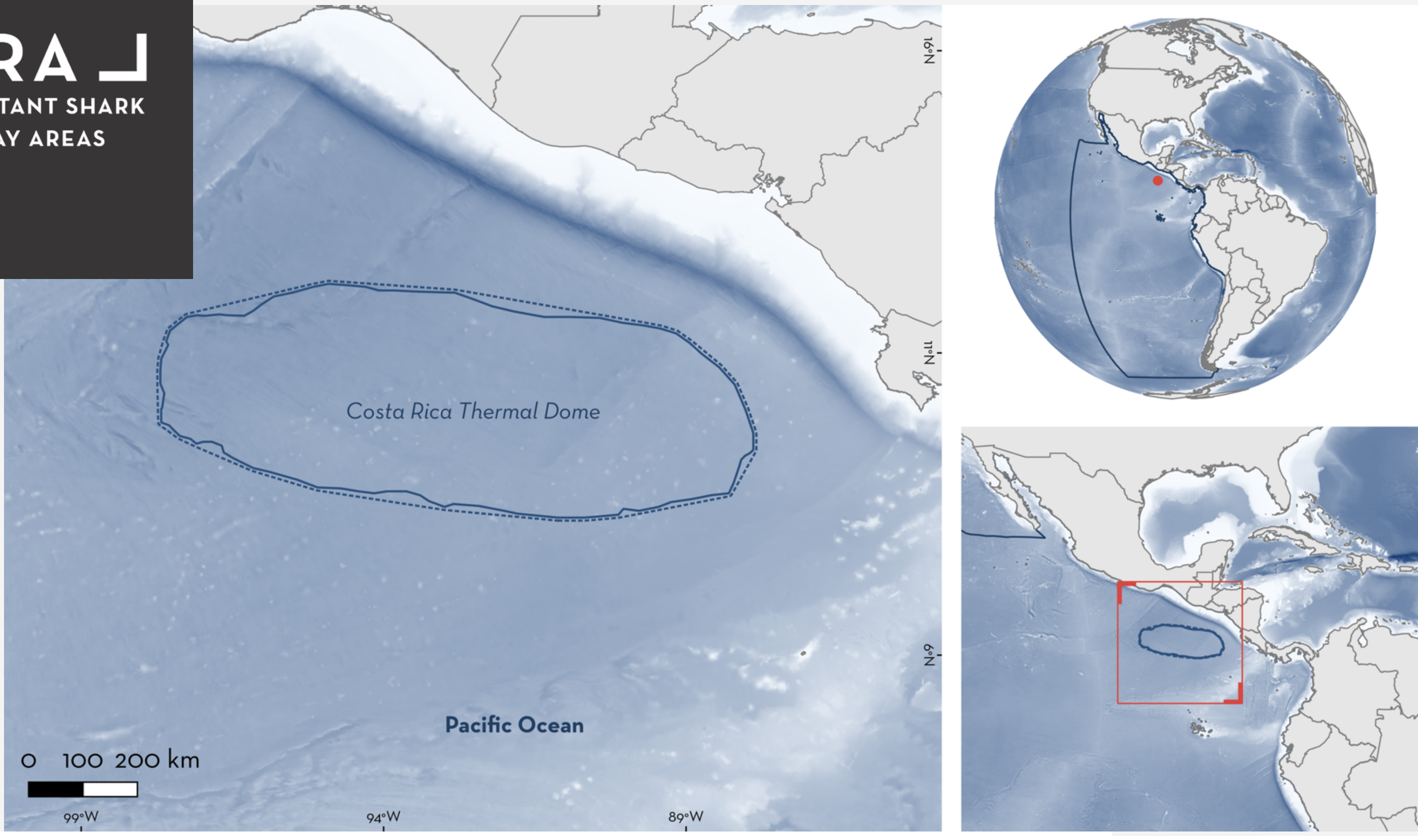
ISRA
IMPORTANT SHARK AND RAY AREAS



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

COSTA RICA THERMAL DOME ISRA

Central and South American Pacific Region

SUMMARY

Costa Rica Thermal Dome is located in the Eastern Tropical Pacific covering part of Costa Rica, Nicaragua, El Salvador, Guatemala, and Areas Beyond National Jurisdiction (ABNJ). This area overlaps with the Papagayo Ecological or Biological Significant Marine Area. It includes a productive and oceanographically dynamic offshore upwelling system and plays an important role as a significant carbon sink with a high concentration of nutrients. Within this area there are: **threatened species** (e.g., Munk's Pygmy Devil Ray *Mobula munkiana*); **feeding areas** (e.g., Spinetail Devil Ray *Mobula mobular*); and **undefined aggregations** (Silky Shark *Carcharhinus falciformis*).

