

Lake 2015

Parameterization of Lakes in Numerical Weather Prediction and Climate Modelling

University of Évora, Évora, Portugal, 7-9 May 2015

ALEX2014
... ALqueva hydro-meteorological EXperiment



Instituto de Ciências da Terra

Ecological assessment of Mediterranean reservoirs: Alqueva reservoir as a case study (Alentejo, Southern Portugal)

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Alexandra Penha, Amely Zavattieri, Miguel Potes & Rui Salgado



«Portugal is mediterranean by conditions, atlantic by position» (Pequito Rebelo em “A Terra Portuguesa” – 1929)

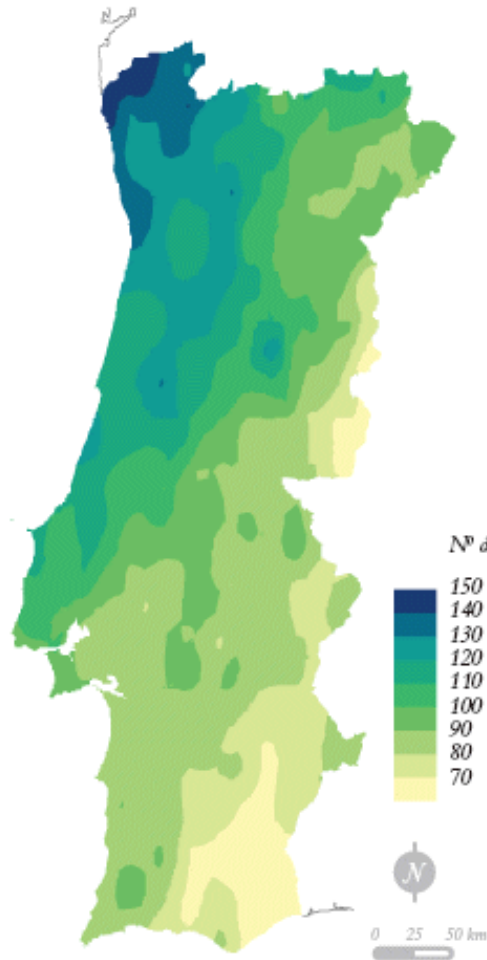
Portugal is a crossroad of influences between the Mediterranean and the Atlantic, attentive to the complexity and to the reversibility of movements of a human geography (Guilherme d'Oliveira Martins)



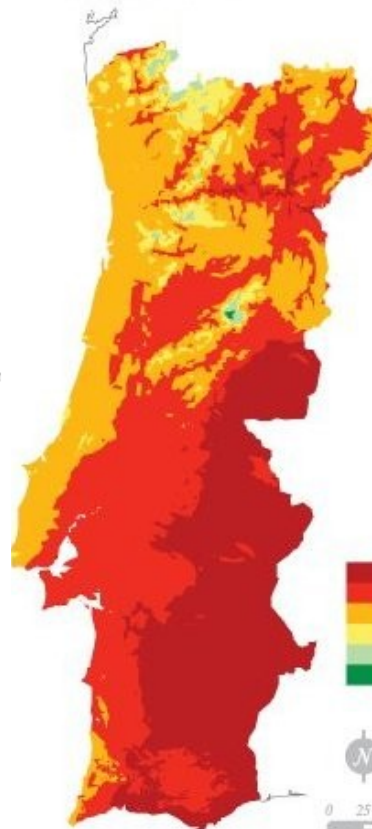
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Influence of the latitude, altitude and distance from the sea.

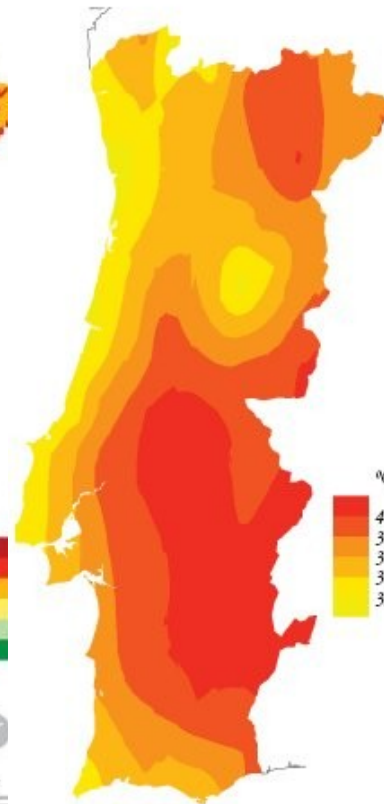
Precipitação $\geq 1\text{mm}$



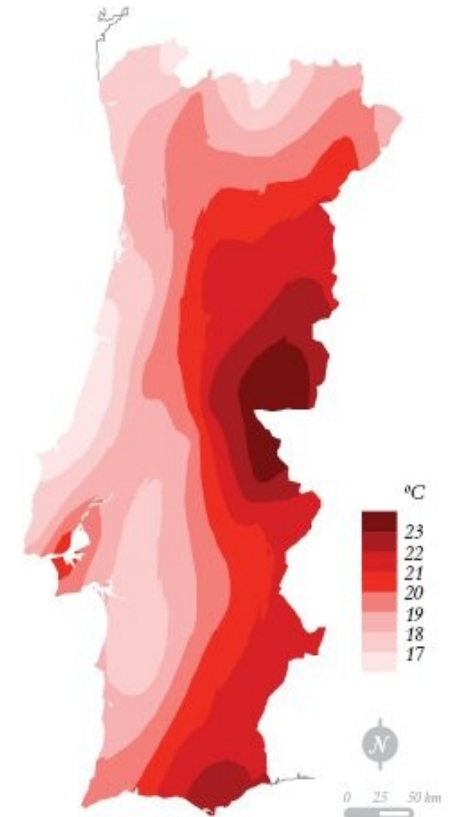
Temperatura média do ar
nos meses de Verão



Média da temperatura máxima do ar
1 a 14 de Agosto 2003



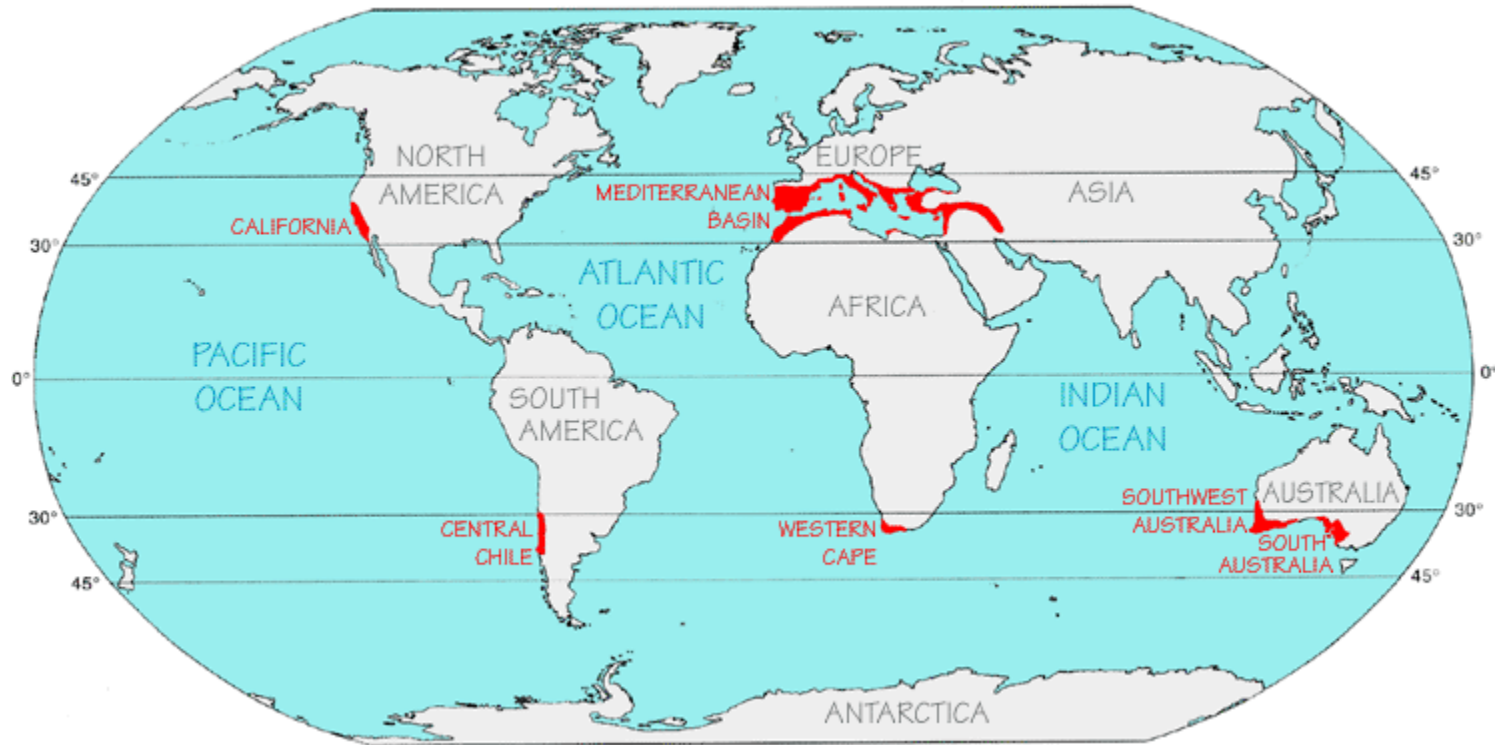
Média da temperatura mínima do ar
1 a 14 de Agosto 2003



