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# Canadian Arctic – Marine Science Programs

## Pacific Arctic Group (PAG) Meeting November 16-17, 2011

Robert Fudge

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Fisheries and Oceans Canada

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# Canadian Arctic Marine Programs

In 2011, Canadian Arctic marine programs included:

- Canada's Three Oceans (C3O)
- Joint Ocean-Ice Study (JOIS)
- Arctic Ice Monitoring (AIM)
- Continental Shelf Mapping Program -UNCLOS
- ArcticNet
- Barrow Strait Program





# Canada's Three Oceans – 2011 Science Activities

To study the impacts of climate variability on the sub-arctic and arctic marine ecosystems.

## Research Vessels:

- *CCGS Louis S. St-Laurent* (LSSL)  
(July 07-21, 2011)  
from St. John's to Resolute

- *CCGS Sir Wilfrid Laurier* (SWL)  
(July 08-20, 2011)  
Victoria to Barrow



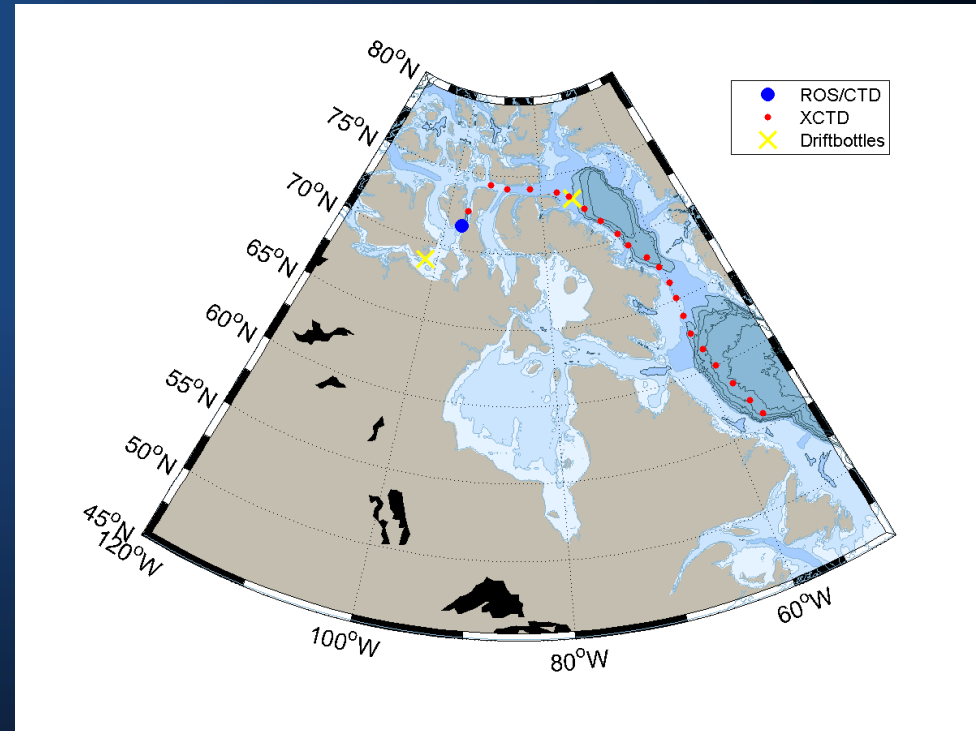




# Canada's Three Oceans – 2011 Science Activities

## CCGS LSSL 2011 program components:

- Underway collection of meteorological and near-surface seawater
- 49 XCTD casts to 1100m depth
- 48 Drift bottles launched at 2 sites
- 1 CTD/Rosette Cast with 11 samples for hydrograph
- Seabird Surveys
- Ice Observations





# Canada's Three Oceans – 2011 Science Activities

CCGS SWL 2011 program components: including the Distributed Biological Observatory stations.

• Collaboration with NOAA- John Calder, Jackie Grebmeier

Areas: North Pacific, Bering Sea and Chukchi Sea

- 37 science stations completed
- 37 CTD/Rosette casts,
- 37 150 kHz ADCP deployments,
- 29 Bongo plankton net hauls,
- 33 Benthic sampling stations.

Underway data collection included

- 32 XCTD profiles
- Surface water properties using the seawater loop
- Bird and mammal observations during daylight hours
- Meteorological data from ship sensors



