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Epipelic Algae Assemblage and Nutrient Status as Indicators of Pollution in Alice Creek, Rivers State, Nigeria

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Abstract

Background and Objective: *Alice creek is a tributary of the Sombreiro River, Akuku-Toru Local Government Area, Rivers State, Nigeria, receiving various anthropogenic wastes. The study investigated the species composition, diversity, abundance, and distribution of epipelic algae, and the nutrient status of Alice Creek, a tributary of Sombreiro river, Rivers State, Nigeria.* ***Materials and Methods:*** *Epipelic and nutrients samples were collected monthly between February and May 2020 from three (3) stations [Ogonikiri (Station 1), Onubio–Okolobio waterside (Station 2), and College Site-bridge (Station 3)] established along the watercourse of the creek following standard method. Epipelic algae were identified microscopically. Phosphate and ammonia were analyzed following scientific procedures. Data analyses were subjected to analysis of variance and descriptive statistics.* ***Results:*** *The study recorded a total of six (6) families, twenty-six (26) genera, thirty-one (31) species, and fifty-two (52) individuals of epipelic algae were encountered in the study. The percentage composition of epipelic algae observed was Bacillariophyceae (30.77%), Chlorophyceae (21.15%), Euglenophyceae (17.31%), Dinophyceae (15.38%), Xanthophyceae (13.46%) and Cyanophyceae (1.92%). The most dominant species were Glenodinium elphatiewskyi (909 no./ml), Trachelomonas lacustris (909 no./ml), and Tribonema viride (909 no./ml). The analyzed nutrients were phosphate (0.34 ± 0.08 mg/L) and ammonia (5.83 ± 0.98 mg/L), higher than 0.1 mg/L and 0.01–2.00 mg/L of USEPA standard, respectively. The increased amount of nutrients favored indicator species such as Cyclotella comta, C. meneghiniana, C. operculate (Bacillariophyta), Scenedesmus acuminatus (Chlorophyta), and Euglena pisciformis (Euglenophyta).* ***Conclusion:*** *The presence of dominant species (Glenodinium elphatiewskyi (Dinophyta), Trachelomonas lacustris (Euglenophyta) and Tribonema viride (Xanthophyta) and pollution-indicator species [Cyclotella comta, C. meneghiniana, and C. operculate (Bacillariophyta), Scenedesmus acuminatus (Chlorophyta), and Euglena pisciformis (Euglenophyta)], as well as high ammonia and phosphate, indicate stress and organic pollution in Alice Creek.*

Keywords: Epipelic algae, species composition, species diversity, abundance, Rivers State, Nigeria

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INTRODUCTION

Epipelic algae are attached microflora that live on the soft mud bottom sediments covering an extensive area of shoreline, wetlands that experience low and high tide [1]. The use of organisms for monitoring pollution is based on the belief that natural, unpolluted environments are characterized by balanced biological condition, and contains a great diversity of plants and animal life with no one species dominating [2]. Epipelic algae are a class of periphyton. Periphyton is classified based on the type of substrate it is attached to grow on living macrophytes (epiphytic algae), log of wood (epixylic algae), stone (epilithic algae), sandy sediment (episammic algae), and muddy sediments (epipelic algae), but when exist on the body surface of living aquatic animal is known as epizoic algae. Epipelic algae play some roles in the ecosystem, such as bio-stabilization of sediments, regulation of benthic–pelagic nutrient cycling, and primary production, highlighted other ecological functions of epipelic algae in habitat degradation, increased resistance to circumstances disturbing them, and regulating nutrients in the water column in and out. The epipelic algae are potential biomass for biofuel production, such as briquettes (biocharcoal) in the Niger Delta, as they grow in the order of days [3].

