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DEEP WATER MARINE ALGAE FROM ESPIRITO SANTO STATE (BRAZIL)

ALGAS MARINHAS DE PROFUNDIDADE DO ESTADO DO ESPÍRITO SANTO

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SUMMARY

The deep-water flora of the area of the Rio Doce Delta (Espírito Santo State) on the East Coast of Brazil is described. The survey comprised 82 dredgings of which 22 presented benthic algae. The plants are restricted to the areas presenting coral or calcareous substrate. Forty three species of algae were found, including the Rhodophyceae,, Phaeophyceae and Chlorophyceae. Though the red algae presented the largest diversity, the brown appears as dominant and more important in the characterization of the flora. The more important species are *Cryptonemia crenulata, Dictyopteris justii, Lobophora variegata, Sargassum hystrix* and *Laminaria brasiliensis.* The last mentioned species was dredged at 73 m deep, being the deepest record of algal growth in the stations studied.

RESUMO

Descreve-se a flora marinha bentônica de profundidade da região do Delta do Rio Doce, no Estado do Espírito Santo. O estudo foi baseado em uma amostragem de 82 estações de dragagens efetuadas em várias profundidades dentro da referida área, sendo que em apenas 22 estações foram coletadas algas marinhas. As plantas estão restritas às àreas onde ocorre coral e areia calcárea como substrato. São mencionadas 43 espécies de algas, incluindo representantes das Rodofíceas e Clorofíceas. A maior diversidade de espécies foi encontrada no grupo de algas vermelhas. Entretanto, as pardas parecem ser as mais importantes para caracterizar a flora dada a abundância com que se apresentaram nas amostras. Dentre as espécies mais representativas destacam-se *Cryptonemia crenulata, Dictyopteris justii, Lobophora variegata, Sargassum hystrix* e *Laminaria brasiliensis.* Esta última espécie foi coletada a uma profundidade de 73 m, constituindo-se na estação mais funda onde se constatou um ativo crescimento algal.

INTRODUCTION

The inter-tidal flora of the Espirito Santo State, on the east coast of Brazil, is supposed to be one of the richest in the country, though only some groups have been studied up to now (cf. Oliveira Filho, 1969 and Behar, 1972). However, almost nothing is known about the deep-water flora of this region, except by a few references in Oliveira Filho (1. c.), Joly & Braga (1.966) and Joly & Oliveira Filho (1.967).

During 1972, in a general survey of the Rio Doce Delta, sponsored by Petrobrás (Petróleo Brasileiro S.A.), 82 dredgings were performed at different depths.

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The objective of this paper is to identify all the species collected in the area and to look for deep-water species indicative of particular ecological conditions. The crustose Corallinaceae were sent to other phycologist and will not be considered here.

DREDGING STATIONS

The positions of the stations, presenting seaweeds and the commonest species in each station are presented in figure 1. Table 1 gives the data of salinity, temperature, oxygen and depth for each station and Table 2 shows the distribution of the more abundant genera on the various substrates.

LIST OF SPECIES

The number after each name corresponds to the station where the plant was found.

RHODOPHYTA

BANGIALES

1 – *Erithrocladia subintegra* Rosenv. (44). Epiphyte on the stems of *Chamaedoris peniculum.*

NEMALIONALES

2 – *Galaxaura obtusata* (Ell. & Sol.) Lamour. (54). A single, incomplete specimen.
3 – *Falkenbergia hillebrandii* (Born.) Falk. (7) Epiphyte *on Laurencia* sp.

CRYPTONEMIALES

4 – *Peyssonnelia* sp. (57). Just a fragment. Calcified only on the lower side; hypothallus with straight filaments; apical cells as tall as the hypothallus cells; epithallus with only two layers of cells near the margin.
5 – *Corallina subulata* Ell. & Sol. (54, 64, 72). A few plants. Some mixed with *Jania adhaerens.*
6 - *Jania adhaerens* Lamour. (64).
7 – *Jania pumila* Lamour. (57). Abundant on *Stypopodium zonale.*
8 – *Cryptonemia crenulata* J. Ag. (53, 54, 64). Well developed specimens; abundant.

