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**ON THE PRESENCE OF THE SPINNER SHARK
CARCHARHINUS BREVIPINNA (MÜLLER & HENLE, 1839)
(CHONDRICHTHYES: CARCHARHINIDAE) IN MALDIVIAN WATERS**

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¹Ente Fauna Marina Mediterranea, Avola, Italy

²Marine Sciences, University of Milano-Bicocca, Milan, Italy

E-mail: scubabiology@gmail.com

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We present the first confirmed report on the presence of spinner shark, *Carcharhinus brevipinna*, in Maldivian waters. The species was observed in front of Kooddoo's harbour, in Villingili pass, Northern Huvadho Atoll, Southern Maldives in March 2020.

Keywords: shark, spinner shark, *Carcharhinus brevipinna*, Huvadho Atoll, ecotourism

To date, a total of 36 species of sharks have been recorded in Maldivian waters, including 13 requiem sharks (family Carcharhinidae) (De Maddalena & Galli, 2017). Detailed lists of the shark species recorded in Maldivian waters have been published by various authors (Adam et al., 1998 ; Ali & Sinan, 2015 ; Anderson & Ahmed, 1993 ; Anderson et al., 1998 ; De Maddalena & Galli, 2017); however, the spinner shark *Carcharhinus brevipinna* (Müller & Henle, 1839) was not listed in any of them. In this article, we report for the first time in scientific literature the presence of *C. brevipinna* in Maldivian waters.

The spinner shark belongs to the order Carcharhiniformes and to the family Carcharhinidae. It is a pelagic species found on continental and insular shelves, at depths ranging from the surface down to at least 100 m, in the Atlantic waters, Mediterranean Sea, and Pacific and Indian oceans (De Maddalena et al., 2015). The spinner shark is active and fast, observed both solitary and in large groups. Its diet includes bony fish, rays, cephalopods, and crustaceans. It feeds on small schooling fishes by swimming fast through the school with an open mouth, spinning along the body axis, and leaping out of the water. It is a placental, viviparous species. The male attains sexual maturity at 170 cm; the female, at 180 cm. After a 12–15-month gestation, the female gives birth to 2–15 young ones ranging 46–80 cm in total length. It can attain a maximum size of 278 cm and can live up to 27 years (Castro, 1983 ; Compagno, 1984 ; De Maddalena et al., 2015 ; Last & Stevens, 1994 ; Randall, 1986).

In the past, the Maldives severely depleted shark species due to overfishing for dried meat exports, oil, and fins. Following concerns by the tourism sector of shark fishing at major dive sites, the Government of the Maldives announced in 1995 the establishment of 15 Protected Marine Areas and the total

protection of the whale shark *Rhincodon typus*. In 1999, further nine Protected Marine Areas were identified. In 1998, the government implemented a 10-year moratorium on all types of shark fishing inside and within the rim of seven major tourist atolls in the Maldives. A failure to enforce the moratorium and effectively ban fishing at Protected Marine Areas led to a total ban on all fishing, capture, killing, or extraction of sharks from Maldivian waters since 15 March, 2010 (Ali & Sinan, 2015 ; Anderson & Ahmed, 1993). To date, the Republic of Maldives is among few countries that have declared a complete ban on shark fishing. The driving force of this fundamental change has been the blossoming of the ecotourism industry, which allows the general public to observe sharks in their natural environment. Apart from *C. brevipinna*, shark species regularly encountered by divers in the waters of Kooddoo include grey reef shark *Carcharhinus amblyrhynchos*, blacktip reef shark *C. melanopterus*, silvertip shark *C. albimarginatus*, and whitetip reef shark *Triaenodon obesus*.

MATERIAL AND METHODS

The observation took place on two different days, on 2 and 9 March, 2020, while the first author (F. R.) was scuba diving, in the waters in front of Kooddoo's harbour, in Villingili pass, Northern Huvadhoo Atoll, or Gaafu Alifu, Southern Maldives, Central Indian Ocean (Fig. 1). Both encounters took place 400–500 m distance from the harbour entrance and 350 m from the beach, in 20-m deep waters, with the sharks swimming at depths ranging from the surface down to 15 m. Fish wastes were used as chum and bait by local fishermen to attract the sharks to the site and keep them interested around the divers for viewing purposes.

