

S4 Adverse impacts on coastal ocean ecosystems: How do we best measure,
monitor, understand and predict?

PICES-2017 Annual Meeting, Vladivostok, Russia Sept. 22 — Oct. 1, 2017

**SEASONAL DYNAMICS OF NUTRIENTS IN THE RIVER
WATER AND ITS INFLUENCE ON PRODUCTIVITY OF THE
COASTAL ZONE IN THE JAPAN/EAST SEA**

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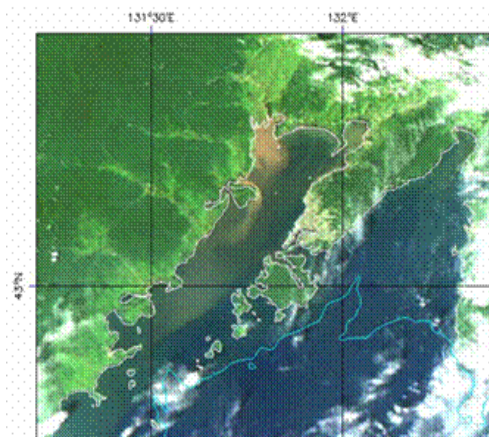
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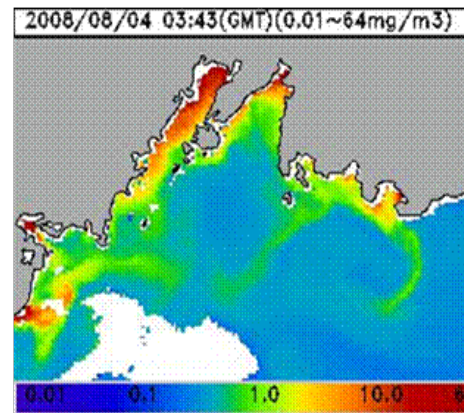
Objective

Rivers are the main source of terrigenous nutrients to the coastal sea and could be responsible for such adverse impacts as red tides or hypoxia and anoxia in the estuarine areas.



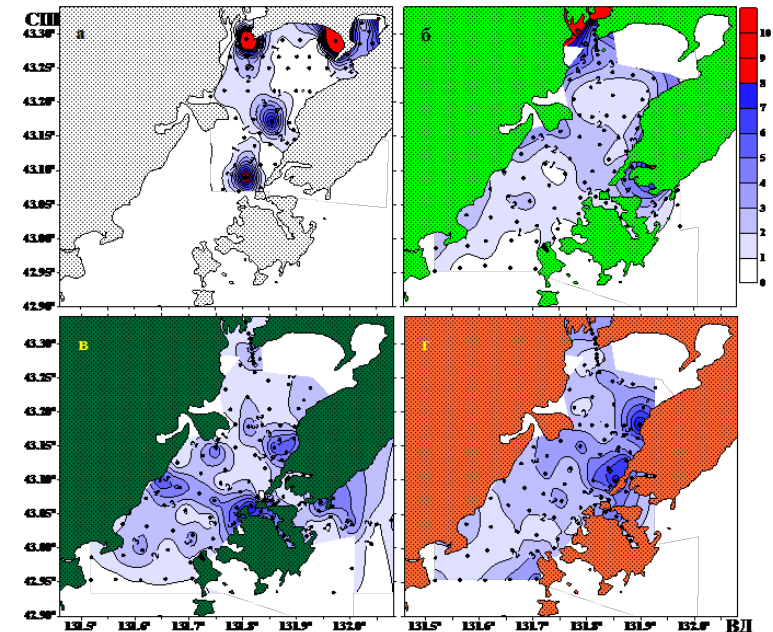
(a)

A color satellite image of MODIS showing the content of suspended matter entering with the river flow into the Amur Bay (a) and the high concentration of chlorophyll a (b) in the surface water of the Amur Bay in the summer season



(b)

