SHARK NEWS

Newsletter
of the IUCN SSC Shark
Specialist Group

#09 | January 2024

IUCN SSC
Shark Specialist Group

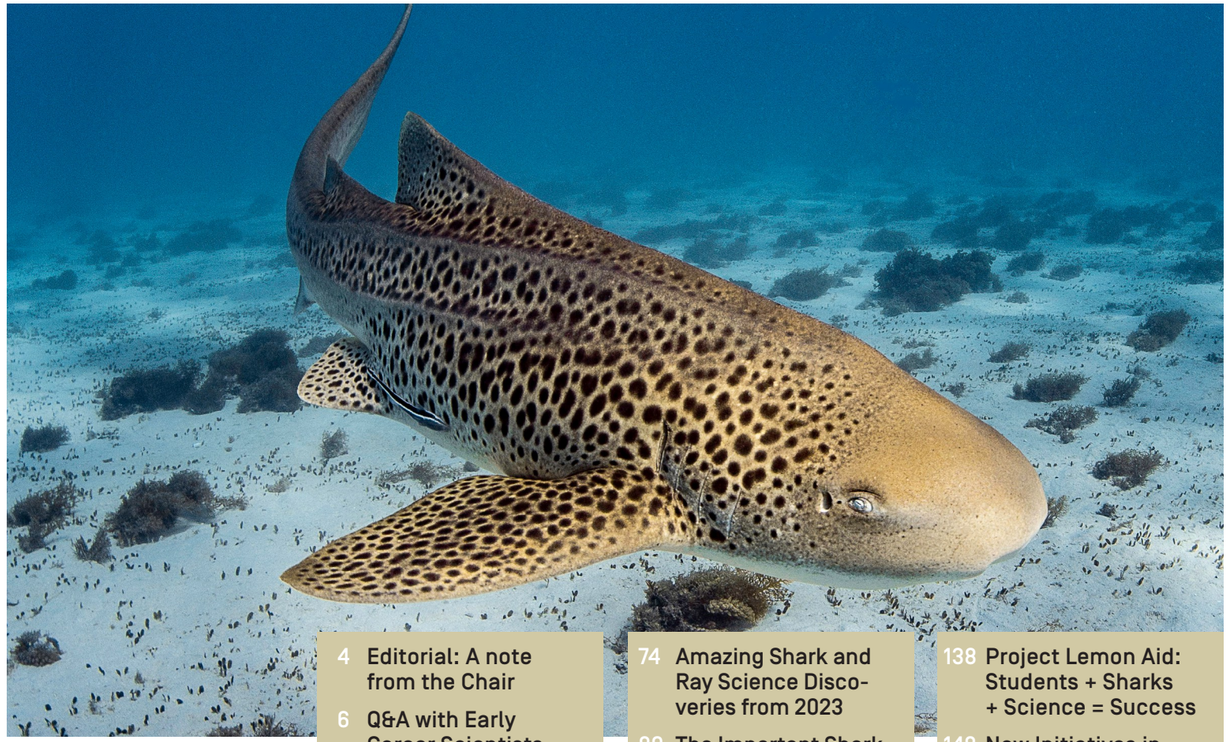
Photo by Michael Scholl | Save Our Seas Foundation

Our Vision

A world where sharks, rays, and chimaeras are valued and managed sustainably.

Our Mission

To secure the conservation, management and, where necessary, the recovery of the world's sharks, rays, and chimaeras by mobilizing technical and scientific expertise to provide the knowledge that enables action.



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Published by the IUCN SSC Shark Specialist Group (SSG)
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P.O. Box 29588 | Dubai
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Cover: Leopard sharks (*Stegostoma tigrinum*) in Ningaloo Reef, Western Australia, Australia
Photos by Brooke Pyke | brookepykephotography.com

Editorial

Artwork by Keith Witmer

Dear readers,

It's hard to believe that another year has gone by. I don't think I have taken stock of or reflected on everything that happened in 2023, but it certainly feels like the momentum for shark, ray, and chimaera conservation is growing. Sharks are on the agenda at every multilateral environmental agreement meeting – fisheries, trade, biodiversity conservation, protected areas, and more. It's been a busy and intense year, but exciting at the same time because we have many opportunities to make a difference. Like many of you, I used to fight to get sharks on the agenda, but now we struggle with having enough time to cover everything during a meeting. There's a sense of urgency in it, and I am proud to belong to this growing shark conservation community and encouraged by the collaborative spirit that is making this possible. Through this issue of Shark News, we are introduced again to some innovative and wonderful initiatives that are helping to keep this momentum growing. Our feature story is about rewilding sharks – something that has been done for many terrestrial and small aquatic species and has now been attempted for the first time with Indo-Pacific Leopard Sharks. We have our usual Q&A series where Chelsea Stein introduces us to early career scientist members working in Angola and Papua New Guinea, two places we know so little about when it comes to shark fisheries. Our third series of fact sheets on human impacts on sharks and rays related to pollution. This is a threat that is less understood for many species, but that is inadvertently having an impact on some. Fisheries remain the key threat, however, and this is reflected in our stories and the work being undertaken worldwide to understand how these affect species. Fisheries surveys are being conducted in Oman, focusing primarily on rays. Oman is another key country where little data have been collected, but it plays a key role in the international trade of fins and meat. We have an overview of the historical fisheries surveys undertaken across the basin from the Mediterranean Sea. Results from these have provided much-needed life history and distribution data and allowed us to determine that this is the body of water with the highest number of threatened sharks. In parallel, we have stories from Iran on how innovative and cross-sectoral awareness of shark conservation issues is becoming and should be! The Great Eggcase Hunt has expanded and is now a global effort allowing the public to report and identify shark and skate eggs found on beaches around the world. From the Canary Islands, we gather insight into how critical habitats are being identified and how research is being integrated into policy. From Central America and the Caribbean, we learn more about how a newly described yet threatened nurse shark is being tracked to understand its ecology, how local ecological knowledge is being used to understand the behaviour of coastal communities in Panama in relation to sharks, and how dedicated efforts to educate students is making a difference in the Turks and Caicos. The Important Shark and Ray Areas (ISRA) project has also kept us extremely busy, with 255 areas now delineated from the Central and South American Pacific, Mediterranean and Black Seas, and Western Indian Ocean regions. This project has only been possible because of the backbreaking and passionate work from the ISRA team but also mostly the over 450 contributors that have already been part of this process. We have three other regions slated for 2024, so thank you all for supporting us in ensuring we can put sharks on the map! We leave you with a snapshot of some amazing shark discoveries for the year and what the SSG has celebrated and accomplished with your support. As always, thank you for your commitment and passion for sharks – and, of course, a massive thank you to Michael and Peter Scholl, who continue to make this newsletter a reality. With all the fantastic work ongoing worldwide, I do not doubt that the momentum will continue to grow. So, I look forward to another year of shark conservation successes and wish you and yours a wonderful 2024! ↪ Rima

Photo by Brooke Pyke | brookepykephotography.com

Q&A

Early career scientists within the SSG

In this Q&A series, get to know members across the group's nine regions | Written by Chelsea Stein

Photo by Ana Lúcia Furtado Soares

With 237 members from 83 countries and territories, the IUCN SSC Shark Specialist Group is one of the largest specialist groups within the IUCN Species Survival Commission. Across the group's nine regions, many early career scientists are pursuing exciting work on shark, ray and chimaera research, policy, and conservation.
In this Q&A series, we will showcase some of these members, sharing their roles within the SSG and their ongoing work.

Ana Lúcia Furtado Soares

Ph.D. candidate at Ludwig-Maximilian University of Munich, SSG Africa Region

Michael Grant

A postdoctoral research fellow at James Cook University in Australia; foreign lecturer at Hasanuddin University in Indonesia; conservation advisor for the Piku Biodiversity Network in Papua New Guinea; SSG Oceania Region

Shark News: What type of research do you focus on?

Ana: My focus is to assess the impact of small-scale fisheries on sharks and rays in Angola (Southwest Africa). My research aims to increase knowledge on sharks and rays, providing baseline information and long-term scientific data to fill the gap in species-specific information to understand shark and ray biodiversity and threats. These data can be used to develop effective management and conservation plans and adequately monitor threatened populations.

Michael: My research focuses mainly on small-scale fishers that interact with threatened species, particularly in riverine environments. Other research areas include population assessments, life history, demography, and elemental analysis of vertebrae.

Shark News: What project(s) are you currently working on?

Ana: I am currently a PhD candidate at the Ludwig-Maximillian-University of Munich, working on a project titled "Elasmobranchs of Angola: Assessing impacts of small-scale fisheries of sharks and rays." Due to scarce information regarding shark and ray species composition, abundance and distribution in Angola, and the negative impact of fisheries on their abundance and diversity, this research project is of high priority for me.

This project is linked to the Elasmo Project (under the supervision of Dr. Rima Jabado), as the Angola Elasmo Project. This project is the first of its kind in the region and aims to create a meaningful impact on shark and ray conservation in Angola, as there are insufficient data, no environmental conservation initiatives for these threatened species, no MPAs, lack of policies regarding conservation and fisheries, and no indications that this dramatic situation will soon be addressed by policy-makers.

A major part of the coastal population depends on marine resources, with fishing being a primary source of income and food. Thus, local community involvement and creating awareness of threats to sharks and rays through capacity building and public involvement is a key factor in achieving positive conservation outcomes. We are currently engaged with the local academic community, fisher communities, and governmental entities, developing awareness campaigns and implementing training workshops.

Michael: I am currently working on various projects across Indonesia, Papua New Guinea, and Australia. In Indonesia, through local knowledge surveys and fishery observations, I lead a project between James Cook University (JCU) and Hasanuddin University to provide population baselines for threatened non-marine sharks and rays in Kalimantan. This project is in the context of relocating the Indonesian capital from Jakarta to East Kalimantan over the next couple of decades. The rivers of Kalimantan provide large expanses of habitat and probably support larger populations of Indo-West Pacific freshwater rays compared to the broader region. Our present data will provide a baseline to measure against future changes to these populations and their habitat, as the capital relocation will likely bring more people and greater riverine pressures to Kalimantan.

I work with a non-governmental organization in Papua New Guinea to study a complex fish maw fishery. Fish maw is the trade term for teleost swim bladder. Chinese cultures highly value fish maw, with end uses mainly being culinary or medicinal. In Papua New Guinea, the high trade demand and value of fish maw have led to the development of intensive fishing practices in a region that is a stronghold for Indo-Pacific sawfishes (Pristidae), river sharks (*Glyphis* spp.), and Winghead Sharks (*Eusphyra blochii*). We work with local fishers to document fishery characteristics such as catch composition and catch per unit of effort (CPUE) of target and non-target species. We are also launching a sawfish conservation campaign that seeks to change social norms around how local fishers currently use and value sawfish through education and outreach materials aimed at fishers and children.

In Australia, I have recently been working on population modelling aspects of the conservation effort to save the Maugean Skate (*Zearaja maugeana*). I also supervise various student projects through JCU, such as understanding human drivers of threatened species in Melanesia, compiling species lists and management policy for various Pacific Nations through the Shark Search Indo-Pacific program, profiling the vulnerability of non-marine sharks and rays in the Indo-West Pacific, and exploring elemental applications of vertebrae toward an increased understanding of species life history and movements.

Sharks News: As a member of the IUCN SSC Shark Specialist Group, what does your role involve?

Ana: My primary role is to increase knowledge of sharks and rays from the Angola region. As a response to the scarce information in Angola regarding shark and ray species composition, abundance and distribution, and the impact of fisheries on their abundance and diversity, research on the region is of high priority.
I have also participated in IUCN Red List of Threatened Species assessment workshops on sharks and rays, contributing to the assessment of some threatened guitarfishes, such as the Spineback Guitarfish (*Rhinobatos irvinei*), Common Guitarfish (*Rhinobatos rhinobatos*), and Whitespotted Guitarfish (*Rhinobatos albomaculatus*).

Finally, I have expanded my network of collaborators, which allowed me to increase my knowledge of sharks and rays through workshops and meetings. An exceptional event was the IUCN SSC

Photo by Ana Lúcia Furtado Soares

Photo by Ana Lúcia Furtado Soares

Photos by Dedi, BPSPL Kota Bangun

Shark Specialist Group's Global Report workshop in Valencia (in which I am contributing with an Angola chapter as lead author), where I finally met some of the researchers I am learning and collaborating with in person.

Michael: My role within the IUCN SSG Oceania region is mainly contributing to Red List assessments and providing input about sharks and rays in the broader Pacific. As an early career researcher, being involved in the Oceania region SSG also offers an excellent opportunity to learn from and connect with some fantastic shark scientists, and to learn about other regional members' different concerns and perspectives.

Shark News: What excites you about sharks, rays, and/or chimaeras?

Ana: Sharks and rays are truly fascinating for me, particularly sharks. I guess I always felt that the public did not pay them the proper attention or realize their true importance. For example, most people fear shark attacks, but I wish they could understand more about these species, their impact on the ecosystem, and the threats they face. The opportunity to work in a region that has not been studied since the '70s is truly remarkable, as every day on the field is exciting and surprising!

Michael: A bit cliché, but I suppose, like everyone, I find large predatory species like sharks and rays pretty cool. Growing up, I did a lot of fishing with my father. We generally fished for mulloway, a large sciaenid that lives in rivers and coasts of southern Australia. In trying to catch these elusive fish, I was inadvertently spending a lot of time thinking about large predator ecology, and we tended to catch a lot more Bull Sharks (*Carcharhinus leucas*) than mulloway. The fascination of seeing large Bull Sharks in the Clarence River in northern New South Wales is definitely what got me excited about shark research. Although, I have to say that I am far more driven by concern rather than excitement these days.

Shark News: What is your favourite shark, ray, or chimaera species? And why?

Ana: Sadly, in Angola, I had the opportunity to work on fishing sites with significant quantities of Smooth Hammerheads (*Sphyrna zygaena*), ranging from adults to juveniles. They are truly beautiful creatures, highly adaptable to different habitats and often caught in the nets of small-scale fishers. By observing them daily at landing sites, I guess I developed a bond with this specific species, as it is genuinely heartbreaking what is happening to them in the region.

Michael: I am strongly interested in any species of shark or ray that occurs in rivers... sawfish, river sharks, freshwater whiprays, they are all fantastic species. I mostly enjoy conducting research in their tropical river environments. I have been lucky to have canvassed all of Papua New Guinea's major river systems searching for sawfish and river sharks, and I am currently about halfway through Kalimantan's rivers. I would take a boat ride through the rainforest-lined freshwater reaches of the Barito River in Kalimantan over the Great Barrier Reef any day!

Shark News: What do you think is the biggest challenge for shark conservation vs. the biggest opportunity?

Ana: The biggest challenge for shark conservation is the complex relationship of various factors contributing to their decline, particularly overfishing, and how to manage them. The worldwide increasing trend in fishing, the low degree of catch selectivity, and the overcapacity in terms of fishing fleets have a direct negative impact on shark and ray communities. From my experience in Angola, the inexistence of fisheries and conservation management measures, the lack of legislation and monitoring of the fishing fleets, and the lack of public awareness are a true challenge that must be addressed.

The biggest opportunity in a country like Angola is that while we are only recently starting to build baseline data and conduct efforts towards conservation, we can learn and adapt from other regions that were previously facing similar conditions and are now developing strategies for the conservation of these species, including its sustainable use.

Michael: The biggest challenge is undoubtedly humans and low-income developing nations. In the context of the riverine environments where I mainly work, the challenges are five-fold: overfishing, construction of barriers to water flow, agricultural land clearing in water sheds, pollution from households and industry and, compounding all of these, forecasted effects of climate change on rainfall patterns. For non-marine sharks and rays, sadly, a lot of irreversible damage has already been done throughout much of their range or former ranges.

However, we continue to find previously unknown populations of river sharks and freshwater stingrays. I think there are still great opportunities to secure some of the world's tropical rivers for their multispecies refuge potential. It will take more policy and research to increase community compliance or community 'buy-in' for that policy. I think right now it is not always clear if we need to set policy and work with communities to comply or whether we need to understand communities' interactions with sharks and rays to then set policy that has the highest chance of being complied to. Ultimately, it is context-specific. I think a more anthropological approach to shark and ray conservation provides immense opportunities for the complex conservation contexts in low-income developing nations moving forward.

Shark News: What's something you are looking forward to this year?

Ana: I look forward to returning to Angola shortly for more exciting fieldwork and awareness campaigns. I plan to visit some new locations (never surveyed before) to assess if shark fisheries are occuring in these areas. I am also looking forward to exploring the beautiful Angolan coast and expanding the network of local people involved in the project.

Michael: I am incredibly excited about my upcoming field expedition to the Barito and Kahayan Rivers of South and Central Kalimantan, which begins next week at the time of writing. These rivers present an opportunity to explore the presence of freshwater rays (and possibly sawfish) in a region of Kalimantan with significantly less human impact than rivers in eastern Kalimantan or the Kapuas in the west. I am also yet to see an orangutan in the wild, and southern Kalimantan is a major stronghold for the species, so hopefully, we get lucky!

Shark News: What's one fun fact about you?

Ana: While my background is in marine sciences and conservation, I worked for many years as a cabin crew in aviation, which allowed me to start the Angola Elasmo Project. I financed my initial visits to assess the feasibility of working there by visiting possible landing sites, building connections, and even developing a pilot study that brought me back to the field full-time as a PhD student and researcher!

Michael: I am not exactly sure how many generations ago, but if you trace the great, great... grandparents on my father's family tree, you will eventually bump into Thomas H. Huxley. He is responsible for one of the most infamous quotes in fisheries science: "Probably all the great sea fisheries are inexhaustible; that is to say, that nothing we do seriously affects the numbers of fish. Any attempt to regulate these fisheries seems consequently, from the nature of the case, to be useless." It would take more than a hundred years until the collapse of the great Newfoundland cod fishery before this view would be tossed out of the fishery management handbook once and for all.

Shark News: How can we keep up with your work?

Ana: You can keep up with mine and the volunteers' work through the Save Our Seas blogs, www.elasmoproject.com/angola-project.html and on Instagram @angola.elasmoproject.
Michael: You can keep up with my work on the Kalimantan project through the Save Our Seas website and the Papua New Guinea project through the Piku Biodiversity Network Facebook page. In addition, You can follow my general research updates on our JCU fish and fisheries lab website, through Research Gate or by following me on Twitter @Mickkgrant.

Photo by Ana Lúcia Furtado Soares

Sharks* and the Inter-American Tropical Tuna Commission (IATTC)

*The term 'shark' refers to all species of sharks, rays, and chimaeras

Written by Alexandra Z.A. Morata
IUCN SSC Shark Specialist Group | Programme Officer

Secretariat

Commission
Mr Andres Arens Hidalgo (ECU)

Committee for the Review of Implementation of Measure adopted by the commission
Chair: Mr Luis Molledo (EU)

Scientific Advisory Committee
Chair: IATTC - IATTC Director

Committee on Administration & Finance
Chair: Ms Rachael Wadsworth (USA)

Permanent Working Group on Fleet Capacity
Chair: Mr Julio Guevara (NIC)

Working Group on Ecosystem and Bycatch
Co-Chair:
Ms Yonat Swimmer (USA)
Mr Manuel Correai (VEN)

Ad Hoc permanent Working Group on FADs
Chair: Mr Josu Santiago (EU)

Ad Hoc Working Group on Electronic Monitoring
Co-Chairs:
Celia Barroso (USA)
Guillermo Moran (ECU)

Ad Hoc Working Group for reviewing the legal and operative coherence of IATTC Resolutions
Chair:
Mr Bernal Chavarria (CRI)

Figure: Organigram as of December 2023 | Source: IATTC

What is the IATTC?

The Inter-American Tropical Tuna Commission (IATTC) is the regional fisheries management organization (RFMO) responsible for the conservation and management of tuna and tuna -like species, associated species and their ecosystems, throughout the Eastern Pacific Ocean, from Canada in the north, to Chile in the south. As per the Antigua Convention, "The area of application of the Convention ("the Convention Area") comprises the area of the Pacific Ocean bounded by the coastline of North, Central, and South America and by the following lines:

1. the 50°N parallel from the coast of North America to its intersection with the 150°W meridian;
2. the 150°W meridian to its intersection with the 50°S parallel; and
3. the 50°S parallel to its intersection with the coast of South America."

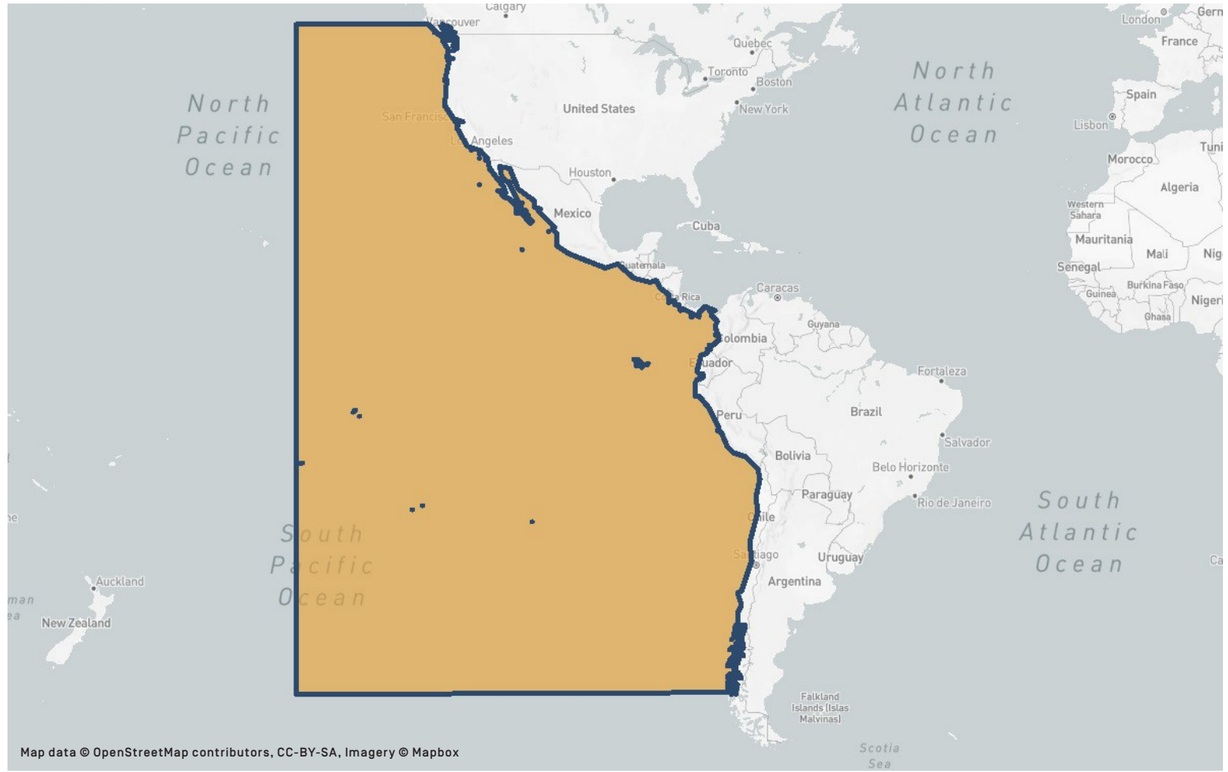
The IATTC was first established by the United States of America and Costa Rica due to their mutual concern in conserving the Yellowfin Tuna (*Thunnus albacares*) and Skipjack Tuna (*Katsuwonus pelamis*) populations in 1949, hence named the "1949 Convention". However, in response to the decreasing tuna populations, the need for global efforts "increased, ultimately" leading to its expanded range and development of the Antigua Convention in 2003, which came into force in 2010.

Structure of IATTC

The governing body of the IATTC is known as the Commission, which is comprised of representatives from Commission members, Cooperating Non-Members (CNM), and observers, and collectively grouped as "CPC".

The **Secretariat** supports the coordination of the Commission, with the support of three committees and four Working Groups. **The Committee for the Review of Implementation of Measure adopted by the Commission** is responsible for monitoring compliance to the IATTC's conservation measures by its Members. **The Scientific Advisory Committee** reviews plans and proposals to the Commission, encourages efforts to improve data collection of the stocks included in the Antigua Convention. **The Committee on Administration and Finance** organises Commission meetings, budgets, and other administrative processes within the Commission.

Within the IATTC there exists several working groups (WG) that reports to and falls under the Scientific Advisory Committee. This includes the **Permanent Working Group on Fleet Capacity** who has the role of monitoring the capacity of the fleet targeting species covered by the Antigua Convention, and developing measures that limit fleet's capacity where necessary.



The **Working Group on Ecosystem and Bycatch** has three primary roles: 1) define relationships among bycatch and target species; 2) develop gear technology to reduce bycatch; and 3) develop management schemes to reduce bycatch.

The **Ad Hoc Permanent Working Group on Fish Aggregating Devices (FADs) has four main responsibilities:** 1) collect information on FADs in the Convention Area; 2) review the requirements for data collection on FADs; 3) consolidate FAD developments in other tuna RFMOs; and 4) compile the latest scientific information on FAD developments.

The **Working Group for Reviewing the Legal and Operative Coherence of IATTC Resolutions** was established with the purpose of analysing current IATTC Resolutions and consolidating all recommendations to the Commission.

Figure: Convention map | Source: ©IATTC

Commission Members

Commission Members are countries and fishing entities that have signed onto the 1949 Convention and/or Antigua Convention and are represented by four individuals each, who are known as "Commissioners". The Members include those that ratified under the original 1949 Convention, coastal states within the Convention Area, and other states with sovereign rights and fished for species covered by the Antigua Convention. Members are obliged to comply with the IATTC's Resolutions and have equal decision-making rights.

Table 1: **List of the 21 Commission Members of the IATTC.**

State	Date of Ratification/Accession
Belize	12 June 2007
Canada	03 June 2009
China	30 October 2009
Chinese Taipei	17 August 2010
Colombia*	
Costa Rica	27 May 2009
Ecuador	07 May 2021
El Salvador	10 March 2005
European Union	07 June 2006
France	20 July 2007
Guatemala	30 September 2009
Japan	11 July 2008
Kiribati, Republic of	29 June 2011
Korea, Republic of	13 December 2005
Mexico	14 January 2005
Nicaragua	13 December 2006
Panama	10 July 2007
Peru	22 October 2018
United States	24 February 2016
Vanuatu*	
Venezuela*	

* The Parties to the 1949 Convention that did not withdraw from the Commission after the entry into force of the Antigua Convention but have not deposited their instrument of ratification or adhesion yet.

Cooperating Non-Members (CNM) are states which follow similar obligations and fishing rights (to species covered by IATTC) as Members. Currently there are five CNMS: Bolivia, Chile, Honduras, Indonesia, and Liberia. They are unable to participate in the voting process of the Commission but can be included as **Observers** at Commission meetings. Observers can include "non-Parties" (CNMs or other states that meet certain requirements), "relevant intergovernmental organizations" (IGOs), and "non-governmental organizations" (NGOs).

Which shark species are covered by IATTC?

Currently, six shark species and one ray family are specifically covered by IATTC's conservation management Resolutions. However, there are active Resolutions that cover "sharks" collectively, which applies to all shark species present in the Convention Area.

Since being listed some species have had their taxonomy updated–hereafter all species names reflect the most updated name as listed on the International Union for Conservation of Nature (IUCN) Red List of Threatened Species™.

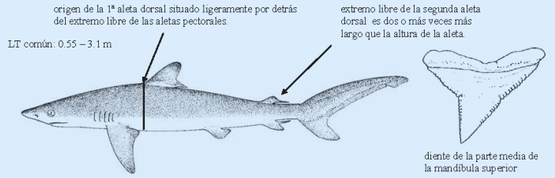
Scientific Name	Common Name
Species specifically included in IATTC's Resolutions	
Carcharhiniformes	
Carcharhinidae	
Carcharhinidae falciformis	Silky Shark
Carcharhinus longimanus	Oceanic Whitetip Shark
Sphyrnidae	
Sphyrna lewini	Scalloped Hammerhead
Sphyrna mokarran	Great Hammerhead
Sphyrna zygaena	Smooth Hammerhead
Myliobatiformes	
Mobulidae	
Mobula spp.	Mantas and devil rays
Orectolobiformes	
Rhincodontidae	
Rhincodon typus	Whale Shark
Species included in IATTC's Resolutions under the category "sharks"	
Carcharhiniformes	
Carcharhinidae	
Carcharhinus albimarginatus	Silvertip Shark
Carcharhinus altimus	Bignose Shark
Carcharhinus brachyurus	Copper Shark
Carcharhinus galapagensis	Galapagos Shark
Carcharhinus leucas	Bull Shark
Carcharhinus limbatus	Blacktip Shark
Carcharhinus melanopterus	Blacktip Reef Shark
Carcharhinus obscurus	Dusky Shark
Carcharhinus plumbeus	Sandbar Shark
Carcharhinus porosus	Smalltail Shark
Carcharhinus signatus	Night Shark
Galeocerdo cuvier	Tiger Shark
Nasolamia velox	Whitenose Shark
Negaprion brevirostris	Lemon Shark
Prionace glauca	Blue Shark
Rhizoprionodon longurio	Pacific Sharpnose Shark
Sphyrnidae	
Sphyrna corona	Scalloped Bonnethead
Sphyrna media	Scoophead Shark
Sphyrna tiburo	Bonnethead Shark
Triakidae	
Galeorhinus galeus	Tope
Mustelus henlei	Brown Smoothhound
Triakis semifasciata	Leopard Shark
Lamniformes	
Alopiidae	
Alopias pelagicus	Pelagic Thresher
Alopias superciliosus	Bigeye thresher
Alopias vulpinus	Common Thresher
Cetorhinidae	
Cetorhinus maximus	Basking Shark
Lamnidae	
Carcharodon carcharias	White Shark
Isurus oxyrinchus	Shortfin Mako
Isurus paucus	Longin Mako
Lamna ditropis	Salmon Shark
Lamna nasus	Porbeagle
Pseudocarchariidae	
Pseudocarcharias kamoharai	Crocodile Shark
Myliobatiformes	
Dasyatidae	
Hypanus longus	Longtail Stingray
Pteroplatytrygon violacea	Pelagic Stingray
Squaliformes	
Squalidae	
Squalus acanthias	Spiny Dogfish
Squatiniformes	
Squatinidae	
Squatina californica	Pacific Angel Shark

To support Contracting Parties implement the IATTC's resolutions, a Spanish identification guide of various fish species interacting with tuna seine fisheries was developed (view here), with a video tutorial available online, and individual species fact sheets online here. Additionally, four shark species whose stock assessments are available, Silky Shark (*Carcharhinus falciformis*), Blue Shark (*Prionace glauca*), Shortfin Mako (*Isurus oxyrinchus*), and Common Thresher (*Alopias vulpinus*).

List of sharks included in IATTC's Resolutions.

Carcharhinus falciformis (Carcharhinidae)

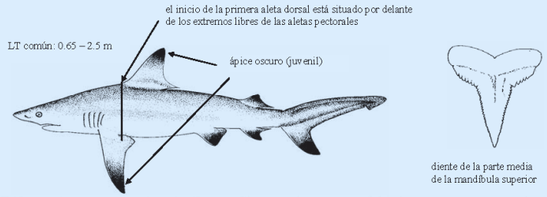
Nombres comunes: Es - Tiburón sedoso, tiburón bobo, tiburón jaquetón, tiburón piloto, tiburón mico; **In -** Silky shark.
Nombres usados por los tripulantes: Tiburón punta negra, toyo, piloto.



Diferencias con especies similares: *Carcharhinus obscurus* presenta el origen de la primera aleta dorsal situado por encima de los bordes internos de las aletas pectorales. *C. galapagensis* presenta el borde interno de la segunda aleta dorsal de tamaño menor a dos veces la altura de la aleta. *C. limbatus* tiene un parecido solamente en el nombre común "punta negra".

Carcharhinus limbatus (Carcharhinidae)

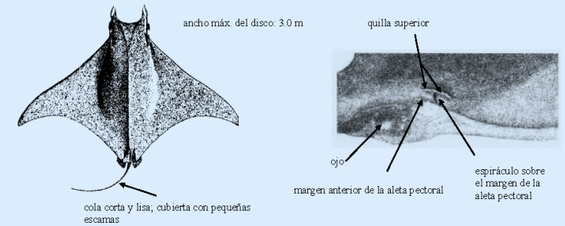
Nombres comunes: Es - Tiburón punta negra; **In -** Blacktip shark.
Nombres usados por los tripulantes: Punta negra.



Diferencias con especies similares: Sin semejanzas morfológicas con otras especies capturadas en esta pesquería. Se confunde mucho con *Carcharhinus falciformis* porque esta especie también es llamada punta negra por los tripulantes.

Mobula tarapacana (Mobulidae)

Nombres comunes: Es – Manta cornuda; **In –** Chilean devil ray.
Nombres usados por los tripulantes: Manta, manta raya, cubana.



Diferencias con especies similares: En *Mobula thurstoni,* la quilla superior es una prolongación del margen anterior de la aleta pectoral. *M. japanica* tiene una cola larga con la superficie rugosa.

Pteroplatytrygon violacea (Dasyatidae)

Nombres comunes: Es – Raya-látigo violeta; **In –** Blue stingray.
Nombres usados por los tripulantes: Raya, manta raya.

Diferencias con especies similares: Las otras rayas de la familia Dasyatidae no son pelágicas.

Compendium of the Management Recommendations and Resolutions

Resolutions are legally binding regulations addressed to CPCs. The first shark-specific Resolution is "C-99-11: Resolution on bycatch implemented in 1999". Since then, several measures have been adopted. There are currently 11 active Resolutions that specifically cover sharks. A summary of the information contained in each active resolution is provided. Resolutions are structured as C-xx–yy, where "xx" refers to the year it was implemented, and "yy" the order it was listed that year.

Resolution	Title	Entered into force	Status
C-99-11	Resolution on bycatch		Inactive
C-00-08	Resolution on bycatch		Inactive
C-02-05	Resolution on bycatch		Inactive
C-03-08	Consolidated resolution on bycatch		Inactive
C-04-05	Consolidated bycatch resolution	2006	Active
C-05-03	Conservation of sharks caught in association with fisheries in the Eastern Pacific Ocean	2005	Active
C-11-08	Resolution on scientific observers for longline vessels		Superseded by C-19-08
C-11-09	Resolution (amended) on establishing a program for transhipments by large-scale fishing vessels		Superseded by C-12-07
C-11-10	Conservation of Oceanic Whitetip Sharks caught in association with fisheries in the Antigua Convention area	2011	Active
C-12-07	Amendment to Resolution C-11-09 on establishing a program for transshipments by large-scale fishing vessels		Superseded by C-22-03
C-15-04	Conservation of mobulid rays caught in association with fisheries in the IATTC Convention Area	2015	Active
C-16-04	Amendment to Resolution C-05-03 on the conservation of sharks caught in association with fisheries in the Eastern Pacific Ocean	2016	Active
C-16-05	Management of shark species	2016	Active
C-16-06	Conservation measures for shark species, with Special emphasis on the Silky Shark (*Carcharhinus falciformis*), for the years 2017, 2018, and 2019		Superseded by C-19-05
C-19-01	Amendment to Resolution C-18-05 on the collection and analyses of data on fish-aggregating devices.	2019	Active
C-19-05	Amendment to the Resolution C-16-06 on the conservation measures for shark species, with special emphasis on the Silky Shark (*Carcharhinus falciformis*), for the years 2020 and 2021		Superseded by C-21-06
C-19-06	Conservation of Whale Sharks	2019	Active
C-19-08	Scientific observers for longline vessels	2019	Active
C-21-06	Amendment to Resolution C-19-05. Conservation measures for shark species, with special emphasis on the Silky Shark (*Carcharhinus falciformis*), for the years 2022 and 2023	2021	Active
C-22-03	Amendment to Resolution C-12-07 on establishing a program for transshipments by large-scale fishing vessels	2022	Active

All Resolutions are available online here.

Table: List of all Resolutions applicable to sharks with the date they came into force and information on whether they are still active or not.

Resolution C-04-05: Consolidated bycatch resolution

This resolution enforces Contracting Parties to report and safely release (to the extent possible) all sharks, rays, and other non-target species caught by purse seiners. This encourages the development of techniques and/or equipment to facilitate safe releases; seek funds to investigate survival rates of release species; and define areas and periods in which they are likely to be caught.

Resolution C-05-03: Conservation of sharks caught in association with fisheries in the Eastern Pacific Ocean

Contracted Parties are to develop a National Plan of Action for Sharks (NPOA). Fishers are to fully utilise caught sharks, except head, guts, and skins. If vessels have fins onboard, the total shall be no more than 5% of the weight of sharks onboard. This resolution encourages vessels to release incidentally caught sharks alive and that are not used for food and/or subsistence. It also encourages contracted Parties to research selective fishing gears, and shark nursery areas.

Resolution C-11-10: Conservation of Oceanic Whitetip Sharks caught in association with fisheries in the Antigua Convention Area

Species specified in C-11-10

Oceanic Whitetip Shark (*Carcharhinus longimanus*)

Prohibits the retention, transshipment, landing, and selling of Oceanic Whitetip Sharks. If caught, Oceanic Whitetip Sharks are to be recorded and released alive and unharmed, to the extent possible.

Resolution C-15-04: Conservation of Mobulid rays caught in association with fisheries in the IATTC Convention Area

Species specified in C-15-04

Mobulid rays

Prohibits the retention, transshipment, landing, and selling of mobulid rays. If caught, mobulids are to be recorded and released alive and unharmed, to the extent possible. It prohibits gaffing, lifting by the gills, and punching holes through the bodies of rays.

Resolution C-16-04: Amendment to Resolution C-05-03 on the conservation of sharks caught in association with fisheries in the Eastern Pacific Ocean

Encourages Contracting Parties to improve knowledge of key biological/ecological parameters, life-history and behavioural traits, and migration patterns of key shark species; identify key shark mating, pupping, and nursery areas; and improve handling practices for live sharks to maximise post-release survival.

Resolution C-16-05: Management of shark species

Species specified in C-16-05

Silky Shark (*Carcharhinus falciformis*),
Great Hammerhead (*Sphyrna mokarran*)
Scalloped Hammerhead (*Sphyrna lewini*)
Smooth Hammerhead (*Sphyrna zygaena*)

Plans to develop full stock assessments for Silky Sharks and hammerheads. Fishers are required to collect and submit data on the mentioned species, including the species, gender, length, number caught, etc. Purse seiners are to release all sharks that are not retained, and longliners not targeting sharks are prohibited from using 'shark lines'.

Resolution C-19-01: Amendment to Resolution C-18-05 on the collection and analyses of data on fish-aggregating devices.

All Contracting Party's purse seiners are to report data on species and number of specimens caught using FAD data with an on-board observer. This resolution also encourages Contracting Parties to design and deploy FADs that reduce entanglement of sharks and other non-target species.

Resolution C-19-06: Conservation of Whale Sharks

Species specified in C-19-06

Whale Shark (*Rhincodon typus*)

Prohibits use of purse-seine nets on Whale Sharks, and if caught, specimens are to be released unharmed and alive, to the extent possible, and the incident recorded.

Resolution C-19-08: Scientific observers for longline vessels

Scientific observers and/or electronic monitoring systems (EMS) operating on longliners are to record the targeted species caught, any interactions with nontarget species such as sharks, and if available, biological information on all catches. For vessels >20 m, at least 5% of all fishing efforts should have a scientific observer onboard. All observers are to follow the minimum reporting criteria set by the IATTC. For incidentally caught species including sharks, observers are to record:

- Gear characteristics (e.g., the number and length of shark lines used);
- Vessel's target species;
- Condition of incidentally caught specimens (e.g., hook location);
- General information (i.e., date, time, latitude, longitude, type of interaction, and species); and
- Landing information (i.e., length, sex, fin weight and carcass weight of finned and/or large sharks, landing and releasing conditions, tag recovery and release).

Resolution C-21-06: Measures for shark species, with special emphasis on the Silky Shark (*Carcharhinus falciformis*), for the years 2022 and 2023

Species specified in C-21-06

Silky Shark (*Carcharhinus falciformis*)

Prohibits the retention, transshipment, landing, and selling of Silky Sharks as a whole or in parts if caught by purse-seine vessels. If caught, the specimen is to be released unharmed and alive to the extent possible, and the incident recorded. If landed, the Silky Shark is to be surrendered to the appropriate authorities. Silky Sharks incidentally caught are limited to 20% of total catch weight in longliners not targeting sharks. If targeting sharks, only 20% of total number of specimens caught can be less than 100 cm total length. It also prohibits fishing in pupping grounds for Silky Sharks.

Resolution C-22-03: Amendment to Resolution C-12-07 on establishing a program for transshipments by large-scale fishing vessels

All transhipments of sharks caught in the Convention Area are restricted to ports and requires notifying the port authorities in advance. Large-scale tuna longline fishing vessels and authorised carrier vessels may tranship at sea but are to establish a monitoring program. This does not apply to troll vessels, pole-and-line vessels or vessels transhipping tuna or tuna-like species that are alive, whole or dressed/gutted.

