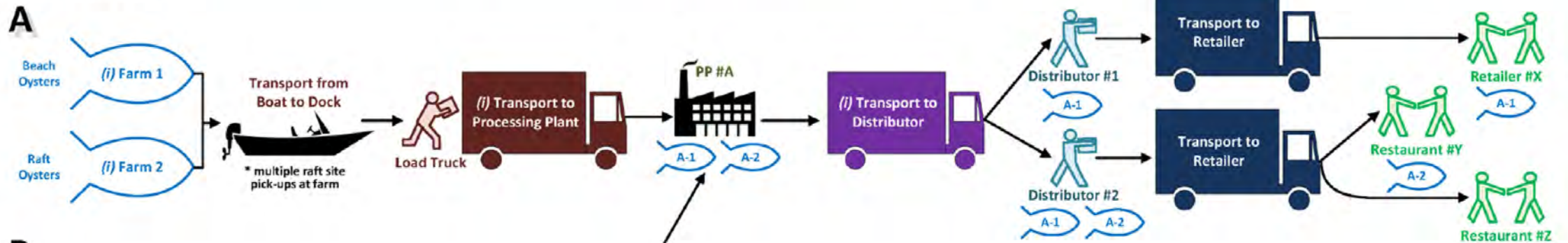
# Where to intervene?

Canadian Shellfish Sanitation Program (CFIA, DFO, ECCC) are responsible for sanitary control of the shellfish industry.

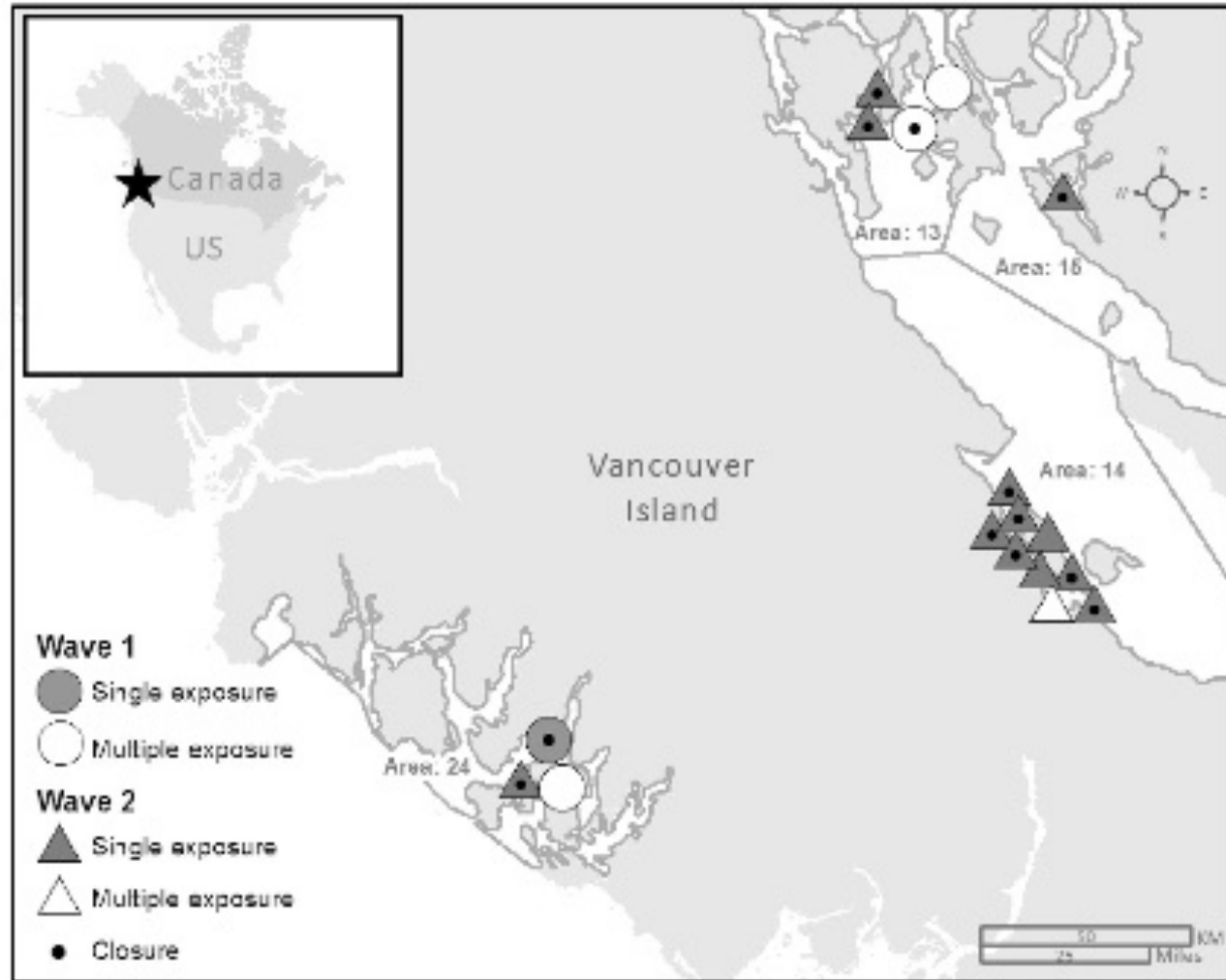
## From Shellfish Farm to Retail – examples of shellfish distribution in BC



