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The Fish Assemblage Associated to the Phytal of *Sargassum Cymosum C. A*gardh, 1820, at Ponta das Garoupas, Bombinhas, Santa Catarina

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ABSTRACT

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With the aim of recognizing the fish associated to the banks of *Sargassum cymosum* C. Agardh and verifing the fluctuation of their densities, monthly visual censuses (September/93 to August/94) was carried out, at Ponta das Garoupas, Santa Catarina. A total of 4,529 fishes were registered, which belonged to 27 species: *Abudefduf saxatilis* (Linnaeus, 1758), *Anisotremus virginicus* (Linnaeus, 1758), *Bathygobius soporator* (Valencienes, 1837), *Centropomus* sp., *Chaetodon striatus* Linnaeus, 1758, *Chaetodon* sp., *Chilomycterus spinosus* (Linnaeus, 1758), *Diplodus argenteus* (Valenciennes, 1830), *Epinephelus guaza* (Linnaeus, 1758), *Fistularia tabacaria* Linnaeus, 1758, *Haemulon steindachneri* (Jordan & Gilbert, 1882), *Holocentrus ascencionis* (Osbeck, 1765), *Hippocampus erectus* Perry, 1810, *Kyphosus* sp., *Mugil* sp., *Mycteroperca bonaci* (Poey, 1860), *Mycteroperca microlepis* (Goode & Bean, 1880), *Mycteroperca rubra* (Bloch, 1763), *Pareques acuminatus* (Bloch & Schneider, 1801), *Pseudupneus maculatus* (Bloch, 1793), *Scartella cristata* (Linnaeus, 1758), *Sphoeroides greeleyi* Gilbert, 1900, *Sphoeroides testudineus* (Linnaeus, 1758), *Stegastes fuscus* (Cuvier, 1830) and *Stephanolepis hispidus* (Linnaeus, 1758). Two another non-identified species were registered. The most abundant species was *Diplodus argenteus* (Valenciennes, 1830) and this dominance shows similarity with the data from the North and South Atlantic. Most fishes did not suffer variations in their abundance in the period of study, but *Abudefduf saxatilis*, *Diplodus argenteus*, *Sphoeroides testudineus* and *Stegastes fuscus* lowered their densities in Winter-Spring months. No significant variation was observed in the diversity during the studied months, but in Summer and Autumn, greater specific richness was registered, when compared with the end of Winter and beginning of Spring. The banks of *Sargassum cymosum* provide shelter and food for fishes that include 13 resident species: *Abudefduf saxatilis*, *Bathygobius soporator Chaetodon striatus, Diplodus argenteus*, *Epinephelus guaza*, *Mycteroperca bonaci, Mycteroperca rubra, Pseudupneus maculates, Scartella cristata*, *Sphoeroides greeleyi, Sphoeroides testudineus*, *Stegastes fuscus*, and *Stephanolepis hispidus*. These fishes constitute main food for the grouper *E. guaza* and the badejo *M.bonaci* and *M.rubra*, which have high commercial value.

ADDITIONAL INDEX WORDS: *Fishes, diversity, richness.*

INTRODUCTION

Investigations about the structure and dynamics of fish population have been done mainly with commercial species. Very few studies are known about species of smaller fish, in particular those living on hard substratum. This lack of data is mainly due to problems on of collection methodology (ZANDER, 1989), which are also related to difficulties in applying methods of traditional sampling (MOURA, 1993).

More recently, the number of in situ studies with fish population has increased in order to understand its role within the coastal environment. However, most of pioneer researches have focused on coral areas and, in Brazil, the fish population living in coastal rocky areas are still unknown (FERREIRA *et al.,* 1993b).

This present work has the objective of recognizing the species composition of fish assemblage living in the surroundings of beds of the brown alga *Sargassum cymosum* C.Agardh 1820, and their temporal variations of densities throughout a year of study.

METHODS

Monthly observation and collections were made from October/93 to September/94 at Ponta das Garopas, Bombinhas, Santa Catarina (for detailed description of the collection site see DUBIASKI-SILVA, 1999). The abundance of *S. cymosum* visiting fishes, was estimated by visual census technique per area: the observations were done in three different 50m^2 square areas and as far as underwater visibility was possible or at least four meters ahead. Such censuses were carried out with the aid of diving mask, snorkel and flippers during 20 minutes in each sampling area. Fish identification in the field was preceded by a detailed examination and identification in laboratory of previously and extensively collected samples from surroundings of *S. cymosum* banks. Mornings and evenings were preferred times for censuses because more species were present in this study local according to previous observations. Seaweeds upright from the bottom were revolved and spaces in rock cracks were examined for more detailed observations on small fishes with cryptic behavior or those hidden between cracks. All species of fish obtained in the previous samplings were registered except the big shoal of plankton fish. The frequency of the species was calculated and expressed as a percentage of the presence in each sample. Four categories of fish frequency were established following HARMELIN (1987) and RELINI *et al*. (1994):> 75%; 50-74,9%; 25-49,9% and < 25%.

