



FISHES OF SAPATAS REEF, NORTHEASTERN BRAZIL

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RESUMO

Peixes do Recife das Sapatas, Nordeste do Brasil. O Recife das Sapatas é um recife pouco visitado localizado a 12 km da costa da cidade de João Pessoa, Paraíba, Brasil. Ele mede 200m de comprimento e 50m de largura, a uma profundidade de 19m. Está formado por uma base de arenito coberta por organismos bentônicos. Os ambientes recifais da costa do Brasil são ecossistemas ecologicamente únicos, com alta diversidade de peixes – 437 espécies, incluindo 46 endêmicas. Com métodos não-destrutivos como censos, observação direta e fotografias foi levantada a diversidade de peixes do recife das Sapatas. Um total de 93 espécies de 38 famílias foi registrado; 75% das espécies ocorrem em todo o Atlântico; 14% são endêmicas da costa brasileira e uma é endêmica do Nordeste do Brasil; 24,7% do total de espécies de peixes recifais registrado na costa do estado da Paraíba ocorrem no recife das Sapatas. Seis espécies deste recife estão incluídas em listas de espécies ameaçadas.

Palavras-Chave: Peixes recifais, Recife das Sapatas, Estado da Paraíba, Nordeste do Brasil

ABSTRACT

Fishes of Sapatas Reef, Northeastern Brazil. Sapatas is a seldom visited reef 12 km off the coast of the city of João Pessoa, Paraíba, Brazil. It measures 200m length and 50m width, at a depth of 19m. It is formed by a sandstone bed, covered by extensive growths of benthic organisms. The reef environments off the Brazilian coast are ecologically unique ecosystems where fishes are highly diverse, 437 species of reef fishes were recorded including 46 endemics. With non-destructive methods, including censuses, direct observations, and photographs, the diversity of fishes of the Sapatas Reef was surveyed. A total of 93 species of 38 families were recorded; 75% of the species occur in the entire Western Atlantic; 14% of the species are endemic to the Brazilian coast and one is endemic to northeastern Brazil; 24.7% of the total reef fishes species recorded off the Paraíba coast occurred in the Sapatas reef. Six species of this reef are included in lists of threatened species.

Key words: Reef fishes, Sapatas Reef, Paraíba State, Northeastern Brazil.

INTRODUCTION

Although they make up only 0.2% in area of the marine environment (VERON *et al.*, 2009), coral reefs are among the most biologically diverse and economically important ecosystems on the planet (ADEY 2000; HOEGH-GULDBERG, 2006; CARPENTER *et al.*, 2008). The fishes are the most conspicuous components in these communities and are responsible for energy flow in the local food webs (CHRISTENSEN and PAULY, 1993; MUMBY *et al.*, 2004; ALVAREZ-FILIP *et al.*, 2006).

The reef environments of the Brazilian coast are found along an extensive area of about 3.000km (KIKUCHI *et al.*, 2003). They are ecosystems considered ecologically unique as they were constructed in large part by calcareous algae associated with other organisms (e.g. corals, sponges, ascidians) and biologically important because of their geographic isolation (GILBERT, 1973). Fishes are highly diverse in these ecosystems. There are approximately 437 reef fish species along the Brazilian coast, including 46 endemics (FLOETER *et al.*, 2008). The reef fish communities along the northeastern coast of Brazil are of great economic and social utility to coastal communities.

Many studies examining different aspects of reef fish biology have been undertaken in Paraíba State (ROSA, 1980; RAMOS, 1994; ROSA *et al.*, 1997; ROCHA *et al.*, 1998; ROCHA and ROSA, 1999; ROCHA *et al.*, 2000; DIAS *et al.*, 2001; FEITOZA *et al.*, 2001; FEITOZA *et al.*, 2002; FEITOZA *et al.*, 2005; ILARRI, *et al.*, 2007; MEDEIROS *et al.*, 2007; NUNES and SAMPAIO, 2007; SAMPAIO *et al.*, 2007; SOUZA *et al.*, 2007; CORDEIRO, 2009; HONÓRIO *et al.*, 2010). The last authors surveyed reef fishes along the coast of the state with visual census techniques, including the fishes of the Sapatas reef. The present paper completes their data with additional censuses, photographic and observational records conducted from 2007 to 2009. This resulted in an additional list of 28 fish species.