### Scenario:



# 2016/17 Norovirus Outbreak



Food and Environmental Virology (2018) 11:130–143  
<https://doi.org/10.1016/j.fev.2018.09.004>

ORIGINAL PAPER

## Outbreaks of Norovirus and Acute Gastroenteritis Associated with British Columbia Oysters, 2016–2017

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### Abstract

Two outbreaks of norovirus and acute gastroenteritis took place in Canada between November 2016 and April 2017. Both outbreaks were linked to oysters from British Columbia (BC) coastal waters. This paper describes the public health investigations to identify the source and control the outbreak. Public health officials conducted interviews to determine case exposures. Tracerback was conducted by collecting oyster tags from restaurants and analyzing them to determine the most common farms. Oyster samples were collected from case homes, restaurants, and harvest sites and tested for the presence of norovirus. Potential environmental pollution sources were investigated to identify the source of the outbreak. Four hundred and 49 cases were identified as part of the two outbreak waves. The oysters were traced to various geographically dispersed farms in BC coastal waters. Twelve farms were closed as a result of the investigations. No environmental pollution sources could be identified as the cause of the outbreak. Similarities in the timeline, genotype, and geographic distribution of identified oyster farms indicate that they may have been one continuous event. Genotype data indicate that human sewage contamination was the likely cause of the outbreak, although no pollution source was identified.

# Environmental transmission of norovirus oysters

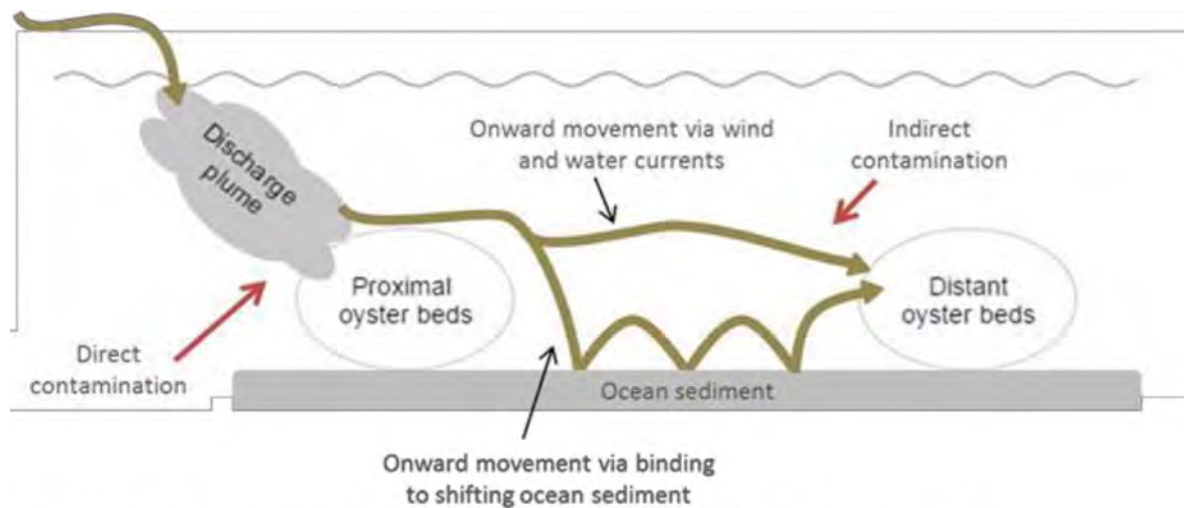


Figure 3. Theoretical transmission routes of norovirus to oyster beds in the marine environment.

## BCCDC 2018 Summary Working Group Report of the Environmental Transmission of Norovirus into Oysters

Risk Analysis Vol. 8, No. 10 2017

DOI: 10.1111/risa.12703

### Risk Assessment of Norovirus Illness from Consumption of Raw Oysters in the United States and in Canada

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Human norovirus (NoV) is the leading cause of foodborne illness in the United States and Canada. Bivalve molluscan shellfish is one commodity commonly identified as being a vector of NoV. Bivalve molluscan shellfish are grown in waters that may be affected by contamination events, tend to bioaccumulate viruses, and are frequently eaten raw. In an effort to better assess the elements that contribute to potential risk of NoV infection and illness from consumption of bivalve molluscan shellfish, the U.S. Department of Health and Human Services/Food and Drug Administration (FDA), Health Canada (HC), the Canadian Food Inspection Agency (CFIA), and Environment and Climate Change Canada (ECCC) collaborated to conduct a quantitative risk assessment for NoV in bivalve molluscan shellfish, notably oysters. This study describes the model and scenarios developed and results obtained to assess the risk of NoV infection and illness from consumption of raw oysters harvested from a quasi-steady-state situation. Among the many factors that influence the risk of NoV illness for raw oyster consumers, the concentrations of NoV in the influent (raw untreated) and effluent (treated) of wastewater treatment plants (WWTP) were identified to be the most important. Thus, mitigation and control strategies that limit the influence from human waste (WWTP outfalls) in oyster growing areas have a major influence on the risk of illness from consumption of those oysters.