ADCP Doppler  
Current Profiler

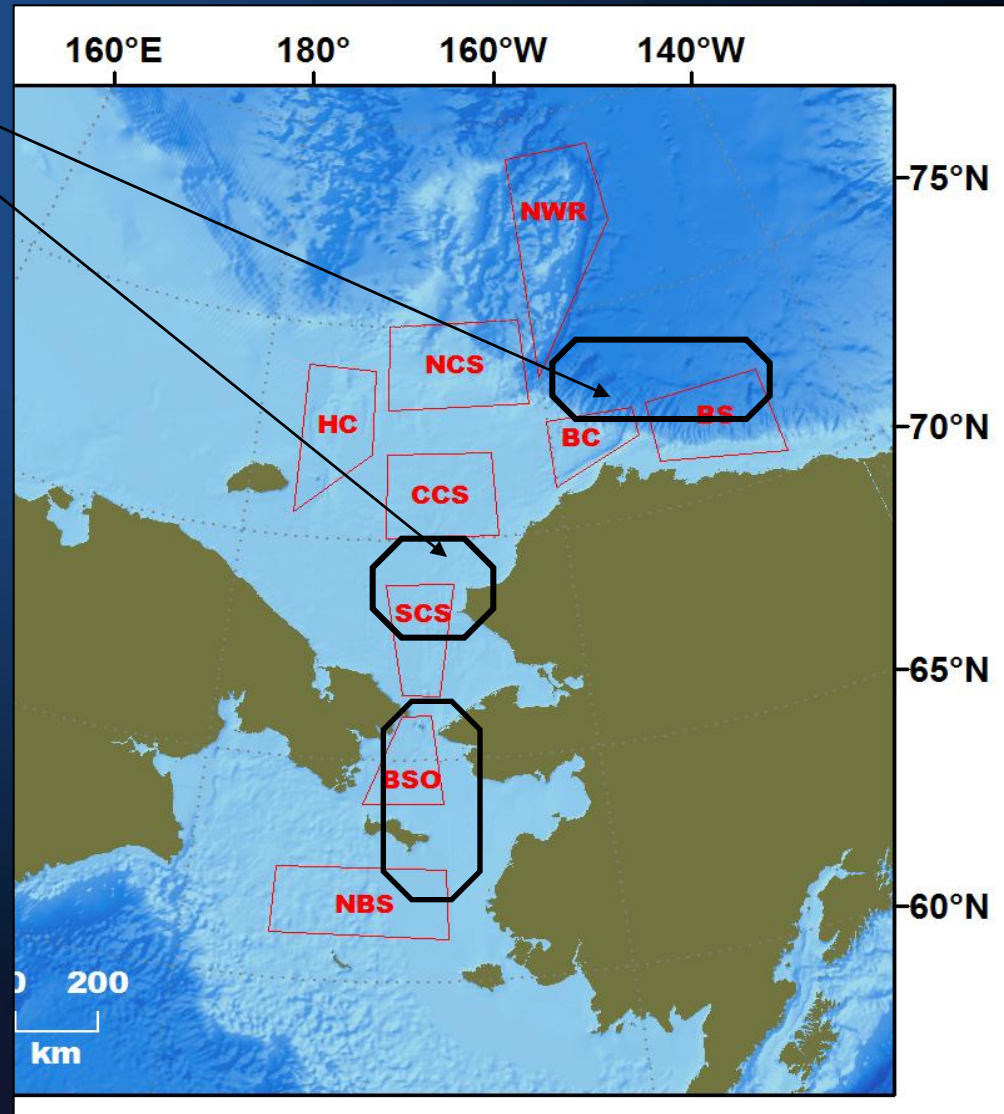
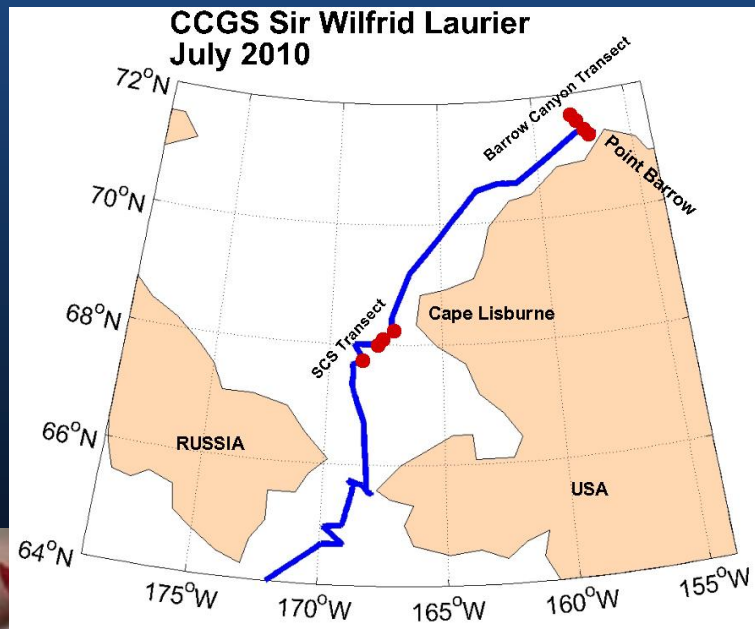
Photo Courtesy of S. Vagle





# Pacific Arctic Group – Distributed Biological Observatory

- SCS and Barrow Canyon “Hotspots”
- Canadian program contributed in the 3 zones indicated in black
- Sir Wilfrid Laurier stations 2010





## AON/Joint Ocean Ice Study (JOIS)

- The Beaufort Gyre in the Canadian Basin is the largest freshwater storage reservoir of the Arctic, however its variability and influence on circulation and the export of freshwater to the global ocean is still poorly understood.
  - 2003 – Joint Ocean Ice Study (US/Can/Japan)
  - 2005 to 2009 – Beaufort Gyre Environmental Program
  - 2010 to 2014 – AON Continuing the Beaufort Gyre Observing Program
    - Collaboration – between Fisheries and Oceans Canada, the US National Science Foundation, Woods Hole Oceanographic Institute and JAMSTEC



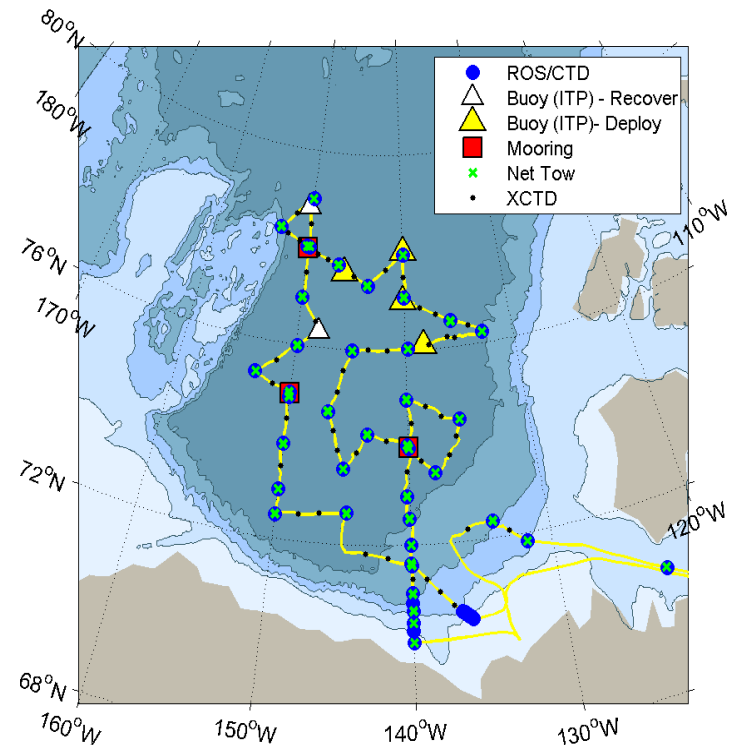


# AON/JOIS – 2011 Science Activities

CCGS SWL 2011 program components: CCGS Louis S. St-Laurent, Jul 21-Aug 18

## CTD/Rosette Stations:

- 52 CTD/Rosette Casts at 48 Stations with 997 water samples collected
- 78 Vertical Net Casts at 37 select Rosette stations (100m to 500m deep)
- 49 XCTD Casts (~ 1100m depth)
- WHOI - Mooring and buoy operations
- Ice Observations







# Arctic Ice Monitoring (AIM) – 2011 Science Activities

The objective of this expedition:

- Recovery, servicing and re-deployment of internally recording instruments on sub-sea moorings.
- Mapping of selected properties of seawater (e.g., temperature, salinity, chlorophyll fluorescence, dissolved O<sub>2</sub>, CO<sub>2</sub>, and CH<sub>4</sub>)
- Ice thickness monitoring – hazard assessment

