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## Effect of some physicochemical parameters on the zooplankton community of Lake Oubeira - a Ramsar wetland in the extreme east of Algeria-


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## INTRODUCTION & AIM

Water physico-chemical parameters, such as temperature, pH, dissolved oxygen, and conductivity, play a fundamental role in maintaining the ecological equilibrium of lacustrine ecosystems. They directly influence biological processes, determine species distribution, and modulate nutrient availability.

Wetlands, as planetary-scale ecotones, constitute the most significant reservoirs of biodiversity and provide essential ecosystem services. However, these environments are subjected to the impacts of global environmental changes on one hand, and to anthropogenic pressures on the other.

Lake Oubeira, designated as a Ramsar site, represents an emblematic model of these challenges. It embodies both exceptional ecological value and heightened fragility, necessitating a detailed understanding of its ecosystem functioning. In this context, the study of zooplankton communities emerges as a particularly relevant scientific approach. These organisms, owing to their central trophic role, and their sensitivity to environmental conditions, serve as powerful bioindicators of the lake's ecological equilibrium.

Therefore, it is essential to precisely characterize the spatiotemporal variability of the physico-chemical parameters of Lake Oubeira's water over a complete seasonal cycle, and to identify and modelize the causal relationships between abiotic factors and the distribution of zooplanktonic taxa.

This research aims to analyze zooplankton responses to the spatiotemporal gradients of abiotic parameters in Lake Oubeira, while also providing an operational diagnostic assessment of the ecosystem's health.

## METHOD

### Study site presentation :

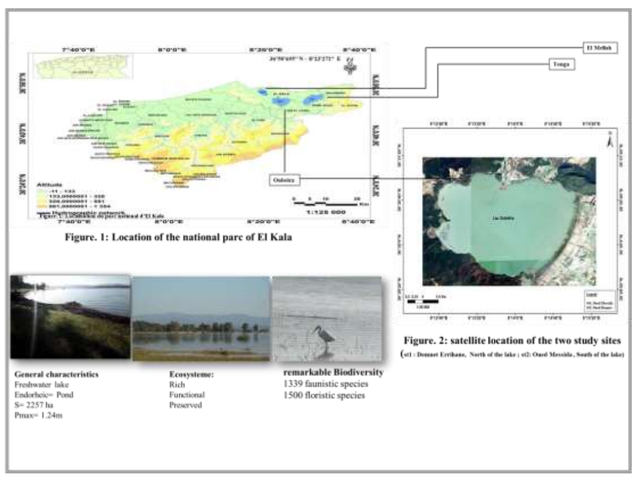



Figure. 1: Location of the national parc of El Kala

Figure. 2: satellite location of the two study sites (st1 : Dennet Errihane, North of the lake ; st2: Oued Messida , South of the lake)