**KEY WORDS:** Food safety; microbial risk assessment; Monte Carlo model; norovirus; shellfish

 CBC

Sign In

COVID-19

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British Columbia

### Ocean currents may have spread norovirus to B.C. oysters

Outbreak of the disease forced closure of 13 farms

The Canadian Press · Posted: Jun 30, 2017 6:45 AM PT | Last Updated: June 30, 2017



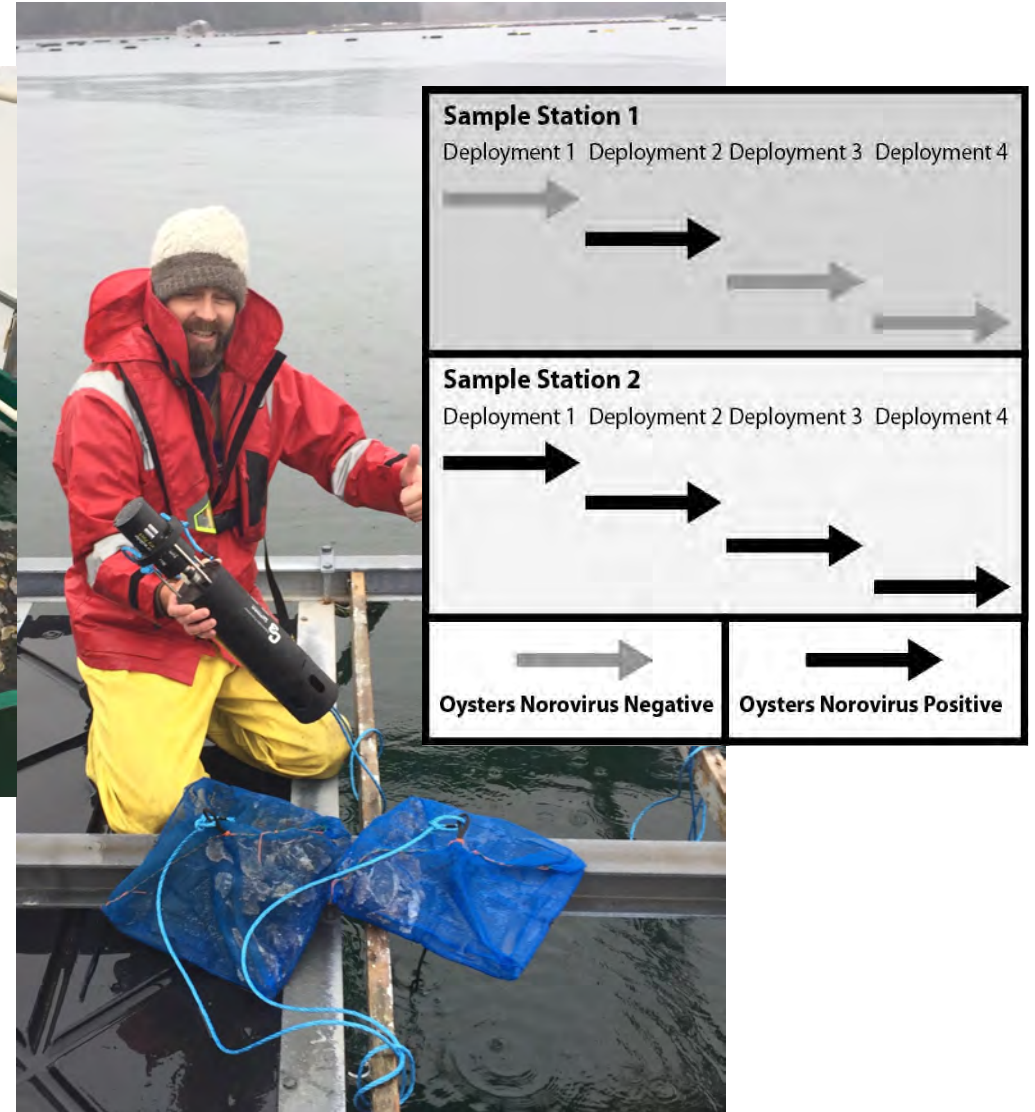


# What is the source of norovirus in Baynes Sound





# Understand environmental transmission of norovirus in the marine environment





# 2020/21 survey results

Table: Clusters of GII HuNoV detected in the fjord between November 2<sup>nd</sup> 2020 to March 8<sup>th</sup> 2021 using the Bernoulli model available in SaTScan v9.6.1.

Cluster	Sites	RT-PCR Confirm.	Cluster Size (km)	Time Frame	OvE	p-value
A	NV1 to NV5	GII.17	15.37	Jan 11 to Feb 8, 2021	4.17	0.029
B	NV7 to NV11	-ve	3.82	Jan 11 to Feb 8, 2021	5.63	0.000

