Manta & Devil Rays:

Vanishing Ocean Giants

Manta TRUST

Manta & Devil Rays:

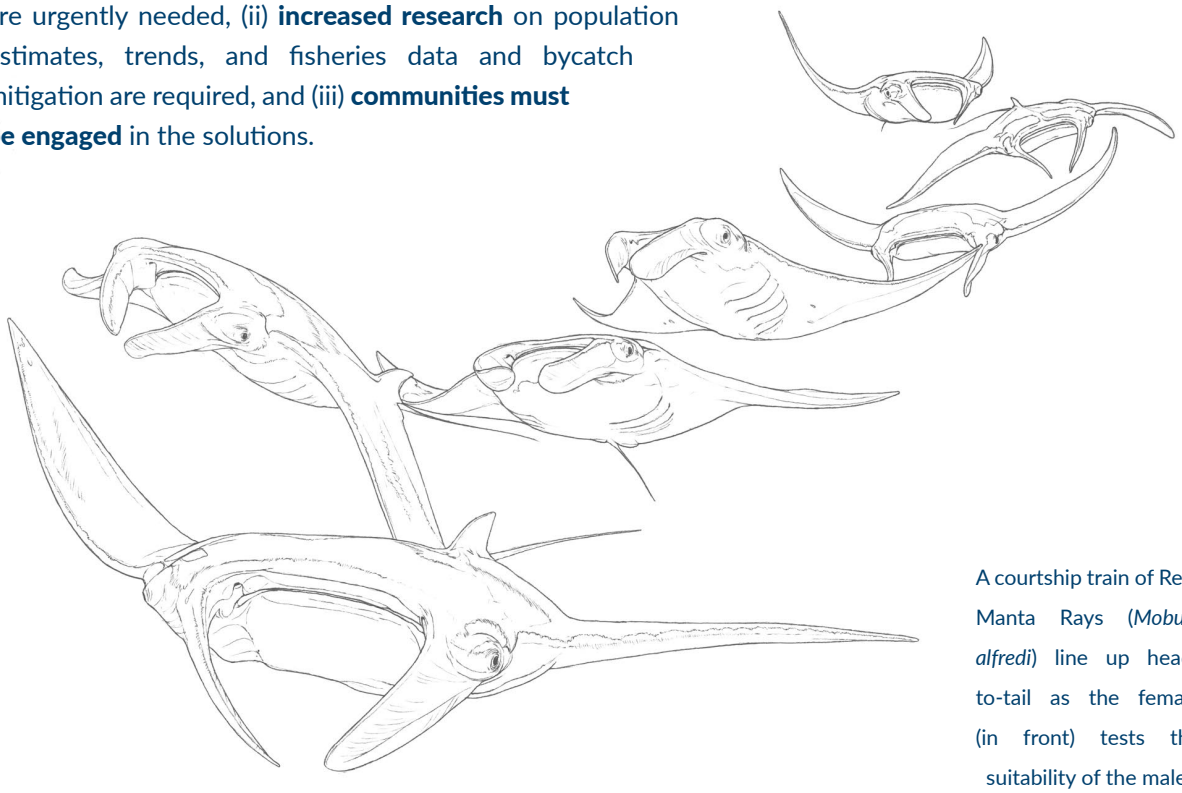
Vanishing Ocean Giants

Unique among rays, the pelagic filter-feeding manta and devil rays stand out for their specialised anatomical feeding adaptations, flattened body form, and striking behaviour – making them some of the most conspicuous and charismatic of all marine species. These zooplanktivorous rays are **extremely biologically vulnerable due to their conservative life history traits,** including slow growth, late maturation, and low fecundity – traits shared by all species within the family, despite their size differences.

The main threats to manta and devil rays are unsustainable levels of fisheries-related mortality from both small-vessel and industrial fishing fleets, with global catch estimated to be ~265,000 individuals per year. These **fisheries are partly driven by demand for domestic meat consumption and international trade in their gill plates and meat**, which has increased and adapted in recent years **despite CITES Appendix II listings**.

As a result, these intrinsically vulnerable species are now all **threatened with extinction, and some are already classified as Critically Endangered. Steep population declines above 80%** (and some up to 99%) have been documented for all species. These declines have been accelerating in the last decade, regardless of extensive national and international protective legislation.

To reduce target and incidental catch of manta and devil rays, halt population declines, and protect these species: (i) **effective and enhanced management measures** are urgently needed, (ii) **increased research** on population estimates, trends, and fisheries data and bycatch mitigation are required, and (iii) **communities must be engaged** in the solutions.



A courtship train of Reef Manta Rays (*Mobula alfredi*) line up head-to-tail as the female (in front) tests the suitability of the males.

A Reef Manta Ray (*Mobula alfredi*) somersault feeds at night in the Maldives.

Species Overview

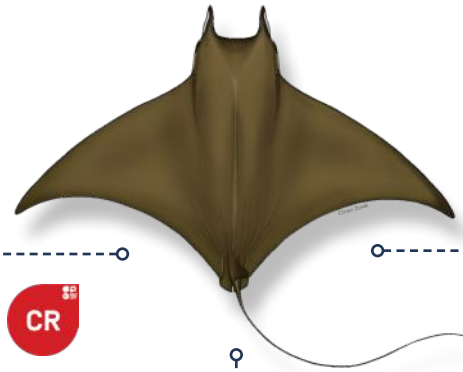
The mobulidae family is monogeneric, comprising ten species in the genus *Mobula*. Within this family, **three manta and seven devil ray species** are recognised. Manta and devil rays are widely distributed globally throughout tropical and sub-tropical waters, typically within 40° of latitude north and south of the equator, although some species' range extends into temperate latitudes. Populations are often fragmented, likely reflecting the patchy availability of resources and suitable habitats. These rays inhabit a variety of environments, ranging from neritic coastal reefs along continental margins to remote oceanic islands and other offshore habitats. All are filter feeders, using their mouths and modified gill plates to strain plankton and small fish from the water (Stevens *et al.* 2025).

MANTA RAYS

Summary of observed and predicted biological size metrics for each species, including mean observed weight (kg), mean observed disc width (DW, cm), maximum observed disc width (cm), predicted maximum weight (kg), and estimated size-at-birth (cm) (Sources: Stevens et al. 2025; D'Costa et al. [In review]).

OCEANIC DEVIL RAYS

Sicklefin Devil Ray
(Mobula tarapacana)
CR



Size-at-birth
122cm

Disc Width
Max: 370cm
Mean: 218cm

Weight
Max: 671kg
Mean: 105kg

Spinetail Devil Ray
(Mobula mobular)
CR

Size-at-birth
100cm

Disc Width
Max: 350cm
Mean: 180cm

Weight
Max: 250kg
Mean: 52kg

Bentfin Devil Ray
(Mobula thurstoni)
CR

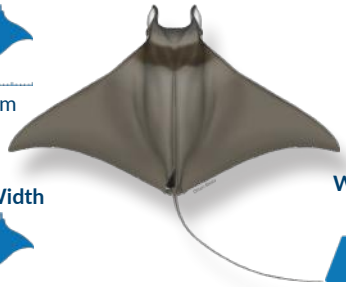
Size-at-birth
78cm

Disc Width
Max: 189cm
Mean: 149cm

Weight
Max: 74kg
Mean: 40 kg

PYGMY DEVIL RAYS

Shorthorned Pygmy Devil Ray
(Mobula kuhlii)
<EN>



Size-at-birth
39cm

Disc Width
Max: 134cm
Mean: 89cm

Weight
Max: 30kg
Mean: 10kg

Longhorned Pygmy Devil Ray
(Mobula eregoodoo)
<EN>

Size-at-birth
39cm

Disc Width
Max: 130cm
Mean: 112cm

Weight
Max: 23kg
Mean: 17kg

Munk's Pygmy Devil Ray
(Mobula munkiana)
<VU>

Size-at-birth
34cm

Disc Width
Max: 130cm
Mean: 109cm

Weight
Max: 21kg
Mean: 16kg

Atlantic Pygmy Devil Ray
(Mobula hypostoma)
<EN>

Size-at-birth
43cm

Disc Width
Max: 134cm
Mean: 89cm

Weight
Max: 30kg
Mean: 10kg

Dangerous Demography: Life History Vulnerabilities

Manta and devil rays are relatively large, slow-growing, migratory animals that form small, highly dispersed populations. They are among the least fecund of all sharks and rays, and have several traits that leave them highly vulnerable to anthropogenic pressures:

- Long-lived (max ~50 years).
- Extremely low fecundity (one pup every 1 – 7 years).
- Long gestation (~1 year).
- Late maturation (~10 years for manta rays).
- Predictable seasonal aggregations.

