

Monitoring and assessment of water quality of Cyprus salt lakes



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A. Water monitoring of salt lakes



WATER FRAMEWORK DIRECTIVE 2000/60/EC

NATURAL LAKES: temporary, shallow, brackish – saline – hypersaline

Monitoring program in 10 Lakes (28 sampling & monitoring stations):

- 13 monitoring and sampling stations:
 1. aquatic biomonitoring & chemical monitoring
 2. measurements of *in situ* hydrological & physical-chemical parameters
- 15 *in situ* monitoring stations: measurements of hydrological & physical-chemical parameters



QUALITY ELEMENTS

According to **preliminary reference conditions** for the temporary salt lakes of Cyprus:

- 4 different types of lakes were identified (salinity, hydrological regime, morphology), 2 heavily modified
- **Phytoplankton** & **zooplankton**: considered the most useful biological quality elements (BQE's) for assessment and are examined constantly, in the monitoring programs
- **Macrophytes** are also examined (if found)
- **Salinity** (& **hydrological status**) seem to shape the communities of salt lakes primarily and then the availability of **nutrients**



In situ MONITORING

physical, chemical & hydrological parameters:

- temperature
- pH
- dissolved oxygen
- electrical conductivity & salinity
- turbidity
- water level

frequency:

2019 & before: EVERY 1 or 2 WEEKS in some lakes

2020 – today: MONTHLY in 15 stations



In situ MONITORING & SAMPLING

In WATER COLUMN:

- physical, chemical & hydrological parameters (*in situ*)
- nutrients, priority substances, chemical & microbiological parameters, major ions, heavy metals: examined since 2017
- **phytoplankton** (composition – abundance – biomass determination & chlorophyll *a*): examined since 2014
- **zooplankton** (composition – abundance): examined since 2014
- **macrophytes** (identification): *if found*, since 2019



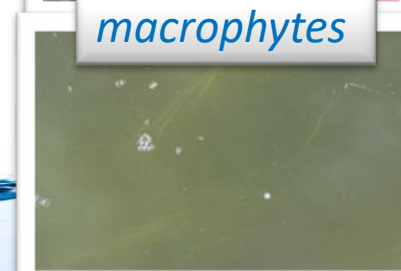
phytoplankton



zooplankton



macrophytes



***In situ* MONITORING & SAMPLING**

frequency:

2019 & before: EVERY 1 or 2 WEEKS in some lakes

2020 – today: MONTHLY in 13 stations

In SEDIMENT:

priority substances, chemical parameters, heavy metals etc.

frequency:

2017 – today: 1 / year in 7 stations (one per lake)



MONITORING & SAMPLING OUTCOMES

- **Phytoplankton** and **zooplankton** knowledge is limited for these unique types of lakes
(very shallow temporary saline/hypersaline lakes)
- **No method** developed yet for assessing the ecological quality, according to WFD 2000/60/EC
- Preliminary reference conditions were set only for phytoplankton - zooplankton
- Extra data is collected frequently, to develop a method for assessing the ecological status / ecological potential for Cyprus natural lakes (i.e. to set the high-good, good-moderate **boundaries** etc.)