**Note: SatScan model clusters up to 50% of sites.**

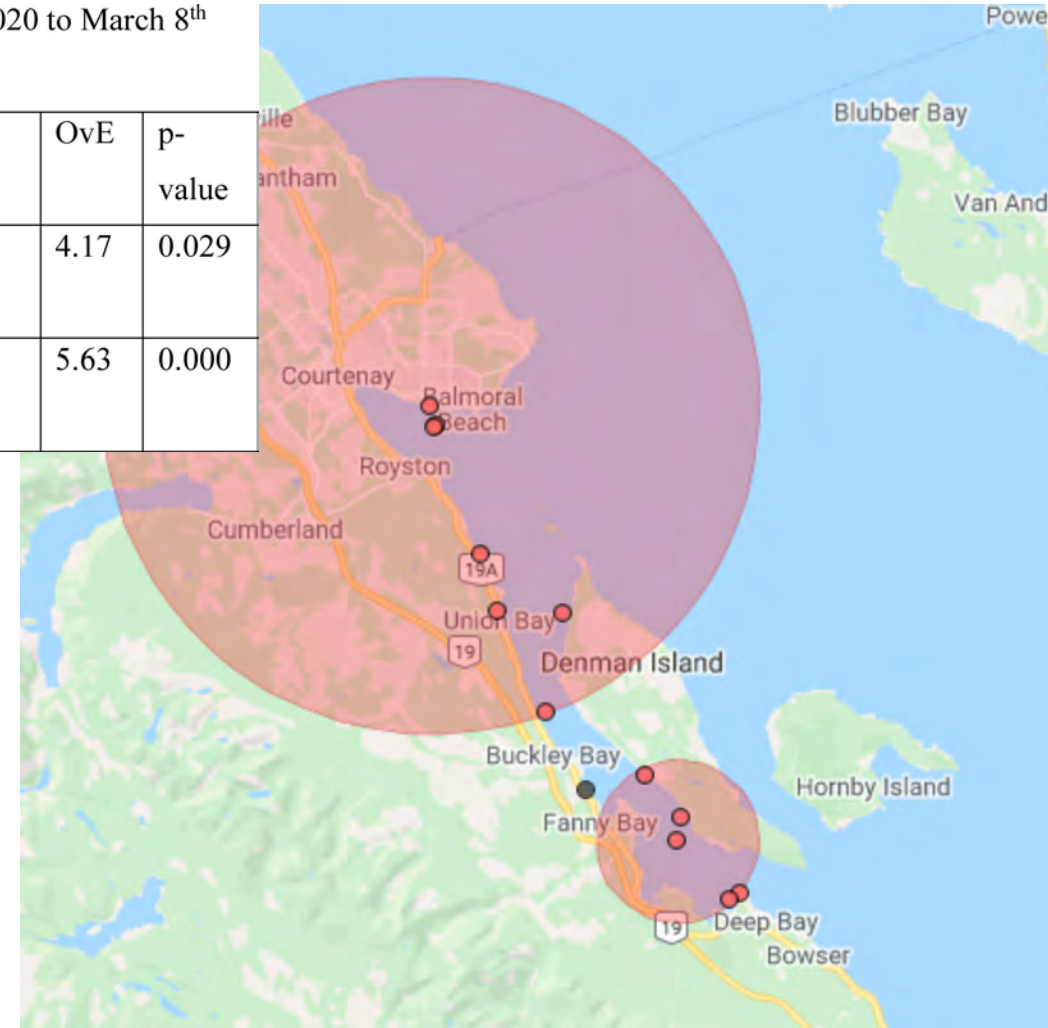
**Estimated Prevalence (entire study) = 0.005 %.