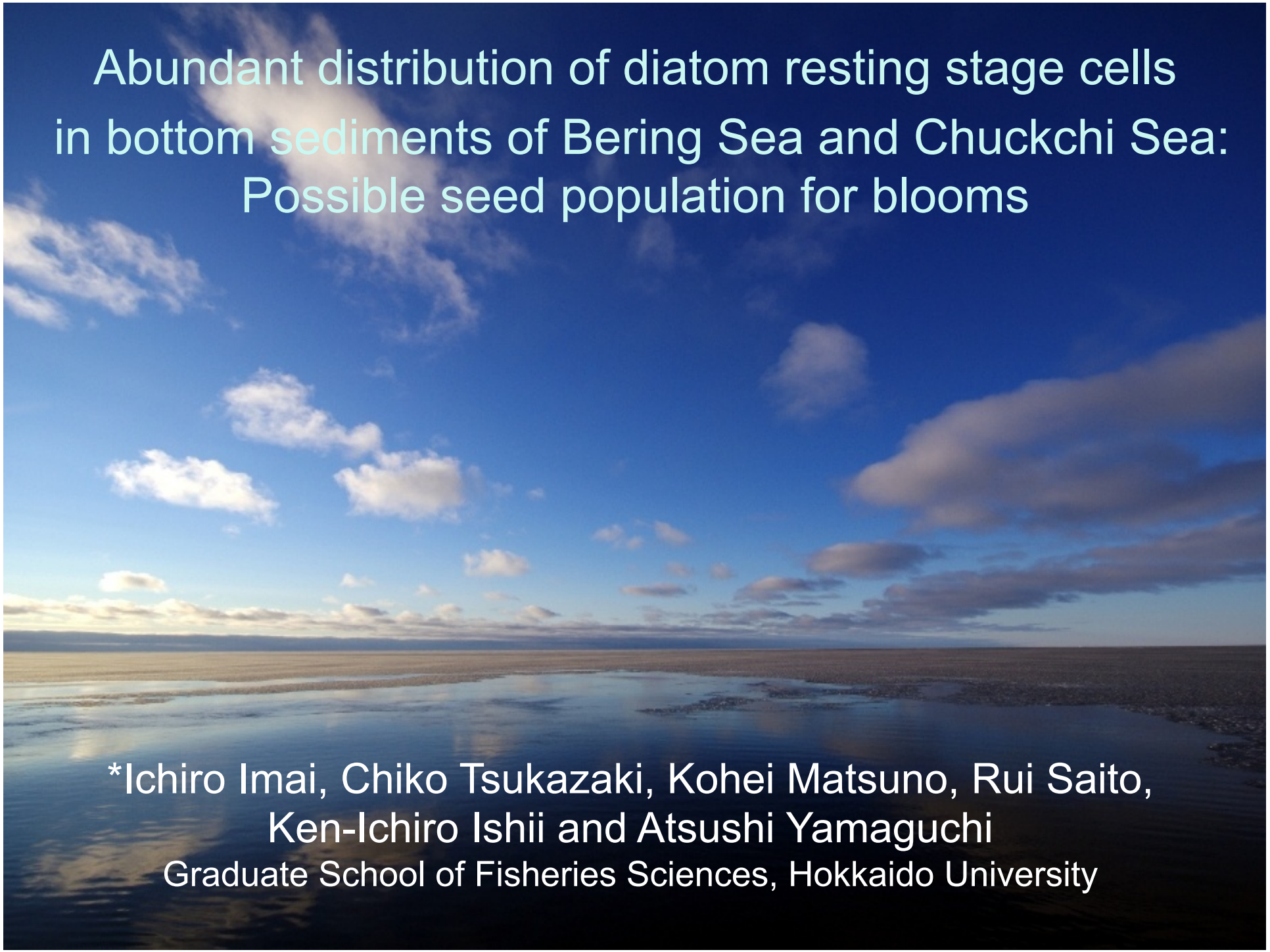

Abundant distribution of diatom resting stage cells in bottom sediments of Bering Sea and Chuckchi Sea: Possible seed population for blooms

*Ichiro Imai, Chiko Tsukazaki, Kohei Matsuno, Rui Saito, Ken-Ichiro Ishii and Atsushi Yamaguchi

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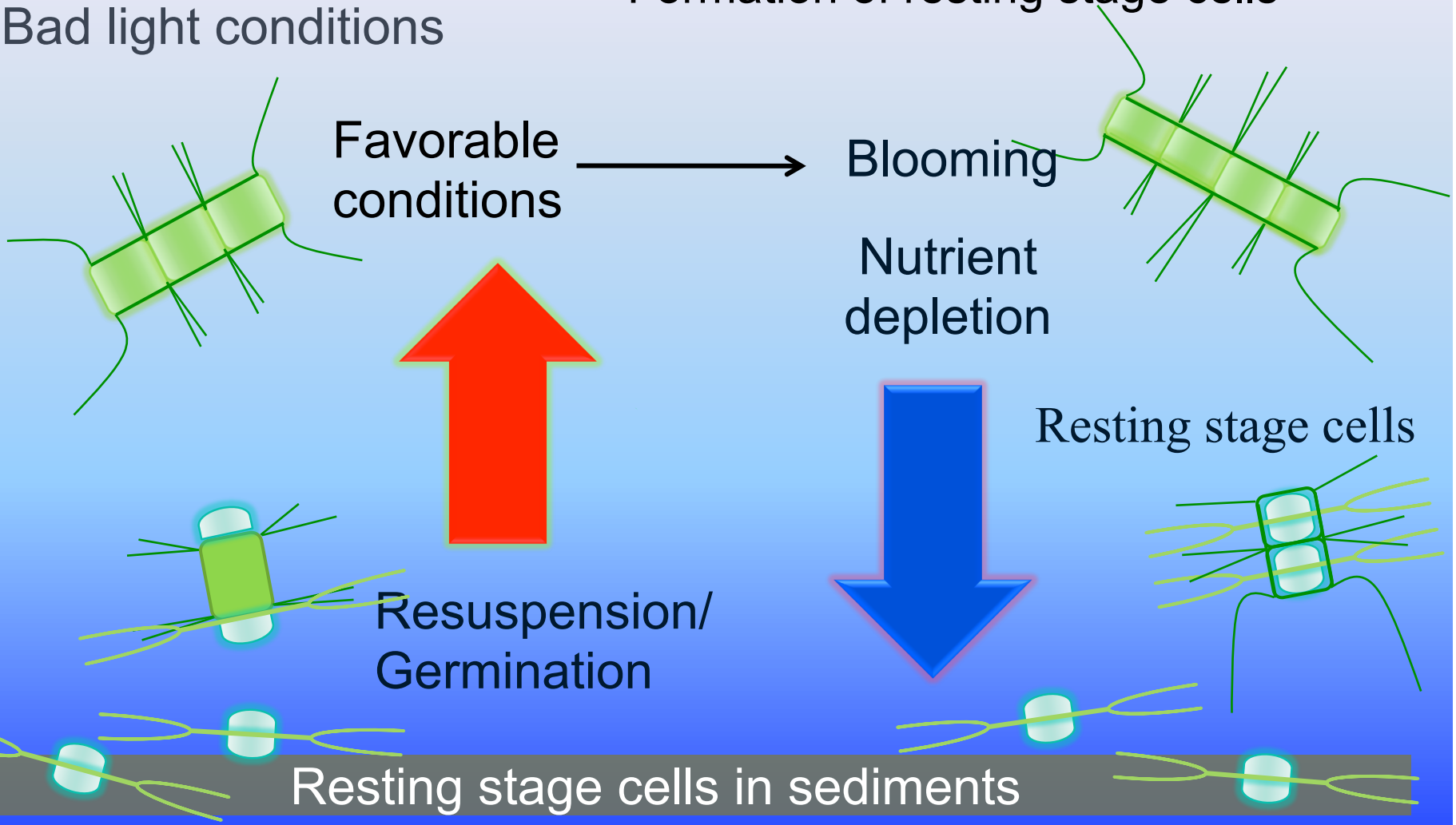
Background and Objectives

