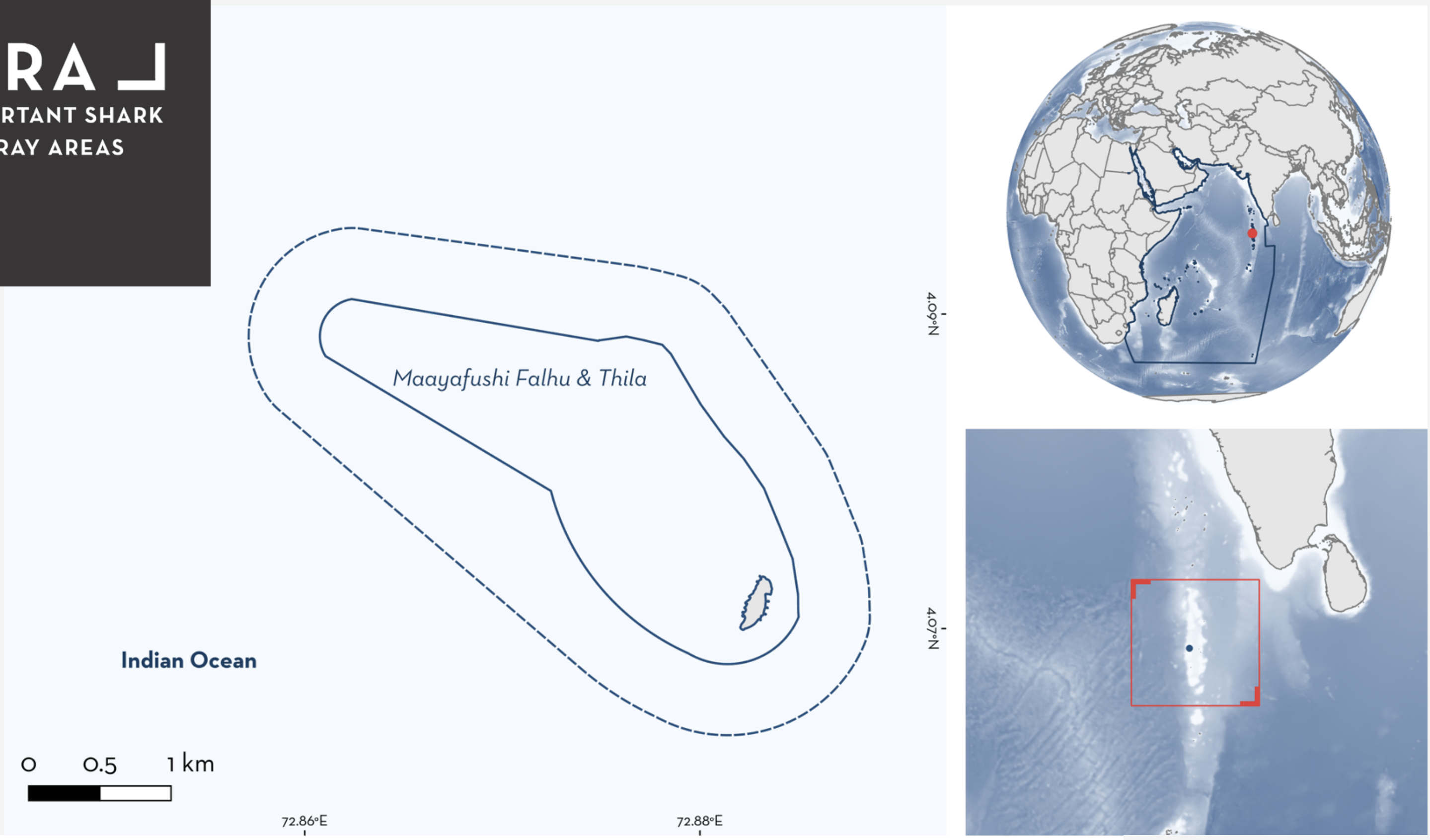
ISRA
IMPORTANT SHARK AND RAY AREAS



Blue lines indicate the area meeting the ISRA Criteria; dashed lines indicate the suggested buffer for use in the development of appropriate place-based conservation measures