**

**Maximum Prevalence = ~20 %.**

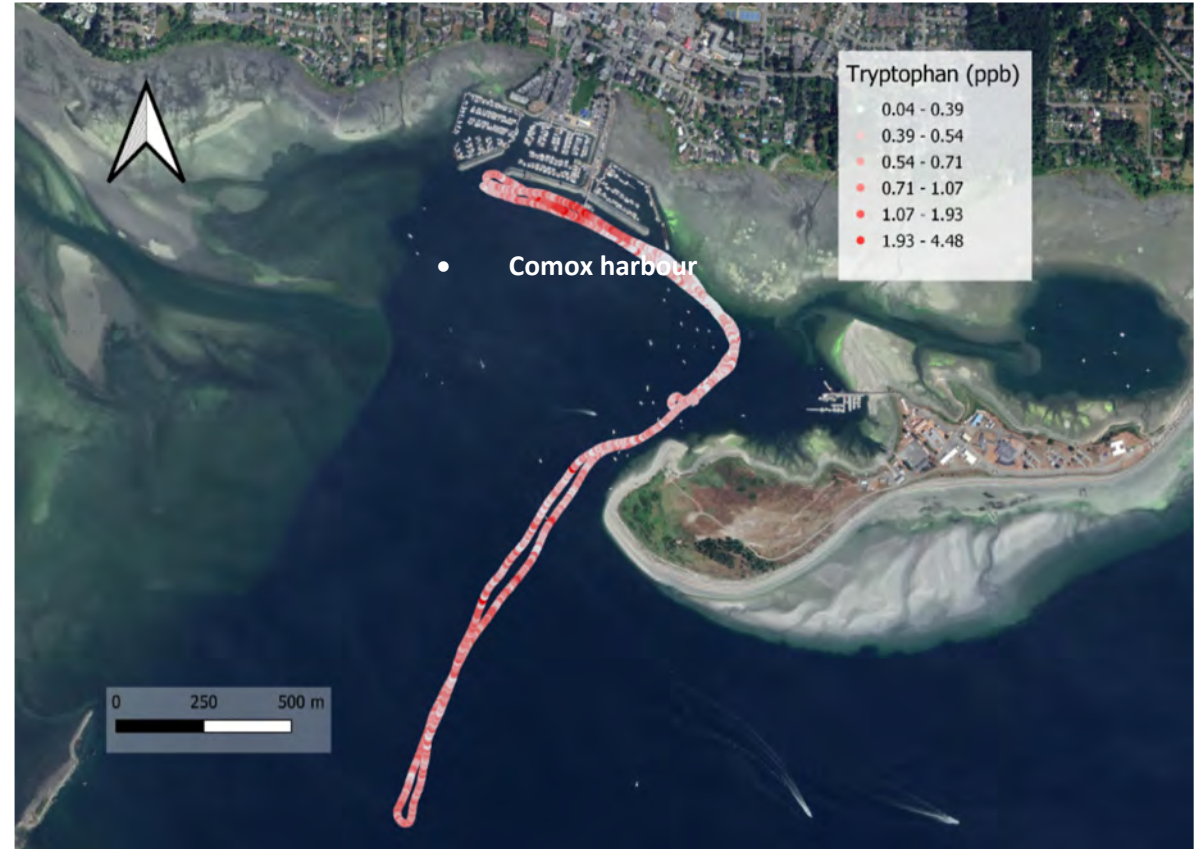
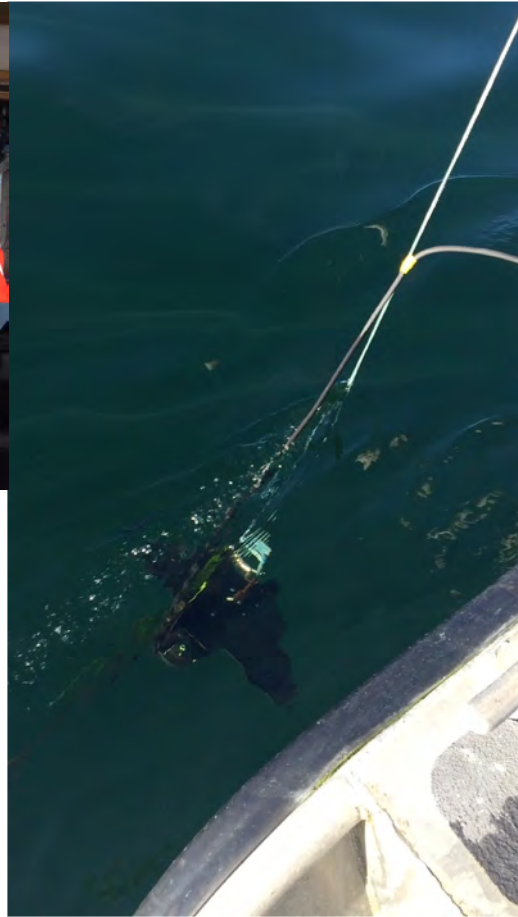
**Norovirus GI positive pools = 0 %.**