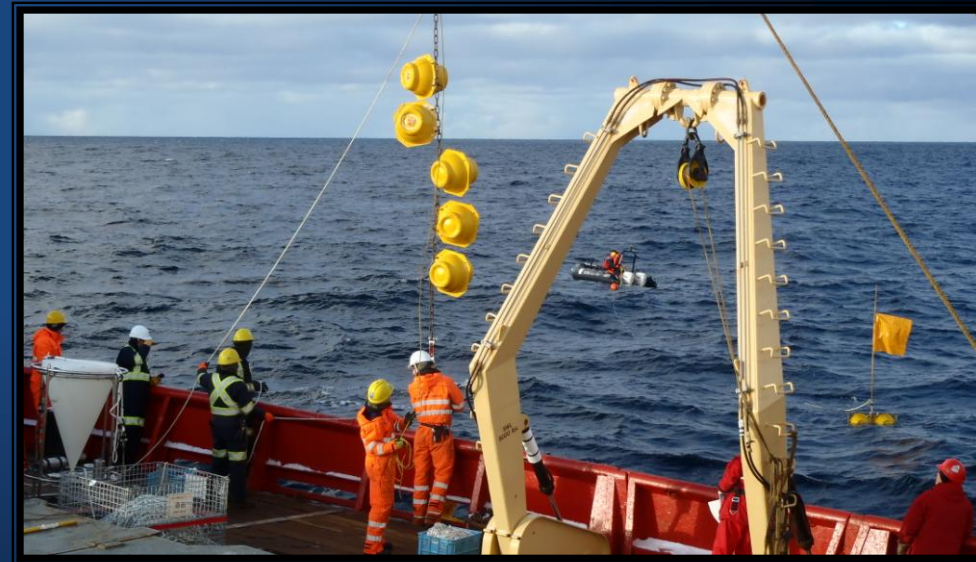
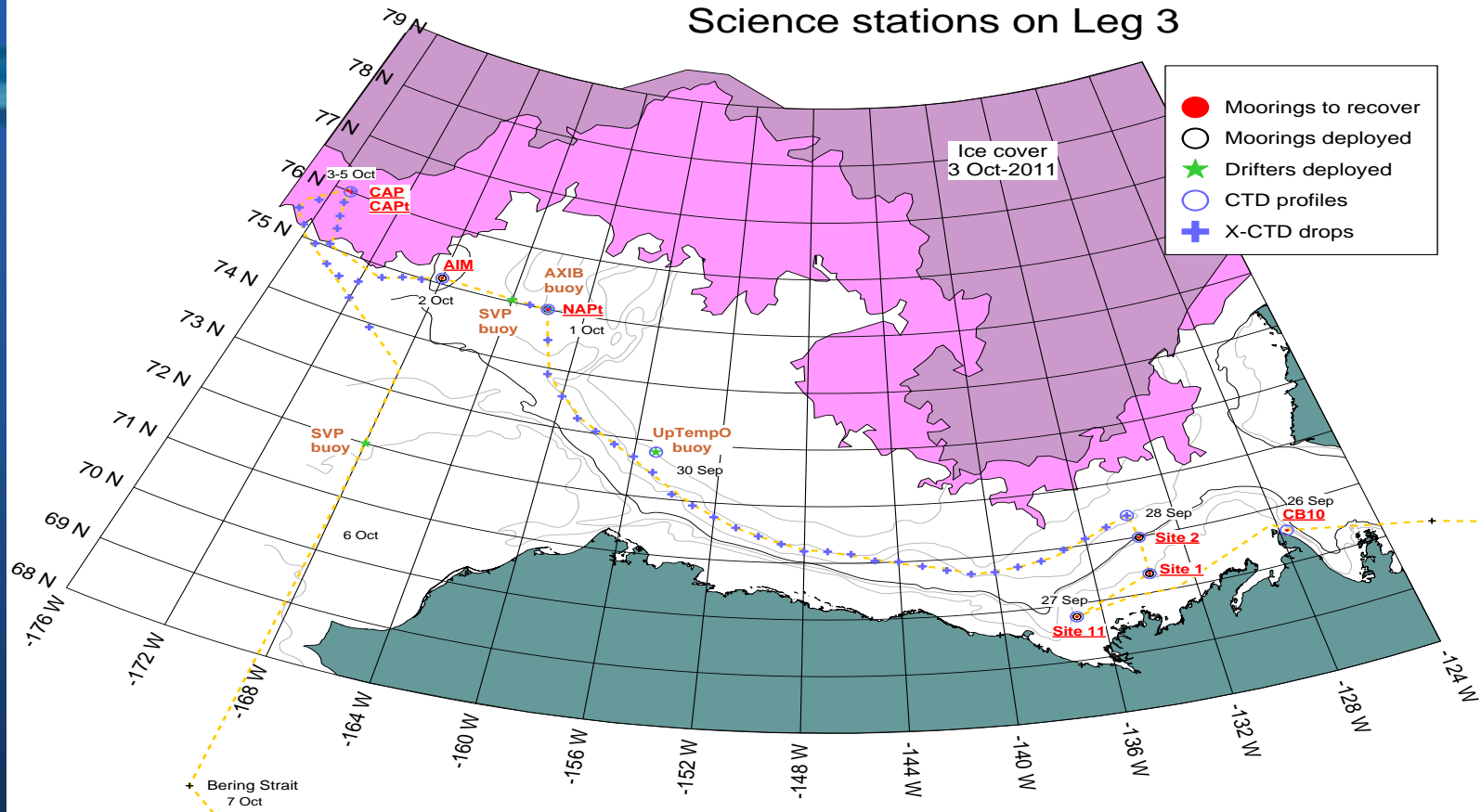


Photo Courtesy of H. Melling

Research Vessels:

- *CCGS SIR WILFRID LAURIER* (SWL)  
(September 20 to October 9, 2011)
- Cambridge Bay to Nome, AK

## CCGS Sir Wilfrid Laurier, 2011 Arctic Patrol Science stations on Leg 3



- Recovered 5 short oceanographic moorings; and redeployed 5 replacement moorings
- Recovered 1 deep-sea mooring with sediment traps
- Deployed 1 prototype satellite reporting drifting buoy (UpTempO) (for U of Washington)
- Deployed 3 ocean-to-ice drifting buoys (for Environment Canada)
- 7 CTD Casts and 3 CTD/Rosette casts completed at mooring sites
- 48 X-CTD drops along the Beaufort slope
- On-shore calibration of instrument compasses

