

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

GALÁPAGOS NURSERY COMPLEX ISRA

Central and South American Pacific Region

SUMMARY

Galápagos Nursery Complex is located in shallow coastal waters of the Galápagos islands in Ecuador. These islands are situated ~950 km from the Central and South American mainland. The area is situated within the Galápagos Marine Reserve, which has been designated a UNESCO World Heritage Site and Biosphere Reserve, and within two Ecologically or Biologically Significant Marine Areas. Galápagos Nursery Complex includes multiple disjunct areas distributed along the coasts of five islands of the archipelago. These areas are generally shallow with sandy bottoms or a combination of sand and rock, often within mangrove-fringed bays. Within this area there are: **threatened species** (e.g., Blacktip Shark *Carcharhinus limbatus*); **range-restricted species** (Galápagos Bullhead Shark *Heterodontus quoyi*); and **reproductive areas** (e.g., Diamond Stingray *Hypanus dipterurus*).

CRITERIA

Criterion A - Vulnerability; Criterion B - Range Restricted; Sub-criterion C1 - Reproductive Areas

— ECUADOR —

— 0-30 metres —

— 571.42 km² —





DESCRIPTION OF HABITAT

Galápagos Nursery Complex is located in shallow coastal waters of the Galápagos islands in Ecuador. The Galápagos Archipelago is located ~950 km west of continental Ecuador, situated in an area of confluence of three major currents of the Eastern Pacific. The Galápagos platform contains all the main islands of the archipelago, except Darwin and Wolf (which are located further north off the Galápagos platform) and includes over 100 islets and emergent rocks encompassing a variety of marine habitats. The Galápagos platform ranges from 0 to 400 meters deep descending rapidly to 3,000 meters on the southern and western aspects of the platform break (Peñaherrera et al. 2018).

Galápagos Nursery Complex is situated within the Galápagos Marine Reserve, which has been designated a UNESCO World Heritage Site and Biosphere Reserve, and within two Ecologically or Biologically Significant Marine Areas, the Eastern Tropical Pacific Marine Corridor and the Galápagos Archipelago and Western Extension. The area consists of 12 disjunct portions of insular coastal marine habitat over five islands located on the Galápagos platform, with a combination of rocky shores, vertical walls, sandy beaches, and mangroves. Mangroves (which cover about 35% of the archipelago's coastline) form a narrow peripheral zone of high productivity between the sea and the arid zones of the islands. They are sporadically distributed in sheltered bays, lava crevices, and occasionally behind the beach line on hard substrates, and within lagoons which remain connected to the sea (Moity et al. 2019). Mangroves in the Galápagos are important habitats that contain a great diversity of species and are considered as nursery areas for several species of fishes (Jaening 2010; Llerena et al. 2015; Llerena et al. 2018; Goodman 2020; Páez & Córdova 2020; Fierro-Arcos et al. 2021.)

This Important Shark and Ray Area is delineated from inshore and surface waters (0 m) to a depth of 30 m based on the maximum depth of the Qualifying Species within the area.

ISRA CRITERIA

CRITERION A - VULNERABILITY

Three Qualifying Species considered threatened with extinction according to the IUCN Red List of Threatened Species™ regularly occur in the area. These comprise two shark species, the Critically Endangered Scalloped Hammerhead (Rigby et al. 2019) and the Vulnerable Blacktip Shark (Rigby et al. 2021), and two rays, the Vulnerable Pacific Eagle Ray (Pollom et al. 2021) and the Diamond Stingray (Pollom et al. 2020).

CRITERION B - RANGE RESTRICTED

Galápagos Nursery Complex holds the regular presence of Galápagos Bullhead Shark as a resident range-restricted species. It is likely that this species is endemic to the area. Although this species is reported to occur in Peru, populations of horned sharks in mainland Ecuador and Colombia previously thought to be Galápagos Bullhead Shark were found to be Horn Shark *Heterodontus francisci* (Kyne et al. 2020). Moreover, there is genetic variation among islands within the Galápagos, likely due to the benthic lifestyle and limited depth range at which the Galápagos Bullhead Shark is found (Hirschfeld 2021). This species is most commonly found in the western bioregion on Fernandina, the western side of Isabela Island, and in smaller numbers in the central-southeastern bioregion (Acuña Marrero et al. 2018).



SUB-CRITERION C1 – REPRODUCTIVE AREAS

Galápagos Nursery Complex is used as a reproductive area for three shark and three ray species: Blacktip Shark, Scalloped Hammerhead, Galápagos Bullhead Shark, Pacific Eagle Ray, Pacific Cownose Ray, and Diamond Stingray.