The composition of epipelic algae continues to act as a means of assessing the biological purity of a water body. Communities of epipelic algae form a dormant stage in sediments until the end of their life, as they serve as a source of oxygen in many shallow water bodies [4]. Therefore, the distribution, abundance, species diversity, and species composition of above-ground algae are used to assess the biological integrity of a water body. Most Niger Delta water bodies differ seasonally, with the ultimate variety and composition of algae in the dry season. The abundance and community structure of epipelic algae depend on the water nutrient, sediment and seasonal variations of algae ranging from a single cell to a multicellular form of periphyton classes. The difference in sensitivity of epipelic algae will lead to ecological victors or scums concerning temporal, and spatial shifts in terms of food disposal in the water. The diversity of epipelic algae blooms is determined by the amount of light, physical, chemical, and biological conditions of the aquatic ecosystem. Species diversity decreases or increase strength may be determined by the environment's health rank (stress, polluted, or unpolluted). The lower the dominance, the higher the diversity of species [5]. The concentration of nutrients and the intensity of light control epipelic algae community settlement since motility is a mutual feature within sediments [5]. However, they do not have control over their journeys, so they cannot escape the pollution and assist as a good indicator of pollution in the utmost aquatic ecosystem. The rise in human population has given birth to negative impacts on the composition of aquatic life in the ecosystem. Hence, the study aimed to investigate species composition, diversity, abundance, and distribution of epipelic algae of Alice creek, a tributary of Sombreiro river, Rivers State, Nigeria [6].

MATERIALS AND METHODS

Duration of Study and Study Area

The study was conducted for four months between February and May 2021 at Alice Creek, a tributary of Sombreiro River, Abonnema, Akuku-Toru Local Government Area, Rivers State. The creek lies between Latitude 4.735ºN and Longitude 6.774ºE. It is characterized by vegetation dominated by Nypa palm (*Nypa fructican*), and mangroves, red mangrove (*Rhizophora racemosa*) and white mangrove (*Avecennia africana*). Human activities within and on the river comprise fishing, boating, and navigation, bridge construction, recreational swimming activities, discharge of domestic refuse from domestic sources, open water toilet systems, and dredging, among others [7–11].

Sampling Stations

Three sampling stations were chosen 500 meters apart along the creek course as follows:

- *Station 1:* Ogonikiri Abonnema Phase III.
- *Station 2:* Onubio–Okolobio waterside.
- *Station 3:* College sites down to the Sombreiro River.

Collection of Epipelic Algae and Analyses

Epipelic algae were collected at low or ebb tide from each sampling station following the method [4, 12–14]. The algae were collected from a 2 x 2 cm quadrant at three random points. Each quadrant was carefully scrapped with a sharp scalpel to a depth of 0.2 cm. The set was stored in a vial bottle containing 50 ml of 10% formalin. These algae were properly homogenized to disperse the algal cells throughout the sample and transported in an ice box to the Department of Fisheries and Aquatic Environment Laboratory, Rivers State University, for microscopic analysis and examination [15–20].

Microscopic Examination and Identification of Epipelic Algae

From the homogenized sample, a 1 ml subsample was collected with a stampel pipette and transferred into a Sedgwick Rafter counting chamber for identification and enumeration under a digital microscope (PD2451) using a combined magnification of between 10x and 40x [21]. Three replicates of the sub-samples were analyzed. The identification of epipelic algae species was made by the descriptive keys.

Calculations of Density and Diversity Indices of Epipelic

Density and diversity indices, such as Margalef, Shannon–Wiener, Simpson, and Pielou's evenness of the epipelic, were calculated following standard formulae [22–28].

Water Nutrients Analysis

Surface water samples were analyzed for ammonia and phosphate methods as follows:

Ammonia

Ammonia concentrations in water samples were determined by the indophenol or phenate (Phenol–hypochlorite) method. It was spectrophotometrically measured at 630 nm wavelength with Spectronic 21D (ThermoFisher Scientific, Waltham, Massachusetts, USA). The concentration of total ammonia in the samples was computed from the equation:

$$C1/C2 = A1/A2$$

where
A1 = the absorbance of the total ammonia–nitrogen standard.
A2 = the absorbance of the sample.
C1 = the concentration of the total ammonia–nitrogen standard.
C2 = the concentration of total ammonia–nitrogen in the sample.

