

## Cruise Summary

### 1. Cruise Information

- Cruise ID: MR16-06
  - Name of vessel: R/V Mirai
  - Title of the cruise: Arctic Challenge for Sustainability (ArCS) Project
  - Chief scientist [Affiliation]: Shigeto Nishino [JAMSTEC]
- Studies on board
- Representative of the Science Party [Affiliation]: Jun Inoue [NIPR]
    - Title of proposal: Predictability study on weather and sea-ice forecasts linked with user engagement
  - Representative of the Science Party [Affiliation]: Fumikazu Taketani [JAMSTEC]
    - Title of proposal: Ship-borne observations of trace gases/aerosols in the marine atmosphere
  - Representative of the Science Party [Affiliation]: Naomi Harada [JAMSTEC]
    - Title of proposal: How plankton responses to multi stressors such as ocean warming and acidification?
  - Representative of the Science Party [Affiliation]: Toru Hirawake [Hokkaido University]
    - Title of proposal: Primary production and transportation of organic materials in the northern Bering and the southern Chukchi Seas
  - Representative of the Science Party [Affiliation]: Atsushi Yamaguchi [Hokkaido University]
    - Title of proposal: Comparison of zooplankton with differences in net mesh-size, and standing stock and material flux role of Appendicularia
  - Representative of the Science Party [Affiliation]: Bungo Nishizawa [Hokkaido University]
    - Title of proposal: Seasonal distribution of short-tailed shearwaters and their prey in the Bering and Chukchi Seas
  - Representative of the Science Party [Affiliation]: Yasuhisa Ishihara [JAMSTEC]
    - Title of proposal: Smart float observation in the marginal ice zone
  - Representative of the Science Party [Affiliation]: Kohei Mizobata [Tokyo University of marine science and technology]
    - Title of proposal: Elucidation of the variability of freshwater in the Arctic Ocean
  - Representative of the Science Party [Affiliation]: Motoyo Itoh [JAMSTEC]
    - Title of proposal: Mooring observations in the Barrow Canyon and southern Chukchi Sea
  - Representative of the Science Party [Affiliation]: Shigeto Nishino [JAMSTEC]
    - Title of proposal: Observational study on the variability of physical and chemical environments in the

Pacific Arctic Ocean

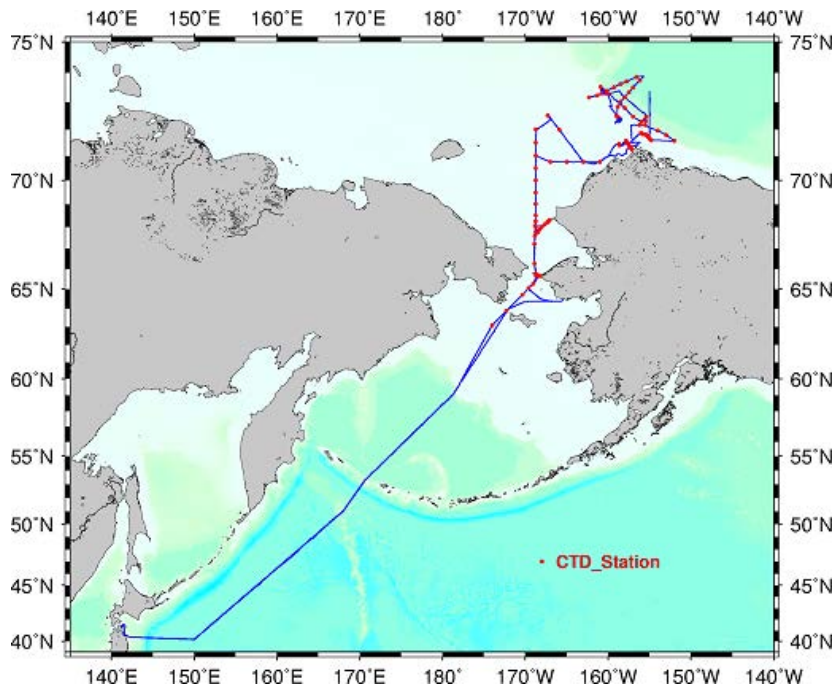
- Studies not on board

- Representative of the Science Party [Affiliation]: Yasunori Tohjima [NIES]
- Title of proposal: Ship-board observations of atmospheric greenhouse gases and related species in the Arctic Ocean and the western North Pacific
  
- Cruise period:
  - 22 August 2016 – 5 October 2016
  
- Ports of departure / call / arrival:
  - 22 August 2016, Hachinohe (leave port)
  - 23 September 2016, Off Nome (arrival and leave after an ice pilot disembarkation)
  - 4 October 2016, Hachinohe (arrival in and leave port)
  - 5 October 2016, Sekinehama (arrival in port)

- Research area:

The North Pacific Ocean, the Bering Sea, and the Arctic Ocean

- Research map



**Figure 1.** Research area and cruise track of MR16-06.

## **2. Overview of the Observation**

We conducted meteorological and hydrographic surveys including marine biogeochemical samplings in the northern Bering Sea and the Arctic Ocean on board the R/V Mirai from 22 August to 5 October 2016 under the Arctic Challenge for Sustainability (ArCS) Project. During the cruise, the above-mentioned 11 studies were carried out.

The planned activities in the northern Bering Sea and the Arctic Ocean were changed or canceled due to sea ice, weather and other conditions. However, we tried to complete the observations in some focused areas where physical, chemical, and biological processes are sustaining unique marine environment and ecosystem that might be influenced by the recent Arctic warming and sea ice reduction.

For example, a biological hotspot off Pt. Hope is maintained by nutrient supplies from the Bering Sea in spring blooms and by nutrient regeneration at the bottom in fall blooms. A new instrument deployed during Green Network of Excellence (GRENE) project off Pt. Hope indicated seasonal changes in zooplankton, and the changes might be associated with migration of sea birds. We have also reported aragonite undersaturation in the bottom water off Pt. Hope and anthropogenic CO<sub>2</sub> has significant impact on the duration of undersaturation in the bottom water. For further studies, we carried out detailed hydrographic surveys and a mooring deployment off Pt. Hope in this year.

Another focused area is the Barrow Canyon, where we have deployed moorings to monitor the flux of warm water from the Pacific Ocean that may impact on the sea ice distribution in the Canada Basin. The water also plays an important role in the biogeochemical cycles, and therefore, we attached chemical and biological sensors to the mooring in this year.

Shelf slopes are important to understand the shelf-basin interaction and its impact on ecosystem in response to meteorological conditions. Thus, some hydrographic sections were provided in the slope area.

In the basin area, the sea ice has been decreasing drastically. We found that oceanographic and biological responses to the sea ice loss are quite different between the Alaskan and Siberian sides of the region. However, on the Siberian side, data are still lacking and many biogeochemical processes may remain unknown. Unfortunately, the planned experiments in the Siberia side were canceled due to a heavy sea ice condition.