Several studies, including periods of standardised monitoring, have been conducted on Blacktip Shark since the discovery of large abundance of juveniles at San Cristobal Island in 2009 (Llerena 2009). At Santa Cruz, 972 Blacktip Sharks were recorded between January 2010 and January 2012, with ~60% of individuals classed as neonates (open umbilical scar) or young-of-the-year (semi-enclosed umbilical scar) (Database-DPNG 2008-2022; Llerena et al. 2015). Acoustic tagging of individuals has shown movement of neonate Blacktip Sharks is restricted to inner mangrove bays (Hirschfeld 2013; Goodman 2020).

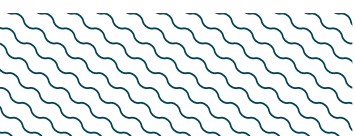
A Scalloped Hammerhead nursery has recently been discovered at San Cristobal Island. Fifteen gillnet surveys between 2017 and 2019 caught 66 individuals identified as recently pupped and young-of-the-year (mean = 52 cm total length [TL]), with every survey recording at least one individual. Acoustic and conventional tagging, along with Baited Remote Underwater Video Surveys (BRUVS), revealed a high residency index of 89% showing juveniles remain for extended periods of time (Chiriboga 2018; Páez & Córdova 2020; Chiriboga et al. 2022).

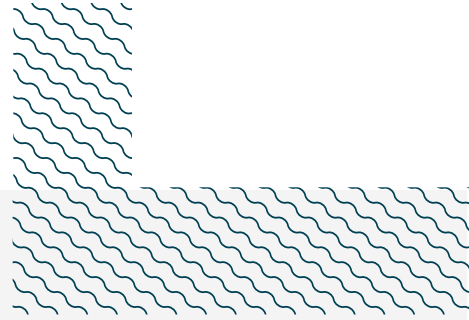
Galápagos Bullhead Shark is an endemic species restricted to cool, coastal waters on the western margins of the islands (Acuña Marrero et al. 2018). Significant genetic variation has been found in this species among islands within the Galápagos suggesting limited dispersal capacity from natal sites (Hirschfeld 2021). The presence of egg cases and/or juveniles have been found over multiple years, since 2015, with potential nursery areas identified on San Cristóbal, Española, Floreana, and the western bioregion, including Isabela and Fernandina Islands (Hirschfeld 2019). The lack of genetic connectivity among individual islands and the western bioregion, and the presence of nursery areas on each island, provide evidence for reproductive isolation among distinct genetic populations (Hirschfeld et al. submitted).

Recently, shark nursery monitoring in the area has expanded to encompass rays (Galápagos Conservation Trust 2021). Since 2019, 125 Pacific Eagle Rays have been sampled (with many more observed) ranging from 32 to 150 cm disc width (DW). Five bays on San Cristobal Island and three bays on Isabela Island are considered potential nursery areas based on the presence of neonates and young-of-the-year over multiple years (Diana Pazmiño unpubl. data 2022).

Similarly, 120 Diamond Stingrays have been sampled (with many more observed) ranging from 22 to 80 cm DW. Five bays on San Cristobal Island and three bays on Isabela Island are considered as potential nursery areas based on the presence of neonates and young-of-the-year over multiple years (Diana Pazmiño unpubl. data 2022).

Hundreds of Pacific Cownose Rays have been observed and 33 individuals been sampled ranging from 45 to 100 cm DW. One bay on San Cristobal Island and one on Isabela Island are considered potential nursery areas based on the presence of neonates and young-of-the-year over multiple years (Diana Pazmiño unpubl. data 2022).





Acknowledgments

Jenifer Suarez (Galápagos National Park Service), Eduardo Espinoza (Galápagos National Park Service; MigraMar), Alex Hearn (San Francisco de Quito University; MigraMar), Diana Pazmiño (San Francisco de Quito University), César Peñaherrera (MigraMar), Maximilian Hirschfeld (San Francisco de Quito University), and Mark Priest (IUCN SSC Shark Specialist Group - ISRA Project) contributed and consolidated information included in this factsheet. We thank the 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. Galápagos Nursery Complex ISRA Factsheet. Dubai: IUCN SSC Shark Specialist Group.

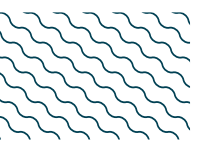
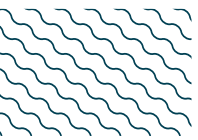
QUALIFYING SPECIES

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>Carcharhinus limbatus</i>	Blacktip Shark	VU	0-140	X		X						
<i>Heterodontus quoyi</i>	Galápagos Bullhead Shark	LC	3-40		X	X						
<i>Sphyrna lewini</i>	Scalloped Hammerhead	CR	0-1,043	X		X						
RAYS												
<i>Aetobatus laticeps</i>	Pacific Eagle Ray	VU	0-60	X		X						
<i>Hypanus dipterurus</i>	Diamond Stingray	VU	0-150	X		X						
<i>Rhinoptera steindachneri</i>	Pacific Cownose Ray	NT	0-64			X						

