ISSN 1676-5788

ON THE PRESENCE OF THE CARIBBEAN REEF SHARK, *Carcharhinus perezi* (POEY, 1876) (CHONDRICHTHYES, CARCHARHINIDAE), IN THE SOUTHWEST ATLANTIC

Jules M. R. Soto

Museu Oceanográfico do Vale do Itajaí, Universidade do Vale do Itajaí, CP 360, CEP 88302-202, Itajaí, SC, Brazil. movisc@terra.com.br

This paper comments on the presence of the Caribbean reef shark *Carcharhinus perezi* (Poey, 1876) in the southwest Atlantic, based on specimens obtained from Brazilian oceanic islands and a review of the literature. It also comments on aspects relating to reproduction, food habits and behavior in this region. Preliminary results indicate that the Rocas Atoll and the Fernando de Noronha Archipelago are important nursery areas for the species in the South Atlantic. A review of its occurrence on the Brazilian coast is also presented.

O presente trabalho comenta a presença do tubarão-dos-recifes *Carcharhinus perezi* (Poey, 1876) no sudoeste do Atlântico, com base em espécimes obtidos em ilhas oceânicas brasileiras e revisão da literatura. Aspectos da reprodução, hábito alimentar e comportamento são também comentados para a região. Resultados preliminares indicam que Atol das Rocas e Arquipélago Fernando de Noronha são importantes áreas de nascimento e cria da espécie no Atlântico Sul. A revisão da ocorrência na costa brasileira é também apresentada.

The Caribbean reef shark, *Carcharhinus perezi* (Poey, 1876), occurs in Western Atlantic, between Bermuda and Southern Brazilian waters, including Gulf of Mexico (Compagno, 1984b; Soto, 2001). A larger concentration has been observed in tropical waters, on continental and insular shelves, at depths of at least 30 m (Compagno, 1984b). On the Brazilian coast, the species was previously recorded off the southern coast, State of Santa Catarina, but consistent data are available only for the Northern and Northeastern coasts, from Amapá to Espírito Santo, including Fernando de Noronha Archipelago (Gadig *et al.*, 1996; Soto, 1997, 2001; Sazima & Moura, 2000).

The biology of this species is not well known and its distribution, in the South Atlantic, has only been defined during the last 5 years. The present work compiles the existing registrations on the Brazilian coast, tracing a picture of the distribution and discussing the previous records, besides gathering the available data such as the biology and ethology of the species.

Material and Methods

The specimens of *C. perezi* were collected sporadically by artisanal fisherman in the Fernando de Noronha Archipelago (03º51'S, 32º25'W) by small fishing boats equipped with longlines and handlines, operating along the insular shelf, at depths of between 15 and 60 m. The sample comprising 27 specimens (21-223 cm TL) collected in the Santo Antônio Harbor, in June 1989, August 1990 and September 2000 (Tab. 1). Additional photographic material of the Rocas Atoll and Trindade Island was also analyzed.

The measurements follows Compagno (1984a) and the parameters used to determine the stage of development were: neonate - umbilicus not totally closed; juvenile - umbilicus totally closed but sexually immature; adult - claspers rigid (calcified) and sperm found in the seminal vesicles (males), or large yolk follicles present in ovary and/or embryos present in uterus (female).

The identification and taxonomic list of prey items follows Menezes & Figueiredo (1980, 1985). The percentage of frequency occurrence [$F=(n_i/n_t)x100$] and percentage of empty stomachs [$E=(n_e/n_t)x100$] follows Hyslop (1980).

Institution: Museu Oceanográfico do Vale do Itajaí, MOVI (Itajaí, Brazil).

Results and Discussion

The distribution of *C. perezi* in the South Atlantic is not clear. The southern limit cited by Compagno

(1984b), Gadig *et al*. (1996) and Soto (2001) was determined based on abstracts published by Sadowsky & Amorim (1977) and Amorim *et al.* (1995), without collected material. The southern limit determined using collected material is Trindade Island (Fig. 1).

