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DBO results from JAPAN: The latest topics for the lower trophic levels and upcoming topics of Japan

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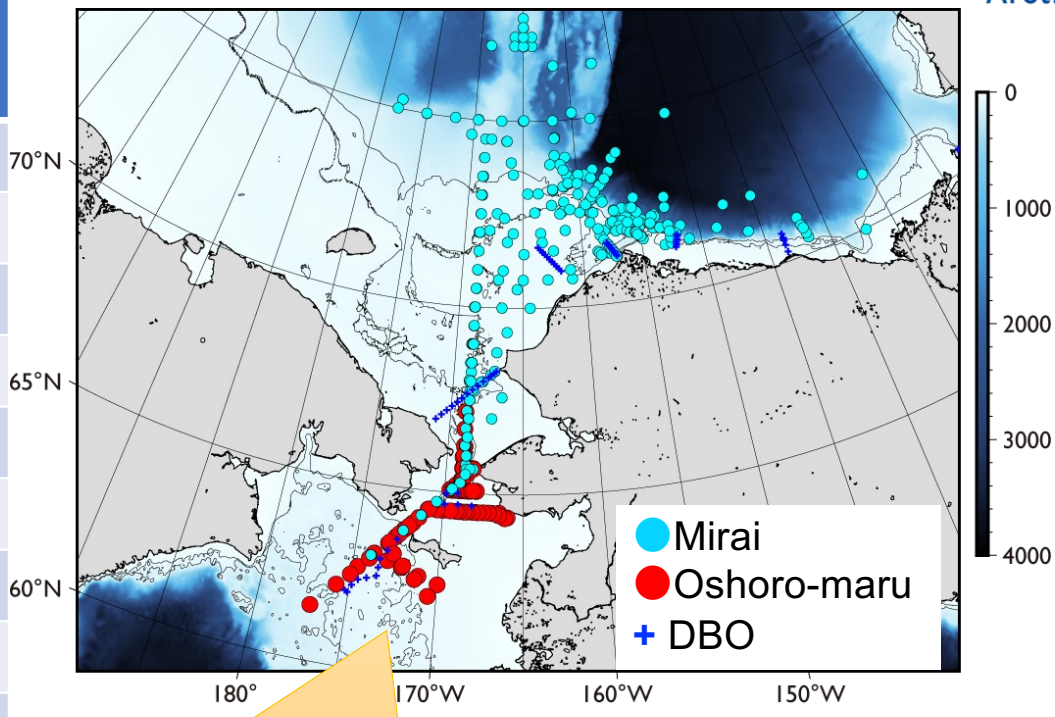
JAMSTEC HOKKAIDO UNIVERSITY NiPR ArCS ArCS II

Recent Japanese Artic research cruises

	R/V Mirai	T/S Oshoro-maru
2015	x	
2016	x	
2017	x	x
2018	-	x
2019	x	
2020	x	
2021	x	
2022	x	
2023	x	x
2024	x	



More than 600 CTD casts
Include the sections of DBO1–6

Arctic Challenge for Sustainability II

R/V Mirai

T/S Oshoro-maru

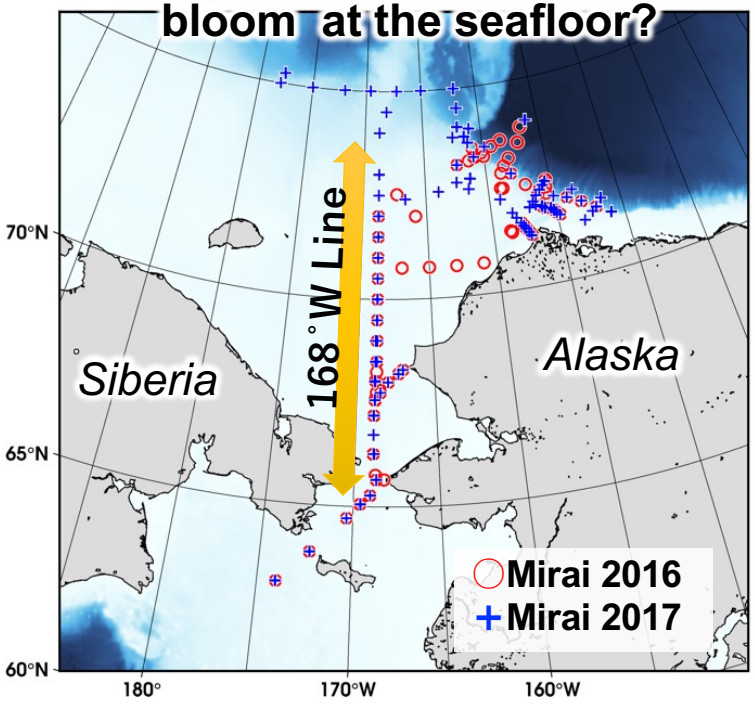
Topic 1a: Discovery of near-bottom phytoplankton production

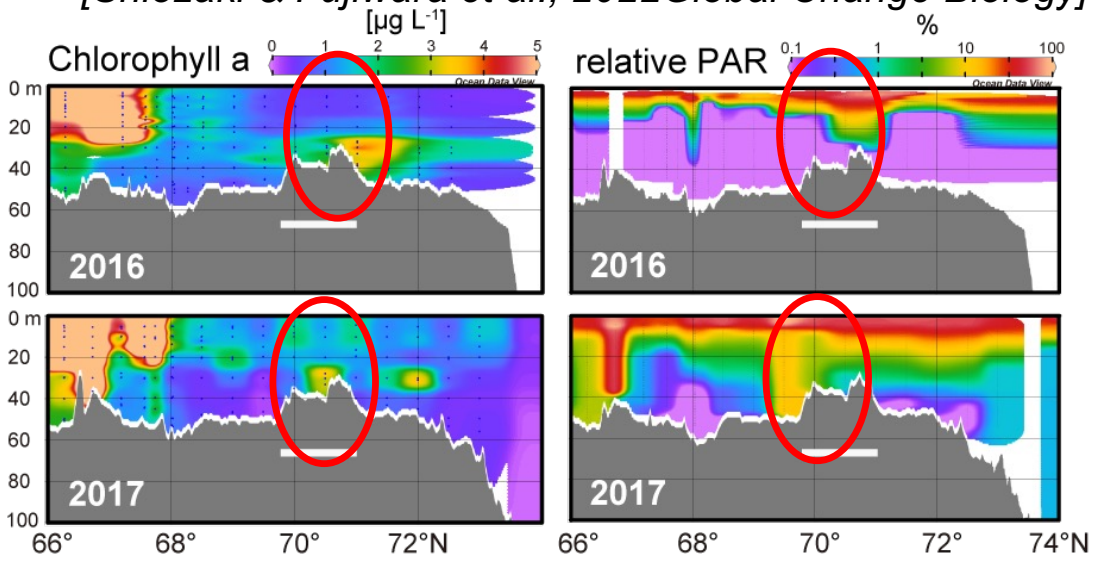
[Shiozaki & Fujiwara et al., 2022Global Change Biology]

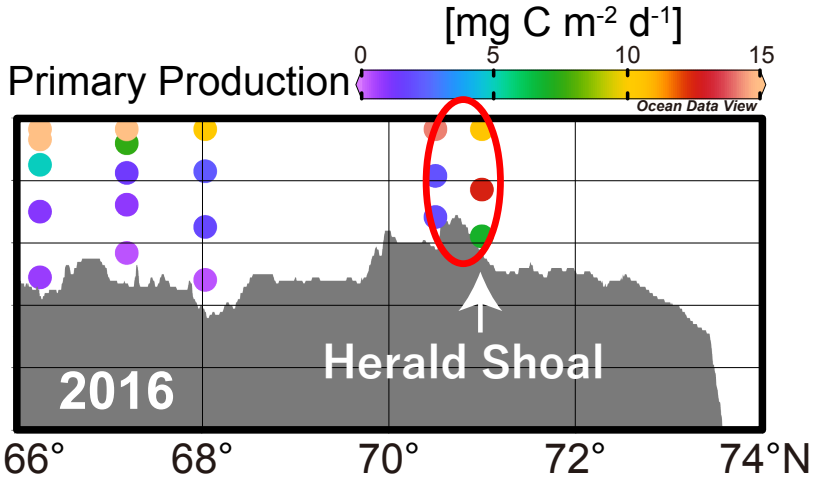
Key findings during the cruises in 2016/17

- Chla maximum in the near bottom layer around DBO4
- Sufficient light reaches the seafloor

Can phytoplankton cells form bloom at the seafloor?