Life cycle strategies of diatoms

- Nutrient depletion
- Bad light conditions

→ → Formation of resting stage cells



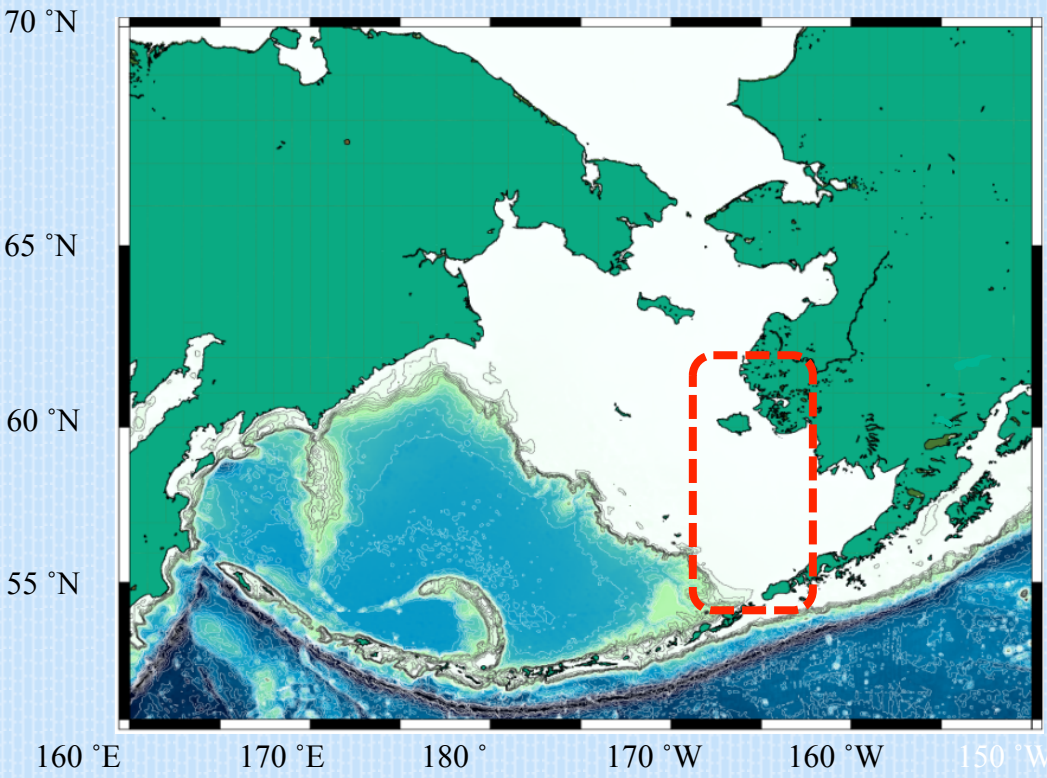
Continental shelf of eastern Bering Sea

- Wide shelf area < 200 m
- High primary productivity▪▪▪Excellent fishery ground

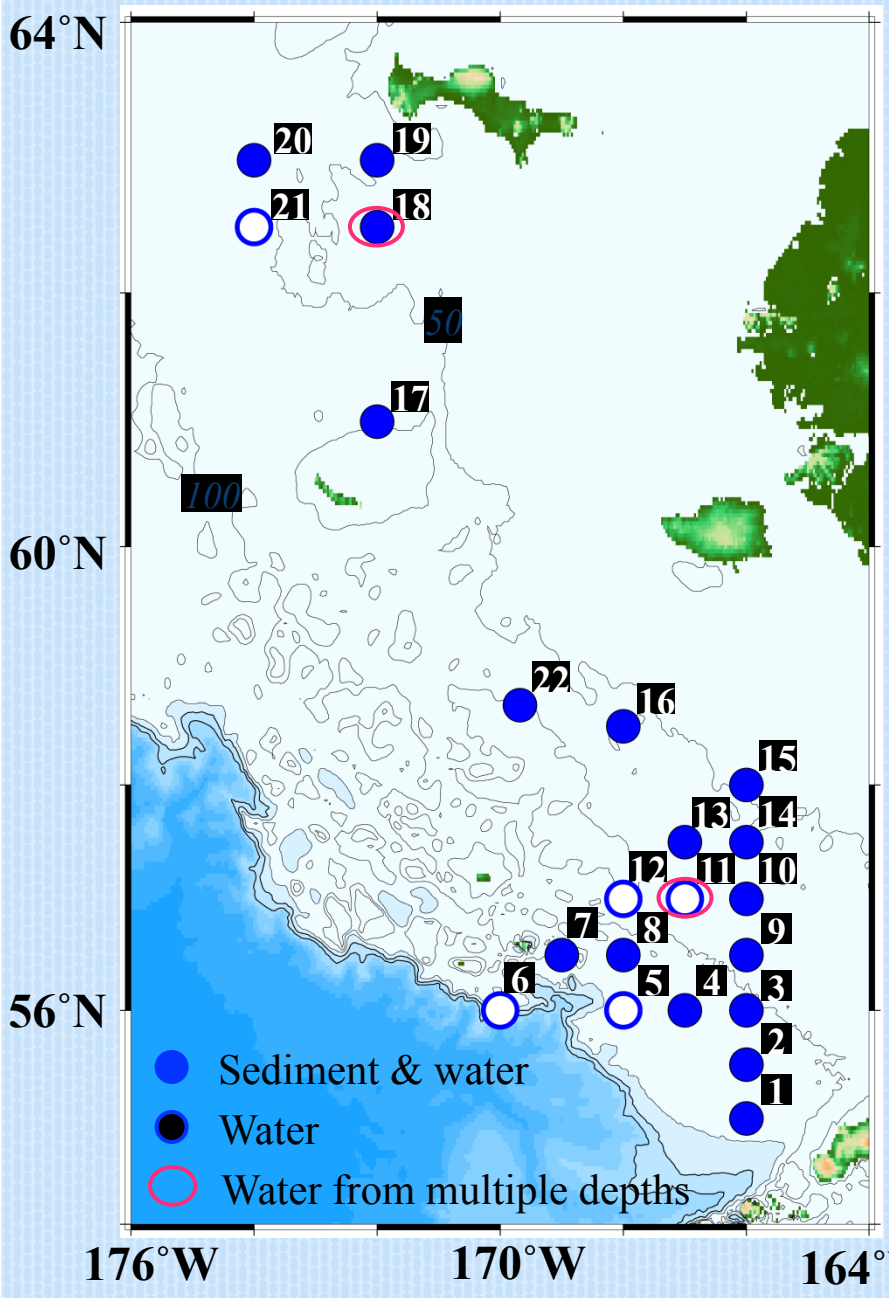
- Ice-covering in winter

↓

Importance of diatoms as primary producers



Bering Sea



Research area

Continental shelf of eastern Bering Sea, 22 points