CRITERIA

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

COSTA RICA
NICARAGUA
EL SALVADOR
GUATEMALA
ABNJ

0–500 metres

379,118 km²

sharkrayareas.org

DESCRIPTION OF HABITAT

Costa Rica Thermal Dome is located in the Eastern Tropical Pacific encompassing parts of the Exclusive Economic Zones of Costa Rica, Nicaragua, El Salvador, and Guatemala as well as Areas Beyond National Jurisdiction (ABNJ). Situated within the Pacific Central-American Large Marine Ecosystem and its adjacent oceanic waters, the Dome is a non-static, dynamic, seasonal, and predictable oceanographic feature created by ocean currents and winds which draw deeper nutrient-rich waters towards the surface (Fielder 2002).

The Costa Rica Thermal Dome is generated mainly by the proximity to the surface of the Northern Equatorial Counter Current flank, as well as by seasonal changes in interconnected phenomena: coastal wind jets, eddies, the Intertropical Convergence Zone, the geostrophic balance, and the upwelling of the thermocline close to 10°N. In some years, the Dome is closer to the coast and in others is further offshore. Unlike other upwellings, the Dome is unique because it is formed by a coastal wind jet from the Gulf of Papagayo in Nicaragua and Costa Rica (Ross Salazar et al. 2019). This generates an area of high primary productivity, which maintains a diverse, complex food web.

This Important Shark and Ray Area is delineated according to the area in which the Dome persisted in the month of September over a period of 30 years (1980–2009); this boundary was refined to its persistence between 11 and 15 years (Ross Salazar et al. 2019). It is delineated from surface waters (0 m) to a depth of 500 m based on the habitat used by the Qualifying Species.

ISRA CRITERIA

CRITERION A – VULNERABILITY

Six Qualifying Species considered threatened with extinction according to the IUCN Red List of Threatened Species™ regularly occur in the area. Threatened sharks comprise one Vulnerable species; threatened rays comprise four Endangered and one Vulnerable species (IUCN 2022).

SUB-CRITERION C2 – FEEDING AREAS

Costa Rica Thermal Dome is an important feeding area for five ray species: Oceanic Manta Ray, Spinetail Devil Ray, Munk's Pygmy Devil Ray, Sicklefin Devil Ray, and Bentfin Devil Ray.

The spatial distribution of devil rays (*Mobula* spp.) in the eastern Pacific Ocean can be explained by variable environmental conditions such as highly productive upwelling zones and prey availability (Crol et al. 2012; Lezama-Ochoa et al. 2019a). Preliminary observations point to a strong association of devil rays to oceanographic conditions of high productivity, such as those found in the Costa Rica Thermal Dome (Hall & Roman 2013; Lezama-Ochoa et al. 2019a, 2019b).

During boreal summer (July-August), this area is an oceanic centre of production as the Costa Rica Thermal Dome is a mesoscale structure with high productivity (Hall and Roman 2013; Lezama-Ochoa et al. 2019a, 2019b). The upwelling systems in this area act as a hotspot for the regular and predictable presence of devil rays (Lezama-Ochoa et al. 2019a, 2019b). Chlorophyll concentration (0.5–1mg/m^{-3}) has been suggested to be an important variable for their presence indicating a direct relationship with productive upwelling systems. Devil ray catches in this area were concentrated to areas of high productivity and prey density, suggesting a direct relation to food availability (Lezama-Ochoa 2019b).