MAAYAFUSHI FALHU & THILA ISRA

Western Indian Ocean Region

MALDIVES

0–40 metres

3.94 km²

SUMMARY

Maayafushi Falhu & Thila is located in North Ari Atoll in the central Maldives. The area includes the Maayafushi lagoon, that reaches a maximum depth of 22 m with a benthic cover of fine sands and scattered coral blocks, and Maaya Thila, a submerged reef pinnacle located 1.5 km from the northern edge of the lagoon. This area overlaps with the Mayaa Thila Marine Protected Area. Within the area there are: **threatened species** (e.g., Grey Reef Shark *Carcharhinus amblyrhynchos*); **reproductive areas** (Reef Manta Ray *Mobula alfredi*); **feeding areas** (Reef Manta Ray); and **undefined aggregations** (e.g., Whitetip Reef Shark *Triaenodon obesus*).

CRITERIA

Criterion A – Vulnerability; Sub-criterion C1 – Reproductive Areas; Sub-criterion C2 – Feeding Areas; Sub-criterion C5 – Undefined Aggregation

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DESCRIPTION OF HABITAT

Maayafushi Falhu & Thila is located inside North Ari Atoll in the central Maldives. The area includes a lagoon, Maayafushi Falhu, and a submerged pinnacle reef, Maaya Thila. The shallow lagoon (22 m deep) is surrounded by a shallow reef rim. The island of Maayafushi is located on the southern edge of the lagoon. The inner lagoon basin is characterised by a sandy, silty substrate with several scattered coral blocks. The geomorphology of the shallow lagoon coupled with the tidal movements and Langmuir Circulation acts as a zooplankton trap, especially during the southwest monsoon (May–November; Hedley et al. 2018; Moloney et al. 2019; Harris et al. 2020; Harris & Stevens 2021).

Maaya Thila, located 4 km northwest of Maayafushi island, is a pinnacle reef that raises from the sandy bottom at 30–40 m to a depth of 6 m. The term *Thila* in Dhivehi, refers to an underwater pinnacle reef where the top of the reef is completely submerged, even during low tide. Maaya Thila is ~80 m in diameter and has a flat reef top and steep reef walls with caves and overhangs with soft corals and gorgonians (Kuiter & Godfrey 2019). The *thila* is often exposed to strong currents induced by tidal movements.

The tides in the Maldives are characterised by a semidiurnal microtidal regime with a tidal range of ~1 m (Caldwell et al. 2015; Rasheed et al. 2021). Combined tidal and wind-driven currents can exceed speeds of 2 m/s, and be very variable in speed and direction, especially though the channels between atolls, atoll rims, and channel gaps in the atoll rims (Ciarapica & Passeri 1993; Kuiter & Godfrey 2019; Rasheed et al. 2021).

The weather in the Maldives is strongly influenced by the South Asian monsoon, especially in the northern and central atolls, as these are closer to the Indian subcontinent (Anderson et al. 2011). Two monsoon seasons occur annually, with the southwest monsoon (locally known as *Hulhan'gu*) from May to November, and the northeast monsoon (locally known as *Iruvai*) from January to March, with transitional periods in December and April (Shankar et al. 2002; Anderson et al. 2011). The southwest monsoon increases average rainfall and wind speeds, causing rougher seas and reduced underwater visibility; in contrast, the northeast monsoon usually brings clear waters (Stevens & Froman 2019). The monsoonal winds generate oceanic currents mirroring the direction and intensity of the winds that interact with the geomorphology of the Maldivian archipelago generating localised upwelling through the Island Mass Effect (Su et al. 2021).

The area includes the Mayaa Thila Marine Protected Area.

This Important Shark and Ray Area is benthopelagic and is delineated from the inshore and surface waters (0 m) to 40 m based on the bathymetry of the area.