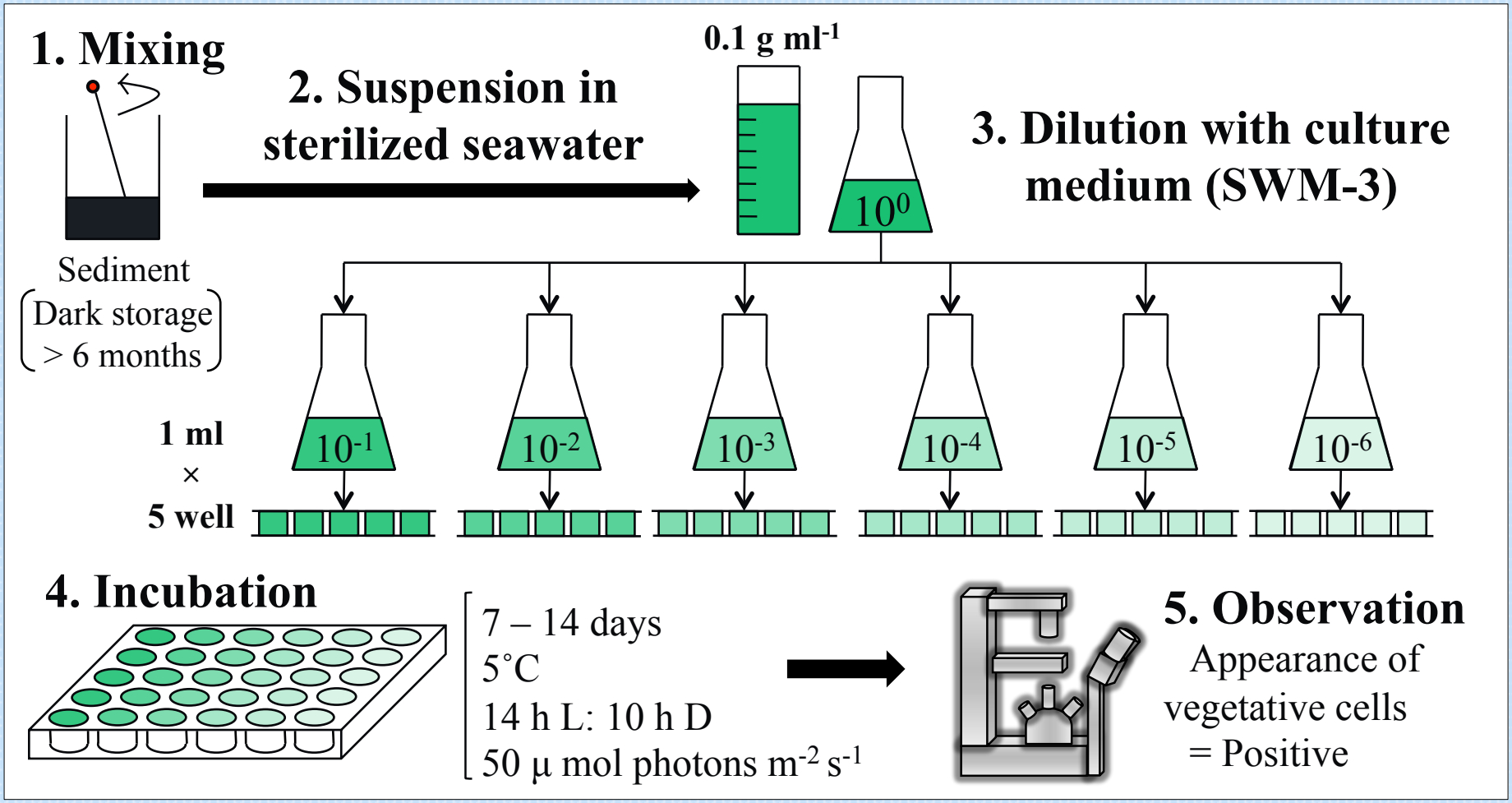
Period

July 8 ~ 15, 2009

Samplings and measurements

- Sediments［S&M sampler］
  - ・Diatom resting stage cells（**MPN** method）
- Water samples
  - ・Chlorophyll a
  - ・Identification and counting of phytoplankton
- WT, Salinity, Density, Nutrients

Method Most probable number (MPN) method ~ Sediments ~

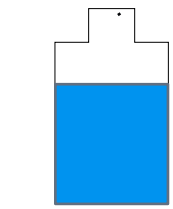


Number of Positive wells in each dilution level

- MPN Table (Throndsen 1978, Itoh and Imai 1987)