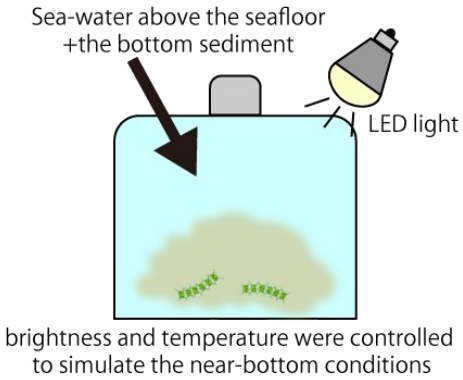


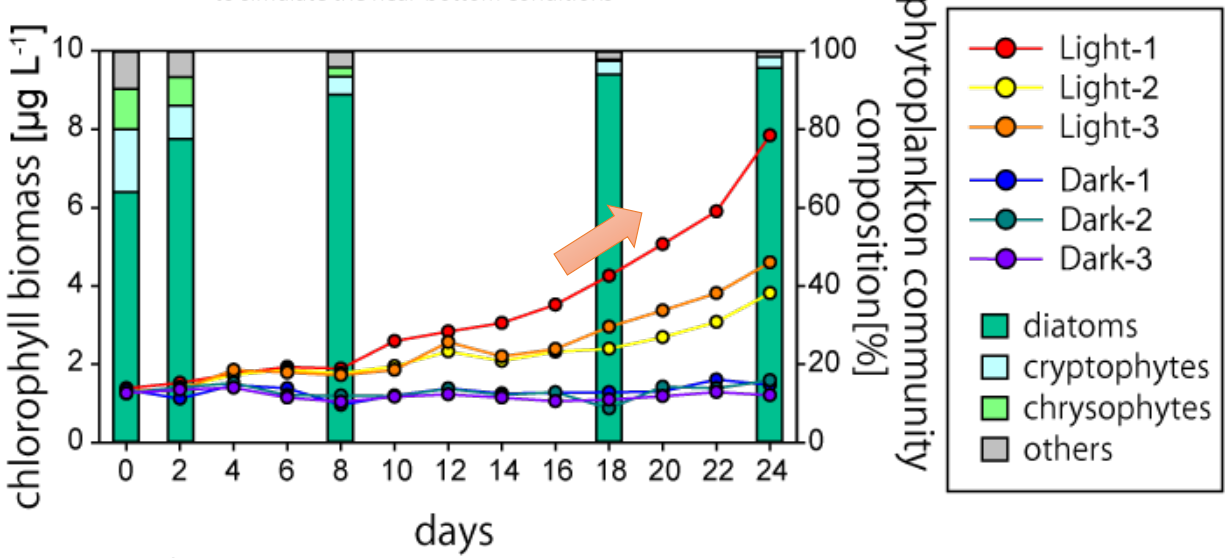


Topic 1a: Discovery of near-bottom phytoplankton production

[Shiozaki & Fujiwara et al., 2022Global Change Biology]

Incubation experiment to simulate the development of bottom-associate bloom during fall



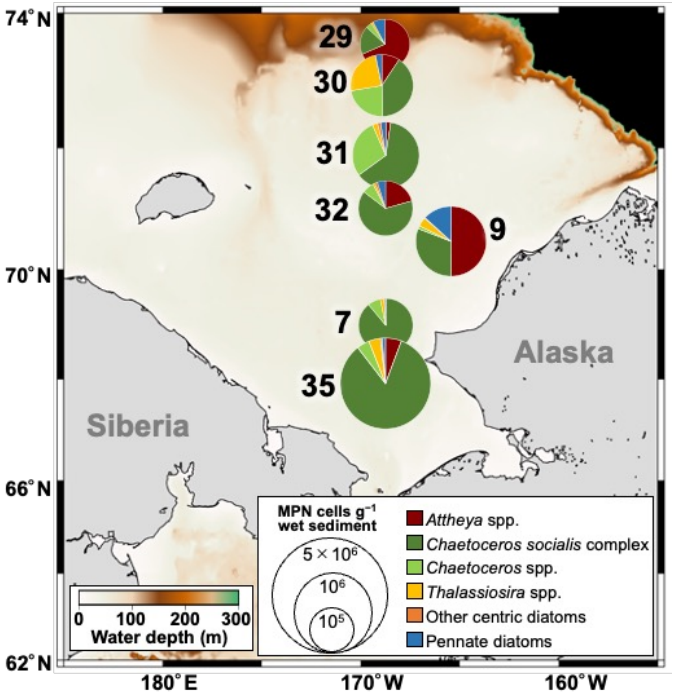


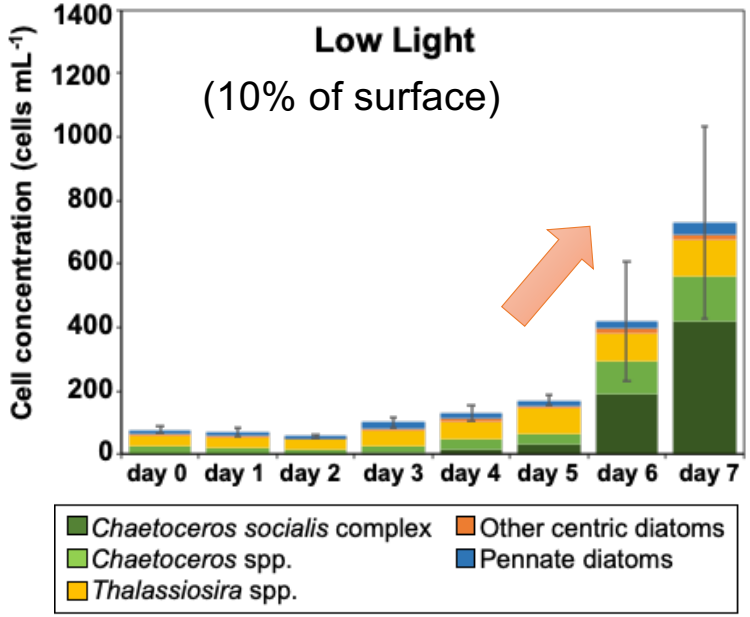
Bottom-bloom was successfully reproduced

Time series of phytoplankton biomass and composition during the experiment

Topic 1b: Seeding potential of sediment diatom cells

[Fukai et al., 2022 Frontiers in Marine Science]

