A First Record of a *Sargassum* (Phaeophyta, Algae) Outbreak in a Caribbean Coral Reef Ecosystem

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ABSTRACT

In 1984, the Caribbean coast of Martinique Island (French West Indies) possessed flourishing coral reef communities. Since then, a community of the benthic phaeophyte *Sargassum* spp. has developed in this area between 5 and 30 meters deep. These algae strongly competed with corals which were the dominant group of the original community. This phenomenon has induced important changes in the benthic community and a decrease in the abundance of the associated fishes.

RESUME

Les récifs coralliens de la Martinique (Antilles françaises) ont fait l'objet d'une étude par les auteurs en 1984. A cette époque, la côte caraïbe possédait un écosystème corallien florissant. Depuis lors, une population de *Sargassum* spp. s'est développée dans cette zone entre 5 et 30 m. Ces algues sont entrées en compétition avec les coraux qui constituaient le groupe dominant de la communauté précédente. Ce phénomène a provoqué des changements dans les communautés benthiques et entraîné une chute de la densité des peuplements ichthyologiques. Ce développement explosif de Sargasses a vraisemblablement été provoqué par une eutrophisation des eaux côtières par les effluents de la ville de Fort-de-France.

INTRODUCTION

The coral reef communities of Martinique island (French West Indies) and their associated ichthyofauna were previously studied in December 1983 and January 1984 (Bouchon and Laborel, 1986; Bouchon-Navaro and Louis, 1986). At this time, some important symptoms of degradation of the benthic communities and their effects on the fish assemblages were noticed (Bouchon *et al.*, 1987). Since then, certain stations were checked from time to time and in 1987, a dense settlement of algae of the genus *Sargassum* was noticed on the Caribbean coast. The present paper reports on this phenomenon and presents the changes observed for the coral communities and their associated fish assemblages.

Table 1. Numbers, location and depth of the stations surveyed in 1984, 1987, and 1988.

YEAR	STATION	LOCATION	DEPTH
1984	1	Pointe de la Baleine	3 m
	2	Pointe de la Baleine	10 m
	3	Pointe de la Baleine	15 m
	4	Cap Salomon	3 m
	5	Cap Salomon	10 m
	6	Cap Salomon	20 m
	7	Pointe Burgos	3 m
	8	Pointe Burgos	15 m
	9	Trois Rivieres	10 m
	10	Trois Rivieres	20 m
1987	11	Pointe de la Baleine	10 m
	12	Cap Salomon	10 m
	13	Pointe Burgos	10 m
	14	Trois Rivieres	10 m
1988	15	Cap Salomon	3 m
	16	Cap Salomon	10 m
	17	Cap Salomon	20 m
	18	Pointe Burgos	3 m
	19	Pointe Burgos	10 m
	20	Pointe Burgos	15 m

METHODS

During the 1983-1984 field trip, 67 stations for the coral communities and 41 for the fish communities were surveyed around Martinique Island. In July and September 1987 and January 1988, 20 stations were visited in order to precisely determine the geographic extension of the phenomenon on the leeward coast of Martinique (Table 1 and Figure 1).

The scleractinian coral communities were investigated in 1983-1984, using a semi-quantitative technique. An index ranging from 1 to 5 was assigned to each species according to its abundance. The coverage of the substratum was estimated visually. In 1987 and 1988, the coral assemblage, which was the major component of the benthic community, was surveyed with a quantitative method using a quadrat of 20 m^2 at each station. The data were rank coded on a semi-quantitative scale in order to be homogeneous with those of 1983-1984.

The fish communities were quantitatively studied using a transect technique (Bouchon-Navaro and Harmelin-Vivien, 1981; Bouchon-Navaro and Louis, 1986). The fishes were counted by two SCUBA divers along a transect 50 m

