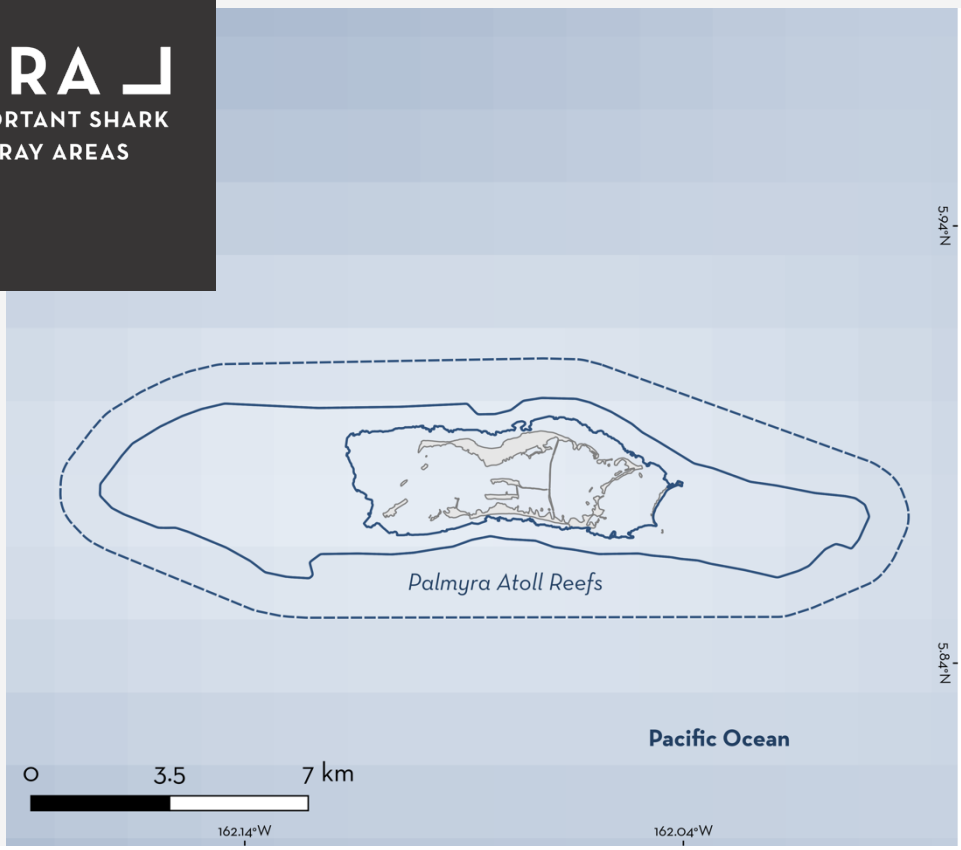
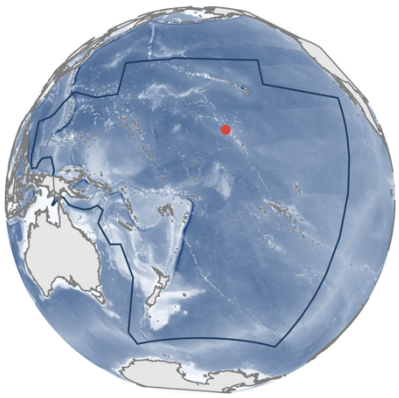
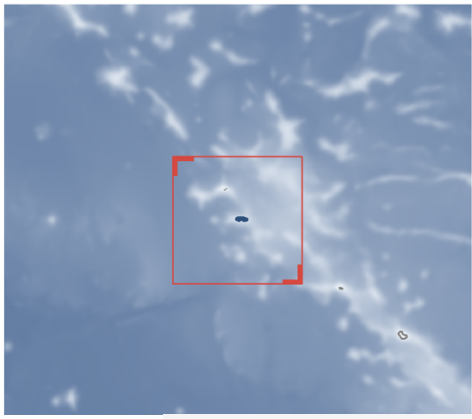
ISRA
IMPORTANT SHARK AND RAY AREAS







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

PALMYRA ATOLL REEFS ISRA

New Zealand & Pacific Islands Region

PALMYRA ATOLL

0–80 metres

40.13 km²

SUMMARY

Palmyra Atoll Reefs is located in the northernmost of the Line Islands in the northern-central Pacific Ocean. This area is remote and uninhabited, situated ~1,700 km south of Hawaii. It is characterised by two basic marine habitat types: steep forereefs with high coral cover which lead to pelagic waters, and shallower backreefs with high coral cover. This area overlaps with a Ecologically or Biologically Significant Marine Area and two Key Biodiversity Areas. It is part of the Pacific Remote Islands Marine National Monument of the United States of America. Within this area there are: **threatened species** (e.g., Grey Reef Shark *Carcharhinus amblyrhynchos*) and **undefined aggregations** (e.g., Blacktip Reef Shark *Carcharhinus melanopterus*).

