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USING BENTHIC DIATOM ASSEMBLAGES TO ASSESS WATER POLLUTION IN BEN TRE CITY

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ABSTRACT

Urbanization has significantly impacted on water quality and aquatic ecosystem composition. In this study, we used diatom assemblages and main environmental variables to access water condition in Ben Tre City. Diatom community, water chemistry, and physical variables were measured at 11 station in rainy (September, 2017) and dry (April, 2018) seasons. A total of *Nitzschia* (21 taxa), *Navicula* (4 taxa) and *Neidium* (one taxon) in the dry or *Fragilaria* (3 taxa) in the rain. The density and biomass of *Nitzschia claussi* was dominant. Pearson's Correlation and multivariable analysis showed that the benthic diatom community was regulated by concentration of salinity, turbidity and nutrients such as nitrogen and phosphorus. Our results suggested that the composition of diatom species was more sensitive to urbanization and could be used to assess water pollution in urban waterways.

Keywords: Bioindicator, benthic diatom, biomonitoring, Ben Tre City.

1. INTRODUCTION

There are many methods used to assess the level of environmental pollution. In particular, the biological method using aquatic organisms to assess the quality of the environment has recently been interested by many scientists. In most water bodies, environmental factors have direct or indirect effects on aquatic life. Microalgae are a group of organisms produced in water bodies. They play an important role in the production of primary energy, participate in the processes of physical metabolism in nature and provide primary biomass for successive organisms in the food chain in the water body. Besides, the diatom community accurately reflects environmental quality and ecological health and has the potential to be used as a biological indicator in surveys, assessments of the status quo, environmental quality monitoring of water bodies [1].

2. MATERIALS AND METHODS

2.1. Study area

Samples of diatom were collected at 11 locations in Ben Tre city in rainy season (September 2017) and dry season (April 2018). The location and coordinates of sampling points are shown in Fig 1.

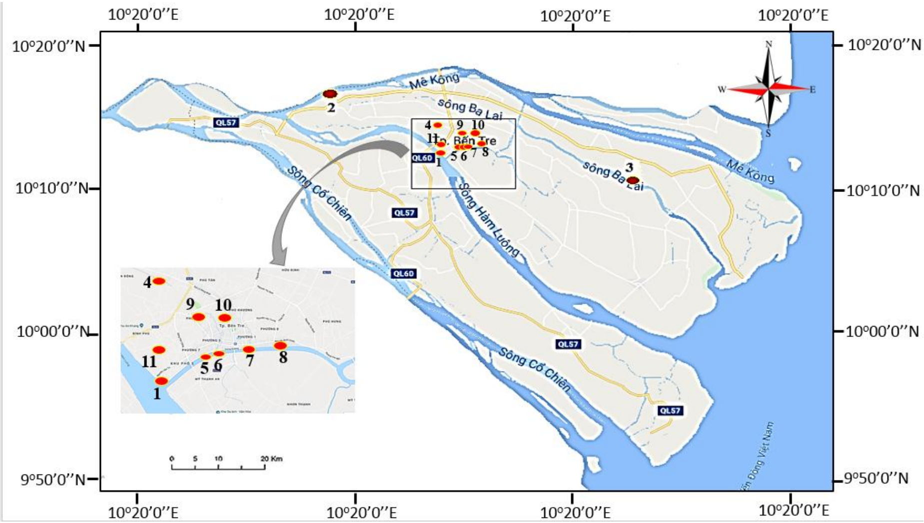

Fig. 1. Location of diatom samples in Ben Tre City.

2.2. Field sampling and nutrient analyses

Diatom wes identified at genus level with the help of the taxonomy literatures for entification [2-6]

Parameters: TSS, TN, TP, NH_4^+, NO_3^-, PO_4^{3-} were analyzed at the water chemistry laboratory of the Institute of Tropical Biology using the standard method of APHA (2005).