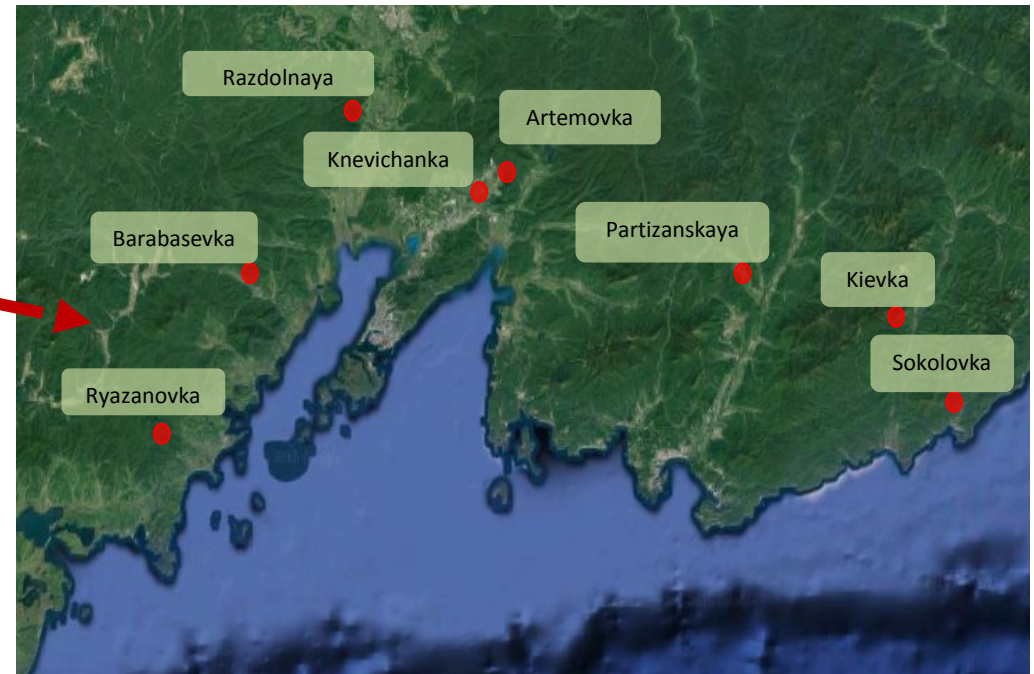
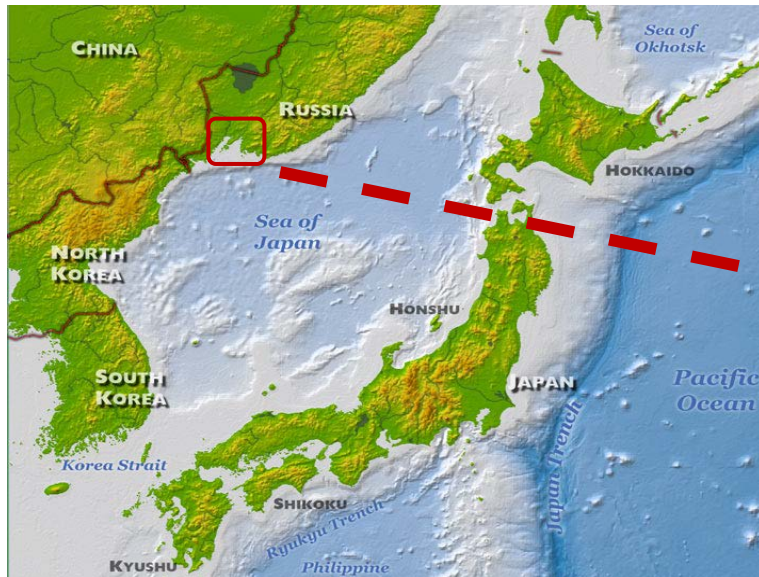
Seasonal distribution of chlorophyll ($\mu\text{g} / \text{l}$) in the surface water layer of the Amursky Bay in 2008
a - winter, b - spring, c - summer, d - autumn



Goal:

Identify the impact of dynamics of nutrients in the river water on productivity of the coastal zone

- Map of the investigated region. The dots indicate the sampling location



To evaluate the rivers impact on chemical environments in the coastal zone, monitoring of the river water properties along the coast of southern Primorye is conducted in 2016 (and continues until nowadays).

