



Fisheries and Oceans
Canada

Pêches et Océans
Canada

Canadian Arctic Marine Science Plans

2020

Pacific Arctic Group Meeting

Arctic Science Summit Week 2020

Online

Bill Williams, Fisheries and Oceans Canada



Canada

CCGS *Louis S. St-Laurent*

JOIS - AON-BGOS



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GEM Arctic 2019



GEM Arctic 2019



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CCGS *Louis S. St-Laurent*

Joint Ocean Ice Studies (JOIS) - Arctic Observing Network - Beaufort Gyre Observing System (AON-BGOS)

- Chief Scientist: Bill Williams
- Supported by: NSF, DFO
- Collaborators: WHOI, JAMSTEC, TUMSAT, KIT ...
- Provisionally 5 – 30 Sept, 2020 (25 days)
- Kugluktuk - Canada Basin - Kugluktuk
- 27 participants
- CTD/rosette profiles + biogeochemical sampling
- Vertical net casts for zooplankton
- XCTD casts
- Underway measurements
- Ice Observations (ship, ice and helicopter)
- BGOS mooring recovery, possible redeployment
- Deploy 4 Ice Tethered Profilers, 2 Seasonal Ice Mass Balance Buoys

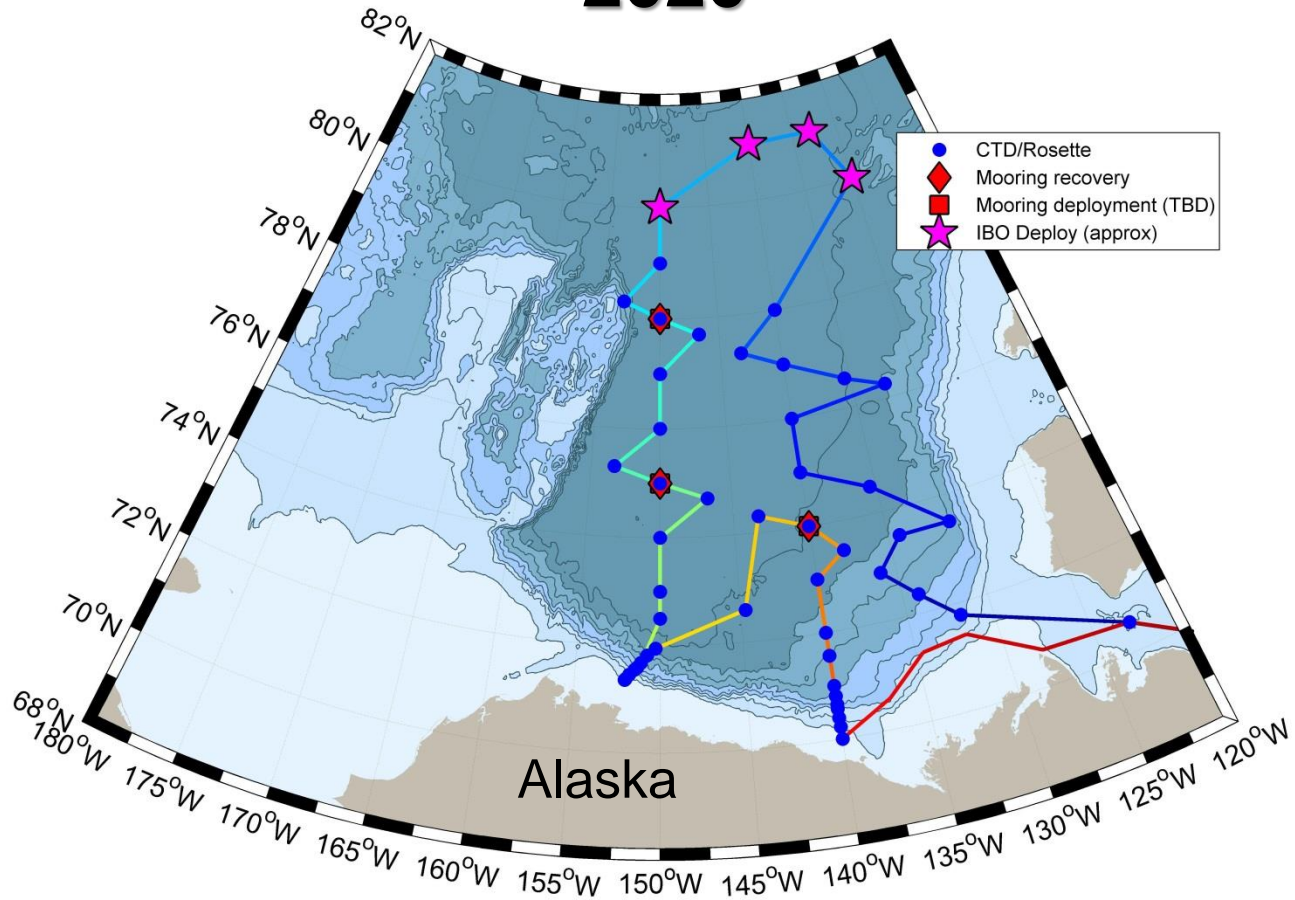


(Photo: Jeffrey Charters)

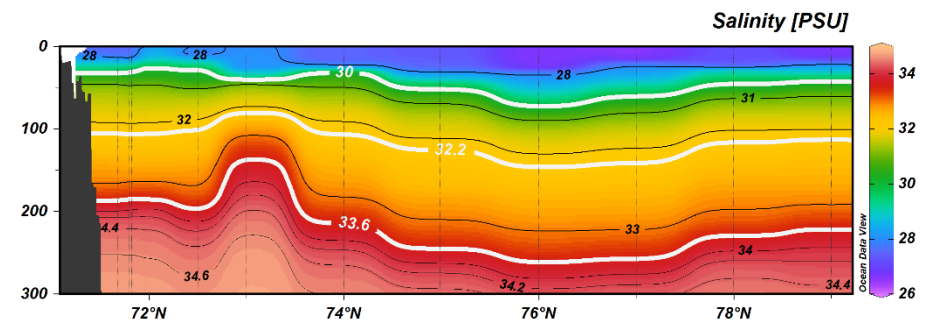
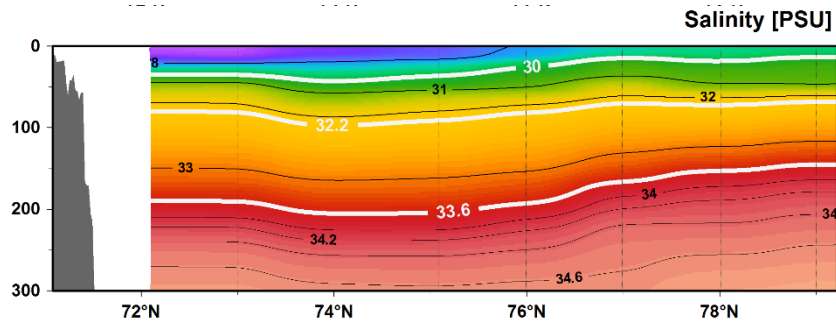
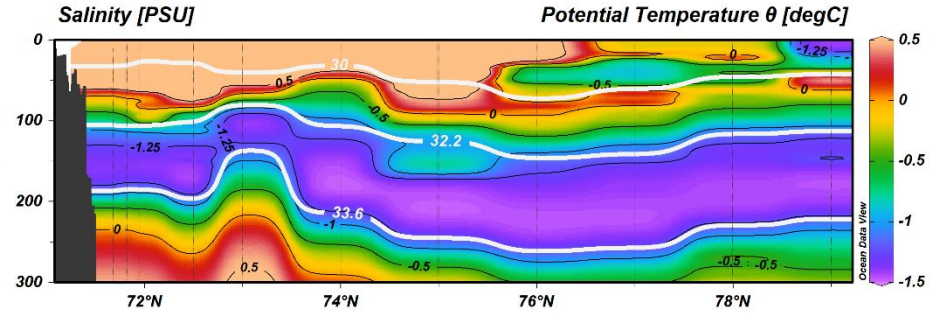
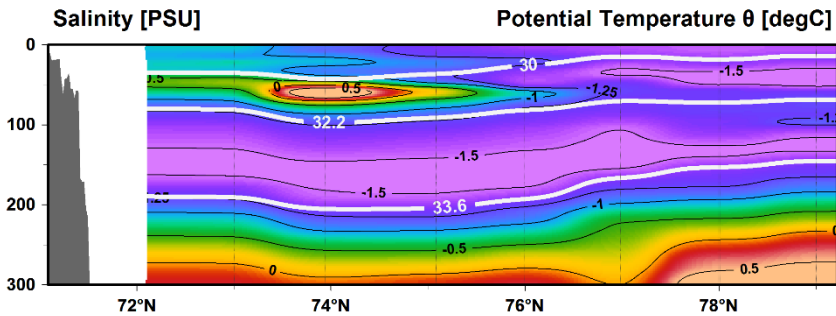
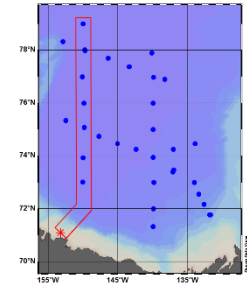
CCGS Louis S. St-Laurent

