

# Observing Canada's Pacific Coastal Ocean: Coastal Ocean: Networks, programs and pathways to operationalization

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AP-NPCOOS

Advisory Panel on North Pacific Coastal Ocean  
Observing Systems



# Operational Observing in Coastal Oceans

## Sectors Served

(sample from Journal of Operational Oceanography)

- Numerical Weather Prediction
- Safe and Efficient Marine Operations
- Ocean and Climate Forecasting
- Eutrophication
- Coastal Flooding
- Reducing Public Health Risks
- Protecting and Restoring Ecosystem Health
- Controlling and Mitigating Natural Hazards

Required frequency of observations

High-frequency, real-time  Occasional surveys

# Conclusion

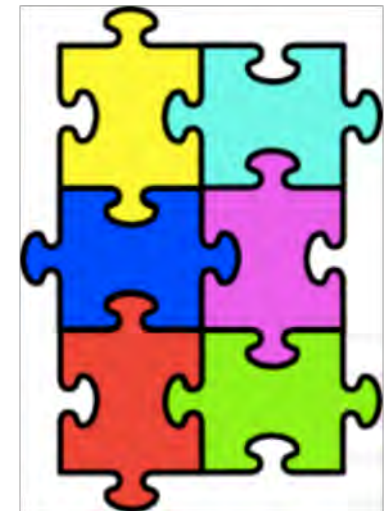
- Observing system components = many, varied
- Coverage = reasonable in many areas
- Functional integration = few success stories



Regional scale  
observing system  
components

## Barriers to implementation

- Data access
- Societal need
- Development of community of practice
- Appropriate scale questions
- Resources for sustained & comprehensive use of all data



Functional regional  
scale observing  
system



# Observing Canada's Pacific Coastal Ocean:

## Networks, programs and pathways to operationalization *...an unfinished journey*

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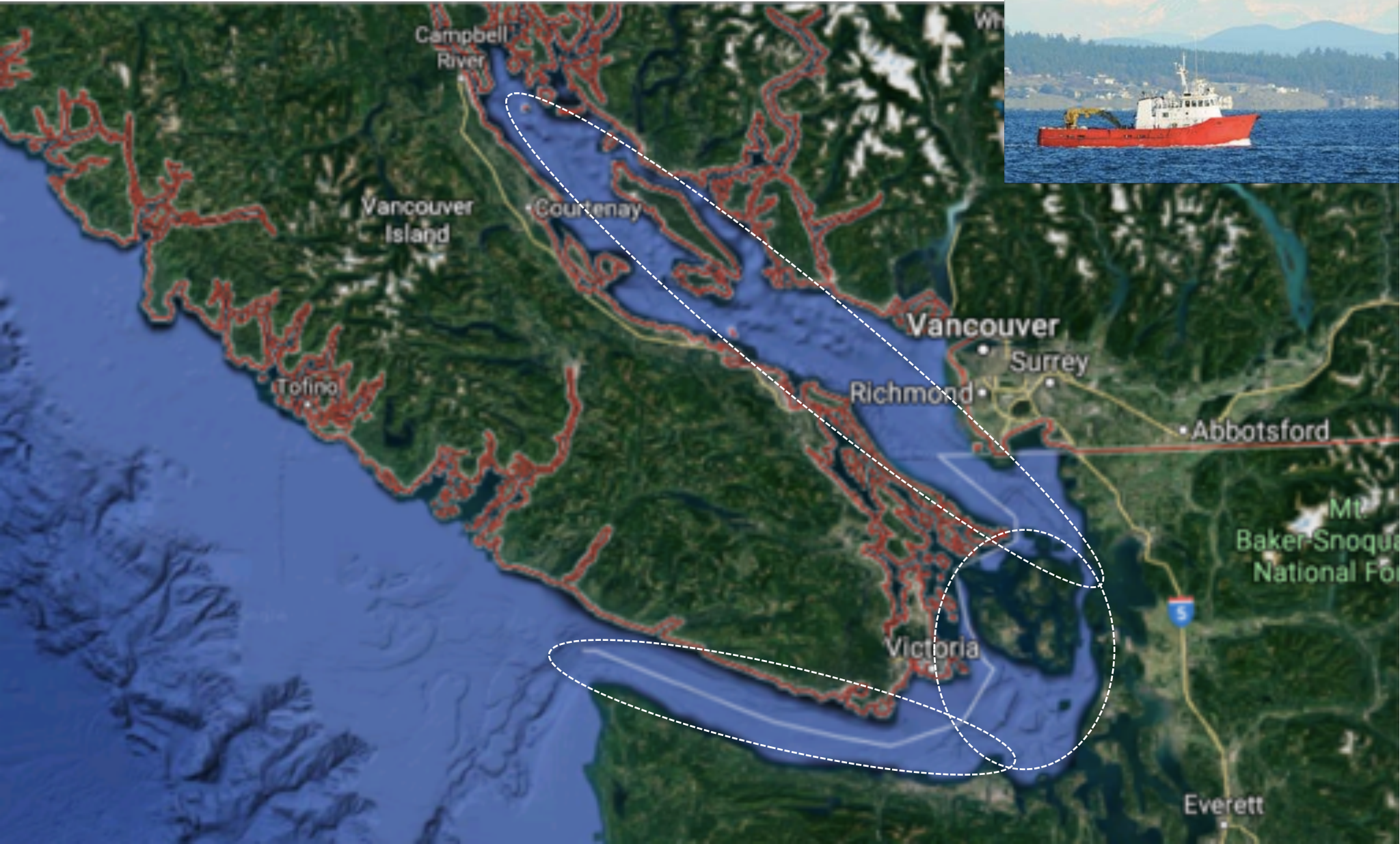
# Canada's Pacific Coast Regions



1. Salish Sea
2. Northern Shelf
3. West Coast Vancouver Island
4. Fjords and coastal inlets

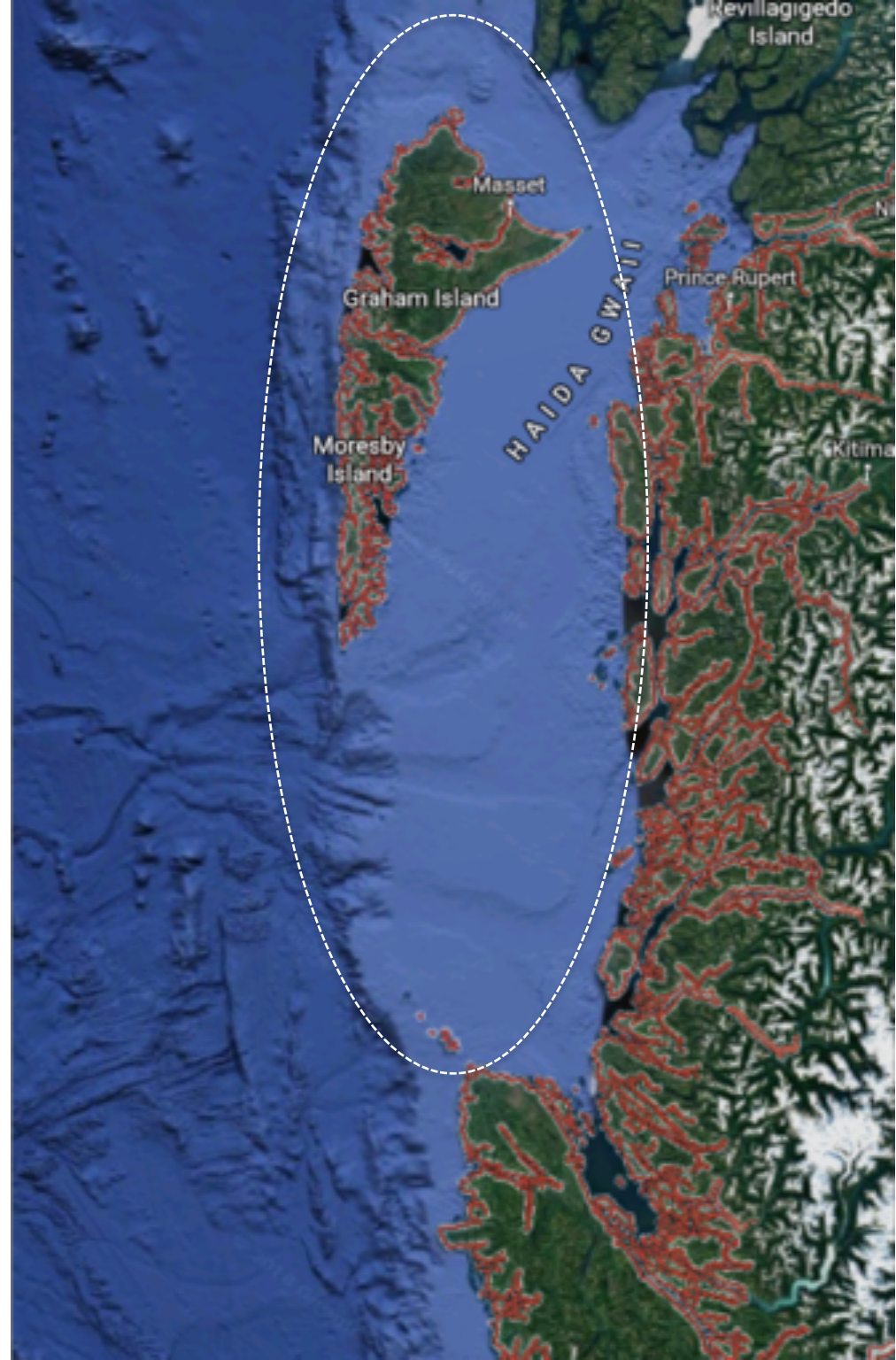


# Salish Sea



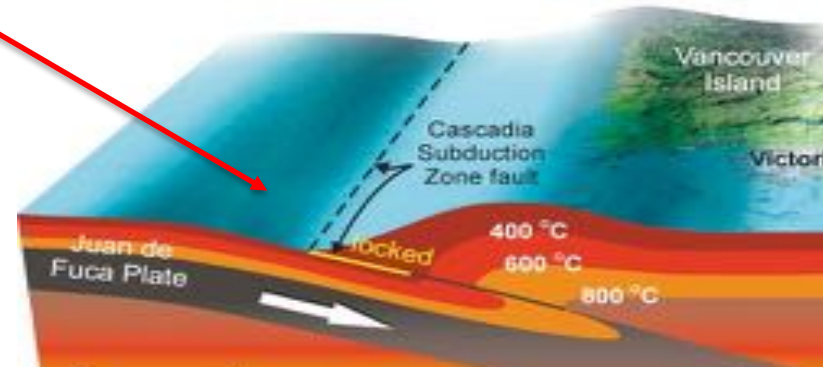
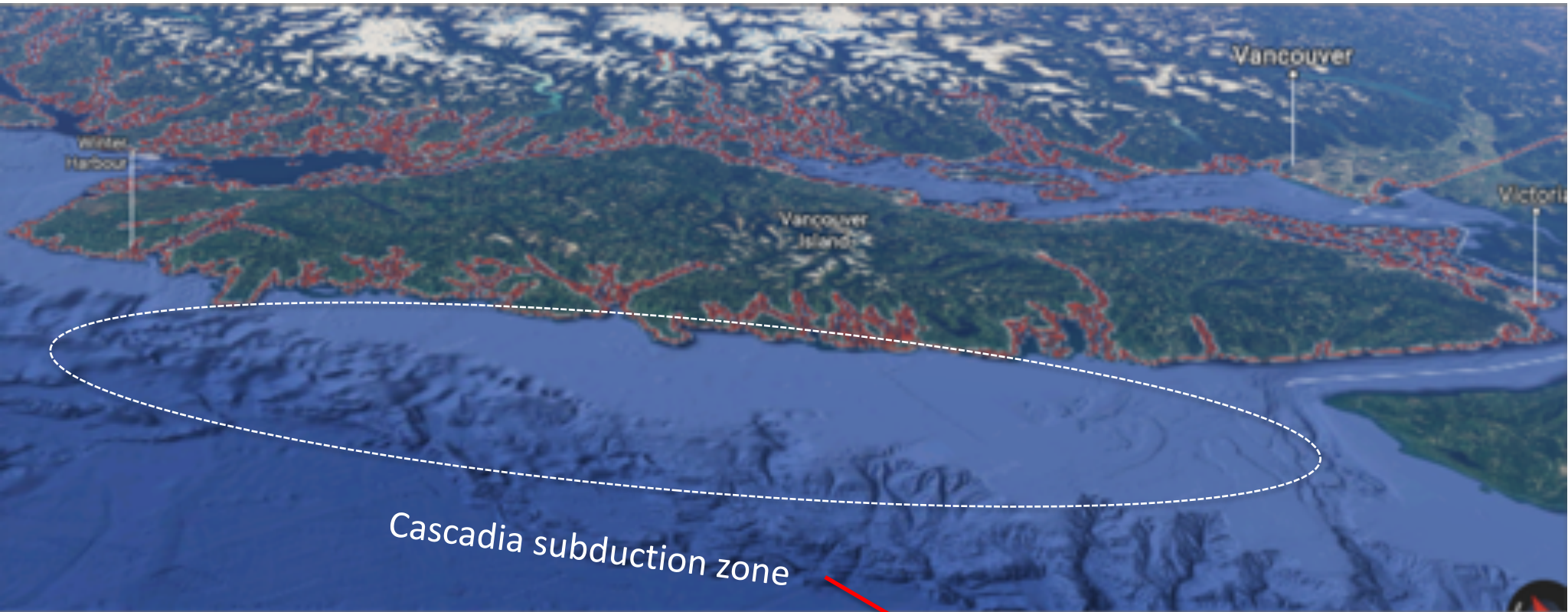