**Water sampling**

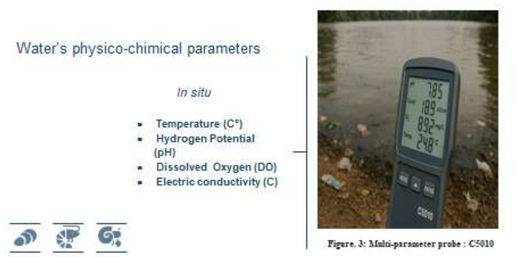



Figure. 3: Multi-parameter probe : C5010

**Zooplankton sampling**

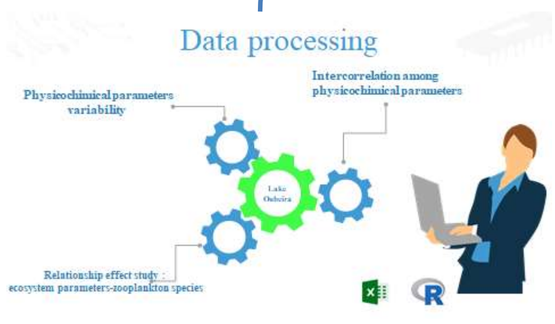

Figure. 4: Zooplankton sampling net



Figure. 5 : Zooplankton sampling process

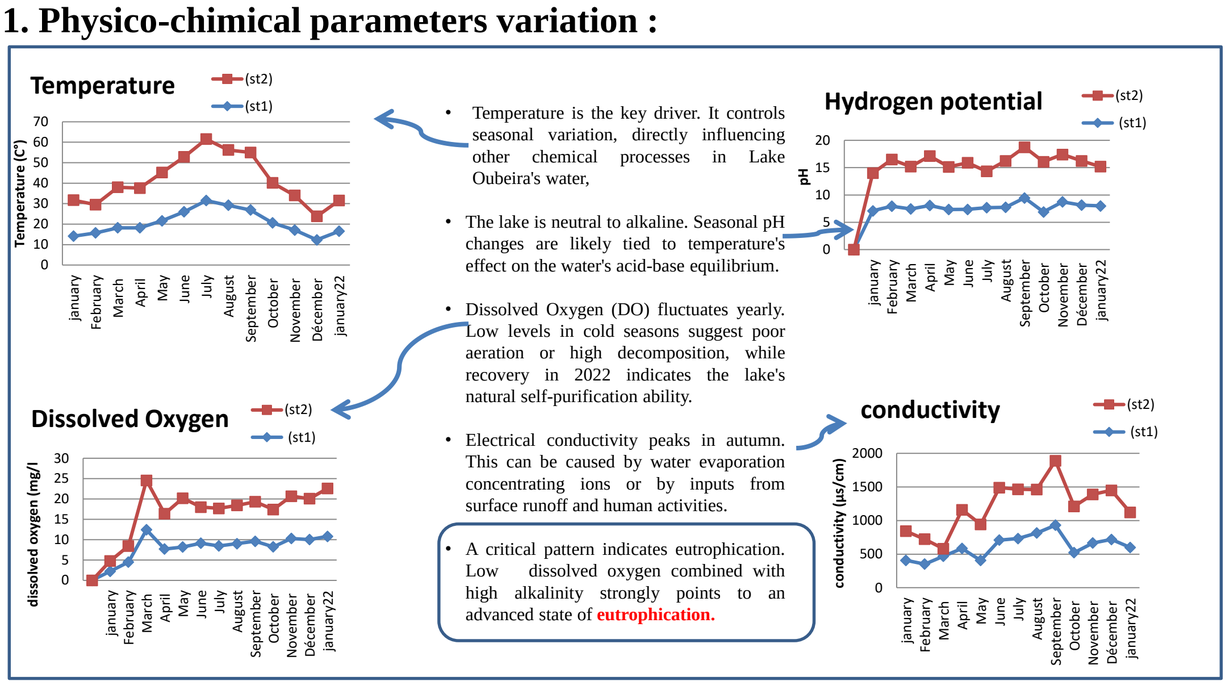
**Final results**

**In Silico analysis**




## RESULTS & DISCUSSION

### 1. Physico-chimical parameters variation :




- Temperature is the key driver. It controls seasonal variation, directly influencing other chemical processes in Lake Oubeira's water,
- The lake is neutral to alkaline. Seasonal pH changes are likely tied to temperature's effect on the water's acid-base equilibrium.
- Dissolved Oxygen (DO) fluctuates yearly. Low levels in cold seasons suggest poor aeration or high decomposition, while recovery in 2022 indicates the lake's natural self-purification ability.
- Electrical conductivity peaks in autumn. This can be caused by water evaporation concentrating ions or by inputs from surface runoff and human activities.
- A critical pattern indicates eutrophication. Low dissolved oxygen combined with high alkalinity strongly points to an advanced state of **eutrophication.**

### 2. Physico-chimical parameters effect on zooplankton distribution:




Figure. 6 : PCA for the water's physicochimical parameters

- The PCA is forming distinct seasonal groups, with autumn and summer showing the strongest contrast.
- Autumn is defined by high pH and high Dissolved Oxygen (DO).
- Summer is characterized by high temperature.
- Winter is associated with low levels of pH, DO, and conductivity. While spring shows intermediate values, overlapping with other seasons.