«Portugal is mediterranean by conditions, atlantic by position»
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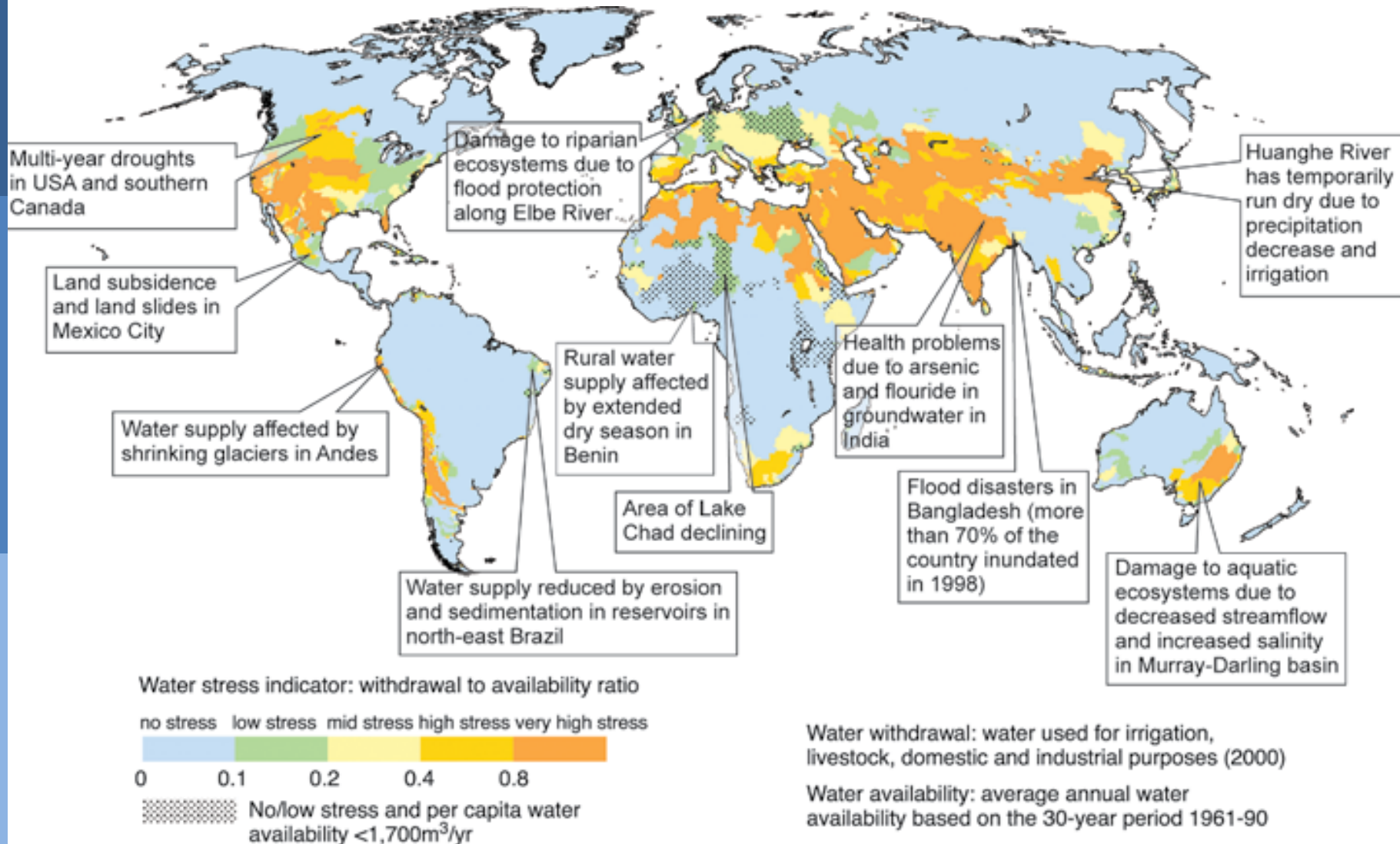


Mediterranean Climate Regions occur between 30°- 45° North and South of the Equator, in the west side of continents of the Mediterranean Basin, Middle East California, central Chile, Western Cape in South Africa, and the South West in Western Australia. Correspond only to 2% of the Earth's land surface

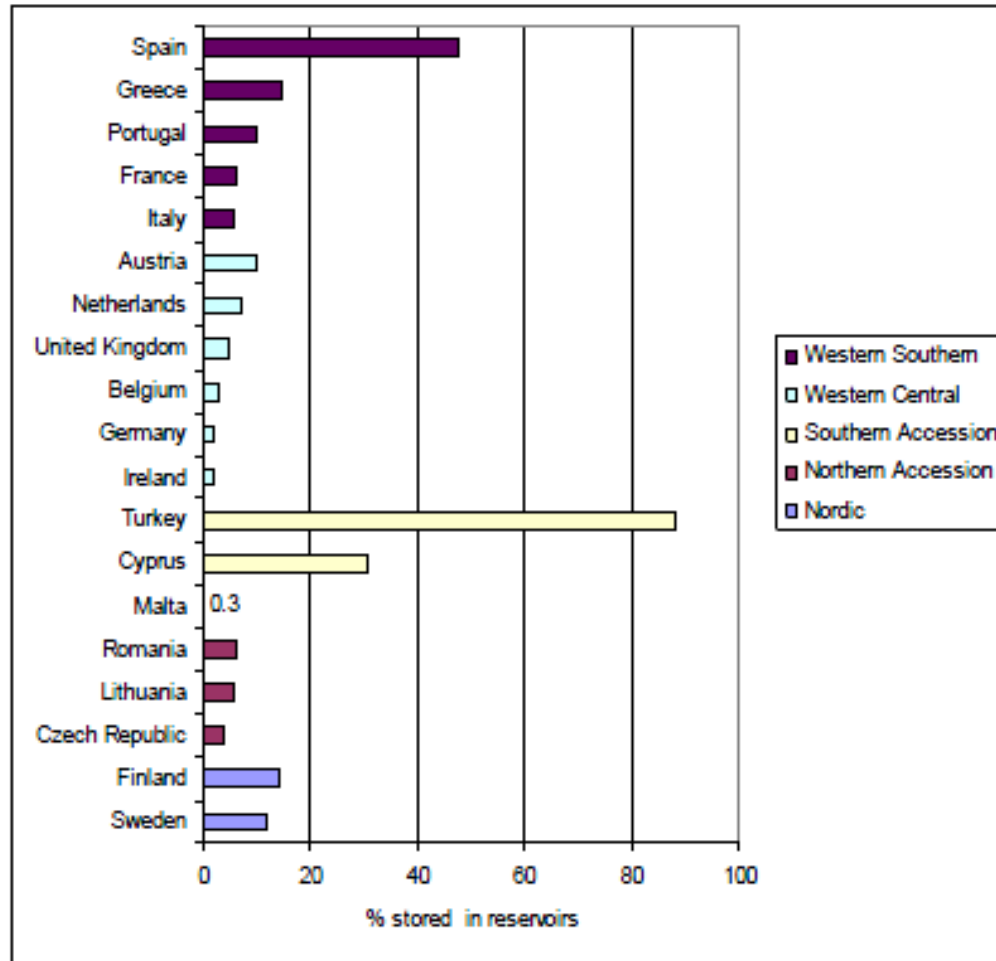
Influenced by cold ocean currents, the Mediterranean climate is characterized by a moderately rainy winter and a hot dry summer.

Adapted from: *Ecosystems of the World, Vol. II, Mediterranean-Type Shrublands* (F. DiCasteri, D.W. Goodall and R.L. Specht, Eds.), Elsevier, Amsterdam, 1981.