# Northern Shelf



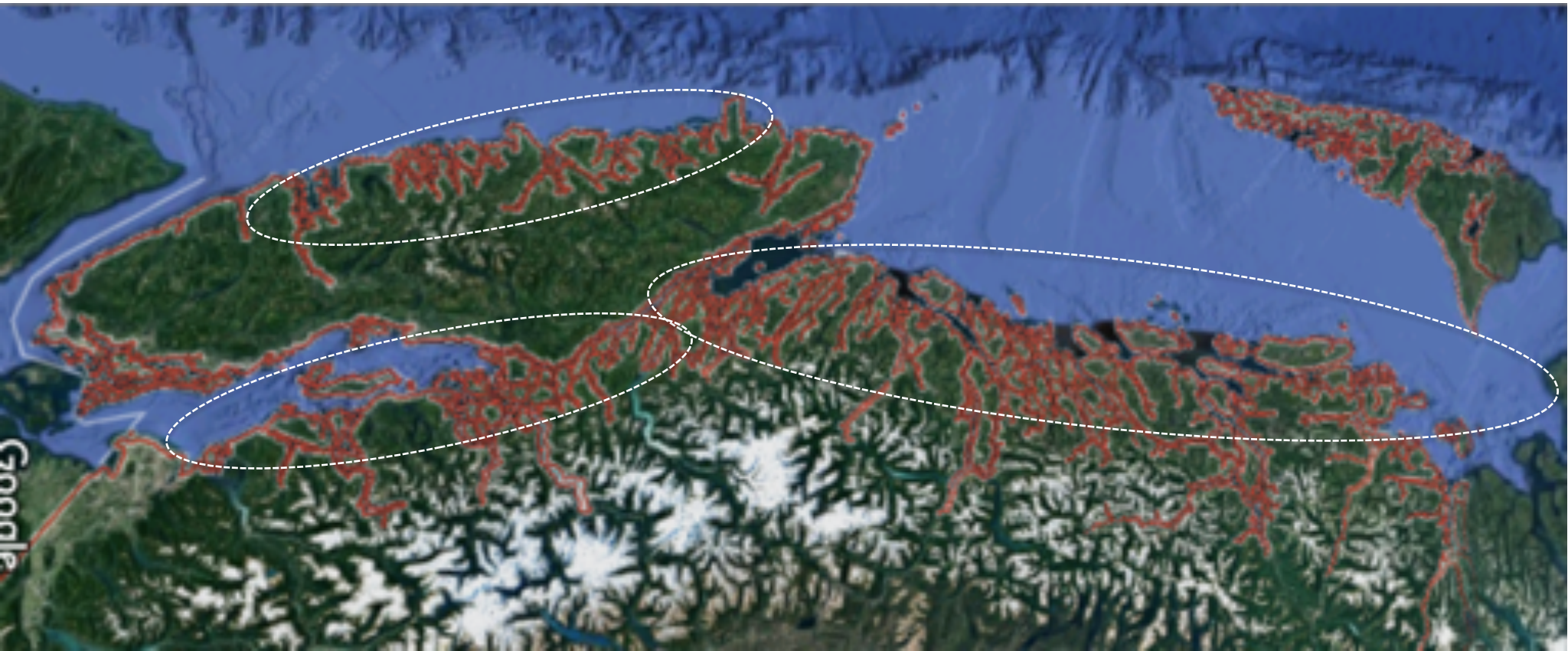


# West Coast Vancouver Island





# Fjords & Coastal Inlets

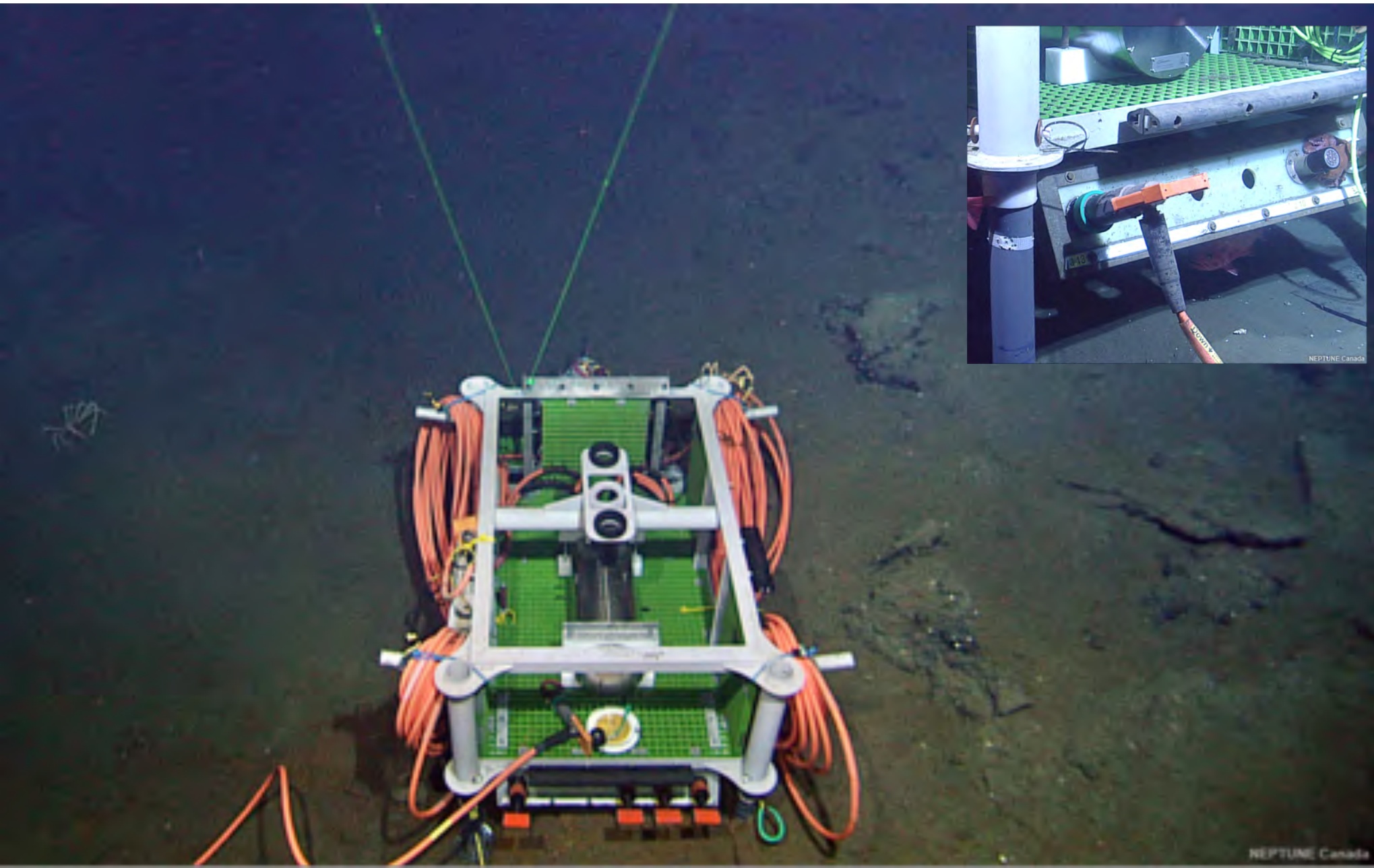


# Coastal Ocean Monitoring Programs and Infrastructure

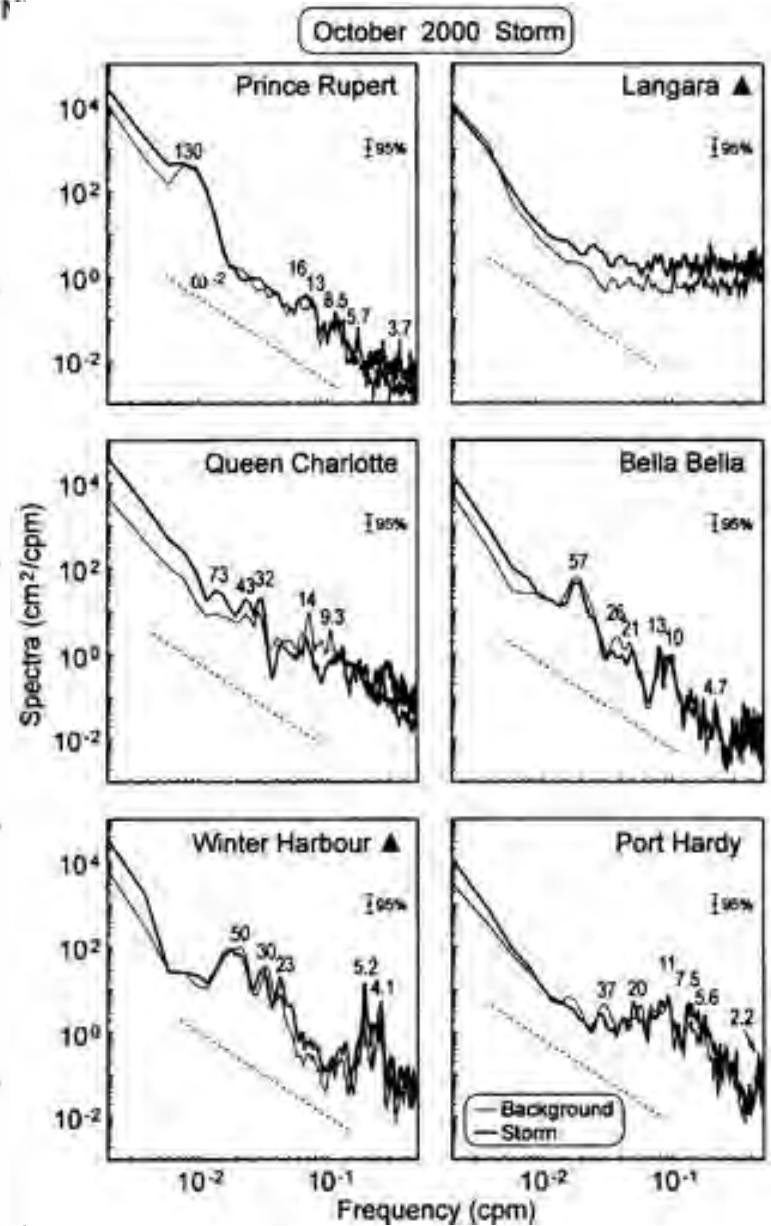
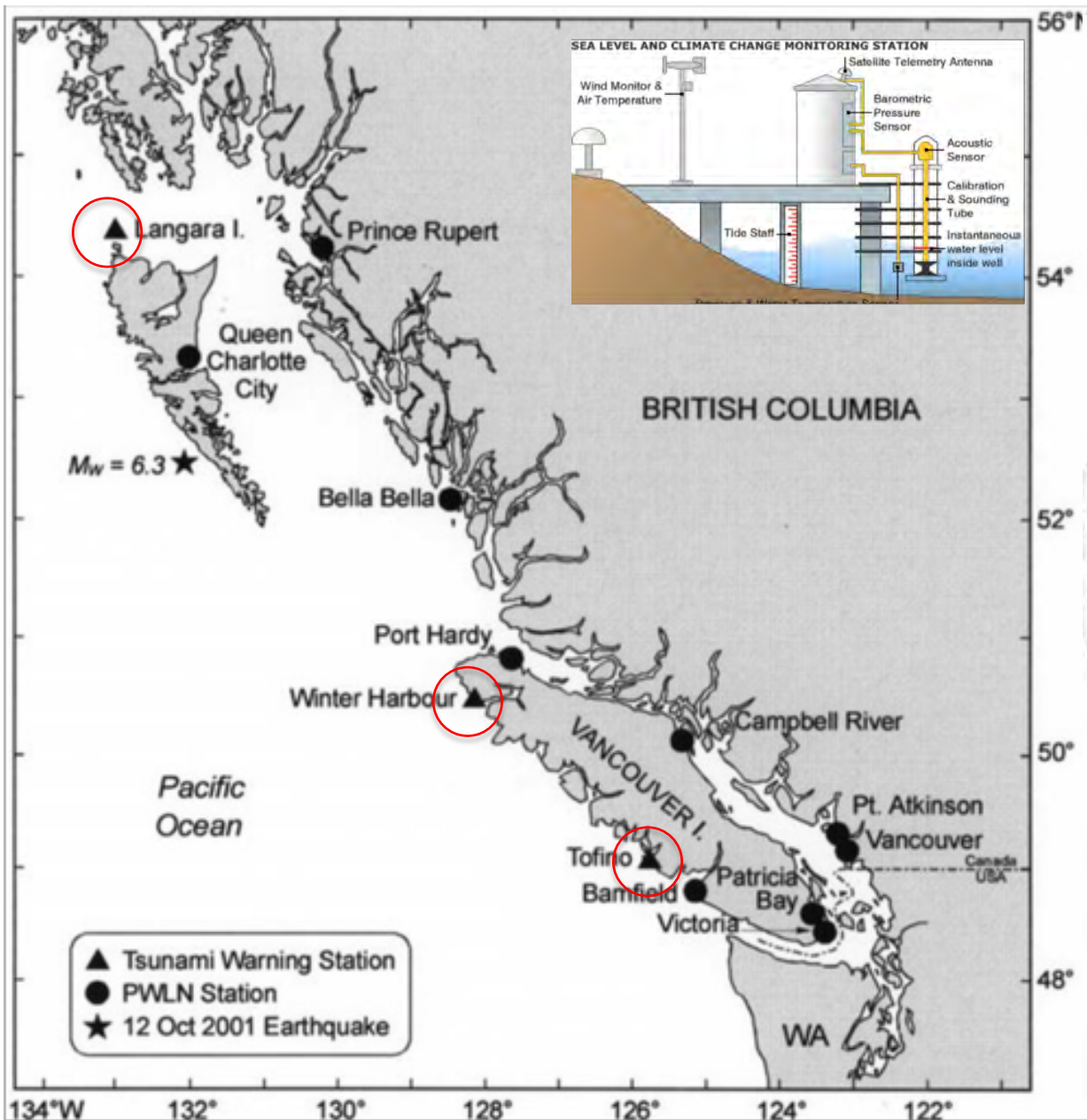
- Fixed monitoring systems
  - Permanent tide gauge network
  - Weather buoys
  - DFO moorings
  - Lighthouse program