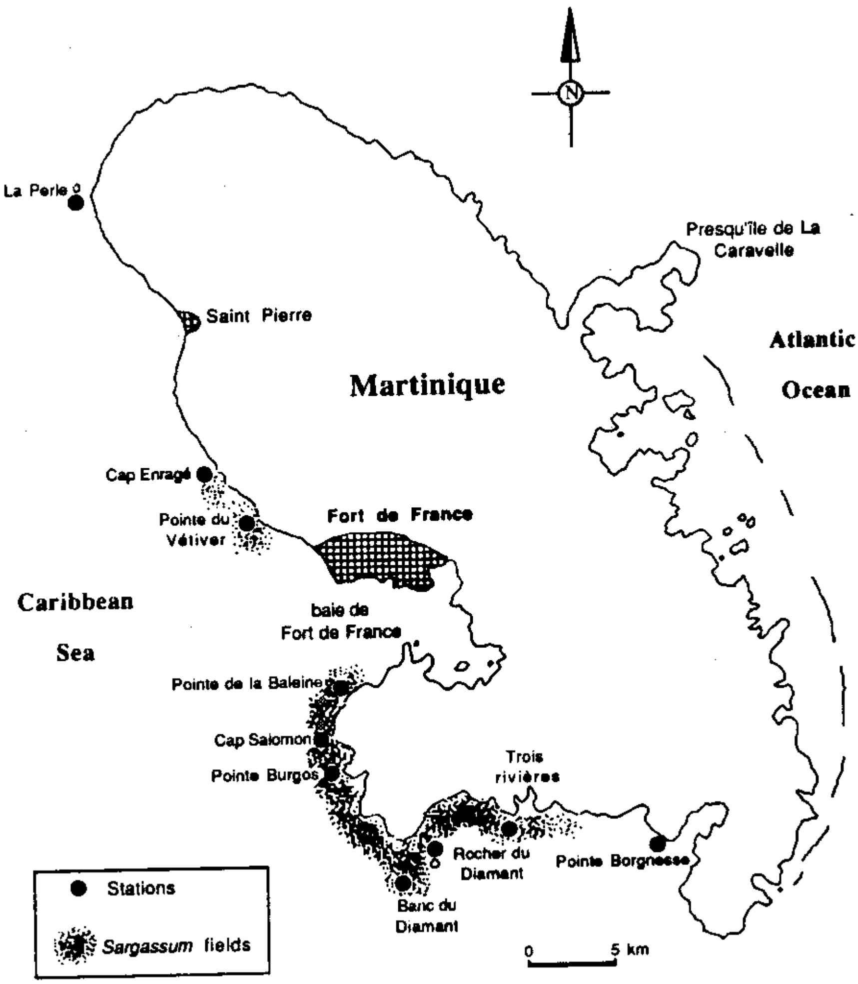

Figure 1. Martinique Island. Location of the stations studied. The dashed areas represents the extension of the Sargassum fields.

long, indicated by a rope unrolled by one of the divers. Each observer counted the fishes within a band 2 m wide. Thus, in most cases, a total area of 200 m^2 was studied at each station. The fishes encountered were grouped in numerical categories : group 1, solitary individuals ; group 2, from 2 to 4 individuals ; group 3, from 5 to 9 individuals ; group 4, from 10 to 29 individuals ; group 5, from 30 to 49 and group 6, more than 50. To calculate the mean density of fishes per 200 m^2, the size of each class was multiplied by its median.

From these data, several parameters characterizing the communities were computed : the species richness, the Pielou index of evenness, the coverage of the substratum for the corals and the density of fishes per 100 m^2. Statistical comparisons between the data obtained for the coral communities before and after the *Sargassum* outbreak were made using the non-parametric Wilcoxon signed-rank test. Comparisons between the species ordinated by their decreasing dominance (corals) or abundance (fishes) were made by the computation of the rank correlation coefficient of Spearman.

RESULTS

The Settlement of *Sargassum*

In 1984, algae of the genus *Sargassum* were only found on the windward coast of Martinique, their usual habitat in the French West Indies. None was observed on the Caribbean coast. In 1986, algae settled on the coast south of the bay of Fort-de-France. They settled on the substratum between the benthic organisms but were also able to grow directly on the coral colonies, the gorgonians and the sponges, inducing the alteration and finally the death of the colonies.

In 1987, they occupied about 20 km of coast (Figure 1) between Pointe de la Baleine and the town of Sainte-Luce. They did not develop inside the bay of Fort-de-France which is very muddy and only a few thalli were observed on the coast north of Fort-de-France (Cap Enragé, Pointe du Vétiver). Several species were incriminated but the dominant one was *Sargassum filipendula*.