SUB-CRITERION C5 – UNDEFINED AGGREGATIONS

Costa Rica Thermal Dome is an important area for Silky Shark aggregations. Juvenile Silky Sharks aggregate around drifting fish aggregating devices (FADs) (Filmalter et al. 2017). These devices are commonly used within commercial purse seine fisheries in the Eastern Tropical Pacific (Hall 1998). Silky Shark is the main shark species caught as bycatch in these fisheries. The highest abundance and frequency of Silky Sharks are from within the Costa Rica Thermal Dome. Between 1994–2009, the highest proportion of Silky Sharks caught in this area were juveniles and was associated with floating objects. The observation of juvenile Silky Sharks aggregating around floating objects is predictable behaviour and denotes their susceptibility to being caught in large numbers around FADs deployed in purse seine fisheries (Filmalter et al. 2015, 2017; Hall & Roman 2013). Although aggregation size cannot be extracted from these fisheries data, it is the tendency of Silky Sharks to aggregate which attributes to their regular high bycatch rate in this area. The purpose of these aggregations is unknown.

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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 falciformis	Silky Shark	VU	0–500	X						X		
RAYS												
Mobula birostris	Oceanic Manta Ray	EN	0–1,000	X			X					
Mobula mobular	Spinetail Devil Ray	EN	0–1,112	X			X					
Mobula munkiana	Munk's Pygmy Devil Ray	VU	0–30	X			X					
Mobula tarapacana	Sicklefin Devil Ray	EN	0–1,896	X			X					
Mobula thurstoni	Bentfin Devil Ray	EN	0–100	X			X					

SUPPORTING SPECIES

Scientific Name	Common Name	IUCN Red List Category
SHARKS		
Alopias pelagicus	Pelagic Thresher	EN
Alopias superciliosus	Bigeye Thresher	VU
Alopias vulpinus	Common Thresher	VU
Carcharhinus longimanus	Oceanic Whitetip Shark	CR
Isurus oxyrinchus	Shortfin Mako	EN
Isurus paucus	Longfin Mako	EN
Prionace glauca	Blue Shark	NT
Rhincodon typus	Whale Shark	EN
Sphyrna lewini	Scalloped Hammerhead	CR
Sphyrna zygaena	Smooth Hammerhead	VU
RAYS		
Pteroplatytrygon violacea	Pelagic Stingray	LC

IUCN Red List categories: *CR, Critically Endangered; EN, Endangered; VU, Vulnerable; NT, Near Threatened; LC, Least Concern; DD, Data Deficient.*

SUPPORTING INFORMATION

There are additional indications that Silky Sharks may be using this area for reproductive purposes. According to fishing-dependent data (mainly data from the Inter-American Tropical Tuna Commission; IATTC) immature animals are also regularly caught from tropical tuna purse seine fisheries in the Pacific Ocean (Román 2014) and comprise a large proportion of the total shark bycatch (Hall & Roman 2013). Juveniles were tagged during a 2005 longline research cruise and animals were found to utilise almost exclusively the upper, warmest surface mixed layer of the water column. This distribution overlapped with the ecological niche of tropical tuna species (Hutchinson et al. 2019).

There are several other shark species (Scalloped Hammerhead, Smooth Hammerhead, Pelagic Thresher, Bigeye Thresher, Shortfin Mako, Longfin Mako, Whale Shark, and Pelagic Stingray) that are caught in this area. These species are frequently caught in high numbers in purse seine fisheries that operate within Costa Rica Thermal Dome. Some of these species also have an affinity to aggregate around floating objects and are susceptible to capture in these fisheries (Hall & Roman 2013; Clarke et al. 2015). Although capture quantities are declining per set for most of these species (Hall & Roman 2013), this is likely more a reflection of the overarching population declines of these species, rather than the cessation of the behaviour to aggregate around these floating objects. Further research is required to monitor the regularity and predictability of aggregations of these species in this area, or any other habitat use.

Devil rays are likely also aggregating within this area. Fisheries data collected through the IATTC fisheries observer program (1993–2014) on large purse-seine vessels indicate that devil rays are caught in every single set, in large numbers of individuals. Specifically, large catches of Oceanic Manta Rays are observed in the Costa Rica Thermal Dome in August (167 individuals per set) (Lezama-Ochoa et al. 2019a).

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