

The image shows the red hull of the CCGS Amundsen, a Canadian icebreaker, partially submerged in a field of white sea ice. The ship's name 'AMUNDSEN' is written in white capital letters on the red hull. The background is a vast, flat expanse of ice under a pale sky.

AMUNDSEN

ArcticNet

ᐃᐅᐃᑦᑲᑲᑲᑲᑲᑲ ᑲᐅᑲᑲᑲᑲᑲᑲᑲᑲ

**CCGS *Amundsen* Marine Research  
through ArcticNet and other  
partner programs**

Martin Fortier, Ph.D.  
Executive Director, ArcticNet

PAG Meeting, ASSW2014  
April 2014



The image shows the red hull of the CCGS Amundsen, a Canadian icebreaker, partially submerged in a body of water. The hull is covered in a layer of white ice or snow. The name "AMUNDSEN" is written in white capital letters on the red hull. The background is a pale, overcast sky and a distant, hazy shoreline.

AMUNDSEN

## Overview

- Short history
- ArcticNet
- The CCGS Amundsen
  - Sampling Capacity
  - Sampling Effort since 2003
- 2014 Plan and beyond



# CCGS AMUNDSEN

Canadian Research Icebreaker



The CCGS *Amundsen*: a Canadian research icebreaker for international collaboration in the study of the changing Arctic







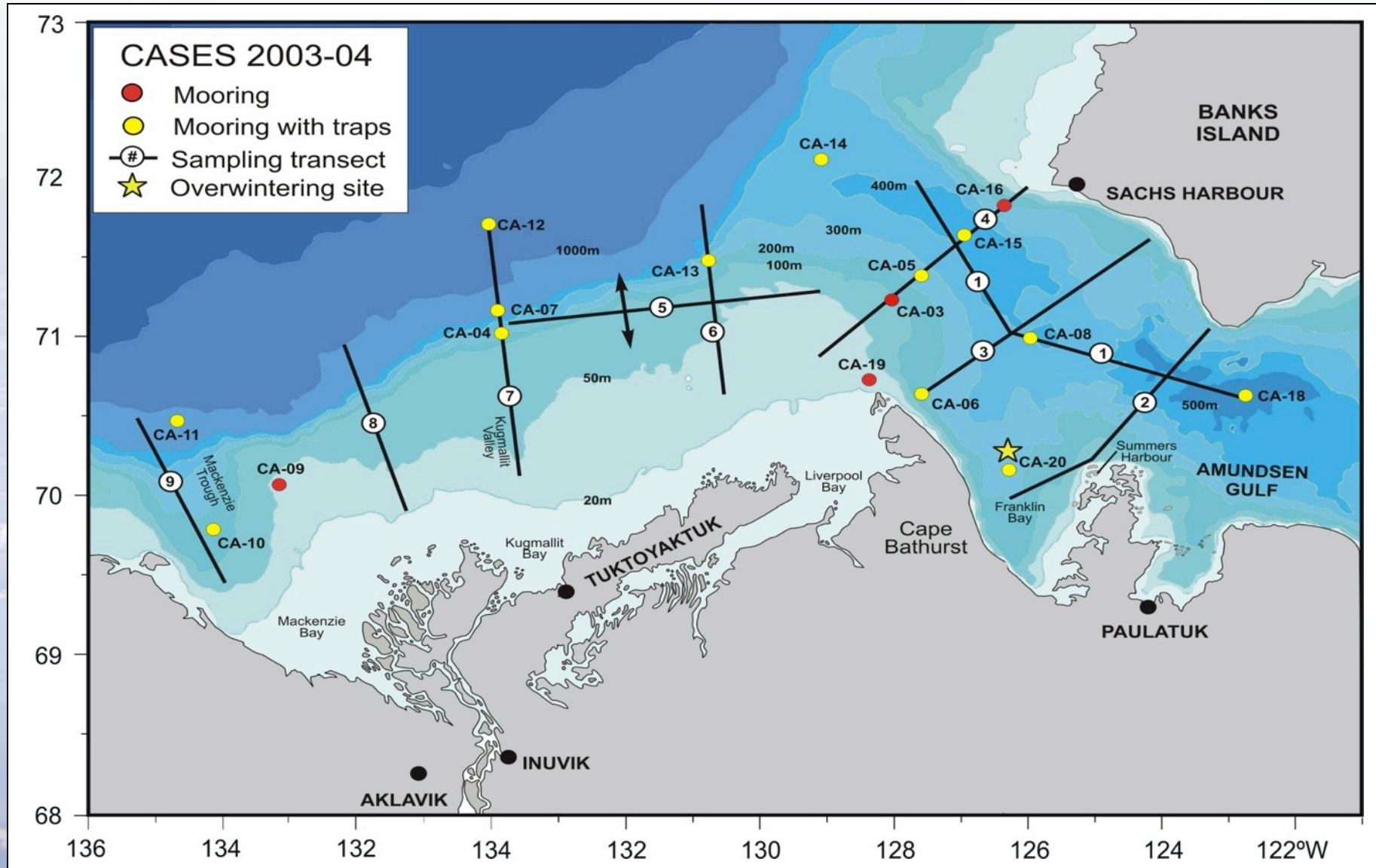
# CCGS AMUNDSEN

Canadian Research Icebreaker





# CASES Sampling (2002-2004)



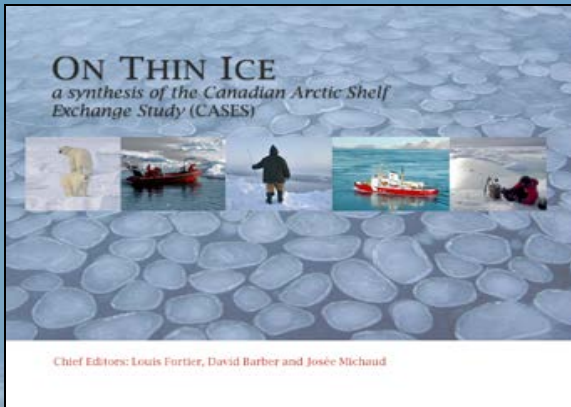
NGCC *Pierre Radisson* (2002) & NGCC *Amundsen* (2003-2004)



# CASES 2003-2004 OVERWINTERING EXPEDITION

Year-round multidisciplinary study to better understand the effect of sea-ice variability on the flux of carbon & contaminants in the Mackenzie Shelf/Amundsen Gulf ecosystem

- ONE-YEAR EXPEDITION
- 29 000 PERSON-DAYS AT SEA
- > 200 SCIENTISTS FROM 8 COUNTRIES
- ENORMOUS AMOUNT OF DATA
- Two dedicated Special issues of scientific journals
- Journal of Marine Systems (Vol .74, 3-4, 2008)
- JGR-Oceans (Vol. 113, C3, 2008)
- A dedicated compendium of results book



AT THE TIME: LARGEST EXPEDITION EVER LAUNCHED TO STUDY THE CHANGING ARCTIC MARINE ECOSYSTEM



Funded at \$6.4M/y during first cycle (2004-2011)  
Funded at \$9.6M/y for second cycle (2011-2018)

Hosted at Université Laval, Quebec City

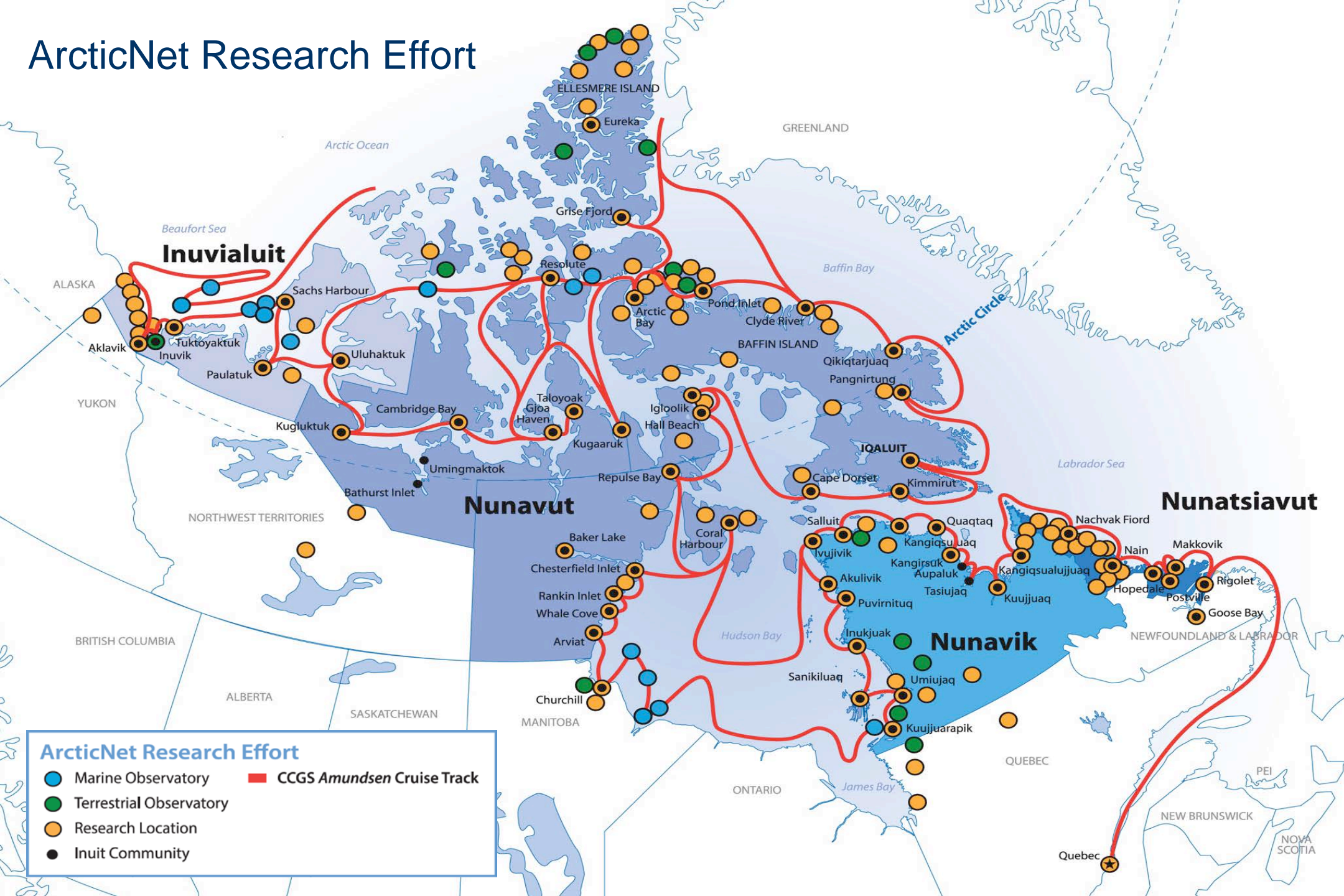


# ArcticNet Research Program

- 38 research projects in natural, human health and social sciences covering the entire Canadian Coastal Arctic
- 150+ Network Investigators from 32 universities and 20 federal and provincial departments/agencies in all provinces and territories of Canada
- 800+ graduate students, research associates and technicians
- 150+ partner organizations and 40 foreign scientists from 14 countries
- With Polar Continental Shelf Program (PCSP), Centre d'Études Nordiques (CEN) and Northern Research Institutes, Canadian research icebreaker *CCGS Amundsen* is major research infrastructure

