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SEVAMOD2 - Results of three years joint Armenian-German research on Lake Sevan

Recent findings on the chemistry of Lake Sevan

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Content

- ❑Water quality Monitoring Lake Sevan basin (rivers, groundwater and lake)
- ❑Comparison rivers, groundwater and lake (selected parameters)
- ❑Profiles T & DO
- ❑Temporal changes at different depths in Big and Small Sevan (selected parameters)
- ❑Nutrient loads
- ❑Conclusions

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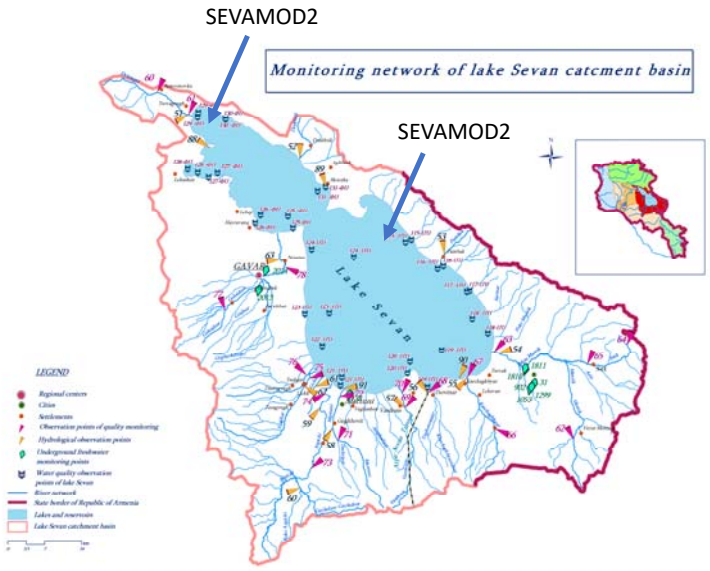
Water quality monitoring in Lake Sevan Basin



Lake Sevan

- Sampling sites: 20 (including littoral and pelagic zones)
- Sampling period: May, July and October

Lake Sevan - within the SEVAMOD2 project

- Sampling sites: 2 (14 sampling points within layers)
- Sampling period: 2018-2023 (monthly)

Outflow rivers

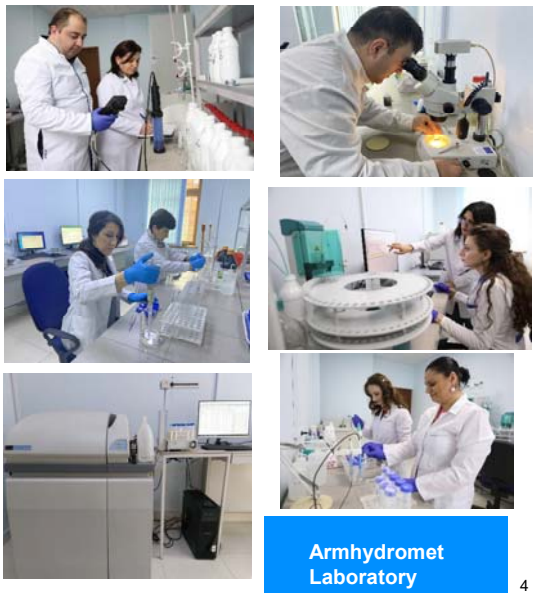
- Inflow rivers: 9 main rivers and the Arpa-Sevan tunnel
- Sampling sites: 20
- Sampling period: monthly

Groundwater

- Sampling sites: 8
- Sampling period: twice a year

Laboratory Analysis

- Nitrate ion, Ammonium ion, Nitrite ion, Total inorganic nitrogen, Total bounded nitrogen
- Phosphate ion, Total phosphorus
- Total organic carbon, Total inorganic carbon, Bicarbonate ion, Carbonate ion
- BOD_5, COD
- Dissolved silicon
- Total iron
- Total manganese
- Sulphate ion, Chloride ion
- and cations
- Heavy metals (Cu, Zn, As, Mo, Cr, Mn, Sb…)
- Total dissolved solids
- Total suspended solids
- Chlorophyll a (in situ)
- pH (in situ)
- Transparency (in situ)
- Dissolved Oxygen (in situ)



