

SPATIAL DISTRIBUTION OF PHYTOPLANKTON COMMUNITY IN THE KONGSFJORDEN, SPITSBERGEN



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Abstract

The marine ecosystem in Kongsfjorden (79°N), a glacial fjord in Svalbard, is to a large extent well known with regard to hydrography, mesozooplankton and higher trophic levels. Research on primary production and lower trophic levels is still scarce and especially investigations from winter and spring periods. To determine the spatial distributions of phytoplankton communities in the Kongsfjorden, we analyzed algal samples during spring and autumn seasons using light microscopic examinations of slides prepared by the HPMa method. The data for the period 2017–2018 were collected.

Temperature and salinity were higher in the outside than in the fjord. And regional differences were larger in autumn than in spring. In the spring of 2017, phytoplankton communities dominated by nano and pico sized phytoplankton such as *Phaeocystis* species. In 2018, the relative abundance was lower than in 2017 and diatoms such as *Fragilariopsis oceanica* showed a high ratio. The species diversity was relatively high in spring (79 taxa in 2017, 57 taxa in 2018) compared to autumn (52 taxa in 2017).

Based on the results, it was determined that *Phaeocystis* sp., *Pyramimonas* sp., *Paralia sulcata*, *Thalassiosira* sp., Nano-size unidentified species and Pico-size unidentified species were indicate species in this study area. The vertical mixing of the water masses has been done to some extent, but the influx of the Atlantic water (AW) of high temperature and salinity will be more influential on the phytoplankton. A better understanding of the ecology of phytoplankton communities in the Kongsfjorden will require multi-season and multi-year analyses.

Objectives

The Characteristics on the spatio-temporal distribution of phytoplankton communities in Kongsfjorden, Svalbard

- To understand characteristics of phytoplankton communities in study area
- To improve understanding correlation between phytoplankton communities and environmental factors

Materials and Methods

- ✓ **Study area**
 - 10 stations in Kongsfjorden, Svalbard
 - May, October in 2017, April in 2018
- ✓ **Hydrographic environmental factors**
 - CTD : The hydrographic characteristics and fluorescence profiles were determined by CTD made with a RBR(RBRconcerto³)
 - Nutrients : Major inorganic nutrients were measured using QuAatro auto analyzer(Seal Analytical, UK)
- ✓ **Chlorophyll a concentration**
 - Samples to be used for the estimation of the size-fractionated chl a were fractionated sequentially on to 20, 2.0 and 0.2 um polycarbonate membranes. Quantitative analyses were performed by Fluorometer(Trilogy, Turner Designs)
- ✓ **Quantity analysis of phytoplankton**
 - All samples were preserved with glutaraldehyde(final concentration 1%). Sample volumes of 100mL were filtered through GN-6(0.45um) filter. The filters were mounted on microscopic slides in a water-soluble embedding medium(HPMA). Phytoplankton in all slides were identified using a microscope(Zeiss, El-einsatz).

