Endangered Species Act (ESA)
Draft Recovery Implementation Strategy
for
Giant Manta Ray (*Mobula birostris*)

October 2024
Version 1

DISCLAIMER

Recovery implementation strategies are flexible, operational documents focused on how, when and with whom recovery actions will be implemented. Recovery implementation strategies and the activities contained therein do not necessarily represent the views, official positions, or approval of any individuals or other agencies involved in the plan or strategy formulation. Recovery implementation strategies are guidance and planning documents only. Identification of an activity to be implemented by any public or private party does not create a legal obligation beyond existing legal requirements. Nothing in this Recovery Implementation Strategy should be construed as a commitment or requirement that any federal agency obligate or pay funds in any single fiscal year in excess of appropriations made by Congress for that fiscal year in contravention of the Anti-Deficiency Act, 31 U.S.C. § 1341, or any other law or regulation. Recovery implementation strategies are subject to modification as dictated by new findings, changes in species' status, and the completion of recovery actions and activities.

LITERATURE CITATION AND AVAILABILITY

National Marine Fisheries Service. 2024. Endangered Species Act (ESA) Draft Recovery Implementation Strategy for Giant Manta Ray (*Mobula birostris*). October 2024, Version 1. NOAA Fisheries, Office of Protected Resources, Silver Spring, MD. 20901. 56 pages.

Download a digital copy of this Draft Recovery Implementation Strategy from the Conservation and Management tab of our NOAA Fisheries giant manta ray profile web site, specifically at https://www.fisheries.noaa.gov/species/giant-manta-ray/conservation-management.

Table of Contents

List of Acronyms

CITES – Convention on International Trade in Endangered Species of Wild Fauna and Flora
CKMR – Close-kin mark-recapture
CMS – Convention on Migratory Species
FAO – Food and Agriculture Organization (of the United Nations)
FY – Fiscal Year
FWS – Fish and Wildlife Service
IATTC – Inter-American Tropical Tuna Commission
ICCAT – International Convention for the Conservation of Atlantic Tunas
IOTC – Indian Ocean Tuna Commission
ISSF – International Seafood Sustainability Foundation
IUCN – International Union for the Conservation of Nature
IUU – Illegal, unreported, and unregulated fishing
NGO – Non-governmental Organization
NOAA – National Oceanic and Atmospheric Administration
NMFS – National Marine Fisheries Service
OLE – Office of Law Enforcement (within NMFS)
RFMO – Regional Fishery Management Organization
SPAW – Specially Protected Areas and Wildlife
SRFC – Subregional Fisheries Commission
WCPFC – Western and Central Pacific Fisheries Commission
WECAFC – Western Central Atlantic Fisheries Commission
WPFMC – Western Pacific Fisheries Management Council

I. Recovery Implementation Strategy

This Recovery Implementation Strategy is one part of a three-part format in which recovery planning components for the giant manta ray are divided into three separate documents. The first document, the Recovery Status Review (NMFS 2024a), provides detailed information on the giant manta ray's biology, ecology, status and threats, and conservation efforts to date, which have typically been included in the background section of a species' recovery plan.

The second document, the Recovery Plan (NMFS 2024b), focuses on the statutory components of a recovery plan, as required under the Endangered Species Act (ESA), to the maximum extent practicable: (1) a description of site-specific management actions necessary for the conservation and survival of the species (hereafter referred to as recovery actions); (2) objective, measurable criteria that, when met, will allow the species to be removed from the endangered and threatened species list (hereafter referred to as recovery criteria); and (3) estimates of the time and cost required to achieve the plan's goals. Site-specific recovery actions in the Recovery Plan are described at a high level and are strategic in nature. Substantial modifications to the Recovery Plan, such as changes to any of the three statutory components of the Recovery Plan, require a revision of the recovery plan with public notice and the opportunity for public comment.