  - Ocean Networks Canada cabled observatories
  - Hakai Institute observing systems
- Vessel-based monitoring
  - DFO monitoring cruises
  - Hakai boat-based monitoring
  - Pacific Salmon Foundation 'Community Fishers'
  - BC ferries
  - Alaskan ferry



# Fixed Monitoring Systems

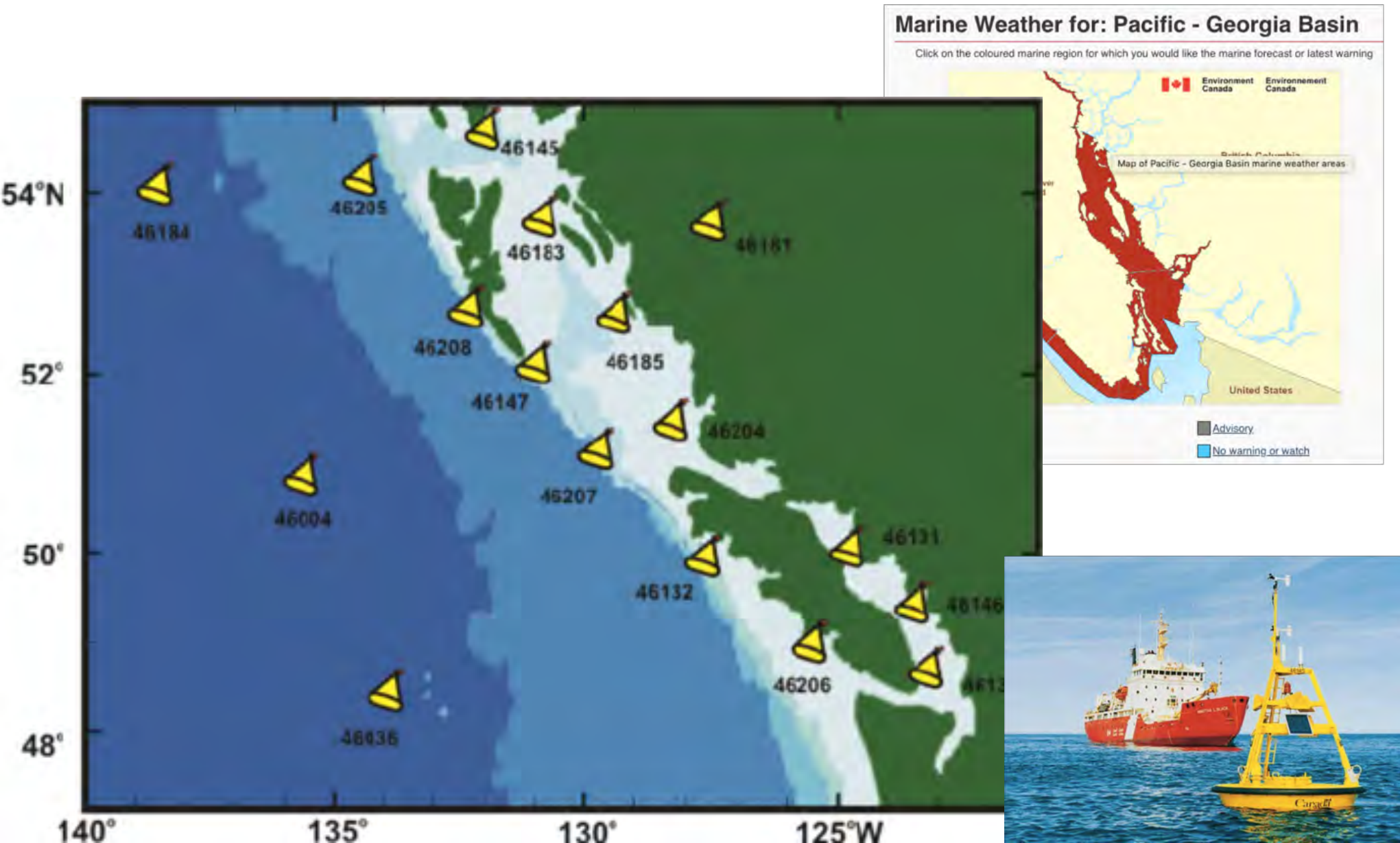


# Tide Gauge Network

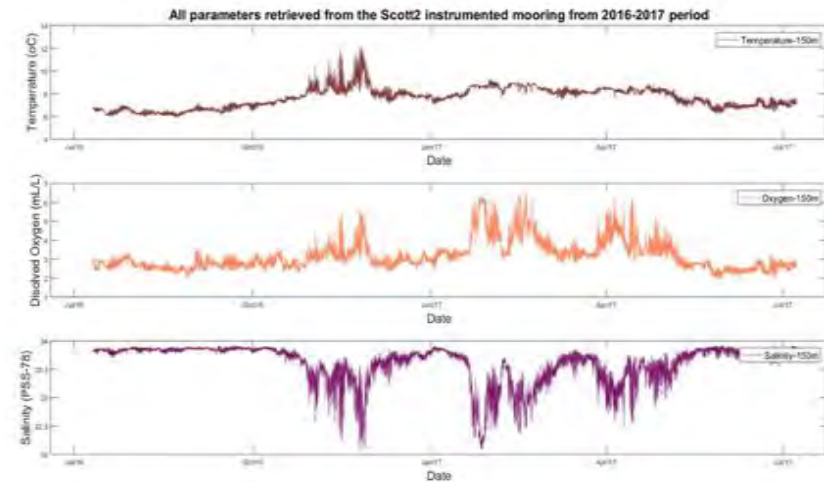
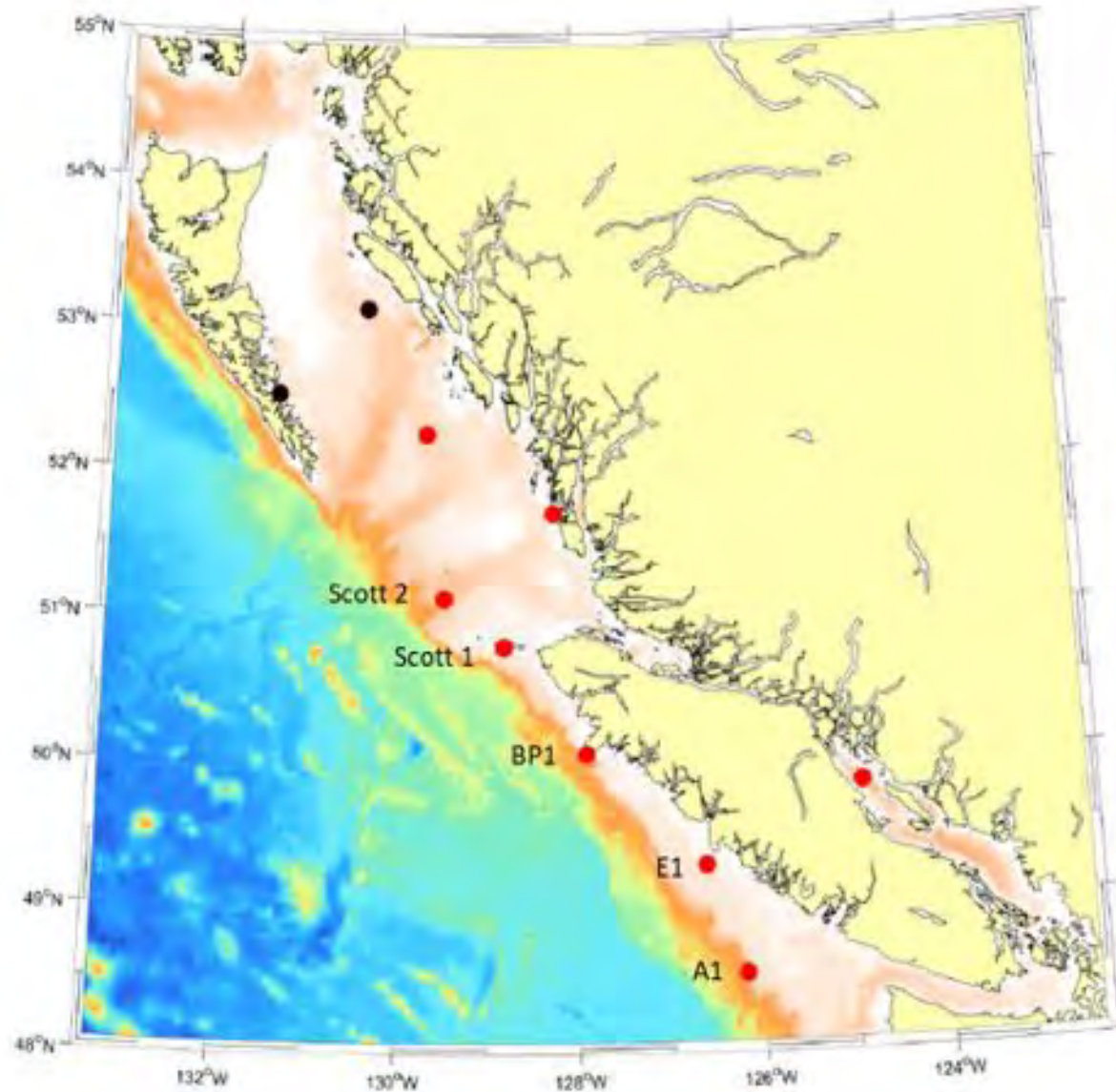