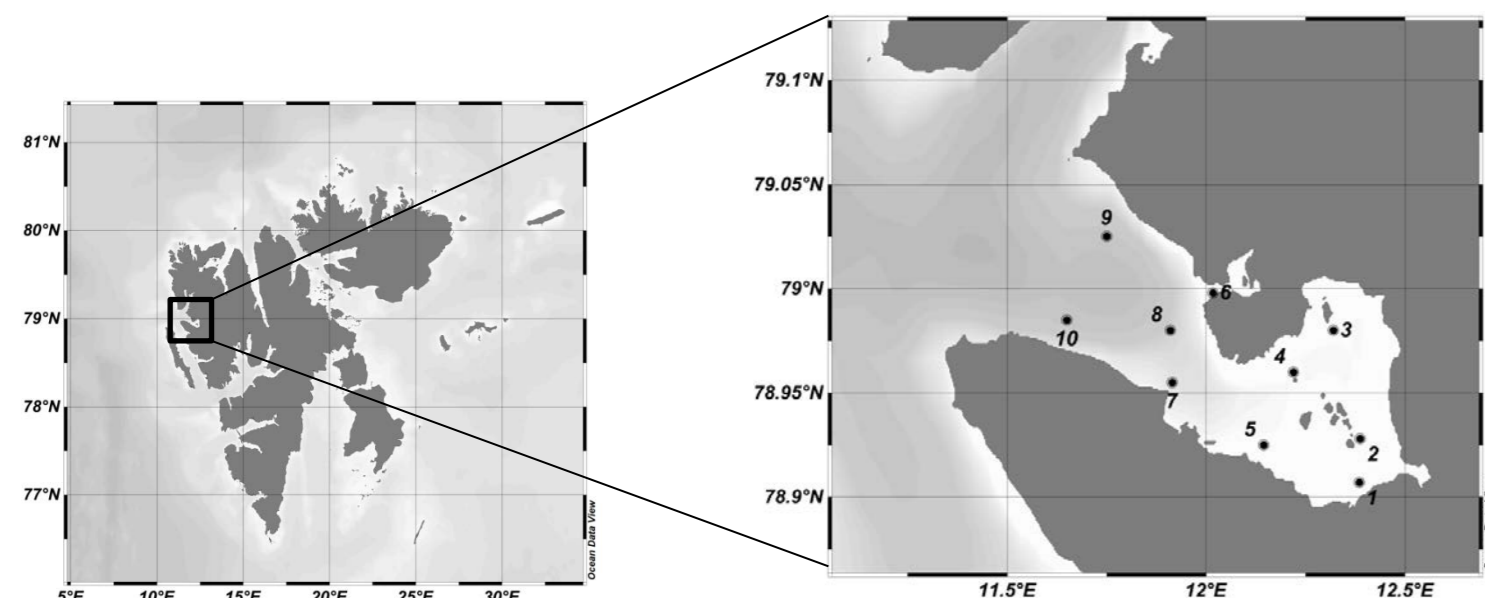


Fig 1. Study area

Summary and Conclusions

- ✓ **Hydrographic characteristics**
 - The nutrients concentration at surface water is higher in spring season(April, May) than autumn season(October)(Figure 2, 3) and shows high level in most of stations except near ice. We considered that large amount of nutrients from Atlantic waters flow into this study area. (Paper in progressing. Not presented in this poster)
 - There is no freezing of ice during this study period. The temporary inflow of large numbers of sea ice from outside of Kongsfjorden was observed during spring season.
- ✓ **Biological characteristics**
 - The phytoplankton blooms occurred after mid-April(Figure 4~7). Dominant species during the blooms period(May) were initially the larger phytoplankton(micro size) and changed to the smaller phytoplankton such as nano and pico-sized plankton(Figure 8).
 - The most abundant species during blooms period was *Phaeocystis* sp forming colony. *Phaeocystis* sp was the most abundant species that caused phytoplankton blooms(Table 1; Figure 9)
 - There were seasonal, regional differences in diversity, but was no noticeable tendency.
- ✓ **Summary**
 - Kongsfjorden is affected by Atlantic water although locate in high latitude. Because of this, we consider phytoplankton communities in this area are affected more by nutrients and lights than sea ice and temperature(additional analysis progressing).
 - Results of this study accord with previous studies and correlation analysis between phytoplankton communities and environmental factors is progressing.
 - A better understanding of the ecology of phytoplankton communities in the Kongsfjorden will require multi-season and multi-year analyses.

Results

✓ Hydrographic environment factors (Nutrients, CTD)