References

Inter-American Tropical Tuna Commission (IATTC). 2000. 2nd Meeting of the Bycatch Working Group. www.iattc.org/GetAttachment/84279f3f-2a3a-4620-ba26-9bed6c51b641/BYC-02-RPT_2nd-Meeting-of-the-Bycatch-Working-Group.pdf

Inter-American Tropical Tuna Commission (IATTC). 2005. Plan for Regional Management of Fishing Capacity. www.iattc.org/getattachment/afdd0f42-8796-4dcf-a7cd-a8838db96463/Plan%20for%20regional%20management%20of%20fishing%20capacity

Inter-American Tropical Tuna Commission (IATTC). 2016. 1st Meeting of the Ad Hoc Working Group on FADs. www.iattc.org/GetAttachment/784b4835-7043-461e-8803-22e58f7b6076/Meeting-FAD-01a%20report

Inter-American Tropical Tuna Commission (IATTC). 2017. Creation of the IATTC Working Group for Reviewing the Legal and Operative Coherence of IATTC Resolutions. www.iattc.org/GetAttachment/9445ede7-19a5-4120-8a85-969d19168fd0/C-17-05-Active_Working-group-on-resolutions.pdf

Inter-American Tropical Tuna Commission (IATTC). n.d. Antigua Convention. www.iattc.org/en-US/About/Antigua-Convention

Inter-American Tropical Tuna Commission (IATTC). n.d. Resolutions. www.iattc.org/en-US/resolution/type/IATTC

Inter-American Tropical Tuna Commission (IATTC). n.d. Role and characteristics. www.iattc.org/en-US/About/Role

Horn Shark

Shark Spotlight

(*Heterodontus francisci*)

Written by Alexandra Morata
IUCN SSC Shark Specialist Group | Programme Officer

Taxonomy

The order Heterodontiformes includes ten valid species from one genus and family: Heterodontidae (bullhead sharks). *Heterodontus francisci* (Girard, 1855), commonly known as the Horn Shark, is one of ten species in the *Heterodontus* genus.

Morphology

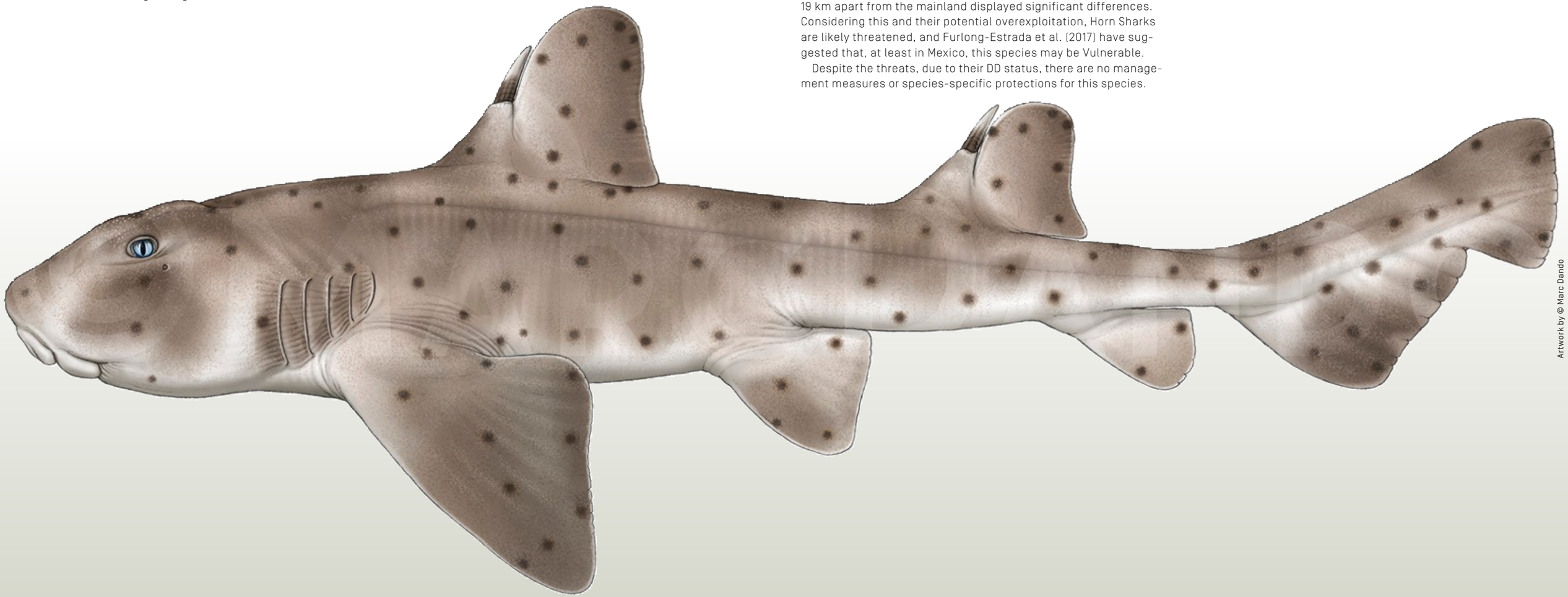
The Horn Shark is grey or brown in light to dark shades, with dark spots and dusky patches across its body. It has a minimum size of 15 cm total length (TL) and reaches a maximum size of 83 (male) or 96 cm (female) TL. It is oviparous and can lay two eggs approximately every two weeks during the breeding season (February–April). Some common traits in the *Heterodontus* genus include having muscular pectoral fins to "crawl" across the seabed; and nostrils that curve outward and are connected to blunt snouts. The Horn Shark closely resembles the Mexican Hornshark (*H. mexicanus*) and Galapagos Bullhead Shark (*H. quoyi*), all of which have overlapping ranges.

Interestingly, the morphology of Horn Sharks varies depending on the habitat they reside in. Smaller animals that prefer reefs or other open, shallow areas tend to have long and sharp fin spines, whereas those that live near caves have short and blunt fin spines, worn down as a result of moving through caves.

Distribution and Range

Horn Sharks are known to be present along the coasts of Mexico and the United States, particularly around Baja California and within the Gulf of California. Additionally, while not confirmed, this species may be present in Ecuador and Peru. Currently, the range of *H. francisci* is based on museum collections. At the same time, the species is caught by fisheries due to its overlapping range with the Mexican Hornshark and Galapagos Bullhead Shark, and there is concern over misidentification. Horn Sharks are nocturnal and are known to occupy small spaces at depths of 2–152 m, but primarily within 2–11 m during warmer seasons. In cooler seasons, this species has been recorded to move to lower depths (<30 m).

Interestingly, depending on what point of their life stage they are in, animals move to different habitats. For example, adolescents tend to remain close to the sandy bottom floor, hidden within feeding pits made by Bat Rays (*Myliobatis californicus*). In contrast, adults tend to reside in areas with plenty of coverage, such as dense algae or caves with crevices, etc.



Artwork by © Marc Dando

Conservation measures and IUCN Red List of Threatened Species status

Horn Sharks have no known commercial value but are occasionally sought out by recreational divers for their fin spines to be made into jewellery. Given their prevalence in shallow waters, their wild populations are susceptible to overfishing from various fishing gear, especially juveniles that tend to reside at shallow depths, plus have high post-release mortality rates. In Mexico, this species is frequently caught incidentally by shrimp trawlers and gillnets, and during winter, it is estimated that one specimen may be caught per boat per trip. However, under human care, Horn Sharks have been known to thrive, and are known to be capable of breeding in aquaria across the United States.

The Horn Shark was assessed as Data Deficient (DD) on the IUCN Red List of Threatened Species™ because of the limited information on its ecology and the impact of fishing on populations. There is also concern that even within their limited range, there may be separate populations around the islands from the mainland based on differences in egg case morphology. This was further supported by a recent, small-scale population structure study looking at the mitochondrial DNA of different populations; regardless of how distant populations were along the mainland, there were no major variations, whereas populations from adjacent islands as short as 19 km apart from the mainland displayed significant differences. Considering this and their potential overexploitation, Horn Sharks are likely threatened, and Furlong-Estrada et al. (2017) have suggested that, at least in Mexico, this species may be Vulnerable.

Despite the threats, due to their DD status, there are no management measures or species-specific protections for this species.

References

Canfield, S.J., Bowen, B.W. A rapid PCR-RFLP method for species identification of the eastern Pacific horn sharks (genus *Heterodontus*). Conservation Genet Resour 13, 79–84 (2021). doi.org/10.1007/s12686-020-01172-6

Canfield, S.J. & Galvan-Magana, F. & Bowen, B.W. (2022). Little Sharks in a Big World: Mitochondrial DNA Reveals Small-scale Population Structure in the California Horn Shark (*Heterodontus francisci*). Journal of Heredity, 113(3), 298–310. DOI: 10.1093/jhered/esac008

Carlisle, A.B. 2015. Heterodontus francisci. The IUCN Red List of Threatened Species 2015: e. T39333A80671300. dx.doi.org/10.2305/IUCN.UK.2015-4.RLTS.T39333A80671300.en. Accessed on 19 September 2023.

Ebert, D. A., Dando, M., & Fowler, S. (2021). Sharks of the World: A Complete Guide. Princeton University Press. doi.org/10.2307/j.ctv1574pqp

Fricke, R., Eschmeyer, W. N. & Van der Laan, R. (eds) 2022. Eschmeyer's Catalog of Fishes: Genera, Species, References. researcharchive.calacademy.org/research/ichthyology/catalog/fishcatmain.asp Electronic version accessed 27 September 2023.

Emmanuel Furlong-Estrada, Felipe Galván-Magaña, Javier Tovar-Ávila. (2017). Use of the productivity and susceptibility analysis and a rapid management-risk assessment to evaluate the vulnerability of sharks caught off the west coast of Baja California Sur, Mexico. Fisheries Research, 194, pp. 197–208. doi.org/10.1016/j.fishres.2017.06.008.

Meese, E.N., Lowe, C.G. Environmental effects on daytime sheltering behaviors of California horn sharks (Heterodontus francisci). Environ Biol Fish 103, 703–717 (2020). doi.org/10.1007/s10641-020-00977-6

Sergio Ramírez-Amaro, Felipe Galván-Magaña. (2019). Effect of gillnet selectivity on elasmobranchs off the northwestern coast of Mexico. Ocean & Coastal Management, 172, pp. 105–116. doi.org/10.1016/j.ocecoaman.2019.02.001.

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The Impacts of Pollution on Sharks and Rays

Dr. Simon J. Pierce

Reëf Manta Ray (*Mobula alfredi*) feeding among plastic pollution at Nusa Penida, Indonesia

Pollution is the introduction of artificial or natural contaminants or energies (such as light or noise) into the environment that cause adverse change.

Until the 1970s, people routinely dumped toxic chemicals and other waste products into the ocean with little understanding of the consequences. We assumed that the vast ocean had an almost unlimited capacity to dilute and disperse our rubbish – out of sight, out of mind. Unfortunately, our steady creation of novel chemicals and long-lasting products, such as plastics, is creating a larger and larger problem for generations to come.

Persistent organic pollutants, heavy metals, crude oil, and marine debris (such as plastic waste, and lost or discarded fishing gear) are the most common ocean pollutants. Some of these substances are used for disease and pest control, or in manufacturing and industrial processes. Others are accidental by-products of waste incineration, vehicle emissions, or forest fires. Pollutants can enter the marine environment from a variety of sources, such as discharge and runoff from agricultural and urban areas, from fishing or transport vessels, and even from winds depositing atmospheric waste onto the ocean surface.

Sharks and rays, many of which are top predators in marine and freshwater ecosystems, are highly susceptible to environmental pollution. Pollutants typically bioaccumulate, where the amount in the animal's body grows faster than their ability to excrete it. This is compounded by biomagnification, where sharks and rays unavoidably ingest the pollutants within their prey species too. When people, in turn, rely on sharks and rays as a source of protein, the pollutants can be passed on to them and their families.

In this fact sheet, we identify the main sources of ocean pollution and how these are likely to impact sharks and rays, with a particular focus on those listed on the Convention on the Conservation of Migratory Species of Wild Animals (CMS) and the Memorandum of Understanding on the Conservation of Migratory Sharks (Sharks MOU), and explore some of the downstream health implications for people.

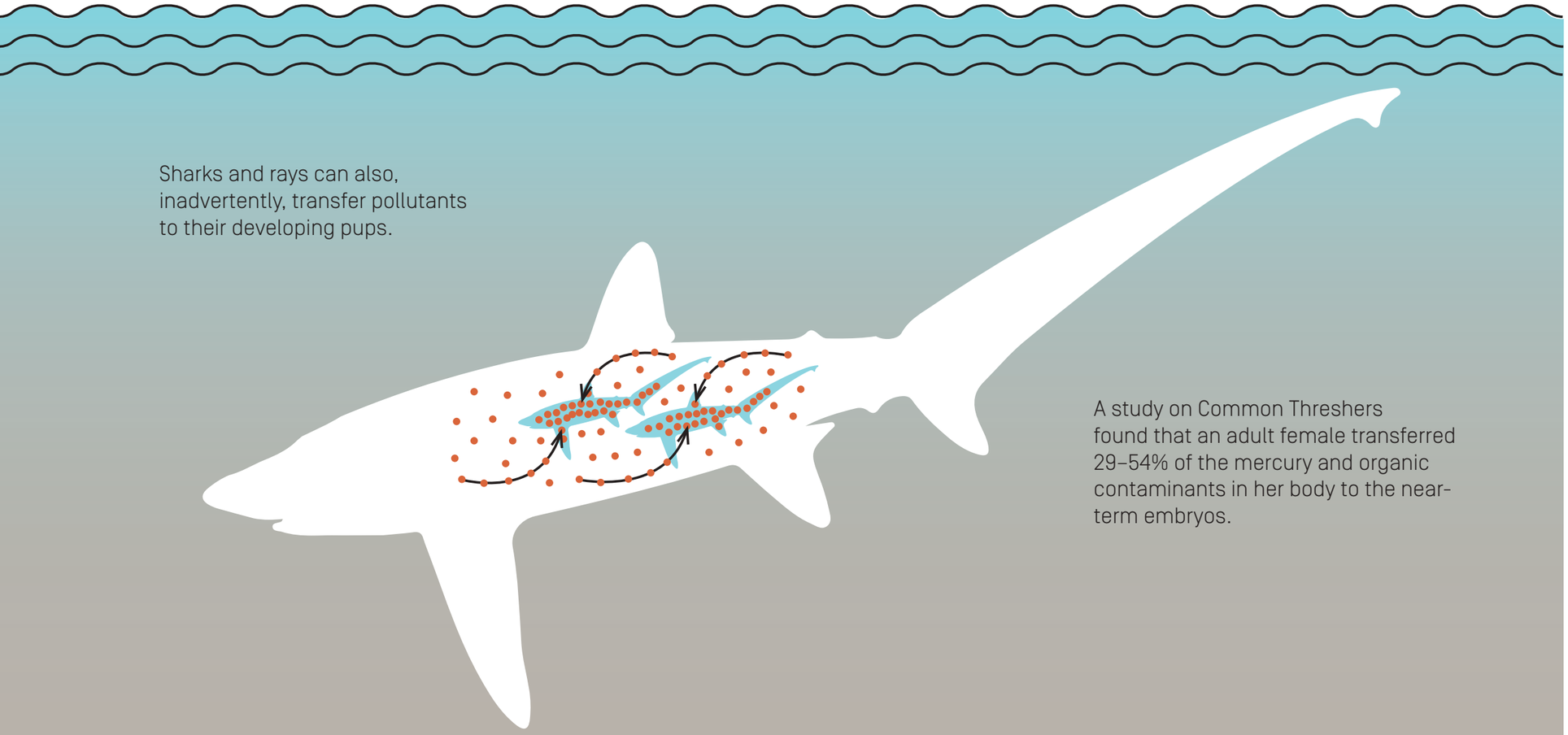
Abandoned fishing gear in seagrass, Greece

Dimitris Poursanidis | Ocean Image Bank

Toxic Chemicals and Heavy Metals

High concentrations of toxic pollutants, including organic (e.g., PCBs, DDTs, and organochlorines) and inorganic substances (e.g., heavy metals, including mercury), are now routinely found in sharks and rays. Research on the impact of these pollutants on these species is still at an early stage, but studies on marine mammals and teleost fishes have found neurological disorders, structural damage to organs and gills, reduced fertility, developmental effects, and cancers, at levels of pollutant exposure similar to those reported from Blue Sharks (*Prionace glauca*), White Sharks (*Carcharodon carcharias*), Shortfin Makos (*Isurus oxyrinchus*), Common Threshers (*Alopias vulpinus*), and Whale Sharks (*Rhincodon typus*). While shark physiology does not necessarily respond in the same way to other animals, these results are a cause for concern as increasing pollutant loads are documented around the world.

Sharks and rays can also, inadvertently, transfer pollutants to their developing pups. A study on Common Threshers found that an adult female transferred 29–54% of the mercury and organic contaminants in her body to the near-term embryos. Similarly, high organochlorine levels have been found in young White Shark pups, presumed to be transferred from their mother's tissue. The elevated levels of pollutants in these young sharks point to a heightened future risk of ill effects, as they will continue to bioaccumulate these contaminants throughout their life-time. While studies of pollutant effects on reproduction have so far focused on sharks that give birth to free-swimming pups, such as those mentioned earlier, the permeable eggs of other species, such as the Smallspotted Catshark (*Scyliorhinus canicula*) and skates (family Rajidae) may mean that their embryos cannot avoid exposure to waterborne pollutants during development.



Red tide events, a toxic bloom of Karenia spp. dinoflagellates associated with nutrient run-off from agriculture, are increasing in frequency along the southern coast of the United States. In 2000, a large bloom led to the mass death of hundreds of Blacktip (*Carcharhinus limbatus*) and Atlantic Sharpnose (*Rhizoprionodon terraenovae*) sharks in northwest Florida. Examination of the dead sharks found that they also transferred brevotoxins from the algal bloom to their embryos, showing that such maternal transfer can take place for a wide variety of pollutants. Red tides are an ongoing problem for a number of shark and ray species in this region, with a probable Whale Shark death also reported from Florida in 2018.

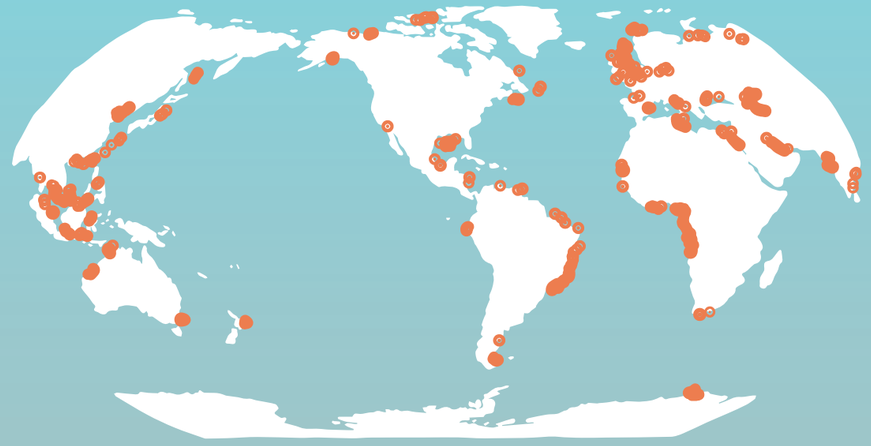
Oil Spills

Oil and gas extraction is a huge and growing industry worldwide, including in the ocean. The first offshore oil drilling platform went live in 1947 and, since then, over 12,000 platforms have been constructed on the continental shelves of 53 countries. As engineering improves, platforms are being built in deeper and deeper waters. The potential threat to sharks and rays comes primarily from large-scale oil spills, either from platform blowouts or tanker accidents. However, these activities also increase vessel traffic, which poses an additional collision risk to large surface-feeders like Giant Manta Rays (*Mobula cf. birostris*) and Whale Sharks.

The Deepwater Horizon oil spill in 2010 was the largest accidental spill in history and the best-studied incident when considering potential effects on sharks and their relatives. The platform was located in the northern Gulf of Mexico, 66 km off the coast of the United States, with the blowout occurring at 1,500 m depth. An estimated 750 million litres of oil were spilled, covering over 180,000 km^2 of surface waters, affecting over 2,100 km of coastal habitats, and contaminating surrounding deepwater areas.

Around 80 species of sharks and rays live in the Gulf of Mexico. Their distributions, habitat preferences, biology and ecology, conservation status, and likely exposure to spilled oil, have been modelled to create vulnerability indices to regional oil spills. Sharks and rays had higher overall vulnerability scores than teleost fishes, with the Whale Shark, Giant Manta Ray, and the Scalloped Hammerhead (*Sphyrna lewini*) the most susceptible overall. The Gulf of Mexico is a globally important feeding area for Whale Sharks and Giant Manta Rays, both of which filter-feed on the surface, leading to concerns that both oil spills and the chemical dispersants used as a treatment for spills could damage their respective gill structures. Neonate and small juvenile Scalloped Hammerheads, on the other hand, use coastal nursery areas that could be affected by spills. All three species are globally Endangered or Critically Endangered on the IUCN Red List of Threatened Species.

Some deepwater sharks (occurring at depths of over 200 m) and ghost sharks (chimaeras) have also been identified as highly susceptible to regional oil spills, particularly the Blotched Catshark (*Scyliorhinus meadi*), Caribbean Roughshark (*Oxynotus caribbaeus*), and Smallfin Catshark (*Apristurus parvipinnis*). Between 0.5–25% of the Deepwater Horizon oil spill is estimated to have been deposited on the seafloor, where a sudden influx of organic hydrocarbon can overwhelm natural microbial biodegradation. Field studies have detected polycyclic aromatic hydrocarbons (PAHs), indicative of oil exposure, in deepwater sharks within 100 km of the spill site. Detrimental effects may be particularly high for the species whose egg cases develop over prolonged periods on the seafloor, such as catsharks (family Scyliorhinidae). Eight years after the spill, surveys indicated oil concentrations in coastal areas of Louisiana remained an order of magnitude higher than baseline. With the oil now sequestered in anoxic sediments, levels are expected to remain significantly above background for decades, with ongoing impacts on sharks, rays, chimaeras, and their prey species in the region.



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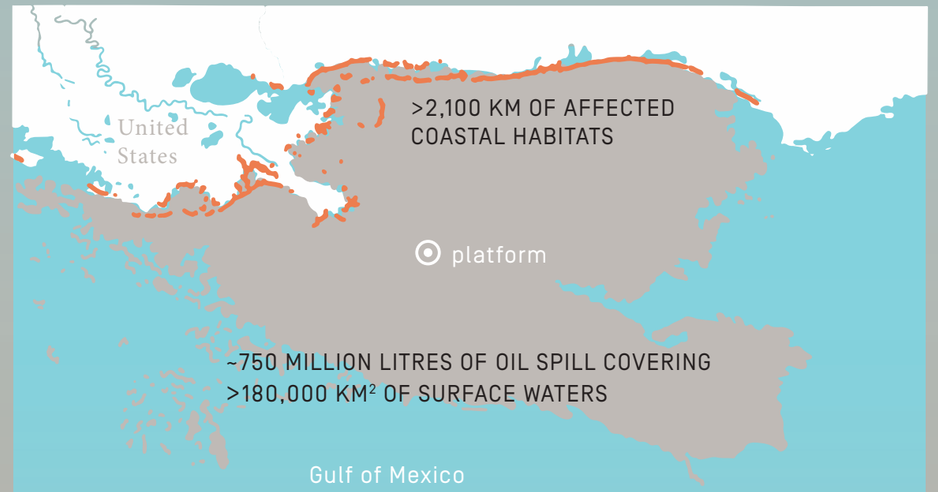

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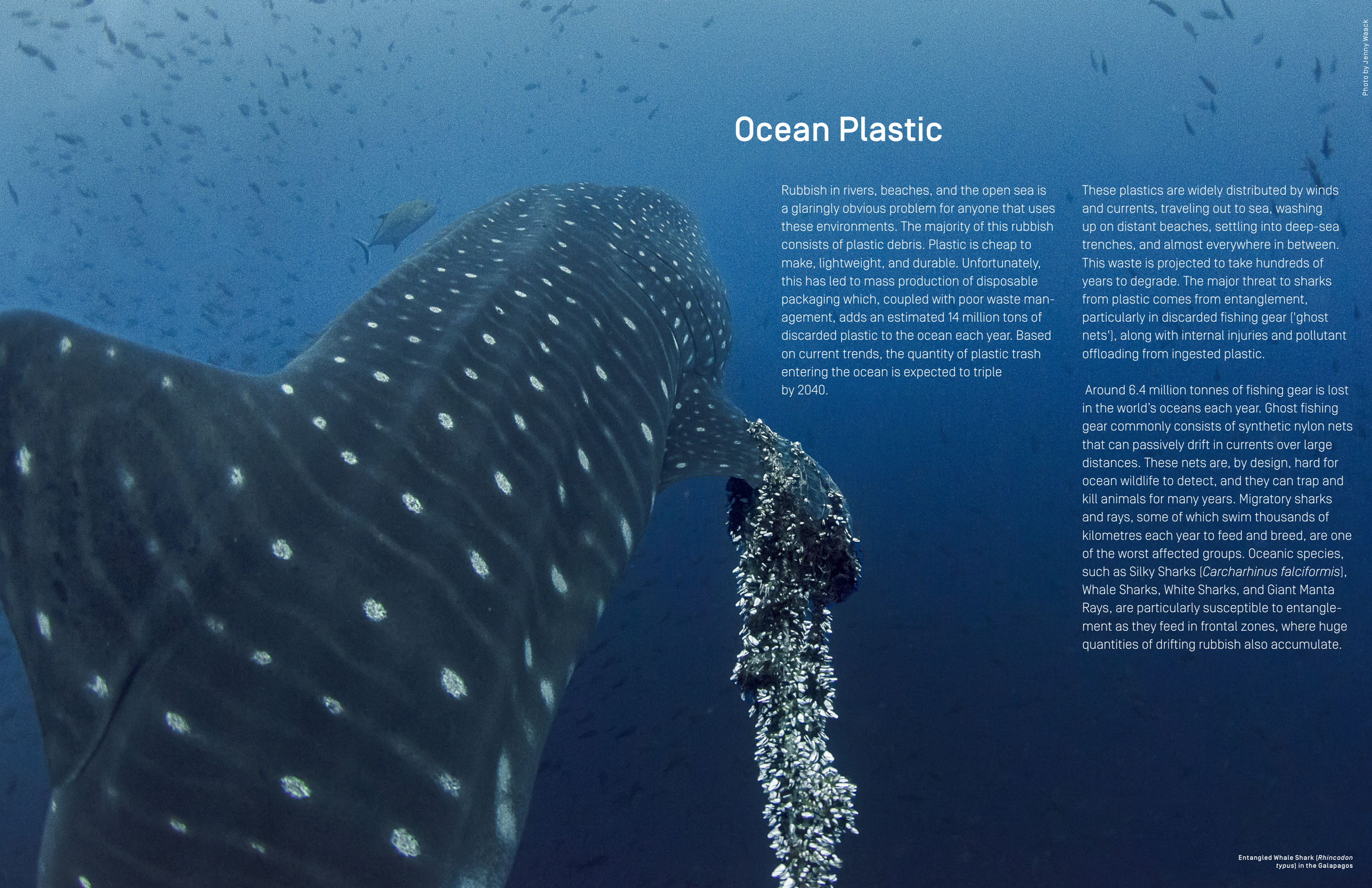


Photo by Jenny Waack

Ocean Plastic

Rubbish in rivers, beaches, and the open sea is a glaringly obvious problem for anyone that uses these environments. The majority of this rubbish consists of plastic debris. Plastic is cheap to make, lightweight, and durable. Unfortunately, this has led to mass production of disposable packaging which, coupled with poor waste management, adds an estimated 14 million tons of discarded plastic to the ocean each year. Based on current trends, the quantity of plastic trash entering the ocean is expected to triple by 2040.

These plastics are widely distributed by winds and currents, traveling out to sea, washing up on distant beaches, settling into deep-sea trenches, and almost everywhere in between. This waste is projected to take hundreds of years to degrade. The major threat to sharks from plastic comes from entanglement, particularly in discarded fishing gear ('ghost nets'), along with internal injuries and pollutant offloading from ingested plastic.

Around 6.4 million tonnes of fishing gear is lost in the world's oceans each year. Ghost fishing gear commonly consists of synthetic nylon nets that can passively drift in currents over large distances. These nets are, by design, hard for ocean wildlife to detect, and they can trap and kill animals for many years. Migratory sharks and rays, some of which swim thousands of kilometres each year to feed and breed, are one of the worst affected groups. Oceanic species, such as Silky Sharks [*Carcharhinus falciformis*], Whale Sharks, White Sharks, and Giant Manta Rays, are particularly susceptible to entanglement as they feed in frontal zones, where huge quantities of drifting rubbish also accumulate.

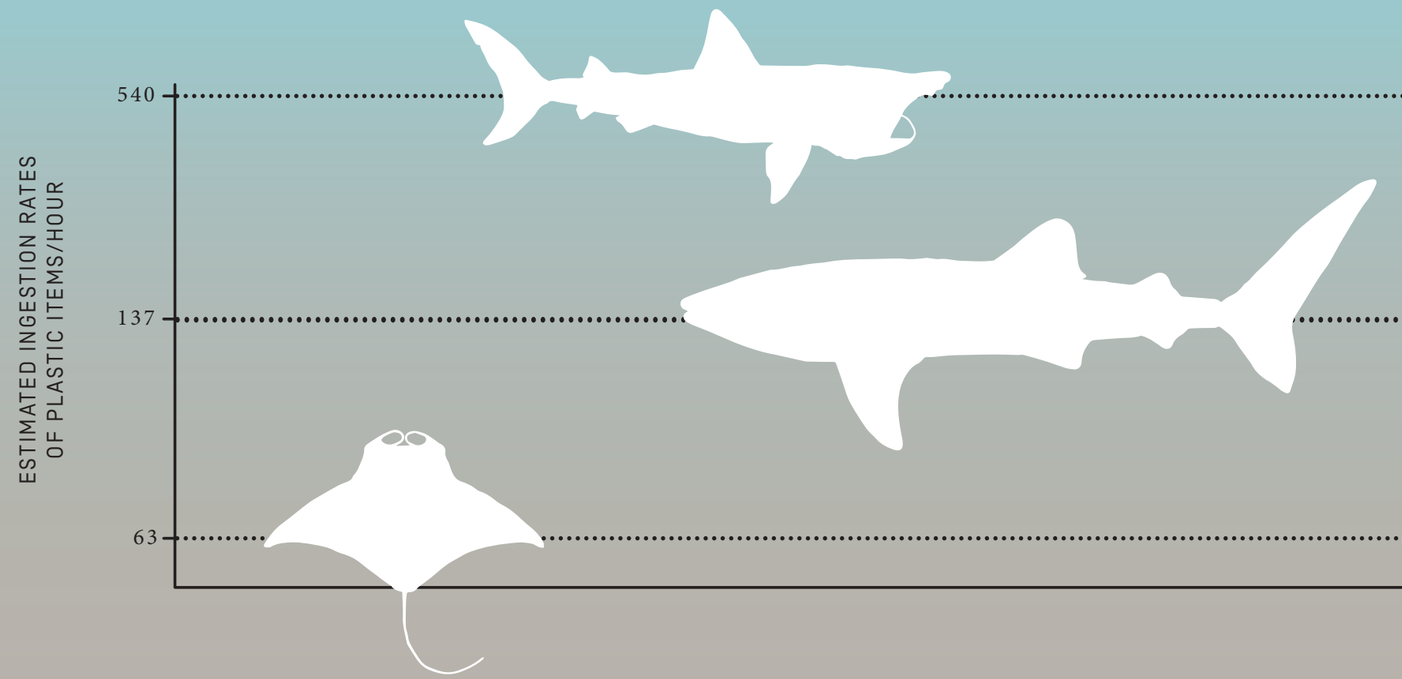
Entangled Whale Shark [*Rhincodon typus*] in the Galapagos

Plastic waste, regardless of whether it was originally a fishing net or a toothbrush, does not disappear over time – rather, it will break up into smaller and smaller pieces. These tiny, toxic pieces of plastic, now ubiquitous throughout the ocean, are impossible for animals to avoid. While plastic fragments have been found in the stomachs of many sharks and rays, accidental ingestion by large filter-feeders such as Manta and Devil Rays (*Mobula* spp.), Whale Sharks, and Basking Sharks (*Cetorhinus maximus*) is a particular concern.

These species feed in areas where zooplankton are swept together by ocean currents and tidal flows; unfortunately, drifting plastics are along for the same ride. Studies of plastic fragments at Reef Manta Ray (*Mobula alfredi*) and Whale Shark feeding areas in Indonesia estimated there to be 20,000–449,000 pieces of plastic per km^2, leading to estimated ingestion rates of up to 63 items per hour for Manta Rays, and up to 137 items per hour for Whale Sharks. Reef Manta Rays were estimated to be ingesting up to 980 g of plastic per kilogram of plankton. Basking Sharks in the Mediterranean Sea were estimated to be ingesting 540 plastic pieces per hour.

Blockages and internal injuries from ingestion can be lethal. Inspection of a dead Whale Shark that washed ashore in Thailand found it had been killed by a single hardened plastic straw that perforated its oesophagus. Dead animals are unlikely to be found in the wild, and are rarely the subject of detailed examinations, so mortalities from plastic have so far only been documented due to unusual circumstances. Two other separate plastic-related deaths in Whale Sharks in Japan were identified because they died in a rehabilitation centre, 201 and 297 days after their respective arrivals, from intestinal damage caused by ingested plastic pieces that were not available to them within the facility.

That said, plastic ingestion by sharks and rays, especially small pieces, will usually result in the fragments passing through the intestinal tract without causing damage. A concern, though, is that individuals will increasingly suffer from malnutrition – such as in the case of Reef Manta Rays in Indonesia, referred to above, where they could be physically 'full' with only 52% zooplankton in their stomach. An additional area of current research is whether ingested plastics will offload pollutants to sharks and rays. Plastics adsorb many of the chemical pollutants listed earlier, such as PCBs, DDT, PAHs, and heavy metals, and can concentrate them up to one million-fold that found in the surrounding water. Upon ingestion, these chemicals can leach into the animals' tissue. In other ocean wildlife groups, such as marine mammals, this is believed to suppress their reproduction. For many species of sharks and rays that are already threatened with extinction, such as the three megaplanktivores listed above, the possibility of a similar inhibitory effect is a significant concern.



Studies of plastic fragments at Reef Manta Ray and Whale Shark feeding areas in Indonesia estimated there to be 20,000–449,000 pieces of plastic per km^2, leading to estimated ingestion rates of up to 63 items per hour for Manta Rays, and up to 137 items per hour for Whale Sharks. Reef Manta Rays were estimated to be ingesting up to 980 g of plastic per kilogram of plankton. Basking Sharks in the Mediterranean Sea were estimated to be ingesting 540 plastic pieces per hour.

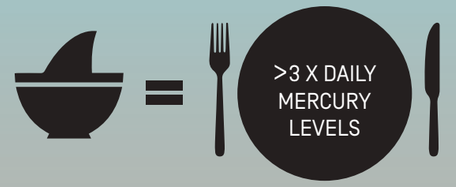
Human Health

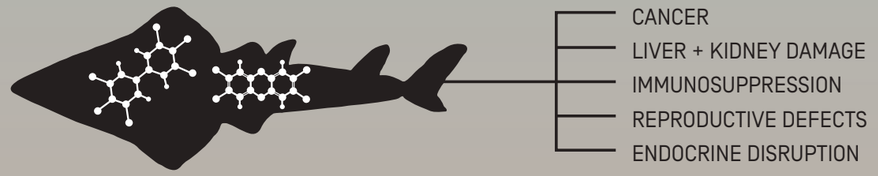
All of us are exposed to environmental pollutants throughout our lifetime. Humans are, effectively, apex predators, and our diet is a significant exposure pathway for bioaccumulation. Around two billion people live within 100 km of the coast, and seafood is an important part of the diet for many coastal communities, particularly where the primary industry is fishing. Meat and secondary products deriving from sharks and rays (e.g., fins or gill plates) are consumed and used worldwide and therefore the high concentrations of pollutants found in these species pose a risk to human health.

Biomonitoring studies on fishing communities have detected elevated concentrations of organic pollutants and mercury. A single serving of shark meat (113 g for adults and 11-year-olds; 28 g for 2-year-olds) can expose adults and children to over three times the maximum recommended daily mercury consumption limit. The US Food and Drug Administration and Environmental Protection Agency have recommended that people avoid eating shark meat entirely. Their current daily recommended limit is 980 ng g-1 for mercury, but a recent study found the average mercury concentrations in sharks actually exceed this value by 66% (1670 ng g-1). People consuming sharks from the orders Carcharhiniformes and Lamniformes are at even greater risk, as the average mercury concentration in these generally large-bodied species exceeded 4000 ng g-1. High mercury levels have been documented in Blue Sharks, Silky Sharks, Dusky Sharks (*Carcharhinus obscurus*), Hammerheads (*Sphyrna* spp.), Shortfin Mako, Threshers (*Alopias* spp.), and Oceanic Whitetip Sharks (*Carcharhinus longimanus*). In addition, exposure to other pollutants found in shark tissue, such as PCBs and dioxins, has been linked to cancer, liver and kidney damage, immunosuppression, reproductive defects, and endocrine disruption. Pregnant women and young children are especially vulnerable to these health risks.

Meat and secondary products deriving from sharks and rays (e.g., fins or gill plates) are consumed and used worldwide and therefore the high concentrations of pollutants found in these species pose a risk to human health.

A single serving of shark meat (113 g for adults; 28 g for children) can expose adults and children to over three times the maximum recommended daily mercury consumption limit.





Exposure to other pollutants found in shark tissue, such as PCBs and dioxins, has been linked to serious health conditions.

Photo by Rima Jabado

Shark and ray meat is increasingly consumed in many coastal communities around the world

Looking Forward

On a population level, pollution is likely to have a minor, but chronic, effect on threatened sharks and rays. Unfortunately, it is getting worse. Large predatory sharks tend to be long-lived, which makes them susceptible to bioaccumulation of pollutants over time. They also biomagnify any contaminants found within their prey. Plankton-feeding sharks and rays are particularly susceptible to plastic pollution and oil spills. All migratory sharks and rays are threatened by ghost fishing gear. Substantial effort is required to stop toxic chemicals, heavy metals, and waste materials from entering the ocean. End-point measures, such as beach clean-ups to remove plastic waste, are an important part of meeting the challenge, but are not themselves a complete solution. To achieve meaningful reductions on a global level, the use of disposable plastics within the supply chain needs to be phased out, and waste management infrastructure improved so that less rubbish reaches the ocean in the first place.

Shark and ray meat and other products commonly contain toxic loads of mercury and other pollutants. Consumers need to be made aware of this, as it presents a significant health risk. Regular testing of shark and ray products by food safety agencies can assist here. A pause on the local sale and export of shark and ray meat and other derivatives, if pollutant levels exceed recognized safe levels, also presents an immediate commercial imperative to help identify and reduce pollution inputs, thereby helping to maintain sustainable fisheries for the species and areas in which this is possible.

To improve the overall situation for sharks and rays, specifically, it is important to identify and prioritize the areas in which threatened species are most likely to be affected. By investigating which pollutants are creating problems in these locations, and the likely sources of contamination, we can in some cases turn a global issue into a relatively local one. Party and Non-Party Range States to CMS will thereby be able to identify opportunities for conservation within their own waters, and for regional partnerships.

Photo by Srikanth Mannepuri | Ocean Image Bank

Fishers sorting plastic waste from fishing nets in Visakhapatnam, India

Further Reading

Microplastics: No small problem for filter-feeding megafauna. Germanov ES, Marshall AD, Bejder L, Fossi MC, Loneragan NR (2018) Trends in Ecology & Evolution 33(4): 227–32.

Are concentrations of pollutants in sharks, rays and skates (Elasmobranchii) a cause for concern? A systematic review. Tiktak GP, Butcher D, Lawrence PJ, Norrey J, Bradley L, Shaw K, Preziosi R, Megson D (2020) Marine Pollution Bulletin 160: 111701.

Assessing the exposure risk of large pelagic fish to oil spills scenarios in the deep waters of the Gulf of Mexico. Romo-Curiel AE, Ramírez-Mendoza Z, Fajardo-Yamamoto A, Ramírez-León MR, García-Aguilar MC, Herzka SZ, Pérez-Brunius P, Saldaña-Ruiz LE, Sheinbaum J, Kotzakoulakis K, Rodríguez-Outerelo J (2022) Marine Pollution Bulletin 176: 113434.

Resharking leopards in Raja Ampat: a behind-the-scenes look at the StAR *(Stegostoma tigrinum)* Augmentation and Recovery) project.

