

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

VANDHOO & KOTTEFARU ISRA

Western Indian Ocean Region

SUMMARY

Vandhoo & Kottefaru is located in eastern Raa Atoll in the northern Maldives. The area encompasses three islands (Neyo, Kottefaru, and Vandhoo) which are surrounded by inner and outer facing reefs, as well as small and large reef pinnacles that lie in the channels between the islands. Outside the channels, the depth drops steeply. Two of these outer reefs are structurally unique with a sheer drop-off, and act as a barrier to the currents, displacing the water and creating deepwater upwelling that enhances productivity. Within this area there are: **threatened species**, **reproductive areas**, and **feeding areas** (Reef Manta Ray *Mobula alfredi*).

CRITERIA

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

MALDIVES

0-100 metres

7.61 km²





DESCRIPTION OF HABITAT

Vandhoo & Kottefaru is located in eastern Raa Atoll in the northern Maldives. This area encompasses three islands: Neyo (south), Kottefaru (central), and Vandhoo (north), which are surrounded by inner and outer facing reefs, as well as small and large *thilas* (underwater reef pinnacles) that lie in the channels between the islands. Outside the channels, the depth drops steeply to 350 m within 1 km of the atoll's eastern rim (Stewart et al. 2019).

This area is influenced by the South Asian Monsoon (Gischler et al. 2013). Productivity in this region peaks during the southwest monsoon (May to November) (J Haines pers. obs. 2019–2022), in which the weather is typically characterised by higher rain and cloud cover, along with reduced underwater visibility and stronger wind speeds resulting in rougher seas (Stevens & Froman 2019). The strong monsoonal winds create oceanic currents that flow northeastward during the southwest monsoon. The outside reefs Kottefaru and Vandhoo act as a barrier to these currents, displacing the water as it flows through and around the atoll, creating deepwater upwelling that brings nutrient-rich water into the euphotic zone and leads to a bloom in phytoplankton; therefore, increasing zooplankton abundance (Stewart et al. 2019; Godfrey 2023).

Kottefaru, Vandhoo, and Neyo are easterly facing reefs. Two of these outer edge atoll reefs (Kottefaru and Vandhoo) are structurally unique in the Maldives, with a sheer drop-off or a wall-like structure reaching depths of ~200 m at the seafloor. This structure of reef formation is very different to the typical sloping reef structure as seen at the Neyo reef which ranges from a top reef depth of ~5 m to depths of ~30 m (Godfrey 2023).

Situated between Kottefaru and Vandhoo Islands is a large, underwater reef pinnacle in the middle of the channel. This is rectangular shaped, with a top reef depth of ~15 m, reaching depths of ~60 m on the surrounding outside area. Situated between Kottefaru and Neyo Islands are two other underwater reef pinnacles, the smallest of the two is a more rounded typically shaped *thila* situated closest to the west of Kottefaru Island with a top reef depth of ~6 m, whereas the larger pinnacle is situated in the middle of the open channel and is a more rectangular shaped *thila* with a top reef depth of ~8 m, sloping to depths of ~40 m in the channel area (Godfrey 2023).

This Important Shark and Ray Area is benthopelagic and is delineated from inshore and surface waters (0 m) to 100 m based on the depth range of Qualifying Species in the area.

ISRA CRITERIA

CRITERION A - VULNERABILITY

The one Qualifying Species within the area is considered threatened with extinction according to the IUCN Red List of Threatened Species™. The Reef Manta Ray is assessed as Vulnerable (Marshall et al. 2022).

SUB-CRITERION C1 – REPRODUCTIVE AREAS

Vandhoo & Kottefaru is an important reproductive area for one ray species.

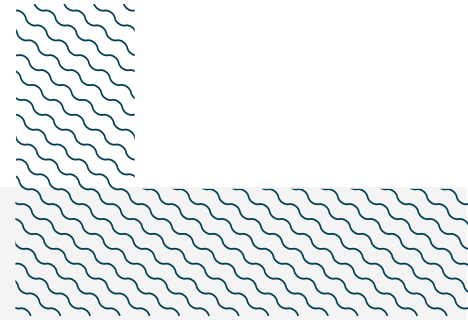
This area holds regular and predictable aggregations of courting and pregnant Reef Manta Rays. Based on 220 underwater visual census surveys conducted by snorkellers and scuba divers between 2007–2023, a total of 1,336 sightings of 517 photo-identified individuals have been observed (IDtheManta unpubl. data 2007–2022). Approximately 10% (49 individuals) were determined to be pregnant females based on the visible presence of extended abdomens observed by trained researchers (Marshall & Bennett 2010; Deakos 2011; Stevens 2016). Pregnancy in Reef Manta Rays has been verified in 2018–2019 using contactless ultrasound scanning in this atoll (Froman et al. 2023). During the southwest monsoon (July to November), this area holds higher number of pregnant females than elsewhere in the atoll, accounting for 72% of pregnant female sightings to 2023 (IDtheManta unpubl. data 2007–2023).

