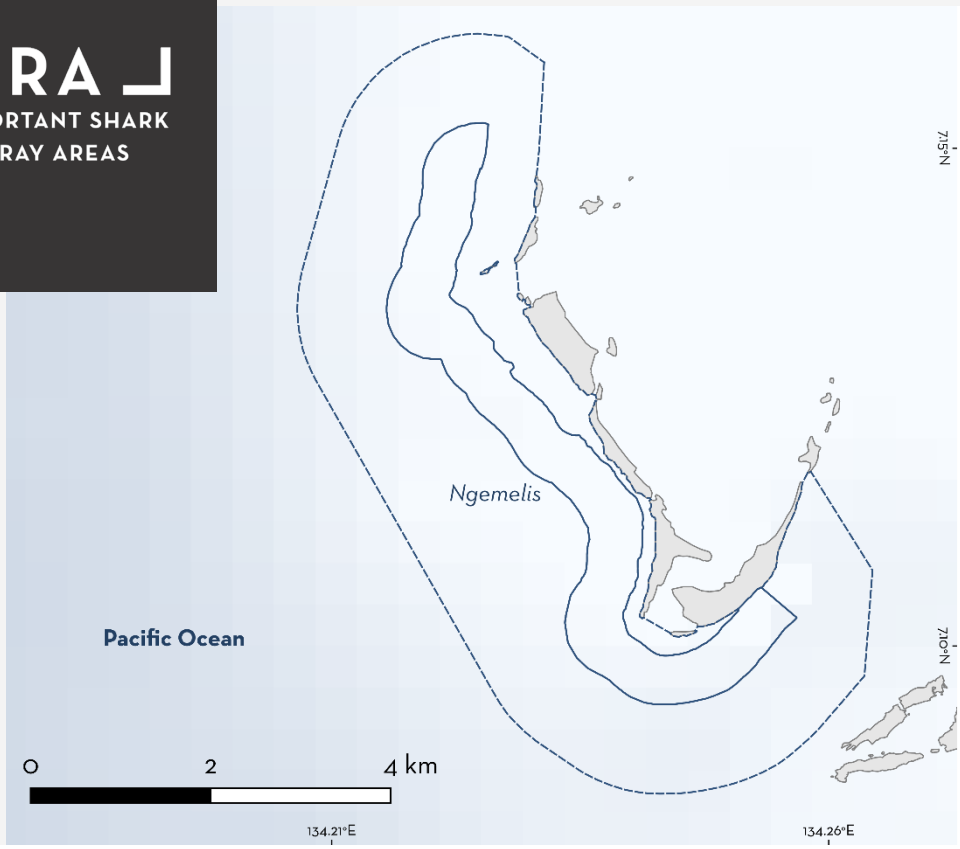
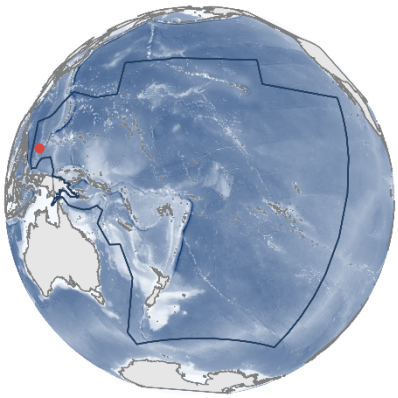
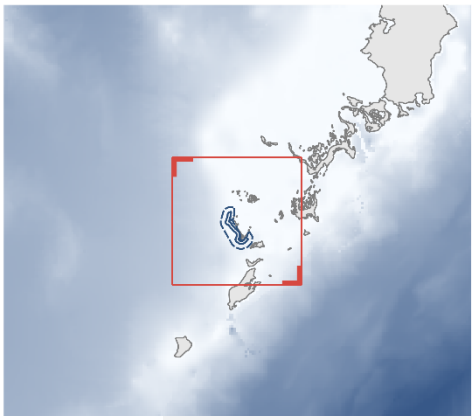
ISRA
IMPORTANT SHARK AND RAY AREAS







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

NGEMELIS ISRA

New Zealand & Pacific Islands Region

PALAU

0–330 metres

5.44 km²

SUMMARY

Ngemelis is located in Koror, Palau. The area is a vertical reef wall off Ngemelis Island that encompasses the dive sites known as 'Blue Corner', 'Blue Holes', 'Big Drop Off', 'New Drop Off', and 'Turtle Wall'. The reef in this area is covered with small gorgonians and lush formations of purple soft corals. Within this area there are: **threatened species** (e.g., Whitetip Reef Shark *Triaenodon obesus*); **reproductive areas** (Grey Reef Shark *Carcharhinus amblyrhynchos*); **feeding areas** (Grey Reef Shark); **resting areas** (Whitetip Reef Shark); and **undefined aggregations** (e.g., Grey Reef Shark).