ISRA CRITERIA

CRITERION A – VULNERABILITY

Three Qualifying Species considered threatened with extinction according to the IUCN Red List of Threatened Species™ regularly occur in the area. These are the Vulnerable Grey Reef Shark (Simpfendorfer et al. 2020a), Whitetip Reef Shark (Simpfendorfer et al. 2020b), and Reef Manta Ray (Marshall et al. 2022).

SUB-CRITERION C1 – REPRODUCTIVE AREAS

Maayafushi Falhu & Thila is an important reproductive area for one ray species.

Of 1,418 Reef Manta Rays recorded throughout Ari Atoll, 3% (n = 42) were observed in Maayafushi Falhu, a location with limited survey effort (n = 151 surveys at this site; with only 3% of all surveys conducted in Ari Atoll). Overall, 88% (n = 37) of the Maayafushi Falhu individuals were young-of-the-year (YOY) and juveniles and 12% were mature (n = 5). Aggregations of YOY individuals can be observed feeding in the lagoon year-round with a peak during the southwest monsoon (Moloney et al. 2019). Data from photo-identification conducted between 2007–2022 revealed that 11% (n = 8 individuals) of YOY identified in Ari Atoll (n = 74) were first recorded in Maayafushi Falhu. YOY were identified based on individual estimated size between 150–190 cm disc width [DW]; length of tail, light ventral/spot pattern pigmentation; creases along pectorals; and often a light pink skin pigmentation on first sighting (Kashiwagi 2014; Stevens 2016; Hedley et al. 2018; Moloney et al. 2019; IDtheManta unpubl. data 2022). Size-at-birth for this species is 130–150 cm DW (Last et al. 2016). This location is one of the main sites where YOY are reported in North Ari Atoll (Hedley et al. 2018; Moloney et al. 2019; IDtheManta unpubl. data 2022).

All eight YOY individuals recorded in Maayafushi Falhu were repeatedly seen within the same area over consecutive years, confirming that this area is used repeatedly across years and as a nursery area (Heupel et al. 2007) (on average individuals are resighted 18 times over 7 consecutive years; IDtheManta unpubl. data 2022).

SUB-CRITERION C2 – FEEDING AREAS

Maayafushi Falhu & Thila is an important feeding area for one ray species.

Data from 151 citizen science reports and underwater visual census surveys utilising photo-identification between the years 2014–2022, recorded a total of 327 sightings of feeding Reef Manta Rays. Forty-two individuals have been identified in this area and 95% of them have been recorded during feeding events. Feeding aggregations in Maayafushi Falhu are composed mainly of YOY and juveniles (88%). Feeding aggregations happen regularly and predictably year-round with peaks during the southwest monsoon, due to the accumulation of zooplankton in the area resulting from monsoon conditions (Dewar et al. 2008; Armstrong et al. 2016; Harris et al. 2021). During this season, Reef Manta Rays are known to aggregate when tidal movements and Langmuir Circulation concentrate zooplankton in the shallow lagoon (Harris et al. 2020; Harris & Stevens 2021), providing an ideal environment for planktivorous megafauna in the area (Dewar et al. 2008; Armstrong et al. 2016; Harris et al. 2021). Aggregations are mostly observed just after sunset or at nighttime, and are composed an average of five individuals (SD = 1.1; minimum = 4; maximum = 7 individuals) on 18 different occasions (IDtheManta unpubl. data 2022).

SUB-CRITERION C5 – UNDEFINED AGGREGATIONS

Maayafushi Falhu & Thila is an important area for undefined aggregations of two shark species. Additional information is needed to determine the main drivers of these aggregations.