GIGARTINALES

9 – *Gracilaria foliifera* (Fors.) Boerg. (64). Just one specimen.
10 – *Gracilaria cylindrica* Boerg. (50). Just a fragment.
11 – *Gracilaria mammillaris* (Mont.) Howe (54). Just one specimen.
12 – *Plocamium brasiliense* (Grev.) Howe & Tayl. (43). Just a fragment.
13 – *Hypnea* (44, 54). Dense tufts, 4 - 5 cm high; terete, irregularly branched; 100-200 um in diameter, tapering to the apex, thallus solid, with 5 inconspicouus pericentrals, sterile. These plants cannot be identified with any of the *Hypnea* spp. refered to Brazil.
14 – *Champia* sp. (57). Probably a young specimen of *C. parvula* (C.Ag.) Harvey. Epiphyte on *Laurencia* sp.

CERAMIALES

15 – *Antithamnion atlanticum* Oliv. F. (54). Epiphyte on *Lobophora variegata* (Lamour) Wom.
16 – *Dohrniella antillarum* (Tayl.) F. Maz. (7). On *Sargassum* sp.
17 – *Ceramium dawsoni* Joly. (7,64). On *Sargassum* sp.
18 – *Ceramium coddi* (Rich.) F. Maz. (54,57). On *Laurencia* sp.
19 – *Spermothamnion investiens* (Crouan) Vick. (64). On *Cryptonemia crenulata.*

20 – *Spyridia clavata* Ketz. (12). Fragments.
21 – *Spyridia filamentusa* (Wulf.) Harv. (17). Fragments.
22 – *Cryptopleura* sp. (7). Fragments.
23 – *Heterodasya sertularioides* (Howe & Tayl.) Joly & Oliv. F, (64).
24 – *Dipterosiphonia dendritica* (C.Ag.) Schm. (57). On *Laurencia* sp.
25 – *Herposiphonia secunda* (C.Ag.) Amb. (54). On *Hypnea (?).*
26 – *H. tenella* (C.Ag.) Naeg. (57). On *Stypopodium zonale.*
27 – *Laurencia* sp. (44, 57). 10 cm high; branchlets 5–10 mm long, usually undivided, tapering towards the base and disposed in one plane.

PHAEOPHYTA

ECTOCARPALES

28 – *Giffordia mitchellae* (Harv.) Hamel. (7). On *Sargassum* sp.

DICTYOTALES

29 – *Dictyopteris justii* Lamour. (44, 53, 54). Abundant and well developed specimens.
30 – *Dictyota cervicornis* Kuetz. (7).
31 – *Lobophora variegata* (Lamour) Wom. (43,44,53,54,57). Abundant.
32 – *Stypopodium zonale* (Lamour). Pap. (44,54,57). Abundant fragments.

LAMINARIALES

33 – *Laminaria brasiliensis* Joly & Oliv. F. (42), (6). Young specimens and fragments.

FUCALES

34 – *Sargassum hystrix* J.Ag. var. *spinulosum* (Kuetz.) Grun. (43,44,54,58,64). Large specimens abundant.
35 – *Sargassum* sp. (7). Fragments similar to *S. cymosum.*

CHLOROPHYTA

CLADOPHORALES

36 – *Anadyomne stellata* (Wulf.) C.Ag. (40,54). A few young specimens.

SIPHONOCLADALES

37 – *Chamaedoris peniculum* (Ell. & Sol.) Kunt. (44). Just a fragment.
38 – *Valonia macrophysa* Kuetz. (72). A few specimens.

SIPHONALES

39 – *Halimeda opuntia* (L.) Lamour. (68). A few segments.
40 – *Halimeda* sp. (7,39,54,64,70 e 77). Segments.
41 – *Penicillus capitatus* Lam. (72). A single specimen.
42 – *Codium isthmocladum* Vick (57). Just a fragment.
43 – *C. spongiosum* Harv. (57). Scarce.