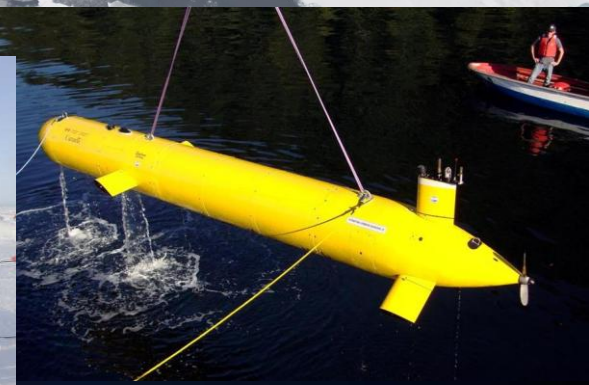
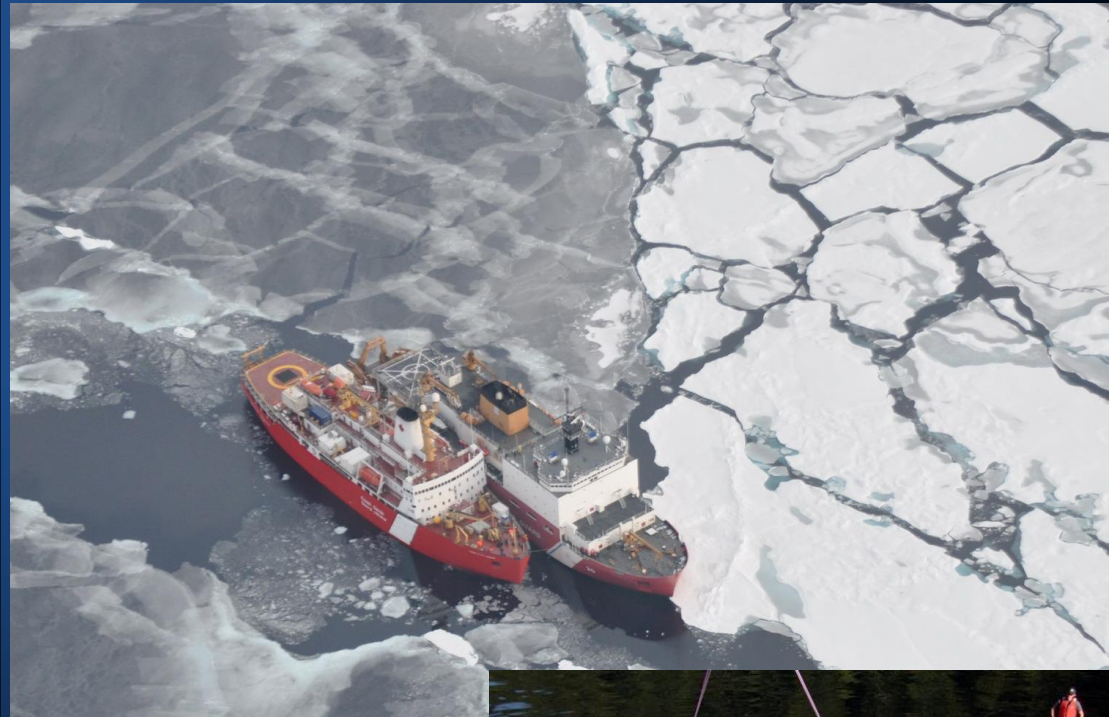


# UNCLOS - Continental Shelf Seabed Mapping

## CCGS Louis S. St-Laurent & USCG Cutter Healy

Aug 18 to Sept 29

- **Successful seismic surveys**
  - Collected 13,500 km of seismic data (very good quality)
  - Covered most of the extended area
- **Joint operations with US in 2008, 2009, 2010 and 2011**
  - able to collect seismic under heavy ice conditions (up to 84)
  - first seismic data in northern Beaufort Sea:
  - Large quantities of sediments in entire Beaufort Sea
  - Fourth joint survey with US planned for 2011
  - Extensive use of AUV's

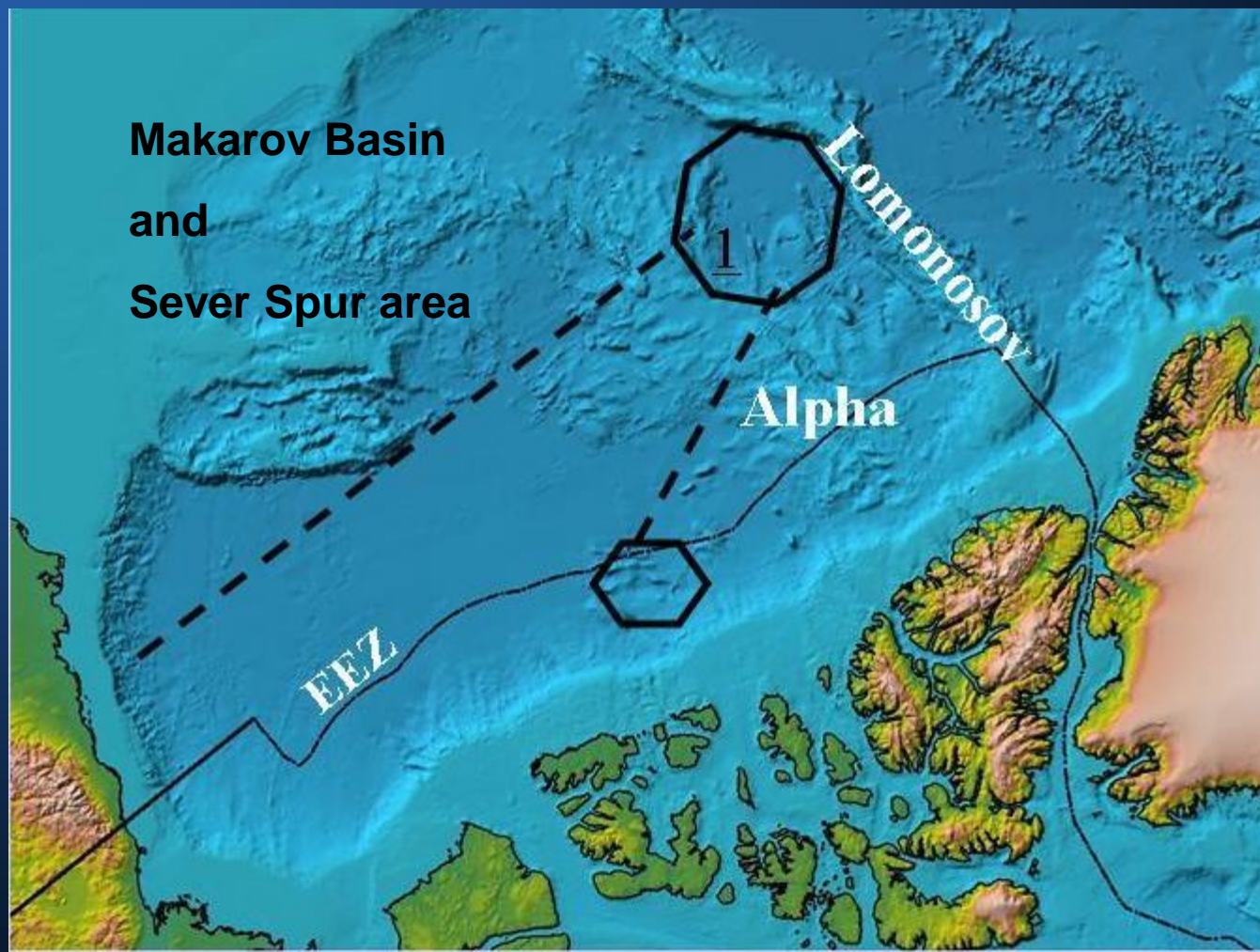


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# UNCLOS survey area for 2011