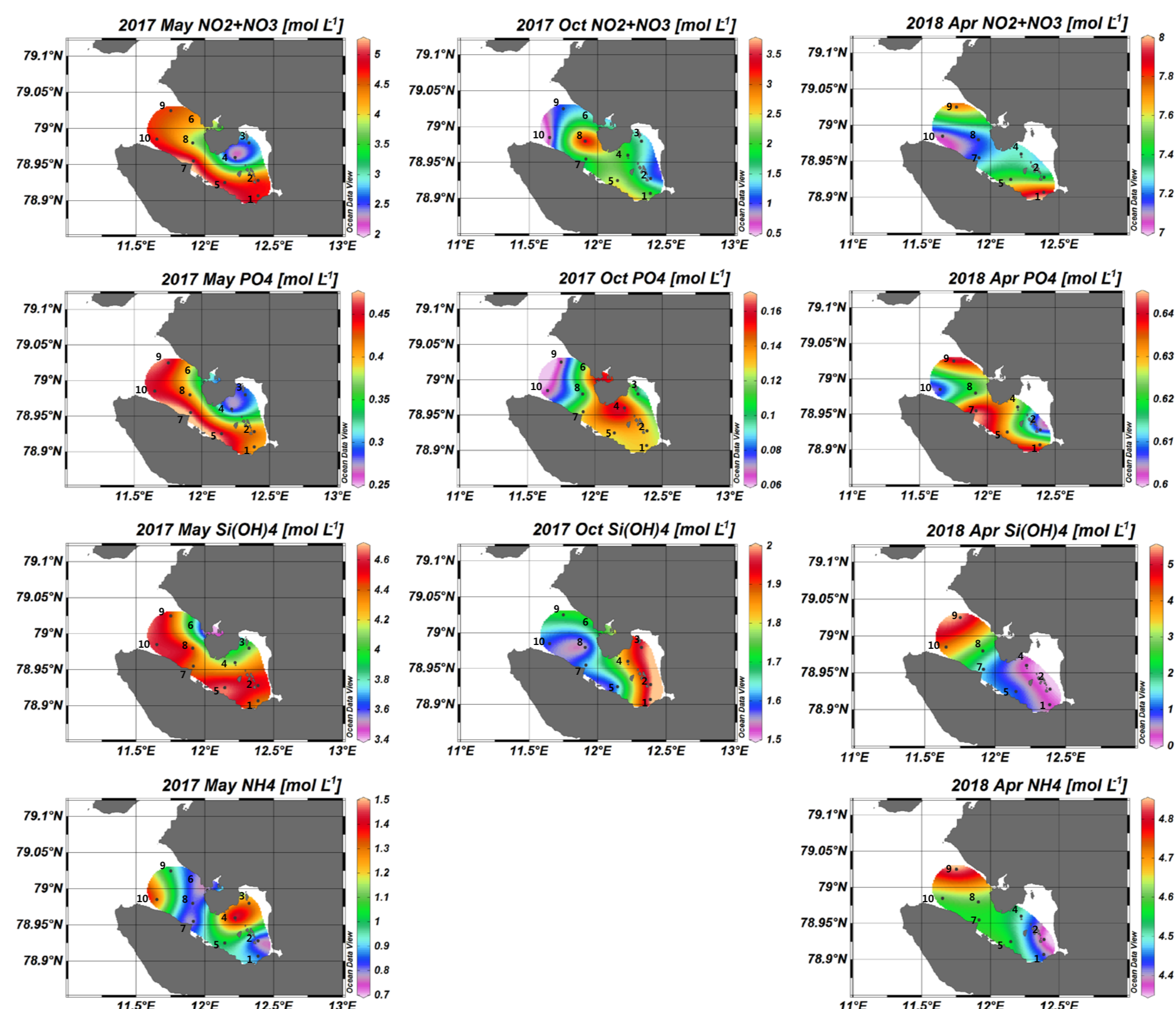


Fig 2. Nutrients distribution at surface waters in Kongsfjorden(2017, 18)

