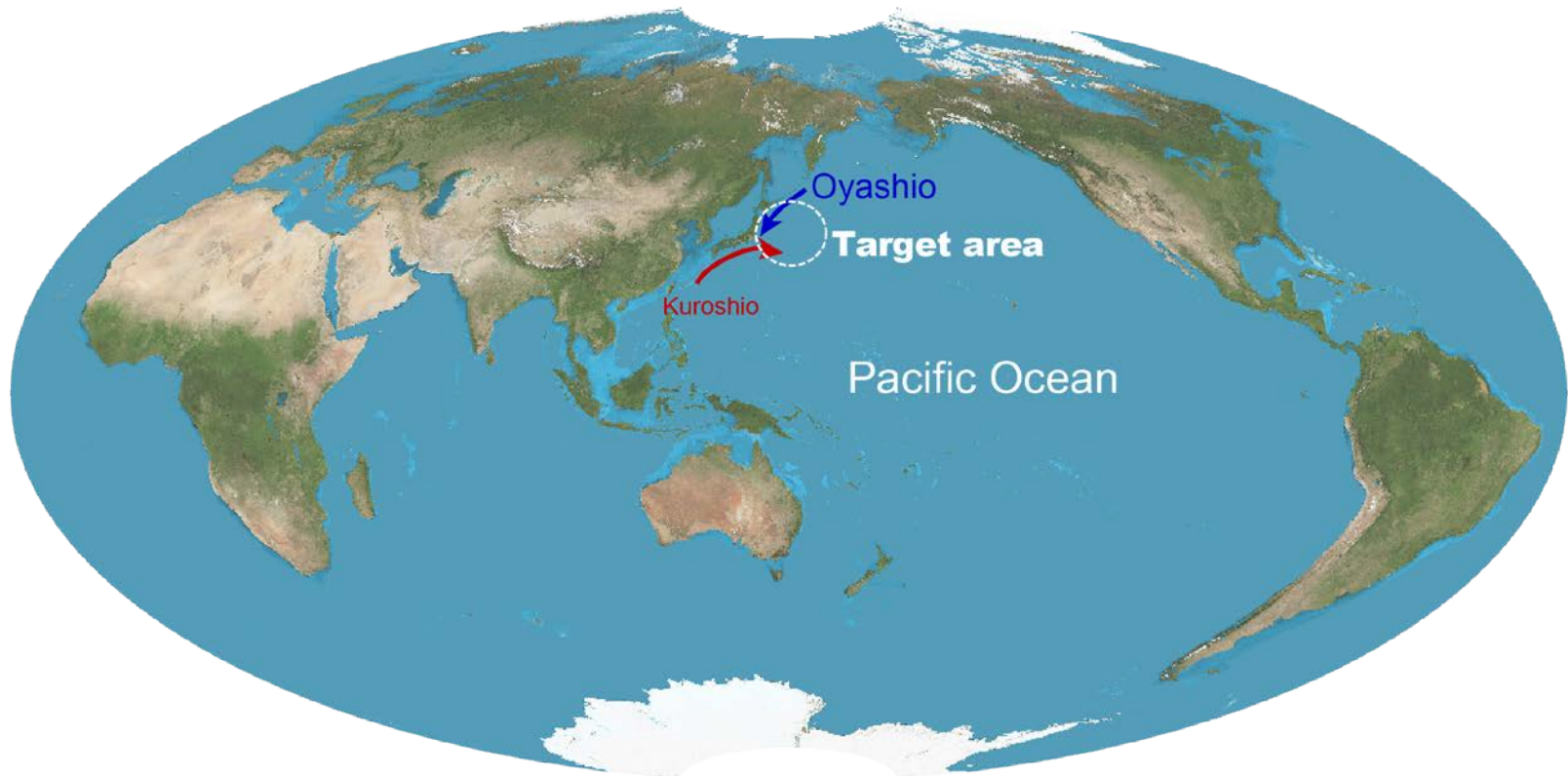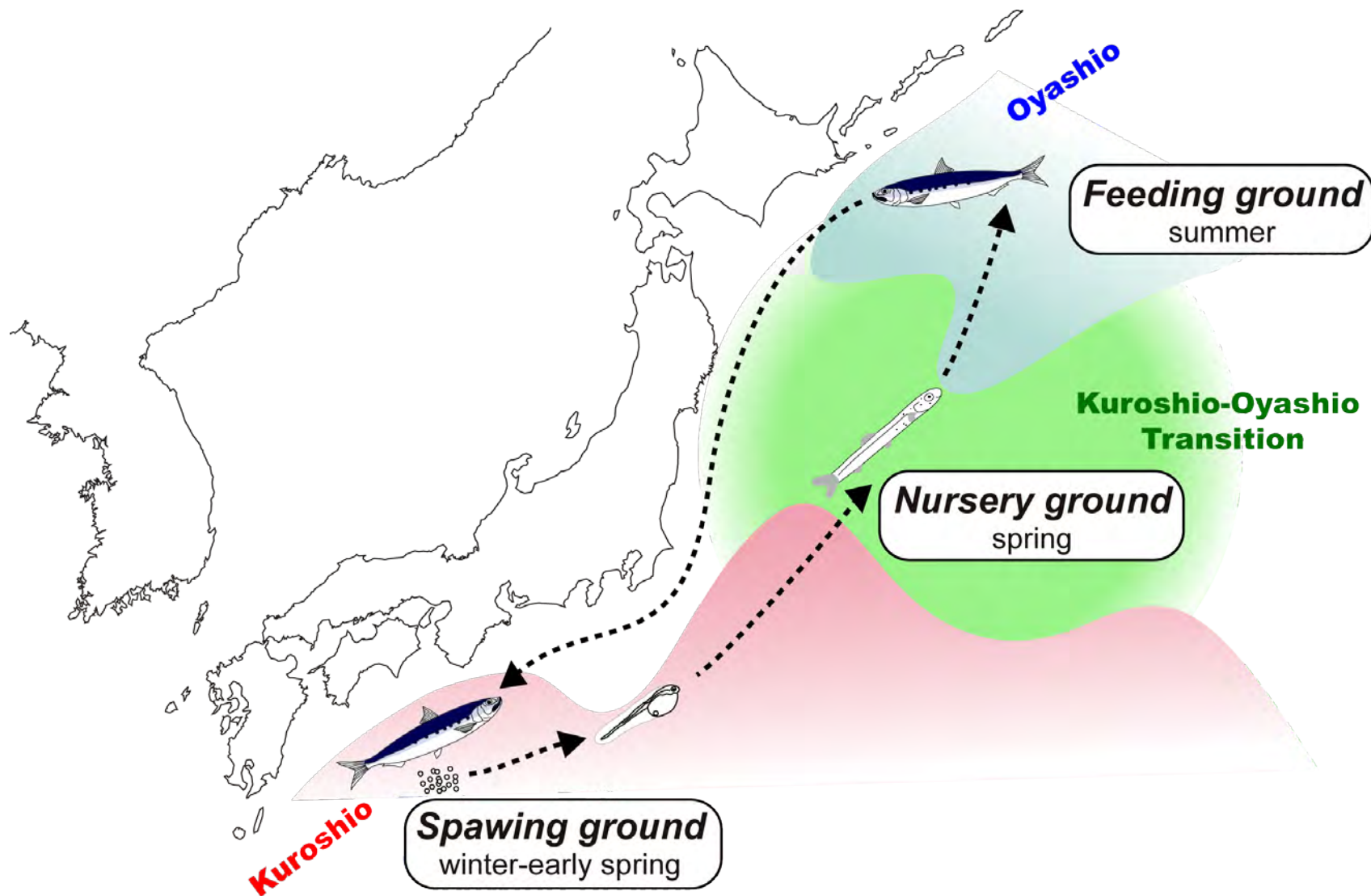# Seasonal variation of plankton community and biodiversity in the Kuroshio-Oyashio Transition waters

Kazuaki Tadokoro, Tsuyoshi Watanabe
Tohoku National Fisheries Research Institute
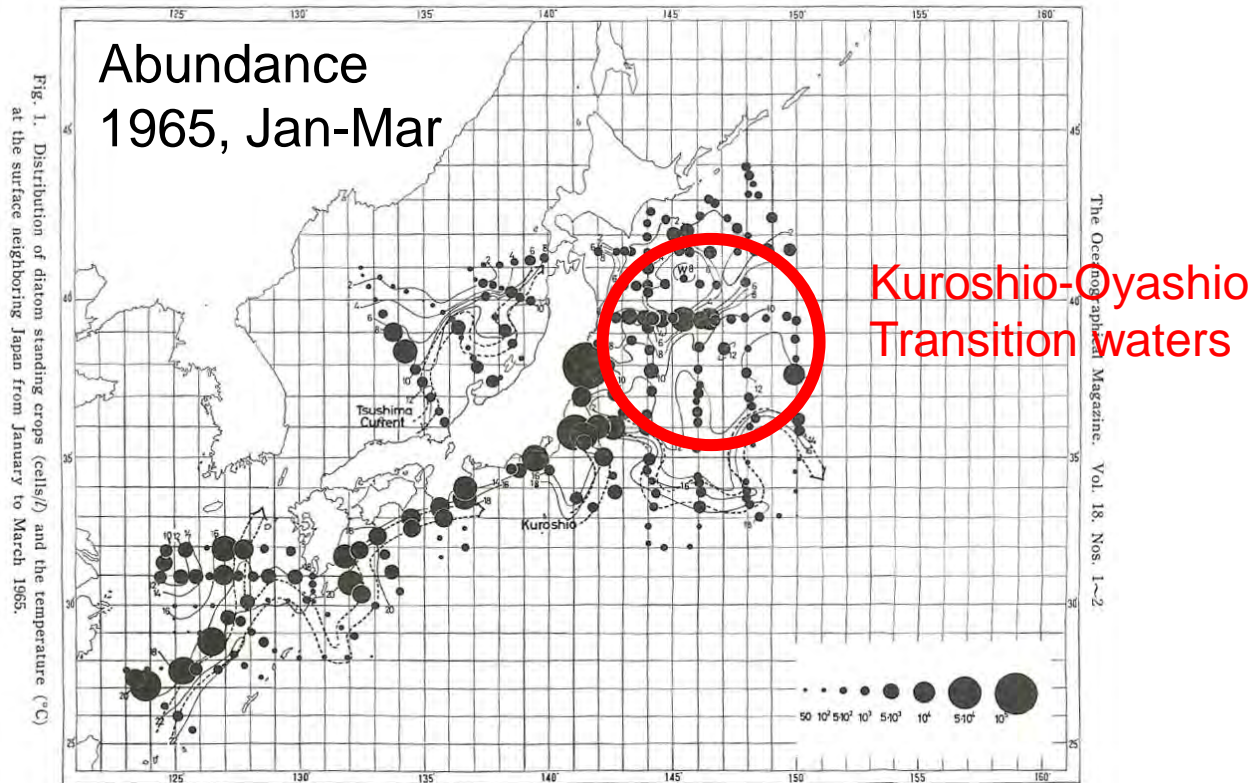
Features of Kuroshio Oyashio Transition waters