# ArcticNet

## CCGS Amundsen

July 17 to November 3, 2011

- To study on a long-term basis how climate induced changes are impacting the marine ecosystem, contaminant transport, biogeochemical fluxes, and exchange processes across the ocean/sea ice/atmosphere interface in the Canadian Arctic Ocean.

### Science activities

- Mooring deployments, oceanographic and biological sampling



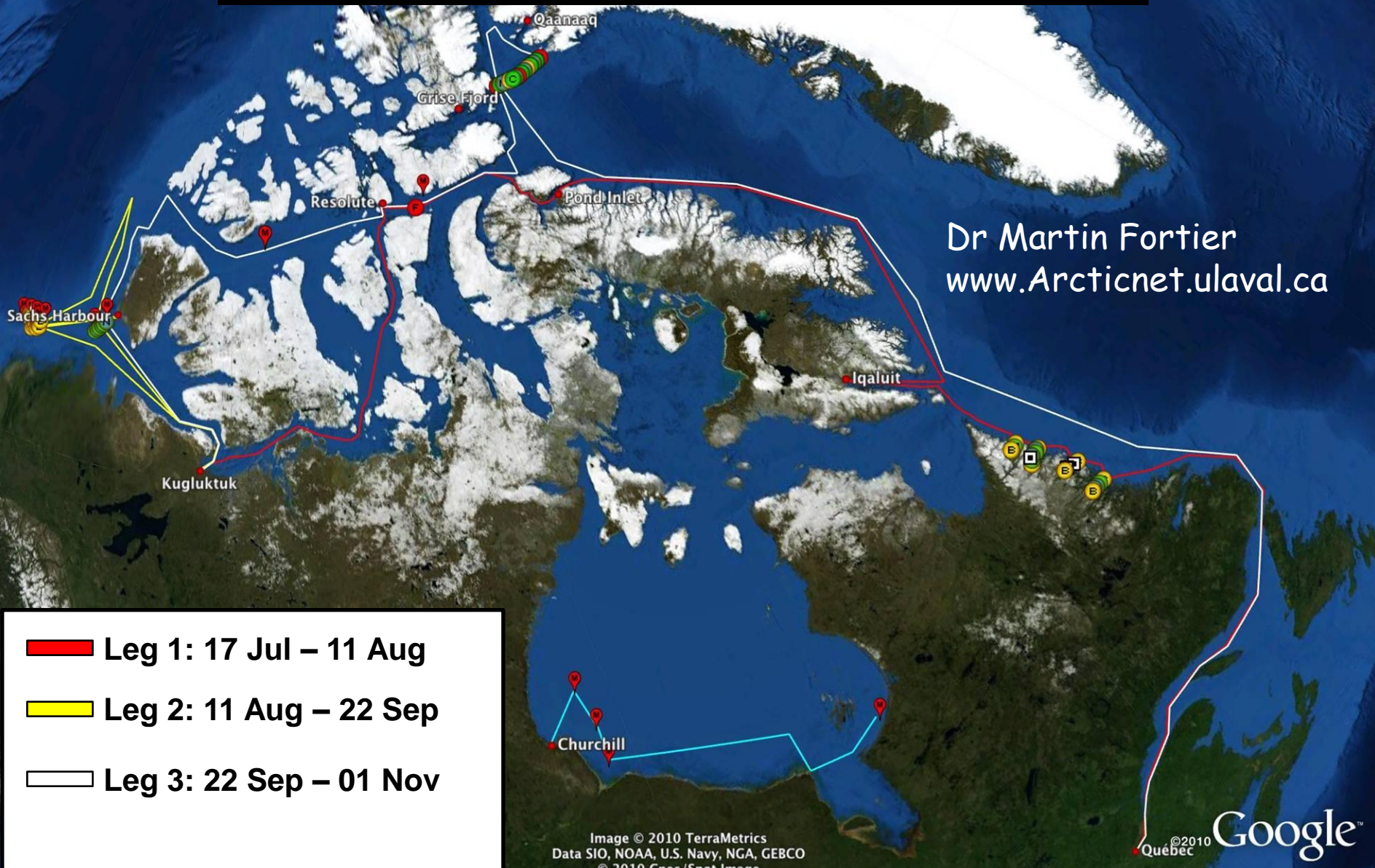




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# 2011 Amundsen/ArcticNet Expedition







# Barrow Strait Project – 2011 Science Activities

## Research Vessel:

- *CCGS Des Groseilliers* (August 02 to August 11, 2011)
- Barrow Strait

## 2011 program components:

- Recovered 5 moorings at 091° W in Barrow Strait.
- Deployed 3 moorings at the Southerly site at 091° W.
- Along the eastern Barrow Strait line at ~091° W
  - Completed 17 CTD stations
  - Collected water samples for biological and chemical analysis
  - Collected zooplankton samples with ring nets