In the stations located near the Bay of Fort-de-France, the thalli measured between 0,5 to 1 m high and their density varied between 5 to 10 per m^2. More to the south, on the Rocher du Diamant and the bank, their size was around 0,5 m and their density about 5 per m^2. Farther, near Sainte-Luce, the thalli measured about 20 cm and the density was lower. So, there was a decreasing gradient of the size and density of the *Sargassum* from the Bay of Fort-de-France towards the south. Their bathymetric distribution ranged between 3 to 30 m (lower limit of the hard substrate). Between these limits, the size and density of the algae were homogeneous, for each station. Between the surface and 3 m, the *Sargassum* did not settle, probably hampered by wave action. Conversely, an abnormal development of large green filamentous algae was noticed in this zone.

Impact on the Coral Communities

In 1984, 32 species of Scleractinian corals were censused (Table 2). In 1987 and 1988, nine of these species were not observed anymore. This corresponds to a decrease of 28 % in the number of coral species. Nevertheless, the disappearance of the species occurred at all the stations, because there is no significant difference when the species richness is compared with a Wilcoxon test, between the 14 matched stations (3, 4, 5, 6, 7, 8, 9 in 1984 versus 11, 12, 14, 15, 18 in 1987 and 1988). Furthermore, the sum of the abundances of the species in 1984 (for the 10 first census) were compared with the sum of the abundance of the species for 1987 - 1988 (census 10 to 20, Table 2) by the computation of the Spearman rank correlation coefficient. The correlation found was highly significant (rejection level: 99%). This means that there was no major change in the ordination of the dominant species of the coral community. The coverage rate of the substratum dropped from 6 to 75 % of its initial value at the different stations. A Wilcoxon test calculated between the matched stations indicates that the difference between the coral coverage (Table 2) in 1984 and after the *Sargassum* outbreak was statistically significant (rejection level: 98 %). In the same way, the statistical comparison of the evenness of Pielou (Table 2) demonstrates a significant difference (rejection level: 98 %).

The *Sargassum* has strongly competed with the corals and has induced an alteration of the original community expressed by the disappearance of some species, a drop in the coverage of the substratum by the corals and a decrease in evenness. This last phenomenon indicates an alteration of the community structure.

Impact on the Fish Communities

The fish communities were investigated by SCUBA diving in 1987 and 1988 between 10 and 20 m during the period of maximal development of *Sargassum* on the reefs (Table 1). In 1984, 3 stations were quantitatively investigated (Bouchon-Navaro and Louis, 1986).

A total of 78 species belonging to 23 families were observed on the study reefs (Table 3). They belong mainly to the Serranidae (12 species), the Pomacentridae (9 species), the Labridae (8 species) and the Scaridae (10 species). The species richness recorded at each station in 1988 did not differ much from the one recorded in 1984. The average number of species per transect remained equivalent in 1984 and 1987-1988. Apparently, the development of *Sargassum* on the reefs did not affect the number of fish species.

In contrast, we observed that the fish density (number of individuals per 100 m^2) decreased in all areas in 1988 in comparison with the results of 1984. The percentage of decrease was 59 % at 20 m (Station 6), 17 % at 15 m (Station 8) and 31 % at 10 m (Station 9). All the counts made in 1987 and 1988 revealed that the fish density in areas covered with *Sargassum* was low at 10 m deep with

Table 2. Semi quantitative distribution of the corals in the stations (1 to 20). Species richness, coral coverage of the substratum and Evenness index of Pielou.