Seasonal variation of community structure of…

1 Diatom

2 Mesozooplankton

Past Studies

Analysis of diatom data by CSK
(cooperative study of Kuroshio and adjacent regions)

Abundance
1965, Jan-Mar

Kuroshio-Oyashio
Transition waters

Fig. 1. Distribution of diatom standing crops (cells/l) and the temperature (°C) at the surface neighboring Japan from January to March 1965.

The Oceanographic Magazine. Vol. 18. Nos. 1~2

Horizontal distribution of diatom abundance was reported by Japan Meteorological Agency. However ,community structure of the diatom has not been studied. So we analyzed the community structure of diatom by using the multivariate analysis.

Data

- Data of Japan Meteorological Agency
- We digitized book data.
- Species level abundance
- Period 1949-1992
- Collected at surface（0m）
- Data number is 18032.

raw data
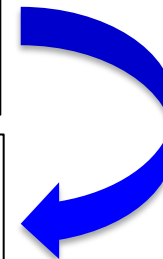
Checking and modified species name by WoRMS website
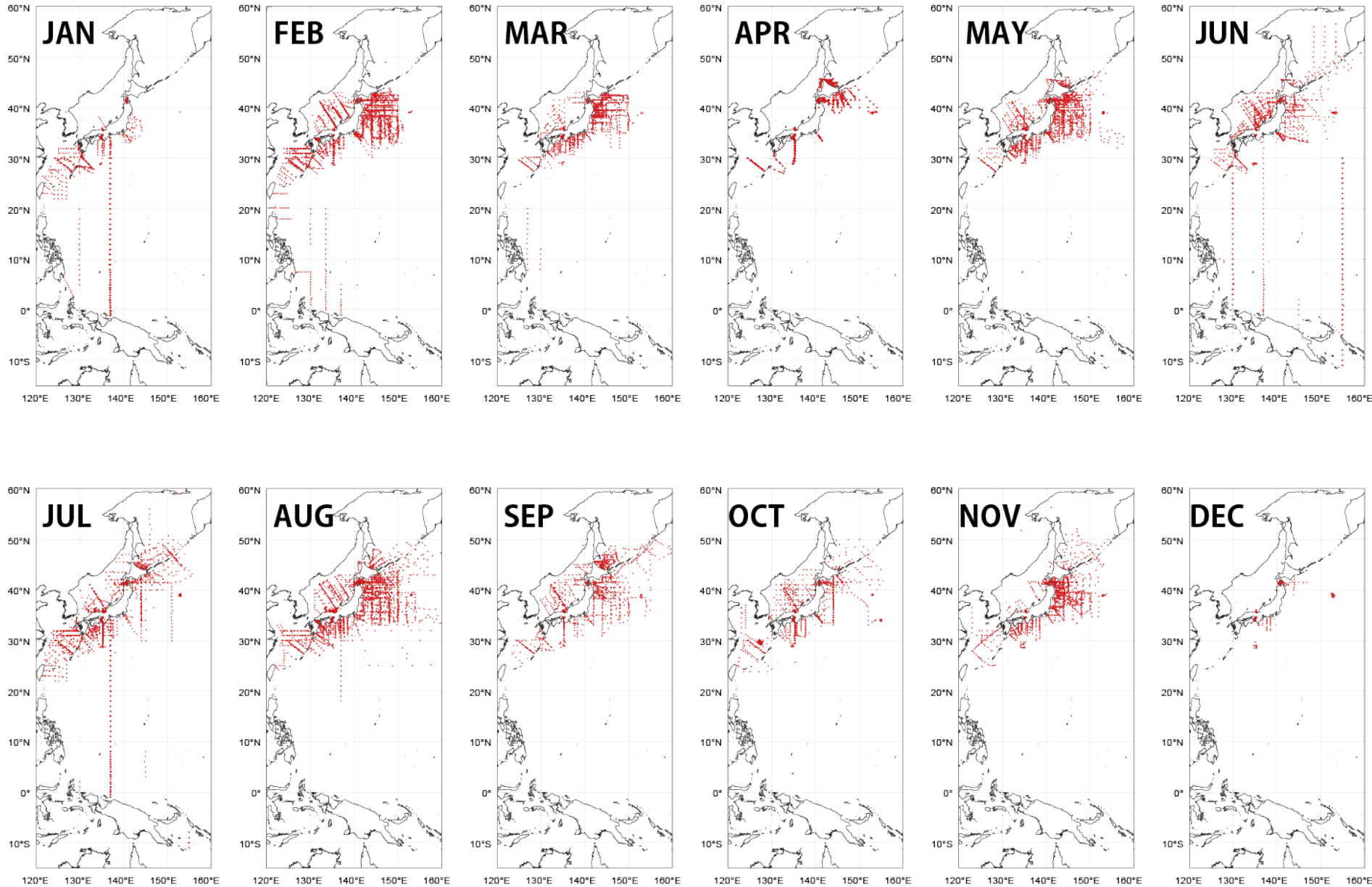

- 271 species appeared.

Data were transformed to Darwin Core format.
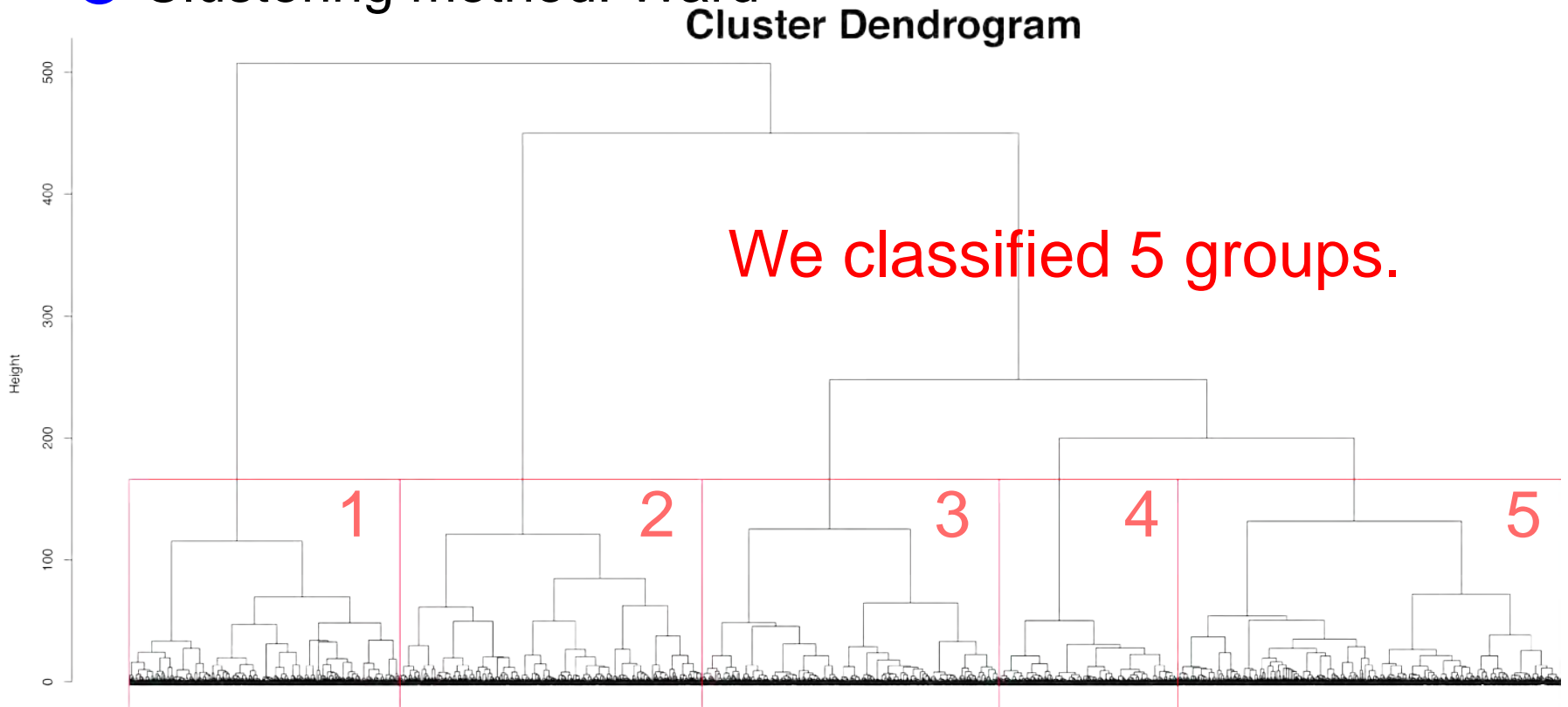