Estimation of resting stage cells
MPN cells cm^{-3} · wet sediment

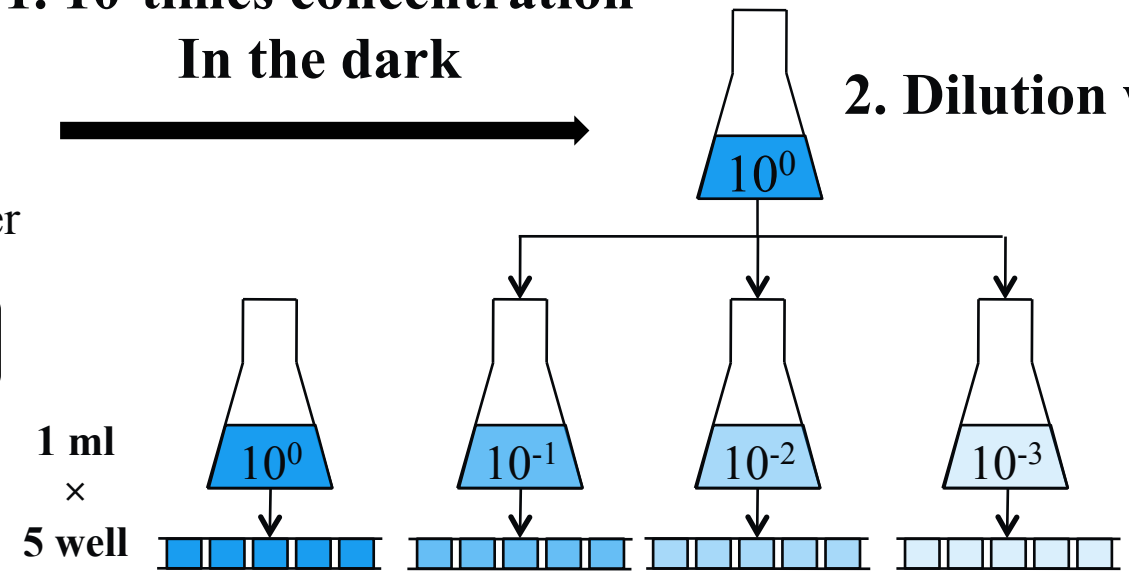
Method　Most probable number (MPN) method ~ Seawater ~



Raw seawater
500 ml
(Dark storage
> 6 months)

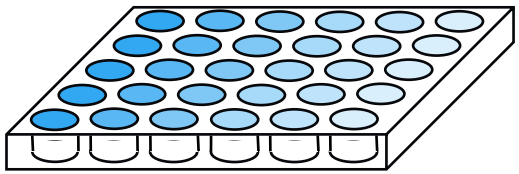
1. 10-times concentration
In the dark

2. Dilution with medium

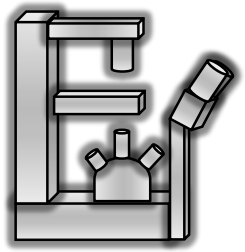


1 ml
×
5 well

3. Incubation



7 – 14 days
5˚C
14 h L: 10 h D
50 μ mol photons m^{-2} s^{-1}



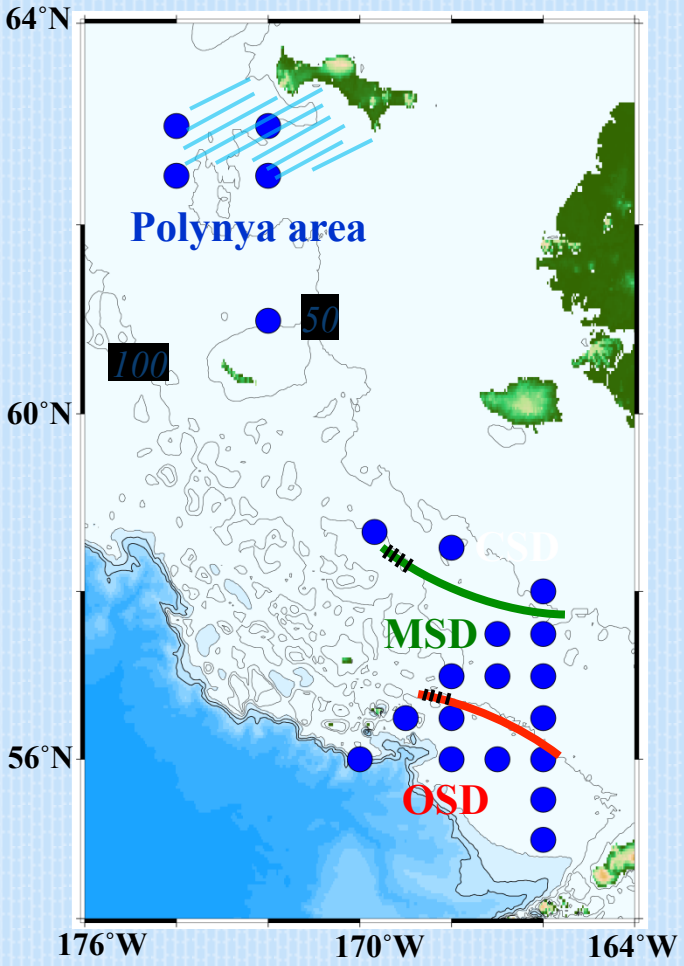
5. Observation
Appearance of
vegetative cells
= Positive