MATERIAL AND METHODS

Sapatas Reef (07° 04'S; 34° 43'W) is formed by a sandstone bed, like other reef areas in north-eastern Brazil, covered by extensive growths of benthic organisms, especially calcareous algae, macroalgae, hydrocorals, vermetid molluscs and other macrobenthos like Zoanthidae and sponges, with rare growths of coral (Figure 1). It is a structure 200 m length and 50 m width at a depth of 19m, located 12km from the coast of João Pessoa and 21.5km from the edge of the continental shelf (HONÓRIO, 2009) (Figure 2). Tourism and artisanal fishing in the Sapatas Reef are uncommon and this reef was seldom visited before by biologists.

The fishes were identified in the field to species level according to



FIGURE 1 - Central area of the Sapatas Reef.

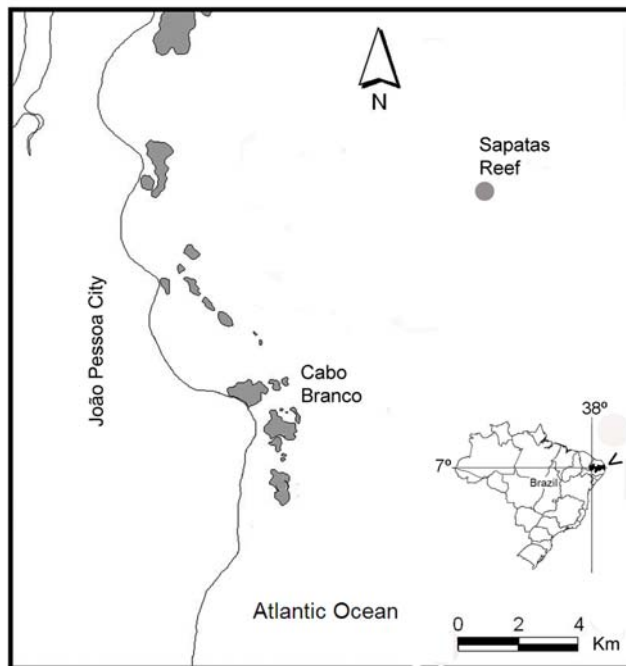


FIGURE 2 - Map showing the study site.

RANDALL (1996), HUMANN and DELOACH (2002) and ROCHA (2004). The species list was compiled from underwater observations, photographs, and 43 Stationary Visual Censuses conducted in 2007, 2008 and 2009. This census method was proposed by BOHNSACK and BANNEROT (1986), modified by VILLARREAL-CAVAZOS *et al.*, (2000) and consists of counting during a period of 15 minutes, all fishes present in observation cylinders whose radius, 5m, was established in previous pilot observations. The initial 5 minutes were dedicated exclusively for recording all the species, and the following 10 minutes for counting the individuals. Observations were made through SCUBA diving and data were recorded on PVC boards and subsequently digitalized. The photographic records are kept at the UFPB Fish Collection.

RESULTS AND DISCUSSION

A total of 93 species belonging to 38 families were recorded at the Sapatas Reef (Table 1). The most speciose families were Labridae (9 species, 9.7% of the total identified species), Serranidae (8, 8.6%), Carangidae (8, 8.6%), Haemulidae (7, 7.5%), Scaridae (7, 7.5%), Lutjanidae (5, 5.4%) and Pomacentridae (5, 5.4%) (Table 1). Seventy four percent of the species (69 species) occur in the entire Western Atlantic, 2.1% (2) are circumtropical, 2.1% (2) are Pan Atlantic, 1.1% (1) occur in northeastern Brazil and mid-Atlantic ridge, 1.1% (1) in northwestern Atlantic and northeastern Brazilian coast and 1.1% (1) throughout western Atlantic and eastern Pacific. Fourteen percent of the species (13) are endemic to the Brazilian coast: *Apogon americanus* (Castelnau), *Lutjanus alexandrei* Moura and Lindeman, *Stegastes fuscus* (Cuvier), *Stegastes pictus* (Castelnau), *Clepticus brasiliensis* Heiser, Moura and Robertson, *Halichoeres brasiliensis* (Bloch), *Thalassoma noronhanum* (Boulenger), *Scarus trispinosus* Valenciennes, *Scarus zelindae* Moura, Figueiredo and Sazima, *Sparisoma amplum* (Ranzani), *Sparisoma axillare* (Steindachner), *Sparisoma frondosum* (Agassiz), *Elacatinus figaro* Sazima, Moura and Rosa. One species (1.1%) is endemic to the northeastern Brazilian coast: *Haemulon squamipinna* Rocha and Rosa.

Six species occurring in Sapatas reef are included in the IUCN Red List of Threatened Species (2010.1) or in the Official List of Threatened Species in Brazil (MMA, 2004). This represents 6.5 % of the total number of species, a value similar to that found on other reefs of Northeastern Brazil.