CRITERIA

Criterion A – Vulnerability; Sub-criterion C1 – Reproductive Areas; Sub-criterion C2 – Feeding Areas; Sub-criterion C3 – Resting Areas; Sub-criterion C5 – Undefined Aggregations

DESCRIPTION OF HABITAT

Ngemelis is located in Koror, Palau. The area is a vertical reef wall off Ngemelis Island that encompasses the dive sites known as 'Blue Corner', 'Blue Holes', 'Big Drop Off', 'New Drop Off', and 'Turtle Wall'. The reef in this area is covered with small gorgonians and lush formations of purple soft corals. The wall drops from 10–330 m and is covered with a variety of giant gorgonian sea fans, hard corals, and soft corals (Harel-Bornovski & Bornovski 2015). The eastern part of the plateau consists of sandy substrates, scattered with large coral heads and rocks. The flat coral plateau on the west drops gently from 10–20 m with colonies of cabbage corals as well as many varieties of hard and soft corals (Harel-Bornovski & Bornovski 2015). During the incoming tide, clear water coming from the open ocean brings increased visibility along the reefs, channels, and inside the lagoon. The current that runs along the western reefs of Palau turns at 'Blue Corner', and hits the reef wall, flowing up and over the plateau creating an area with current and turbulence, and brings an abundance of plankton and algae, which attract large fishes (Colin 2009). Within this area, there are caverns in the reef face with many species normally found in deeper water (Colin 2009). Water temperature ranges from ~24 ºC between January–March to ~29 ºC throughout the rest of the year (Vianna et al. 2013).

This Important Shark and Ray Area is benthic and pelagic and is delineated from surface waters (0 m) to 330 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 Endangered Grey Reef Shark (Simpfendorfer et al. 2020a) and the Vulnerable Whitetip Reef Shark (Simpfendorfer et al. 2020b).

SUB-CRITERION C1 – REPRODUCTIVE AREAS

Ngemelis is an important reproductive area for one shark species.

Between 2009–2024, 3–20 mature female Grey Reef Sharks with fresh mating scars were observed during 80% of dives in the area between December–April at 'Blue Corner'. This site is visited 4–5 times a week and these records represent ~25% of larger aggregations, although some aggregations have been observed as late as July (T Harel-Bornovski pers. obs. 2009–2024). Males are mostly recorded in the area during the austral summer, when the water temperature is lower, suggesting that mating likely occurs during this period (T Harel-Bornovski pers. obs. 2024). Additionally, mating has been recorded within the area in November (n = 1, 2016), February and March (n = 1, 2009 and n = 2, 2012; T Harel-Bornovski unpub. data 2012). At 'New Drop Off' (visited twice per week), 5–8 neonate/young-of-the-year (YOY) Grey Reef Sharks are observed on 60% of the year-round dives (T Harel-Bornovski pers. obs. 2009–2024; J Alpert pers. obs. 2013–2024). Visual estimates of their total length (TL) ranged between 60–80 cm (T Harel-Bornovski pers. obs. 2009–2024). The size-at-birth of this species is 45–60 cm TL (Ebert et al. 2021), indicating that most were YOY.

SUB-CRITERION C2 – FEEDING AREAS

Ngemelis is an important feeding area for one shark species.

Aggregations of ~100–200 Grey Reef Sharks were observed up north in the area, at 'Blue Corner', feeding on Moorish Idol *Zanclus cornutus*, Bignose Unicornfish *Naso vlamengii*, and Blackstreak Surgeonfish *Acanthurus nigricauda* spawning aggregations during six aggregation periods (January 2009, December 2009–February 2010, December 2011–January 2012, January 2015, January 2016, and December 2016–January 2017) (Etpison & Colin 2018). Aggregations of Moorish Idols are seen at 'Blue Corner' for roughly six days around the first quarter moon (a period of neap tides with high water occurring at midday). The school moving up and down the reef is often trailed by Grey Reef Sharks (Etpison & Colin 2018). As the tide rises towards high water, animals attempt to separate individuals or small groups of Moorish Idols from the school (Etpison & Colin 2018).

The Blackstreak Surgeonfish has also been observed in large mixed aggregating schools to spawn on days from first quarter to full moon in October and November, spawning high in the water column and are also pursued by Grey Reef Sharks and other reef predators (Etpison & Colin 2018).

