Distribution of Nutrients in the Phosphorescent Bay at La Parguera, on the Southwest Coast of Puerto Rico

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ABSTRACT

Organic matter is of great importance in the marine environment as it is the source of electrons that drives most biologically mediated redox reactions. As a result, the biogeochemical cycle of organic matter has a great influence on the cycles of these biologically active elements. This study examines the distribution and concentrations of nutrients (NO_3^-, $N0_2^-$ PO_4^{3-}, SiO_4^{2-} and NH4+) in a phosphorescent bay at La Parguera on the southwest coastal of Puerto Rico, including the redox potential in sediments. Water samples and sediments were obtained at eight stations selected based on observations of phytoplankton concentration. The analysis data demonstrate significant differences ($P < 0.05$) in nutrient concentration. Stations with high phytoplankton concentrations were associated to high levels of nutrients, with spatial and temporal patterns. Low redox potential and high organic matter in sediments are related to these stations. These observations suggest that ammonification could be a key process in the release of nitrogen from the sediments to the water column required to maintain a high primary productivity in the bay.

KEY WORDS: Nutrients, Phosphorescent Bay, anthropogenic impacts

INTRODUCTION

Organic matter is of great importance in the marine environment as it is the source of electrons that drives most biologically mediated redox reactions. As a result, the biogeochemical cycle of organic matter has a great influence on the cycles of these biologically active elements. The Phosphorescent Bay, located on the southwest coast of Puerto Rico, is fringed by red mangroves. The Bay is highly turbid, which is associated with high phytoplankton concentrations, debris from mangrove swamp, rainfall runoff and stirring of loose sediments by wind and fishes. This study examines the distribution of and concentration of inorganic nutrients in the bioluminescent bay at La Parguera, including the redox potential and organic matter with a view towards the evaluation of sediment influence upon nutrient availability in the water column.

MATERIALS AND METHODS

The study was conducted in the Bioluminescent Bay at La Parguera, in the southwest coast of Puerto Rico (17° 58' 30" N; 67° 01' 10" W). A total nine stations (Figure 1) were selected based on observations of phytoplankton concentrations in previous studies. Three replicates of water samples were taken at each station. Inorganic nutrient concentration were determinate according to methods described by Strickland and Parsons (1968). In each station, with seven station exception, sediments core were samples in order to determine redox potential and percent organic matter. Sediment samples were collected using 6 cm on diameter and 30 cm longitude cores with acrylic removal liners.