	1984										1987				1988					
STATIONS	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Stephanocoenia michelini	0	0	1	1	3	0	1	1	2	3	0	0	1	1	0	1	0	0	0	0
Madracis decactis	0	0	2	0	0	3	0	2	3	2	2	2	1	1	0	1	1	0	1	1
Madracis mirabilis	0	0	1	0	0	1	0	2	1	1	1	1	0	1	0	0	1	1	1	0
Acropora palmata	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Agaricia agaricites	1	2	3	2	4	0	1	0	3	2	3	3	5	1	0	3	1	2	3	4
Agaricia lamarcki	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Helioseris cucullata	0	0	3	0	1	2	0	1	1	2	4	1	1	1	0	1	3	0	1	3
Siderastrea radians	2	0	0	2	1	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0
Siderastrea siderea	0	3	2	0	3	3	4	0	4	2	4	2	2	5	1	1	1	1	1	1
Porites astroides	2	3	3	3	4	0	3	0	3	3	2	4	1	1	1	1	1	3	1	1
Porites divaricata	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	1	1	0
Porites porites	2	4	3	3	3	2	5	0	3	3	5	2	4	1	1	1	0	4	4	1
Favia fragum	2	0	0	2	0	0	3	0	0	0	0	0	0	0	1	1	0	1	0	0
Diploria clivosa	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Diploria labyrinthiformis	0	1	1	0	1	1	0	0	2	2	1	0	0	2	0	1	0	0	1	1
Diploria strigosa	0	0	0	1	0	0	1	0	3	4	0	1	0	1	0	0	0	1	0	0
Colpophyllia natans	0	1	1	1	1	2	1	1	2	2	1	1	0	1	1	1	1	0	1	1
Solenastrea bournoni	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Montastrea annularis	1	4	2	1	1	1	1	1	3	1	1	2	1	4	1	1	1	1	1	1
Montastrea cavernosa	0	0	2	1	2	5	0	1	4	3	0	3	1	5	0	1	5	0	1	1
Phyllangia americana	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 2. Ctd.

STATIONS	1984										1987				1988					
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Meandrina meandrites	1	4	4	2	3	4	1	0	4	4	1	5	5	4	1	4	4	1	5	5
Dichocoenia stokesi	0	2	1	2	1	1	1	2	2	1	1	1	2	2	1	1	1	1	2	1
Dendrogyra cylindrus	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	1	0	1	1
Mussa angulosa	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Isophyllastrea rigida	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Isophyllia sinuosa	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Mycetophyllia aliciae	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Eusmilya fastigiata	0	0	3	0	0	3	0	1	1	1	2	2	1	0	0	1	1	0	1	1
Millepora alcicornis	5	5	2	5	5	1	0	1	2	2	5	5	1	0	5	5	4	5	3	1
Millepora squarrosa	3	0	1	3	1	0	5	0	2	1	1	0	1	2	3	1	0	3	0	0
Stylaster roseus	1	0	1	1	0	1	0	0	0	0	1	1	0	0	0	0	1	0	1	1
Species richness	11	10	20	17	16	18	13	10	21	22	16	16	14	16	10	17	16	13	18	16
Coral coverage(%)	1	10	10	2	15	25	1	16	35	25	7	8	9	9	1	10	10	1	10	8
Evenness	.94	.95	.96	.95	.93	.94	.91	.98	.97	.96	.91	.94	.91	.91	.90	.92	.91	.92	.93	.92

Table 3. Quantitative results of the fish counts made at different periods.

	1984			1987				1988			
STATIONS	**6**	**8**	**9**	**11**	**12**	**13**	**14**	**16**	**17**	**19**	**20**
Synodus intermedius	0	0	0	0	1	0	0	1	1	0	0
Myrichthys oculatus	0	0	0	1	2	0	0	0	0	0	0
Gymnothorax moringua	0	1	0	0	0	0	0	0	0	0	0
Aulostomus maculatus	8	9	4	8	9	6	0	3	4	13	6
Adioryx coruscus	0	1	0	0	0	0	0	0	0	0	0
Flameo marianus	1	0	2	1	0	0	0	2	1	0	0
Holocentrus ascencionis	0	0	2	0	0	0	0	0	0	0	0
Holocentrus rufus	1	0	0	1	4	0	1	1	3	1	1
Myripristis jacobus	0	87	0	12	11	14	8	23	1	11	0
Alphestes afer	0	0	0	1	0	0	0	0	0	0	0
Epinephelus cruentatus	0	1	0	0	0	0	0	0	0	1	0
Cephalopholis fulvus	8	9	2	0	2	2	6	1	10	10	7
Mycteroperca interstitialis	0	0	0	1	0	0	0	0	0	0	0
Hypoplectrus chlorurus	0	0	0	0	1	0	0	0	0	0	0
Hypoplectrus guttavarius	0	0	0	2	0	0	0	0	4	0	1
Hypoplectrus nigricans	0	0	0	1	1	0	0	3	2	1	0
Hypoplectrus puella	0	0	8	2	0	0	1	1	1	0	0
Hypoplectrus sp.	0	0	0	0	0	0	0	2	3	0	0
Paranthias furcifer	18	10	0	0	0	0	0	0	0	0	4
Serranus tabacarius	0	23	2	4	0	0	0	0	0	0	5
Serranus tigrinus	3	16	2	5	5	4	0	0	6	4	14
Priacanthus cruentatus	0	0	0	0	0	0	3	9	5	0	0
Amblycirrhitus pinos	3	2	0	0	0	0	0	0	0	1	0
Caranx ruber	0	0	0	2	1	0	0	0	0	0	0
Scomberomorus regalis	0	0	0	0	0	0	0	0	0	0	0