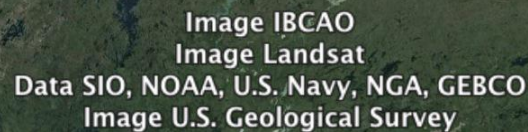


# ArcticNet Research Effort





- Covered most of the Canadian Coastal Arctic since 2003





# Met/Ocean

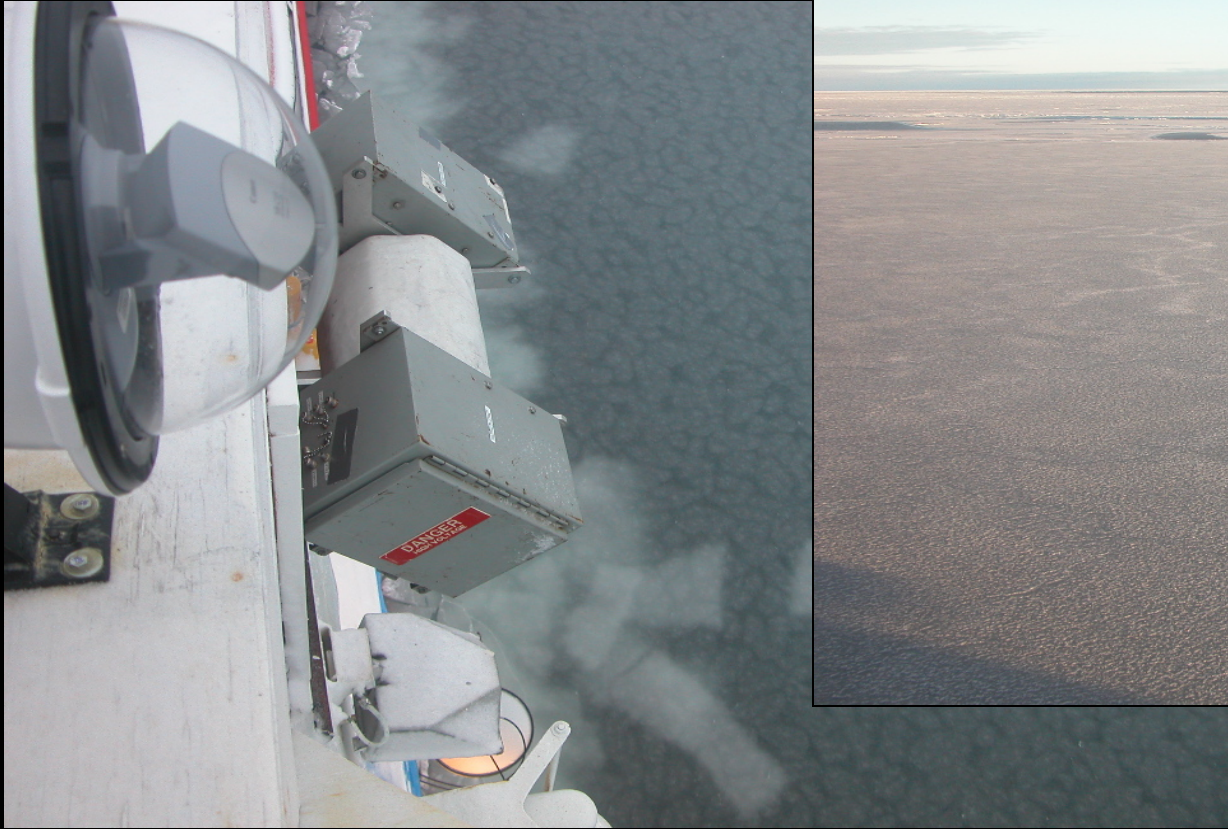




# CCGS AMUNDSEN

CANADIAN RESEARCH ICEBREAKER

Scientific  
Equipment



Microwave scatterometers and Radiometers



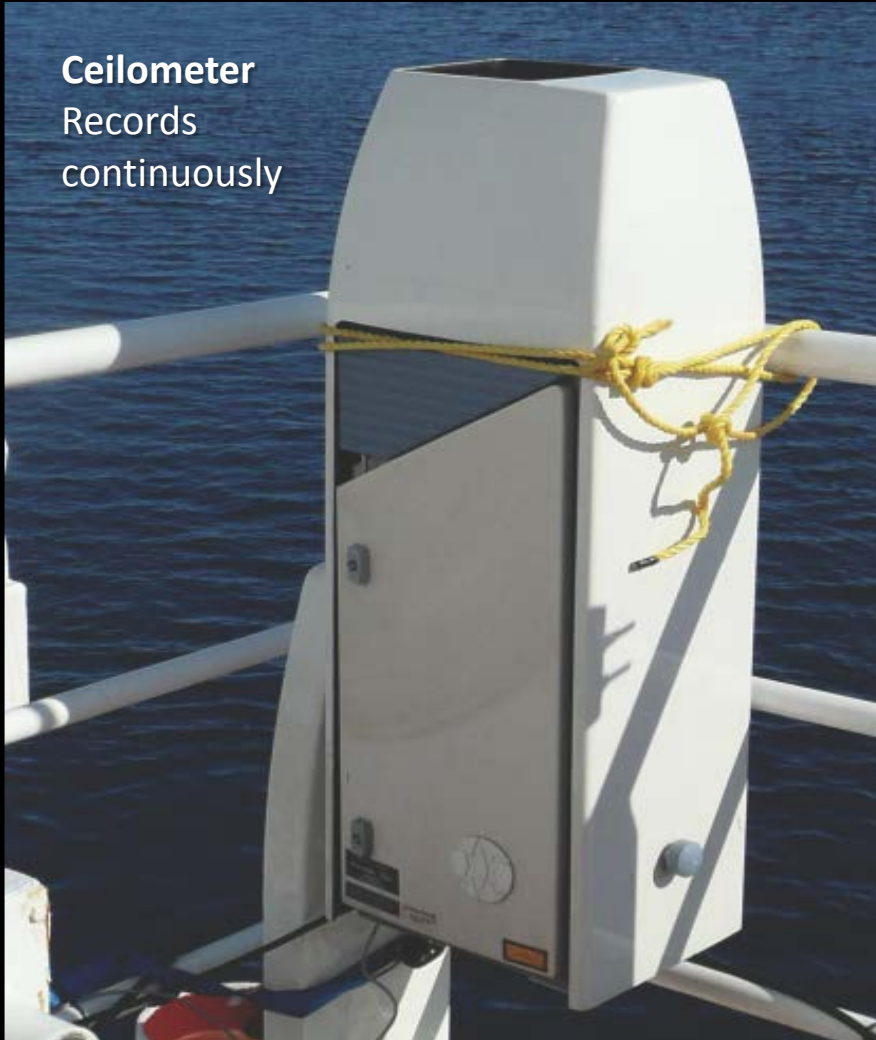
# CCGS AMUNDSEN

CANADIAN RESEARCH ICEBREAKER

## Scientific Equipment



**Ceilometer**  
Records  
continuously



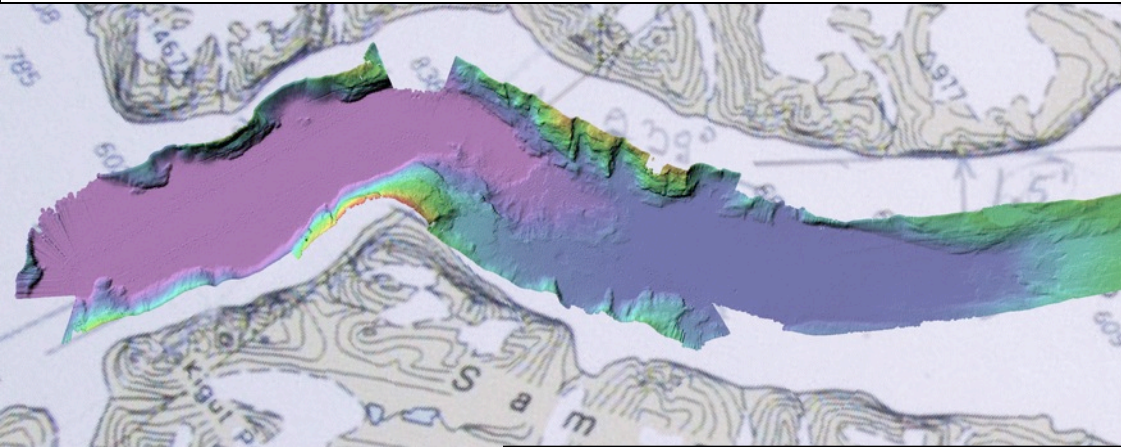
**Microwave radiometer profiler (MWRP)**  
Profiles Continuously  
Horizontal scanning  
When near the ice edge



**All Sky Camera**  
Records every 15 min



# Hull mounted active acoustics



Sam Ford Fjord,  
Baffin Island

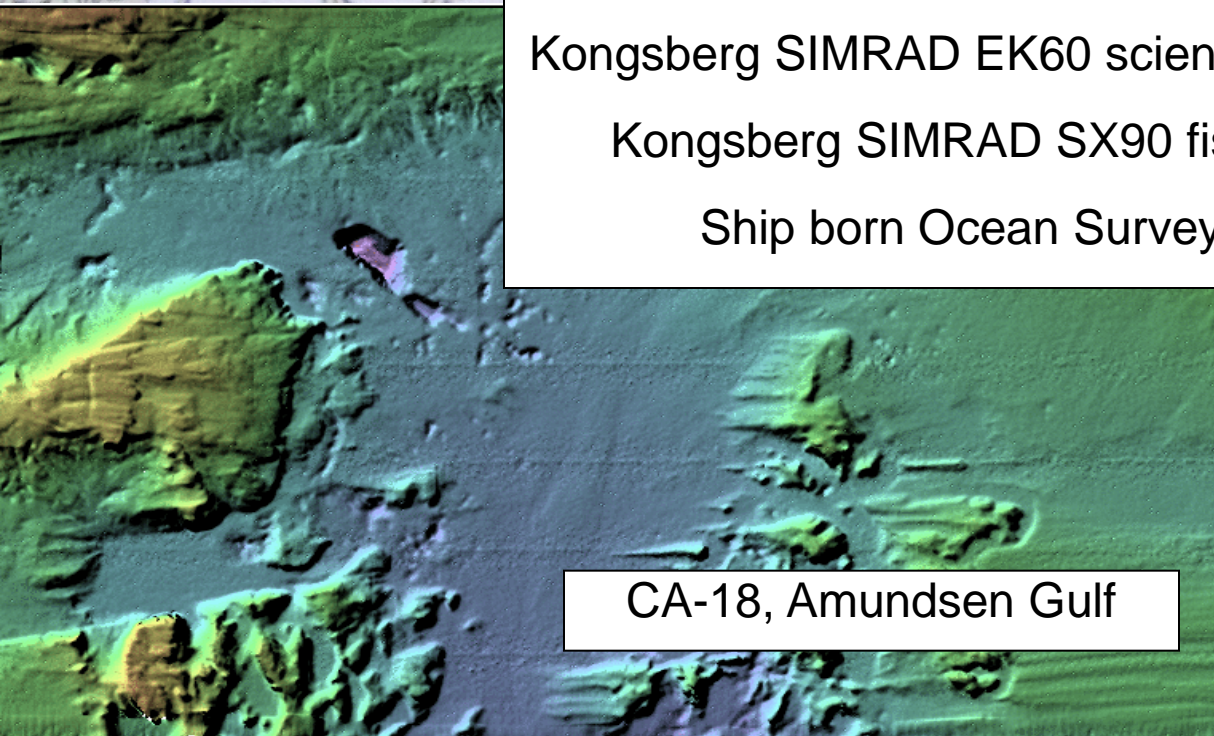
Kongsberg SIMRAD EM302 multibeam sounder

Knudsen K320R 3.5 kHz subbottom profiler

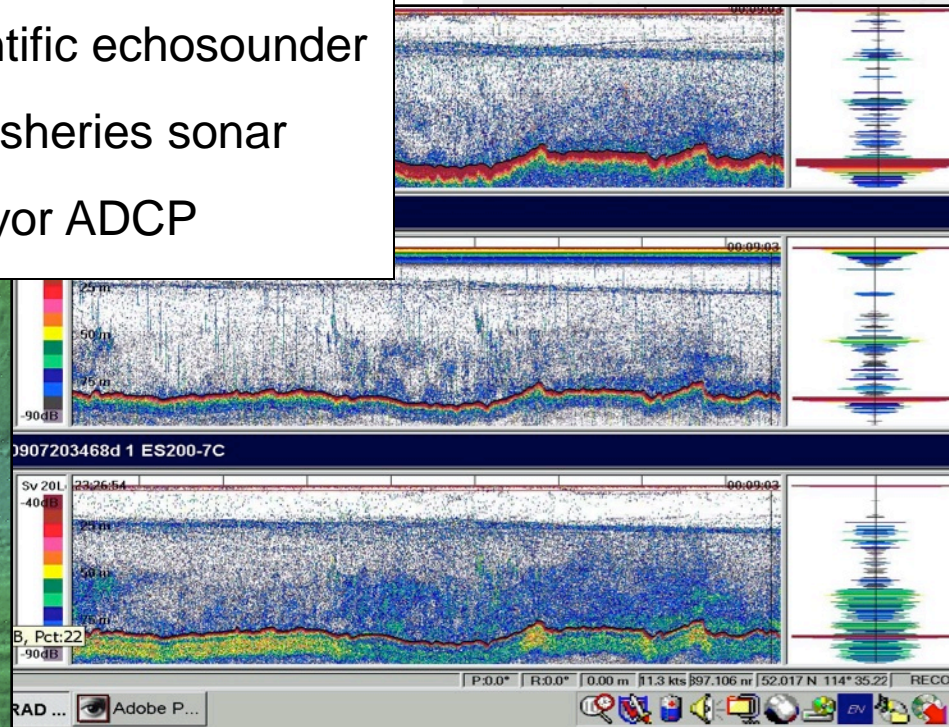
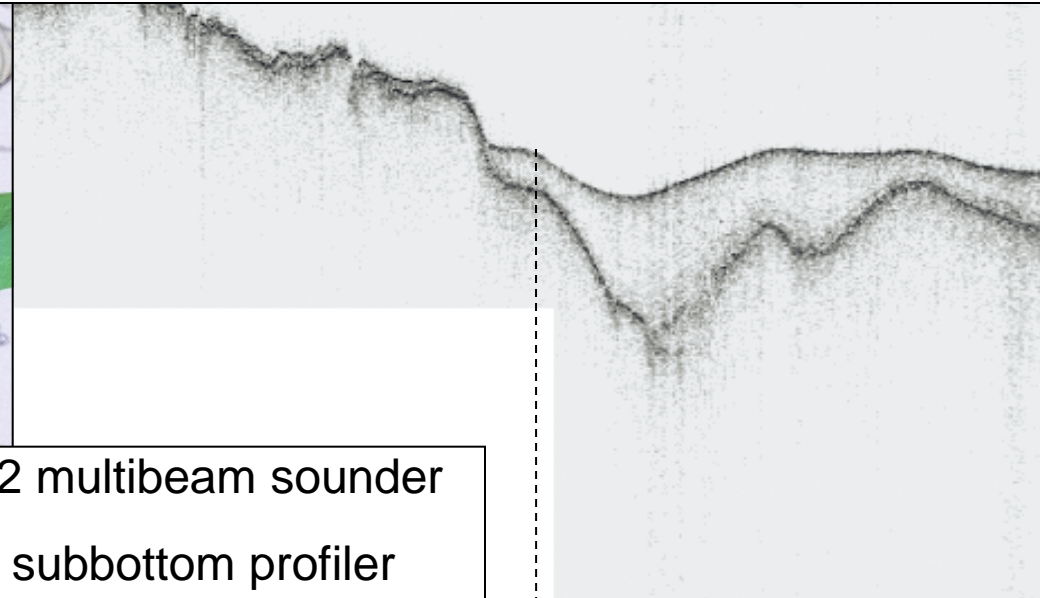
Kongsberg SIMRAD EK60 scientific echosounder