**Norovirus GII positive pools = 2.6 %**

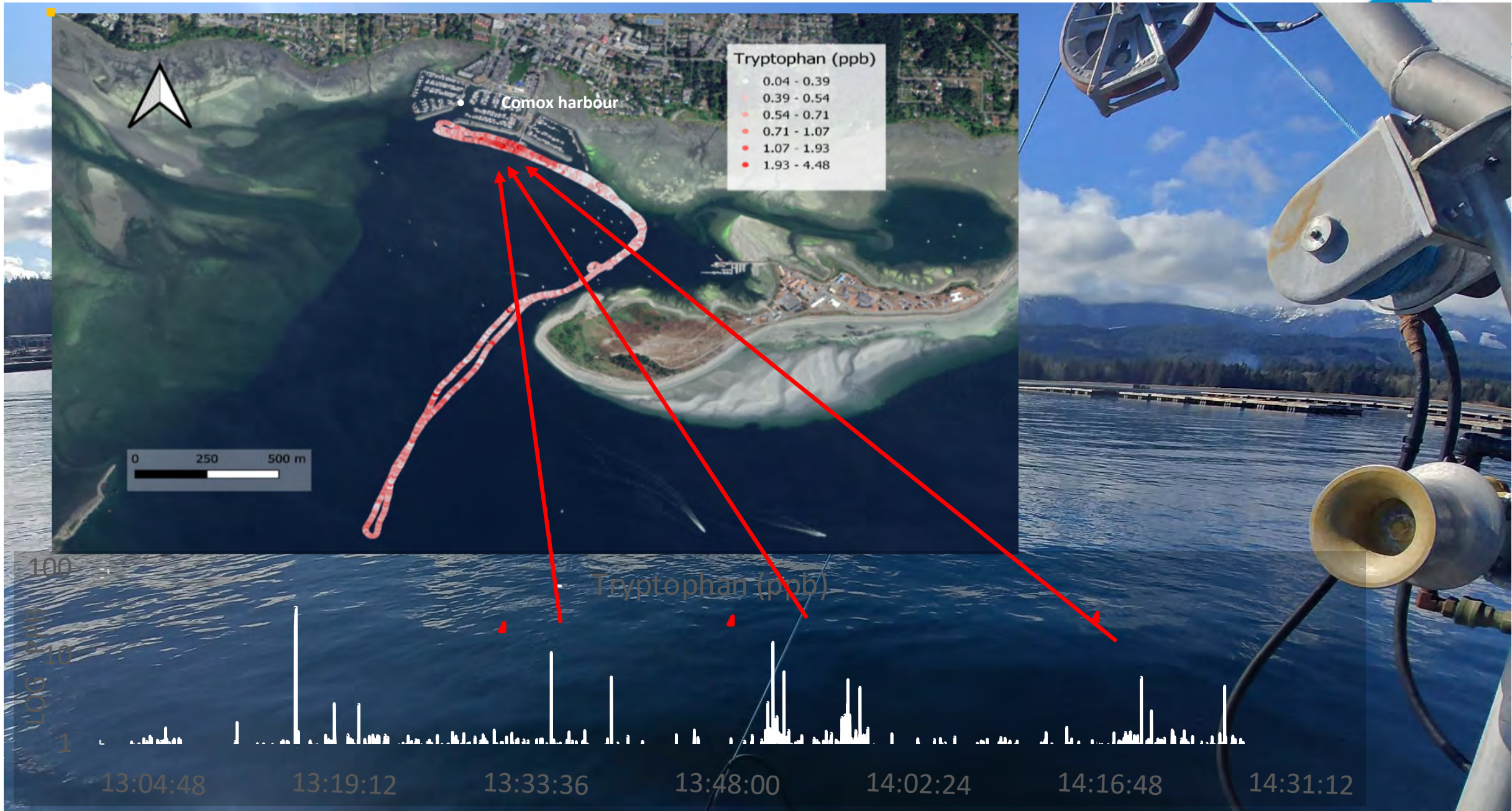
**Inconclusive pools = 12.4 %**



# Wastewater mapping

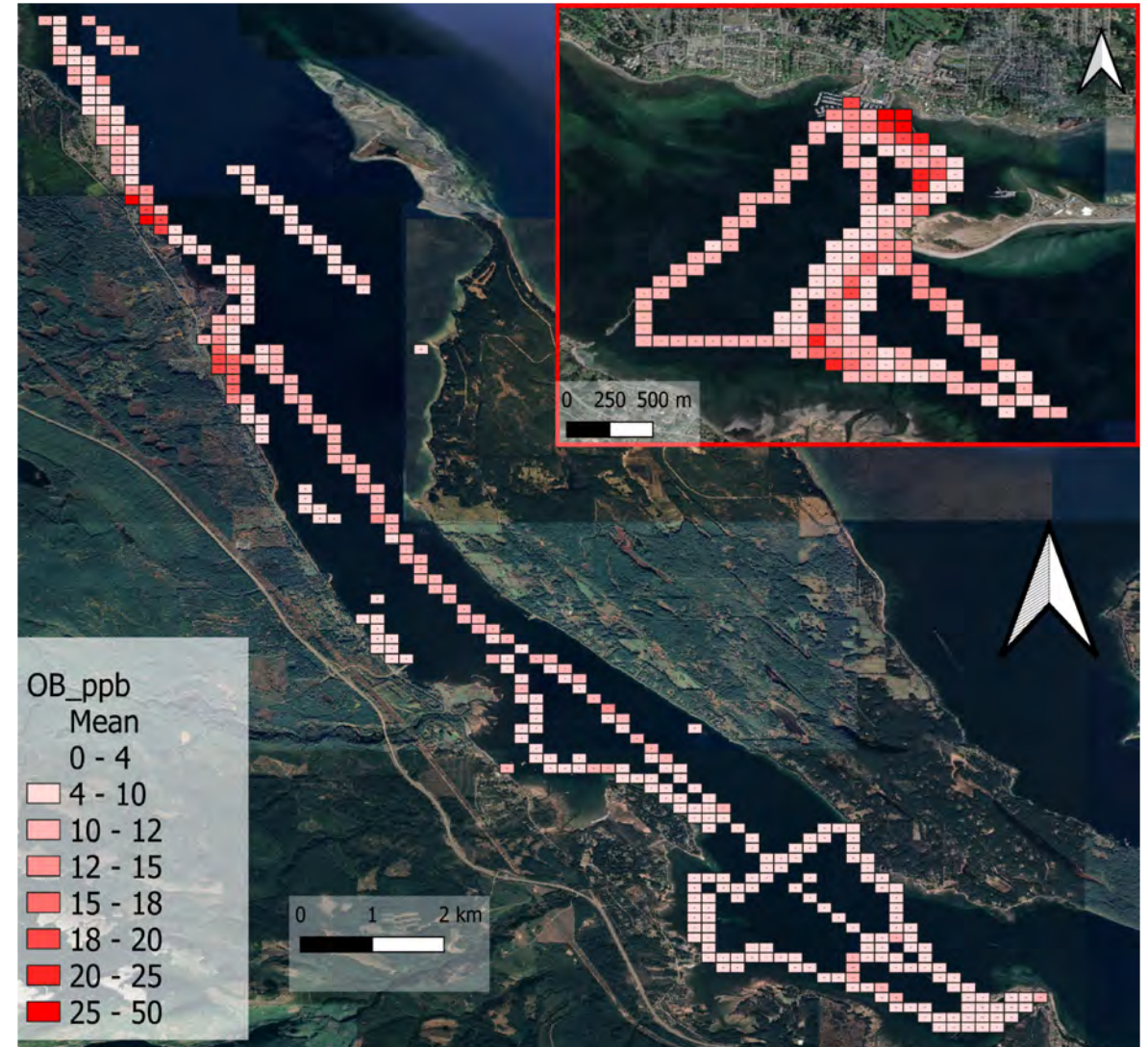
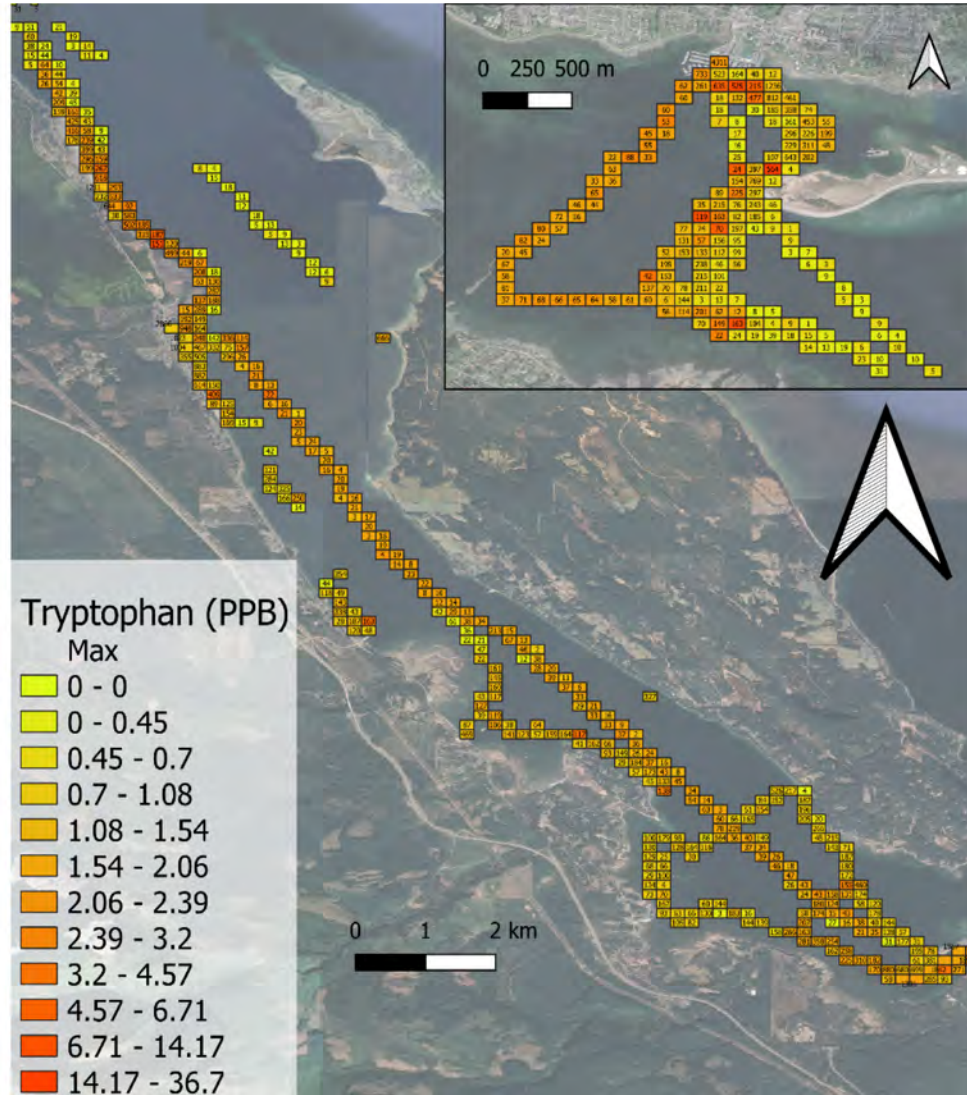