Phosphate

Phosphate was determined using the stannous chloride method (AHPA, 2005). A volume of 50 ml sample and the addition of 2.0 ml ammonium molybdate reagent, and 0.2 ml stannous chloride reagent mixed. 10 minutes after the addition of stannous chloride, the absorption of the treated sample was read on Spectronic 21 D (ThermoFisher Scientific, Waltham, Massachusetts, USA) at 690 nm. Phosphate level was obtained by reading off absorption level from the standards curve of known standard treated samples. The detection limit is 0.05 mg/L [29–34].

Statistical Analysis

Data collected were subjected to statistical analysis using Statistical Package for Social Sciences (SPSS) Version 23 at 5% significance level. Two-way analysis of variance (ANOVA) was used to determine the differences between stations and months, seasons, and the taxonomic groups of epipelic observed, and Turkey's test for mean separation of the studied epipelic algae and water nutrients [35–38].

RESULTS

A total number of 52 individuals, 26 genera, and 31 species of epipelic from six taxonomic groups with a total density of 11818.18 no/ml were recorded from Alice Creek as shown in Table 1. Bacillariophyta dominated with a total of 9 species, with 16 individuals representing 30.77%, followed by Chlorophyta with a total of 8 species, with 11 individuals representing 21.15% (Table 1, Figure 1). Euglenophyta recorded six species with nine individuals (17.31%), Dinoflagellata had three species with eight individuals (15.39%) and Xanthophyta 4 species with seven individuals (13.46%). The Cyanophyta had the minor species (1), with one individual representing 1.92% of the taxonomic groups recorded (Table 1, Figure 1). The highest density of epipelic algae (5909.09 no/ml) was observed in Station 3, while the lowest number (1590.91 no/ml) was observed in Station 1 (Table 1).

Spatial distributions of the observed epipelic taxa were significantly different ($p < 0.05$), as indicated in Table 2. Bacillariophyta recorded the highest mean spatial distribution (0.74 ± 0.16%) in Station 1, and the least mean value (0.29 ± 0.15%) in Station 2. At the same time, Chlorophyta had the highest mean spatial distribution (0.62 ± 0.20%) in Station 2 and the lowest (0.20 ± 0.14%) in Stations 1 and 3 (Table 2). Cyanophyta was absent in all stations except Station 2 (0.83 ± 0.03%). Euglenophyta was absent on Station 3 but present on Station 1 (0.33 ± 0.19%) and Station 2 (0.33 ± 0.14%). Furthermore, Xanthophyta and Dinoflagellata were absent in Station 1 but present in Stations 2 and 3. Both taxa recorded the same mean spatial distribution value (0.25 ± 0.13%) in Station 2 and the highest values of 0.56 ± 0.19% and 0.73 ± 0.27%, respectively, in Station 3.

The temporal distributions of the epipelic taxa. Generally, there were significant ($p < 0.05$) temporal variations of the various taxa of the epipelic as shown in Table 3. For example, the temporal distribution of Bacillariophyta ranged from 0.36 ± 0.21% (May) to 0.76 ± 0.21% (February). For Chlorophyta, the minimum value (0.11 ± 0.18%) was observed in March, while the maximum (0.60 ± 0.18%) was recorded in February. Cyanophyta had the most negligible temporal variations (0.00 ± 0.00% to 0.83 ± 0.03%), absent in all the months except March. Euglenophyta was absent in February but, in other months, it ranged between 0.11 ± 0.11% (March) and 0.44 ± 0.18% (April). In addition, Xanthophyta was absent in May, recorded the highest (0.67 ± 0.19%) in April and the lowest (0.30 ± 0.19%) in February. Furthermore, the temporal distribution of Dinoflagellata ranged from 0.22 ± 0.16% (February) to 0.38 ± 0.16% (May).