Kongsberg SIMRAD SX90 fisheries sonar

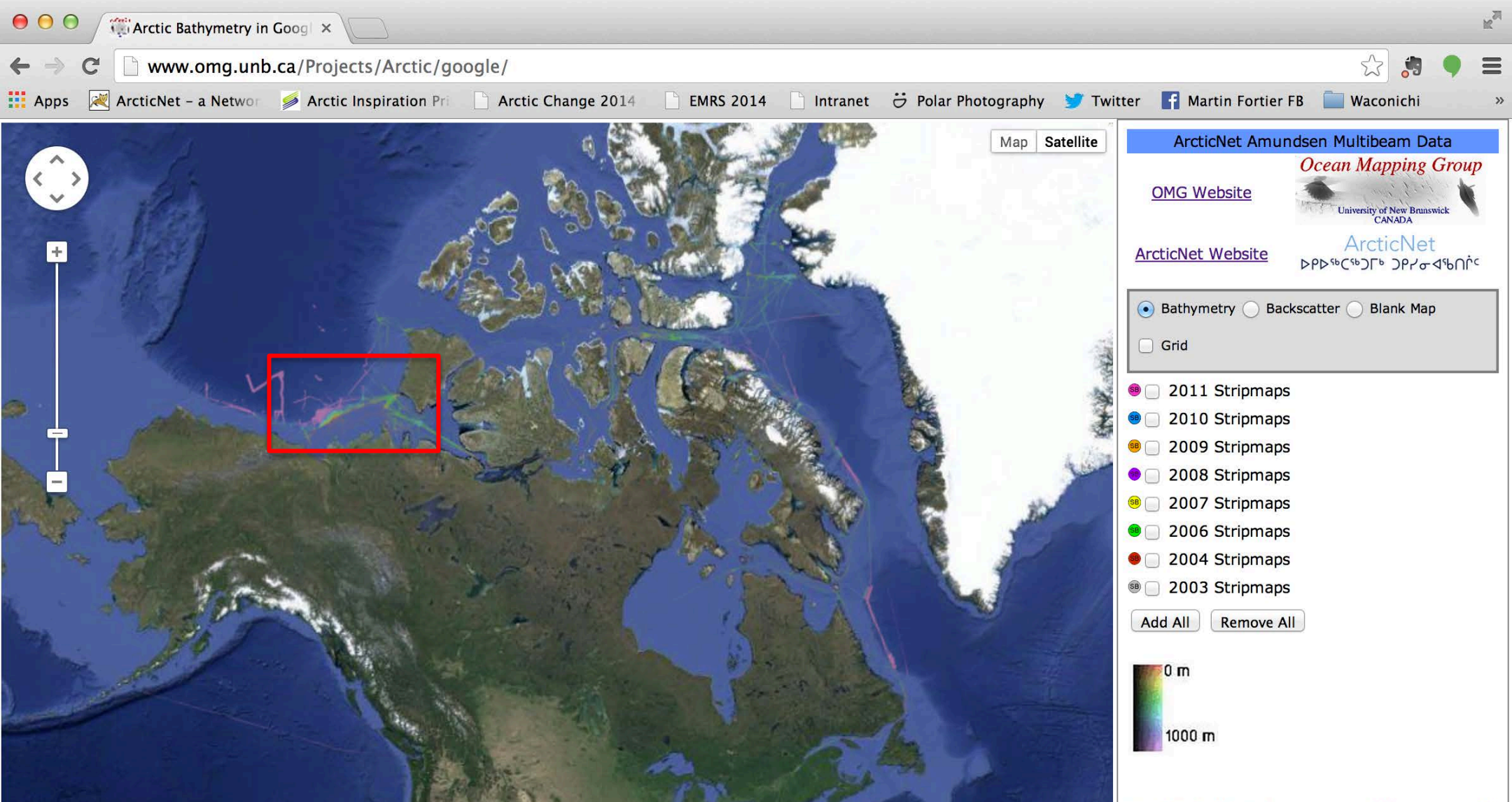
Ship born Ocean Surveyor ADCP



CA-18, Amundsen Gulf

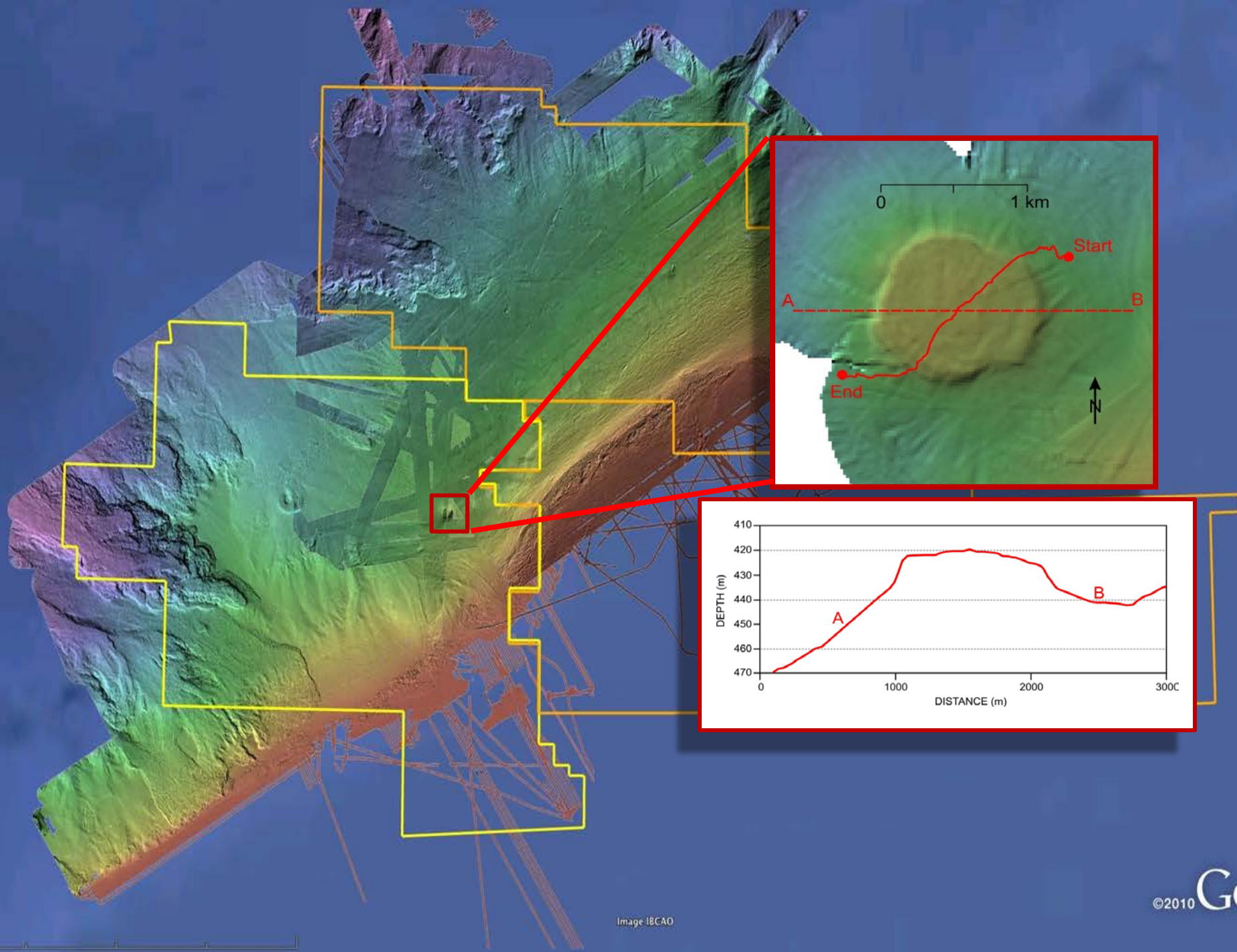






All Multibeam Bathymetry and Backscatter Data available on Ocean Mapping Group (UNB) website ([www.omg.unb.ca](http://www.omg.unb.ca))







# Remotely Operated Vehicle Visual Survey of Expulsion Feature









23:41:11 28/07/2009

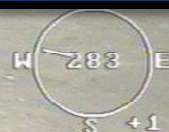
23:05:40 28/07/2009

Depth  
Tilt  
Pan

23:21:02 28/07/2009



Depth 418.4Mtrs  
Tilt -27.0Deg  
Pan -17.2Deg



Depth 418.9Mtrs  
Tilt -20.8Deg  
Pan -11.1Deg





# CCGS AMUNDSEN

CANADIAN RESEARCH ICEBREAKER

Scientific  
modifications



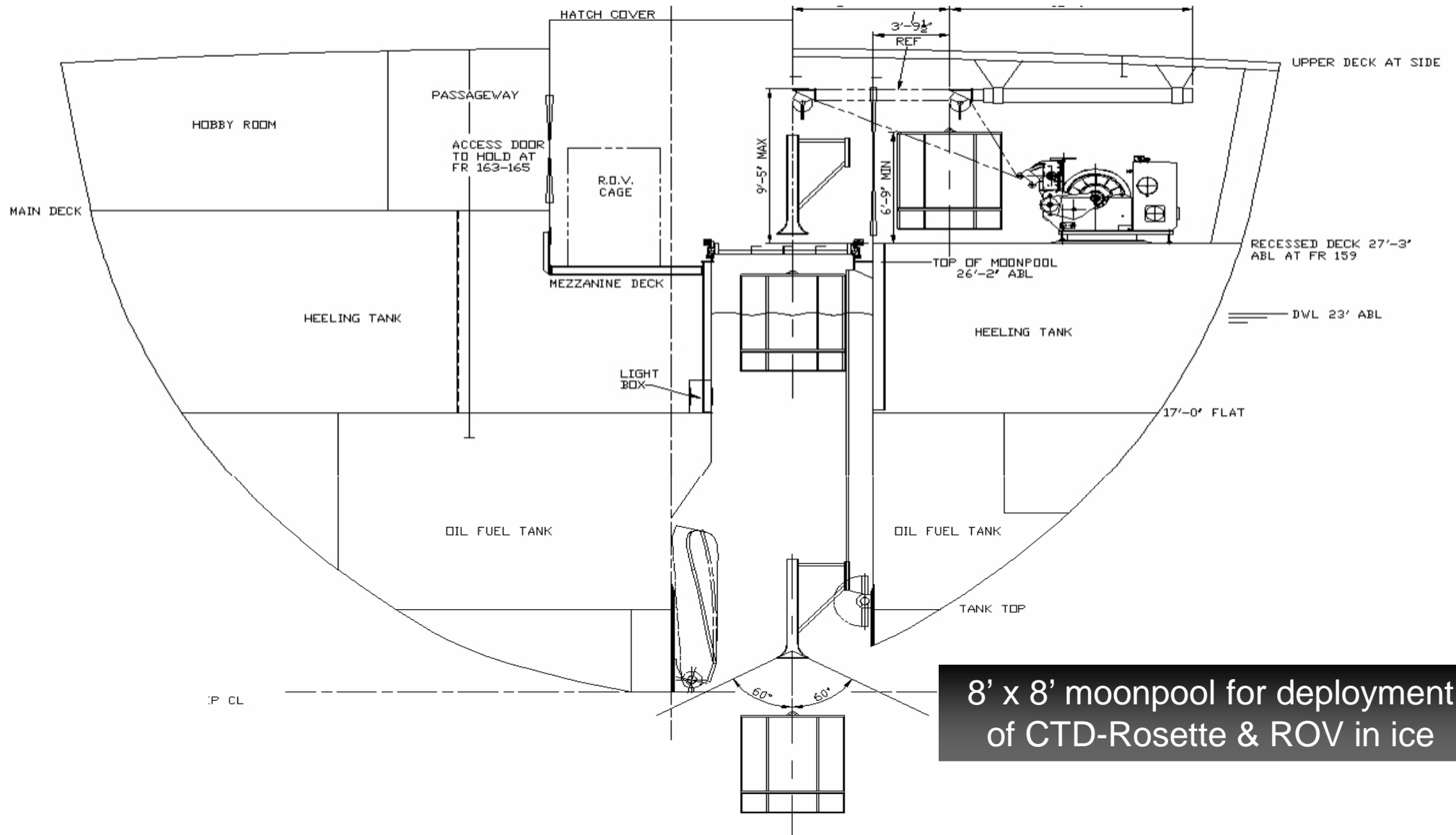
8' x 8' moonpool for deployment  
of CTD-Rosette & ROV in ice



# CCGS AMUNDSEN

CANADIAN RESEARCH ICEBREAKER

## Scientific modifications





# CCGS AMUNDSEN

CANADIAN RESEARCH ICEBREAKER

Scientific  
modifications





# Over 3300 CTD-Rosette casts in Canadian Arctic waters since 2003

## Seabird Carousel Rosette with SBE911+ CTDs

- Temperature
- Salinity
- pH
- Oxygen
- Nutrients
- Light
- Turbidity
- Currents