The species is viviparous, with a yolk-sac placenta, and the females have a gestation period of 11-12 month. The parturition, in Fernando de Noronha Archipelago, probably occurs between November and December (Fig. 2). According to the literature, fecundity ranges from 4 to 6 pups (Gadig *et al*., 1996), and is apparently not related to the length of the female. One pregnant female collected from the archipelago (206 cm TL) had 4 embryos, 1 female and 3 males, 2 per uterus, between 211 and 239 mm TL (June 1989) .

The smallest neonates in the literature were a female measuring 74 cm TL (Compagno, 1988) and a male with 78 cm TL (Poey, 1876). In the Fernando de Noronha Archipelago, the smallest specimen was a neonate female with 82 cm TL. A male with 177 cm TL and a female with 200 cm TL are adult (Gadig *et al*., 1996; Garrick, 1982; respectively) (Fig. 3). The distribution of bathymetrical size classes, observed during the dives, indicates that neonates and small juveniles are born and remain in shallow waters (1-30 m) until they reach about 1 m TL.

The common occurrence of neonates and juveniles in the Fernando de Noronha Archipelago and Rocas Atoll, indicates that these islands are an important nursery area for this species (Figs. 4 and 5). Longline fishing operations are common and continual around the Fernando de Noronha Archipelago, there being no studies on the sustainability of the stock, with the species being under threat in the region (Fig. 6). With the exception of *Ginglymostoma cirratum*, *C. perezi* can be considered the more easily observed shark species, and it was also the most common in the landings of Fernando de Noronha Archipelago in the 1980's and 1990's (Fig. 7).

The stomach contents of 19 specimens, 2 adults and 17 juveniles, collected in Fernando de Noronha Archipelago, consisted of at least 3 different prey items,

Table 1. Specimens of *Carcharhinus perezi* used in the study, all collected in Fernando de Noronha Archipelago, Brazil.

Date	Development stage				Sex			Total
	E	N	J	A	M	F	U	
June 1989	4	1	9	1	11	4		15
August 1990			6	1*	1	5	1*	7
September 2000			1			1		1
Total	4	1	16	2	12	10	1	23

Abbreviations: E - embryo; N - neonate; J - juvenile; A - adult; M - male; F - female; U - undetermined.
*Only the head was examined.

Figure 1. Distribution of *Carcharhinus perezi* with the study area circulated.

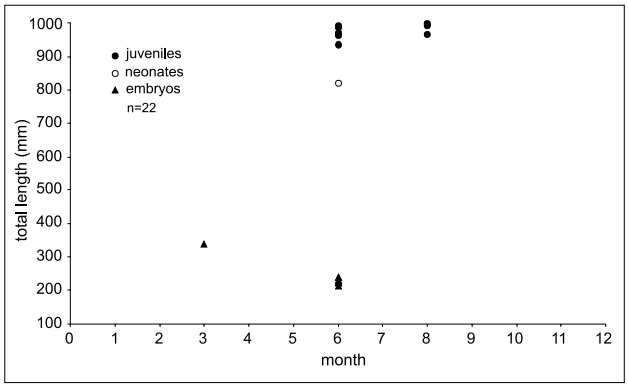

Figure 2. Relationship between month of capture and total length (TL) of embryos, neonates and juveniles to 1000 mm of *Carcharhinus perezi.*

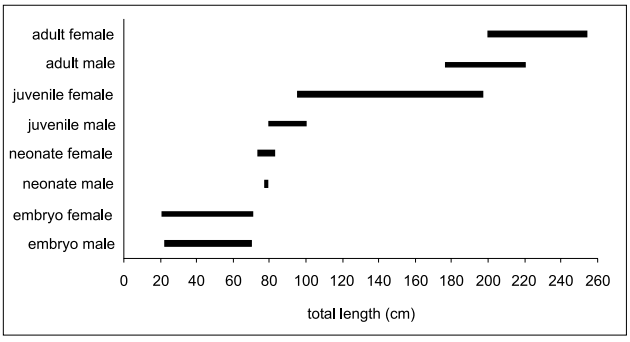

Figure 3. Specimens (n=42) of *Carcharhinus perezi* distributed by size, sex and development stage, based on literature (Poey, 1876; Bigelow & Schroeder, 1948; Cervigón, 1966; Garrick, 1982; Compagno, 1988; and Gadig *et al*., 1996) and 24 specimens of the present paper.

