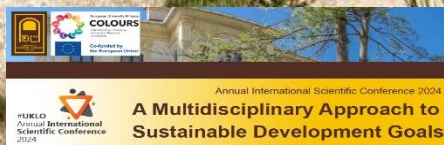


TROPHIC STATE ASSESSMENT OF LAKE PRESPA ACCORDING PHYSICAL, CHEMICAL AND BIOLOGICAL INDICATORS

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PROJECT: UNDERSTANDING
ANTHROPOGENIC PRESSURES ON
LAKE PRESPA

LAKE PRESPA

- Lake Prespa (40°54' N, 21°02' E) is a transboundary lake shared between Macedonia, Albania and Greece. The lake is located at 849 m above sea level has a surface area of 254 km², a catchment area of 1300 km², a maximum water depth of 48 m, a mean water depth of 14 m, and a volume of 3.6 km³. The total inflow is estimated to 16.9 m³s⁻¹, with 56% originating from river runoff from numerous small streams, 35% from direct precipitation, and 9% from Lake Mikri Prespa to the south. There is no surface outlet of Lake Prespa. Water loss derives through evaporation (52%), irrigation (2%) and outflow through karst aquifers (46%).



Point Source Pollution

- **Settlements:** Resen, Dolno Dupeni, Podmocani, Carev Dvor, Stenje, Krani, Likanes, Pustec etc.

- **Water Treatment Plant in Ezerani**



Industry: Food and Juices
Textiles,
Chemical Industry
Metal Processing (AD Algreta), civil constructions (AD IGM Sloga) -
Poultry Farming (Swisslion Agrar)
Ceramics Production (Hamzali)
Wood Processing (DOO Interbrauk).

- **Fish Farms:** near Izbiste and Resen etc.

Tributaries: Golema, Brajcanska, Kranska Istocka (seasonally)





**Tourism Units (Hotels,
Villages
Tourist capacities)**



The aim of this work is to assess the trophic state of Lake Prespa and to illustrate the effects of anthropogenic impact.

We made comparative research at:

- littoral zone (7 sampling sites) and
- pelagic vertical profile (four depths)

Collecting is seasonally during the 2023,

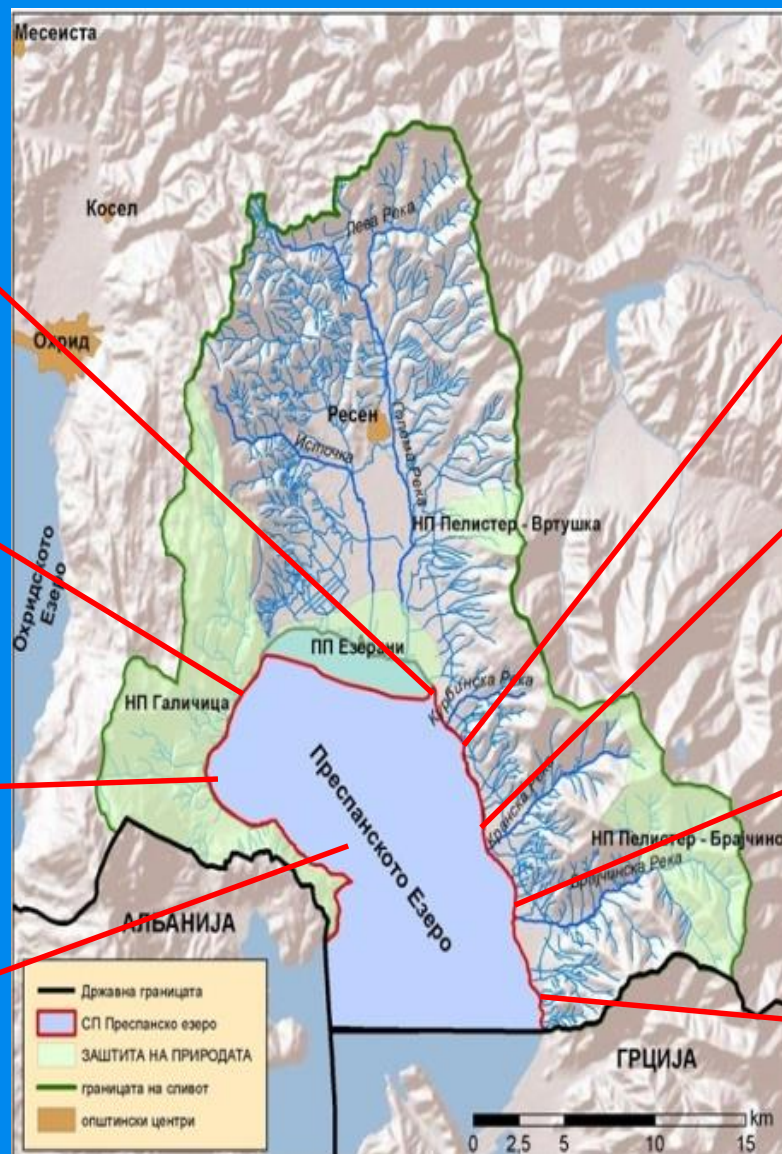
Parameters:

- physical and chemical (dissolved oxygen, biochemical oxygen demand, biodegradable organic matter, concentration of total phosphorus and total nitrogen) and
- biological parameters as total number of heterotrophic bacteria and total number of coliform bacteria, rotifers and chlorophyll a.
- The collection and storage of water samples for physico-chemical and biological analyzes is by standard limnological methods