JOIS - AON-BGOS

2020



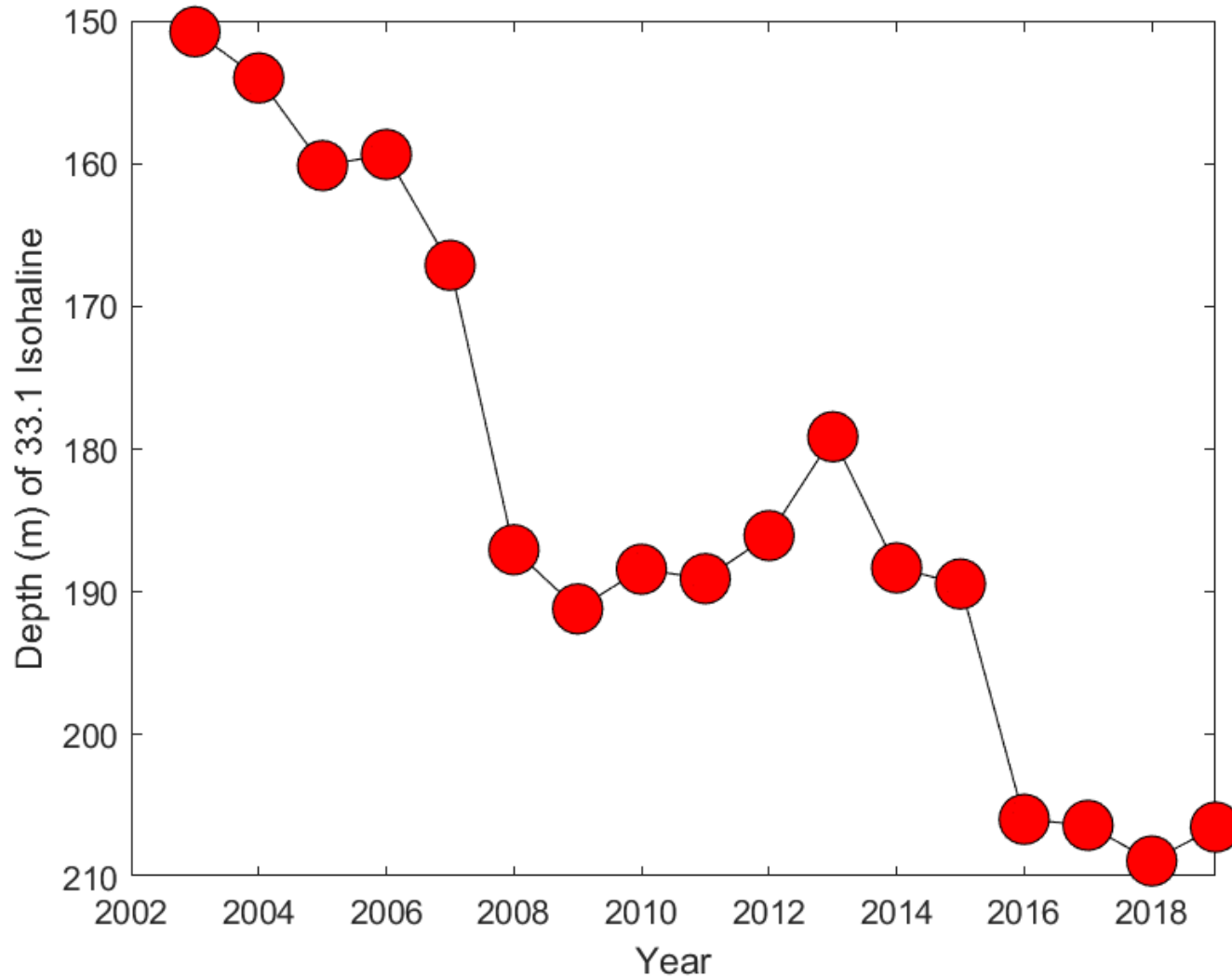
Section along 150W



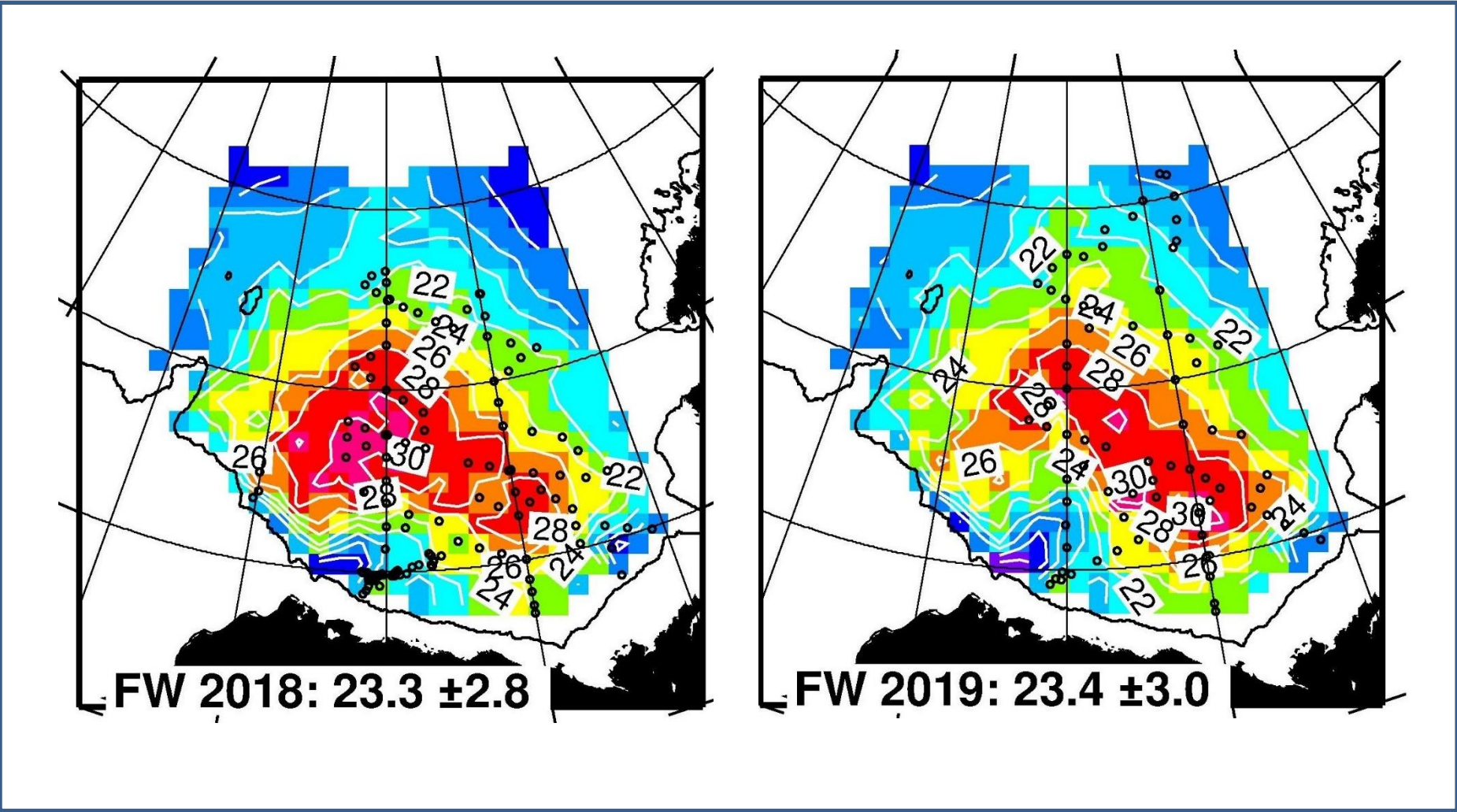
2004

2019

Depth (m) of Pacific Water (S=33.1)