The third document, this Recovery Implementation Strategy, is a flexible, operational document separate from the Recovery Plan that identifies specific, prioritized activities necessary to fully implement recovery actions in the Recovery Plan, while affording us the ability to modify these activities efficiently to reflect changes in the information available as well as progress towards recovery. This Recovery Implementation Strategy is intended to assist NOAA Fisheries and other stakeholders in planning and implementing activities to carry out the recovery actions in the Recovery Plan. The stepped-down recovery activities identified here in this Recovery Implementation Strategy may be revised as needed during the recovery process, whenever experience and information gained call for a change in tactics, therefore maximizing flexibility of recovery implementation.

All documents used to inform the recovery of the giant manta ray, including the Recovery Status Review, the Recovery Plan, and the Recovery Implementation Strategy, are available on the Conservation and Management tab of the NOAA Fisheries giant manta ray species profile website, specifically at https://www.fisheries.noaa.gov/species/giant-manta-ray#conservation-management.

Recovery Goal and Objectives

The ultimate recovery goal is to remove (i.e., delist) the giant manta ray from the List of Endangered and Threatened Wildlife under the ESA (50 CFR 223.102). This will be accomplished by: 1) ensuring the giant manta ray maintains resiliency and geographic representation, and is a functional component of the ecosystem, by increasing overall abundance to achieve viable populations in all ocean basins; 2) increasing giant manta ray resiliency by managing or eliminating significant anthropogenic threats; and 3) ensuring the continued viability of the giant manta ray through development and effective implementation of regulatory mechanisms for the long-term protection of the species.

Recovery Criteria

Demographic Criterion

1. The annual rate of population change is found to be increasing at a rate of a minimum of 2-4% in the Indian Ocean, Western Pacific Ocean Subregion and Eastern Pacific Subregion, and is stable or increasing at a rate of a minimum of 1-2% in at least one Atlantic Ocean Subregion, over 40 years. These subregions and regions represent all ocean basins and include the significant portion of the giant manta ray's range. This criterion can be determined by using the rate of population growth from annual count data or an index of relative abundance.

Threats-based Criteria

2a. Fcurrent (i.e., the current level of total fishing mortality (at-vessel + post-release mortality)) < Flimit (i.e., the fishing mortality rate that corresponds to the maximum level of mortality that can occur that may drive the population to low levels in the long-term) over a period of 2 generations (~40 years) for each subregion/region (in the Demographic Recovery Criterion).

2b. Based on population viability analysis (which focuses on the number of females), theoretical levels of fishing mortality will not exceed 1% of the current population size for each subregion/region (in the Demographic Recovery Criterion).

3. All nations identified by the respective RFMOs, their compliance committees, the Food and Agricultural Organization of the United Nations [FAO], and/or CITES as having significant catch, bycatch, and/or trade of giant manta rays have acceded to international and multilateral agreements and enacted national legislation or equivalent regulatory measures to implement management measures specified under the agreements.

4. Measures prohibiting retention of any part or whole carcass of giant manta rays are maintained by the IOTC, WCPFC, and IATTC RFMOs, and Parties are implementing these measures adequately as measured by landings data and country reports to RFMOs as well as at-sea compliance monitoring and observer programs. This can be verified by each of the compliance committees in the respective RFMOs.

5. Within an individual country's EEZ located within the Indian Ocean Region, Eastern Pacific Subregion, and Western Pacific Ocean Subregion that are not subject to RFMO retention prohibitions and are known to have fisheries that catch giant manta rays, laws are developed and/or maintained, implemented, and sufficiently enforced to prohibit retention of any part of the species when caught as bycatch and to prohibit trade in manta ray gill plates.

6. The number of giant manta ray gill plates in international trade is at or near zero, on average, over 20 years (one generation), demonstrating that the trade has been essentially eliminated.

