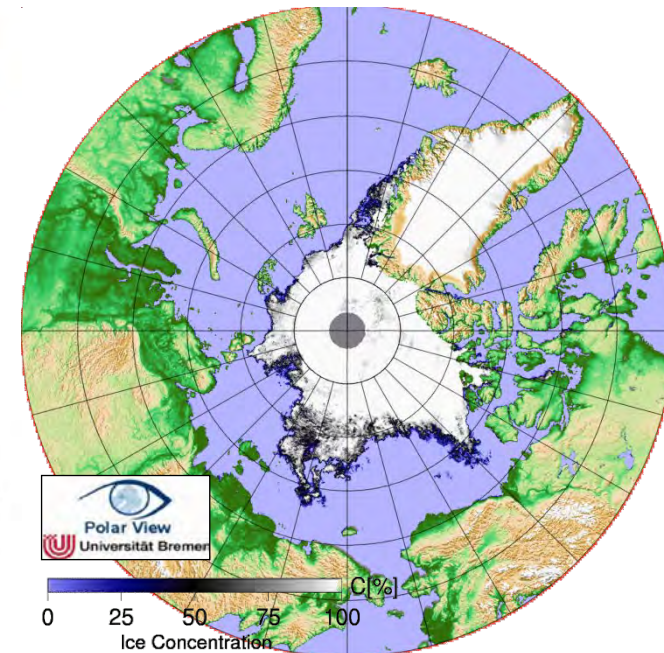
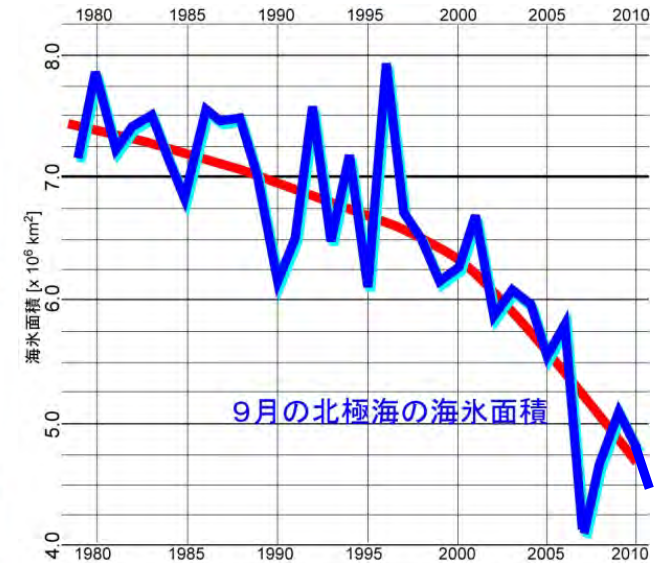
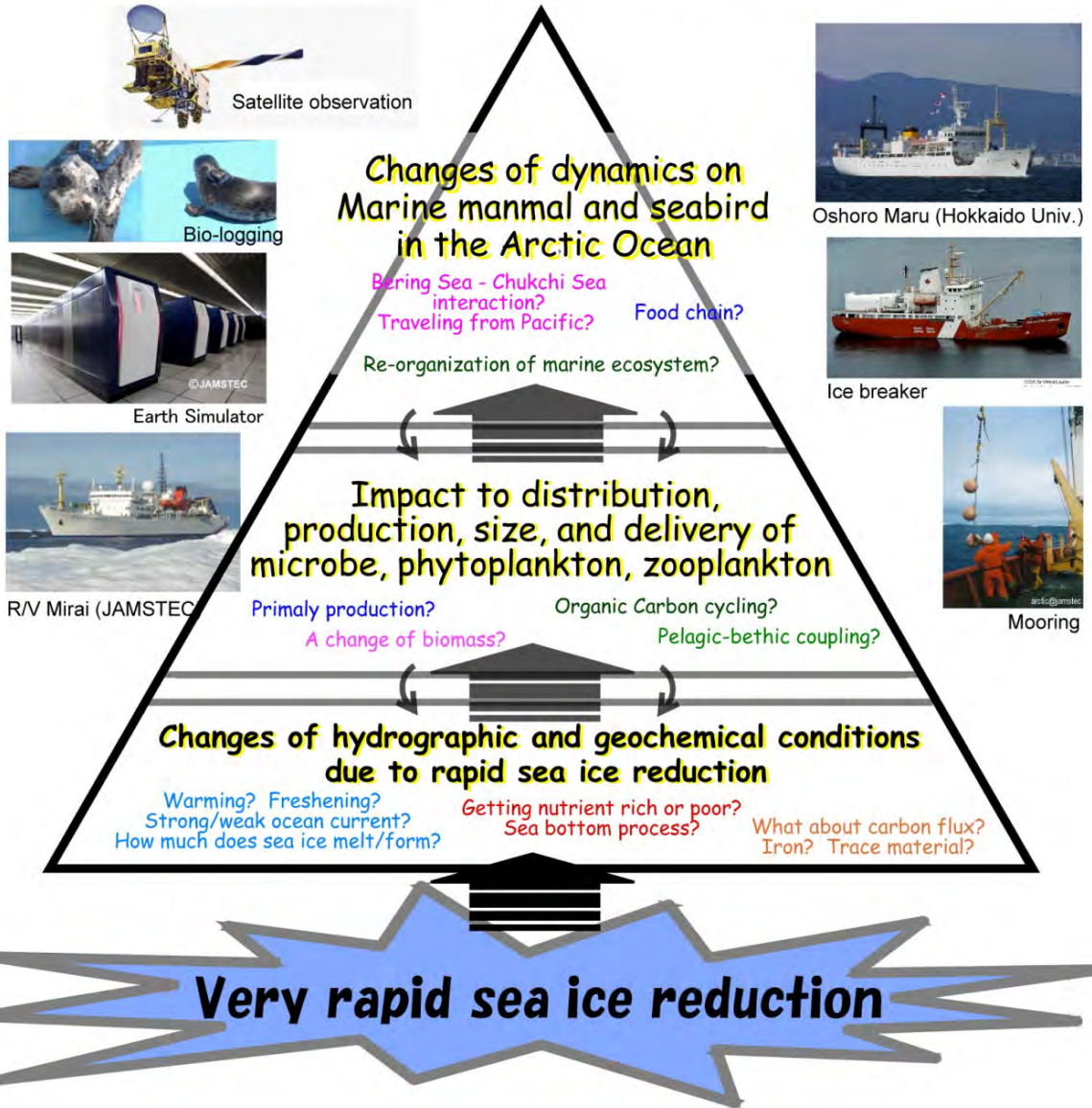