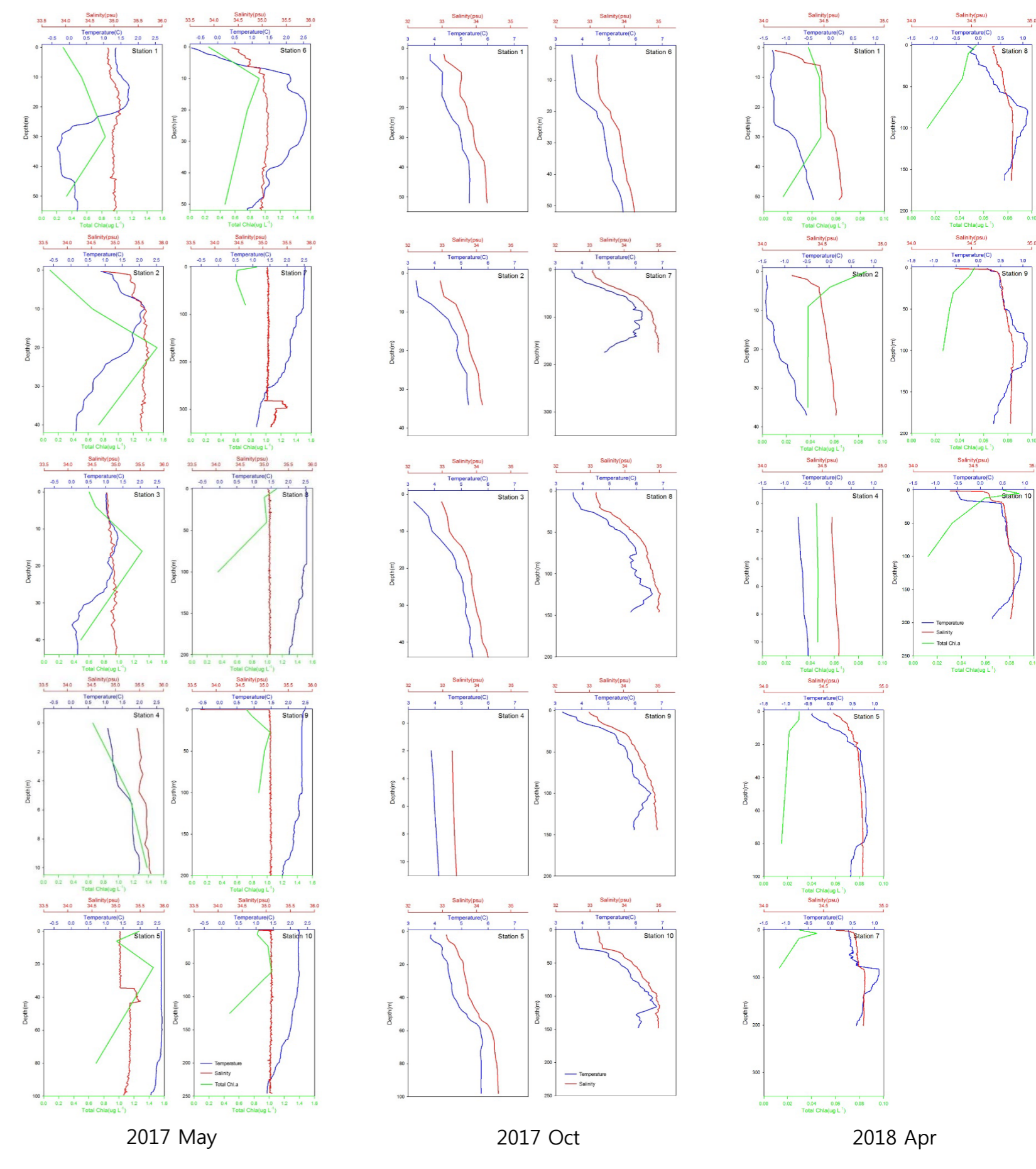


Fig 3. Vertical profile of temperature, salinity, total chlorophyll a in Kongsfjorden (2017, 18)

✓ Chlorophyll a (Total, Size fraction)