OCEAN BIOGEOGRAPHIC INFORMATION SYSTEM

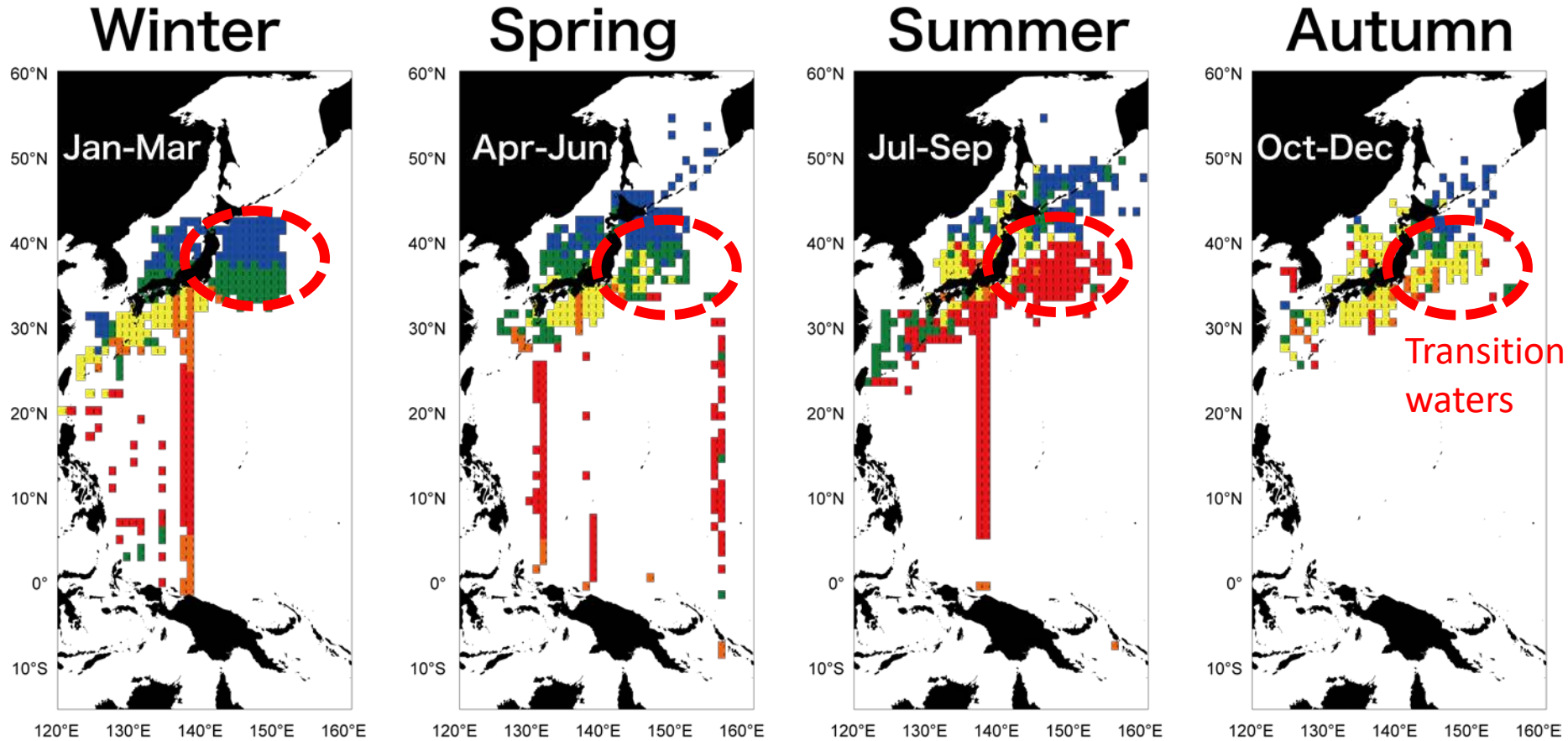# Data collecting locations for each months

Classification of community structure by cluster analysis

Method

- Species level abundance data for each station (data 18032)
- Logarithm transformed
- Similarity index: Bray-Curtis
- Clustering method: Ward

Cluster Dendrogram

We classified 5 groups.

Horizontal distribution of 5 groups for each season

Mainly appeared..

1 ■ North of 38°N
2 ■ Kuroshio-Oyashio Transition areas
3 ■ Kuroshio currents
4 ■ Appeared in equatorial
5 ■ Tropical and Subtropical areas

Top 5 species for each cluster groups

Group 1 (Colder)

Rank	Species	%
1	Chaetoceros debilis	32
2	Thalassiosira nordenskioeldii	23
3	Chaetoceros socialis	15
4	Fragilariopsis oceanica	11
5	Chaetoceros compressus	5
	Total N (cell N L-1)	138991

Group 2

Rank	Species	%
1	Skeletonema costatum	48
2	Chaetoceros compressus	11
3	Eucampia zodiacus	5
4	Chaetoceros debilis	4
5	Pseudo-nitzschia seriata	4
	Total N (cell N L-1)	31870

Group 3

Rank	Species	%
1	Skeletonema costatum	22
2	Chaetoceros compressus	13
3	Cerataulina pelagica	8
4	Leptocylindrus minimus	7
5	Chaetoceros socialis	5
	Total N (cell N L-1)	49665

Group 4

Rank	Species	%
1	Pseudo-nitzschia delicatissima	18
2	Eucampia zodiacus	9
3	Guinardia striata	7
4	Skeletonema costatum	7
5	Leptocylindrus mediterraneus	5
	Total N (cell N L-1)	28

Group 5 (Warmer)

| Rank	Species	%
1	Skeletonema costatum	40
2	Rhizosolenia calcar-avis	11
3	Climacodium biconcavum	6
4	Rhizosolenia styliformis	6
5	Leptocylindrus mediterraneus	4
	Total N (cell N L-1)	73

- *Chaetoceros debillis* is important for northern areas, on the other hand *Skeletonema costatum* is important for southern areas.

- Abundance of diatom is highest in group1 and lowest in group 4.