SAMPLING POINTS, METHODS, PARAMETERS

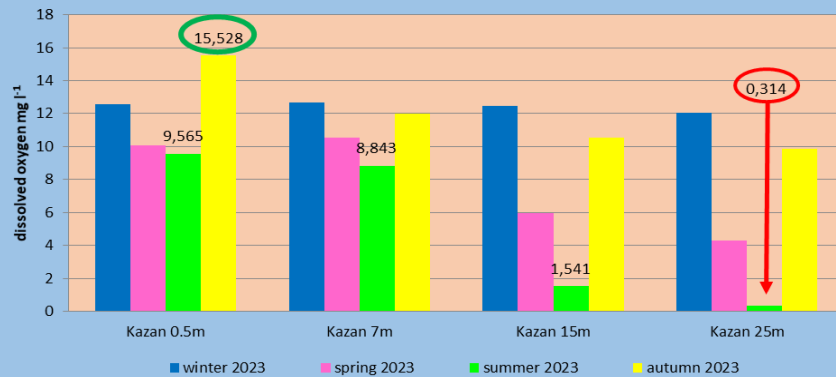


SAMPLING POINTS

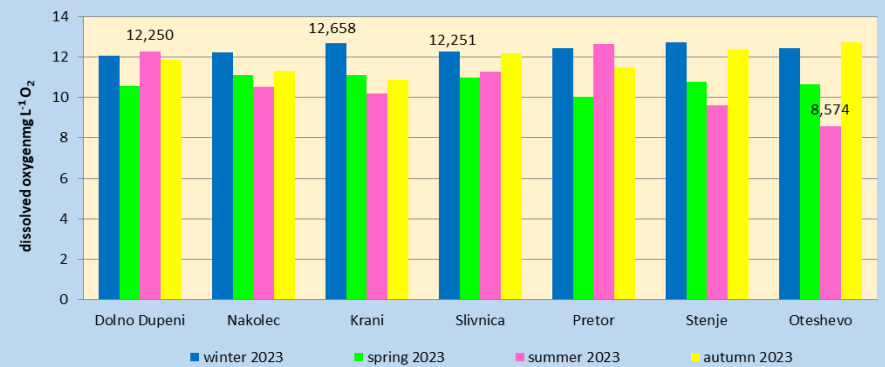


Dissolved Oxygen, BOD, Organic matter

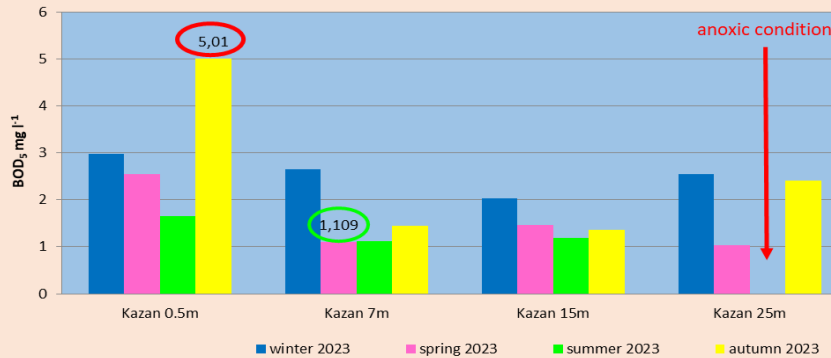
Dissolved oxygen



Dissolved oxygen



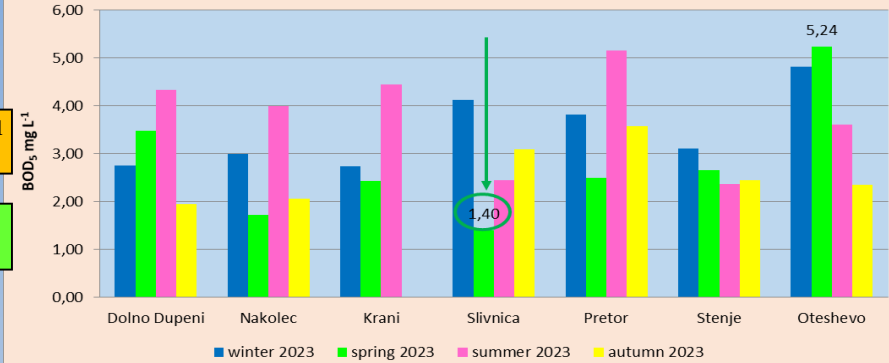
Biochemical oxygen demand



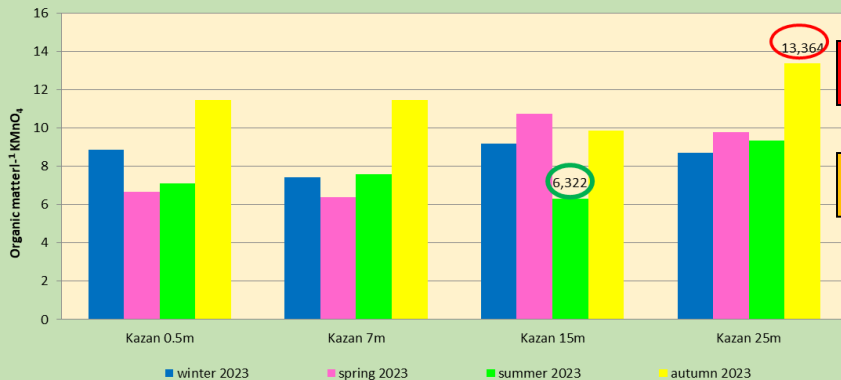
2,01-4,0 mg/l
II class

< 2,0 mg/l
I class

Biochemical oxygen demand



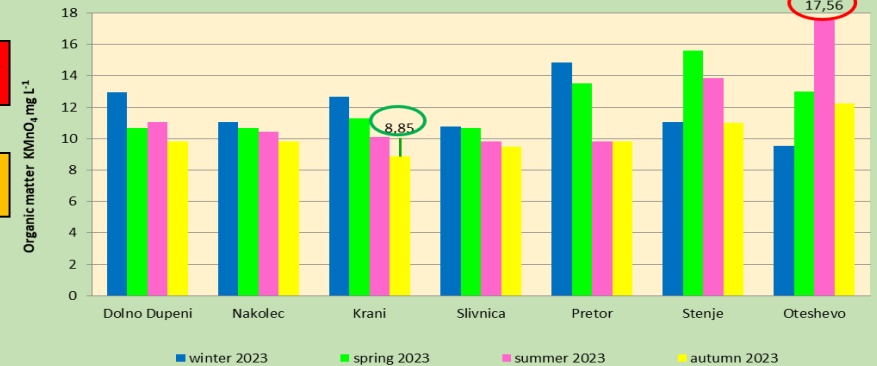
