ECOLOGICAL ASPECTS OF A BENTHIC MARINE ALGAL COMMUNITY IN SOUTHEAST BAY, ARCHIPELAGO OF FERNANDO DE NORONHA, BRAZIL

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ABSTRACT

The structure of the benthic algal community in the Archipelago of Fernando de Noronha (3°50'10" S, 32°25'30" W) was studied. Sampling was random, utilizing a 25 cm x 25 cm quadrat. The community was divided in two subgroups, the first, visually dominated by Dictyota mertensii with 1.606 bits ind.$^{-1}$ (dry weight) of diversity and a biomass of 4876 g dry wt m^{-2} (77.9%) and the second visually dominated by Laurencia papillosa with 1.388 bits ind.$^{-1}$ (dry weight) of diversity and a biomass of 1383 g dry wt m^{-2} (22.1%). The more important species in regard to biomass were species of Melobesioideae (2064 g dry wt m^{-2}), Halimeda tuna (1191 g dry wt m^{-2}), Laurencia papillosa (876 g dry wt m^{-2}), Amphiroa fragilissima (731 g dry wt m^{-2}) and Dictyota mertensii (377 g dry wt m^{-2}). The communities are equivalent qualitatively but not in terms of biomass.

Key words: benthic, Brazil, ecology, marine macroalgae, seaweeds

INTRODUCTION

The Archipelago of Fernando de Noronha is formed by 21 islands in the South Atlantic Ocean. It belongs to Pernambuco State, Brazil, and is a reserve where ecotourism is well developed. Therefore, its faunal and floral diversity have stimulated many research programs, among them studies of the benthic marine algae.

Existing reports about the macroalgae refer only to their occurrence (Dickie, 1874; Hemsley, 1885; Murray, 1891), taxonomic inventory (Williams & Blomquist, 1947; Ferreira-Correia & Pinheiro-Vieira, 1969; Széchy et al. 1989; Pedrini et al. 1992) or vertical distribution (Eston et al., 1986).

In order to increase our knowledge of this group in the area and understand the impact caused by ecotourism, we studied the spatial and temporal distribution of species and the diversity, frequency and biomass of species associations.

MATERIALS AND METHODS

The Archipelago of Fernando de Noronha is located at 3°50'10" S, 32°25'30" W, around 545 km from the city of Recife on the continent (Fig. 1). It occurs within an oceanographic region with a total area of 26 km^2. The climate is warm-humid tropical (Koppen AW), with a mean annual temperature of 25.4°C

and rainfall of 1,200-1,800 mm yr^{-1}, concentrated from March to August. Trade-winds are predominant (Almeida, 1957).