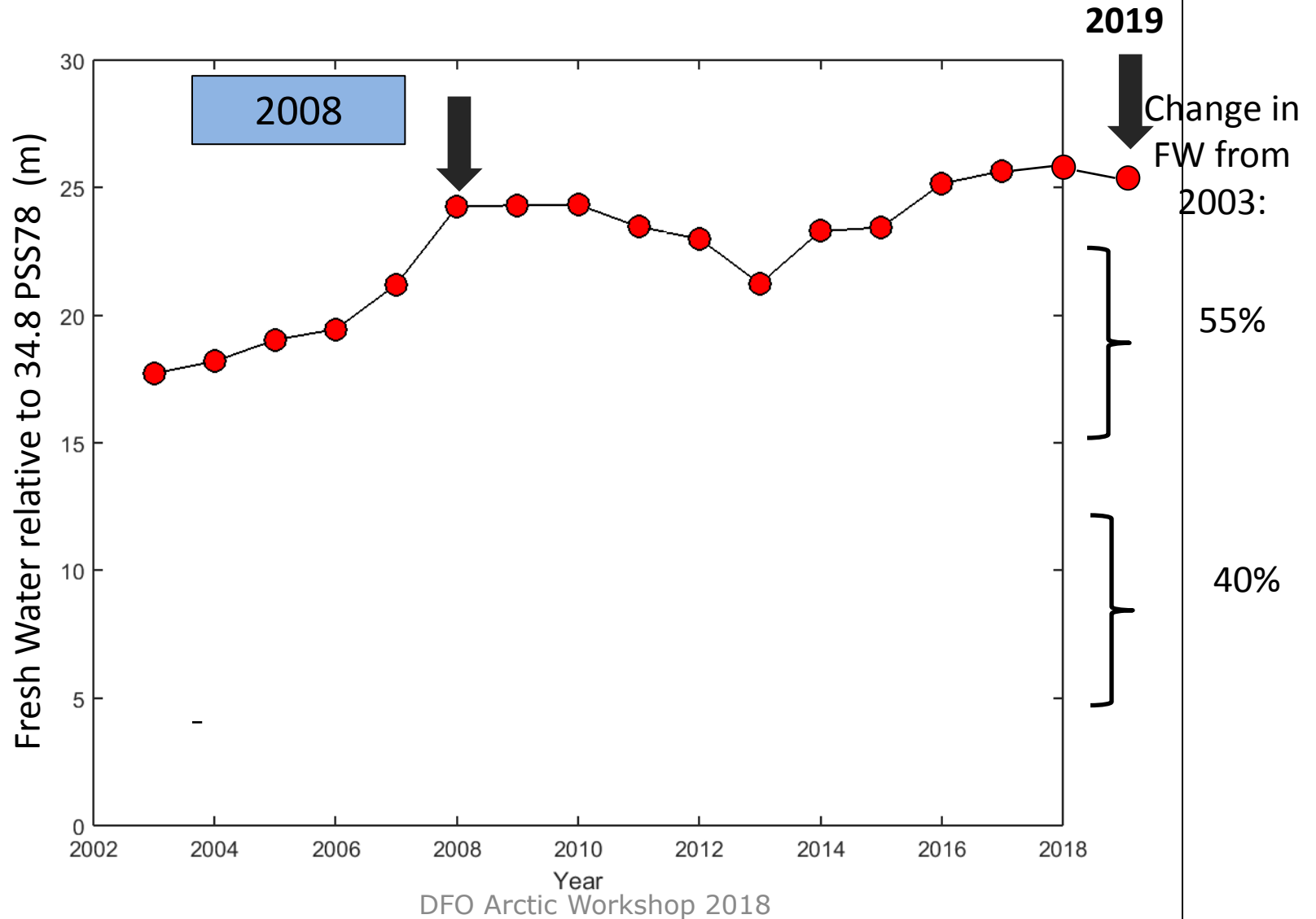


Freshwater content



From Rick Krishfield

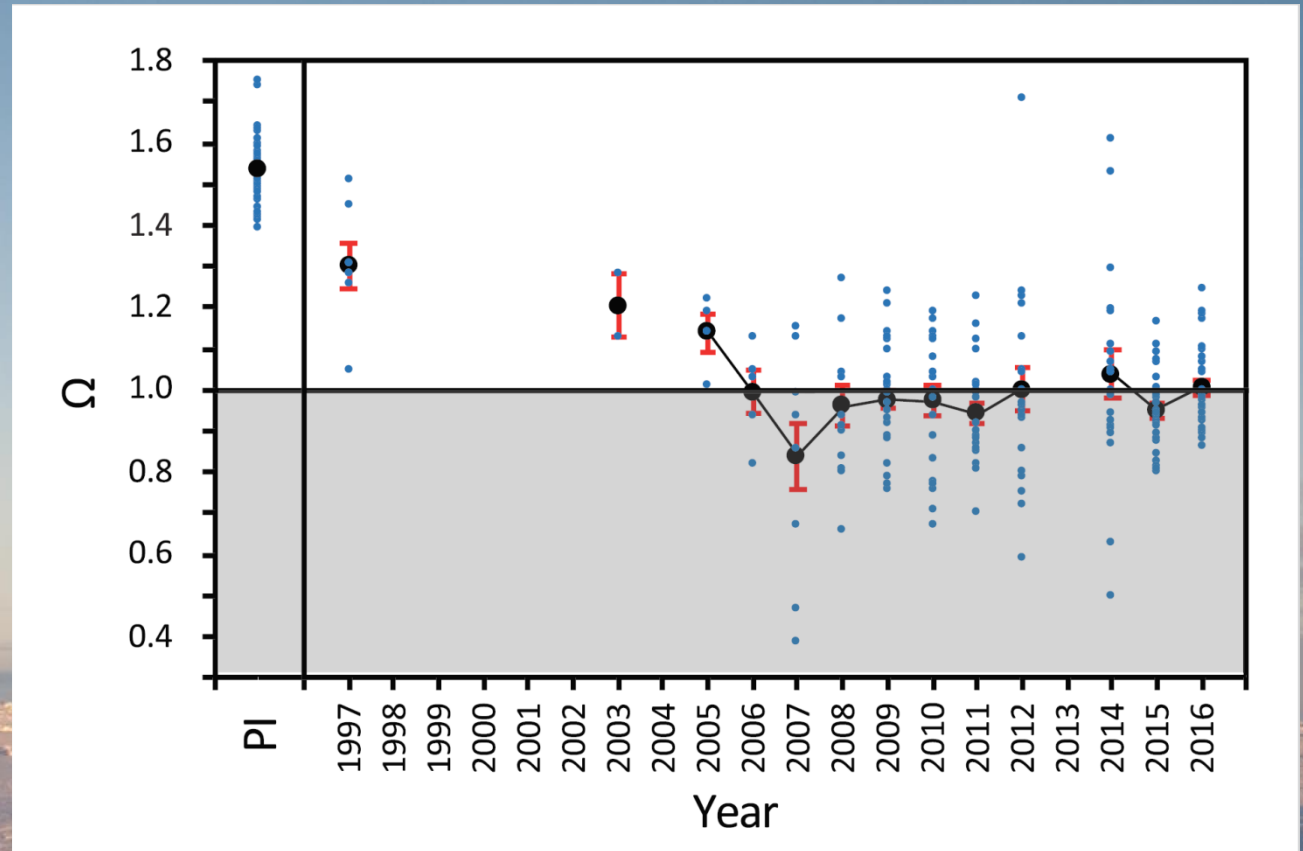
Total Fresh Water (m)



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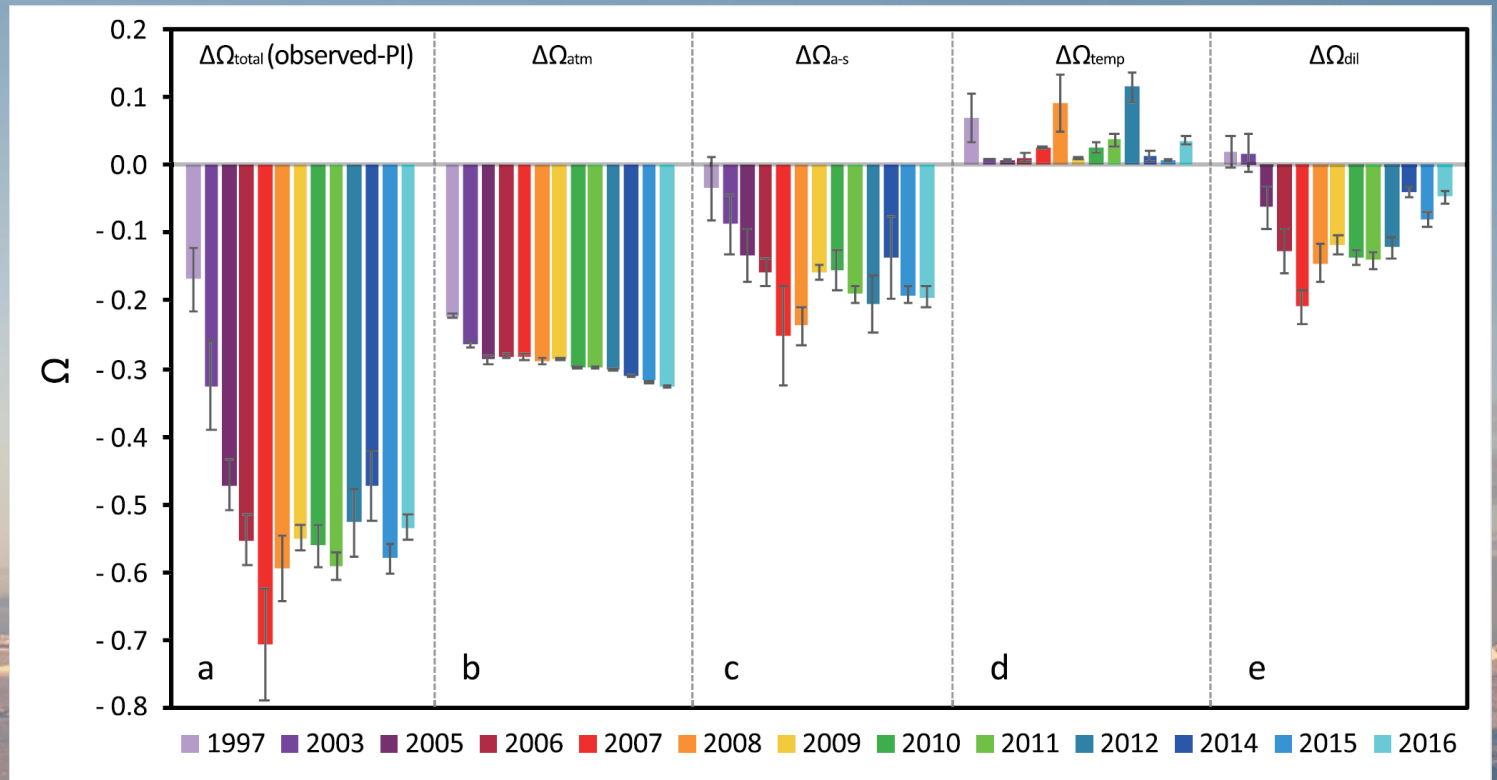
Ocean acidification in the surface waters of the Beaufort Gyre



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Ocean acidification in the surface waters of the Beaufort Gyre



CCGS Sir Wilfrid Laurier



Transit to the Arctic across the NE Pacific: C3O, DBO



7 days for science, 16 scientists, boarding in Victoria

- U-CTD & X-CTDs during transit
- CTD/Rosette, bongo net casts across the Gulf of Alaska.
- Underway seawater sensors and water sampling
- Deployment of 5 Argo floats
- On-board incubations to estimate primary productivity
- **After Dutch Harbor**
- Benthic sampling using Van Veen grabs & Haps corer
- CTD & water sampling with the vertically towed bongos.
- Seabird and marine mammal observation
- On-board incubations to estimate primary productivity
- Continuous Plankton Recorder
- Mooring recovery

CCGS Sir Wilfrid Laurier (Arctic Leg 3)

Marine Hazards ... Ocean Monitoring

23 Sep – 5 Oct 2020

14 oceanographic moorings to be recovered, 14 to be deployed

Continuous near-surface temperature & salinity

1 oceanographic section, CTD only: DBO-8; 2 CPR tows, each 550 mi

Organic contaminants sampling – seawater

Seabed mapping by multi-beam sonar - opportunistic



Chief Scientist

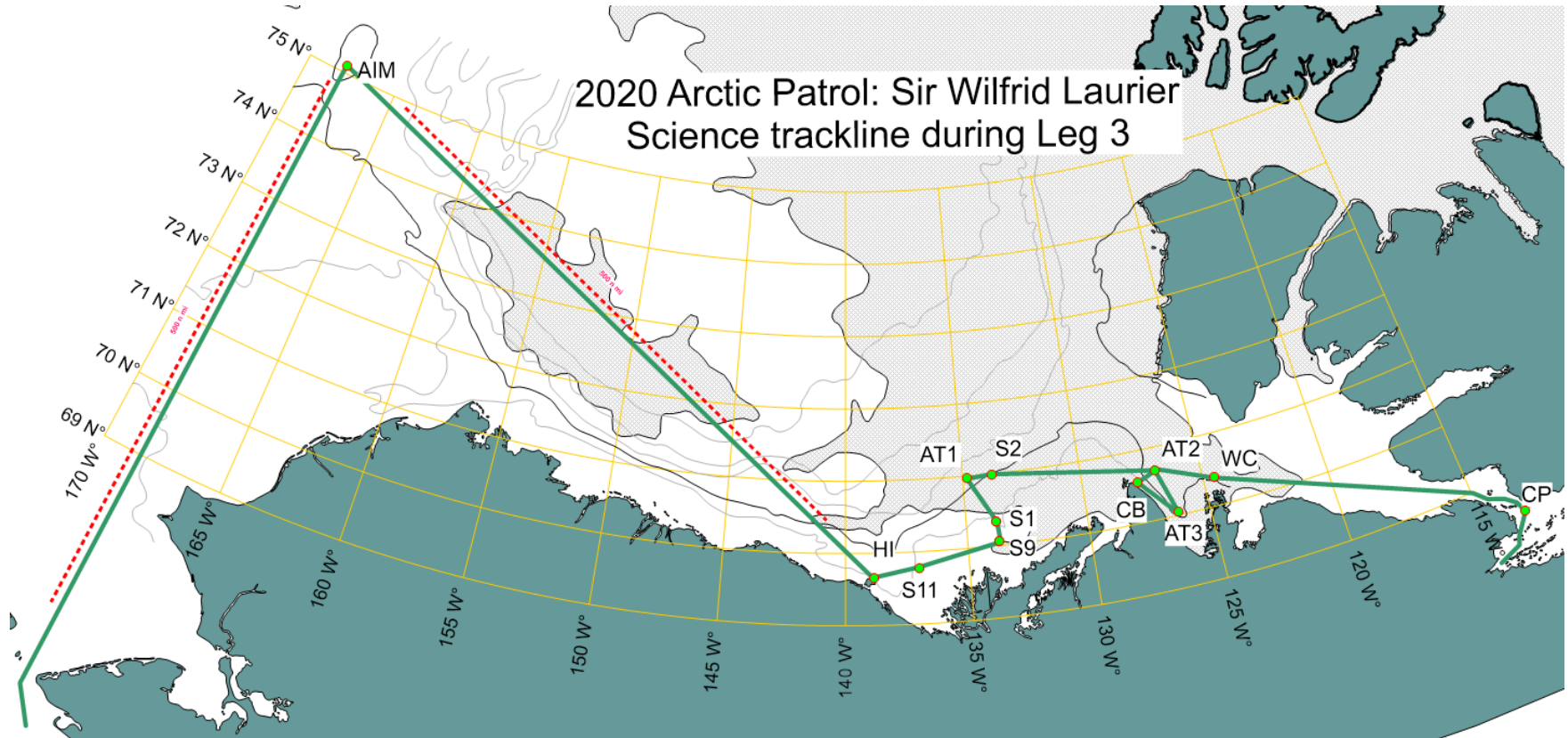
Humfrey Melling, DFO at IOS

Collaborators

DFO at FWI, CHS, ECCC, NOAA

Supported by

Fumes, OPP



Year-round data document marine climate: Norms, natural variation, extremes, progressive change