Their life history vulnerabilities, aggregatory nature and schooling behaviour put them at risk from even small-scale artisanal fisheries. As a result, their populations cannot withstand even moderate fishing levels. Removal of breeding adults results in a rapid decline in the overall population within a short time frame because the remaining mature individuals cannot breed fast enough to replace the losses.

End of the Line: Major Threats

Manta and devil rays are experiencing high extinction risk due to unsustainable fishing pressure from both coastal and offshore fleets, **partially driven by the consumption and trade of their meat and gill plates**. Their use of oceanic and near-shore habitats exposes them to capture in a range of fishing gear, particularly gillnet and purse-seine fisheries, and they constitute a notable bycatch component worldwide.

Global fishery catch

Manta and devil ray catch is globally widespread, includes all species, and is significantly more severe than previously thought. A new global manta and devil ray fisheries review (Laglbauer *et al.* 2025a) estimates the **global catch to be ~265,000 individuals per year, from at least 92 countries.** The scale of global catch is incompatible with a sustainable future for these vulnerable species. The Indian Ocean is the most affected ocean basin, representing 72% of the global catch. **Only 11 countries have reported** their manta and devil ray catches to the FAO database (2000 – 2023).

Fished devil rays in Sri Lanka.

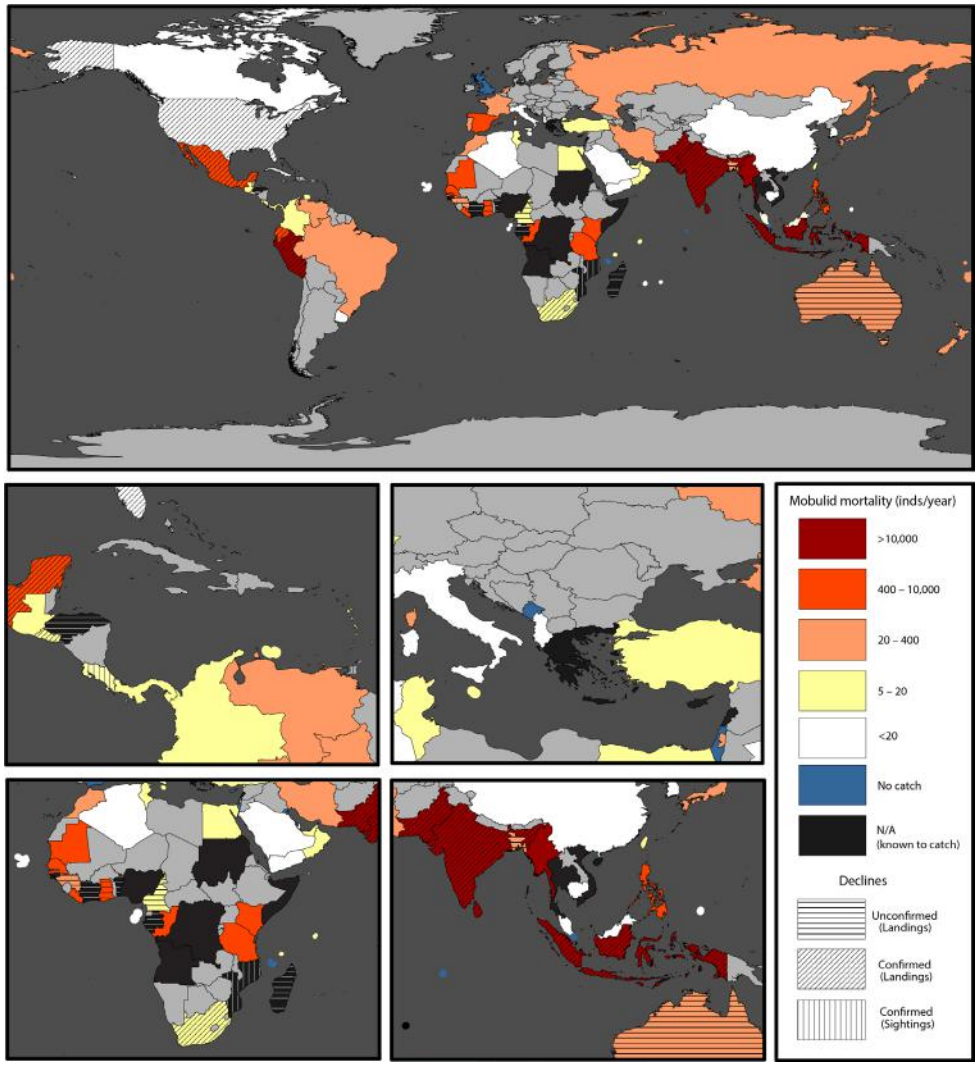


Figure 1: Combined estimated mobulid fisheries mortality across small-vessel (SV) and large-vessel (LV) fisheries. Countries are classified based on estimated mortality (combined SV landings and LV retention and at-vessel mortality) in number of individuals per year. Mobulid declines are highlighted based on (i) unconfirmed declines in landings based on expert interviews (horizontal stripes), (ii) confirmed declines based on catch/ landings data (diagonal stripes), or (iii) confirmed declines based on sightings data (vertical stripes) (From Laglabauer *et al.* 2025a).

Small-vessel (<15m) fishing

- Catch documented in at-least 76 countries.
- 85% of the global catch and 87% of the global mortality.
- Estimated 225,047 ind./year, all ten species.
- Top-5 countries (Indonesia, India, Sri Lanka, Myanmar and Peru) account for more than 90% of catch.

Large-vessel (≥15m) fishing

- Landings by 37 countries plus two t-RFMOs (Tuna Regional Fisheries Management Organisations).
- Estimated 39,470 ind./year (87% estimated mortality).