The overall mean values of some diversity indices of the epipelic of Alice Creek. Margalef index. The orders of the diversity indices from highest to lowest were Chlorophyta > Bacillariophyta > Euglenophyta > Xanthophyta > Dinoflagellata > Cyanophyta (Margalef's index); Bacillariophyta > Chlorophyta > Euglenophyta > Xanthophyta > Dinoflagellata > Cyanophyta (Shannon–Wiener); Chlorophyta > Bacillariophyta > Xanthophyta > Dinoflagellata > Cyanophyta (Evenness) and Bacillariophyta > Chlorophyta > Euglenophyta = Xanthophyta = Dinoflagellata = Cyanophyta (Simpson) as shown in Table 4.

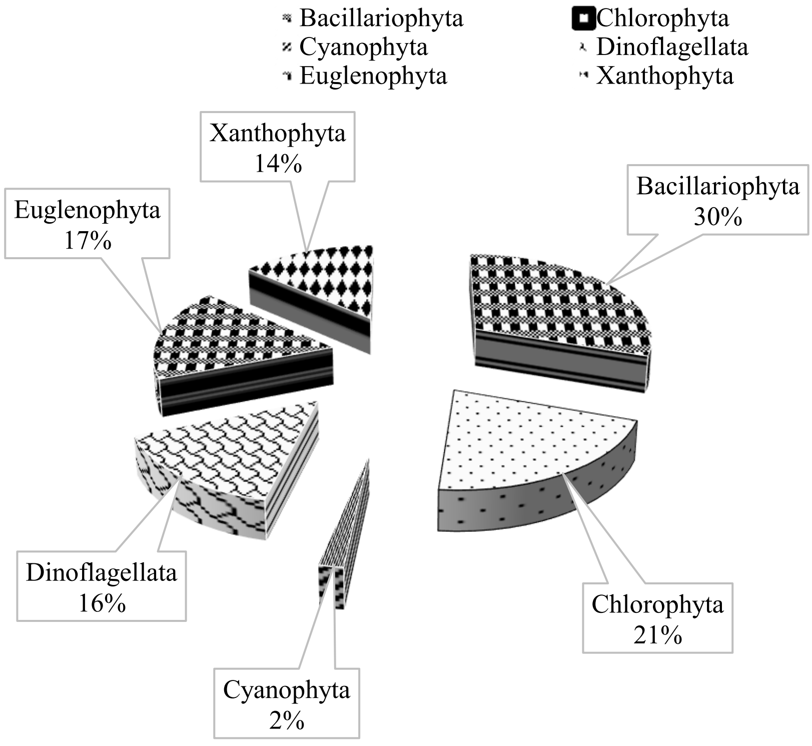

Figure 1. Percentage composition of epipelic algae in Alice creek.

Table 1. Composition, density, and distribution of epipelic algae in Alice Creek.

Taxa	Species	Density (No./ml)			
		STN 1	***STN 2***	***STN 3***	**No. of Inds.**
Baccillariophyta	*Cyclotella comta*	454.55	0.00	0.00	
	C. meneghiniana	227.27	0.00	0.00	
	C. operculata	227.27	0.00	0.00	
	Asterionella formosa	0.00	454.55	681.82	
	Terbellaria fenestrata	0.00	0.00	227.27	
	Gyrosigma attenuatum	227.27	0.00	0.00	
	G. acuminatum	0.00	0.00	454.55	
	Cymatopleura elliptica	0.00	0.00	227.27	
	Attheya zachariasi	0.00	0.00	454.55	
Total					16
Chlorophyta	*Scenedesmus acuminatus*	0.00	227.27	0.00	
	Closterium dianae	0.00	681.82	0.00	
	Cosmarium portianum	0.00	0.00	227.27	
	Chloroganim elegans	0.00	0.00	227.27	
	Ankistrodesmus falcatus	227.27	227.27	0.00	
	Tetraedron victorieae	227.27	0.00	0.00	
	Euostrium elegans	0.00	227.27	0.00	
	Closteridium lunula	0.00	227.27	0.00	
Total					11
Cyanophyta	*Coelosphaerium dubium*	0.00	227.27	0.00	
Total					1
Dinophyta	*Crytomonas rostrata*	0.00	0.00	681.82	
	Massartia vorticella	0.00	227.27	0.00	
	Glenodinium elphatiewskyi	0.00	0.00	909.09	
Total					8
Euglenophyta	*Trachelomonas lacustris*	0.00	909.09	0.00	
	T. Tambowica	0.00	227.27	0.00	
	Phacus caudatus	0.00	227.27	0.00	
	Colacium vesiculosum	0.00	227.27	0.00	
	Astasia klebsii	0.00	0.00	227.27	
	Euglena pisciformis	0.00	0.00	227.27	
Total					9
Xanthophyta	*Fragilaria campucina*	0.00	0.00	227.27	
	Tribonema viride	0.00	0.00	909.09	
	Ophiocytium capitatum	0.00	227.27	0.00	
	O. parvulum	0.00	0.00	227.27	
Total					7
Total Density (no./ml)		1590.91	4318.18	5909.09	
Overall Density (no./ml)	11818.18				
Grand total no. of Individuals					52
Total no. of species	31				