Sea ice

Thickness, drift, hazardous features

Sea surface

Storm waves, storm surge

Ocean current – surface to seabed

Seawater pathways (e.g. nutrient delivery, pollutant dispersal), dangerous currents

Ocean water masses – temperature, salinity

Identify properties, origins of seawater

Sediment in seawater

Suspension, transport & deposition

Organic contaminants in seawater

Biological enhancers

Nutrient upwelling, zooplankton variation

Ambient sound

Mammal's vocalization, species presence, natural sound, seismic surveys, ship noise



F/V Frosti: 41m commercial fishing trawler





Canadian Beaufort Sea Marine Ecosystem Assessment (CBS-MEA)

**Science in support of a changing
Beaufort Sea ecosystem**

DFO Leads: A. Majewski, A. Niemi,
J. Reist and R. Young



Banks Island, NT. (A. Niemi)

Project approach

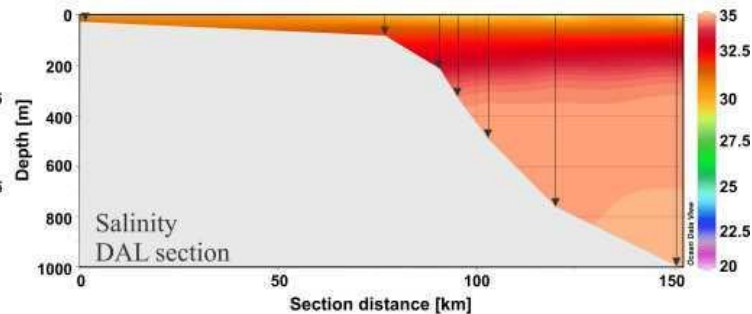
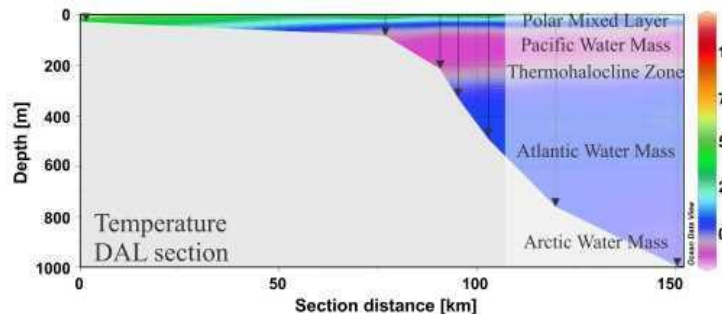
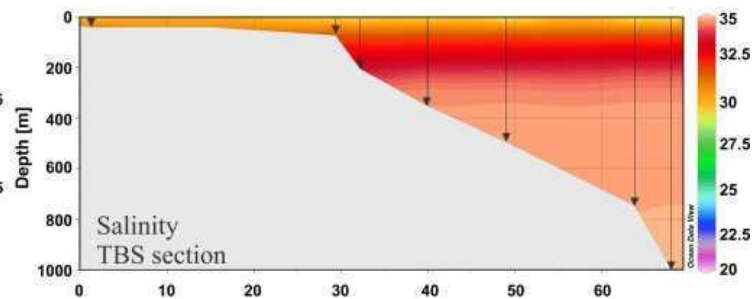
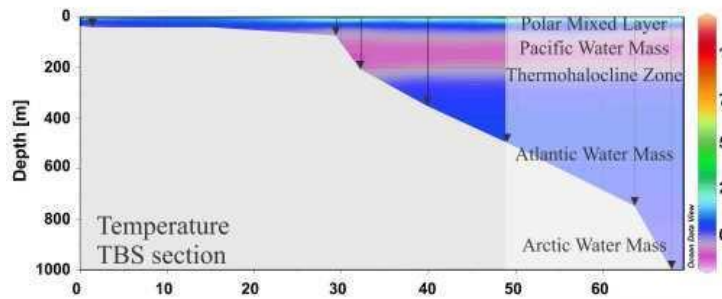
- Multidisciplinary science team consisting of DFO, University and Community partners
- Off-shore, ship-based sampling - physical, chemical and biological (bacteria to bowheads) data collection
 - Linked mooring program (Niemi)
- Real-time ecosystem integration
- Complementary nearshore/coastal work included in the study area



Water-column sampling

CTD-Rosette:

- Temperature, salinity, and other water properties will be measured to identify water mass habitats for fishes, plankton, and benthic invertebrates

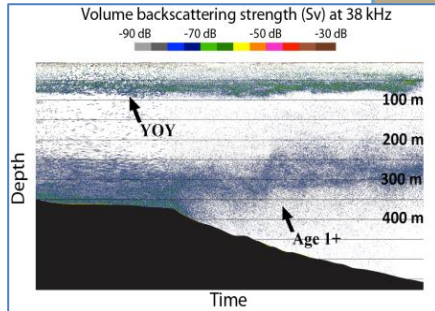


Water-column profiles of temperature and salinity on the CBS shelf and slope

Water-column sampling

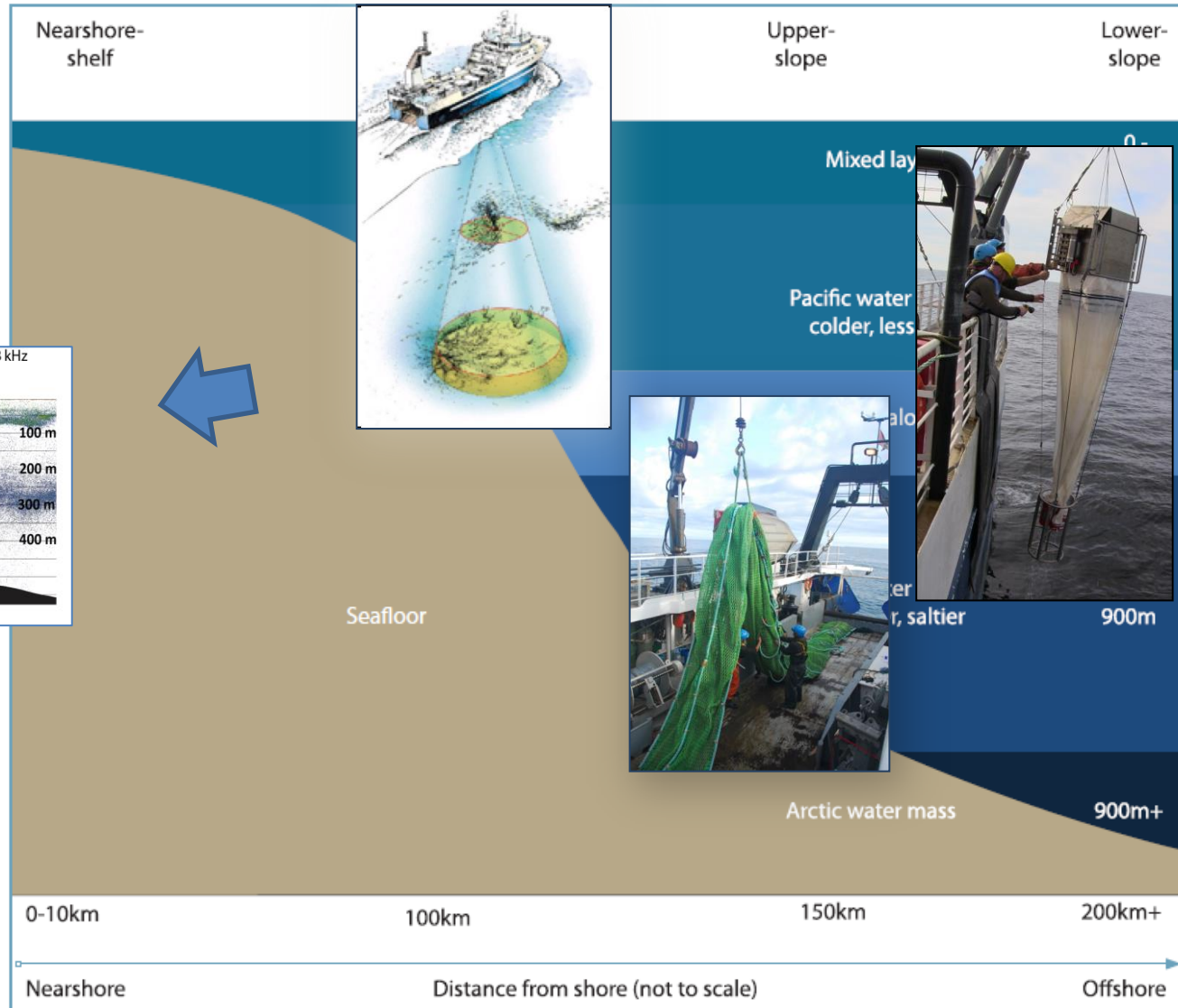
Hydroacoustics:

Ship-mounted hydroacoustics provide a picture of where the fish and plankton are in the water column



Mid-water nets:

Mid-water trawls and plankton nets will identify the species that live within different water masses



Bottom sampling

Box-core and beam trawl:

- Document bottom-type (e.g., mud vs. gravel) where fish and invertebrates are sampled
- Sample the communities of invertebrates (fish & MM food) living within the sediments and on the sea floor