Recovery Actions Narrative and Stepped-down Activities

Population Dynamics

1. **Improve knowledge and understanding of giant manta ray population status, abundance trends, and genetic structure.**
    - 1.1. Conduct population assessments regularly (ideally every 5 years) in all ocean basins, but particularly the Indian Ocean, Western Pacific Subregion, and the Eastern Pacific Subregion.
    - 1.2. Develop and conduct scientific surveys to improve relative abundance estimates, ideally every 1–2 years depending on survey methodology.
    - 1.3. Increase and improve genetic sampling in all ocean basins to provide a better understanding of population structure.
        - 1.3.1. Continue and enhance cooperative research programs between scientists and fishermen to increase genetic sampling of giant manta rays.
        - 1.3.2. Enhance, as needed, standardized genetic collection protocols for all ocean basins to improve genetic sampling.
    - 1.4. Determine census and effective population sizes for each Subregion/Region using genetics research (ideally every 5 years).

1.5. Utilize new emerging techniques, such as close-kin mark-recapture (CKMR), to estimate population size as a form of validation of the estimates derived through population assessments.

2. **Improve knowledge and understanding of giant manta ray distribution, movement, and habitat use.**
   2.1. Develop and enhance cooperative research programs between scientists and fishermen to increase tagging effort of giant manta rays.
   2.2. Continue and expand and/or develop ecosystem-based/habitat-predictive modeling efforts to improve understanding of environmental, oceanographic, and other factors influencing areas of high use/occurrences of giant manta rays and identify important habitat areas for different life stages.
   2.3. Identify additional locations to tag giant manta rays to further understand movement patterns and connectivity and expand these studies to places that have not already been heavily studied to date.

3. **Improve knowledge and understanding of the demographics and life history of giant manta rays.**
   3.1. Increase and improve data collection and biological sampling of giant manta rays in all Regions, including but not limited to: fishery observer programs (domestic and international), scientific surveys, and landings data.
   3.2. Determine and/or update life history information (e.g., age, growth, reproduction) using accepted or novel techniques.

Fisheries Interactions

4. **Minimize and ultimately eliminate targeted fisheries for giant manta rays in foreign fisheries through enhanced coordination and collaboration with relevant organizations to support national and regional development of policies, management plans, and capacity to make giant manta ray fishing commercially unviable and domestically less favorable relative to sustainable species.**
   4.1. Encourage and assist countries with targeted manta ray fisheries, particularly in the Indian Ocean, in the development of policies and management plans to prohibit targeting fishing.
      4.1.1. Encourage countries to implement and/or enforce regulations for the conservation of the giant manta ray.
      4.1.2. Coordinate and collaborate with relevant organizations to monitor and evaluate the effectiveness of enforcement.

4.2. Coordinate and collaborate with relevant organizations, governments, and communities to develop alternative income and food resources in communities that are dependent on giant manta ray fisheries.
    4.2.1. Support development projects (e.g., through grants or technical assistance) to generate alternative sources of protein for the communities.
    4.2.2. Support development projects (e.g., through grants or technical assistance), such as manta ray tourism locales, to generate alternative sources of income for the communities.
    4.2.3. Support or directly provide outreach and education on giant manta ray conservation to encourage and motivate communities to choose alternatives.