Water stress indicator: A ratio of water withdrawal to water availability



Proportion of total freshwater resources stored in reservoirs in Europe



Notes:

Western Southern: Italy, France, Portugal, Greece, Spain

Western Central: Ireland, Germany, Belgium, United Kingdom, Netherlands, Austria

Southern Accession: Malta, Cyprus, Turkey

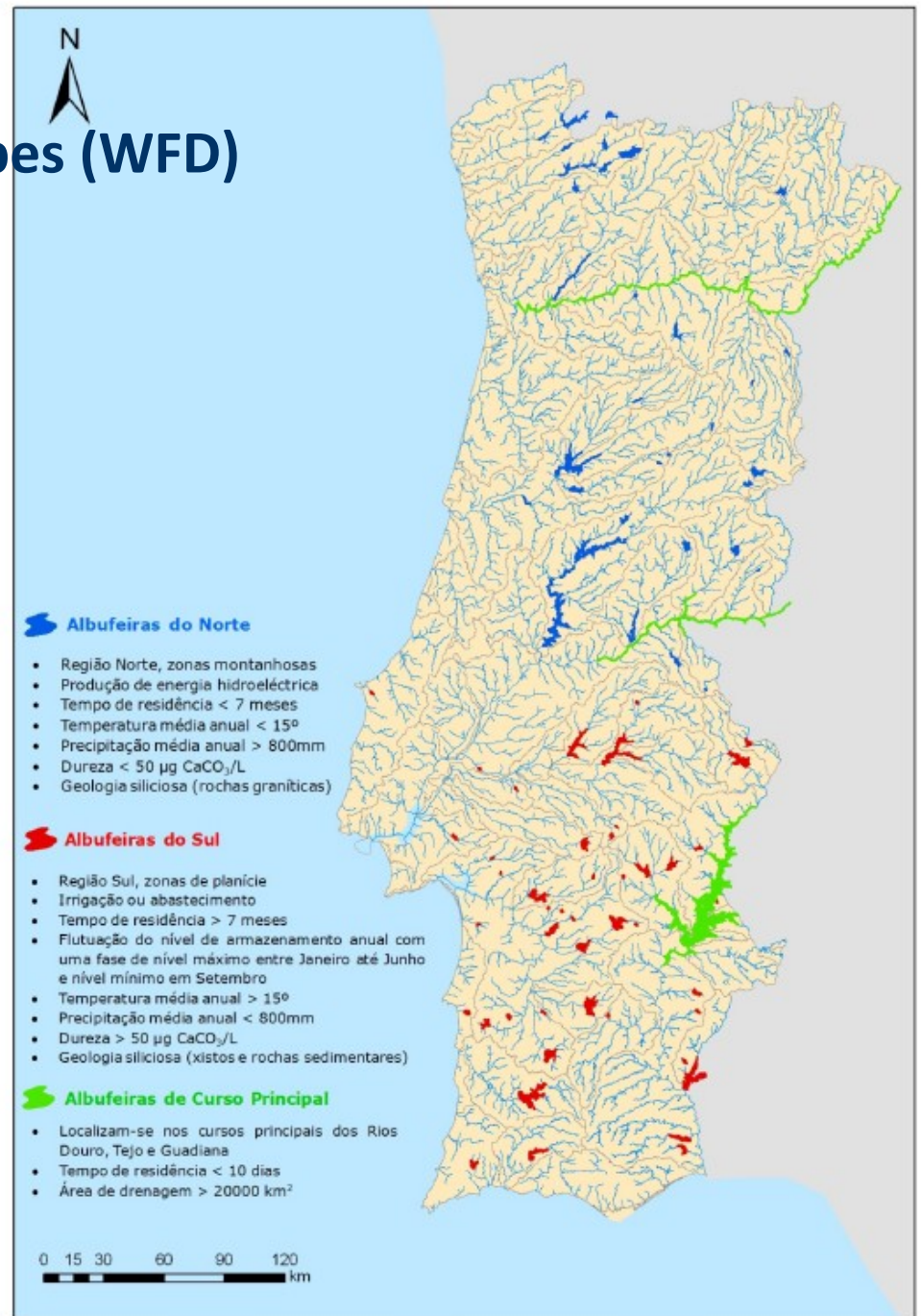
Northern Accession: Czech Republic, Lithuania, Romania

Nordic: Sweden, Finland

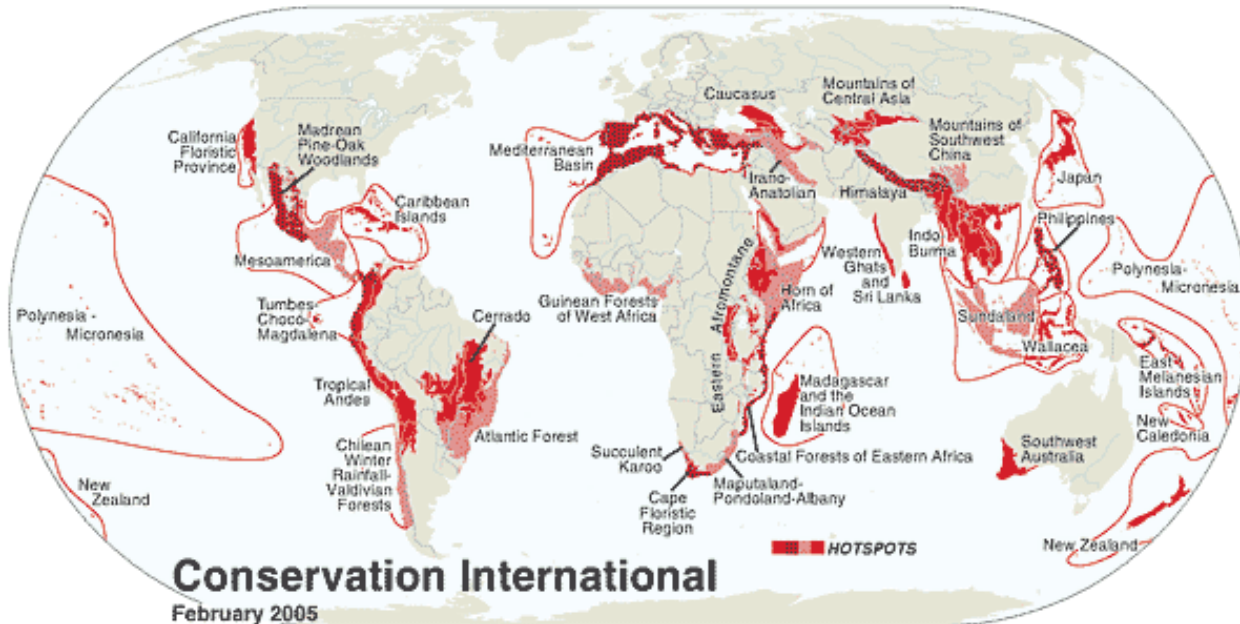
77 reservoirs in Portugal organized in three abiotic types (WFD)

- North;
- South;
- Main course;

Reservoirs are impoundments created by humans. They are being constructed on an unprecedented scale in response to the exponential water demands to human activities. Such alterations will result in major modifications in topography and regional climate that are not yet fully recognized or even partially understood.



Conservation and biodiversity



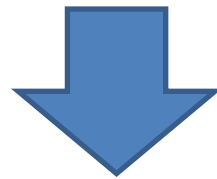
The 34 hotspots identified by Conservation International cover 2.3 percent of the Earth's land surface, yet more than 50 percent of the world's plant species and 42 percent of all terrestrial vertebrate species are endemic to these areas. All are threatened by human activities.

With many endemic species, Mediterranean is recognized as one of the first 25 Global Biodiversity Hotspots, with many endemic threatened species

Additional

- ❑ The total population of the Mediterranean countries grew from around 300 million in 1970 to 400 million in 2000 (a 1,4 % increase per year) and to 466 million in 2010. The population is predicted to reach 500 million by 2025.
- ❑ This overgrowing population is increasing water resources pressure and requesting new water planning and management approaches

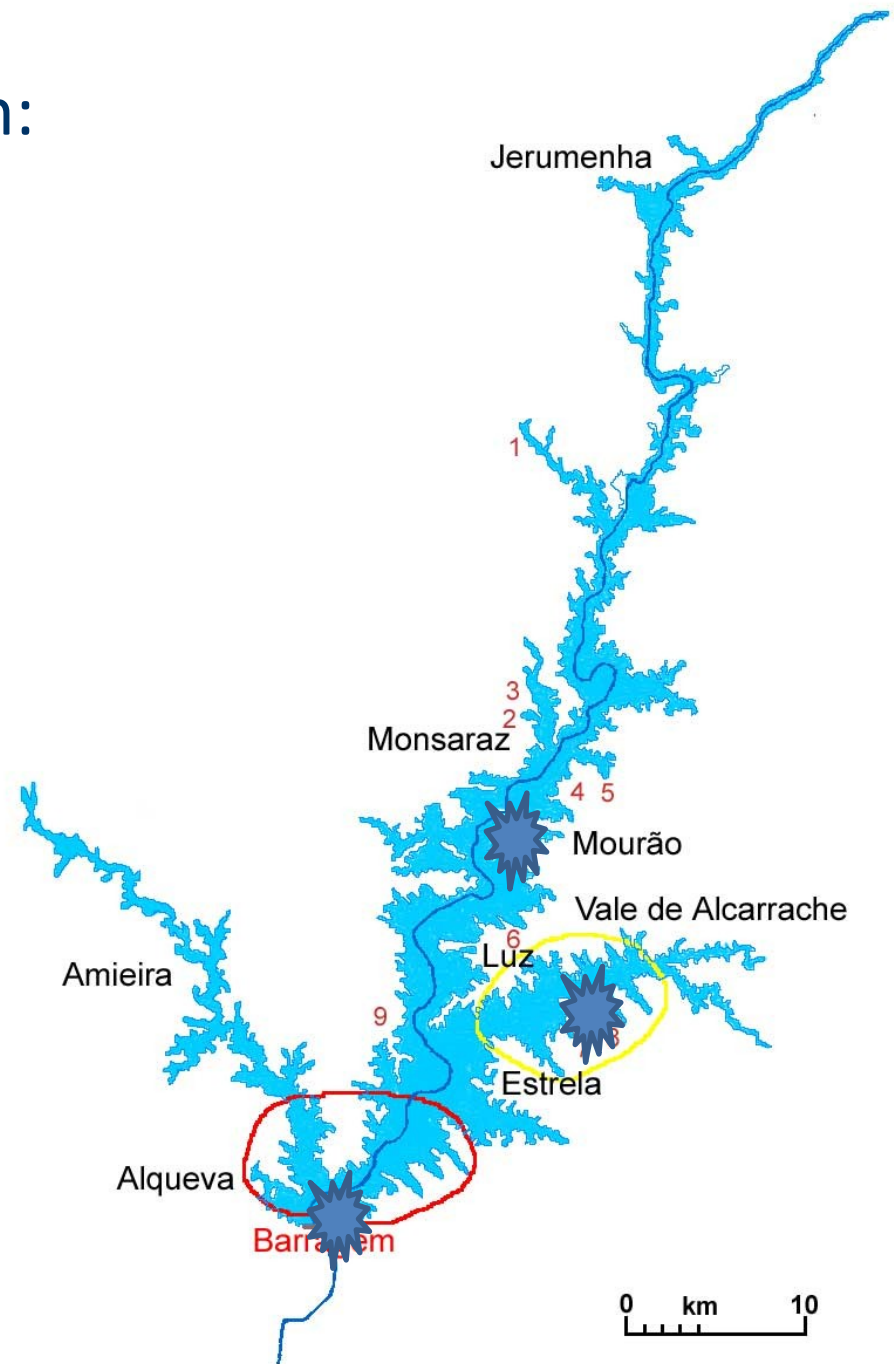
To go further on the understanding of the functioning of large and deep reservoirs during the summer period in the Mediterranean Region, Alqueva reservoir was studied from June until September 2014.