Armhydromet Laboratory

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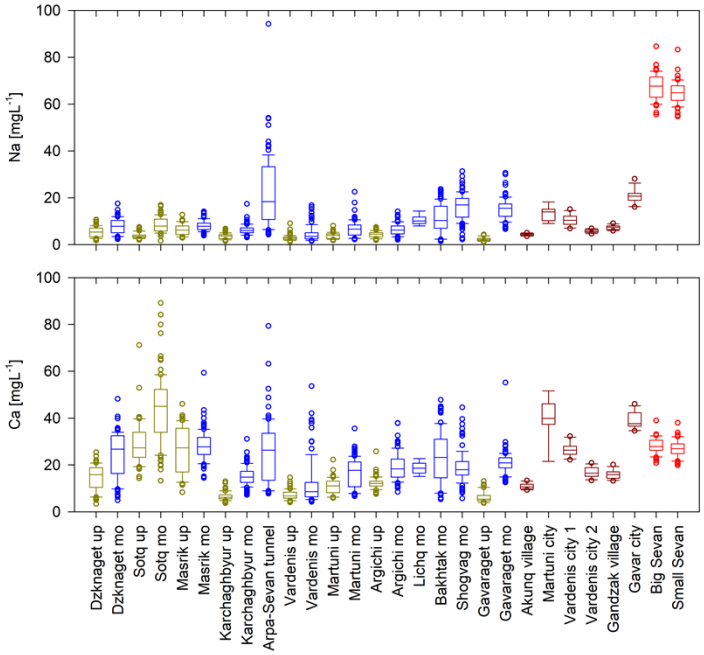
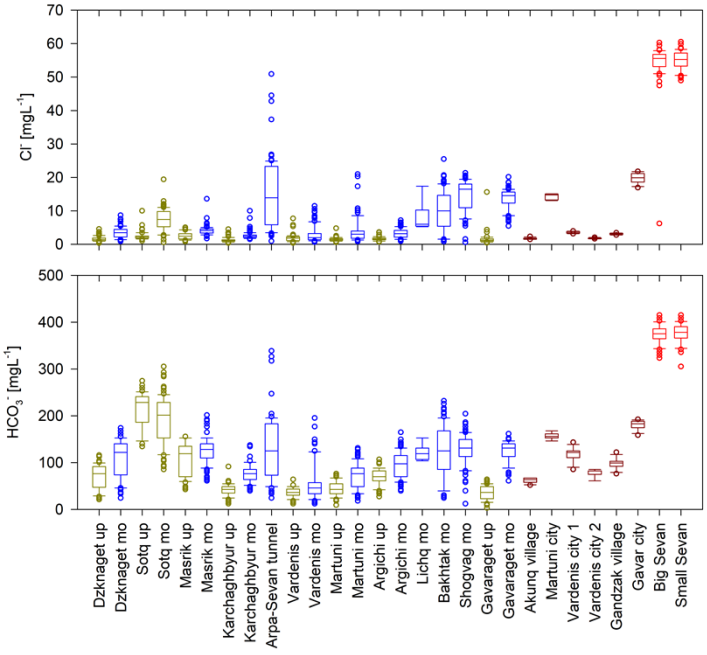
Comparison of rivers, groundwater and Lake Sevan: Na and Ca

- **Na concentration** is higher in Lake – **strong impact of evaporation**
- **Calcite precipitation-algae** blooming effect on Ca



