Canadian Arctic Marine Science Plans

2019

Pacific Arctic Group Meeting

Arctic Science Summit Week 2019

Arkhangelsk, Russia

Bill Williams, Fisheries and Oceans Canada


CCGS Louis S. St-Laurent
IMO 6705937
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Joint Ocean Ice Studies (JOIS) - Arctic Observing Network - Beaufort Gyre Observing System (AON-BGOS)

- Chief Scientist: Bill Williams / Sarah Zimmermann
- Collaborators: WHOI, JAMSTEC, TUMSAT, KIT …
- Supported by: NSF, DFO, KIT
- 10 Sept - 02 Oct, 2019 (20 days)
- Kugluktuk - Canada Basin - Kugluktuk
- 27 participants
- CTD/rosette profiles + biogeochemical sampling
- Vertical net casts for zooplankton
- XCTD casts
- *No mooring recovery or deployment (WHOI)*
- Underway measurements
- Ice Observations (ship, ice and helicopter)
- Deploy 4 Ice Tethered Profilers, 2 Seasonal Ice Mass Balance Buoys

(Photo: Jeffrey Charters)

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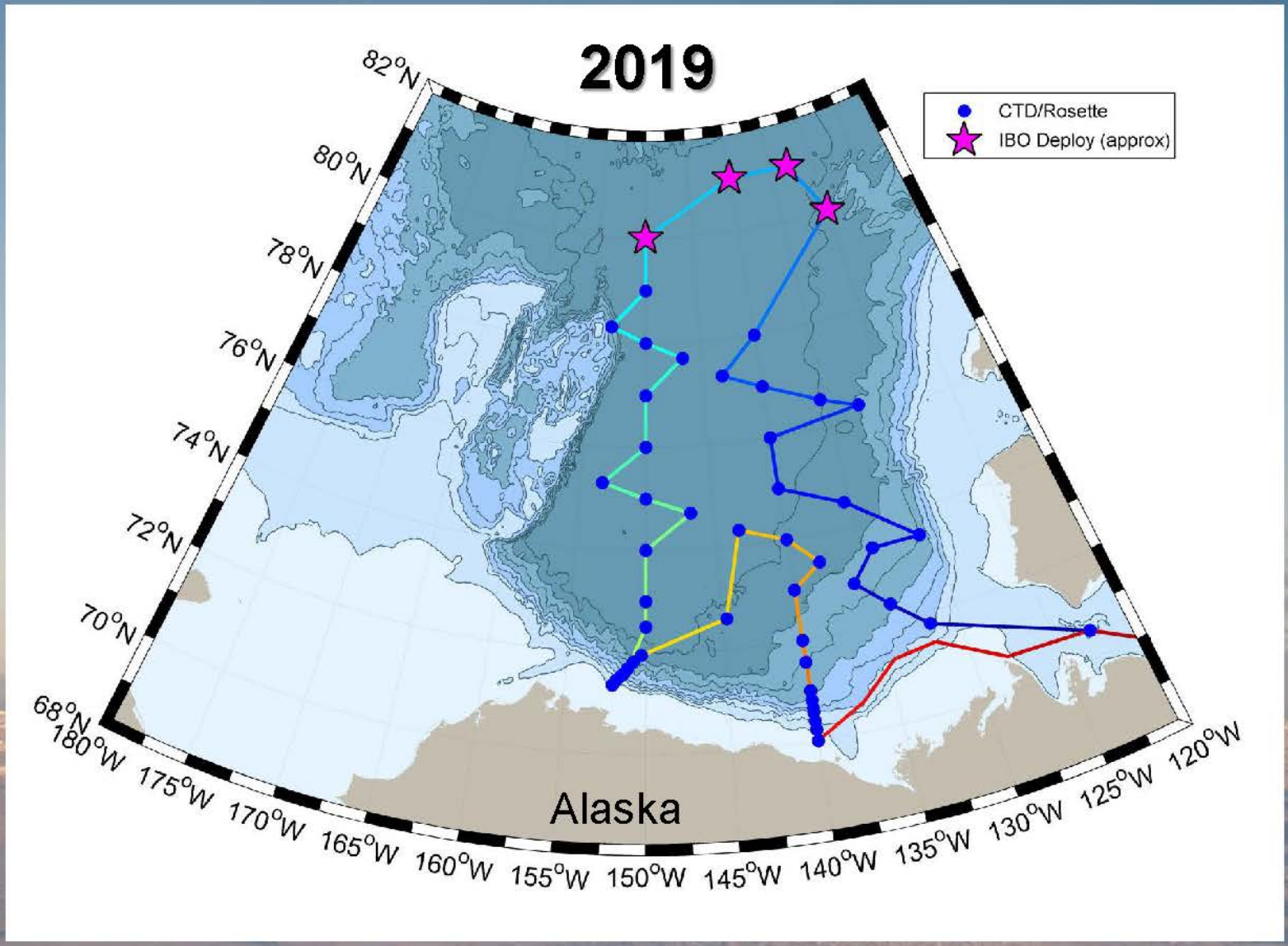
JOIS - AON-BGOS



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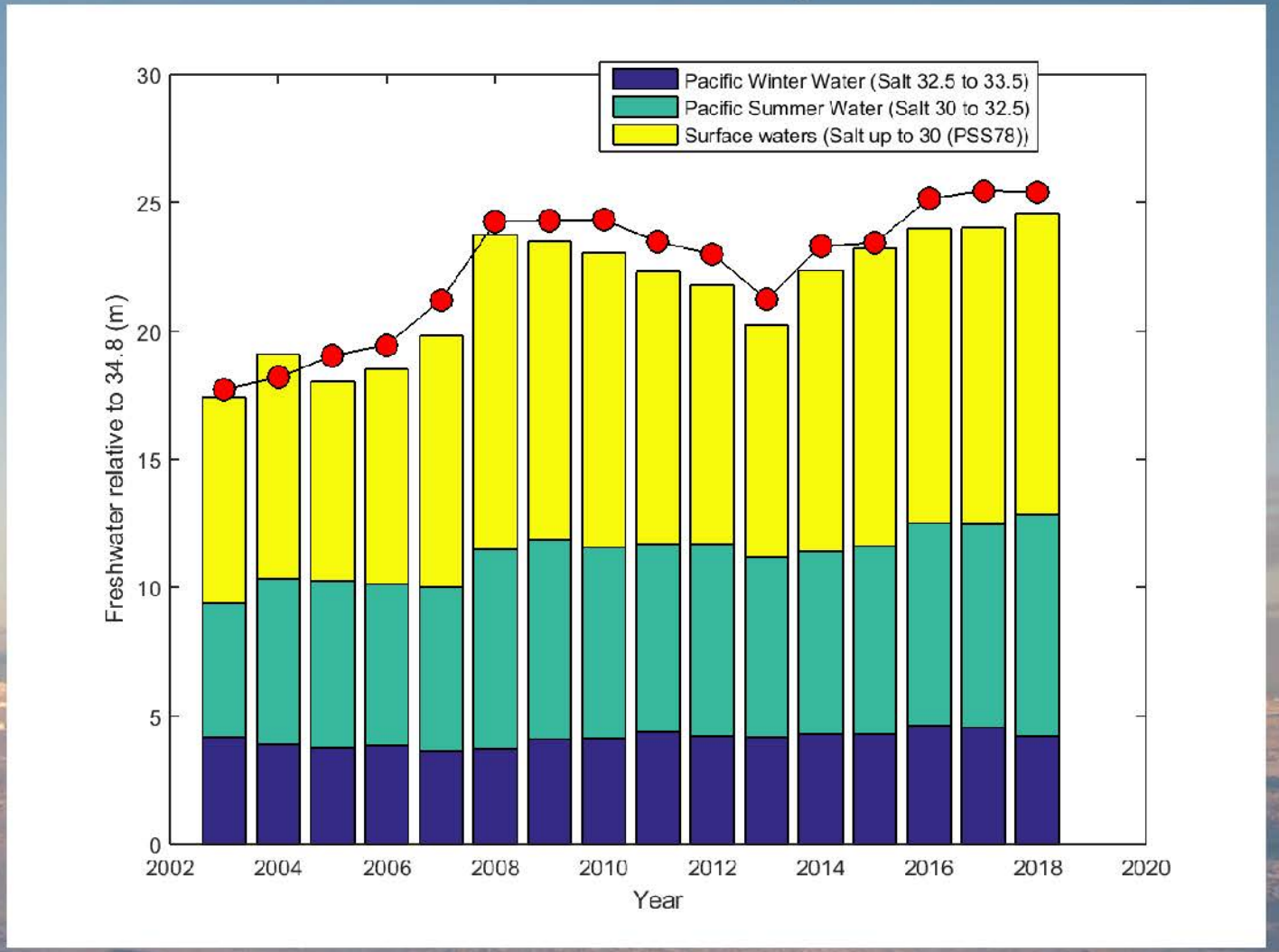
JOIS - AON-BGOS

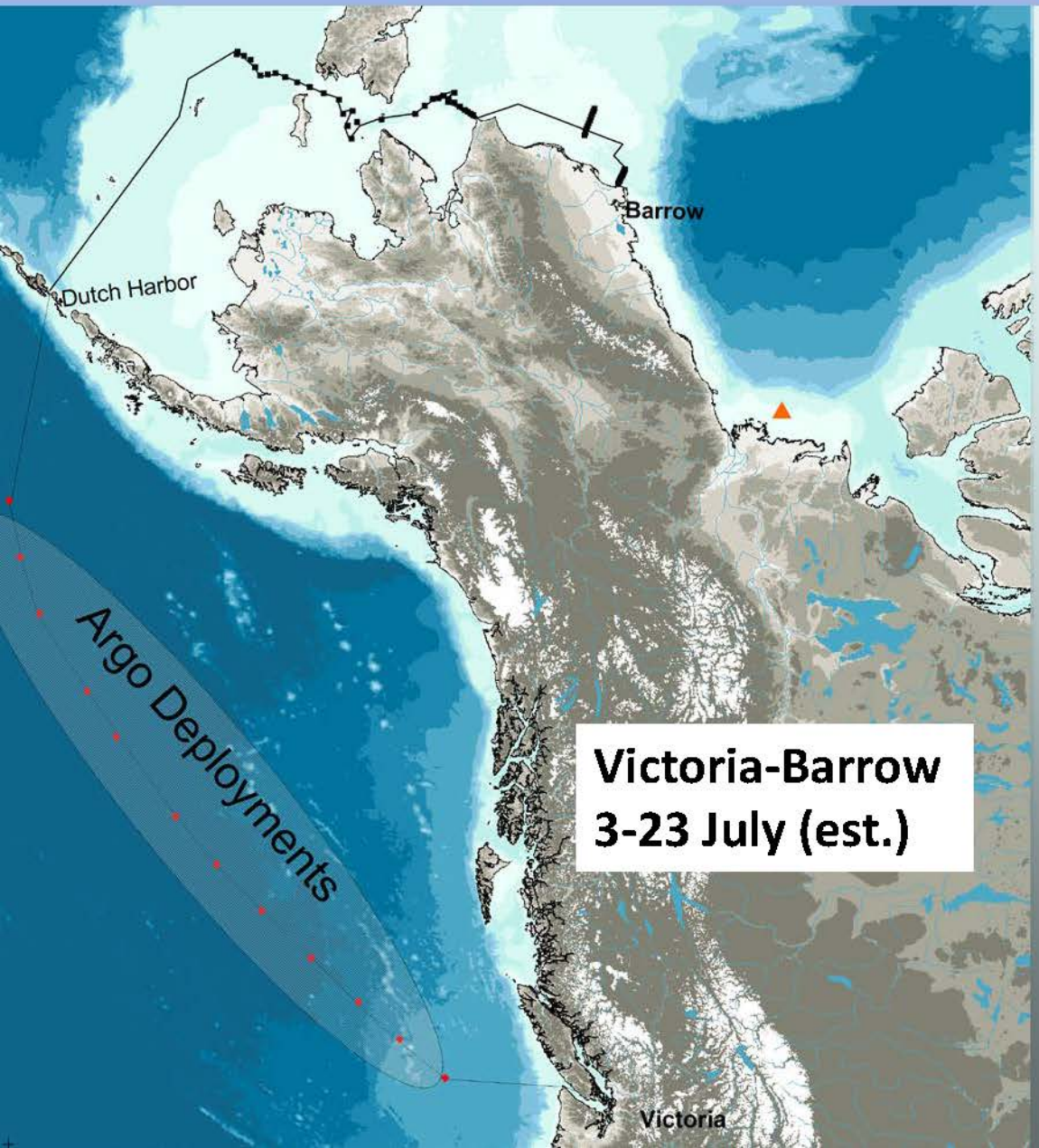
Freshwater content of the Beaufort Gyre:



From
Sarah Zimmermann

CCGS Sir Wilfrid Laurier

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



6 days for science, 16 scientists

- U-CTD & X-CTDs during transit
- CTD/Rosette, ADCP, bongo net casts across the Gulf of Alaska.
- underway seawater sampling
- deployment of 5 Argo floats
- onboard incubations to estimate primary productivity

board 12 scientists in Dutch Harbor for DBO

- sediment sampling using VanVeen grabs & Happs corer
- CTD & water sampling with the rosette
- vertically towed bongos.
- seabird and marine mammal observation
- onboard incubations to estimate primary productivity

CCGS Sir Wilfrid Laurier (Arctic Leg 3)

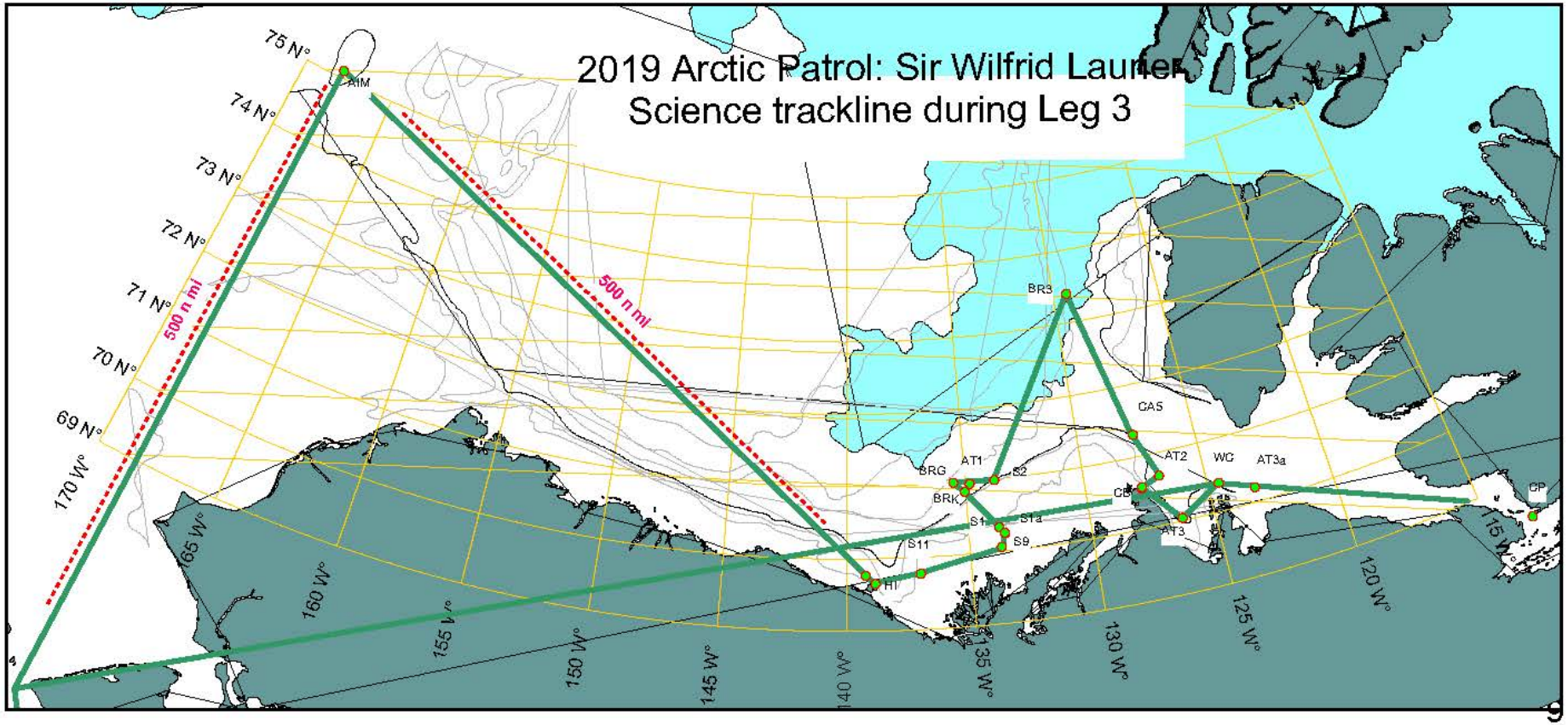
Marine Hazards … Ocean Monitoring

25 Sep – 10 Oct 2019

Fisheries and Oceans | Pêches et Océans

21 oceanographic moorings to be recovered, 16 to be deployed
Continuous near-surface temperature & salinity
1 oceanographic section, CTD only: DBO-8; 2 CPR tows, each 550 mi
Organic contaminants sampling – air & seawater
Bottom mapping by multi-beam sonar - opportunistic

Chief Scientist
Humfrey Melling, DFO at IOS
Collaborators
ArcticNet, ASL Env Sci, ECCC, CHS, NOAA, Stantec
Supported by
PERD, ASL, 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

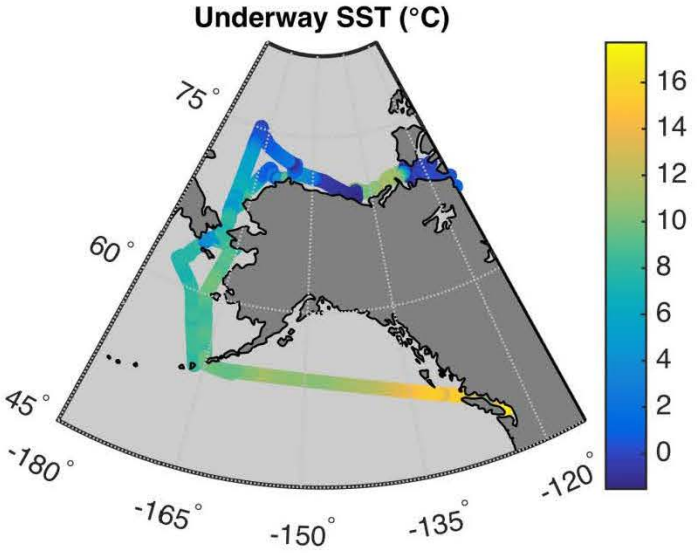
Biological enhancers

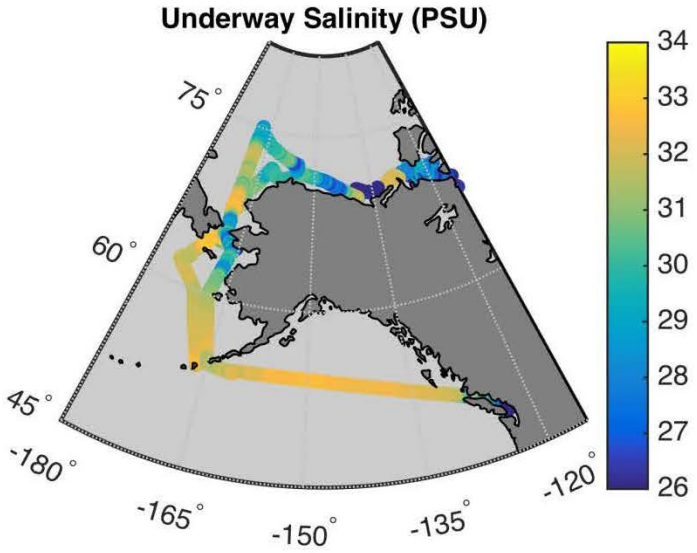
Nutrient upwelling, zooplankton variation

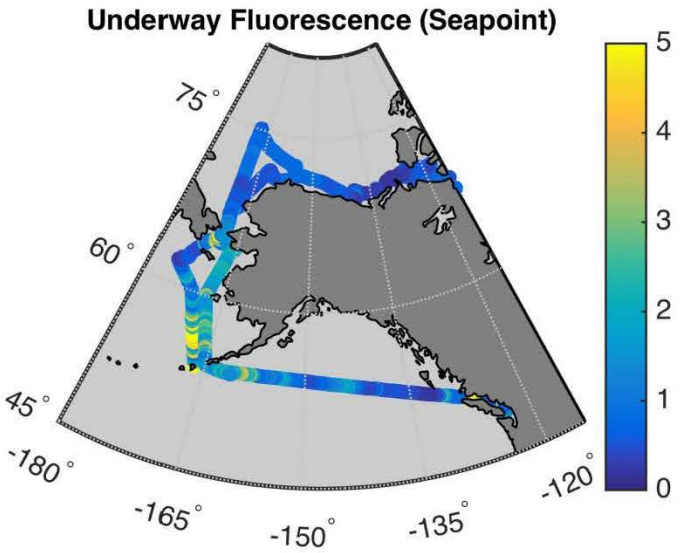
Ambient sound

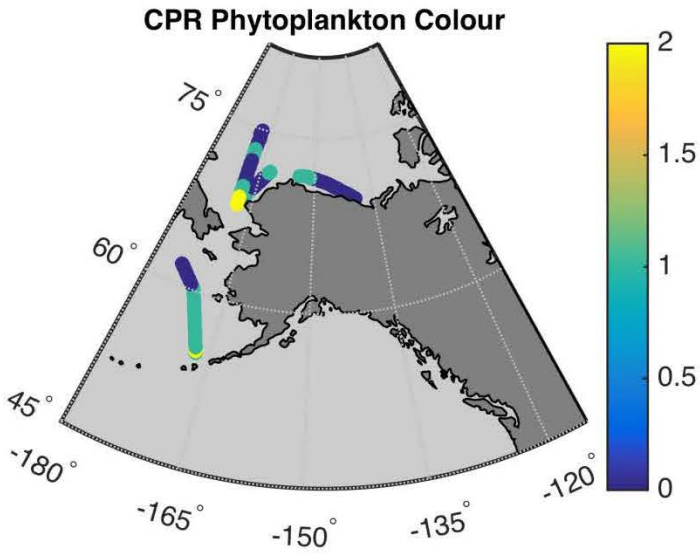
Mammal's vocalization, species presence, natural sound, seismic surveys, ship noise