DISCUSSION AND CONCLUSIONS

The algae seem to be restricted to the calcareous sand and coral bottoms, since only fragments of plants were found on other substrates.

The deepest station to present algal growth was station 42 in which *Laminaria brasiliensis* were found growing at 73 m. This is in agreement with Joly & Oliveira Filho (1967), since these authors mentioned the occurrence of that species at a point not very far from the area now surveyed. Howewer those authors give the plants as growing at a temperature of 15° C (sept. 66), while our plants were collected at a temperature of 20, 4° C. (July 1972). This indicates that *L. brasiliensis* tolerate a relatively high temperature and could well live in the waters of the Brazilian Current.

Stations 57 and 54 at 28 m and 41 m deep, respectively, presented the largest diversity. This could be due to a larger transparency of the water at these places, or just to an inadequate sampling. Howewer no data is available to support this assumption.

Lobophora variegata seems to be the more abundant and common species in the area, being found in 5 different stations, ranging between 27-28 to 50 m deep.

The algae collected in the stations 6 and 7 at 267 and 590 - 790 m deep, respectively, were represented only by fragments and certainly were not growing there as one should expect. The same is probably true for the finding of *Codium isthmocladum, C. spongiosum, Anadyomne stellata, Giffordia mitchellae* and *Falkenbergia hillebrandii,* since all of them are common plants of the intertidal region and were present only as fragments.

Considering the richness in species diversity and biomass of the interdital surroundings, the large number of dredings at depths under 100 m and the presence of adequate bottom substrate one should exgect much richer samples. The presence of a large number of species just as fragments, indicates that the collecting was not very efficient.

Of the collected species, *Cryptonemia crenulata, Dictyopteris justii, Lobophora variegata* and *Stypopodium zonale* were already known as occuring in deep water up to 60 meters on the northeast coast (Kempf, 1970). The last mentioned species was also referred to a point near the surveyed area (Joly & Braga 1966). In opposition to the observations of Kempf, (1970) who mentions several species of green (mainly Siphonales) and red algae in the deep water flora of Pernambuco State, it seems that the deep water flora of Espirito Santo State have the brown algae as the more representative group.

The large number of the Rhodophyceae referred to in this paper, with exception of *Cryptonemia crenulata*, are mainly small epiphytic species, growing on the larger Phaeophyceae. The Chlorophyceae are represented mainly as fragments of the intertidal species.

Although *C. crenulata, D. justii, S. zonale, C. peniculum* and *P. capitatus* are clearly plants of the infra-littoral, they are also found at or close to the infra-littoral fringe. This is not the case of *S. hystrix* that is always found at deeper places and not

of *L. brasiliensis*, that so far is known only that depths of over 70 m.

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TABLE 1 (Data after "Projeto Rio Doce – Convênio USP - PETROBRÁS, Relatório Final Vol. 30.)

	Salin. ‰ 0	Temp. °C	Oxyg. ml/l	Depth m
6 CD	35, 36	–	4, 25	267
7 RD	34, 34	04, 97	4, 35	790 - 590
12 VV.	–	–	–	11
17 VV.	–	–	–	18
39 VV.	36, 83	–	4, 25	50
40 VV.	36, 73	–	4, 24	56
42 CD	36, 30	20, 40	4, 28	73
43 VV.	37, 13	24, 98	4, 83	50
44 VV. - CD	36, 69	22, 60	3, 97	40
50 VV.	36, 86	–	4, 40	25
53 VV.	36, 94	24, 97	4, 94	27
54 BT	36, 94	24, 97	4, 35	41
57 CB	36, 99	24, 80	4, 70	28
58 CB	37, 02	24, 90	4, 36	31
61 CB	37, 10	–	–	48
64 CB	36, 95	24, 98	4, 67	27
68 VV	36, 63	–	4, 44	17
70 VV	36, 95	–	4, 85	18
72 VV	37, 11	–	4, 82	43
77 VV	36, 66	–	4, 18	48

CB – Chain Bag; VV – Van Veen; CD – Circular dredge; BT – Bean Trawl; RD – Rectangular dredge.