Investigated rivers

Razdolnaya 245 km
 $S=16\,830\text{ km}^2$



Artemovka 73 km
 $S=1\,460\text{ km}^2$



Knevichanka 33 km
 $S=476\text{ km}^2$



Partizanskaya 142 km
 $S=4\,140\text{ km}^2$



Investigated rivers

Barabashevka 61 km
 $S = 576 \text{ km}^2$



Ryazanovka 34 km
 $S = 155 \text{ km}^2$



Sokolovka 21 km
 $S = 188 \text{ km}^2$



Kievka 105 km
 $S = 3\,120 \text{ km}^2$

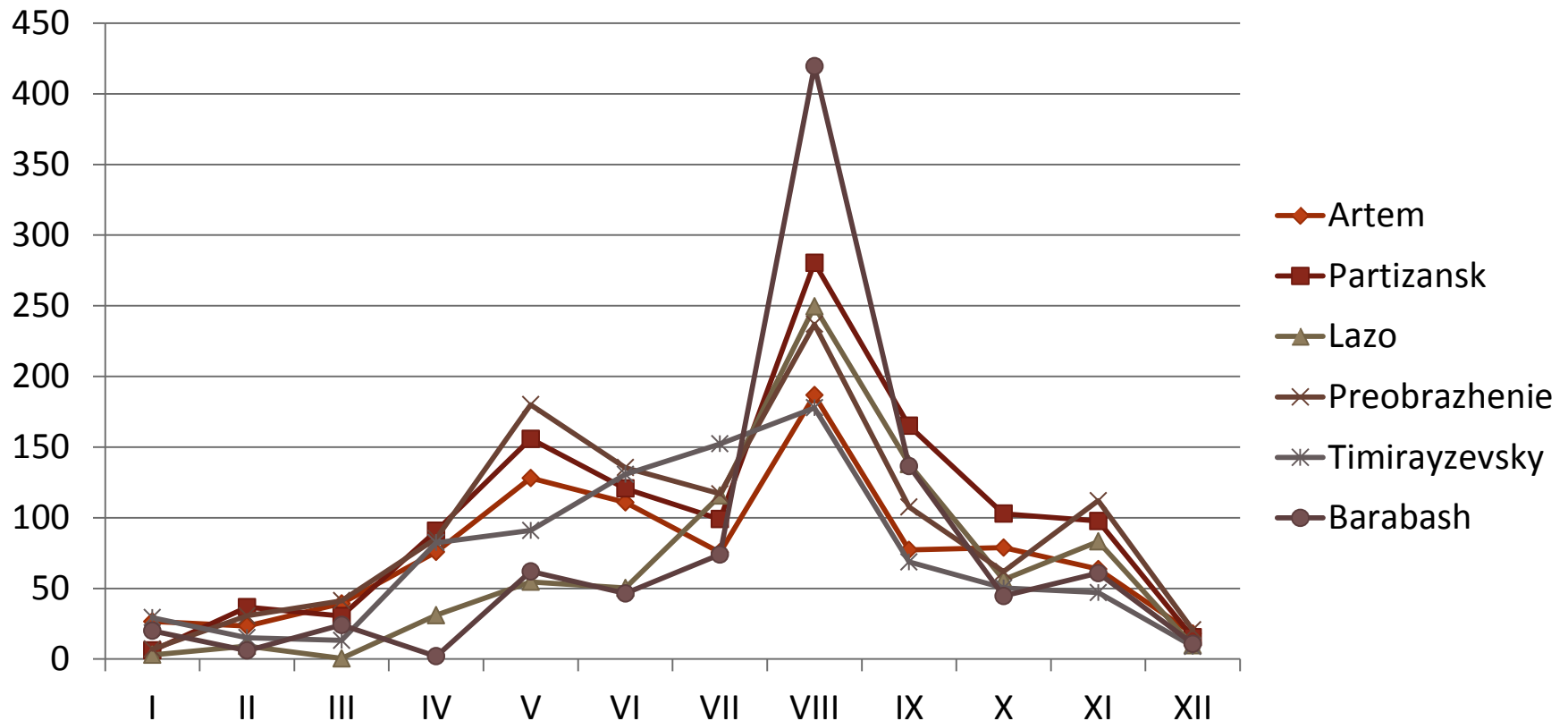


Dates of sampling

<i>Rivers</i>	<i>II February</i>	<i>IV April</i>	<i>VI June</i>	<i>VIII August</i>	<i>IX September</i>	<i>X October</i>	<i>XII December</i>
Ryazanovka	19	25		8			26
Barabashevka	19	25		8			26
Razdolnaya	19	25		8	16	1	26
Partizanskaya	24	25	18	18	5	26	
Artemovka	24	25	18	18	5, 16	26	
Knevichanka	24	25	18	18	5, 16	26	
Kievka	24	25	18	18		26	
Sokolovka	24	25	18	18		26	