There are, approximately, 437 reef fish species along the Brazilian coast, including 46 endemics (FLOETER *et al.*, 2008). Therefore, the ichthyofauna of Sapatas Reef comprise 21.2% of all Brazilian reef fishes and 30,4% of the endemic reef fishes of Brazil.

A survey of the literature and of the ichthyology collection of the Department of Systematics and Ecology (UFPB) resulted in 376 species of

Table 1 - List of fishes of the Sapatas Reef. Families according to NELSON (2006). * = species included on the IUCN Red List of Threatened Species 2010.1 or on the Official List of Species Threatened with Extinction of the MMA (MMA, 2004).

DASYATIDAE <i>Dasyatis americana</i> Hildebrand & Schroeder	ECHENEIDAE <i>Echeneis naucrates</i> Linnaeus
MURAENIDAE <i>Gymnothorax funebris</i> Ranzani <i>Gymnothorax miliaris</i> (Kaup) <i>Gymnothorax moringa</i> (Cuvier) <i>Gymnothorax vicinus</i> (Castelnau) <i>Muraena pavonina</i> Richardson	CARANGIDAE <i>Alectis ciliaris</i> (Bloch) <i>Caranx bartholomaei</i> (Cuvier) <i>Caranx crysos</i> (Mitchill) <i>Caranx latus</i> Agassiz <i>Caranx ruber</i> (Bloch) <i>Selene vomer</i> (Linnaeus) <i>Trachinotus falcatus</i> (Linnaeus) <i>Trachinotus goodei</i> Jordan & Evermann
OPHICHTHIDAE <i>Ahlia egmontis</i> (Jordan)	LUTJANIDAE <i>Lutjanus alexandrei</i> Moura & Lindeman <i>Lutjanus analis</i> (Cuvier & Valenciennes)* <i>Lutjanus chrysurus</i> (Bloch)* <i>Lutjanus synagris</i> (Linnaeus) <i>Lutjanus jocu</i> (Bloch & Schneider)
CLUPEIDAE <i>Opisthonema oglinum</i> (Lesueur)	HAEMULIDAE <i>Anisotremus virginicus</i> (Linnaeus) <i>Haemulon aurolineatum</i> Cuvier <i>Haemulon parra</i> (Desmarest) <i>Haemulon plumieri</i> (Lacépède) <i>Haemulon squamipinna</i> Rocha & Rosa <i>Haemulon steindachneri</i> (Jordan & Gilbert) <i>Orthopristis ruber</i> (Cuvier)
SYNODONTIDAE <i>Synodus intermedius</i> (Spix & Agassiz) <i>Synodus synodus</i> (Linnaeus)	SPARIDAE <i>Calamus pennatula</i> Guichenot
BATRACHOIDIDAE <i>Amphichthys cryptocentrus</i> (Valenciennes)	MULLIDAE <i>Mulloidichthys martinicus</i> (Cuvier) <i>Pseudupeneus maculatus</i> (Bloch)
OGCOEPHALIDAE <i>Ogcocephalus vespertilio</i> (Linnaeus)	CHAETODONTIDAE <i>Chaetodon striatus</i> Linnaeus
HOLOCENTRIDAE <i>Holocentrus adscensionis</i> (Osbeck) <i>Myripristis jacobus</i> Cuvier	POMACANTHIDAE <i>Holacanthus ciliaris</i> (Linnaeus) <i>Holacanthus tricolor</i> (Bloch) <i>Pomacanthus paru</i> (Bloch)
DACTYLOPTERIDAE <i>Dactylopterus volitans</i> Linnaeus	POMACENTRIDAE <i>Abudefduf saxatilis</i> (Linnaeus) <i>Chromis multilineata</i> (Guichenot) <i>Stegastes fuscus</i> (Cuvier) <i>Stegastes pictus</i> (Castelnau) <i>Stegastes variabilis</i> (Castelnau)
SCORPAENIDAE <i>Scorpaena plumieri</i> Bloch	
SERRANIDAE <i>Cephalopholis fulva</i> (Linnaeus)* <i>Diplectrum formosum</i> (Linnaeus) <i>Epinephelus adscensionis</i> (Osbeck)* <i>Mycteroperca bonaci</i> (Poey)* <i>Rypticus saponaceus</i> (Bloch & Schneider) <i>Serranus annularis</i> (Günther) <i>Serranus baldwini</i> (Evermann & Marsch) <i>Serranus flaviventris</i> (Cuvier)	
OPSTOGNATHIDAE <i>Opistognathus</i> sp.	
PRIACANTHIDAE <i>Heteropriacanthus cruentatus</i> (Lacépède) <i>Priacanthus arenatus</i> Cuvier	
APOGONIDAE <i>Apogon americanus</i> (Castelnau)	