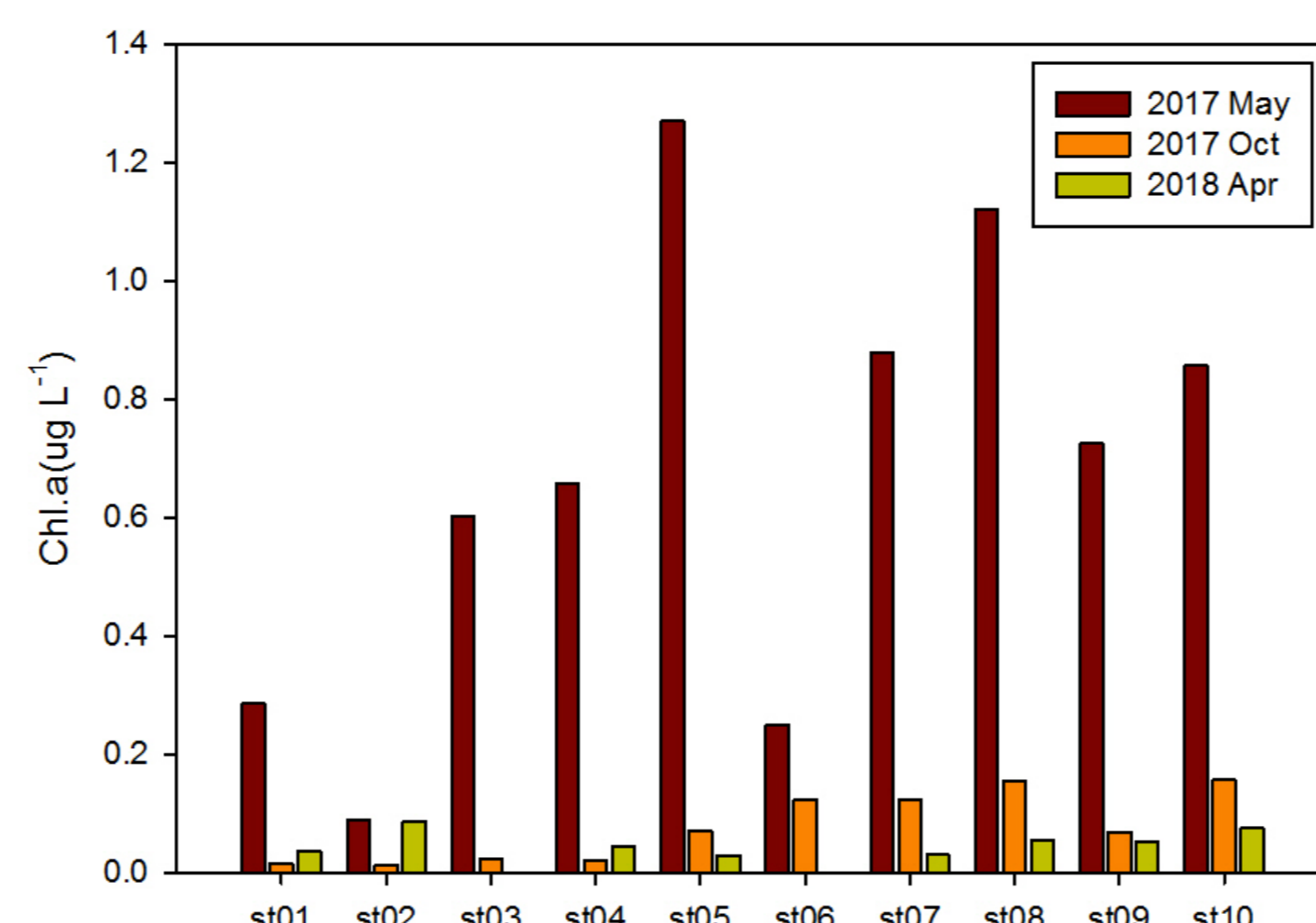


Fig 4. Total Chlorophyll a concentration at surface waters in Kongsfjorden(2017, 18)