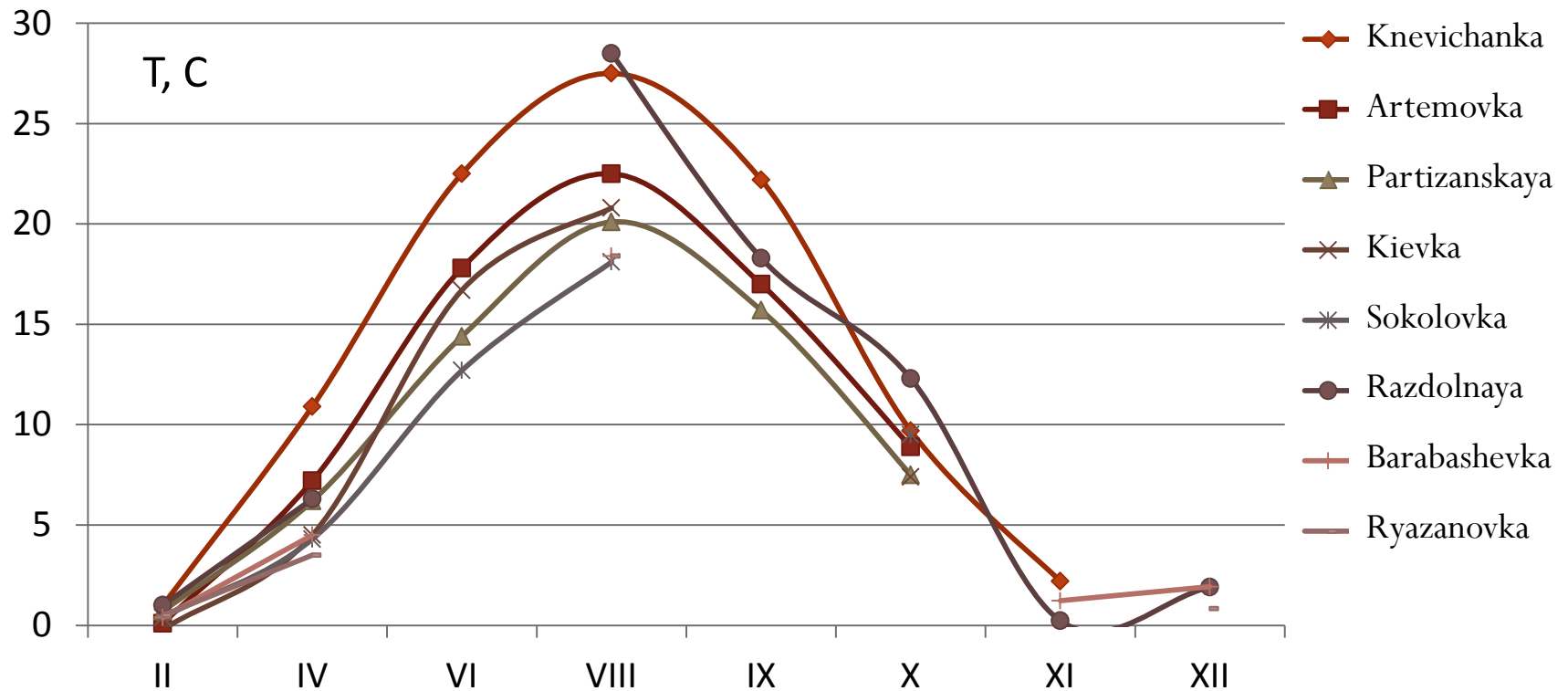
Monthly rainfall at meteorological stations in the valleys of the investigated rivers

Seasonal changes in the water content of rivers can be indirectly characterized by changes in monthly precipitation at weather stations located in or near their valleys.