2.3. Data analysis

ANOVA (one-way and two-way analysis of varance) variance analysis method was used to consider the difference between points and surveys.

3. RESULTS AND DISCUSSION

3.1. Physico-chemical and nutrient variables

The average physico-chemical variables concentrations from the surface waters of the Ben Tre City in both dry and wet seasons were shown in Fig. 2.

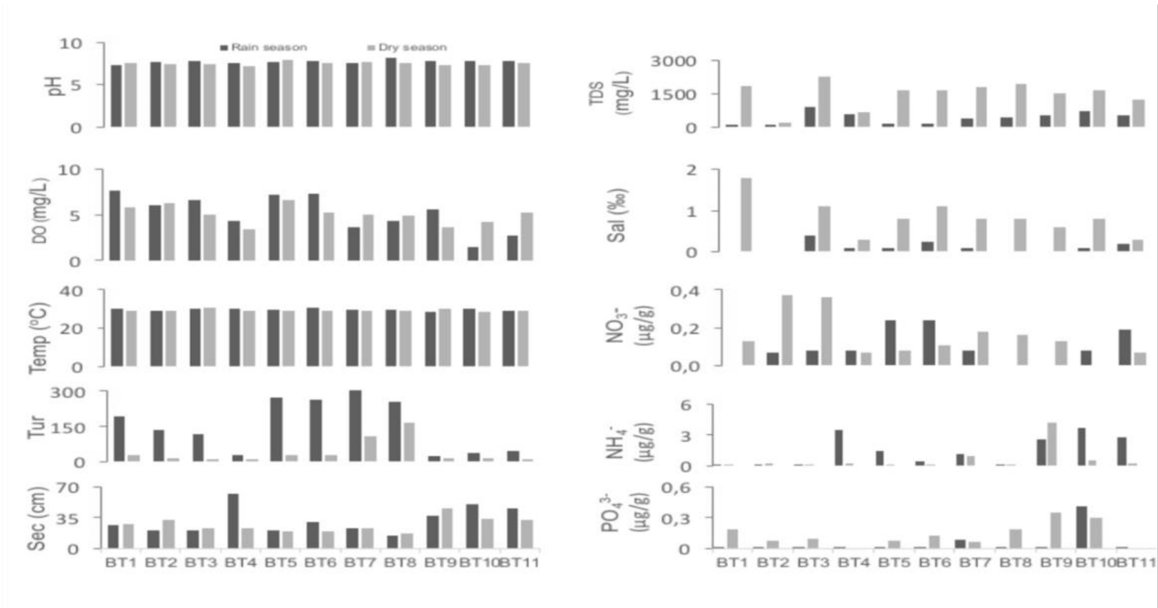

Fig. 2. Water quality variables from sampling sites in dry and wet seasons.

3.2. Density and diversity of diatom communities at different sediment environmental characteristics

Overall, 66 diatom samples were collected in 11 location in Ben Tre City including 93 taxa in 39 familes. There are 72 taxa in the dryseason and 79 taxa in the rain. The three most abundant families are *Nitzschia* (21 taxa), *Navicula* (4 taxa) and *Neidium* (one taxon) in the dry or *Fragilaria* (3 taxa) in the rain.

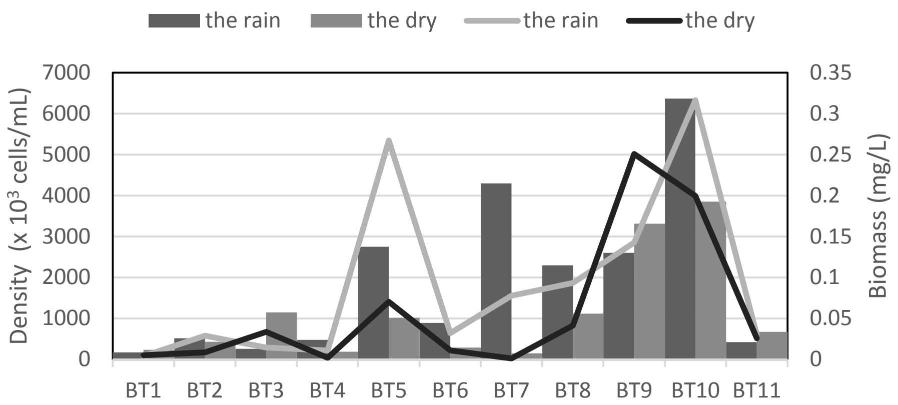

Fig. 3. Diatom density and biomass in urban and rural sites.

