






**HELMHOLTZ**  
Centre for Environmental Research



detect more.

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## Introduction to SEVAMOD2 - Building up science-based management instruments for Lake Sevan, Armenia

Martin Schultze  
(on behalf of SEVAMOD2 team)  
UFZ-Department Lake Research

October 5, 2023

Western part of Small Sevan  
(early in the morning)




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## SEVAMOD2

### Basic information

#### Funding

- Funding period: April 1, 2020 – December 31, 2023, ca. 515 T€
- Federal Ministry for Education and Research of Germany (Project ID 01DK17022)
- Co-funding by Ministry of Environment RA (60% of costs for chemical analyses, ca. 48 T€)

#### Goals

- Monthly sampling for chemical analyses and plankton
- Nutrient budget for Lake Sevan and nutrient management concept
- Coupled physical-ecological 1D eutrophication model for Lake Sevan (nutrients, plankton, oxygen)
- Use of satellite-based remote sensing for estimation of water quality of Lake Sevan
- Evaluation of alternative management scenarios and identification of major water quality threats for Lake Sevan including the preparation of a policy brief
- Capacity Building in Armenia for use of satellite remote sensing and lake modelling
- Publication of the project results including realization of a final public project workshop in 2023

## SEVAMOD2

### Project partners

- Scientific Centre of Zoology and Hydroecology NAS RA, Institute of Hydroecology and Ichthyology (SCZHE), Yerevan, Armenia
- Center for Ecological Noosphere Studies NAS RA (CENS), Yerevan, Armenia
- Hydrometeorology and Monitoring Center SNCO of the Ministry of Environment RA (HMC), Yerevan, Armenia
- EOMAP, Seefeld, Germany
- Helmholtz Centre for Environmental Research – UFZ, Department Lake Research, Magdeburg, Germany



SEVAMOD2 project meeting, March 2022, Magdeburg

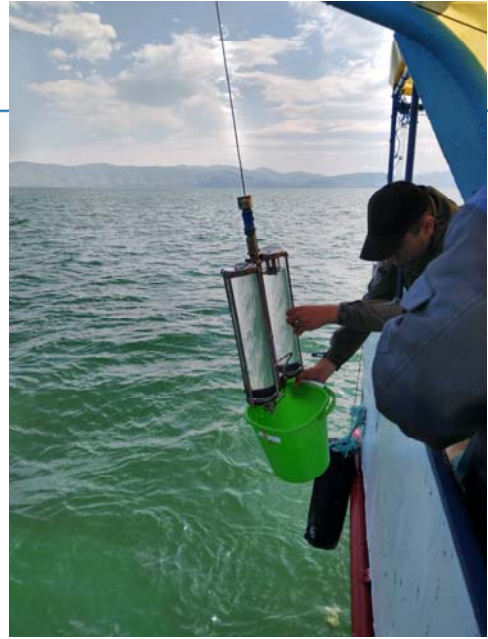
## SEVAMOD2

### Goals and related activities and results in more detail

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### Monthly sampling Summer



### Monthly sampling Winter + May 2023



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→ **presentations on chemistry and plankton**
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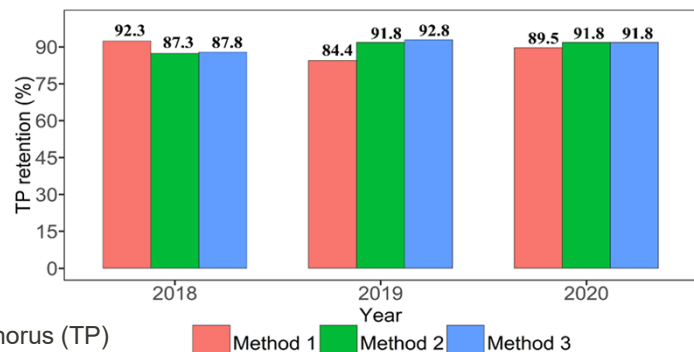
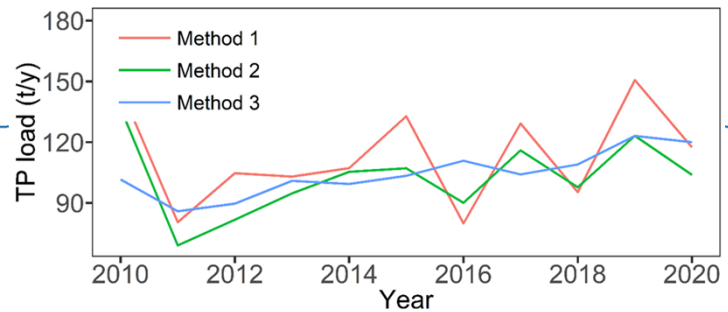
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## SEVAMOD2

### Nutrient budget

- Loads (i.e. inputs from inflows) calculated using three different methods for more robust results  
 $Load = Concentration * Flow$
- Budget compares loads with export by outflow, i.e. via Hrazdan River (like in economy)
- Retention is percentage of input that is not exported but accumulated in Lake Sevan, mainly in the sediment  
 $Retention = (Load - Export) : Load$



Results for total phosphorus (TP)

Method 1 Method 2 Method 3

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→ presentation on model and results of simulations
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→ **presentation on remote sensing application**
- Evaluation of alternative management scenarios and identification of major water quality threats for Lake Sevan including the preparation of a policy brief
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→ presentation on remote sensing application
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## Capacity building