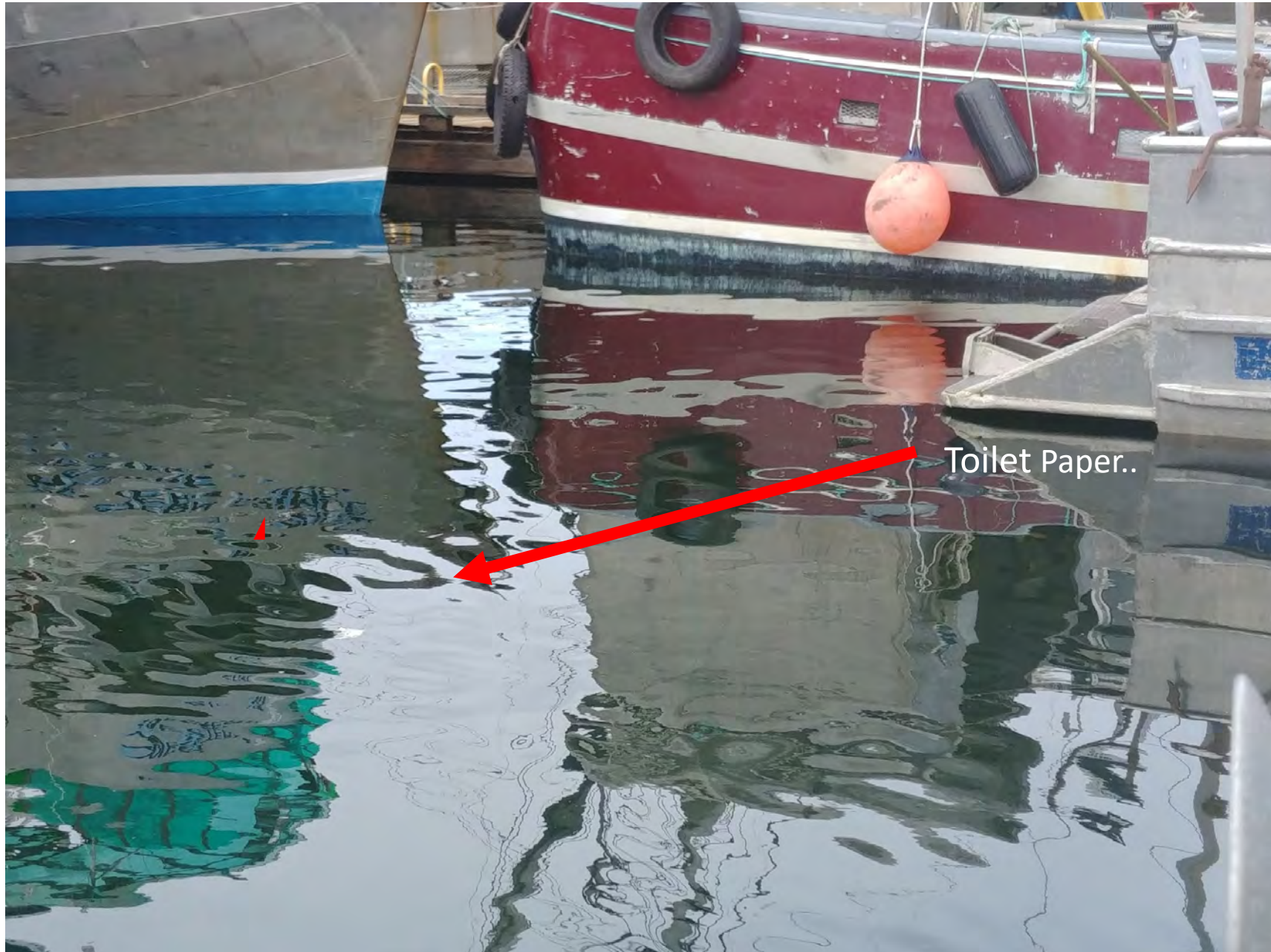




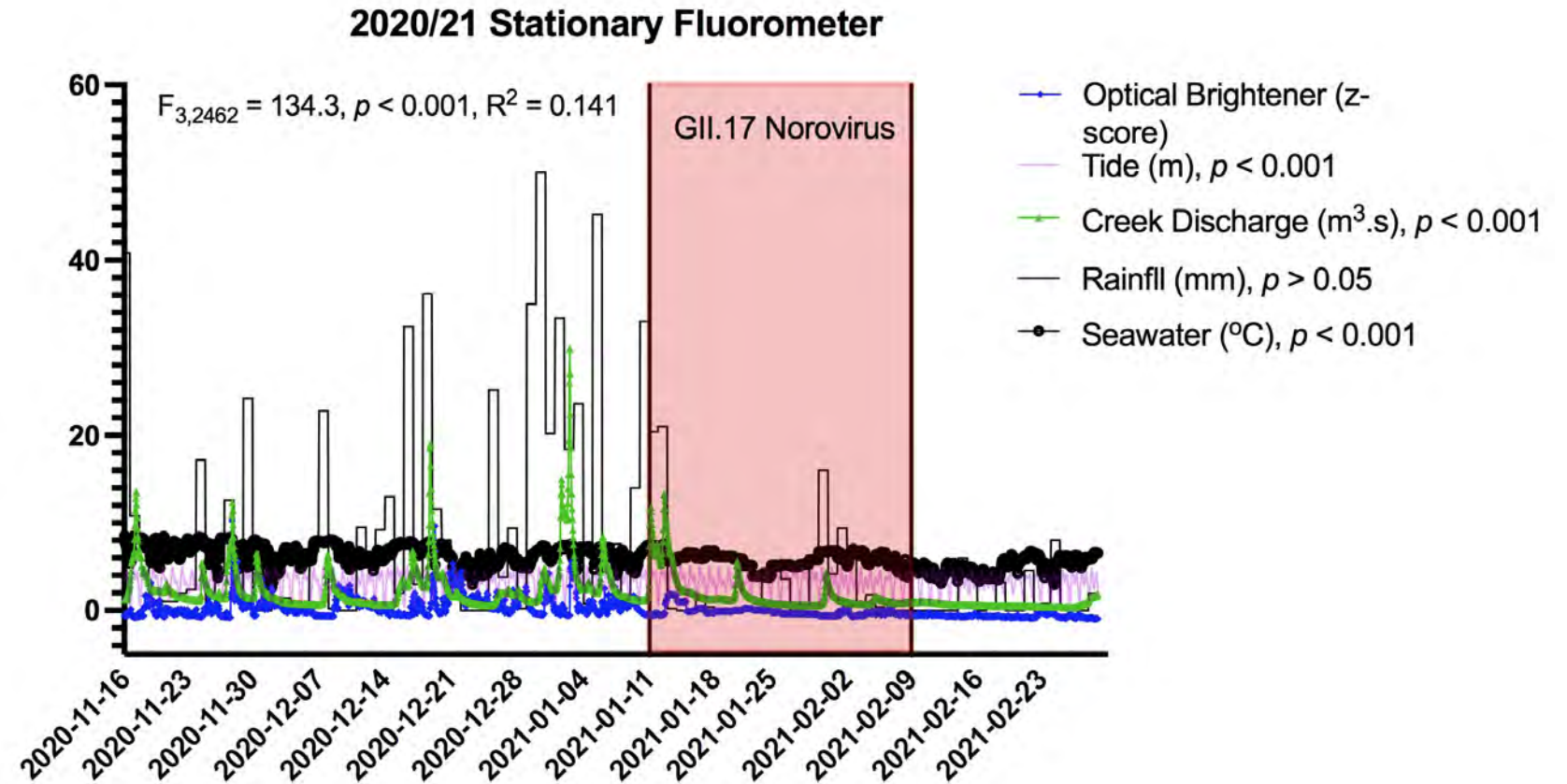
# Wastewater mapping







# Early Warning System





# Next steps.....

Upgrading sewage infrastructure will take at least a decade:

1. Active surveillance (\$\$\$\$\$).
2. Public education campaign.... Impact to BC Shellfish Brand.
3. Other approaches (I'm listening).