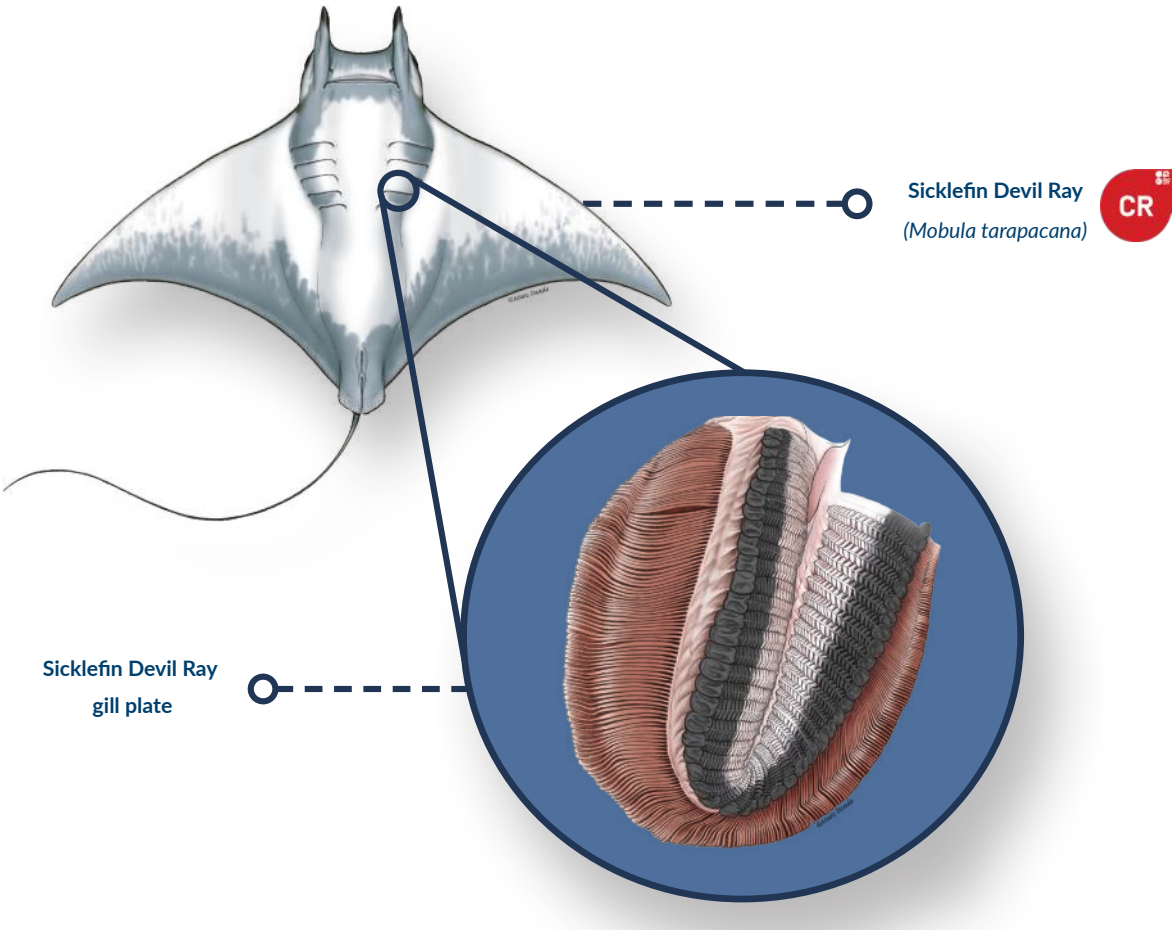
Gill Plate Trade

Manta and devil ray gill plates are used as an Asian health tonic, sold as a traditional medicine and purported to have anti-inflammatory properties that treats a wide variety of ailments. However, there is no scientific evidence for these claims, or any mention of gill plates in historic texts. Unfortunately, the demand for gill plates continues to drive unsustainable fisheries for manta and devil rays, despite international efforts to regulate international trade. A recent global review of international trade in manta and devil ray products (Palacios *et al.* 2024) shed new light on the geographical and economic scale of this trade (see Fig. 2).

Gill plate exports from 14 countries/regions:
Mainland China, Hong Kong SAR, Indonesia, Myanmar, Bangladesh, Sri Lanka, India, Philippines, Yemen, Thailand, South Africa, Senegal, Somalia, Ghana.

- Exported via land, sea, or air.
- Plates are likely concealed with other elasmobranch products or labelled as dried fish.
- Plates are likely taking the same routes as shark fins.

Five major import hubs:
Mainland China, Hong Kong SAR, Singapore, South Korea, Thailand.



Mobulid gill plates drying in the sun,
ready to be sold in Sri Lanka.

Fishers in Myanmar carry a landed Spinetail Devil Ray (*Mobula mobular*) to be processed and sold at the market.

Most of the gill plate trade is not reported in the CITES database (2017 – 2023), which only shows exports from Sri Lanka (75%), India, Oman and Yemen into Hong Kong SAR and Singapore. Indeed, most CITES trade database entries are not species-specific, and coding errors are highly suspected.

The Palacios *et al.* (2024) study highlights that the **gill plate trade is migrating to online platforms,** driven by rising economic values for demand-country traders, which has resulted in an overall increase in the number of retailers trading mobulid products after CITES App. II listings.

- Physical retailers in Guangzhou, China decreased from 60 to 40 from 2013 to 2023.
- Online retailers increased from 56 to 94 from 2014 to 2023.
- Average price increase (adjusted for inflation) of 28.3% since 2011.
- Online prices higher than physical retailers.
- Manta gill plates reaching more than 450 UDS/kg.

This trading change indicates increasing and widespread non-compliance with the CITES listings and a less transparent sales system, making it more challenging for authorities to trace and regulate traders.

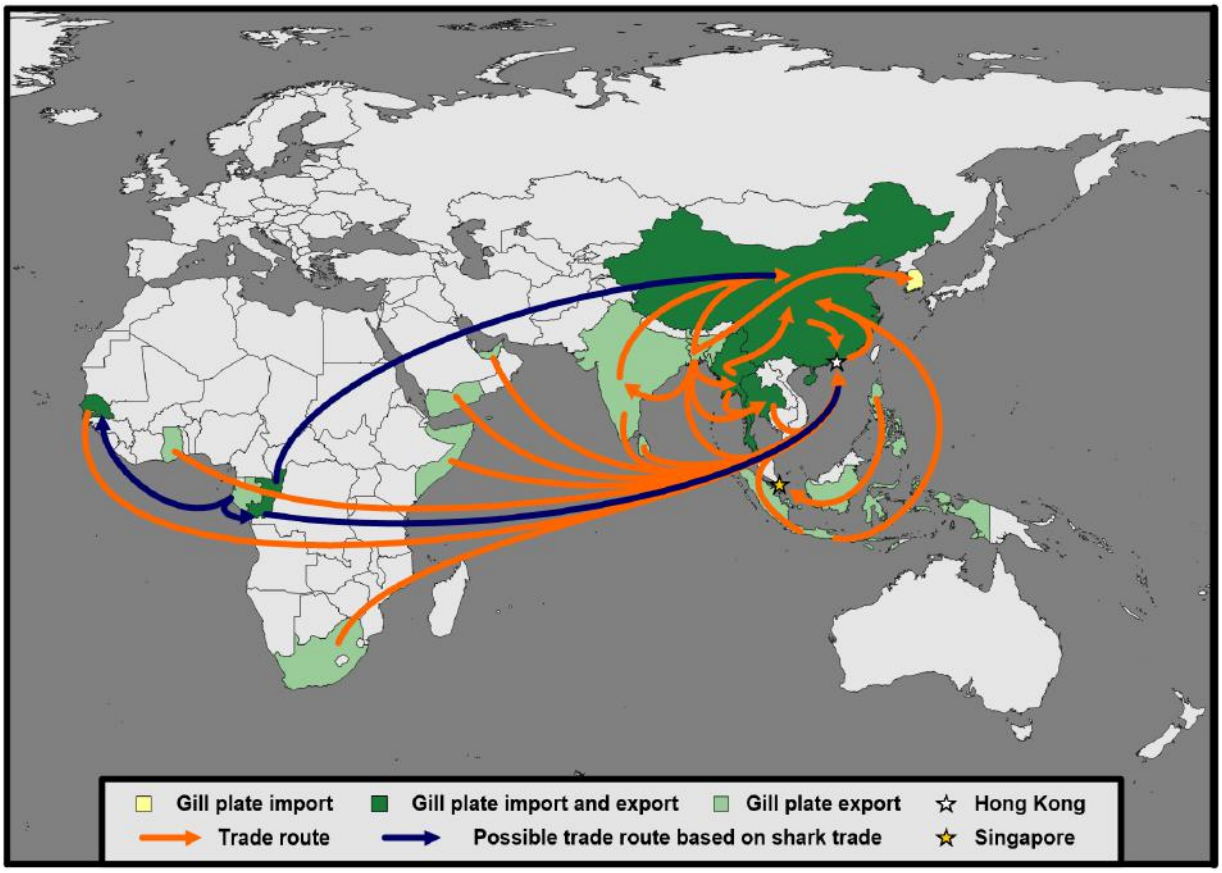


Figure 2: Export and import routes of gill plates. Exporting countries are highlighted in green, importer countries in yellow and exporters and importers countries in dark green. Trade routes are indicated by arrows. Confirmed trades are in orange, while possible routes based on shark products are in blue (from Palacios *et al.* 2024).