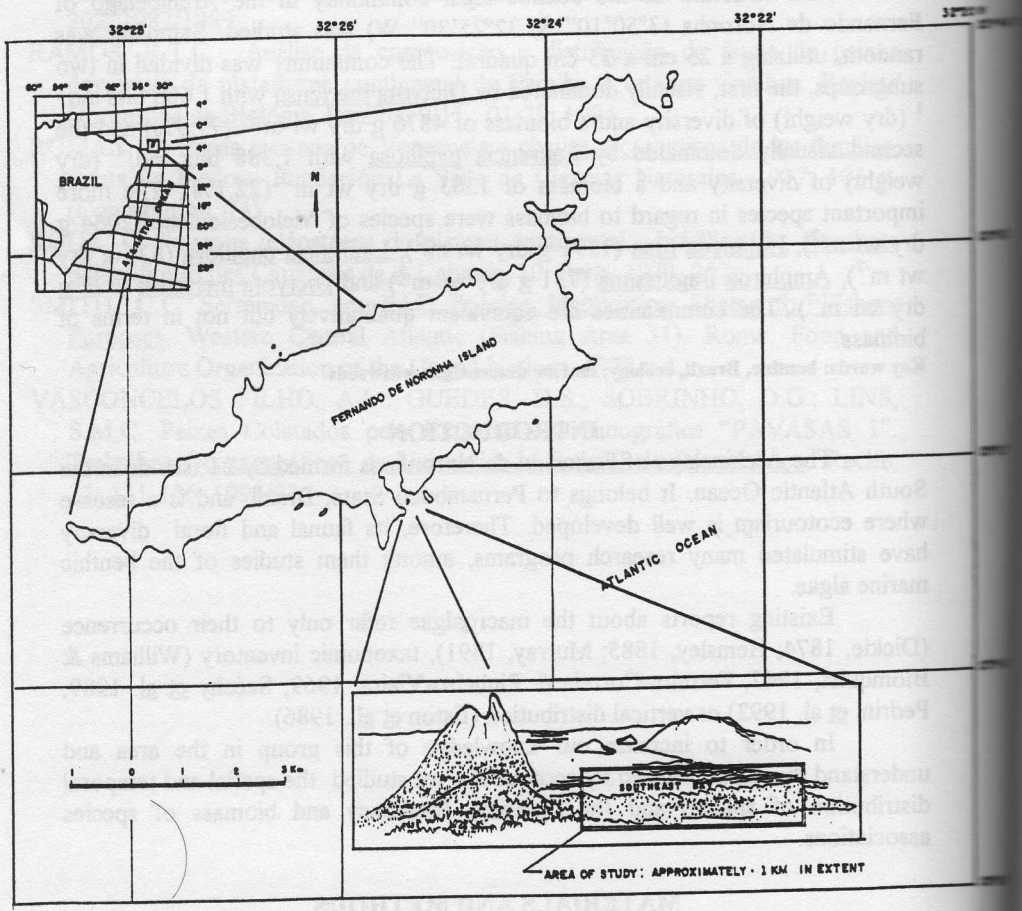

Fig. 1. Location of the study area in Southeast Bay, Fernando de Noronha Island, SouthWest Ocean.

Land vegetation is subxerophilous and composed of a few arboreal species. On the main island of Fernando de Noronha, the only insular mangrove of the South Atlantic is in a state of degradation. Fringing Fernando de Noronha island are sandy and rocky shores. The former are formed by calcareous grains mainly from thallus fragments of corallinaceous algae. The rocky shores are formed by reefs of fringe or barrier type, also composed of species of Corallinaceae.

In March 1992, samples were collected at random in a 1 km x 1 km area during low tide. An iron quadrat of 25 cm x 25 cm was used. Due to the predominace of Laurencia papillosa (C. Agardh) Greville and Dictyota mertensii (Martius) Kuetzing, the area was divided in two subareas, each sampled randomly for a total of 40 samples. The algae were collected for biomass according to DeWreede (1985), and the nomenclature followed Wynne (1986). Species diversity was calculated by the Shannon index (1948): $H = - \Sigma p_i \ln p_i$ where: $p_i = n_i/N$, n_i = biomass (dry wt) of individuals of each species, and N = total biomass of all individuals.

Species associations were characterized using the Jaccard Index for frequency data (Boesch,1977). A cluster analysis based on the similarity matrix was performed using the WPGMA (Weighted pair-group method, arithmetic averages - NTSYS - PC Rohlf, 1987).

RESULTS AND DISCUSSION

Eight species of Rhodophyta (38.1%), seven species of Chlorophyta (33.3%) and six species of Phaeophyta (28.6%) were found (Table1). These species are distributed in two subgroups, the first with 1.607 bits ind^{-1} (biomass) of diversity, dominated by Dictyota mertensii, and the second with 1.387 bits ind^{-1} (biomass) of diversity, dominated by Laurencia papillosa. These values show a balanced distribution of the species in the community. In contrast, Mansilla et al. (1993), working on a rocky shore community in the littoral of South Pernambuco, concluded that Sargassum polyceratium Montagne was responsible for almost all the biomass of the area. Considering the frequencies (presence/absence) of the species, the most evident association in this study is the group formed by Dictyota mertensii, Gelidiella acerosa (Forsskal) J. Feldmann et Hamel and Laurencia papillosa, which, being the most common species in the community, are numerically associated (Fig. 2). Padina gymnospora (Kuetzing) Sonder, Gelidium pusillum (Stackhouse) Le Jolis and Caulerpa mexicana Sonder ex Kuetzing should also be mentioned because they occurred in low frequencies and are typical of biodetritic substrata.

With reference to biomass, the subgroup dominated by Dictyota mertensii was more important (4876 g m^{-2} dry wt., representing 77.9% of the total biomass of the community) than the subgroup dominated by Laurencia papillosa (1383 g m^{-2} dry wt., representing 22.1% of the total community biomass; Table 1).

Table 1. List of taxa with their biomass (dry wt) and frequency (%) in the two subareas sampled in the Archipelago of Fernando de Noronha, March 1992.