Consumption of KMnO₄



10,01-20,0 mg/l
IV class

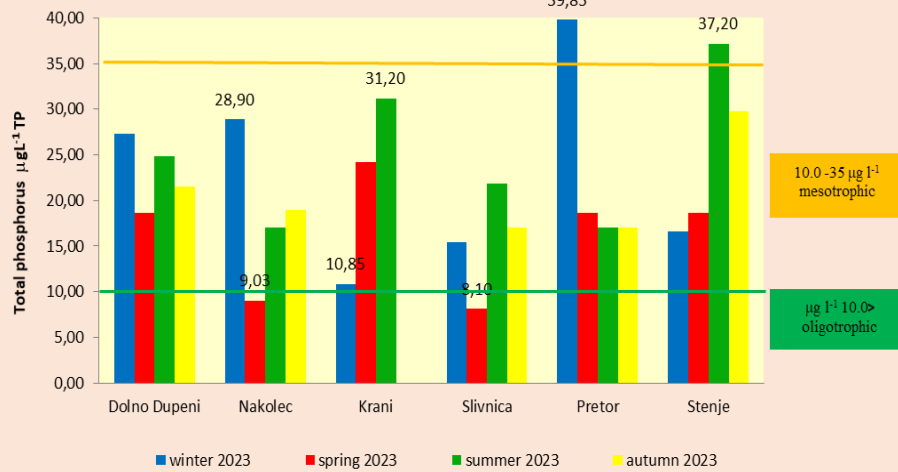
5,01-10,0 mg/l
III class

Consumption of KMnO₄

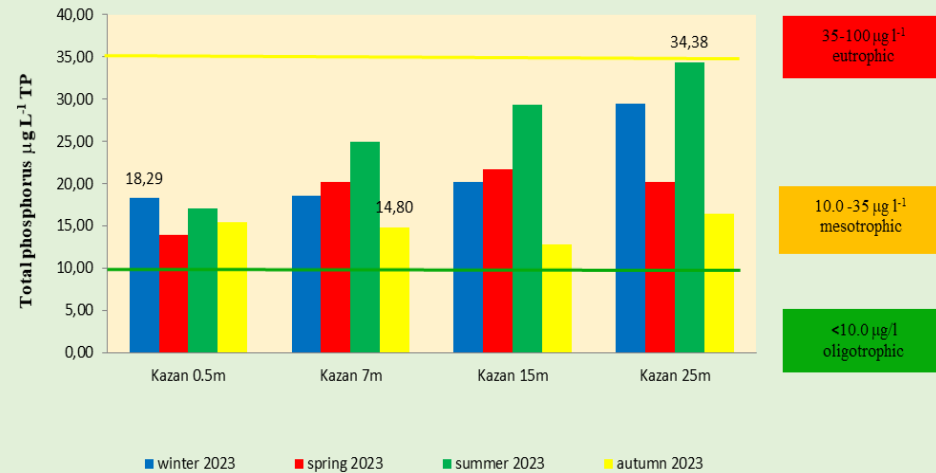


Total phosphorus, total nitrogen

Total phosphorus

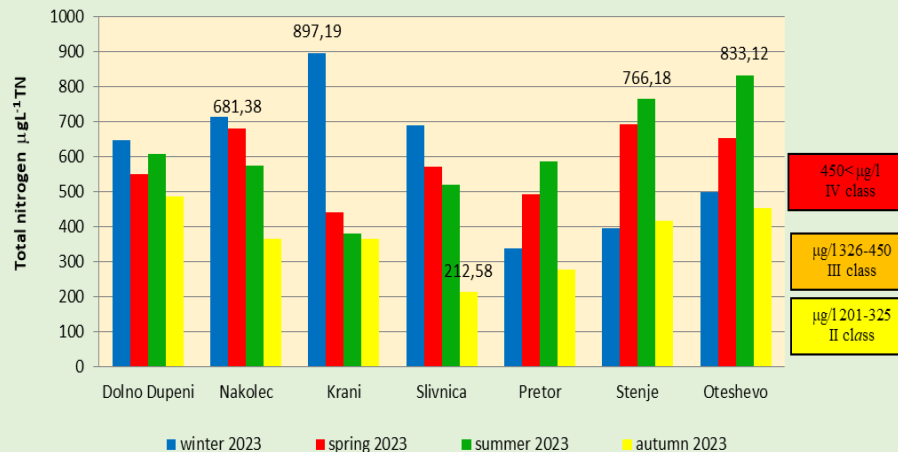


Total phosphorus

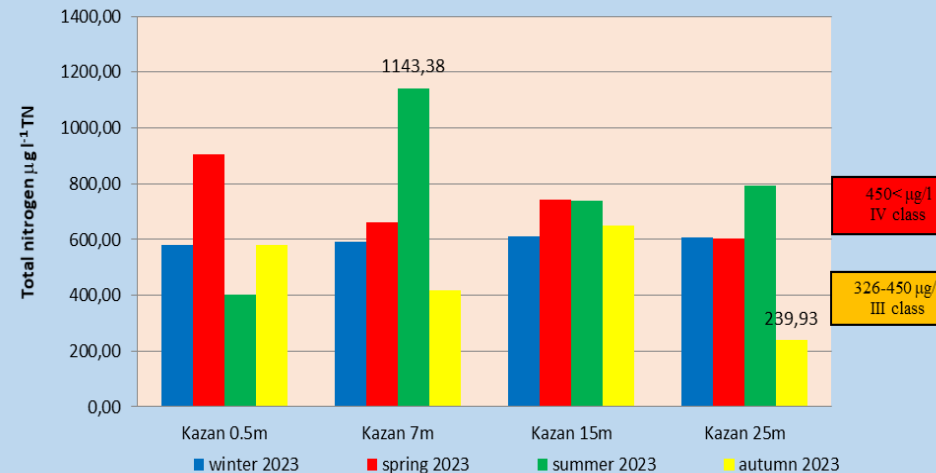


Generally, values for concentration of total phosphorus during the investigated period for littoral zone belongs to III - IV class (mesotrophic state)