# Over 3300 CTD-Rosette casts in Canadian Arctic waters since 2003

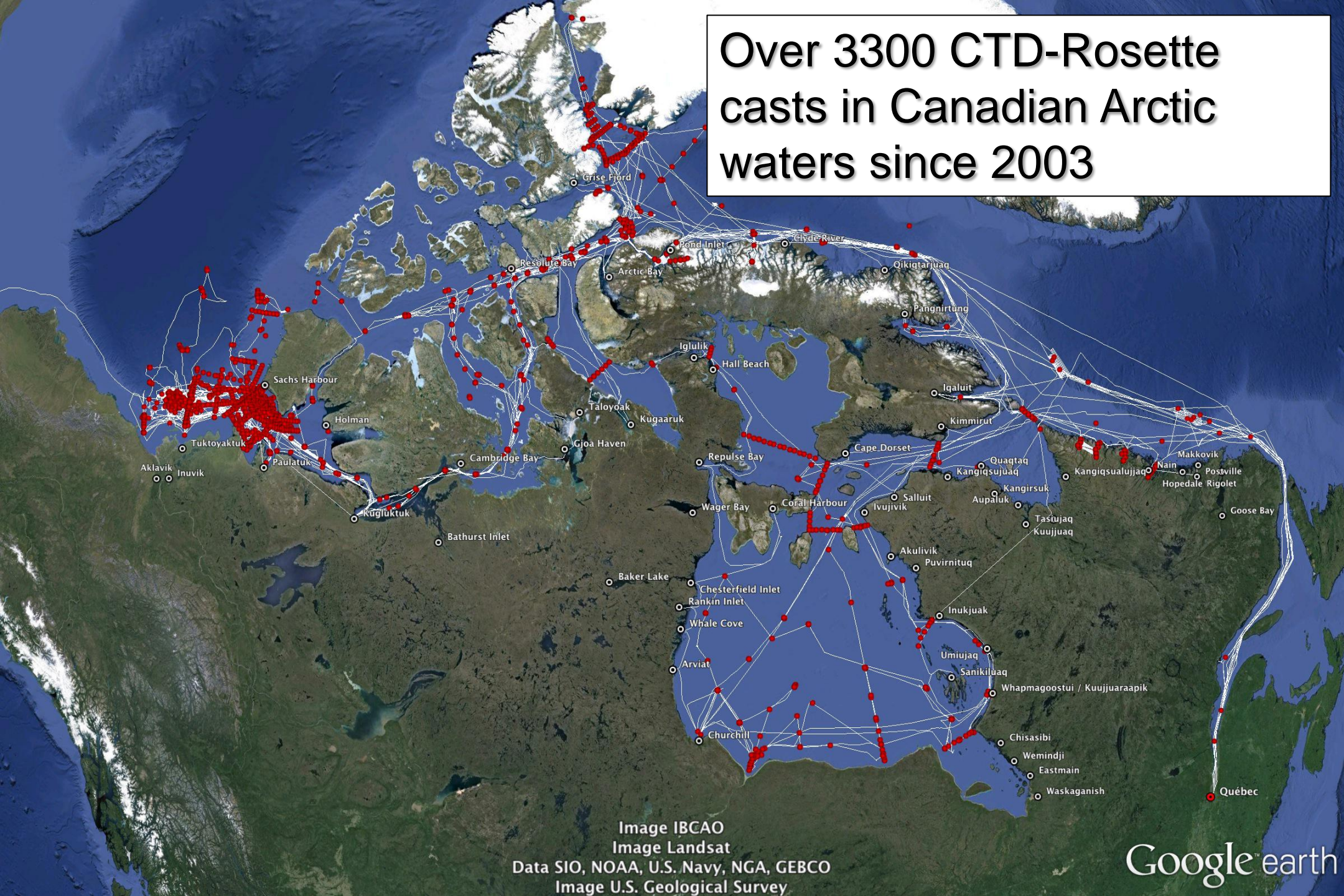


Image IBCAO  
Image Landsat  
Data SIO, NOAA, U.S. Navy, NGA, GEBCO  
Image U.S. Geological Survey

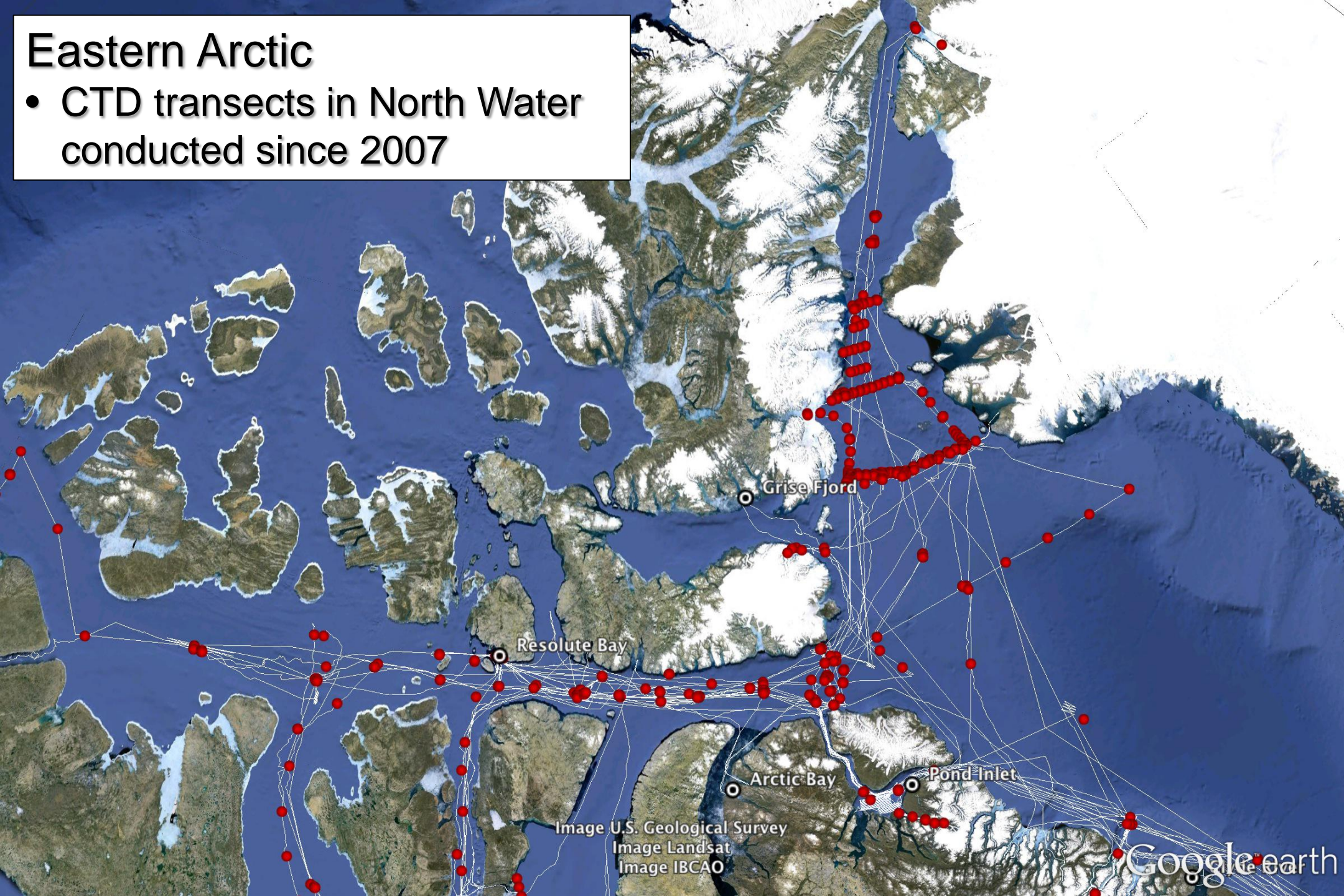


Google™ earth

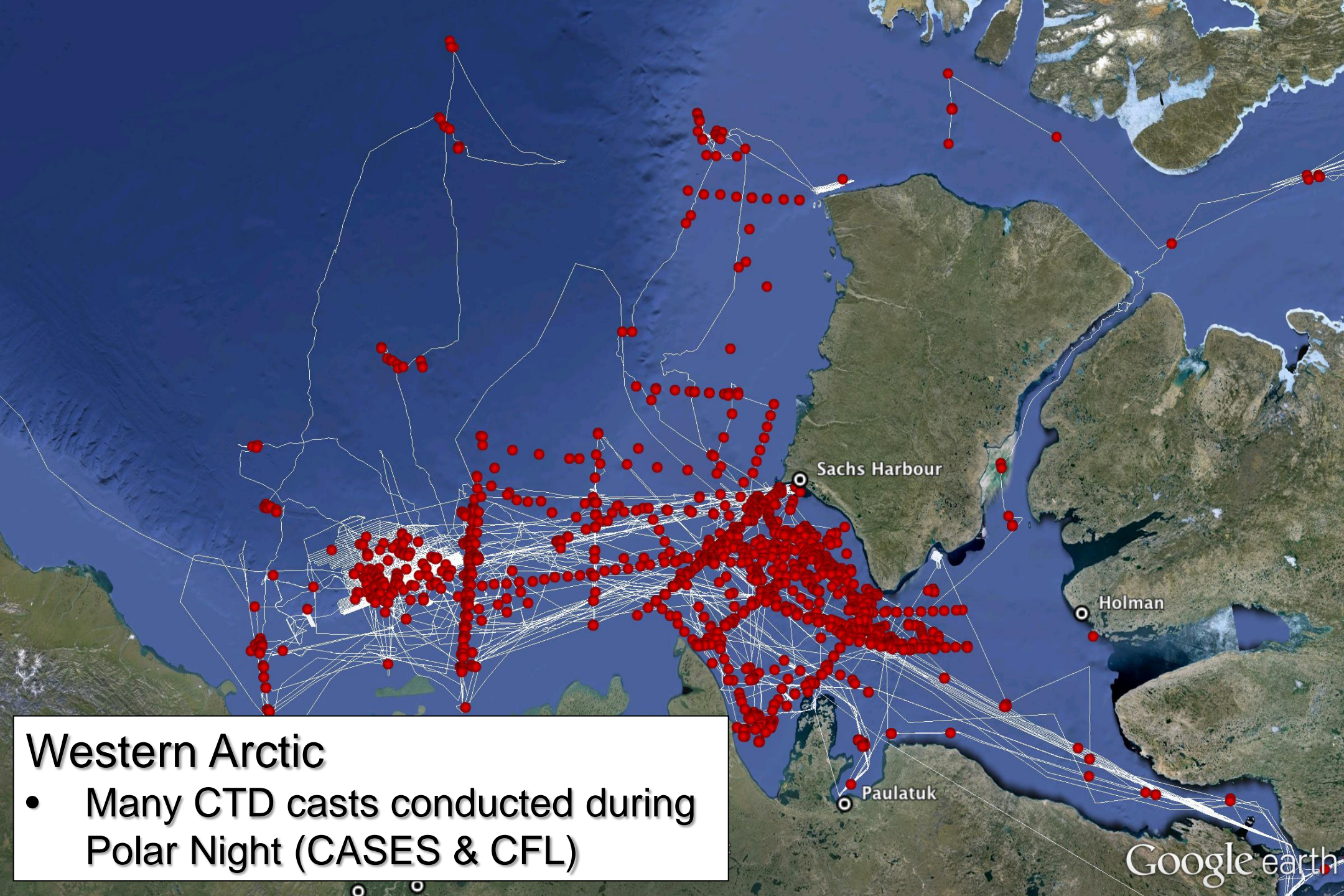


# Eastern Arctic

- CTD transects in North Water conducted since 2007





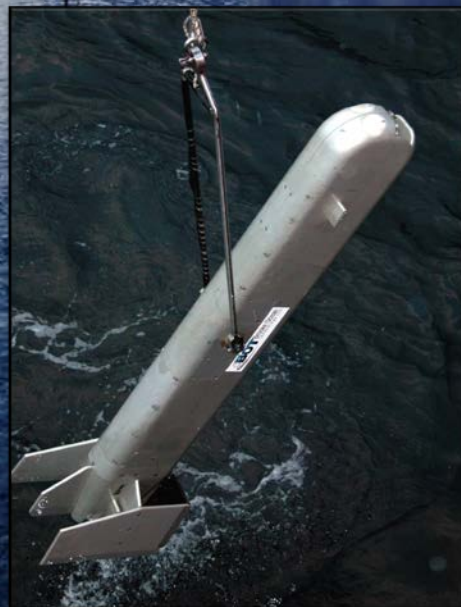
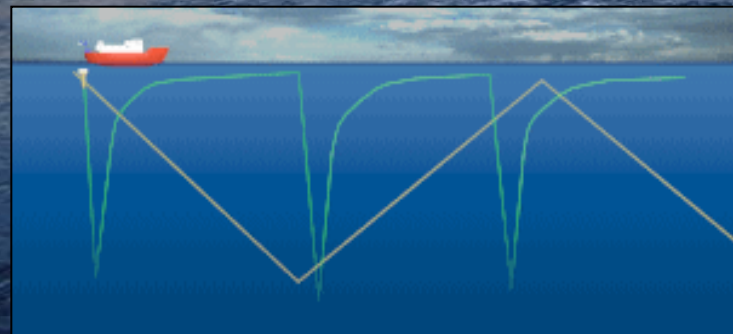


## Western Arctic

- Many CTD casts conducted during Polar Night (CASES & CFL)



Dozens of Moving Vessel Profiler (SBE911+) transects across major straits of CAA (Lancaster Sound, Hudson Strait...)

