

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

## GOLFO DULCE ISRA

### Central and South American Pacific Region

#### SUMMARY

Golfo Dulce is a large tropical inlet located on the southern Pacific coast of Costa Rica. It encompasses an area that is approximately 50 km in length and 10–15 km wide with an effective sill of about 60 m at the entrance to the gulf. The inner basin area is deep (to 215 m) with an anoxic bottom, whereas the coastline has a shallow platform surrounded by diverse habitats including rainforest, mangroves, sandy beaches, soft-mud bottoms, seagrasses, and coral reefs. Local geomorphological features make this area one of the few low-circulation tropical systems known globally. Within this area there are: **threatened species** (e.g., Whale Shark *Rhincodon typus*); **reproductive areas** (Scalloped Hammerhead *Sphyrna lewini*); **feeding areas** (Whale Shark); and an area important for **movements** to offshore areas (Scalloped Hammerhead).

#### CRITERIA

**Criterion A - Vulnerability; Sub-criterion C1 - Reproductive Areas; Sub-criterion C2 - Feeding Areas; Sub-criterion C4 - Movement**

COSTA RICA

0-30 metres

388 km<sup>2</sup>





## DESCRIPTION OF HABITAT

Golfo Dulce is a relatively large tropical inlet (700 km<sup>2</sup>) located on the southern Pacific coast of Costa Rica, in the province of Puntarenas. Situated in the Pacific Central-American Coastal Large Marine Ecosystem, the inlet is approximately 50 km in length, and 10–15 km wide with an effective sill of about 60 m at the entrance to the gulf (Dean 1996; León-Morales & Vargas 1998; Quirós 2003). The inner basin has a deep (to 215 m) and anoxic bottom, whereas the coastline has a shallow platform surrounded by diverse habitats including rainforest, mangroves, sandy beaches, soft-mud bottoms, seagrasses, and coral reefs (Svendsen et al. 2006). Golfo Dulce is a sheltered embayment with high productivity around its entrance, as tidal forces and riverine inputs increase nutrient levels (Lei 2002). This facilitates a high abundance of small fishes and plankton (Dean 1996). The gulf has special geomorphological features, which make it one of the few low-circulation systems described for tropical areas of the world.

This Important Shark and Ray Area is delineated from surface waters to a depth of 30 m based on the maximum depth range of the habitat used by the Qualifying Species.

## ISRA CRITERIA

### CRITERION A – VULNERABILITY

There are two Qualifying Species considered threatened with extinction according to the IUCN Red List of Threatened Species™. These are the Critically Endangered Scalloped Hammerhead and the Endangered Whale Shark (Pierce and Norman 2016; Rigby et al. 2019).

### SUB-CRITERION C1 – REPRODUCTIVE AREAS

Golfo Dulce is an important reproductive area for one shark species. Artisanal fisher catch indicates that young-of-the-year and juvenile Scalloped Hammerheads (mean 74.3 ± 17.4 cm total length [TL]) are regularly caught in this area. Of 152 individuals observed in landings over a 1-year period, 48% were newborn (based on the presence of open umbilical scars and the size of animals) (Zanella & López-Garro 2015). The remaining 52% were considered juveniles based on clasper calcification and known size-at-maturity.

Seasonal variability was documented between July and August where landed Scalloped Hammerheads had the smallest mean size of 64 cm TL, with a high relative catch-per-unit-effort (CPUE) of 0.0075 (Zanella & López-Garro 2015). The use of Golfo Dulce area as a nursery is supported by the tagging of juveniles (87–102 cm TL) that were detected for up to 372 days (average of 245 days) (Zanella et al. 2019). These results indicate that there is high residency of Scalloped Hammerheads for at least one month (directly after tagging) with presence of up to a year. Data also suggest that Golfo Dulce is used across multiple years and this area facilitates the recruitment of juvenile Scalloped Hammerheads into adult populations by connecting the juvenile habitat in Golfo Dulce to the wider Eastern Tropical Pacific (Zanella et al. 2019).