Box Core



Invertebrates in the sediments



Bottom Trawling



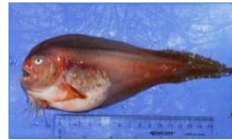
Invertebrates on/near bottom



Bottom sampling

Small beam trawl

- Catches small bodied fishes
e.g., sculpins, lumpsuckers, snailfishes
- Extend coverage from CCGS *Nahidik*
- Allows comparisons with Alaskan data



Larger bottom trawl

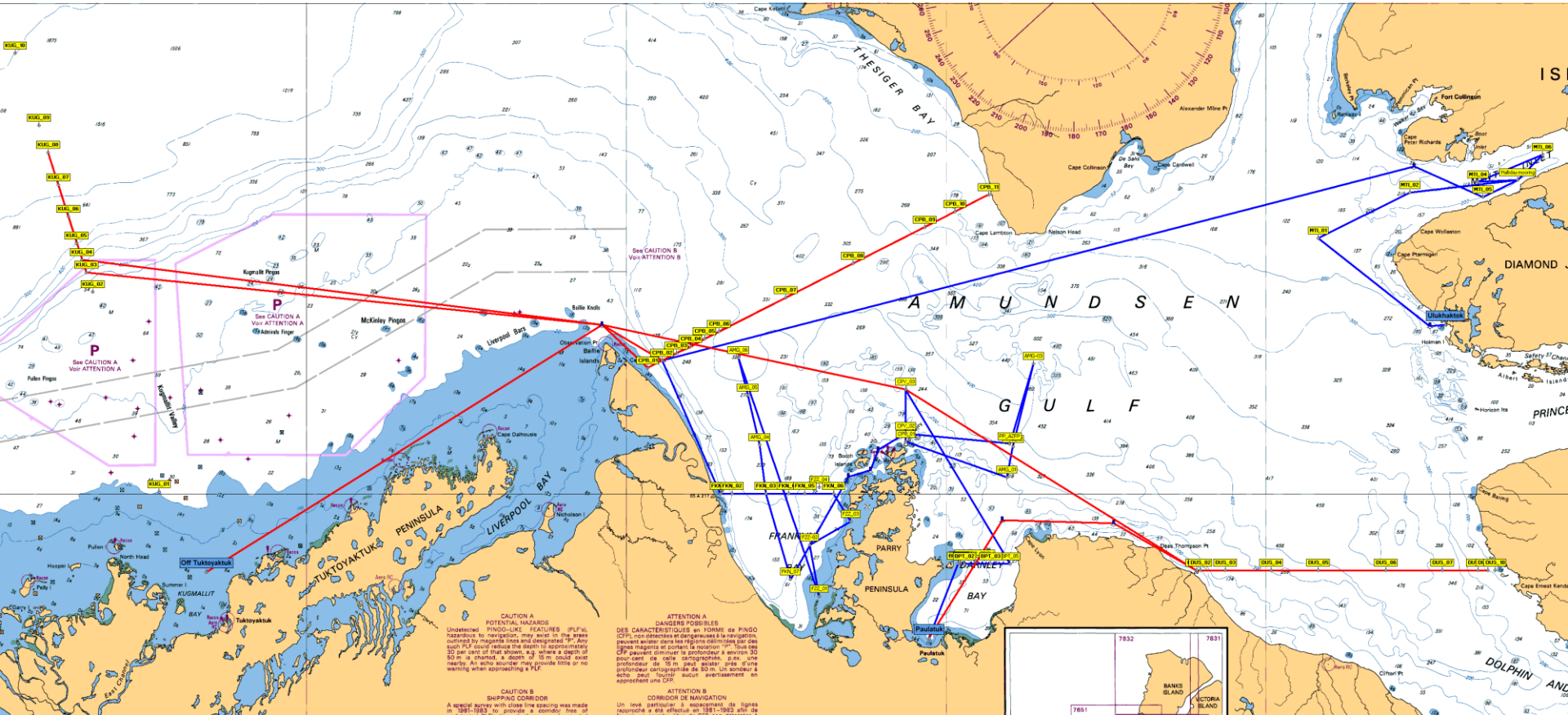
- Catches a broad spectrum of species & sizes including larger, faster fishes.

e.g., flatfishes, skates

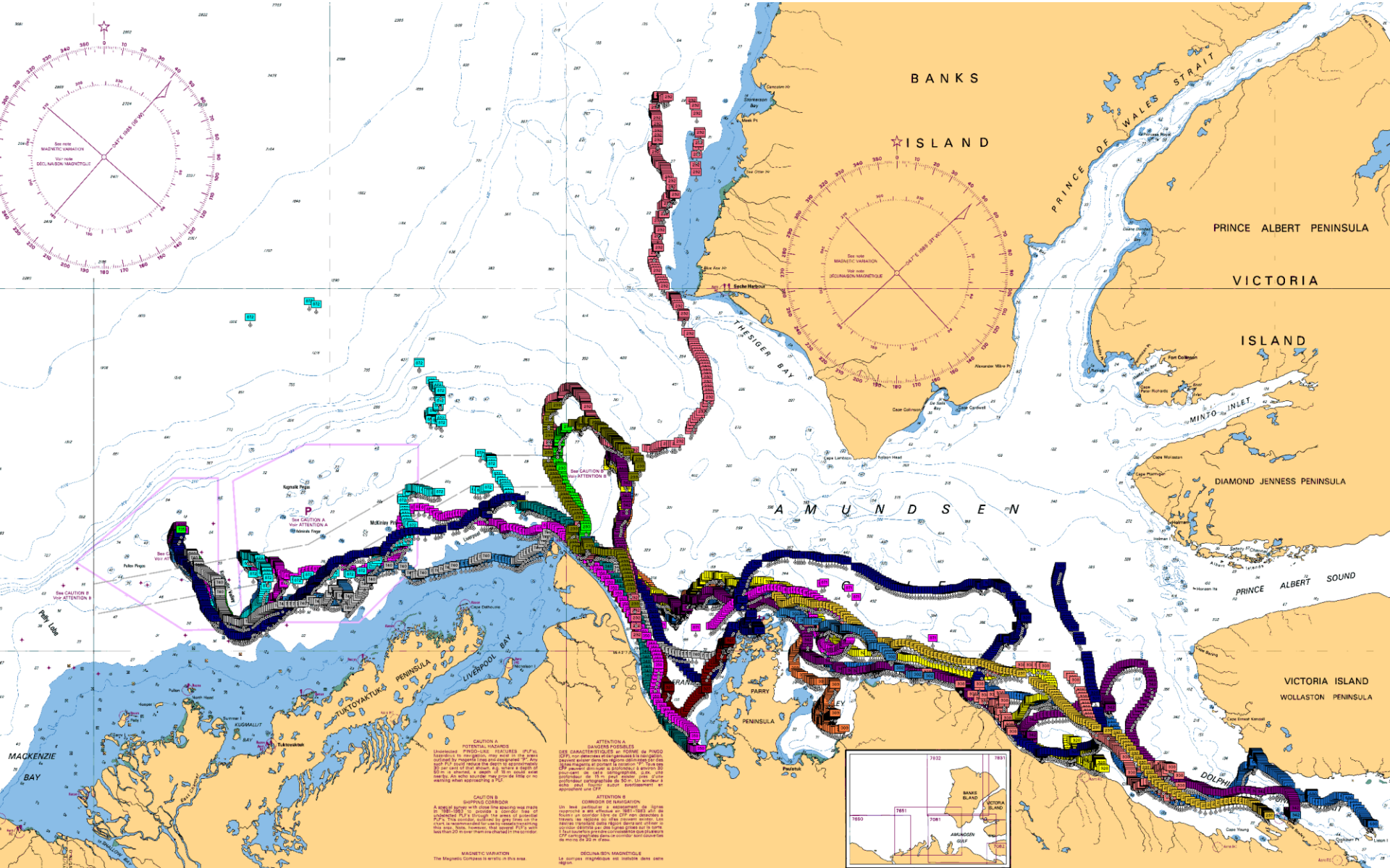




2019 stations:



2020: 1 August – 11 September, stations TBD.



CAUTION A
POTENTIAL HAZARDS (PUL)
 Uncharted PROPOSED OBSTACLES (PUL) are outlined by magenta lines and designated 'P'. Any depth PL is listed below the depth by approximately 20 m in shallower areas. PL is not a depth as it may vary. An entry number may give an idea of the waiting time when approaching a PL.

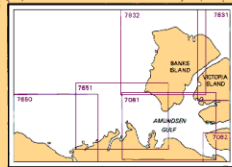
CAUTION B
HAZARDOUS OBSTACLES
 A vessel's radar will show the location of these in 1981-1983. A vessel's radar may not show all potential PL's through the areas of potential PL's. The vessel's radar may not show all PL's in this area. Note, however, that some PL's will be marked on this chart when they are measured.

MAGNETIC VARIATION
 The Magnetic Course is given in this area.

ATTENTION A
LES DANGERS POSSIBLES
 DES OBSTACLES NON CHARTÉS (PUL) sont indiqués par des lignes roses et désignés 'P'. Toute profondeur PL est indiquée sous la profondeur d'environ 20 m dans les zones moins profondes. PL n'est pas une profondeur car elle peut varier. Un numéro d'entrée peut donner une idée du temps d'attente lorsqu'on s'approche d'un PL.

ATTENTION B
OBSTACLES DANGEREUX
 Un radar embarqué va indiquer la position de ces obstacles en 1981-1983. Un radar embarqué peut ne pas montrer tous les PL potentiels à travers les zones de PL potentiels dans cette région. Notez cependant que certains PL seront indiqués sur cette carte lorsqu'ils seront mesurés.

DÉCLINAISON MAGNÉTIQUE
 La déclinaison magnétique est indiquée dans cette région.