Table 3. Ctd.

STATIONS	1984			1987				1988			
	6	8	9	11	12	13	14	16	17	19	20
Lutjanus mahogoni	1	0	0	0	0	0	0	1	0	0	0
Ocyurus chrysurus	1	0	0	3	1	0	0	0	0	2	1
Haemulon aurolineatum	0	7	0	0	0	0	0	0	0	0	0
Haemulon chrysargyreum	63	10	0	0	0	0	1	6	0	0	0
Haemulon flavolineatum	0	7	0	1	0	0	0	9	0	0	0
Haemulon sciurus	1	0	0	1	0	0	0	0	0	0	0
Haemulon sp.	0	0	0	1	0	0	0	0	0	0	0
Equetus acuminatus	0	0	0	0	0	0	4	0	0	0	0
Equetus punctatus	0	1	0	0	1	0	0	0	0	0	0
Odontoscion dentex	0	0	0	1	1	0	0	2	1	0	0
Mulloides martinicus	1	33	0	0	3	0	0	11	2	17	0
Pseudupeneus maculatus	0	4	0	5	5	0	3	0	0	0	0
Pempheris scomburgki	0	0	0	0	0	0	0	1	0	0	0
Centropyge argi	1	1	4	0	1	0	0	0	0	0	0
Chaetodon capistratus	0	0	2	0	0	0	0	0	0	0	0
Chaetodon sedentarius	1	0	0	0	0	0	0	0	0	0	0
Holacanthus tricolor	1	2	0	1	1	2	0	0	0	0	0
Prognathodes aculeatus	3	6	0	1	2	2	2	0	3	1	7
Abudefduf saxatilis	0	0	0	4	0	0	0	0	3	1	0
Abudefduf taurus	0	0	0	0	0	2	0	0	0	0	0
Chromis cyanea	45	40	54	67	10	74	9	20	18	36	24
Chromis multilineatus	147	180	214	0	0	0	180	7	21	227	170
Stegastes dorsopunicans	0	0	0	1	0	0	0	0	0	0	0
Stegastes planifrons	0	0	24	0	0	0	0	0	1	0	0

Table 3. Ctd.

STATIONS	1984			1987				1988			
	6	8	9	11	12	13	14	16	17	19	20
Microspathodon chrysurus	0	0	0	0	0	2	0	0	0	4	0
Stegastes partitus	251	528	86	332	200	400	84	61	113	285	522
Stegastes sp.	1	0	0	0	0	0	0	0	0	0	0
Bodianus rufus	0	0	0	1	0	0	1	0	0	0	0
Clepticus parrai	0	0	0	0	20	0	3	0	0	0	0
Halichoeres bivittatus	0	23	0	2	1	2	0	0	0	0	0
Halichoeres garnoti	22	23	62	15	21	8	8	28	19	15	44
Halichoeres maculipinna	1	2	0	0	4	2	0	0	0	0	0
Halichoeres poeyi	0	0	0	0	0	0	2	0	0	4	0
Halichoeres radiatus	0	0	0	1	0	0	0	3	0	1	2
Thalassoma bifasciatum	25	33	16	13	62	106	6	64	7	95	38
Scarus croicensis	0	0	0	0	0	0	0	0	2	0	0
Scarus taeniopterus	0	0	0	0	0	0	3	0	0	0	6
Scarus vetula	0	0	0	0	0	0	0	3	1	6	0
Scarus sp.	0	0	14	0	0	0	0	1	1	0	0
Sparisoma cf atomarium	0	0	0	28	0	30	0	0	0	0	0
Sparisoma aurofrenatum	0	0	0	3	7	4	0	6	8	12	42
Sparisoma radians	0	0	0	0	0	0	6	0	0	0	0
Sparisoma rubripinne	0	0	0	0	7	0	0	0	0	0	0
Sparisoma viride	1	0	2	2	0	2	4	1	1	4	0
Sparisoma sp.	0	0	0	6	19	0	0	0	0	0	0
Coryphopterus lipernes	0	3	0	0	0	0	0	0	0	0	0
Gobidae sp.	0	7	2	0	0	0	0	0	0	0	0
Acanthurus bahianus	0	0	0	4	5	12	11	0	0	4	3
Acanthurus chirurgus	0	0	0	0	0	0	1	0	0	0	0