2018 Underway Data:









F/V Frosti: 41m commercial fishing trawler


30741
FROSTY

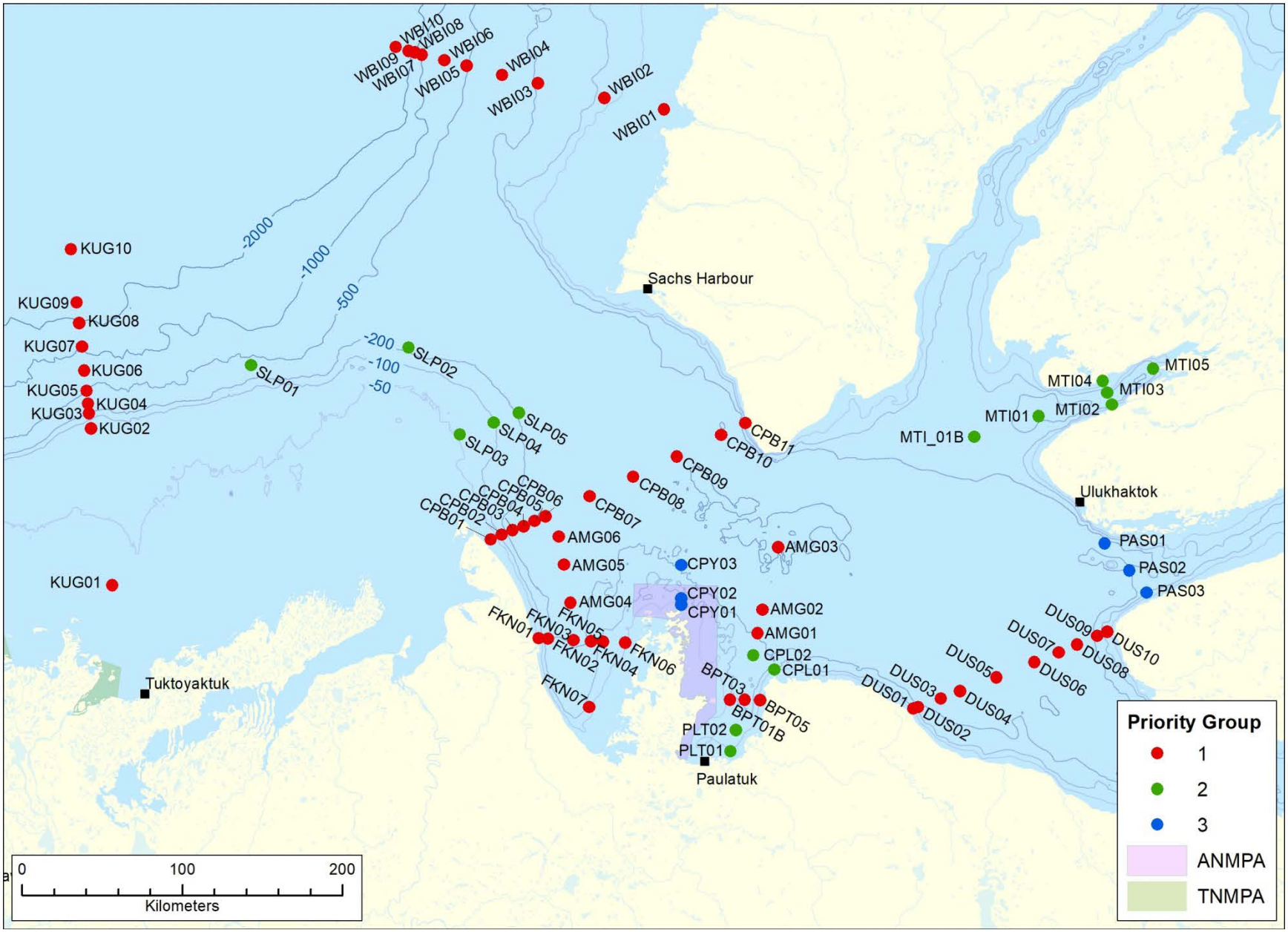
Canadian Beaufort Sea Marine Ecosystem Assessment (CBS-MEA)

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)

CBS-MEA 2018: 1 Aug to 11 Sept, 2018



Project approach

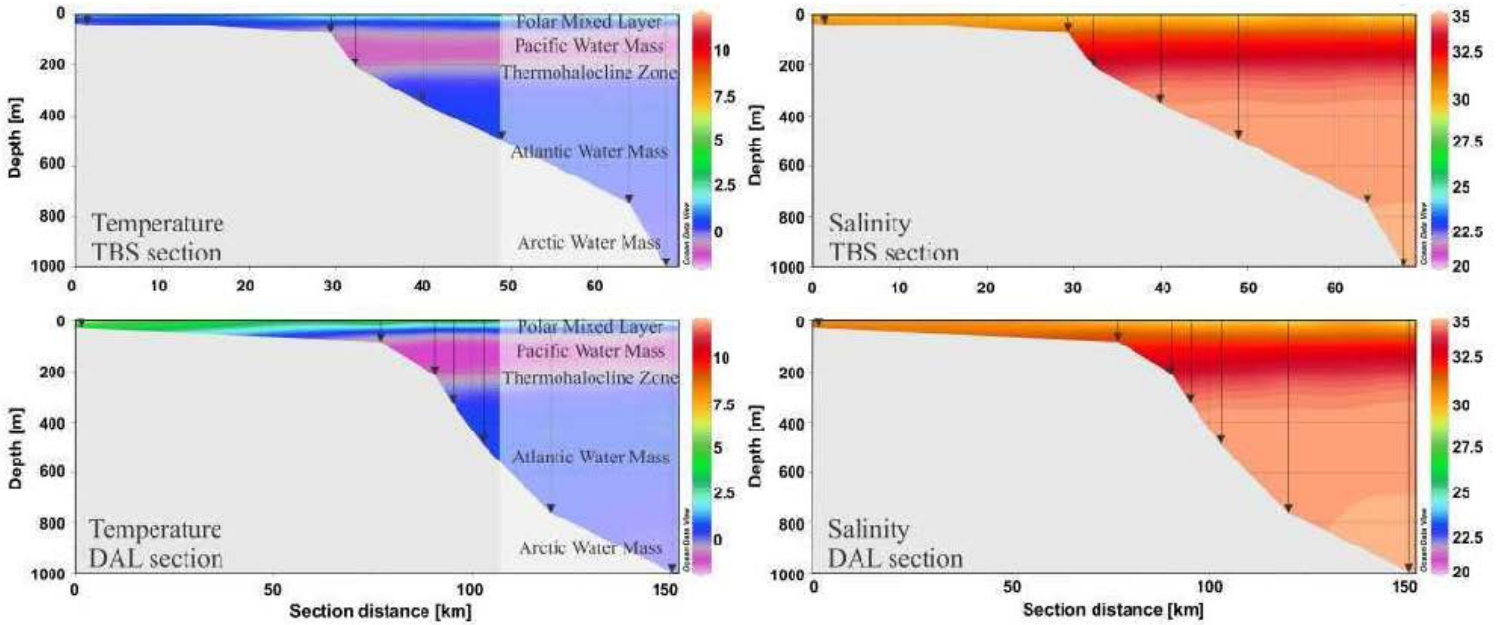
- Multidisciplinary science team consisting of DFO, University and Community partners
- Off-shore, ship-based sampling - physical, chemical and biological (bacteria to bowheads) data collection
  - Linked mooring program (Niemi)
- Real-time ecosystem integration
- Complementary nearshore/coastal work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

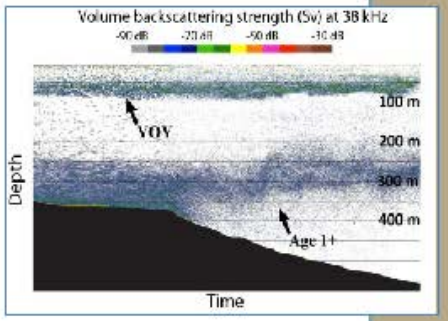


Water-column profiles of temperature and salinty on the CBS shelf and slope

Water-column sampling

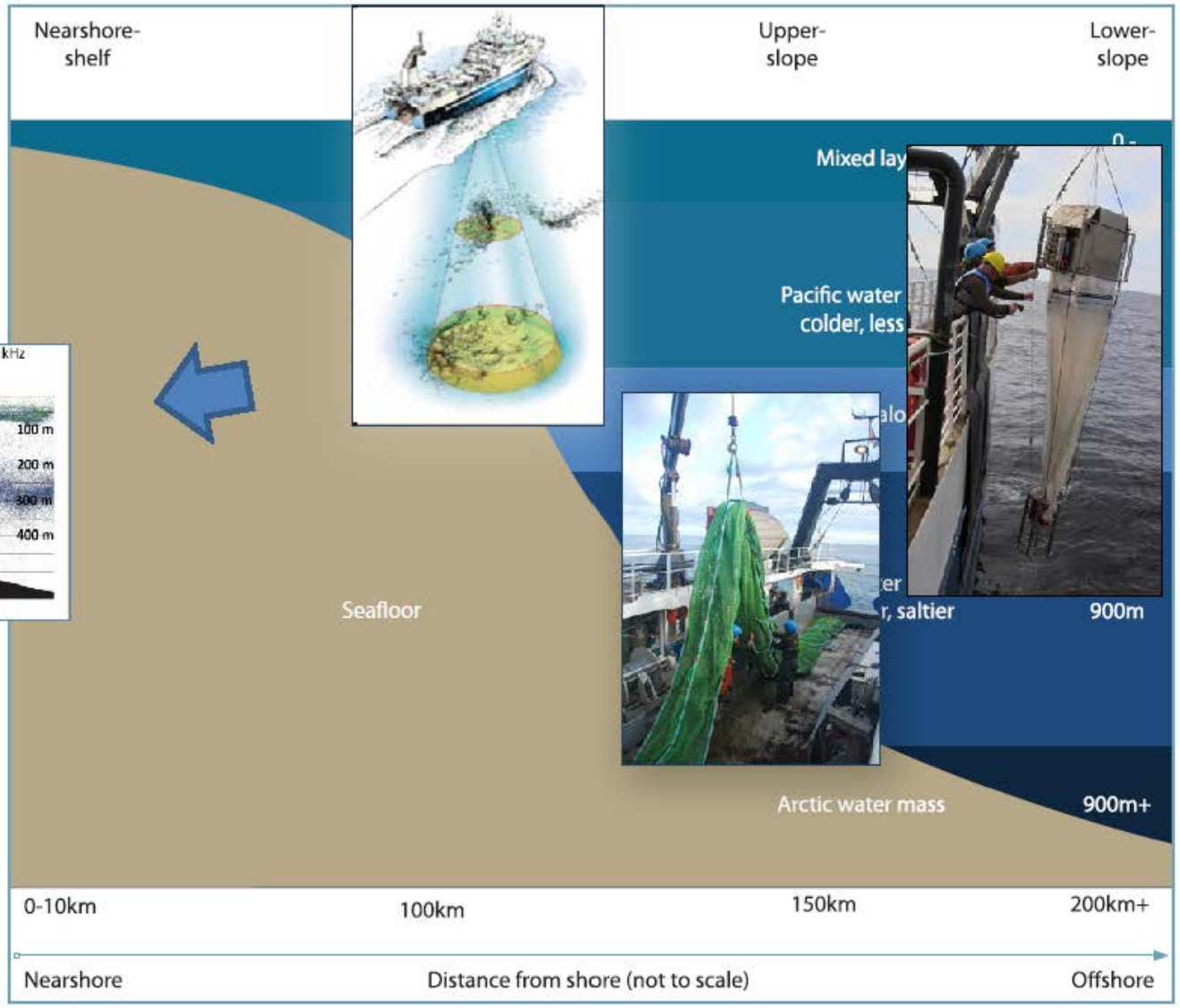
Hydroacoustics:

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



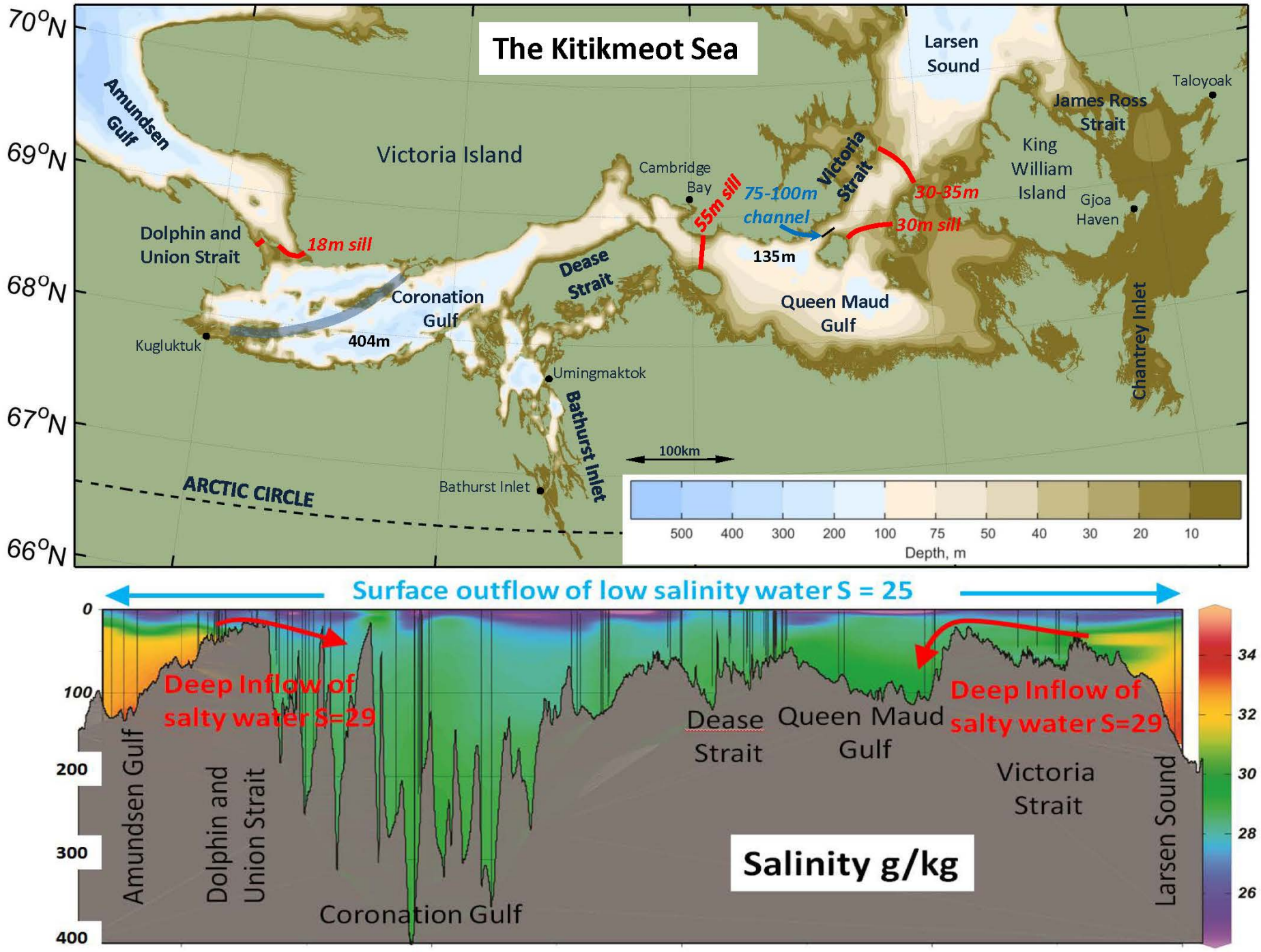
R/V Martin Bergmann

ARCTIC
RESEARCH
FOUNDATION

R/V Martin Bergmann

19-m coastal research vessel
6 scientists
Based in Cambridge Bay, NU

ARCTIC RESEARCH FOUNDATION


The Kitikmeot Sea
70°N
69°N
68°N
67°N
66°N
Amundsen Gulf
Victoria Island
Larsen Sound
Taloyoak
James Ross Strait
King William Island
Gjoa Haven
Cambridge Bay
55m sill
75-100m channel
Victoria Strait
30-35m
30m sill
135m
Dolphin and Union Strait
18m sill
Dease Strait
Coronation Gulf
404m
Queen Maud Gulf
Chantrey Inlet
Kugluktuk
Umingmaktok
Bathurst Inlet
Bathurst Inlet
100km
ARCTIC CIRCLE
500 400 300 200 100 75 50 40 30 20 10
Depth, m
Surface outflow of low salinity water S = 25
0
100
200
300
400
Deep Inflow of salty water S=29
Deep Inflow of salty water S=29
Amundsen Gulf
Dolphin and Union Strait
Coronation Gulf
Dease Strait
Queen Maud Gulf
Victoria Strait
Larsen Sound
Salinity g/kg
34
32
30
28
26

Ecological Research & Monitoring in the Kitikmeot Sea

RV Martin Bergmann's home base is Cambridge Bay:

- Operated by the non-profit Arctic Research Foundation
- Northern anchorage permits immediate start when local ice clears in late July
- Supports initiatives of DFO, ONC, OTN, Polar Knowledge Canada, UVic, UAF, UiT, MEOPAR

Ocean moorings:

- Submerged instruments monitor ocean current, salinity, temperature, PAR, DO, acoustic backscatter, underwater sound, light. Year-round operation .(DFO, ARF, Polar Knowledge Canada)
- Submerged listening stations track char during summer feeding at sea operated by Ocean Tracking Network (OTN)

Cabled observing station in Cambridge Bay:

- Operated as a test-bed cabled observatory by Ocean Networks Canada (ONC)

Reference oceanographic transects:

- Temperature, salinity, fluorescence, DO, turbidity measured from *R/V Martin Bergmann* in August & from the ice surface in March by the Canadian Rangers (CROW)

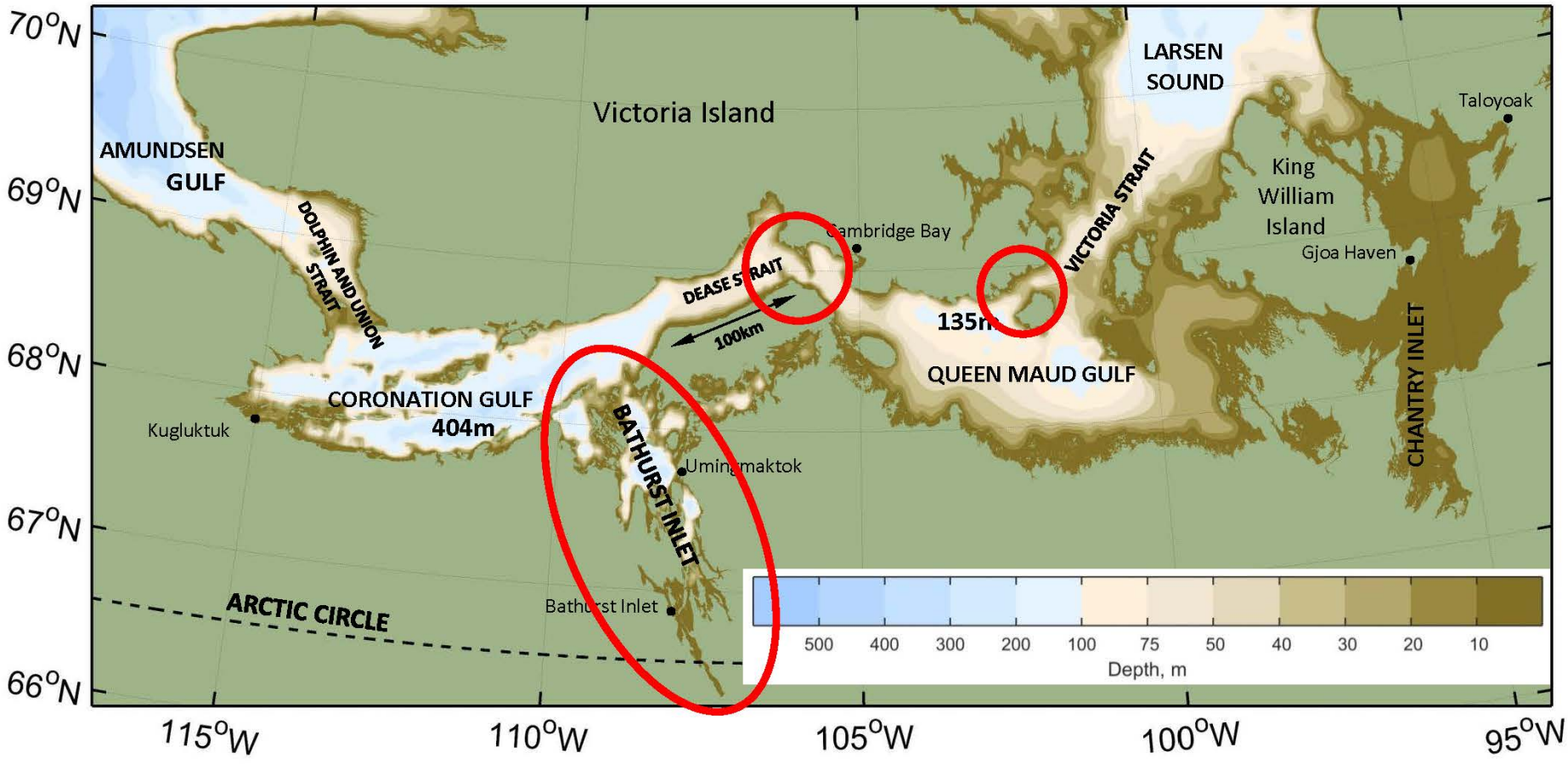
Biological hotspots:

- Search for areas where upwelling brings nutrient rich water into the photic zone – traditional knowledge & science working together

Kitikmeot Sea Science Study (K3S)