Figure 4. Juvenile female of *Carcharhinus perezi* (MOVI 05577) in Fernando de Noronha Archipelago in June 1989. (Photo: Jules M. R. Soto)

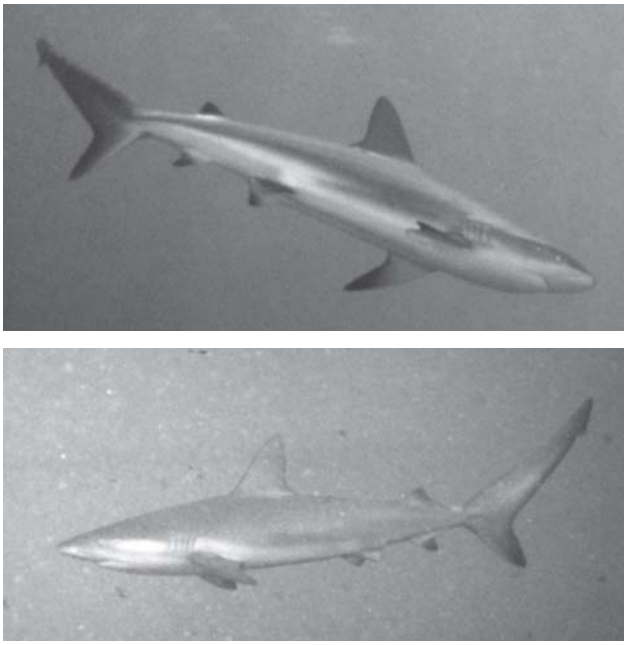

Figure 5. Juvenile females of *Carcharhinus perezi* (MOVI 10134, 10135) in Rocas Atoll in January 1990. (Photos: Enrico Marcovaldi)

all teleost fishes, with a predominance of the black margate, *Anisotremus surinamensis* (F=68.4%). Six stomachs analyzed were empty (E=31.6% - all juvenile) (Tab. 2).

The *C. perezi* agonistic display was previously described by Soto (1997), with the same characteristics observed in *Carcharhinus acronotus*, *C. amblyrhynchos*, *C. galapagensis*, *C. falciformis* and *C. limbatus* (Hobson, 1964; Johnson & Nelson, 1973; Compagno, 1984b; Ritter & Godknecht, 2000), denoting a behavior common to the genus (Fig. 8). In spite of being considered moderately aggressive, encounters and/or interactions with divers are frequent in the Rocas Atoll and Fernando de Noronha Archipelago, there being no records of attacks on divers (Fig. 9).

The presence of the species in Trindade Island is confirmed in this present paper based on an adult male, 220 cm TL (MOVI 31303) (Fig. 10). According to Alexandre Filippini - IBAMA (pers. com.), *G. cirratum* and *C. perezi* can be easily observed in dives around the island and were commonly captured by spearfisherman in the 1980's.

Figure 6. Longline fishing operations in Fernando de Noronha Archipelago. (Photo: Leonardo B. Veras)

Table 2. Stomach contents, in percentage of frequency occurrence, of 2 adults and 17 juveniles (6 empty) of *Carcharhinus perezi* collected in Fernando de Noronha Archipelago, Brazil.

Prey items	F(%)		
	juvenile	adult	total
Pisces			
Osteichthyes			
Perciformes			
Haemulidae			
Haemulon chrysargyreum Günther, 1859		5.3	5.3
Anisotremus surinamensis (Bloch, 1791)	57.9	10.5	68.4
Mullidae			
Pseudupeneus maculatus (Bloch, 1793)		5.3	5.3

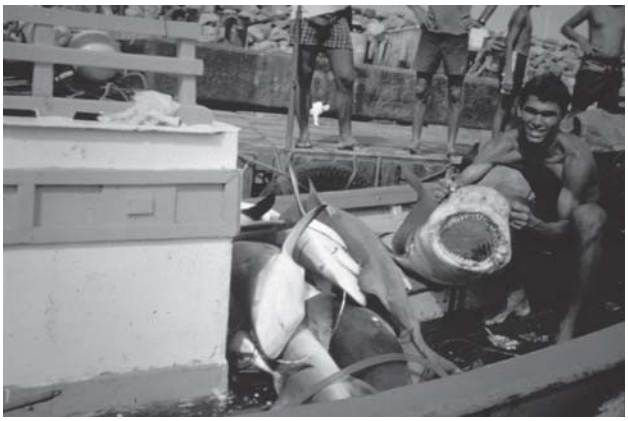

Figure 7. Landings of Santo Antônio harbor, Fernando de Noronha Archipelago. (Photos: Leonardo B. Veras)