RESULTS

A total of 4,529 fish belonging to 27 species were registered, on the *S. cymosum* banks. Amongst them, there were two non-

identified species. The average densities are on Table I.

The total density of fish varied from 43,32 ind/50m^2 (September/93) to 197,33 ind/50m^2 (June/94). The highest averages were registered from December/93 to July/94 when two peeks occurred, one in December/93 and another in June/94. The lowest averages, below 05 ind/50m^2, occurred from September to November/93 and in August/94. The density's fluctuation for the fish assemblage and for the five more abundant species which accounted more than 80.65% of the ictiofauna can be found on Figure 1.

Twelve species of fishes were observed every month, among which seven summed to 75.40% of the total fish number: *A. saxatilis, C. striatus, D. argenteus, E. guaza, M. rubra, S. testudinus*, and *S. fuscus*. Except October/93 when ~~this~~ these species corresponded to 51.27% of the total ictiofauna, their contribution was never lower than 82.84% (February/94) during all remaining period; it reached a maximum of 95.10% in June/94.

In October/93, A. virginicus exceptionally totaled 41.85% of the all fishes number when it was seen in big shoals. This species was also registered in February/94 with only 1.58% of the ictiofauna and was absent in the remainder months.

D. argenteus was the most abundant species and corresponded to 42.98% of all observed fishes. Its minimum participation of 18.91% occurred in October/93 and the maximum of 69.59% in June/94. September/93 and October/93 were the months with the lowest densities with 17.00 ind/50m^2 and 17.33 ind/50m^2 respectively. The highest densities (above 30.00 ind/50m2) were registered from December/93 to June/94. During this period, two peeks in the density fluctuation curve were observed: the first one with 104.33 ind/50m^2 in December/93, and the second one with 137.33 ind/50m^2 in June/94. Many shoals of young fish of *D. argenteus* were observed during these two peak months.

In a general way, the fluctuation standard of the fish assemblage abundance followed that of *D. argenteus*, due to the constant presence of this species during all study period.

The second most abundant species was *A. saxatilis* (16.72% of the total fish population), followed by *S. fuscus* (10.34%), *S. testudineus* (5.45%) and *H. steindacneri* (5.30%). *A. saxatilis* presented higher densities from November/93 to June/94, with peeks in the density fluctuation curve in January/94 (60.33 ind/50 m2) when young shoals were observed, and in May/94. *S. testudineus* showed higher densities from January to August/94. Although *S. fuscus* did not present significant fluctuation, it showed a high peek of 20.00 ind/50m2 in January/94 with a predominance of young fish. H. steindacneri was not present every month; it was indeed absent in an irregular pattern of time, and when it was present, it seemed more like a cluster with a high number as 20 individuals.

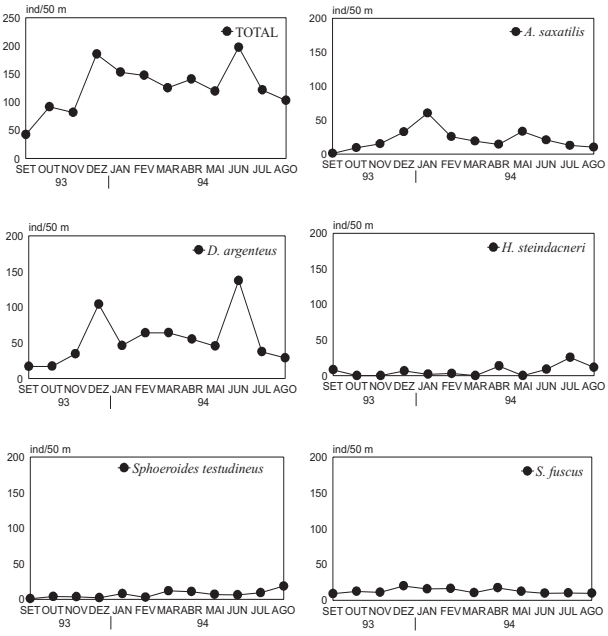

Figure 1. Ponta das Garoupas. Density fluctuation of the fish assemblage and of the five more abundant species associated to the *S. cymosum* banks, from September/93 to August/94.

Figure 2 presents the diversity and species richness estimated for twelve months of observation. The lowest diversity rate occurred in June/94 followed by December/93; highest densities of D. argenteus occurred in these months can explain the low values. On the other hand, the species richness was higher from February to June/94 than September to October/93 months.