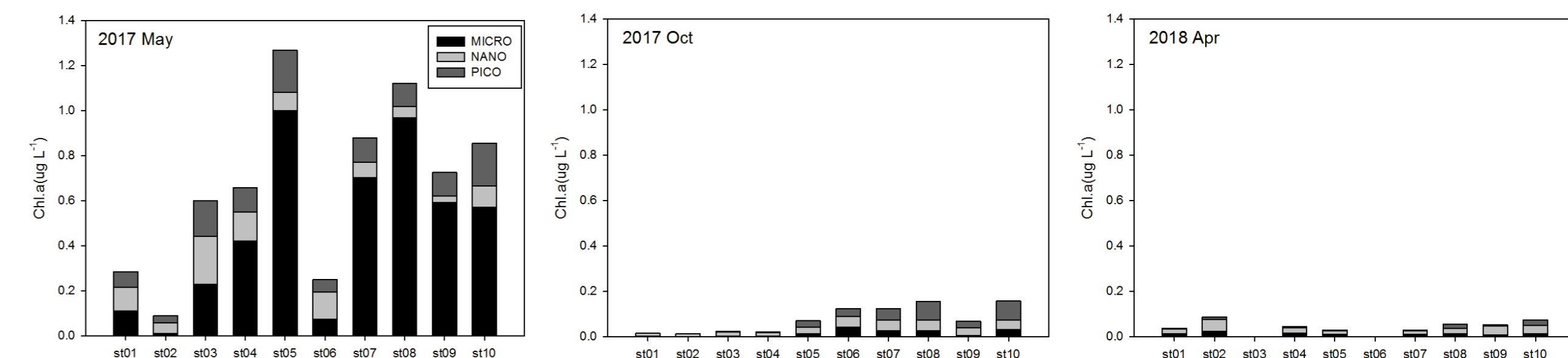


Fig 5. Chlorophyll a concentration by size at surface waters in Kongsfjorden(2017, 18)

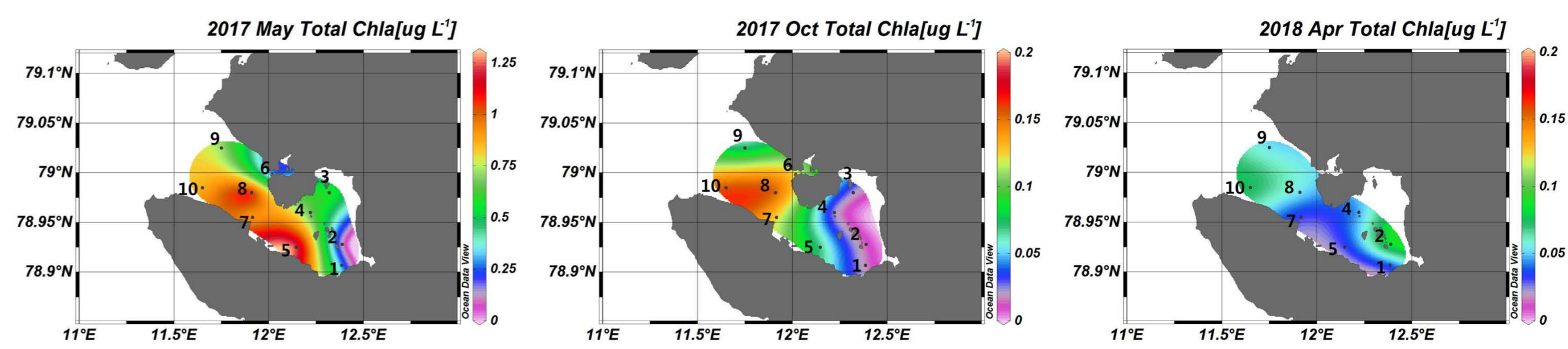


Fig 6. Chlorophyll a concentration distribution at surface waters in Kongsfjorden(2017, 18)