Ecosystem studies of the Arctic Ocean declining Sea ice (ECOARCS)



Ecosystem studies of the Arctic Ocean declining Sea ice (ECOARCS)

Question: **How does sea ice variability** (melting/formation, motion, seasonal cycle, recent inter-annually rapid decrease) **affect the Arctic Ocean environments** (physical, chemical, and biological)?

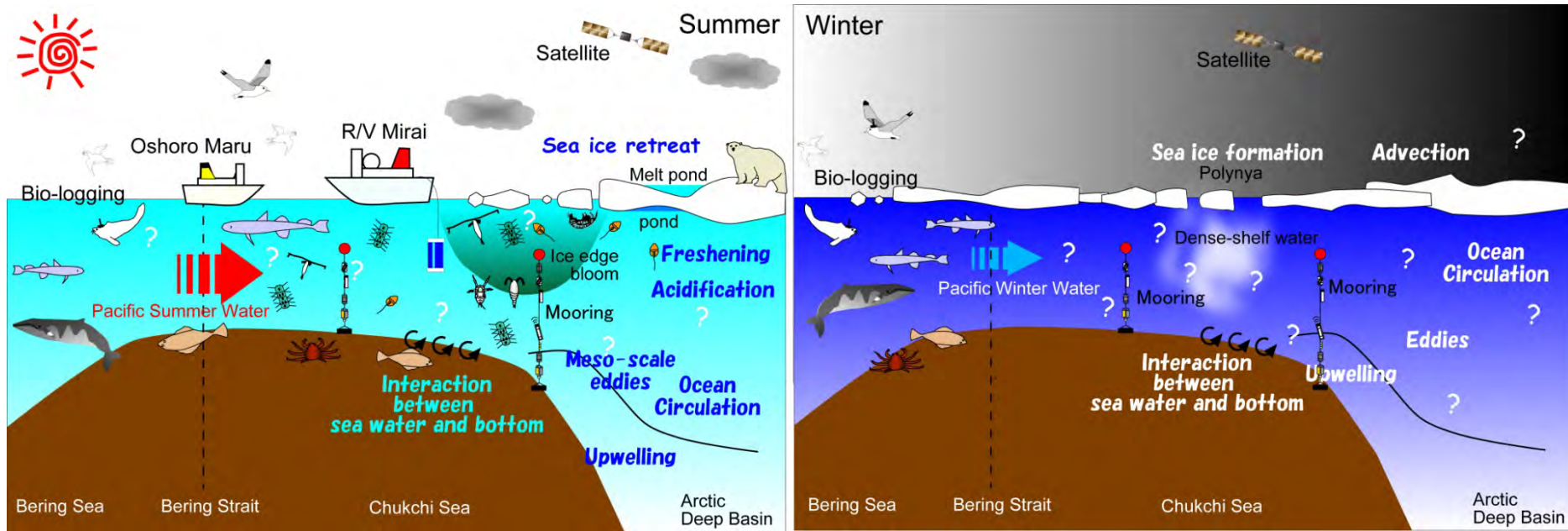
For example,

✓Improvement of the light environment due to the sea ice reduction may induce a favourable condition for the Arctic marine ecosystem, i.e., it may cause an increase in phytoplankton in the ice-free area. However, there is observational evidence which indicates that the increase in sea ice melt-water could inhibit the phytoplankton growth, because the nutrient supply from lower layer is suppressed by enhanced stratification due to the melt-water.

