

Occurrences of whale shark (*Rhincodon typus* Smith, 1828) in the Saint Peter and Saint Paul archipelago, Brazil

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(With 3 figures)

Abstract

The Saint Peter and Saint Paul Archipelago in the central tropical Atlantic, is an important ground of whale sharks that are commonly sighted throughout the year close to the fishing boats in the adjacencies of the islands. In sightings reported between February 2000 and November 2005, the lengths of the individuals ranged between 1.8 to 14.0 m. The causes of these concentrations in the archipelago are still unclear, once there are no upwellings and plankton concentrations for feeding, and no reproductive activities were reported. Nevertheless, they could be associated to the spawning period of the abundant flying fishes, mainly in the first semester, when sightings were more frequent.

Keywords: whale shark, Saint Peter and Saint Paul archipelago.

Ocorrências de tubarão-baleia (*Rhincodon typus* Smith, 1828) no arquipélago de São Pedro e São Paulo, Brasil

Resumo

O Arquipélago de São Pedro e São Paulo situado na área central tropical do Atlântico, é um importante local de concentração de tubarões-baleia, que são vistos ao longo de todo ano, próximos às embarcações de pesca nas adjacências das ilhas. Em avistagens registradas entre fevereiro de 2000 e novembro de 2005, os comprimentos dos indivíduos variaram entre 1,8 e 14 m. As causas destas concentrações no arquipélago ainda não são claras, uma vez que não há há ressurgências e grandes concentrações de plâncton no arquipélago, e também não foram observadas atividades reprodutivas. No entanto, podem estar associadas ao período de desova dos peixes-voadores, marcadamente no primeiro semestre, quando as aparições são mais frequentes.

Palavras-chave: tubarão-baleia, arquipélago de São Pedro e São Paulo.

1. Introduction

The whale shark, *Rhincodon typus* is the biggest fish of the world, inhabiting all tropical and subtropical oceans, with records of them in warm tropical waters, except in the Mediterranean (Compagno, 1984; Colman, 1997). Although whale sharks have a wide distribution, knowledge of its biology and ecology still limited (Jones and Kaly, 1995). In general, occurrences of whale sharks are sporadic and unexpected, which can be associated with the limited knowledge of its ecology (Colman, 1997).

According to Gudger (1922, 1923) cited by Soto (2001), the first record of a whale shark in Brazilian waters was on the coast of Bahia. Since then about 63 records of whale shark are known in Brazilian waters (Bertoncini and Sampaio, 2002), ranging from 1.8 to 14 m (Edwards and Lubbock, 1982; Gaelzer, 1985; Gadig, 1991; 1994;

1997; 2005; Soto, 1995; Alecrim-Santos et al., 1988; Amorim and Ferreira, 2002, Campos et al., 2005).

Due to the strategic position of the Saint Peter and Saint Paul Archipelago (SPSPA) between the two hemispheres, and the Atlantic and African continents, the archipelago is an important concentration ground of migratory species such as tunas, billfishes, turtles, dolphins, and the whale sharks. It is one of the smallest, most isolated groups of oceanic islands in the world. The rocky islands are particularly interesting from the population biology and biogeographical perspectives because of their very small size and isolation. They are uniquely influenced by both the superficial Southern Equatorial Current flowing eastward, and the Equatorial Undercurrent flowing westward. The area has been visited by scientific expeditions

since 1799 when the inhospitable nature and inaccessibility of the archipelago prevented detailed biological studies. However, since the establishment of a scientific research station by the Brazilian Navy, in July 1998, researchers have been able to visit the island periodically and continually.

Records of whale shark in the SPSPA were reported by Edwards and Lubbock (1982), Gadig (1994), and Rangel (1998). Since the beginning of scientific research in the SPSPA in 1998, whale sharks have been frequently sighted around the islands.

The aim of this study is to compile the existing data of sightings of the whale sharks recorded in the SPSPA, localize the sighting points, estimate the lengths of individuals, and observe the sighting frequency throughout the year.