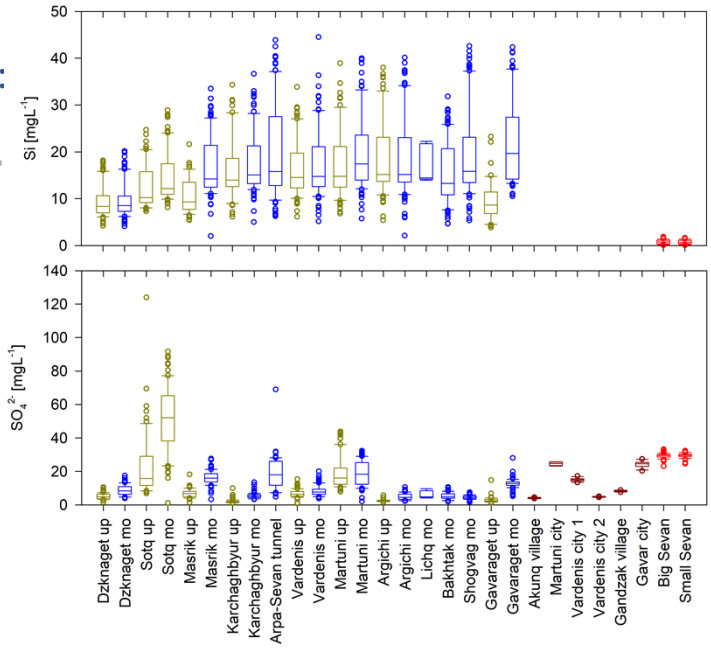
Comparison of rivers, groundwater and Lake Sevan: Cl and HCO3

- **Cl and HCO3 concentrations are high in Lake** –effect of evaporation
- Evaporation effect on **HCO3 smaller due to calcite precipitation**



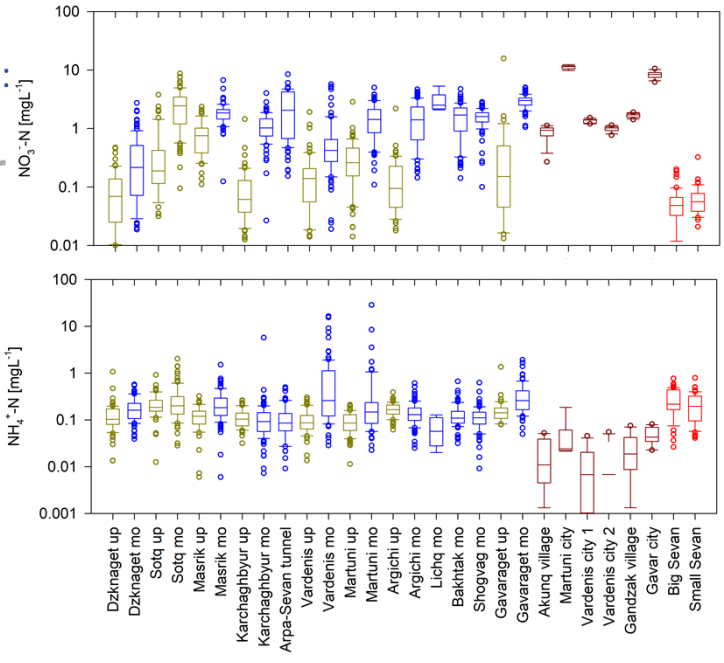
Comparison of rivers, groundwater and Lake Sevan: Si and SO4

- Si uptake by diatoms in lake
- Sulfate concentration is similar to the rivers- **sulfate reduction effect in lake**



