



VISUAL RESOURCES AS TOOLS FOR CONSERVATION AND COMPLIANCE OF RES. 19/03

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Purpose

This paper presents the newly published *Field Guide to the Manta and Devil Rays of the World* as the foundation for the development of additional complementary IOTC-specific visual species identification and best handling and release instructional resources, and recommendations to adapt their contents to the IOTC to help improve data collection for mobulids, to support goals identified by Resolution 19/03.

Discussions (for information and open discussion):

The paper informs meeting members of the mobulid field guide, the management and conservation needs it addresses, and identifies future opportunities to improve the accessibility of recommendations included in Resolution 19/03.

Feedback (to collect input and suggestions)

Feedback on country interest in these resources, preferred formats, languages, and funding recommendations are requested.

Conclusion (to record a concluded position or summary)

The paper seeks to inform on the need for disseminate and develop illustrated resources to improve data collection for mobulids and seeks country feedback on the content, format, and funding of these materials.

Recommendation (to ask the meeting to endorse a recommendation)

The paper seeks endorsement for the developing of recommended resource materials and feedback from members about how to make these resources effective and useful.

Decisions (to request formal approval of actions)

The paper seeks cooperation and support from countries for the development of illustrated resources for mobulid identification and best handling and release practices.

Abstract

Manta and devil rays (mobulids) face ongoing fisheries-related mortality across the Indian Ocean, with the IOTC area accounting for 72% of the estimated global catch of ~265,000 individuals annually. Recent research confirms declines exceeding 80%-99% for studies on populations in Pakistan, Sri Lanka, Mozambique, Indonesia, India and Kenya. In addition, all three oceanic devil ray species to Critically Endangered in 2025 (IUCN). The 30th IOTC Annual Meeting's update to Resolution 19/03, incorporating updated mobulid bycatch best practices (e.g., the mobulid grid) into safe handling and release guidelines now represents a comprehensive standard among tuna Regional Fisheries Management Organizations (tRFMOs). On the water, however, its effectiveness remains constrained by two persistent barriers: inadequate species-level catch reporting, and poor species identification stemming from visual similarity between species, post-mortem color changes, and inconsistent use of outdated taxonomy.

In direct response to these challenges, a coalition of scientists and practitioners developed the *Field Guide to the Manta and Devil Rays of the World*, a global, field-ready resource available in four languages (English, Spanish, French and Portuguese), distilling over two decades of taxonomic, ecological and handling knowledge into more than 200 images, maps and illustrations, including the first-ever documented reference for post-mortem color change and a new set of illustrated safe handling and release guidelines.

Building on this resource, this paper recommends that IOTC supports collaborative work to create vessel-ready visual tools, e.g., region-tailored live/dead specimen ID plates (e.g., visual reference cards/sheets for each species), an illustrated version of the adopted safe handling and release guidelines, and visual data collection aids designed to be accessible to fishers and translated into formats and languages to be defined jointly with the IOTC Secretariat and CPCs. Immediate next steps are to confirm these specifications and secure funding for development.

Fisheries-related mortality and declines in IOTC area

Manta and devil rays (collectively known as mobulids) are distributed globally, primarily in tropical and subtropical waters. *Mobula birostris*, *M. tarapacana*, *M. mobular*, and *M. thurstoni* are distributed circumglobally in the Atlantic, Pacific, and Indian Oceans; seasonally venturing into the temperate regions of these oceans (Stevens et al. 2025). *Mobula alfredi*, *M. eregoodoo*, and *M. kuhlii* are restricted to the Indo-West Pacific (Notarbartolo di Sciara et al. 2020; Stevens et al. 2025).