R/V Martin Bergmann

19-m coastal research vessel

6 scientists

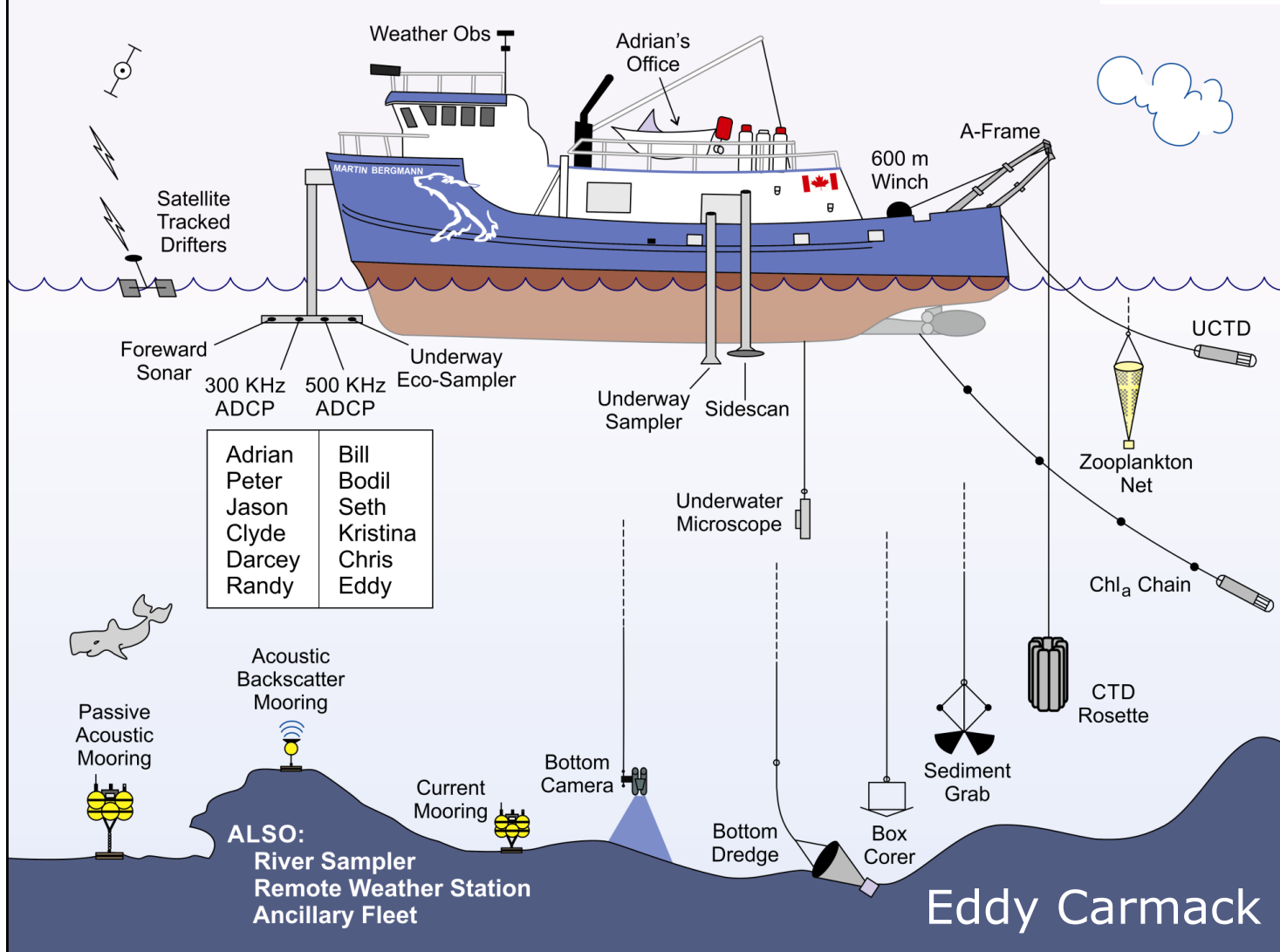
Based in Cambridge Bay, NU

ARCTIC
RESEARCH
FOUNDATION



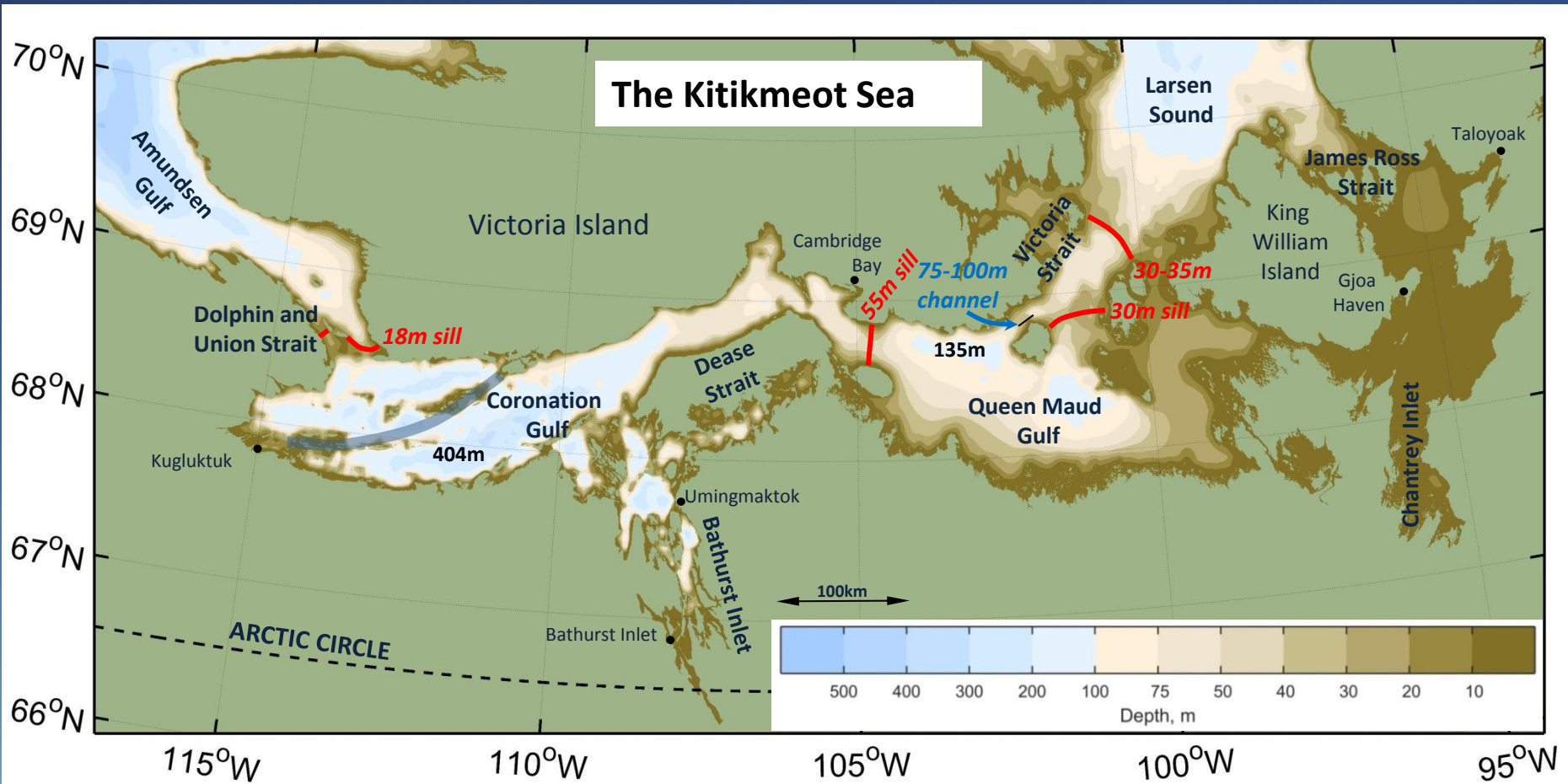
R/V Martin Bergmann

THE LITTLE BOAT THAT DID



Kitikmeot Sea Science Study (K3S, since 2016)

To explore the physical and geochemical drivers of ecosystems in the Kitikmeot Sea.

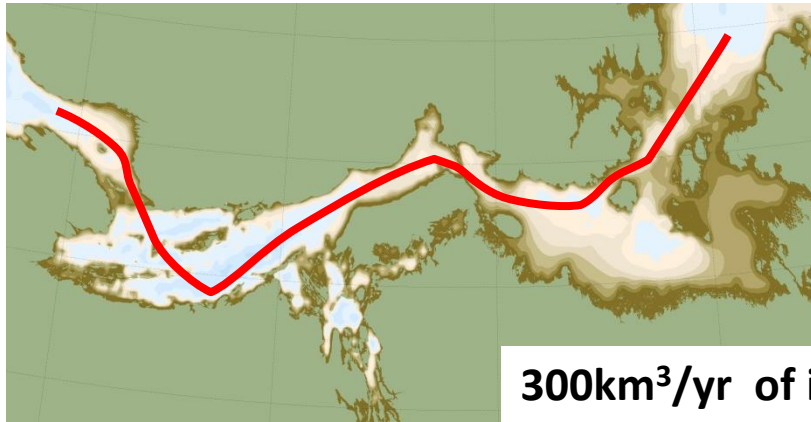


Bill Williams, Bodil Bluhm, Kristina Brown, Eddy Carmack,
Seth Danielson, Lina Rotermund, Brent Else, CJ Mundy



Overall estuarine freshwater - saltwater balance:

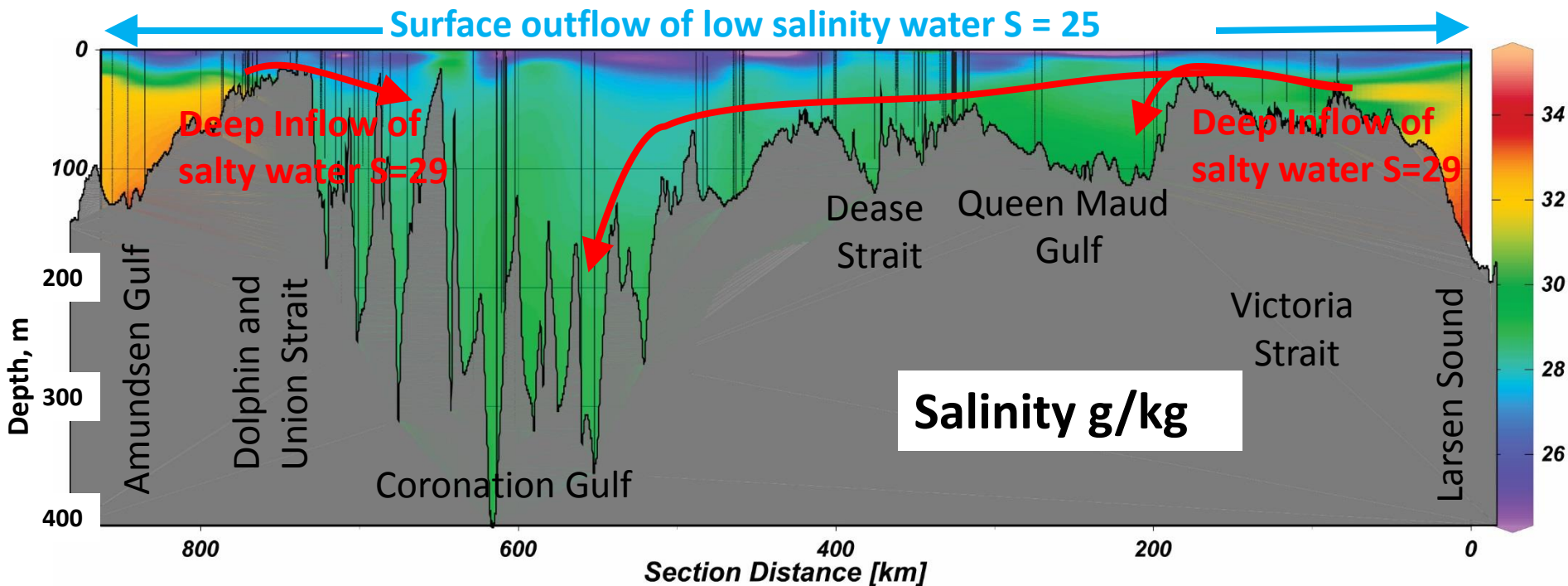
Inflowing freshwater from rivers mixes with inflowing deep salty water to make the shallow outflow :