5. **Minimize fisheries bycatch and mortality of giant manta rays by determining and addressing the frequency of capture and severity of fishing interactions in artisanal/small-scale and commercial fisheries globally.**
    5.1. Determine and reduce the frequency of giant manta ray interactions in artisanal/small-scale and commercial fisheries, taking into account potential impacts to other protected species (e.g, time-area closures and shifting of fishing effort on other species).
        5.1.1. Conduct research to determine factors (e.g., environmental conditions, fishing tactics) affecting frequency of giant manta ray interactions in artisanal/small-scale fisheries and commercial purse seine, gillnet, trawl, and longline fisheries.
        5.1.2. Evaluate the potential utility and efficacy of time-area closures and/or protected areas in locations shown to have higher occurrences of giant manta rays and high fishing efforts (i.e., overlap between distribution and fishing activity) in order to reduce interactions with the species in artisanal/small-scale and commercial fisheries, and if deemed effective, develop regulations and encourage governments to implement.
        5.1.3. Investigate hotspots for ghost fishing (i.e., areas where giant manta rays are entangled/captured in derelict fishing gear) and impacts on giant manta rays to define appropriate mitigation methods.
        5.1.4. Based on results of above research, develop and implement a strategy to reduce fishery interactions with giant manta rays.
    5.2. Reduce mortality associated with capture, handling, and release of giant manta rays in artisanal/small-scale and commercial fishing gear, specifically gillnets, purse seines, longlines, and trawls, taking into account potential impacts to other protected species.

5.2.1. Continue to evaluate factors (e.g., soak time, gear use, handling) affecting at-vessel and post-release mortality of giant manta rays in commercial fisheries.

5.2.2. Based on results of the above research, implement best practices for increasing giant manta ray survivorship in domestic and international commercial fisheries.

5.2.3. Continue to support partners evaluating factors (e.g., soak time, gear use, handling) affecting at-vessel and post-release mortality of giant manta rays in artisanal/small-scale fisheries.

5.2.4. Based on results of above research, provide best practices for increasing giant manta ray survivorship in artisanal/small-scale fisheries.

5.3. Continue to support and develop existing domestic education and training programs for fishermen to enhance safe handling, release, and data collection, and expand internationally, particularly to artisanal/small-scale and commercial fishermen operating in the Indian Ocean, Western Pacific Subregion, and the Eastern Pacific Subregion.

6. **Minimize fisheries bycatch and mortality of giant manta rays in international fisheries through enhanced international coordination and collaboration with relevant international organizations, such as RFMOs.**

6.1. Develop international capacity building programs and conduct regional training workshops with stakeholders in priority areas related to giant manta ray safe handling and release, species ID, and data collection protocols to address bycatch issues related to giant manta rays.

6.2. Coordinate through RFMOs to enhance implementation, compliance, and effectiveness of existing conservation and management measures, and identify any new protective measures that may be needed for giant manta rays to reduce fishing impacts to the species.

6.2.1. Consolidate the latest information on countries known to be catching and/or trading giant manta rays to increase knowledge and understanding of international fisheries impacts to giant manta rays and compliance levels with existing regulations.

6.2.2. Encourage and assist Parties to RFMOs to develop, implement, and enforce domestic fishing regulations to minimize giant manta ray bycatch in artisanal/small-scale and commercial fisheries, and to comply with existing RFMO conservation measures related to giant manta rays, particularly retention prohibitions.

6.2.3. Encourage and assist Parties to comply with minimum observer coverage requirements established by relevant RFMOs, and work

towards increasing observer coverage, particularly with the Indian Ocean Tuna Commission (IOTC), through at-sea observers and/or electronic monitoring.

6.2.4. Encourage RFMOs to require reporting of giant manta ray catches and discards, and for Parties to increase reporting of giant manta ray catch and disposition to improve data quality and quantify the impact of fishing on the species.

6.2.5. Work bilaterally with countries that have known illegal trade of giant manta rays to assist them in combating illegal trade.

Indian Ocean Region

6.2.6. Increase U.S. engagement with IOTC by participating as an observer at relevant meetings related to giant manta rays, fisheries, and bycatch issues.

6.2.7. Encourage the IOTC Secretariat and Members to prioritize giant manta rays as a conservation issue and advocate for an assessment of the Indian Ocean stock status.

6.2.8. Encourage the IOTC Secretariat and Members to prohibit subsistence fisheries from targeting giant manta rays.

6.2.9. Encourage the IOTC Secretariat and Members to monitor and ensure the compliance of Resolution 19/03, particularly pertaining to artisanal and subsistence fisheries and the prohibition to sell or offer for sale any part or whole carcass of mobulid rays.