✓ Phytoplankton Abundance, Diversity

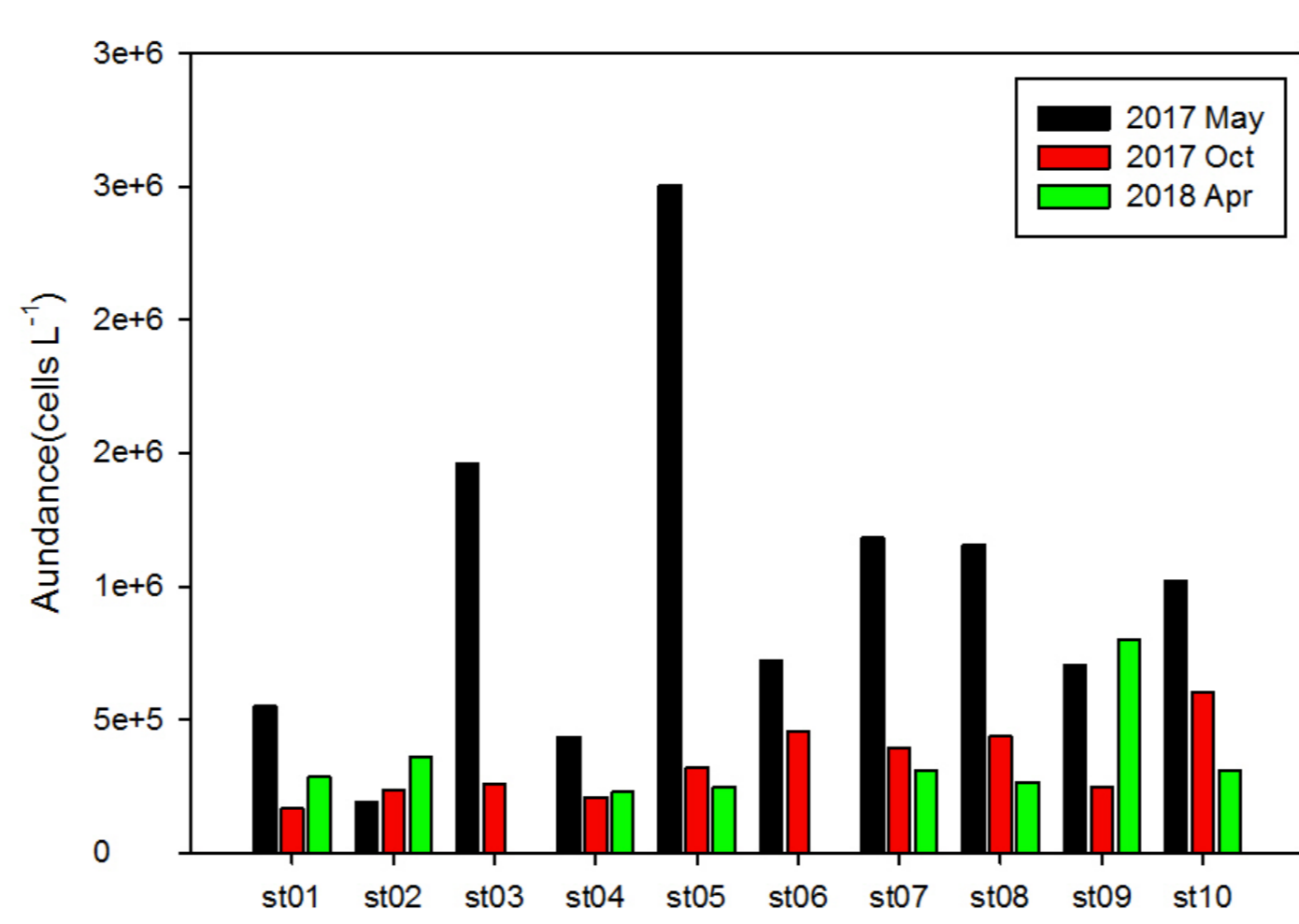


Fig 7. Phytoplankton abundance at surface waters in Kongsfjorden(2017, 18)