Meat Consumption & Trade

Although considered low quality in most regions, **mobulid ray meat is consumed locally in at least 35 countries** (Palacios *et al.* 2024). The meat is cut into strips and sold fresh, or consumed after being dried in the sun for a few days. **International trade in mobulid meat is widespread** (see Fig. 3)**,** although it has been largely overlooked until recently, in part because **no credible reports for it exist in the CITES trade database (2017 – 2023).**

Meat exports from 10 countries:
Bangladesh, Ecuador, India, Madagascar, Mauritania, Myanmar, Oman, Senegal, United Arab Emirates and Yemen.

Five major import hubs:
Mainland China, Myanmar, Thailand, Peru and United Arab Emirates.

- Transportation is most common by land across borders into adjacent countries (e.g., Ecuador to Peru or Myanmar to Thailand).

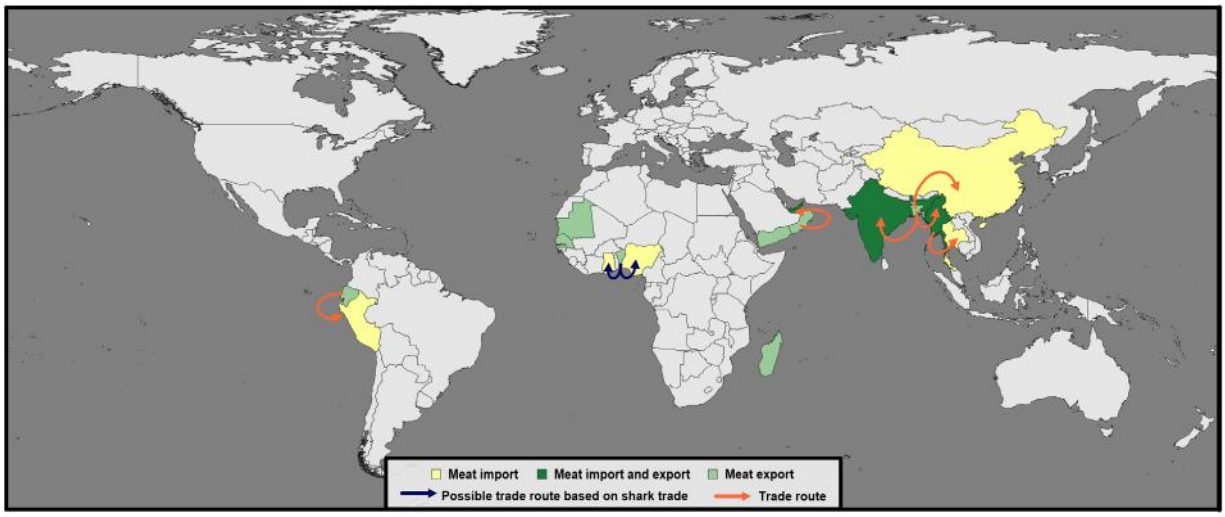


Figure 3: Export and import routes of mobulid meat. Exporting countries are highlighted in light green, importer countries in yellow and exporters and importers countries in dark green. Confirmed trade routes are indicated by orange arrows while possible trade routes based on shark trade are indicated in blue (Palacios *et al.* 2024).

Below: Manta and devil ray meat is cut into strips before being salted and dried in the sun for several days.

Bycatch & Discard

Each year, tens of thousands of manta and devil rays are caught as bycatch in the global hunt for more desirable species. Manta and devil rays need to swim forward to enable oxygen-rich water to flow through their mouth and over their gills. Therefore, being caught in nets mean that they are often dead or dying when released back into the sea and thus need specific handling practices to significantly increase post-release survival. Furthermore, post-release survival rates are highly dependent on the species, handling conditions, and the amount of time spent on deck (Stewart *et al.* 2025). In coastal fisheries, gillnets are by far the largest cause of mortality among manta and devil rays, while purse-seine is the most fatal gear in offshore fishing (Laglbauer *et al.* 2025a).

The Manta Trust has developed gear-specific illustrated safe handling and release guidelines for manta and devil rays that can be used to upgrade t-RFMO retention bans and for dissemination in fishing communities (Stevens *et al.* 2025).

A Munk's Pygmy Devil Ray (*Mobula munkiana*) caught in a gill net in Mexico.

Safe Handling and Release Guidelines: What not to do (Stevens *et al.* 2025).

Vanishing Fast

Unsurprisingly, overfishing is having a huge impact on manta and devil ray populations worldwide. Significant declines have been documented or inferred from sightings, landings, and catch data (Laglbauer *et al.* 2025a). In Laglbauer *et al.*, declines data were compiled following an in-depth analysis of reviewed literature; calculating average landings per survey day/vessel using both published and unpublished data, breaking down decline rates by species, and correcting for fishing effort and seasonality, where possible.

Plotting these declines in time and space reveals their steepness and acceleration in the last decade, post-CITES-listings (see Fig. 4).

- **Declines of 80% and up to 99%** in several countries and locations, across all ocean basins, and **covering all mobulid species.**
- Declines all occurred within **one to two generations.**
- Local **commercial extinction and local extirpation** have occurred in some areas (e.g., Venables *et al.* 2024; Rojas-Perea *et al.* 2025; Chopra *et al.* [In Review]).
- Mean **disc width reduction** (an indicator of overfishing) has also been documented in several areas (e.g., Fernando & Stewart 2021; Laglbauer *et al.* 2025b).
- Declines have accelerated **in the last decade.**