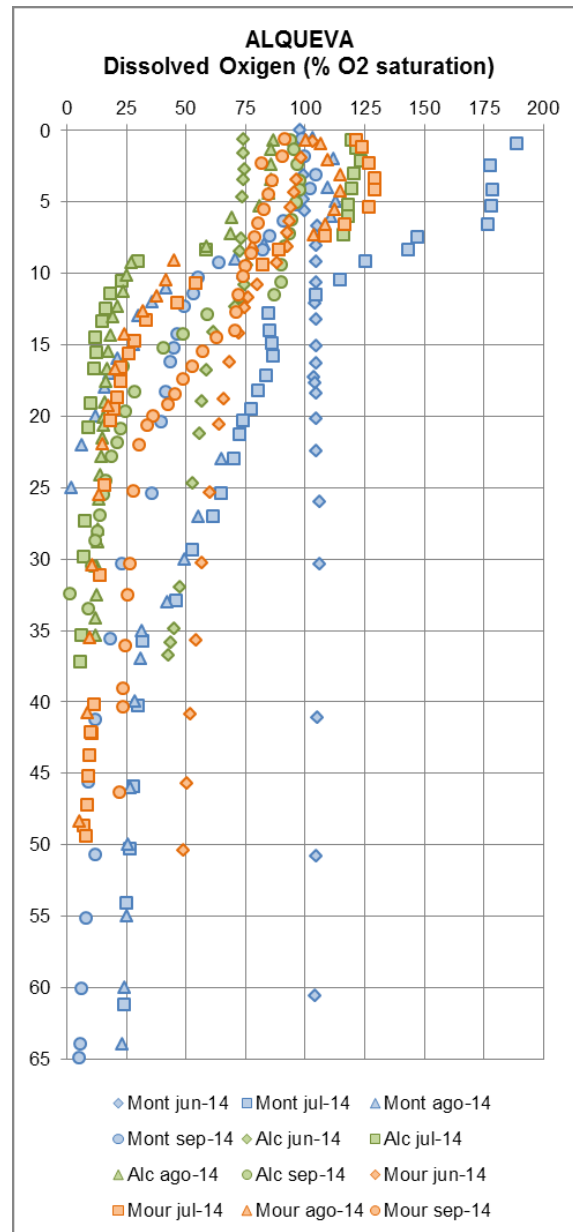
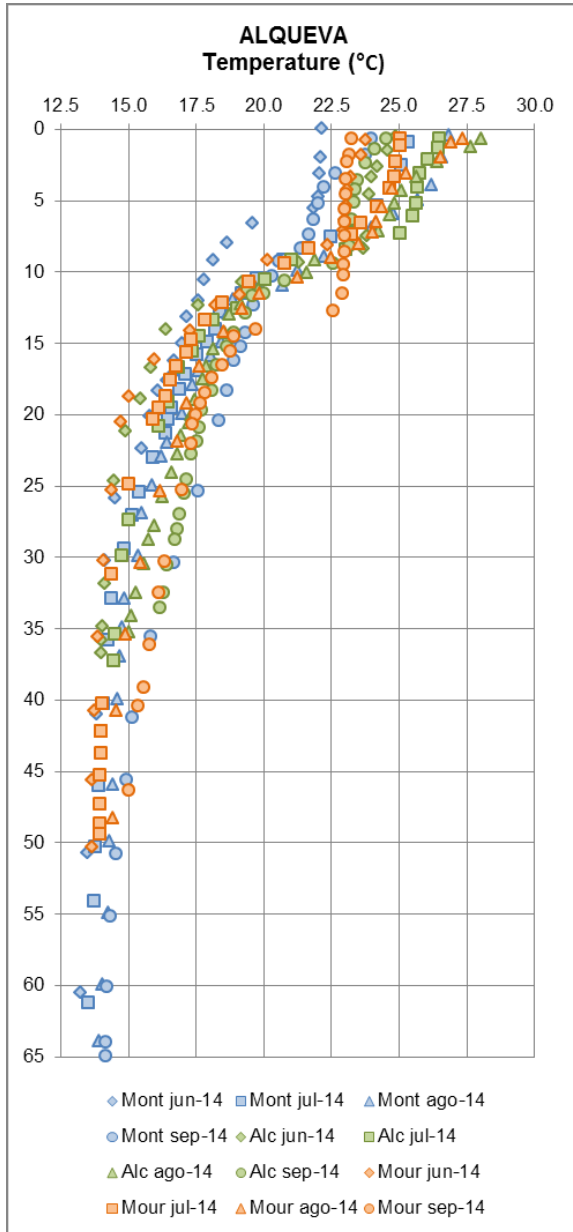


- To do so, vertical profiles of temperature, dissolved oxygen, pH, oxidation-reduction potential and conductivity were monthly taken;
- simultaneously, water samples were collected for physical-chemical analyses and an integrated sample, representative of the euphotic zone, was collected for phytoplankton identification and quantification.

Three sites were chosen:

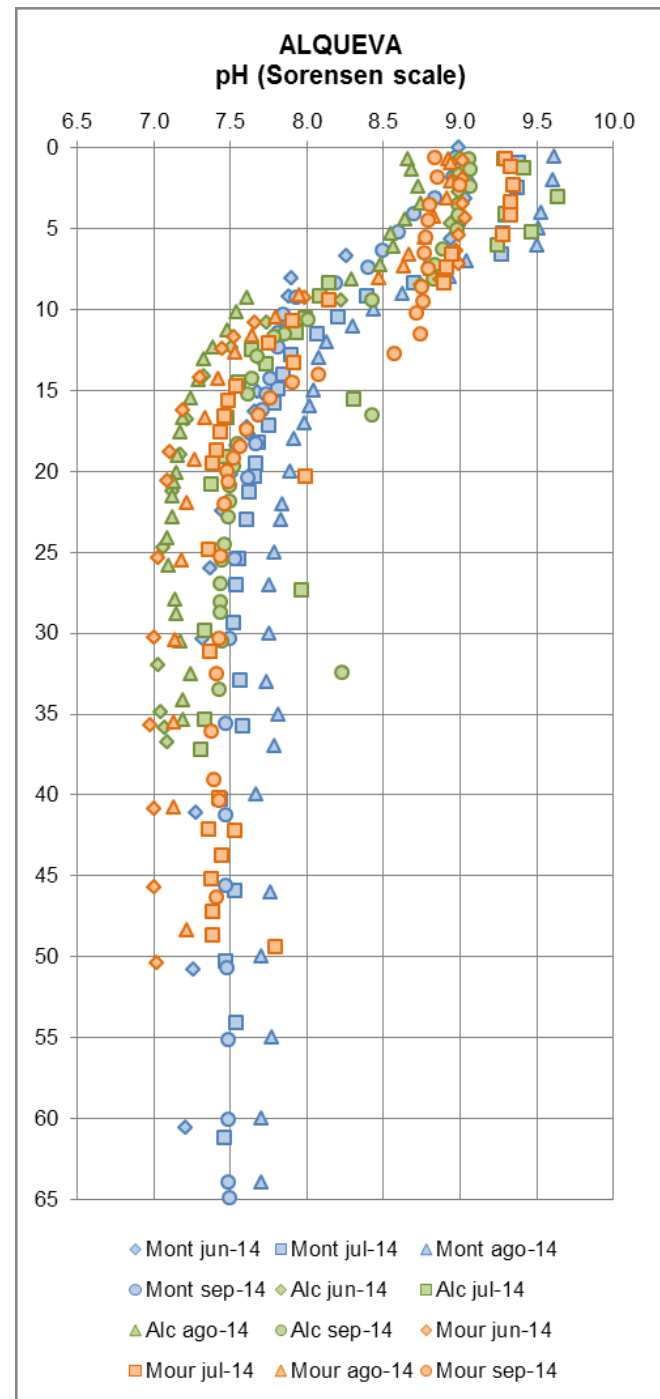
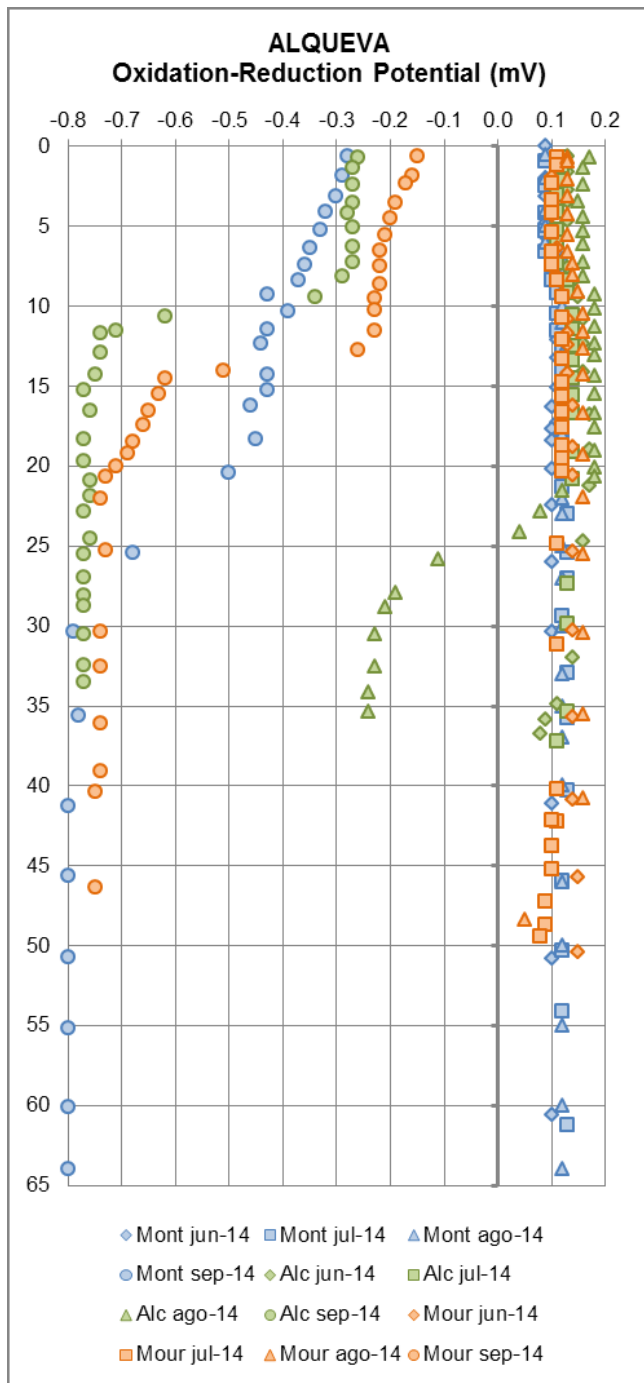
- near the dam;
- middle section;
- Alcarrache tributary





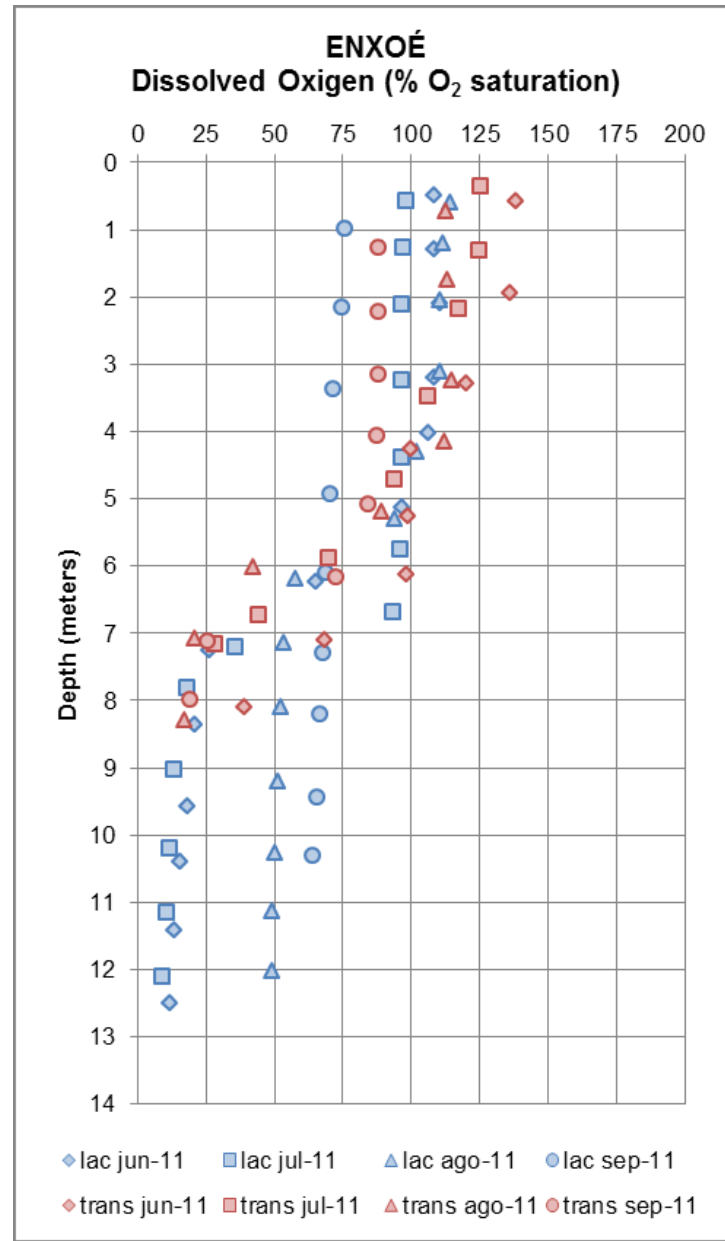
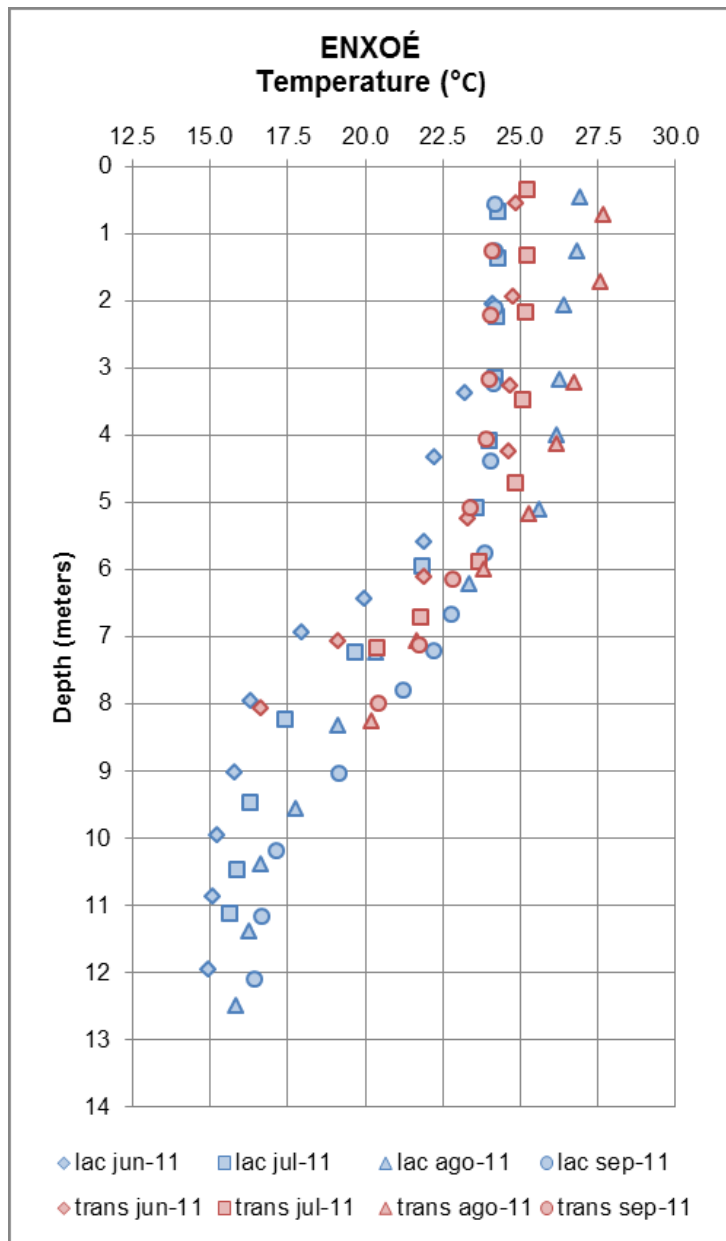
The thermocline is the transition layer between the mixed layer at the surface and the deep water layer.