SUPPORTING SPECIES

Scientific Name	Common Name	IUCN Red List Category
SHARKS		
<i>Carcharhinus falciformis</i>	Silky Shark	VU
<i>Carcharhinus galapagensis</i>	Galápagos Shark	LC
<i>Galeocerdo cuvier</i>	Tiger Shark	NT
<i>Rhincodon typus</i>	Whale Shark	EN
<i>Triaenodon obesus</i>	Whitetip Reef Shark	VU
<i>Triakis maculata</i>	Spotted Houndshark	CR
RAYS		
<i>Hypanus longus</i>	Longtail Stingray	VU
<i>Mobula birostris</i>	Oceanic Manta Ray	EN
<i>Mobula mobular</i>	Spinetail Devil Ray	EN
<i>Myliobatis californica</i>	Bat Ray	LC
<i>Tetronarce tremens</i>	Chilean Torpedo	LC

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





REFERENCES

- Acuña Marrero D, Smith ANH, Salinas-de-León P, Harvey ES, Pawley MDM, Anderson MJ. 2018.** Spatial patterns of distribution and relative abundance of coastal shark species in the Galápagos Marine Reserve. *Marine Ecology Progress Series* 593: 73-95. <https://doi.org/10.3354/meps12505>
- Chiriboga-Paredes Y. 2018.** Ecología espacial y conservación de tiburones neonatos y juveniles punta negra (*Carcharhinus limbatus*) en la Isla San Cristóbal - Reserva Marina de Galápagos. Unpublished Bachelor's Thesis, Universidad San Francisco de Quito, Quito.
- Chiriboga-Paredes Y, Palomino Á, Goodman L, Córdova F, Páez V, Yépez M, Jorgensen S, Armijos D, Pazmiño D, Hearn A. 2022.** Discovery of a putative scalloped hammerhead shark *Sphyrna lewini* (Carcharhiniformes: Sphyrnidae) nursery site at the Galápagos Islands, Eastern Tropical Pacific. *Environmental Biology of Fishes* 105: 181-92. <https://doi.org/10.1007/s10641-021-01207-3>
- Fierro-Arcos D, Jarrín JR, Aburto-Oropeza O, Harvey ES, Rastoin-Laplane E, Salinas-de-León P. 2021.** Mangrove fish assemblages reflect the environmental diversity of the Galápagos Islands. *Marine Ecology Progress Series* 664: 183-205. <https://doi.org/10.3354/meps13628>
- Galápagos Conservation Trust. 2021.** Endangered rays of the Galápagos. Available at: <https://galapagosconservation.org.uk/projects/endangered-rays-of-galapagos/> Accessed November 2022.
- Goodman LS. 2020.** Feasibility of new methods for nursery ground Identification for the Juvenile Blacktip Shark (*Carcharhinus limbatus*) using drone technology-San Cristobal Island, Galápagos. Unpublished PhD Thesis, The University of North Carolina at Chapel Hill, Chapel Hill.
- Hirschfeld M. 2013.** Habitat use and movement patterns of juvenile and neonate blacktip sharks, *Carcharhinus limbatus* in nursery areas on San Cristobal Island, Galápagos. Quito. Unpublished Master's Thesis, Universidad San Francisco de Quito, Quito.
- Hirschfeld M. 2019.** Distribución, demografía, tamaño poblacional y conectividad poblacional de dos especies de la familia Heterodontidae, *Heterodontus quoyi* y *Heterodontus mexicanus* en las Islas Galápagos. Puerto Ayora: Informe de avances DPNG-Galápagos.
- Hirschfeld M. 2021.** Population structure and connectivity of demersal sharks in isolation. Unpublished PhD Thesis, James Cook University, Townsville.
- Hirschfeld M, Barnett A, Sheaves M, Dudgeon D. Submitted.** What Darwin couldn't see: Island formation and historical sea levels shape genetic divergence and island biogeography in a coastal marine species. *Heredity*
- Jaenig M. 2010.** Sharks (Selachii) in mangrove-fringed habitats of the Galápagos Marine Reserve (GMR) with implications for management and conservation. Unpublished Master's Thesis, University of Bremen, Bremen.
- Kyne PM, Charvet P, Areano EM, Cevallos A, Espinoza M, González A, Herman K, Mejía-Falla PA, Morales-Saldaña JM, Navia AF, et al. 2020.** *Heterodontus quoyi*. *The IUCN Red List of Threatened Species* 2020: e.T44579A124433617. <https://doi.org/10.2305/IUCN.UK.2020-3.RLTS.T44579A124433617.en>
- Llerena Y. 2009.** Identificación de tiburones juveniles y caracterización de sus hábitats en las zonas costeras de pesca de la Isla San Cristóbal-RMG. Guayaquil. Unpublished Bachelor's Thesis, Universidad de Guayaquil, Guayaquil.
- Llerena Y, Penaherrera C, Espinoza E, Hirschfeld M, Wolff M, Vinuesa L. 2015.** Nursery grounds of blacktip sharks (*Carcharhinus limbatus*) in mangrove-fringed bays in the central part of the Galápagos Archipelago. In: *Galapagos Report 2013-2014*. Puerto Ayora: GNPD, GCREG, CDF and GC, 103-110.
- Llerena Y, Peñaherrera C, Espinoza E. 2018.** Fish assemblages in three fringed mangrove bays of Santa Cruz Island, Galápagos Marine Reserve. *Revista Biología Tropical* 66: 674-687. <https://doi.org/10.15517/rbt.v66i2.33400>