### SUB-CRITERION C2 – FEEDING AREAS

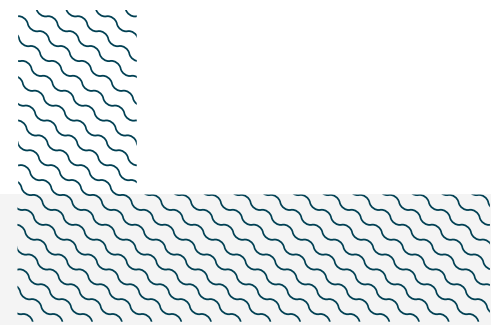
Golfo Dulce is an important feeding area for one shark species. Whale Shark feeding aggregations in groups of various sizes (up to 13 individuals per sighting) have been documented. These were recorded close to the Rincón and Tigre rivers on the northwestern coast of the inner basin, in



January 2009, August 2009, March 2012, and January 2013. Whale Sharks were observed aggregating around copepods which are known to persist as a result of important nutrients sourced within the Rincón and Tigre rivers (Pacheco-Polanco et al. 2015). This feeding behaviour has also been observed outside of Golfo Dulce (Heyman et al. 2001; Rowat et al. 2009; Motta et al. 2010).

## SUB-CRITERION C4 - MOVEMENT AREAS

Golfo Dulce is an important area for the movement of one shark species. Tagging data for 10 Scalloped Hammerheads between June 2011 and June 2012 indicate that juveniles in Golfo Dulce are connected to the offshore adult populations in the wider Eastern Tropical Pacific (Zanella et al. 2019). High residency of juveniles within one month of being tagged was documented. Residency then decreased exponentially and only remained high for eight consecutive months for two tagged individuals (Zanella et al. 2019).



---

### Acknowledgments

Ilena Zanella (Mision Tiburón; MigraMar), Mario Espinoza (CIMAR - Universidad de Costa Rica; MigraMar), Elpis J. Chávez (MigraMar), and Ryan Charles (IUCN SSC Shark Specialist Group - ISRA Project) contributed and consolidated information included in this factsheet. We thank all participants of the 2022 ISRA Region 12 - Central and South American Pacific workshop for their contributions to this process.

This factsheet has undergone review by the ISRA Independent Review Panel prior to its publication.

This project was funded by the Shark Conservation Fund, a philanthropic collaborative pooling expertise and resources to meet the threats facing the world's sharks and rays. The Shark Conservation Fund is a project of Rockefeller Philanthropy Advisors.

### Suggested citation

IUCN SSC Shark Specialist Group. 2023. Golfo Dulce ISRA Factsheet. Dubai: IUCN SSC Shark Specialist Group.

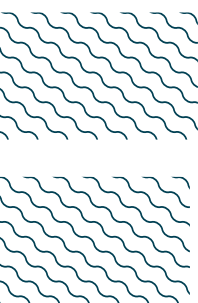
## QUALIFYING SPECIES

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>Rhincodon typus</i>	Whale Shark	EN	0-1,928	X			X						
<i>Sphyrna lewini</i>	Scalloped Hammerhead	CR	0-1,043	X		X			X				