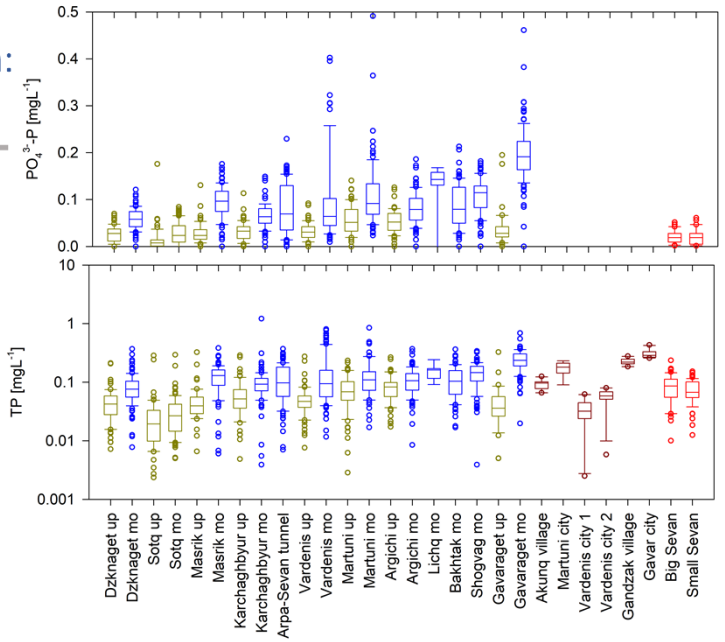
Comparison of rivers, groundwater and Lake Sevan: NO3 and NH4

- High concentration of NO3 in rivers
- Increase of NO3 along the rivers
- Strong impact of biological uptake and denitrification in lake



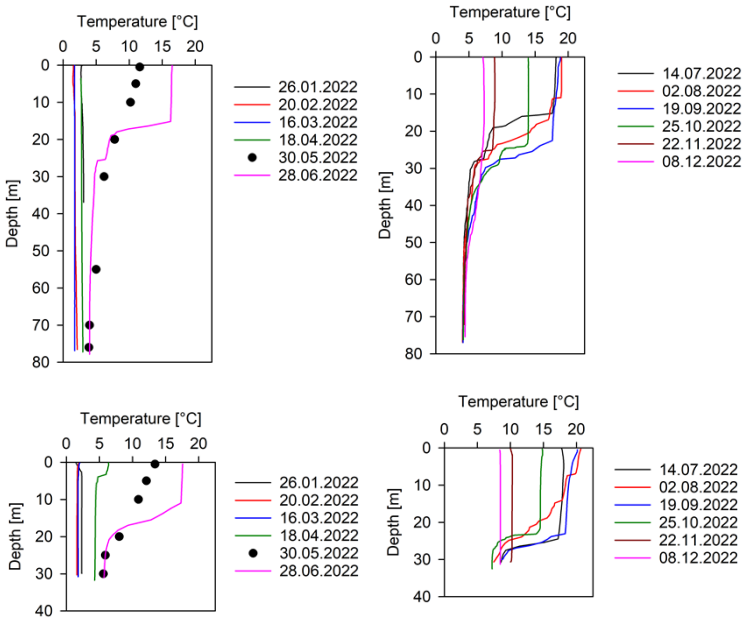
Comparison of rivers, groundwater and Lake Sevan: PO4 and TP

- Strong impact of biological uptake and sedimentation
- Increase of PO4 along Rivers
- High TP in lake and Rivers



Profiles in Lake Sevan: Temperature

- Stratification: from June to October in Small Sevan
- Thermocline: in 20-30 m depth



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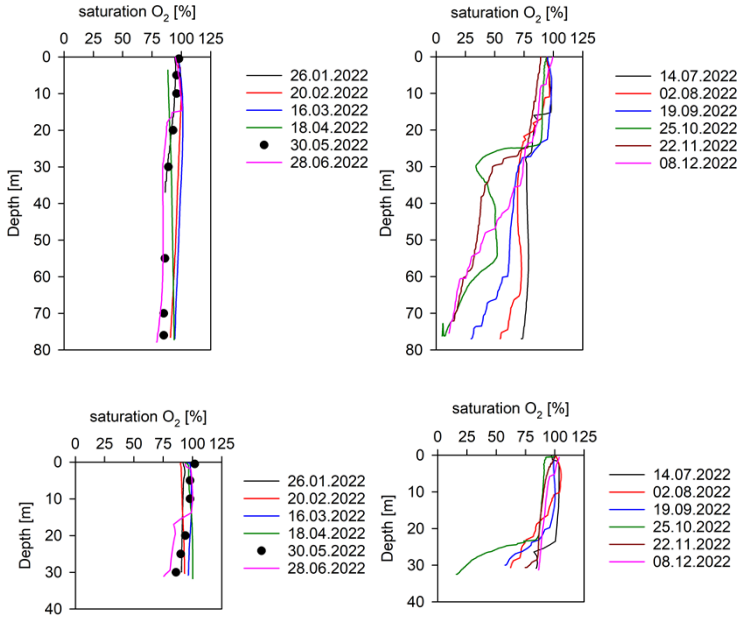
Profiles in Lake Sevan: Dissolved Oxygen