When spawning and shark predation are high during December–January, the fish often do not aggregate and spawn in February–March, suggesting a critical mass needed to spawn is no longer present. In other years if aggregation and/or spawning does not start until January, it can continue into March (Etpison & Colin 2018). In the days following spawning, most sharks disperse and are not seen at the sites in high numbers, indicating that the largest concentration of animals is when they gather specifically to target the spawning (Etpison & Colin 2018).

SUB-CRITERION C3 – RESTING AREAS

Ngemelis is an important resting area for one shark species.

This area is regularly visited by recreational divers (2–5 times a week year-round). Whitetip Reef Sharks regularly aggregate in this area and are predictably observed resting ~0.5 m apart from each other on the plateau, or inside caves and crevices in the reef wall. Resting Whitetip Reef Sharks are observed in groups of 2–10 individuals, mostly between 15–35 m depth (T Harel-Bornowski pers. obs. 2009–2024). Resting during the day is typical of this primarily nocturnal hunter (Randall 1977). This is one of three areas in Palau where Whitetip Reef Sharks can be seen regularly and predictably resting in groups. Ngemelis is the only area where they are seen resting in groups inside caves and reef substrates, while in the Ulong and Ngemelis Channel areas, Whitetip Reef Sharks are mostly seen resting on the sandy substrate (T Harel-Bornowski pers. obs. 2009–2024).

SUB-CRITERION C5 – UNDEFINED AGGREGATIONS

Ngemelis is an important area for undefined aggregations of two shark species.

Based on local ecological knowledge, dive surveys, and acoustic tagging, Grey Reef Sharks and Whitetip Reef Sharks regularly aggregate in the area. Ngemelis is regularly visited by recreational divers (2–5 times a week), and Grey Reef Sharks are regularly and predictably observed forming aggregations of 10–80 individuals, sometimes with jaws open to be cleaned, mostly at depths between 15–35 m (T Harel-Bornowski pers. obs. 2024).

Passive acoustic telemetry was used to monitor the occurrence of resident Grey Reef Sharks in the area. An array of five acoustic receivers monitored sharks tagged with acoustic transmitters from November 2008–December 2012. The receivers were deployed between 25–40 m depth on the barrier reef drop-off or slope, and recorded the presence of tagged sharks within 200 m of the receiver location (Siaes Corner, Ulong Channel, Ulong Sand Bar, Blue Corner, and New Dropoff). A total of 39 Grey Reef Sharks were tagged during November 2008 (n = 8), May 2009 (n = 18), and

March 2011 (n = 13) (Vianna et al. 2013). Thirty-seven sharks were monitored for an average of 594 days (370 SE) of which 49% were detected only within the area, and 56% (n = 10) were detected both at 'Blue Corner' and 'New Drop Off', indicating that Grey Reef Sharks aggregate in the larger area encompassing the dive sites (Vianna et al. 2013). A 12-hour peak detection frequency for almost all (88%) of the sharks also supports that Grey Reef Sharks are aggregating within the area (Vianna et al. 2013).

Between 2007–2012, 62 dive guides recorded counts of individual sharks sighted across 2,360 dives at 52 dive sites in Palau (Vianna et al. 2014). The total number of dives at 'Blue Corner' was 388. Grey Reef Sharks were seen year-round on 86% of dives and the mean daily relative abundance (mean value of all dives on a given day at the same site) was 12.4 (range 1–60, 0.5 SE) (Vianna et al. 2014).

Aggregations of Whitetip Reef Sharks are also observed mostly between 15–35 m depth. Although they are observed resting in larger groups, they are also observed swimming in the current at the edge of the wall in groups of 3–6 individuals (T Harel- Bornovski pers. obs. 2009-2024). Whitetip Reef Sharks were also seen on 86% of dives undertaken between 2007–2012, with a mean daily relative abundance of 7.7 (range 1–40, 0.3 SE) (Vianna et al. 2014). Although the behaviour of sharks was not noted in the report, the records supports the number of individuals that are seen aggregating in the area.

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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												
Carcharhinus amblyrhynchos	Grey Reef Shark	EN	0–280	X		X	X			X		
Triaenodon obesus	Whitetip Reef Shark	VU	0–330	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
RAYS		
Aetobatus ocellatus	Spotted Eagle Ray	EN
Pastinachus ater	Broad Cowtail Ray	VU
Taeniurops meyeni	Blotched Fantail Ray	VU

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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