The PERMANOVA test revealed a highly significant effect of the factor "seasons" on species distribution (P-value < 0.001), while the factor "stations" showed no significant effect*

| | Df | SumOfSqs | R2 | F | Pr(>F) |
|---|---|---|---|---|---|
| Seasons | 3 | 2.5289 | 0.27759 | 2.3828 | 0.001 *** |
| Station | 1 | 0.2134 | 0.02343 | 0.6033 | 0.922 |
| Residual | 18 | 6.3678 | 0.69898 | | |
| Total | 22 | 9.1101 | 1.00000 | | |

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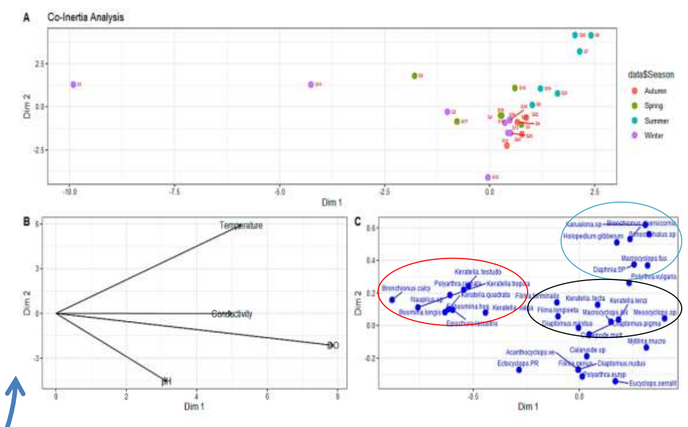
Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

**Figure.7 : PERMANOVA test for seasons effect on species distribution**




- **Co-inertia Analysis** directly links specific environmental factors to zooplankton distribution. Species cluster based on their affinity for gradients like temperature, pH, and dissolved oxygen (DO).
- **Temperature:** Species highlighted in blue prefer warmer, more conductive conditions typical of spring/summer.
- **Alkaline, High-Oxygen**: Species in black within the same genus prefer alkaline, oxygen-rich environments.
- **Acidic, Low-Oxygen (Winter):** Species in red are linked to the acidic, low-oxygen conditions characteristic of winter.
- **Oxygen is a Key Driver**: Dissolved oxygen is a major factor structuring the entire community, especially in spring and autumn.

**Figure. 7: Co-inertia analysis : physico-chimical parameters-species-seasons**

## CONCLUSION

The distribution of zooplankton species is fundamentally driven by key physicochemical factors. Dissolved oxygen (DO) emerges as a critical determinant, especially during transitional seasons, directly structuring community composition. Temperature acts as the primary seasonal separator, explaining the major shifts in species assemblages between warm and cold periods. Meanwhile, pH and conductivity serve as secondary, yet important, filters, delineating finer-scale ecological niches. This interplay of factors is evident in the distinct seasonal clustering and the clear niche partitioning observed even among closely related species, underscoring how these environmental gradients collectively govern the spatial and temporal distribution of aquatic organisms.

## FUTURE WORK / REFERENCES

**Environmental Monitoring and Management:**
Implement a continuous monitoring program for the lake's physico-chemical and biological parameters, including measures to reduce nutrient inputs (e.g., establishing riparian buffer zones and treating wastewater discharges),


**References**

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[2] **Neelgund. H.D & Kadadevaru.G.G (2022).** A study on zooplankton community with respect to abundance. diversity. trophic status and variations in physicochemical factors at Bidi minor irrigation tank of Khanapur taluk. Belagavi District. Karnataka. India. *International Journal of Ecology and Environmental Sciences. 48(1):*85-101.

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