2. Material and Methods

The Saint Peter and Saint Paul Archipelago is a very small group of rocky islands located on the mid-Atlantic Ridge, just north of the Equator (00° 55' N and 29° 21' W), 1,000 km from the Brazilian coast, and 1,890 km from Senegal, Africa (Figure 1). Data were obtained between February 2000 and November 2005, from recorded registers, besides interviews and information provided by fishermen and researchers that utilized the scientific station. Total length was obtained by visual estimate, or using a tape measure when appropriate. A χ^2 text was used to compare sightings with moon phase.

3. Results

In the present study, 54 observations of whale shark were made in the SPSPA (Table 1). Total length ranged from 1.8 to 14 m, although precise lengths were collected only on one occasion with a metric cable, in June 2001 (Figure 2). The maximum length of 14 m on March

27th 2000 was estimated comparing the fish to the length of the fishing boat since the whale shark remained for 10 minutes by the side of the boat. Most sightings were made in the morning (25), and in the afternoon (16). In January 2004, four sharks were seen at night, one of them remained for 360 minutes beside the boat. Sighting times ranged between 1 to 360 minutes, with no correlation between the moon phase (χ^2 ; $p < 0.001$). Sex determination of all individuals was not possible due to most of the sightings being made from the fishing boats and not from underwater observations. In the SPSPA, the whale shark did not present a clear period of occurrence, but the sightings were more common mainly during the first semester (Figure 3).

Twenty three sightings were reported at buoy 1, eighteen at buoy 2 where fishing boats are commonly moored and ten were not described (Figure 4). Only two sightings were recorded on the east side, and on one occasion very close to the rocks. Probably the sightings of June 18th, 19th and 20th, 2000, were of the same individual of 8 m TL. The same situation may have occurred with the sighting recorded on March 27th and 28th, 2002, both for individuals of 5 m TL. Two whale sharks presented some remarkable characteristics, one shark (5 m TL) had the top of the caudal fin cutted, and another shark (8 m TL) did not present the first dorsal fin. Both were photographed.

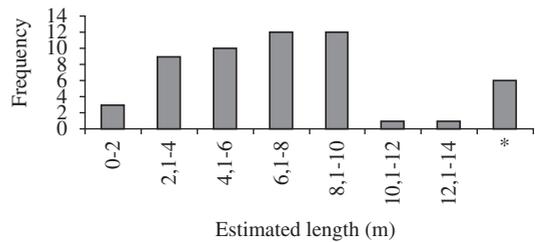


Figure 2. Length distribution of whale sharks sighted in the Saint Peter and Saint Paul Archipelago between February 2000 and November 2005. *Undefined.

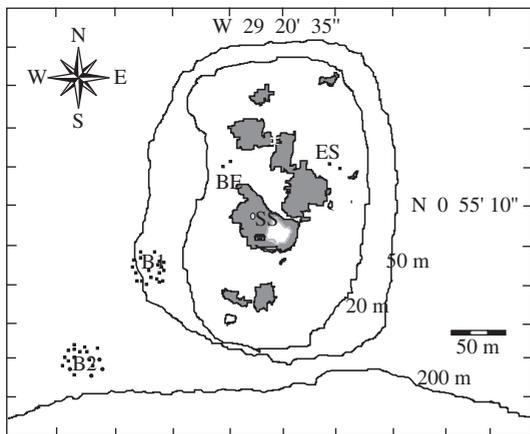


Figure 1. Saint Peter and Saint Paul Archipelago in the central Atlantic with isobaths. B1 – buoy 1 (23); B2 – buoy 2 (18); BE – bay entrance (2); ES – east side (2); SS – scientific station.

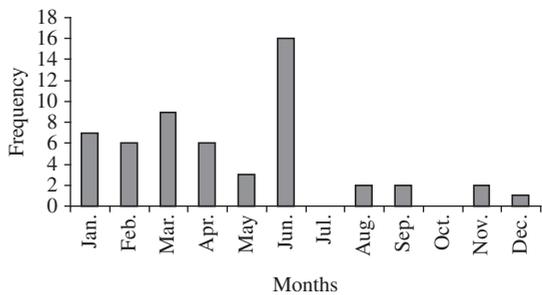


Figure 3. Monthly frequencies of sightings of whale shark in the Saint Peter and Saint Paul Archipelago.

Table 1. Whale shark occurrences in Saint Peter and Saint Paul Archipelago.