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Photo by Mark V Erdmann

Adult Zebra Shark (*Stegostoma tigrinum*), Julian Rocks Nguthungulli Nature Reserve, New South Wales, Australia

With growing conservation concern for sharks and rays, the majority of interventions have consisted of species protection advocacy at the local and national levels, fisheries regulations at the national and regional levels, international treaties (e.g., Convention on the International Trade in Endangered Species of Flora and Fauna [CITES], Convention on the Conservation of Migratory Species of Wild Animals [CMS]), and spatial protections (e.g., Marine Protected Areas [MPA], dedicated "Shark Sanctuaries", etc.). In stark contrast, one intervention strategy that has received almost no attention for threatened elasmobranchs is ex-situ breeding for wild release and other translocation efforts. This might seem surprising given the success of this approach for recovering other threatened species such as the California Condor (*Gymnogyps californianus*), Scimitar-horned Oryx (*Oryx dammah*), and Black-footed Ferret (*Mustela nigripes*); we suspect that this is mainly explained by differences in our understanding of the diverse reproductive strategies of sharks and rays relative to mammals and birds, combined with the dominant perception of elasmobranchs as commodities or a menace to human safety rather than as ecologically important and charismatic species deserving of concerted protection efforts. There is, however, no *a priori* reason why translocations should not form an essential part of integrated conservation strategies for sharks and rays. Enter ReShark (www.reshark.org), an international collective focused on linking in-situ and ex-situ conservation solutions for threatened shark and ray species through captive breeding and/or other translocations. The first project within the ReShark collective, the ***Stegostoma tigrinum* Augmentation and Recovery (StAR) project**, serves as a successful model for ex-situ conservation management of shark and ray species following IUCN's *One Plan Approach* and the IUCN SSC *Guidelines on the use of ex-situ management for species conservation*. Here, we provide an overview of the StAR project, from conceptualization to implementation, as an example of how the ReShark approach can be successfully applied to threatened elasmobranch conservation efforts.

IUCN One-Plan Approach
This initiative of the IUCN Species Survival Commission (SSC) Conservation Planning Specialist Group (CPSG) aims to develop one comprehensive conservation plan for individual species that bridges the gap between field-based initiatives to conserve threatened species and long-term ex-situ breeding programs for maintaining sustainable wildlife populations in human care. Under this initiative, there are guidelines to assist with the use of ex-situ breeding populations for wildlife management that have helped to formulate the ReShark approach.

Star Project

Early Ideas of ReSharking
The origins of the ReShark approach date to 2015. During the reassessment of the Indo-Pacific Leopard Shark (also known as Zebra Shark; *Stegostoma tigrinum*) for the IUCN Red List of Threatened Species™, a striking conservation asymmetry was revealed: the species was highly threatened throughout much of its range in the wild but was thriving in aquarium facilities around the world. Given the implementation of ex-situ breeding programs to conserve other species, this raised the question of the feasibility for threatened sharks and rays. At that time, Dr Mark Erdmann of Conservation International was working in Raja Ampat, Eastern Indonesia, in collaboration with the SEAA Aquarium (Singapore). In contrast to the SEAA Aquarium, which had an over-abundance of Indo-Pacific Leopard Shark pups in their facility, this species was nearly extirpated from the Raja Ampat MPA network (established in 2007, comprising nine MPAs totaling just under 2 million hectare of high diversity coral reefs and associated ecosystems). Though a decade of conservation efforts, including the designation of the entire area as a strict shark and ray sanctuary in 2012, produced an impressive recovery of the local populations of reef shark species and Reef Manta Rays (*Mobula alfredi*), there was no noticeable recovery of Indo-Pacific Leopard Sharks.

Initial discussions between Erdmann and Indo-Pacific Leopard Shark researcher Dr Christine Dudgeon around the potential of an ex-situ conservation initiative were generally favorable but raised questions about potential genetic pollution from the release of animals bred in captivity (see Genetics inset box), the feasibility of the project and ethical considerations. Interest in the project was reignited in 2017 from work being conducted at the Aquarium des Lagons in New Caledonia, which had been collecting Indo-Pacific Leopard Shark eggs from the wild, hatching and rearing the pups as part of a display for the public, and then releasing them back to Noumea's reefs. Further, the Aquarium had successfully shipped Indo-Pacific Leopard Shark eggs across the Pacific to Chicago's Shedd Aquarium, providing proof-of-concept for long-distance egg shipments and rearing and releasing pups into the wild.

Genetics
Two primary considerations for genetics in ex-situ breeding programs are outbreeding and inbreeding. Outbreeding concerns genetic pollution and ensures that released animals originate from the appropriate genetic stock. For *Stegostoma*, population genetics had shown the global distribution to be split into two major sub-populations divided within Indonesia by the Indonesian Throughflow Current, which coincides with the biogeographic feature of the Wallace Line. Raja Ampat falls on the eastern side of this divide. All animals in human care are screened using maternally inherited mitochondrial DNA (ND4) and bi-parentally inherited microsatellite markers (16 marker panel). If both marker types support an eastern population provenance, the animal is deemed an appropriate breeder. All genetic samples are screened at the same facility (Feldheim Laboratory, The Field Museum, Chicago USA) to ensure calibration across samples.
Inbreeding is concerned with genetic fitness, where mating of closely related animals results in reduced genetic diversity. Using microsatellite markers, we select potential breeding pairs that demonstrate low genetic relatedness – that is, they do not fall into the categories of parent-offspring, full-sibling, or half-sibling relationships. An extreme form of inbreeding is parthenogenesis. This translates to 'virgin birth' and has been recorded from over ten shark and ray species, including the Indo-Pacific Leopard Shark. Although the mechanism is not determined, the genetic signal of parthenogenesis is clear. The DNA in the haploid egg cell is duplicated. Hence, the diploid parthenote offspring have identical gene copies at each genetic marker, rather than the genetic diversity observed when different gene copies are passed on from each parent. Parthenotes have a very high level of mortality, as any harmful gene will be expressed. The first batch of viable eggs from each potential ex-situ breeding pair are screened for parthenotes. Only breeding pairs that are producing heterozygous offspring, indicating sexual reproduction, are approved for the program.

Georgia Aquarium workshop, Setting up the structure, SC and the COVID years

The StAR Project is born
The next momentum pulse came from discussions between Erdmann and Dr. Al Dove from the Georgia Aquarium, which eventually led to a seminal December 2019 workshop on *Stegostoma* conservation. The workshop, which was hosted by the Georgia Aquarium and included 21 representatives from Association of Zoos and Aquariums (AZA)-accredited aquariums, academia, conservation organizations and the IUCN SSC CPSG, comprised three days of examining the feasibility and appropriateness of a conservation translocation program for Leopard Sharks. There was resulting unanimous support to proceed with the idea, with Raja Ampat deemed an appropriate demonstration site given its healthy and well-managed reefs and strongly supportive stakeholders. Further conversations demonstrated support from multiple levels of the Indonesian government (see below). Moreover, two local NGOs based at Raja Ampat dive resorts, the Raja Ampat Research and Conservation Centre (RARCC), and Misool Foundation (MF), indicated strong interest in building and managing the nurseries envisioned for the project.

By February 2020, as the COVID pandemic swept the globe, a small team began holding biweekly video conferences to discuss how to turn this bold idea into reality. A Steering Committee (SC) was formed, with Dr. Erin Meyer from Seattle Aquarium appointed chair, and within two months, an overall workplan was agreed upon and a Charter drafted. The project, named the *Stegostoma tigrinum* Augmentation and Recovery (StAR) project, now had a clear objective: to re-establish a healthy, self-sustaining population of Indo-Pacific Leopard Sharks beginning with the Raja Ampat archipelago through the world's first conservation translocation of captive-bred threatened sharks and rays.

In May 2020, the SC obtained the endorsement of the StAR concept from the joint chairs of the IUCN SSC Shark Specialist Group at the time, Dr Nick Dulvy and Dr Colin Simpfendorfer, following discussions and reassurance that this approach complements and does not replace other elasmobranch conservation measures, including fisheries management approaches and MPA designations. Dulvy and Simpendorfer further recommended modelling the approach to demonstrate the need for conservation translocation to recover the Raja Ampat population and clearly define what success would look like for the project (see PVA inset box).

An initial "anchor grant" for StAR was successfully secured from Fondation Segré to fund implementation activities in Indonesia (ranging from governmental meetings to nursery construction and operations and staffing). Over 30 institutional and private donors have joined the coalition to support the StAR project, including a number participating in the "Adopt-A-Leopard-Shark" program by contributing $10,000 to adopt and name one of the pups to be released.

As momentum for the StAR project continued to build, Nesha Ichida (from the Indonesian NGO Thrive Conservation) was hired as the Indonesian Program Manager, and the SC developed topical working groups which meet regularly to further flesh out important details for project implementation and to develop Standard Operating Procedures (SOPs).

Indonesian Implementation Working Group (WG)

The Indonesian Implementation WG is tasked with engaging and coordinating the range of stakeholders within Indonesia for the successful implementation of the StAR project. Its immediate focus upon formation was to ensure strong local ownership, while also building national-level support from relevant ministries that needed to endorse the project and issue the various permits to import eggs, release pups into the wild, and conduct research. The Indonesian Implementation WG has representation from relevant government agencies and local NGOs Konservasi Indonesia and Thrive Conservation.

Multiple levels of government support
The Raja Ampat MPA Management Authority was the first agency to be engaged to ensure local ownership; immediately after that, the Regional Research and Innovation Agency of West Papua Province was brought on as the lead project agency under the direction of Prof Charlie Heatubun. In March 2021, a high-level meeting in Jakarta to gain national-level government support was chaired by Prof Heatubun along with the Governor of West Papua. This brought together local and regional agencies, including the special staff to the President of the Republic of Indonesia; representatives of multiple departments of the Ministry of Marine Affairs and Fisheries; numerous local NGOs; and StAR Project international representation. Collaborators from the National Research and Innovation Agency provided critical support. Though participants largely supported the approach, two significant concerns raised included whether the project is needed for the species' recovery (see PVA inset box) and genetic pollution (see Genetics inset box). These concerns were duly addressed, and representatives from the four Ministries attending signed a high-level commitment to support the project. In November 2022, once the first shipment of eggs had been received and the first release of pups was imminent, the West Papua government hosted a gala launching ceremony for the StAR project that included a tour of the nursery facilities for government officials.

PVA

Population Viability Analysis (PVA) is a quantitative assessment of species extinction risk under current or predicted conditions. Dr. Kathy Traylor-Holzer from the IUCN CPSG was engaged to run through the PVA for the Indo-Pacific Leopard Shark in Raja Ampat with the StAR committee. One of the very first critical steps was defining success. What is the project's major goal, and how do we know when we have reached it? The definition of success for StAR is: 'to re-establish a healthy, genetically diverse and self-sustaining population of Leopard Sharks in the Raja Ampat archipelago'. The PVA was then implemented through multiple computer simulation scenarios with this definition of success as the target. The scenarios included 'business as usual' – that is, no contribution from ex-situ breeding programs - as well as multiple scenarios with different numbers of animal releases over varying time frames. The outputs showed that under a 'business as usual' scenario, the Raja Ampat population would need more than 60 years to recover to a base population (100–200 individuals) with a 23% chance of extinction. The optimal release scenario supported a much more robust recovery through animal releases from ex-situ breeding over a 10-year time frame and a highly reduced chance of extinction. The PVA was instrumental in formulating an animal release design (numbers of animals and frequency of releases) and being an essential tool for demonstrating the conservation utility of the ex-situ breeding program for stakeholders. www.cpsg.org/content/zebra-shark-pva

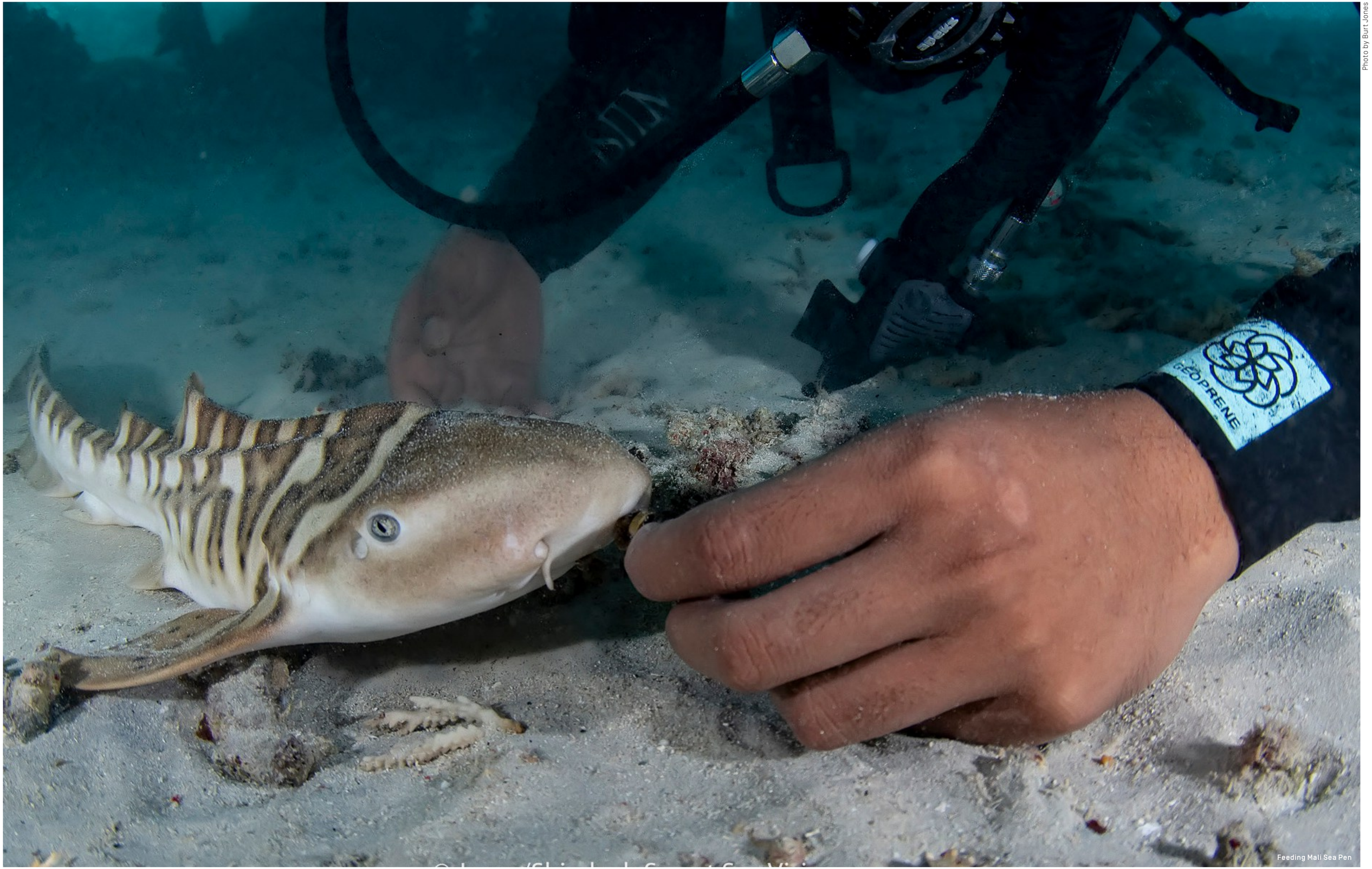

Photo by Burt Jones

Feeding Mali Sea Pen

In-situ Facilities
Following life support system recommendations formulated by the Husbandry WG, a critical role of the Indonesian Implementation WG was constructing the nursery facilities for rearing eggs and pups in Raja Ampat. Designing the appropriate system and developing the standard operating procedures took about 1.5 years to reach full agreement between partners, including pro bono support from several international companies for designs and equipment. Despite the challenges of procuring and shipping equipment to the remote sites of Kri Island and Misool, the nursery partners worked hard throughout the first half of 2022 to build the nurseries. This also provided much-needed employment to local communities of Raja Ampat during the pandemic, including a local school, who were engaged to help build the facilities and provide locally sourced construction materials.

The Aquarists
A team of Indonesian, and mostly West Papuan, aquarists have been trained to care for the eggs and pups in the nurseries and conduct post-release monitoring. The Jakarta Aquarium and Safari hosted trainee aquarists who underwent intensive training in life support system maintenance, basic husbandry, and veterinary care. This included a simulation tank filled with bamboo shark pups and eggs to care for during the final week. It was an immersive and valuable experience for our aquarists, preparing them to receive the first egg shipment. The aquarists were also involved in the initial set-up of the life support systems at both nurseries to ensure familiarity with every aspect of functioning and maintenance. A rotating schedule of Husbandry WG members flew to Indonesia during the first month of the pups' hatching to provide further training on critical pup care.

Research Working Group
Confirming the success of the StAR translocations requires monitoring the pups after release. The Research WG was formed to develop post-release monitoring tools and guidelines to evaluate the movement, habitat use, and survivability of tagged juvenile Indo-Pacific Leopard Sharks post-release. Several monitoring tools are being employed to address these questions, including active and passive acoustic telemetry, new predator tag technology, eDNA monitoring, and visual and photographic surveys utilizing the extensive dive community in Raja Ampat. In addition to post-release monitoring, the Research WG provides guidance and technical expertise in developing numerous research projects on pup growth, feeding rates, diet composition, parthenogenesis, and the reproductive cycles of adult animals. Additionally, research is conducted by partner organizations on wild and ex-situ Indo-Pacific Leopard Sharks in Australia, the United States, and New Caledonia to fill important knowledge gaps needed for the successful implementation of the StAR Project in Raja Ampat.

Husbandry Working Group
The Husbandry WG oversees all aspects of ex-situ animal care within StAR breeding and nursery facilities and during transport and was instrumental in assisting with designing the life support systems for the Raja Ampat nurseries and commissioning the first life support system at RARCC. In preparation for shipments where eggs may be in transit for multiple days, the Husbandry WG conducted mock shipments to work through all possible challenges and worked with the Veterinary Working Group to compile the shipping instruction manual for animal care in transit. Members of the Husbandry WG accompanied the first shipments of eggs (from SEA LiFE Sydney through to Raja Ampat) and assisted in ensuring the safe arrival of eggs at the nurseries. They were instrumental in training the aquarists at the Indonesian nurseries, wrote the manual for the care of eggs and pups, and led the design of the life support systems for the nurseries. They regularly interact with the onsite aquarists and provide advice at different stages of animal development. Additionally, they liaise with potential breeder institutions regarding breeding animals and animal transfer between facilities and track egg production for downstream contribution to the StAR project.

Veterinary Working Group
The Veterinary WG comprises veterinarians in Indonesia, Hong Kong, and the United States. This team combines expertise in shark and ray care, breeding, transport, and fieldwork, with field-ready veterinary skills and an understanding of resource management. They oversee disease assessment and health monitoring of breeders, eggs, and hatchlings. Following IUCN guidelines, the Veterinary WG developed the Disease Risk Assessment for Indo-Pacific Leopard Sharks. Two major hazards common to elasmobranchs in human care were identified: systemic vibriosis (*Vibrio harveyi*), and invasive Scuticociliates *(Philasterides dicentrarchi, Miamiensis avidus*). Processes put in place to reduce these risks include transporting viable eggs before eclosion, following biosecurity protocols, and monitoring hatchlings for up to five months before release. Mitigation measures were reviewed with health representatives from the Indonesian government. The Veterinary WG screens potential breeding animals in aquarium facilities through an Egg Assessment scoring protocol. This includes consideration of the genetics, disease risks, and logistics for each source. Each potential breeding institution completes the egg assessment, which the Veterinary WG reviews before onboarding the institution as a partner. The Veterinary WG includes Dr Jaya Ratha, a veterinarian with Thrive Conservation, who carries out the surgical tag implants on pups prior to release and is available to respond to any emergency concerns at the nurseries. Other veterinarians in the Veterinary WG provide an advisory role as needed to the nurseries, steering committee, and other working groups.

Communications and Public Relations Working Group
The Communications and Public Relations WG comprises experts in branding, communications, messaging, and public relations from partner aquariums and international and Indonesian NGOs. The Communications and Public Relations WG aims to coordinate and provide guidelines for ReShark communications efforts, including branding guidelines, documentaries and filming, messaging framework, media, and web-based outreach. At its inception, this WG focused on the StAR Project and has since shifted its focus to ReShark. Over the last three years, this team created the website and social media platforms; has secured, managed, and supported media coverage from international outlets like National Geographic to national outlets in the United States and Indonesia and local outlets around the world; and worked with the Indo-Pacific Films team to produce eight films documenting the major milestones in the evolution of the StAR Project and ReShark.

Proof of concept
The first shipment
The first shipment of seven viable Indo-Pacific Leopard Shark eggs arrived in early August 2022, enduring a 40-hour journey from SEA LiFE Sydney Aquarium via Jakarta and Sorong to Raja Ampat. Delays due to paperwork considerations and closed government facilities over the weekend resulted in an additional four days in transit at Jakarta. Transit from Jakarta to the final destination at Kri Island in Raja Ampat, including a two-hour boat ride to the RARCC nursery, went smoothly and finished with a welcome by our local aquarists and an official blessing ceremony. Following this shipment, we adjusted protocols to account for unforeseen scenarios to facilitate smooth shipping from start to finish.

Rearing the pups
Although the husbandry of Indo-Pacific Leopard Sharks is well-established in large aquariums, there is a critical difference in raising pups for aquaria versus raising pups for wild release. Our goal is to ensure the pups develop foraging skills, including feeding on live food, as soon as possible and expose them to the environment they will face upon release while simultaneously rearing healthy pups with optimal nutrition and growth. The StAR aquarists encourage the pups to predate on live littorinid and neritid snails from the day they hatch while supplementing their diet with locally sourced frozen fish, squid, prawns, and bivalves.

This diet, coupled with the warm water (average 29.5°C) from the flow-through seawater life support system, has led to impressive growth rates that are more than double that reported from most large aquariums (which typically raise their pups in cooler conditions of 25–26°C). An important aspect of the preparation for release into the wild is the transfer of pups into enclosed sea pens within three months of hatching to maximize interaction with a natural reef environment as early in their development as possible in preparation for their release into the wild.

At 70 cm total length (TL), pups are of sufficient size to be operated upon to insert an acoustic tag (see Post Release Monitoring section below) into the body cavity, after which they are kept in tanks and monitored for 1–2 weeks to ensure their incision site heals properly before being released back into the sea pens. At 80 cm TL, they are ready for release into the wild.

Releasing the pups
To date, four Indo-Pacific Leopard Shark pups have been released: three in early 2023 in the Wayag Lagoon in northern Raja Ampat and one in July 2023 within the SE Misool MPA in the south of Raja Ampat. Both release sites are in well-enforced no-take zones within the Raja Ampat MPA Network. They are in areas where adult sharks are occasionally observed and thus assumed to be appropriate habitats.

The January 2023 release of two pups into the Wayag Lagoon was a world-first conservation milestone covered in an exclusive feature article in National Geographic magazine. On the morning of the release, the pups were each moved from their sea pens into their own 200 liter transport tank for a 130 km, seven-hour speedboat ride through rough seas to Wayag. The day before, they had been carefully measured and weighed for the last time, given a large meal of snails and prawns, and blood and cloacal swab samples were taken.

On arrival at the release site, a sizeable crowd of Indigenous leaders, local and national government leaders, and conservationists had gathered to witness the ground-breaking release. A traditional prayer was conducted by the leaders of the Kawe Tribe (the Indigenous owners of Wayag), and the pups were released with much fanfare into the lagoon.

The subsequent releases focused on monitoring the movements of the newly released pups (see below). In the case of the fourth release into the Misool Marine Reserve, transport was less than a kilometre from the sea pen to the release site.

Post-release monitoring
A critical requirement for an ex-situ or translocation conservation program is a robust post-release monitoring program to track the fate of the released individuals and adapt protocols as necessary to optimize survival. The Research WG developed a post-release monitoring program that combines active and passive acoustic telemetry and a relatively dense array of 15–20 acoustic receivers around each release site. Upon release, a rotating team of researchers actively tracks the pup for 48 hours to monitor the initial survival of the pup and gain an understanding of its movements. Following this, the passive array of receivers monitors their movements for the duration of the tag's battery life. We are also experimenting with different tag types (including altering pinging rates and using Innovasea predation tags) and array configurations to effectively monitor the movements and survivorship of the released pups for at least 2–3 months.

As the population of Indo-Pacific Leopard Sharks grow, we hope to enlist the tens of thousands of divers that visit Raja Ampat each year in a citizen scientist approach to monitoring using photo ID. Spot patterns of adults stabilize after 24 months of age, so each shark has an RFID tag that can be scanned to link its identity with its photo ID pattern.

Future Directions
After 3.5 years of hard work and the cooperation of institutions across the globe, the StAR project has now effectively demonstrated full proof of concept and has a working model for conservation translocations of an Endangered shark species using ex-situ breeding. In the coming year, the urgent focus of the project is to dramatically ramp up egg production and shipments by adding several breeding institutions (including in Europe, the United States and Australia) - targeting the release of 50–100 pups per year over the next 6–10 years. We are also now in discussions with several other MPAs in locations across the Indo-Pacific that are interested in conducting PVAs to examine the utility of similar conservation translocations for Indo-Pacific Leopard Sharks in areas where the population has been extirpated, but shark fishing is now under control.

Recent progress has also been made on the ReShark initiative, with a workshop held in Seattle, United States, in August 2023 to formulate the objectives, governance structure and implementation strategy for expanding the IUCN One Plan conservation approach to additional threatened shark and ray species.

Members
The StAR Steering Committee consists of Nesha Ichida (co-chair), Erin Meyer (co-chair), Alistair Dove, Christine Dudgeon, Mark Erdmann, Caitlin Hatfield, Iqbal Herwata, Leah Neal, and Abraham Sianipar. Members of the working groups are as follows. **Husbandry WG**: Tim Carpenter (co-chair), Leah Neal (co-chair), Abdul Wahid Hasdar, Jack Jewell, Hugo Lassauce, John Masson, Aaron Morgan-Jupp, Wayne Phillips, Laura Simmons, Lise Watson, and Jennifer Wyffels; **Indonesia WG**: Charlie Heatubun (chair), Haerul Arifin (Vice Chair), Daniel Jemmy Oruw (Secretary), Max Ammer, Ferdinand Irianto Patrick Bata, Ezoom Baturindu, Mark Erdmann, Fahmi, Nikka Gunadharma, Abdi Wunanto Hasan, Abdul Wahid Hasdar, Iqbal Herwata, Nesha Ichida, Shannon Latumahina, Ronald Mambrasar, Aaron Morgan-Jupp, Regina Nikijuluw, Selvia Oktaviyani, Jaya Ratha, Pingkan Katharina Roeroe, Rian Puspita Sari, Abraham Sianipar, Hendrik Sombo, Wida Sulistyaningrum, Dolfina Tahalele, Maryrose Tapilatu, Syafri Tuharea, Made Abiyoga Udaya, Imam Wahyudi, Kyra Bestari Wicaksono, Virly Yuriken; **Research WG**: Christine Dudgeon (co-chair), Lisa Hoopes (co-chair), Mark Erdmann, Fahmi, Iqbal Herwata, Steve Kessel, Hugo Lassauce, Shannon Latumahina, Kady Lyons, Selvia Oktaviyani, Jaya Ratha, Abraham Sianipar, Julia Tapilatu, Mary-Rose Tapilatu, Made Abiyoga Udaya, and Kyra Bestari Wicaksono; **Veterinary WG**: Caitlin (Catherine) Hatfield (chair), Lance Adams, Mike Hyatt, Paolo Martelli, Allyson McNaughton, Sarah Miller, Atlan Panigus Parsetyo, Jaya Ratha; **ReShark Communications and Public Relations WG**: Tim Kuniholm (chair); Johnny Ford, Nikka Gunadharma, Paige Hale, Nesha Ichida, Emmeline Johansen, Emily Malone, Erin Meyer, Regina Nikijuluw, and Nathaniel Soon.

Wayag release site

Audrey prior to release

Photos by Mark V Erdmann

Photo by Mark V Erdmann

Kathlyn 10 weeks

Photo by Indo Pacific Films

Water quality monitoring training

Photo by Mark V. Erdmann

RARCC Hatchery

Photo by Mark V Erdmann

Blessing newly arrived eggs

Photos by Shawn Heinrichs

Zebra Shark fishery, Raja Ampat, Southwest Papua, Indonesia

Photo by Indo Pacific Films

ReShark Aquarist training
in Jakarta, Indonesia

The Great Eggcase Hunt – A global citizen science project

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Abstract
The Great Eggcase Hunt (GEH) is a citizen science project run by the Shark Trust. Approximately 44% of sharks, rays, and chimaeras are oviparous, with their eggcases often distinctive enough to identify down to the species level. Running since 2003, this project has received reports of over 400,000 eggcases from around the world. With 87% of these eggcases being verified by a photo, expert identification, or a specimen, this dataset provides a valuable tool to help us better understand eggcase morphology, species diversity and range, and possible key areas of use. This project continues to grow and spread both in the UK and internationally, with project partners in Europe and Australia. Identification materials have also been developed for several regions and languages, with more in development.

Photo by Rick Bruintjes | GEH

A Nursehound (*Scyliorhinus stellaris*) eggcase was found washed ashore in Cornwall, UK, showing the developing embryo inside

Introduction

Of over 1,200 species of chondrichthyans (sharks, rays and chimaeras) worldwide, approximately 44% are oviparous (egg-laying). This includes five orders – namely the skates (Rajiformes), horn sharks (Heterodontiformes), chimaeras (Chimaeriformes), catsharks (Scyliorhinidae and Pentanchidae), and some carpet sharks (Orectolobiformes). These oviparous species deposit eggs encased in a tough 'leathery' capsule, primarily made of collagen – the eggcase.

The key form of these eggcases differs by order, and typically, eggcase morphology is species-specific, with key diagnostic features helping to differentiate between eggcases from different species. The features to look for when identifying an eggcase are its general form, dimensions, shape (i.e., tapering, distinctive pinches), and any other presence, absence, or variation in key features such as horns, tendrils, or keels (extra fringe of material along the edges of the eggcase). Using these key features, you can tell most eggcases apart. However, these features can become obscured as eggcases dry out and get damaged over time.

Project History

Established in 2003, the GEH encourages members of the public to report any eggcases that they find, either washed ashore or those sighted underwater, developing in situ. What began as a chance find has now evolved into the Shark Trust's flagship citizen science project, with people reporting eggcases from all around the world. Over the last 20 years, the project has grown and spread, with more and more people taking part from increasingly further afield. This project continues to grow and spread from 128 eggcases recorded in 2003 to over 40,000 eggcases reported in the first half of 2023 alone.

The GEH has received nearly 30,000 submissions from over 14,000 recorders (although this figure represents a far greater pool of participants from group events), totalling over 440,000 eggcases from over 40 species. Although most records come from the British Isles (98% of eggcases), the number of eggcases being reported internationally is increasing, with eggcases being reported from over 30 countries.

Citizen Science – Filling data gaps

Starting on paper forms before evolving to online recording, smartphones and the rise of social media have allowed this project to grow even more rapidly. Primarily spread by word of mouth and through dedicated eggcase hunting events, this project is enabled by a dedicated online recording hub and a mobile app for the Shark Trust's citizen science projects. With these technological developments, more entries have had photos attached, allowing us to verify a higher proportion (87%) of the records we receive. At this point, information becomes data. Once verified, each record combines to create a long-term dataset with far more information than the Shark Trust could have collected alone.

Analysis of this dataset can be used to pick out temporal and seasonal patterns: it can allow for a greater understanding of species range and diversity, and hotpots for eggcases can be identified – signifying potential egg-laying grounds – as well as highlighting locations that are lacking in records and may require focused effort.

It is important to note that the GEH relies on the public's submitted findings. This information can only show the 'presence' of species – it does not provide a standardised, effort-based recording scheme. As well as effort, meteorological and oceanographic features and events influence the number of eggcases that wash ashore. For example, stormy weather is more likely to dislodge eggcases, resulting in them washing ashore to be found and reported.

This dataset is a valuable resource. Regularly submitted data allow for a finer-scale understanding of the seasonality of eggcase finds and the influence of factors such as notable meteorological events.

We are fortunate to have some regular reporters from across the UK who have spent years reporting eggcases from their local beaches. Several organisations also regularly contribute through data exchanges, including the Orkney Skate Trust and several of the Wildlife Trusts. These subsets allow for comparison and a more nuanced interpretation of potential yearly and seasonal trends.

Wider Applications

Data from the GEH have led to an improved understanding of eggcase morphology (see Gordon et al. 2016) and can be used to help identify possible spawning grounds (Ellis et al. in prep.). Understanding where species of commercial interest - or those of conservation concern - spawn could be used to inform conservation action, such as providing evidence to support the creation of Marine Protected Areas or informing proposals for candidate Important Shark and Ray Areas. As well as gathering species-specific data, a dataset of this size provides valuable insight into citizen science engagement, including the growth of the project and the spread of engagement, along with the seasonality of reporting.

International collaboration

The Shark Trust, in collaboration with regional partners, has created several translated and/or regional eggcase identification resources in Spanish (Sanmares), Turkish (Mersea), and Welsh (Project SIARC), with other ID guides in development. Furthermore, the GEH has project partners in the Netherlands (2015 - Dutch Shark Society), Portugal (2018 - APECE), and Australia (2023 - CSIRO), all with their identification materials, helping to grow this project and encourage engagement. While the GEH is the longest-running project of its kind, there are sister projects in other countries, including France (Capsules d'Oeufs de Raies) and Ireland (Purse Search Ireland, Marine Dimensions).

As well as enabling the GEH to reach a wider audience, these resources and partnerships can help generate public awareness while building our knowledge of oviparous sharks, rays, and chimaeras.

Get involved

The GEH is a fun and easy way to get involved with shark science and conservation - anyone who can get to a beach can participate. It is nature's treasure hunt, and it can get very competitive! Get involved, join the hunt, and let us know if you find an eggcase!

To record an eggcase, visit recording.sharktrust.org or use the 'Shark Trust' mobile app.

To find out more about the project, see eggcase.org

If you would like to get involved to develop a specific ID guide or get involved as a partner organisation, please contact eggcase@sharktrust.org

Acknowledgements

Thank you to all the members of the public and other organisations who have participated in the Great Eggcase Hunt. Thank you to all Shark Trust staff and volunteers (past and present) for documenting and managing eggcase records and promoting the project.

References

Gordon, C., Hood, A. and Ellis. J. 2016. Descriptions and revised key to the eggcases of the skates (Rajiformes: Rajidae) and catsharks (Carcharhiniformes: Scyliorhinidae) of the British Isles. Zootaxa, 4150(3): 255-280. doi: 10.11646/zootaxa.4150.3.2.

Photo by Bethan Clyne | GEH

Photo by The Shark Trust | GEH

Photo by James Harris | GEH

Photo by Rick Bruintjes | GEH

Amazing Shark and Ray Science Discoveries from 2023

By David Shiffman
SSG Communications Officer

Photo by Amanda Cotton | Ocean Image Bank

Whale Shark feeding

There is always more to learn about sharks, rays, and chimaeras and scientists worldwide are working hard to add to growing bodies of knowledge! In this article, we'd like to highlight some amazing scientific discoveries from this year (so far!)

Museum collections have incredible scientific value. Will White and his team discovered a new species of "demon catshark" by investigating a mystery: an unusually shaped shark egg case held in a museum collection for years! This shows that there are many fascinating species yet to be discovered.

White, W. T., O'Neill, H. L., Devloo-Delva, F., Nakaya, K., & Iglésias, S. P. (2023). What came first, the shark or the egg? Discovery of a new species of deepwater shark by investigation of egg case morphology. Journal of Fish Biology. doi.org/10.1111/jfb.15415

Shark conservation is often hampered by lack of understanding of conservation and management regulations, and how they vary between jurisdictions. A new paper by Anna Oposa summarizes the laws and management regimes of the Philippines, a shark science and conservation hotspot. This paper is a great introduction to the laws of that country and region, and we hope to see similar papers for other parts of the world!

Oposa, A. R., & Techera, E. J. (2023). A review of shark conservation and management legal frameworks in the Philippines. Marine Policy, 155, 105713. doi.org/10.1016/j.marpol.2023.105713

Scientists have long wondered how Scalloped Hammerheads (*Sphyrna lewini*) survive in their brief forays into oxygen-poor deep water. An amazing new behavioral adaptation in hammerhead sharks was discovered by Mark Royer and colleagues. This paper shows that hammerheads close their gill slits, effectively "holding their breath" until they are back in oxygen-rich, shallower waters.

Royer, M., Meyer, C., Royer, J., Maloney, K., Cardona, E., Blandino, C., ... & Holland, K. N. (2023). "Breath holding" as a thermoregulation strategy in the deep-diving scalloped hammerhead shark. Science, 380(6645), 651-655. doi.org/10.1126/science.add4445

Think Great Whites (*Carcharodon carcharias*) are the apex predators of the ocean? Think again! Alison Towner and her team described Killer Whales (*Orcinus orca*) hunting and killing Great Whites. In graphic detail, complete with some incredible drone footage! This is some of the most fascinating large animal ecology work happening in the world today, with unknown- but possibly vast- consequences for the surrounding ecosystems.

Towner, A. V., Kock, A. A., Stopforth, C., Hurwitz, D., & Elwen, S. H. (2023). Direct observation of killer whales preying on white sharks and evidence of a flight response. Ecology, 104(1). doi.org/10.1002/ecy.3875

Protecting an area of the ocean to help conserve a species only works if the species actually spends their time there. With that vital principle in mind, Ross Dwyer and colleagues studied whether or not Australia's marine protected area network is enough to protect Critically Endangered Grey Nurse Sharks (A.K.A. Sand Tiger Sharks, *Carcharias taurus*). This is a great example of the type of applied science that we need to help protect species of concern.

Dwyer, R. G., Rathbone, M., Foote, D. L., Bennett, M., Butcher, P. A., Otway, N. M., ... & Kilpatrick, C. (2023). Marine reserve use by a migratory coastal shark, *Carcharias taurus*. Biological Conservation, 283, 110099. doi.org/10.1016/j.biocon.2023.110099

An epic team of nearly 150 shark scientists from all over the world (led by former IUCN SSC Shark Specialist Group Co-Chair Colin Simpfendorfer) presented the results of a global-scale analysis of shark and ray presence on coral reefs. Their troubling conclusion: many once-common reef shark species have declined by up to 73%, and some are totally gone from some reefs. But it's not too late to act!

Simpfendorfer, C. A., Heithaus, M. R., Heupel, M. R., MacNeil, M. A., Meekan, M., Harvey, E., ... & Wirsing, A. J. (2023). Widespread diversity deficits of coral reef sharks and rays. Science, 380(6650), 1155-1160. doi.org/10.1126/science.ade4884

Bull Sharks (*Carcharhinus leucas*) can famously enter freshwater (though they are not the only shark to be able to do so), but how long they can survive there has been a matter of debate...until now! Peter Gausmann presented an investigation of a population of Bull Sharks that lived on a golf course lake for at least 17 years after a nearby river flooded.

Gausmann, P. (2024). Who's the biggest fish in the pond? The story of bull sharks (*Carcharhinus leucas*) in an Australian golf course lake, with deliberations on this species' longevity in low salinity habitats. Marine and Fishery Sciences (MAFIS), 37(1). doi.org/10.47193/mafis.3712024010105

While sharks face many serious conservation threats, their less famous relatives get much less conservation attention. A new analysis by Samm Sherman and colleagues found that threatened species of guitarfish are widely traded internationally, but the scope of this threat is difficult to assess because of poor recordkeeping and low-quality data. We hope you participated in this year's inaugural Rhino Ray Awareness Day, which helps bring much-needed attention to these highly threatened and little-known animals!

Sherman, C. S., Simpfendorfer, C. A., Haque, A. B., Digel, E. D., Zubick, P., Eged, J., ... & Dulvy, N. K. (2023). Guitarfishes are plucked: undermanaged in global fisheries despite declining populations and high volume of unreported international trade. Marine Policy, 155, 105753. doi.org/10.1016/j.marpol.2023.105753

What made a group of all-female Great Hammerheads (*Sphyrna mokarran*) gather under a full moon in French Polynesia? This previously unknown behavior documented by Tatiana Boube and colleagues launched a thousand social media memes, and even some fan artwork of a hammerhead coven.

Boube, T., Azam, C. S., Guilbert, A., Huveneers, C., Papastamatiou, Y. P., Mourier, J., ... & Stenger, P. L. (2023). First insights into the population characteristics and seasonal occurrence of the great hammerhead shark, *Sphyrna mokarran* (Rüppell, 1837) in the Western Tuamotu archipelago, French Polynesia. Frontiers in Marine Science, 10, 1234059. doi.org/10.3389/fmars.2023.1234059

Wildlife tourism is often presented as the silver bullet solution to shark conservation crises. However, poorly regulated wildlife tourism can cause conservation challenges of its own. A new analysis by Christine Barry and colleagues found that being surrounded by SCUBA divers with few restrictions on their behavior led to significant physiological stress in Whale Sharks (*Rhincodon typus*) – the kind of stress that can result in having fewer offspring and being unable to engage in important behaviors like migration.