# Barrow Strait Project – 2011 Science Activities

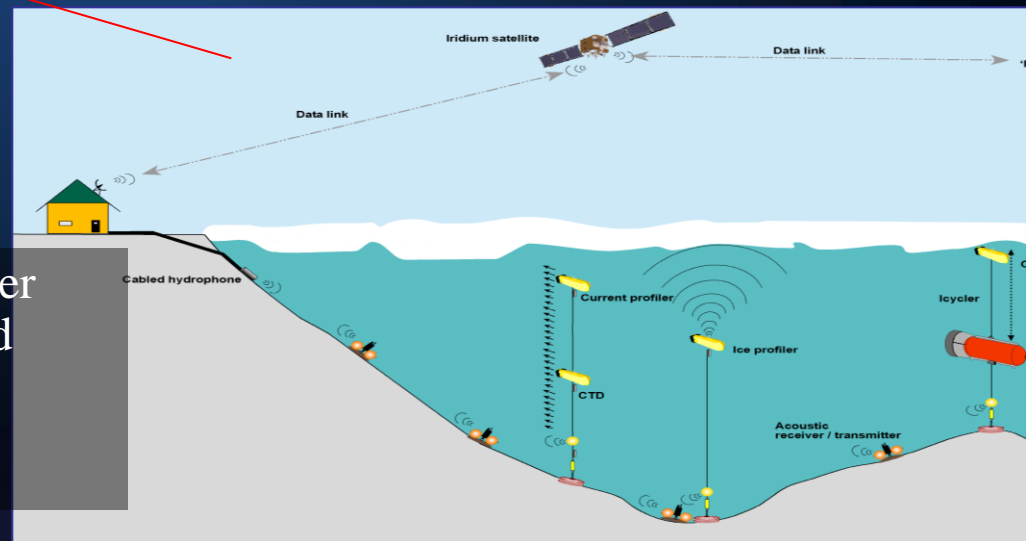
Real time ocean and ice data from Barrow Strait  
(Partnering with DRDC)



Deployed a 5 km extension to the underwater cable at Gascoyne Inlet and an instrumented mooring near the offshore end of the cable.



“Northern Watch” camp at Gascoyne Inlet





# Canadian Arctic Marine Programs -2012

In 2012, Canadian Arctic marine programs will include:

- Canada's Three Oceans (C3O) – Bill Williams, Svein Vagle
- Joint Ocean-Ice Study (JOIS) – Svein Vagle, Bill Williams, Jane Eert
- Arctic Ice Monitoring (AIM) – Humfrey Melling
- ArcticNet – Martin Fortier
- Barrow Strait Program – Jim Hamilton







# Canada's Three Oceans - 2012 Science Plans

July, 2012, CCGS LSSL from St-John's transit to Kugluktuk (Leg 1)

## Leg 1 mission

- Only underway measurements will be carried out during the transit of LSSL to the Arctic
- 2-3 science berths
- Collect data underway, including:
  - Underway xCTDs deployed from stern
  - Seawater loop measurements
  - Bird observations





# Canada's Three Oceans - 2012 Science Plans

## July, 2012 CCGS SWL from Victoria to Barrow (Leg 1)

The Canada's Three Oceans – Distributed Biological Observatory

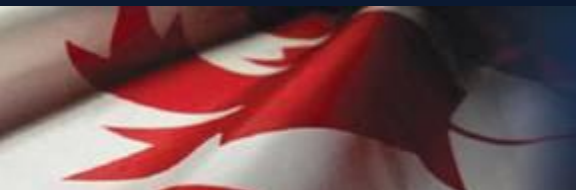
To monitor physical, biological and geochemical changes affected by climate variability.

5 days of dedicated ship time requested for Distributed Biological Observatory science as the SWL transits the Bering Strait to the Arctic.

- CTD/Rosette
- Bottom sampling using VanVeen grabs and Happs corer at 40-50 stations (Bering and Chukchi Seas)
- Vertically towed bongos
- Recover a sediment equipment lost during 2010 C3O July cruise.
- Deploy a physical-bio-geochemical mooring

Collect data underway, including:

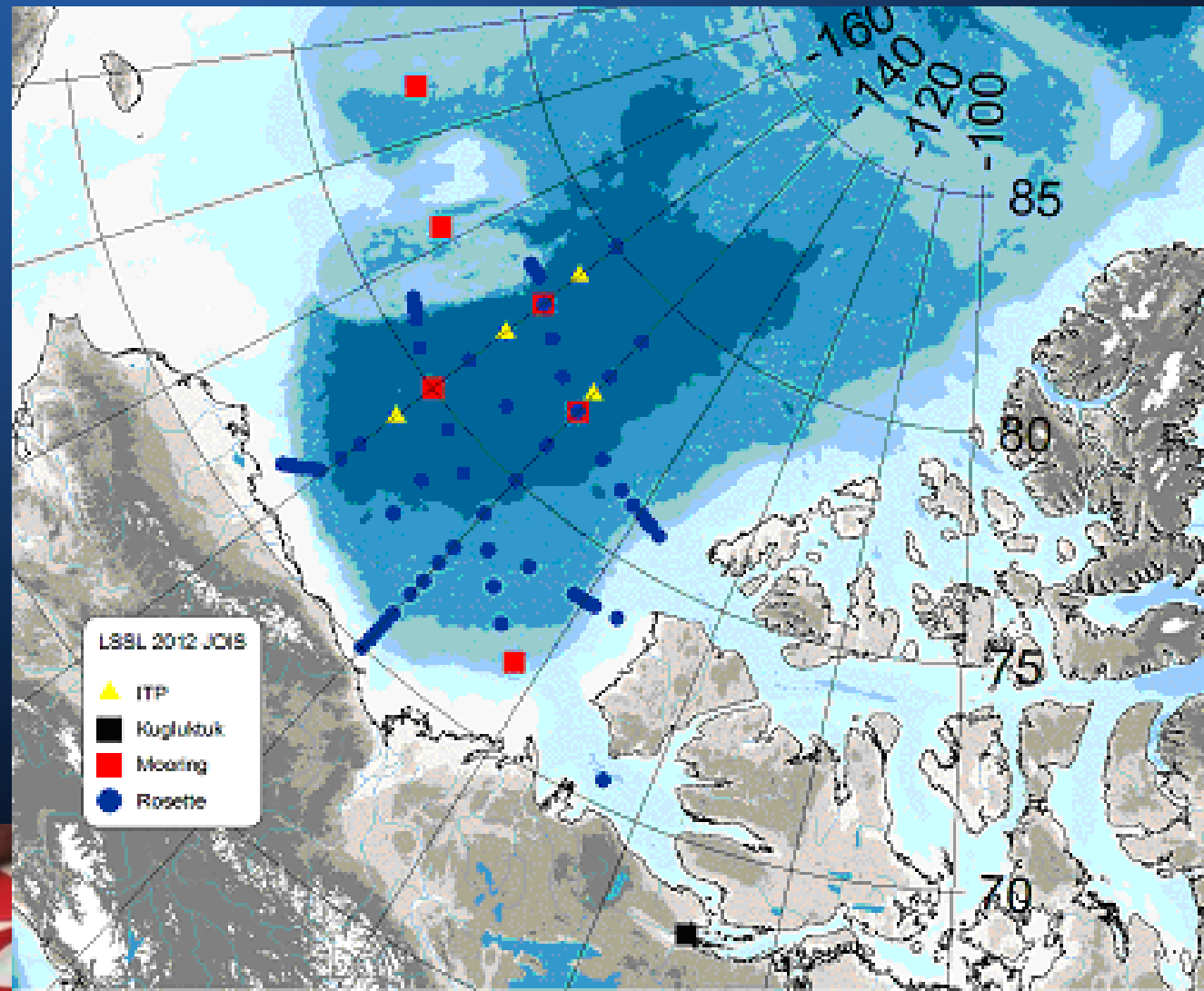
- xCTDs deployed from stern
- Seawater loop
- Bird observations