Total nitrogen



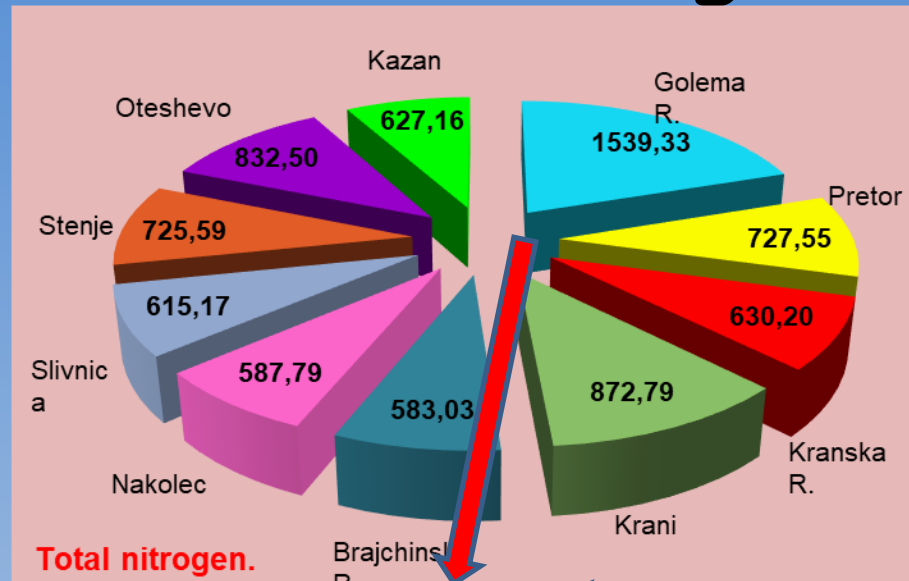
Total nitrogen



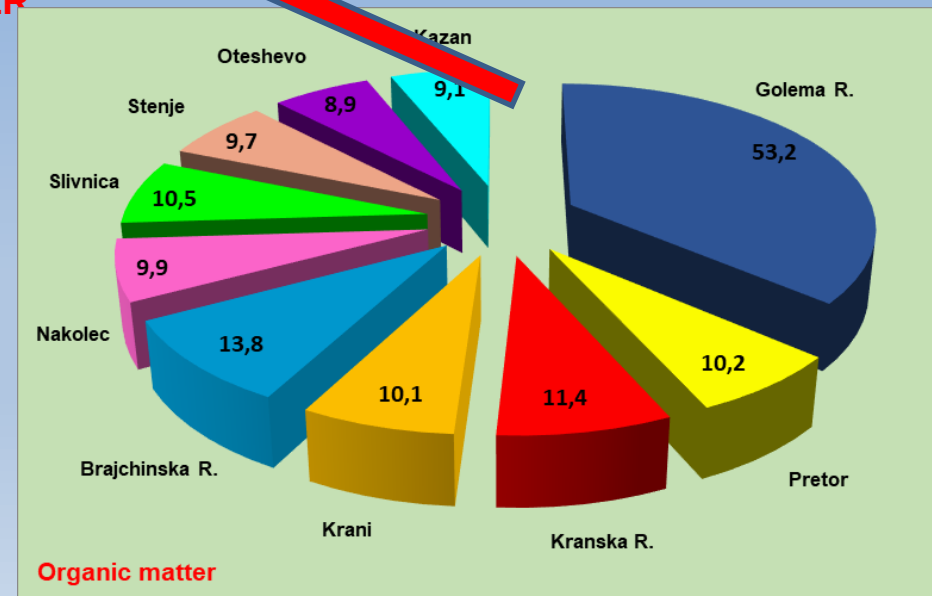
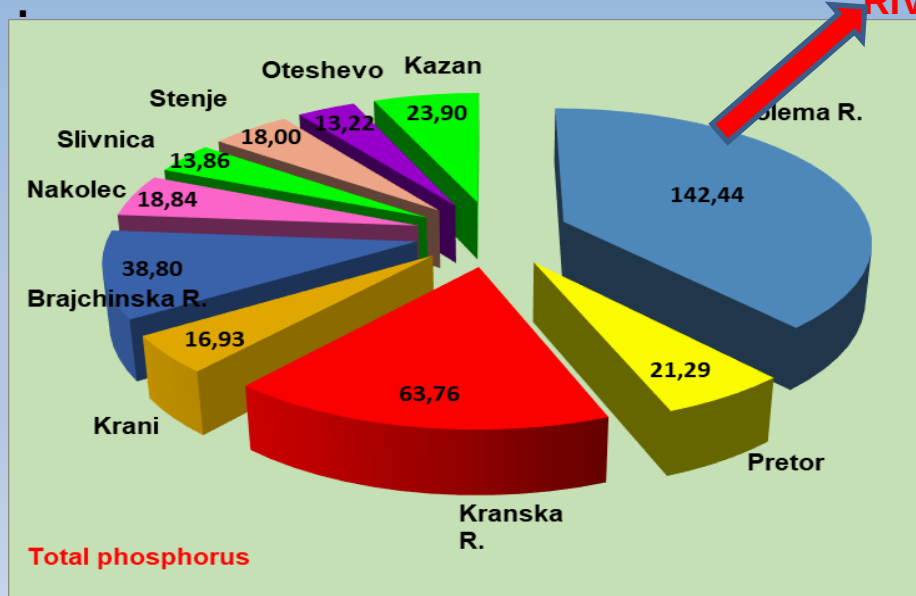
Nutrient's and organic matter



* Generally, more polluted points are the littorals near the rivers mouth. Especially alarming condition is noticed in the littoral Pretor, near the river bed of River Golema.