N	Date	Est. Length (m)	Sex	Day hour	Sight. time (minutes)	Moon
1	fev/2000	9	-	morning	10	-
2	11/03/2000	6	-	-	-	first quarter
3	19/03/2000	10	-	8:00 AM	45	full
4	27/03/2000	14	-	6:00 PM	10	last quarter
5	aug/2000	-	-	-	-	-
6	04/03/2001	8	-	afternoon	15	first quarter
7	24/03/2001	5	-	1:00 PM	15	new
8	april/2001	8	-	-	-	-
9	18/04/2001	-	-	12:00 AM	-	last quarter
10	12/06/2001	7,8	F	10 to 11:00 AM	60	last quarter
11	12/06/2001	12	M	10 to 11:00 AM	60	last quarter
12	aug/2001	-	-	-	-	-
13	20/09/2001	3	-	7:00 AM	20	new
14	mar/2002	-	-	-	-	-
15	27/03/2002	5	-	12:00 AM	15	full
16	28/03/2002	5	-	7:00 AM	5	full
17	01/06/2002	10	-	morning	2	last quarter
18	02/06/2002	10	-	-	-	last quarter
19	02/06/2002	3	-	-	-	last quarter
20	18/06/2002	8	-	3:00 PM	30	first quarter
21	19/06/2002	8	-	6:00 AM	15	first quarter
22	20/06/2002	8	-	1:00 PM	15	first quarter
23	23/12/2002	-	-	morning	-	full-first quarter
24	25/01/2003	6	-	afternoon	30	last quarter
25	09/02/2003	6	-	morning	40	first quarter
26	13/02/2003	10	-	morning	20	full
27	23/02/2003	2	-	afternoon	40	last quarter
28	19/01/2004	8	-	2:00 AM	1	new
29	21/01/2004	4	-	8:42 PM	1	new
30	22/01/2004	1,8	-	8:00 PM	2	new
31	24/01/2004	10	-	10:35 PM	8	new
32	25/01/2004	7	-	5:00 PM	10	new
33	29/01/2004	7	-	11 to 5:00 AM	360	first quarter
34	31/03/2004	8	-	5:00 PM	0,40	first quarter
35	04/04/2004	9	-	6:00 PM	2	full
36	02/06/2004	4	-	6:00 PM	15	full
37	03/06/2004	4	-	6:00 AM	10	full
38	04/06/2004	4	-	5:00 PM	15	full
39	05/06/2004	4	-	6:00 AM	1	full
40	06/06/2004	4	-	9:30 AM	15	full-first quarter
41	19/02/2005	2	-	2:35 PM	-	first quarter
42	19/02/2005	6	-	2:35 PM	38	first quarter
43	12/04/2005	6	-	7:43 AM	-	first quarter
44	18/04/2005	9	-	9:30 AM	-	first quarter
45	25/04/2005	7	-	11:10 AM	20	full
46	06/05/2005	7	-	11:20 AM	40	new
47	11/05/2005	10	-	11:00 AM	60	new

Table 1. Continued...

N	Date	Est. Length (m)	Sex	Day hour	Sight. time (minutes)	Moon
48	11/05/2005	-	-	11:00 AM	-	new
49	03/06/2005	10	-	11:30 AM	-	new
50	06/06/2005	3	-	10:20 AM	-	new
51	06/06/2005	10	-	10:20 AM	-	new
52	21/09/2005	8	-	6:30 AM	5	full
53	25/11/2005	5	M	11:25 AM	1	last quarter
54	27/11/2005	5	M	5:45 AM	4	last quarter-new

4. Discussion

The movements of the whale sharks can be related to productivity and invertebrate egg deposition (Compagno, 1984; Colman, 1997), commonly associated with turbulence around oceanic islands, as in the SPSPA. Gunn et al. (1992) pointed out the association between whale sharks and tunas in the Coral Sea, where the sharks concentrate for predation upon the lantern fishes during the reproduction period of these fishes. In the case of SPSPA, shoals of yellow fin tuna (*Thunnus albacares*), concentrate around the islands from October onwards, to feed upon the flying fish (*Cypselurus cyanopterus*) that reproduce in the area mainly between December and March (Lessa et al., 1998; Lessa et al., 1999; Vaske-Jr, et al., 2003; Vaske Jr. et al., 2005). Although no filter feeding activity has been reported during sightings. Eggs and larvae of flying fish are the most abundant planktonic item in the adjacencies of the SPSPA that could be the main food item for whale sharks in this period.