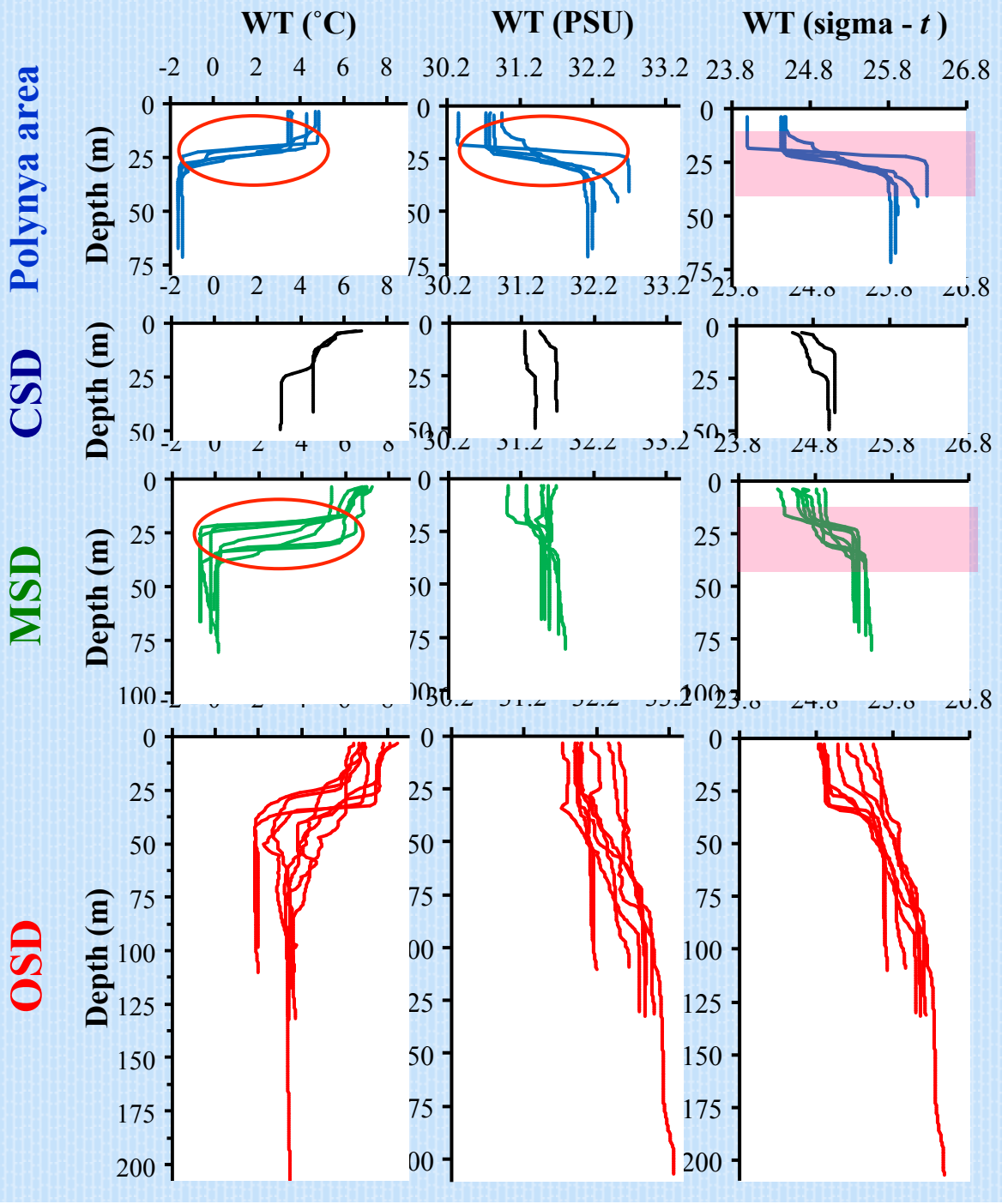
Number of Positive wells in each dilution level

- MPN Table (Throndsen 1978, Itoh and Imai 1987)

Estimation of resting stage cells
MPN cells L^{-1}

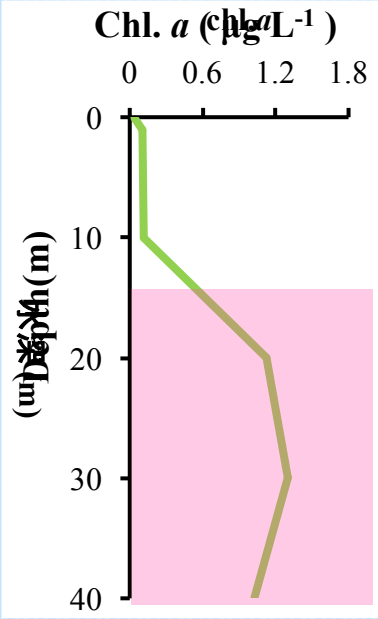
Environments



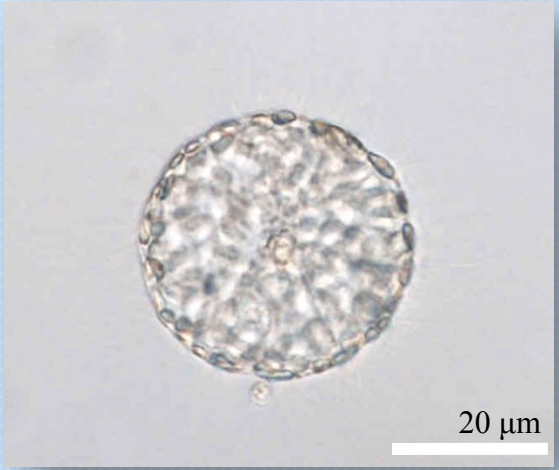


Phytoplankton (Chl.a)

Polynya



◆Diatoms

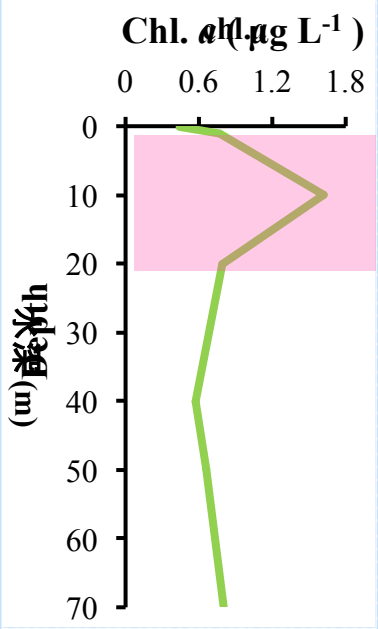


Porosira glacialis

Thalassiosira sp.