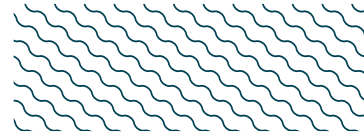
## SUPPORTING SPECIES

Scientific Name	Common Name	IUCN Red List Category
<b>SHARKS</b>		
<i>Carcharhinus limbatus</i>	Blacktip Shark	VU
<i>Galeocerdo cuvier</i>	Tiger Shark	NT
<i>Ginglymostoma unami</i>	Pacific Nurse Shark	EN
<i>Heterodontus mexicanus</i>	Mexican Hornshark	LC
<i>Mustelus lunulatus</i>	Sicklefin Smoothhound	LC
<i>Nasolamia velox</i>	Whitenose Shark	EN
<i>Rhizoprionodon longurio</i>	Pacific Sharpnose Shark	VU
<i>Sphyrna mokarran</i>	Great Hammerhead	CR
<i>Sphyrna tiburo</i>	Bonnethead Shark	EN
<b>RAYS</b>		
<i>Aetobatus laticeps</i>	Pacific Eagle Ray	EN
<i>Gymnura marmorata</i>	California Butterfly Ray	NT
<i>Hypanus longus</i>	Longtail Stingray	VU
<i>Pseudobatos leucorhynchus</i>	Whitesnout Guitarfish	VU
<i>Rhinoptera steindachneri</i>	Pacific Cownose Ray	NT
<i>Urotrygon chilensis</i>	Blotched Round Ray	NT

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



## SUPPORTING INFORMATION



There are indications that this area is important for juveniles of seven shark species and the movement of one shark species. Fishery-dependent and independent surveys, and ongoing telemetry data provide evidence that Blacktip Shark, Tiger Shark, Longtail Stingray, Sicklefins Smoothhound, Pacific Nurse Shark, Pacific Sharpnose Shark, and Great Hammerhead are using this area for reproductive purposes (López-Garro 2012; Zanella & López-Garro 2015a; Zanella & López-Garro 2015b; López-Garro & Zanella 2015; Rodríguez et al. unpubl. data). However, there is currently insufficient evidence to confirm the predictable and regular use of this area by these species.

Landing data from 60 individual Pacific Sharpnose Shark indicate a mean size of  $65.2 \pm 14.0$  cm TL (López-Garro & Zanella 2015b). These animals are smaller than their typical size-at-first-maturity (between 85–87 cm TL for females and 93 cm TL for males) (Márquez et al. 2005).

The mean size of Blacktip Sharks landed was  $76.7 \pm 4.4$  cm TL (López-Garro & Zanella 2015b) whereas the reported size-at-first-maturity is 120–190 cm TL in females, and 135–180 cm TL in males (Gaitán & López 2008).

Landing data on the Longtail Stingray from 30 artisanal fishery sites collected between May 2010 and May 2011 indicate that the mean disc width (DW) of 84 observed individuals was  $84.6 \pm 12.1$  cm DW (minimum = 60 cm DW; maximum = 199 cm DW; López-Garro & Zanella, 2015a; López-Garro & Zanella, 2015b). Considering the reported size-at-maturity within the Colombian Pacific (92 cm DW for males and 120 cm DW for females; López 2009), these data suggest this area is likely important for juveniles of this species. Some seasonal variability in the CPUE was reported and was highest in January–February (0.006 stingrays per hook per hour) and lowest in July–August (0.0004; López-Garro & Zanella 2015a).

The mean size of Great Hammerheads observed ( $74.3 \pm 17.4$  cm TL) indicated that within the proposed area (López-Garro & Zanella 2015b) there are landings of individuals below the size-at-first-maturity (Branstetter 1987; Anislado 2000).

Evidence from acoustic and satellite telemetry data suggest this area might be important for the movement connectivity of Whale Sharks (Pacheco-Polanco et al. 2015; Guzman et al. 2022; Zanella et al. unpubl. data).



## REFERENCES

**Anislado TV. 2000.** Ecología pesquera del tiburón martillo *Sphyrna lewini* (Griffith Y Smith, 1834), en el litoral del estado de Michoacán, México. Unpublished Master's Thesis, Universidad Nacional Autónoma de México, México.

**Dean H. 1996.** Polychaete worms (Annelida) collected in Golfo Dulce, during the victor Hensen Costa Rica expedition (1993/1994). *Revista de Biología Tropical* 44: 81-86.

**Heyman W, Graham RT, Kjerfve B, Johannes RE. 2001.** Whale shark *Rhincodon typus* aggregate to feed on fish spawn in Belize. *Marine Ecology Progress Series* 15: 275-282. <https://doi.org/10.3354/meps215275>

**Lei Z. 2002.** Marine coastal dynamics and primary production response in Golfo Dulce, Costa Rica: A multi-sensor satellite approach. Unpublished Master's Thesis, International Institute for Geoinformation Science and Earth Observation, Enschede, Netherlands.