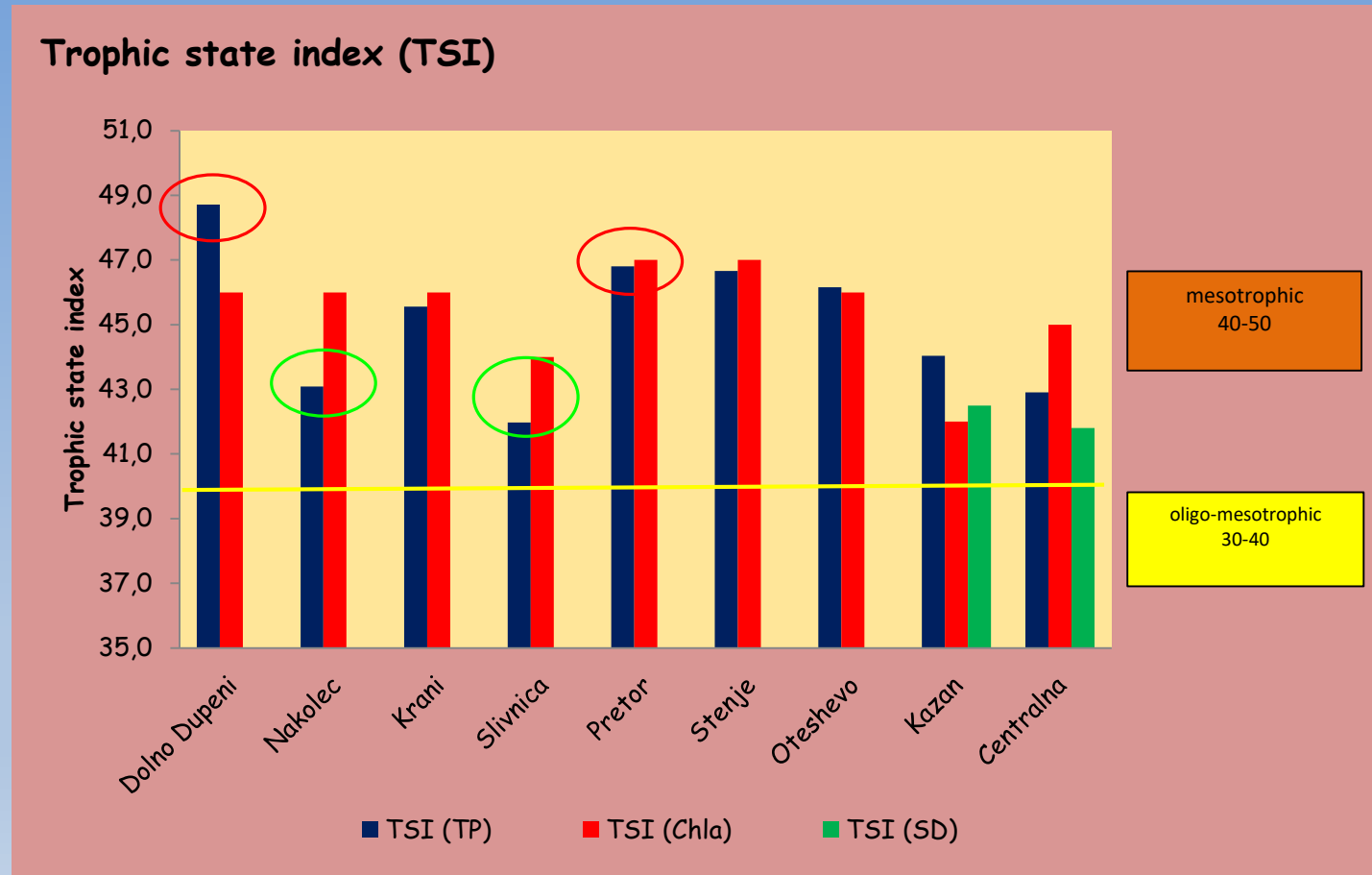


**"HOT SPOT"
GOLEMA
RIVER**



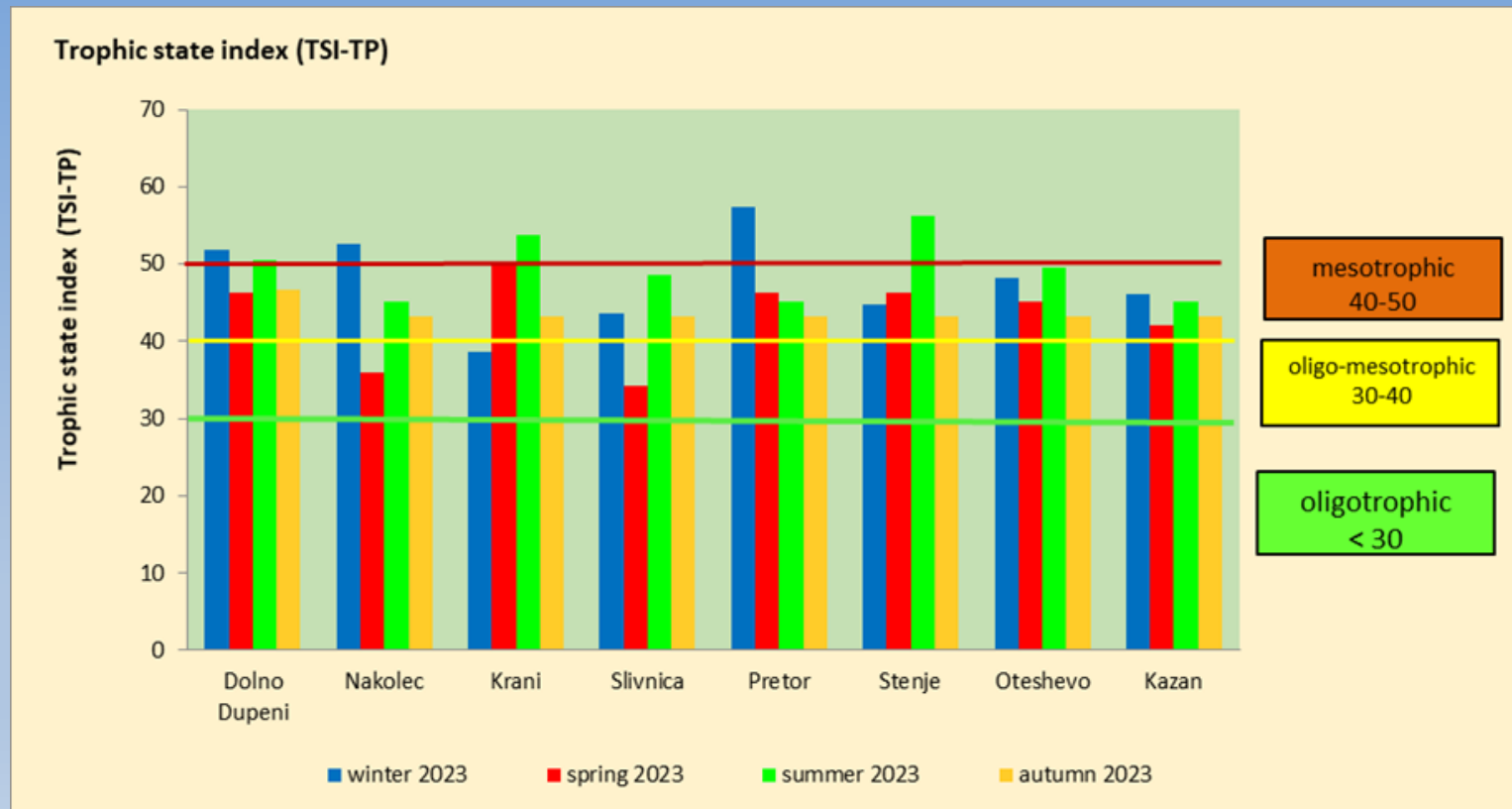
Trophic State Index

***To define trophic state, we used Carlson's trophic state index calculated on basis of the Secchi transparency, concentrations of the total phosphorus and Chl a. Numerical values for the trophic state index in the littoral and pelagic zone are mostly lower than 50 and indicate the mesotrophic character of Lake Prespa.**



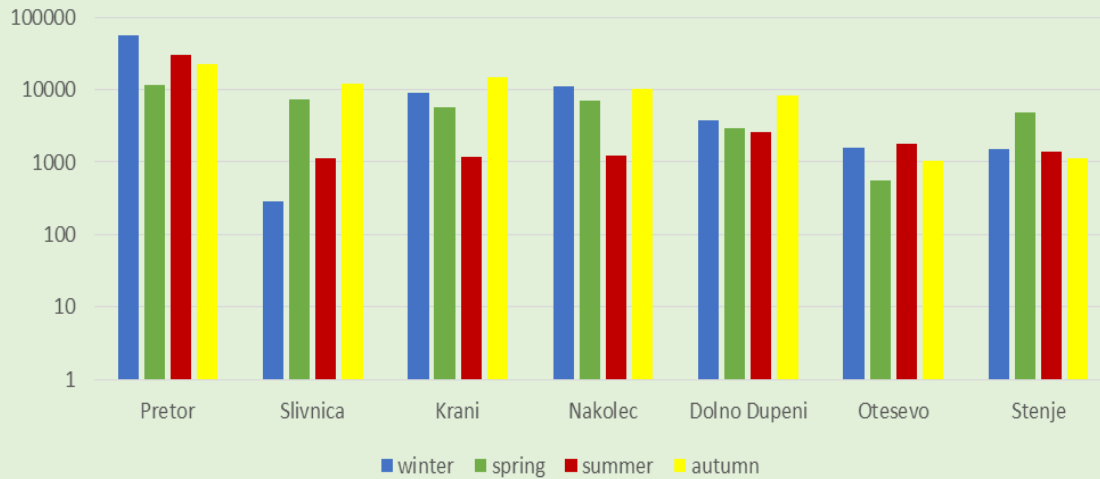
Trophic State Index