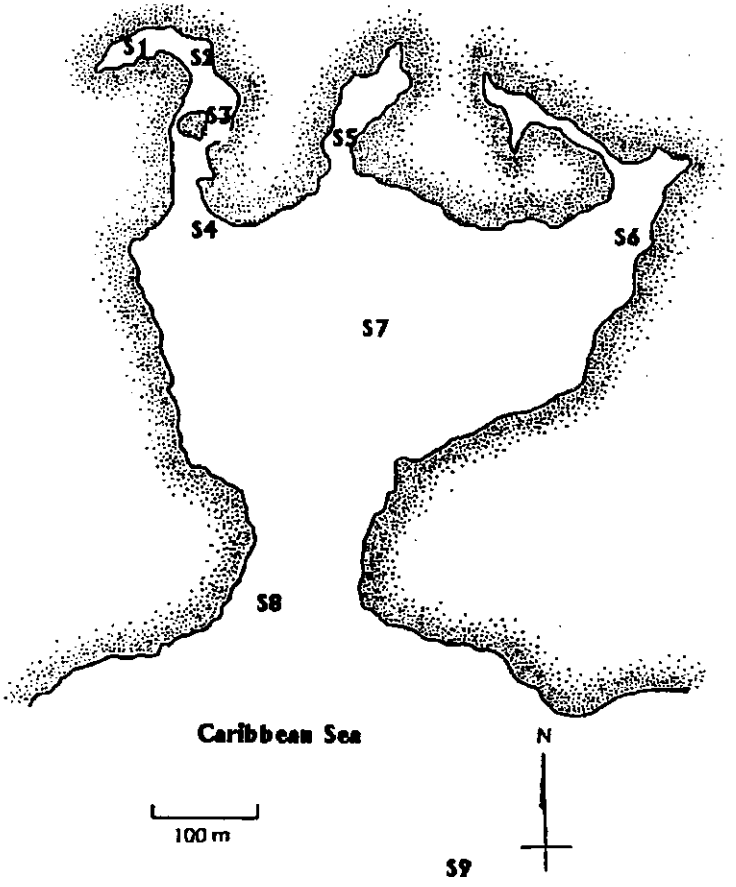

Figure 1. Sample sites in Phosphorescent Bay at La Parguera on the southwest coastof Puerto Rico

RESULTS AND DISCUSION

The data analysis demonstrate significant differences ($P > 0.05$) in nutrient concentration. Stations with high phytoplankton concentration were associated to high levels of inorganic nutrients, with spatial and temporal patterns. There are differences of distribution of ammonia concentrations, considered the most limiting nutrients in sea water (Figure 2). This could explain the very high density of phytoplankton in this Bay.

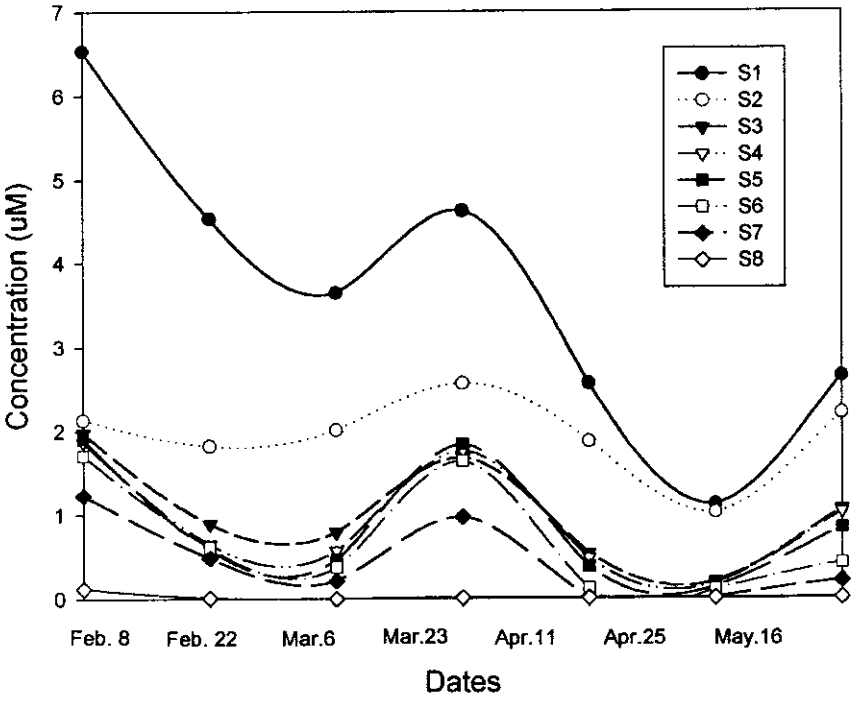

Figure 2. Variations in concentrations of ammonia measured at sampling stations in Phosphorescent Bay at La Parguera on the southwest coast of Puerto Rico

Low redox potential (Figure 3) in sediments are related to stations with higher phytoplankton density. Redox potential invariably decreased toward deeper layers. Redox potential at depth are also significantly lower ($P < 0.05$) at stations 1 and 2.