**Léon-Morales R, Vargas JA. 1998.** Macroinfauna of a tropical fjord-like embayment: Golfo Dulce, Costa Rica. *Revista de Biología Tropical* 46: 81-90

**López J. 2009.** Aspectos biológicos de la raya látigo *Dasyatis longa* (Pisces: Dasyatidae) de la zona central del Pacífico colombiano (Trabajo de grado). Unpublished PhD Thesis, Universidad del Valle Facultad de Ciencias, Santiago de Cali, Colombia.

**López-Garro A, Zanella I. 2015.** Tiburones y rayas capturados por pesquerías artesanales con línea de fondo en el Golfo Dulce, Costa Rica. *Revista de Biología Tropical* 63: 183-198. <https://doi.org/10.15517/rbt.v63i1.23102>

**Motta PJ, Maslanka M, Hueter RE, Davis RL, Parra R, Mulvany SL, Habegger ML, Strother AA, Mara KR, Gardiner JM, Tyminski JP, Zeigler LD. 2010.** Feeding anatomy, filter-feeding rate, and diet of whale shark *Rhincodon typus* during surface ram filter feeding off Yucatan Peninsula, Mexico. *Zoology* 113: 199-212. <https://doi.org/10.1016/j.zool.2009.12.001>

**Pacheco-Polanco JD, Herra-Miranda D, Oviedo-Correa L, Quirós-Pereira W, Figgener C. 2015.** Whale shark, *Rhincodon typus* (Orectolobiformes: Rhincodontidae) feeding aggregations in Golfo Dulce, Osa Peninsula, Costa Rica. *Revista de Biología Tropical* 63: 299-306. <https://doi.org/10.15517/RBT.V63i1.23109>

**Pierce SJ, Norman B. 2016.** *Rhincodon typus*. *The IUCN Red List of Threatened Species* 2016: e.T19488A2365291. <https://dx.doi.org/10.2305/IUCN.UK.2016-1.RLTS.T19488A2365291.en>

**Quirós G. 2003.** Circulación del Golfo Dulce: un fiordo tropical. *Tópicos Meteorológicos y Oceanográficos* 10: 75-83.

**Rigby CL, Dulvy NK, Barreto R, Carlson J, Fernando D, Fordham S, Francis MP, Herman K, Jabado RW, Liu KM, Marshall A, Pacoureaux N, Romanov E, Sherley RB, Winker H. 2019.** *Sphyrna lewini*. *The IUCN Red List of Threatened Species* 2019: e.T39385A2918526.

**Rowat D, Speed CW, Meekan MG, Gore MA, Bradshaw CJ. 2009.** Population abundance and apparent survival of the vulnerable whale shark (*Rhincodon typus*) in the Seychelles aggregation. *The International Journal of Conservation* 43: 591-598. <https://doi.org/10.1017/S0030605309990408>

**Svendsen H, Rosland R, Myking S, Vargas J, Lizano O, Alfaro E. 2006.** A physical-oceanographic study of Golfo Dulce, Costa Rica. *Revista de Biología Tropical* 54: 147-170.

**Zanella I, López-Garro A. 2015.** Abundancia, reproducción y tallas del tiburón martillo *Sphyrna lewini* (Carcharhiniformes: Sphyrnidae) en la pesca artesanal de Golfo Dulce, Pacífico de Costa Rica. *Revista de Biología Tropical* 63: 307-317. <https://doi.org/10.15517/rbt.v63i1.23110>

**Zanella I, López-Garro A, Cure K. 2019.** Golfo Dulce: critical habitat and nursery area for juvenile scalloped hammerhead sharks *Sphyrna lewini* in the Eastern Tropical Pacific Seascape. *Environmental Biology of Fishes* 102: 1291-1300. <https://doi.org/10.1007/s10641-019-00907-1>