

ABSTRACT

This study aimed to analyze the effect of total phosphorus on the abundance and biological indices of phytoplankton in Lake Laut Tawar, an important lake in Aceh that is currently experiencing a decline in fish populations due to environmental degradation and eutrophication. Phytoplankton serve as primary producers and indicators of aquatic fertility. The study employed a field survey conducted in Lake Laut Tawar over three months (July–September 2025). Water samples were collected from one station at three different depths and at two observation times (morning and afternoon). The results showed that total phosphorus concentration varied spatio-temporally among months, but did not differ significantly between observation times (morning–afternoon) or depths, presumably due to water-column mixing and continuous input of waste. The phytoplankton community was dominated by Chlorophyceae (41%) and Bacillariophyceae (27%), with an average abundance of 9,637.61 sel/L. The phytoplankton ecological indices indicated moderate diversity ($H' = 2.0006$), high evenness ($E = 0.7850$), and low dominance ($D = 0.1628$), with no significant differences among month, observation time, or depth. Correlation and regression analyses revealed very weak and non-significant relationships between total phosphorus and phytoplankton abundance, diversity, evenness, and dominance. The study concluded that total phosphorus concentration in Lake Laut Tawar fluctuated but were not the main limiting factor or driver of phytoplankton abundance and biological indices. The phytoplankton community structure was considered relatively stable. However, phosphorus concentration exceeding water quality standards may increase the risk of eutrophication. Therefore, Controlling pollution sources from land base activity highly recommended.

Keywords: Total Phosphate, Lake Laut Tawar, Phytoplankton, biological indices

ABSTRAK

Penelitian ini bertujuan untuk menganalisis pengaruh total fosfat terhadap kelimpahan dan indeks biologi fitoplankton di Danau Laut Tawar, yang merupakan danau penting di Aceh yang menghadapi penurunan populasi ikan akibat degradasi lingkungan dan eutrofikasi. Fitoplankton berperan sebagai produsen primer dan indikator kesuburan perairan. Metode penelitian menggunakan survei langsung di Danau Laut Tawar selama tiga bulan (Juli-September 2025). Sampel air diambil di satu stasiun pada tiga kedalaman dan dua waktu pengamatan (pagi dan siang). Hasil penelitian menunjukkan bahwa kadar total fosfat bervariasi secara spasial-temporal antar bulan, namun tidak berbeda nyata antar waktu pengamatan (pagi-siang) dan kedalaman, diduga karena pengadukan massa air dan masukan limbah yang kontinu. Komunitas fitoplankton didominasi oleh kelas Chlorophyceae (41%) dan Bacillariophyceae (27%), dengan kelimpahan rata-rata 9637,61 sel/L. Indeks ekologi fitoplankton menunjukkan keanekaragaman sedang ($H' = 2,0006$), keseragaman tinggi ($E = 0,7850$), dan dominansi rendah ($D = 0,1628$), dengan tidak adanya perbedaan signifikan berdasarkan bulan, waktu, atau kedalaman pengamatan. Analisis korelasi dan regresi menunjukkan hubungan yang sangat lemah dan tidak signifikan antara total fosfat dengan kelimpahan, keanekaragaman, keseragaman, maupun dominansi fitoplankton. Kesimpulan penelitian ini adalah bahwa total fosfat di Danau Laut Tawar mengalami fluktuasi, tetapi tidak menjadi faktor pembatas utama atau pengendali terhadap kelimpahan dan indeks biologi fitoplankton. Struktur komunitas fitoplankton dinilai cukup stabil, namun kadar fosfat yang terlampaui baku mutu berisiko mendorong eutrofikasi, sehingga disarankan pengendalian sumber pencemar dari darat.

Kata kunci: Total Fosfat, Danau Laut Tawar, Fitoplankton, Indeks Biologi