✓The benthic organisms of the Arctic Ocean are also threatened by changes in marine environments. Currently, they feed on the ice-edge bloom of phytoplankton that sinks to the seafloor (Pelagic-Benthic type). However, warming of the Arctic Ocean may increase the population of zooplanktons and fishes, which will feed on phytoplankton at the ice-edge (Pelagic-Pelagic type). What type of marine ecosystem will the sea ice reduction bring about?

✓The reduction of sea ice influences not only species that are inherent to the Arctic but also those from the Pacific Ocean. These changes further influence the lives of marine mammals and polar bears.

Ecosystem studies of the Arctic Ocean declining Sea ice (ECOARCS)

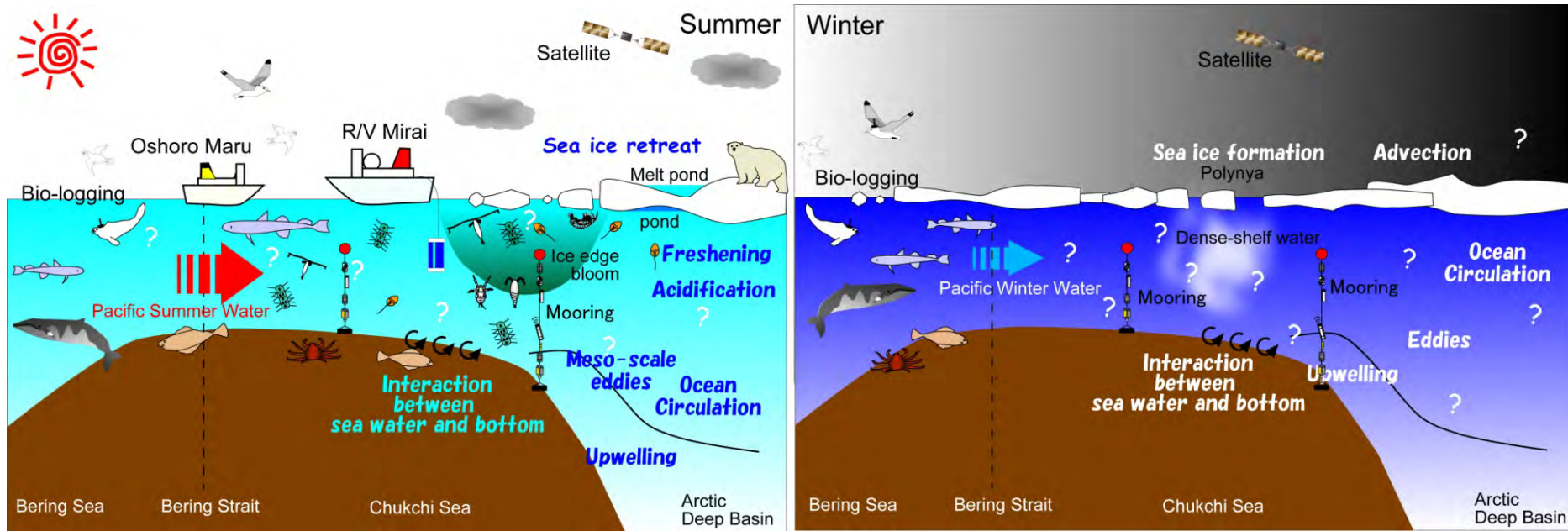


For better understanding of these changes in Arctic climate and ecosystems, we will conduct multi-disciplinary studies examining not only biological but also physical and chemical aspects of the drastically changing Arctic environments.