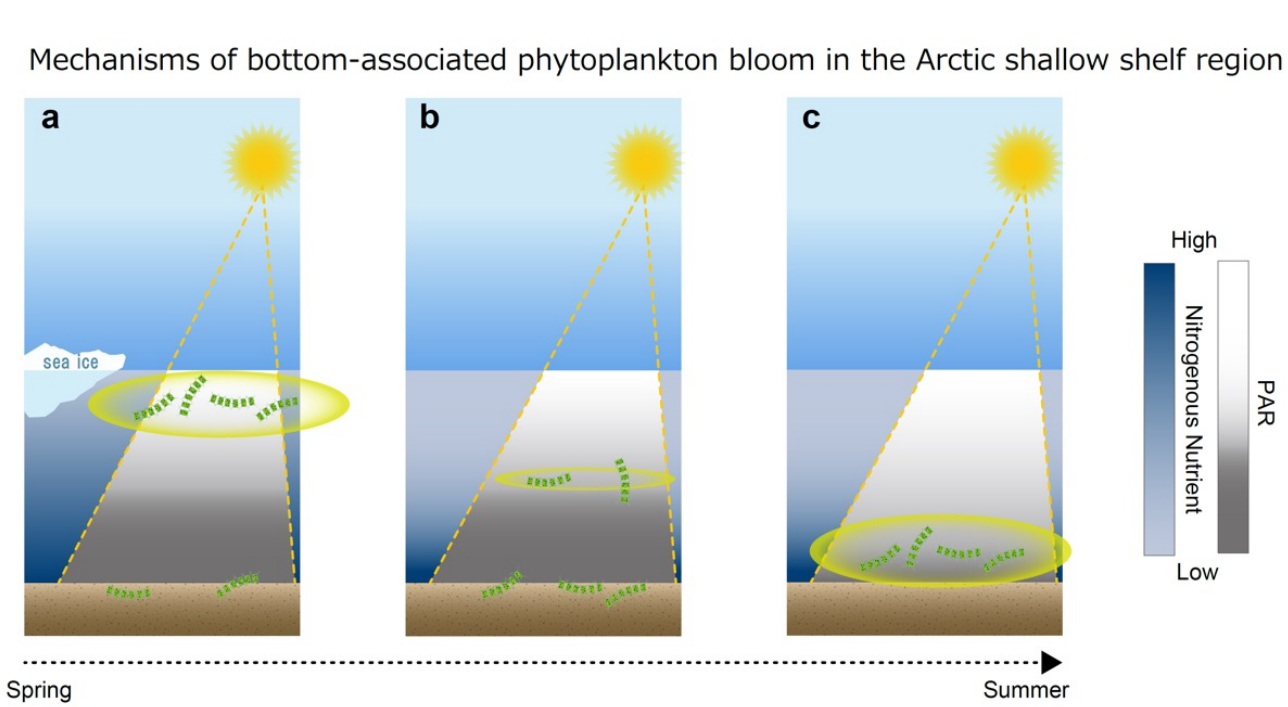


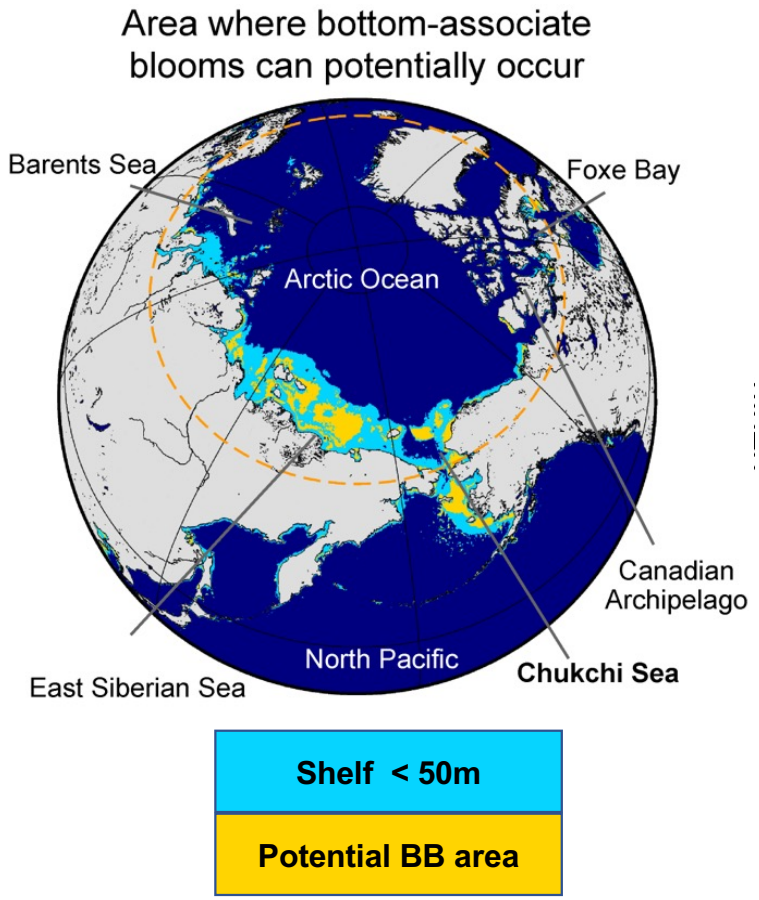


Time series of diatom cells conc and composition

A large number of diatom resting stages on the seafloor
→ recovered and restarted to grow in the fall light&nutrient condition
→ **Diatom cells on the sea floor are capable of being the "seed" for the fall bloom & bottom associate bloom**