3.3. Relation of environmental factors to Abundance, Biomass and the biological indicators

The correlation between abundance, biomass, the biological indicators and environmental variables is shown by Spearman's correlation analysis. The results of the Spearman's correlation analysis between the environmental variables and abundance, biomass, the biological indicators in the wet season are shown in Table 1. Abundance was positive correlated with PO_4^{3-} (r= 0.6742) and TDI index was strong positive correlated with Secchi disk (r= 0.7127), while H' index had a negative correlation with DO (r= -0.6925).

Table 1. The correlation coefficient between abundance, biomass, the biological indicators and environmental variables in the wet season.

The environmental variables	Abundance (Correlation Coefficient)	Biomass (Correlation Coefficient)	TDI (Correlation Coefficient)	H' Index (Correlation Coefficient)	D Index (Correlation Coefficient)
pH	0.6194	0.5299	0.5981	0.1697	0.7369
DO	0.2154	0.5075	0.6701	0.0285*	0.0611
Temperature	0.6973	0.7513	0.5019	0.2864	0.3064
Turbidity	0.7086	0.863	0.4115	0.4209	0.7518
Secchi disk	0.9306	0.6846	0.0242*	0.9076	0.6634
TDS	0.2622	0.4376	0.5451	0.4376	0.8181
Salinity	0.6884	0.9054	0.8059	0.3972	0.2121
NO^{3-}	0.7658	0.9406	0.6597	0.3716	0.2165
NH_4^+	0.2458	0.2831	0.1004	0.7496	0.8618
PO_4^{3-}	0.033*	0.1356	0.8643	0.6089	0.5224

*Note: * Correlation is significant at the 0.05 level*

In the dry season, the results of the Spearman's correlation analysis between the environmental variables and abundance, biomass, the biological indicators are indicated in Table 2. Biomass had a strong positive correlation with PO_4^{3-} (r = 0.7094) and TDI index was positive correlated with Temperature (r = 0.7723), while the negative relationship between H' index and Temperature were found in this research (r = -0.6699).

Table 2. The correlation coefficient between abundance, biomass, the biological indicators and environmental variables in dry season

The environmental variables	Abundance (Correlation Coefficient)	Biomass (Correlation Coefficient)	TDI (Correlation Coefficient)	H' Index (Correlation Coefficient)	D Index (Correlation Coefficient)
pH	0.2929	0.4723	0.2875	0.9771	0.7958
DO	0.5168	0.625	0.0701	0.5653	0.3428
Temperature	0.5357	0.918	0.0146*	0.0341*	0.08
Turbidity	0.4135	0.8852	0.4792	0.686	0.9539
Secchi disk	0.0744	0.7175	0.8849	0.7502	0.9078
TDS	0.9655	0.8405	0.9084	0.6455	0.5849
Salinity	0.8415	0.8476	0.8708	0.813	0.7562
NO^{3-}	0.3581	0.644	0.2788	0.1155	0.1747
NH_4^+	0.6337	0.9082	0.6448	0.8968	0.5356
PO_4^{3-}	0.0537	0.0249*	0.4517	0.3852	0.1561

*Note: *Correlation is significant at the 0.05 level.*

4. CONCLUSION

Urbanization has significantly impacted on water quality and aquatic ecosystem composition. So that water protective methods are necessary in Ben Tre City.

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