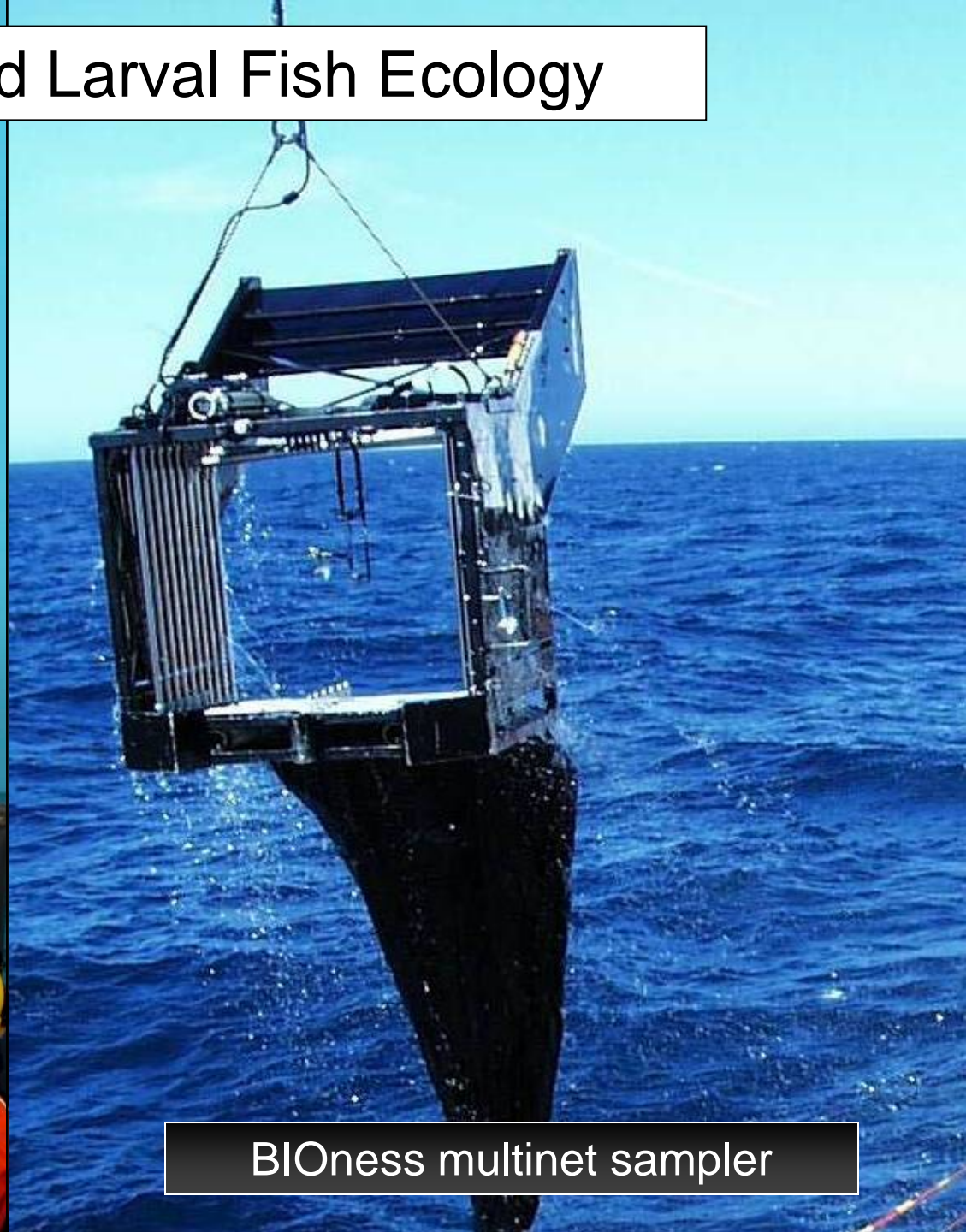




# Zooplankton and Larval Fish Ecology



Hydrobios multinet sampler

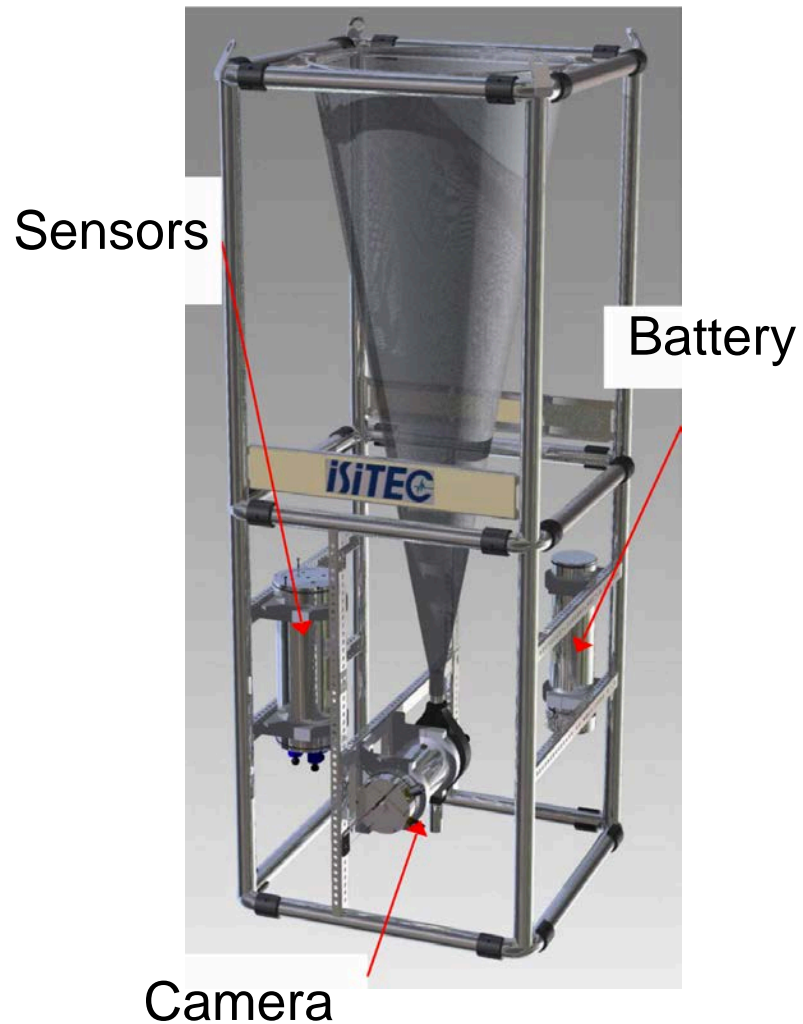


BIOness multinet sampler



# Zooplankton and Larval Fish Ecology

## Lightframe Onsite Keyspecies Investigation (LOKI)



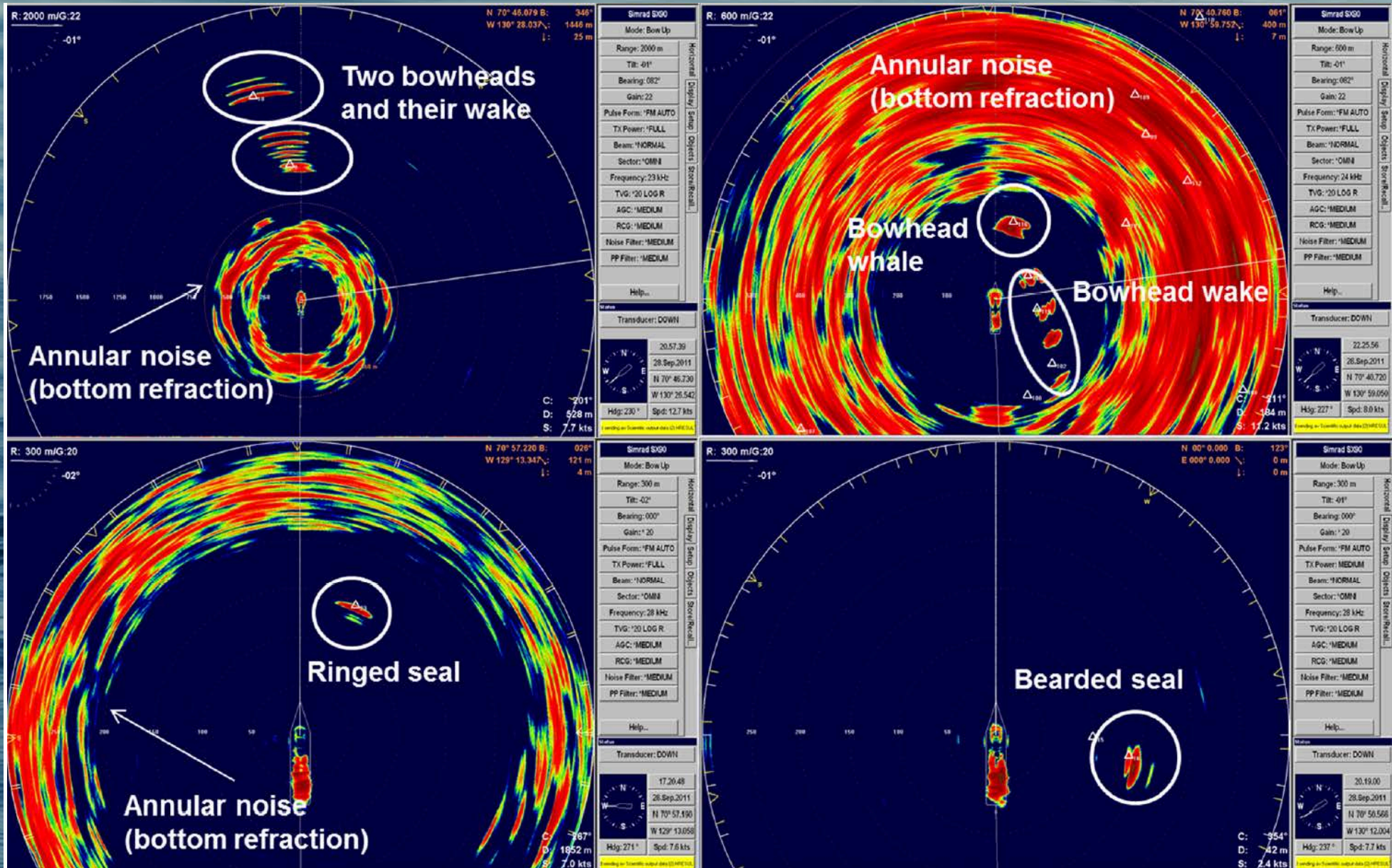