Barry, C., Legaspi, C., Clarke, T. M., Araujo, G., Bradshaw, C. J., Gleiss, A. C., ... & Huveneers, C. (2023). Estimating the energetic cost of whale shark tourism. Biological Conservation, 284, 110164. doi.org/10.1016/j.biocon.2023.110164

Though sharks very rarely strand on beaches the way marine mammals do, it can happen when species travel far outside of their known range. Recently, Smalltooth Sand Tiger Sharks (*Odontaspis ferox*) have been washing up on the beaches of the UK and Ireland, which is documented here by David Curnick and colleagues. These sorts of range extensions are important for understanding these poorly known species.

Curnick, D. J., Deaville, R., Bortoluzzi, J. R., Cameron, L., Carlsson, J., Carlsson, J., ... & Payne, N. L. (2023). Northerly range expansion and first confirmed records of the smalltooth sand tiger shark, Odontaspis ferox, in the United Kingdom and Ireland. Journal of Fish Biology. doi.org/10.1111/jfb.15529

What was your favorite scientific discovery this year?
Let us know on social media!

Hammerhead Sharks, Hawaii, USA

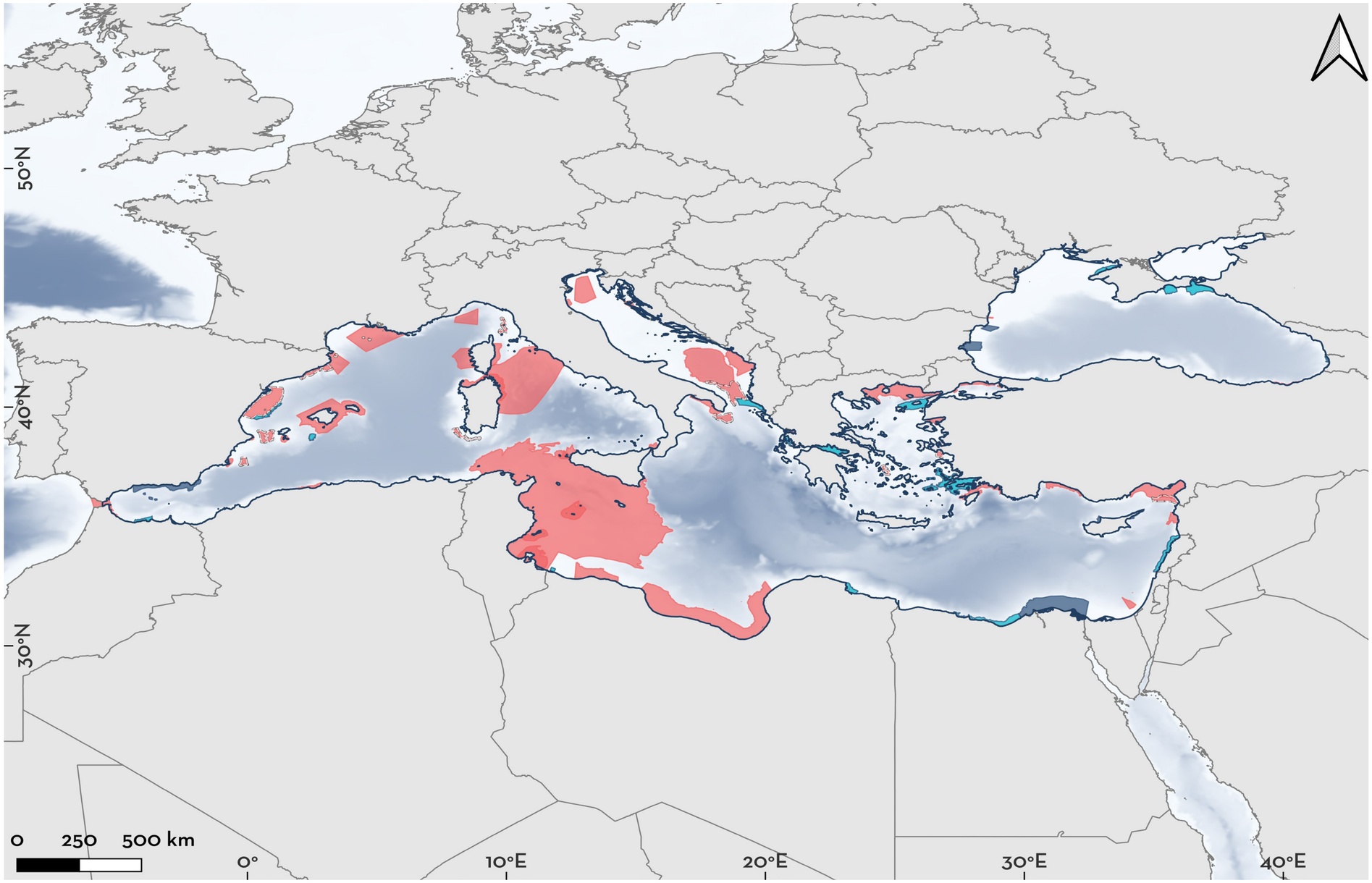
Photo by Kimberly Jeffries | Ocean Image Bank

Photo by Jayne Jenkins | Ocean Image Bank

Great white sharks in seagrass, South Australia

The Important Shark and Ray Areas of the Mediterranean and Black Seas

Written by
Ryan Charles
Research Assistant | Important Shark and Ray Areas (ISRAs) | IUCN SSC Shark Specialist Group (SSG)



The Important Shark and Ray Areas (ISRA) team has continued its endeavour to put sharks on the map. The aim is to identify 'discrete, three-dimensional portions of habitat important for one or more shark species that are delineated and have the potential to be managed for conservation'. This innovative approach to place-based conservation takes inspiration from Important Marine Mammal Areas (IMMAs), Key Biodiversity Areas (KBAs), Ecological and Biological Significant Marine Areas (EBSAs), and Important Bird and Biodiversity Areas (IBAs). The ISRA initiative succeeded at delineating 65 ISRAs in the Central and South American Pacific following the first regional expert workshop in Bogotá, Columbia in October 2022.

This momentum was maintained whilst investigating the Mediterranean and Black Seas – the second of thirteen regions to be examined by the ISRA team. The IUCN SSC Shark Specialist Group hosted a regional expert workshop in Thessaloniki, Greece, in May 2023. This facilitated conversations between regional experts crucial to the collation of information. The best available science, including peer-reviewed scientific articles and local ecological knowledge, was used to propose areas that may meet the ISRA Criteria.

In total, 166 experts contributed to the process, either in-person or online. This international effort resulted in delineating 65 ISRAs across 28 jurisdictions. In addition, six areas were mapped as candidate ISRA, which benefit from ongoing research that may help define their importance in the future. Also, 20 Areas of Interest were mapped to highlight potential areas for future investigation. These areas varied greatly in size, from small underwater (subsurface) areas (0.09 km^2 at depths of 1,100–1,150 metres) to large transboundary areas (219.913 km^2 at surface waters to 2,000 metres deep).

All areas are mapped on the ISRA e-Atlas launched earlier this year at the 5th International Marine Protected Areas Congress. The e-Atlas can be filtered to display areas specific to various requirements or interest, for example, sub-surface areas or areas with a particular Qualifying Species. Every area has a unique factsheet detailing the species, ISRA Criteria, and geographic information. The recently published compendium entitled 'Mediterranean and Black Seas: A Regional Compendium of Important Shark and Ray Areas' collates summaries of all factsheets for the region. This is free to download from the ISRA website (sharkrayareas.org). This makes the information available to everyone, including scientists, policymakers, and the public.

In the Mediterranean and Black Seas, ISRAs were mapped for a range of species, including those threatened with extinction and/or range-restricted. Some ISRAs were also delineated using regular and predictable observations that demonstrated the importance of areas for the life history of sharks. This includes areas important for reproductive purposes, feeding, movement, and undefined aggregations. Other areas had unique attributes, such as having a high diversity of sharks or having distinct features. For example, the Blackchin Guitarfish (*Glaucostegus cemiculus*) have been observed to leave the water to rest on the wet sand at Dalia Beach, Israel.

At the time of writing, the ISRA team have worked with international experts to map 130 ISRAs, 11 candidate ISRAs, and 31 Areas of Interest (AoI) in two regions of the world. A workshop was also recently held in Durban, South Africa, for the Western Indian Ocean – the third region to be investigated. The proposals are being prepared for an upcomin workshop. After an independent review, the most Important Shark and Ray Areas for the Western Indian Ocean will be put on the map! Asia will then be the next region to be investigated in early 2024, followed by Polar Waters. Factsheet summaries have been extracted from the Mediterranean and Black Seas Region Compendium: Jabado RW, García-Rodríguez E, Kyne PM, Armstrong AH, Bortoluzzi J, Charles R, Mouton T, Gonzalez Pestana A, Battle-Morera A, Rohner C, Notarbartolo di Sciara G. 2023. Mediterranean and Black Seas: A regional compendium of Important Shark and Ray Areas. Dubai: IUCN SSC Shark Specialist Group.

ISRA

IMPORTANT SHARK
AND RAY AREAS

MEDITERRANEAN AND BLACK SEAS

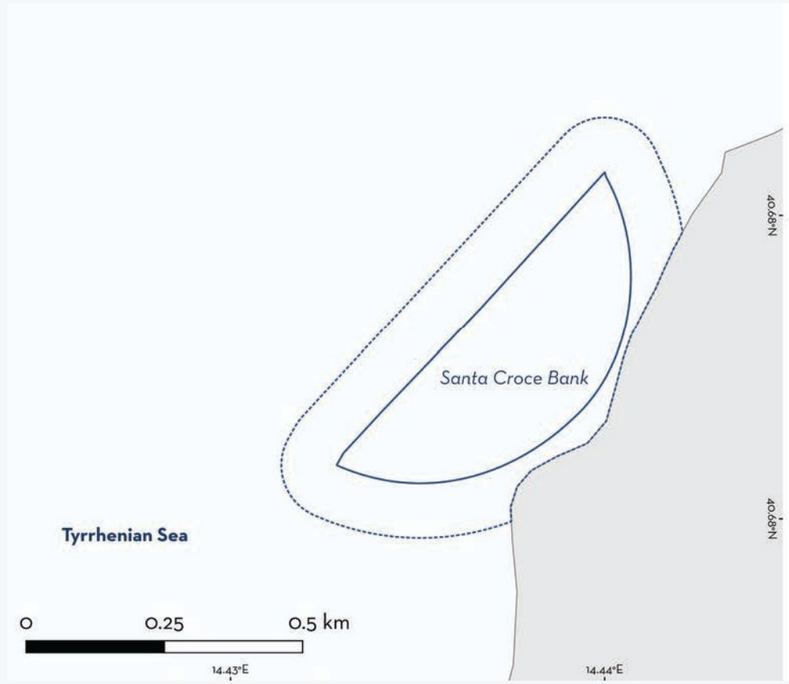
A REGIONAL COMPENDIUM OF IMPORTANT SHARK AND RAY AREAS

IUCN SSC SHARK SPECIALIST GROUP

AUGUST 2023

Photo by Alessandro Pagano

Angular Roughshark (*Oxynotus centrina*)



SANTA CROCE BANK ISRA

SUMMARY

Santa Croce Bank sits in the southeastern sector of the Gulf of Naples, central Tyrrhenian Sea, Italy. Its rocky outcrops rise from seafloor depths of 9–50 m and are surrounded by sandy areas. The strong currents and suspended particulate matter, due in part to inflow from the Sarno River, support rich invertebrate and fish biodiversity. The area has been designated a 'biologically protected area' since 1993 and falls within a Natura 2000 site. Within this area there are: **threatened species** (e.g., Common Eagle Ray *Myliobatis aquila*); **reproductive areas** (Nursehound *Scyliorhinus stellaris*); **resting areas** (Nursehound); and **undefined aggregations** (Common Eagle Ray).

CRITERIA

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

–

ITALY

–

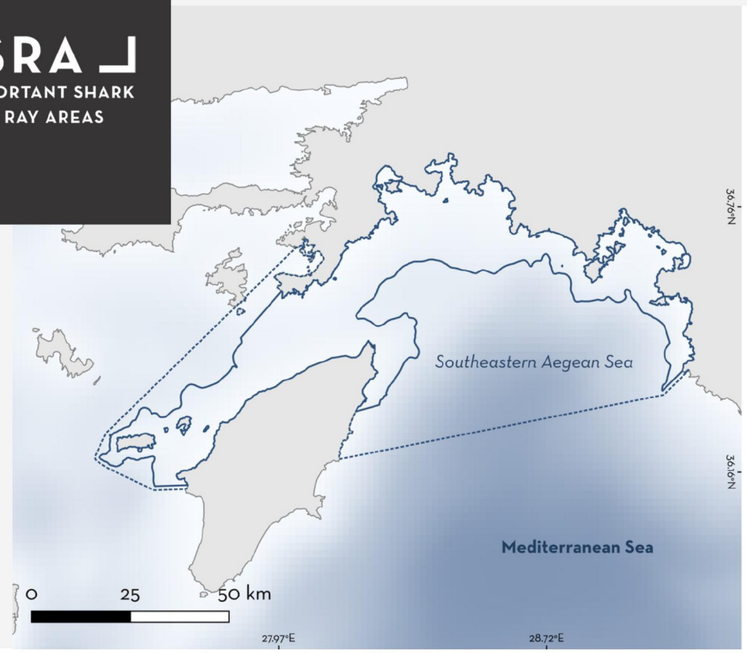
0–50 metres

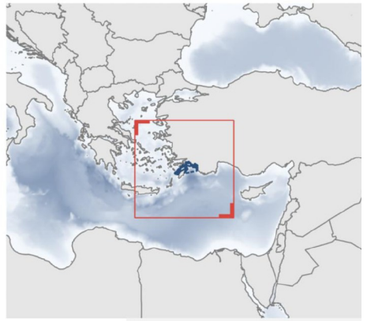
–

0.13 km²

–

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

SOUTHEASTERN AEGEAN SEA ISRA

Mediterranean and Black Seas Region

SUMMARY

Southeastern Aegean Sea is located between Greece and Türkiye. On the Greek side, it includes Northwest Rhodes Island and its small islets, the strait of Rhodos, and continues south to Aphantou. On the Turkish side, the area extends from Oludeniz Bay in Fethiye, to Datça Peninsula. The area is characterised by diverse coastal and benthic habitats, including a subtropical open sea environment and bays, sandy to muddy substrates, rocky shores, islets, and rivers that flow into the bays. The area overlaps with five Natura 2000 sites, two Key Biodiversity Areas, and an Ecologically or Biologically Significant Marine Area. Within this area there are: **threatened species** (e.g., Smoothback Angelshark *Squatina oculata*); **reproductive areas** (Smoothback Angelshark); and **undefined aggregations** (Sandbar Shark *Carcharhinus plumbeus*).

CRITERIA

Criterion A – Vulnerability; Sub-criterion C1 – Reproductive Areas; Sub-criterion C5 – Undefined Aggregations

–

TÜRKIYE

GREECE

–

0–500 metres

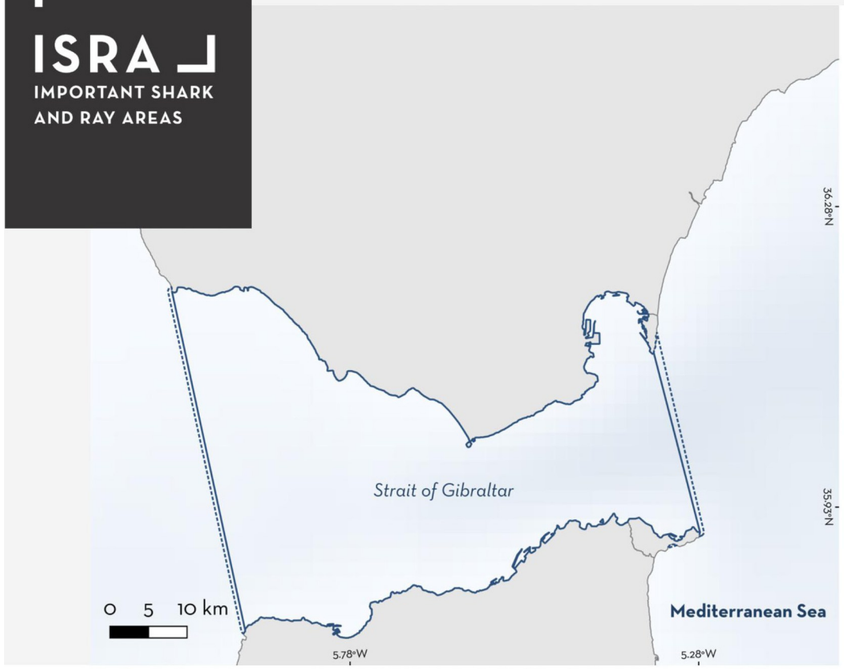
–

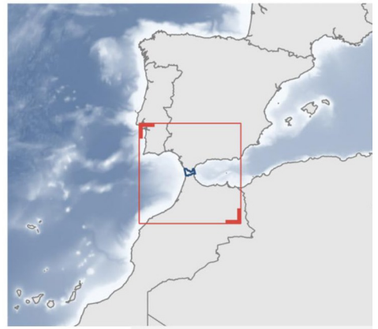
2,719 km²

–

sharkrayareas.org

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

STRAIT OF GIBRALTAR ISRA

Mediterranean and Black Seas Region

SUMMARY

Strait of Gibraltar is the only connection between the Atlantic Ocean and the Mediterranean Sea and separates the Iberian Peninsula of Spain from Morocco. Water flows through the strait from the Atlantic Ocean into the Mediterranean Sea by a surface current, and out of the Mediterranean Sea into the Atlantic Ocean by a deep outflow of water. The area overlaps with one Ecologically or Biologically Significant Marine Area (Gulf of Cadiz) and five Key Biodiversity Areas. Within this area there are: **threatened species** (e.g., Blue Shark *Prionace glauca*), and areas important for **movement** (e.g., Tope *Galeorhinus galeus*).

CRITERIA

Criterion A – Vulnerability; Sub-criterion C4 – Movement

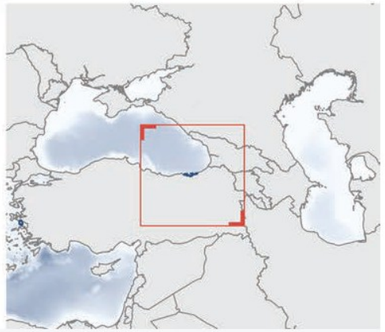
SPAIN

MOROCCO

UNITED KINGDOM

0–900 metres

1,710.5 km²



THE TRABZON-RIZE ISRA

TÜRKIYE

0–120 metres

258.5 km²

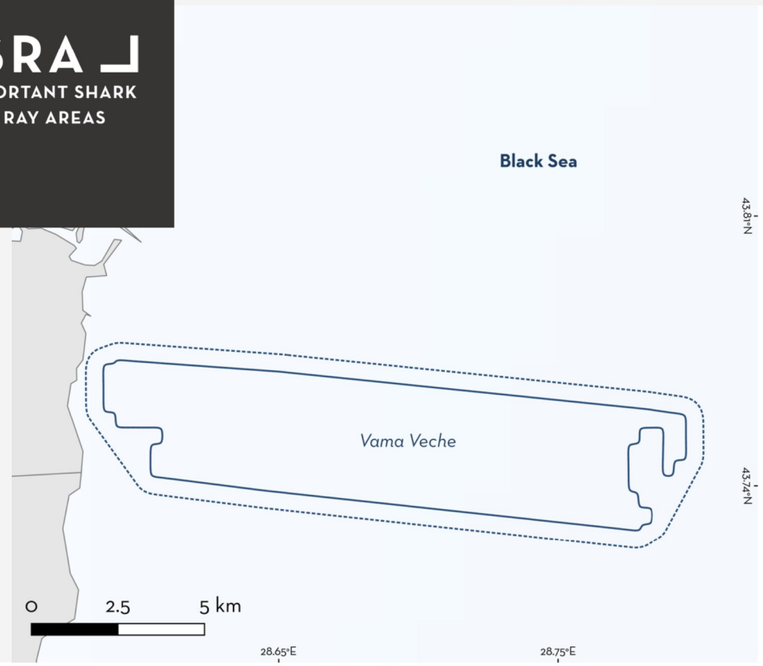
SUMMARY

The Trabzon-Rize is located in the southeastern Black Sea of Türkiye. The area is characterised by mud and sand-gravel substrates, with the discharge of several rivers contributing terrestrial nutrients to coastal waters. The area overlaps with two Ecologically or Biologically Significant Marine Areas (Trabzon-Arsin and Trabzon-Surmene). Within the area there are: **reproductive areas** (Thornback Skate *Raja clavata*).

CRITERIA

Sub-criterion C1 – Reproductive Areas

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

VAMA VECHE ISRA

Mediterranean and Black Seas Region

SUMMARY

Vama Veche is located in the southern Romanian Black Sea. The area is characterised by a wide continental shelf with sandy and muddy substrates. Other habitats within the area include reefs, rocky areas, and patches of seagrass. This area overlaps with the Vama Veche-2 Mai Marine Reserve Ecologically or Biologically Significant Marine Area, the Black Sea Key Biodiversity Area, and a Natura 2000 site. Within this area there are: **threatened species** and **undefined aggregations** (Spiny Dogfish *Squalus acanthias*).

CRITERIA

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

–

ROMANIA

–

0–120 metres

–

52.3 km²

–

WESTERN VIRSKO MORE ISRA

SUMMARY

Western Virsko More is a small coastal area in Croatia in the eastern mid-Adriatic Sea. The area includes parts of the coastline of 11 large islands, and 48 smaller islets and rocks, with Olib and Molat Islands being the largest islands in the area. Shallower areas consist of sandy and rocky substrates, while deeper areas (to 85 m depth) comprise muddy-sandy or muddy substrates. Habitats include large shallow bays, channel areas, and open water. The area includes 16 Natura 2000 Special Areas of Conservation (SAC). Within the area there are: **threatened species** and **reproductive areas** (Angelshark *Squatina squatina*).

CRITERIA

Criterion A – Vulnerability; Sub-criterion C1 – Reproductive Areas

–

CROATIA

–

0–85 metres

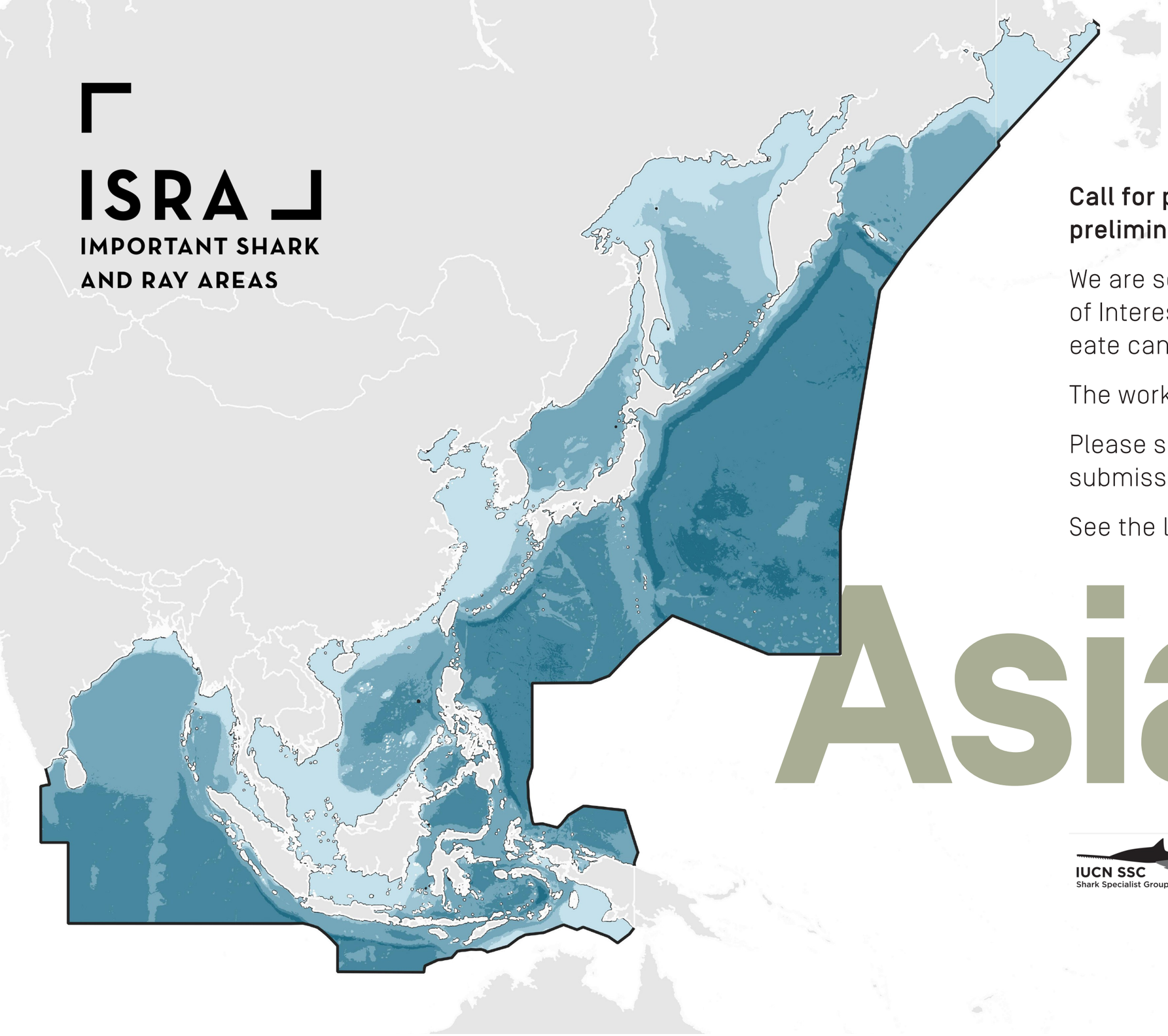
–

499 km²

–

ISRA

IMPORTANT SHARK AND RAY AREAS



Call for proposals for preliminary Areas of Interest

We are seeking proposals for preliminary Areas of Interest in Asia which we will be used to delineate candidate Important Shark and Ray Areas.

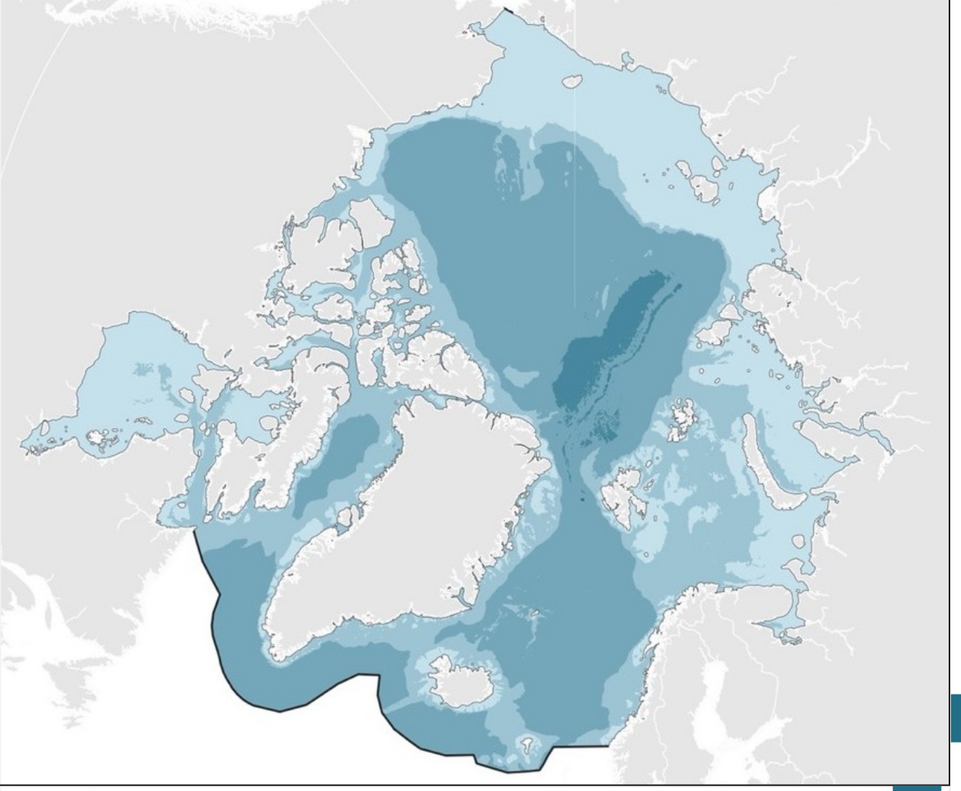
The workshop will be held in January 2024

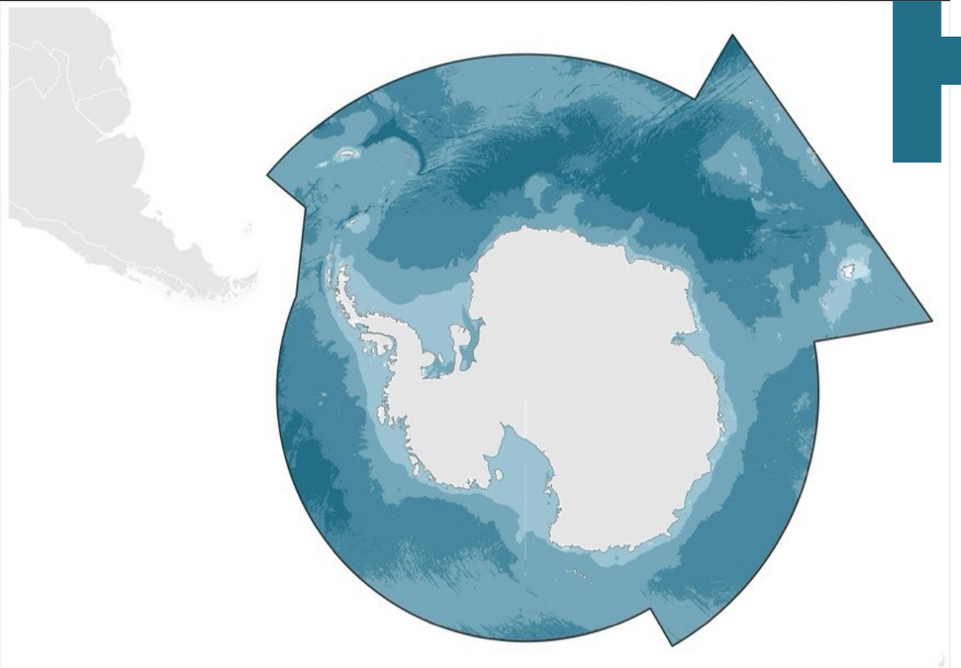
Please submit proposals to submissions@sharkrayareas.org

See the link for more details.

Asia

IUCN SSC
Shark Specialist Group





Call for proposals for preliminary Areas of Interest

We are seeking proposals for preliminary Areas of Interest in the Polar Waters – Arctic and Antarctic which we will be used to delineate candidate Important Shark and Ray Areas.

The workshop will be held in May 2024

Please submit proposals to submissions@sharkrayareas.org

Polar Waters

ISRA
IMPORTANT SHARK AND RAY AREAS

The deadline is Friday March 20th, 2024
See the link for more details.

IUCN SSC
Shark Specialist Group

Establishing a method to identify and prioritise areas for the protection of Angelshark (*Squatina squatina*) in the Canary Islands.

Written by the Angel Shark Project (ASP): Canary Islands (CI) Team: Hector Toledo, Charlotte Pike, Michael Sealey, Joanna Barker, Eva Meyers, David Jimenez Alvarado, Lucy Mead, Maria Belén Caro
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Region Update: African Atlantic Ocean

Photo by Michael Sealey

Juvenile Angelshark (*Squatina squatina*) in the largest known nursery area for the species, Playa de Las Teresitas, San Andrés, Santa Cruz de Tenerife in Tenerife, Spain

A critical situation for Angelsharks

The Angelshark (*Squatina squatina*) was formerly common across the East Atlantic and Mediterranean Seas[1], but populations have declined drastically. Threats such as overexploitation and habitat loss[2] have contributed to this decline. Angelsharks are currently listed as Critically Endangered on the International Union for the Conservation of Nature (IUCN) Red List of Threatened species[3].

Despite this reduction, the Canary Islands remain a significant stronghold for this flat-bodied, benthic predator[4]. Therefore, protection in the Canary Islands is vital to ensure this species' global survival. However, here too, Angelsharks are still impacted by habitat loss and incidental capture by various methods of professional and recreational fishing[5].

Like many sharks and rays, Angelsharks are highly susceptible to anthropogenic impacts due to their biology and ecology[2,4,5,6,7], including slow reproductive rates, late maturation, and use of coastal areas. Therefore, immediate actions are required to ensure their survival.

Strengthening Angelshark protection

In 2019, the Angelshark, along with the Sawback Angelshark (*Squatina aculeata*), and the Smoothback Angelshark (*Squatina oculata*), were listed on the Spanish Endangered Species List for Canary Island waters under the category "In danger of extinction" the highest category within this legislation. Inclusion in this category was the result of the development and application of the Angelshark Action Plan for the Canary Islands[5] ("Action Plan") developed by the Angel Shark Project: Canary Islands (ASP: CI; a collaboration between Leibniz Institute for the Analysis of Biodiversity Change, Universidad de Las Palmas de Gran Canaria, and Zoological Society of London) and various research groups, together with the Canary Islands and Spanish Governments, to set the path towards adequate protection of Angelsharks. The inclusion of this species on the Spanish Endangered Species List reinforces the national regulatory and legal framework and the protection under European Union's legislation and is a critical step to safeguard these species.

Following the listing "in danger of extinction", it was required that a Recovery Plan (RP) be developed to include the delineation of Areas Relevant to the Conservation of the Angelsharks (ARCAs), where specific and appropriate measures should be implemented for the conservation of the species. Inside this framework, ASP: CI was contracted by the Canarian government to develop a draft of the Recovery Plan for Angelsharks in the Canary Islands.

The conservation measures

Identifying threats facing this species in the Canary Islands was the first step towards developing conservation measures. The most severe threats were highlighted during the 2016 Angelshark Conservation Workshop and included in the Action Plan[5].

The proposed objectives of the RP aim to minimise, diminish, or eliminate the threats to angelsharks. To fulfil these objectives, a series of conservation measures were then designed.

Through this process, ASP: CI gathered information and encouraged the participation of relevant actors in the development of the measures through surveys, meetings, seminars, and a participatory workshop.

The ASP: CI developed draft measures that were: (1) **compatible** with the interaction groups related to angelsharks, (2) **aligned** with the basic principles and objectives of the PR, (3) **viable** so that they could be applied, and (4) **effective** so they would deliver the required impact.

Areas relevant to the conservation of Angelsharks – ARCAs

To identify ARCAs in the Canary Islands using an evidence-based approach, the ASP: CI completed a geospatial analysis of Angelshark distribution using all available datasets. These were collated from various sources: scientific survey data were available from ASP: CI and Asociación Tonina, and published data on habitat suitability for Angelsharks in the Canary Islands; citizen science data were available through the Angel Shark Sightings Map, ePoseidon, RedPromar, and dive centres; Local Ecological Knowledge (LEK) was also gathered during the consultation process.

Before geospatial analysis, data were standardised and cleaned, with any apparent duplicates or false records removed.

A portfolio of maps was created using QGIS to delineate the boundaries for ARCAs. Data were layered to determine potentially important areas for Angelsharks, such as areas where there were resightings of tagged individuals, where mating behaviour or pregnant sharks had been observed, and aggregations or nursery areas had been identified. This was an iterative process as we developed the criteria definitions. The maps were continually refined to ensure we were using the data in the best way possible, and the final definitions were agreed:

Critical Areas (CA): Distribution areas that contain habitats with physical or biological characteristics for the favourable conservation of the species[8]. This included:

- Confirmed nursery areas
- Aggregation areas
- Breeding areas
- High fidelity areas
- Areas with acoustic detections

Sensitive Areas (SA): Areas where there are insufficient data to classify as a CA but where there is enough information to indicate importance for the species. SA are likely to be upgraded to CA once evidence is demonstrated. These included:

- Buffer zones
- Possible nursery areas
- Possible aggregation areas
- Possible breeding areas
- Areas of high occurrence
- Identified as a good suitable habitat in a predictive model
- Corridors between CAs
- Local Ecological Knowledge (LEK) sites

Specific lateral and depth boundaries were determined by the available data within the criteria definitions and prior knowledge of Angelshark ecology[3,4] and through multiple consultation meetings with the Canary Islands Government. In particular, depth limits for juveniles and adults sourced from published literature determined depth boundaries. Consultation meetings with the government were conducted to discuss the areas in greater detail and modify them to allow for adequate management, such as increasing the boundaries to include geographic markers and, in some instances, important habitat (e.g., seagrass beds), as well as existing Marine Protected Areas (MPA), and areas designated as Special Zones for Protection (ZEC, by their Spanish acronym).

The maps also underwent a public consultation (surveys, meetings, seminars, and a participatory workshop). They gave opportunities for feedback from relevant parties, where, in some cases, LEK was incorporated. Following this process, 49 ARCAs were included within the RP, including 22 Critical Areas, and 27 Sensitive Areas identified around the Canary Islands.

The ARCAs were developed using available data to provide an independent, expert-based, and scientific framework to objectively infer potentially important areas for the conservation of Angelsharks in the Canary Islands. ARCAs will enhance conservation by providing decision-makers and other relevant parties with the actionable place-based knowledge required to implement conservation measures. The correct designation and delineation of Critical Areas was a fundamental step in developing the draft RP.

Limitations

Angelsharks are extremely data-limited due to their rarity, benthic ecology and highly cryptic, making the identification of ARCAs challenging. Specific limitations included:

- Most data were only available up to 40 m depth (due to recreational diving limits); thus, we could not identify ARCAs in deeper waters, which may be important for Angelsharks.
- Effort data were unavailable for citizen science sightings, so Angelshark abundance indices could not be used during this process.
- Combining multiple citizen science datasets (with varying levels of detail) may have led to the risk of duplication and/or misreporting, despite our best efforts to minimise this.
- ASP: CI has completed scientific research in specific focal areas where Angelsharks are more frequently encountered, which may have biased the dataset.

In conservation, efficient action is often required even when data and understanding are incomplete or limited. It is also critical that evidence guides decision-making without the risk of misinterpretation causing unanticipated harm. It is therefore essential to acknowledge these limitations and information gaps while ensuring current data are translated into policy action. As our evidence base grows, the Recovery Plan process allows for reassessment and the incorporation of new data.

Future of the recovery plan

The Angelshark Recovery Plan for the Canary Islands will soon become a reality. The final public consultation period will be launched in spring-summer 2023. Once completed and the RP is finalised, the specific conservation measures and identified ARCAs will be included in Spanish legislation. These key milestones pioneered in Spain will provide decision-makers with actionable knowledge and the capacity and obligation to implement critical conservation actions.

We believe this approach could be replicated in other areas where angel sharks are still present and could establish the foundation for developing similar conservation strategies for angel sharks at international, regional, national, and local levels.

Given the rapid degradation of the conservation status of shark species, shark conservation is considered a matter of urgency. Sharks play a vital role in habitat health, and we hope that the Angelshark Recovery Plan creates a precedent for other species and their habitats.