TABLE 2*

SUBSTRATE	DEPTH (m)	STATION Nº	ABUNDANT GENERA
	12	12	*Spyridia*, fragments
M	39	50	*Halimeda*, fragments
U	267	6	*Laminaria*, fragments
D	790 - 590	7	*Sargassum*, fragments
C	17	68	*Halimeda*, fragments
A	14	17	*Spyridia*, fragments
L	18	70	*Halimeda*, fragments
C S	27	53	*Cryptonemia, Lobophora, Dictyopteris*
A A		64	*Cryptonemia*
R N	41	54	*Dictyopteris, Lobophora, Cryptonemia*
E D			and *Sargassum.*
O			
U			
S			
C	25	50	*Gracilaria.*
O	28	57	*Lobophora, Sargassum, Laurencia,*
R			*Stypopodium, godium*
A	31	58	*Sargassum*
L	40	44	*Dictyopteris, Sargassum, Lobophora*
	48	61	*Sargassum*
	50	43	*Lobophora, Sargassum*
	56	40	*Anadyomne*
	73	42	*Laminaria*

* Epiphytic species were not included in this table.

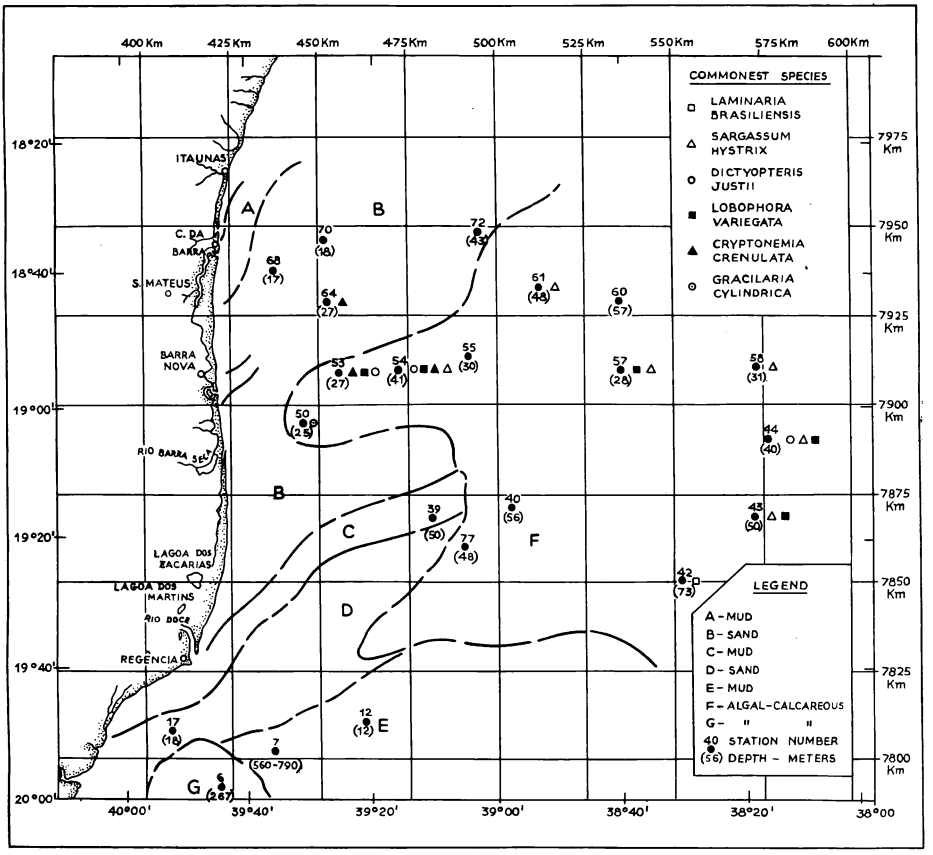

Figure 1

Position of the dredging stations with the commonest species and kinds of substrate.

Posição das estações de dragagem indicando as espécies mais comuns e os tipos de substrato.