# Weather Buoys



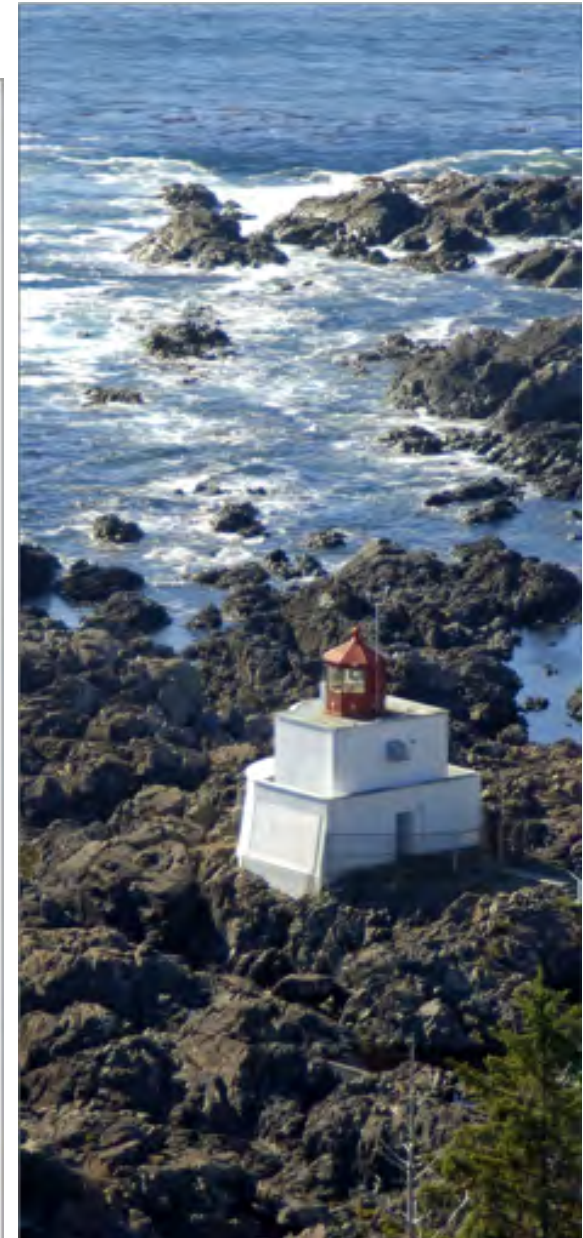
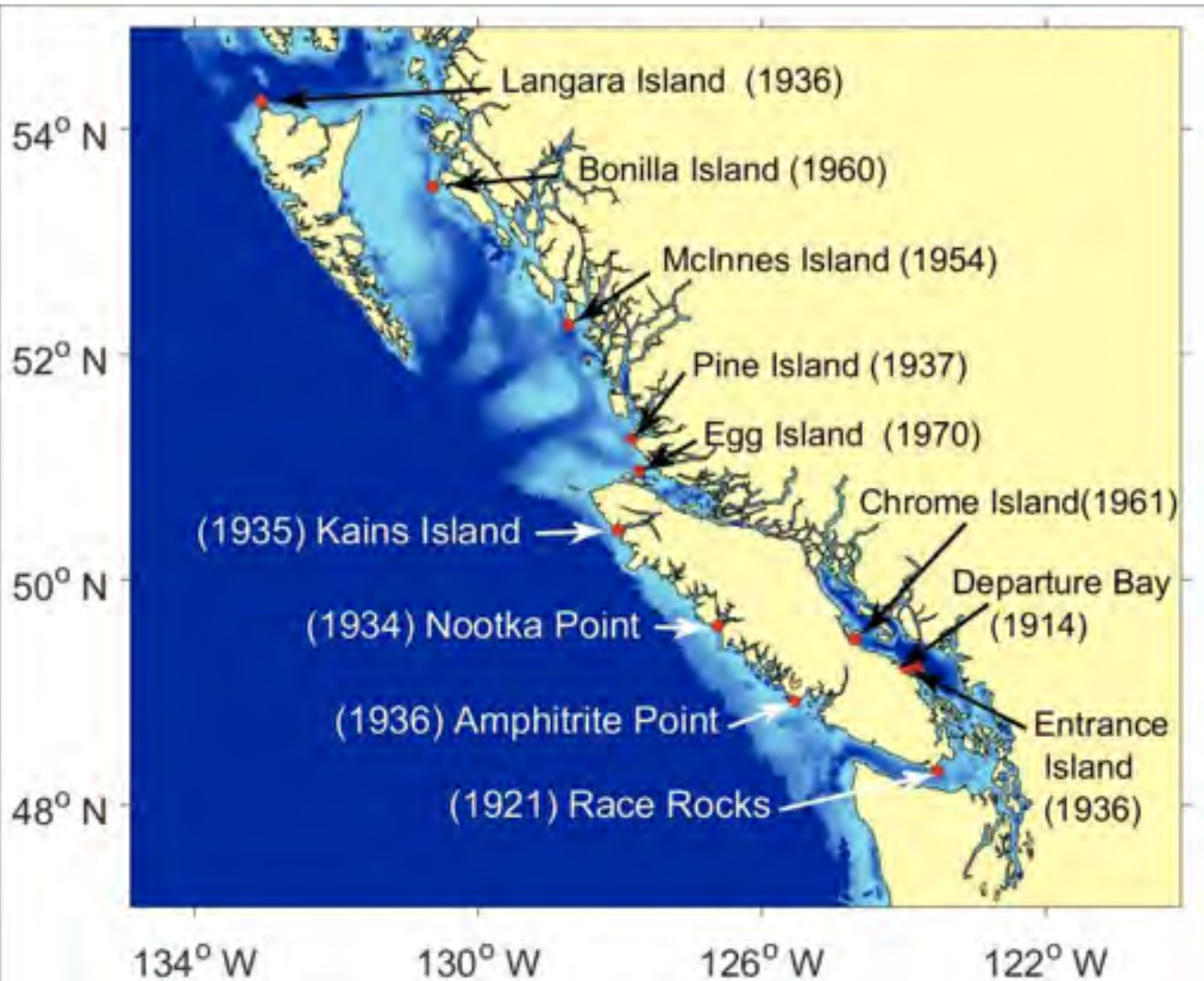
# DFO Moorings





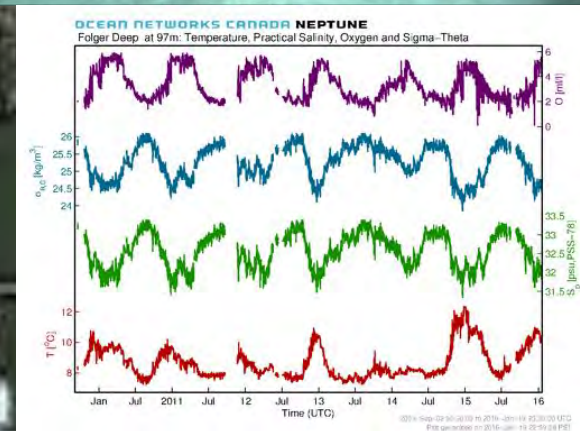
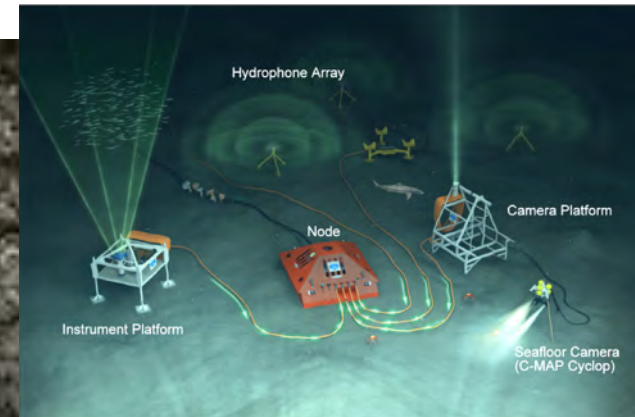
# BC Lighthouse program

- daily temperature & salinity (bucket sample at high tide)