The SPSPA does not present upwellings or high primary productivity in the adjacencies (Travassos et al., 1999) that could explain the concentrations of whale sharks as observed by Arnborn and Papastravrou (1988) in the Galapagos Islands. Thus, if the whale shark utilizes the SPSPA for feeding, it is probable that the more frequent sightings in the first semester could be associated with the greater abundance of eggs and larvae of the flying fish. No reproductive activities were reported or observed, so the whale shark could also utilize the archipelago as a resting point on their migratory routes in the Atlantic, which remain unknown.

The sighting time was variable, which means that sharks are not annoyed with the presence of the boats; on the contrary, they may even be attracted by the boats.

Future studies are necessary for knowledge on the whale shark in the SPSPA, including telemetry as used by Eckert and Stewart (2001) to elucidate the migratory routes, and observe if the individuals of the SPSPA come from another point in the oceans, or if they are part of a resident population.

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References

- ALECRIM-SANTOS, CA., ANDREATTA, JV. and GOMES, UL., 1988. Sobre a ocorrência de *Rhincodon typus* (Smith, 1829) (Elasmobranchii, Rhincodontidae) em águas brasileiras e aspectos de sua taxonomia. *Acta Biol. Leopoldensia*, vol. 10, no. 2, p. 175-182.
- AMORIM, AF. and FERREIRA, L.A., 2002. Occurrence of a small free living whale shark, *Rhincodon typus* (Smith, 1828) off subtropical waters of Western Atlantic. In *Resumos da III Reunião da Sociedade Brasileira para o Estudo dos Elasmobrânquios – SBEEL*, 2002, João Pessoa, PB, vol. 1. p. 37-38.
- ARNBORN, T. and PAPA-STRAVROU V., 1988. Fish in association with whale sharks *Rhincodon typus* near the Galapagos islands. *Notícias de Galapagos*, no. 46, p. 13-15.
- BERTONCINI, AA. and SAMPAIO, CLS., 2002. Novos Registros de Tubarão-Baleia, *Rhincodon typus* SMITH, 1829 no Litoral da Bahia, nordeste do Brasil. In: *Resumos da III Reunião da SBEEL*, 2002, João Pessoa, PB, vol. 1. p. 29-30.
- CAMPOS, CEC., SILVA, MB., TARGINO, SG. and BORGOFF, C., 2005. First record of whale shark, *Rhincodon typus* (Condriichthyes: Rhincodontidae) in Atol das Rocas, Brazil. In *Resumos do XVI Encontro Brasileiro de Ictiologia*, janeiro de 2005, João Pessoa, PB. p. 203.
- COMPAGNO, LJV. 1984. Sharks of the World. An Annotated and Illustrated Catalogue of Shark Species Known to Date. FAO Species Catalogue. vol. 4, Parts 1 and 2. FAO Fish. Synopsis 125, FAO, Rome.
- COLMAN, JG., 1997. A review of the biology and ecology of the whale shark. *J. Fish Biol.* no. 51, p. 1219-1234.
- ECKERT, SA. and STEWART, BS., 2001. Telemetry and satellite tracking of whale sharks, *Rhincodon typus*, in the Sea of Cortez, Mexico, and the North Pacific Ocean. *Env. Biol. Fishes.*, vol. 60, no 1-3, p. 299-308.
- EDWARDS, A. and LUBBOCK, R., 1982. The shark population of Saint Paul's Rocks. *Copeia.*, no. 1, p. 223-225.
- GADIG, OBF., 1991. Dados complementares sobre a ocorrência do tubarão-baleia, *Rhincodon typus* Smith, 1829 (Orectolobiformes, Rhincodontidae) no Brasil. In *Resumos do Encontro Nacional de Pesca e Aqüicultura*, Santos. p. 113.
- GADIG, OBF., 1994. *Fauna de tubarões da costa norte/nordeste do Brasil (Condriichthyes, Elasmobranchii)*. (Dissertação de mestrado) – Departamento de Sistemática e Ecologia da Universidade Federal da Paraíba. 230 p.