- More than 4000 times higher in group 1 than group 4.
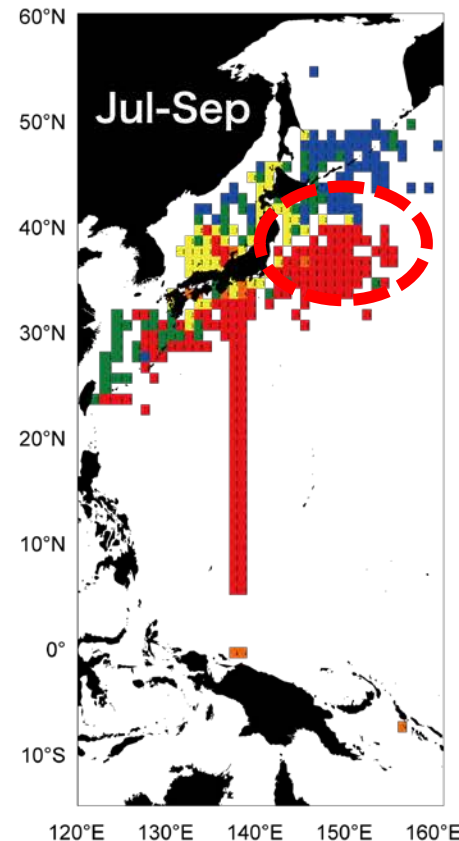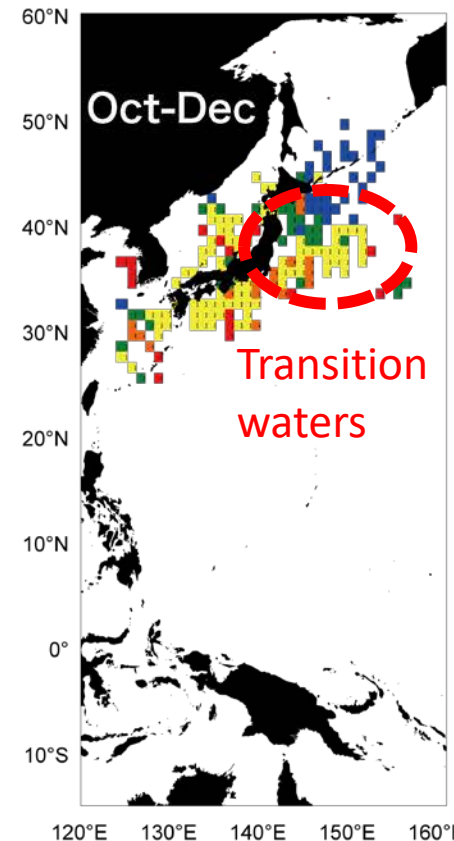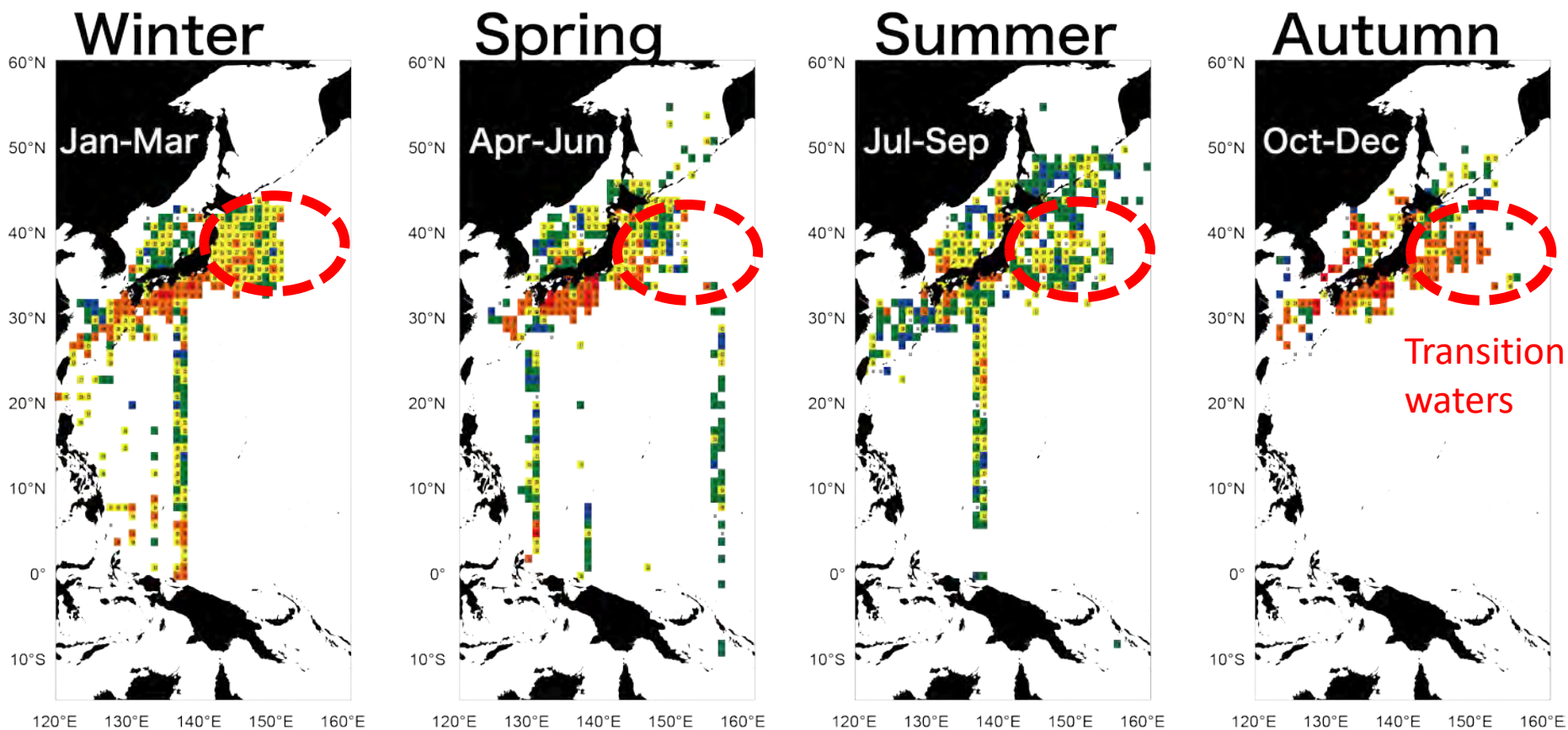
Naming of Communities
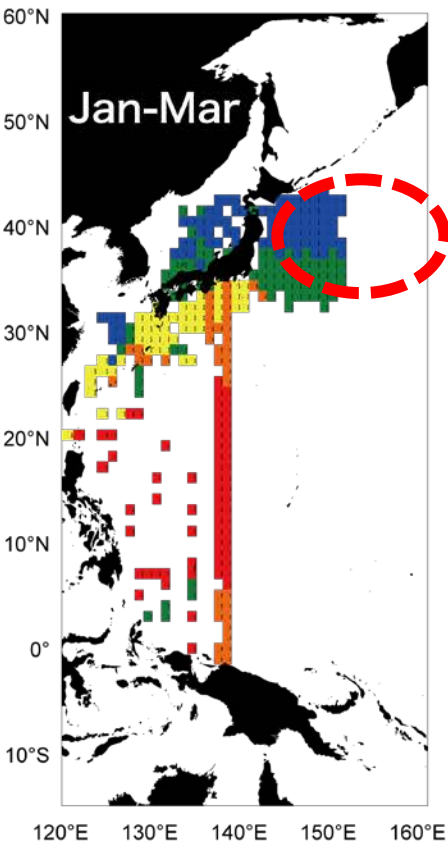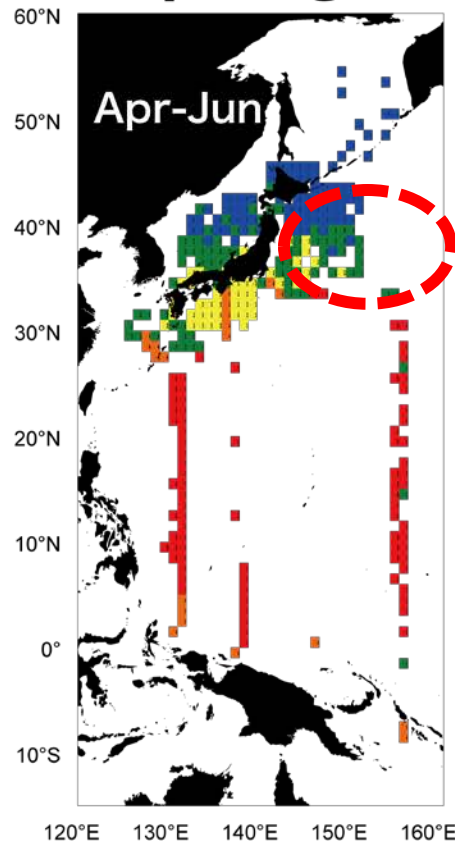
Group 1 ■	Cold water community
2 ■	Cold-warm mixed community
3 ■	Kuroshio community
4 ■	Equatorial community
5 ■	Tropical and Subtropical community

Shannon-Wiener index (H') for each season

	Winter	Spring	Summer	Autumn
	Jan-Mar	Apr-Jun	Jul-Sep	Oct-Dec

Transition waters

Shannon-Wiener H'

5
4
3
2
1

● Relatively high index values appeared in the Kuroshio-Oyashio Transition waters throughout year.

● The values increased during autumn in the Kuroshio-Oyashio Transition waters.

Summary of diatom

Community structure of diatom significantly changed in the Transition waters by the seasons.

Cold and cold- warm mixed communities dominated from winter to spring.

Tropical and Subtropical community expand that distribution to the Transition waters in summer.

Kuroshio community dominated in Autumn.

Mesozooplankton

Past study
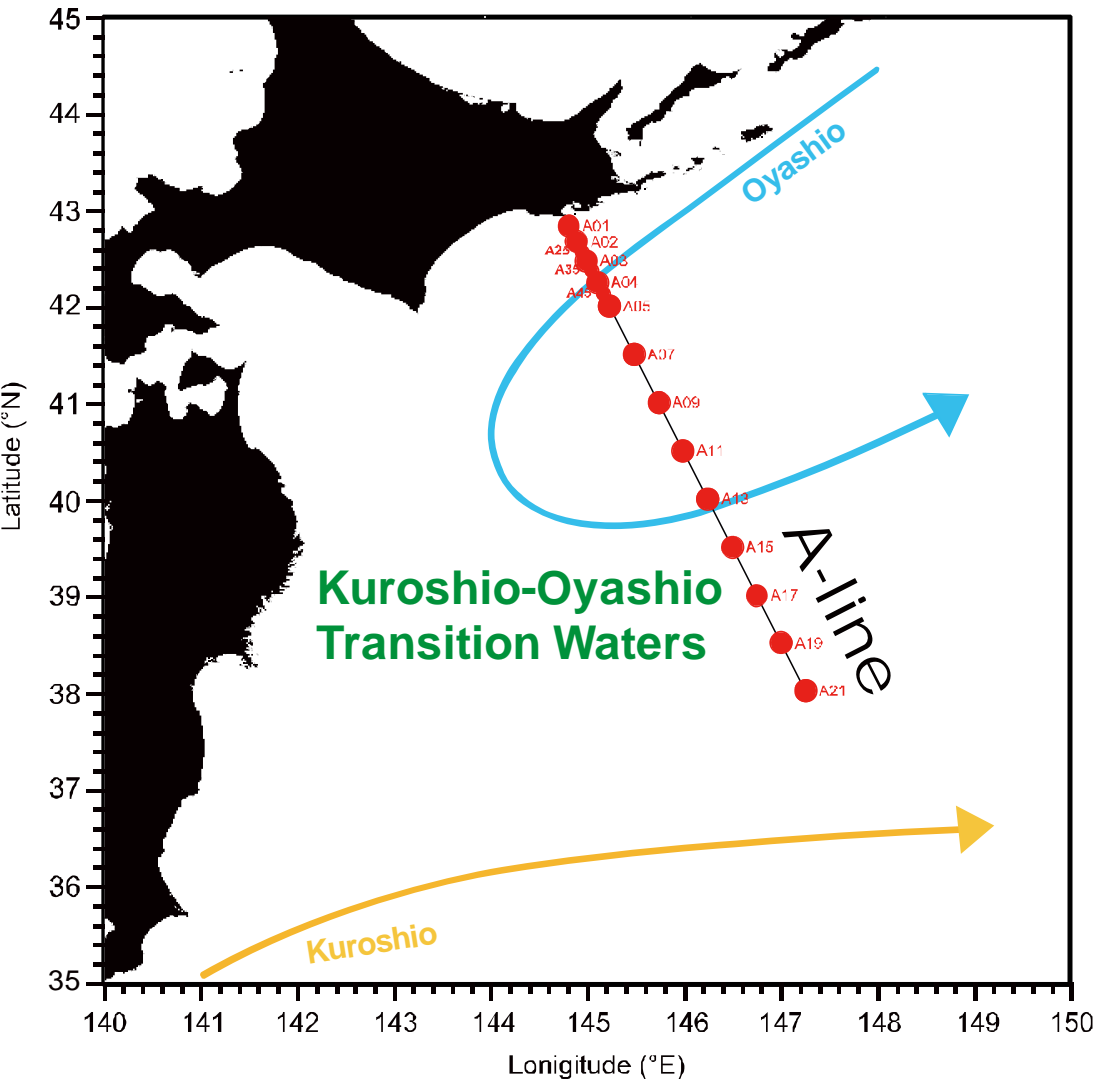
Seasonal change of the mesozooplankton biomass
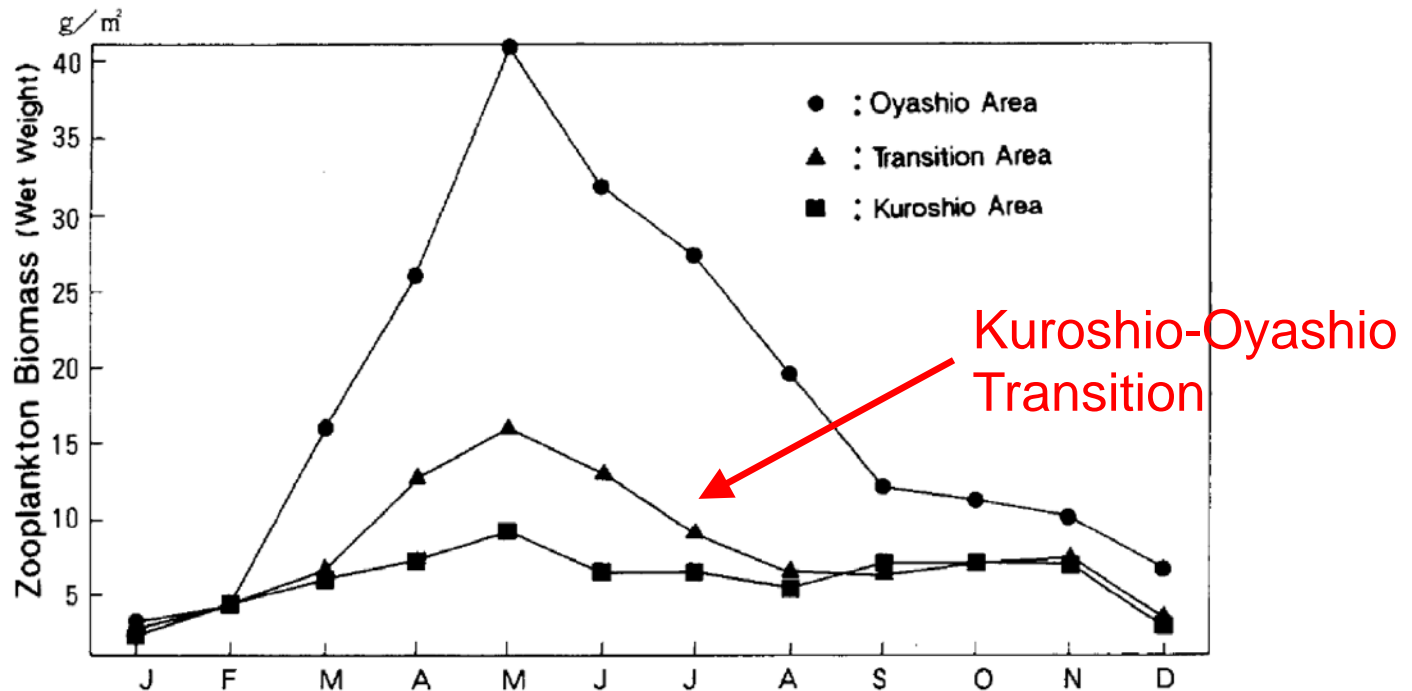
Fig. 10 Seasonal change of the total mean value of zooplankton biomass from 1951 to 1990.