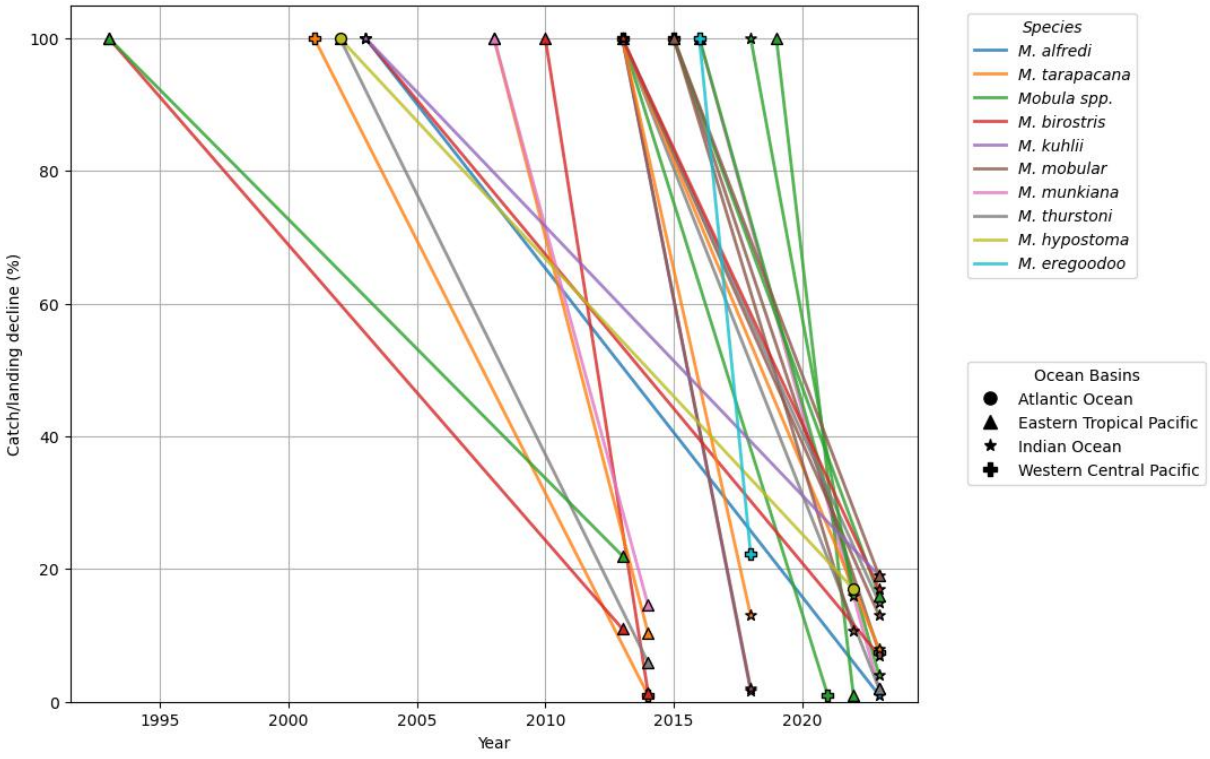


Figure 4: Catch/landing declines of manta and devil rays over time by species and ocean basin (Laglbauer *et al.* 2025a).

A Sicklefin Devil Ray (*Mobula tarapacana*) is offloaded at the dock of a fish market in Sri Lanka where it will be processed into parts; its meat and gill plates sold separately.

Trending Down: Increased Threat Status

The IUCN Red List is the world's most comprehensive and critical indicator of the status of global biodiversity, helping to guide conservation efforts and inform policy decisions. In October 2025, the status of the three oceanic devil rays was reassessed as Critically Endangered (CR); the last category before extinction in the wild. **These oceanic devil rays are the most prevalent in the global catch** of mobulids (Laglbauer *et al.* 2025a). This CR reassessment means that current national, regional and international protections **are failing to halt declines in these species.** This uplisting is a clear signal that stronger, science-based and enforceable conservation measures are urgently needed. All other mobulid species are currently listed as either Endangered or Vulnerable and require urgent Red List reassessment of their threat status as similar trends are occurring (Laglbauer *et al.* 2025a).

The Devil in the Detail

Identification Challenges

Due to their visual similarities, and highly variable patterning and colouration, distinguishing between some manta and devil ray species can be challenging for fishers, enforcement personnel, and researchers. Furthermore, when a mobulid ray dies, the pigmentation contained within the mucus coating dorsally is often rubbed off through handling, and the skin colours and patterning also fade in some species. And most meat found in markets has already been processed; cut and sliced, making species identification very challenging.

Manta and devil ray gill plates are also challenging to identify to the species level. Once extracted and dried for trade, the plates can only be grouped into four types. All types were found in the global trade assessments undertaken to date (O´Malley *et al.* 2017; Palacios *et al.* 2024), and genetic barcoding has proved the presence of pygmy devil ray gill plates in trade (Zeng *et al.* 2016).

A *Field Guide to the Manta and Devil Rays of the World* (Stevens *et al.* 2025) has been published to address these identification challenges. The guide distils decades of knowledge into a format that is accessible, easy to use, and provides a critical tool for ensuring the correct implementation of fisheries and trade regulations and conservation measures; whether examining landings in fisheries or inspecting specimens in trade.

Data Reporting Challenges

Official sources (e.g., FAO, RFMOs, etc.) typically report manta and devil ray catches in aggregate (e.g., total weight in metric tonnes or as generic “manta/devil rays”) rather than by species or number of individuals (Croll *et al.* 2016). While aggregate weight data facilitate broad reporting, they obscure critical information on species composition and size structure of catches. Furthermore, not all manta and devil ray species share the same ecological or life-history characteristics, so treating them as a uniform group in data and management is problematic (Lawson *et al.* 2017). This lack of resolution makes it difficult to estimate

species-specific population trends or assess the impact of fishing on specific size classes and life stages. It also hinders cross-regional comparisons and the development of targeted management strategies tailored to each species' biology.

One fundamental approach to address these data gaps is to establish robust size–weight relationships (SWRs), which quantitatively connect an individual's size (e.g., disc width in rays) to its weight; they enable conversion of aggregated catch weight into estimates of individual biomass, reveal ontogenetic shifts in growth, and inform management measures, such as size limits and nursery-area protection (Mvomo Minko *et al.* 2025).

A recent study by D'Costa *et al.* [In review] compiled the first global dataset of length–weight relationships for all manta and devil ray species, which helped to: (i) examine geographic variability, (ii) standardized conversion methods to translate weight-based catch and trade data (e.g., dried gill plate and meat exports, or total landed biomass) into estimated numbers of individual rays by sex and area; and (iii) provide improved estimates of the total (whole-body) weight corresponding to processed manta and devil parts (e.g., carcasses, fins, gill plates) to facilitate better trade monitoring and enforcement.

Distinguishing between manta and devil ray species in the field is often hard. This *Field Guide to the Manta and Devil Rays of the World* was published in 2025 to address these identification challenges.

An Oceanic Manta Ray (*Mobula birostris*) in the Maldives.