R/V Martin Bergmann

mid-August to mid-September 2019

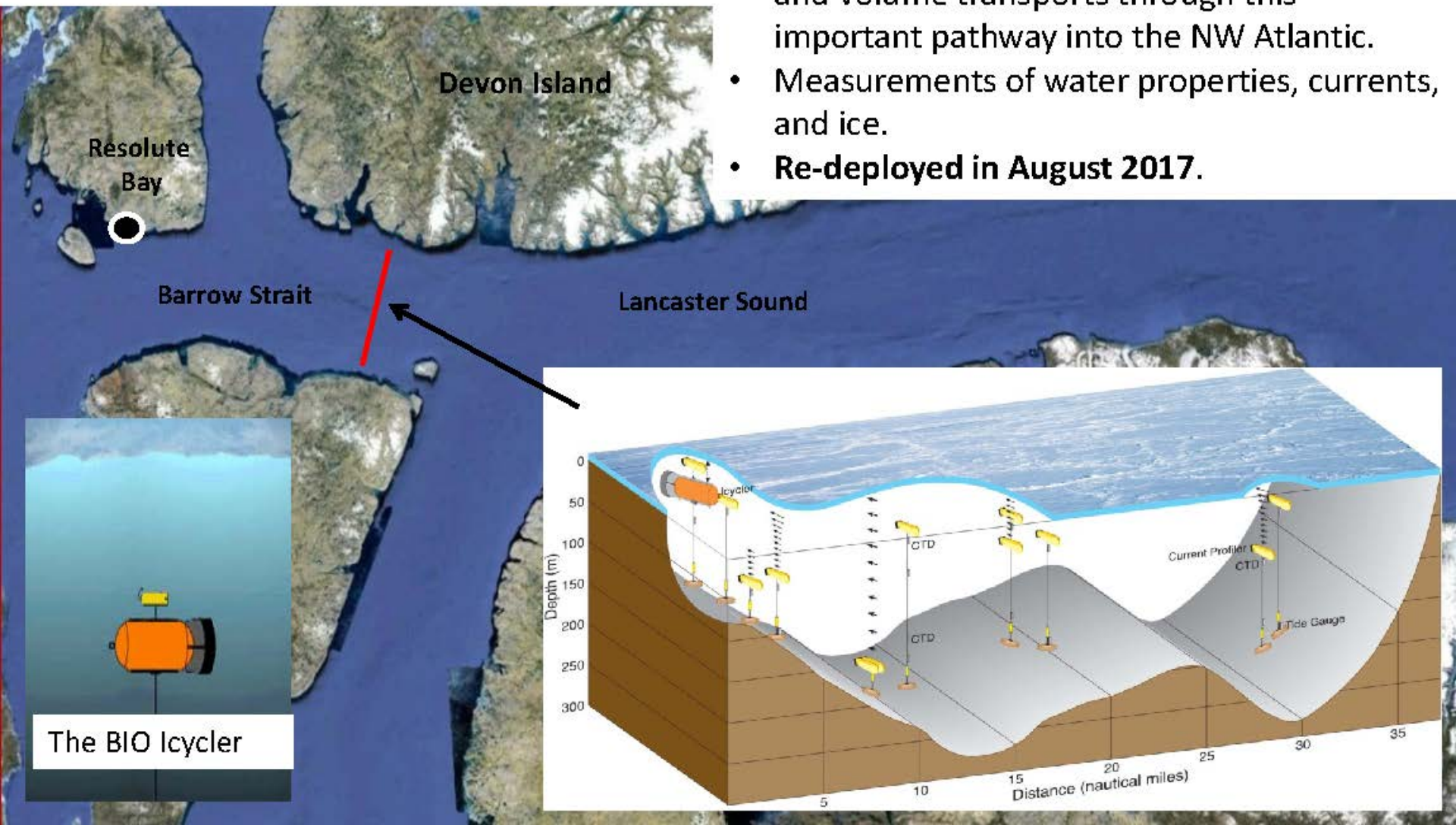


The Barrow Strait Monitoring Program and Real-time ocean observatory

Clark Richards,
Bedford Institute of Oceanography

Fisheries and Oceans Canada
Pêches et Océans Canada

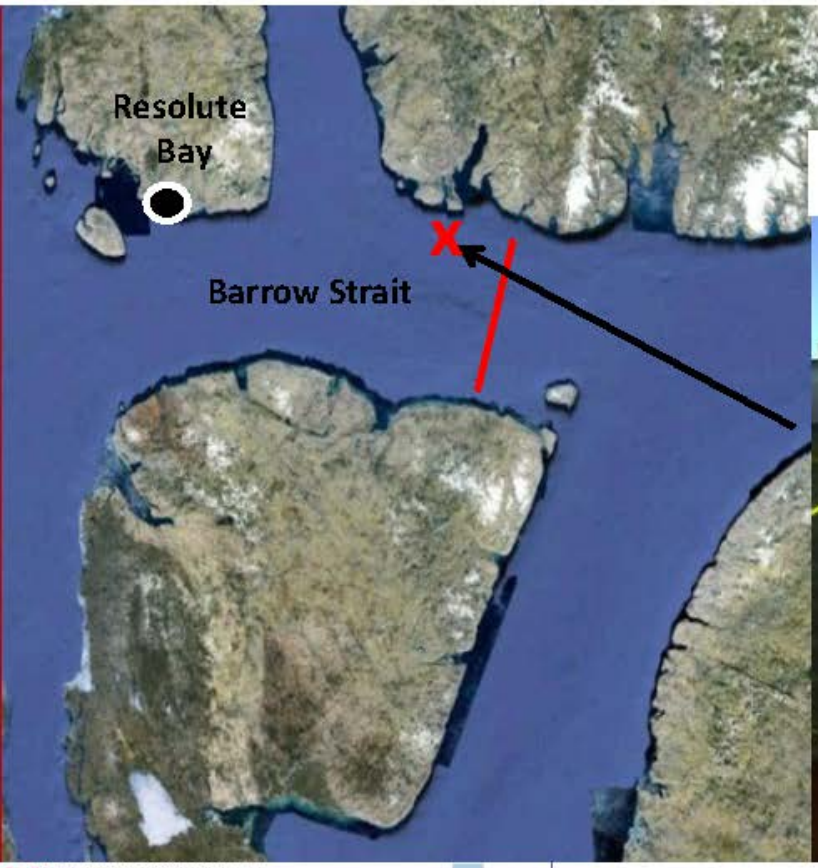
- Originally maintained from 1998 to 2011.
- **Principle objective:** To quantify the magnitude and variability of the freshwater and volume transports through this important pathway into the NW Atlantic.
- Measurements of water properties, currents, and ice.
- **Re-deployed in August 2017.**



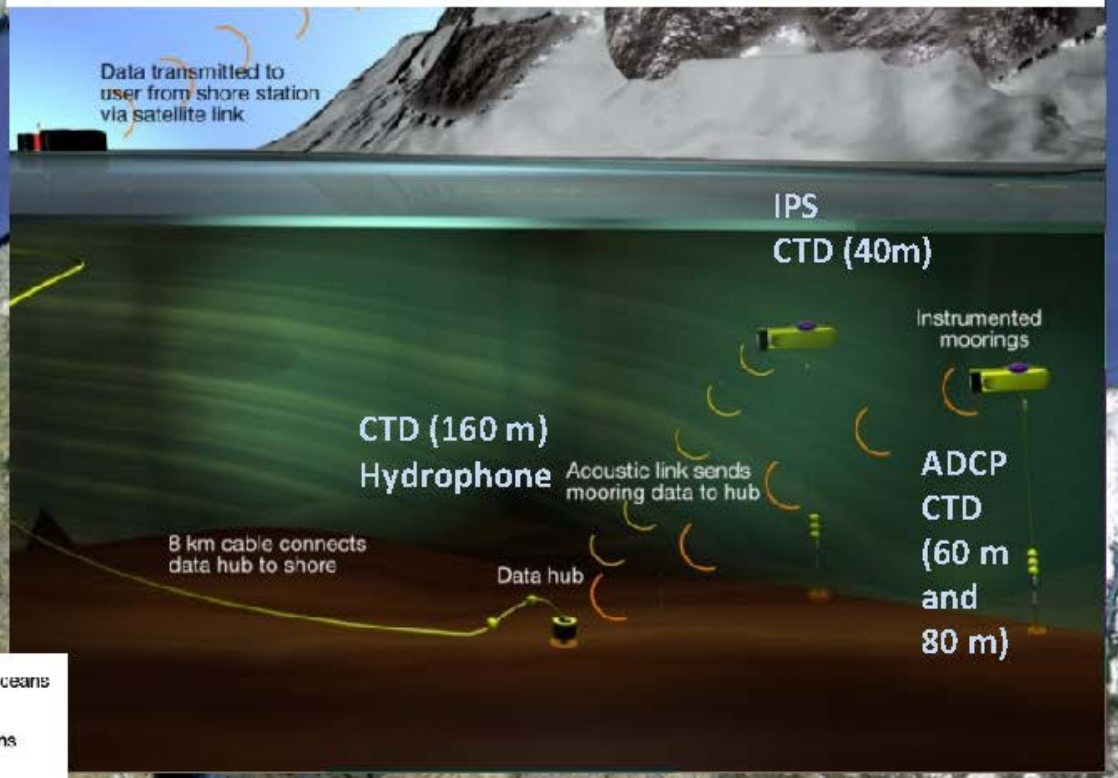
The Barrow Strait Real Time Observatory:

- An under-ice, cabled, autonomous ocean observatory for web-accessible, real-time ice and ocean data
- Real-time measurements of:
  - water temperature/salinity (4 depths, used to predict freeze-up date!),
  - Ice draft (4 times daily)
  - Passive acoustics (ships, ice, marine mammals)

On Twitter @BarrowStrait



https://noise.phys.ocean.dal.ca/barrow/bsrto/



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SCIENCE, TECHNOLOGIE et SAVOIR pour la DÉFENSE et la SÉCURITÉ du CANADA

Fisheries and Oceans Canada
Pêches et Océans Canada

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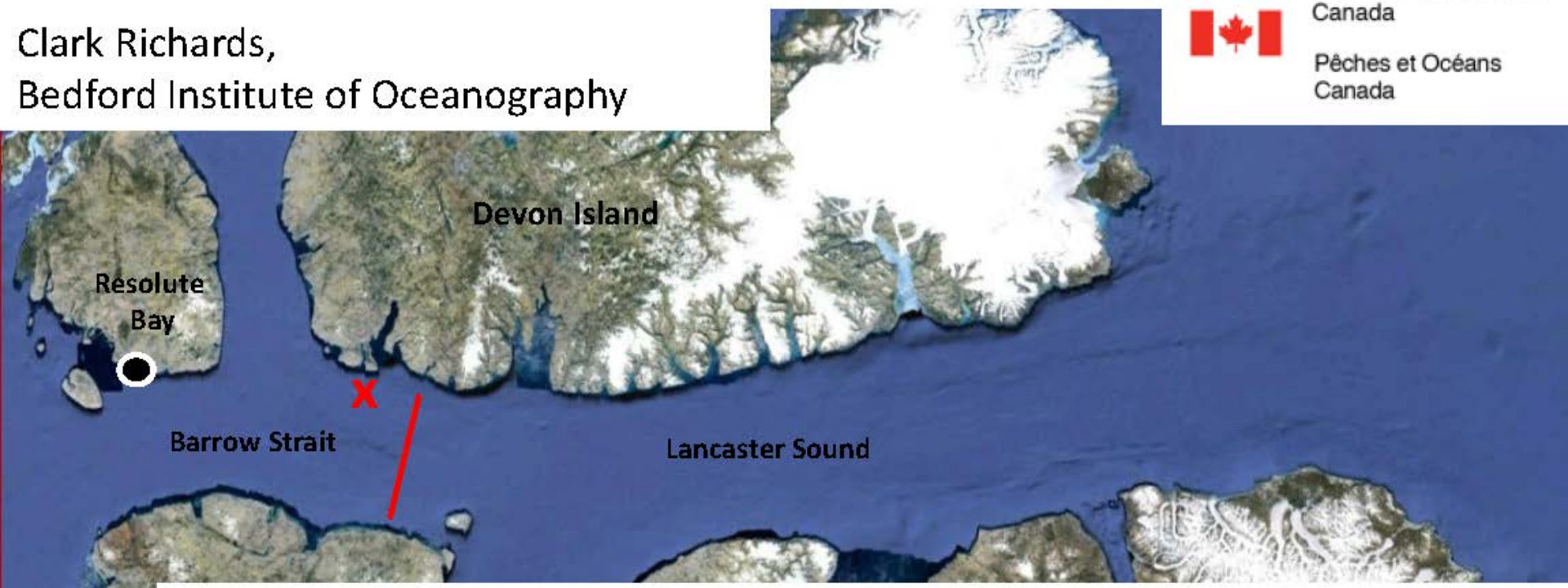
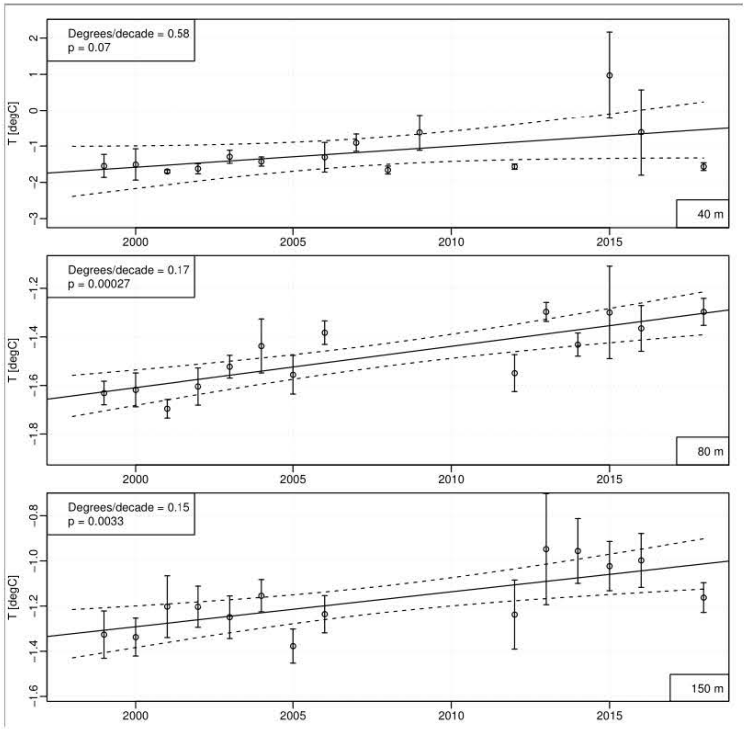