- GADIG, OBF., 1997. Avistagens de tubarão-baleia, *Rhincodon typus*, durante as operações de caça à baleia no litoral da Paraíba, nordeste do Brasil. In: *Resumos do I Encontro da Sociedade Brasileira para Estudos de Elasmobrânquios*. Universidade estadual de Santa Cruz, Ilhéus. p. 101.
- GADIG, OBF., 2005. Occurrence, distribution, and conservation of the whale shark in the Western South Atlantic. *Abstracts from the International Whale Shark Conference*, Perth, Australia. p. 22.
- GAEZLER, LR., 1985. Ocorrência de tubarão-baleia (*Rhincodon typus*) (Smith, 1828) na costa brasileira. In *Resumos do XII Congresso Brasileiro de Zoologia*. Campinas. 378 p.
- GUDGER, EW., 1922. The fourth record of occurrence in the Atlantic ocean of the whale-shark, *Rhincodon typus*. *Scienc*, no. 56, p. 251-252.
- , 1923. An extraordinary capture of the giant shark, *Rhincodon typus*. *Natural History*, no. 23, p. 62-63.
- GUNN, JS., WHITELAW, AW., DAVIS, TLO., BAILEY, K. and ITANO, DG., 1992. Tuna tagging in the Coral Sea. *Australian Fisheries*, no. 51, p. 22-24.
- JONES, GP., KALY, UL., 1995. Conservation of rare, threatened and endemic marine species in Australia. In ZANN, LP. and KAILOLA, PK. (Eds). State of the marine environment report for Australia, Technical Annex 1: The marine environment. *Ocean Rescue 2,000 Program*, Department of the Environment, Sport and Territories.
- LESSA, R., MAFALDA-JR., P., ADVÍNCULA, R., LUCCHESI, R., BEZERRA-JR., JL., VASKE-JR., T. and HELLEBRANDT, D., 1999. Distribution and abundance of ichthyoneuston at seamounts and islands off north-eastern Brazil. *Arch. Fish. Res.*, vol. 47, no. 2-3, p. 133-146.
- MONTEIRO, A., VASKE-JR., T., LESSA, RP. and EL-DEIR, ACA., 1998. Exocoetidae (Beloniformes) off northeastern Brazil. *Cybium*, vol. 22, no. 4, p. 395-403.
- RANGEL, CE., 1998. Novo registro de ocorrência de tubarão-baleia, *Rhincodon typus* (Orectolobiformes: Rhincodontidae), no Arquipélago de São Pedro e São Paulo. *Bol. da SBEEL*, no. 3, p. 3.
- SOTO, JMR. and CASTRO-NETO, WN., 1995. Relação dos primeiros registros de tubarão-baleia, *Rhincodon typus* (Orectolobiformes: Rhincodontidae), em águas brasileiras, com a ampliação de sua distribuição para o sul do Brasil. In *Resumos da VII Reunião do Grupo de Trabalho sobre Pesca e Pesquisa de Tubarões e Raias no Brasil*. Rio Grande, RS. p. 67.
- SOTO, JM., 2001. Annotated systematic checklist and bibliography of the coastal and oceanic fauna of Brazil. I – Sharks. *Mare Magnum*, vol. 1, no. 1, p. 51-120.
- TRAVASSOS, P., HAZIN, FHV., ZAGAGLIA, JR., ADVINCULA, R. and SHOEBER, J., 1999. Thermohaline structure around seamounts and islands off North-Eastern Brazil. *Arch. Fish. Mar. Res.*, vol. 47, no. 2-3, p. 211-222.
- VASKE-JR, T, VOOREN, CM. and LESSA, RP., 2003. Feeding strategy of yellowfin tuna (*Thunnus albacares*) and wahoo (*Acanthocybium solandri*) in the Saint Peter and Saint Paul Archipelago. *B. Int. Pesca*, vol. 29, no. 1, p. 173-181.
- VASKE-JR., T., LESSA, RP., NÓBREGA, MF., MONTEALEGRE-QUIJANO, S., SANTANA, FM., and BEZERRA-JR., JL., 2005. A checklist of fishes from Saint Peter and Saint Paul Archipelago, Brazil. *J. Applied Ichthyology*, vol. 21, no. 1, p. 75-79.