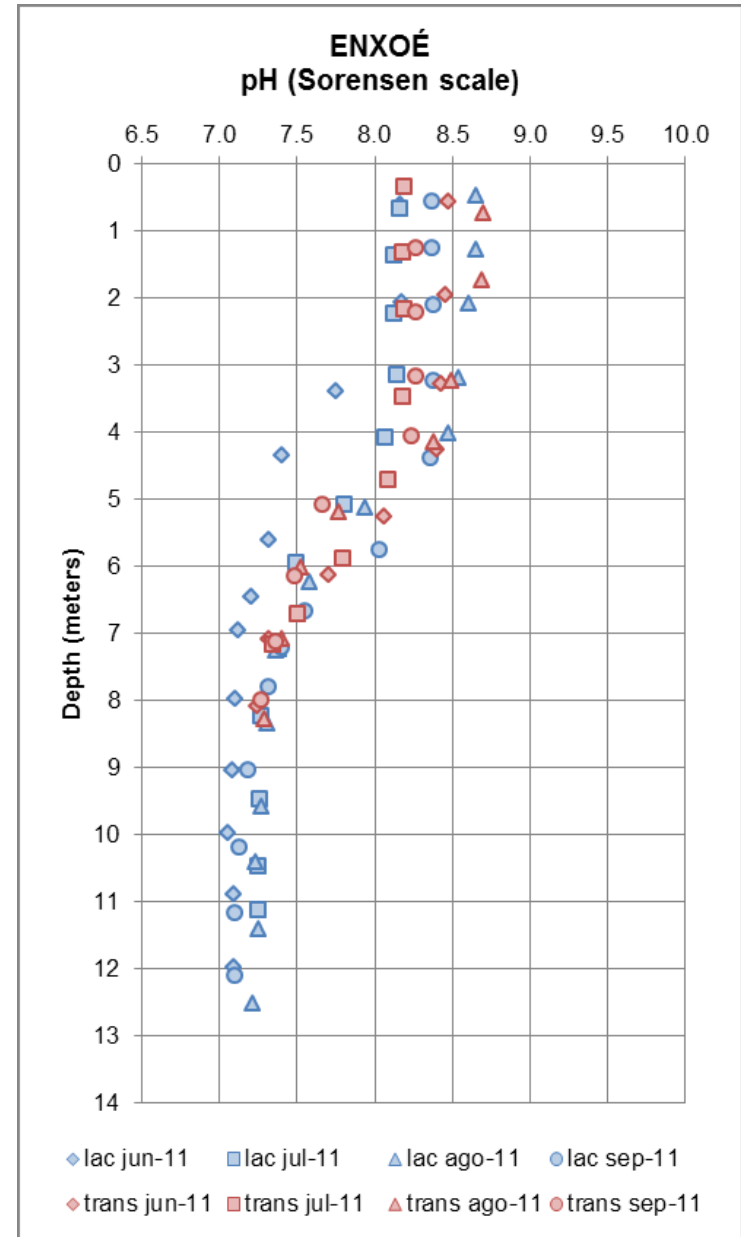
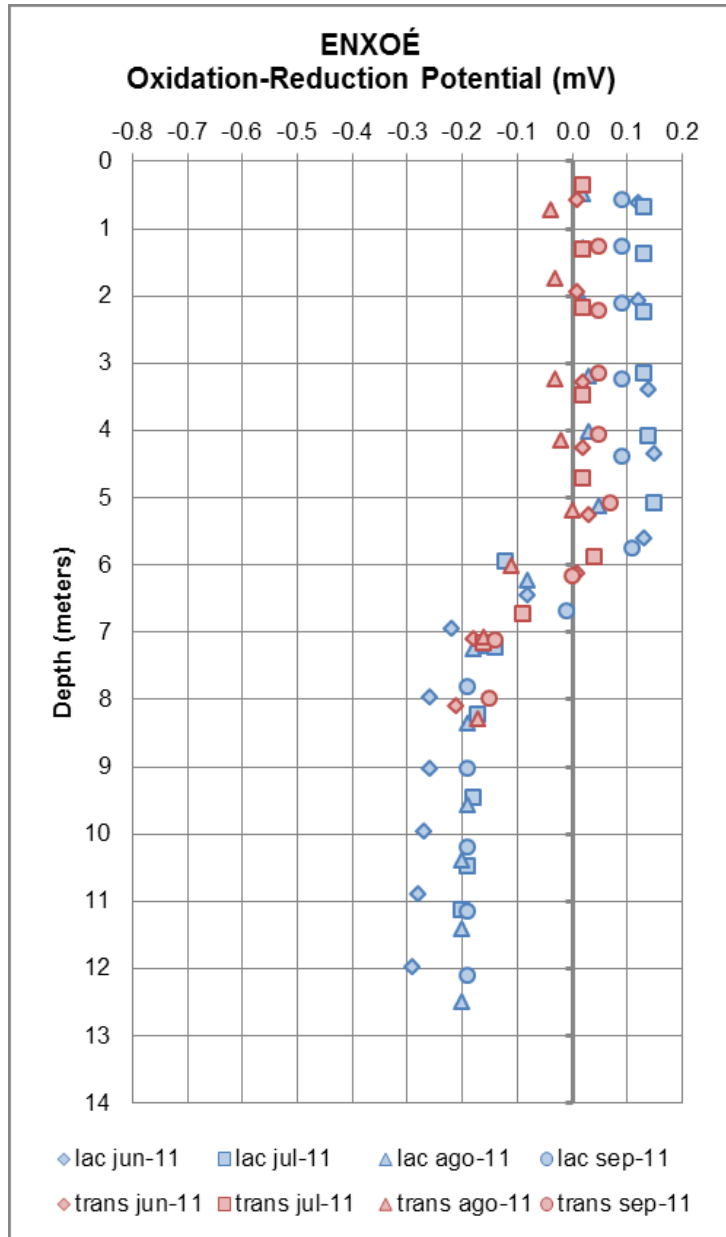
In the thermocline, the temperature decreases rapidly from the mixed layer temperature to the much colder deep water temperature. The mixed layer and the deep water layer are relatively uniform in temperature, while the thermocline represents the transition zone between the two.



Enxoé reservoir



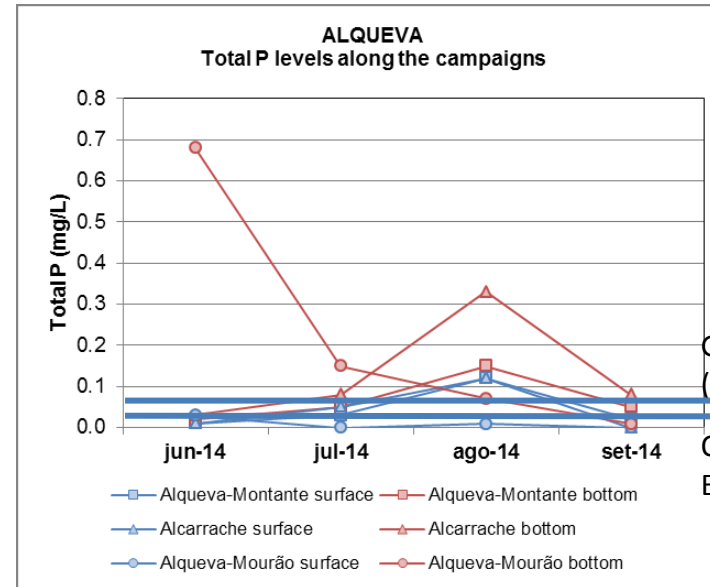
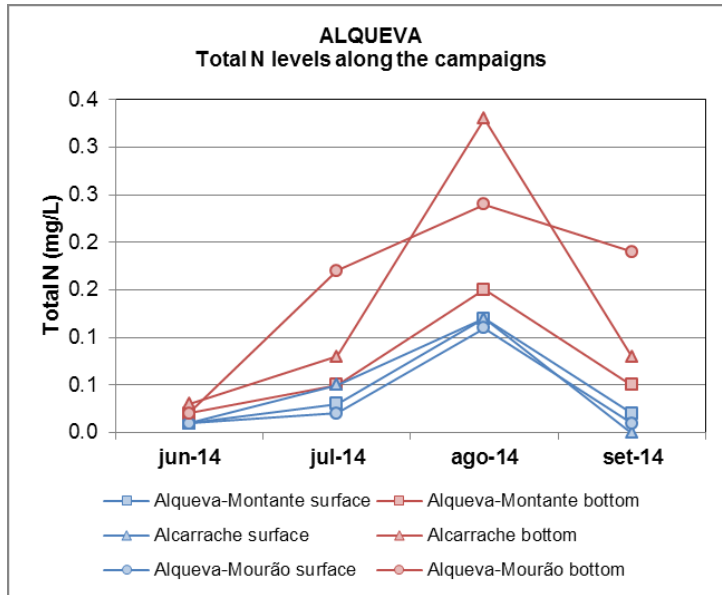




