

## Article

# Limnological Characteristics and Relationships with Primary Productivity in Two High Andean Hydroelectric Reservoirs in Ecuador

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**Citation:** Sotomayor, G.; Alvarado, A.; Romero, J.; López, C.; Aguilar, M.; Forio, M.A.E.; Goethals, P.L.M. Limnological Characteristics and Relationships with Primary Productivity in Two High Andean Hydroelectric Reservoirs in Ecuador. *Water* **2024**, *16*, 2012. <https://doi.org/10.3390/w16142012>

Academic Editors: Dubravka Čerba, Maja Raković, Djuradj Milošević and Filip Stevic

Received: 5 June 2024  
Revised: 6 July 2024  
Accepted: 9 July 2024  
Published: 16 July 2024



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**Abstract:** Studies on limnology are essential to reservoir management; nevertheless, few are known about the limnological features of the Andean reservoirs in Ecuador. To overcome this limitation in the information, from December 2018 to December 2019, the limnological characteristics of El Labrado and Chanlud reservoirs in the Machángara river basin (Ecuador south) were examined. Using the light/dark bottles technique, the primary productivity (PP) of phytoplankton was studied in conjunction with (1) vertical profiles of oxygen concentrations, water temperature, nitrogen, phosphorus, alkalinity, and heterotrophic bacteria; (2) Secchi disk transparency; and (3) meteorological factors such as wind force, precipitation, and water level. Data indicate that both reservoirs are polymictic, with alkaline waters, low nutrients, and low PP rates. Despite this, a principal component analysis revealed that Chanlud exhibits higher nitrogen, alkalinity, heterotrophic bacteria, and PP values. In two approaches through multiple linear regression analysis, each per reservoir, the PP was explained mainly by water temperature, depth, light, heterotrophic bacteria, and meteorological parameters. The low concentrations of nutrients and the low residency time explain the low PP values. Likewise, the altitudinal factor (i.e., both reservoirs are 3400 m above sea level) and the low human perturbations in surrounding reservoir zones play a crucial role in explaining their poor PP. Notwithstanding the low metabolic rates, clear seasonal trends were observed in both reservoirs; the lowest PP rates occurred during the cold season. To our knowledge, this is the first limnological study of high Andean reservoirs in Ecuador. These findings should be part of Andean reservoir management protocols, contributing significantly to local conservation efforts. Additionally, they could be extrapolated as a frame of reference to similar eco-hydrological systems.

**Keywords:** limnological features; primary productivity; high Andean reservoirs

## 1. Introduction

Reservoir construction is one of the most remarkable human activities in modifying freshwater ecosystems. It is a widespread practice worldwide that involves utilizing rivers