LIST OF TAXA	SUBAREA A		SUBAREA B	
	Biomass (gm^{-2})	Frequency (%)	Biomass ($g\ m^{-2}$)	Frequency (%)
RHODOPHYTA				
Gelidium pusillum (Stackhouse) Le Jolis	3.20	5	---	---
Gelidiella acerosa (Forsskal) J. Feldmann et Hamel	11.52	15	27.84	25
Amphiroa fragilissima (Linnaeus) Lamouroux	731.20	35	---	---
Jania adhaerens Lamouroux	---	---	16.64	20
Ceramium sp.	---	---	23.68	5
Spyridia sp.	2.56	5	---	---
Dictyurus occidentalis J. Agardh	78.08	10	2.52	25
Laurencia papillosa (C.Agardh) Greville	221.76	30	876.32	75
Melobesioideae	2064.16	55	---	75
SUB-TOTAL	**3112.48**		**947.00**	
PHAEOPHYTA				
Dictyopteris delicatula Lamouroux	40.80	20	21.28	15
Dictyopteris jolyana Oliveira & Furtado	---	---	5.92	5
Dictyopteris justii Lamouroux	---	---	6.24	5
Dictyota dichotoma (Hudson) Lamouroux	23.84	10	105.56	15
Dictyota mertensii (Martius) Kuetzing	376.64	75	117.76	50
Padina gymnospora (Kuetzing) Sonder	2.72	5	---	---
SUB-TOTAL	**444.00**		**256.76**	
CHLOROPHYTA				
Dictyosphaeria cavernosa (Forsskal) Borgesen	---	---	6.40	20
Bryopsis pennata Lamouroux	1.12	5	5.92	15
Halimeda tuna (Ellis et Solander) Lamouroux	1190.56	30	138.4	5
Caulerpa mexicana Sonder ex Kuetzing	---	---	23.2	5
Caulerpa prolifera (Forsskal) Lamouroux	---	---	4.96	5
Caulerpa racemosa (Forsskal) J. Agardh var. racemosa	73.92	10	---	---
Caulerpa sertularioides (Gmelin) Howe	54.24	10	---	---
SUB-TOTAL	**1319.84**		**178.88**	
TOTAL	**4876.32**		**1382.64**	

Subarea A: dominated by Dictyota mertensii
Subarea B: dominated by Laurencia papillosa

This fact supports the observation of Oliveira Filho (1977) that the Dictyotales form the most important algal group on the Brazilian northeastern coast. From the 21 species collected, each subgroup is represented by 15 taxa, and eight species were common to the two subgroups (Table 1). The most important taxa regarding biomass in the subgroup dominated by Dictyota mertensii were Melobesioideae (42.3%), Halimeda tuna (Ellis et Solander) Lamouroux (24.4%), Amphiroa fragilissima (Linnaeus) Lamouroux (15.0), and Dictyota mertensii (7.7%), and in the subgroup dominated by Laurencia papillosa

were Laurencia papillosa (63.4%) and Halimeda tuna (10.0%). We believe that substratum is the main factor responsible for the occurrence of the two subgroups in the area, that dominated by Laurencia papillosa occurring on rocky substrata and the other, dominated by Dictyota mertensii, occurring on rocky substrata covered by sand.

The herbivores in the area, represented by the observation of fishes and sea urchins, may be the main reason for the low occurrence of species, as observed by Eston et al. (1986) and Széchy et al. (1989) for the Archipelago of Fernando de Noronha. Eston et al. (1986), based on Norris & Fenical (1982) and Hay (1984), reported that some Dictyotales produce diterpenoids and Caulerpales produce secondary metabolites such as caulerpin, caulerpicin and caulerpenyne. Thus, emphasis should be put on herbivory as an important parameter in future community structure research.

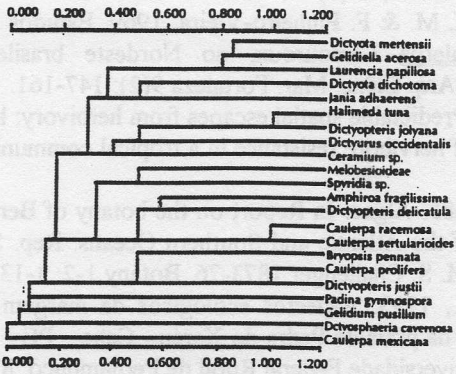

Fig. 2. Macroalgal associations, using the Jaccard Index, for the community in Southeast Bay, Archipelago of Fernando de Noronha, Brazil.

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