# Seasonal dynamics of dissolved inorganic nutrients in the Bering Sea

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## Introduction

- Bering Sea (BS) ecosystem supports commercially valuable fisheries
- BS ecosystem is suggested to depend on climate change; BS waters influence on Arctic Ocean
- Knowledge of nutrient dynamics is essential for understanding of the BS and Pacific Arctic ecosystem functioning
- Yet, this sort of research in the BS are regional and sparse in time
- Large amount of nutrient data is collected for the region
- **What is mean seasonal nutrient dynamics?**
- **Is there any regional distribution of seasonal nutrient draw-downs?**

## Methods

- Data on temperature and nutrients profiles: WOD (USA), JAMSTEC (Japan), TINRO-Center (Russia)
- Seasonal (July-September) averaging in 1°×2° (lat×lon) bins for every year, and then between years
- Data standardization, cluster analysis of multiannual data in coordinates ($T_{10m}$, $O_{10m}$, $Si_{10m}$, $P_{10m}$, $T_{50m}$, $O_{50m}$, $Si_{50m}$, $P_{50m}$)
- Expert evaluation and adaptation of results to published information on currents, mixing, and fronts
- Monthly averaging of existing data on nutrients within regions

## Results

Cluster analysis of T, $O_2$, Si, P multiannual mean summer distribution

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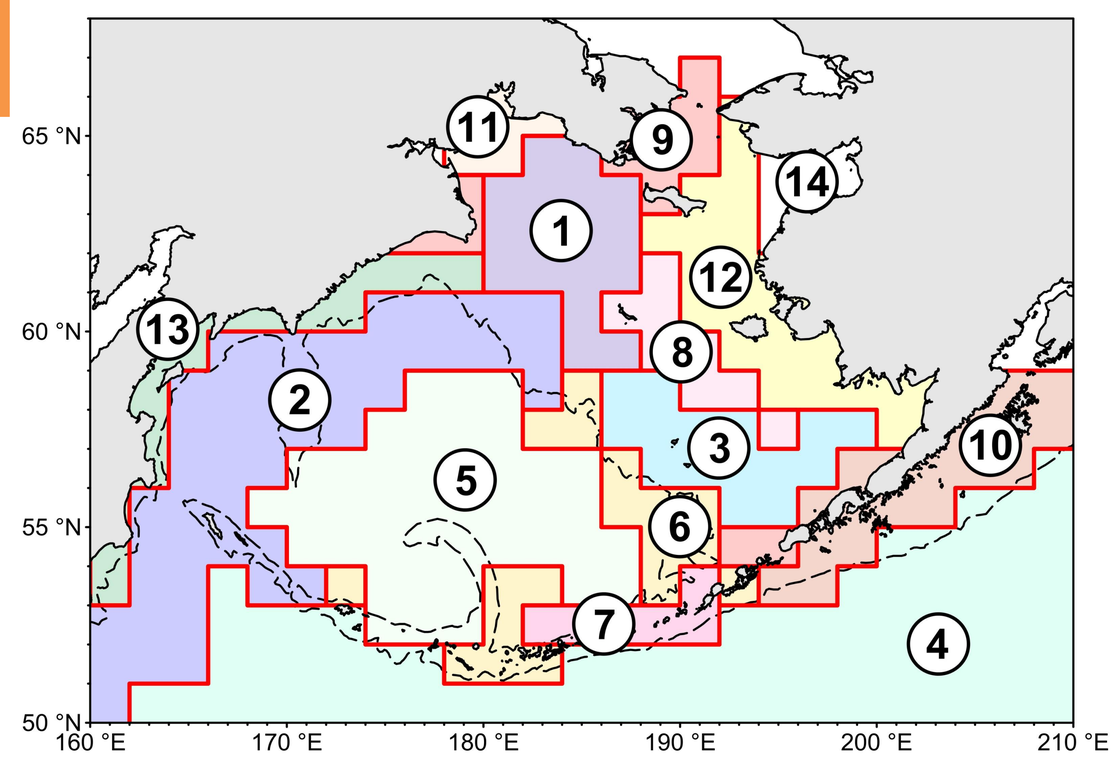
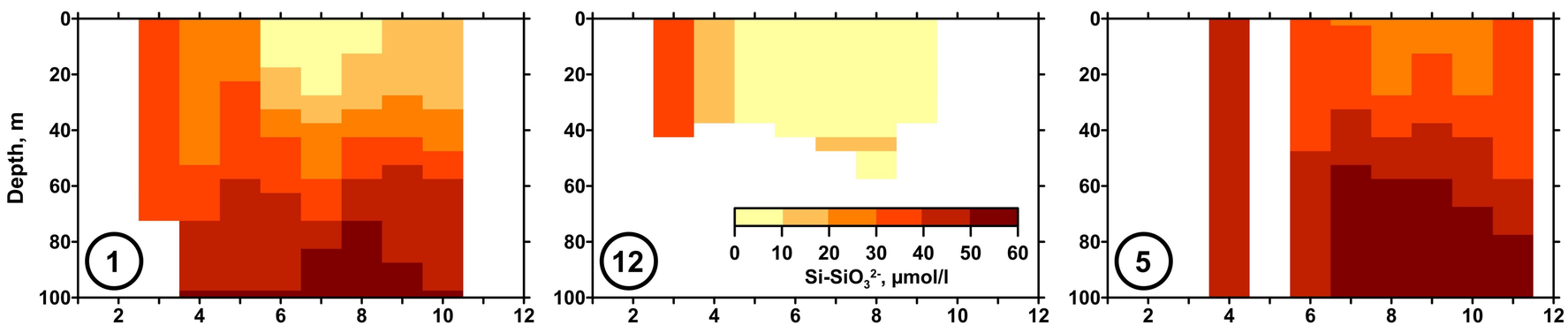
Published data on currents, fronts etc.