# JOIS - 2012 Science Plans

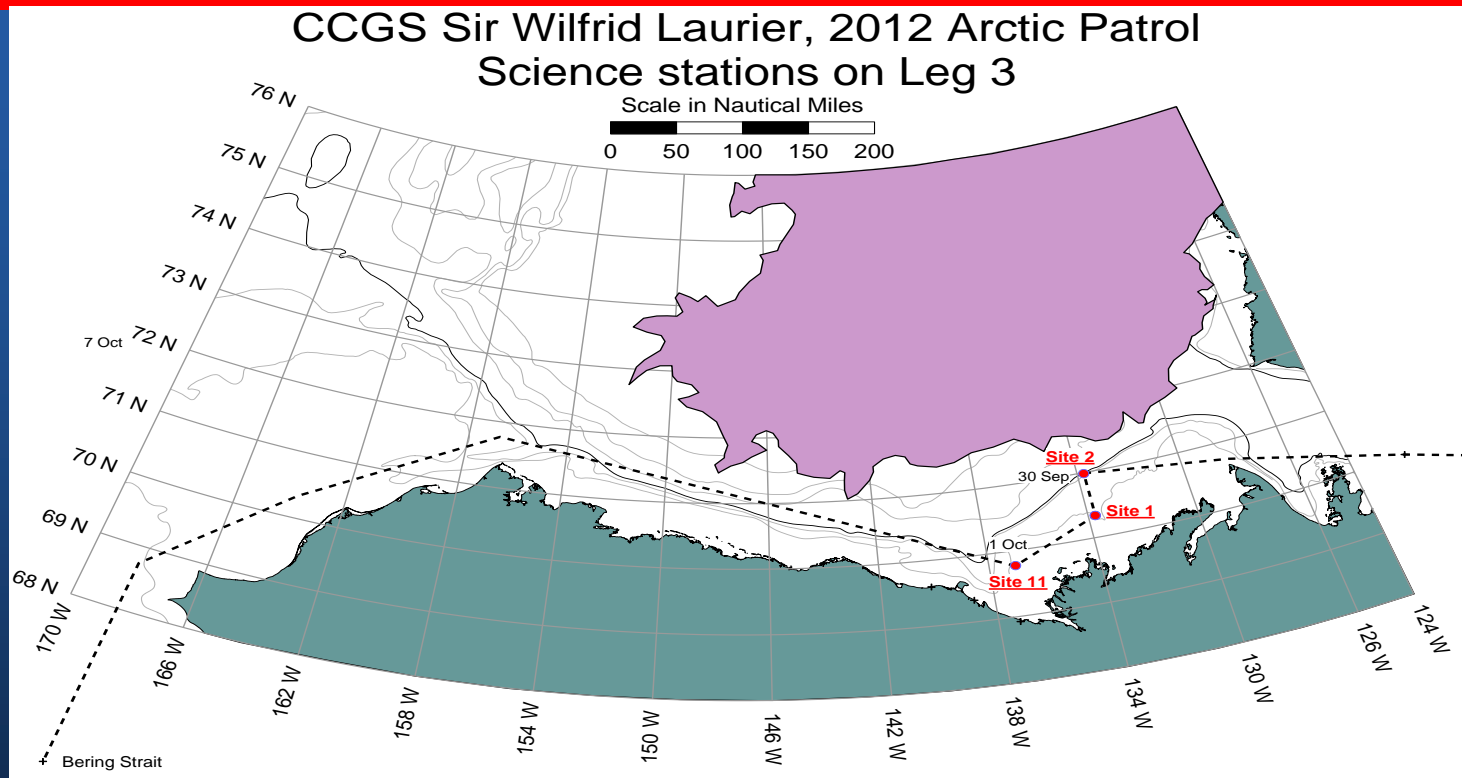
July – August 2012, CCGS LSSL from Kugluktuk to Beaufort Sea and Canada Basin







# Arctic Ice Monitoring (AIM) – 2012 Science Plans



SWL, 25 Sept 2012 - Humfrey Melling

- To service 4 sub-surface moorings
- Underway temp, salinity measurements
- CTD casts at mooring locations