Within these broad ranges, populations are often sparsely distributed and highly fragmented, likely due to their resource and habitat needs, in addition to over-exploitation (Stewart et al. 2018). Manta and devil rays are highly biologically vulnerable due to their conservative life history traits, such as slow growth and late maturation, and with some the lowest fecundity rates of all elasmobranch species (Dulvy et al. 2014). A comprehensive review of manta and devil ray catch and landings (Laglbauer et al. 2025a) showed that manta and devil rays are targeted and caught as bycatch in at least 92 countries globally. This study estimated the global manta and devil ray catch to be ~265,000 individuals per year, being either targeted or retained through bycatch – a number which is incompatible with a sustainable future for these slow-growing, late-maturing species, with such low fecundity.

Laglbauer et al. also found that small-vessel fisheries (<15 m in length) are responsible for 85% of the global catch and 87% of the global mortality. Manta and devil ray bycatch from the global tuna purse seine fleet was previously estimated at 13,000 individuals annually (Hall & Roman 2013; Croll et al. 2016). However, considering all large-vessel (>15 m) fleets, Laglbauer et al. (2025a) found that 37 flag states and two RFMOs for which publicly available data could not be attributed to specific flag states (IATTC and WCPFC) catch an estimated 39,470 rays per year, which results in mortality (at-haul back) of 34,387 mobulid rays per year. These are much higher estimates than the previously known.

Of outmost regional relevance for IOTC, is that 72% of global catches are from the Indian Ocean (Laglbauer et al. 2025a). Fisheries-related mortality has led to significant declines in manta and devil ray populations worldwide, which have been documented or inferred from sightings, landings, and catch data covering all species. To assess the order of magnitude of these declines, Laglbauer et al. (2025a) performed a detailed analysis, involving in-depth literature review, calculating average landings per survey day/vessel, breaking down decline rates by species and correcting for fishing effort and seasonality where possible.

This new data compilation shows declines of more than 80% in all manta and devil ray species, across all ocean basins, and of up to 99% in some cases, including steep declines in the IOTC area - namely in Pakistan, Sri Lanka, Mozambique, Indonesia, India and Kenya (Moazzam, 2018; Fernando & Stewart 2021; Venables et al. 2024; Laglbauer et al. 2025b; Chopra et al. 2026; FAO 2024; IOTC 2025 a, b).

Changes in population structure include local commercial extinction and local extirpation in certain areas of the Indian Ocean (Venables et al. 2024) and proved mean disc-width reduction in some populations, indicating evidence of overfishing (Fernando and Stewart 2021; Laglbauer et al. 2025b). These declines likely occurred over the last 30 years, equivalent to one to two generations for mobulids, despite national, regional and international protections (Laglbauer et al. 2025a; Chopra et al. 2026).

In the last decade, all manta and devil ray species have been included in the threatened categories of the IUCN Red List and keep moving up the threat assessment status. The three oceanic devil rays (*M. tarapacana*, *M. mobular*, and *M. thurstoni*) were reassessed in 2025, and have all been updated to “Critically Endangered”, the last category before “Extinct in the Wild”.

Bycatch mitigation research updates

In the 30th Annual Meeting of the IOTC, Resolution 19/03 was discussed to update safe handling and release guidelines, as in recommended by recent mobulid bycatch mitigation research (Cronin et al. 2026; Stewart et al. 2024).

In tuna purse seine fisheries, Stewart et al. 2024 identified a significantly negative effect of time spent on deck on mobulid mortality. This study also identified a 3-minute critical time limit between being brought on deck and release within which likelihood of survival is highest for mobulids.

Also in tuna purse seine fisheries, Cronin et al. (2026) examined bycatch of manta and devil rays, where handling and release practices currently vary from vessel to vessel. This study evaluated a fisher-designed sorting grid (referred to in this paper as the “mobulid grid”) as a practical intervention for releasing mobulids caught incidentally, suggesting that it can facilitate rapid and effective release even for very large individuals. The authors conclude that the adoption of mobulid sorting grids among other best handling and release practices by tuna regional fisheries management organizations would improve global post-release survival rates turning a bottom-up, fisher-developed solution into binding, fleet-wide policy.