CRITERIA

Criterion A – Vulnerability; Sub-criterion C5 – Undefined Aggregations

DESCRIPTION OF HABITAT

Palmyra Atoll Reefs is located in the northern end of the Line Island chain, ~1,700 km south of Hawaii in the northern-central Pacific Ocean. This remote, historically uninhabited area consists of two marine habitat types: steep forereefs with high coral cover, low rugosity, and a steep slope leading to pelagic ecosystems; and shallower backreefs of 2–3 m depth, with clear water and high coral rugosity (Sabando et al. 2020). Sea surface temperature is on average 27.9°C, and the area has a coral coverage of 20.4% (Sandin et al. 2008). The oceanic primary productivity ranges between 147–445 mg $C\text{-}m^{-2}$ $\text{-}day^{-1}$ which represents one of the highest compared to other areas in the central-western Pacific (Nadon et al. 2012). Due to Palmyra's location in the Inter-tropical Convergence Zone, the atoll receives up to 500 cm of rainfall per year (Papastamatiou et al. 2009).

This area is located in the Central Pacific high productivity zone, a large-scale oceanographic feature, comprising the western extent of flow from the Pacific south equatorial current. This westerly flowing cool upwelling tongue of water brings high nutrients to the surface waters of the central Pacific Ocean supporting high primary production (CBD 2024).

This area partly overlaps with the Equatorial High-Productivity Zone Ecologically or Biologically Significant Marine Area (EBSA; CBD 2024). This area overlaps with two Key Biodiversity Areas (KBA): Palmyra Atoll Marine (KBA 2024a) and Proposed Central Pacific World Heritage Site (KBA 2024b). It is part of the Pacific Remote Islands Marine National Monument of the United States of America.

This Important Shark and Ray Area is benthopelagic and is delineated from inshore and surface waters (0 m) to 80 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), the Vulnerable Blacktip Reef Shark (Simpfendorfer et al. 2020b).

SUB-CRITERION C5 – UNDEFINED AGGREGATIONS

Palmyra Atoll Reefs is an important undefined aggregation area for two shark species.

This area has a significantly higher biomass of reef sharks (i.e., Grey Reef Shark, Blacktip Reef Shark, and Whitetip Reef Shark) than neighbouring islands in the central and southwestern Pacific Ocean (Stevenson et al. 2007; Sandin et al. 2008; Nadon et al. 2012).

Between 2004–2010, reef sharks were recorded biennially around 46 US islands, atolls, and banks (e.g., Mariana, Hawaii, American Samoa, Wake, Phoenix, Jarvis, Johnston, and Line Islands) on surveys (divers towed behind a boat) that each covered >0.01 km^2 on forereefs at 15–20 m of depth (Nadon et al. 2012). Sites were grouped in 15 locations according to their geographic proximity. Line Islands, where this area is located, had the third highest abundance for all reef sharks (Line Islands = 4.5 individuals/0.01 km^2; Palmyra atoll = 3.4 individuals/0.01 km^2) and the third rank for Grey Reef Sharks and Whitetip Reef Sharks. Line Islands also had the second highest abundance of Blacktip Reef Shark among the 15 locations. The study suggested that the overall abundance of reef sharks is

similar to the expected baseline shark density given no humans within 200 km. So, these shark populations are considered to be at their likely carrying capacity (Bradley et al. 2017b).

Between 2003–2005, three studies compared reef shark abundance, mainly Grey Reef Sharks, in the Line Islands (i.e., Christmas and Fanning islands, Kingman, Tabuaeran, and Kiritimati atolls) using belt-transect dive surveys at shallow depths (2–12 m) (Stevenson et al. 2007; DeMartini et al. 2008; Sandin et al. 2008). These studies demonstrated that this area had the highest abundance of reef sharks. One of these studies reported that top predators dominated the unpopulated Palmyra Atoll, where sharks represented 57% of top predator biomass, compared with the populated atolls of Tabuaeran and Kiritimati (Sandin et al. 2008). Grey Reef Sharks were the most abundant shark species on Palmyra, followed by Blacktip Reef Sharks and Whitetip Reef Sharks (DeMartini et al. 2008; McCauley et al. 2012; Nadon et al. 2012).