Summer 2019 (August):

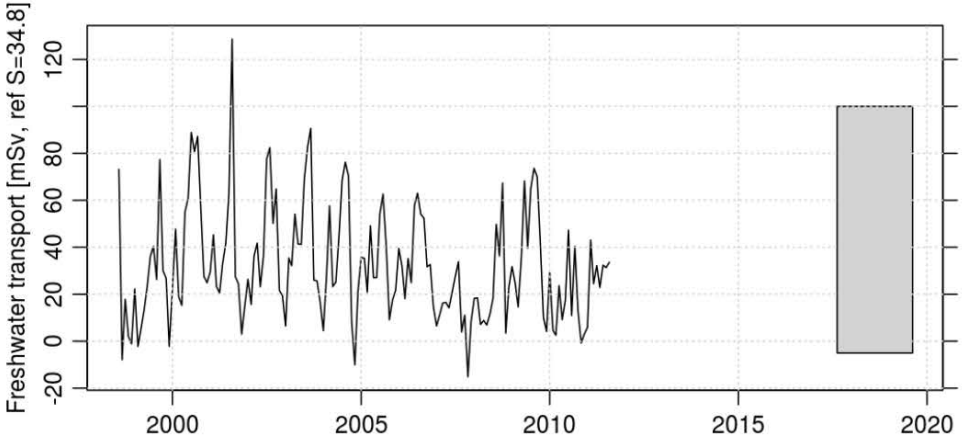
- Turn-around all moorings and observatory for a 2-year interval.
- CTD/water samples across Barrow Strait.
- Recover Icycler, begin work on upgraded system (for 2021), including integration to the real-time system.

The Barrow Strait Monitoring Program and Real-time ocean observatory

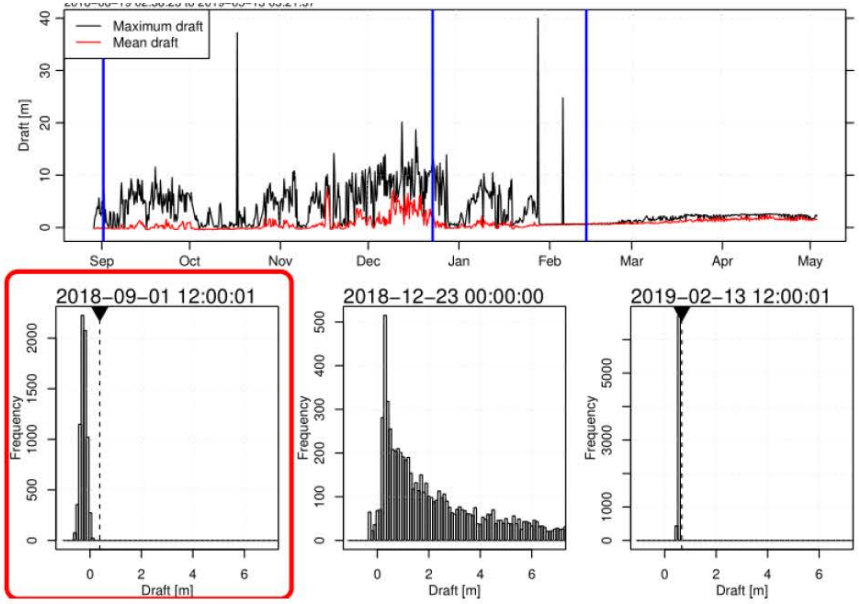
Northside warming (1998-2018):



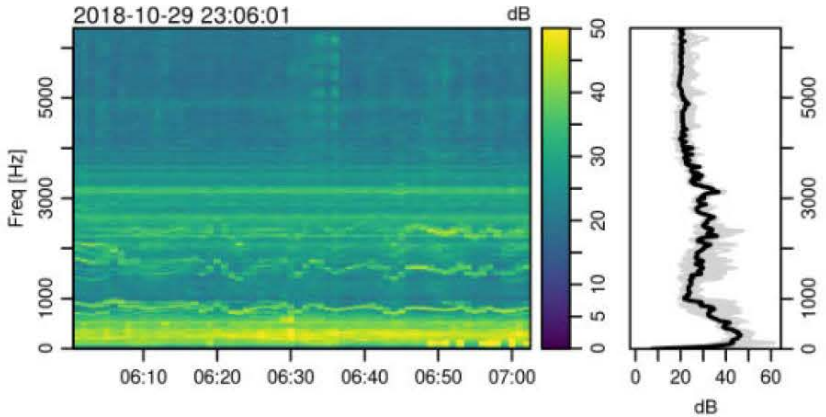
Soon to be continued transport time series



Real-time ice draft



Real-time acoustic monitoring



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AMUNDSEN

BRISE-GLACE DE RECHERCHE CANADIEN
CANADIAN RESEARCH ICEBREAKER

AMUNDSEN SCIENCE

2019 Updated *Amundsen* Expedition Plan

29 April 2019

2019 *Amundsen* Expedition - Overview

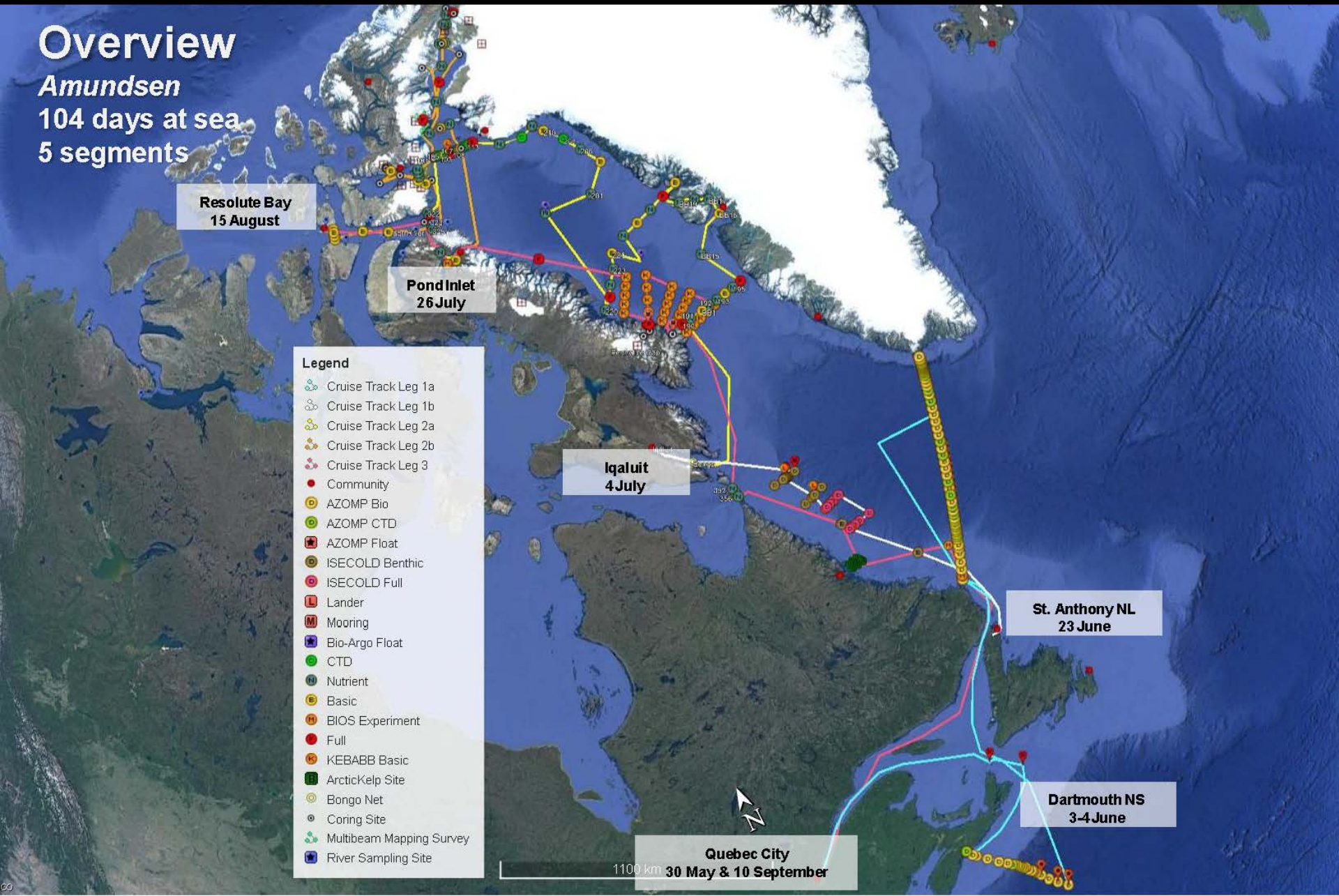
Overview

The following updated expedition plan is the result of ship time applications and sampling requests received from the different programs selected by the User Advisory Committee to participate in the 2019 CCGS *Amundsen* Expedition and consolidated during the Planning Workshop held in Quebec City on 3 April.