References

1. Lawson, Julia M.; Riley A. Pollom; Cat A. Gordon; Joanna Barker; Eva K. M. Meyers; Heike Zidowitz; Jim R. Ellis. (2020) Extinction Risk and Conservation of Critically Endangered Angel Sharks in the Eastern Atlantic and Mediterranean Sea, 77 (1), 12-29.
2. Ellis, Jim R.; Joanna Barker; Sophy R. McCully Phillips; Eva K. M. Meyers; Michelle Heupel. (2021) Angel Sharks (Squatinidae): A Review of Biological Knowledge and Exploitation. Journal of Fish Biology. 10.1111- jfb.14613.
3. Morey, G; Barker, J.; Hood, A.; Gordon, C.; Bartolí, A.; Meyers E.K.M., Ellis, J.; Sharp, R.; Jimenez-Alvarado, D.; Pollom, R. *Squatina squatina.* (2019) The IUCN Red List of Threatened Species.: e.T39332A117498371. 10.2305/IUCN.UK.2019-1. RLTS.T39332A117498371
4. Meyers, E. K. M., Tuya, F., Barker, J., Jiménez Alvarado, D., Castro Hernández, J.J., Haroun, R., Rödder, D. (2017). Population structure, distribution and hábitat use of the Critically Endangered Angelshark, *Squatina squatina,* in the Canary Islands. Aquatic Conserv: Mar Freshw Ecosyst. doi.org/10.1002/aqc.2769
5. Barker, J.; Bartoli, A.; Clark, M.; Dulvy, N.K.; Gordon, C.; Hood, A.; Jiménez Alvarado D.; Lawson, J.; Meyers, E. (2016) Plan de Acción para el Angelote en las Islas Canarias. ZSL.
6. Dulvy, N. K., Fowler, S. L., Musick, J. A., Cavanagh, R. D., Kyne, P. M., Harrison, L. R., Carlson, J. K., Davison, L. N. K., Fordham, S. V. & Francis, M. P. (2014). Extinction risk and conservation of the world's sharks and rays. Elife 3, e00590.
7. Jiménez-Alvarado, D., Meyers, E. K., Caro, M. B., Sealey, M. J., & Barker, J. (2020). Investigation of juvenile angelshark (*Squatina squatina*) habitat in the Canary Islands with recommended measures for protection and management. Aquatic Conservation: Marine and Freshwater Ecosystems.
8. Article 3.2 of Law 42/2007 Spanish National regulatory on Natural Heritage and Biodiversity definition of critical areas for species.
9. Noviello, N., McGonigle, C., Jacoby, D.M.P., Meyers, E.K.M., Jiménez-Alvarado, D. & Barker, J. (2021). Modelling Critically Endangered marine species: Bias-corrected citizen science data inform habitat suitability for the angelshark (Squatina squatina). Aquatic Conservation: Marine and Freshwater Ecosystems, 1–15. doi.org/10. 1002/aqc.3711

Photo by Michael Sealey

Juvenile Angelshark (*Squatina squatina*) buried beneath the sand at Las Teresitas, the largest known nursery area for the species

Close-up of an acoustic tag attached to an adult Angelshark (*Squatina squatina*) in La Graciosa Marine Reserve

Photo by Michael Sealey

Releasing a juvenile Angelshark (*Squatina squatina*) after the biometric study and tagging process

Photos by Michael Sealey

Adult male Angelshark (*Squatina squatina*) swimming over sandy terrain within one of the Critical Areas for their conservation

Angelshark (*Squatina squatina*) buried in the sand, where they rest and wait to ambush their prey

Photo by Michael Sealey

Photo by Michael Sealey

Adult female Angelshark (*Squatina squatina*) swimming over seagrass in one of the critical conservation areas

Main historical steps of fishing research in the Mediterranean targeted to Sharks and Rays

(The contribution of MEDITS programme to knowledge on biology and ecology)

Region Update:
Mediterranean

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A Roman mosaic with fishing scene, found in Hippolytus House in Madrid, Spain

Since ancient times (10,000–8,000 BC), fishing activity in the Mediterranean Sea has produced some of the greatest food resources, guaranteeing social and economic benefits. For centuries, fishers have carried out sustainable fishing activities while also targeting sharks and rays in coastal waters (Fig. 1). However, in recent decades the increase in fishing pressure and illegal activities has led to concerns about the sustainability for the populations of sharks and rays in many areas of the world including in the Mediterranean Sea. In the Mediterranean (Food and Agriculture Organization [FAO] Fishing Area 37), one of the areas most impacted by fishing activities, stocks that are fished to unsustainable levels constitute up to 63.4%, second only to the Southeast Pacific. The greatest concern is for sharks and rays because of a close stock-recruitment relationship and low resilience in response to overfishing. At the same time, their adequate conservation and management is hindered by the lack of data on catch, discards, and trade, as well as limited information on the biology of many species and their accurate species-specific identification. Finally, these species have constituted an important component of the fishery bycatch.

The capture of fish has been known since the Egyptian, Greek, and Roman periods. During the ancient Roman empire, small mackerel and slices of tuna were salted in factories, called cetariae, to extend their conservation time. These salted fish were put inside amphorae filled with salt and mixed withthe famous garum sauce, . These were taken onboard ships bound for the great harbour-emporia of the time.

We must wait until the 16th century, an era of transition between ancient and new ways of fishing, to witness the most intensive fishing activities, though still limited to coastal areas. To assert themselves and then spread all around the Mediterranean, these new ways of fishing needed favourable inputs related to the socio-economic conditions that were changing. Since that time, to avoid depleting resources, various forms of local regulations had been devised in the Mediterranean.

From the transformation of the fish trade that began during medieval times - at the end of the 16th century - in two centuries the fish trade traffic and consumption completely changed. Between the 17th and 20th centuries, important improvements influenced fish production, conservation, and trade which inexorably led to the worrying phenomenom of generalised overexploitation of fish stocks at the end of 20th century.

In the middle of the 19th century, the observed variations in abundance of many species were mainly attributed to natural fluctuations. In fact, the abundance of marine resources was at this time considered an unlimited gift of nature. However, over time, with increasing knowledge and the development of fisheries, this thought (myth) quickly vanished. Today, we observe a constant tendency of decline of shark and ray populations. This is mainly caused by overexploitation, and we are now finally aware that marine resources, although renewable, are not infinite.

Today there is a broad awareness that marine resources must be properly managed if we want to guarantee their availability in future generations in terms of food, economic, and social values. Careful management requires that catch rates and fishing patterns correspond to the capability of the population to renew itself. In this sense technical-managerial interventions aim to reverse the phenomenon of overexploitation, even in mixed fisheries across the Mediterranean where sharks, rays, and chimaeras are generally caught as bycatch.

The State of World Fisheries and Aquaculture (SOFIA report), highlights how the trend in catches is decreasing in most oceans and in the Mediterranean Sea. This is particularly noticeable for sharks for which the FAO adopted a specific program in 1999 to ensure their conservation and management for sustainable fisheries (the International Plan of Action (IPOA)-SHARKS). This program has been elaborated within the framework of the FAO Code of Conduct for Responsible Fisheries.

Reliable and complete information on trend in catches is of fundamental importance for optimal management of fishery resources. However, given the nature of bycatch and its associated high discard rates of sharks, rays, and chimaeras, it is very difficult to have reliable data from commercial fisheries. For this reason, albeit in a fragmentary way, many Mediterranean countries since the middle of 20th century have tried to acquire them, often through fishery independent research programs. France, Tunisia, Greece, Egypt, Spain, Türkiye, Croatia, and Italy are the countries that have invested the most in research applied to fisheries, but up to the end of the 1970s there were few defined programs. The more valuable and historical datasets come from the scientific trawl-surveys carried out in the Mediterranean since the mid-1900s. Below are just a few of the most significant programmes:

- The 'expedition HVAR' (1948–1949), was the first large-scale fishery independent trawl-survey performed in the Adriatic Sea.
- Between June 5, 1957 and July 4, 1958 a series of trawl-surveys (here referred as Bios-Predvodnik 1) were organised in the Croatian channels around the Hvar Island. At the same period Matta (1958) carried out scientific surveys in Tuscan waters (Italy).
- Between October 1956 and January 1971, the Institute of Oceanography and Fisheries (IOF) performed another series of trawl-surveys (Bios-Predvodnik 2).
- In November 1972, October 1975, and September 1981 in the Central Adriatic fishery-independent joint research utilizing the Italian commercial trawlers was carried out.
- At the end of the 70s, the first Italian coordinated program 'Progetto finalizzato Oceanografia e fondi marini' began.
- The 'Pipeta programme' started in 1982 (successively named GRUppo Nazionale Demersali, GRUND) that involved several Italian Operative Units and ended in 2008.
- From 1987 to 1991 Greece carried out seasonal demersal trawl surveys around the Island of Crete.
- At the beginning of the 1980s, Italy committed to a multi-year program called GRUND. In 1994, within the frame of the European programs, France, Spain, Greece, and Italy launched the Mediterranean International Trawl Survey (MEDITS) project, which l refers to the general program of the Data Collection Framework (DCF) in 2002.
- From 2009 to 2015, Egypt carried out some scientific trawl surveys in front of the Nile River delta.
- Türkiye from 1981 to 1984 carried out demersal trawl surveys along the Eastern Mediterranean, and from 1985 to 1986 in the Central-Eastern Black Sea. Meanwhile, between 1991 and 1993, the Ministry of Agriculture and Rural Affairs (MARA) and Japan International Cooperation Agency (JICA) carried out a research project on the demersal fishery resources in Turkish waters. After this period, investigations on demersal fish stocks were continued in the Aegean Sea until 1996, and there are minor research programmes that occur to this day.
- Finally, we must mention the joint project 'Understanding Mediterranean multi-taxa bycatch of vulnerable species and testing mitigation – a collaborative approach' (the MedBycatch project), funded by the MAVA Foundation (Partners: General Fisheries Commission for the Mediterranean (GFCM), Agreement on the Conservation of Cetaceans of the Black Sea, Mediterranean Sea and Contiguous Atlantic Area (ACCOBAMS), Specially Protected Areas Regional Activity Centre (SPA/RAC), International Union for Conservation of Nature (IUCN), BirdLife International and Mediterranean Association to Save the Sea Turtles (MEDASSET)).

The interest and concern about sharks, rays, and chimaeras is high even for those countries that have not activated structured scientific campaigns. For example, Tunisia has produced over time the largest number of scientific contributions on this topic.

In the wake of the fisheries management support research of the European Commission and based on previous experiences, in 1993 researchers from France, Greece, Italy, and Spain began to work at a standardised protocol for collecting, processing, and managing information collected from trawl surveys in the Mediterranean.

The following year (1994) was a milestone moment, a key year which marked a turning point in research applied to fisheries. For the first time in the Mediterranean, we witnessed a coordinated research program among various countries of the European Union which adopted shared research tools aimed at collecting standardised information relating to many species which have a common interest for their sustainable exploitation of the fish populations for food purposes, the MEDITS.

The MEDITS program

At the beginning of the project, only a few shark and ray species, namely Thornback Skate (*Raja clavata*), Smallspotted Catshark (*Scyliorhinus canicula*) and Blackmouth Catshark (*Galeus melastomus*) were considered among the priority species of the MEDITS programme. Today, we have 32 sharks, rays, and chimaeras as priority species, for which the distribution as well as demographic structure, on the continental shelves and on the upper part of the continental slope from 10 to 800 meters of depth, are investigated.

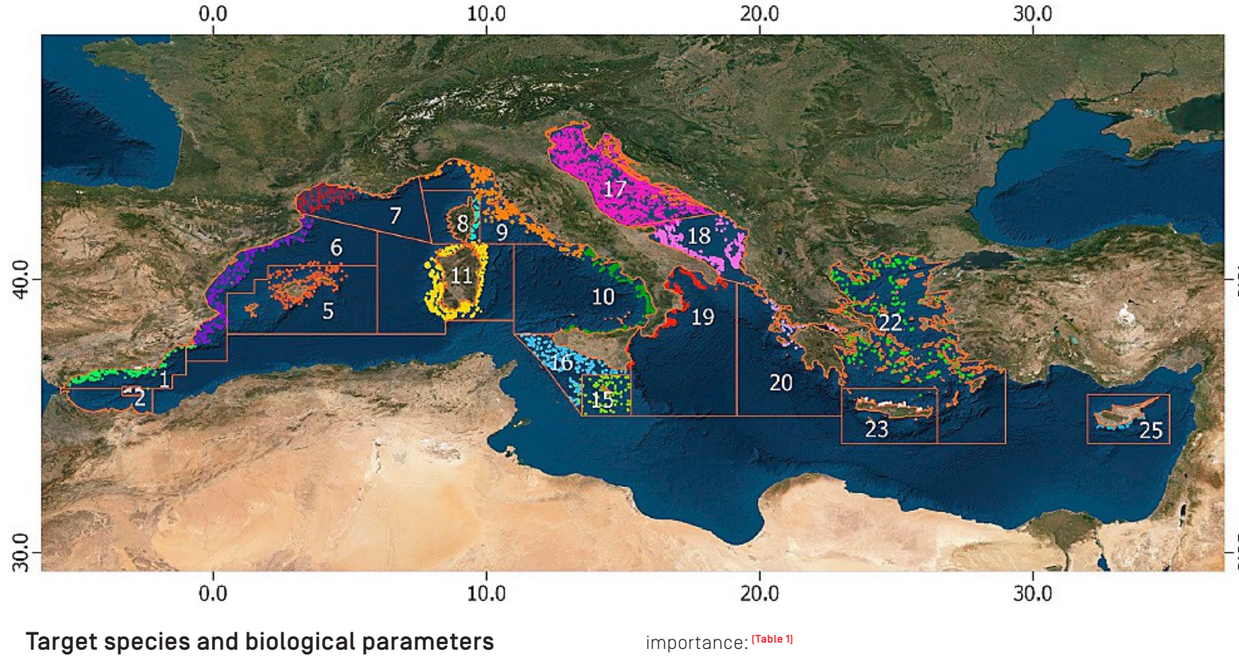
Study area

MEDITS carries out surveys on demersal resources in the European waters of the Mediterranean basin considering the subdivision into Geographical Sub-Areas (GSAs) defined by the GFCM. France, Greece, Italy, and Spain conducted the first two surveys (1994 and 1995). In 1996, some Adriatic countries (Slovenia, Croatia, and Albania) joined the MEDITS. Since 1999, the Mediterranean Moroccan coast has also been included in the survey programme as well as Malta since 2000. Later in 2002, the program was included in the European regulation related to the collection of fishery data (Data Collection Framework). Cyprus and Montenegro joined the coordinated project in 2006 and 2008, respectively. Collaborations with non-European countries were facilitated by the GFCM and FAO Regional Projects. Although not involved in the MEDITS international coordination group, Morocco, Algeria, and Tunisia have carried out trawl surveys by using the MEDITS protocol since 2020; Egypt and Libya joined in 2023; and Türkiye and Lebanon conducted trawl surveys according to the MEDITS protocol in some pilot areas in the last years.

The sample stations (hauls) have been allocated according to a random stratified sampling design inside strata (Fig. 2). The stratification criterion was the depth and the bathymetric limits of strata were: 10–50, 51–100, 101–200, 201–500 and 501–800 m. The sampling activity always takes place during daylight hours using a standard bottom trawl net GOC-73, with codend mesh size of 20 mm (stretched mesh).

The number of hauls in each stratum were set proportional to the stratum surface of the haul position and is maintained, when possible, constant along the years. The duration of each haul is 30' at less than 200 m depth and 60' at a depth greater than 200 m. Nowadays, the MEDITS sampling covers 543,000 km^2 with, on average, about 1,283 sampling stations per year for a total of just under 35,000 hauls in almost 30 years of trawl surveys.

Study area of the MEDITS bottom trawl surveys in the GSA where the surveys are carried out by European countries, showing the hauls allocated to the Geographical Sub-Areas established by the General Fisheries Commission for the Mediterranean



Target species and biological parameters

A Taxonomic list of Mediterranean (TM) species collected during the MEDITS surveys has been developed. This list contains 43 taxonomic categories linked to 1,470 observed taxa, and is composed of about 1,617 codes in total. Today, the identified taxa include 385 bony fish, one sea lamprey, one chimaera, 49 demersal sharks and rays (including dubious species), 220 crustaceans (decapods), and 25 other crustaceans, 267 molluscs (bivalve, gastropod, and opisthobranch) plus 60 cephalopods, 93 echinoderms, 72 tunicates (mainly Ascidiacea), 28 bryozoans, 90 cnidarians, 42 polychaetes, 50 porifera, 100 aquatic plants and macroalgae, and other less numerous groups. The species collected during the MEDITS programme have been split into three groups G1, G2 and G3 relating to their ecological and commercial importance: [Table 1]

- MEDITS G1, which includes 44 species, (six bony fish, four crustaceans, two cephalopods and 32 sharks and rays).
- MEDITS G2, which includes 19 species, (12 bony fish, two crustaceans and five cephalopods).
- MEDITS G3 are species considered of lower importance.

Table 1: Number of species in priority 1 and MEDITS groups to which they belong. The number of the other species gathered is also reported.

Groups of species	No	G1	G2	G3	Relative Total
Teleosteans	38	6	12	20+347	385
Chondrichthyans (Sharks, rays and chimaeras)	32	32		+18	50
Crustaceans	7	4	2	1+238	245
Cephalopods	7	2	5	+53	60
Total	84	44	19	21+659	743

The MEDITS protocol also provides a common format for storing the collected data in standard files.

Some information from MEDITS on some selected shark and ray species

(Distribution and relative abundance)

A total of 50 shark, ray, and chimaera species have been collected in the MEDITS program, of which 44 are included in the TM list, in particular, 19 sharks (four orders and 10 families), 24 rays (three orders and six families), and one chimaera. Four of these 44 are questionable species and need to be confirmed for the Mediterranean Tortonese's Stingray (*Dasyatis tortonesei*), Common Blue Skate (*Dipturus cf. batis*), Shagreen Skate (*Leucoraja cf. fullonica*), and Spotted Skate (*Raja montagui*). Moreover, single or sporadic captures have also been recorded such as the Common Thresher (*Alopias vulpinus*), Sandbar Shark (*Carcharhinus plumbeus*), Pelagic Stingray (*Pteroplatytrygon violacea*), Sand Tiger Shark (*Carcharias taurus*) and Spinetail Devil Ray (*Mobula mobular*). These last five species, due to their pelagic habits, have been considered as occasional catches and have not been included in the general list. Other species like Spiny Butterfly Ray (*Gymnura altavela*) and Lusitanian Cownose Ray (*Rhinoptera marginata*) have been considered as random catches and added to TM list anyway.

Three sharks and one skate (Smallspotted Catshark, Blackmouth Catshark, Spiny Dogfish (*Squalus acanthias*), and Thornback Skate) showed both high occurrence (>5% of the hauls) and relative high abundance (> 10 kg/km^2 or > 10% of relative biomass) and altogether they can reach about 65% of the whole biomass of the Mediterranean sharks, rays, and chimaeras caught by MEDITS. [Fig. 3]

With regards to depth distribution, three main faunistic groups are recognized: a) species living exclusively close to the coast like the Starry Skate (*Raja asterias*), Nursehound (*Scyliorhinus stellaris*), etc.; b) species living across a wide depth range, especially on the continental shelf such as Thornback Skate and Smallspotted Catshark; c) species with preference for the slope such as Little Gulper Shark (*Centrophorus uyato*), Blackmouth Catshark and Velvet Belly Lanternshark (*Etmopterus spinax*).[Fig. 4] Some species of sharks (e.g., *Squalus* spp.) show signs of depletion, although there is evidence of zones of relatively high density.

From a geographical point of view, the occurrence of some species in terms of relative abundance (kg/km^2) in all areas is recorded (Smallspotted Catshark, Thornback Skate, Rabbitfish (*Chimaera monstrosa*), etc.); other species are more common in the western Mediterranean (Blackmouth Catshark, Velvet Belly Lanternshark, and Longnose Spurdog (*Squalus blainville*)) or in the eastern basin and Black Sea (Spiny Dogfish, Blonde Skate (*Raja brachyura*), etc.). Some species are localised in restricted areas (Brown Skate (*Raja miraletus*) in the Tyrrhenian Sea and the Strait of Sicily, Blonde Skate and Undulate Skate (*Raja undulata*) in the Aegean Sea, and Atlantic Sawtail Catshark (*Galeus atlanticus*) in the Alboran Sea). In general, the western basins show higher standing stocks, except for Spiny Dogfish, Blonde Skate, Tope (*Galeorhinus galeus*), and Thornback Skate. [Fig. 5]

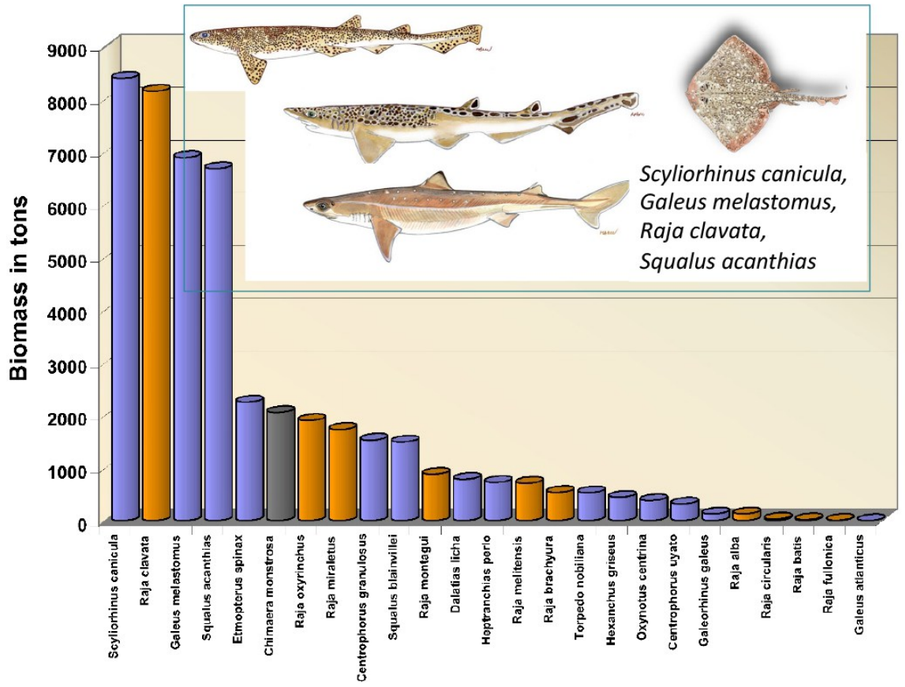


Fig. 3. Index of abundance (kg/km2) of deep-sea sharks and rays in the European Mediterranean.

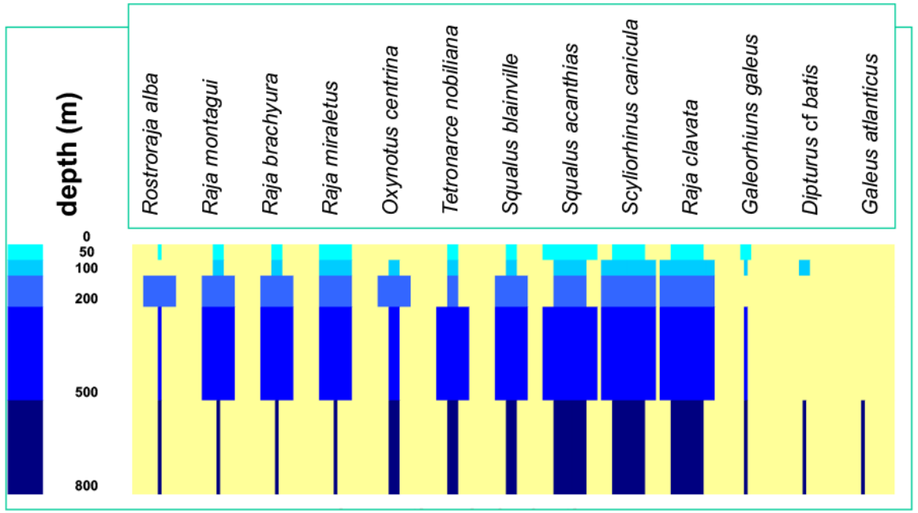


Fig. 4. Species on the whole depth range. Bar width represents the density index with the ranges: <0.1, 0.1-1, 1-10, >10 kg/km2.

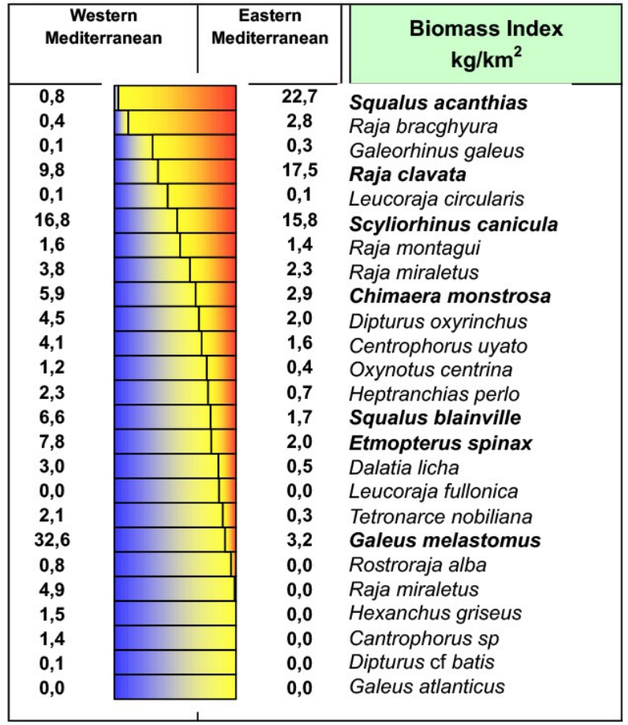


Figure 5. Distribution of biomass indexes (kg/km2) in the European Mediterranean related to their east-west gradient.

The Blackmouth Catshark was caught in all areas except for the North Adriatic, due to its shallow waters. This species is mainly distributed in the deeper strata of the slope - especially in the Gulf of Lions, Sardinian waters, and Alboran Sea - caught even beyond 1,000 meters depth. Considering the biomass indexes of Smallspotted Catshark, values higher than an arbitrary threshold of 100 kg/km^2 resulted in the shelf of Corsica and Sardinia waters, as well as in the Gulf of Lions, Catalan, and Aegean seas. The maximum biomass index was detected in Northeast Corsica. The Thornback Skate occurrence preferentially at the edge of the shelf and in the upper slope (200–500 m), and the highest biomass indexes (above 200 kg/km2) have been observed only in the waters surrounding Sardinia and Corsica. [Fig. 6]

Demography

The length frequency distribution patterns of the two most abundant sharks (Smallspotted Catshark and Blackmouth Catshark) show a modal peak around 20 cm total length (TL) and a plateau between 30 and 40 cm TL. The size range is wide, ranging from 8 to 68 cm TL for Blackmouth Catshark and from 10 to 50 cm TL for Smallspotted Catshark. In both cases immature individuals represent about 80% of the sampled population. Conversely, the number by size of Thornback Skate increases gradually from 10 up to 35 cm TL, thereafter they decrease progressively up to the maximum-recorded size of 90 cm TL. However, in this case most individuals are smaller than the size at first maturity (55–60 cm TL) and the spawner fraction represents only 15% in number of the sampled population. [Fig. 7]

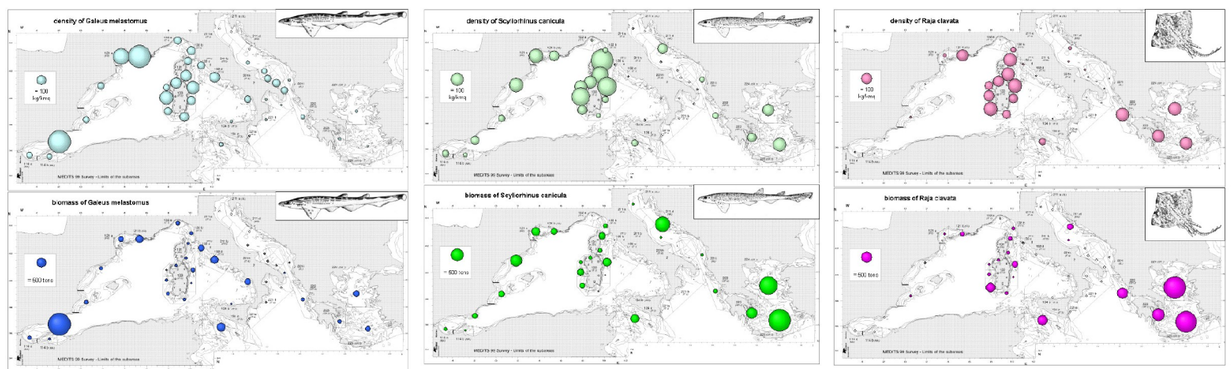


Fig 6. Density and Biomass estimates of Blackmouth Catshark, Smallspotted Catshark and Thornback Skate.

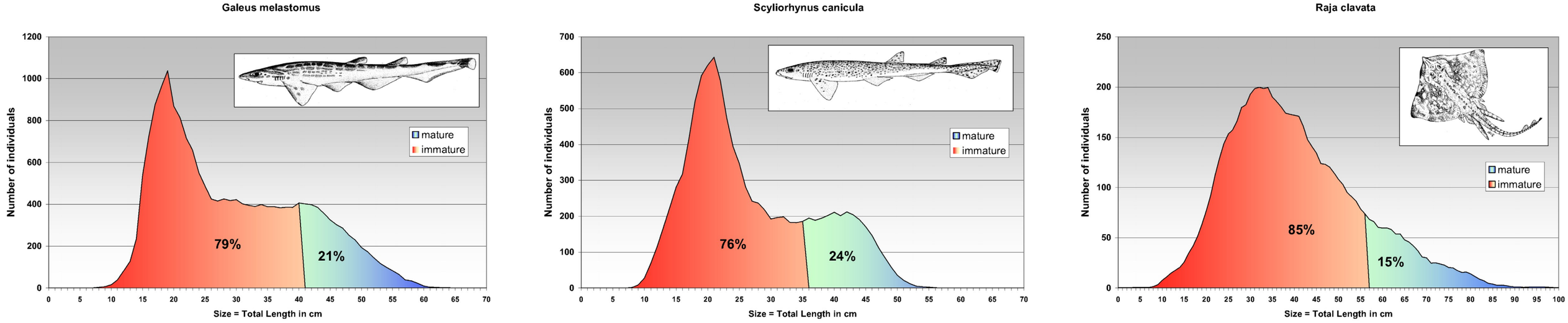


Fig. 7. Length frequency distribution of three main elasmobranchs in the catches

With regards to the location of nursery areas, they can be identified by means of the identification of areas where every year high concentrations of juveniles can be found.[Fig. 8]

For Blackmouth Catshark, albeit at a preliminary way, MEDITS indicated the most plausible nursery areas as the Alboran Sea, Sardinian waters, and South-Eastern Tyrrhenian Sea at depths ranging between 200–500 m and 500–800 m. The highest concentration areas of juvenile Smallspotted Catshark are in the upper slope (200–500 m), especially in Northeast Corsica, Northeast Sardinia, and Western Morocco (Fig. 9). To date, no reliable information has been collected on Thornback Skate's nursery area.

The MEDITS trawl survey, in some cases, has shown increasing catch rates (e.g., Smallspotted Catshark and Thornback Skate in the GSA 9 – Liguarian Sea and northern Tyrrhenian Sea) (Fig. 10). This is also in agreement with other authors who, among the species sampled in the surveys, report only two ubiquitous (Longnose Spurdog and Smallspotted Catshark) and three deep-water species (Rabbitfish, Little Gulper Shark, and Blackmouth Catshark) with a wide geographical distribution and a consistent abundance-

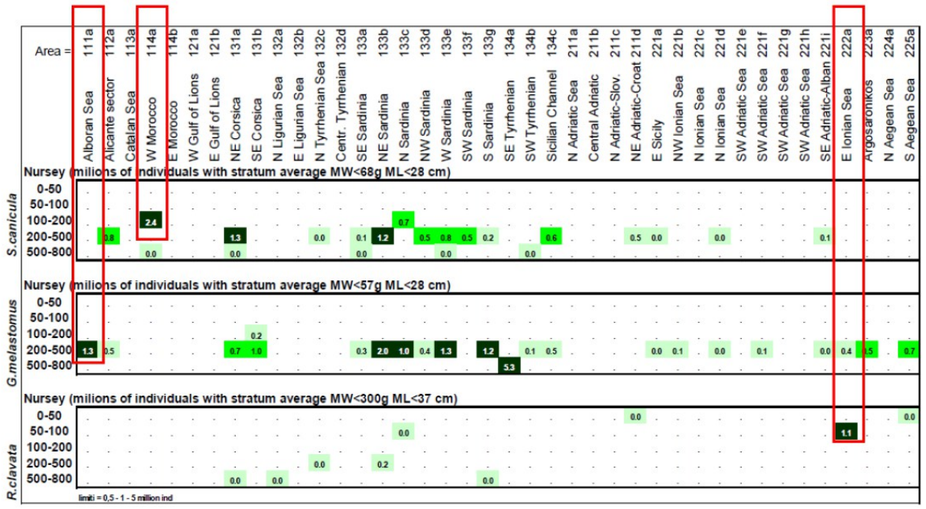


Fig. 8. Location of nursery grounds of Smallspotted Catshark, Blackmouth Catshark and Thornback Skate in the Mediterranean Sea by MEDITS areas and depth

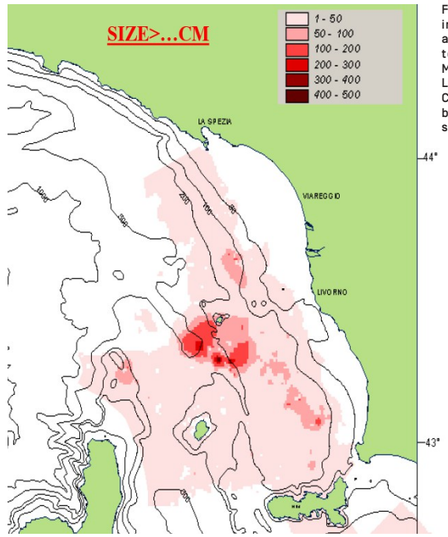
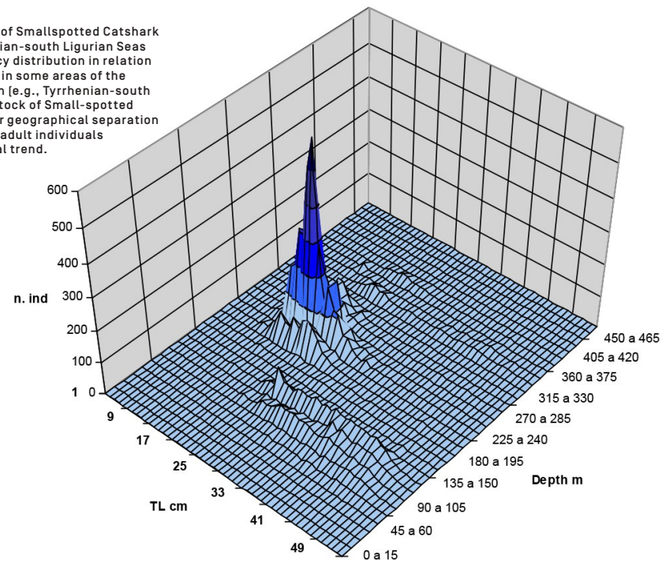


Fig. 9. Nursery area of Smallspotted Catshark in the north Tyrrhenian-south Ligurian Seas and length frequency distribution in relation to depth. Currently, in some areas of the Mediterranean basin (e.g., Tyrrhenian-south Ligurian Seas) the stock of Small-spotted Catshark has a clear geographical separation between young and adult individuals showing a polymodal trend.



Conclusions

The utility of such a survey programme, as support for fishery management, is strongly related to its ability in producing abundance and/or demographic indices able to characterize the state of the populations at sea and their variations and trends in time. The MEDITS programme also offers a key source of data to improving knowledge on biology, and ecology of demersal species, including sharks, rays, and chimaeras, and biodiversity of the bottom communities. Furthermore, MEDITS data have been utilised in hundreds of studies on the localization of essential fish habitats (e.g., nursery and spawning grounds), fish stock identification, biodiversity patterns, and the validation of integrated ecosystem models at Mediterranean scale.

The experience gained in MEDITS in terms of standardisation of the procedures and data quality checks, have allowed to produce a common database, with the possibility to compare the MEDITS time series with those collected in previous and historical surveys from different countries, such as the GRUND and DESEAS surveys or the Recovery of Fishes (RECFISH) project, etc.

It is recommended that a survey such as the MEDITS is extended to the whole Mediterranean region including the Black Sea. The evaluation of only some part of this region, while providing important information on the biology and exploitation of fish communities, will never be able to give a reliable picture of the status of sharks, rays, and chimaeras in the entire basin. For this purpose, the GFCM data collection program is of fundamental help in achieving the coverage of all GSAs in which the Mediterranean and Black Sea are divided.

The MEDITS programme was a precursor of the fishery data collection for the European Union that fuelled the Common Fishery Policy. Over the years, the program scope has been extended to include the identification of essential fish habitats and Vulnerable Marine Ecosystems. Today the MEDITS provide important scientific support not only to other European policies such as the Marine Strategy Framework Directive, the Maritime Spatial Planning Directive, and the Biodiversity Strategy but also to the GFCM 2030 Strategy, contributing to improve knowledge on fish populations and enacting an ecosystem-based approach to fishery.

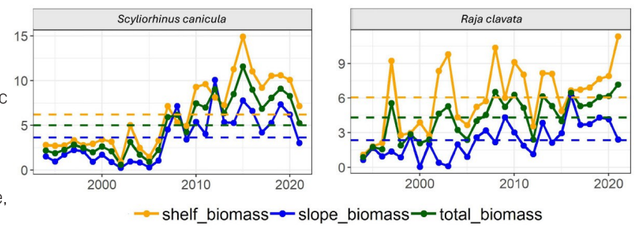
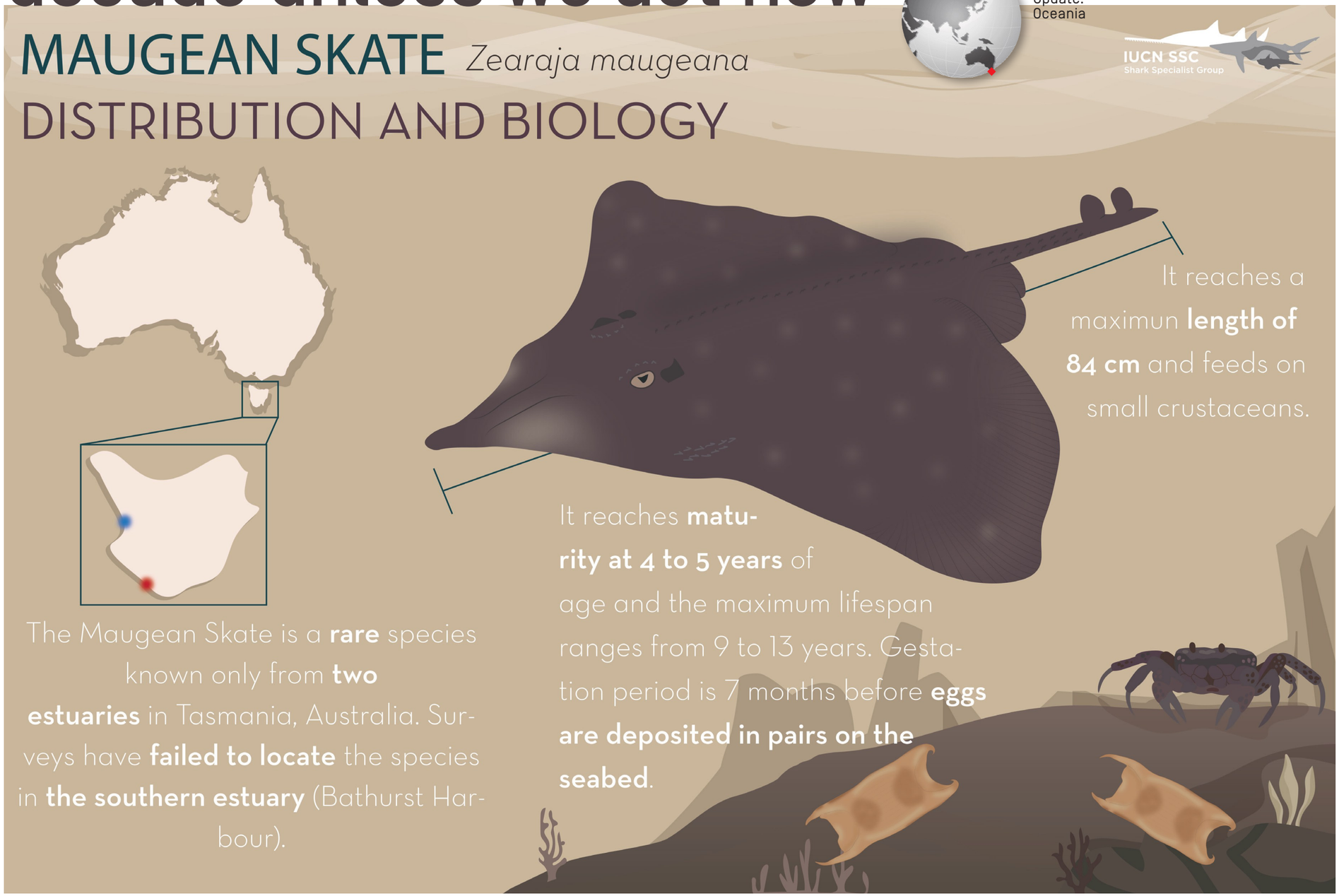


Fig. 10. Trend of the biomass index (kg/km2) of the two species of sharks and rays estimated on the distribution area of GSA 9 (Series MEDITS 1994-2021).