Reef Manta Ray courtship behaviour has been observed by divers and snorkellers regularly and predictably in this area during the southwest monsoon from July to November (IDtheManta unpubl. data 2007–2023). Observations from nine courtship interactions recorded has revealed courtship trains developing to stage two ('endurance') of the long courtship behaviour (Stevens et al. 2018; J Haines pers. obs. 2021–2022). In October and November of 2016, animal borne video cameras (Critttercams) were deployed on 16 Reef Manta Rays (Stewart et al. 2019; Pelletier et al. 2023). These captured multiple courtship events at depths between 25–86 m which is mostly deeper than recreational scuba diving limits. Thus, this behaviour might be more common than previously recorded. These studies identified courtship as the third most important behaviour, with cruising and cleaning the first and second most important, respectively.

SUB-CRITERION C2 – FEEDING AREAS

Vandhoo & Kottefaru is an important feeding area for one ray species.

On 220 underwater visual census surveys conducted by snorkellers and divers between 2007–2023, a total of 364 Reef Manta Ray sightings of 272 individuals were observed using five feeding strategies (straight, surface, chain, piggyback, and cyclone) to strain zooplankton prey over their gill plates (Stevens 2016; J Haines pers. obs. 2019–2022). In October and November 2016, animal borne video cameras (Critttercams) were deployed on 16 Reef Manta Rays (Stewart et al. 2019; Pelletier et al. 2023). These studies revealed that some individuals fed in high-density zooplankton patches associated with the thermocline (20–70 m depth). The largest aggregation of feeding Reef Manta Rays observed comprised 119 individuals (J Haines pers. obs. 2019). These feeding aggregations are observed predictably between September to November, as the productivity of the area is strongly influenced by the southwest monsoon (Gischler et al. 2013). During this time, Vandhoo & Kottefaru is recognised as the second most important feeding area for Reef Manta Rays in Raa Atoll representing 38% from a total of 953 sightings (IDtheManta unpubl. data 2007–2023).



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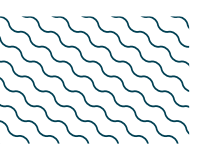
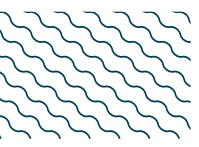
QUALIFYING SPECIES

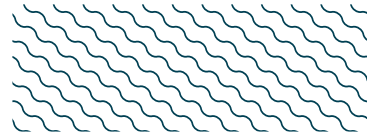
Scientific Name	Common Name	IUCN Red List Category	Global Depth Range (m)	ISRA Criteria/Sub-criteria Met									
				A	B	C1	C2	C3	C4	C5	D1	D2	
RAYS													
<i>Mobula alfredi</i>	Reef Manta Ray	VU	0-711	X		X	X						

SUPPORTING SPECIES

Scientific Name	Common Name	IUCN Red List Category
SHARKS		
<i>Carcharhinus 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
<i>Aetomylaeus vespertilio</i>	Ornate Eagle Ray	EN
<i>Taeniurops meyeri</i>	Blotched Fantail Ray	VU
<i>Urogymnus granulatus</i>	Mangrove 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.

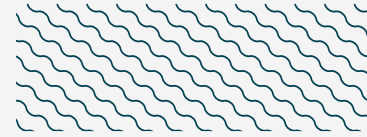




SUPPORTING INFORMATION

There are additional indications that this area is important for aggregations of one shark species.

The area may hold regular aggregations of resting Grey Reef Sharks, based on visual observations, local ecological knowledge, and data from diving surveys (J Haines pers. obs. 2019–2022). Aggregations of up to ten Grey Reef Sharks are observed holding their position passively in the ocean current at the shallow (10–20 m) pinnacle reefs in the area. This behaviour has been observed in most of the logged dives (~1,000 sightings). Research shows that they may be aggregating in the warmer water in this area to thermoregulate (Bernal & Lowe 2015). These sightings are regular and may occur all-year round; however, surveys in this area were limited to July through November. Further information is needed to confirm the nature and importance of this area for this shark species.



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