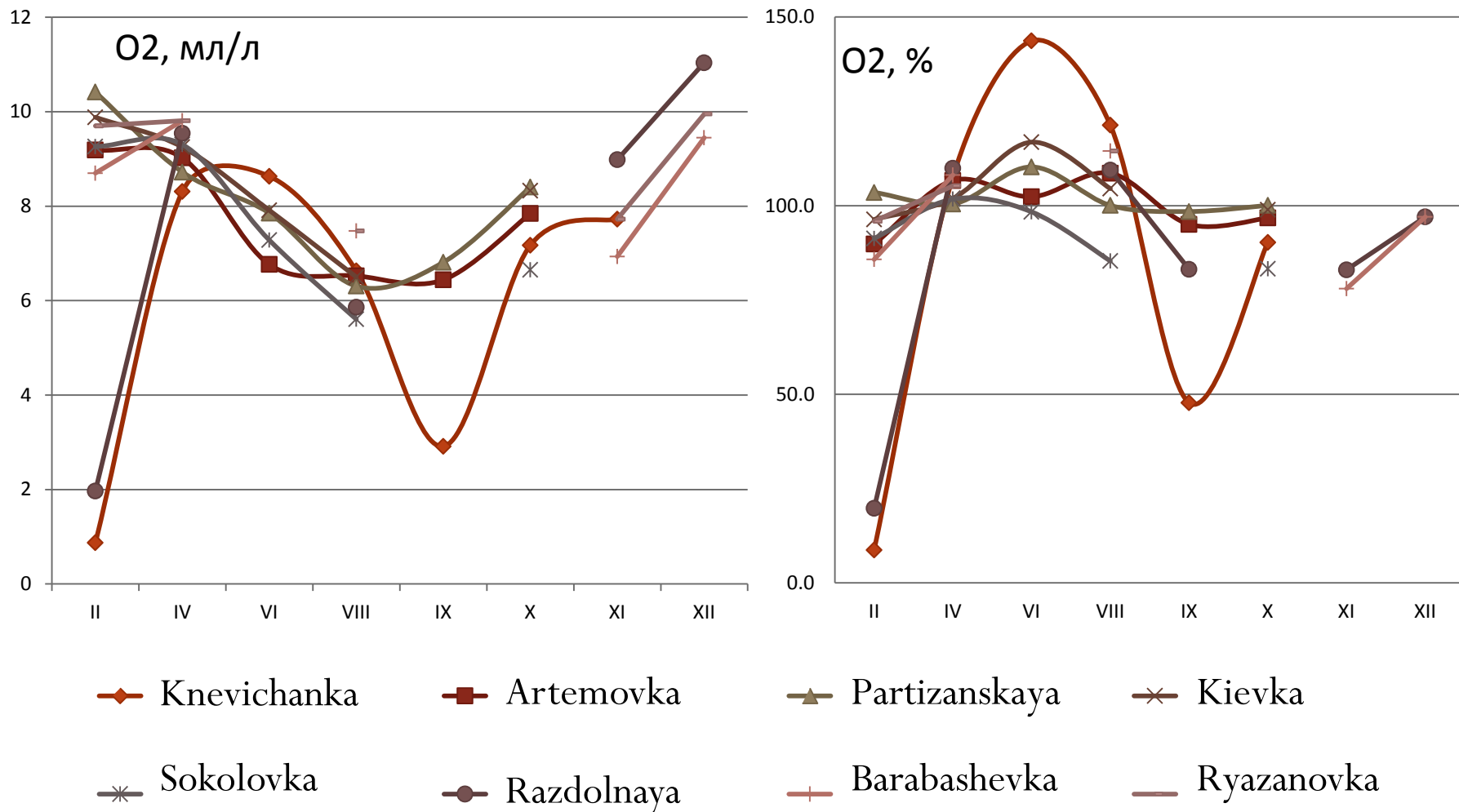


Seasonal dynamics of water temperature at the rivers surface in 2016

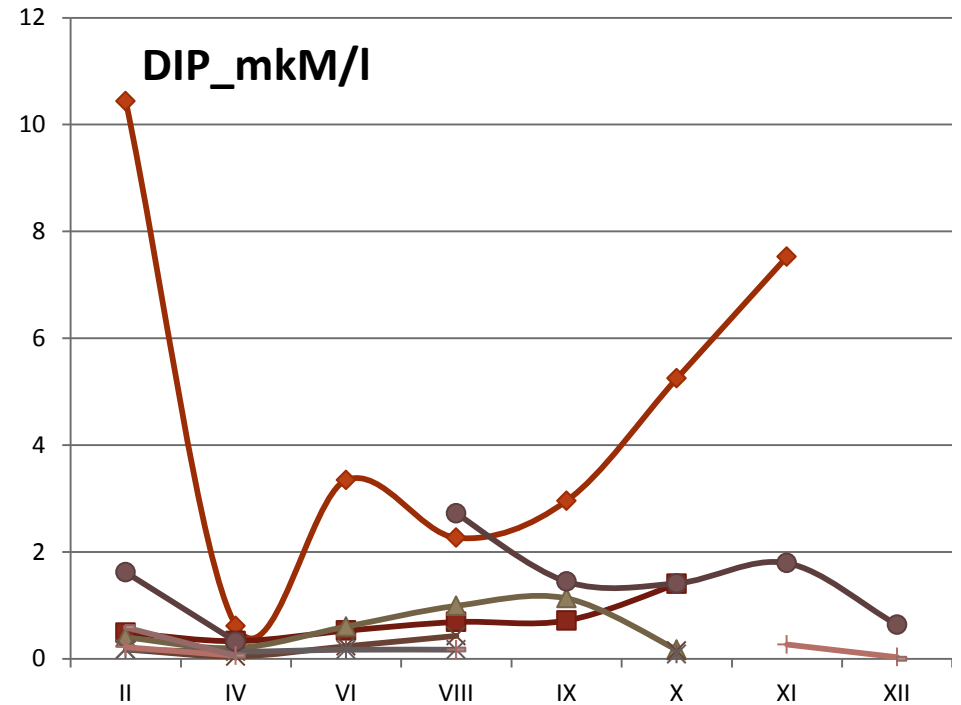
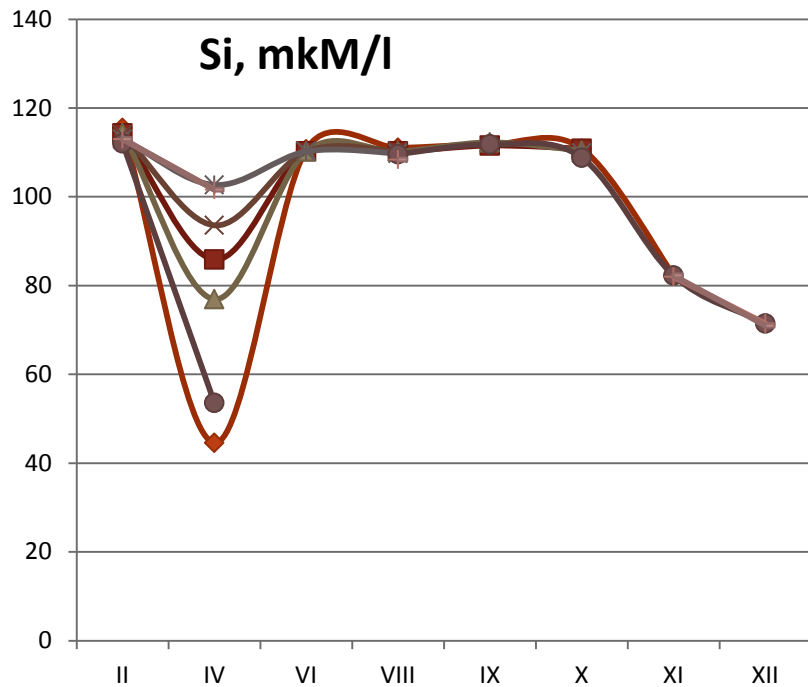
The seasonal dynamics of temperature on the surface of the investigated rivers is also determined by the climate of the region, and its features by the geographic location of the rivers.