- Oxygen depletion from July-December in Small Sevan
- Hypoxia in hypolimnion from October to December-in Small Sevan
- Oxygen depletion from July to October in Big Sevan



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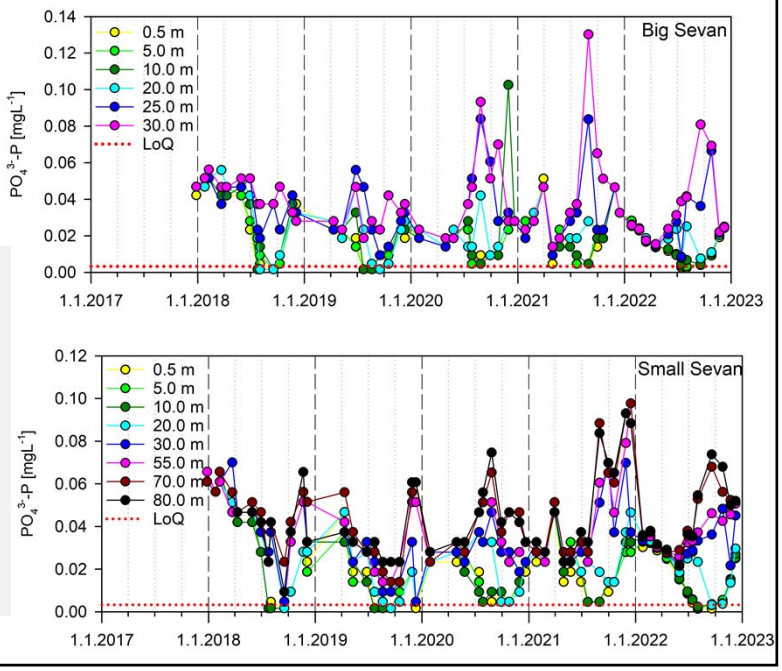
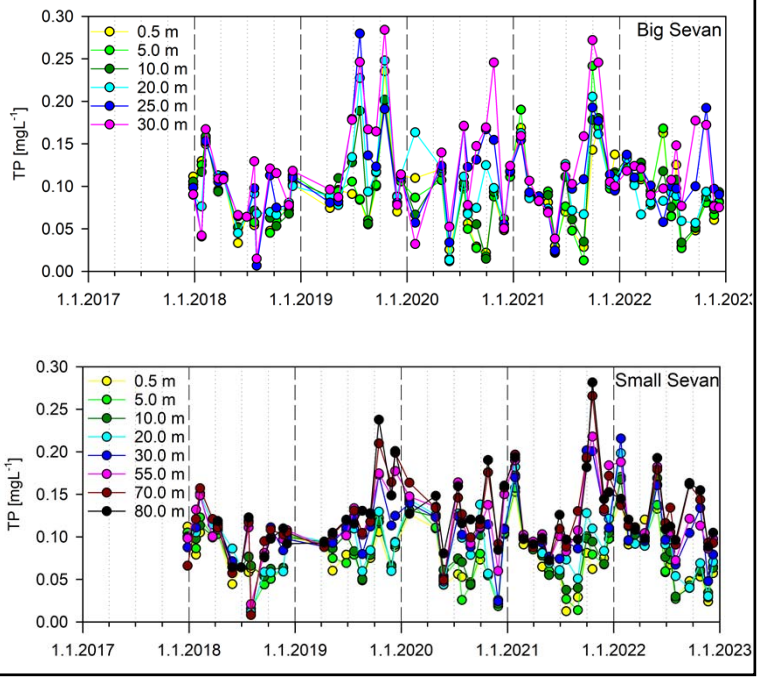
Changes of concentrations in Big and Small Sevan related to depth and time: Phosphate