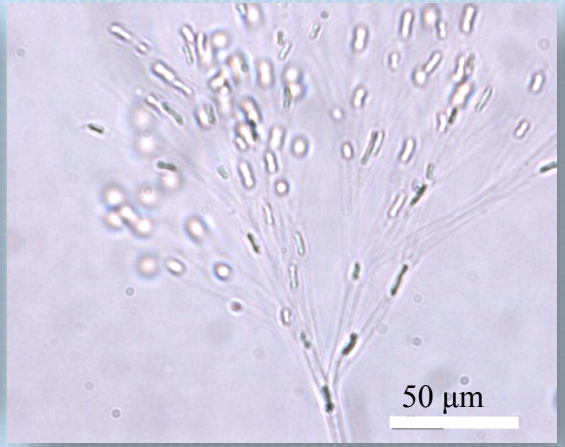
***Pauliella* spp.**

MSD



◆Flagellate

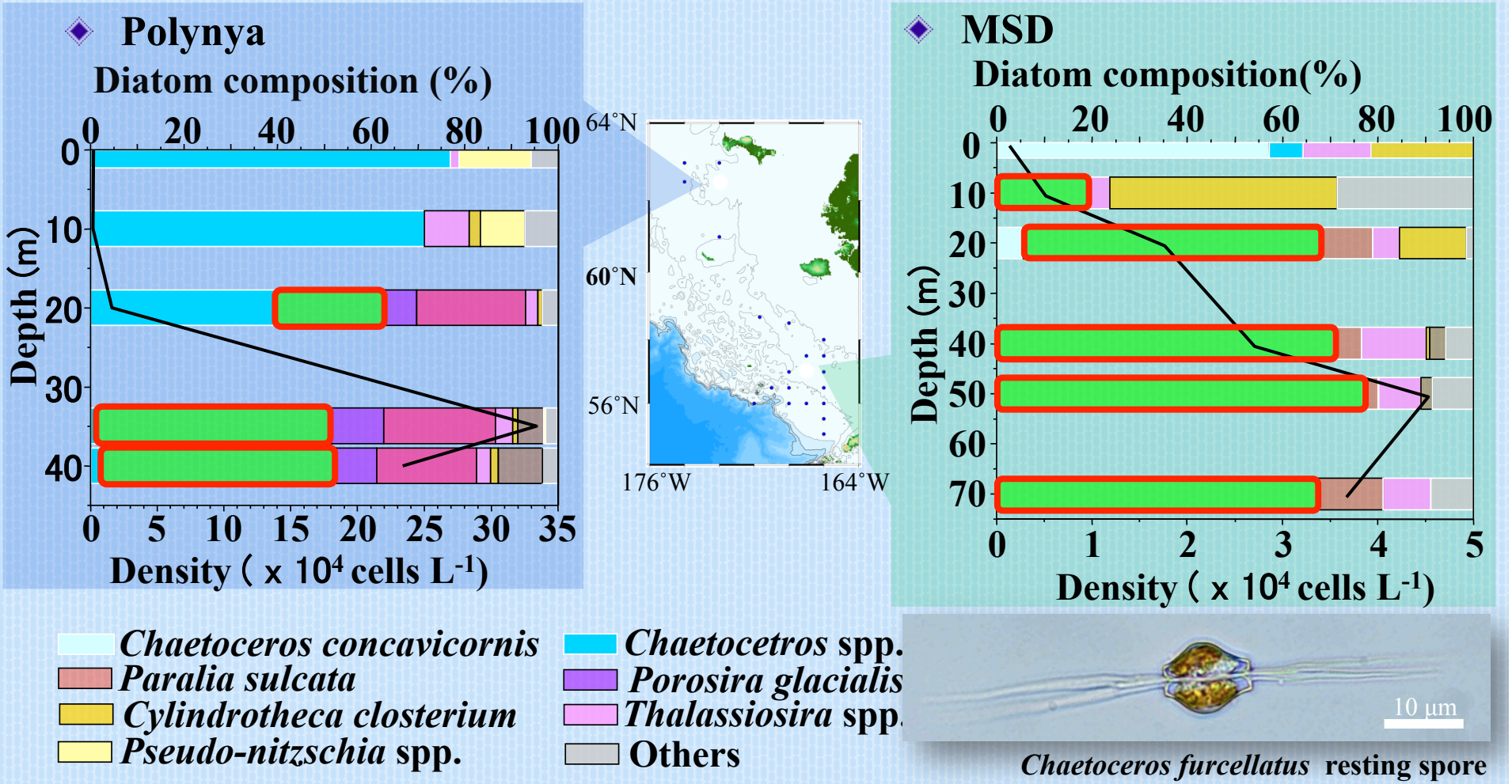
Cryptophyceae



Dinobryon sp.

Protoperidinium sp.

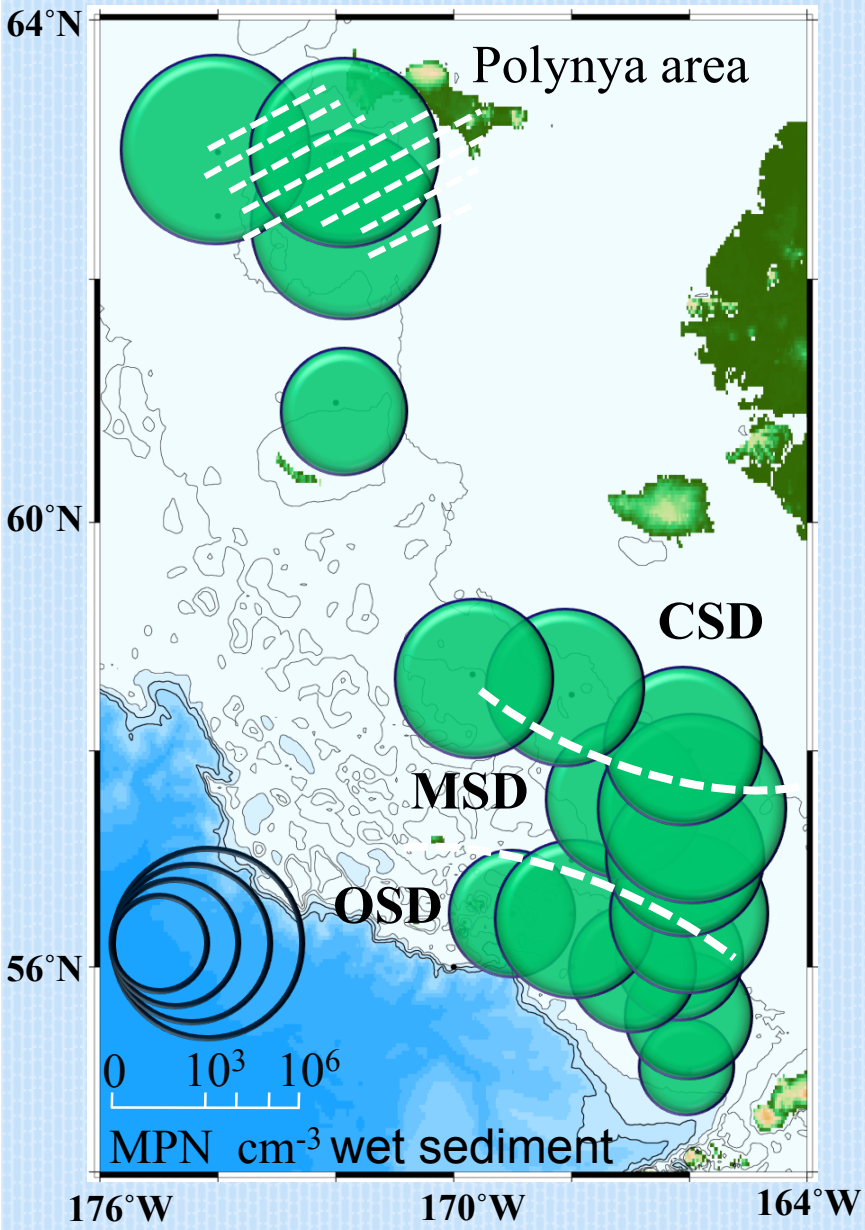
Vertical distribution of diatoms



High density of *Chaetoceros* resting spores in deeper layer

Formation of resting stage cells and sinking at the end of blooming

Distribution of diatom resting stage cells (DRSCs) in sediments



Total DRSCs (**MPN** cm^{-3} sed)