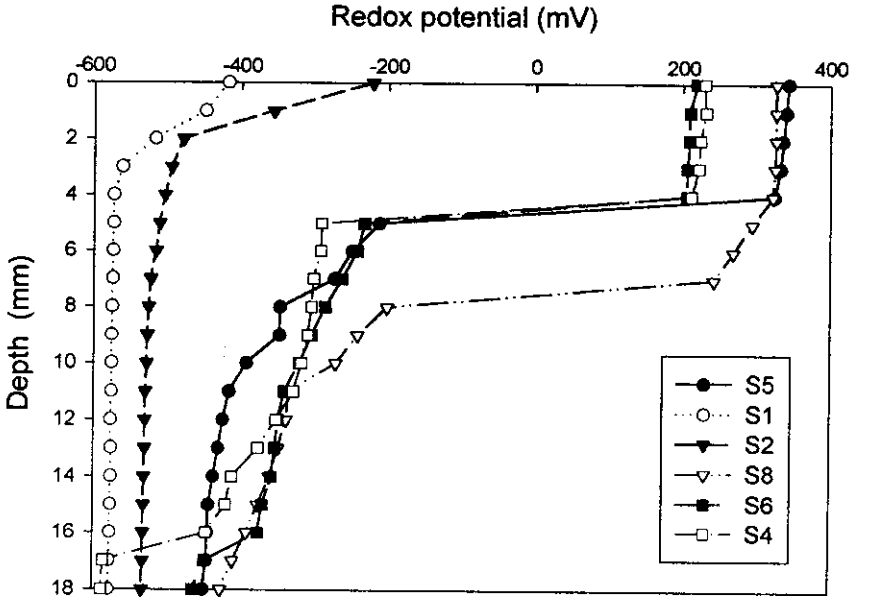

Figure 3. Potential redox measured at sediment sampling stations in Phosphorescent Bay at La Parguera on the southwest coast of Puerto Rico

Organic matter content (Figure 4) was higher at stations 1 and 2, core tops exhibited higher contents of organic matter normally diminishing toward the deeper sections as a result of microbial diagenetic processes.

These observations suggest that ammonification could be a key process in the release of nitrogen from the sediments to the water column, resulting in high primary productivity in the Bay.

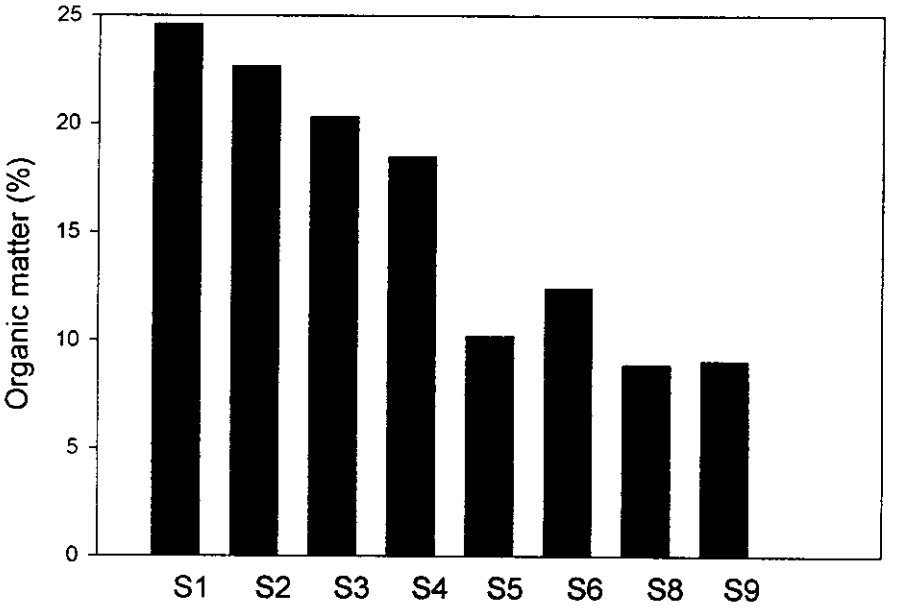

Figure 4. Organic matter content in sediment samples in Phosphorescent Bay at La Parguera on the southwest coast of Puerto Rico

ACKNOWLEDGMENTS

This work was supported by NASA-EPSCoR. The authors thank Dr. Jorge Corredor for the use of his Laboratory.

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