According to fish frequency, the following categories were found:

Group I (> 75% of fish frequency): it is composed of 8 species, among them, two were registered in all 36 sampling them were present in each one of the 36 observation~~s~~, *M. rubra* and *S. fuscus*. The remaining species were *A. saxatilis, B. soporator, D. argenteus, E. guaza, S. cristata* and *S. testudineus*. Although monthly nocturnal observation~~s~~ was not systematic, the decapod crustaceans *M. hispidus* and *P. spinimanus* may be included within this group, as they were present in all observation.

Group II (50 74.9%): it was composed of five species *C. striatus, M. bonaci, P. maculatus, S. greeley* and *S. Hispidus*;

Group III (25 49,9%): it was composed of only *H.steindacneri*;

Group IV (<25%): it included 13 taxa Anguiliformes, *A. virginicus, Centropomus sp., Chaetodon sp., C. atinga, F. tabacaria, H. erectus, K. sectaris, M. microlepis, Mugil sp., P. acuminatus* and two non-identified species.

The fishes belonging to the first two categories are resident species and can be considered the base population in the collection sites. The low rates of frequency for the Anguiliformes and H. erectus can be due to their cryptic behavior. In addition, these two taxa, *Chaetodon sp*. and *C. spinosus* were registered in limited number of individuals when they were observed. Although these species had low frequency, it could be considered as resident species, as finding them and identifying them is not so easy. The remaining species can be considered periodical visitors in the study site.

DISCUSSIONS

The use of visual census technique is one of the most effective methods of fish observation in the rocky coast. This method has also the advantage of being non-destructive (FERREIRA *et al*., 1993b). However, according to the same authors, dominant species are usually overestimated and the rare ones, underestimated. This happens mainly with the species with cryptic behavior and the visitors with high level of mobility even with a large number of samples. On the other hand, BROCK (1982) mentioned that both, abundant and cryptic species are underestimated. Actually, in the current work, even though we have given special attention to the species with cryptic behavior, we believe that Bleniidae, Gobiidae and Hippocampus may have been underestimated due to the natural difficulty in of visualizing them. The same may have occurred with fishes with high mobility and shoals that are composed by dozens of hundreds of young fish: it is a real challenge in counting them. As a matter of fact, it is impossible to supervise a fish assemblage as a total using only one method. However, the visual census was chosen in the present work for constituting the methodology that demands little effort and offers little lesser error than capture one.

All fish species observed and collected during this study have already been registered by GODOY (1987) and its presence in the rocky coast are well known (MENEZES and FIGUEIREDO 1980, SZPILMAN 1992). In spite of this knowledge, it is difficult to compare the data from Brazilian coastal ecosystem, because specific studies about fish assemblage are lacking in this environment.

Table 1. *Ponta das Garoupas. Average density of the observed fishes in surroundings of S. cymosum banks from September/93 to August/94.*

	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG
Abudefduf saxatilis	1.00	9.33	15.00	32.67	60.33	25.67	9.00	14.33	33.33	20.67	12.67	10.00
Anguilliformes	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00
Anisotremus virginicus	0.00	38.33	0.00	0.00	0.00	2.33	0.00	0.00	0.00	0.00	0.00	0.00
B. soporator	1.00	0.33	2.00	1.33	3.00	1.67	1.67	1.33	2.00	0.33	3.00	3.00
Centropomus sp.	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.33	0.67	0.00	0.00	0.00
Chaetodon striatus	0.33	1.00	1.00	2.33	1.67	4.00	4.33	3.33	4.33	1.33	6.00	5.67
Chaetodon sp.	0.00	0.00	0.00	0.00	0.00	0.00	0.33	0.00	0.00	0.00	0.00	0.00
Chilomycterus spinosus	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.33	0.00	0.00	0.00
Diplodus argenteus	17.00	17.33	34.67	104.33	46.33	64.00	64.33	55.33	45.67	137.33	37.67	29.00
Epinephelus guaza	0.67	1.00	5.67	3.00	3.67	1.67	3.33	7.33	2.33	2.00	2.67	1.33
Fistularia tabacaria	0.00	0.00	0.00	0.00	0.00	0.33	0.67	0.00	0.00	0.00	0.00	0.33
Haemulon steindacneri	8.33	0.00	0.00	6.67	2.00	3.00	0.00	13.67	0.00	9.00	25.67	11.67
Hippocampus erectus	0.00	0.00	0.00	0.33	0.67	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Kyphosus sp.	0.00	0.00	0.00	0.00	1.00	8.33	1.33	1.67	0.33	0.00	0.00	0.00
Mycteroperca bonaci	0.33	0.33	0.67	0.33	0.33	0.67	0.33	1.00	1.00	1.33	1.33	1.00
Mycteroperca microlepis	0.00	0.00	0.00	0.00	0.00	0.33	0.00	0.33	0.00	0.33	0.33	0.00
Mycteroperca rubra	1.67	2.33	2.33	4.67	2.00	5.00	4.67	4.33	4.33	2.33	3.67	1.33
Mugil sp.	0.00	0.00	0.00	0.00	0.00	0.67	0.00	0.00	0.00	0.00	0.00	0.00
Pareques acuminatus	0.33	0.00	0.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.33	0.00
Pseudupneus maculatus	0.33	0.67	1.00	4.33	2.67	6.00	4.00	4.00	1.00	1.33	2.00	1.67
Scartella cristata	0.33	0.33	1.33	1.33	2.67	1.00	2.33	2.00	2.33	1.00	3.00	2.67
Sphoeroides greeleyi	0.33	1.00	1.00	0.67	3.33	1.67	5.33	2.33	2.33	2.67	4.00	4.00
Sphoeroides testudineus	0.67	3.67	3.33	2.00	7.67	2.67	11.67	10.67	6.67	6.00	9.00	18.33
Stegastes fuscus	9.00	12.33	11.00	20.00	15.67	16.33	10.33	17.33	12.33	9.67	10.00	9.67
Stephanolepis hispidus	1.00	3.67	2.33	1.33	0.33	1.33	0.33	1.33	0.67	0.67	0.33	1.00
Non-identified fishes (2 spp.)	0.00	0.00	0.00	0.00	0.00	0.00	1.33	0.33	0.00	1.00	0.00	2.33
TOTAL	42.33	91.67	81.67	185.33	153.33	147.67	125.33	141.00	119.33	197.33	121.67	103.00