Summary of Topic 1

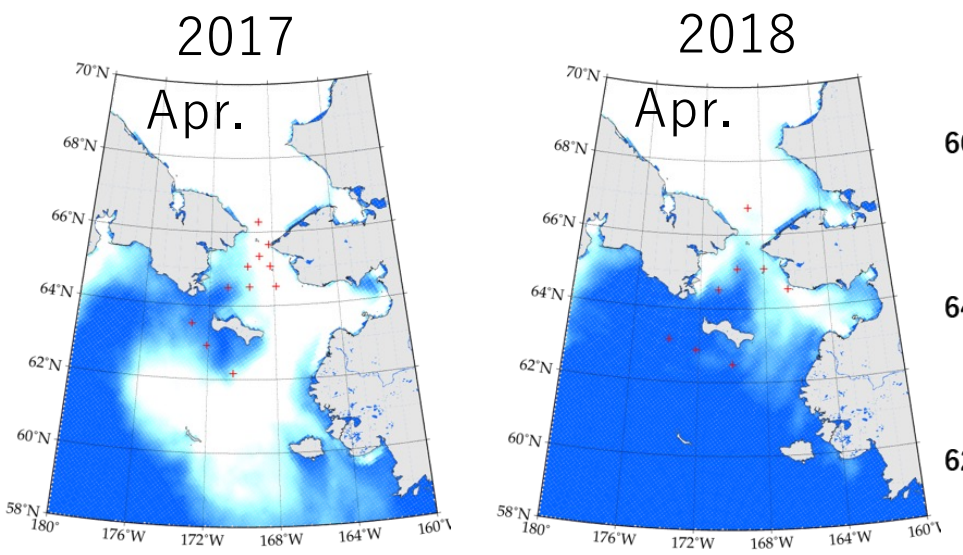




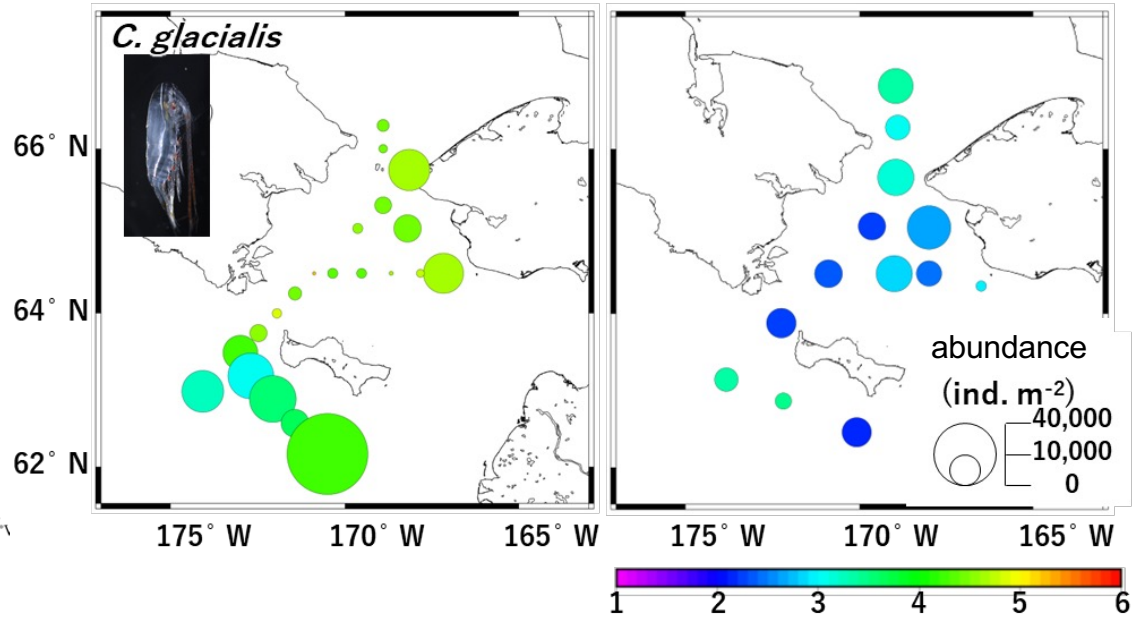
Topic 2: Impact of sea ice retreat timing on the reproduction of copepods

[Kimura et al., 2022 Frontiers in Marine Science]

Comparison between 2017 and 2018



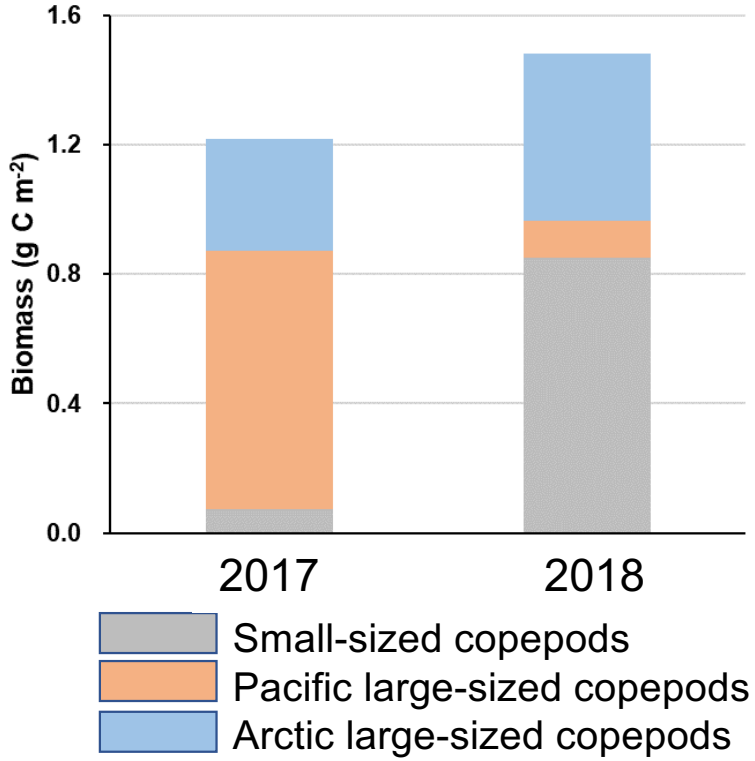
April mean sea ice concentration



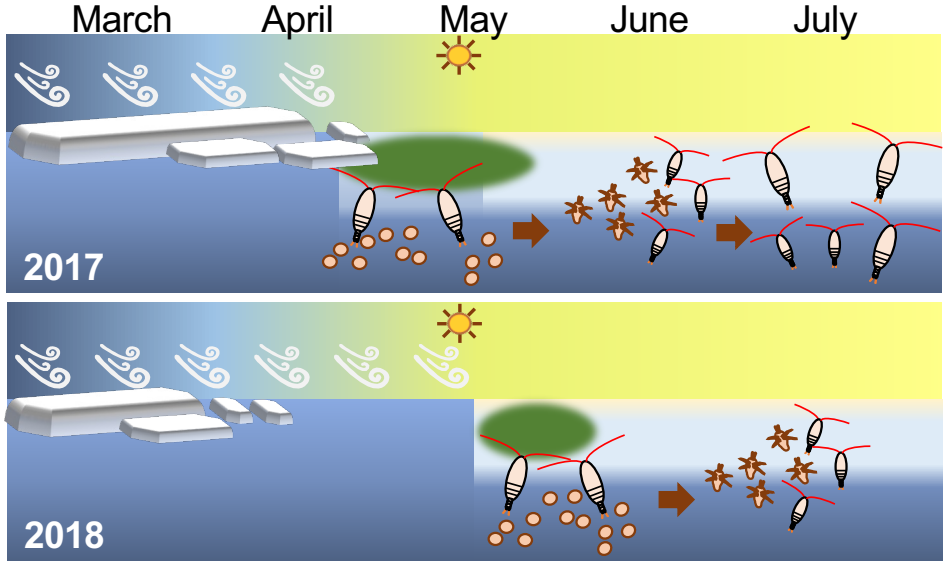
Horizontal distribution of abundance and mean copepodite stages of *C. glacials in July 2017 and 2018*