Grey Reef Sharks are abundant species at Maaya Thila year-round and can be observed daily by recreational divers at 0–30 m depth (C Casolin pers. obs. 2017–2023). Animals usually aggregate on the side of the *thila* where the current is coming from. Larger aggregations (~15 individuals) occur during medium local tidal currents from the west (C Casolin pers. obs. 2017–2023). Overall, sightings of 1–10 individuals are common (A Thompson pers. comm. 2023). Aggregations include individuals of different body sizes, from large females to 1–2 neonates of ~30–50 cm total length (TL) (size-at-birth = 45–64 cm TL; Ebert et al. 2021) (C Casolin pers. obs. 2017–2023). According to data from 120 Underwater Visual Census survey dives conducted in Maaya Thila between 2009–2018, the Grey Reef Shark is the second most abundant species observed in Maaya Thila year-round (average encounter rate of ~2 individual per hour and a maximum of 24 individuals per hour) (Maldives Marine Research Institute [MMRI] unpubl. data 2023). Grey Reef Sharks in Maaya Thila are observed cruising in circles along the edge of the *thila* where the current is coming from (C Casolin pers. obs. 2017–2023), a behaviour that may be linked to resting as their negative buoyant bodies get lifted in the upward currents generated by the geomorphology of the sea floor (Papastamatiou et al. 2021).

According to data from 120 underwater visual census survey dives conducted between 2009–2018, the Whitetip Reef Shark is the most abundant species observed in Maaya Thila all year-round (average encounter rate of ~3 individuals per hour) (MMRI unpubl. data 2023). Animals can be regularly observed swimming around the *thila* and resting over sandy patches during daytime (A Batlle-Morera pers. obs. 2011–2020). Whitetip Reef Sharks are nocturnal hunters (Ebert et al. 2021) and it is also common to observe groups of 4–5 individuals hunting together at night at this location (C Casolin pers. obs. 2017–2023). Maaya Thila together with Mushimasmigili Thila (Fish Head) are the two best-known locations in North Ari Atoll where Whitetip Reef Sharks can be observed feeding regularly during night dives (C Casolin pers. obs. 2017–2023). Whitetip Reef Sharks have small home ranges occupied for long periods of time (Ebert et al. 2021) and it is likely that they use this area to feed.

Acknowledgments

Miriam NO Staiger (Manta Trust - Maldives Manta Conservation Programme), Tamaryn J Sawers (Manta Trust - Maldives Manta Conservation Programme), and Amanda Batlle-Morera (IUCN SSC Shark Specialist Group – ISRA Project) contributed and consolidated information included in this factsheet. We thank all participants of the 2023 ISRA Region 7 – Western Indian Ocean workshop for their contributions to this process.

This factsheet has undergone review by the ISRA Independent Review Panel prior to its publication.

This project was funded by the Shark Conservation Fund, a philanthropic collaborative pooling expertise and resources to meet the threats facing the world's sharks and rays. The Shark Conservation Fund is a project of Rockefeller Philanthropy Advisors.

Suggested citation

IUCN SSC Shark Specialist Group. 2023. Maayafushi Falhu & Thila ISRA Factsheet. Dubai: IUCN SSC Shark Specialist Group.

QUALIFYING SPECIES

Scientific Name	Common Name	IUCN Red List Category	Global Depth Range (m)	ISRA Criteria/Sub-criteria Met								
				A	B	C1	C2	C3	C4	C5	D1	D2
SHARKS												
Carcharhinus amblyrynchos	Grey Reef Shark	EN	0–280	X						X		
Triaenodon obesus	Whitetip Reef Shark	VU	0–330	X						X		
RAYS												
Mobula alfredi	Reef Manta Ray	VU	0–711	X		X	X					

SUPPORTING SPECIES

Scientific Name	Common Name	IUCN Red List Category
SHARKS		
Carcharhinus albimarginatus	Silvertip Shark	VU
Carcharhinus melanopterus	Blacktip Reef Shark	VU
Rhincodon typus	Whale Shark	EN
RAYS		
Aetobatus ocellatus	Spotted Eagle Ray	EN
Taeniurops meyeni	Blotched Fantail Ray	VU
Pastinachus sephen	Cowtail Ray	NT
Pateobatis jenkinsii	Jenkins' Whipray	EN

IUCN Red List of Threatened Species Categories are available by searching species names at www.iucnredlist.org Abbreviations refer to: CR, Critically Endangered; EN, Endangered; VU, Vulnerable; NT, Near Threatened; LC, Least Concern; DD, Data Deficient.

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