Between 2004–2014, baited remote underwater video station (BRUVS) surveys (n = 47) were deployed at the forereef, backreef and lagoon environments and MaxN (the maximum number of individuals of a species observed in a single frame) was determined (Papastamatiou et al. 2018a). The highest MaxN was four for the Grey Reef Sharks, at the forereef, and five for the Blacktip Reef Sharks, at the forereef and backreef.

The Grey Reef Shark is a highly social species, reported in aggregations in this area (Papastamatiou et al. 2018b, 2020). From October 2006 to October 2014, 1,399 Grey Reef Sharks were captured using hand lines in the forereef, backreef, lagoon, and channel habitats on Palmyra Atoll. Most were adults, with females measuring 146 cm total length (TL) and males measuring 139 cm TL (Bradley et al. 2017a). The size class mode was 141–160 cm TL for both females and males. Females mature at 120–142 cm TL, and males mature at 130–145 cm TL (Ebert et al. 2021). Between 2004–2010, density estimates of Grey Reef Sharks in this area ranged from ~200 sharks/km^2 (Nadon et al. 2012; McCauley et al. 2012) to >1,000 sharks/km^2 (Nadon et al. 2012). Observations were recorded from stationary point counts, belt transects, video surveys, and towed-diver surveys.

From October 2006 to October 2014, 1,356 Grey Reef Sharks were captured over 88 days of fishing in this area (Bradley et al. 2017b). Of these, 389 individuals were recaptured during unique sampling periods. Grey Reef Sharks (n = 37) were acoustically tagged in 2010–2012 and tracked through August 2015 (Bradley et al. 2017b). Grey Reef Shark adult and sub-adult density was 21.3 sharks/km^2 (95% CI = 17.8–24.7), and total population abundance was 8,344 individuals (95% CI = 6,977–9,698). Density hotspots were located on the eastern and western forereefs, with shark densities up to an order of magnitude lower on the north and south forereefs, on the backreefs, and within the lagoons. Sharks used core areas that were highly stable over several years (Papastamatiou et al. 2018a, b). The unfished shark population was also stable over time; there were no significant differences in Grey Reef Shark abundance or density throughout the study period (Bradley et al. 2017b).

This area has one of the highest densities of Blacktip Reef Sharks in the central-western Pacific Ocean with animals regularly observed together (Stevenson et al. 2007; Sandin et al. 2008; Nadon et al. 2012). Line Islands had the second highest abundance for Blacktip Reef Shark among 15 locations surveyed (Nadon et al. 2012). Furthermore, in another survey, the average density of Blacktip Reef Sharks on the forereef of Palmyra was measured as 2.3 sharks per 0.01 km^2 (SE = ± 0.8) (McCauley et al. 2010). Regular observations of mating behavior and reproductive scars of Blacktip Reef Sharks have been recorded in this area. In October 2007, at the northern forereef of Palmyra Atoll at a depth of 5–20 m, a Blacktip Reef Shark mating event was recorded (McCauley et al. 2010). This was characterised by seven males following a single female, a male grabbing the female near the pectoral fin and positioning her head down on the bottom and copulating (McCauley et al. 2010). During sampling for a concurrent population study of Blacktip Reef Sharks, it was reported that many female sharks were caught with large amounts of scarring, generally concentrated on the anterior

body flank and pectoral fins. This suggests that mating is frequent in this area; however, further information is needed to confirm this and determine whether these aggregations are for reproductive purposes.

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Yannis Papastamatiou (Florida International University) and Adriana Gonzalez Pestana (IUCN SSC Shark Specialist Group – ISRA Project) contributed and consolidated information included in this factsheet. We thank all participants of the 2024 ISRA Region 10 – New Zealand and Pacific Islands workshop for their contributions to this process.

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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		
Carcharhinus melanopterus	Blacktip Reef Shark	VU	0–100	X						X		

SUPPORTING SPECIES

Scientific Name	Common Name	IUCN Red List Category
SHARKS		
Carcharhinus galapagensis	Galapagos Shark	LC
Galeocerdo cuvier	Tiger Shark	NT
Negaprion acutidens	Sharptooth Lemon Shark	EN
Sphyrna lewini	Scalloped Hammerhead	CR
Triaenodon obesus	Whitetip Reef Shark	VU
RAYS		
Aetobatus ocellatus	Spotted Eagle Ray	EN
Mobula alfredi	Reef Manta 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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