- Phosphate consumption by phytoplankton in upper layers during stratification
- **Phosphorus enrichment in hypolimnion** via sedimentation of dead phytoplankton or release from sediments during stratification



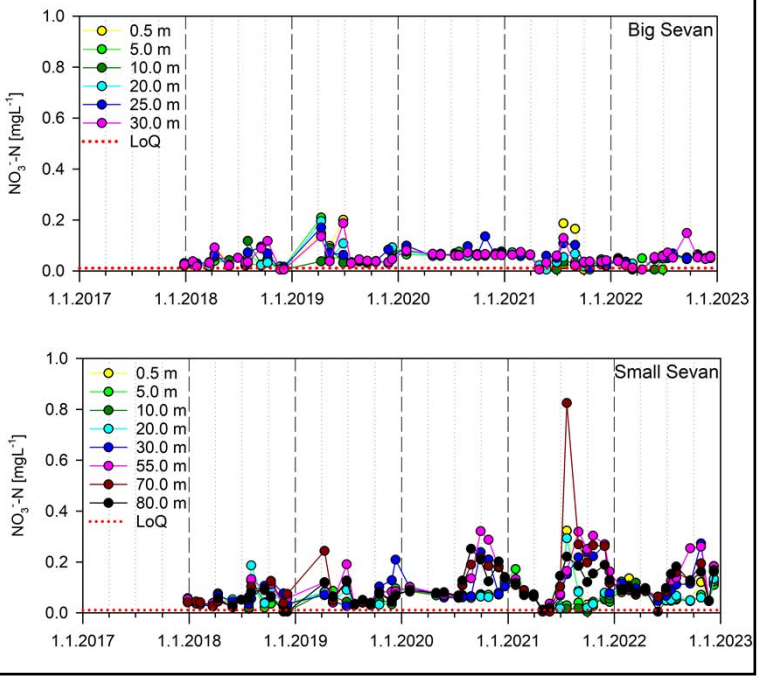
Changes of concentrations in Big and Small Sevan related to depth and time: Total Phosphorus

- Similar trends to PO4 with more complicated differentiation between layers
- Phosphorus enrichment in hypolimnion during stratification



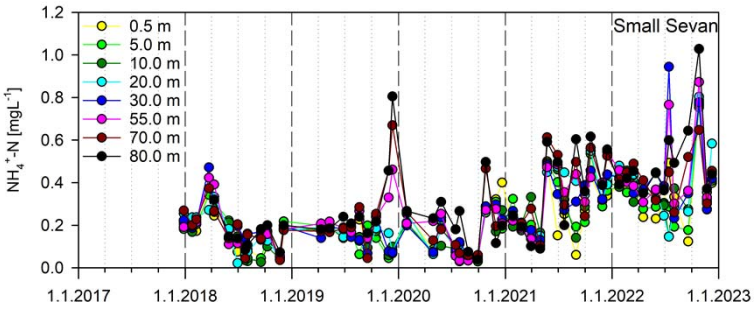
Changes of concentrations in Big and Small Sevan related to depth and time: Nitrate-N