# Ocean Networks Canada real-time cabled observing platforms



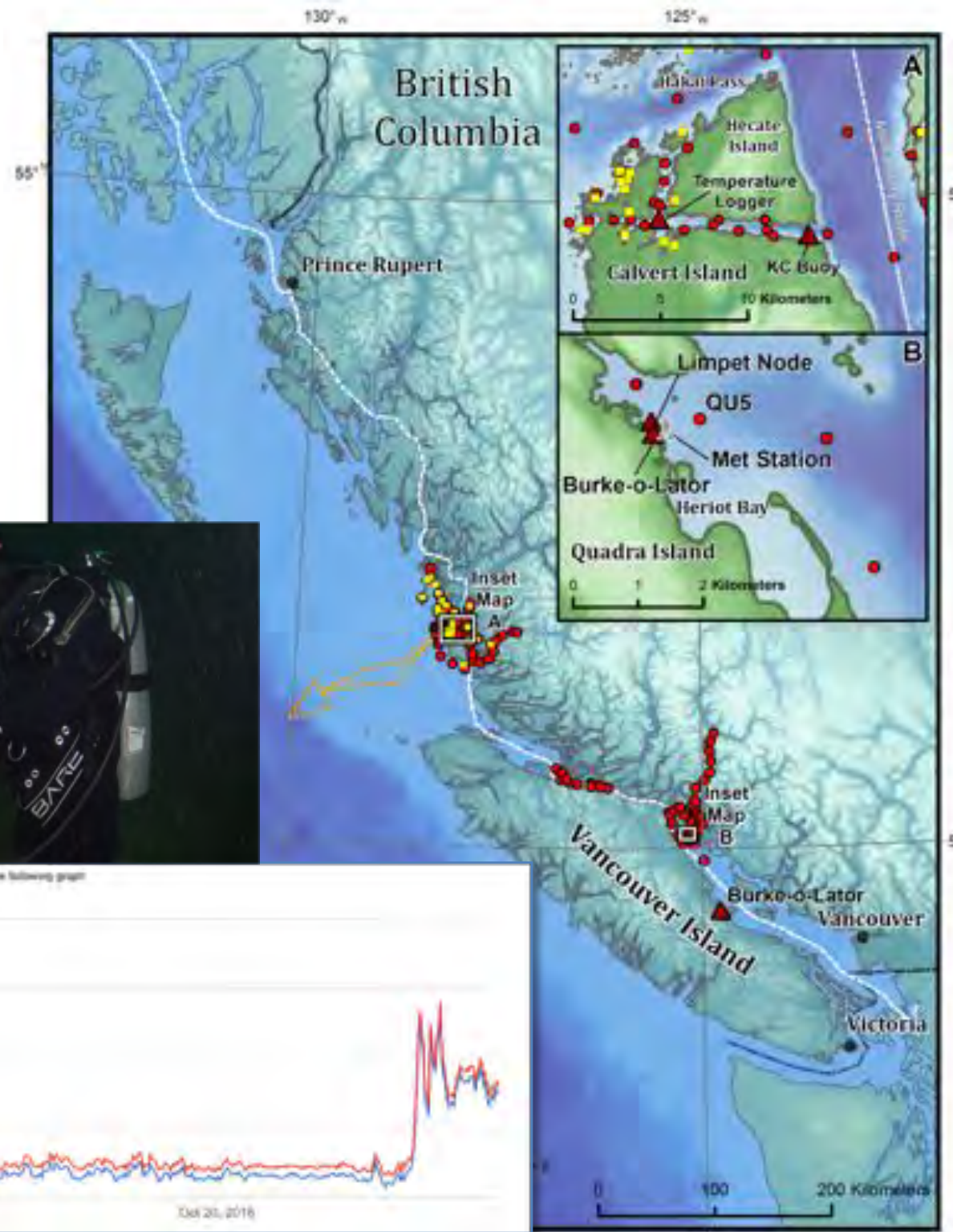
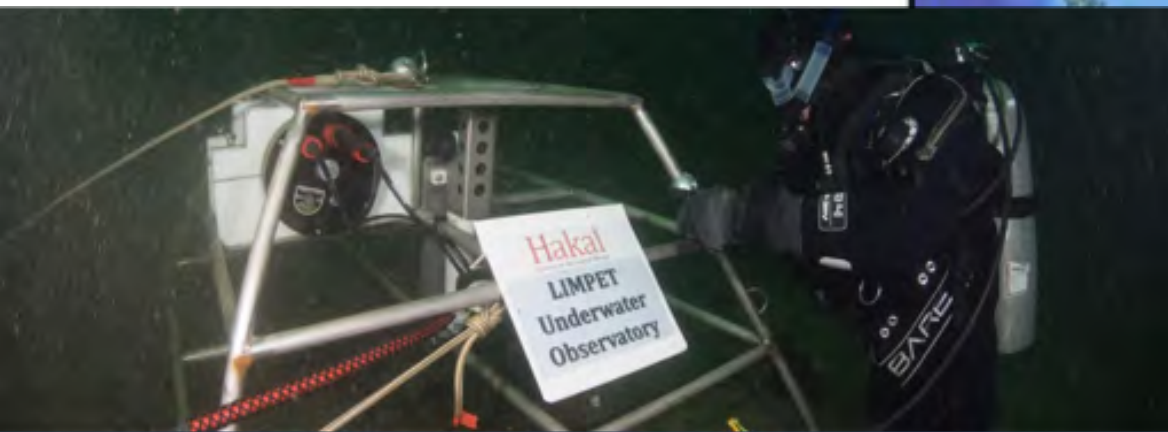