Note: STN: Station; Inds: individuals.

Table 2. Spatial distribution of taxonomic groups of epipelic algae in Alice Creek (Mean ± SEM).

Taxa	Station (Mean ± SEM %)		
	1	***2***	***3***
Bacillariophyta	0.74 ± 0.16^{a}	0.29 ± 0.15^{b}	0.66 ± 0.23^{ab}
Chlorophyta	0.20 ± 0.14^{b}	0.62 ± 0.20^{a}	0.20 ± 0.14^{b}
Cyanophyta	0.00 ± 0.00^{b}	0.83 ± 0.03^{a}	0.00 ± 0.00^{b}
Euglenophyta	0.33 ± 0.19^{a}	0.33 ± 0.14^{a}	0.00 ± 0.00^{b}
Xanthophyta	0.00 ± 0.00^{b}	0.25 ± 0.13^{ab}	0.56 ± 0.19^{a}
Dinophyta	0.00 ± 0.00^{b}	0.25 ± 0.13^{ab}	0.73 ± 0.27^{a}

Note: Means with different superscripts within the same row are significantly different ($p < 0.05$).

Table 3. Temporal distribution of taxonomic groups of epipelic algae in Alice Creek (Mean ± SEM).

Taxa	Month (Mean ± SEM %)			
	February	***March***	***April***	***May***
Bacillariophyta	0.76 ± 0.21^{a}	0.44 ± 0.21^{b}	0.68 ± 0.21^{ab}	0.36 ± 0.21^{c}
Chlorophyta	0.60 ± 0.18^{a}	0.11 ± 0.18^{c}	0.49 ± 0.18^{ab}	0.16 ± 0.18^{b}
Cyanophyta	0.00 ± 0.00^{b}	0.83 ± 0.03^{a}	0.00 ± 0.00^{b}	0.00 ± 0.00^{b}
Euglenophyta	0.00 ± 0.00^{b}	0.11 ± 0.11^{b}	0.44 ± 0.18^{a}	0.33 ± 0.24^{ab}
Xanthophyta	0.30 ± 0.19^{ab}	0.33 ± 0.19^{ab}	0.67 ± 0.19^{a}	0.00 ± 0.00^{c}
Dinophyta	0.22 ± 0.16^{ab}	0.30 ± 0.16^{a}	0.22 ± 0.16^{ab}	0.38 ± 0.16^{a}

Note: Means with different superscripts within the same row are significantly different (p < 0.05).

Table 4. Diversity indices of epipelic algae of Alice Creek.