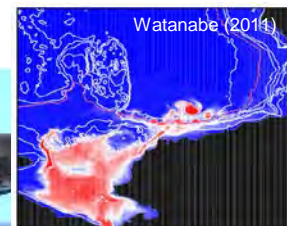
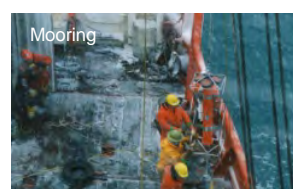
Keywords Ocean circulation, Water mass distribution/modification, Bottom processes (Nutrients, Fe, organic materials), Acidification, Organic carbon cycling, DOMs and microbial loop, Annual changes of biomass/distribution of phyto- and zoo- plankton, Primary production, Pelagic-Benthic coupling, Food chain,

→ Re-organization of the Arctic marine ecosystem

Ecosystem studies of the Arctic Ocean declining Sea ice (ECOARCS)



- Action
- 1) Ship-based observation by R/V Mirai and Oshoro-Marui
 - 2) Mooring observation to find seasonal changes of ecosystem
 - 3) Bio-Logging
 - 4) Satellite monitoring
 - 5) Numerical simulation



Ecosystem studies of the Arctic Ocean declining Sea ice (ECOARCS)

2012

CCGS Laurier cruise in July (mooring deployments)

CCGS L.S.S.Laurant cruise in August (XCTD & mooring recoveries)

R/V Mirai Arctic cruise in September-October

2013

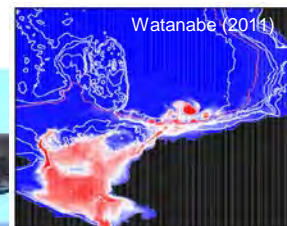
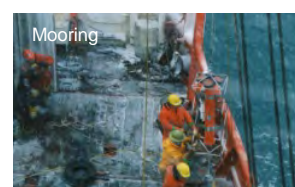
T/S Oshoro-maru cruise in July-August

R/V Mirai Arctic cruise in August-October

2014 (under discussion)

R/V Mirai Arctic cruise in August-September (meteorology)