New plan to save one of the world's most threatened rays from extinction: the Maugean Skate will be extinct in a decade unless we act now



Written by David Shiffman

IUCN SSC Shark Specialist Group | Communications Officer

The Maugean Skate (*Dipturus maugeanus*, formerly known as *Zearaja maugeana*), one of the world's most threatened fish, has less than a decade before extinction unless authorities act soon. The entire population of Maugean Skates lives in Macquarie Harbor on the west coast of Tasmania in Australia, an area of less than 300 square kilometres. Macquarie Harbor's environment faces many threats, including salmon aquaculture and hydropower that affect oxygen levels in the water, pollution from mining wastes, and fishing. A new conservation strategy report released by Australia's Federal Minister for the Environment outlines key conservation actions that the Australian and Tasmanian governments should take to prevent the extinction of the Maugean Skate. The minister also announced AUD $2.1 million in funding to establish a captive breeding program for the species.

One of the biggest threats facing the Maugean Skate is aquaculture or fish farming. This has existed in Macquarie Harbor for decades but rapidly expanded in 2009. Fish food and waste from fish farms cause low oxygen zones in the skate's preferred habitat, the deepest parts of the harbour. Skates seek out more oxygen-rich, shallow water, facing new threats, including high temperatures, predators, and fishing gear. But if they get too shallow, they also encounter lower salinity water that is energetically costly for them to deal with on a physiological level. The skates are getting squeezed from both sides. Additionally, during certain types of storms, low-oxygen water from the deep is spread throughout the water column, which is known to kill skates.

Hydropower operations in the rivers flowing into the harbour add to the low oxygen conditions by restricting the flow of oxygen-rich water into the harbour. Combined with pollution from nearby mines, fishing, and the environmental impacts of climate change, the Maugean Skate's only remaining habitat is in serious trouble.

Key conservation actions recommended by the new report include reducing the number of salmon fish farms to increase oxygen levels in the water, using mechanical devices to oxygenate the water artificially, and modifying hydroelectric dam flows. The report also recommends initiating a captive breeding program, remediation of mining pollution, and a variety of research priorities.

The Maugean Skate is listed under Tasmania's Threatened Species Protection Act and Australia's Environment Protection and Biodiversity Conservation Act. It is among 110 species prioritized under Australia's Threatened Species Strategy Action Plan.

"The Maugean Skate is a unique species, the only skate that permanently lives within estuaries. Living in this environment has exposed it to a variety of threats that, if not urgently dealt with, could be extinct within a decade."

Dr Colin Simpfendorfer
James Cook University, Australia

"The decline of the Maugean Skate has continued despite early warnings and a clear understanding of the cause and the solutions. The science is clear, and there needs to be an immediate improvement in water quality in Macquarie Harbor for this species to stand a chance of survival. It is encouraging that there is political commitment to make a change. Still, the urgency is real", added **Dr Rima Jabado**, Chair of the IUCN Species Survival Commission Shark Specialist Group.

Suggested further reading:

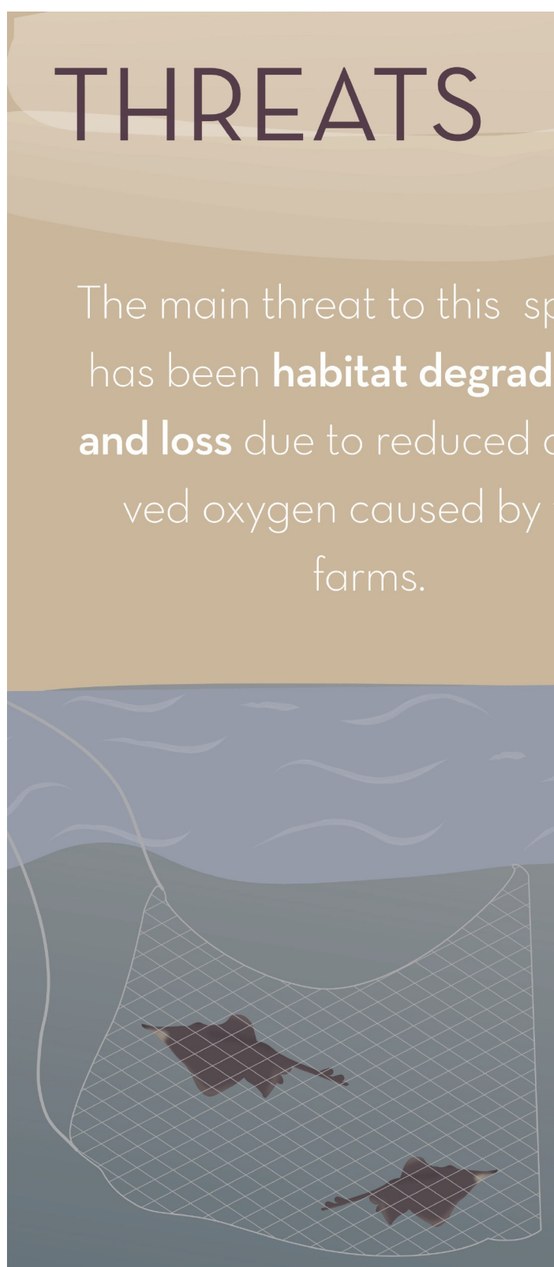
- Task force recommendations
- Department of Natural Resources and Environment Tasmania fact sheet
- An in-depth Tasmanian Inquirer article

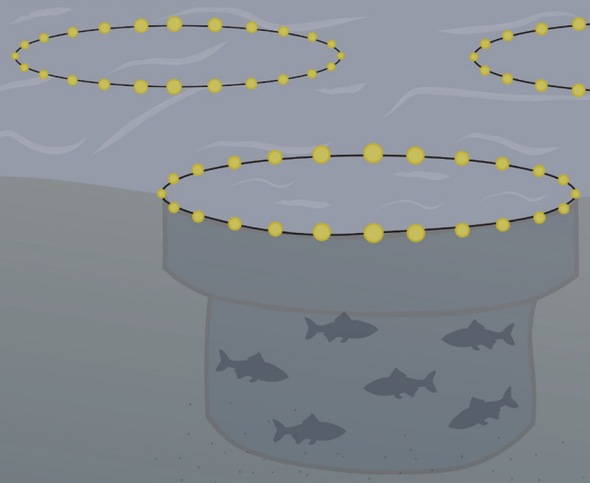
THREATS

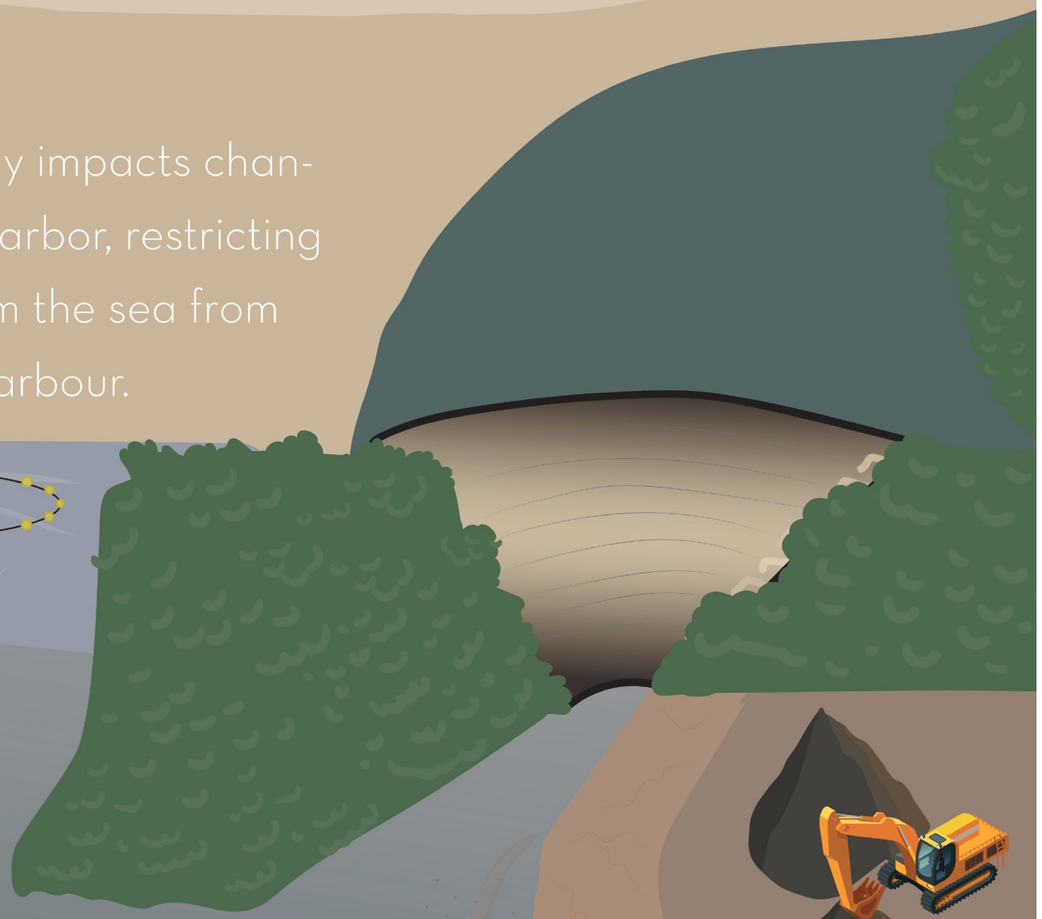
IUCN SSC
Shark Specialist Group

The main threat to this species has been **habitat degradation and loss** due to reduced dissolved oxygen caused by fish farms.

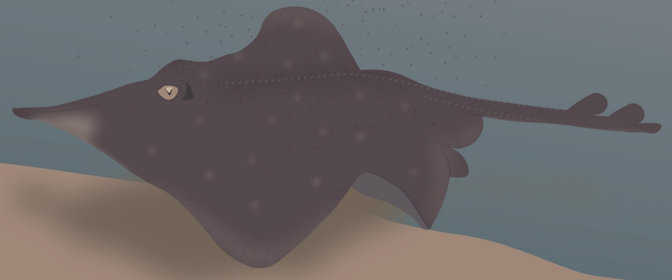
Hydropower significantly impacts changing river flow into the harbor, restricting oxygen-rich water from the sea from entering the harbour.







It is also accidentally **captured in net fisheries** targeting other species.



Historic **mining** in the catchment has led to high levels of **heavy metals** in the system. Such pollutants have **affected the reproduction** of other rays.

POPULATION MODEL RESULTS

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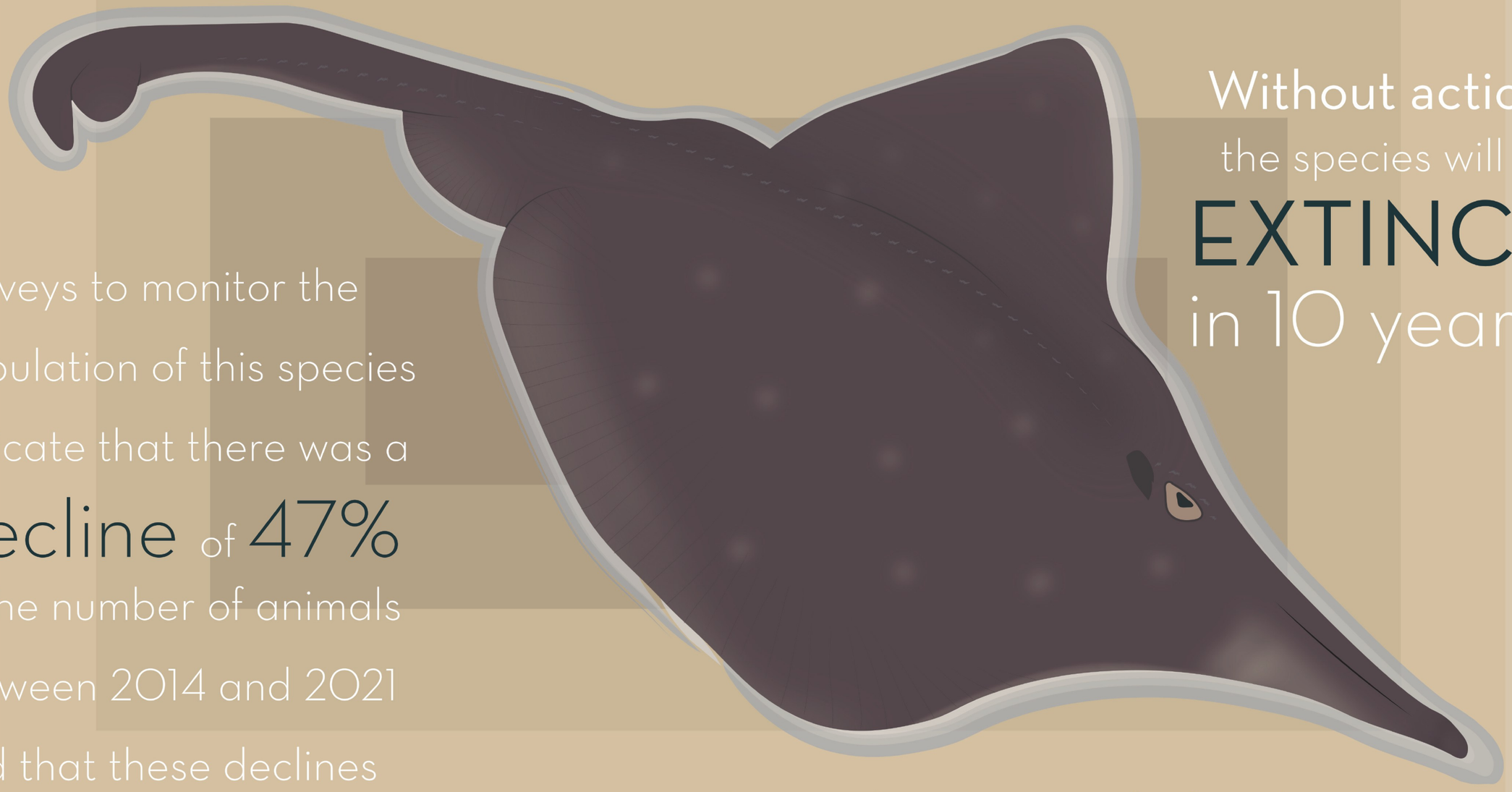


Surveys to monitor the population of this species indicate that there was a **decline** of **47%** in the number of animals between 2014 and 2021 and that these declines are continuing.

Without action, the species will be **EXTINCT** in 10 years!

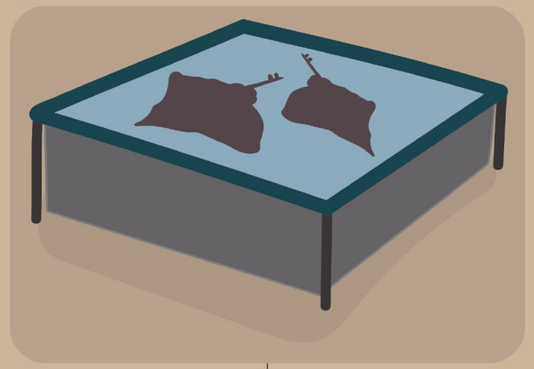
Surveys show that **juveniles have become very rare** in the system, a possible indicator of **recruitment failure**.

SOLUTIONS

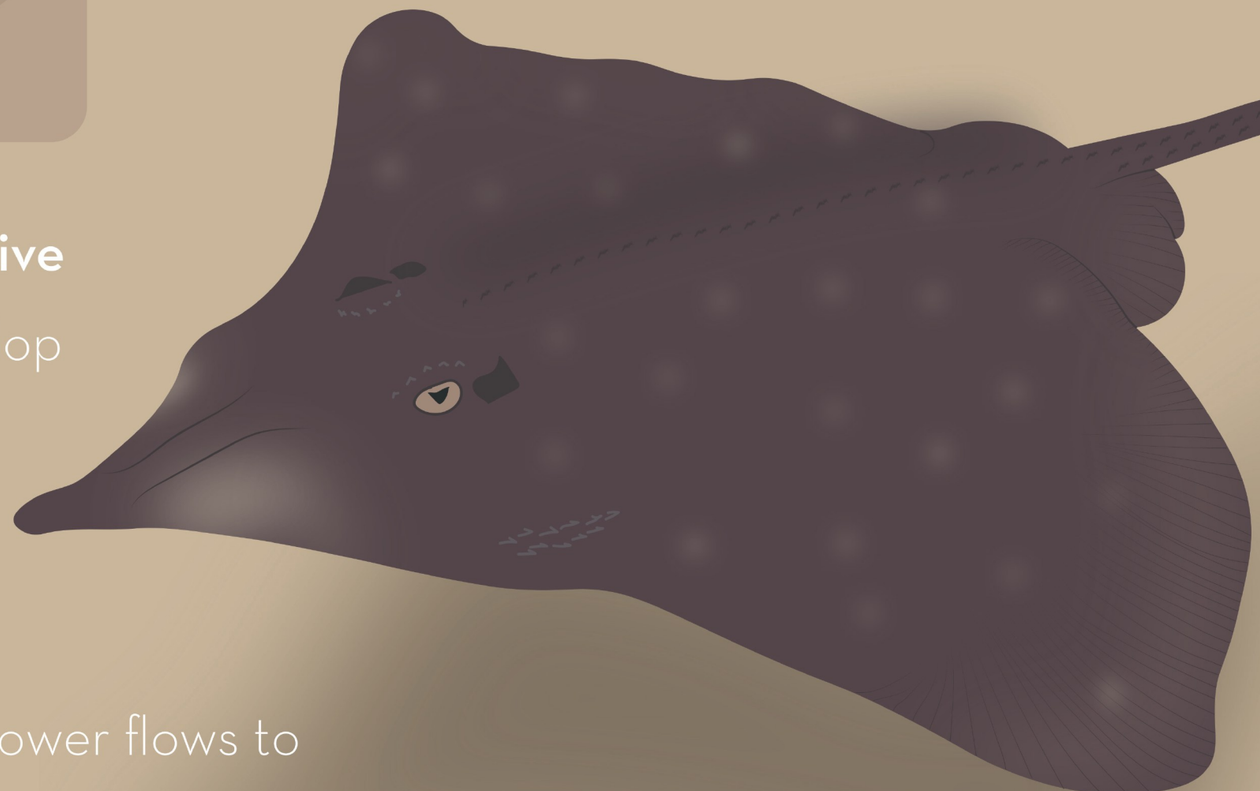
IUCN SSC
Shark Specialist Group

To provide a chance for this species's survival,

all threats must be tackled at once.



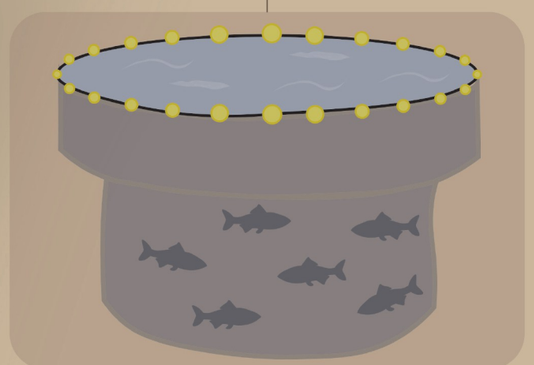
Undertaking **captive breeding** to develop an 'insurance' population.



Adapting hydropower flows to **improve oxygen input** from the ocean.

Priority measures include:

Reducing fish farms to allow oxygen levels to recover.



The Australian Government is working to address this situation, but **actions are needed quickly.**

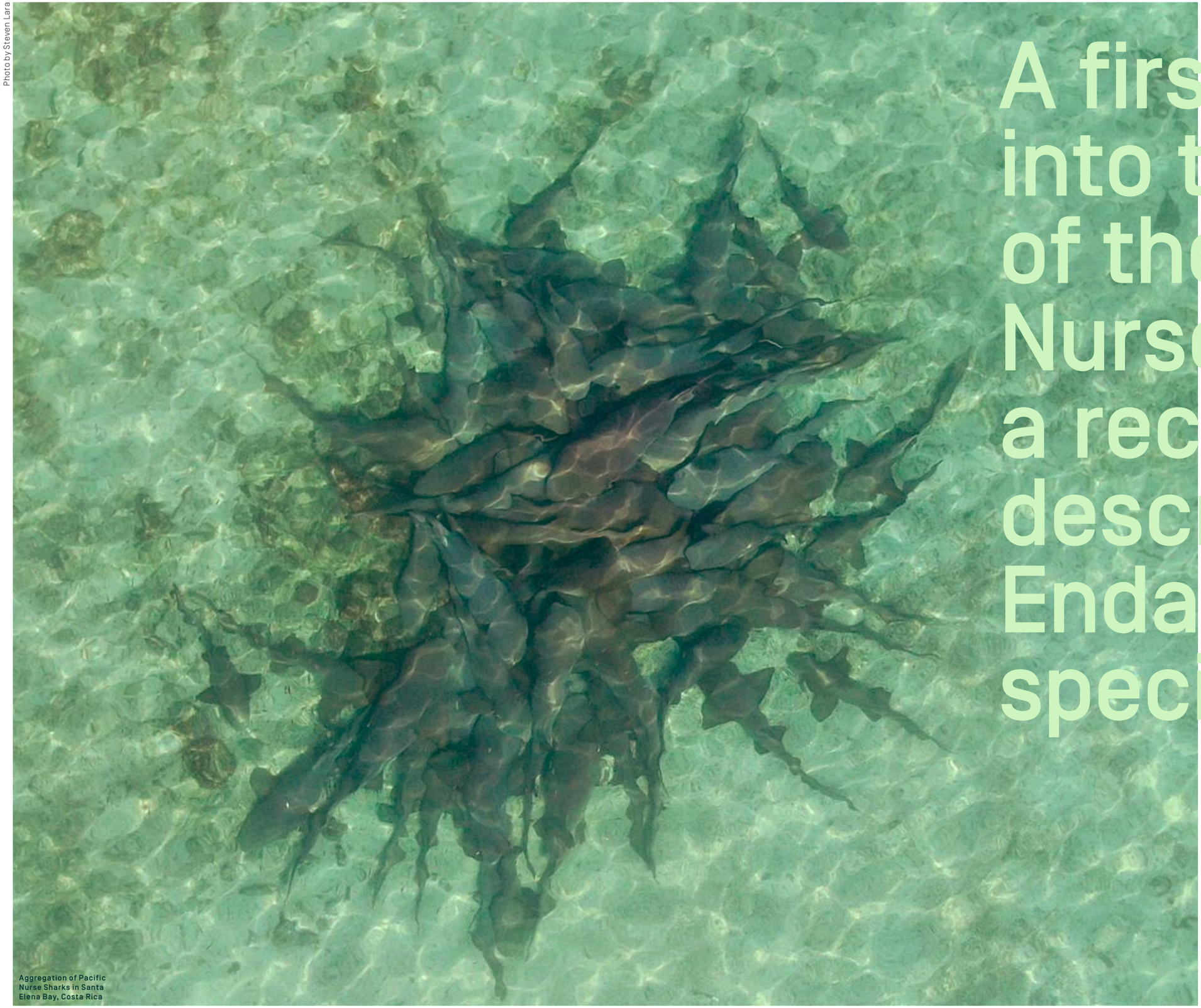


Photo by Steven Lara

Aggregation of Pacific Nurse Sharks in Santa Elena Bay, Costa Rica

A first glimpse into the life of the Pacific Nurse Shark, a recently described but Endangered species

Region Update: Central and South America

Written by:
Sergio Madrigal-Mora[1,2],
Tejas Patel[2]
Christopher G. Lowe[1]
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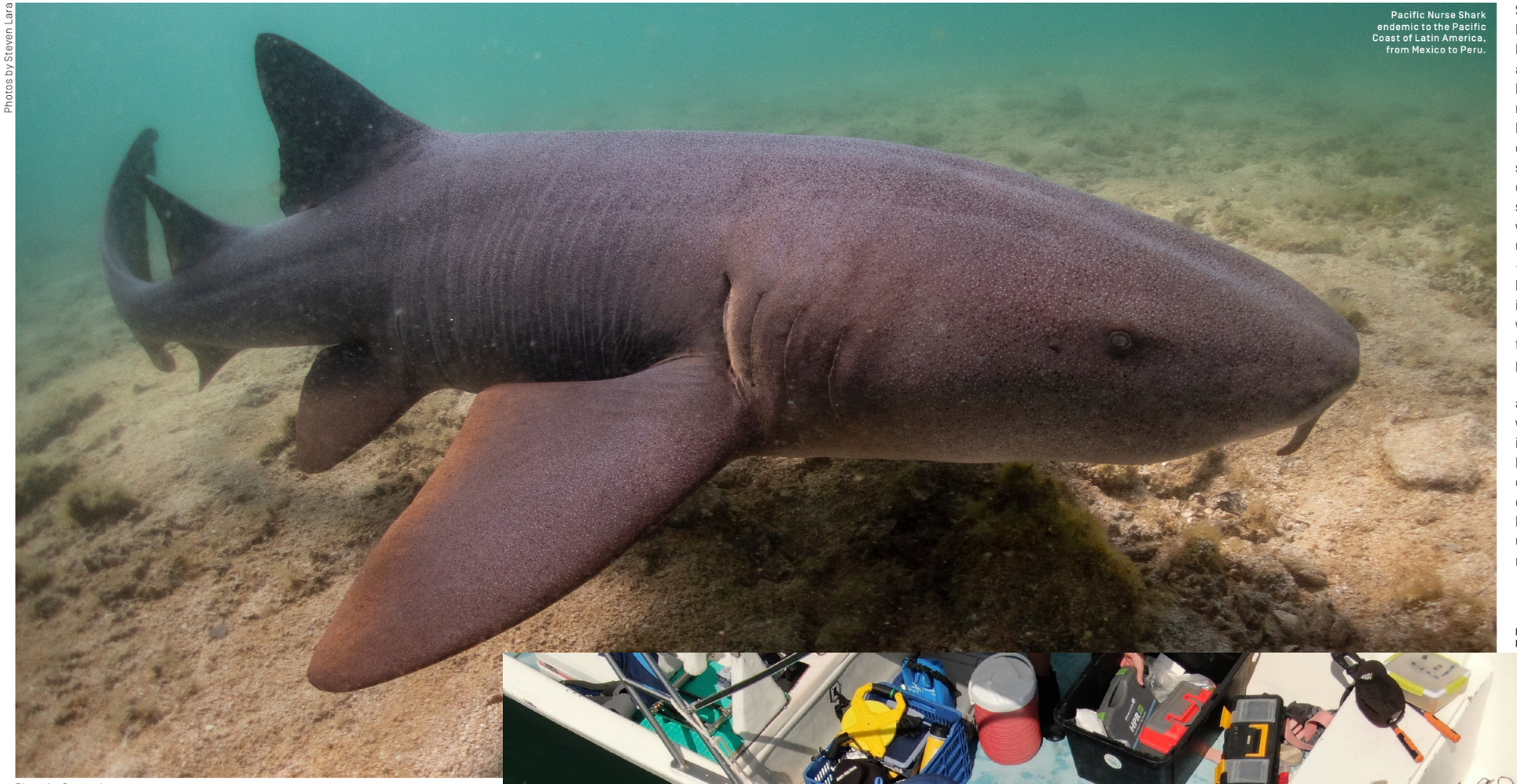
Photos by Steven Lara



Pacific Nurse Shark endemic to the Pacific Coast of Latin America, from Mexico to Peru.

Photo by Steven Lara

Abstract: The Pacific Nurse Shark (*Ginglymostoma unami*) is a recently described species endemic to the tropical Pacific of Latin America. We are studying their spatial ecology inside Santa Elena Bay, a Marine Management Area, and its adjacent waters in the North Pacific of Costa Rica using acoustic telemetry and drone surveys. Pacific Nurse Sharks are listed as Endangered (EN) by the International Union for Conservation of Nature (IUCN) Red List of Threatened Species because of its interactions with fisheries and limited knowledge of its biology. This research will, therefore, provide a baseline to inform management and conservation of this species throughout its distribution.

Not long ago, scientists believed that nurse sharks living in the warm waters of the Caribbean, Atlantic and Pacific oceans were the same species; however, recent analyses indicate that Pacific Nurse Sharks (*G. unami*) are a different species than those found in the Caribbean and Atlantic (*G. cirratum*). Just a few years after it was discovered, this new species was assessed as Endangered (EN) on the IUCN Red List. The Pacific Nurse Shark is often caught in coastal fisheries throughout its narrow distribution range (from Baja California to northern Perú), which, based on limited assessment, has resulted in rapid population declines. Therefore, any knowledge of the species' distribution, movements, and habitat use are crucial to guide management and conservation efforts and ensure its future welfare.

Since 2018, we have been studying Pacific Nurse Sharks in Santa Elena Bay, a 7.3 km^2 embayment in the north Pacific coast of Costa Rica surrounded by the tropical dry forest of the Santa Rosa National Park. The same year our project began, the bay was declared a Marine Management Area (MMA), which prohibits intensive fishing methods (i.e., trawling, longline, and gillnet). In 2023, Santa Elena Bay was also identified as an Important Shark and Ray Area (ISRA) of Costa Rica since it provides a wide range of habitats essential for sharks and rays, including estuarine mangrove forests, rocky and coral reefs. This region is also unique in its oceanography, as marine species are exposed to seasonal changes associated with upwelling. From December to April, strong trade winds cause coastal upwelling that cools ocean water temperature from an average of ~28°C to ~18°C. Since nurse sharks are ectothermic and obtain their body heat from their surroundings, we expect that they must behaviorally thermoregulate to find optimal temperatures when available waters get colder. They may, therefore, move into the shallow waters of Santa Elena Bay in search of warmer pockets of water to find physiologically optimal temperatures.

When working with such a poorly studied species, almost every aspect of our research raises new questions. Fundamentally, we want to understand when and why Pacific Nurse Sharks are present in the waters of Santa Elena Bay. What makes the bay a truly unique habitat for these sharks? Are their movements driven by seasonal environmental conditions available in Santa Elena? And how can our research here be applied across the Costa Rican coastline and broader distribution of this species? To tackle these questions, we used a small array of five acoustic receivers in 2018 to monitor their movements and residency. Over the years, and thanks to many

In the process of internally tagging a Pacific Nurse Shark before release. Photo by Steven Lara

collaborators, we have expanded our collection to 25 receivers inside and out of Santa Elena Bay. As of August 2023, we have tagged 41 Pacific Nurse Sharks with acoustic transmitters that can last between five and ten years. On average, this species is detected in 37% of the days inside Santa Elena Bay, with females staying longer than males. Our data also reveal that Pacific Nurse Sharks, especially males, are frequently venturing outside the protected waters of Santa Elena, where they may interact with artisanal fisheries as incidental catch. We also found an annual seasonality in the occurrence of Pacific Nurse Sharks within Santa Elena Bay, with more individuals detected during the upwelling season.

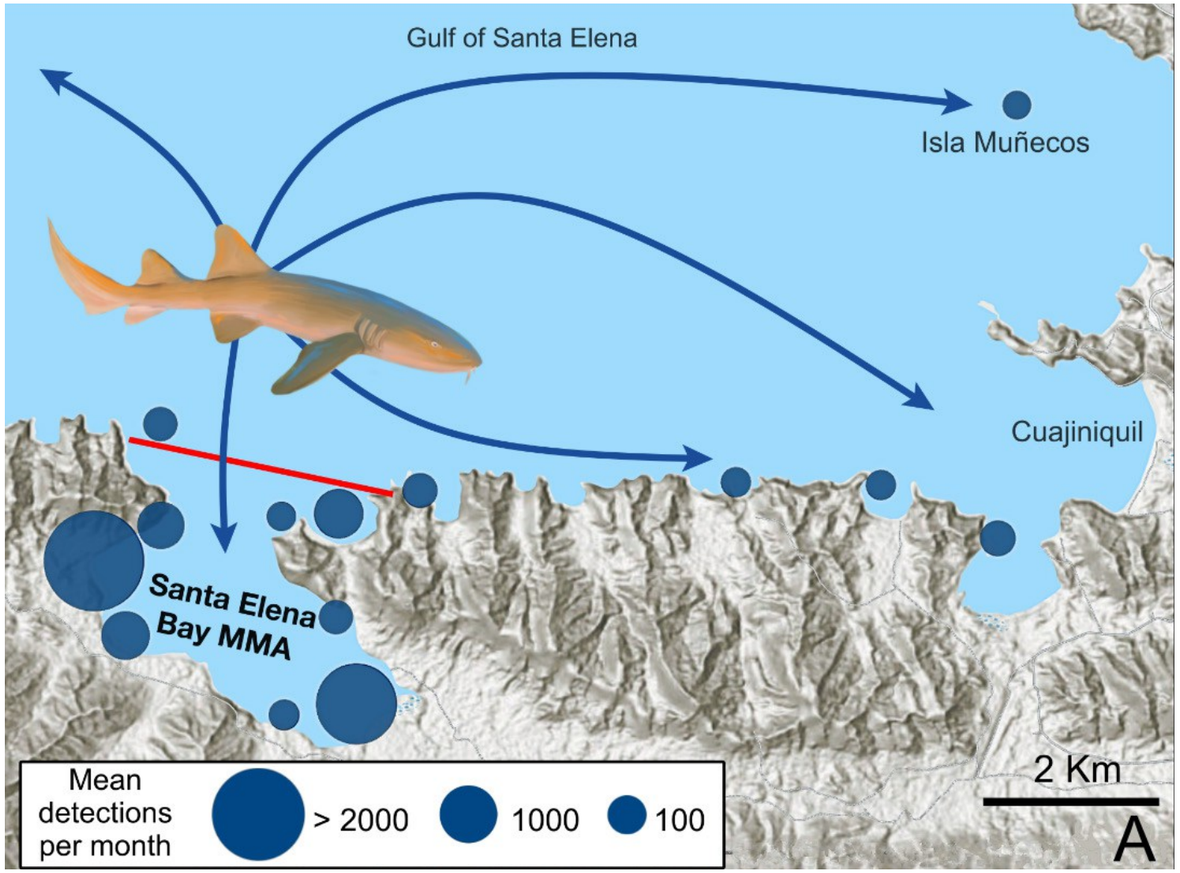
During the upwelling season, we frequently observe large aggregations of Pacific Nurse Sharks in Santa Elena. In 2022, we started monitoring these aggregations with aerial drone surveys, and so far, we have found that these aggregations can range from as few as three or four individuals to over 50 in a single group. In the Caribbean, scientists have found Atlantic Nurse Sharks forming apparently similar aggregations; however, these are typically associated with courtship. During the breeding season, females group in shallow water to avoid males. Males then attempt to drag females into deeper water for copulation. So far, we have not observed any courtship behaviour in Pacific Nurse Shark aggregations. Though this might be happening while we are not looking, we suspect that aggregations in Santa Elena may be driven by environmental factors rather than reproduction.

Further analysis of our drone survey and water temperature data will clarify the dynamics of these aggregations. We have only observed aggregations during the upwelling season and the "Veranillo," a period in July when weaker upwelling events occur. These distinct seasonal changes allow our study site to function as a large-scale lab experiment or mesocosm: findings on Pacific Nurse Shark's tolerance for temperature changes will be invaluable to understanding variations in shark movements under climate change scenarios.

Nurse sharks are generally considered sedentary, with small home ranges and limited dispersal. This is starting to seem like a misconception as researchers in Florida recently found Atlantic Nurse Sharks tagged in the Dry Tortugas, travelling as far as Tampa Bay (670 km linear distance round trip), and we see similar behaviour in our Pacific Nurse Sharks. One of our tagged sharks travelled the longest distance observed for the species, covering over 400 km in less than two months. Though our sample size for such a long-distance movement has only been observed from one shark, the possibility for a Pacific Nurse Shark to undergo such a journey has important implications for conservation. A small Marine Management Area like Santa Elena Bay may not be ideal to protect these species if individuals undergo such wide-range movements. We aim to expand collaborations with researchers in other regions of Costa Rica, collect additional tracking data from our more recently tagged sharks, and get a better picture of the frequency of these forays within the population. Although Pacific Nurse Sharks are not currently a target species in Costa Rican fisheries, our research can provide baseline knowledge for a relatively undisturbed population. This may strengthen management and conservation approaches for the species throughout its range.

Acknowledgements:

We would like to thank our collaborators Costa Rica Wildlife Foundation, Área de Conservación Guanacaste (ACG), Diving Center Cuajiniquil, Christopher Clarke at HMU Lab for Autonomous and Intelligent Robotics, and I. Chaves, T. Araya, J. Valerio, M. Lara, S. Lara, and A. Lara the field assistant from University of Costa Rica and California State University Long Beach for their invaluable support. Our gratitude also goes to our funding sources that have made this project possible: Universidad de Costa Rica (VI-UCR No. B8600, B8186, C2102 and C1127), the Whitley Fund for Nature, the Sandler Foundation, the Fulbright Program, The Idea Wild Foundation, CSU COAST, the STCT Marine Biology Foundation, the Donald Reish Research Grant, the Richard D. Greene Research Fellowship Award, and the American Elasmobranch Society. The study was conducted under the permits ACG-PI-021-2017 and ACT-OR-DR-068-18.



(A) Detections and movements of Pacific Nurse Sharks through our acoustic telemetry array. (B) The longest movement reported for one of our tagged Pacific Nurse Sharks. The individual was a male who travelled over 400 km round trip in less than two months.

Pacific Nurse Shark released after tagging. Photo by Sergio Madrigal-Mora

Photo by Sergio Madrigal-Mora

Local ecological knowledge to support shark conservation in the central Caribbean of Panama

Region Update:
Central and
South America

Photo by Celso Hernández

Jorge Morales is preparing to measure and weigh a juvenile Scalloped Hammerhead (*Sphyrna lewini*) just landed as part of the research project

Written by
Jorge Manuel Morales-Saldaña

IUCN SSC Shark Specialist Group | Central America |
Member Department of Biology, McGill University, Montreal, Quebec H3A 1B1 Canada
Smithsonian Tropical Research Institute, Box 0843-03092, Balboa, Republic of Panama

Although small-scale fisheries have been operating on Panama's Caribbean coast for decades, data on shark captures inside Panama's exclusive economic zone are extremely scarce. Using local ecological knowledge and surveys at landing sites, we are currently researching the current and historical interaction between fisheries and shark populations in the central Caribbean coast of Panama, along the coast of the province of Colón. This area is approximately 200 km long and has typical Caribbean marine ecosystems such as mangrove forests, shallow fringing coral reefs, seagrass beds, and estuaries, which serve as nursery or feeding grounds for some shark species. Notably, in the central Caribbean of Panama, around 20 landing sites in coastal communities are associated with small-scale fishing, prompting questions about these fisheries' impact on the area's shark populations.

So far, after more than 30 interviews, the research results have shown that most fishers consider sharks less abundant in the study area than in previous years. According to fishers, the main reasons for the reduction in shark abundance are more fishing boats in the area, the use of multiple gillnets per boat, and the destruction of critical habitats such as mangroves and coral reefs. Most of this habitat destruction is associated with coastal development, including hotel construction, urban development, and an increment of human settlement near the coast. Fishers also cited runoff water pollution as a potential reason for shark declines in the area.

In addition to the interviews, we are conducting regular visits to landing sites to support the identification of shark species described by the fishers during the interviews. The composition of shark species found during the visits coincides with the species described by the fishers during the interviews and with previous work conducted in the area (Monzini, 2004; Návalo, 2021). Thus, around seven shark species have been identified so far, including the Atlantic Nurse Shark (*Ginglymostoma cirratum*), Scalloped Hammerhead (*Sphyrna lewini*), and Blacktip Shark (*Carcharhinus limbatus*), which are commonly reported in the study area. Notably, most shark species recorded during the study are threatened according to the IUCN Red List of Threatened Species, emphasizing the need to strengthen the area's fishery management and conservation plans.

During our visits to the landing sites, we observed other shark and ray species not previously reported for Panama. For example, we found the first record of the Atlantic Pygmy Devil Ray (*Mobula hypostoma*; Morales-Saldaña & Ehemann, in press). Except for Belize, this species had yet to be reported in other Central American countries, making this record a critical contribution to better understanding the distribution of this species of Mobula in the Caribbean.

In terms of shark conservation, most fishers mentioned they would favor a seasonal restriction on shark fishing if one were offered. Furthermore, most fishers mentioned that they are unaware of the country's law against shark finning (Law No. 9; implemented on March 16, 2006), nor do they receive any information or training to assist shark conservation from government agencies or non-governmental organizations (NGOs). This might indicate that the area's shark conservation management strategies need to be strengthened.

The results of this study will improve local fishery management plans by providing an understanding of fisheries' present and historical impact on shark populations, the human dimension of shark conservation, and the spatial distribution of fishing grounds. The project's findings are expected to interest stakeholders to incorporate the study area in future discussions on the conservation and management of sharks in Panama.

Acknowledgements

We would like to express our gratitude to Neyssa Ortíz, Matías Días, Orivel Ortega, and Veronica Corpas for their incredible support during the execution of this project. We would also like to express our deepest gratitude to all the fishers who contributed to this endeavor.

The Society for Conservation Biology, marine section partially finances this research project.