Taxa	Diversity Index			
	Margalef	***Shannon–Wiener***	***Evenness***	***Simpson***
Bacillariophyta	2.89 ± 0.04^{a}	1.98 ± 0.02^{a}	0.901 ± 0.04^{a}	0.121 ± 0.04a
Chlorophyta	2.92 ± 0.02^{a}	1.97 ± 0.01^{a}	0.947 ± 0.02^{a}	0.073 ± 0.02b
Cyanophyta	0.00 ± 0.00^{a}	0.00 ± 0.00^{a}	0.00 ± 0.00^{a}	0.00 ± 0.00^{a}
Dinophyta	0.96 ± 0.01^{c}	1.10 ± 0.01^{d}	1.001 ± 0.02^{b}	0.00 ± 0.00^{c}
Euglenophyta	2.27 ± 0.04^{b}	1.79 ± 0.02^{b}	0.999 ± 0.02^{c}	0.00 ± 0.00^{c}
Xanthophyta	1.54 ± 0.03^{d}	1.39 ± 0.01^{c}	1.003 ± 0.03^{b}	0.00 ± 0.00^{c}

Note: Means with different superscripts within the same column are significantly different (p < 0.05).

From Table 5, ammonia concentrations ranged from 5.66 ± 1.12 mg/L (Station 1) to 6.34 ± 0.86 mg/L (Station 3), while phosphate ranged between 0.42 ± 0.11 mg/L (Station 1) and 0.38 ± 0.58 mg/L (Station 3) with significant difference ($p < 0.05$). Temporally, ammonia recorded the highest concentration (7.26 ± 0.18 mg/L) in February and the lowest (4.76 ± 0.40 mg/L) in March, while phosphate had the maximum value (0.42 ± 0.14 mg/L) in March and the minimum (0.39 ± 0.02 mg/L) in May. Temporal variations of the two nutrients were significant ($p < 0.05$). The overall mean for ammonia was 5.83 ± 0.98 mg/L, while phosphate was 0.34 ± 0.08 mg/L.

Table 5. Spatial and temporal variations of nutrients in the study area.

Nutrient (mg/L)	Station			Month				Overall Mean ± SD	Standard (USEPA, 2001)
	1	***2***	***3***	***February***	***March***	***April***	***May***		
Ammonia (mg/L)	5.66 ± 1.12^{ab}	5.59 ± 0.91^{b}	6.34 ± 0.86^{a}	7.26 ± 0.18^{a}	4.76 ± 0.40^{c}	5.32 ± 0.48^{b}	5.75 ± 0.51^{ab}	5.83 ± 0.98	0.01–2.00
Phosphate (mg/L)	0.42 ± 0.11^{a}	0.35 ± 0.56^{b}	0.38 ± 0.58^{ab}	0.38 ± 0.03^{b}	0.42 ± 0.14^{a}	0.40 ± 0.40^{ab}	0.39 ± 0.02^{b}	0.34 ± 0.08	0.1

DISCUSSION

The revealed spectrum of epipelic algae in this study depicted Alice Creek's health, a tributary of Sombreiro River, Akuku-Toru Local Government Area, Rivers State, Nigeria. Algae are considered effective indicators of water quality. Different types of periphyton (epipelon, epiphyton, epixylon, epilithon, episammon, and epizoic) measure the biological integrity of an aquatic environment. A healthy water environment has insignificant periphyton, such as epipelic algae, because invertebrate grazers usually eat up algae.

The top–down influences might explain the observed low species composition, diversity, abundance, and distribution of the epipelic algae. The top–down forces, such as herbivores' consumption, affect algae. Also, the observed epipelic algae could signify an area under stress due to an over-supply of nutrients, salinity, and high temperature. These factors might reduce biodiversity by making the streambed habitat unsuitable for many sensitive invertebrates. Within Nigeria, the study's observed epipelic algae was lower than the 79 species identified from Amadi–Ama creek and the 53 species epipelic algae species in the Brackish Water Axis of Sombreiro River, Niger Delta, Nigeria but higher than the 19 species of epipelic algae at the Bayeku area of the Lagos lagoon, Nigeria 30 species of epipelic algae at the University of Lagos Shoreline and ten species of the Okpoka River in the Upper Bonny Estuary, Nigeria .Outside Nigeria, the study's epipelic algae were lesser than the 61 species of epipelic algae observed in the Yedigöller Lakes 46 species of epipelic algae from of Küçükgöl Lake, 46 species of epipelic algae in Limni Lake (Gümüşhane, Turkey) reported , 93 species of epipelic algae from a shallow, mesotrophic pond in Bezedník recorded 85 species of epipelic algae in Balik lagoon and 78 species epipelic algae identified in Uzun lagoon, 173 species of epipelic diatoms in Balik Lake determined and 34 species of epipelic algae in urban river network water system of Nanjing, China.