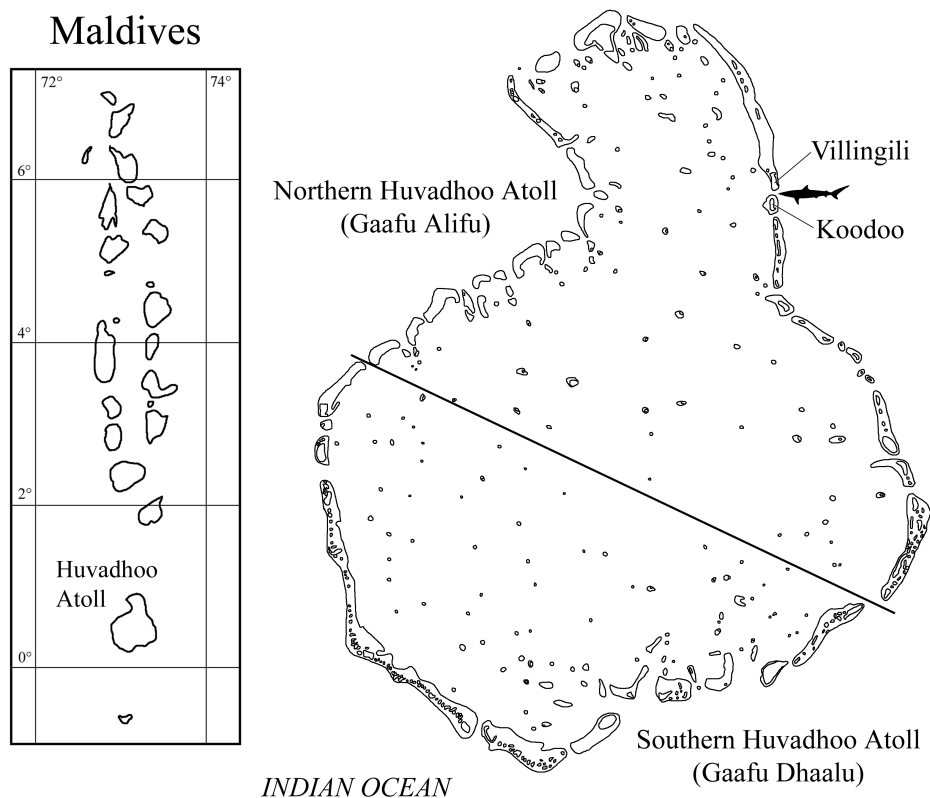


Fig. 1. Map showing the location where the spinner sharks *Carcharhinus brevipinna* were observed off the Northern Huvadhoo Atoll, Southern Maldives

On 2 March, 2020, approximately 20 spinner sharks were observed for 45 minutes, 14:40 to 15:25. It was a sunny day, with +28.8 °C mean temperature (maximum: +30.8 °C; minimum: +28.8 °C), calm seas, and no current. Underwater visibility was sufficient at the beginning of the dive (between 10 and 5 m) but became very poor near the end (less than 5 m), due to chumming. The size of the spinner shark was estimated from 1.5–1.6 m in total length for the smaller individuals up to 1.9–2.0 m in total length for the larger ones. Most individuals were female but a few males were observed as well (the males have two copulatory organs called claspers, which are located at the base of the pelvic fins). The divers remained suspended half-way in the water column, close to each other, and in vertical position. There was no interaction between the sharks, and they showed no interest in the divers. The sharks appeared interested only in the fish wastes thrown overboard by the fishermen. In order to attract the sharks and keep them around the divers, the fishermen were using the delayed surface marker buoy as the target to throw the fish wastes into the water.

On 9 March, 2020, approximately 20 spinner sharks were observed for 46 minutes, 14:37 to 15:23. It was a sunny day, with a +30.3 °C mean temperature (maximum: +31.2 °C; minimum: +30.0 °C), calm seas, and no current. Underwater visibility was good at the beginning of the dive (between 15 and 10 m) and remained sufficient until the end (between 10 and 5 m). The size of the spinner sharks was the same as observed on the previous encounter. Similarly, the large majority of individuals were female; only one male was later spotted in the filmed footage. The behavior of the sharks was similar to that during the previous dive. The sharks hit the delayed surface marker buoy several times and finally broke it.

Two spinner sharks had a fishing line wrapped around their head, and one of them was spotted on both 2 and 9 March.

On both dives, other fishes were attracted to the site by the chumming, including species of the families Acanthuridae and Caesionidae, at least a humphead wrasse *Cheilinus undulatus*, several great barracudas *Sphyrna barracuda*, and a green sea turtle *Chelonia mydas*. The sharks were accompanied by some live sharksuckers *Echeneis naucrates*.

Videos of the sharks were taken with an action cam full HD for subsequent analysis (Fig. 2).

The species identification was based mainly on the morphological descriptions given in Castro (1983), Compagno (1984), and De Maddalena *et al.* (2015).



Fig. 2. Spinner shark *Carcharhinus brevipinna* accompanied by live shark-suckers *Echeneis naucrates*, observed in the waters in front of Kooddoo's harbour, in Villingili pass, Northern Huvadhoo Atoll, Southern Maldives. Photo by Fabio Russo

RESULTS AND DISCUSSION

There could be multiple reasons to explain why the spinner shark was not previously recorded from the area. This may be due to the lack of specific surveys in the waters of the Northern Huvadhu Atoll. Moreover, spinner sharks are sometimes mistaken for other requiem shark species because of their similar morphology. Species, with which the spinner shark may be confused, that have been recorded in Maldivian waters, include the silky shark *C. falciformis* and the blacktip shark *C. limbatus*. Further observations of *C. brevipinna* are needed to reveal whether this species is an occasional visitor in the area or there is a stable population that reproduces in Maldivian waters.