References

Monzini, J. 2004, The Shark of Bahia las Minas (Panama). Programs in Sustainable International Development, M.A. degree in Sustainable International Development. The Heller School for Social Policy and Management, Brandeis University. Pp

Návalo, J., Mark, J., Victoria, V., & Morales-Saldaña, J. M. (2021). A preliminary assessment of shark captures by a small-scale fishery in the central Caribbean coast of Panama. Journal of Applied Ichthyology, 1–5. doi.org/10.1111/jai.14211

Morales-Saldaña, J. M. & Ehmann, N.R. (in press). First record of the Atlantic Pygmy Devil Ray *Mobula hypostoma* (Elasmobranchii, Mobulidae) (Bancroft, 1833) in the western Caribbean Sea. Cybium.

Photo by Celso Hernández

Jorge Morales examines an adult Great Hammerhead (*Sphyrna mokarran*), which is infrequently found at landing sites in the Colón Province

After landing, sharks are commonly stowed in plastic crates to be weighed

Photo by Jorge Manuel Morales-Saldaña

Photo by Jorge Manuel Morales-Saldaña

Views of La Playita, one of the fishing communities visited during the study

Photo by Ele Love

Students + Sharks + Science = Success

Written by Jillian Morris | Sharks4Kids

Jillian Morris and Leann Winn teach students how a scientific workup is done and what data is collected


BIGBLUE
SALT CAY DIVERS
PROJECT LEMON AID

Project Lemon Aid is a research project developed to establish a baseline population survey of juvenile Lemon Sharks (*Negaprion brevirostris*) at sites around the Turks and Caicos Islands. We want to understand how many females are coming into these sites to pup and how long the juveniles stay in the region. The first part of this research involves tagging young-of-theyear up to sub-adult Lemon Sharks the coastal waters, focusing on key mangrove habitats. Turks and Caicos do not currently protect sharks, and Lemon Sharks are caught for food. These data are essential for managing and conserving not only these sharks and the mangroves but also the ecosystems around the island.

During each scientific workup, a PIT (Passive Integrated Transponder) tag is inserted just under the shark's dorsal fin. Genetics from a tiny fin clip on the shark's dorsal fin will help us reveal family trees of the Lemon Sharks inhabiting the area and see how the Turks and Caicos populations are related to The Bahamas and Florida Lemon Shark stocks.

While data are critical for conservation, community engagement, and involvement are equally important. Scientists often focus solely on data collection and do not involve local stakeholders. For conservation to be successful and sustainable, diverse voices from the community need a seat at the table.

We developed Project Lemon Aid with the community in mind, mainly focusing on how we could get local students involved. Kids as a stakeholder are usually overlooked, but they are an integral part of how a society functions. Sharks4Kids has provided school programs and field trips for over a decade, and we have seen the positive impact these have. We have partnered with the Guy Harvey Research Institute at Nova Southeastern University to take hundreds of student shark tagging, and getting kids in the field and allowing them to participate can be life-changing.

Adding students to already challenging field logistics certainly takes more planning. We had to consider extra safety, the boats we were using, long hours in the sun and heat, and the locations we could visit. It took some time to work through all of this, too, but once we had a plan, things moved smoothly. Although the goal is to get as many kids in the field as possible, we also want each student to have a quality experience. Too many students and some might not get to participate in a workup. Additional people can also add stress to the workup and thus stress on the animal, which we did not want. We considered all this and eventually found the best number to be 4–6 students per half-day trip.

Our local partners, Big Blue Collective and Edward C Gartland (ECG), were integral in making this project possible. Local knowledge from the Big Blue team helped us locate our field sites and catch the sharks. The team from ECG worked to coordinate interested students for the field trips. It was a lot of preparation work, but it was all worth it when we finally got our first group in the field.

Field days can be long, hot, and boring if you are not actively doing something. The challenge with high school students is keeping them engaged, as fishing does not always mean catching. We included the students in all aspects of a day in the field. While we waited for the sharks, our team did a full workup explanation to prepare the students. They also got a general shark biology and ecology lesson and a mangrove ecology lesson from our team member (and science teacher), Leann Winn. Some days, we also set BRUVs (Baited Remote Underwater Video). This gave students the chance to get hands-on experience with another research technique. Our team member Candace Fields worked with them and talked about her PhD research using BRUVs.

During our spring fieldwork, we took 20 students into the field with us. Most of the students were able to assist with a scientific workup. They measured the sharks, took DNA samples, and inserted PIT tags. They also determined whether the sharks were male or female, checked the belly button scars, and took notes on the animal's health. They were scientists for the day and helped us with all aspects of our research. They also learned about future opportunities for work as a marine biologist. Many of these students do not think they can become a scientist because they have never had a chance to see what it is like. Not only are we providing an exciting experience, but we are also opening doors and inspiring future marine biologists. We hope that some of these students will take on project leadership roles in the future. Our local intern, Luis, has gained valuable field experience to enhance his classroom learning. He plans on pursuing a marine biology degree and will continue to assist us in the field to learn even more.

During our visit, we also balanced field days with school lessons. It is a great chance to change fear into fascination and answer many questions, especially from teachers. Sharing research being done in their backyard and mentioning that they can get involved makes the lessons that much more engaging. It is also another way of connecting the greater community to our work and helping them understand why.

We are working to support fisheries management and government decisions to safeguard the environment for the future. We are also inspiring and empowering the future of shark conservation in the region. The project is in its early stages, but we have already seen a positive impact. Government officials have joined us in the field, and local NGOs and businesses support the work. Students and schools are eager to get involved. We have learned a lot and have had some incredible conversations. We have also added a local ambassador to our team. Throughout the year, she will deliver shark lessons and assist with the project.

Visiting schools is incredibly rewarding, and I love teaching students around the world about sharks and shark science. Bringing kids into the field, however, is very special. It brings learning to life. Seeing the smile on a student's face when they get to tag a shark is incredible. You know they will remember it for the rest of their life. These students are future teachers, scientists, government officials, fishers, tour guides, dive instructors, consumers, voters, and community leaders. Creating opportunities for them to be part of science and conservation now can shape their future and ocean and shark conservation efforts in Turks and Caicos and beyond.

Special thanks to Save Our Seas Foundation, Sandals Foundation, and Rock The Ocean for funding and supporting this important work. To learn more, check out www.sharks4kids.com/lemon-shark-research

Photo by Duncan Brake

Candace Fields speaks to students in North Caicos

Photo by Duncan Brake

Sharks4Kids and DECR Staff visiting a school in North Caicos

Photo by Arenthia Baker

Sharks4Kids and the Big Blue Collective team are ready to release a tagged Lemon Shark

New initiatives in Elasmobranchs research in the Sultanate of Oman

Photos by Khalfan M. Alrashdi

Omani project team taking tissue sample of Cowtail Stingray, *Patinachus sephen*, for genetic identification. The ray was landed at Mahout Fish market, Alwusta Governorate, Sultanate of Oman

Omani Project team taking the measurements of shark ray, *Rhina ancylostomus*, landed in Musandam Governorate, Sultanate of Oman

Omani Project team taking measurements of Halavi Guitarfish, *Glaucostegus halavi*, brought to fish market center in Salalah, Dhofar governorate, Sultanate of Oman

Written by Khalfan M. Alrashdi, Iman S. Alkharusi, Saud S. Albusaidi and Asaad S. Alrajhi Ministry of Agriculture, Fisheries & Water Resources, Directorate General of Fisheries Research, Muscat, Sultanate of Oman. (khafahrashdi@gmail.com)

Short Abstract

Oman ranks as one of the largest fish producers in the Arabian region. More than 95% of the production is derived from artisanal fisheries. Sharks and rays have historically been an important marine food resource in Oman. Around 97% of the shark and ray landings in the country are by artisanal fisheries, either as targeted or bycatch, and are consumed locally. Considering the lack of sufficient, recent information on sharks and rays from Oman waters and the growing global concern over threats to several species of sharks and rays, a national research project on rays diversity entitled "Study of sustainable and economical aspects of batoids in Oman" was initiated in the Sultanate of Oman by the Marine Science & Fisheries Center, Directorate General of Fisheries Research and funded by the Agriculture and Fisheries Development Fund. This article provides a brief insight into the work being done under this project.

Main article

The Sultanate of Oman, located in the southeastern corner of the Arabian Peninsula, possesses a 3,165 km long marine coastline along the Indian Ocean. It is flanked by the Arabian Sea, the Sea of Oman, and the entrance to the Arabian Gulf. This makes Oman one of the richest fishing grounds in the Arabian Peninsula.

Fishing is among the oldest professions and activities in Oman (Setlur & Arbuckle, 2015) and the most important non-energy source of income for Oman (Alrashdi & McLean, 2014). With total landings of more than 900,000 tonnes and a value of approximately USD 1 billion being reported in 2021 (MAFWR, 2022), Oman ranks as the largest fish producer in the Western Asia region and net exporter of fish and fish products (FAO, 2021). More than 95% of the production is derived from artisanal fisheries using small, motorized fibreglass boats and a few large wooden boats, while the rest of the production is by commercial and coastal vessels (MAFWR, 2023). Fish landings in Oman are categorized into six types: small pelagic fish, large pelagic fish, demersal fish, crustaceans, molluscs, and elasmobranchs (sharks and rays).

Sharks and rays are one of the most threatened groups of marine species, with over one-third threatened with extinction (Pacoureau et al., 2021; Dulvy et al., 2021), primarily because of fishing and their restrictive life history (Dulvy et al., 2021). Sharks and rays have historically been an essential marine food resource in Oman, even long before the export of fins to the Asian markets began (Henderson et al., 2007).

Around 97% of the shark and ray landings in the country are by artisanal fisheries either as targeted or bycatch (MAF, 2023) and are consumed in fresh or processed into products, mainly dried salted fish. Dried shark and ray meat remain one of the favourite traditional dishes in Oman, contributing significantly to food security in Oman. Fins, however, are sold separately to local companies and exported to the Asian markets (Aliya et al. 2018).

Not much research has been done on fisheries, species diversity, and the biology of sharks and rays in Oman waters. The most recent studies being those of Henderson et al. (2006), Henderson et al. (2007), Henderson et al. (2009), Henderson & Reeve (2011), and Reeve & Henderson (2012). Considering the importance of sharks and rays in Oman's domestic market and the growing global concern over threats to several species of sharks and rays, a national research project on the fishery and diversity of rays was initiated in the Sultanate of Oman by Marine Science and Fisheries Center, Directorate General of Fisheries Research and funded by the Agriculture, Fisheries Development Fund. The project, entitled "Study of Sustainable and Economical Aspects of Batoids in Oman", envisages documenting the updated checklist of rays in Oman waters to identify the status of rays in the fishery, conserve threatened species, and ensure sustainable utilization of the leftover from the fisheries and bycatch. Some of the major achievements under the project thus far have been

1. An updated checklist of shark, ray, and chimaera species in Oman documenting around 50 species of rays belonging to 16 families, 67 shark species belonging to 20 families, and two species of chimaeras belonging to one family. The study indicates that Oman ranks first among the Middle East and North African countries in shark and ray diversity.
2. Documentation on the first record of 11 species of rays in Omani waters.
3. Field identification guide of commercial and threatened ray species in Omani waters
4. Documentation of the status of the ray fishery in Oman
5. Modification of nomenclature of rays in the Fishery Statistics Book to the level of genus and species-specific information

In addition, studies have also been initiated on sharks to commence a similar project dedicated to the study of the fishery, diversity, and biology of sharks in Oman waters. As a prelude to this, Oman has prepared Non-Detriment Findings (NDF) reports for the Silky Shark (*Carcharhinus falciformis*) and Bigeye Thresher Shark (*Alopias superciliosus*) which are listed in Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) Appendix II. These publications will soon be made available on public platforms.

With these new initiatives, the Sultanate of Oman underlines the importance of sharks and rays in the region and hopes to contribute significantly to sustainable fisheries management and conservation of these resources in the Indian Ocean.

References

Alrashdi, K.M. McLean, E. 2014. Contribution of Small-Scale Fisheries to the Livelihoods of Omani Women: A Case Study of the Al Wusta Governorate. In: Gender in Aquaculture and Fisheries: Navigating Change. Asian Fisheries Science Special Issue, 27S:135-149.

Aliya, A., Sudheesh, P., Nasser, A., Umkalthoum, A., Wafaa, A., Humaid, A., ... Mahmood, A. (2018). Microbiological, chemical and nutritional quality and safety of salted cured fishery products from traditional dry fish processing plants in the Sultanate of Oman. Food Research, 2(3), 279-286

Dulvy, N., Pacoureau, N., Rigby, C., Pollom, R., Jabado, R. Ebert, D., Finucci, B., Pollock, C., Cheok, J., Derrick, D., Herman, K., Sherman, S., VanderWright, W., Lawson, J., Walls, R., Carlson, J., Charvet, P., Bineesh, K.K., Fernando, D., Simpfendorfer, Colin. (2021). Overfishing drives over one-third of all sharks and rays toward a global extinction crisis. Current Biology, 31: 5118-5119. 10.1016/j.cub.2021.11.008.

FAO, 2021. Aquaculture growth potential in Oman WAPI factsheet to facilitate evidence-based policy-making and sector management in aquaculture. www.fao.org/3/cb3949en/cb3949en.pdf

Henderson, A., Mcilwain, J., Al-Oufi, H., Ambuali, A. 2006. Reproductive biology of the milk shark *Rhizoprionodon acutus* and the bigeye houndshark *Iago omanensis* in the coastal waters of Oman. Journal of Fish Biology. 68. 1662 - 1678. 10.1111/j.0022-1112.2006.01011.x.

Henderson, A., Mcilwain, J., Al-Oufi, H., Al-Sheili, S. 2007. The Sultanate of Oman shark fishery: Species composition, seasonality and diversity. Fisheries Research. 86. 159-168. 10.1016/j.fishres.2007.05.012.

Henderson, A., Mcilwain, J., Al-Oufi, H., Al-Sheili, S., Al-Abri, N. 2009. Size distributions and sex ratios of sharks caught by Oman's artisanal fishery. African Journal of Marine Science - AFR J MAR SCI. 31. 233-239. 10.2989/AJMS.2009.31.2.11.883. Henderson & Reeve (2011)

MAFWR, 2023. Fishery Statistics Book. Ministry of Agriculture, Fisheries and Water Resources, Sultanate of Oman.

Pacoureau, N., Rigby, C.L., Kyne, P.M., Sherley, R.B., Winker, H., Carlson, J.K., Fordham, S.V., Barreto, R., Fernando, D., Francis, M.P., Jabado, R.W. 2021., Half a century of global decline in oceanic sharks and rays. Nature, 589(7843): 567-571.

Reeve, A.J., Henderson, A.C. 2012. New mobulid records from Oman. Journal of Applied Ichthyology, 29. 10.1111/jai.12046.

Stevens, J. D., Bonfil, R., Dulvy, N. K., Walker, P. A. 2000. The effects of fishing on sharks, rays, and chimaeras (chondrichthyans), and the implications for marine ecosystems. ICES Journal of Marine Science, 57: 476–494.

Setlur, B., Arbuckle, M.W. 2015. Sustainable management of the fisheries sector in Oman: a vision for shared prosperity (English). Washington, D.C. World Bank Group. documents.worldbank.org/curated/en/901371480601979449/Sustainable-management-of-the-fisheries-sector-in-Oman-a-vision-for-shared-prosperity

Acknowledgements:

The project is implemented by the Marine Science & Fisheries Center, Directorate General of Fisheries Research, Sultanate of Oman. It is funded with appreciation by the Agriculture, Fisheries Development Fund, Sultanate of Oman. We thank Dr. Shoba Kizhakudan, Head of Finfish Fisheries Division, ICAR-Central Marine Fisheries Research Institute, India, for reviewing this article.

Fish market center in Mahout, Alwusta governorate, Sultanate of Oman, where more than 40% of the daily fish exhibited are rays

Various shark species landed at Dibba, Musandam Governorate, Sultanate of Oman

Putting sharks in the public spotlight: on the celebration of Shark Awareness Day 2023 in Iran

Region Update: Indian Ocean

Ali Yazi, the cyclist and executor of The Sunset of Sharks project, rode along the whole Iranian coastline of the Persian Gulf and the Gulf of Oman with the shark statue and spoke to people about the magnificence of sharks and their threats.

Photo by Ali Yadi

Written by Mohsen Rezaie-Atagholipour

Qeshm Environmental Conservation Institute (QECI)
IUCN SSC Shark Specialist Group/ Indian Ocean Regional Group/ Member

Celebrating Shark Awareness Day on July 14 does not have a long history in Iran, but the number of national events held on this day has increased over the last couple of years. This year, we, Haleh Abedi and I from Qeshm Environmental Conservation Institute (QECI), a shark-focused research and conservation non-governmental organization (NGO) based on Qeshm Island, Dr. Saber Vatandoust, co-chair of the Iranian Society of Ichthyology, and Morteza Eslami, founder and CEO of the Trip4Wildlife, decided to celebrate this day differently.

A shark event far from the ocean

We had an event, but not in a coastal town, where its people are familiar with sharks and not with people just from fishing or shark-science communities who regularly encounter these ancient marine creatures. The event was held in Alborz Café, one of the most popular and traditional cafes in Tehran, the capital of Iran, over 1,000 km away from the sea. The participants were from various professions, from journalists, documentarists, bloggers, and influencers to physicians, athletes, artists, and even a master chef and an architect. Despite their different occupations, all guests had two things in common: all were shark enthusiasts and were widely and actively communicating with the public. So, they were the best people to put sharks in the Iranian public spotlight, which is our ultimate goal for celebrating Shark Awareness Day this year.

Big cats in the Persian Gulf

In Iran, similar to most other places around the world, when it comes to wildlife conservation, charismatic land mammals, like Persian Leopards and Asiatic Cheetahs, get all the public attention. If a cheetah is killed on the road accidentally or a hunter deliberately shoots a leopard, the news becomes viral in just a few hours, and thousands of people respond. But few people care about the thousands of sharks and rays killed daily in fisheries, either targeted or incidentally. Saber explained it to the audience abstractly: "Fish are by far the most oppressed group of wildlife in Iran; no one hears their voice or sees their tears." I also tried to explain this more to our guests: "Once upon a day, we had four big cats in Iran, but the Caspian Tiger and Persian Lion became extinct long ago, and now we regret it. Nowadays, people admire conservationists who try to safeguard the fragile populations of the Asiatic Cheetah and Persian Leopard in the country. Sharks and rays are like big cats of our seas; the only problem is that people do not know them enough. If our people do not know these majestic creatures and do not give them enough attention, we will lose them someday soon, and our children will regret it. So, we are responsible for putting sharks in the public spotlight".

Our team also produced a short animation to raise public awareness about sharks and their threats in Iranian waters, which our guests widely distributed among their audience. You, Shark News readers, are also invited to watch this animation with English subtitles here: www.instagram.com/reel/CuuoqBpAwb8/?igshid=MzRlODBiNWFlZA==

Every guest who attended the event had an inspiring and impressive shark story. It would be too long to tell them all, but I would like to write about three of them:

An architect fascinated by sharks

As an architect, Shahrzad Rahmati seems to have nothing to do with sharks. But it is not true; she is hugely fascinated by the magnificence of these ancient fishes, which led her to read exhaustively through the research literature and contact many people to learn about these animals. A few years later, Shahzad decided to take it a step further and use her knowledge to raise public awareness about sharks and their threats, especially the fin trade. She, therefore, wrote a book in Farsi entitled "The Taste of Extinction: A General Guide for Shark Conservation." Unveiled in our event, the book is now freely available for the public to download from the internet and read.

Biking for sharks

During the pandemic, when social distancing separated people from each other, Ai Yazdi, an Iranian cyclist and influencer, decided to do a solo activity and ride along the whole southern Iranian coastline. But he wished to give meaning to his long journey. It was when Shahrzad and some friends (see their names in the Acknowledgments) gave him a fascinating idea. They formed a team and launched a voluntary project named "The Sunset of Sharks." Ali rode along the coastline in that project with a 2.5-meter papier-mâché colourful shark sculpture attached to his bike. The team made the statue colourful, aiming to be more attractive for children playing outdoors near the beach and seeing Ali biking along the road. For people who were attracted to his bizarre bike on social media and in open spaces at the beach, Ali talked about sharks and their threats. Ali brought the sculpture to our event and, along with his team members, spoke to us about his fantastic shark journey during the pandemic.

A man who has kept an old shark story alive

About half a century ago, the ancestral fishers of Salakh Village at the south of Qeshm Island used to hunt Whale Sharks (*Rhincodon typus*) to extract their liver oil, locally named Sifeh, which was used to waterproof wooden lenjs (boats). In 1975, Hamidreza Ahmadi Lari, an Iranian documentarist and filmmaker, filmed, produced, and directed the documentary Sayd-e Koulikar, which means Whale Shark Hunting in English. This documentary showed the process of hunting Whale Sharks, extracting the liver oil, and the socio-economic values behind that industry. If Hamidreza had not filmed it, we would not have known enough about this tremendous historical Whale Shark fishery that probably led to catching over 1,000 of these oceanic giants in Qeshm Island's waters annually. We were very fortunate to have Hamidreza at our event to talk about the documentary and the challenges he had to film the hunt aboard, where using a camera tripod could not help, and he had to strap an NPR camera to his waist, weighing 17.5 kilograms along with its batteries.

More shark enthusiasts than previously thought

Honestly, I would never have imagined that if a Shark Awareness Day event were held in a city in Iran thousands of kilometres away from the ocean, so many shark enthusiasts would attend, each one with a unique and impressive story about sharks. But it happened, and all these people left the event with educational material and exciting memories, which they later passed to their audience via social and national media, a message to the Iranian public about the irreplaceable roles of sharks in Persian waters. The event, however, also had an invaluable take-home message personally for me: as a shark conservationist, simultaneously with knowing sharks, I must also know people who love sharks, the people who may not necessarily be biologists or even work in relation with nature. While some stories persist and lead to people fearing sharks, several real stories, like our Shark Awareness Day 2023, show that people can love sharks if they know these majestic creatures correctly, and it is our job to let people know how magnificent sharks are.

Acknowledgements:

We at QECI are indebted to many sponsors whose kind support made it possible for us to hold the event and produce the animation, including Mr Saman Golriz, the famous Iranian master chef and philanthropist who has supported several wildlife conservation projects in Iran and sharks are his most famous animal; Trip4Wildlife, a company organising responsible wildlife ecotours in Iran aiming to support the sustainable livelihood of local people and wildlife conservation; Iranian Society of Ichthyology and Fish Conservation Society, two NGOs working toward research and conservation of fishes in Iran; Infogram, a private company producing short advertisement animations, infographics, and info-motions; Dr. Mohammad Radmanesh, the physician and founder of Dr. Radmanesh Environmental Award; Shahid Bahonar University of Kerman, and Deputy of Marine Environment in Iran Department of Environment, who in cooperation with QECI are developing the Iran National Plan of Action on Shark Conservation. The Sunset of Sharks project was an entirely voluntary teamwork held by Sharzad Rahmati, the team manager who also developed the initial idea; Hamidreza Bargahi, the scientific advisor; Mohammadreza Hashem Zadeh, the animator and writer of the scenario; Sina Rezaei, the sculptor, Dr Saber Vatandoust, the executive advisor, and Ali Yazdi, the cyclist and executor of the project.

Photo by Haleh Abedi
A group picture with some of the guests surrounding the shark statue that Ali Yazdi had with himself during The Sunset of Sharks journey

Photo by Haleh Abedi
Saber Vatandoust, ichthyologist and director of Fish Conservation Society, welcoming guests of the Shark Awareness Day 2023 in Alborz Café, Tehran. The Whale Shark statue on the table is made by Mona Jeevad, an artist sculptor with sharks dear in her heart.

Photo by Haleh Abedi
The architect, Shahrzad Rahmati, presenting her book, "The Taste of Extinction", and explaining how her endless enthusiasm for sharks motivated her to learn and write about sharks and their threats.

Photo by Ali Yazdi
A 2.5-meter papier-mâché statue of a shark, made mainly of recycled papers. Ali Yazdi attached it to his bike during The Sunset of Sharks journey along the southern coastline of Iran.

Shark safeguards: Elevating EU controls on shark trade

Executive summary

Sharks are incredibly important for ocean health as well as local livelihoods through the tourism and small-scale artisanal fisheries they support. Like other predators, sharks play an important role maintaining healthy ocean ecosystems. How and where they feed controls food chains, affecting the numbers and distribution of prey species, which has knock-on effects for various marine habitats. For example, the presence of tiger sharks has been shown to prevent turtles from overgrazing seagrass beds that play an important role as carbon sinks. Large fish like sharks are also effective carbon sinks themselves, so keeping more large fish in our ocean by preventing overfishing helps reduce the carbon dioxide being released into our atmosphere. Through their migrations and diving behaviour, sharks also help cycle nutrients between different locations in the ocean and between deep and shallow water. A 2013 study estimated shark tourism generated more than USD314 million and supported more than 10,000 jobs around the world. In the following two decades the value of shark tourism was expected to generate more than the landed value of global shark fisheries.

Yet, global demand for shark products, primarily fins and meat, together with a lack of catch and trade management, is driving shark populations to extinction. The European Union (EU) plays a significant role in the global trade as a major catcher and supplier to Asian markets. The International Fund for Animal Welfare (IFAW) undertook an extensive analysis of official raw customs data of Hong Kong SAR, Singapore and Taiwan province and published the findings in its report Supply and Demand: The EU's role in the global shark trade on 1 March 2022, demonstrating that the EU is one of the top sources of shark fin products for these Asian markets. It concluded that the EU has a responsibility to ensure that its participation in the global trade is not driving these species further towards extinction.

Crucial developments have taken place since the publication of IFAW's extensive trade analysis. At the Convention on International Trade in Endangered Species (CITES) 19th Conference of the Parties (CoP19), which took place 14-25 November 2022, the EU and other CITES parties supported the inclusion of 97 additional shark and ray species on Appendix II and, together with already listed species, approximately 90% of global fin trade is now under CITES control.

IFAW's 2022 report was based on the analysis of legal data as registered by customs authorities from Hong Kong SAR, Singapore and Taiwan province. This report is based on follow-up research looking at both the legal trade data as reported by the EU27, covering import into and export by the EU27 to all countries worldwide, and also includes illegal trade data as registered by the Member States in the EU Trade in Wildlife Information eXchange database (EU-TWIX).

Regarding the legal trade data, the report complements the earlier research by providing: i) fuller details on the total trade between 2017 and 2021 by the EU27, ii) new data on the economic value of all shark imports by the EU and the countries supplying shark products to the EU, and iii) the export value and main destinations where EU Member States are exporting their products. The illegal trade data focuses on seizures of shark products as reported by EU Member States between 2017 and 2020.

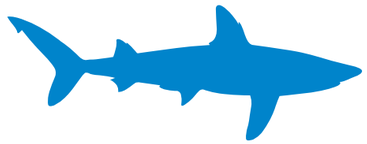
Implementation and enforcement are urgently needed to prevent the global demand from driving shark species to a point of no return.

ifaw

Visual data overview of EU trade in shark fins and meat

Legal trade

Study period 2017-2021



>161 million kg import

of shark fins and meat reported by EU27

>169 million kg export

of shark fins and meat reported by EU27

Total import and export of fins and meat

Reporter(s) / Partner(s)				
EU27 / All partners	Total import quantity (kg)	Total import value	Total export quantity (kg)	Total export value
Shark fins	1,004,099	€8,085,598	12,761,166	€176,984,297
Shark meat	160,876,807	€366,810,323	156,500,277	€341,318,806
Total	161,880,906	€374,895,921	169,261,443	€518,303,103

Not only the shark fin trade represents a high economic value; the quantity and value of the meat trade is even more substantial for the EU27.

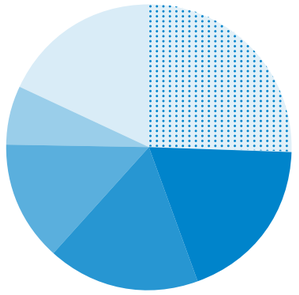
2x

The economic value of the (re-)export (including intra-EU trade) of shark meat is almost double the value of the fin export.

Top fin suppliers

>1 million kg import

of fins reported by EU27



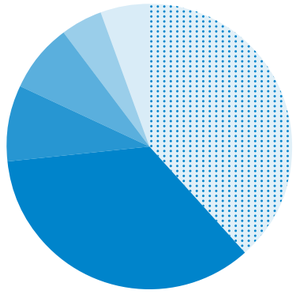
- Spain 25,6% (256,616 kg)
- Portugal 19,1% (191,760 kg)
- Morocco 17,2% (173,139 kg)
- United Kingdom 13,4% (134,629 kg)
- Netherlands 6,7% (67,466 kg)
- Rest 18,0% (180,489 kg)

Top five shark fin import partners (suppliers) by percentage and quantity

Top fin receivers

>12 million kg export

of fins reported by EU27

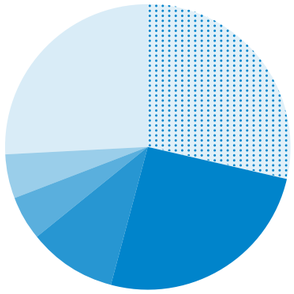


- Singapore 38,6% (4,926,212 kg)
- China 34,8% (4,444,336 kg)
- Spain 8,7% (1,104,421 kg)
- Hong Kong 7,8% (994,115 kg)
- Taiwan 4,6% (591,250 kg)
- Rest 5,5% (700,832kg)

Top five shark fin export partners (receivers) by percentage and quantity

Top meat suppliers >160 million kg import

of meat reported by EU27

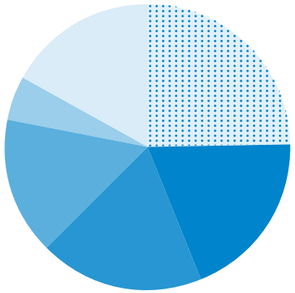


- Spain 28,7% (46,097,392 kg)
- Portugal 25,5% (41,055,420 kg)
- Namibia 10,0% (16,062,793 kg)
- United States 5,2% (8,433,537 kg)
- Japan 4,9% (7,906,568 kg)
- Rest 25,7% (41,321,097 kg)

EU27 top five shark meat import partners (suppliers) by percentage and quantity.

Top meat receivers >156 million kg export

of meat reported by EU27



- Spain 24,9% (39,009,526 kg)
- Portugal 19,0% (29,725,520 kg)
- Italy 18,7% (29,317,180 kg)
- Brazil 15,5% (24,245,833 kg)
- Morocco 5,2% (8,141,784 kg)
- Rest 16,7% (26,060,434 kg)

EU27 top five shark meat export partners (receivers) by percentage and quantity.

Illegal trade

Study period 2017-2020

30

seizures of shark products were reported by only nine EU Member States in four years, of which 14 were registered under the common category 'Sharks' showcasing a lack a proper identification of the affected shark species

3

out of the 30 seizures took place at a maritime port despite the vast majority of shark products being transported through shipping

1

seizure consisted of shark fins (5.7 kg).

7

unregistered seizures - including five containing fins - were detected through a simple media search in different Member States with translated search terms

EU provides a platform for transit of illegal shark products

4 out of 8 significant seizures are transit shipments, intercepted by an EU Member State which was neither the country of origin nor the destination

Photo: © Shane Gross

Recommendations

1. Prioritise the use of trade data to combat illegal wildlife trade in sharks and shark products

- Consistently record all seizures in the EU-TWIX database and other seizure databases;
- Increase enforcement capacity (focus on maritime ports) and organize product identification trainings;
- Share trade data in cross-national platforms;
- Make intelligence from seizures accessible to trading partners

2. Improve the quality of trade monitoring

- Expand the HS codes to differentiate between the status of the traded species and the specific species of traded shark fins, and update the HS codes for meat
- Create a specific HS code for cartilage products;
- Review the HS commodity codes for shark products and standardise code use with key trading partners;
- Encourage collaboration and sharing of trade data between trade officials and enforcement authorities.

3. Implementation of CITES shark listings and capacity building

- Organise implementation workshops for authorities to become familiar with listings, to identify shark products accurately, and to build capacity to accurately capture and report trade data;
- Use data from this report as a baseline to evaluate whether new listings result in increased trade data entries;
- Evaluate the significant levels of catch and trade of CITES-listed shark species by EU Member States to ensure these meet CITES sustainability requirements.

International Fund for Animal Welfare

Shark safeguards: Elevating EU controls on shark trade

About IFAW
For over a decade, IFAW has been working with governments around the world to support better management for sharks and rays. From the development of shark identification materials for fisheries, customs and enforcement officers, to raising awareness on the conservation needs of shark species, and building the capacity of governments to meet their obligations under international conventions such as the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) and the Convention on the Conservation of Migratory Species of Wild Animals (CMS). IFAW also provides technical support for governments looking to enact progressive and precautionary management for shark catch limits, or prohibitions when warranted, at a national level.

Published by: International Fund for Animal Welfare, 2023

Citation: Slee, B., Collis, M. (2023) *Shark safeguards: Elevating EU controls on shark trade*. Stichting IFAW (International Fund for Animal Welfare), The Hague, The Netherlands. 52pp.

Cover photo: © Robert Marc Lehmann
Blue sharks.

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Endnotes

Hammerschlag et al (2019) *Ecosystem Function and Services of Aquatic Predators in the Anthropocene.* Trends in Ecology & Evolution.
doi.org/10.1016/j.tree.2019.01.005

Heithaus (2014) *Seagrasses in the age of sea turtle conservation and shark overfishing.* Frontiers.
doi.org/10.3389/fmars.2014.00028

Atwood et al. (2015) *Predators help protect carbon stocks in blue carbon ecosystems.* Nature Climate Change.
doi.org/10.1038/nclimate2763

Mariani et al. (2020) *Let more big fish sink: Fisheries prevent blue carbon sequestration – half in unprofitable areas.* Science Advances.
doi.org/10.1126/sciadv.abb4848

Williams et al. (2018) *Mobile marine predators: an understudied source of nutrients to coral reefs in an unfished atoll.* The Royal Society.
doi.org/10.1098/rspb.2017.2456

Cisneros-Montemayor (2013) *Global economic value of shark ecotourism: implications for conservation.* Cambridge University Press
doi.org/10.1017/S0030605312001718

Shea S, Slee B, O'Toole, M. (2022) *Supply and Demand: The EU's role in the global shark trade,* IFAW.
www.ifaw.org/international/resources/eu-role-global-shark-trade

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IUCN

SSC
Species Survival Commission

Position Statement

On Shark Control Programs and Shark Culls

Photo by Carlos Diaz | Ocean Image Bank

Tiger Shark, The Bahamas

IUCN SSC
Shark Specialist Group

IUCN Species Survival Commission Statement on Shark Control Programs and Shark Culls

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The IUCN Species Survival Commission (SSC) is aware that lethal approaches to reducing the risk of human-shark interactions are increasingly being adopted around the world. Several governments either have active shark control programs (i.e., bather protection programs) or frequently implement shark culls in response to actual or perceived risk to humans. Hereby, the SSC outlines its position in relation to existing shark control programs and culls and provides context to allow managers and governments to make informed decisions when faced with delicate situations. We strongly encourage non-lethal approaches as a response and management option.

Context

There are around 535 species of sharks around the world (Ebert et al. 2021). Public perception of sharks varies from reverence to fear. Over the last decades, there has been a growth in positive human-shark interactions via shark tourism which can result in significant economic benefits to communities (e.g., Huveneers et al. 2017; Mustika et al. 2020). But for many species, perception has been shaped by negative media attention that has led to anxiety and fear about the risk they pose to humans (McPhee 2014; Sabatier & Huveneers 2018; Simmons and Mehmet 2018; Pepin-Neff and Wynter 2019). However, shark bites on humans undertaking activities in aquatic environments have been recorded from very few species, less than 5% of known species (International Shark Attack File 2023). For example, in Australia, 75% of bites are attributed to three species: the Great White *Carcharodon carcharias*, Tiger Shark *Galeocerdo cuvier*, and Bull Shark *Carcharhinus leucas* (Riley et al. 2022). Global annually reported interactions (unprovoked bites) and subsequent fatalities are few, numbering 57 and 5 in 2022, respectively (International Shark Attack File 2023).

Human-shark conflicts are diverse and complex. While shark bites are rare and unlikely, the occurrence and probability of such events have increased in several areas of the world (e.g., Australia, Brazil, Reunion Island, and Egypt) (McPhee 2014; Ferretti et al. 2015; Guyomard et al. 2019; Riley et al. 2022). This has been attributed to factors such as growth in human population and associated increase in the number of people participating in water-based activities; changing shark behavior due to habitat loss and degradation; declining water quality; changes in environmental variables such as water temperature, rainfall, currents, and turbidity; variations in the distribution and abundance of prey from overexploitation or range shifts due to climate change; and sharks' behavioral patterns including movements and distribution (McPhee 2014; Bradshaw et al. 2021; Simpfendorfer et al. 2021; Barnett et al. 2022; Riley et al. 2022). There have also been suggestions that increased interactions are due to the expanding popularity of tourism activities that use feeding, baiting, or chumming (Meyer et al. 2021). While sharks respond to stimuli and can learn associations with food, this learnt behavior needs frequent rewards (e.g., through wildlife tourism or recreational fishing activities). However, sharks can also lose responsiveness to stimuli (e.g., smell of fish products) if not associated with sufficient food reward (Heinrich et al. 2022). Therefore, learnt behaviors are less likely in migratory species that temporarily frequent tourism sites (e.g., White Shark, Tiger Shark). Importantly, even when behavioral change occurs, the extent to which it increases the risk or probability of shark bites is unknown.

The response to shark bites (one incident or a spate of incidents within an area) by some communities and governments has been the establishment of shark hazard mitigation strategies, including lethal and non-lethal control programs (McPhee 2014; Gibbs and Warren 2015; Pepin-Neff and Wynter 2019). Lethal methods are usually a combination of gear placed in areas to reduce local populations of potentially dangerous species and include shark nets (sometimes referred to as beach meshing), drumlines (i.e., large, baited hooks), longlines, and/or targeted fishing (i.e., culls) (Dudley et al. 1997; McPhee et al. 2021). On the other hand, non-lethal alternatives rely on various technologies and early detection, monitoring, and warning systems. These mitigation measures have been deployed in various parts of the world and include, but

are not limited to, physical barriers such as swimming enclosures, aerial surveillance (including fixed-wing, helicopter, and unmanned aircraft or drones), Shark-Management-Alert-in-Real-Time (SMART) drumlines, in-water and land-based detection with spotters, real-time detection of telemetry-tagged sharks via listening stations and public alerts through mobile technology, or changing human behavior by requesting water users to avoid times and locations with high probability of relatively higher shark abundance (Engelbrecht et al. 2017; Butcher et al. 2019; Guyomard et al. 2019; Bradshaw et al. 2021; Riley et al. 2022). In some countries, personal deterrents are also used to mitigate risk. They include electric, magnetic, olfactory, and visual deterrents that aim to disorient an approaching shark and discourage it from biting by overwhelming its sensory organs (Huveneers et al. 2018; Thiele et al. 2018; Gauthier et al. 2020). Lastly, novel puncture- and tear-resistant fabrics and wetsuits are also being developed to reduce the severity of injuries when other mitigation measures cannot prevent shark bites (Thiele et al. 2018; Whitmarsh et al. 2019). Each of these approaches come at varying economic costs to governments and/or individuals to ensure they are developed, operated, and maintained over long periods (McPhee et al. 2021).

Shark culls have been the most controversial of these approaches, with those concerned about ensuring the safety of humans by removing animals from particular areas meeting resistance from those opposing the use of lethal methods. Some studies have suggested that lethal approaches are likely to have successfully reduced the incidences of interactions, injuries, and fatalities in certain locations, but not eliminated them (e.g., Dudley et al. 1997). Other research highlights that is no change in bite rates after culling programs are implemented (e.g., Wetherbee et al. 1994). Overall, the efficacy of lethal approaches and any other shark control programs is still often debated, partly due to the low incidence of shark bites and resulting difficulty in showing any statistically significant effect of mitigation measures. Recent studies highlight a shift in public sentiment with surveys showing their increasing preference for non-lethal measures (Gibbs and Warren 2015; Pepin-Neff and Wynter 2019; Martin et al. 2022).

Worldwide, populations of many shark species have been declining over the last few decades. An estimated 31.2% of sharks are listed in a threatened category (Critically Endangered, Endangered, or Vulnerable) on the IUCN Red List of Threatened Species (Dulvy et al. 2021). Reducing populations of top predators in aquatic environments can have broader ecological consequences (Ferretti et al. 2010). Sharks play a critical role in regulating trophic webs and maintaining ecosystem balance and structure, controlling abundance and distribution of prey populations, and promoting ecosystem connectivity. Therefore, their removal from the environment may have unpredictable impacts on aquatic ecosystems. Lethal methods are often unselective and can substantially impact populations of already threatened and/or protected species of sharks and other non-target marine animals - impacts have been reported for rays, turtles, dugongs, dolphins, and whales (e.g., Reid et al. 2011; Guyomard et al. 2019). Indeed, in instances where lethal methods are used, mortality rates for all animals, including sharks, are high (>60%). Furthermore, most sharks impacted by these shark control programs are species that do not pose a threat to human life, such as the Tawny Nurse Shark Nebrius ferrugineus or the Scalloped Hammerhead Sphyrna lewini (Vulnerable and Critically Endangered on the IUCN Red List, respectively) (Guyomard et al. 2019; Dulvy et al. 2021).