6.2.10. Conduct regional workshops with pertinent stakeholders in priority areas (e.g., India, Sri Lanka, Mozambique, Thailand) about potential ways to address bycatch of giant manta rays.

6.2.11. Encourage and assist (when possible) governments to develop protected areas in manta ray hotspots (as they become known) with adequate enforcement to ensure a decrease in the catch of manta rays.

6.2.12. Encourage and assist foreign nations with existing manta ray sanctuaries (e.g., Maldives) to enforce regulations for the conservation of giant manta rays.

Western Pacific Subregion

6.2.13. Continue U.S. participation and engagement in Western and Central Pacific Fisheries Commission (WCPFC) on giant manta ray issues.

6.2.14. Analyze data to determine if giant manta rays are being caught in foreign EEZs outside the purview of WCPFC as there is little or no observer data from those areas.

6.2.15. Encourage the WCPFC Secretariat and Members to prioritize giant manta rays as a conservation issue and advocate for an assessment of the western and central Pacific stock status

6.2.16. Encourage the WCPFC Secretariat and Members to monitor and ensure the compliance of Conservation and Management Measure 2019-05, particularly the prohibition to sell or barter any part or whole carcass of mobulid rays when caught by purse seine vessels.

6.2.17. Conduct regional workshops with pertinent stakeholders in priority areas (e.g., Philippines, Papua New Guinea, Indonesia, Malaysia) about potential ways to minimize bycatch of giant manta rays.

6.2.18. Encourage and assist (when possible) governments to develop protected areas in manta ray hotspots (as they become known) with adequate enforcement to ensure a decrease in the catch of manta rays.

6.2.19. Encourage and assist foreign nations with existing manta ray sanctuaries (e.g., Indonesia) to enforce regulations for the conservation of giant manta rays.

Eastern Pacific Subregion

6.2.20. Continue U.S. participation and engagement in the Inter-American Tropical Tuna Commission (IATTC) on giant manta ray issues.

6.2.21. Identify and prioritize fisheries in coastal Latin America (i.e., those that are not subject to IATTC resolutions) for engagement, and conduct regional workshops with regard to bycatch reduction of giant manta rays.

6.2.22. Encourage the IATTC Secretariat and Members to prioritize the giant manta ray as a conservation issue and advocate for an assessment of the eastern Pacific stock status.

6.2.23. Encourage the IATTC Secretariat and Members to prohibit small-scale/artisanal fisheries from targeting giant manta rays for domestic consumption.

6.2.24. Conduct regional workshops with pertinent stakeholders in priority areas (e.g., Peru, Ecuador, Mexico) about potential ways to minimize bycatch of giant manta rays.

6.2.25. Encourage and assist foreign nations with existing manta ray sanctuaries (e.g., Galapagos Islands, Colombia, and Costa Rica) to enforce regulations for the conservation of giant manta rays.

Atlantic Ocean Region

6.2.26. Conduct regional workshops with pertinent high-level government officials in priority areas (e.g., Gulf of Mexico, Caribbean Sea, North

and South Atlantic) about potential ways to minimize bycatch of giant manta rays.

6.2.27. Encourage the International Commission for the Conservation of Atlantic Tunas (ICCAT) Parties to prioritize giant manta rays as a conservation issue and prohibit all vessels from retaining onboard, transhipping, landing, or storing, any part or whole carcass of mobulid rays caught in the ICCAT Convention Area.

6.2.28. Continue and enhance coordination with the Western and Central Atlantic Fisheries Commission (WECAFC) to ensure coordination with ICCAT for non-ICCAT members and address artisanal fishing issues.

6.2.29. Continue U.S. participation and coordination in the WECAFC working group on sharks and rays, and advocate for WECAFC member countries to support a retention prohibition for giant manta rays.

6.2.30. Encourage West African nations to reduce capture and consumption and/or trade of giant manta rays in artisanal/small-scale fisheries.