Odate（1994）

Seasonal variations of the community structure is few.

Data and methods

● A-line (monitoring transect)
Total N. of stations: 16

● NORPAC net
Sampling layer: 0-150m
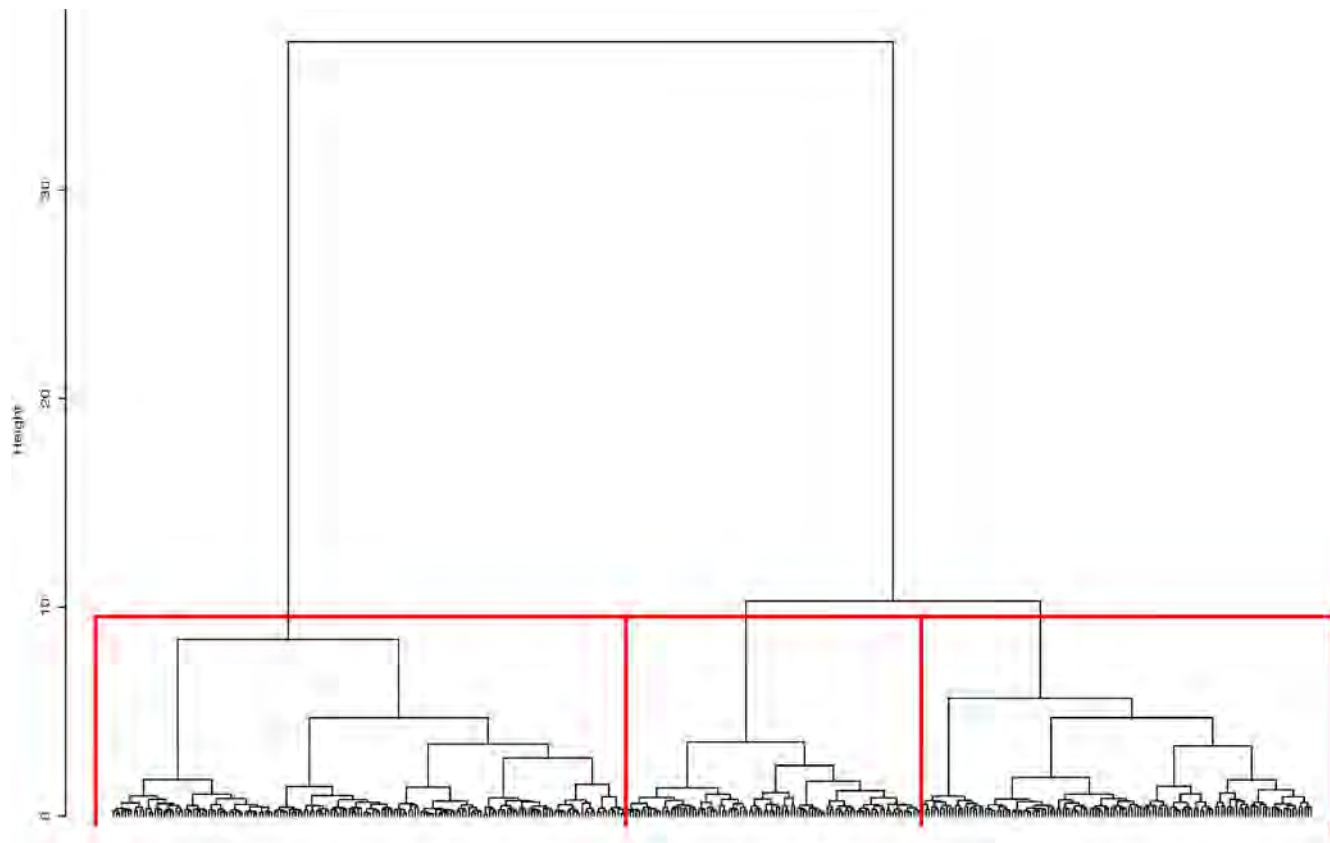Mesh size 0.335mm

● Period: 2010-2015

● Frequency: 5time per year
January, March, May, July,
October

Stations were classified by cluster analysis

Classified 3 groups

● Species level abundance data for each station
● Logarithm transformed
● Similarity index: Bray-Curtis
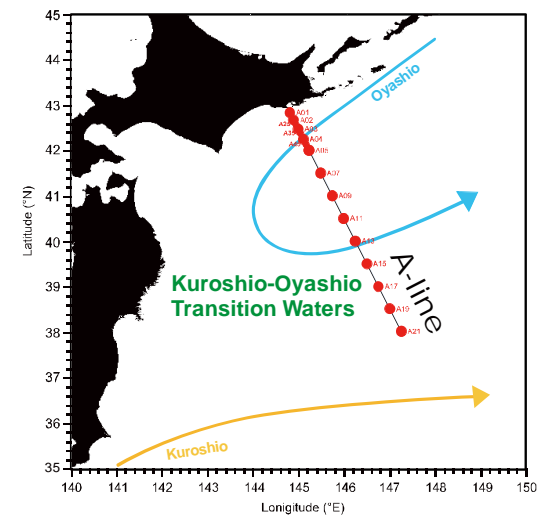● Clustering method: Ward
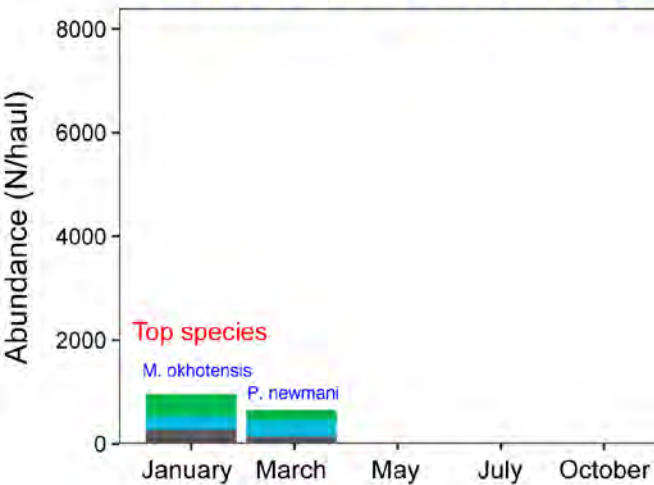
Classification of Stations by cluster analysis