- * According to the numeric values for the Carlson's index of the trophic state, calculated on basis of the concentrations of the total phosphorus, Kazan and littoral zone of Lake Prespa belong mainly to the mesotrophic state (2023)
- Pretor, Stenje – eutrophic state



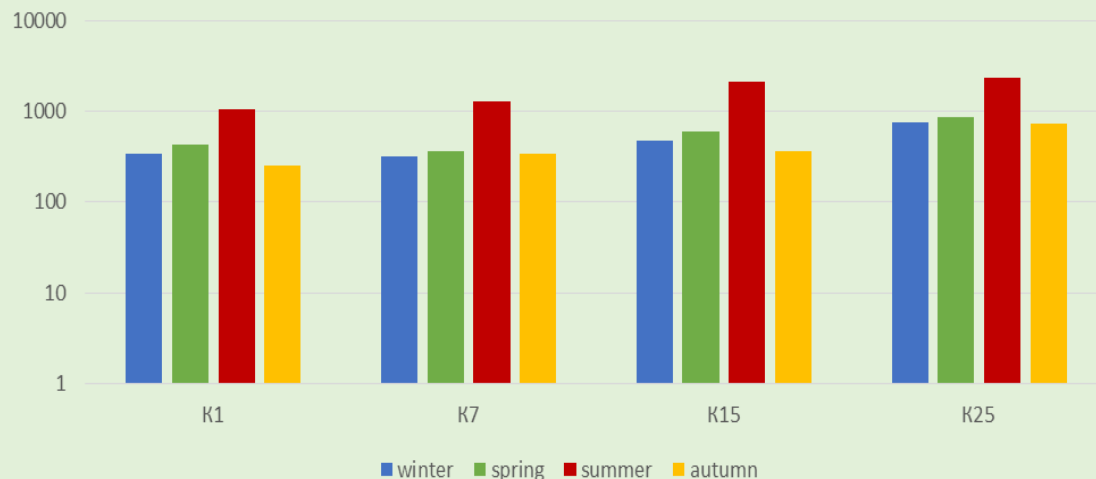
Biological indicators - Heterotrophic and total coliform bacteria

Heterotrophic bacteria (bact./ml)



Microbiological values are in correlation with physico-chemical parameters. According to the heterotrophic bacteria at the littoral zone of Lake Prespa, all localities belongs usually at class II. Pretor belong at III class (Kavka and Poetsch,2002).