# Zooplankton and Larval Fish Ecology



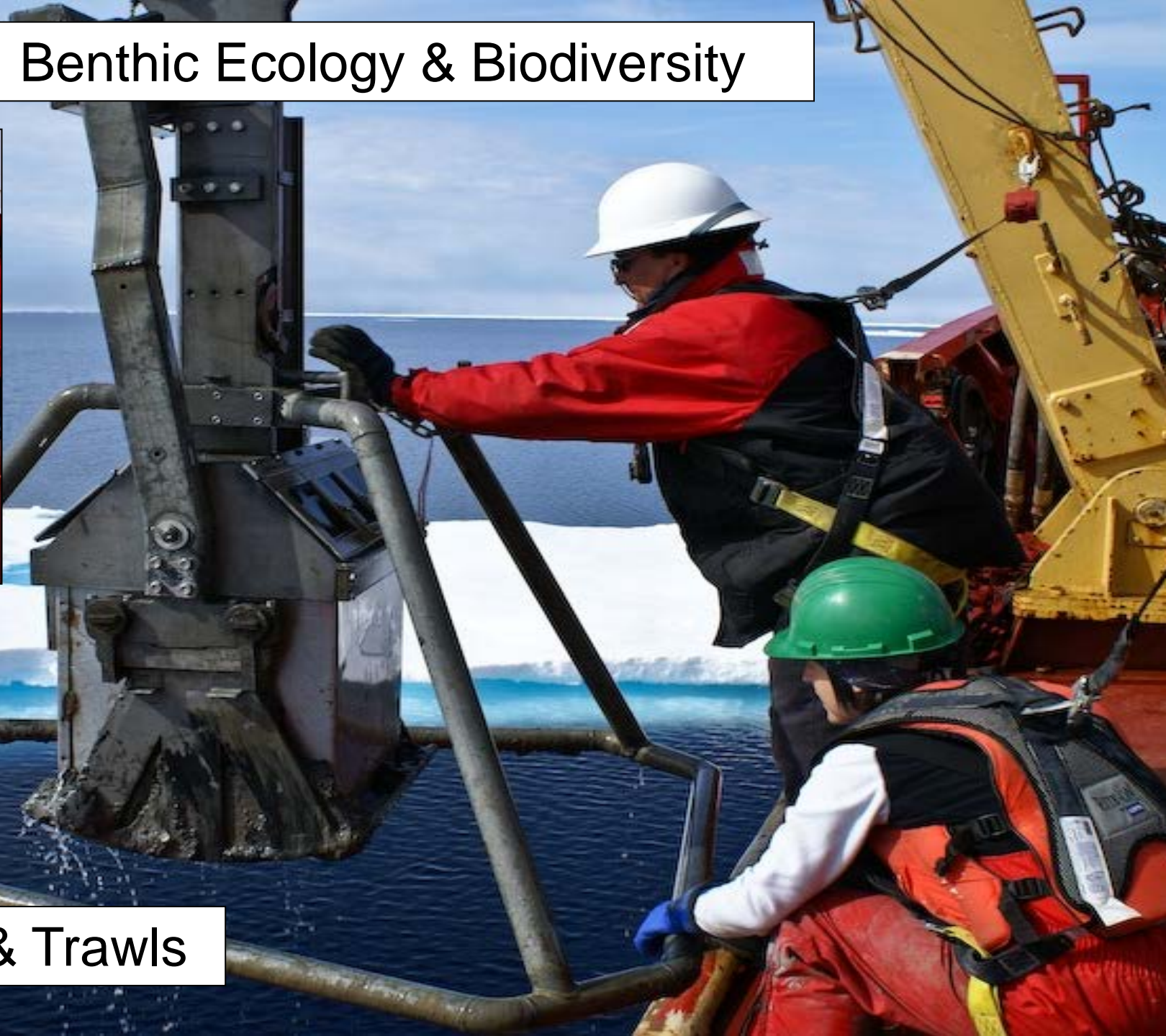


# Active acoustics program for fish and cetacean





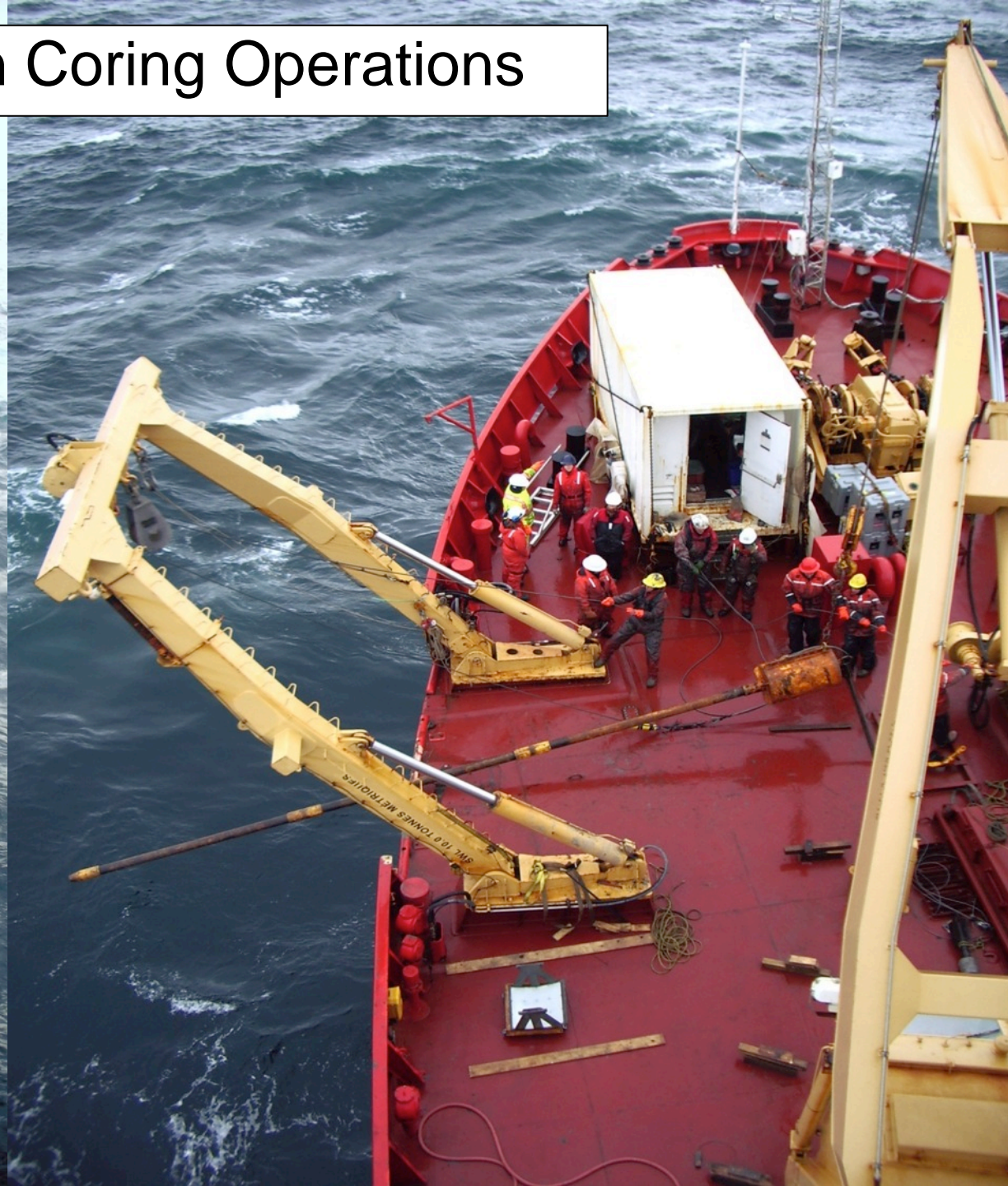
# Benthic Ecology & Biodiversity



Box Corers & Trawls

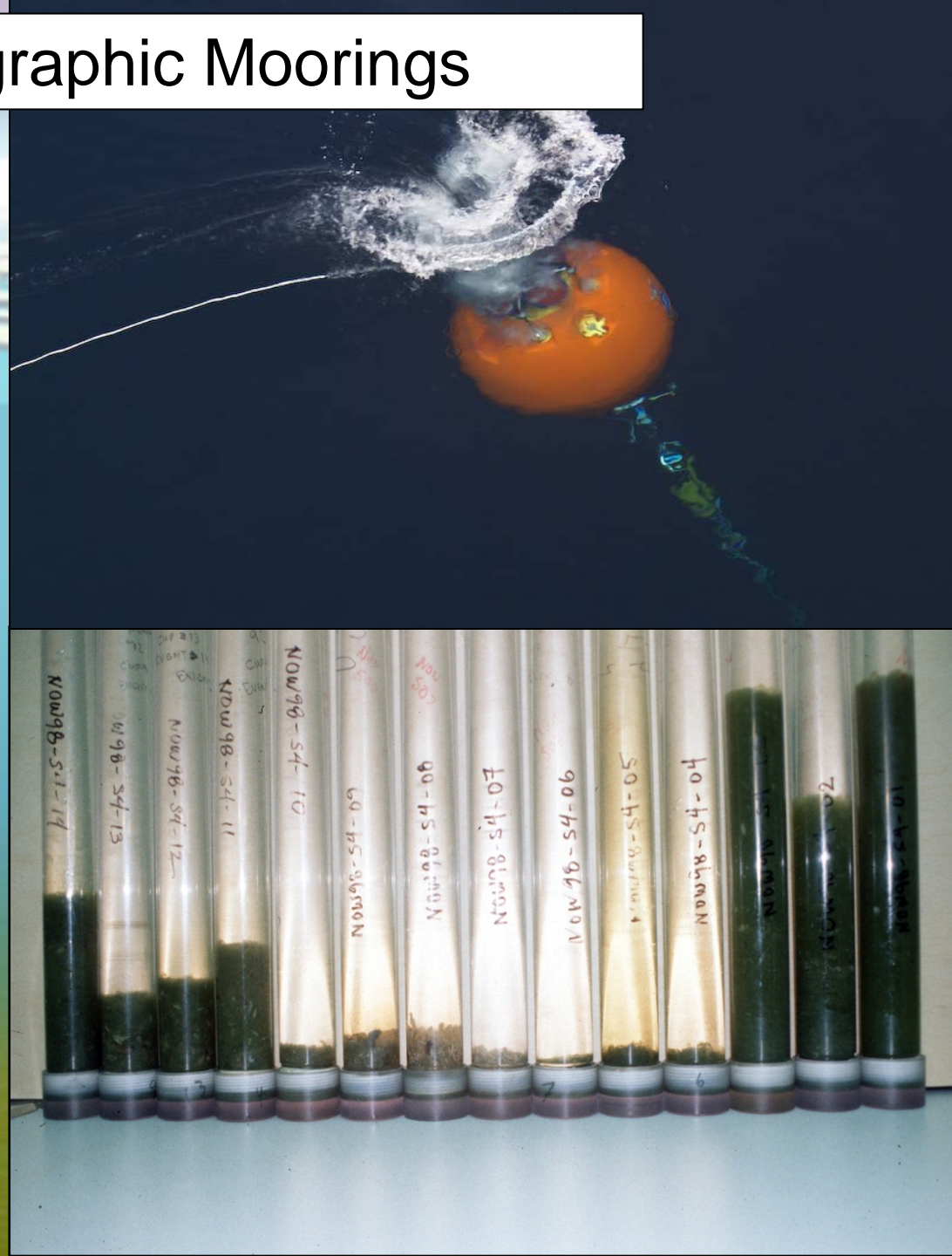
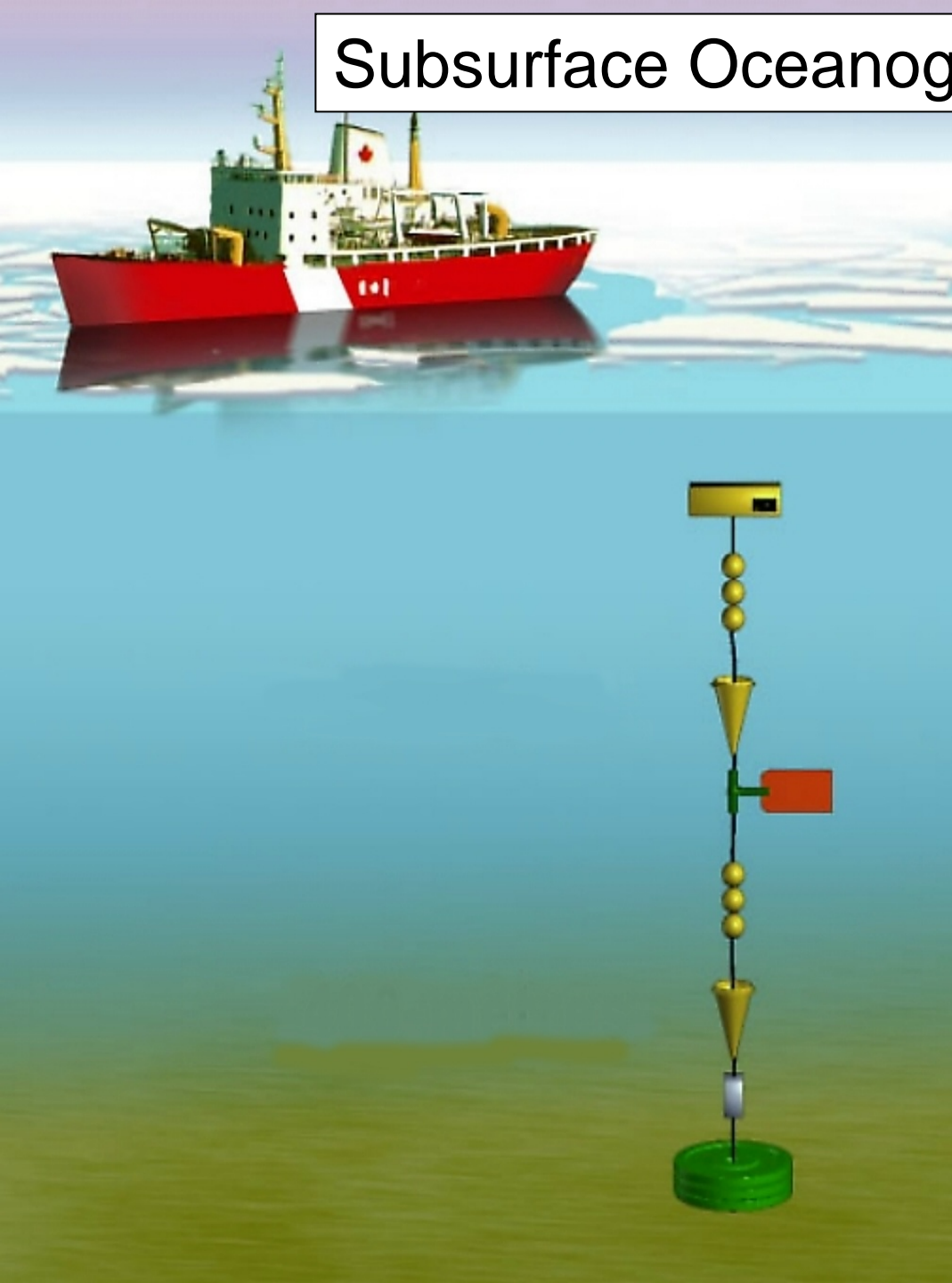


