International Workshop on Arctic Ocean Observation Future Collaboration by Research Vessels and Icebreakers

Name of session:
Aspirations for Arctic Ocean Observation from Early Career Scientists
Co-chairs: Kazutoshi Sato (National Institute of Polar Research, NIPR) and Lisa Winberg von Friesen (University of Copenhagen)

The workshop organizers invited six early career scientists who participated in the R/V Mirai Arctic cruise in 2023 and requested oral presentations covering 1) their research interests (e.g., themes of post-doctoral and PhD activities), 2) insights into the Arctic Ocean observation based on the previous field experiences (including the 2023 Mirai cruise), and 3) thoughts and aspirations regarding new research icebreakers (not only the Japanese new icebreaker and other similar vessels).

In the break-up session on Day 1, Dr. Kazutoshi Sato (National Institute of Polar Institute, Japan) and Dr. Lisa Winberg von Friesen (University of Copenhagen, Denmark) chaired the six presentations and consequent discussions. The brief summary of each presentation is described below.

Dr. Kazutoshi Sato is measuring cloud characteristics over ice-free area in the Chukchi and Beaufort seas using various kinds of meteorological instruments. He detected recent changes in major cloud types from traditional low-level stratus cloud to convective one generating relatively heavy snowfall around marginal ice zones. The subsequent increase in snow depth on sea ice is considered to prevent sea ice growth during winter and spring. He expects the new icebreakers to investigate air–sea interaction over the Arctic Ocean during all seasons, contributing to reduce error and uncertainty of weather forecasts.

Ms. Alix Rommel (University of St. Andrews, United Kingdom) is focusing on colonial gelatinous zooplankton in the mesopelagic layer (200–1,000m depth) using acoustic sound-scattering methods. She utilizes multi-frequency echo-sounder, which is a cost-effective and non-invasive instrument capturing biomasses of fish and plankton communities. Collaboration with eDNA analysis and zooplankton net sampling operated by other cruise participants will hopefully strengthen her PhD thesis. She proposed the installation of scientific echo-sounders on the new icebreakers to advance marine ecosystem researches.

Ms. Eva Lopes (University of Porto, Portugal) is trying to reveal roles of microbial communities from an integrated view of all micro-plankton components. During the Mirai cruise, rRNA gene sequencing and micro-cosmos experiment were conducted to address

impact of “Pacification” on micro-biome diversity and function. She expects the new icebreakers to serve safe and longer seawater sampling in sea ice area and greater chances to have more international collaboration to expand research target of each participant.

Dr. Yuri Fukai (JAMSTEC, Japan) operated on-deck incubation experiments using in situ seawater and sediment samples during the Mirai cruise to clarify the detailed mechanics of viable diatom cells. In this session, she listed advantage and disadvantage of the Mirai cruise and the landfast ice observation at Point Barrow, respectively, based on her experiences. The new icebreakers are expected to enable sampling in sea ice area with well-equipped laboratory and massive instruments for understanding of microalgae response to environmental changes during early spring (i.e., polar morning).

Dr. Zhangxian Ouyang (University of Delaware, U.S.A.) is an expert of the Arctic marine carbonate chemistry and has detected the remarkable increase in partial pressure of carbon dioxide (pCO_2) in the Canada Basin and its smaller change due to biological CO_2 removal in the Chukchi shelf. For the new icebreakers, he requests equipment of state-of-the-art scientific instruments, incubator for innovation, and open platforms supporting broad collaborations.

Dr. Lisa Winberg von Friesen is studying microbial-mediated biogeochemical cycles of nitrogen, especially nitrogen fixation in the Arctic Ocean. She appeals interdisciplinary and collaborative researches to more accurately predict the future Arctic marine ecosystem under global change. Besides, she introduced previous and ongoing shifts in her responsibility along the career stage from a student to a coordinator.

In the wrap-up session on Day 2, Dr. von Friesen integrated thoughts and aspirations regarding the new icebreakers from all presenters on Day 1. Education of next generation of scientists requires specific training program composed of planning, practical sampling, data handling and reporting. Well-being and confidence of early-career participants should also be ensured, because the cruise life is influenced by heavy pressure from their supervisors at home, unfamiliar equipment, language barriers, and unspoken rules. Pre-cruise manual document describing necessary goods, unique culture, and key vocabulary is highly beneficial. During the cruises, initial and frequent meetings should create a casual space to ask questions for various scientists and crews each other. Facilitating communicative environment onboard (including outside benches) produces additional perspectives and interaction. The post-cruise workshops would accelerate newly born collaborative works. It was also remarked that construction of the new icebreakers provides great motivation and opportunity to become the Arctic researchers for undergraduate and graduate students.