Mendoza Alcívar GN. 2020. Relaciones filogenéticas del género *Aetobatus*: un enfoque en las rayas águila del Pacífico Oriental. Unpublished Bachelor's Thesis, Universidad San Francisco de Quito, Quito.

Moity N, Delgado B, Salinas-de-Leon P. 2019. Mangroves in the Galápagos islands: Distribution and dynamics. *PLoS One* 14: e0212440. <https://doi.org/10.1371/journal.pone.0209313>

Páez V, Cordova F. 2020. Do juvenile sharks display behavioural thermoregulation? A case study of *Sphyrna lewini* and *Carcharhinus limbatus* at a nursery site in the Galápagos Marine Reserve. Unpublished Bachelor's Thesis, Universidad San Francisco de Quito, Quito.

Páez-Rosas D, Suarez-Moncada J, Elorriaga-Verplancken FR, Proaño A, Arnés-Urgellés C, Salinas-de-León P, Galván-Magaña F. 2021. Trophic variation during the early stages of blacktip sharks (*Carcharhinus limbatus*) within coastal nurseries of the Galápagos Marine Reserve. *Journal of Sea Research* 170: 102023. <https://doi.org/10.1016/j.seares.2021.102023>

Peñaherrera-Palma C, Arauz R, Bessudo S, Bravo-Ormaza E, Chassot O, Chinacalle-Martínez N, Espinoza E, Forsberg K, García-Rada E, Guzmán H, et al. 2018. Justificación biológica para la creación de la MigraVía Coco-Galápagos. Portoviejo, Manabí, Ecuador: MigraMar y Pontificia Universidad Católica del Ecuador Sede Manabí.

Pollom R, Avalos C, Bizzarro J, Burgos-Vázquez MI, Cevallos A, Espinoza M, González A, Herman K, Mejía-Falla PA, Morales-Saldaña JM, Navia AF, Pérez Jiménez JC, Sosa-Nishizaki O. 2021. *Aetobatus laticeps*. *The IUCN Red List of Threatened Species* 2021: e.T104021731A104021771. <https://doi.org/10.2305/IUCN.UK.2021-1.RLTS.T104021731A104021771.en>

Pollom R, Bizzarro J, Burgos-Vázquez MI, Cevallos A, Velez-Zuazo X, Avalos C, Espinoza M, González A, Herman K, Mejía-Falla PA, et al. 2020. *Hypanus dipterurus*. *The IUCN Red List of Threatened Species* 2020: e.T60152A80677563. <https://doi.org/10.2305/IUCN.UK.2020-3.RLTS.T60152A80677563.en>

Rigby CL, Dulvy NK, Barreto R, Carlson J, Fernando D, Fordham S, Francis MP, Herman K, Jabado RW, Liu KM, et al. 2019. *Sphyrna lewini*. *The IUCN Red List of Threatened Species* 2019: e.T39385A2918526.

Rigby CL, Carlson J, Chin A, Derrick D, Dicken, M, Pacoureaux N. 2021. *Carcharhinus limbatus*. *The IUCN Red List of Threatened Species* 2021: e.T3851A2870736. <https://doi.org/10.2305/IUCN.UK.2021-2.RLTS.T3851A2870736.en>

Simpfendorfer C, Yuneni RR, Tanay D, Seyha L, Haque AB, Bineesh KK, D, Bin Ali A, Gautama DA, Maung A, Sianipar A, et al. 2020. *Triaenodon obesus*. *The IUCN Red List of Threatened Species* 2020: e.T39384A173436715. <https://doi.org/10.2305/IUCN.UK.2020-3.RLTS.T39384A173436715.en>

Suarez J. 2019. Identificación, evaluación y monitoreo de zonas de manglar en la RMG para determinar su importancia como zonas conservación y reproducción para especies de interés. Puerto Ayora: Informe DPNG-Galápagos.