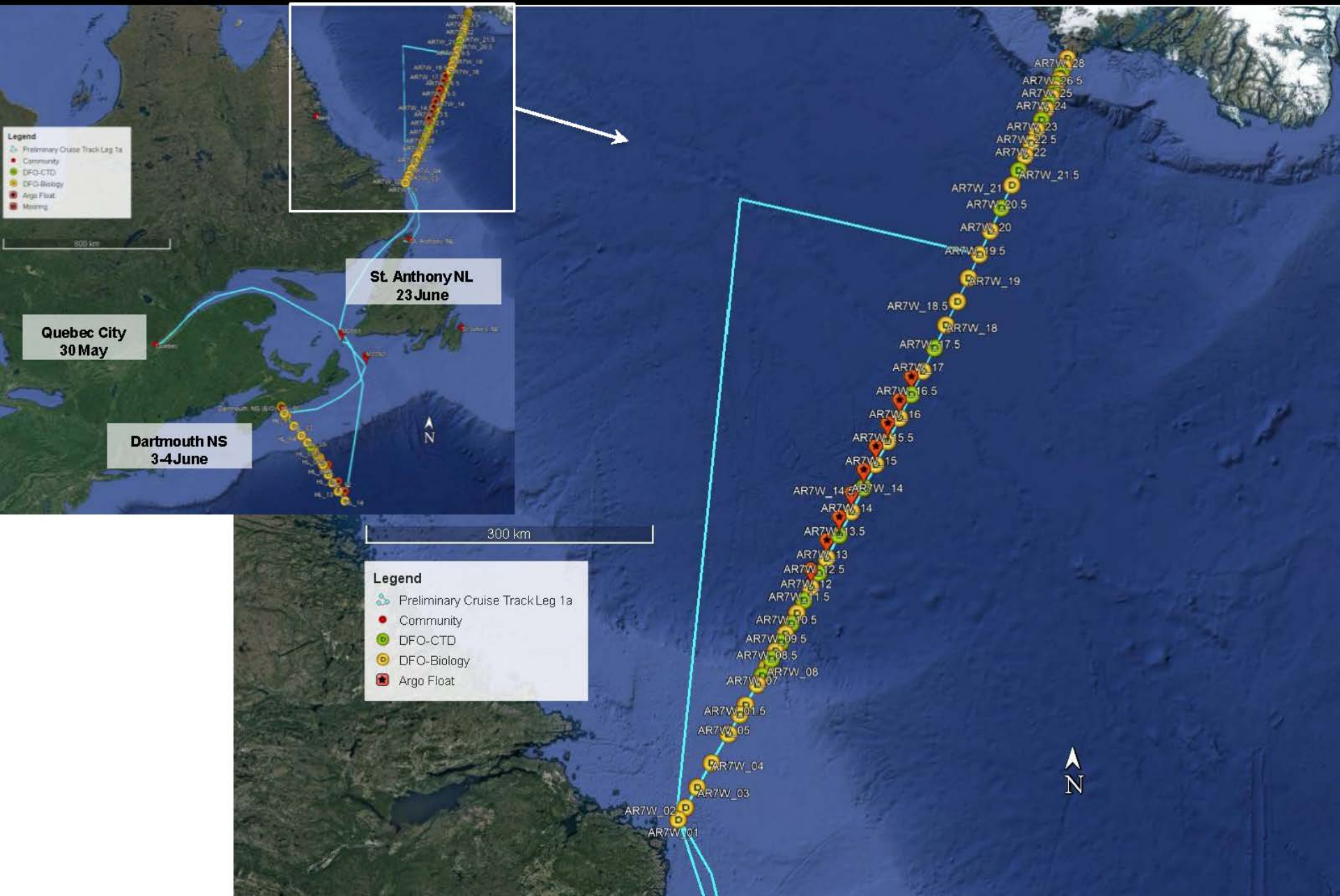
The plan is divided into 5 segments for a total of 104 days at sea.

- Leg 1a: AZOMP – DFO & Dalhousie University
  Quebec City to St. Anthony NL – 30 May to 23 June With 2nd mobilization in Dartmouth NS on 3-4 June
- Leg 1b: ISECOLD – DFO, Memorial University & Dalhousie University St. Anthony NL to Iqaluit – 23 June to 4 July
- Leg 2a: ArcticNet / Bio-Argo Floats
  Iqaluit to Pond Inlet – 4 July to 26 July
- Leg 2b: ArcticNet
  Pond Inlet to Resolute Bay – 26 July to 15 August
- Leg 3: ArcticNet / DFO KEBABB
  Resolute Bay to Quebec City – 15 August to 10 September

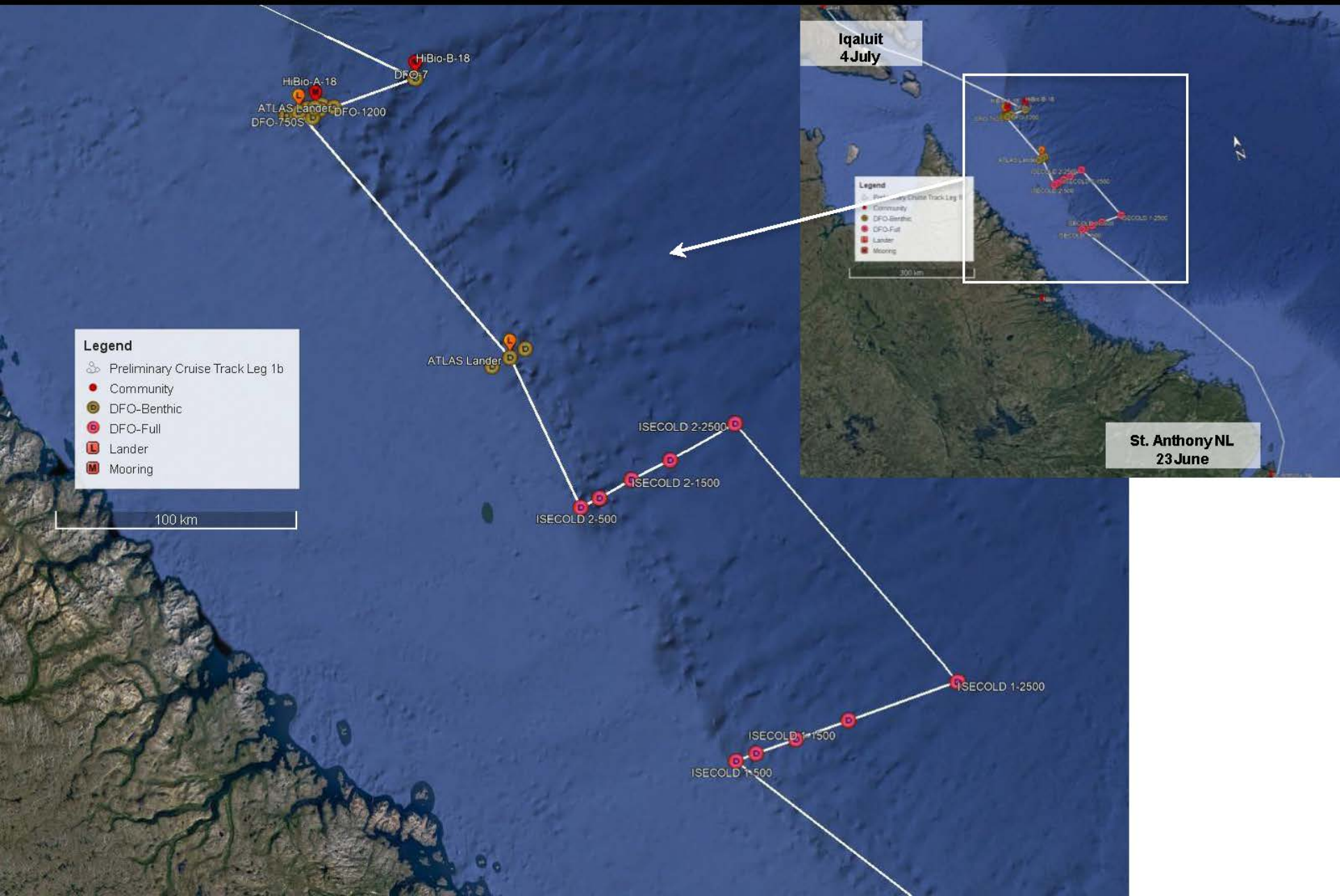
2019 *Amundsen* Expedition - Overview



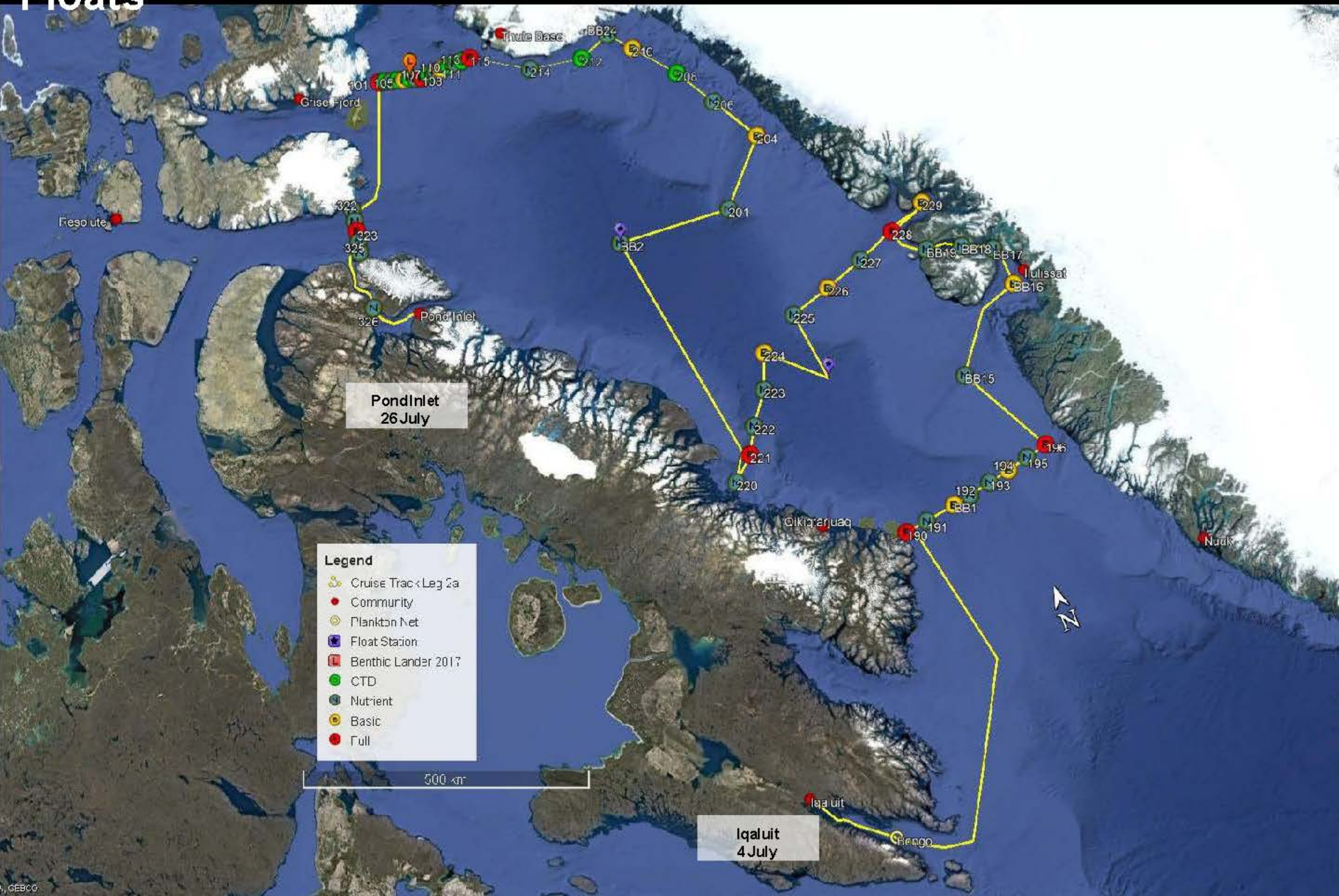
2019 *Amundsen* Expedition – Leg 1a AZOMP