6.2.31. Increase coordination and engagement with the Sub-Regional Plan of Action for the conservation and sustainable management of Shark populations (SRPOA-Sharks) and RFMOs that manage West Africa fisheries (SRFC), as this is an area where more data is needed on the species.

6.3. Coordinate through other relevant non-RFMO international organizations and mechanisms to enhance conservation and management of giant manta rays to promote their recovery globally.

6.3.1. Continue U.S. engagement in the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) regarding giant manta rays (see **International Trade** section).

6.3.2. Facilitate recovery of giant manta rays through enhanced engagement in the Convention on Migratory Species (CMS) and the CMS Sharks Memorandum of Understanding (MOU).

6.3.2.1. Support implementation of actions of the CMS Sharks MOU for giant manta rays.

6.3.2.2. Encourage top manta ray fishing nations to become signatories to the CMS Sharks MOU.

6.3.2.3. Encourage signatories to CMS and the Sharks MOU to develop a strategy for expanding legal protections in priority areas.

6.3.3. Facilitate recovery of giant manta rays in the Wider Caribbean Region through continued and enhanced engagement in and collaboration with the United Nations Environment Programme Protocol for Specially Protected Areas and Wildlife (SPAW Protocol).

6.3.3.1. Encourage the use of existing SPAW protected areas to protect the species, identify hotspots, and collaborate and develop partnerships and strategic planning among Parties.

6.3.3.2. Work with SPAW Parties to improve implementation of obligations under the Protocol with regard to giant manta rays.

6.3.4. Facilitate recovery of giant manta rays through continued and enhanced engagement in and collaboration with the International Union for the Conservation of Nature (IUCN) Shark Specialist Group (SSG).

6.3.4.1. Encourage SSG to update and disseminate their Conservation Strategy for devil and manta rays.

6.3.4.2. Support and collaborate with the IUCN SSG to conduct safe handling/release, species ID, and other relevant training workshops, particularly with developing nations with capacity-building needs.

6.3.5. Facilitate recovery of giant manta rays through enhanced collaboration with the United Nations-Food and Agriculture Organization (FAO).

6.3.5.1. Support initiatives and recommendations developed as part of the Kobe Bycatch Workshop to reduce bycatch, in particular, as they pertain to rays and specifically giant manta rays.

6.3.6. Facilitate recovery of giant manta rays through continued and enhanced collaboration with the International Seafood Sustainability Foundation (ISSF).

6.3.6.1. Coordinate with the fishing industry, including the ISSF, to develop and implement proven mitigation measures across the international fishing community for improving survivorship of giant manta rays in commercial fisheries.

6.3.6.2. Work with ISSF to encourage knowledge sharing/technology transfers among the international fishing community.

6.4. Enhance bilateral cooperation and engagement with pertinent government officials and stakeholders through regional workshops in key countries that target or have significant bycatch of giant manta rays to promote conservation and recovery.

International Trade

7. **Implement management actions to eliminate giant manta ray gill plates in international trade.**

7.1. Explore an uplisting of the giant manta ray in Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) to Appendix I.

7.1.1. Work with other CITES Parties on the implementation of the existing Appendix II listing of giant manta rays.

7.1.2. Increase market surveys of landings to quantify domestic capture, local consumption, and local trade of giant manta rays in key areas (e.g., Indian Ocean Region, Western Pacific Ocean Subregion, Eastern Pacific Ocean Subregion).

7.1.3. Determine prevalence of giant manta ray products being imported, exported, and re-exported in the international trade and by which Parties.

7.2. Advocate for thorough and scientifically robust manta ray non-detriment findings, particularly those from CITES Parties located in the Indian Ocean, Western Pacific Subregion, and Eastern Pacific Subregion, and share results with the CITES Secretariat.