While the safe handling and release guidelines adopted at the 30th Annual Meeting make the IOTC safe handling and release guidelines represent substantial progress, these guidelines should be complemented by visual illustrations to improve effectiveness. Another challenge for mobulids is species-level reporting. For mobulids, only Mauritius and Kenya currently report at this level (Laglbauer et al. 2025a) within the IOTC area. One barrier to high-quality data reporting is poor species ID. The field guide described below can help facilitate accurate species-level ID.

Species misidentification as a challenge for compliance

The lack of species-specific size and weight data for mobulid rays presents a significant challenge for their conservation and fisheries management. Most datasets, including those managed by Regional Fisheries Management Organizations (RFMOs), the Food and Agriculture Organization (FAO), and the Sea Around Us Project (SAUP), report mobulid catches in tons rather than individual counts, and rarely at the species level.

Collecting accurate data on mobulids can be challenging due to considerable visual similarities across the species, highly variable patterning and colouration; post-mortem colour changes, and the use of outdated taxonomy not consistent with the most recent literature. To help fill in critical knowledge gaps to support conservation work, there is need to improve the quality and quantity of data collection for these species.

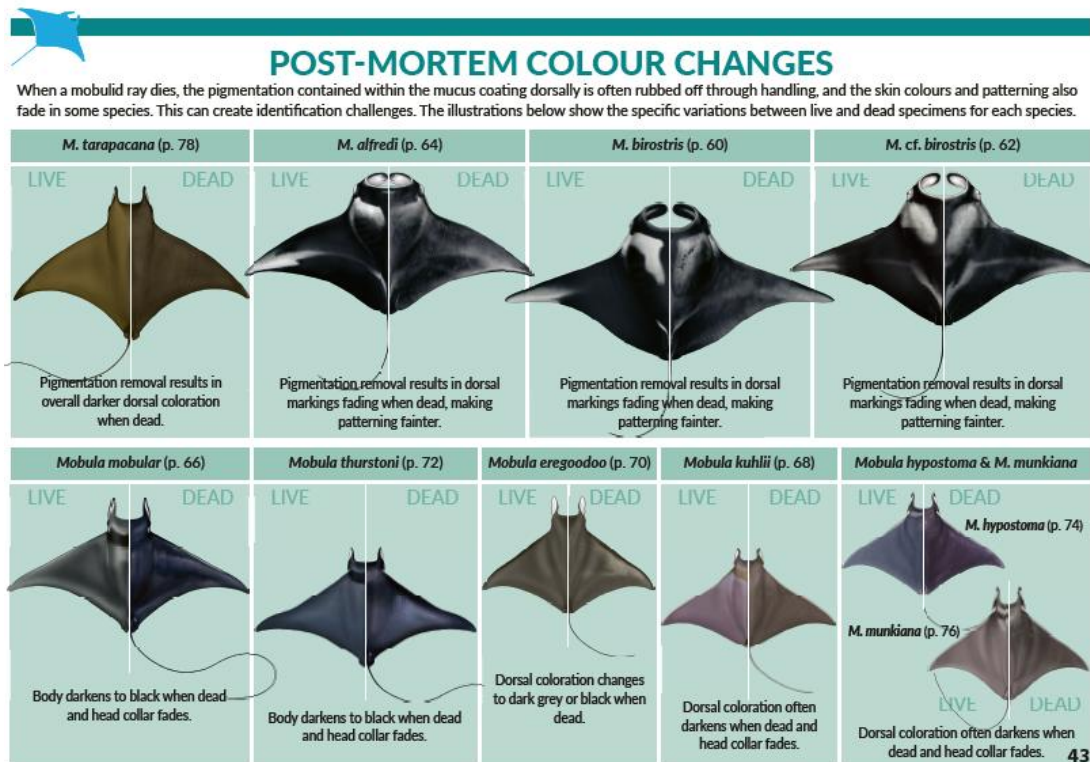


English version cover of the Field guide to the Manta and Devil Rays of the World