Alqueva reservoir



Nitrogen and Phosphorus levels

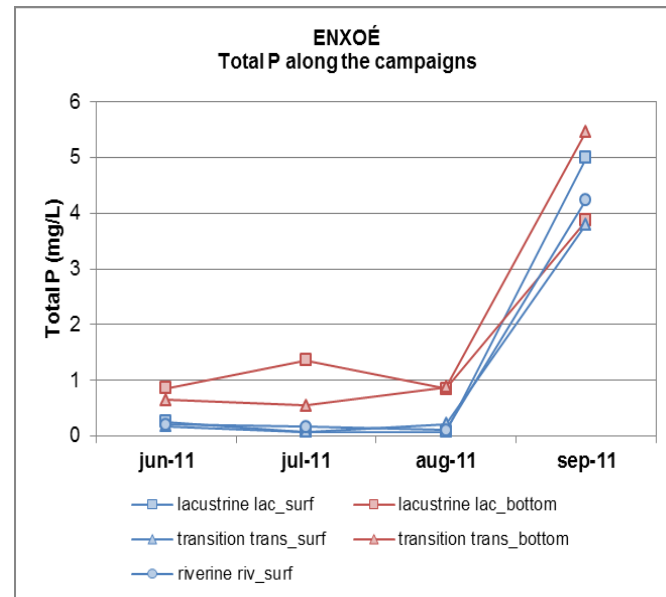
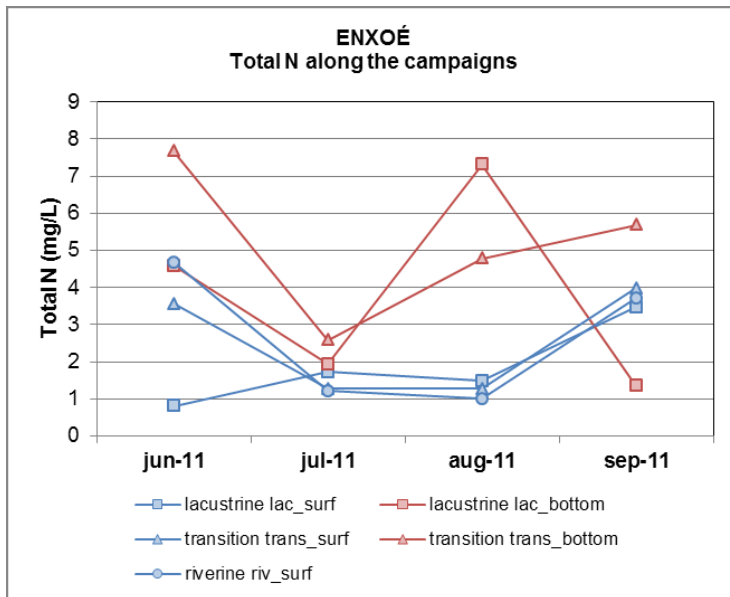


Good ecological potential
(0,07mg/L)
OECD classification system
Eutrophic (0,035mg/L)

Enxoé reservoir



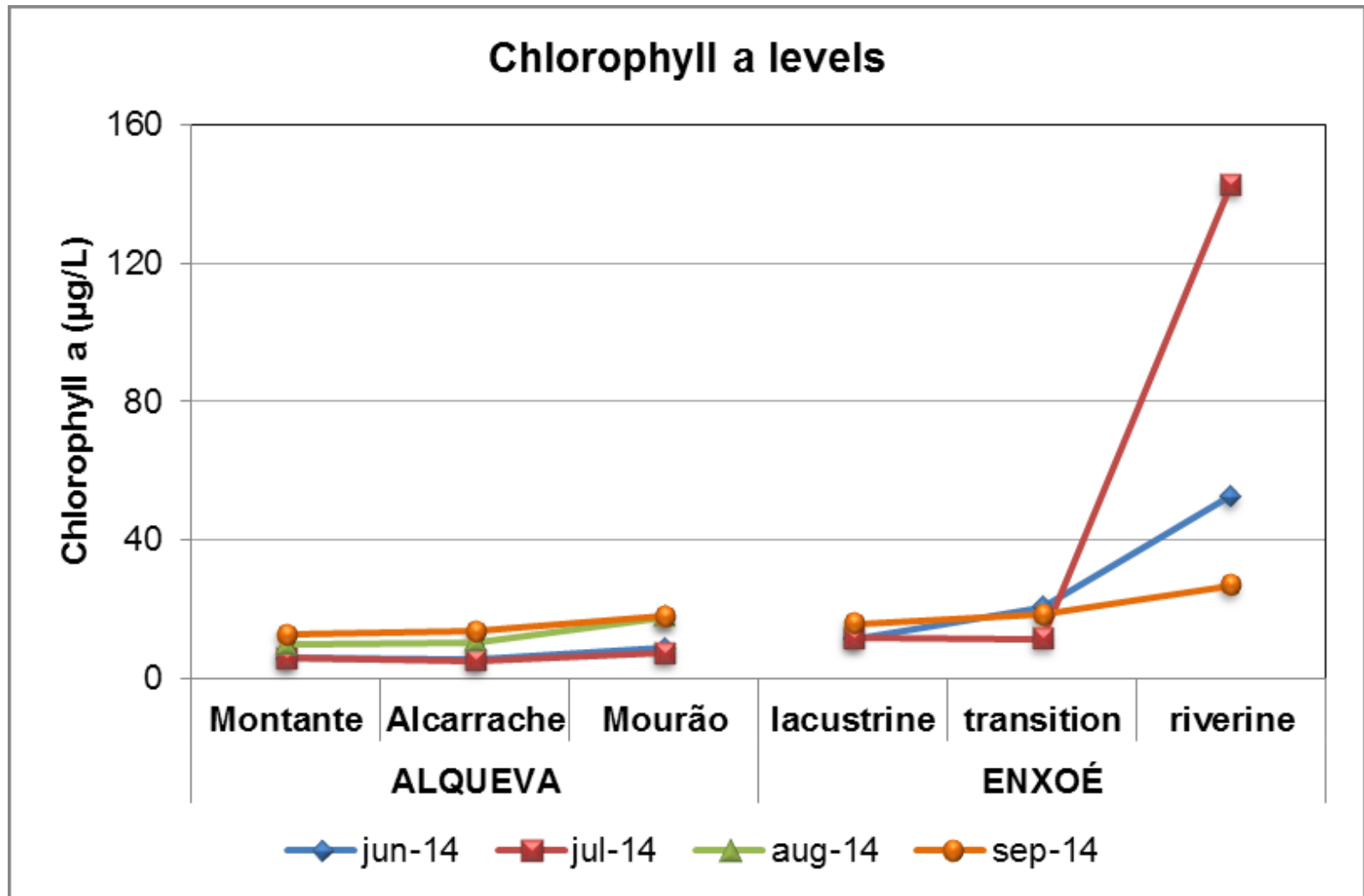
Nitrogen and Phosphorus levels



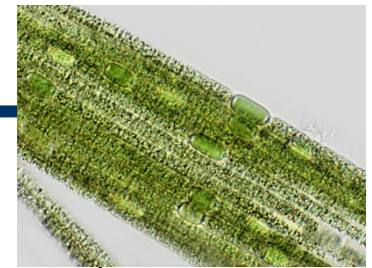
All the concentrations are higher than the thresholds for good ecological quality (0,07 mg/L) and for eutrophic status (0,035 mg/L)



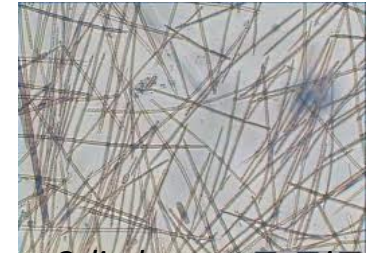
Chlorophyll a



Phytoplankton in ALQUEVA reservoir



Aphanizomenon sp.



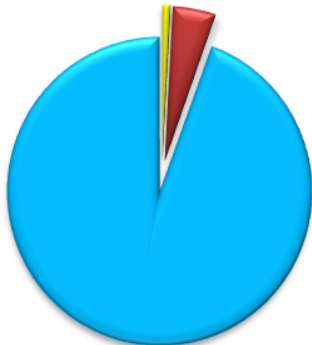
Cylindrospermopsis sp.



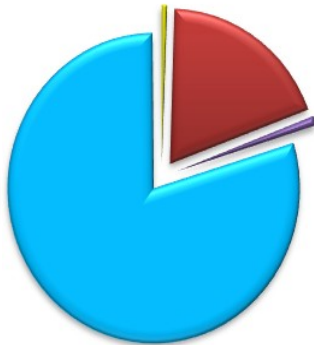
Aphanocapsa sp.