The dominance of Bacillariophyceae in the present study agreed with the studies. This dominance of Bacillariophyceae could be due to their ability to compete favorably with other epipelon families for nutrients. Organisms are used for monitoring pollution based on the belief that natural, unpolluted environments are known by balanced biological conditions and have a high diversity of plants and animal life with no one species dominating. Also, the report of distribution of diatoms reflects the average biological condition of water bodies was in line with the present study. The presence of dominant species *Glenodinium elphatiewskyi* (Dinophyta), *Trachelomonas lacustris* (Euglenophyta), and *Tribonema viride* (Xanthophyta) signified that Alice Creek is polluted. The observed pollution-indicator species [*Cyclotella comta*, *C. meneghiniana*, and *C. operculate* (Bacillariophyta), *Scenedesmus acuminatus* (Chlorophyta), and *Euglena pisciformis* (Euglenophyta)] denoted the presence of organic pollution in Alice Creek.

Species richness evaluates the number of species in an environment and is used to evaluate biodiversity. This low diversity of epipelon in Alice Creek indicated a polluted environment. The study attributed the observed epipelon's diversity indices in Alice Creek to climate change. Climate change affects biological communities, biodiversity and adaptive responses of organisms. The observed values of Margalef's index for all taxa except Cyanophyta indicated moderately high species richness. At the same time, Shannon–Wiener Diversity Index showed that the species of all the taxonomic groups except Cyanophyta were not the same and were not evenly distributed between all the species in the sample. The recorded values of Pielou's evenness demonstrated low even distribution of epipelic algae except Cyanophyta between the species and the presence of a dominant species among the epipelon in Alice Creek. On the other hand, Simpson's Diversity Index's values indicated that the diversity of the epipelic algae in Alice Creek was moderately high.

The ammonia and phosphate levels exceeded the permissible concentrations in the natural open water of 0.2 and 0.02 mg/L. This could be tied to the high anthropogenic deposit of feces, bridge construction, and waste dump site along the riverbank, which enhance the amount of nutrients (ammonia and phosphate) in Alice creek. Nitrogen–Ammonia and Phosphate–Phosphorus are essential nutrients for algae growth. The creek welcomes frightful measures of waste, which boost the high nutrient quantities that lead to algal proliferation in Alice Creek. The present study accorded with the reports that high nutrients level favors some biological integrity of the aquatic ecosystem.

CONCLUSIONS

The species composition, species diversity, distribution, and abundance of epipelic algae in Alice creek unveiled that Bacillariophyceae was the dominant family and species, such as *Glenodinium elphatiewskyi* (Dinophyta), *Trachelomonas lacustris* (Euglenophyta), and *Tribonema viride* (Xanthophyta), were the species. At the same time, some species, such as *Cyclotella comta*, *C. meneghiniana*, *C. operculate* (Bacillariophyta), *Scenedesmus acuminatus* (Chlorophyta), and *Euglena pisciformis* (Euglenophyta), are illustrious pollution-indicator species sensitive to high nutrient levels. These dominant and pollution-indicator species and high ammonia and phosphate indicate stress and organic pollution in Alice Creek.

Recommendations

The study recommends regular monitoring of the Creek's aquatic life and water quality to ascertain the impact of anthropogenic activities like sand dredging and the influx of organic and inorganic wastes on the health status of the creek.

Significance of Statement

This study discovered the occurrence of bio indicator species of epipelic algae that could be beneficial in water quality monitoring. This study will help the researchers to uncover the critical areas of algal species community dynamics in an aquatic ecosystem that is prone to an influx of varying degrees of anthropogenic inputs in the Niger Delta and beyond.

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