Modeling of Water Quality Parameters of the Boukourdene Dam W.Tipaza Algeria

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Abstract

The Boukourdene dam, located in the town of Cherchell in the Wilaya of Tipaza, plays a crucial role in the region's water supply and irrigation, as well as in the local ecosystem. This study aims to model the trophic status of the reservoir to improve our understanding of ecological dynamics and predict future variations in water quality, identifying the key factors that influence it.

To achieve this objective, an integrated modelling approach was employed. Models were developed to define patterns of phosphorus and turbidity evolution based on other parameters using analysed physicochemical data that had been collected.

The study analysed changes in the physicochemical parameters of the dam's water to better understand the environmental dynamics at play and contribute to the sustainable management of this resource. Samples were taken monthly over a period of four years (2020–2023). The results revealed significant seasonal variations in temperature, pH and dissolved oxygen, with peaks in turbidity observed following periods of rainfall. Our modelling results indicate that the reservoir's trophic status mainly varies between mesotrophic and eutrophic states, influenced by factors such as nutrient inputs, climatic conditions, and human activities. An increase in nutrient levels was observed seasonally.

For the sake of designing a reliable model, a PCA (Principal Component Analysis) was performed using the Xlsat software. This made it possible to know the rate of variability of the variance of the parameters studied in the space and the correlation between the parameters. Thus the variables were represented on two axes having 49.199% of variance, a good dispersion. These results allowed us to conclude that ammonium, temperature, hydrogen potential (pH), chlorophyll (a), biochemical oxygen demand, and bicarbonate are the elements with the strongest correlations with total phosphorus.

The mathematical model for estimating total phosphorus was chosen according to performance criteria following multiple linear regression and statistical tests.

In conclusion, this study emphasises the importance of proactively managing nutrient inputs in order to maintain acceptable levels of trophic status. Our results also suggest implementing continuous monitoring strategies and targeted remediation actions to prevent eutrophication episodes. Rigorous management measures must also be implemented to prevent water quality degradation.

Index Terms

Physico-Chimical Water Parameters, PCA Analysis, Anova Analysis, Eutrophication, Total Phophorus