Generally, the applicability of human-shark mitigation measures will vary depending on environmental and socio-economic considerations as well as their ability to reduce the risk of interactions with sharks. However, education and outreach are essential for stakeholders to understand risks, possible responses (i.e., applying suitable first aid), and to develop pro-conservation attitudes (Muter et al. 2013). In fact, surveys of ocean users in Australia highlight that developing effective strategies to improve and enhance public perceptions, attitudes, and behaviors towards sharks in areas with high incident rates, should be a priority (Muter et al. 2013; Simmons et al. 2021).

Conclusion

Human-wildlife conflict is one of the greatest challenges to the effective conservation of wildlife species and resolution and management actions need to consider coexistence (IUCN 2023). The available evidence and expert opinion suggest human-shark interactions are likely to continue increasing due to growing coastal populations and the use of aquatic environments, as well as shifting shark habitat and prey availability. Before considering implementing human-shark mitigation measures that involve lethal approaches as a response to a shark bite, it is essential to thoroughly examine the situation and potential causes of interactions in an area. The use of lethal approaches for managing the risk of shark bites is a poor solution given their considerable environmental impacts and economic costs compared to the alternative non-lethal methods now available (McPhee et al. 2021). Encouraging safer behaviors among individuals who engage with the ocean is likely to be more impactful when dealing with human wildlife conflicts (Ferretti et al. 2015). Based on existing evidence, the use of non-lethal approaches in shark bite mitigation is the preferred management option.

This IUCN SSC Position Statement was prepared by members of the IUCN Species Survival Commission Shark Specialist Group in June 2023. For more information, please contact:

IUCN SSC
Shark Specialist Group
www.iucnssg.org

Citation: IUCN 2023. Position Statement on Shark Control Programs and Shark Culls. IUCN Species Survival Commission (SSC) Shark Specialist Group. Available at:

A version of the statement is attached and can also be downloaded from the IUCN Species Survival Commission website: www.iucn.org/resources/commission-statement/iucn-commission-statement-shark-control-programs-and-shark-culls

And our Shark Specialist Group website: www.iucnssg.org/statements.html

Literature cited

Ebert DA, Fowler S, Dando M. 2021. Sharks of the World. Princeton University Press, Plymouth, UK

Barnett, A., Fitzpatrick, R., Bradley, M., Miller, I., Sheaves, M., Chin, A., Smith, B., Diedrich, A., Yick, J.L., Lubitz, N. and Crook, K., 2022. Scientific response to a cluster of shark bites. People and Nature, 4(4): 963–982. doi.org/10.1002/pan3.10337

Bradshaw, C.J., Meagher, P., Thiele, M.J., Harcourt, R.G. and Huveneers, C., 2021. Predicting potential future reduction in shark bites on people. The Royal Society of Open Science, 8(3), p.201197. doi.org/10.1098/rsos.201197

Butcher, P.A., Piddocke, T.P., Colefax, A.P., Hoade, B., Peddemors, V.M., Borg, L., Cullis, B.R. 2019. Beach safety: can drones provide a platform for sighting sharks? Wildlife Research, 46: 701–712. doi.org/10.1071/WR18119

Dudley, S.F.J. 1997. A comparison of the shark control programs of New South Wales and Queensland (Australia) and KwaZulu-Natal (South Africa). Ocean & Coastal management 43(1): 1-27. doi.org/10.1016/S0964-5691(96)00061-0

Dulvy, N.K., Pacoureau, N., Rigby, C.L., Pollom, R.A., Jabado, R.W., Ebert, D.A., et al. 2021. Overfishing drives over one-third of all sharks and rays toward a global extinction crisis. Current Biology, 31(22): 5118-5119. doi.org/10.1016/j.cub.2021.11.008.

Engelbrecht T, Kock A, Waries S, O'Riain MJ (2017) Shark Spotters: Successfully reducing spatial overlap between white sharks (*Carcharodon carcharias*) and recreational water users in False Bay, South Africa. PLoS ONE 12(9): e0185335. doi.org/10.1371/journal.pone.0185335

Ferretti, F., Worm, B., Britten, G. L., Heithaus, M. R., & Lotze, H. K. 2010. Patterns and ecosystem consequences of shark declines in the ocean. Ecology Letters, 13(8): 1055-1071. doi.org/10.1111/j.1461-0248.2010.01489.x

Ferretti F., Jorgensen, S., Chapple, T., De Leo, G. and Micheli, F. 2015. Reconciling predator conservation with public safety. Frontiers in Ecology and the Environment, 13(8): 412–417. doi.org/10.1890/150109

Gauthier, A.R.G., Chateauminois, E., Hoarau, M.G., Gadenne, J., Hoarau, E., Jaquemet, S., Whitmarsh, S.K. and Huveneers, C. 2020. Variable response to electric shark deterrents in bull sharks, *Carcharhinus leucas*. Scientific Reports, 10(1), p.17869. doi.org/10.1038/s41598-020-74799-y

Gibbs, L., and Warren, A. 2015. Transforming shark hazard policy: Learning from ocean-users and shark encounter in Western Australia. Marine Policy, 58: 116–124. doi.org/10.1016/j.marpol.2015.04.014

Guyomard, D., Perry, C., Tournoux, P. U., Cliff, G., Peddemors, V., Jaquemet, S. 2019. An innovative fishing gear to enhance the release of non-target species in coastal shark-control programs: the SMART (smart management alert in real-time) drumline. Fisheries Research, 216: 6–17. doi.org/10.1016/j.fishres.2019.03.011

Heinrich, D.D., Huveneers, C., Houslay, T.M., Dhellemmes, F. and Brown, C. 2022. Shark habituation to a food-related olfactory cue. Animal Behaviour, 187, pp.147-165. doi.org/10.1016/j.anbehav.2022.03.003

Heinrich, D., Dhellemmes, F., Guttridge, T.L., Smukall, M., Brown, C., Rummer, J., Gruber, S. and Huveneers, C. 2021. Short-term impacts of daily feeding on the residency, distribution and energy expenditure of sharks. Animal Behaviour, 172, pp.55-71. doi.org/10.1016/j.anbehav.2020.12.002

Huveneers, C., Meekan, M., Apps, K., Ferreira, L.C., Pannell, D., Vianna, G.M.S. 2017. The economic value of shark-diving tourism in Australia. Reviews in Fish Biology and Fisheries. 27: 665–680. link.springer.com/article/10.1007/s11160-017-9486-x

Huveneers, C., Whitmarsh, S., Thiele, M., Meyer, L., Fox, A. and Bradshaw, C.J., 2018. Effectiveness of five personal shark-bite deterrents for surfers. PeerJ, 6, p.e5554. doi.org/10.7717/peerj.5554

International Shark Attack File. 2023. Yearly worldwide shark attack summary. www.floridamuseum.ufl.edu/shark-attacks/yearly-worldwide-summary/ Accessed 30 June 2023
IUCN. 2023. IUCN SSC guidelines on human-wildlife conflict and coexistence. First edition. Gland, Switzerland: IUCN. doi.org/10.2305/YGIK2927

Martin, C.L., Curley, B., Wolfenden, K., Green, M. and Moltschaniwskyj, N.A., 2022. The social dimension to the New South Wales Shark Management Strategy, 2015–2020, Australia: Lessons learned. Marine Policy, 141, p.105079. doi.org/10.1016/j.marpol.2022.105079

McPhee, D.P. 2014. Unprovoked shark bites: are they becoming more prevalent? Oceans and Coastal Management 42: 478–492. doi.org/10.1080/08920753.2014.942046

McPhee, D.P., Blount, C., Lincoln Smith, M.P., Peddemors, V.M. 2021. A comparison of alternative systems to catch and kill for mitigating unprovoked shark bite on bathers or surfers at ocean beaches. Oceans and Coastal Management 201, 105492. doi.org/10.1016/j.ocecoaman.2020.105492

Meyer, L., Barry, C., Araujo, G., Barnett, A., Brunnschweiler, J.M., Chin, A., Gallagher, A., Healy, T., Kock, A., Newsome, D. and Ponzo, A., 2022. Redefining provisioning in marine wildlife tourism. Journal of Ecotourism, 21(3), pp.210-229. doi.org/10.1080/14724049.2021.1931253

Mustika, P.L.K., Ichsan, M., Booth, H. 2020. The economic value of shark and ray tourism in Indonesia and its role in delivering conservation outcomes. Frontiers in Marine Science. 7: 261. doi.org/10.3389/fmars.2020.00261

Muter, B.A., Gore, M. L., Gledhill, K.S., Lamont, C., Huveneers, C. 2013. Australian and US news media portrayal of sharks and their conservation. Conservation Biology 27(1): 187-196. doi.org/10.1111/j.1523-1739.2012.01952.x

Pepin-Neff, C., and Wynter, T. 2019. Save the sharks: reevaluating and (re)valuing feared predators. Human Dimensions of Wildlife, 24: 87–94. doi.org/10.1080/10871209.2018.1539887

Reid, D.D., Robbins, W.D. and Peddemors, V.M. 2011. Decadal trends in shark catches and effort from the New South Wales, Australia, Shark Meshing Program 1950-2010. Marine and Freshwater Research 62: 676-693. doi.org/10.1071/MF10162

Riley, M., Bradshaw, C.J. and Huveneers, C., 2022. Long-range electric deterrents not as effective as personal deterrents for reducing risk of shark bite. ICES Journal of Marine Science, 79: 2656-2666. doi.org/10.1093/icesjms/fsac199

Riley, M., Meagher, P., Huveneers, C., Leto, J., Peddemors, V.M., Slip, D., West, J., Bradshaw, C.J. 2022. The Australian Shark-Incident Database for quantifying temporal and spatial patterns of shark-human conflict. Scientific Data 9, 378. doi.org/10.1038/s41597-022-01453-9

Sabatier, E. & Huveneers, C. 2018. Changes in media portrayal of human-wildlife conflict during successive fatal shark bites. Conservation and Society 16: 338-350. doi.org/10.4103/cs.cs_18_5

Simmons, P. and Mehmet, M.I., 2018. Shark management strategy policy considerations: community preferences, reasoning and speculations. Marine Policy, 96, pp.111-119. doi.org/10.1016/j.marpol.2018.08.010

Simmons, P., Mehmet, M., Curley, B., Ivory, N., Callaghan, K., Wolfenden, K. and Xie, G., 2021. A scenario study of the acceptability to ocean users of more and less invasive management after shark-human interactions. Marine Policy, 129, p.104558.

Simpfendorfer, C. A., Heupel, M. R., & Kendal, D. 2021. Complex human-shark conflicts confound conservation action (Perspective). Frontiers in Conservation Science, 2(35):692767. doi.org/10.3389/fcosc.2021.692767

Thiele, M., Mourier, J., Papastamatiou, Y., Ballesta, L., Chateauminois, E. and Huveneers, C., 2020. Response of blacktip reef sharks *Carcharhinus melanopterus* to shark bite mitigation products. Scientific reports, 10(1), pp.1-12. doi.org/10.1038/s41598-020-60062-x

Wetherbee, B., Lowe, C., Crow, G. 1994. A review of shark control in Hawaii with recommendations for future research. Pacific Science, 48: 95–115.

Whitmarsh, S.K., Amin, D.B., Costi, J.J., Dennis, J.D. and Huveneers, C., 2019. Effectiveness of novel fabrics to resist punctures and lacerations from white shark (*Carcharodon carcharias*): Implications to reduce injuries from shark bites. PloS one, 14(11), p.e0224432. doi.org/10.1371/journal.pone.0224432

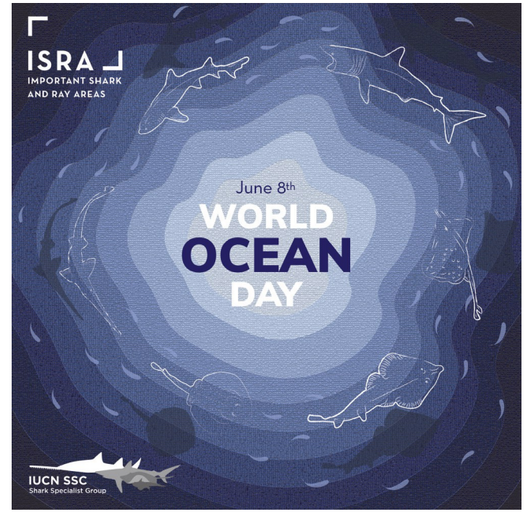
Wildlife and Ocean Fest: Dive into Conservation Celebrations! Did you Celebrate?

Throughout the year, various important days and celebrations related to wildlife and marine conservation are observed. These celebrations serve as opportunities to educate and engage the public in conservation efforts and highlight the critical role of marine life in maintaining the health of our planet.

Illustrations by Eloisa Pinheiro

World Wildlife Day [March 3rd]: A day dedicated to raising awareness about the importance of wildlife and its conservation. This year the theme was focused on partnerships for wildlife conservation.

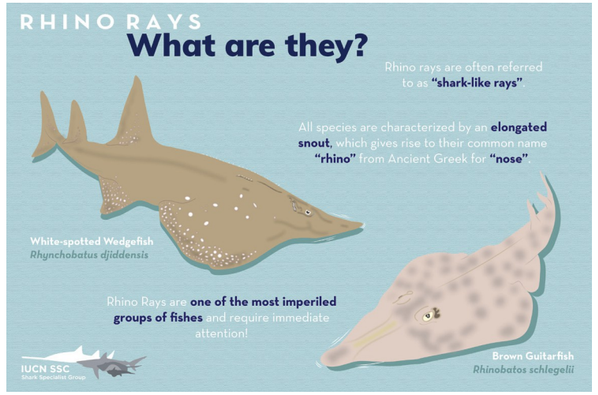
International Day for Biological Diversity [May 22nd]: This day highlights the significance of biodiversity in sustaining life on Earth

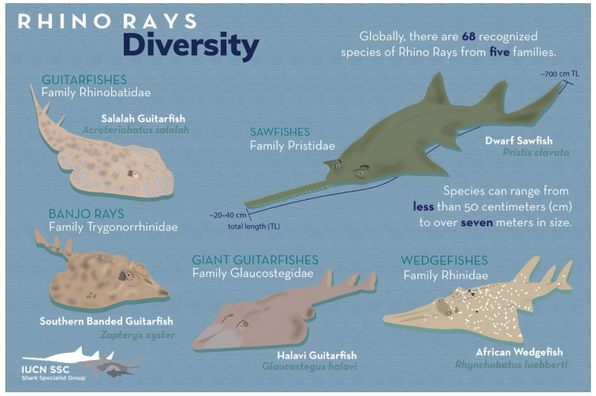


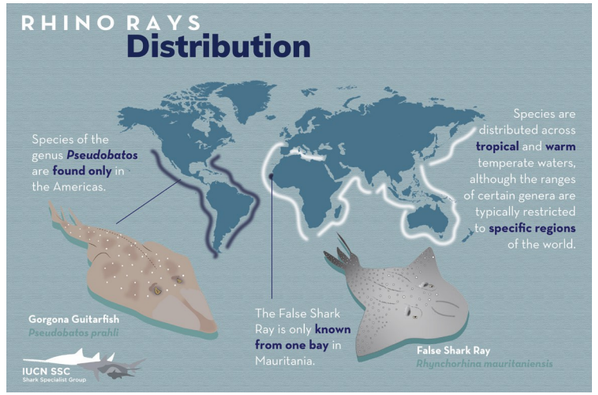
World Ocean Day [June 8th]: Celebrated to promote ocean conservation and sustainable use of marine resources

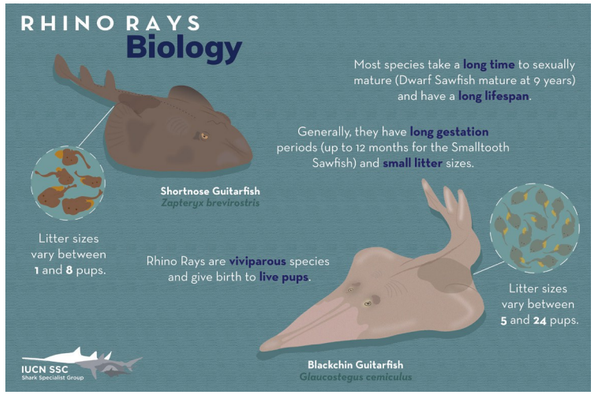
Angel Shark Day [June 26th]: A day focused on raising awareness about angel sharks [*Squatina* spp.],

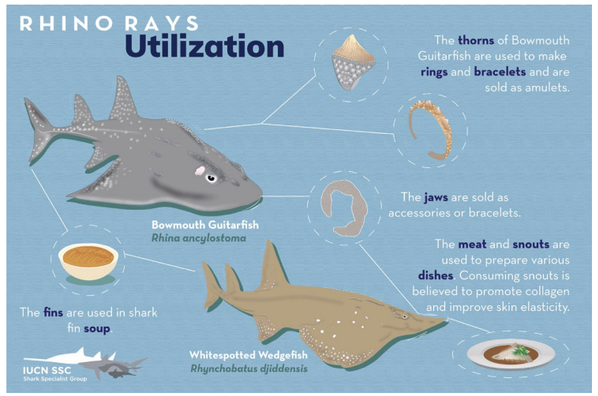
Shark Awareness Day [July 14th]: An occasion to educate people about the vital role of sharks in marine ecosystems.

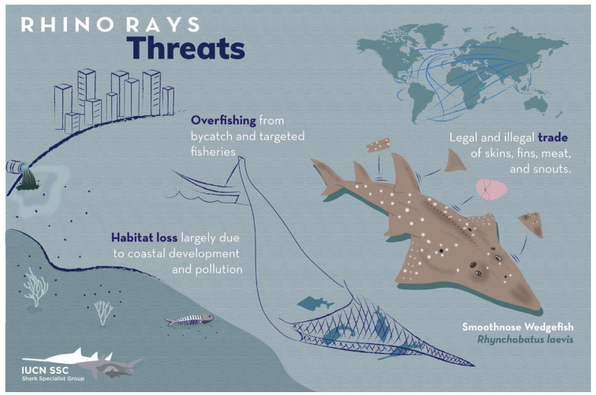




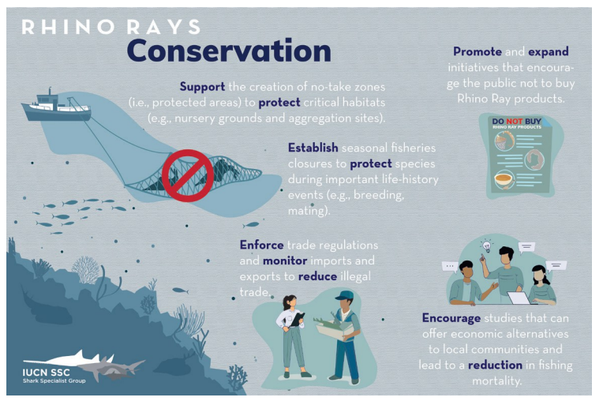


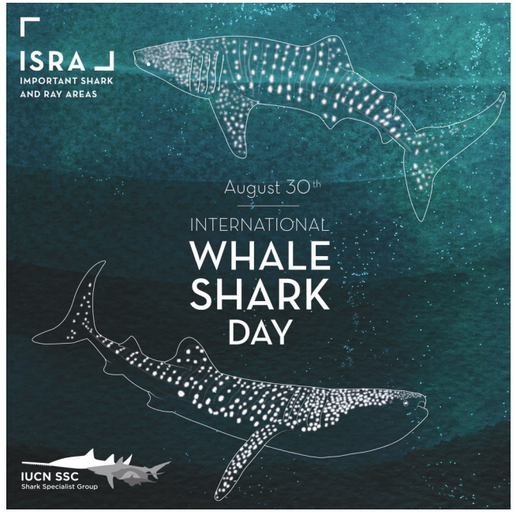




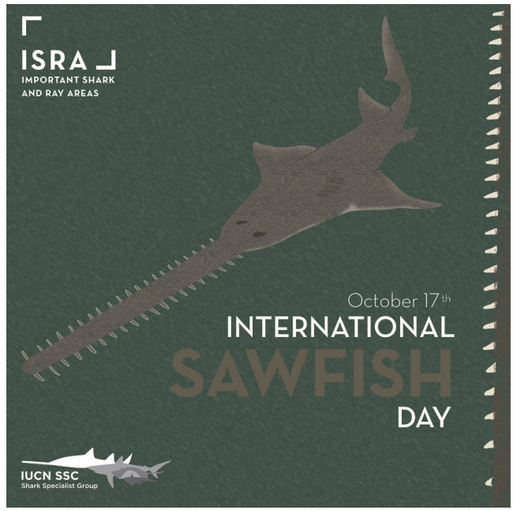


Shark Awareness Day (July 14th): This year, our focus was on Rhino Rays – some of the most threatened sharks and rays in the world!





International Whale Shark Day (August 30th): This day recognizes and celebrates the gentle giant of the ocean, the Whale Shark (*Rhincodon typus*)



International Sawfish Day (October 17th): A day to emphasize the conservation of sawfish, a unique and threatened species group

World Manta Day (September 17th): A day dedicated to manta rays (Mobulidae), highlighting the need for their protection

International Ghost Shark Day (October 30th): A day to highlight the importance of conserving the often overlooked chimaeras

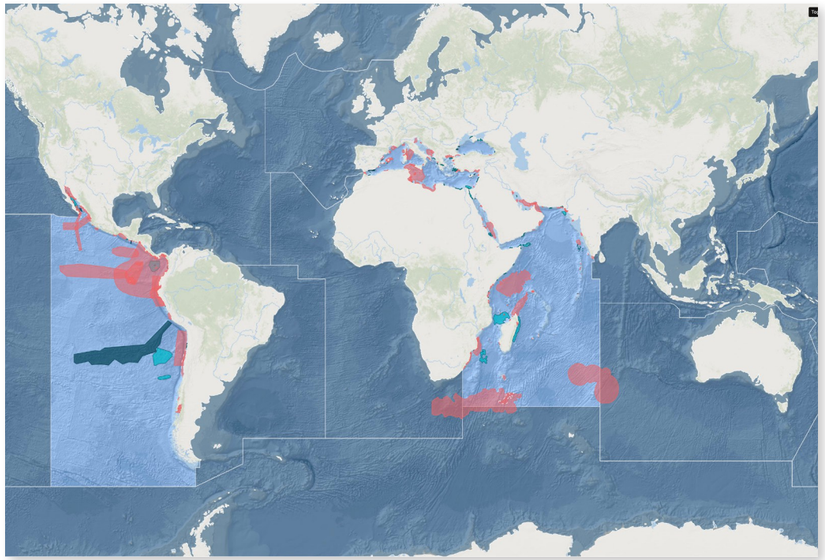
World Fisheries Day (November 21st): Focusing on sustainable fishing practices and the importance of fisheries management

WHAT THE SSG HAS DONE IN 2023

Communication:

Released three issues of Shark News (#07– 09)
© IUCN SSC Shark Specialist Group

The IUCN SSC Shark Specialist Group's (SSG) mission is to secure the conservation, management and, where necessary, the recovery of the world's sharks, rays, and chimaeras by mobilizing technical and scientific expertise to provide the knowledge that enables action. To carry out this mission, in 2023, the SSG accomplished the following activities. These activities demonstrate the SSG's commitment to shark conservation and research, including communication, publications, and workshops to advance their mission.

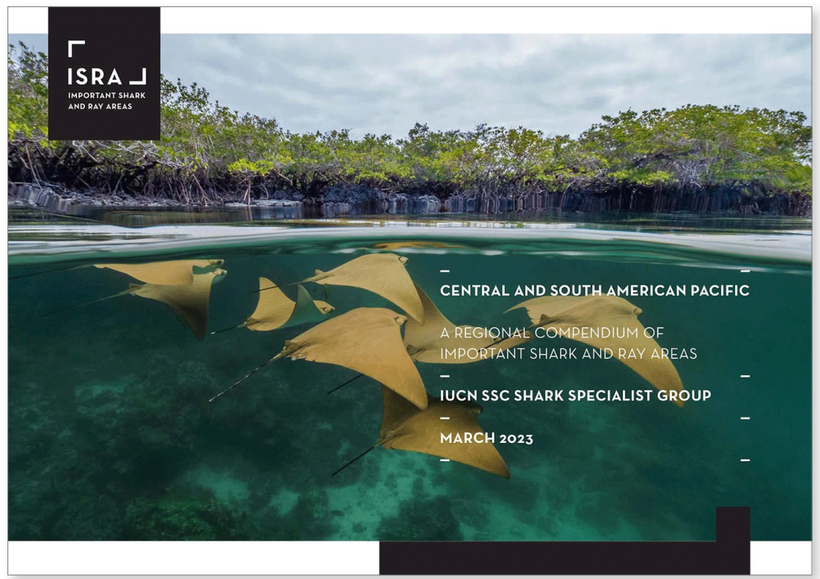


Launched the Important Shark and Ray Areas (ISRA) e-Atlas
© Important Shark and Ray Areas (ISRA)
The ISRA e-Atlas is interactive and undergoing updates as the project continues, and it is available online here.

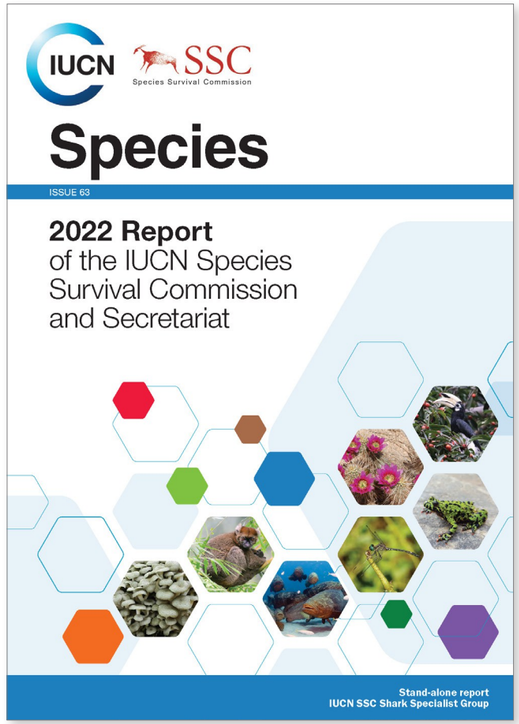
Publications:

Important Shark and Ray Areas: a new tool to optimize spatial planning for sharks
March 09, 2023
Click here to download the newsletter or view it online here.
How to cite this document: Kyne, P., Notarbartolo di Sciara, G., Morera, A., Charles, R., Rodríguez, E., Fernando, D., Jabado, R. (2023). Important Shark and Ray Areas: A new tool to optimize spatial planning for sharks. Oryx, 57(2), 146-147. doi.org/10.1017/S0030605322001624

Mediterranean and Black Seas Region: A Regional Compendium of Important Shark and Ray Areas
September 01, 2023
How to cite this document: Jabado RW, García-Rodríguez E, Kyne PM, Charles R, Armstrong AH, Bortoluzzi J, Mouton TL, Gonzalez-Pestana A, Battle-Morera A, Rohner C, Notarbartolo di Sciara G. 2023. Mediterranean and Black Seas: A regional compendium of Important Shark and Ray Areas. Dubai: IUCN SSC Shark Specialist Group. doi.org/10.59216/ssg.isra.2023.r3

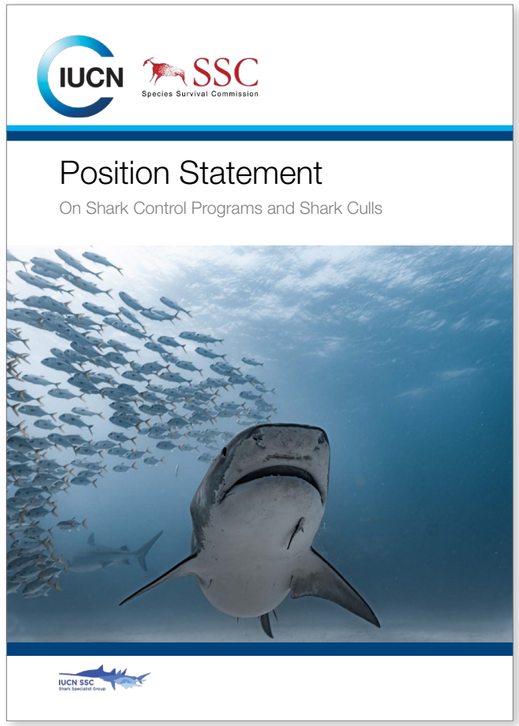


Central and South American Pacific Region: A Regional Compendium of Important Shark and Ray Areas
March 23, 2023
How to cite this document: Jabado RW, García-Rodríguez E, Kyne PM, Charles R, Gonzalez Pestana A, Priest MA, Battle-Morera A, Notarbartolo di Sciara G. 2023. Central and South American Pacific: A regional compendium of Important Shark and Ray Areas. Dubai: IUCN SSC Shark Specialist Group. doi.org/10.59216/ssg.isra.2023.r12



IUCN SSC SSG Annual Report 2022
It is available online on the SSC SSG's portal or downloaded here.

IUCN SSC SSG Position Statement
It is available online on the IUCN Species Survival Commission website and the Shark Specialist Group website.



ISRA Workshop – Mediterranean and Black Seas region
May 8–12, 2023
in Thessaloniki, Greece
ISRA Mediterranean Workshop participants | © Javier Guallart
For further information, the workshop report is available online here.

ISRA Workshop – Western Indian Ocean
September 11–15, 2023,
in Durban, South Africa
For further information, the workshop report is available online here.

Workshops:

Global Report Writing Retreat Workshop
March 18–20, 2023,
in Kuala Lumpur, Malaysia
Global Report Writing Retreat Workshop participants |
© Benaya Simeon

IUCN SSC SSG Human Dimensions Working Group's workshop
June 5–8, 2023 online
The workshop is available online as a playlist on the SSG's YouTube channel.
© Hettie Brown

Upcoming Meetings

Please visit the respective websites and communication from the host organisation for more information.

Fourteenth Meeting of the Conference of the Parties (CoP) to Convention on the Conservation of Migratory Species of Wild Animals (CMS)
February 12–17, 2024
Samarkand, Uzbekistan
cms.int/en/meeting/fourteenth-meeting-conference-parties-cms

The Conference of the Parties (COP) is the principal decision making body of the Convention as set out in Article VII of the CMS text.
It meets once every three years and sets the budget and priorities of the following three years (the triennium). It also decides on the amendment of the Appendices and considers reports submitted by the Parties, the Scientific Council and the Agreements established under the Convention. It also has the task of recommending to Parties whether they should conclude further regional Agreements for the conservation of particular species or groups of species.

Oceania Chondrichthyan Society Conference
April 3-5, 2024
Geelong, Victoria, Australia
oceaniasharks.com.au/ocs-conference-2024

The OCS conference, a much-anticipated annual gathering stands as the premier regional forum for shark and ray researchers within the Indo-Pacific. Our mission is to advance research, education and management of sharks and rays across the vast expanse of the Indo-Pacific region. After a brief hiatus during the challenging times of the pandemic, we are thrilled to revive this event into its full in-person glory.
The event is scheduled to take place from April April 3rd to 5th 2024, in the picturesque city of Geelong, Victoria. We are now taking Conference workshop submissions, abstract submissions open from November 6th 2023 to February 9th 2024, and registrations open from November 6th 2023 to March 1st 2024.

Ocean Decade Conference
April 10–12, 2024
Barcelona, Spain
oceandecade-conference.com | oceandecade.org/events/2024-ocean-decade-conference/

2024 will mark the fourth year of implementation of the UN Decade of Ocean Science for Sustainable Development (2021-2030). Under the leadership of UNESCO's Intergovernmental Oceanographic Commission, the Ocean Decade has already galvanized thousands of partners around the world to start delivering the science we need for the ocean we want.
Focused on 'delivering the science we need for the ocean we want', the 2024 Ocean Decade Conference, which will be hosted by the Government of Spain in Barcelona from 10 - 12 April 2024, will bring together the global Ocean Decade community and partners to celebrate and take stock of progress, and set joint priorities for the future.
An important milestone on the path to 2030, the event will cover the full range of Ocean Decade Challenges including critical issues such as climate change, food security, sustainable management of biodiversity, sustainable ocean economy, pollution, and natural hazards.

Our Ocean Conference 2024
April 15–17, 2024
Athens, Greece
ourocean2024.gov.gr

Our Ocean Conferences bring together governments and non-state actors – including private-sector, philanthropic, academic, and non-governmental representatives – to make concrete commitments to protect ocean health and security. Since the Our Ocean Conferences began in 2014, they have resulted in more than 1,800 commitments worth nearly $108 billion.

Upcoming Meetings

Seventh (7th) International Marine Conservation Congress (IMCC)
October 13–18, 2024
Cape Town, South Africa
conbio.org/mini-sites/imcc7 | conbio.org/groups/sections/marine/meetings/

Save the Date: The 7th International Marine Conservation Congress will be October 13-18 in Cape Town, South Africa. This meeting, hosted by the Society for Conservation Biology Marine Program, is the largest interdisciplinary marine conservation conference for scientists and practitioners in the world. Stay tuned for updates on symposia, workshop, and abstract submission deadlines.

IUCN World Conservation Congress
October 9–15, 2025
Abu Dhabi,
United Arab Emirates
iucn.org/press-release/202306/united-arab-emirates-host-iucn-world-conservation-congress-2025

"Held every four years, the IUCN Congress is the world's largest conservation event. It brings together leaders from government, civil society, Indigenous peoples' organisations, business and academia to determine the world's most pressing environmental and development challenges, and actions to address them. The IUCN Congress will address ways to deliver the Global Biodiversity Framework, adopted by over 190 countries last December. The Framework comprises targets to scale up the conservation of ecosystems, species and genetic diversity.

Funding Opportunities

Preventing Extinction Fund:
Protected Area Conservation Action Grants
quickresponsefund.org/preventing-extinction-fund/

Status: Open

The Quick Response Fund for Nature and Rainforest Trust jointly launched The Preventing Extinction Fund, to protect habitat for the world's most threatened species.
Priority will be given to "Rare Species Sites" as defined on the Global Safety Net.
The Protected Area Conservation Action Grants will support actions that establish or expand protected areas during the timeframe of the grant. Projects will help improve the status of threatened animal species and their habitats. Two levels of funding are available:

1. Rapid Response Awards (funds up to $50,000): 100% of funding must go directly towards establishment or expansion of protected areas.
2. Extended Awards (funds $100,000 to over $1,000,000): funding is available for protected area creation and management costs.

Preventing Extinction Fund:
Species Planning Grants
quickresponsefund.org/preventing-extinction-fund/

Status: Open

Applications endorsed by IUCN Species Survival Commission (SSC) or World Commission on Protected Areas (WCPA) Specialist/Working Groups or Task Forces will be viewed favorably as will applications with a clear linkages to other IUCN Commissions and the KBA Secretariat.
The Species Planning Grants, of up to USD 10,000, will be provided to IUCN Specialist Groups, KBA regional focal points or local Civil Society Organizations to support the identification and assessment of priority sites for protected area establishment.
These grants are intended to provide groups with the opportunity to identify key sites and begin the process of protection.

ASAP Species
Rapid Action Fund
speciesonthebrink.org/asap-grants/rapid-action-fund/

Status: Open

During a conservation project, conservation emergencies or a need for unforeseen activities may arise. In such cases, time is of the essence. Fast action can make all the difference to a species' chance of survival. That is why ASAP is offering grants of up to SGD 13,500 to ASAP Partners for urgent and emergency conservation of ASAP species. The fund will provide rapid disbursement of small amounts of funds to address urgent requests from the field for conservation actions. Grants can be used in the following ways:

- To address unforeseen conservation emergencies where urgent action is needed; and
- For the seamless continuation of important current conservation actions. Proposals to support the on-going costs of a long-term conservation project are not eligible except where there is an unforeseen funding gap, and where the seamless continuation of activities is imperative for the ongoing or long-term conservation of the ASAP species in question.

They invite ASAP Partners to submit proposals to the ASAP Species Rapid Action Fund. Proposals will be reviewed on a rolling basis throughout the year; they can be submitted at any time.

ASAP Species
Conservation Grant
speciesonthebrink.org/asap-grants/asap-species-conservation-grants-2023/

Deadline for application:
8 January 2024

ASAP Species are some of the most at risk of extinction on the planet. The ASAP Species Conservation Grant is designed to support ASAP Partners in their efforts to conserve ASAP Species and their habitats.
To be considered for an ASAP Species Conservation Grant, an organisation must be an existing ASAP Partner. ASAP Partners are invited to submit pre-proposals for a maximum of SGD 16,000. The duration of the ASAP-funded project or project component should be 12 months or less.
The priorities for ASAP Species Conservation Grants are:

- projects within Southeast Asia, but priority conservation actions for ASAP species outside this region will be considered where there is strong justification.
- projects submitted by national organisations and those where the Project Lead is from the country in which the conservation actions take place.
- ASAP Species that are receiving less conservation attention globally than is average for ASAP Species, and to applications making a clear case that the species in question is severely under-supported globally.

Please note that funding for this opportunity is limited and the grant will close once funding is allocated.

Funding Opportunities

ASAP Species
Continuation Grant
speciesonthebrink.org/asap-grants/asap-species-continuation-grants-2023/

Status: Open

The ASAP Species Continuation Grant is open to ASAP Partners who have previously received funding from either the ASAP Species Conservation Grant or the ASAP Species Rapid Action Fund.
There are two components to the ASAP Species Continuation Grant: funding to enable follow-up conservation activities for ASAP Species and funding to address the organisational needs or priorities of ASAP Partners. Applications must address both components.
Proposals should be submitted in Singapore Dollars for a maximum of SGD 30,000 a year, with activities relating to project implementation and organisational development included in each year of the grant. Up to SGD 20,000 a year can be for project activities, with up to SGD 10,000 a year to support organisational development. Proposals can be for a maximum of three years.

ASAP Partner
Networking Grant
speciesonthebrink.org/asap-grants/asap-partner-networking-grant-2023/

Deadline for application:
8 January 2024

The ASAP Partner Networking Grant is designed to facilitate collaboration and networking between ASAP Partners to catalyse conservation action for ASAP Species.
To be eligible:

- All applicants must be ASAP Partner organisations.
- The application must detail how the collaboration will further the conservation of ASAP Species. This can be for a single or multiple ASAP Species.

Proposals should be submitted in Singapore Dollars for a maximum of SGD 13,500. The duration of the ASAP-funded activities should be 6 months or less.

The Indianapolis Prize:
Emerging Conservationist Award
indianapoliszoo.com/prize/conservation-heroes/emerging-conservationist-2/

Deadline for application:
26 February 2024

The Indianapolis Prize created a new award recognizing conservationists early in their careers. The Emerging Conservationist award – made possible through a grant from the Kobé Foundation – is a biennial award recognizing conservationists under 40 years of age with the talent and drive to make a significant impact on saving an animal species or group of species. Established to help support their work, the Emerging Conservationist Award aims to encourage the courageous, talented and dedicated people who devote themselves to protecting Earth's wild things and wild places.
Through a two-stage selection process, a Review Committee will narrow the application pool to 10 Finalists who will then be sent to the Selection Committee. Once the Selection Committee chooses a Winner from the top three applicants, the Winner will be notified and receive a $50,000 award to further their conservation work.

IUCN SSG Sponsors & Supporters

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The IUCN SSC Shark Specialist Group is fiscally sponsored by Re:wild, a 501(c)(3) non-profit organization with headquarters in Austin, TX, USA (tax ID: 26-2887967).

DONATE

Sharks and rays need you.
Please donate and help us make a difference.

Sharks and rays are some of the most threatened species in the world, more so than land animals. Populations are declining at alarming rates and 37% of species are already threatened with extinction. With your support we can find solutions and take actions to conserve these incredible animals before it is too late.

The IUCN SSC Shark Specialist Group achievements over the last 30 years have been possible due to the generous support of funders, members, and other volunteers from countless organizations. Our members volunteer their time, effort and expertise to advance our mission and vision.

We would like to express our most sincere gratitude for the generous grants, collaborations, and support to our group, our teams, our projects, and our efforts. We appreciate the support that has been provided over the years and look forward to continuing our journey and endeavors together into the future.

ATLANTIS
DUBAI

Shark Conservation Fund

WHITE SHARK

save our seas foundation

Federal Ministry
for the Environment, Nature Conservation,
Nuclear Safety and Consumer Protection

صندوق محمد بن زايد
للمحافظة على الكائنات الحية
The Mohamed bin Zayed SPECIES CONSERVATION FUND

CMS

CMS SHARKS MOU

Photo by Brooke Pyke | brookepykephotography.com

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