The Field Guide to the Manta and Devil Rays of the World

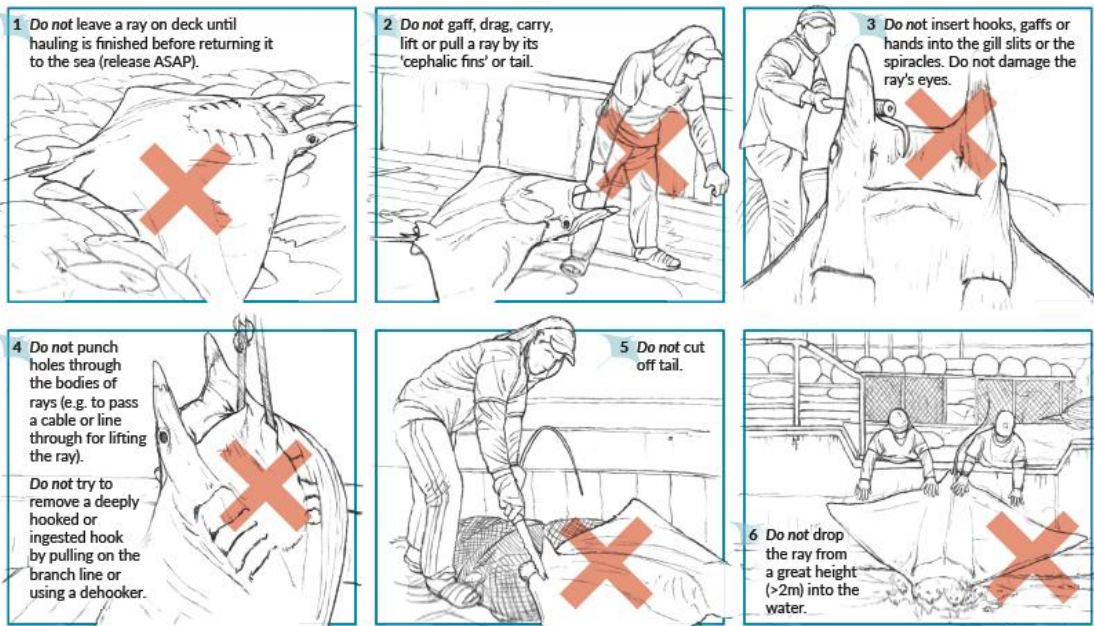
The set of field guide – [Field Guide to the Manta and Devil Rays of the World](#) - arose from the necessity to overcome ID challenges in a format that would be accessible, practical and visually appealing. Hence, it contains more than 200 images, maps and illustrations.

The guide is aimed for field use, therefore it's made with durable thick paper and its ring-bound so users can easily flick through, and available in four languages (English, Spanish, French and Portuguese). Soon, it will also be available in E-PDF format.



Examples of visual tools inside the field guide: Post-mortem color changes plates (left);

What not to do



Examples of visual tools inside the field guide: "Common what not to do's" for the new safe handling and release guidelines.

Recommendations on future work under IOTC

We recommend the development of visual tools such as posters or brochures that help to improve compliance of species-level reporting and safe handling and release protocols, ensuring effective implementation.

These would feature:

- Species identification reference guides for live and dead specimens tailored to the species distributed in the IOTC convention area
- Illustrated safe handling and release guidelines, based on the adopted IOTC guidelines and the Manta Trust illustrated field guide
- Visual recommendations for data collection

These resources would be developed by the Manta Trust and translated into the most relevant formats and languages, as proposed by the IOTC Secretariat/CPCs.

Next steps would be to seek clarification on preferred formats and languages, and recommendations to secure funding to support the proposed work.



The field guide being used in a mobulid ID workshop in Chagos by the Chagos Manta Ray Project @Leila Scheltma/Manta Trust

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