Table 3. Ctd.

	1984			1987				1988			
STATIONS	**6**	**8**	**9**	**11**	**12**	**13**	**14**	**16**	**17**	**19**	**20**
Acanthurus coeruleus	0	0	0	6	3	4	1	1	3	0	0
Cantherhines pullus	0	1	0	1	0	2	0	0	0	0	1
Lactophrys triqueter	0	0	0	0	4	0	0	2	0	1	1
Canthigaster rostrata	2	9	2	8	2	2	1	2	4	0	2
Studied surface (m^2)	200	200	100	200	200	100	200	200	200	200	200
Total species richness	25	30	20	38	32	21	24	29	29	25	21
Average species richness	18	22.5	20	27.5	23.5	21	18	21.5	21	19.5	21
Number of fish/100 m^2	305	540	254	274	209	341	175	138	125	379	450
Evenness	0.57	0.57	0.63	0.48	0.60	0.48	0.54	0.73	0.66	0.56	0.49

numbers varying from 175 to 379 individuals per 100 m^2, but remained relatively high at 15 m deep for one station (Station 19: 450 individuals per 100 m^2).

The values of evenness in 1987-1988 compared to those in 1984 are lower for two stations at 10 and 15 m deep (Stations 8 and 9) but slightly higher at 20 m (Station 6). In general, the values obtained at this latter station are higher than those obtained elsewhere, in 1984 as well as 1988. These high values correspond to a better distribution of the number of individuals per species. For example in 1988, at 10 m deep (Cap Salomon), evenness reached 0.73. At this station, the most abundant species (*Thalassoma bifasciatum*) only represented 23.3 % of the total population. The lowest evenness (E = 0.49) was found at 10 m and 15 m (Pointe Burgos) where the dominant species reached over 58 %.

The numerical abundance of the species in 1984 and 1987-1988 was compared with a Spearman rank correlation coefficient. The results showed that there was no significant correlation of the classification of the species abundance between the two periods. The close examination of the species abundance (Table 3) shows that certain species abundant in 1984 had decreased in 1988 (*Myripristis jacobus, Paranthias furcifer, Haemulon chrysargyreum, Mulloidichthys martinicus*). Conversely, the abundance of certain species increased in 1988 (*Sparisoma aurofrenatum* and *Acanthurus bahianus*).

Furthermore, in order to evaluate if the changes observed affected all the trophic categories, the fishes were divided into different groups according to their diets following Randall (1967) (Table 4) :

- group 1 : herbivorous fishes
- group 2 : omnivorous fishes
- group 3 : planktivorous fishes
- group 4 : carnivorous fishes feeding on invertebrates
- group 4 : carnivorous fishes feeding on invertebrates and also on fishes
- group 6 : carnivorous fishes with piscivorous tendencies (more than 80 % of fishes in their diets)

We can first notice that the fish community is in all cases dominated by the plantivorous fishes. They always represent more than 60 % of the number of fishes and sometimes they reach up to 80 % (Table 4).We can also notice that there is a general decrease of all the trophic categories except the category of herbivorous fishes. In the 3 study areas, the number of herbivorous fishes (mainly the Acanthuridae and the Scaridae) is more important in 1988 than in 1984 (Table 4). Considering the proportion of each group in the fish population, the dominance of herbivorous fishes also increased in 1988 (Figure 2).

Table 4. Distribution of the trophic fish categories in 1984, 1987 and 1988 at thre stations.