Summary of Topic 2

Comparison of biomass of each copepod size



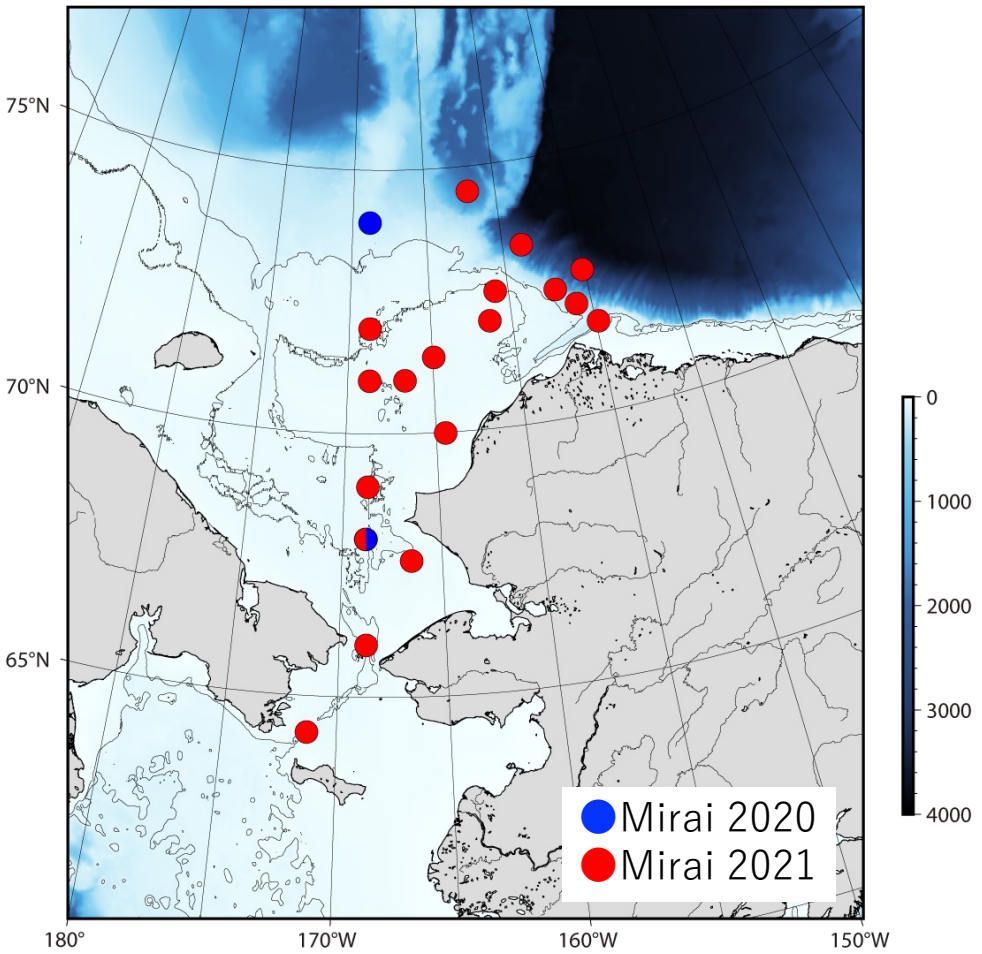
Zooplankton between 2017 and 2018



Early sea ice melt
→ Late phytoplankton bloom
→ Delay in copepods reproduction
→ Decrease of large size copepods in summer
→ Low food availability for fishes
➔ **match/mismatch hypothesis**

Topic 3: Spread of microplastic pollution in the Chukchi Sea

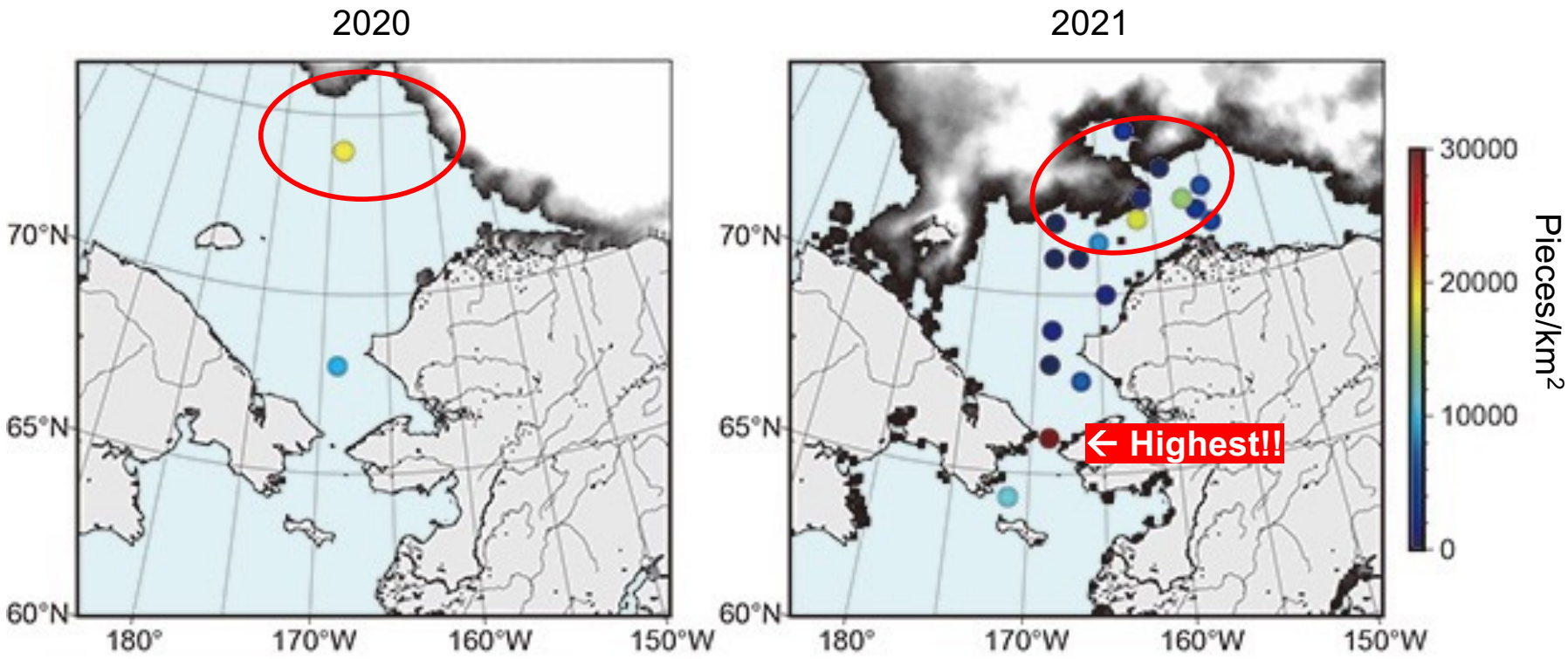
[Ikenoue et al., 2022 Science of the Total Environment]



Collection of Floating micro-plastic using a Neuston net

Topic 3: Spread of microplastic pollution in the Chukchi Sea

[Ikenoue et al., 2022 Science of the Total Environment]