$3.1 \times 10^2 \sim 7.1 \times 10^5$

Area	DRSCs
Polynya	$1.1 \times 10^3 \sim 1.2 \times 10^6$ (平均 2.5×10^5)
CSD	$3.3 \times 10^4 \sim 6.6 \times 10^5$ (平均 6.5×10^4)
MSD	$2.9 \times 10^4 \sim 2.1 \times 10^5$ (平均 8.0×10^4)
OSD	$3.1 \times 10^2 \sim 1.9 \times 10^4$ (平均 6.2×10^3)
Seto Inland Sea	$10^3 \sim 10^6$

High densities of DRSCs

Centrales: 9 genera17species, Pennales: 5 genera 2 species

Chaetoceros **N. D.** ~ 4.7 x 10^5 (**MPN** cm^{-3} wet sediment)

Chaetoceros diadema

Chaetoceros furcellatus

Chaetoceros socialis

Ch. diadema

Ch. furcellatus

Ch. socialis

Scale bar : 20 μm

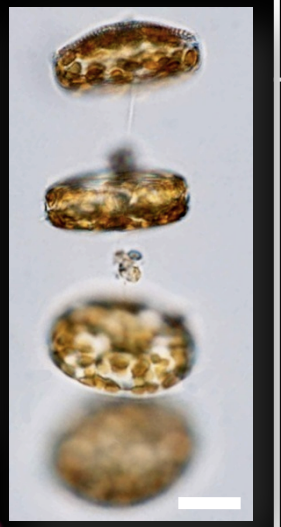
Thalassiosira **N. D.** ~ 4.2 x 10^5 (**MPN** cm^{-3} wet sediment)

Thalassiosira nordenskioeldii

Thalassiosira gravida

Bloom forming species in spring to summer

Th. nordenskioeldii



Th. gravida

Others

Porosila gracialis

Paralia sulcata

Detonula sp.

Reflection of bloomingg species in water columns

Resting stage cells of ice algal species in sediments

Ribbon type colony species

N. D. ~ 2.7 x 10^4 (MPN cm^{-3} wet sed)

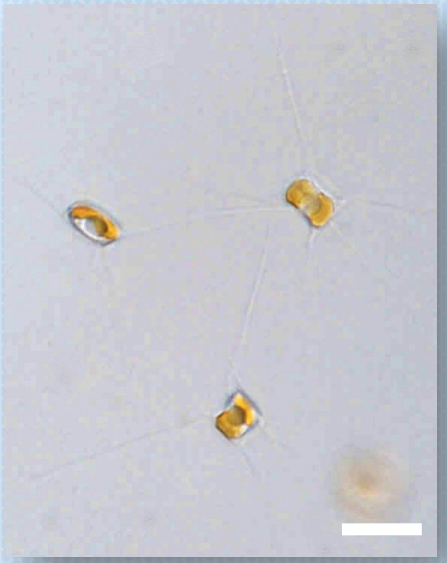
Attheya

N. D. ~ 4.6 x 10^5 (MPN cm^{-3} sed)

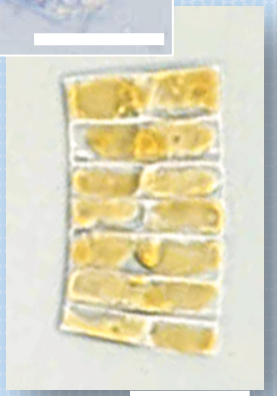
<Ice algae species>

Fragilaria*, *Fragilariopsis*, *Pauliella*, *Synedropsis*, *Navicula*, *Attheya

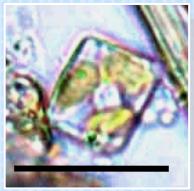
→ Overwintering at bottom



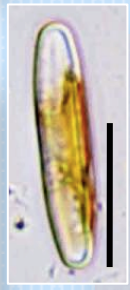
Attheya sp.

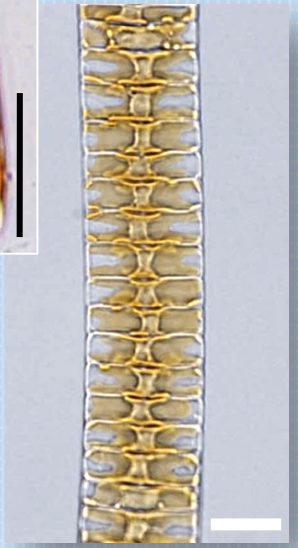


Fragilariopsis oceanica



Fragilaria sp.