Figure 8. Agonistic display in juvenile female of *Carcharhinus perezi* (MOVI 05578) in Fernando de Noronha Archipelago in June 1989. (Photo: Jules M. R. Soto)

Figure 9. Shark dive with *Carcharhinus perezi* (MOVI 31301) in Fernando de Noronha Archipelago in October 1994. (Photo: Leonardo B. Veras)

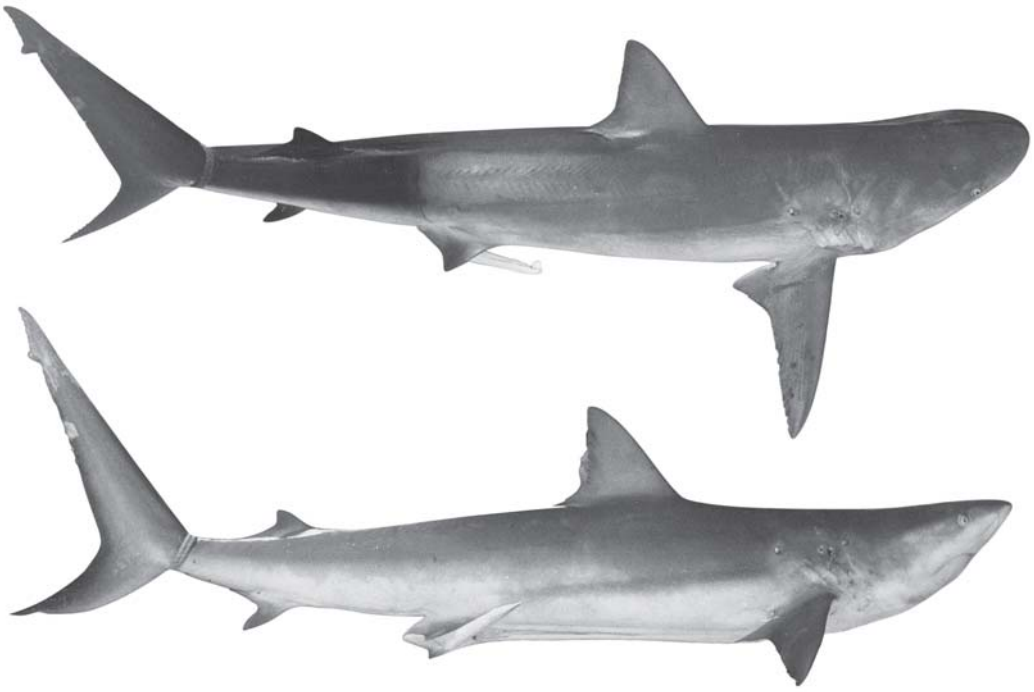

Figure 10. Adult male of *Carcharhinus perezi* (MOVI 31303), 2.2 m TL, harpooned in Trindade Island in February 1986. (Photo: Hélio Bulhões)

ACKNOWLEDGEMENTS

I would like to thank Paulo Sampaio, Simão Marrul, Heleno da Silva (*in memoriam*) and Alexandre Filippini of the "Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis" (IBAMA); 2nd and 5th "Comandos Aéreos da Aeronáutica" (COMAR); the divers Alecsi Bugowicz, Marco Aurélio Dias and Sebastian Widholzer; and the team of "Águas Claras Prod. Subm.", Randal Fonseca, Danielle Fonseca and Clayton Fonseca, for their collaborations in field. My thanks also to Alexandre Filippini, Enrico Marcovaldi, and Leonardo B. Veras for allowing use of their photographs of Trindade Island, Rocas Atoll, and Fernando de Noronha Archipelago, respectively.