TROPHIC CATEGORIES	CAP SALOMON 1984 N	CAP SALOMON 1984 D(%)	CAP SALOMON 1988 N	CAP SALOMON 1988 D(%)	CAP SALOMON % change	POINTE BURGOS 1984 N	POINTE BURGOS 1984 D(%)	POINTE BURGOS 1988 N	POINTE BURGOS 1988 D(%)	POINTE BURGOS % change	TROIS RIVIERES 1984 N	TROIS RIVIERES 1984 D(%)	TROIS RIVIERES 1987 N	TROIS RIVIERES 1987 D(%)	TROIS RIVIERES % change
Herbivorous fishes	1	0.2	16	6.4	+1500.0	0	0	51	5.7	+∞	8	3.1	13	7.5	+62.5
Omnivorous fishes	5	0.8	8	3.2	+60.0	23	2.13	4	0.4	-82.6	15	5.9	0.5	0.3	-96.6
Planktivorous fishes	464	76.0	153	61.4	-67.0	847	78.5	720	79.9	-14.9	177	69.7	142	81.4	-19.8
Carnivorous fishes (invertebrates)	55	9.0	35	14.0	-36.4	139	12.9	92	10.2	-33.8	45	17.7	11.5	6.6	-74.4
Carnivorous fishes (invertebrates + fishes)	77	12.6	32	12.8	-58.4	60	5.6	28	3.1	-53.3	7	2.8	7.5	4.3	+7.1
Carnivorous fishes (piscivorous tendency)	8	1.3	5	2.0	-37.5	10	0.9	6	0.7	-40	2	0.8	0	0	-100.0

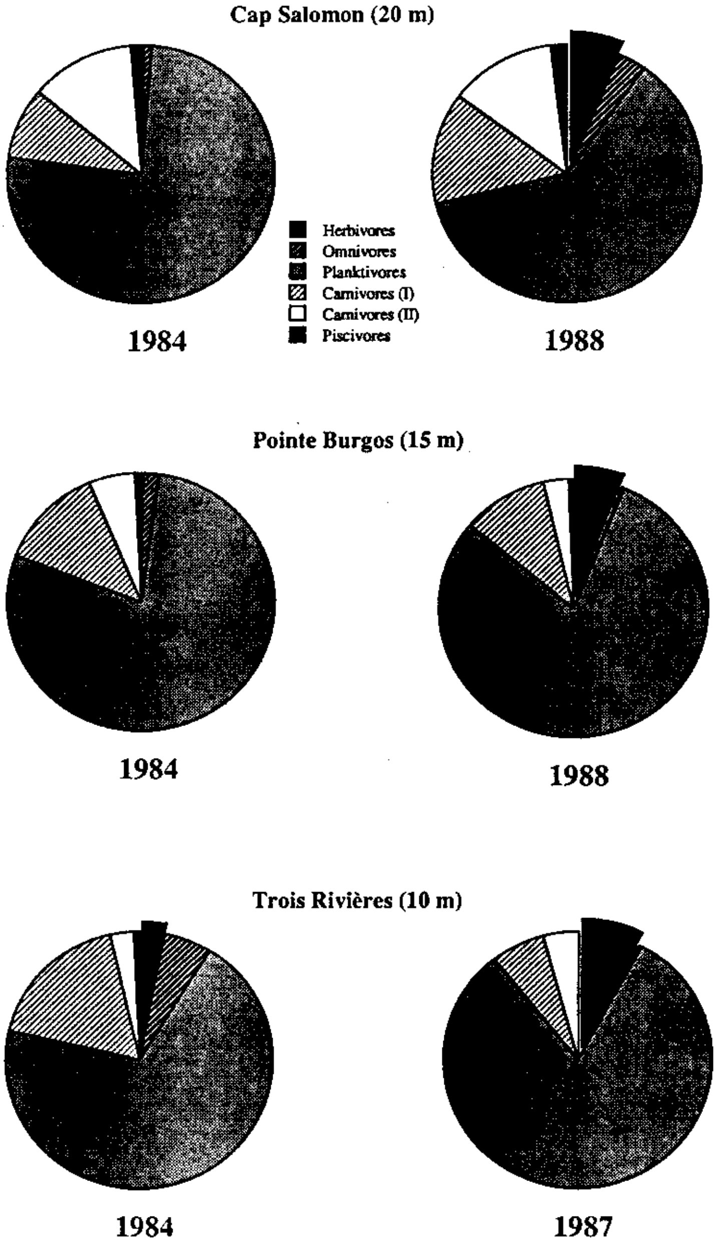

Figure 2. Importance of the main trophic groups in three stations before and during the Sargassum outbreak (Carnivores I : feeders on invertebrates; carnivores II : feeders on invertebrate and fishes).