Heterotrophic bacteria (bact./ml)

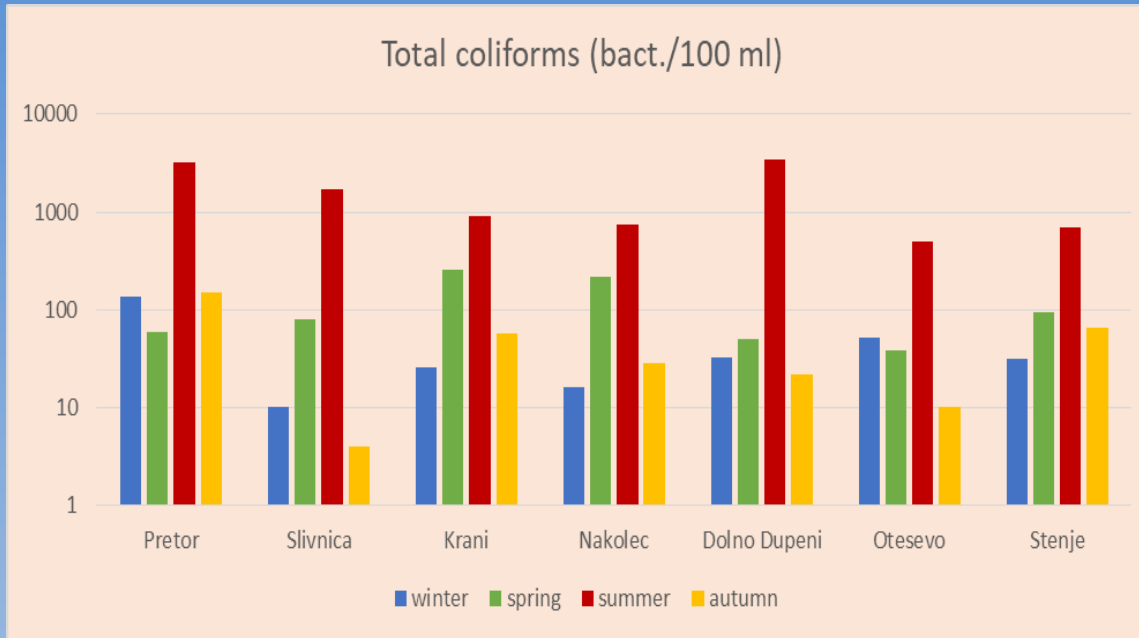


K1 and K7 I class, summer II class

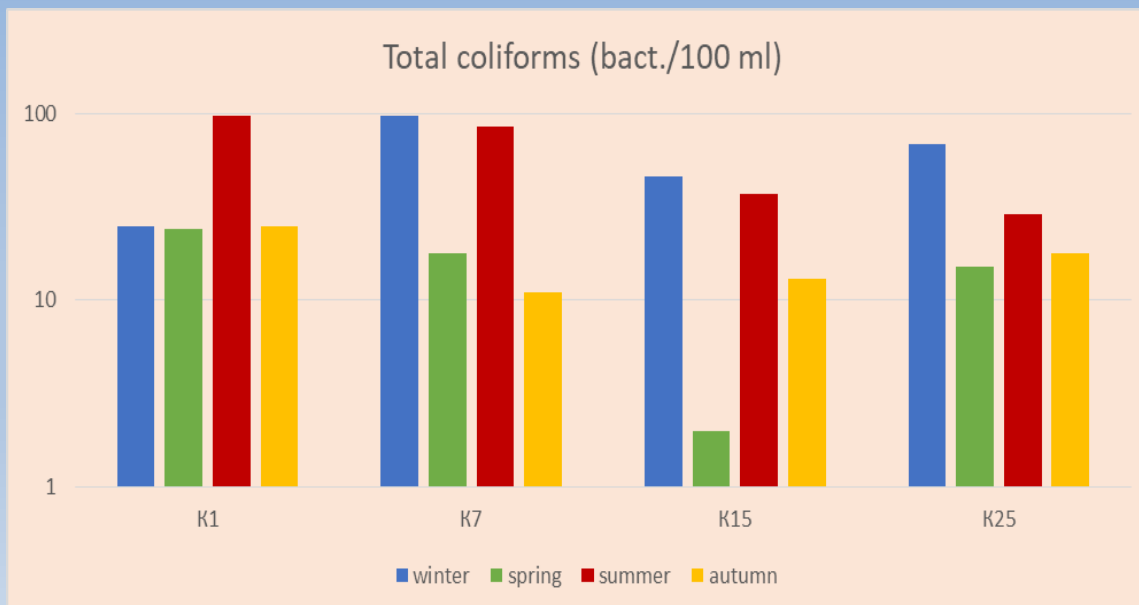
K15 winter and autumn I class, spring and summer II class

K25 II class

Biological indicators - Heterotrophic and total coliform bacteria



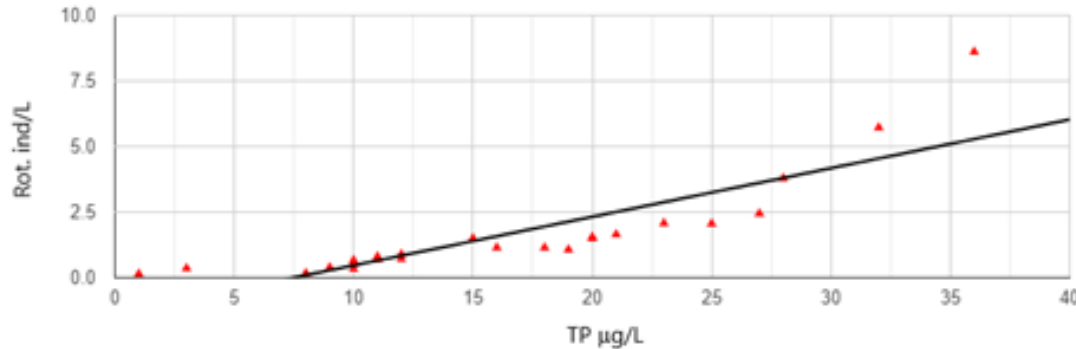
Microbiological values are in correlation with physico-chemical parameters. According to the number of total coliforms as indicators of faecal pollutions, at the littoral zone of Lake Prespa, localities belongs usually at class I. (Kavka and Poetsch,2002). During the summer, all localites belongs at II class.



