

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

BODU HITHI KANDU ISRA

Western Indian Ocean Region

SUMMARY

Bodu Hithi Kandu is located in west North Malé Atoll in the central Maldives. This area encompasses a channel connecting the inner atoll lagoon to the open ocean. In the middle of the channel, there is a submerged pinnacle reef with several bays with sandy substrate and caves. In the southern channel lies the northern corner of Rasfari, a shallow flat reef. This area partially overlaps with a Marine Protected Area. Within this area there are: **threatened species** (e.g., Whitetip Reef Shark *Triacnodon obesus*); **reproductive areas** (Reef Manta Ray *Mobula alfredi*); **feeding areas** (Reef Manta Ray); and **undefined aggregations** (Whitetip Reef Shark).

CRITERIA

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

MALDIVES

0-40 metres

11.04 km²





DESCRIPTION OF HABITAT

Bodu Hithi Kandu is located in the northern-central Maldives archipelago which sits centrally upon the Chagos-Laccadive Ridge (Stevens & Froman 2019). This area is mainly located in a major channel in western North Malé Atoll. Channels, known locally as *kandu*, are recognised by high current flow (Stevens & Froman 2019). This area is composed of three sites: Boduhithi Kandu, Boduhithi Thila, and North Rasfari.

Boduhithi Kandu (also known as Hithi Kandu) is a smaller channel within this area on the outer edge of the atoll. Its deepest part at the edge of the atoll is ~30 m and becomes shallower (~2 m) when reaching Boduhithi Faru which is a lagoon with sandy substrate and a shallow, sloping reef at the inner edge of the major channel.

Boduhithi Thila sits in the centre of the mouth of the major channel. Thila is the local name for underwater pinnacle reef where the top of the reef is completely submerged, even during low tide (Godfrey 2023). The thila is 8 m at its shallowest point and ~30 m at its deepest point. The thila is split into two parts with a channel running between, with a sandy substrate and coral bommies. Incoming currents bring in a high density of zooplankton (Armstrong et al. 2021).

North Rasfari is located in the southern entrance of the major channel, bordering the northern corner of Rasfari reef with calm, shallow environments at 5 m depth (Godfrey 2023).

The weather in the Maldives is strongly influenced by the South Asian monsoon, especially the northern and central atolls as these are closer to the Indian subcontinent (Anderson et al. 2011). Two monsoons occur annually in Maldives: the southwest monsoon (known locally as *Hulhangu*), from May to November, and the northeast monsoon (known locally 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 visibility; in contrast, the northeast monsoon usually brings clear waters (Stevens & Froman 2019).

The Maldives archipelago disrupts the flow of the monsoon-driven North Equatorial Current as it crosses the Indian Ocean (Schott & McCreary 2001) which creates a current flow through the channels of the Maldives (Sasamal 2006). The strongest lunar currents can overcome the prevailing monsoonal currents through the tidal suction mechanism along the channel's outer edges (Stevens 2016).

This area partially overlaps with a Rasfari Marine Protected Area which encompasses North Rasfari and a part of Boduhithi Thila.

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

ISRA CRITERIA

CRITERION A - VULNERABILITY

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

SUB-CRITERION C1 – REPRODUCTIVE AREAS

Bodu Hithi Kandu is an important reproductive area for one ray species.

Data collected between 2007–2022 showed 15 courtship events by 12 Reef Manta Rays at Boduhithi Thila and 16 courtship events by 13 Reef Manta Rays at North Rasfari (IDtheManta unpubl. data 2007–2022). During this period, 63 pregnant females were recorded: 36 were in their 4th trimester, 20 were in their 3rd trimester, and seven were in their 2nd trimester (IDtheManta unpubl. data 2007–2022). The gestation time of the Reef Manta Ray is reported to be one year (Stevens 2016). Females are determined to be pregnant by the presence of extended abdomens by trained researchers (Stevens 2016). These researchers can establish the trimester using the size of the rounded belly through sight. Using photo-identification, the pregnancy periods can be tracked for re-sighted Reef Manta Rays. Pregnancy in Reef Manta Rays has been verified in 2018–2019 using contactless ultrasound scanning in other sites of the Maldives (Froman et al. 2023). Additionally, six courtship events have been documented with photographic evidence in this area (Stevens et al. 2018).

SUB-CRITERION C2 – FEEDING AREAS

Bodu Hithi Kandu is an important feeding area for one ray species.