# Ocean Networks Canada real-time cabled observing platforms



# Hakai Institute observing systems

Cabled system on Quadra Island  
- underwater and shore-based sensors

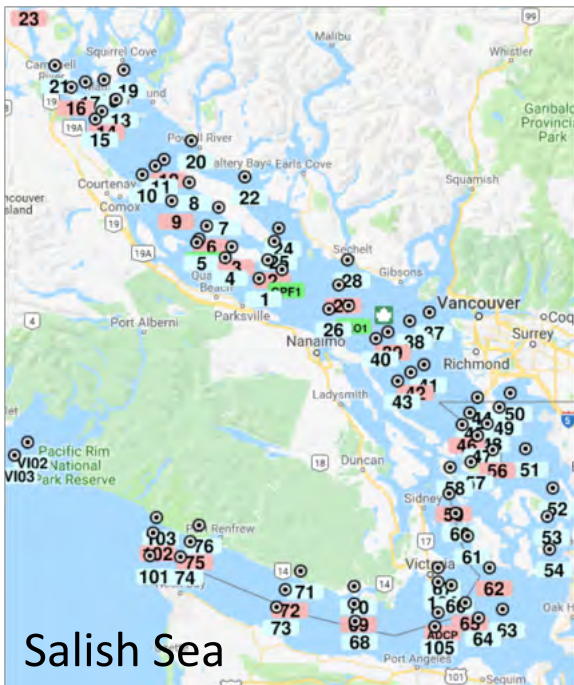




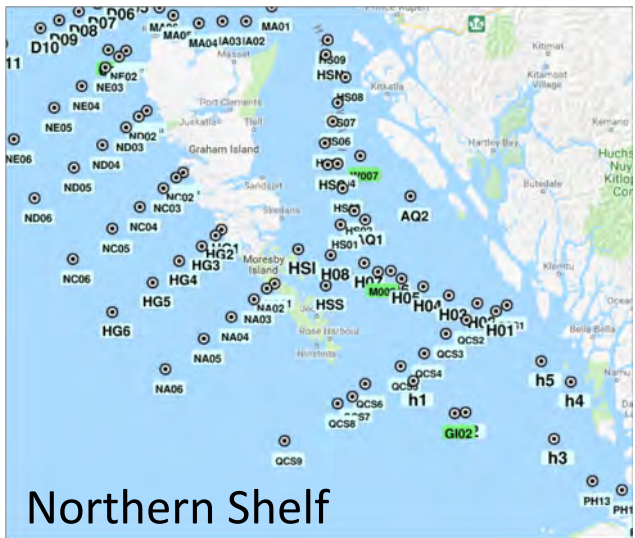
# Vessel-Based Monitoring



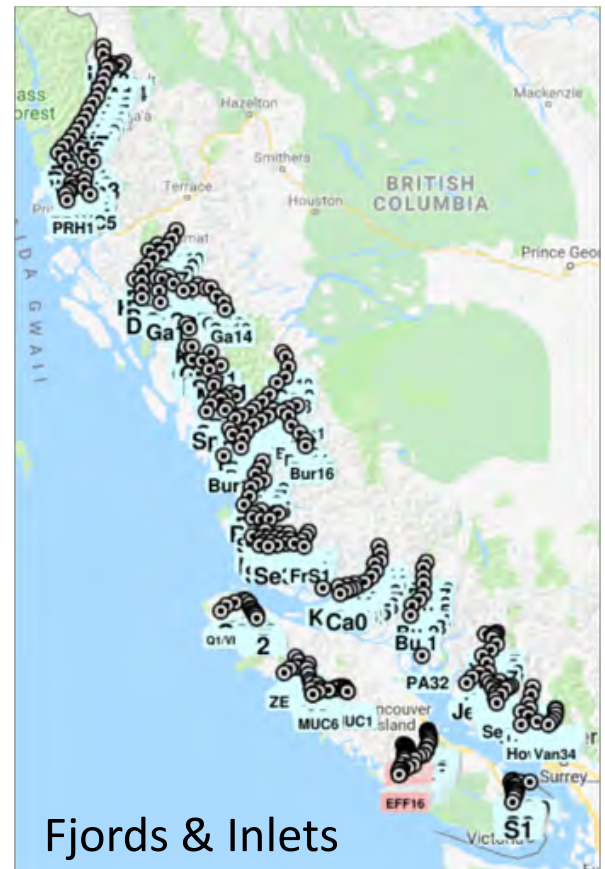
# DFO Surveys and Monitoring Cruises



Salish Sea



Northern Shelf



Fjords & Inlets



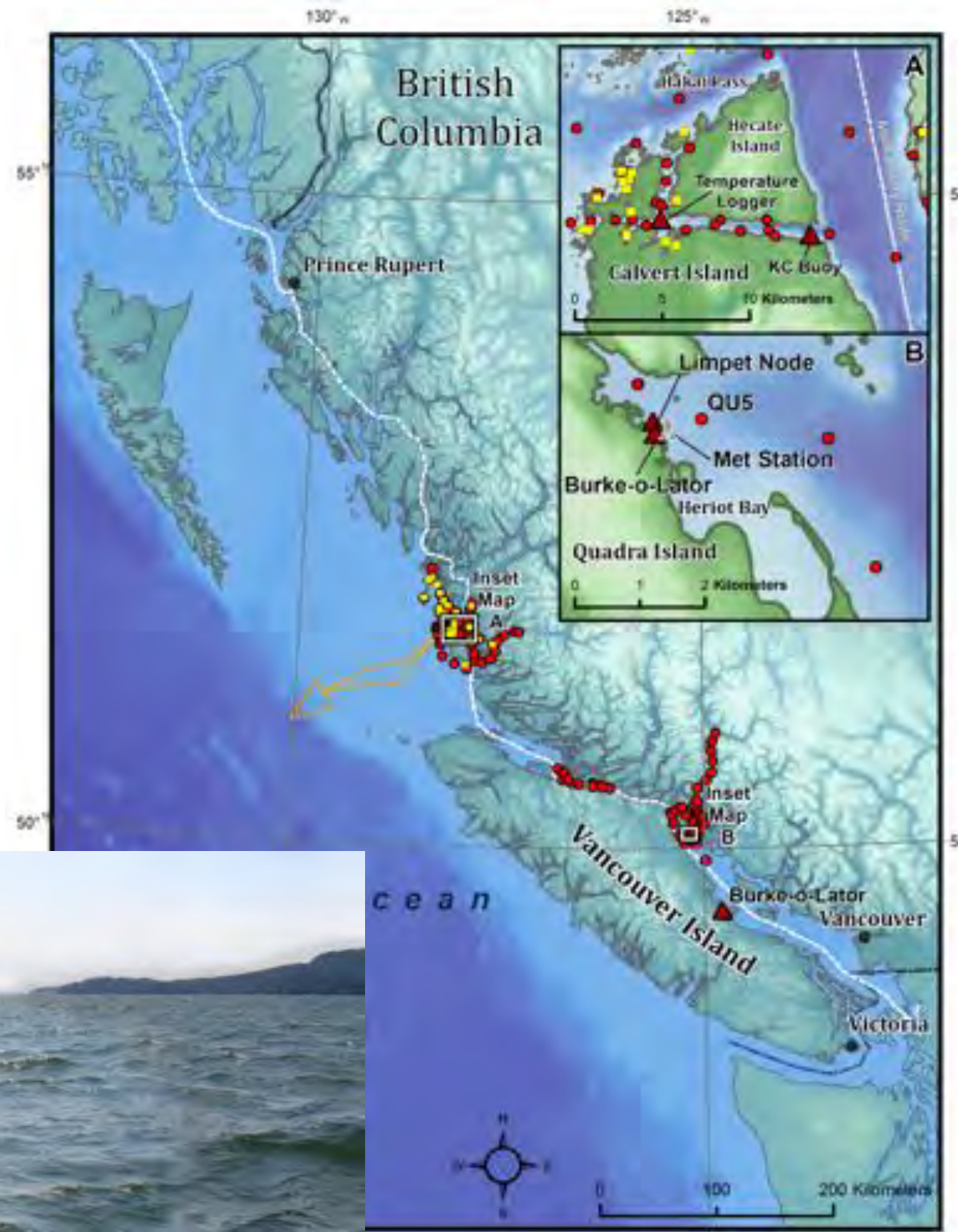
West Coast Vancouver Island





# Hakai boat-based observing programs

- Central Coast
- Johnstone Strait
- Northern Salish Sea



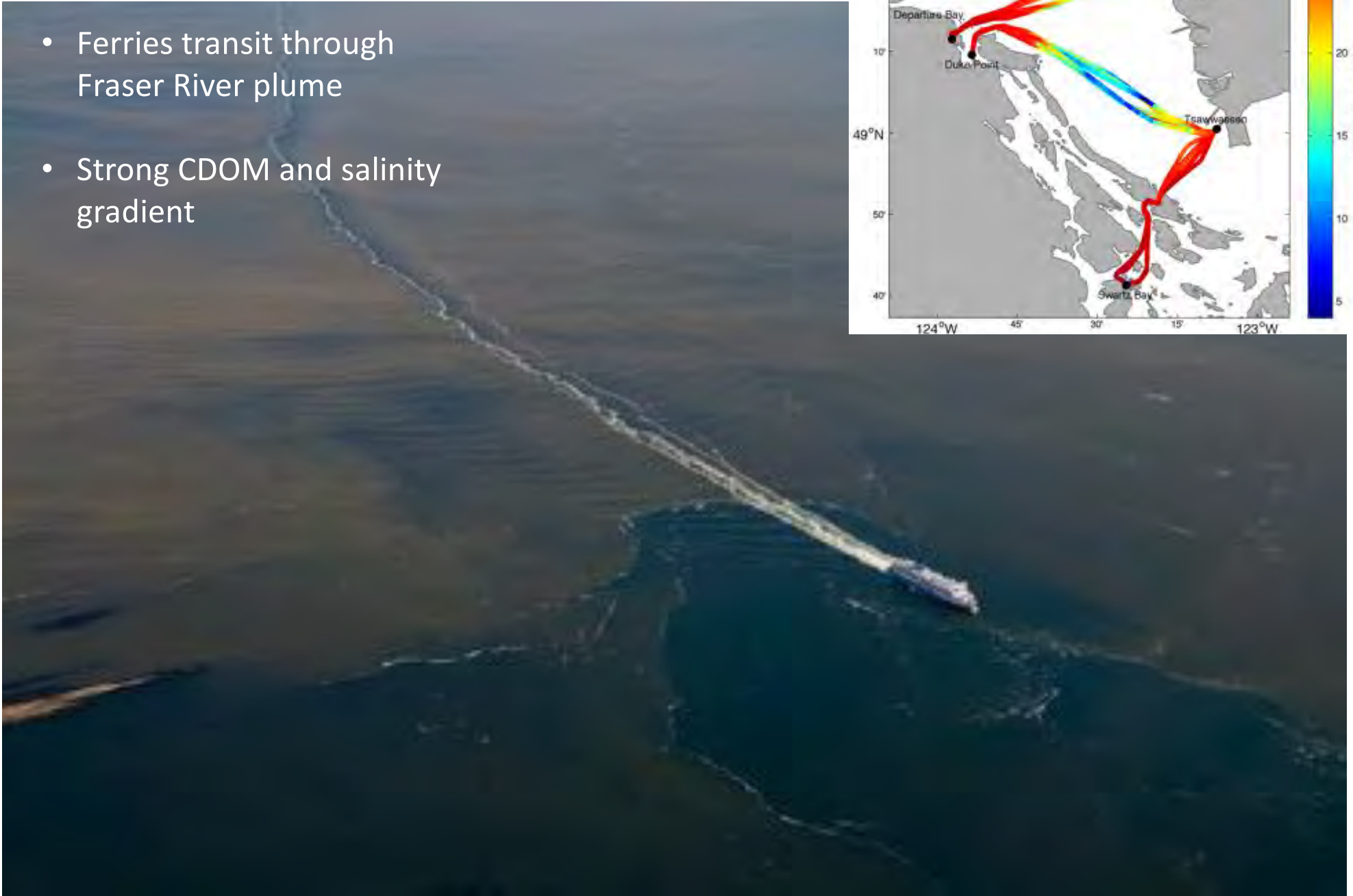
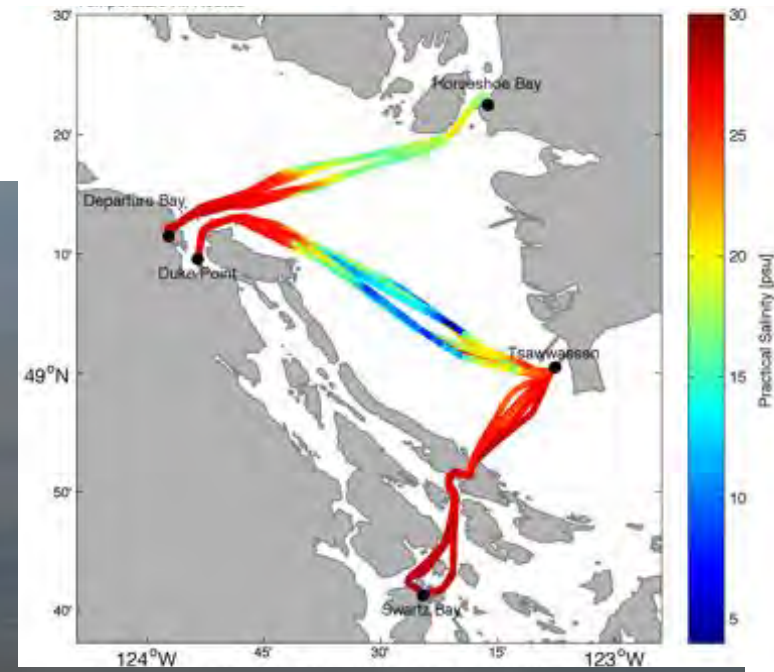
# *Community Fishers* - Pacific Salmon Foundation



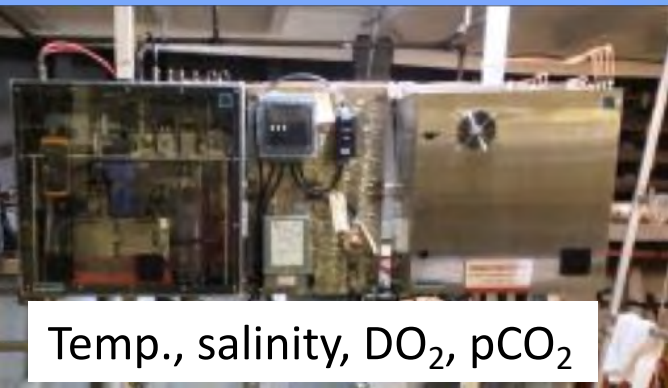


# BC Ferries - ONC

- Ferries transit through Fraser River plume
- Strong CDOM and salinity gradient



# Alaska State Ferry – Hakai



Temp., salinity, DO<sub>2</sub>, pCO<sub>2</sub>



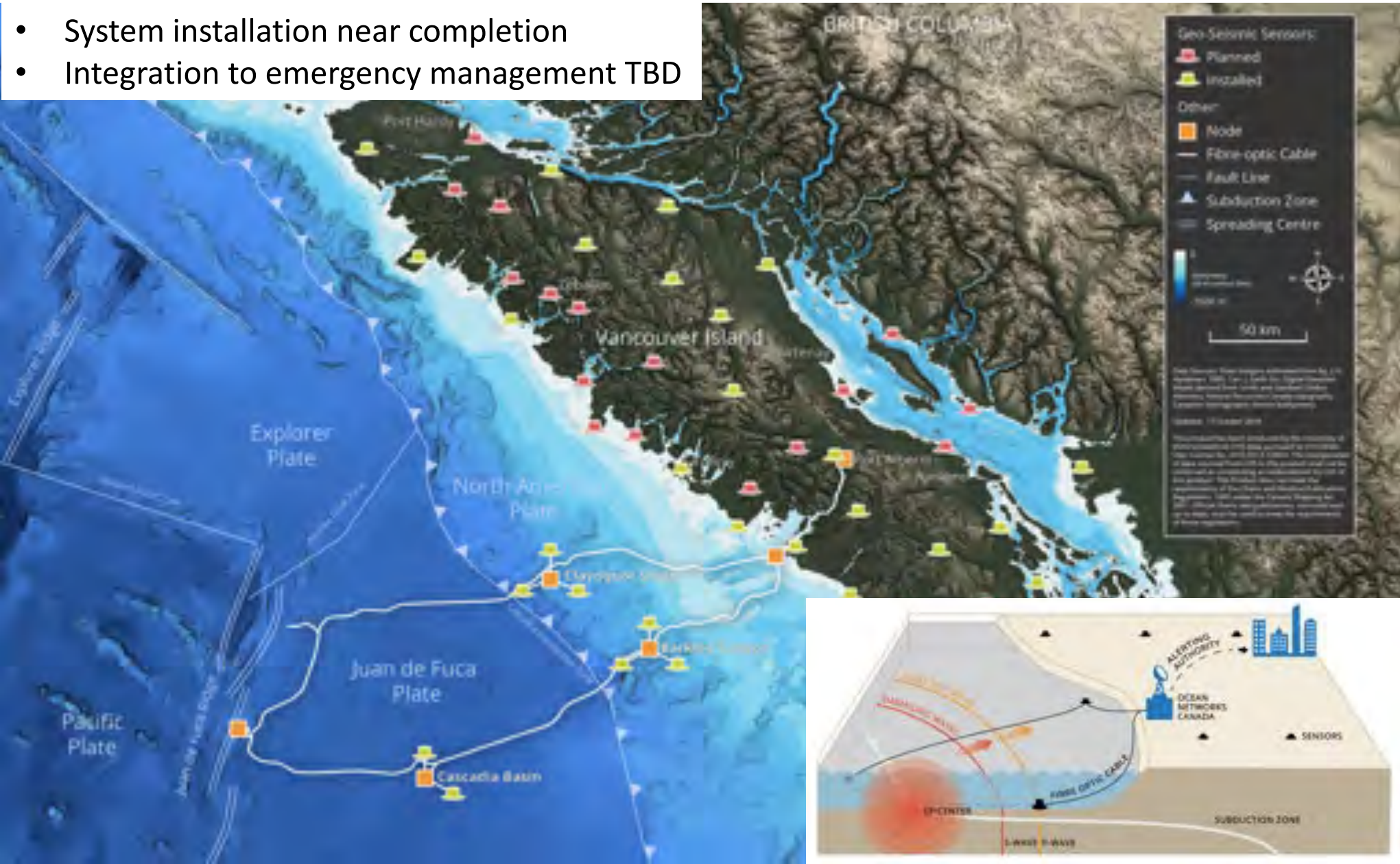
# Contribution of current observing systems and programs to operational observing needs for Canada's Coastal Pacific

Operational Need	Status	Required observational time scale
Marine geohazard mitigation <ul style="list-style-type: none"> <li>- Earthquake early warning</li> <li>- Tsunami detection</li> <li>- Storm surge</li> </ul>		Real-time, data assimilation by models Real-time, data assimilation by models Real-time, data assimilation by models
Maritime Safety <ul style="list-style-type: none"> <li>- Sea state</li> </ul>		Real-time or near-real time
Aquaculture & Public Health		Daily to monthly
Marine Conservation <ul style="list-style-type: none"> <li>- MPA &amp; ecosystem health</li> <li>- Whale protection</li> </ul>		Annual to longer Real-time to longer
Monitoring regional scale oceanographic processes		Hourly to seasonal