Classified 3 groups

North

January | March | May | July | October
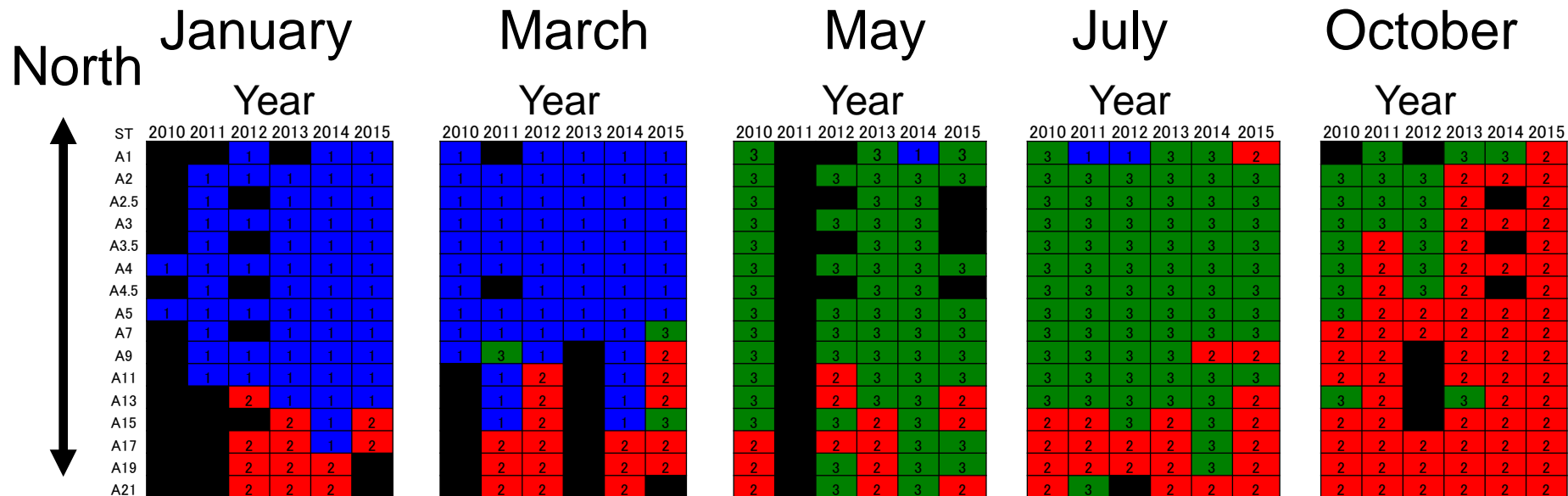
South

Group1: Cold water community

Group2: Subtropical community

Group3: Mixed community

Mean composition of each groups

Group1
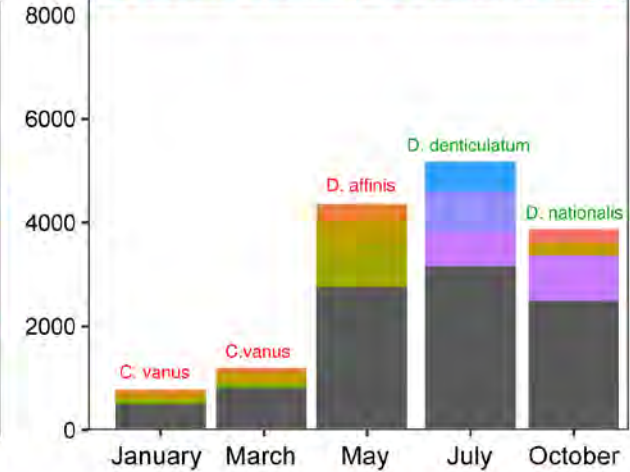**Cold water community**

Group3
Mixied community
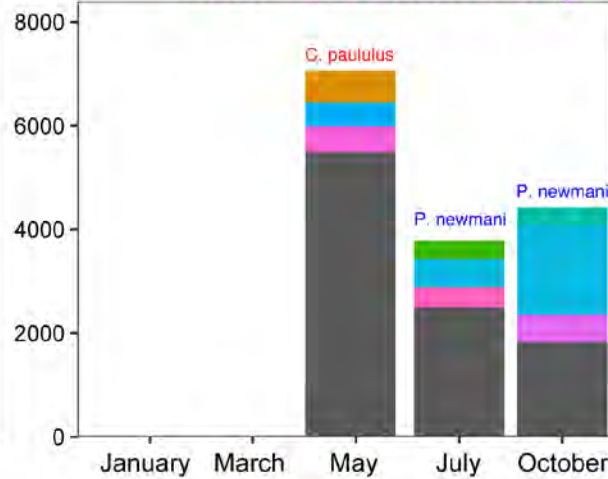
Group2
Warm water community

Abundance (N/haul)

Top species
M. okhotensis
P. newmani

C. paululus
P. newmani
P. newmani

D. denticulatum
D. affinis
D. nationalis
C. vanus
C.vanus

Non copepods
- Vibilia armata
- Penilia avirostris
- Doliolum denticulatum
- Doliolum nationalis
- Fritillaria tenella
- Oikopleura intermedia
- Oikopleura parva
- Others

Cold water copepods
- Eucalanus bungii
- Metridia okhotensis
- Neocalanus cristatus
- Paracalanus gracilis
- Pseudocalanus minutus
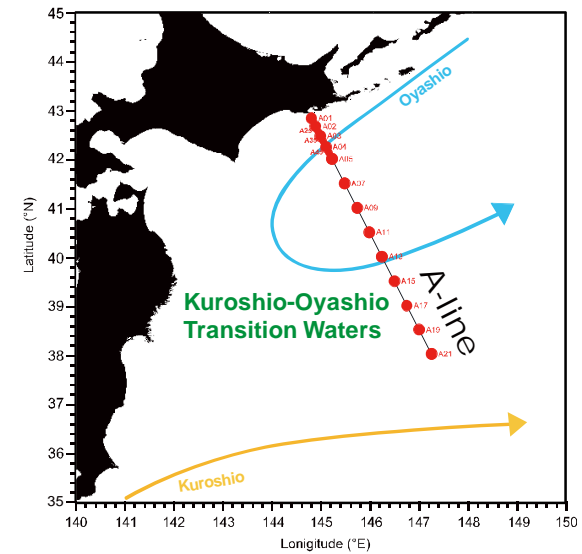- Pseudocalanus newmani

Warm water copepods
- Clausocalanus furcatus
- Clausocalanus parapergens
- Clausocalanus paululus
- Ctenocalanus vanus
- Ditrichocorycaeus affinis
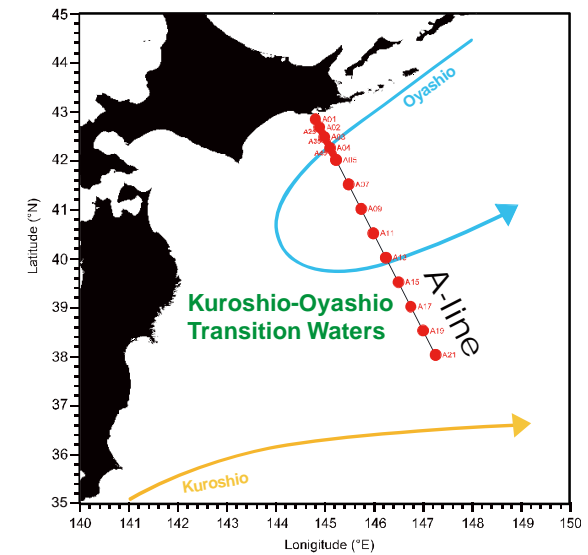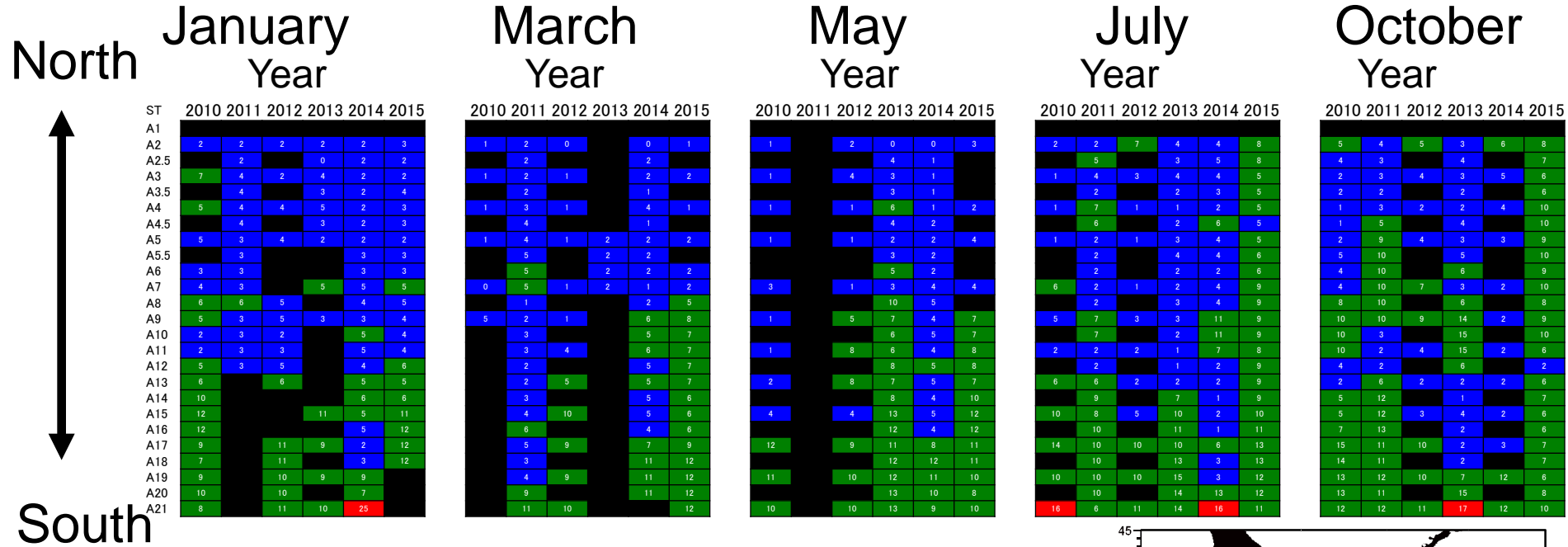- Oithona atlantica