Dynamics of dissolved oxygen content and oxygen saturation for the investigated rivers



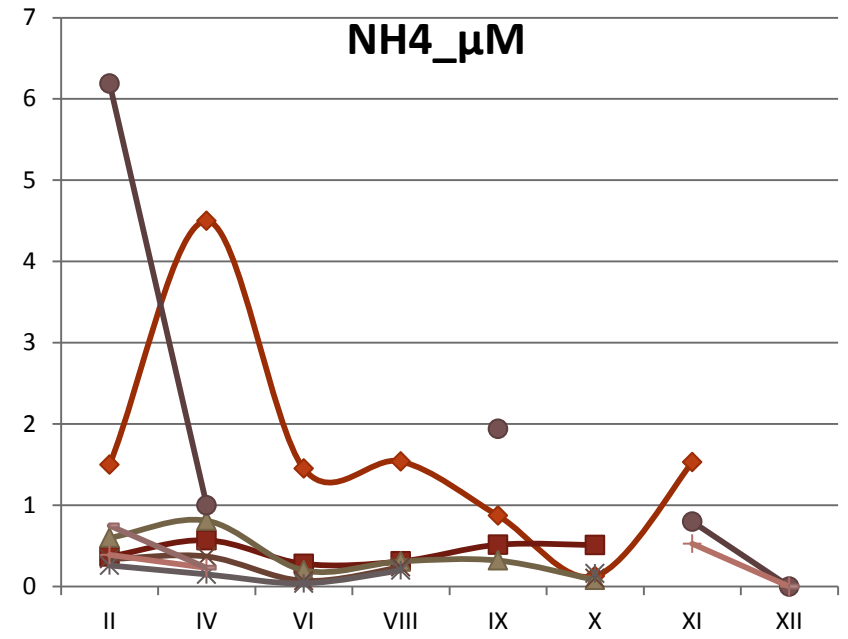
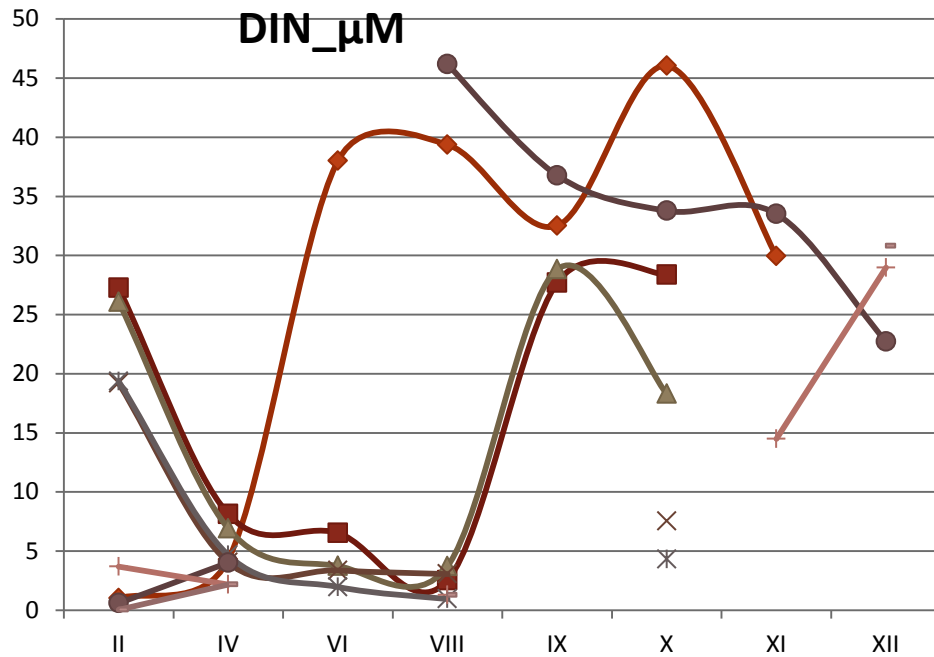
Dynamics of silicate, phosphate concentrations for the investigated rivers