# Geohazard Mitigation - Earthquake early warning



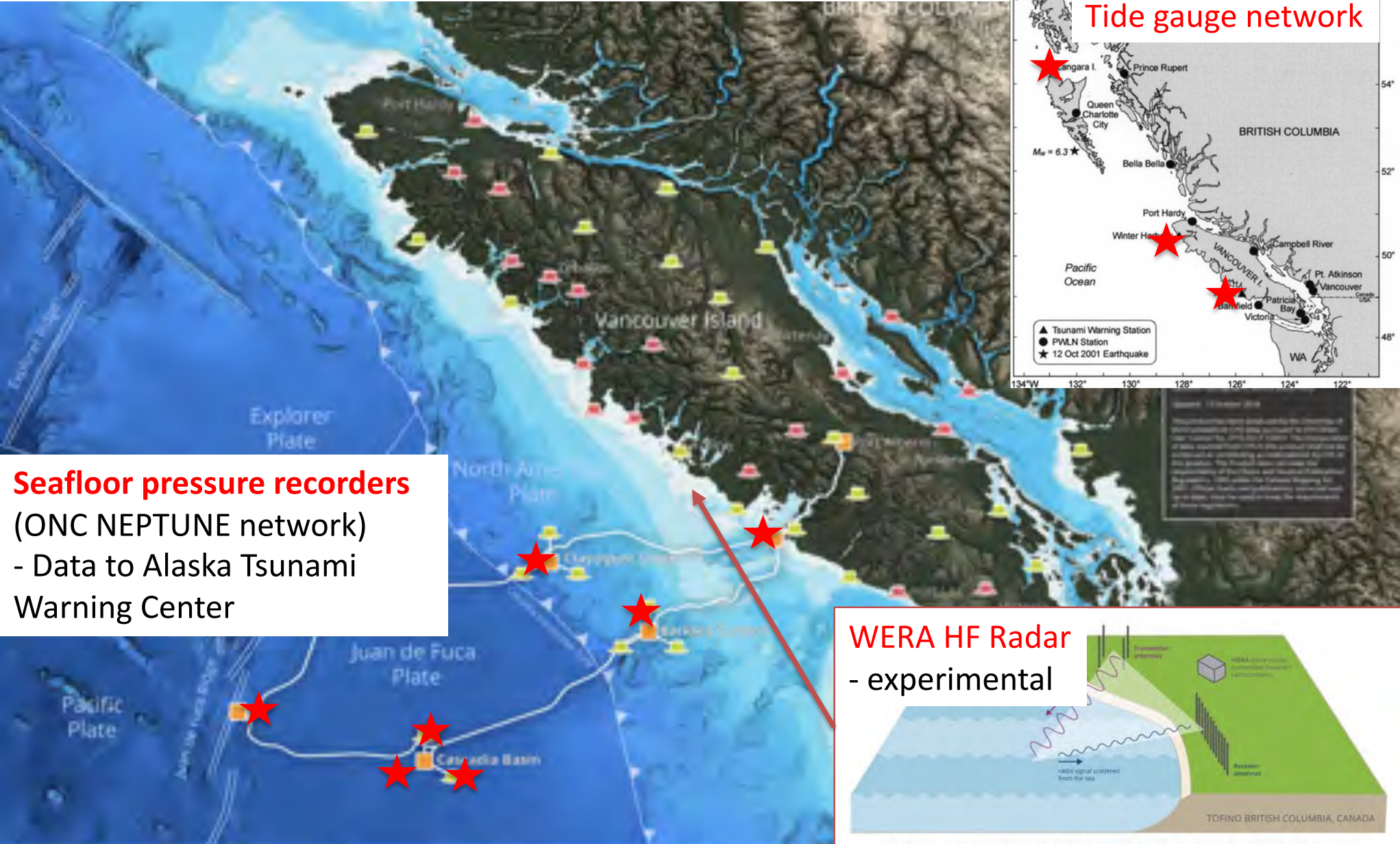
- System installation near completion
- Integration to emergency management TBD







# Geohazard Mitigation - Tsunami detection





# Geohazard Mitigation

## - Storm surge



SalishSeaCast NEMO Model  
(Susan Allen, UBC)



# ● Maritime Safety – Sea State

## Marine Weather for: Pacific - Georgia Basin

Click on the coloured marine region for which you would like the marine forecast or latest warning



Warning

Watch

Advisory

No warning or watch

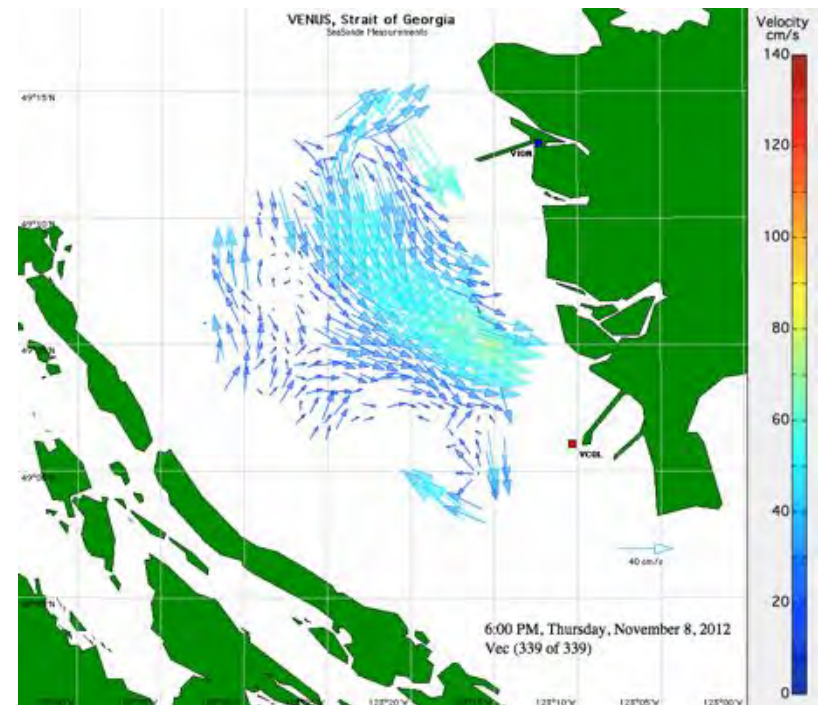
## General Marine Wind and Wave Forecasts

- Based on terrestrial observations and data from buoys
- Higher spatial and temporal resolution needed for some operational requirements
  - BC Ferries sailing decisions
  - Search and rescue
  - Oil spill response



# Maritime Safety – HF Radar

Several systems operating or planned, but no operational uptake

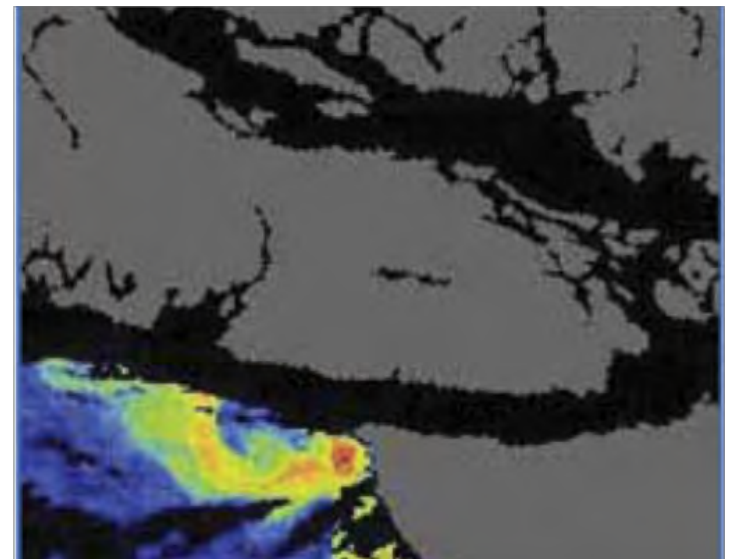
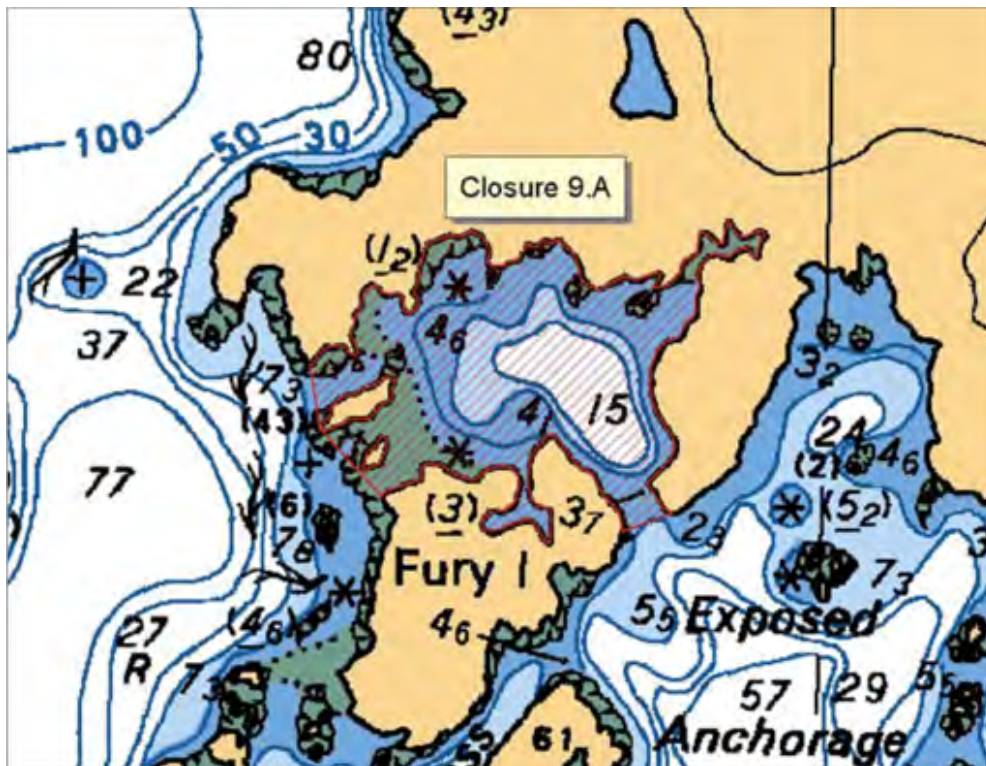




# ● → ● Aquaculture and Public Health

HAB monitoring in the field

- Some localized sampling & monitoring by industry
- Research projects but no regional monitoring program
- Seasonal area closures