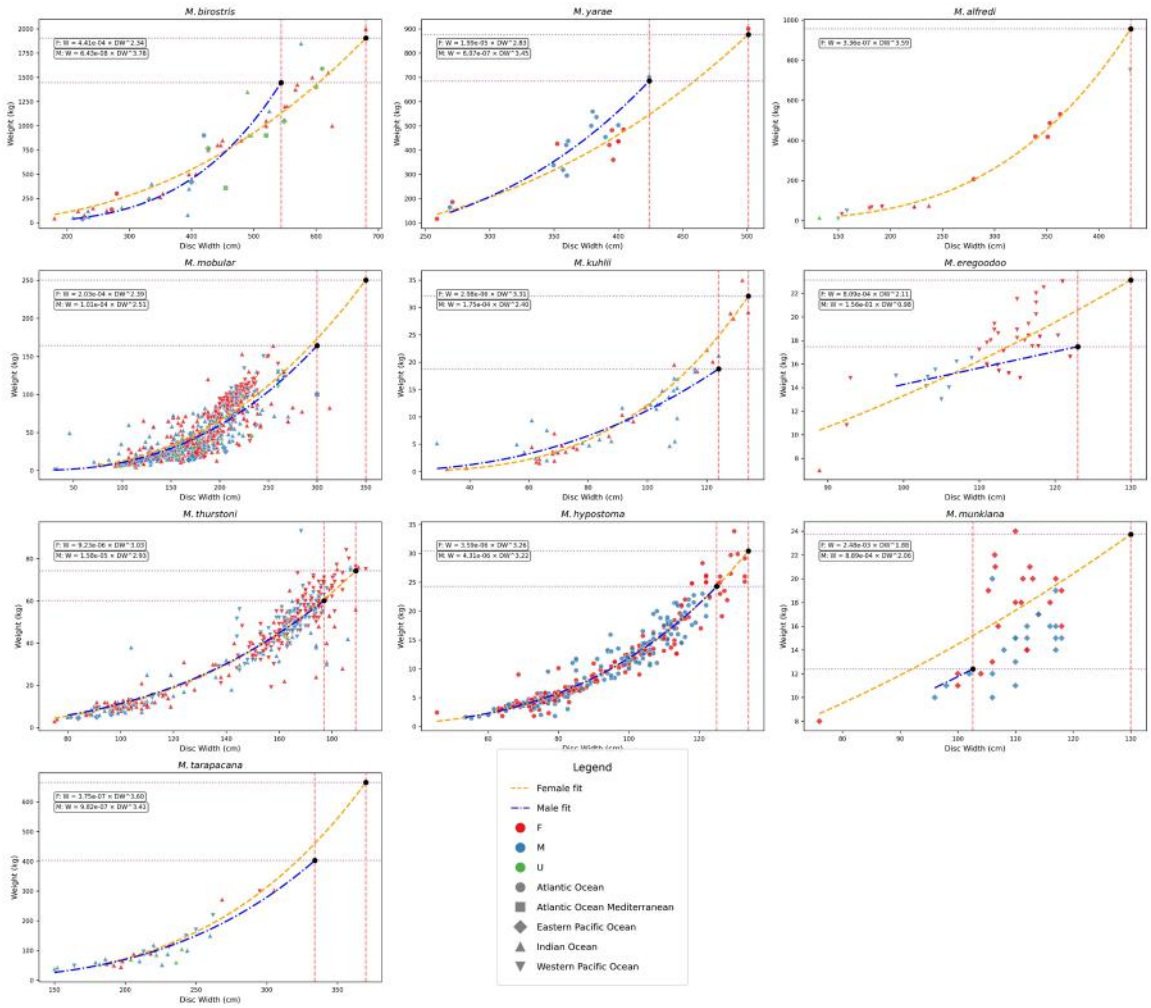


Figure 5: Adjustment curves between standard disc width and weight for representative mobulid species across ocean regions. Points represent observed data; solid lines show the fitted non-linear model for each species and region (from D'Costa *et al.* [In Review]).

A Sicklefin Devil Ray (*Mobula tarapacana*) in the Azores.

Saving Giants: Protective legislation

Regional and national protective legislation for manta and devil rays has improved in recent years, and provides these species with a robust framework for their preservation. However, current ongoing declines prove it is not enough. There is still a much greater need for well-managed protective legislation throughout the ranges of all species globally.

Global Protections

- **Convention on International Trade in Endangered Species (CITES) Appendix II:** Party nations must demonstrate that any trade in manta and devil rays or their derivatives between member states is sustainable and non-detrimental to the survival of the species.
- **Convention on the Conservation of Migratory Species (CMS) Appendix I & II:** Prohibits taking of manta and devil from their natural environment by party nations, with restricted scope for exceptions.

Regional Protections

- **Retention bans in place by all four tRFMOs & EU fishing vessels:** Prohibits retaining on board, trans-shipping, landing, storing, selling, or offering for sale any part or whole carcass of manta or devil rays caught.
- **Bern and Bonn Conventions Annex II** (*M. mobular* in the Mediterranean Sea).
- **SPAW Protocol Annex II** (*M. birostris* in Wider Caribbean Region).

National Protections

- Worldwide, **at least 44 countries (and ten states/territories) have enabled protective legislation** for manta and devil rays to different degrees withing their territorial waters.

Reef Manta Rays (*Mobula alfredi*) are protected in the Maldives, which supports the world's largest population of this vulnerable species.