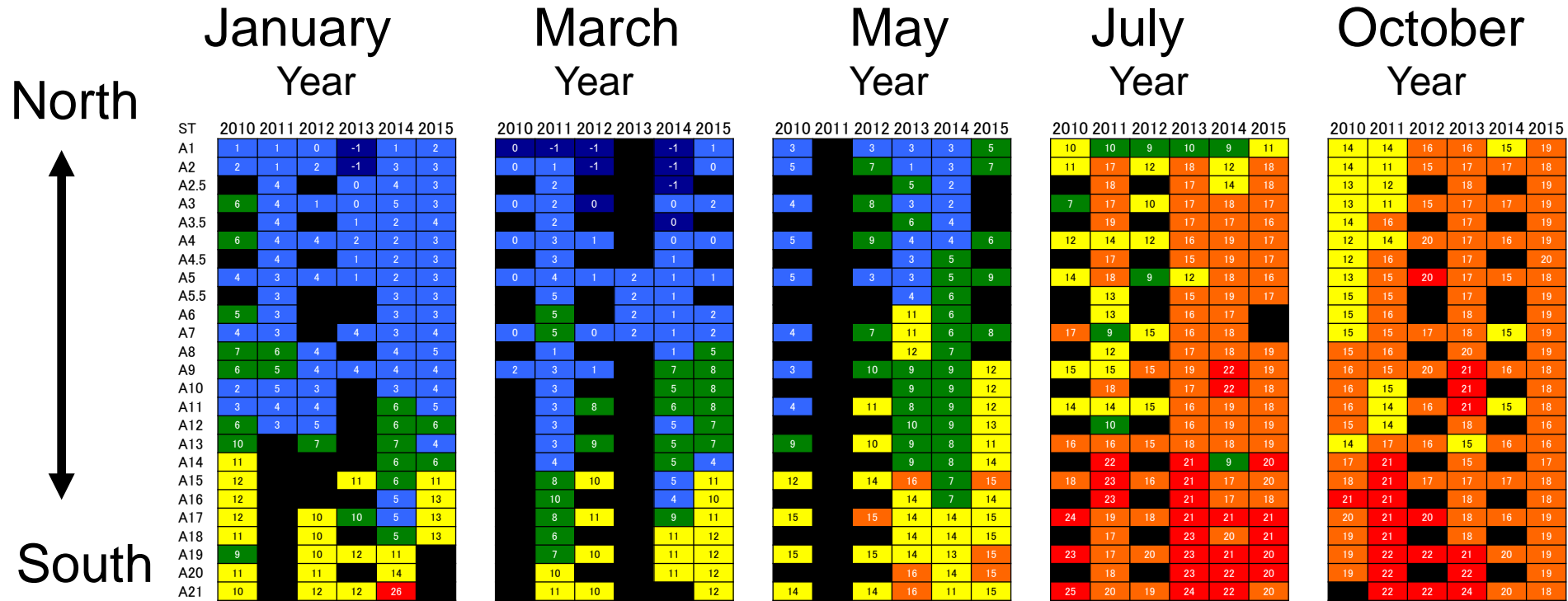# Biodiversity index

Shannon-Wiener (H')
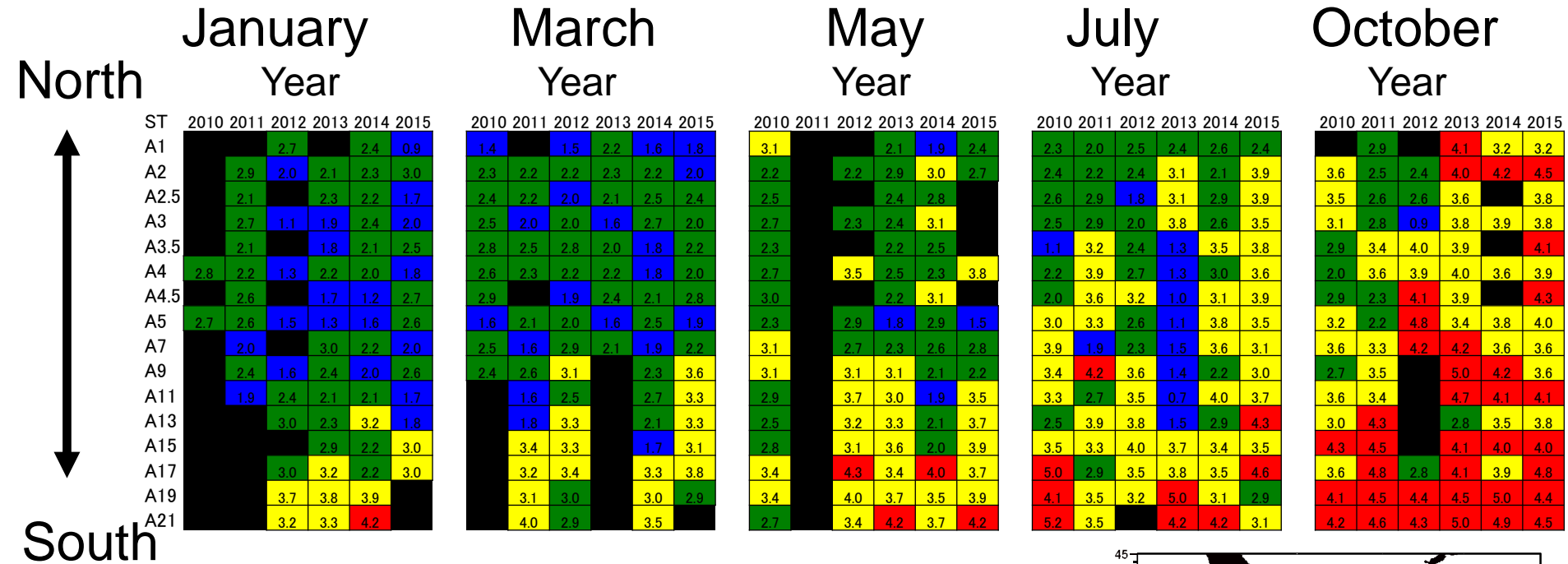
Biodiversity index represented
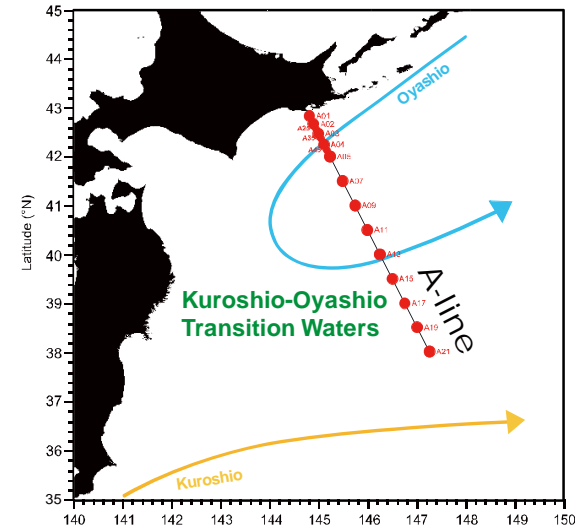Significant seasonal change.

Temperature at 100m
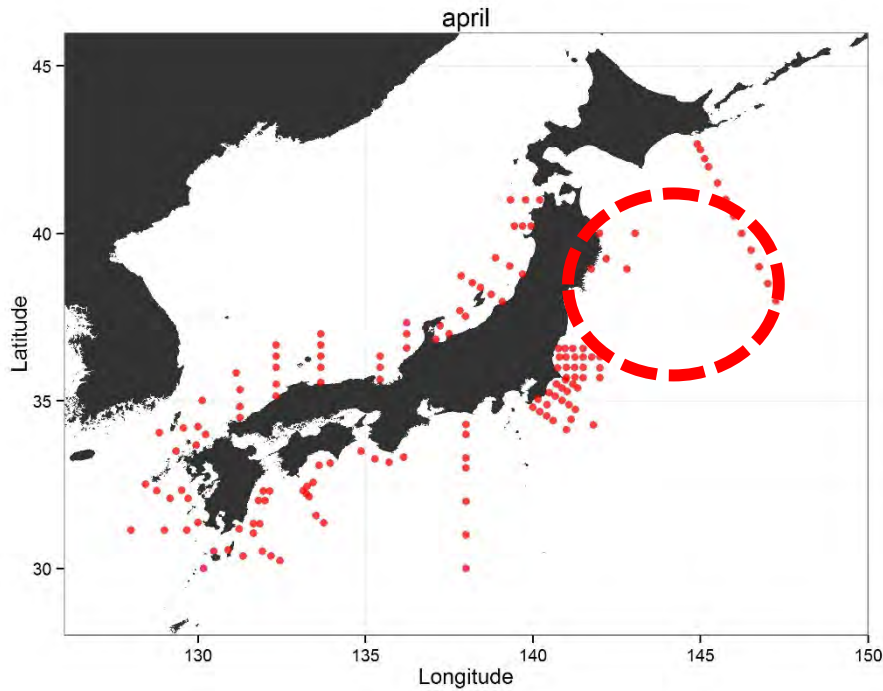## index of water mas classification

Temperature at surface (10m)

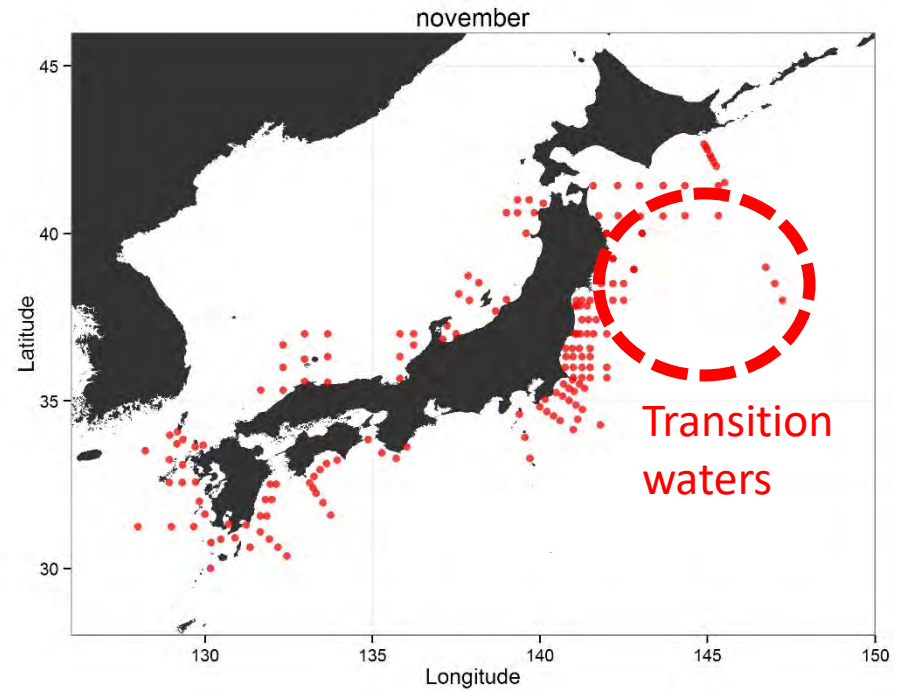The surface temperature represented significant seasonal change.