- Bacillariophyta
- Chlorophyta
- Chrysophyta
- Cryptophyta
- Cyanophyta
- Euglenophyta
- Pyrrophyta

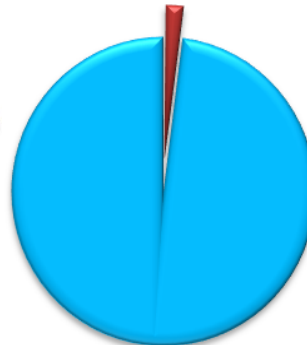
ALQ MONTANTE jun-14



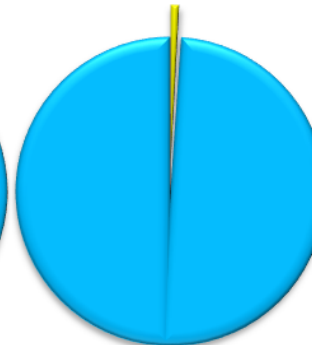
ALQ MONTANTE jul-14



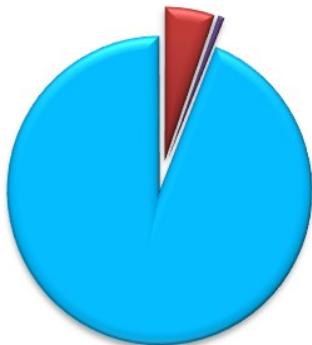
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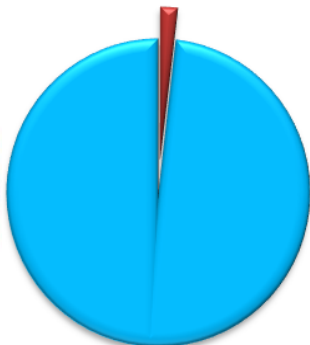
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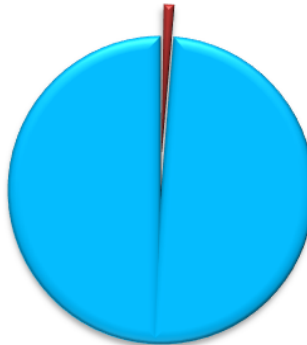
ALCARRACHE jun-14



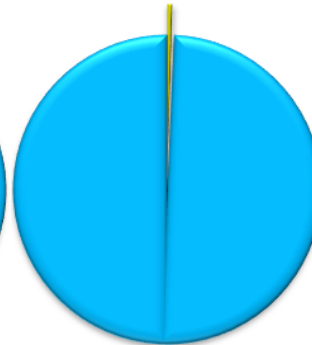
ALCARRACHE jul-14



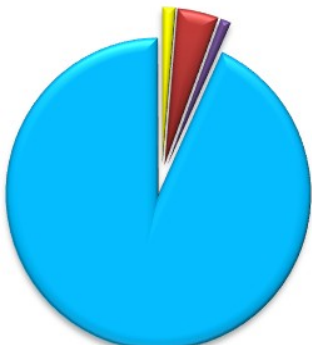
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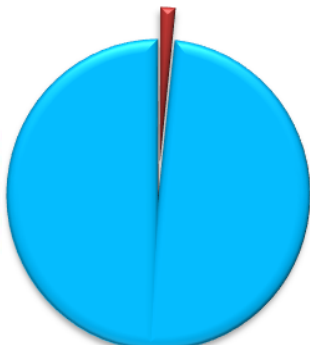
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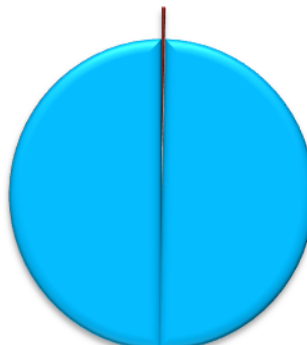
ALQ MOURÃO jun-14



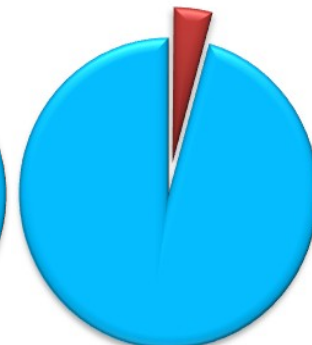
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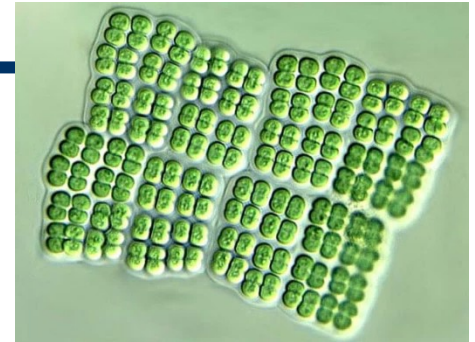
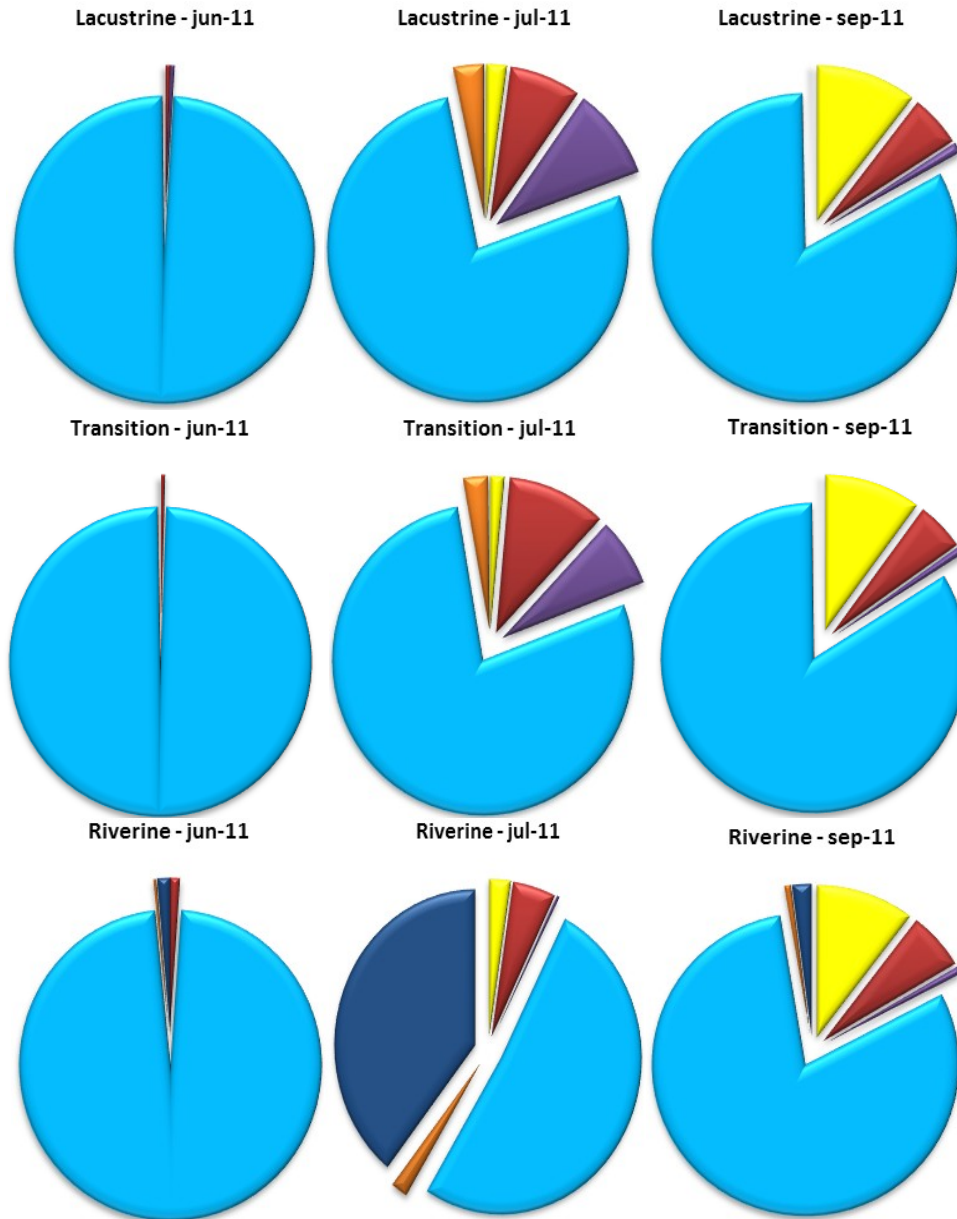
ALQ MOURÃO aug-14



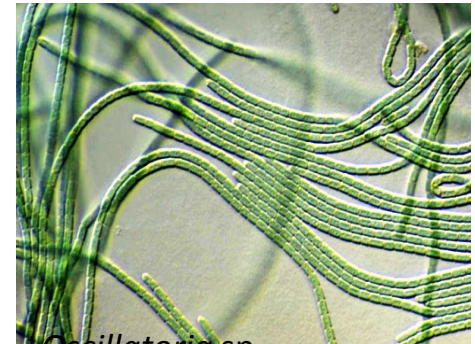
ALQ MOURÃO set-14



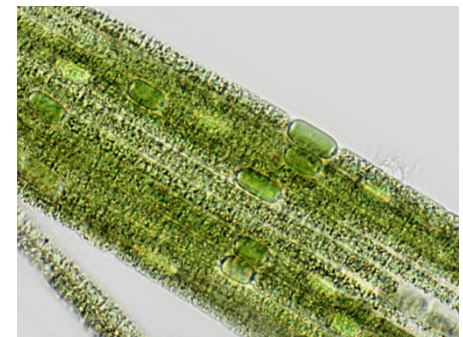
Phytoplankton in Enxoé reservoir



Merismopedia sp.



Oscillatoria sp.



Aphanizomenon sp.

Concluding

- ❑ Given the trophic status of the Portuguese reservoirs, management strategies should be implemented in order to prevent the impairment of the ecological status and consequently the water quality.
- ❑ All the abovementioned results contribute to improve the knowledge of the reservoir dynamics and therefore to propose adequate management measures to preserve the observed biological integrity.
- ❑ Meteorological data greatly contribute to understand the abiotic and biotic temporal evolution of the system.
- ❑ Water resources management is a complex matter of enormous strategic importance for a sustainable development in Mediterranean regions.



Obrigada