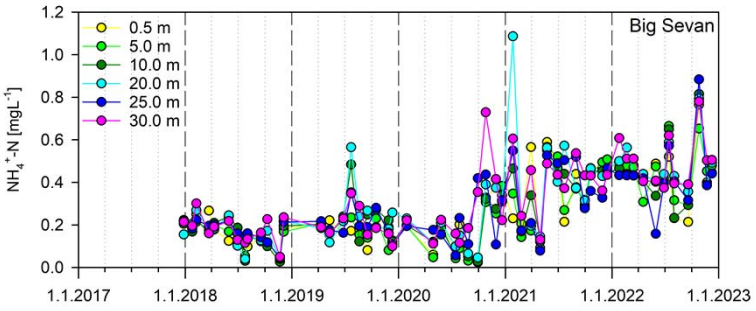
- Low Nitrate concentration for intake by phytoplankton but high enough to not limit the growth
- Increased concentration of Nitrate in deeper layers of Small Sevan during stratification



Changes of concentrations in Big and Small Sevan related to depth and time: Ammonia-N

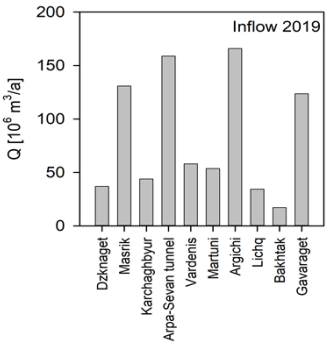
- No seasonal trends of ammonia
- Slightly increase in concentration last years

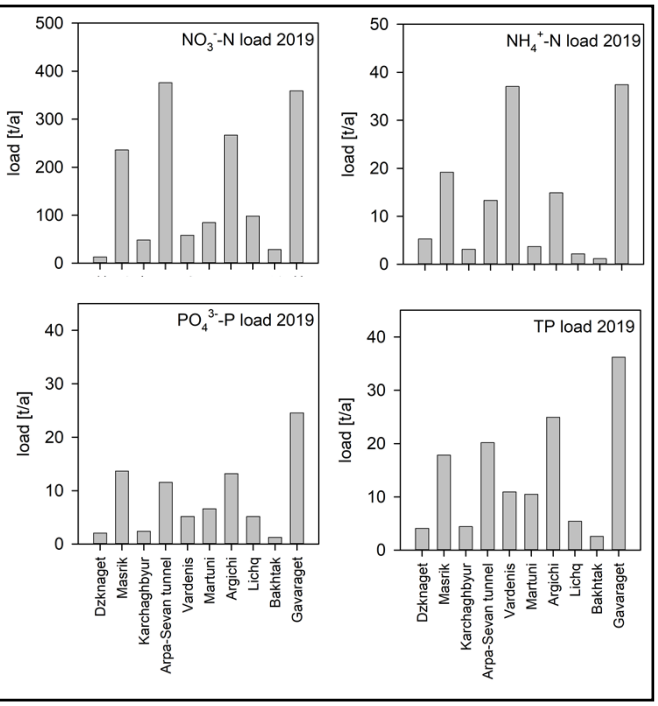




Nutrient loads

- **Main Load Nitrate-N, TP and Phosphate-P:** Masrik, Argichi and Gavaraget rivers, Arpa-Sevan tunnel
- **Main Load Ammonia-N:** Masrik, Argichi, Vardenis and Gavaraget rivers, Arpa-Sevan tunnel





Conclusion

- Concentrations of Na, Cl, and HCO3 are high in Lake due to evaporation
- Calcium precipitation occurs due to the high hydrobiological activity
- Sulphate reduction occurs due to the low concentration of Dissolved Oxygen
- Main Load of nutrients: Masrik, Argichi and Gavaraget rivers, Arpa-Sevan tunnel
- Oxygen depletion from July-December in Small Sevan
- Hypoxia in hypolimnion from October to December-in Small Sevan
- Eutrophication of Lake Sevan is obvious (e.g. from yearly summer blooming in last years) and requires reduction of nutrient inputs, including implementation of adequate waste water treatment
- Very likely climate change will make management more complicated regarding both water quantity and water quality
- Monitoring of both water quantity and water quality is essential for successful management of Lake Sevan, including monthly sampling

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Thank you