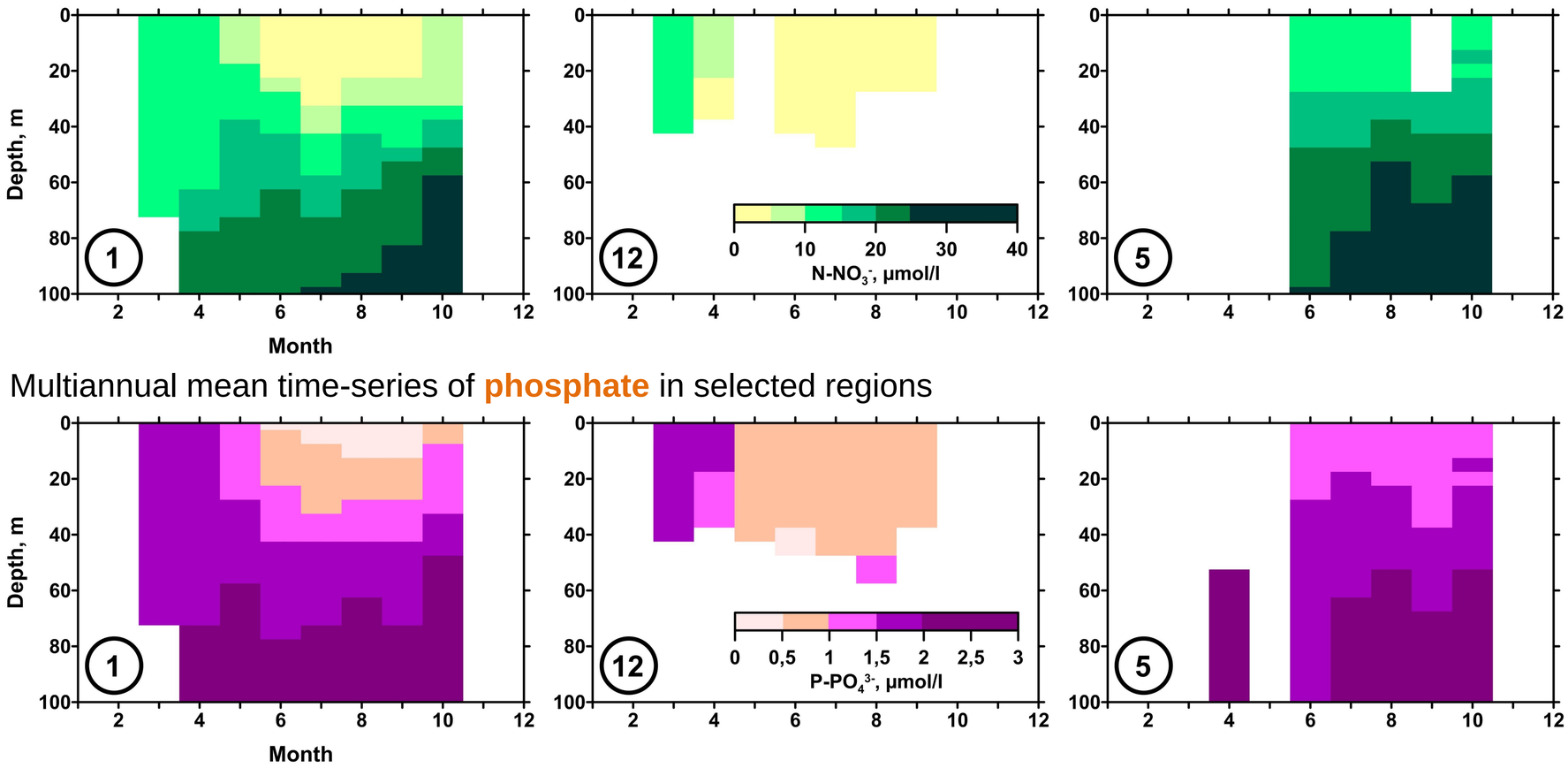
Oceanographic regions




Multiannual mean time-series of **silicate** in selected (northern shelf, inner shelf, and deep central) regions




Multiannual mean time-series of **nitrate** in selected (northern shelf, inner shelf, and deep central) regions




Multiannual mean time-series of **phosphate** in selected regions




Ratios of seasonal nutrients draw-downs and net community production

| Region | Months | ΔSi:ΔP | ΔSi:ΔN | ΔN:ΔP | NCP g C $m^{-2}$ $yr^{-1}$ |
|---|---|---|---|---|---|
| 1 | III-VII | 32 | 3.6 | 9 | 28 |
| 2 | IV-VII | 28 | 2.0 | 14 | 52 |
| 3 | IV-VIII | 21 | 1.8 | 12 | 31 |
| 5 | V-IX | 24 | 1.6 | 15 | 29 |
| 6 | IV-VIII | 17 | 1.0* | 17* | 56* |
| 8 | V-VII | 28 | 2.9 | 10 | 27 |
| 12 | III-VI | 26 | 2.2 | 11 | 81* |

## Conclusions

- Data allowed delineation of 13 oceanographic regions in the area
- Differences in multiannual mean seasonal dynamics of nutrients within same region → decoupling of Si, N, and P cycles
- Differences in multiannual mean spring and summer nutrient concentrations, nutrients draw-downs and ΔSi/ΔN/ΔP-ratios between regions
- Summer macronutrients concentrations in the deep central region of the BS suggests absence of macronutrient limitation

## Acknowledgements

RFBR RUSSIAN FOUNDATION FOR BASIC RESEARCH

VNIRO RUSSIAN FEDERAL RESEARCH INSTITUTE OF FISHERIES AND OCEANOGRAPHY

PICES