◆ Knevichanka ■ Artemovka
✱ Sokolovka ● Razdolnaya

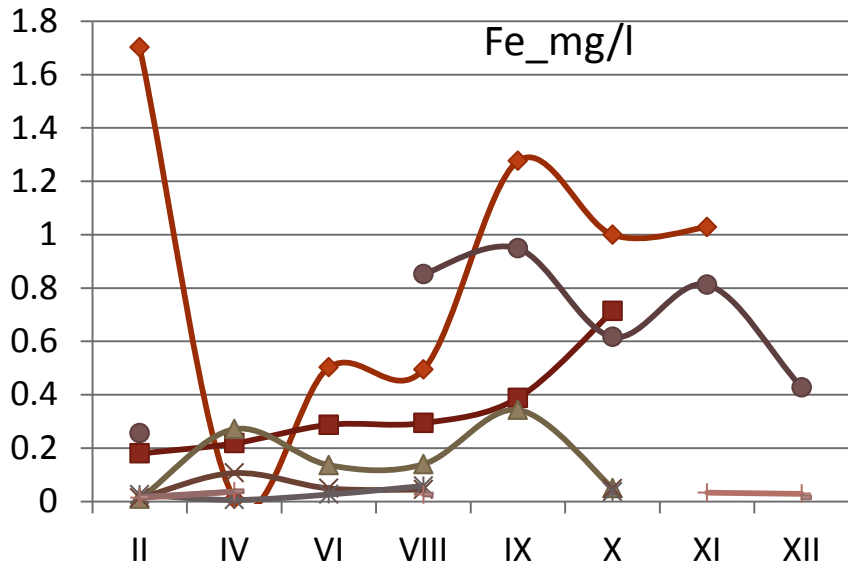
▲ Partizanskaya ✱ Kievka
+ Barabashevka — Ryazanovka

Dynamics of mineral nitrogen and ammonium nitrogen concentrations for the investigated rivers

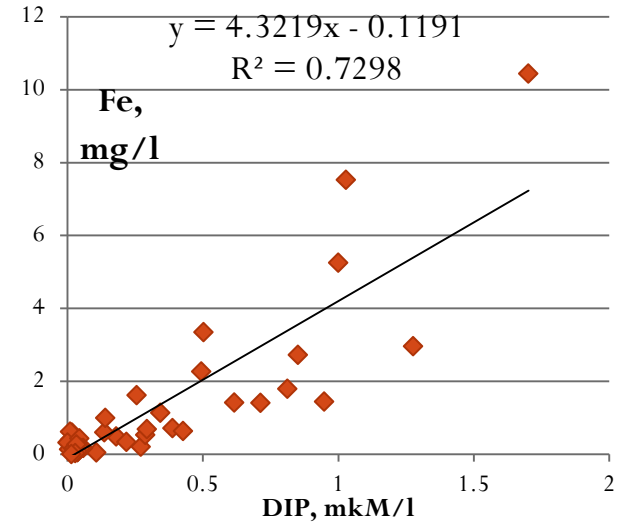


- ◆ Knevichanka
- Artemovka
- ▲ Partizanskaya
- × Kievka
- * Sokolovka
- Razdolnaya
- + Barabashevka
- Ryazanovka

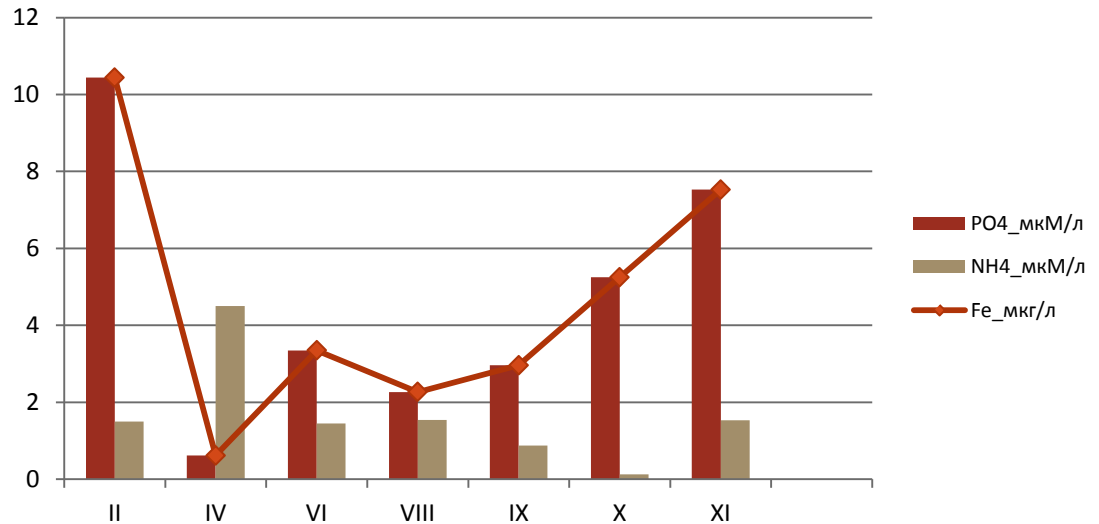
Dynamics of dissolved iron concentrations for the investigated rivers