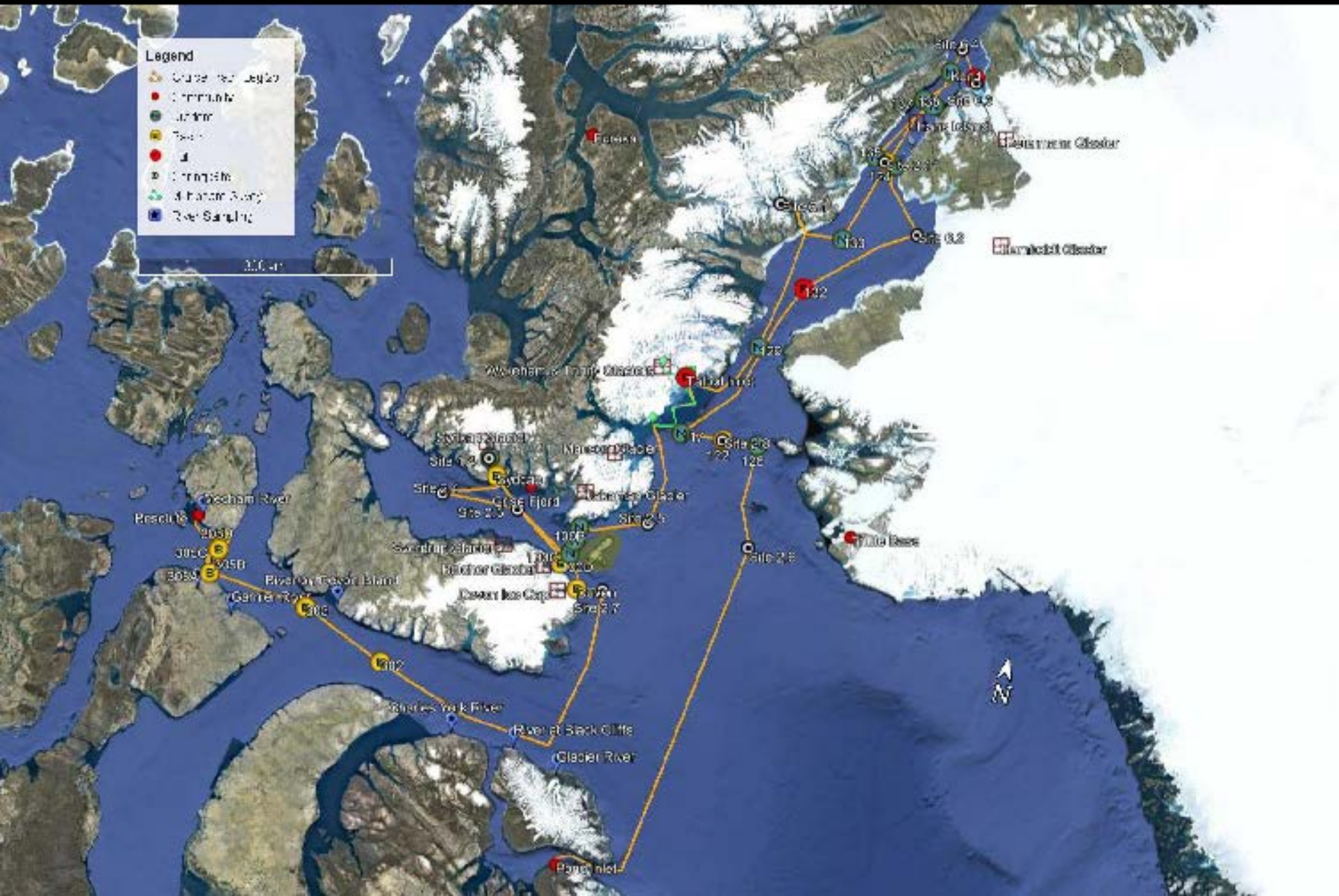
2019 *Amundsen* Expedition – Leg 1b ISECOLD



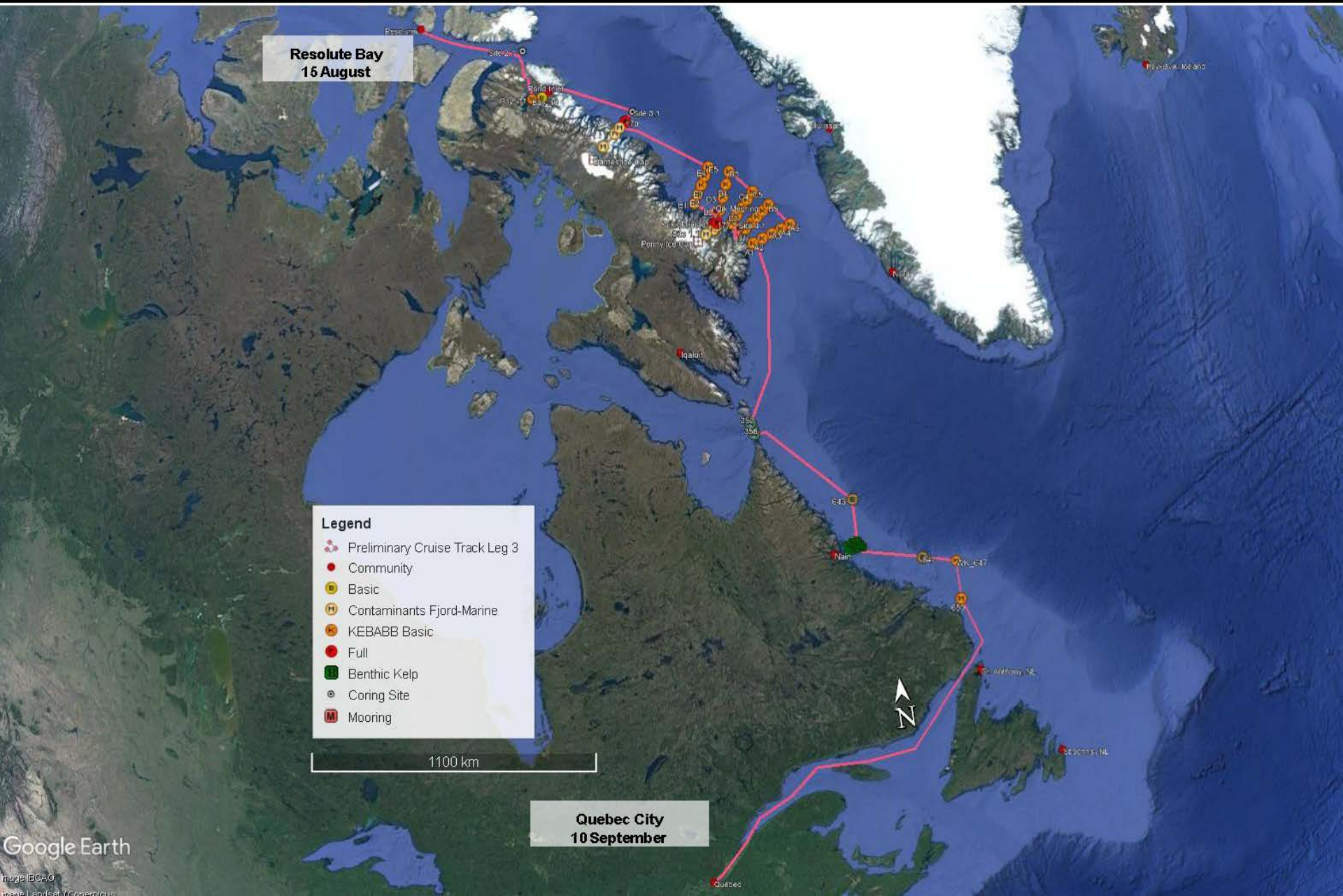
2019 *Amundsen* Expedition – Leg 2a ArcticNet & Bio-Argo Floats



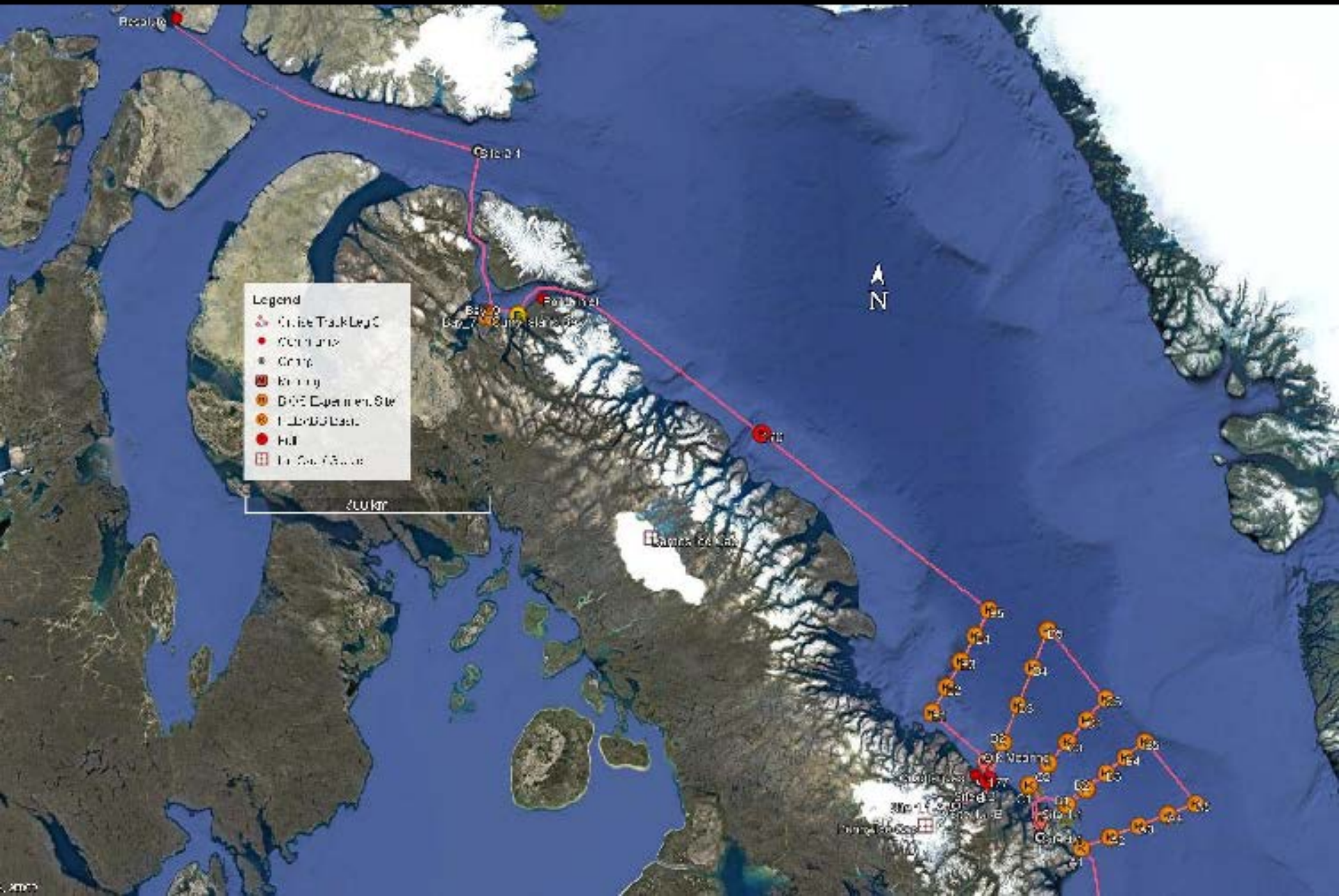
2019 *Amundsen* Expedition – Leg 2b ArcticNet



2019 *Amundsen* Expedition – Leg 3 ArcticNet & KEBABB



2019 *Amundsen* Expedition – Leg 3 ArcticNet & KEBABB



2019 *Amundsen* Expedition – Leg 3 ArcticNet & KEBABB