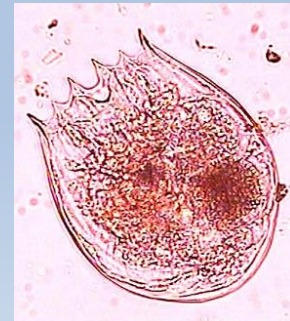
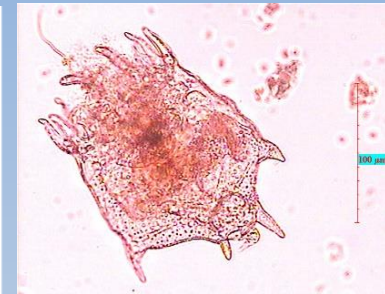
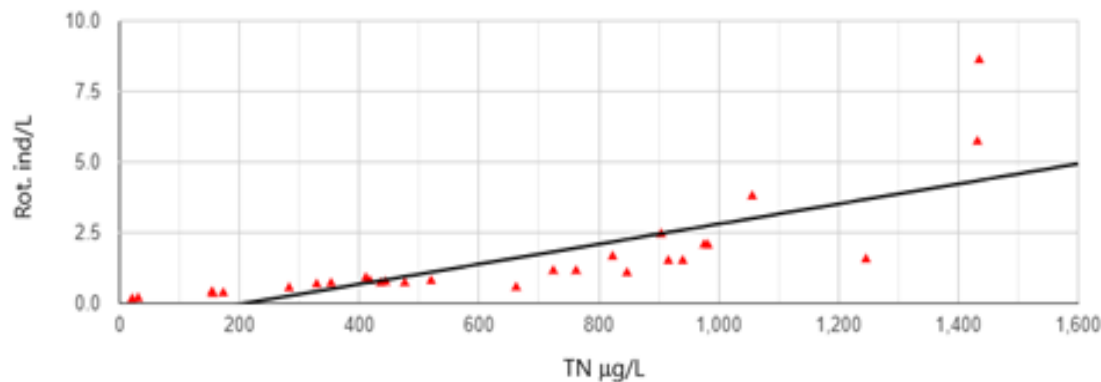
Pelagic zone (Kazan), according to the number of total coliforms results belong at I class.

The results for the physico-chemical and microbiological parameters indicate a strong anthropogenic influence, especially in the littoral zone of Lake Prespa.

*** Rotifers as sensitive indicators of environmental changes indicated oligo- β -mesosaprobic and β -mesosaprobic character of water in the littoral zone of Lake Prespa.**



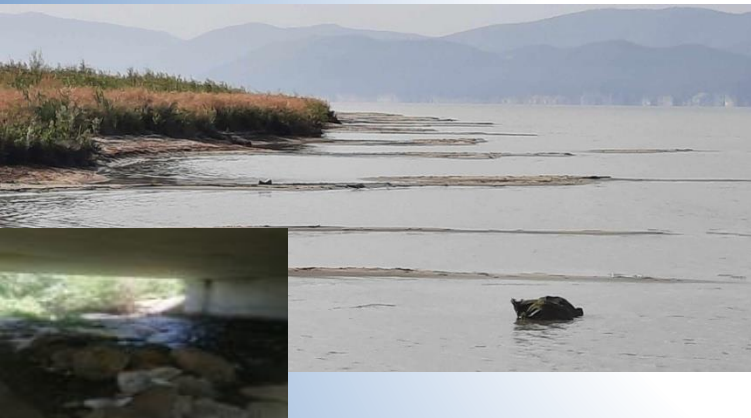
Pearson's correlation indicated that rotifer abundance significantly related to TP ($R = 0.802$, $P = .016638$, $p < .05$) and TN ($R = 0.776$, $P = .023589$, $p < .05$).



*** All the investigated parameters indicated to the fact that Lake Prespa is in an intensive process of eutrophication.**



*** Generally, more polluted points are the rivers and littorals near the rivers mouth. This is the result from the high influence of the tributaries in the watershed of the lake. The tributaries are the final destinations for the waste communal and industrial waters, and drainage waters which are coming from the surrounding agricultural. The water from rivers with this quality entirely migrates to the littoral zone which is to be considered as their end recipient and prime danger for this aquatic ecosystem.**

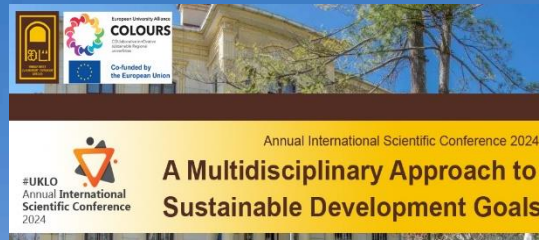


The intensive influence of the rivers which are flowing into Lake Prespa, which is manifested in the lake littoral, is a potential danger for the waters of the pelagic zone as well.



*** Besides the increased phosphorus loading which was evident during the period of the investigations in Lake Prespa, additional characteristic factor which influences the lake trophic state, was the water level declination. The changes in the volume of the Lake have a direct effect on the concentrations of dissolved nutrients.**

- Considering the great scientific importance of Lake Prespa, its multifunctionality as a water reservoir for drinking, fishing, sports and recreation, there is a need for constant monitoring of the quality of the lake water and its protection.



Thank you
for
your attention



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