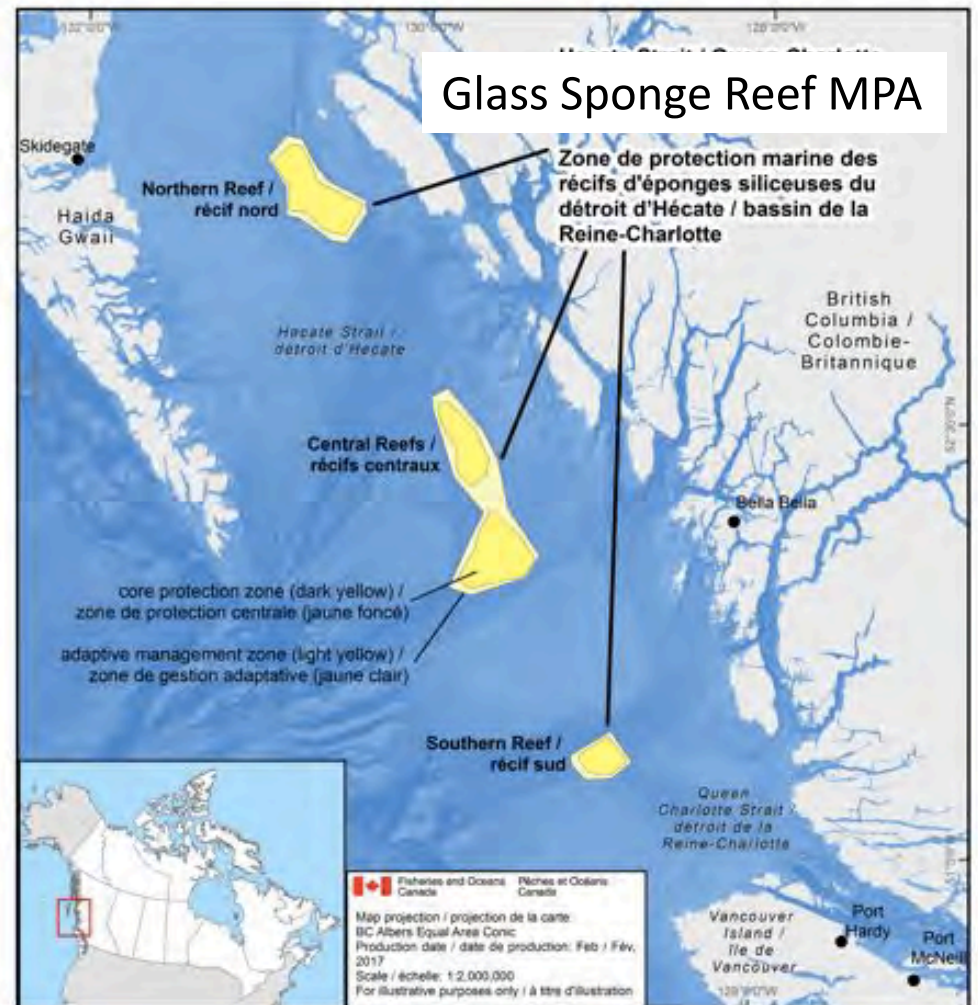
# Marine Conservation

## - MPA & Ocean Health Monitoring

Ocean Health compilations



MPA surveys but no monitoring programs





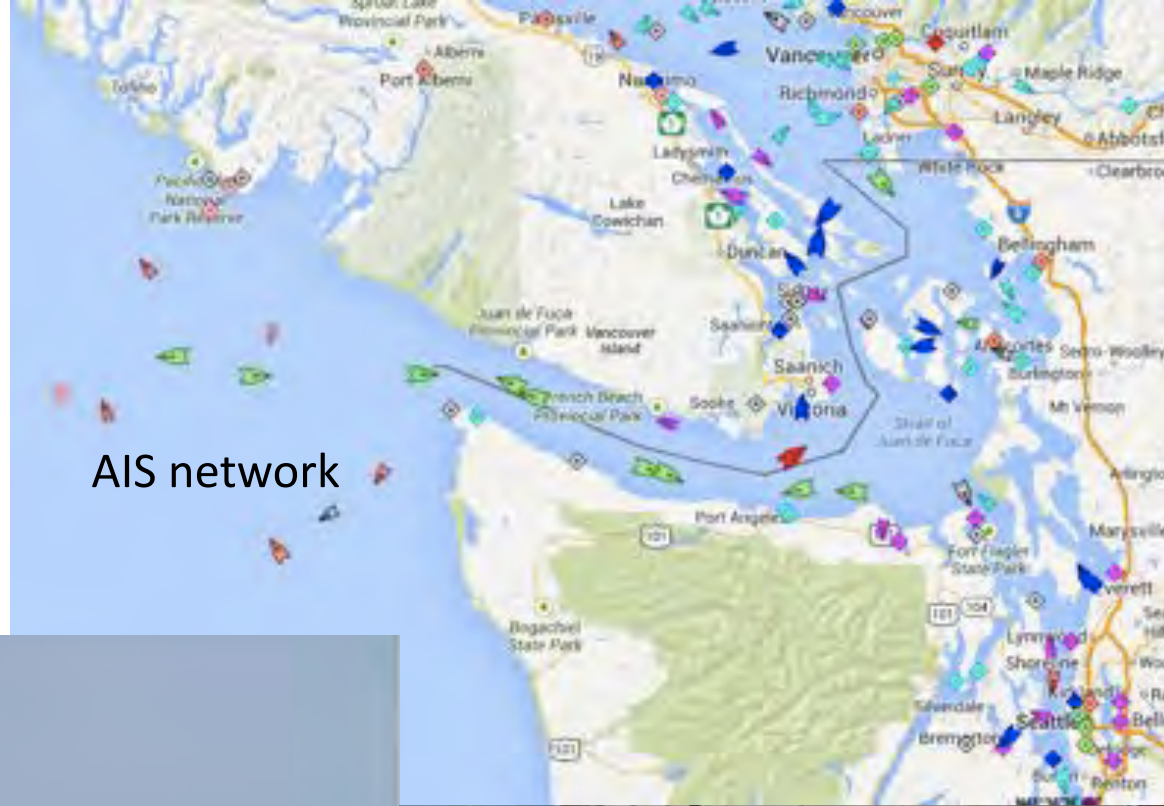
# Marine Conservation

## - Whale protection

Monitoring capacity in place in critical areas

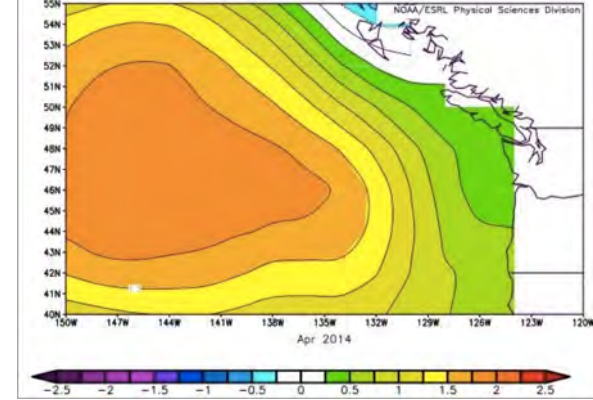
- AIS vessel traffic
- Hydrophone network

No operational use or integration...yet

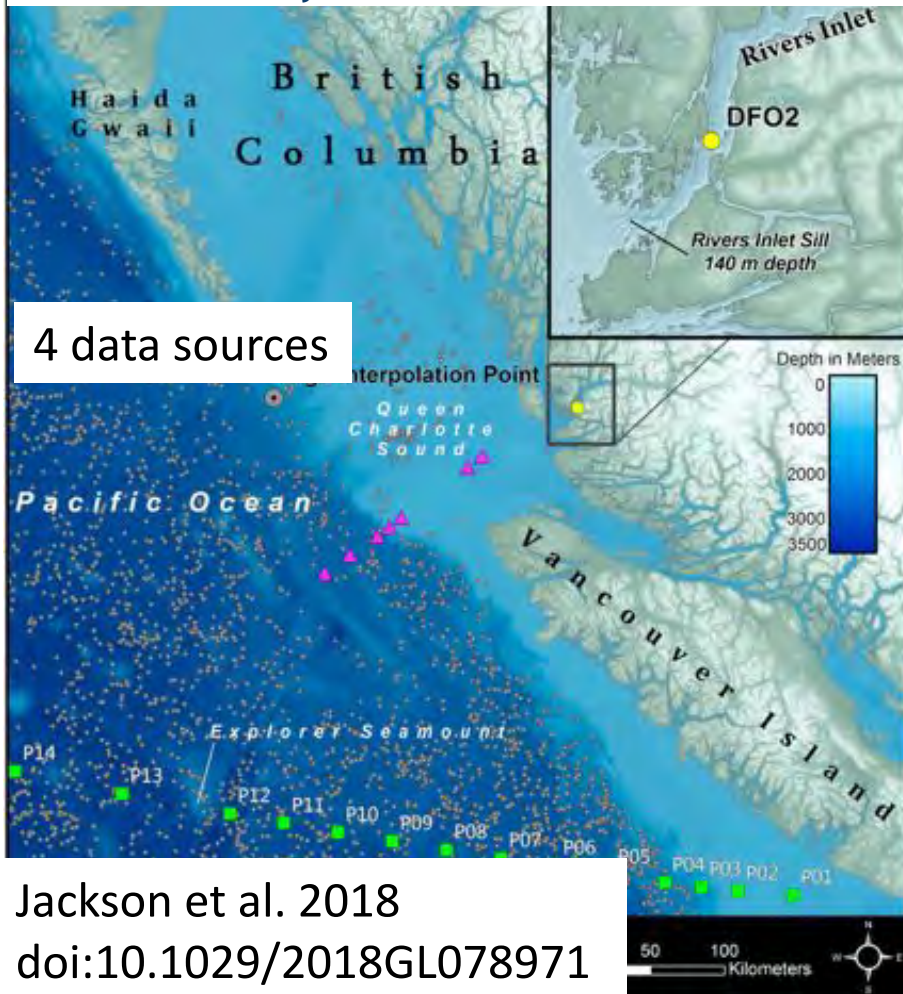


# Monitoring Regional Scale Oceanographic Processes

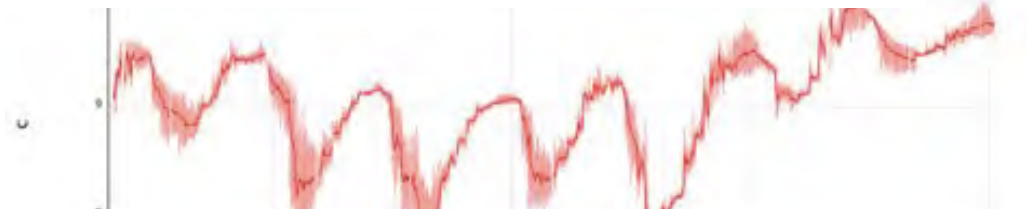
- warm blob comes to the coast



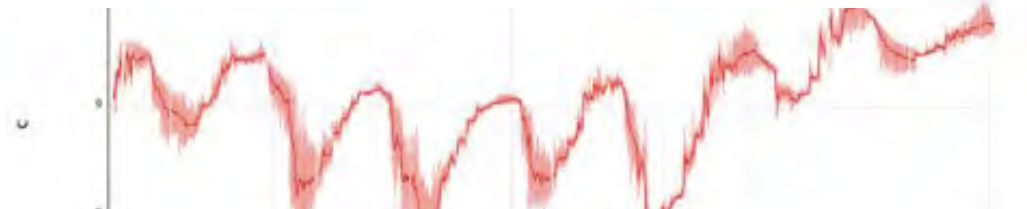
## Warming From Recent Marine Heatwave Lingers in Deep British Columbia Fjord



Ocean Networks Canada cabled observatory  
- **Folger** (100m depth)



Ocean Networks Canada cabled observatory  
- **Saanich Inlet** (95m depth)





# Data Access Challenge

*Multiple operators, multiple monitoring systems, multiple databases*

- Fixed monitoring stations
  - Permanent tide gauge network
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# Data Access

Observing System

Canadian Integrated Ocean

## CANADIAN INTEGRATED OCEAN OBSERVING SYSTEM

**DEADLINE:** June 7, 2018 at 4PM Atlantic. Submit as a PDF to Aixa Rendon  
All interested applicants must contact Aixa Rendon before submitting the

NAVIGATION

[Back to Funding](#)

[Canadian Integrated Ocean  
Observing System](#)

### 3 Initial Regional Organizations

- Pacific CIOOS
- St. Lawrence CIOOS
- Atlantic CIOOS





# Challenge – sorting through data archives

Historic



Currently Active



West Coast Vancouver Island

# Conclusion

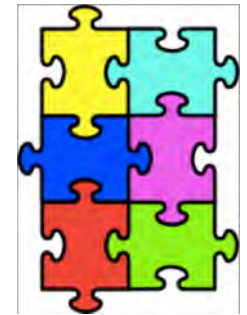
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components

- Data access
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- Development of a community of practice
- ~~• Appropriate scale questions~~
- ~~• Resources for sustained & comprehensive use of all data~~



Functional regional  
scale observing  
system





Great Bear Rainforest, pastel & resin on canvas | By: Karen Hamilton, Victoria, British Columbia, Canada | @kharriet

# PICES SUMMER SCHOOL 2018

## Coastal Ocean Observatory Science

Learn about ocean sensors, data QA/QC, time-series analysis and Ocean Networks Canada's observing technology, through field expeditions, laboratory demonstrations and lectures. Financial support available.

**JULY 9-13, 2018 VICTORIA, BRITISH COLUMBIA, CANADA**

# THANK YOU!

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 @ocean\_networks  OceanNetworksCanada visit: [oceannetworks.ca](http://oceannetworks.ca)