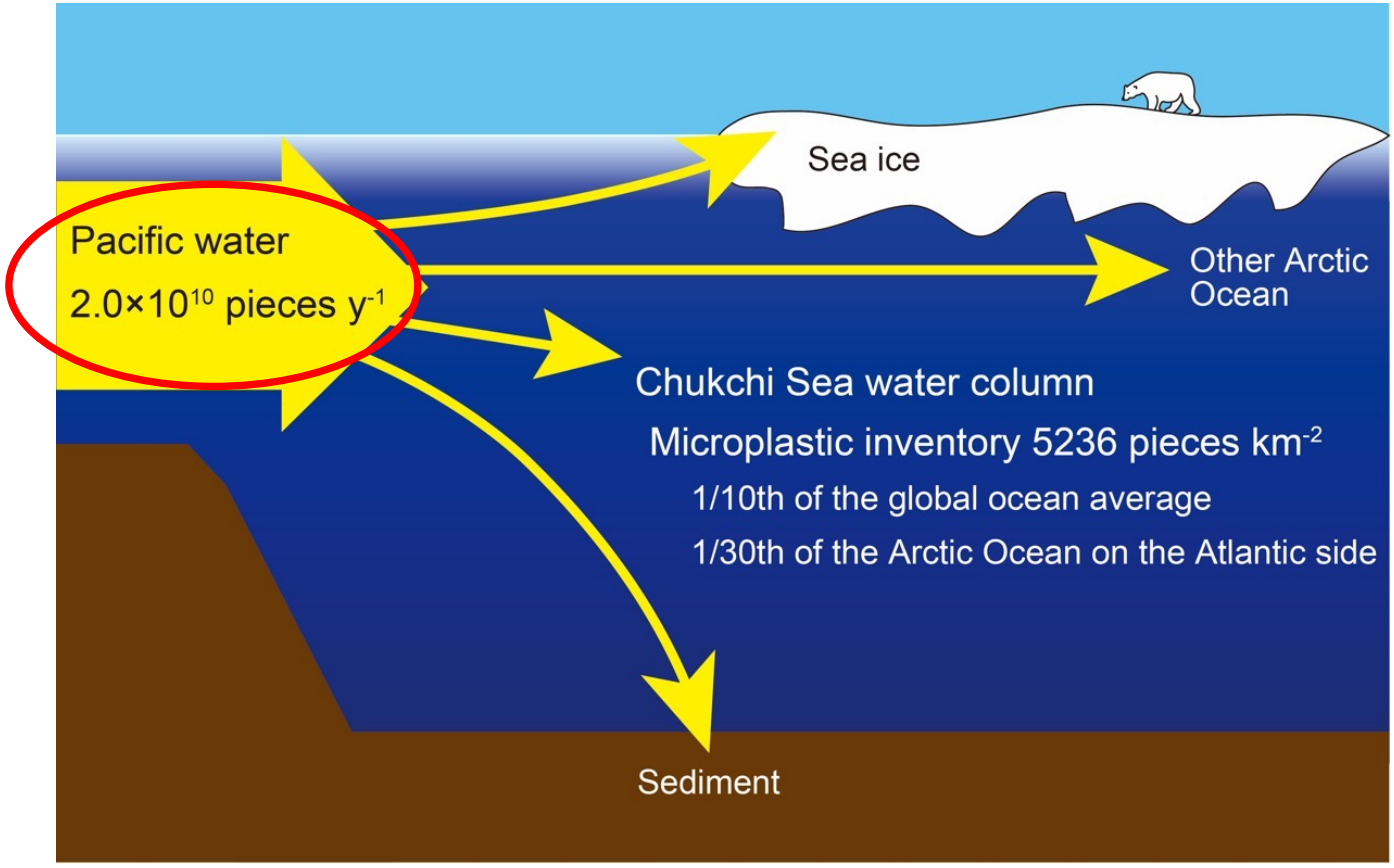


Distribution of microplastic particle inventory

- **Mean water-column inventory = 5,236 pieces/km^2 (1/10 of global average)**

➔ **Less polluted!**

Summary of Topic 3



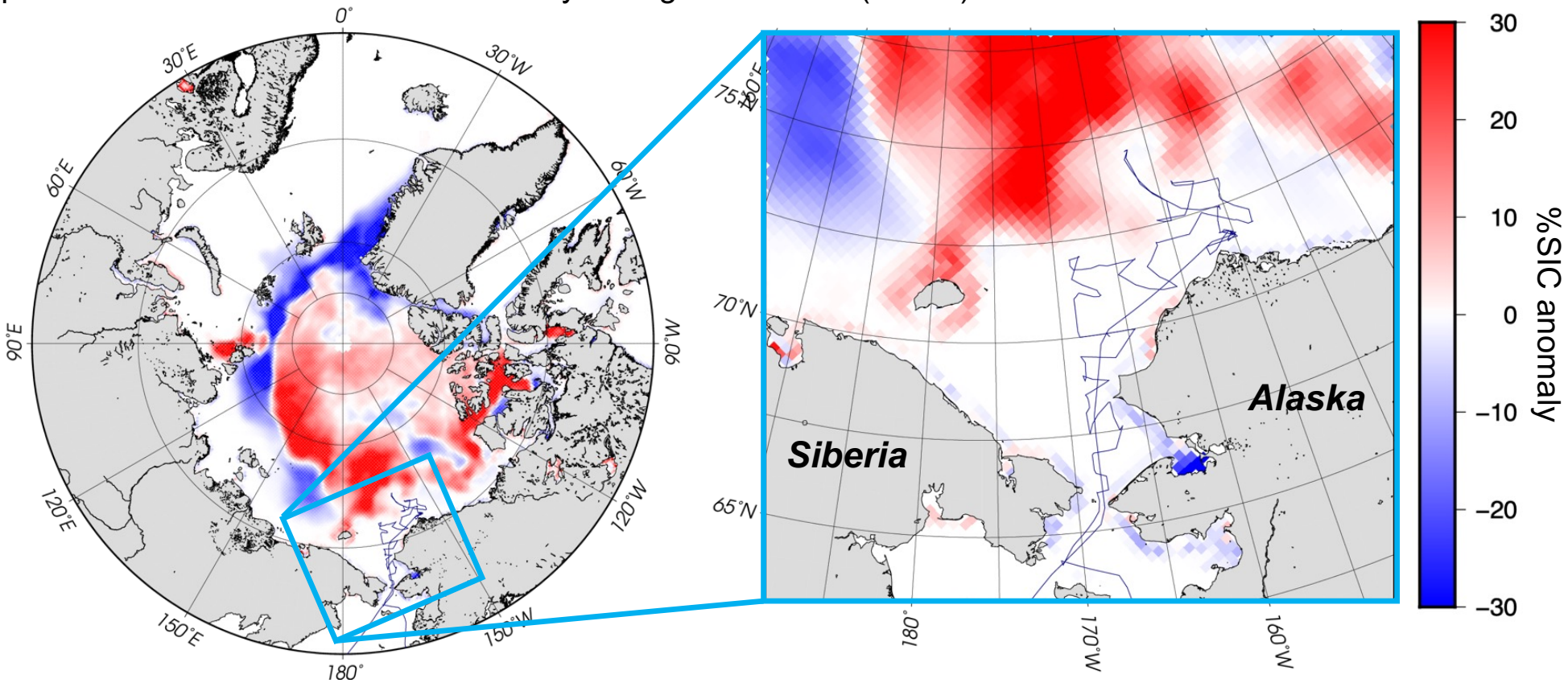
However…

Microplastic inflows from the Pacific Ocean are accumulating in large amounts in reservoirs other than the Chukchi Sea water (e.g., sea ice and seafloor sediments)

➔ Keep monitoring DBO2&3, 5 and downstream region, sea-ice, sediment etc

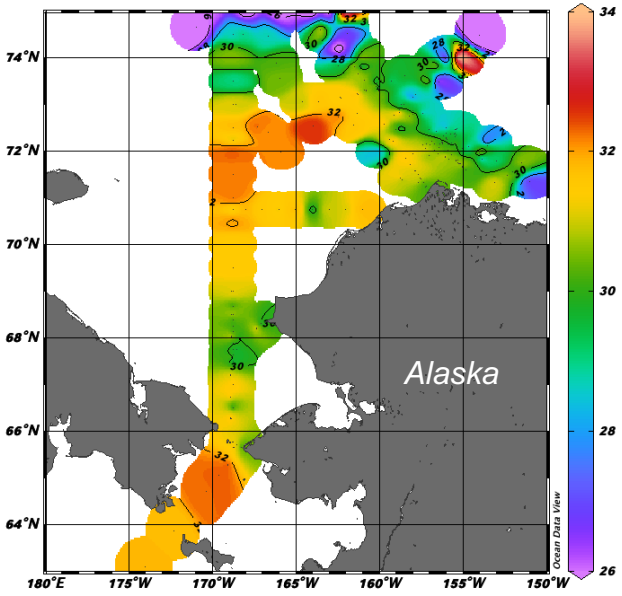
Upcoming topics from R/V Mirai 2021 cruise: the anomalously icy year and its impact

September Sea ice concentration anomaly during 2010–2021 (SSM/I) and cruise track of R/V Mirai 2021 cruise