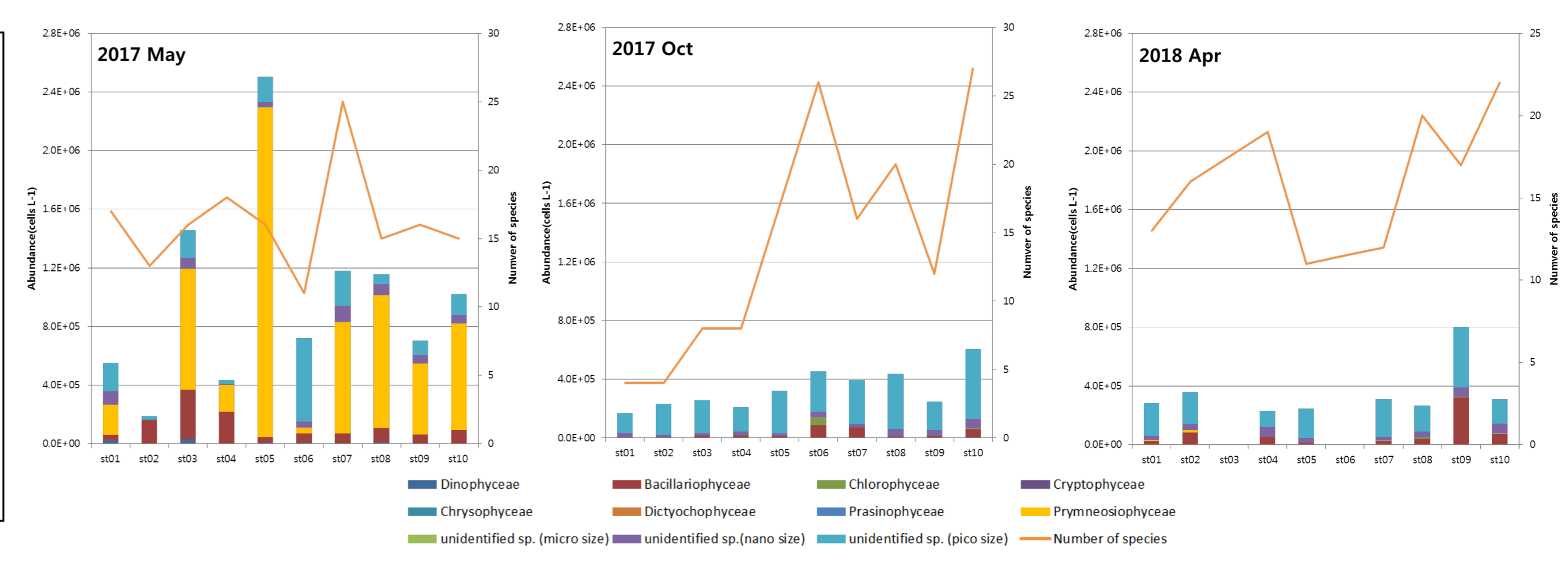


Fig 8. Phytoplankton relative abundance and diversity at surface waters in Kongsfjorden(2017, 18)

Year	Station	1st	2nd	3rd
2017 May	st01	<i>Phaeocystis</i> sp.	<i>Navicula vanhoefenii</i>	<i>Phaeocystis</i> sp.
	st02	<i>Gymnodinium wulfi</i>	<i>Nitzschia frigida</i>	<i>Fragilariopsis oceanica</i>
	st03	<i>Fragilariopsis cylindrica</i>	<i>Fragilariopsis cylindrica</i>	<i>Navicula vanhoefenii</i>
2017 Oct	st01	<i>Navicula</i> sp.	<i>Pseudonitzschia</i> sp.	<i>Minidiscus</i> sp.
	st02	<i>Pseudonitzschia seriata</i>	<i>Thalassiosira</i> sp. (< 20um)	<i>Fragilariopsis</i> sp. (< 20um)
	st03		<i>Thalassiosira</i> sp. (< 20um)	<i>Pseudonitzschia</i> sp.
2018 Apr	st01	<i>Fragilariopsis</i> sp.	<i>Fragilariopsis oceanica</i>	<i>Navicula vanhoefenii</i>
	st02	<i>Phaeocystis</i> sp.	<i>Navicula vanhoefenii</i>	<i>Fragilariopsis</i> sp. (> 20um)
	st03	<i>Thalassiosira</i> sp. (< 20um)	<i>Phaeocystis</i> sp.	<i>Chaetoceros wighamii</i>

Table 1. Major dominant species at surface waters in Kongsfjorden(2017, 18)

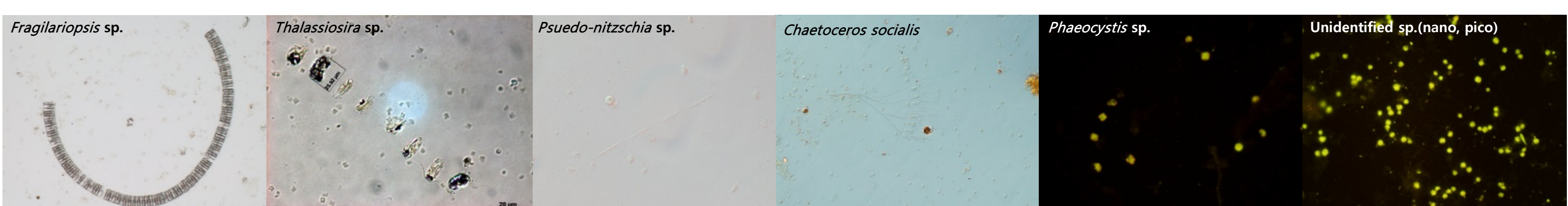


Fig 9. Microscopic images of major dominant species at surface waters in Kongsfjorden(2017, 18)

Acknowledgments

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