7.3. Advocate for an increase in compliance with CITES permitting and reporting.

7.4. Support custom agencies to identify accurately giant manta rays and their gill plates to better enforce CITES international trade regulations.

7.4.1. Provide identification pamphlets and training for custom agents, particularly in Guangzhou and Hong Kong, China.

7.5. Conduct mixed-stock analysis for Guangzhou and Hong Kong gill plate trade to determine which subregions/regions most giant manta rays originate from in order to inform RFMOs to take further management actions and to address illegal, unreported, and unregulated fishing.

Monitoring and Reporting

8. **Improve species-specific monitoring and reporting of giant manta rays in commercial and artisanal fisheries by RFMOs and individual countries to improve estimates of catch and discards, provide a better understanding of the effects of illegal, unreported, and unregulated (IUU) fishing, and measure progress towards recovery.**

8.1. Evaluate the efficacy of electronic monitoring (EM) coupled with artificial intelligence (AI) for identifying giant manta rays and monitoring interactions in commercial and artisanal fisheries; if shown to be effective, promote the increased use of EM.

8.2. Promote improved reporting of giant manta ray bycatch and discards in commercial and artisanal fishing logbooks.

8.3. Investigate the use of advanced technology (e.g., satellite imaging) to monitor IUU fishing and better understand IUU fishing impacts to giant manta rays.

8.4. Continue to support training and deployment of observers on artisanal and commercial fishing vessels operating in the giant manta ray range, both domestically and internationally.

8.5. For artisanal fishing vessels that cannot support observers, encourage deployment of alternative scientific monitoring that will collect data equivalent to the observer approach in a manner that ensures comparable coverage.
8.6. Increase domestic observer coverage in longline, trawl, and purse seine fisheries as funding allows.
8.7. Promote an increase in observer coverage globally (see Activity 6.2.3).
8.8. Collaborate internationally through RFMOs and other international fora to increase understanding of the scale and impacts of IUU fishing.

Regulatory Mechanisms and Enforcement

9. **Minimize fishing mortality of giant manta rays through effective development, implementation, and enforcement of international and domestic measures, such as legislation and regulations.**
   9.1. Encourage development of and participation in multinational agreements that facilitate conservation of giant manta rays and eliminate the gill plate trade.
   9.2. Encourage non-signatory nations to accede to relevant international agreements that facilitate management and conservation of giant manta rays.
   9.3. Encourage Parties of RFMOs (specifically the IOTC, WCPFC, IATTC) to ensure sufficient enforcement exists to monitor compliance with regional and domestic retention prohibitions.
      9.3.1. Conduct assessments to evaluate spatial and temporal scale of giant manta ray retention and evaluate compliance levels with RFMO no-retention measures; if compliance is deemed inadequate, determine causes and solutions for improvement.
      9.3.2. Investigate economic tools to incentivize compliance at the individual and national scale levels.
   9.4. Encourage Parties of RFMOs to implement measures to increase the survival of manta rays, including measures to avoid interactions (such as time/area closures), modifications to fishing gear, and best practices for handling and release.
      9.4.1. Evaluate spatial and temporal distribution and mortality data of mobulid bycatch provided by observers to support the development and implementation of manta ray management measures.
   9.5. Develop, as appropriate, and implement regulations to increase the survival of giant manta rays, including measures to avoid interactions (such as time/area closures), modifications to fishing gear, and best practices for handling and release in all U.S. commercial fisheries.

9.5.1. Evaluate spatial and temporal distribution and mortality data of giant manta ray bycatch provided by observers to support the development and implementation of giant manta ray regulatory measures.

9.6. Revisit whether protective regulations under section 4(d) are necessary and advisable for the conservation of the giant manta ray.

9.7. Ensure sufficient enforcement exists to monitor compliance with domestic regulations for giant manta rays.

Outreach and Education

10. **Develop and implement outreach and education strategies and programs to increase public (including consumers) and stakeholder (including fishermen) awareness on the status and recovery needs of the giant manta ray and decrease the demand for gill plates.**

10.1. Conduct socio-economic surveys among fishing communities and stakeholders to contextualize attitudes and behaviors towards giant manta ray conservation and management measures.