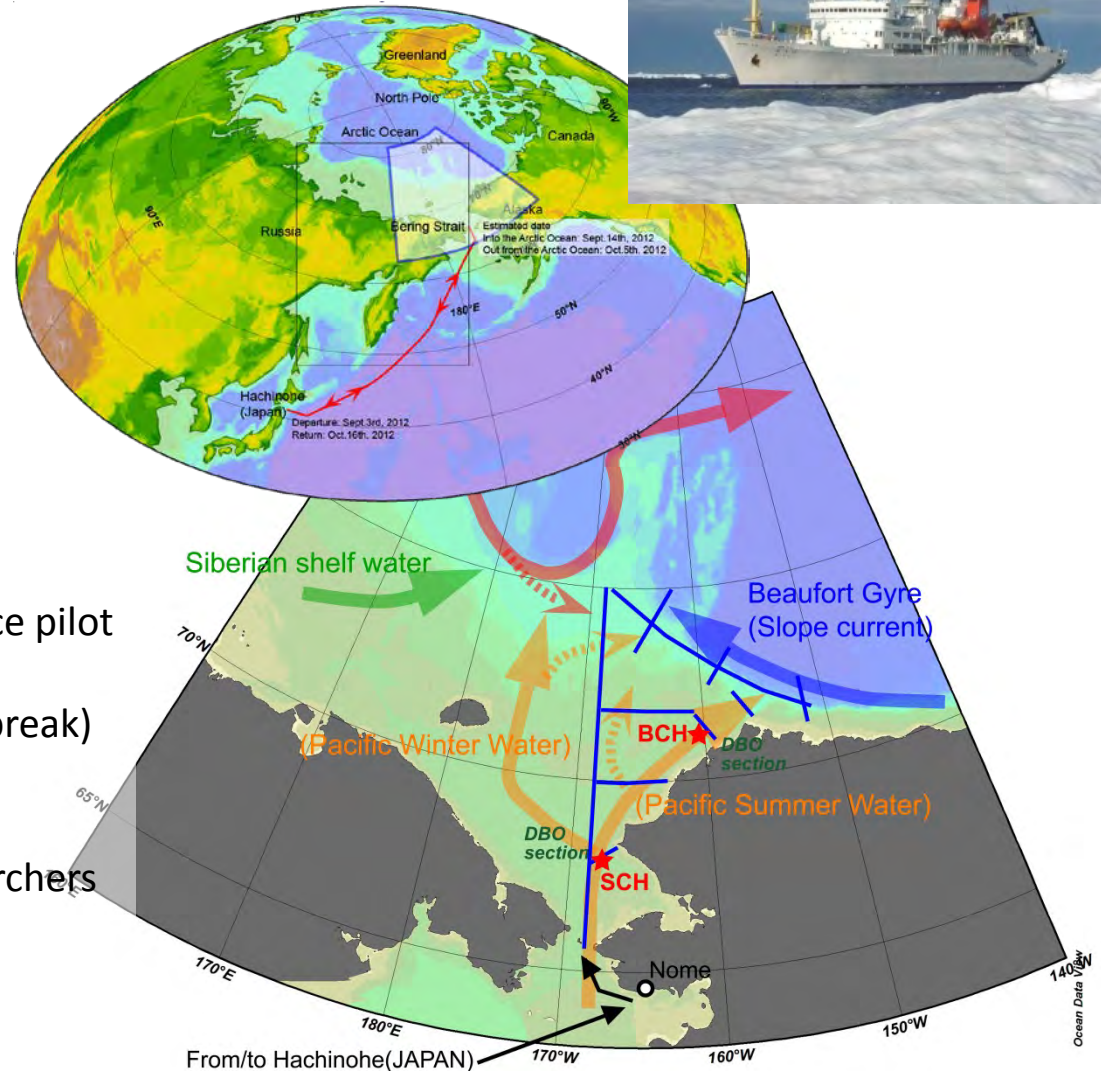
CCGS Laurier cruise for mooring recoveries/deployments ???



R/V Mirai Arctic cruise in Sept.-Oct. 2012

In 2012 there is a tentative R/V Mirai Arctic Ocean cruise plan scheduled for early September to late October. The main target will be the Chukchi shelf and shelf slope areas. Tentative activities will include:

- CTD/LADCP/water sampling & XCTD
- Mooring recovery/deployment
- Plankton net sampling
- Bio-geochemical measurements
- Multiple corer sampling
- General meteorological monitoring
- Surface water sampling/monitoring
- Shipboard ADCP monitoring
- Sea bird and marine mammal survey



Cruise Plan:

Sept. 4th, Hachinohe (JAPAN)

Sept. 14th?, Nome for embarkation of ice pilot

Sept. 14th, Bering Strait

(Chukchi continental shelf and shelf break)

Oct. 5th?, Bering Strait

Oct. 5th?, Nome for disembarkation of
ice pilot and some researchers

Oct. 16th, Hachinohe (JAPAN)

Contact:

Dr. Takashi Kikuchi, takashik@jamstec.go.jp

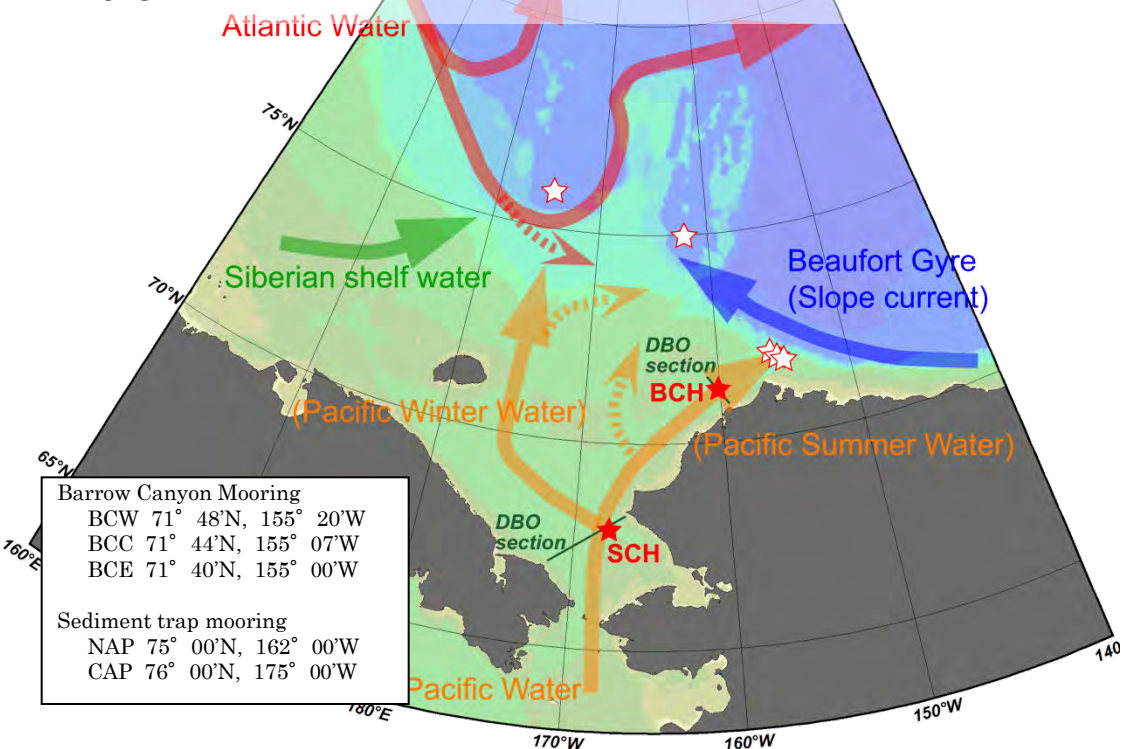
ECOARCS Mooring observation plan during 2012-2015

Two moorings (BCH & SCH) will be deployed close to the DBO repeat observation lines in the Barrow canyon and the southern Chukchi Sea, respectively.

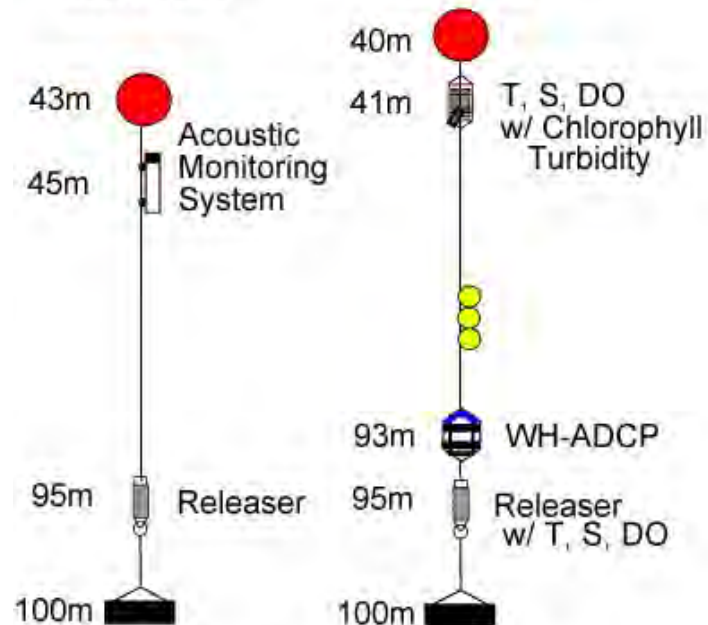
BCH : 71.45N, 157.58W, ~100m depth

SCH : 68.00N, 168.00W, ~50m depth

First (short-term) mooring will be deployed by CCGS Laurier cruise in July 2012. After the recoveries, year-round mooring observation will start from September 2012 (R/V Mirai cruise). Mooring observation under ECOARCS project will continue until 2015.