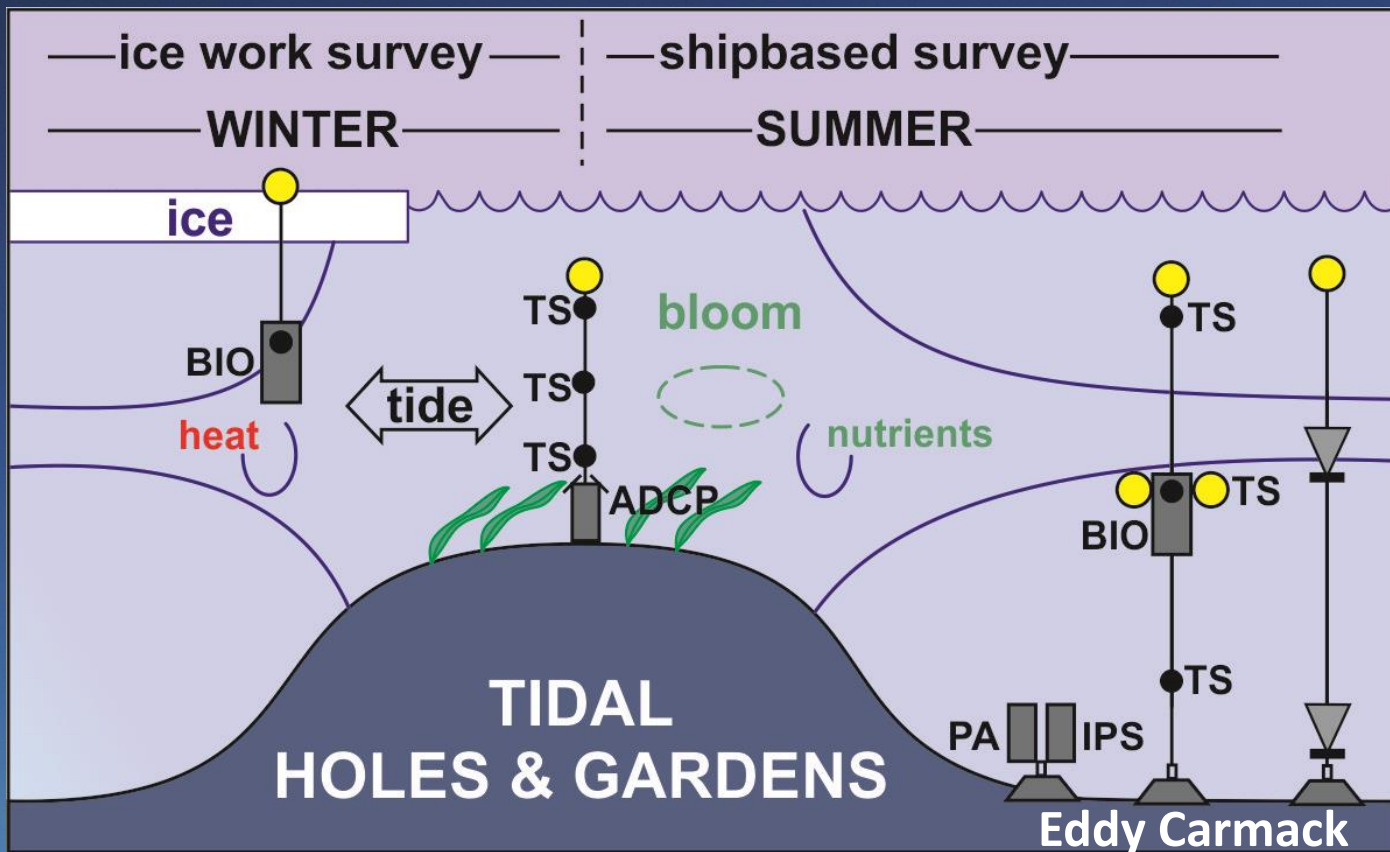


	Salinity g/kg	Volume km ³ /year
Deep Inflow	29	256.25
Freshwater Inflow	0	41
Shallow Outflow	25	297.25

Residence time: 13 years

300km³/yr of inflow at 8 mmol/m³ of NO₃ = 2.7 gC/m²/yr





Components:

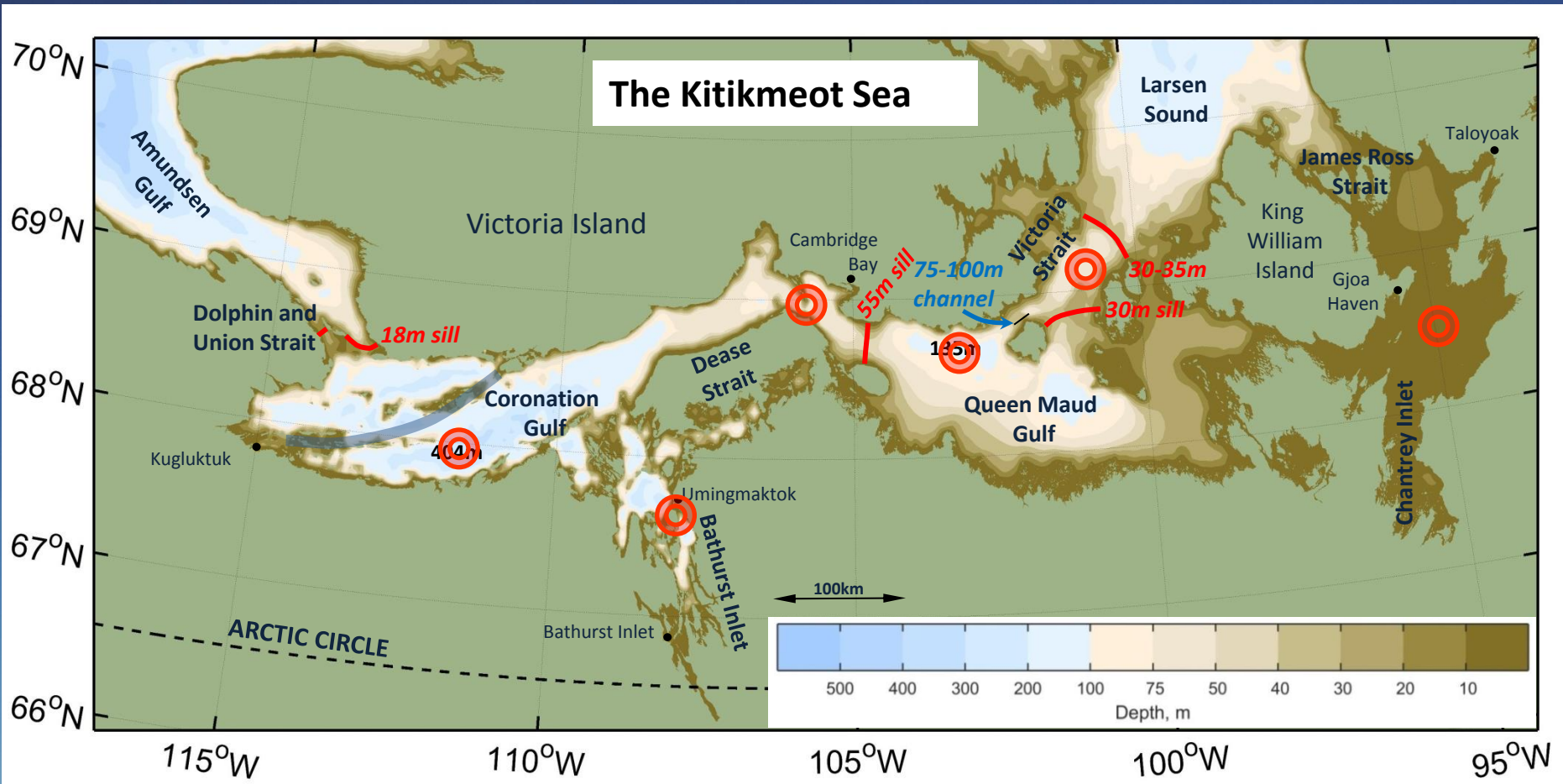
- Estuarine circulation
- Wind-driven flows
- Freshwater inflow
- Tidal dynamics
- Tidal mixing in narrow straits

- Primary production
- Geochemical tracers
- Inorganic carbon cycles
- Benthic ecology



2020 Kitikmeot Sea Science Study (August 2020)

Mooring deployments across the Kitikmeot Sea: 



Bill Williams, Bodil Bluhm, Kristina Brown, Eddy Carmack,
Seth Danielson, Lina Rotermund, Brent Else, CJ Mundy



The Barrow Strait Monitoring Program and Real-time ocean observatory

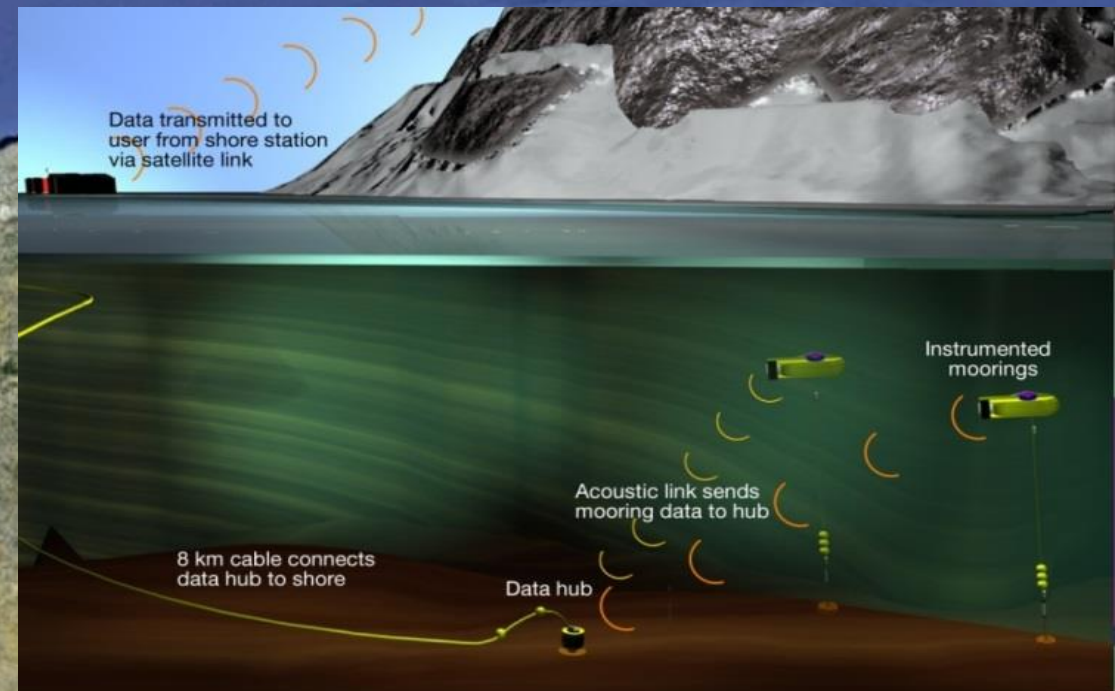


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Clark Richards,
Bedford Institute of Oceanography

- Originally maintained from 1998 to 2011.
- **Re-deployed in August 2017.**
- **Turned-around August 2019 for 2 years**
- **Principle objective:** To quantify freshwater and volume transports into the NW Atlantic.
- Measurements of water properties, currents, and ice draft, passive acoustics.



