## Abstract

## [Research Title]

# Prediction of Sea Ice and Ocean Variations and Climate Change Risk Assessment on Marine Ecosystems in the Southern Sea of Okhotsk Including Shiretoko, a World Natural Heritage

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Principal Investigator :	Humio Mitsudera
(PI ORCID) :	
Principal Institution :	Institute of Low Temperature Science, Hokkaido University Kita-19, Nishi-8, Kita-ku, Sapporo 060-0819, JAPAN Tel: +81117065465 Fax: +81117067142 E-mail: kyodo@lowtem.hokudai.ac.p
Cooperated by :	Japan Fisheries Research and Educational Institute, Tsukuba University, Hokkaido Research Organization, Shiretoko Nature Foundation, Kyoto University
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# [Abstract]

Shiretoko was listed as a World Natural Heritage because of its outstanding universal value (OUV) that is productive interaction of marine and terrestrial ecosystems, influenced by the formation of seasonal sea ice. It is concerned, however, that the sea ice in the Sea of Okhotsk is decreasing because of the climate change. In this project, we conducted predictive evaluation of sea ice variations in the middle and the end of the 21<sup>st</sup> century focusing on the Shiretoko area, as well as impact assessments of the marine ecosystems in case of disappearance of the sea ice. It is predicted that the sea ice will reduce to 1/3 in the future even with the low CO<sub>2</sub> emission scenario, but nevertheless, the seasonal sea ice will reach the Shiretoko in most of the years with this scenario. In contrast, without restriction in  $CO_2$  emissions, sea ice will disappear from the Shiretoko area in the end of the 21<sup>st</sup> century. Impacts of disappearance of sea ice on marine ecosystems are significant. Sea ice carries iron, which is one of essential micronutrients for phytoplankton to grow. We have found that iron concentration in the sea surface layer, where phytoplankton bloom occurs in spring, increases as much as ~55% when iron is released from sea ice as it melts. Seeding effects by ice algae on the spring phytoplankton bloom were also uncovered scientifically for the first time (Yan et al., 2022). These biogeochemical effects will be risked when sea ice disappears. There are also likely to be significant impacts on fish community due to sea ice variations. It was found that the abundance of demersal fish community is correlated significantly with the sea ice coverage over the continental shelf in the Sea of Okhotsk off the coast of Hokkaido. The salmon catch is correlated positively with the sea ice cover with a lag of three years. Further, a long-term monitoring of marine mammals by passive acoustic measurements were conducted in the Sea of Okhotsk where the marine mammals' distribution is not yet well known. Acoustic data of iceloving seals were collected during winter adjacent to sea ice; the seals' population is predicted to decrease in the future. It is therefore important to realize a low carbon society from a point of view of preserving the OUV of the Shiretoko World Natural Heritage.

#### [References]

Yan, D. et al. (2022) 'Winter microalgal communities of the southern Sea of Okhotsk: A comparison of sea ice, coastal, and basinal seawater', Progress in Oceanography, 204, 102806, <u>https://doi.org/10.1016/j.pocean.2022.102806</u>

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