DISCUSSION AND CONCLUSION

The occurrence of algae of the genus *Sargassum* in the French West Indies is usually restricted to the windward side of the islands (Adey *et al.*, 1977; Bouchon and Laborel, 1986). The cause of the outbreak of *Sargassum* on the leeward coast of Martinique is still unclear. It is most likely due to eutrophication of the water south of the Bay of Fort-de France by the sewage from the town. This hypothesis is supported by the fact that the size and the density of the algae decreased from the north of the Bay to the south, and also by the proliferation of large green filamentous algae, between the surface and 3m, in the same area. The scarcity of *Sargassum* north to the bay of Fort-de-France implies the existence of a coastal current setting to the south. Another hypothesis would be that such a phenomenon is natural and appears randomly in time. No report in the literature was found supporting either one or the other hypothesis.

The scleractinian corals, which are the major components of the reef ecosystem, were poor competitors with *Sargassum*. The effect of the algae on the benthic animals is direct (by growing on the colonies) and indirect by shadowing the underneath organisms (as demonstrated by Rogers, 1979) and modifying the hydrodynamic factors near the bottoms. The general result is a deterioration of the coral community. This competition between *Sargassum* and corals probably explains the low coverage of the substratum by sessile animals on the reefs of the windward coast in the West Indies where *Sargassum* are permanently present and abundant.

Numerous publications have dealt with the effect of environmental stress on the coral communities. The stress can be due to natural factors (Randall and Eldredge, 1977; Woodley *et al.*., 1981; Rogers, 1985) or human activities such as organic and chemical pollution (Smith *et al.*, 1973; Johannes, 1975; Marszalek, 1982). From the work of Rogers (1985), it appears that most of the Caribbean reefs exhibit some forms of man induced alterations. In Martinique, in 1984, heavy signs of pollution were concentrated inside the Bay of Fort-de-France (Bouchon and Laborel, 1986). The coral reef community of the Caribbean coast was then considered as the richest of the island. Presently, this ecosystem is threatened and it is likely that the ability of the ecosystem to recover is not strong enough to balance the impact of human activities.

Many studies have already shown the influence of physical disturbances on the fish communities. These disturbances were sometimes natural such as tropical storms or cyclones (Lassig,1983; Walsh, 1983; Woodley *et al.*, 1981; Kaufman, 1983), due to cold spell, (Bohnsack, 1983), caused by *Acanthaster planci* infestation (Sano *et al.*, 1984, 1987; Williams, 1986; Bouchon-Navaro *et al.*, 1985), or sometimes due to human activities (Galzin, 1979; Amesbury, 1982; Bouchon *et al.*, 1987).

In the present study, some changes of the fish communities were observed after a disturbance due to an outbreak of *Sargassum*. This outbreak did not seem to have affected the species richness. The major changes were a strong decrease of the fish density (about 30 %) and a change in the species dominating the community. Moreover, the close examination of the trophic categories and of the numerical abundance of the species revealed that the number of herbivorous fishes in 1988 increased in the areas occupied by the *Sargassum*. Their increase may be due to an augmentation in the cover of filamentous algae on dead substrate following the decay of the coral colonies, rather than a direct feeding on the *Sargassum*.

However, the results on evenness, which indicates the level of equilibrium of the fish communities, show that the values remained stable for a same station. In spite of the decrease in fish density and the increase in the numbers of herbivorous fishes, it may be expected that these communities which have still kept their original species richness could be able to recover their initial level of organization. Nevertheless, man-induced disturbances have long-term effects and are often non-reversing as previously demonstrated in Martinique (Bouchon *et al.*, 1987). This requires a higher control of pollution in order to preserve the coastal resources which are still presently altered.

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