# 10m Piston Coring Operations



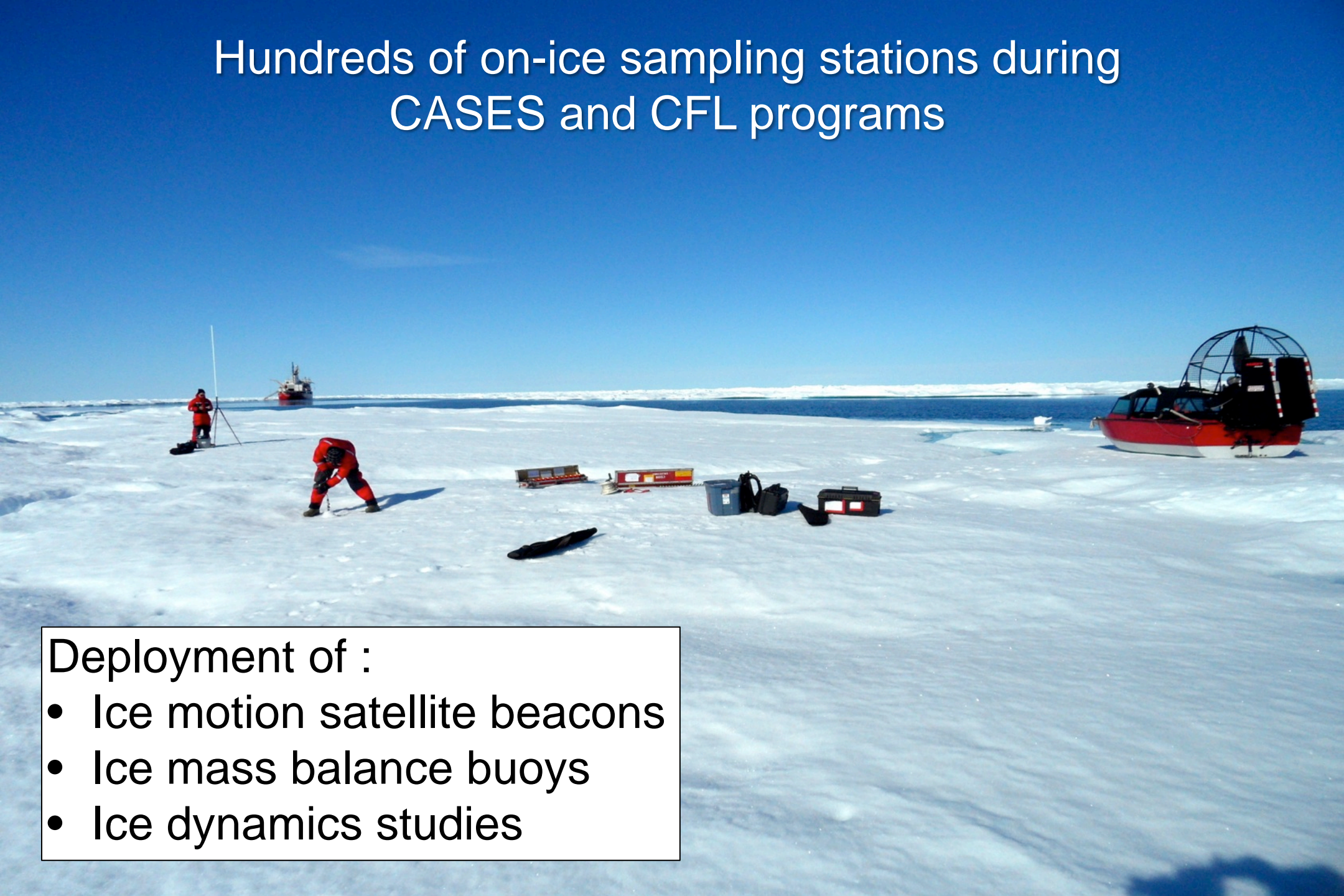


# Subsurface Oceanographic Moorings





# Hundreds of on-ice sampling stations during CASES and CFL programs



## Deployment of :

- Ice motion satellite beacons
- Ice mass balance buoys
- Ice dynamics studies



# Portable In-situ Laboratory for Mercury Speciation (PILMS)

Self sufficient laboratory that either sits on the back deck of the Amundsen or at any northern Arctic site (with power).

Class 100 (ISO Class 5) Cleanliness

## Equipment:

- Tekran 2537A (TGM), 1130 (RGM), 1135 (pHg) – Air
- Tekran 2600 (Preconcentration/Detector), 2610 (Pump unit), 2620 Auto-sampler - Water
- Tekran 2537A (DGM)
- Brook Rand methyl mercury analyzer
- Milli-Q Element ultra pure water system
- Continuous flow in line surface water system



Stern and Wang









# IPY-Circumpolar Flaw Lead System Study (2007-11)

Countries with Institutions participating in CFL:



Canada, USA, China, Spain, Germany, Sweden, Norway, Russia, Belgium, France, Great Britain, Netherlands

\$40M, 4 years

\$11M in new CFI funds

International lead- Pan-AME

Strong northern partnerships

11 month field program

First time!

370 investigators

102 Senior Scientists

122 graduate students

46 technicians

35 Schools on Board

41 media

Countries of origin of CFL researchers and media:



Canada, USA, China, Spain, Switzerland, Germany, Sweden, Norway, Russia, Belgium, France, Great Britain, Netherlands, Finland, Scotland, Poland



## Major collaborations with O & G industry in Beaufort Sea since 2009

ArcticNet 2009  
Leg 2a Cruise Report

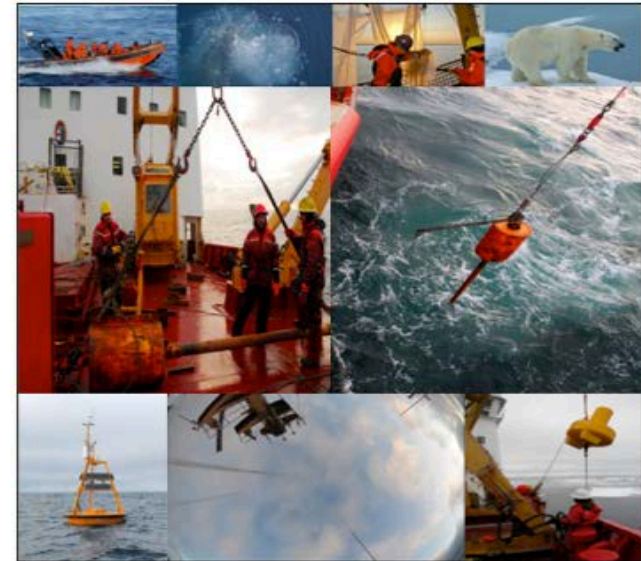
CCGS *Amundsen*  
16 July to 30 July 2009



By  
On-board participants  
Edited by Dr. Martin Fortier, Chief Scientist

ArcticNet 2009  
Leg 3b Cruise Report


CCGS *Amundsen*  
12 September to 8 October 2009



By  
On-board participants  
Overview by Dr. Martin Fortier (ArcticNet Executive Director)  
Edited by Dr. Tim Papakyriakou, Chief Scientist, Leg 3b



# BEAUFORT REGIONAL ENVIRONMENTAL ASSESSMENT

[Home](#)[Research](#)[Working Groups](#)[News](#)[Resources](#)[Publications](#)[About](#)[Contact](#)[Members](#)

Building a strong knowledge base for informed decisions on oil and gas activity.

## Who We Are

The Beaufort Regional Environmental Assessment (BREA) is a multi-stakeholder initiative to sponsor regional environmental and socio-economic research that will make historical information available and gather new information vital to the future management of oil and gas in the Beaufort Sea.

The BREA will help ensure governments, Inuvialuit, and industry are better prepared for oil and gas exploration and development in the offshore by building upon the regional information base for the Beaufort Sea. This will support effective and efficient regulatory decision-making by providing the necessary scientific and socio-economic information to all stakeholders.

[Read More...](#)

## How We Help

BREA funds targeted research projects that will improve management of oil and gas activities in the Beaufort Sea. Projects may fall under different categories such as research, monitoring, baseline data collection, modelling, data mining and/or synthesis. [Read more...](#)

## Working Groups

The BREA Working Groups implement specific program components and ensure that information contributes to the regulatory requirements for offshore oil and gas activity. Working Groups have been established to address the following: Cumulative Effects, Climate Change, Socio-Economic Indicators, Oil Spill Preparedness and Response, Waste Management, and Information Management. [Read more...](#)

[www.beaufortrea.ca](http://www.beaufortrea.ca)



## **Deep Water Seabed Geohazards (2011 - 2014)**

**Lead:** Steve Blasco, Natural Resources Canada

## **Active Acoustic Mapping of Fish in the Beaufort Sea (2011 - 2015)**

**Lead :** Louis Fortier, ArcticNet

## **Radarsat Mapping of Extreme Ice Features in the Southern Beaufort Sea (2011 - 2015)**

**Lead:** David Barber, University of Manitoba

## **Southern and Northeastern Beaufort Sea Marine Observatories (2011 - 2015)**

**Lead:** Martin Fortier, ArcticNet



## Levies

Funding for the ESRF is provided through levies on frontier lands

[more...](#)

## Legislation

Environmental Studies Research Fund Regions Regulations [more...](#)

[ESRF Mailing List](#)



- integrated Beaufort Observatory (iBO)
- Role of nepheloid layers and shelf-slope exchange for oil spill fate and effects in Beaufort Sea



Fisheries and Oceans  
Canada

Pêches et Océans  
Canada





## Overview of 2014 Expedition Plan







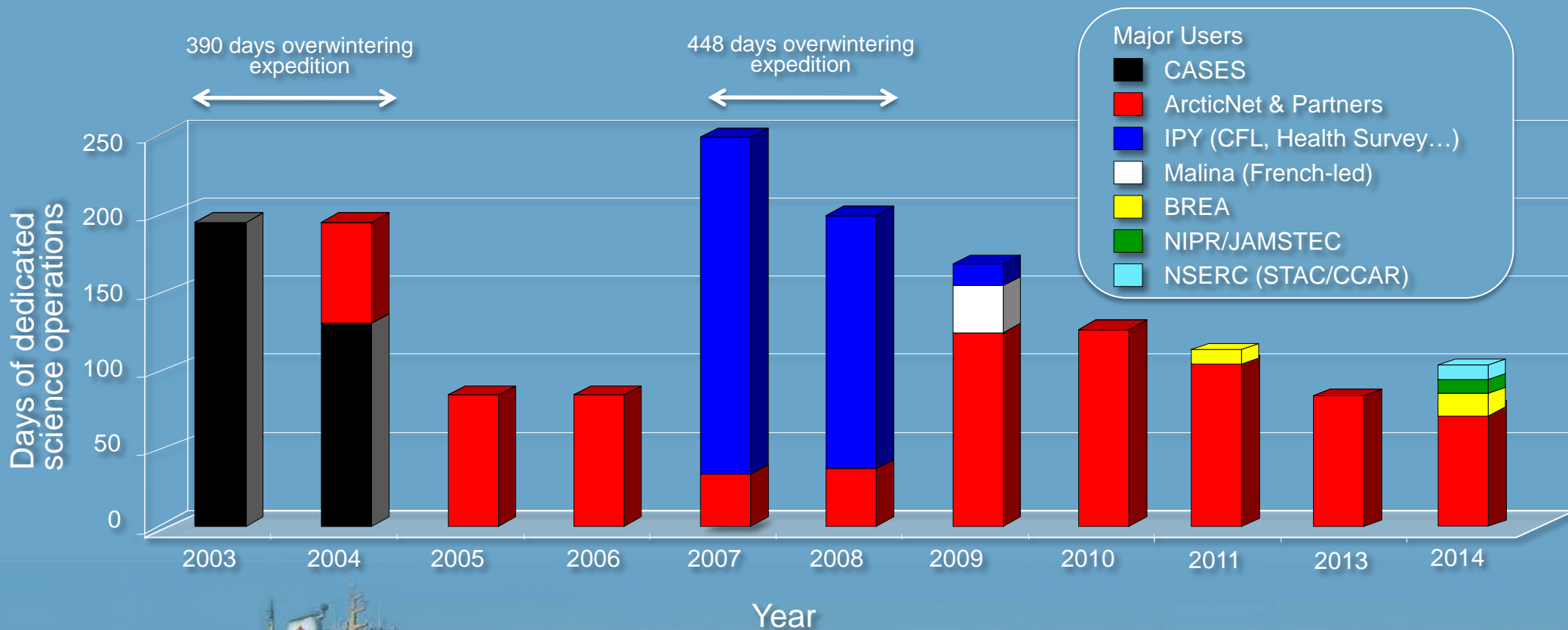






# Providing major access to the Arctic for the Canadian and international scientific community since its inauguration in 2003

- 1500 days of dedicated scientific operations over 10 years or 150 days per year on average
- Supported 2 major international overwintering studies in the Beaufort Sea (CASES & CFL)
- Supported science teams from 15 countries
- Visited all Canadian coastal Inuit communities as part of an international Inuit Health Survey





# Data Management & Dissemination

Polar Data Catalogue: [www.polardata.ca](http://www.polardata.ca)



## Welcome to the Polar Data Catalogue

The Polar Data Catalogue is a database of metadata and data that describes, indexes and provides access to diverse data sets generated by Arctic and Antarctic researchers. The records follow *Federal Geographic Data Committee* (FGDC) standard format to provide metadata exchange with other data centres. The records cover a wide range of disciplines from natural sciences and policy, to health and social sciences. This geospatial search tool is available to the public and researchers alike and allows searching data using a mapping interface or other parameters.

Please click on the [PDC Search map](#) below to start searching for datasets or [sign in](#) to contribute metadata to the Polar Data Catalogue. The [PDC Lite Search](#) is also available for users with limited internet speed.



POLAR DATA  
CATALOGUE  
METADATA  
ENTRY

- Dataset description
- Indexing
- Discovery
- Full data archiving and sharing



# Publications Database

[www.aina.ucalgary.ca/arcticnet](http://www.aina.ucalgary.ca/arcticnet)

ArcticNet  
ᐃᐅᐃᑦᑕᑦᐅᐅᑦ ᐅᐅᑦᐅᑦᐅᑦᐅᑦ

Publications



The ArcticNet Publications Database describes publications from the ArcticNet, Canadian Arctic Shelf Exchange Study (CASES) and International North Water Polynya Study (NOW) research projects.

La Banque de données des publications d'ArcticNet décrit les publications des projets de recherche du réseau ArcticNet, de l'étude internationale du plateau continental arctique canadien (CASES) et de l'étude internationale de la polynie des Eaux du Nord (NOW).