In a study of the rocky sites of the Arquipelago de Alcatrazes-SP, MOURA (1993) listed 90 species of fishes of 34 families. Such study was done during daytime and nocturnal diving from zero to 33 meters deep. The record in the present study of at least 26 species in a very restricted area depth (about 4 meters) can be considered as a reasonable specific richness. In addition, it is relevant to say that the shoals of vegetarian fishes and the nocturnal ones were not registered.

In warmer regions of the globe, the temperatures throughout the year in the coastline favor most of the fish species, and many of them remain active all year round in shallow waters (BEJA 1995). The small range in the density oscillations registered in the present investigation can be explained by low variation in the abiotic variable at Ponta das Garoupas. The least abundant species of the ictiofauna from September to November/93 and in August/94 was due to the lower density rates of the dominant species, *D.argenteus*. The highest densities of *D.argenteus, A. saxatilis* and *S. fuscus* occurred at the end of spring and early fall due to recruiting of young fish. The low density variations of this last species were due to its habit. "Maiden fish" are territorial of shallow waters (FERREIRA *et al.,* 1995).

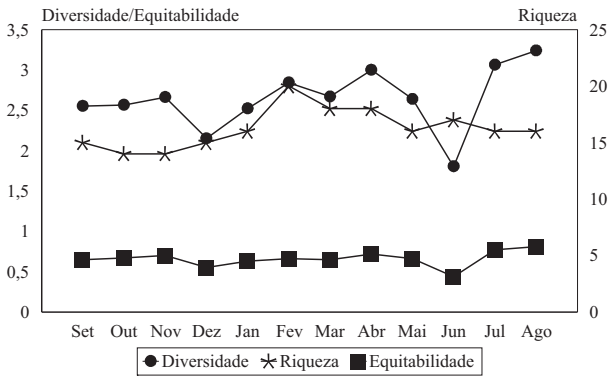

Figure 2. Ponta das Garoupas. Diversity and species richness fluctuation of the fish assemblage during the months from September/93 to August/94 on *S. cymosum* banks.

Dominant presence of *D. argenteus* at Ponta das Garoupas is similar to another studied assemblage. *Diplodus* species are considered as the most abundant fish in rocky coast, sand substratum and reefs, natural and artificial ones in the North Atlantic (PIKE and LINDQUIST, 1994) and South Atlantic (COETZEE, 1986). In the Mediterranean coast of Egypt, Sparidae species is an important fishing resource (WASSEF, 1985). In Brazil, although its meat is considered to be of good quality, it does not present commercial value. Only fishermen and low-income families have consumed this fish in the areas where it is abundant (SZPILMAN ,1992).

The record of K. sectaris only during the summer and early fall may be related to the increase of food availability at Ponta das Garoupas. This is due to the higher number of biomass of *H. musciformis* in the summer (DUBIASKI-SILVA, 1999), since these fish are herbivore (FERREIRA and GONÇALVES, 1995): five fish which were captured had intestines filled with this algae.

The banks of *S.cymosum* offer shelter and food to for the various species of fish and decapod crustaceans that are resident species there. These fish, in turn, constitute the main food for commercial species of high value such as the grouper *E. guaza* and the badejo *M.bonaci* and *M.rubra*.

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