Results of simultaneous comprehensive observation around Japan

April, 2012
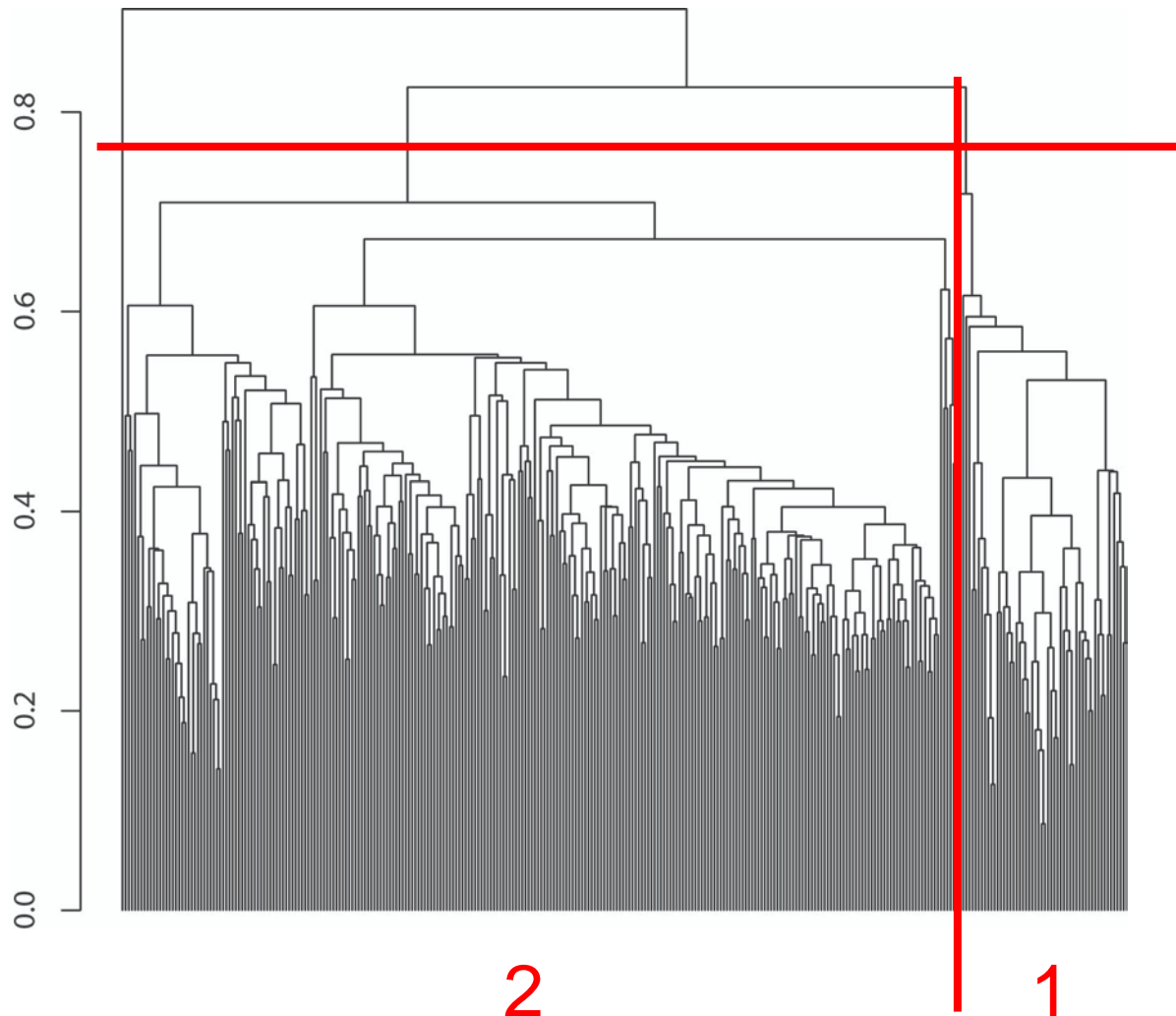

November, 2012

Transition waters

NORPAC net
Sampling layer: 0-150m
Mesh size 0.335mm

Miyamoto (in prep.)

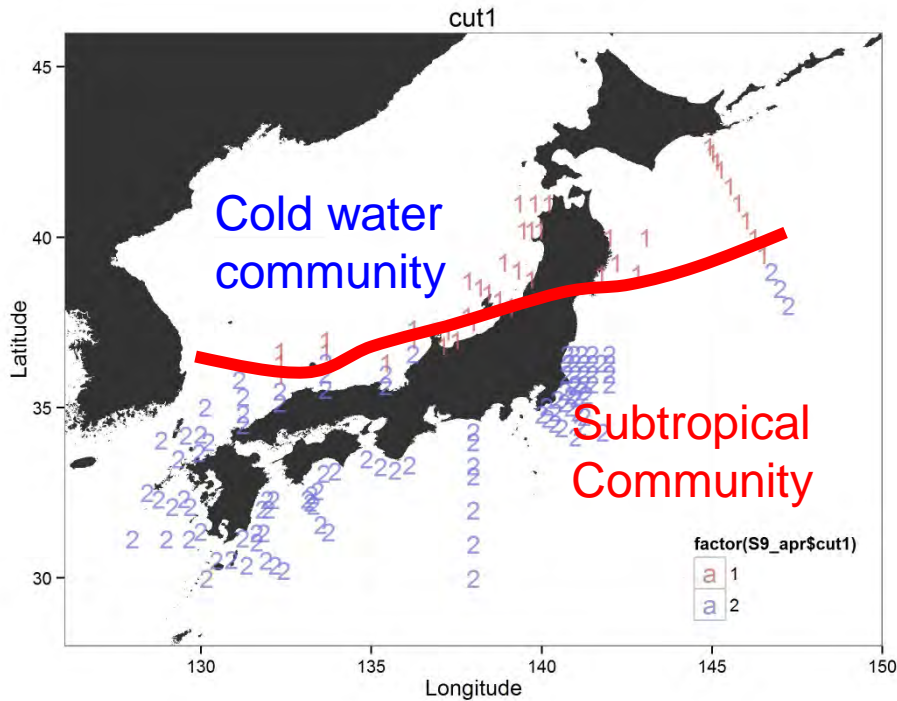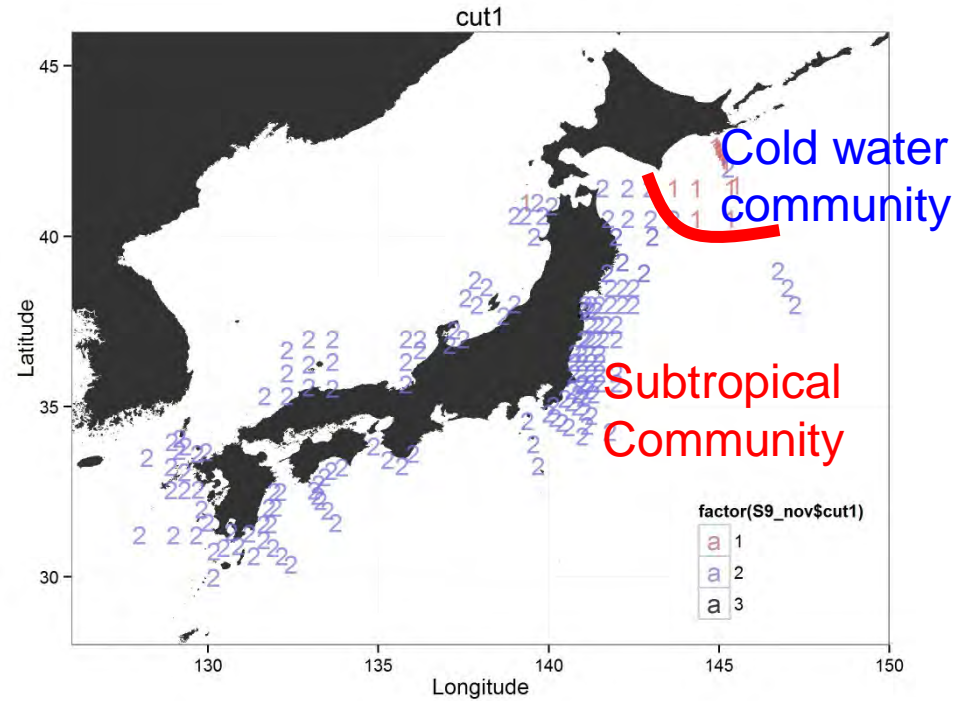# Stations were classified by cluster analysis

Classified 2 groups

Distribution of groups by cluster analysis

Distribution of subtropical community represented significant northward shift in November.

Summary

1. Community structure of diatom and mesozooplankton represented significant change by season in the Kuroshio-Oyashio Transition waters.

2. In diatom, cold water community dominated from winter to spring, subtropical-tropical group dominated in summer, and Kuroshio community dominated in autumn.

3. In mesozooplankton, cold water community dominated in January to March, mixed community dominated in May to July, and subtropical community dominated in October.

4. Seasonal variation of plankton community will be associated to the variation in surface layer temperature.