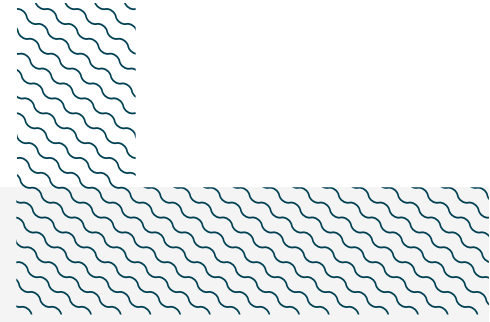
Reef Manta Rays aggregate when tidal movements bring large concentrations of zooplankton (Armstrong et al. 2021) which occurs at the outer entrance of the channel in this area. Between 2007–2022, 48% (n = 161) of all Reef Manta Ray sightings (n = 336) documented feeding events in the channel by 94 Reef Manta Rays in the northeast monsoon season (IDtheManta unpubl. data 2007–2022). At least seven aggregations have been recorded of Reef Manta Ray feeding between 2014–2020 with a range of 9 to 25 individuals. In this area, high concentrations of plankton drive group feeding behaviour to maximise food intake and minimise energy expenditure (Stevens 2016).

SUB-CRITERION C5 – UNDEFINED AGGREGATIONS

Bodu Hithi Kandu is an important undefined aggregation area for one shark species.

Data were collected from a citizen-science program known as the Sharkwatch project which was a government-led initiative between 2009–2019 (Maldives Marine Research Institute [MMRI] unpubl. data 2023). Data were collected by experienced dive guides using the roving diver technique where surveyors can swim in any direction and count the number of individuals encountered by species during one-hour dive surveys.

From the ~1,110 sites surveyed in the Maldives, this area has been identified as one of the most important aggregations for the Whitetip Reef Shark (MMRI unpubl. data 2023). Sharkwatch surveys conducted over ten years in this area (2009–2019; n = 839) showed that Whitetip Reef Sharks are regularly present aggregating at this area with a mean encounter rate of five sharks/hour (MMRI unpubl. data 2023). On 92% of surveys (n = 773), at least one Whitetip Reef Shark was encountered and on 13 surveys, aggregations of >15 Whitetip Reef Shark/hour were observed in 2013–2015 and in 2017–2019 (MMRI unpubl. data 2023). Whitetip Reef Shark are observed in both monsoon seasons. In 2013, encounter rates of ~20 Whitetip Reef Sharks/hour were observed in each season (MMRI unpubl. data 2023). Further information is needed to understand the nature and function of these aggregations.



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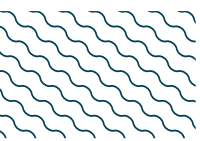
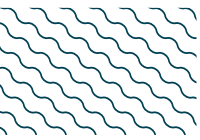
QUALIFYING SPECIES

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													
<i>Triaenodon obesus</i>	Whitetip Reef Shark	VU	0-330	X							X		
RAYs													
<i>Mobula alfredi</i>	Reef Manta Ray	VU	0-711	X		X	X						

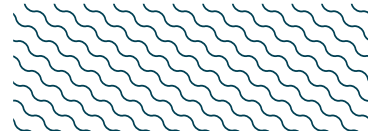
SUPPORTING SPECIES

Scientific Name	Common Name	IUCN Red List Category
SHARKS		
<i>Carcharhinus albimarginatus</i>	Silvertip Shark	VU
<i>Carcharhinus amblyrhynchos</i>	Grey Reef Shark	EN
<i>Carcharhinus melanopterus</i>	Blacktip Reef Shark	VU
<i>Nebrius ferrugineus</i>	Tawny Nurse Shark	VU
<i>Rhincodon typus</i>	Whale Shark	EN
RAYS		
<i>Aetobatus ocellatus</i>	Spotted Eagle Ray	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.



SUPPORTING INFORMATION



There are additional indications that Bodu Hithi Kandu is important for aggregations of one shark and one ray species.

Grey Reef Sharks are regularly sighted in this area with a mean encounter rate of two sharks/hour. Maximum encounter rates of >30 Grey Reef Sharks/hour were recorded in 2017 and 2019. Grey Reef Sharks are observed in both monsoon seasons. In 2017, one dive survey in the southwest monsoon season recorded >20 individuals/hour, and one survey in northeast monsoon season recorded >30 individuals/hour (MMRI unpubl. data 2023). This area might be used as a resting ground for this species. In channels with strong currents from French Polynesia, Grey Reef Sharks use current-induced updraft zones to reduce energy expenditure, since these are negatively buoyant fishes and obligate swimmers (Papastamatiou et al. 2021). Further information is needed to determine if sharks aggregate at this area and understand the nature and function of these potential aggregations.

The world's largest known population of Reef Manta Rays is located in the Maldives. Bodu Hithi Kandu is one of four sites that was sampled between 2000 and 2009 (Kitchen-Wheeler et al. 2011). Reef Manta Rays regularly use North Rasfari for cleaning purposes between January and April. From 2,134 surveys undertaken between 2007-2022 in North Rasfari, cleaning events by 315 Reef Manta Rays were documented in 97% (n = 2,071) of surveys. Bodu Hithi Kandu has two cleaning stations and data collected between 2007-2022 (n = 322) showed 27% of sightings (n = 91) included cleaning events by 79 individuals. Reef Manta Rays may use this cleaning site to thermoregulate (Stevens 2016) and engage in social interactions (Stevens et al. 2018), both of which are important aspects of resting behaviour. Further information is needed to understand the nature and function of these activities.



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