- ◆ Knevichanka
- Artemovka
- ▲ Partizanskaya
- ✕ Kievka
- ✱ Sokolovka
- Razdolnaya
- + Barabashevka
- Ryazanovka

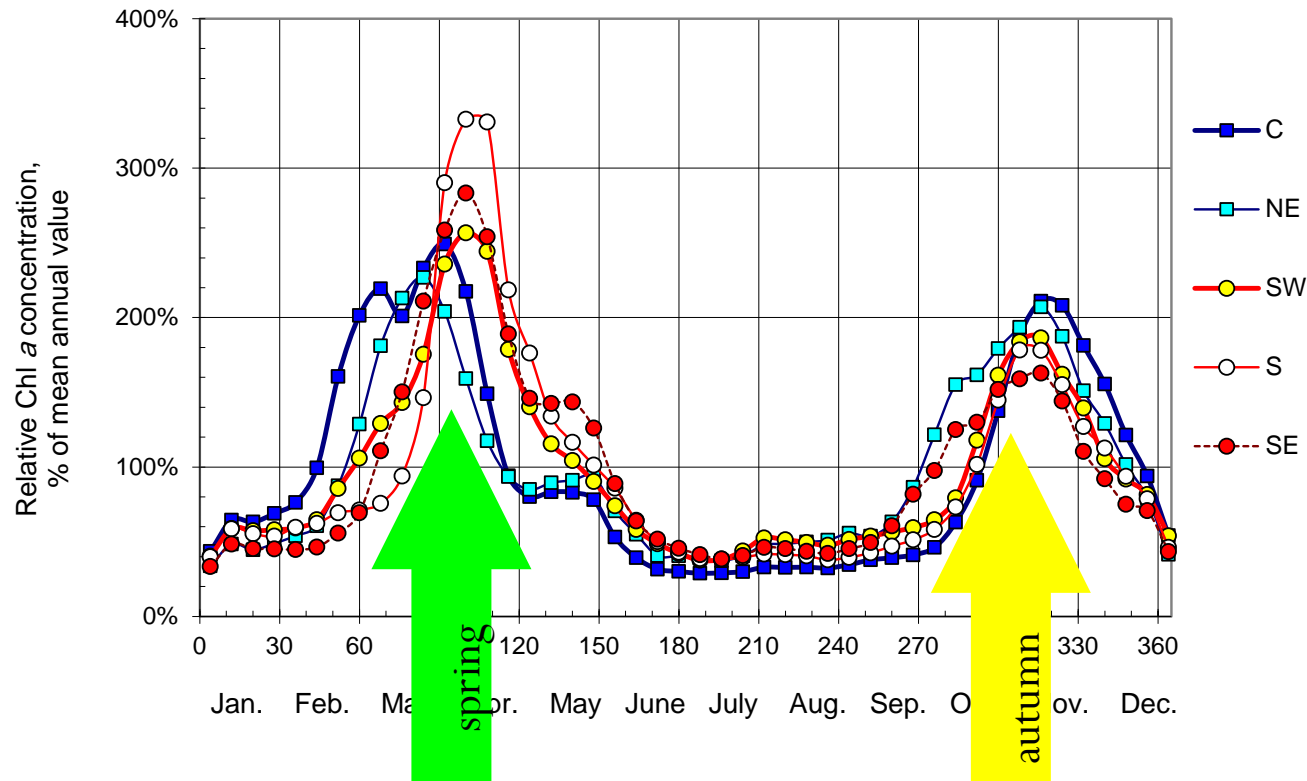


Seasonal changes in the concentrations of phosphates, iron, and ammonium nitrogen in samples from the Knevichanka river



Influence on productivity of the coastal zone

- Transferred to the sea, the nutrient elements of terrestrial origin are converted back to organic matter enhancing the coastal waters productivity, but consequences of this impact are principally different for the natural regime with the winter-spring maximum and for the distorted regime with the summer-fall maximum.



Summary

- Therefore, eutrophication of the estuarine areas is developed because of coincidence of light and nutrients supply for photosynthesis. That's why red tides are more frequent in the external estuaries of these rivers (though this problem is still inactual for the Russian waters) and hypoxia appears there at the sea bottom after the summer blooms because of biochemical consumption of oxygen for mineralization of the detritus.
- Prominent seasonal dynamics of chemical indicators is revealed that generally corresponds to seasonal changes of freshwater discharge caused by monsoon cycle of precipitations.

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THANK YOU FOR YOUR ATTENTION

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