Table - 1 continued

LABRIDAE	EPHIPPIDAE
<i>Bodianus rufus</i> (Linnaeus)	<i>Chaetodipterus faber</i> (Broussonet)
<i>Clepticus brasiliensis</i> Heiser, Moura & Robertson	ACANTHURIDAE
<i>Halichoeres bivittatus</i> (Bloch)	<i>Acanthurus bahianus</i> Castelnau
<i>Halichoeres brasiliensis</i> (Bloch)	<i>Acanthurus chirurgus</i> (Bloch)
<i>Halichoeres dimidiatus</i> (Agassiz)	<i>Acanthurus coeruleus</i> Bloch & Schneider
<i>Halichoeres penrosei</i> Starks	SPHYRAENIDAE
<i>Halichoeres poeyi</i> (Steindachner)	<i>Sphyræna picudilla</i> Poey
<i>Thalassoma noronhanum</i> (Boulenger)	SCOMBRIDAE
<i>Xyrichtys splendens</i> Castelnau	<i>Scomberomorus cavalla</i> (Cuvier)
SCARIDAE	<i>Scomberomorus regalis</i> (Bloch)
<i>Cryptotomus roseus</i> Cope	BOTHIDAE
<i>Scarus trispinosus</i> Valenciennes	<i>Bothus</i> sp.
<i>Scarus zelindae</i> Moura, Figueiredo & Sazima	BALISTIDAE
<i>Sparisoma amplum</i> (Ranzani)	<i>Balistes vetula</i> Linnaeus
<i>Sparisoma axillare</i> (Steindachner)	MONACANTHIDAE
<i>Sparisoma frondosum</i> (Agassiz)	<i>Cantherhines pullus</i> (Ranzani)
<i>Sparisoma radians</i> (Valenciennes)	TETRAODONTIDAE
GOBIIDAE	<i>Canthigaster figueiredoi</i> Moura & Castro
<i>Elacatinus figaro</i> Sazima, Moura & Rosa*	DIODONTIDAE
MALACANTHIDAE	<i>Diodon holacanthus</i> Linnaeus
<i>Malacanthus plumieri</i> (Bloch)	

reef fishes recorded in natural and artificial reefs along the coast of the State of Paraíba. Comparing the species richness observed in the present study with that obtained in the survey (376), we find that 24.7% of the total reef fishes species of the Paraíba coast occurred in the Sapatas reef. Comparing the species richness previously observed in the Sapatas reef (65 species) by HONÓRIO *et al.*, (2010) with the total reef fishes recorded for the coast of Paraíba (376 species), only 17.3% occurred in Sapatas reef.

It must be considered that the present Sapatas data include results of 13 more censuses than the former study published by HONÓRIO *et al.*, (2010) as well as photographic and direct observation records. The low percentage of species (24%) present in Sapatas probably reflects a high ecological diversity between the different reefs off the coast of Paraíba.

Five species are included on the IUCN Red List of Threatened Species (2010.1): *Lutjanus analis* (Cuvier and Valenciennes) is classified as "Vulnerable", *Mycteroperca bonaci* (Poey) as "Near Threatened" and *Alphesthes afer* (Bloch), *Cephalopholis fulva* (Linnaeus) and *Epinephelus adscensionis* (Osbeck) as "Least Concern". The species *Elacatinus figaro* is included in the Official List of Species Threatened with Extinction prepared by the Brazilian Ministry of the Environment, while *Ocyurus chrysurus* (Bloch) is listed as overexploited (MMA, 2004).

The majority of fishes observed during the surveys in Sapatas Reef



were adults, a common fact on the reefs with intermediate depths (between 15 and 30m). However, we did not record large fishes and top predators that are commercially exploited. The artisanal fishing in the Sapatas Reef is apparently uncommon, but fishing activities on the adjacent reefs are historically intense. Decline in top predators reduces overall species diversity and alters the trophic structure, leading to loss of biomass and the demise of other trophic groups, also affecting adjacent communities (HEITHAUS *et al.*, 2008; KNOWLTON and JACKSON, 2008; VERON *et al.*, 2009). The deep reefs (exceeding 30 m) are one of the last refuges for large commercially exploited reef fishes off the northeastern Brazilian coast, such as snappers (Lutjanidae) and groupers (Serranidae), and globally threatened species (e.g. *Lutjanus analis*) (FEITOZA *et al.*, 2005).

The Brazilian Ministry of the Environment includes reef environments along the coast of Paraíba State among priority conservation areas (Prates, 2003).

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