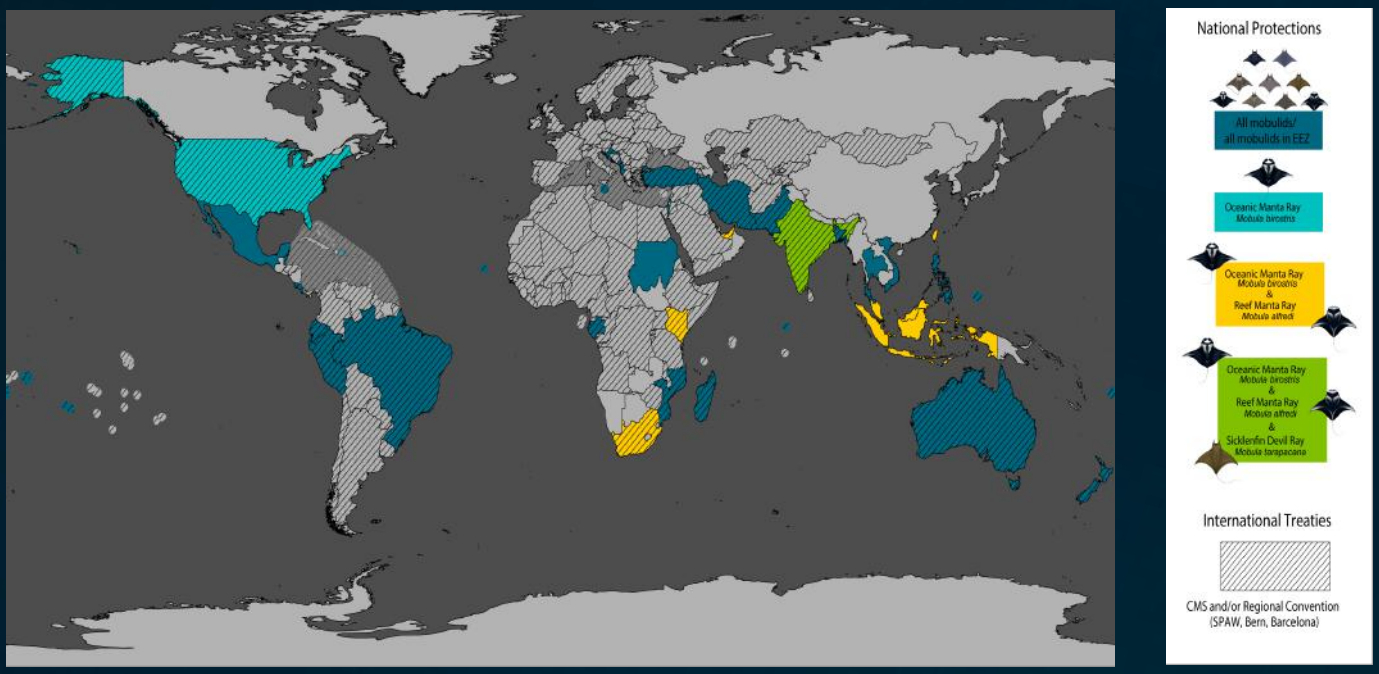


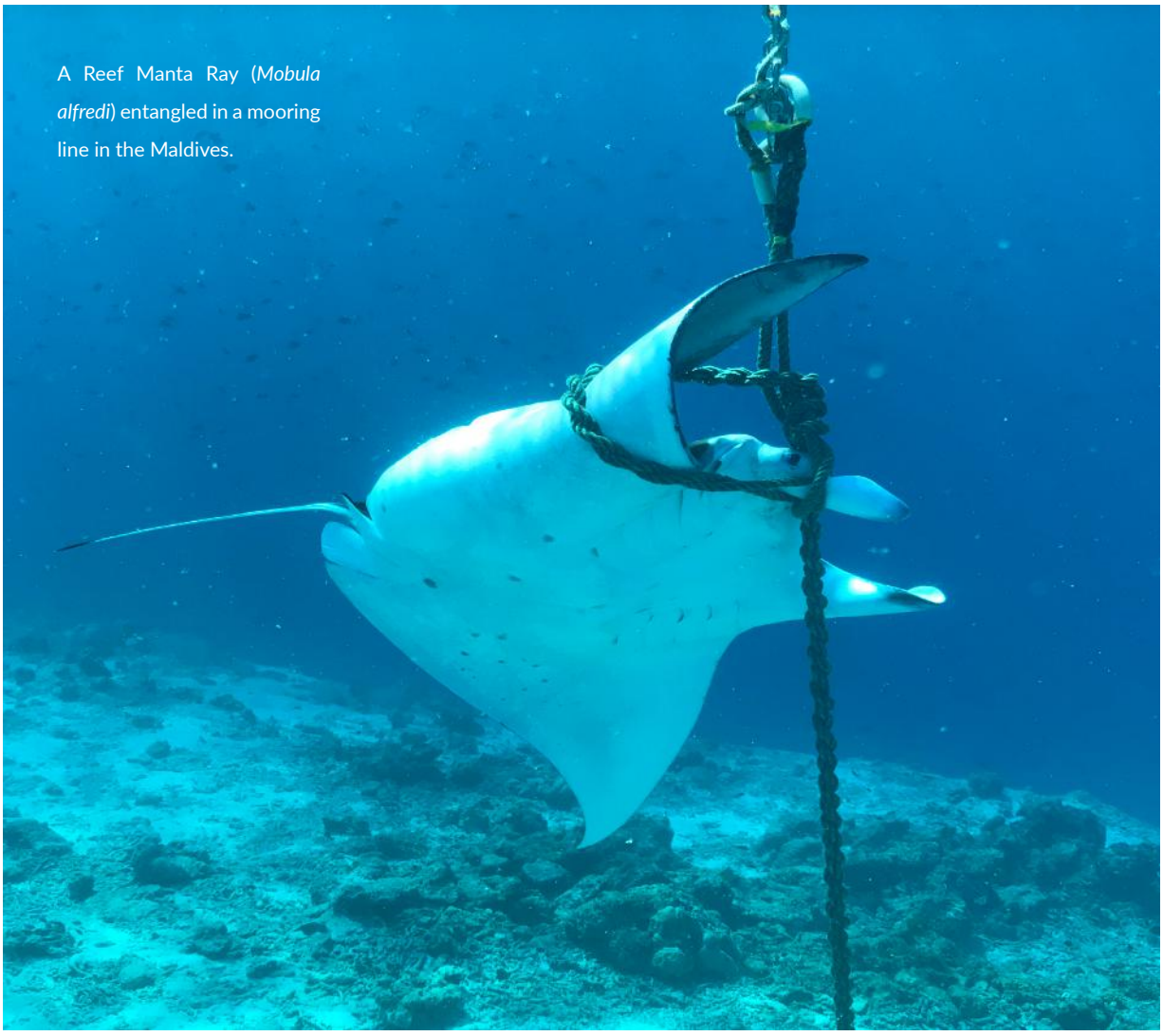
Figure 6: National and international protections for mobulids globally. International agreements to protect mobulids are grouped (diagonal lines), (Stevens *et al.* 2025).

Secondary Threats

Apart from fisheries, unmanaged human (often tourism-related) interactions with manta and devil rays can also lead to negative impacts on local populations, especially as the number of these encounters increase. These interactions pose threats such as entanglement in tourism and operator mooring lines and marine debris, boat strikes, and anthropogenic disturbance.

Entanglement in Mooring Lines

Manta and devil rays are increasingly at risk of entanglement in mooring lines, ropes, and discarded fishing gear (Strike *et al.* 2022). Their large, wing-like fins and curious nature make them particularly vulnerable, often leading to injuries, restricted movement, or even death. To address this problem, the Manta Trust has developed entanglement response and prevention protocols. These include training divers to safely free entangled rays, promoting the use of manta-safe mooring designs, and encouraging proper management of ropes and marine debris.



A Reef Manta Ray (*Mobula alfredi*) entangled in a mooring line in the Maldives.

Boat Strikes

With the rise in tourism and coastal development, boat traffic has surged, leading to a concerning increase in boat strikes on marine animals. Manta and devil rays often swim near the ocean's surface, making them highly vulnerable to collisions with boats. These boat strikes can cause severe injuries, amputations, or even death, and are an increasing threat in busy coastal and tourism areas. High prevalence of boat and propeller injuries have been found in busy locations such as Bora Bora in French Polynesia (Carpentier *et al.* 2019), the Atlantic coast of Florida, USA (Pate & Marshall 2020), throughout the Maldives (Strike *et al.* 2022), or in the Bay of Banderas, Mexico (Domingez-Sanchez *et al.* 2024). To tackle this problem, it's necessary to identify high-risk areas which can be used to inform management measures, such as imposing speed regulations.

Swimming-With-Mantas

Tourism can form part of the solution to combating the issue of global manta fisheries, providing many countries and governments with a strong economic incentive to protect these animals. For example, in the Maldives, 39 million USD is directly spent on diving and snorkelling trips to see manta rays in the wild annually, based on 2021 figures (Moloney *et al.* [In Review]).

Manta rays are very sensitive to disturbance, and if left without proper management, swim-with-tourism activities can lead to harassment (Murray *et al.* 2019). To avoid this, The Manta Trust has developed a Best Practice Code of Conduct for Manta Ray Tourism. These guidelines outline how divers and snorkellers should behave in-water, to both enhance their experience and to ensure their presence does not disturb the manta rays they encounter.

Snorkellers swimming alongside Reef Manta Rays (*Mobula alfredi*) in the Maldives.

A Reef Manta Ray (*Mobula alfredi*) feeding in the Maldives.

How to Save Manta & Devil Rays?

Given the concerning state of the world's manta and devil ray populations, the ongoing threats they face, and the current failure to tackle them, these species need a wide set of urgent management, research, and community-based measures to secure their future. To halt the ongoing steep population declines for these species, all range states must implement protections nationally to prohibit catch and take of manta and devil rays. Additionally, upgrading and enforcing international protections, enhancing scientific research on key data gaps, and involving communities and collaborative management will also be key to any conservation gains.

Reduce target and incidental catch through management measures:

- Uplist manta and devil rays to CITES Appendix I to discourage retention and halt international trade.
- Implement legislation that supports manta and devil ray conservation, especially in high-mortality risk countries, by enforcing retention bans and zero incidental catch retention quotas.
- Improving fisheries and trade enforcement and traceability through capacity building and technology.
- Adopt and disseminate safe handling and release methods to reduce bycatch mortality.
- Transition away from destructive fishing gear.
- Establish inclusive area-based management to tackle manta and devil ray fishing in critical habitats.

Close knowledge gaps in population estimates and trends, fisheries data and bycatch mitigation by:

- Supporting research that improves knowledge on target and incidental manta and devil ray catch.
- Undertake global population estimates and stock assessments for all species.
- Establish long term data collection programs on fisheries data.
- Continuous monitoring of mobulid gill plate and meat trade in key hubs.

Engage communities to drive collaborative management:

- Reduce the demand for manta and devil ray products through education and communication.
- Involve communities in regulatory or legislative changes, such as area-based management.
- Support the development of alternative livelihood programs with communities through collaborative planning and capacity building.
- Promote best practices for manta and devil ray interactions and safeguarding in countries with established dedicated tourism.

Conclusions

If the current rate of manta and devil ray fishing and commercial trade continues, populations will continue to decline rapidly towards extinction in the wild.