LITERATURE CITED

Amorim, A. F. de; Motta, F. dos S. & Arfelli, C. A. 1995. Notes on shark embryos of *Carcharhinus obscurus* and *Carcharhinus perezi*, and new born *Carcharhinus falciformis* off southern Brazil. p.16. *In*: Resumos da 7ª Reunião do Grupo de Trabalho Sobre Pesca e Pesquisa de Tubarões e Raias no Brasil. Fundação Universidade do Rio Grande, 20-24 de novembro de 1995, Rio Grande, 79p.

Bigelow, H. B. & Schroeder, W. C. 1948. Sharks. p.59-576. In: Fishes of the western North Atlantic. *Memoir Sears Foundation for Marine Research*, n.1, part 1, New Haven, 576p.

Cervigón, F. 1966. *Los Peces Marinos de Venezuela*. Tomo 1. Est. Inv. Mar. Margarita, Fundación La Salle de Ciencias Naturales, Caracas, 436p., 181 figs.

Compagno, L. J. V. 1984a. FAO species catalogue. Sharks of the world. An annotated and illustrated catalogue of shark species known to date. Part 1. Hexanchiformes to Lamniformes. *FAO Fisheries Synopsis*, 4(125): 1-249.

Compagno, L. J. V. 1984b. FAO species catalogue. Sharks of the world. An annotated and illustrated catalogue of shark species known to date. Part 2. Carcharhiniformes. *FAO Fisheries Synopsis*, 4(125): 251-655.

Compagno, L. J. V. 1988. *Sharks of the Order Carcharhiniformes*. Princeton University Press, Princeton, 486p., figs.

Gadig, O. B. F.; Bezerra, M. A. & Furtado-Neto, M. A. A. 1996. Nota sobre a biologia do tubarão *Carcharhinus perezi* (Poey, 1861) (Chondrichthyes, Carcharhinidae) do norte-nordeste do Brasil. *Rev. Nordestina Biol.*, 11(1): 31-36.

Garrick, J. A. F. 1982. Sharks of the genus *Carcharhinus*. *NOAA Tech. Rep.* NMFS 445: 1-194.

Hobson, E. S. 1964. Feeding behavior in three species of sharks. *Pacific Science* 17: 733-746.

Hyslop, E. J. 1980. Stomach contents analysis - a review of methods and their application. *Journal of Fish Biology* 17: 411-429.

Johnson, R. H. & Nelson, D. R. 1973. Agonistic display in the gray reef shark, *Carcharhinus menissorah*, and its relationship to attacks on man. *Copeia* 1973(1): 76-84.

Menezes, N. A. & Figueiredo, J. L. 1980. *Manual de peixes marinhos do Sudeste do Brasil. IV. Teleostei (3)*. São Paulo. Museu de Zoologia da Universidade de São Paulo. 96p.

Menezes, N. A. & Figueiredo, J. L. 1985. *Manual de peixes marinhos do Sudeste do Brasil. V. Teleostei (4)*. São Paulo. Museu de Zoologia da Universidade de São Paulo. 105p.

Poey, F. 1876. Enumeratio piscium cubensium. *An. Soc. Esp. Hist. Nat. Madrid* 5: 177-218.

Ritter, E. K. & Godknecht, A. J. 2000. Agonistic displays in the blacktip shark (*Carcharhinus limbatus*). *Copeia* 2000(1): 282-284.

Sadowsky, V. & Amorim, A. F. de. 1977. Sobre a composição da fauna dos esqualos pelágicos do Brasil. *Ciência e Cultura* (Supl.), 29(7): 792.

Sazima, I. & Moura, R. L. 2000. Shark (*Carcharhinus perezi*), cleaned by the goby (*Elacatinus randalli*), at Fernando de Noronha Archipelago, western South Atlantic. *Copeia*, 2000: 297-299.

Soto, J. M. R. 1997. Tubarões e raias (Chondrichthyes) encontrados no Arquipélago Fernando de Noronha durante as expedições ARFENOR I e II. *Alcance*, 4(2): 71-80.

Soto, J. M. R. 2001. Annotated systematic checklist and bibliography of the coastal and oceanic fauna of Brazil. I. Sharks. *Mare Magnum* 1(1): 51-120.

Date submited: March 21, 2001
Date accepted: June 04, 2001