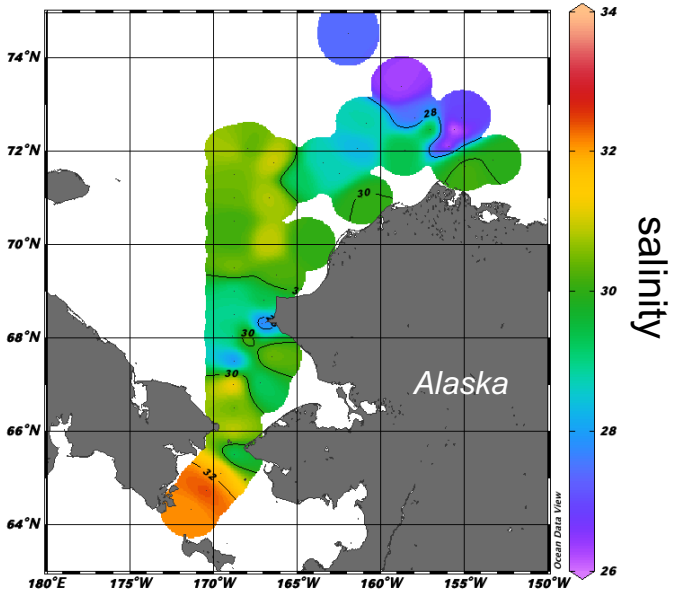


Widespread fresh summer-water in 2021

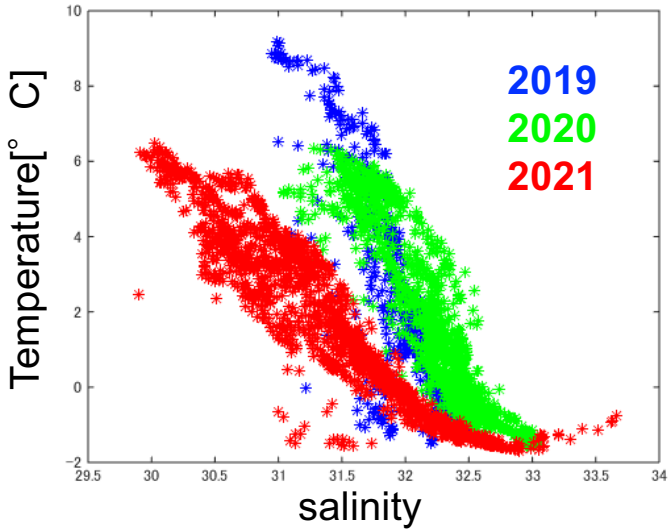
General September surface salinity (2008–2017)



2021 surface salinity



Yearly comparison of August Temperature&salinity from the Barrow Canyon mooring



(provided by Dr. Motoyo Itoh)

Upcoming topics

1. How did this freshening occur? (ice melt? River discharge?)
   ➔ Oxygen isotope, nutrients, Alkalinity and CDOM etc are underanalysis
2. How does this less saline water impact hydrographic and biogeochemical properties?
   ➔heat flux, freshwater & nutrient budget, PP, ZP, eDNA etc


ArCSII
JAMSTEC
Thank you very for your attention!
Acknowledgements
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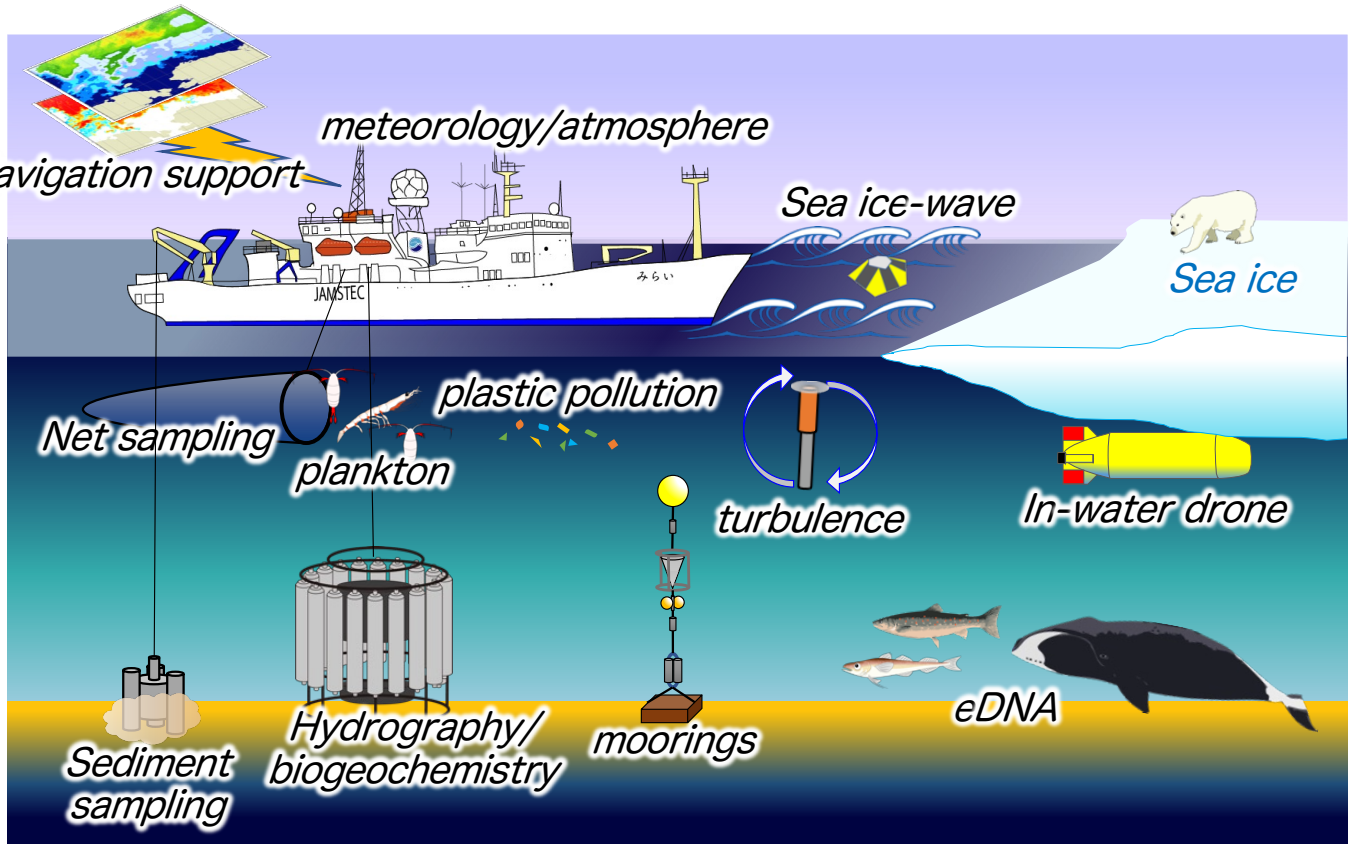
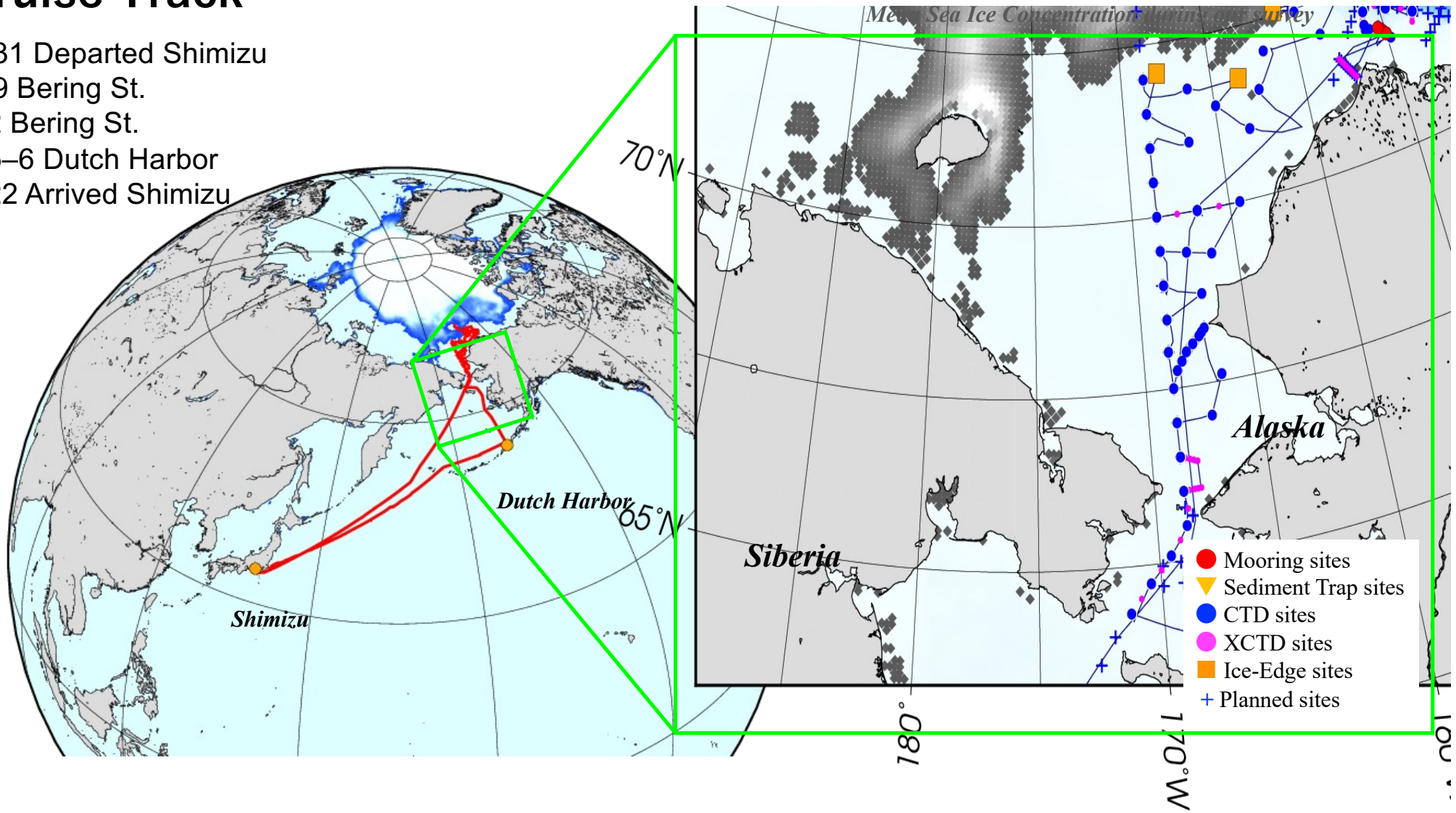
科研費
KAKENHI
HOKKAIDO UNIVERSITY
FOUNDED 1876
北極域研究
共同推進拠点
J-ARC Net