Kooddoo Fisheries Complex started its operations in 1996; it is the main cold storage facility of Maldives Industrial Fisheries Company Ltd. This facility has an alongside berth which can accommodate vessels up to 2500 deadweight tonnage. The fish processing station grew bigger in 2006, with a consequent increase in the processing wastes that are thrown at sea just out of the harbour. People noticed that fish wastes had started to attract a good amount of spinner sharks in the area, and diving companies began promoting shark diving on the site. The concentration of spinner sharks may reach 40 individuals encountered on a single dive. The fishermen are now getting paid by diving cruise boats companies to throw the waste when the divers are in the water.

Such collaboration between diving companies and fishermen is a good element in this particular scenario, since the various parts draw an economic profit from the conservation of that population of spinner sharks, and then there can hopefully be successful conditions to conserve this newly discovered local natural resource. It is also positive that the sharks are being attracted by using fish wastes rather than fishes specifically killed to feed the sharks.

On the other hand, the fact that on diving days the spinner sharks can be fed for several hours in a row, may alter the normal predatory behavior of this species in the area. Therefore, feeding fish wastes to sharks should be kept to a minimum.

Conclusion. Two major economic activities in the Maldives are fishing and tourism. In 1992, the number of dives *per year* at 35 shark observation dive sites was estimated at over 70,000, and the amount of money spent on those dives was estimated at US\$2.3 million. Based on these numbers, it was estimated that a single reef shark was worth about US\$33,500 *per year*, at the most popular dive site, and an average of US\$3,300, when taking into account all the shark observation dive sites (Anderson & Ahmed, 1993). Since grey reef sharks can live more than 25 years, a single grey reef shark may be worth over US\$800,000 during its whole lifetime (De Maddalena & Galli, 2017). In contrast, a dead grey reef shark was calculated to have a one-time value of about US\$32, to a local fisherman (Anderson & Ahmed, 1993). Therefore, a grey reef shark is worth up to 25,000 times more alive than dead.

Ecotourism is an extremely powerful and effective tool for animal protection, when properly managed. By setting solid guidelines, monitoring diving activities, and enforcing the rules, the operators and enforcement personnel will make sure that shark diving is a useful activity and not just an alternative way to simply make a profit from the exploitation of wild animals, which often ends up harming them, alters their natural behavior, and damages their habitat (De Maddalena & Galli, 2017).

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REFERENCES

1. Adam M. S., Merrett N. R., Anderson R. C. Additions to the fish fauna of the Maldivian Islands. Part 1: An annotated checklist of the deep demersal fishes of the Maldivian Islands. *Ichthyological Bulletin of the J. L. B. Smith Institute of Ichthyology*, 1998, no. 67, pp. 1–19.
2. Ali K., Sinan H. *National Plan of Action for the Conservation and Management of Sharks in the Maldives*. Male : Ministry of Fisheries and Agriculture, Republic of Maldives, 2015, 44 p.
3. Anderson R. C., Ahmed H. *The Shark Fisheries of the Maldives*. Male : Ministry of Fisheries and Agriculture, Republic of the Maldives, Food and Agriculture Organization of the United Nations, 1993, 73 p.
4. Anderson R., Randall J., Kuitert R. New records of fishes from the Maldivian Islands with notes on other species. *Ichthyological Bulletin of the J. L. B. Smith Institute of Ichthyology*, 1998, vol. 67, no. 2, pp. 20–32.
5. Castro J. *The Sharks of North American Waters*. College Station : Texas A & M University Press, 1983, 180 p.
6. Compagno L. J. V. FAO Species Catalogue. Vol. 4. Sharks of the World. An annotated and illustrated catalogue of shark species known to date. Part 2. Carcharhiniformes. *FAO Fisheries Synopsis*, 1984, no. 125, pp. 251–655.
7. De Maddalena A., Baensch H., Heim W. *Sharks of the Mediterranean. An Illustrated Study of All Species*. Jefferson : McFarland & Co., 2015, 204 p.
8. De Maddalena A., Galli P. *Sharks of the Maldives*. Milano : Editoriale Magenes, 2017, 216 p.
9. Last P. R., Stevens J. D. *Sharks and Rays of Australia*. Melbourne : CSIRO, 1994, 514 p.
10. Randall J. E. *Sharks of Arabia*. London : Immel, 1986, 148 p.

**О НАЛИЧИИ КОРОТКОПЁРОЙ СЕРОЙ АКУЛЫ
CARCHARHINUS BREVIPINNA (MÜLLER & HENLE, 1839)
 (CHONDRICHTHYES: CARCHARHINIDAE)
 В АКВАТОРИИ МАЛЬДИВ**

Ф. Руссо¹, А. Де Маддалена²

¹Управление морской фауны Средиземноморья, Авола, Италия

²Международная программа «Морские науки», Миланский университет Бикокка, Милан, Италия
 E-mail: scubabiology@gmail.com

Это первое подтверждённое сообщение о наличии короткопёрой серой акулы *Carcharhinus brevipinna* в акватории Мальдив. Особь была замечена перед гаванью Кудду на перевале Виллингилли (атолл Северный Хувадху, Южные Мальдивы) в марте 2020 г.

Ключевые слова: акула, короткопёрая серая акула, *Carcharhinus brevipinna*, атолл Хувадху, экотуризм