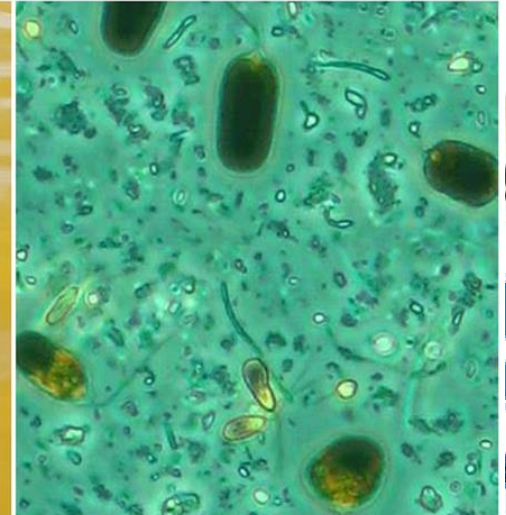
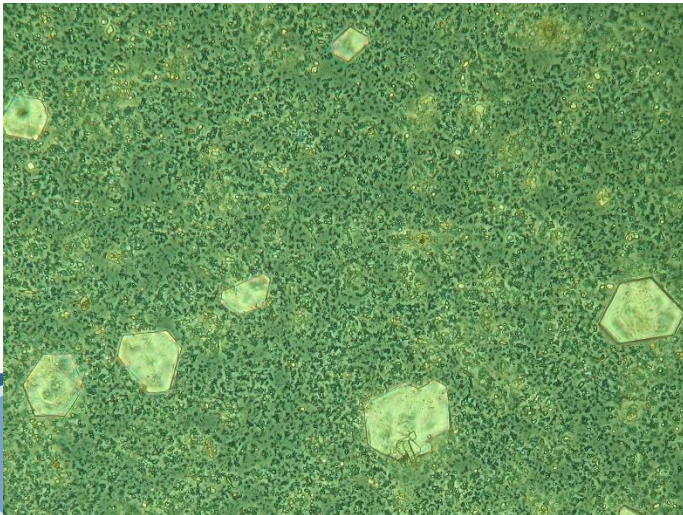


B. Assessment of water quality



MONITORING & RESEARCH OUTCOMES

- **SALINITY** seems to affect the communities of salt lakes primarily (**left image**), while recent data suggest that bottom-sediment effect is huge
- Anthropogenic activities, particularly urban and artificial land uses within their catchments, contribute to eutrophication
- Frequently in saline to hypersaline lakes orange color lake-water (**center**) is observed, due to phytoplankton **BLOOMS**: carotene - producing chlorophyte *Dunaliella* (**right image**)



WATER QUALITY ASSESMENT

A new research agreement between the Water Development Department, Cyprus and the Aristotle University of Thessaloniki, Greece, aims to:

- focus on **pressure of nutrient pollution** and its impact, eutrophication affecting the ecological status
- provide a preliminary outline of the methods for data collection and BQE analysis
- provide recommendations for **water sampling** in general
- include **molecular analysis** in water monitoring (environmental DNA – eDNA)
- undertake **chemical analysis** of nutrients (total phosphorus and total nitrogen)
- develop a novel and reliable (national) **method** for assessing ecological status/ecological potential for salt lakes protection and sustainable management.

The projects' progress and research
knowledge serve the public interest at the
European level



WATER QUALITY – 3rd River Basin Management Plan

period: 2014-2019

- based on *phytoplankton*, salt lakes have **unknown**, or **lower than good ecological** status.
- based on *zooplankton* and the *physicochemical parameters*: it appears that **ecological reference conditions** were not achieved
- All of the salt lakes **failed to achieve good** **chemical** status, mainly due to metals & pesticides

CODE	NAME	ECOLOGICAL STATUS/POTENTIAL	CHEMICAL STATUS
CY_L7-2-6-70	Paralimni lake	Unknown potential*	Failing to achieve good
CY_L8-1-2-94	Oroklini lake	Unknown potential (Failing to achieve good)	Failing to achieve good
CY_L8-3-2-82	Larnaka's main lake	Unknown quality (Failing to achieve good)	Failing to achieve good
CY_L8-3-2-85	Aerodromiou lake no. 2	Unknown quality (Failing to achieve good)	Failing to achieve good
CY_L8-3-2-88	Orfani lake	Unknown quality *	Failing to achieve good
CY_L8-3-2-96	Soros lake	Unknown quality *	Failing to achieve good
CY_L9-5-3-50	Akrotiri lake	Unknown quality *	Failing to achieve good

* Due to the lack of sufficient data for the years 2014-2017, 2018-2019 result is adopted as representative for the entire evaluation period.





Thank you for your attention

Aknowledgements:

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