BCH; Barrow Canyon Hotspot

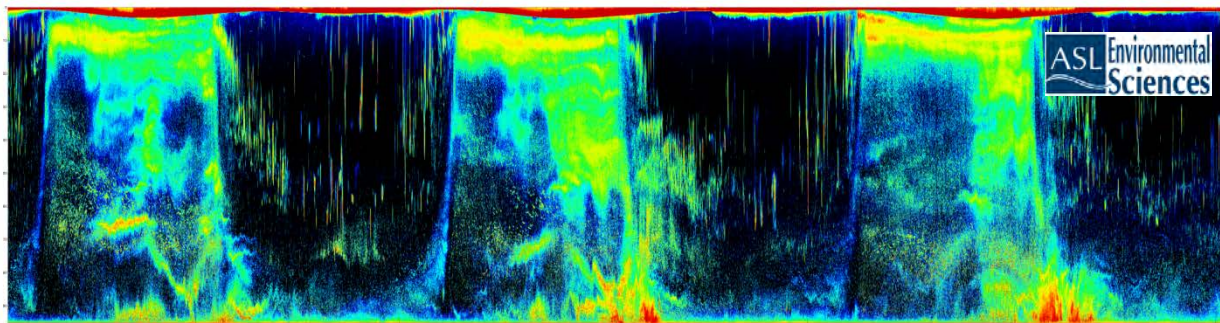


SCH ; Southern Chukchi Hotspot









ECOARCS Mooring observation plan during 2012-2015

Multi-frequency Acoustic Water Column Profiler (ASL Env. Sci.) will be used for detecting dynamics of marine zooplankton.

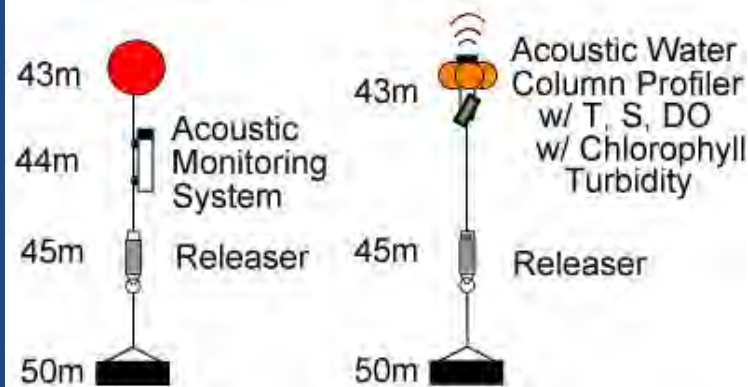


Example 200k Hz echo sounder data from the VENUS Observatory in Saanich Inlet (260,000 pings)
<http://venus.uvic.ca/data/data-plots/> Three-day Echogram, September 12 – 14, 2006






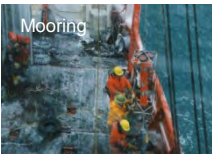

| Instrument Frequency (kHz) | Approximate Minimum Particle Size Detected (mm) | | Representative Organisms | Estimated effective Range (m) |
|----------------------------|---|---|--------------------------------------|-------------------------------|
| 775 | 2 |  | small copepods, nauplii | 50 |
| 460 | 6 |  | mysids, larval euphausiids | 100 |
| 200 | 16 |  | larval fish, euphausiids | 200 |
| 125 | 20 |  | adult euphausiids, mysids, amphipods | 250 |
| 70 | 30 |  | small fish | Est 275 |
| 38 | 75 |  | larger fish | Est 325 |

SCH ; Southern Chukchi Hotspot



Ecosystem studies of the Arctic Ocean declining Sea ice (ECOARCS)

Table 1 Yearly Plan of the project

| | 2011 | 2012 | 2013 | 2014 | 2015 |
|---------------------------|---|--|--|---|--------------------------------|
| 1) Ship-based Observation | Preparation | Sept.-Oct. R/V Mirai Arctic Ocean cruise | July Oshoro-Maru Cruise Aug.-Oct. R/V Mirai Arctic Ocean Cruise | | |
| |  |  | |  | |
| 2) Mooring | Preparation | Jul. Deployment by SWL | Sept. Recoveries & Deployments by Mirai | Sept.-Oct. Recoveries & Deployments by SWL(?) | Sept.-Oct. Recoveries by Mirai |
| |  | | | | |
| 3) Bio-Logging | Preparation | Bio-Logging | Oshoro-Maru Cruise | Oshoro-Maru Cruise | |
| | |  | | | |
| 4) Satellite | (GCOM-W) | Collaboration with ship-based observations | Satellite monitoring Collaboration with ship-based observations | Collaboration with ship-based observations | |
| 5) Numerical simulation | | | Model development & simulation | | |