Schematic of the Mirai activities



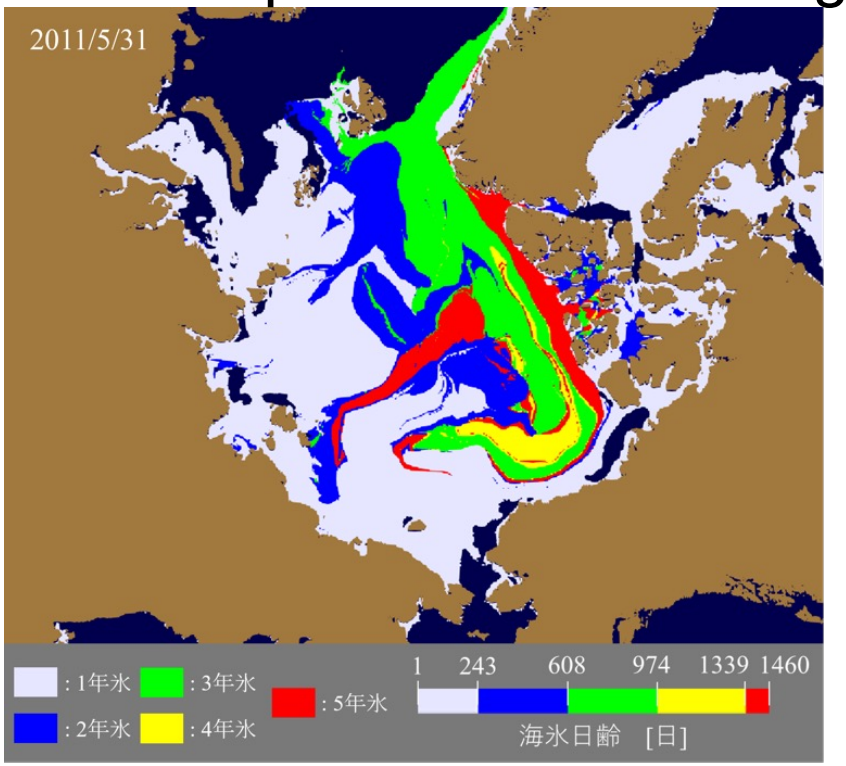
Cruise Track

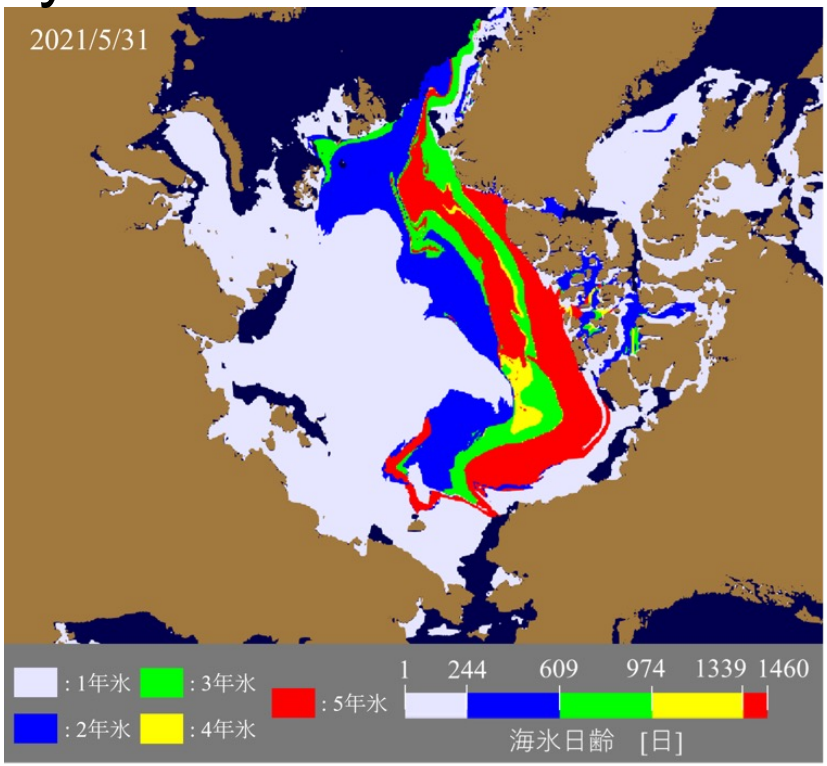
Aug 31 Departed Shimizu
Sep 9 Bering St.
Oct 2 Bering St.
Oct 5–6 Dutch Harbor
Oct 22 Arrived Shimizu



Why did heavy ice cover remained?

Comparison of sea ice age on May 31st 2011 and 2021





Old thick ice remained in the western side of the Arctic

Provided by Dr. Yamaguchi (Arctic Sea Ice Information Center, NIPR)
[https://www.nipr.ac.jp/sea_ice/(e)]