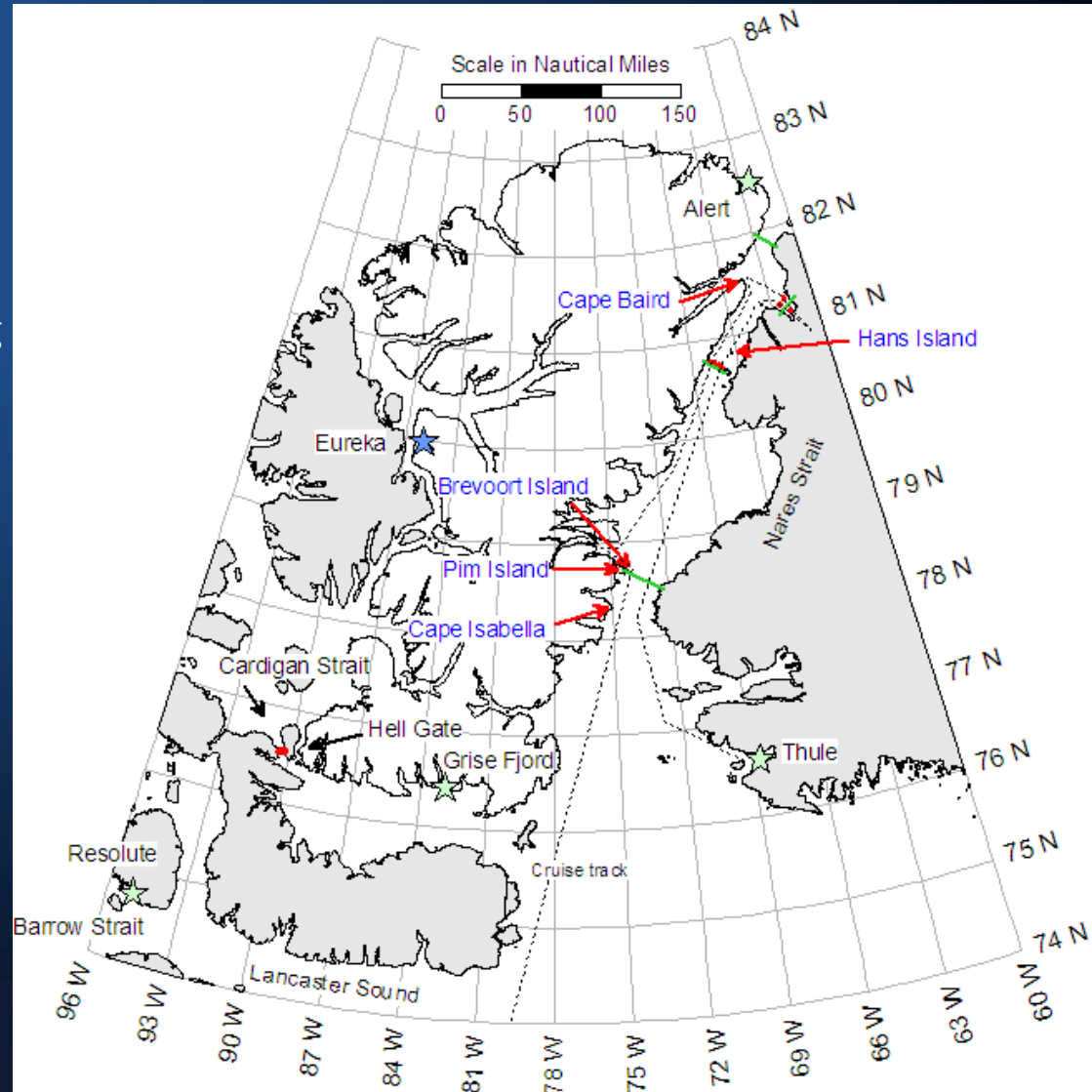


# Canadian Arctic Through-flow Study – 2012 Science Plans

Oceanographic Moorings in Nares Strait  
(from Smith Sound to Hall Basin &  
Petermann Fjord)

Tentatively August 2012 onboard the  
CCGS Henry Larsen – Humfrey Melling

- Recover 7 deep-water moorings
- Recover 1 shallow-water mooring
- Deploy a smaller array of 3 deep-sea moorings
- Service automatic weather stations at Brevoort Island, Hans Island (Canada & Denmark) and Cape Baird
- Retrieve robot cameras from Petermann Fjord (Canada & USA NSF)
- CTD profiles

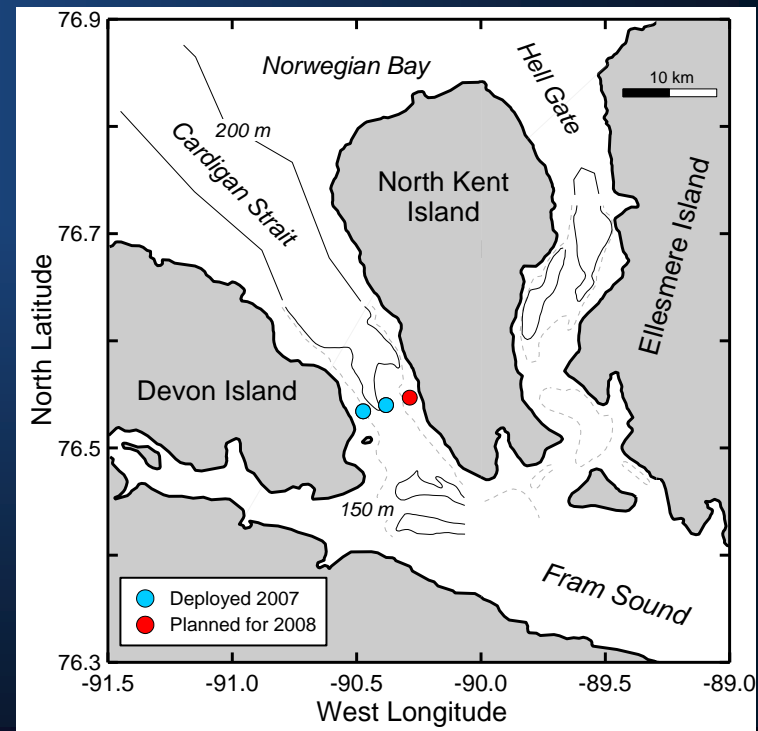
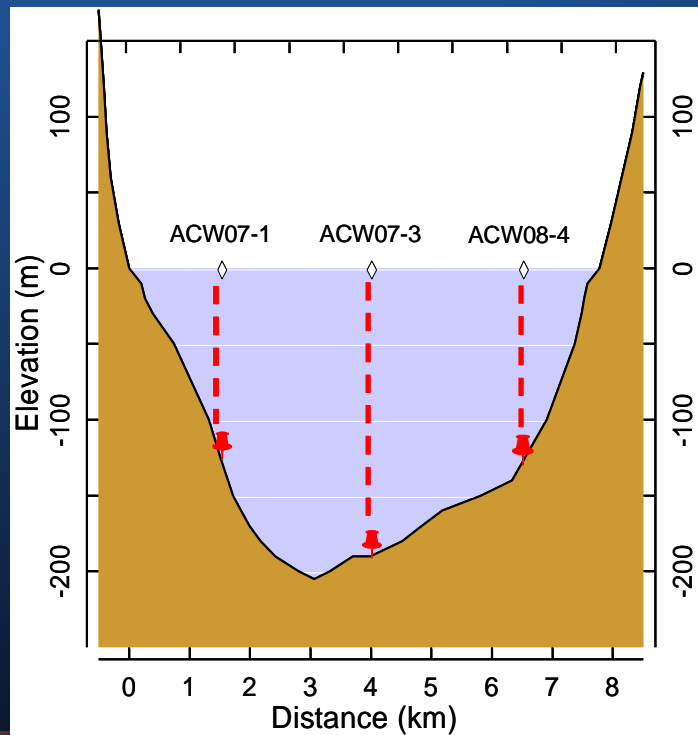




# Canadian Arctic Through-flow Study – 2012 Science Plans

## CCGS Des Groseilliers – Hunfrey Melling

- Recover oceanographic moorings at 3 sites in Cardigan Strait during CCGS Des Groseilliers re-supply mission to Eureka
- CTD casts at the location of moorings







## Barrow Strait Project – 2012 Science Plans

CCGS Henry Larsen – Jim Hamilton

- Eastern Barrow Strait Area (Gascayne Inlet)
- Tentatively August 27 to September 02, 2012 (2 days)
- Cable laying operations using ship's barge
- Recovery of 2 moorings at Gascoyne Inlet
- Deployment of 2 - 3 moorings at Gascoyne Inlet
- CTDs at Gascoyne Inlet





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Thank you!



Photo Courtesy of S. Wong