### 11 training stays of one month in Germany

Name, Institution	Training host	Subject (number of stays)
A. Misakyan, ArmHydromet	UFZ, Department Lake Research	Introduction into lake limnology + lake modelling (3)
A. Hayrapetyan, SCZHE	UFZ, Department Lake Research	Advanced data evaluation (1)
G. Gevorgyan, SCZHE	UFZ, Department Lake Research	Advanced data evaluation (1)
A. Hovsepyan, SCZHE	UFZ, Department Lake Research	Advanced methods of phytoplankton analysis (1)
T. Khachikyan, SCZHE	UFZ, Department Lake Research	Advanced methods of phytoplankton analysis (1)
A. Khlgatyan, CENS	EOMAP	Remote sensing (2)
R. Avetisyan, CENS	EOMAP	Remote sensing (1)
A. Hovsepyan, CENS	UFZ, Department Lake Research	Introduction into lake limnology (1)

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## Publications

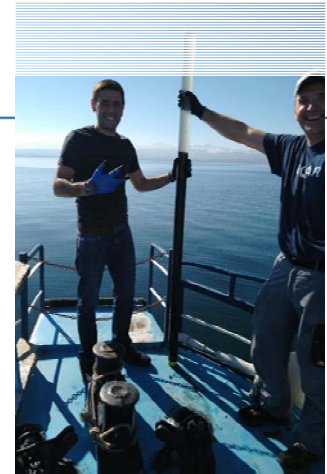
- Gevorgyan, G., Rinke, K., Schultze, M., Mamyán, A., Kuzmin, A., Belykh, O., Sorokovikova, E., Hayrapetyan, A., Hovsepyan, A., Khachikyan, T., Aghayan, S., Fedorova, G., Krasnopeev, A., Potapov, S., Tikhonova, I., (2020): First report about toxic cyanobacterial bloom occurrence in Lake Sevan, Armenia. *International Review of Hydrobiology* 105:131-142
- Shikhani M, Mi C, Gevorgyan A, Gevorgyan G, Misakyan A, Azizyan L, Barfus K, Schulze M, Shatwell T, Rinke K (2021) Simulating thermal dynamics of the largest lake in the Caucasus region: The mountain Lake Sevan. *Journal of Limnology* 81(s1):2024
- Gabrielyan B, Khosrovyan A, Schultze M (2022) A review of anthropogenic stressors on Lake Sevan, Armenia. *Journal of Limnology* 81(s1):2061
- Gevorgyan G, von Tuempling W, Shahnazaryan G, Friese K, Schultze M (2022) Lake-wide assessment of trace elements in surface sediments and water of Lake Sevan. *Journal of Limnology* 81(s1):2096
- Dadi T, von Tümping W, Mi C, Schultze M, Friese K: Assessment of phosphorus behavior in sediments of Lake Sevan, Armenia. *Journal of Limnology* 81(s1):accepted
- Hayrapetyan A, Gevorgyan G, Schultze M, Shikhani M, Khachikyan T, Krylov A, Rinke K: Contemporary community composition, spatial distribution patterns, and biodiversity characteristics of zooplankton in the large alpine Lake Sevan, Armenia. *Journal of Limnology* 81(s1):in revision



## Collaboration with other projects

### Stimulated research

- **The rising problem of blooming cyanobacteria in Lake Sevan: identifying mechanisms, drivers, and new tools for lake monitoring and management**
  - Gor Gevorgyan, SCZHE
  - Funded by Science Committee of Ministry of Education, Science, Culture and Sport RA
  - Funding Period: 2020-2023
- **Assessing spatio-temporal changes of the water quality of mountainous lakes using remote sensing data processing technologies**
  - Shushanik Asmaryan, CENS
  - Funded by Science Committee of Ministry of Education, Science, Culture and Sport RA
  - Funding Period: 2021-2024
- **Paleo-limnological studies based on sediments from Lake Sevan**
  - Torsten Haberzettl (University Greifswald), Lilit Sahakyan (Institute of Geological Sciences NAS RA), Kurt Friese, Martin Schultze (UFZ Lake Research)
  - Some funding by DAAD for exchange of students



Sediment sampling  
October 2021

Longest core: 141 cm  
→ ~5100 years!

## Collaboration with other projects

### Complementary projects

- **GlobeWQ - Pilot Project to create a Global Water Quality Analysis and Service Platform – use case Lake Sevan**
  - UFZ, Dietrich Borchard; Funded by Federal Ministry for Education and Research of Germany; Funding Period: 2020-2022; collaboration with ArmHydromet
- **EU4Sevan – Environmental Protection of Lake Sevan (GIZ, UNDP)**
  - Development project funded by EU and UNDP
  - **Output 1:** The water monitoring and management capacities for the Lake Sevan watershed are (further) improved.
    - **UFZ/SEVAMOD2-contribution:** Sevan Conference (co-organiser); Monitoring concept; Groundwater characterisation; Modelling of future water balance
  - **Output 5:** The Lake Sevan ecosystem governance is further improved.
    - **UFZ/SEVAMOD2-contribution:** Modelling of future water balance and water quality of Lake Sevan at different water levels (contribution to development of national vision for Lake Sevan)



Sevan Conference  
July 2022

**SEVAMOD2**  
Special events



Meeting with  
Minister  
Simidyan,  
May 2022

Visit of  
Ambassador  
Richter at  
Lake Sevan  
03.08.2023



Visit of BMBF  
delegation at  
Lake Sevan  
11.07.2023



Reception of  
Ambassador  
Yengibaryan  
21.09.2022

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**Thank you very much for your attention!**