- Manta and devil rays are **highly vulnerable** to overexploitation.
- Global catch is **severe and widespread**, threatening species' survival.
- There are **steep and accelerating declines** in populations worldwide.
- There is evidence of **on-going, increasing and adaptive trade** in manta and devil ray products.
- Ongoing fisheries trade is **much higher than the levels reported to official databases** and is unsustainable and/often illegal.

Robust and urgent measures are needed to halt population declines, through legislation, management, research and community-based actions.

References

Carpentier *et al*. Preliminary insights into the population characteristics and distribution of reef (Mobula alfredi) and oceanic (M. birostris) manta rays in French Polynesia. Coral Reefs 38, 1197–1210 (2019). https://doi.org/10.1007/s00338-019-01854-0

Chopra *et al* (In review). Fewer devil rays in the sea: Evidence of declining mobulid populations off India's southeastern coast. Conservation Biology.

Croll *et al* (2016). Vulnerabilities and fisheries impacts: the uncertain future of manta and devil rays. Aquatic Conserv: Mar. Freshw. Ecosyst., 26: 562-575.

D'Costa *et al* [In Review]. A review on the size-weight relationship of manta and devil rays globally. Journal of Applied Ichthyology.

Domínguez-Sánchez *et al* (2024). Oceanic manta rays aggregating near a major population center have far higher injury rates than at an offshore protected area. Endangered Species Research. 55. 10.3354/esr01358.

Fernando D, Stewart JD (2021) High bycatch rates of manta and devil rays in the "small-scale" artisanal fisheries of Sri Lanka. PeerJ 9. https://doi.org/10.7717/PEERJ.11994

Laglbauer *et al*. (2025a). Global manta and devil ray population declines: Closing policy and management gaps to reduce fisheries mortality. Biological Conservation, 313 (2026) 111589. https://doi.org/10.1016/j.biocon.2025.111589

Laglbauer *et al* (2025b) High take of mobulid rays amongst other threatened elasmobranchs in East Java, Indonesia: landing trends and socio-economic context. Environmental Biology of Fishes.

Lawson *et al* (2017). Sympathy for the devil: a conservation strategy for devil and manta rays. PeerJ. 2017 Mar 14;5:e3027.

Moloney *et al* [In Review]. Valuing conservation and natural wealth: The blue economy of manta ray watching in the Maldives. PLOS One.

Murray *et al* (2019). Protecting the million-dollar mantas; creating an evidence-based code of conduct for manta ray tourism interactions. Journal of Ecotourism, 19(2), 132–147. https://doi.org/10.1080/14724049.2019.1659802

Mvomo Minko *et al* (2025). Length–weight relationships of elasmobranchs caught by artisanal fisheries from southern Gabon. Journal of Applied Ichthyology, 41(1), Article e4821258. https://onlinelibrary.wiley.com/doi/10.1155/jai/4821258

O'Malley *et al* (2016). Characterization of the trade in manta and devil ray gill plates in China and South-East Asia through trader surveys, Aquatic Cons.: Mar. and Freshw. Eco., 27:2.

Palacios *et al* (2024). Global assessment of manta and devil ray gill plate and meat trade: conservation implications and opportunities. Environmental Biology of Fishes

Pate, J. & Marshall, A. (2020). Urban manta rays: potential manta ray nursery habitat along a highly developed Florida coastline. Endangered Species Research. 43. 10.3354/esr01054.

Rojas-Perea *et al*. (2025). Fisheries, trade, and conservation of manta and devil rays in Peru. Environ Biol Fish 108, 725–748. https://doi.org/10.1007/s10641-024-01647-7

Stevens *et al* (2025). Field Guide to the Manta and Devil Rays of the World. Wild Nature Press (pp. 1-100)

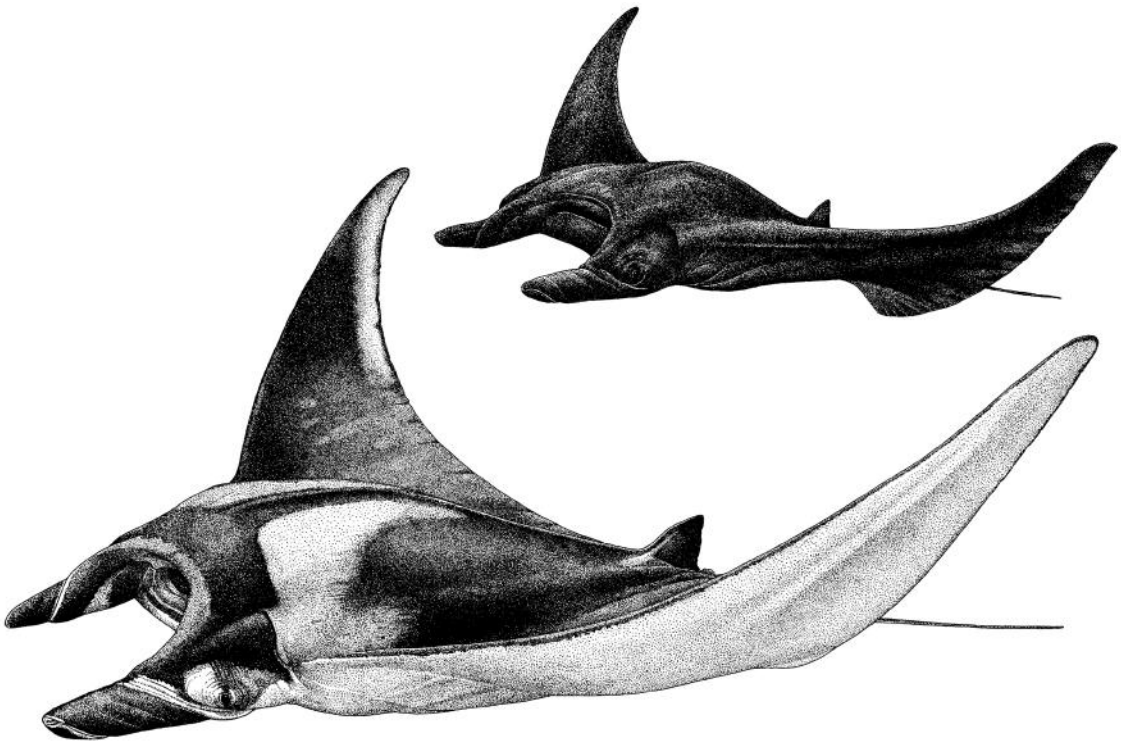
Stewart *et al* (2024). Get them off the deck: Straightforward interventions increase post-release survival rates of manta and devil rays in tuna purse seine fisheries. Biological Conservation, volume 299, 110794.

Strike *et al* (2022). Sublethal Injuries and Physical Abnormalities in Maldives Manta Rays, Mobula alfredi and Mobula birostris. Frontiers in Marine Science, 9, Article 773897. https://doi.org/10.3389/fmars.2022.773897

Venables *et al* (2024). Persistent declines in sightings of manta and devil rays (Mobulidae) at a global hotspot in southern Mozambique. Environmental Biology of Fishes, 1-17.

Zeng *et al* (2016). DNA barcoding of Mobulid Ray Gill Rakers for Implementing CITES on Elasmobranch in China. Sci Rep 6, 37567. https://doi.org/10.1038/srep37567

Over-fished in the 1980's and 90's, the now protected Munk's Pygmy Devil Rays (*Mobula munkiana*) aggregate in large schools in the Sea of Cortez, Mexico to socialise, migrate, and seek protection from predators.



Credits

Illustrations: Marc Dando
Photographs: Manta Trust

The Manta Trust

The Manta Trust is a registered charity in England & Wales (Charity Number 1145387).

Catemwood House
Norwood Lane
Corscombe
Dorset
DT2 0NT
United Kingdom

info@mantatrust.org

www.mantatrust.org