☒ English ☐ Français

Enter = Entrez



- 2,677 publications
- 1,560 refereed
  - 721 non-refereed
  - 396 theses





11 | 13  
ANNUAL REPORT  
ᐱᓐᓂᐱᓐᓂᐱᓐᓂᐱᓐᓂᐱᓐ  
RAPPORT ANNUEL  
ArcticNet  
ᐱᓐᓂᐱᓐᓂᐱᓐᓂᐱᓐᓂᐱᓐᓂᐱᓐ

## CORPORATE PROFILE

150+

Partner organizations

14

Countries

145

Network Investigators

1000+

Graduate students, postdoctoral fellows,  
research associates, technicians and others

32

Canadian Universities

Understanding the present transformation of  
environment and anticipating its consequences  
and challenges faced by Canadians, the Arctic  
and the national and international scientific community

ArcticNet brings together scientists and other  
human health and social sciences with their  
northern communities, governments and the  
private sector to prepare for the impacts and opportunities for  
and modernization in the Arctic. Over 140  
graduate students, postdoctoral fellows, research  
associates, technicians and others from 32  
Canadian universities and regional departments and agencies  
collaborate on research projects with over 140 partner organizations

### CCGS AMUNDSEN

19,000+

nautical miles travelled during the 2011  
CCGS Amundsen expedition

150,000+

nautical miles travelled by the CCGS Amundsen since 2003

1,400+

research days at sea on the CCGS Amundsen since 2003

On 19 July 2011, for an eighth consecutive season, the state-of-the-art Canadian research icebreaker CCGS Amundsen left her homeport of Quebec City for a 135-day expedition in support of ArcticNet's ongoing marine-based research program and a third year of collaborations with industry partners in the Beaufort Sea. During the three-day expedition, the Amundsen travelled along the coasts of Labrador and Bathurst Island, through Lancaster Sound to Resolute Bay, then Kugluktuk. The vessel spent six weeks in the Beaufort Sea conducting operations with ArcticNet's industry partners and as part of research funded through the Beaufort Regional Environmental Assessment (BREA) initiative. In early October, the Amundsen began its final back cast, sampling stations in McCarroll Channel, Perry Channel and Bathurst Bay. The ship returned to Quebec City on 30 October 2011, after travelling more than 35,000 km throughout the coastal Canadian Arctic.

In 2012, the Amundsen underwent major repairs to her engines and service generators at the Seaway Marine and Industrial Inc. dry-dock in St. Catharines, Ontario. As the vessel was not available in 2012, the CCGS Pierre Pettigrew and CCGS Sir Wilfrid Laurier were used as the main platforms to conduct the core activities of ArcticNet's marine-based research program. In addition, ArcticNet provided shipborne funding for some ArcticNet Network Investigators to conduct their research on alternative vessels including the CCGS Henry Larsen, CCGS Louis S. St-Laurent, RV Frost, M/V Nuuksuk and M/V What's Happening.

23 | 88

## INUIT HEALTH, EDUCATION AND ADAPTATION

The central objective of ArcticNet is the formulation of adaptation strategies to help Inuit and other Northerners face the impacts and opportunities of climate change and modernization across the coastal Arctic. Over the last two years, ArcticNet teams conducted multidisciplinary research in each of the four Inuit regions of Canada: Inuvialut, Nunavut, Nunavik and Nunatsiut. Many of Canada's 53 Inuit communities were visited in 2011-2013 as part of ArcticNet's effort to address issues important to Northerners and to involve communities in the scientific process through exchange of knowledge, training and technology.

ArcticNet researchers collaborated with Inuit organizations, regional governments and community members to examine key themes ranging from human health to education and landscape stability. Community food samples were collected and analyzed to identify key protective nutrients for Inuit health. Recruitment of community members continued as part of an *H. pylori* bacteria testing initiative and an *H. pylori* treatment program was launched in Tuktoyaktuk. Other community research initiatives focused on improving access to education, evaluation of wild-traditional food security, improvement of community food programs, and documentation and transmission of traditional knowledge to younger generations.

With the goal of developing community sustainability plans adapted for climate change, monitoring and survey sites were established to measure environmental impacts to coastal communities caused by changing sea levels, storms, sea ice and wave conditions. Other community adaptation projects examined the integration of scientific and traditional knowledge of coastal systems and wildlife with information on community use of these ecosystem services.





## ArcticNet

ArcticNet is a [Network of Centres of Excellence of Canada](#) that brings together scientists and managers in the natural, human health and social sciences with their partners from Inuit organizations, northern communities, federal and provincial agencies and the private sector. The objective of ArcticNet is to study the impacts of climate change and modernization in the coastal Canadian Arctic. Over 145 ArcticNet researchers from 30 Canadian Universities, 8 federal and 11 provincial agencies and departments collaborate with research teams in Denmark, Finland, France, Greenland, Japan, Norway, Poland, Russia, Spain, Sweden, the United Kingdom and the USA.



## Highlights



## 2011-2013 Annual Report

ArcticNet's multidisciplinary research program is addressing the challenges and opportunities facing the Canadian Arctic.



### Arctic Inspiration Prize

The Prize recognizes teams who implement their Arctic knowledge into concrete actions to benefit the Canadian Arctic.



## IRIS Report

IRIS 4: From Science to Policy in Nunavik and Nunatsiavut was launched in Kuuujuaq on 29 November 2012.

## Quick Links

### Schools on Board

### Student Association

## Photo Gallery

## 2013 Photo Contest Winners

### Research Projects Phase 3

## Inuit Research Advisors

Polar Data Catalogue

## ArcticNet Meetings

Billboard

ArcticNet Renewal

## Arctic Change 2014

ArcticNet and its national and international partners will welcome the Arctic research community to Ottawa for the International [Arctic Change 2014](#) Conference from 8-12 December 2014.





# ARCTIC CHANGE 2014

8-12 DECEMBER - OTTAWA CONVENTION CENTRE - OTTAWA, CANADA



## An invitation to international Arctic researchers, stakeholders and decision-makers

8-12 December 2014, Ottawa, Canada

# Call for Sessions until 16 May

[www.arcticnet.ulaval.ca](http://www.arcticnet.ulaval.ca)



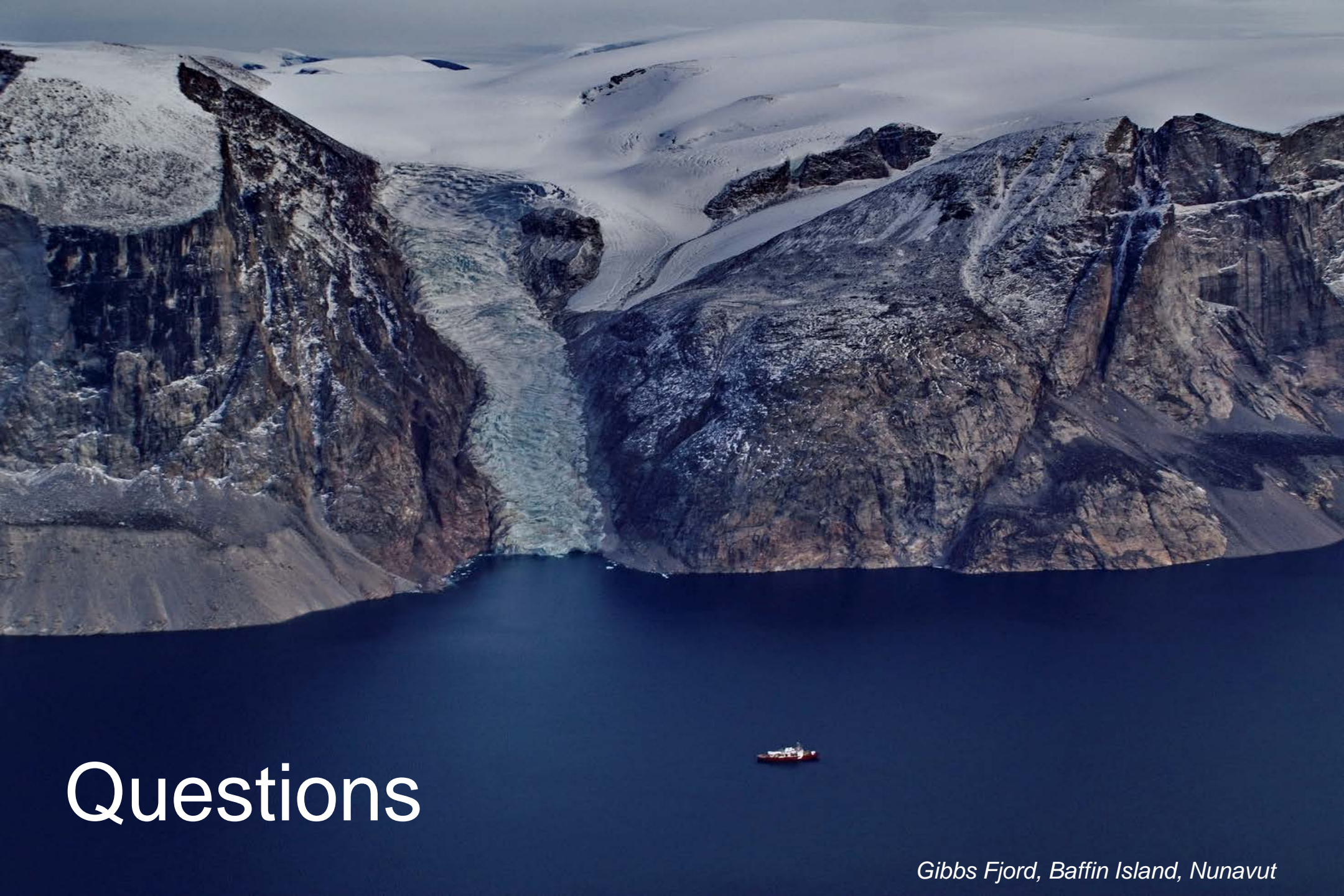
Aboriginal Affairs and  
Northern Development Canada

Affaires autochtones et  
Développement du Nord Canada

INTER = ACTION







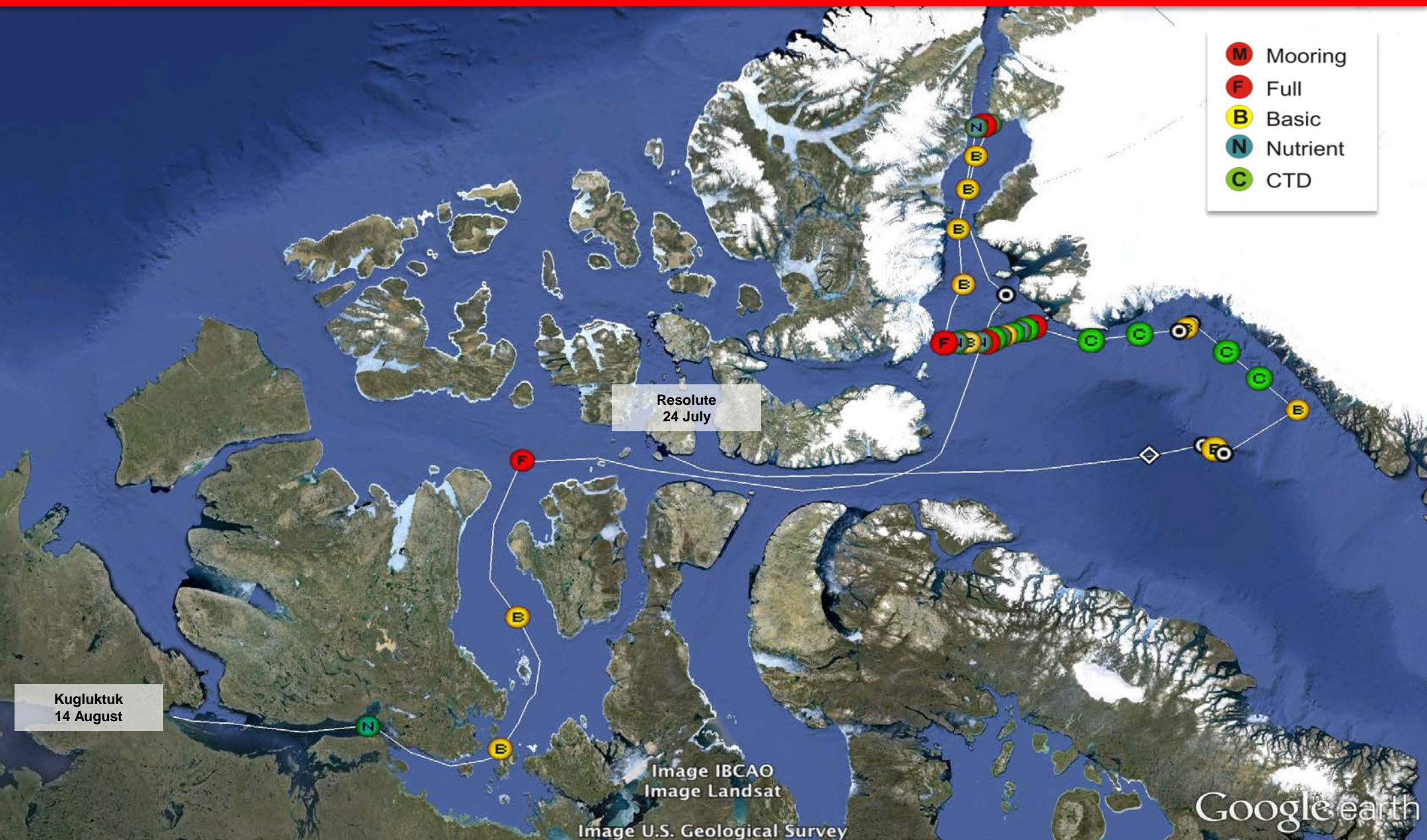
# Questions

*Gibbs Fjord, Baffin Island, Nunavut*



















## Canadian Research Icebreaker

# Leg 3 (17d)