DRAFT 2020 *Amundsen* Expedition Plan

Draft February 2020



AMUNDSEN
SCIENCE

NGCC • CCGS

AMUNDSEN

2020 Amundsen Expedition - Overview

Overview

114 days at sea
4 legs



Resolute Bay
27 August

Pond Inlet
19 August

Cambridge Bay
24 September

Kugluktuk
2 September

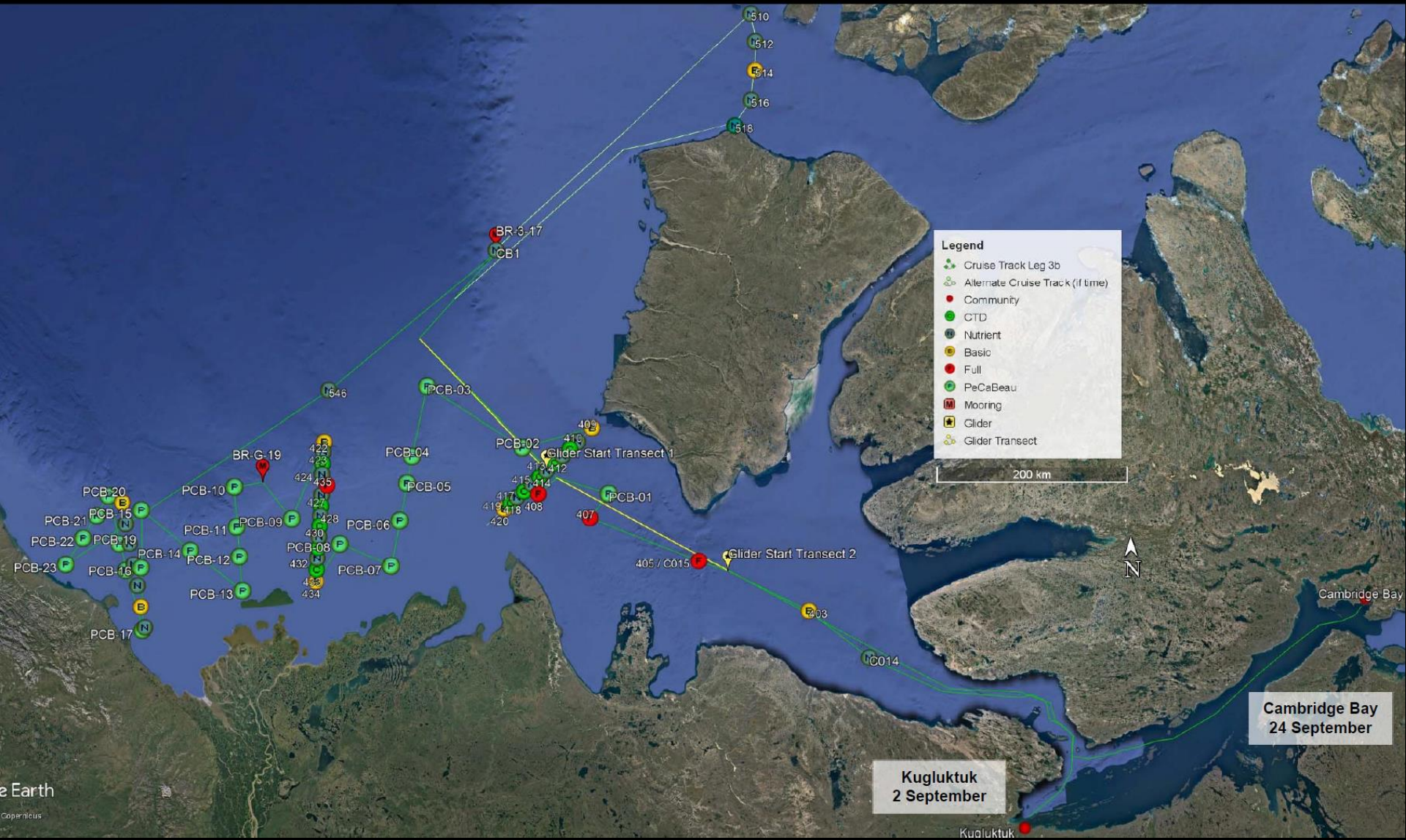
St. Anthony NL
30 July

Quebec City
3 July & 24 October

- Legend**
- Cruise Track Leg 1 AZOMP
 - Cruise Track Leg 2a Coral Seep ROV, ArcticNet & Bio-Argo Floats
 - Cruise Track Leg 2b ArcticNet & SN Techno
 - Cruise Track Leg 3a ArcticNet & RadCARBBS
 - Cruise Track Leg 3b PeCaBeau, ArcticNet, Gliders & SN
 - Alternate Cruise Track Leg 3b (if time)
 - Cruise Track Leg 4 KEBABB, ArcticNet & SN Quaqtq
 - Community/City
 - CTD
 - KEBABB Basic
 - Nutrient
 - AZOMP Bio
 - AZOMP CTD
 - Contaminants
 - Basic
 - DFO Benthic
 - Full
 - PeCaBeau
 - Sentinel North
 - Mooring
 - ROV
 - ArcticKelp
 - Argo Float
 - Bio-Argo Float
 - Coring
 - Glacier/Ice
 - Glider
 - River

1000 km

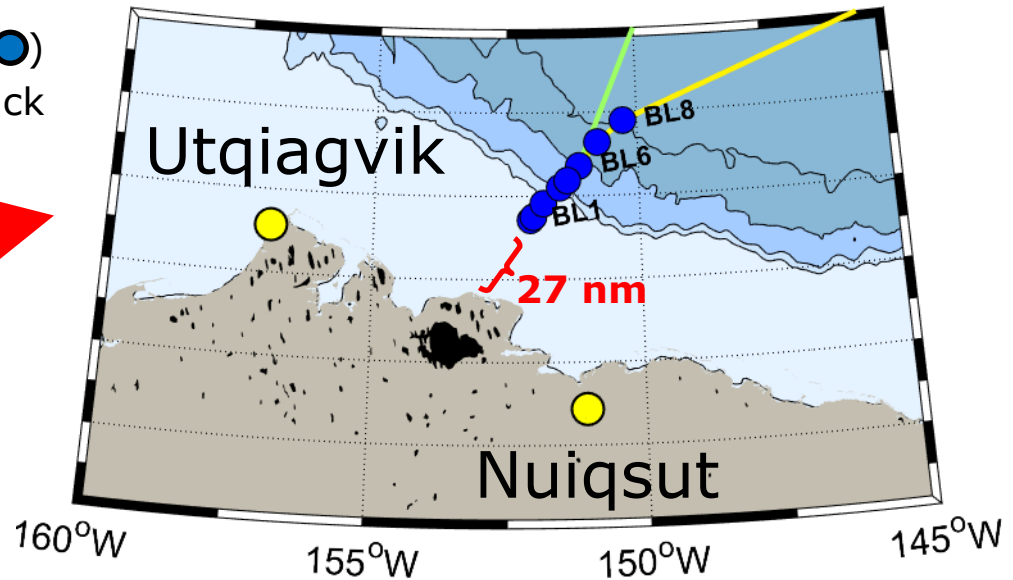
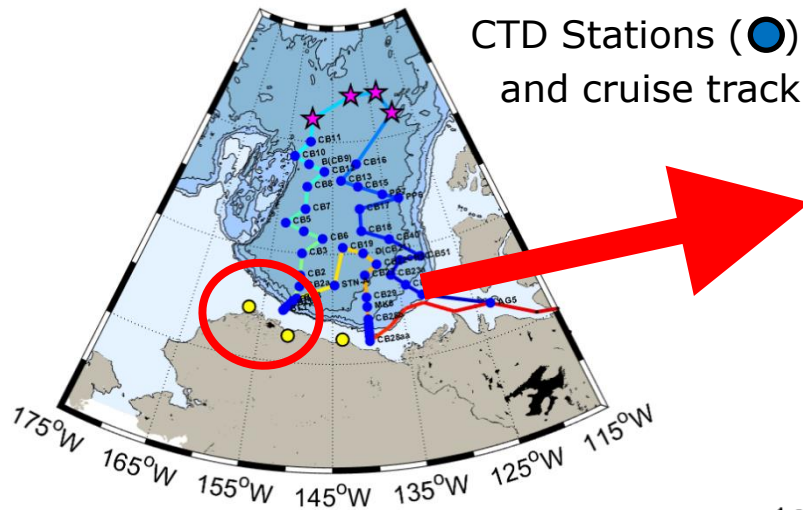
2020 Amundsen Expedition – Leg 3b ArcticNet, PeCaBeau & SN, Gliders







Climate Change, Ocean Currents and Biology: Joint Ocean Ice Study / Beaufort Gyre Observatory



Data collection near coast:

- Seawater temperature, salinity, tracers of sea-ice melt water and velocity
- Nutrients, oxygen, carbon products (ocean acidification), microplastics
- Zooplankton, Phytoplankton, Microbes
- Signs of Fukushima spill

Date	Location	DBO Line	Distance from shore	Time within 50 nm of shore
22 Sep	Barrow Line	6	27 nm	14 hrs



Fisheries and Oceans
Canada

Pêches et Océans
Canada



Contact: Bill Williams Bill.Williams@dfo-mpo.gc.ca

Data and cruise reports available:

<https://www.who.edu/website/beaufortgyre/data>