Pauliella taeniata

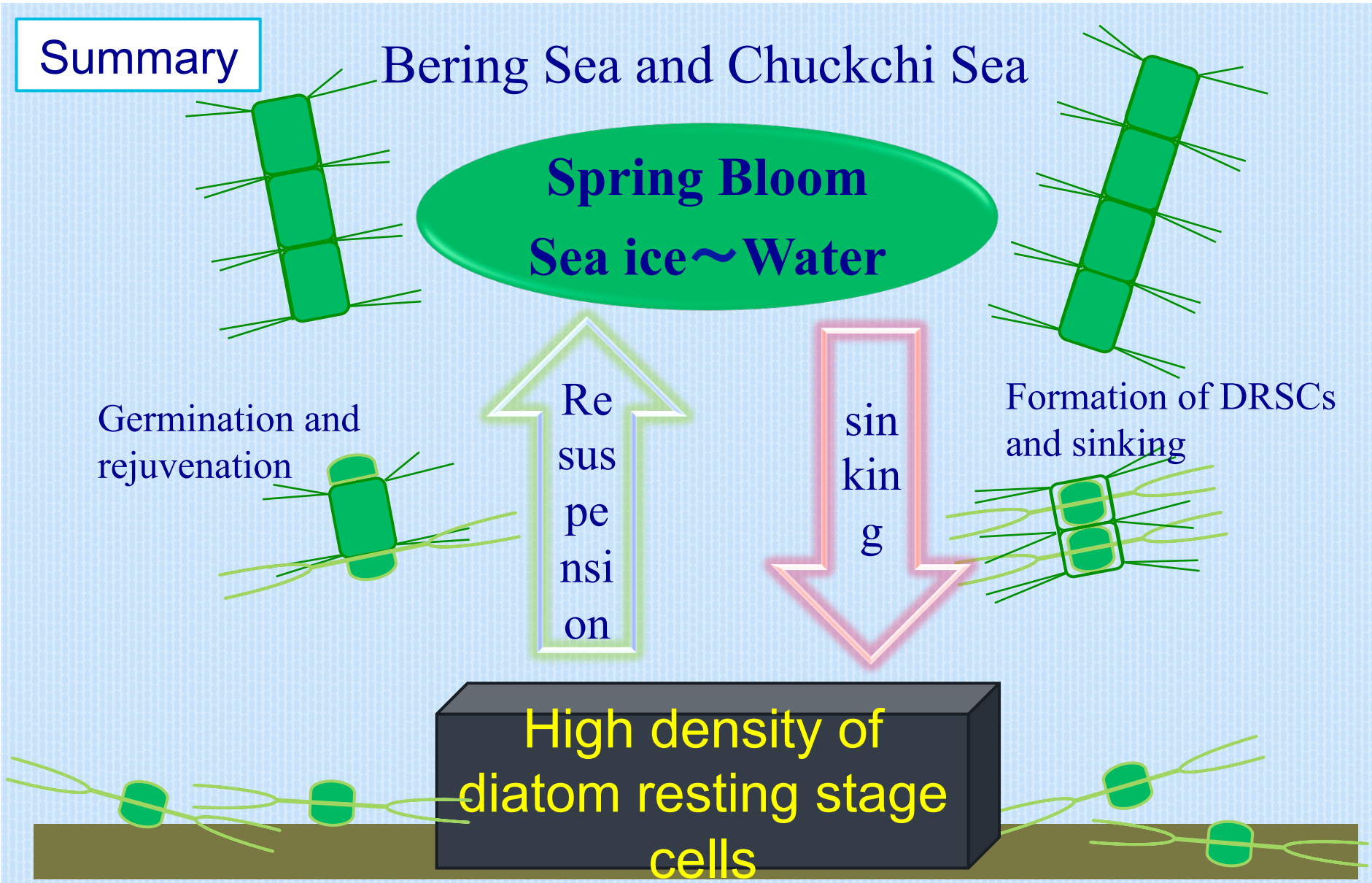
Scale bar : 20 μm

Seed population of ice algae

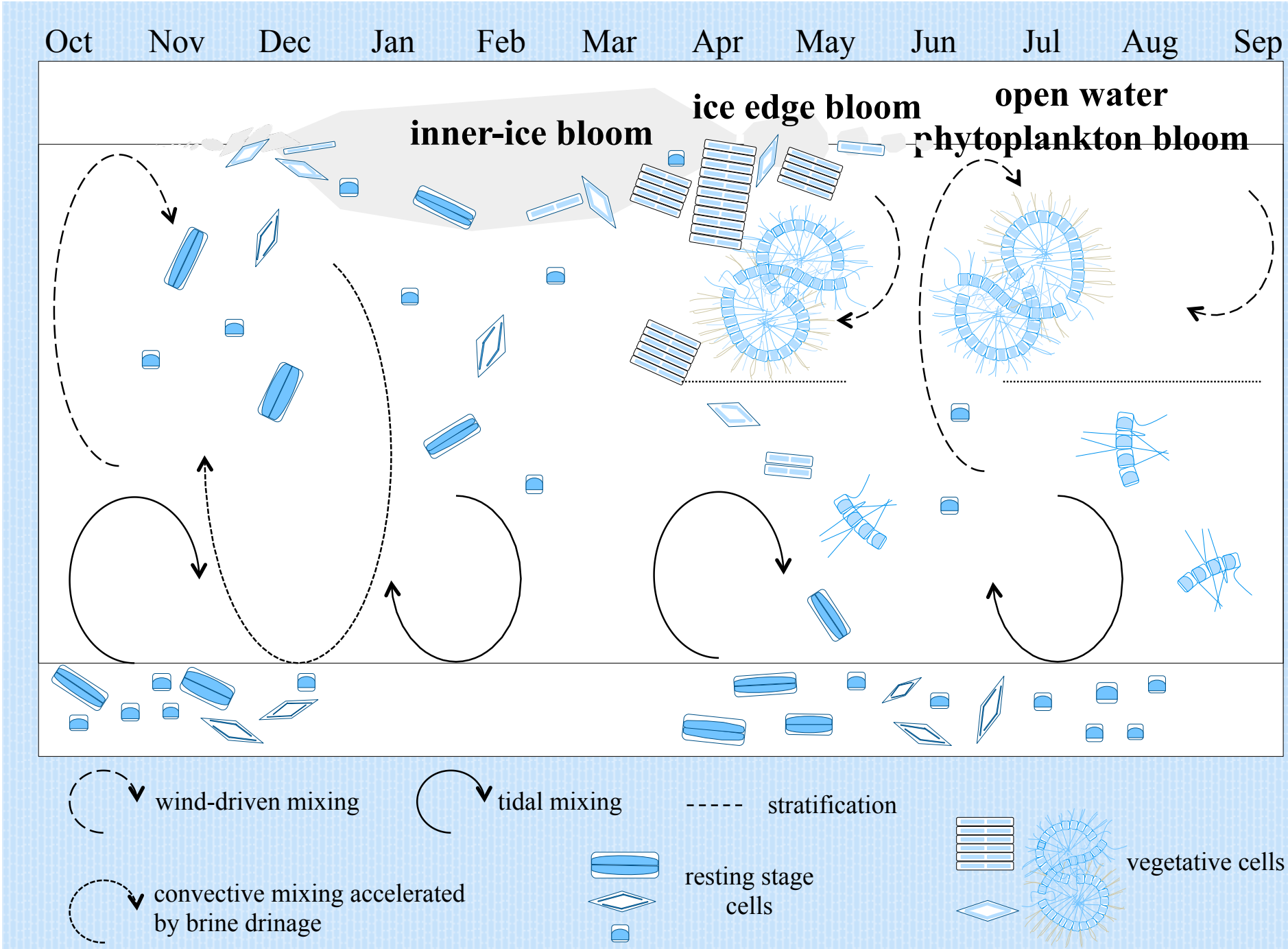
- Resuspension by strong mixing in winter
- Sea ice = Attching strata

→Bloom formation by ice algae

Summary



Seed population = Important factor for productivity



Re Fig. 7 (Tsukazaki et al.)

We are grateful to the captain and crew of R/V Mirai and the Training Ship Oshoro-Maru for the cooperation at the Chuckchi Sea and Bering Sea.