10.2. Using results from the surveys, develop and implement an outreach campaign (including workshops, brochures in different languages, online learning, and video and photography tools) aimed at providing fishermen with understanding of the impact of their fishing on the status of the species and the rationale for management measures, recommendations for alternative economic incentives, and best effort and handling practices that could reduce mortality of giant manta rays.

10.3. Using results from the surveys, develop an outreach and education campaign, including regional communication strategies in native languages, for the public to increase awareness of the status and importance of giant manta rays, while incorporating cultural insights and perspectives from various regions/locations of the species' range.

10.4. Develop disincentive consumer campaigns of manta ray gill plates, such as providing information on heavy metals present in gill plates and the unverified medical claims, to encourage consumers to find alternatives to Traditional Chinese Medicine (TCM) involving gill plates.

10.5. Develop regional outreach/education communication strategies to encourage communities reliant on subsistence fishing of the species for revenue to develop sustainable alternative strategies, such as tourism.

10.6. Promote sustainably managed manta ray tourism locations.

10.6.1. Ensure that current and future manta ray tourism is properly managed, promoting responsible visitor practices and reducing human impacts on the habitats

10.7. Place educational signs regarding the legal and conservation status of giant manta rays at public fishing/boat access points to the marine environment in priority areas.

10.8. Develop and expand community and citizen science programs to increase data collection on giant manta rays and develop strong community relationships to explain goals of data collection.

10.9. Increase social media campaigns on awareness, including highlighting threats to the species as well as specific expeditions and/or other on-going research projects.

10.10. Use video and film tools for effective storytelling and distribute to the public, with a particular focus on younger generations.

10.11. Continue to promote and contribute to World Manta Day (September 17th) to help raise public awareness of threats to giant manta rays

Implementation Schedule

Table 1: Implementation schedule for the giant manta ray. Recovery "actions" (i.e., Tier 1 (e.g., 1., 2., 3., represented in bold text)) are measures from the Recovery Plan that describe what needs to be done to accomplish the goal of long-term viability; recovery "activities" (i.e., Tiers 2, 3 and 4 (e.g., 2.1.1., 2.1.1.1., 2.1.1.2.)) are the detailed, on-the-ground tactical steps needed to implement the recovery actions. Projected time and cost estimates for each recovery activity are intended as a planning aid only. The "potential partners" are not obligated to expend the amounts shown.
*No cost associated (NOAA Fisheries staff time)

				Cost Estimates							
Activity #	**Activity Description**	**Duration (Years)**	**Potential Partners**	**FY1**	**FY2**	**FY3**	**FY4**	**FY5**	**FY6+**	**Total Costs ($)**	**Comments**
Population Dynamics											
1	**Improve knowledge and understanding of giant manta ray population status, abundance trends, and genetic structure.**			**$1,560**	**$25**	**$775**	**$25**	**$750**	**$39,900**	**$43,035**	
1.1	Conduct population assessments regularly (ideally every 5 years) in all ocean basins, but particularly the Indian Ocean, Western Pacific Subregion, and the Eastern Pacific Subregion	Continuous	RFMOs, academia, NGOs	$500					$7,500	$8,000	

				Cost Estimates							
Activity #	**Activity Description**	**Duration (Years)**	**Potential Partners**	**FY1**	**FY2**	**FY3**	**FY4**	**FY5**	**FY6+**	**Total Costs ($)**	**Comments**
1.2	Develop and conduct scientific surveys to improve relative abundance estimates, ideally every 1–2 years depending on survey methodology	Continuous/ biannual	Academia, NGOs, foreign governments	$750		$750		$750	$28,125	$30,375	
1.3	Increase and improve genetic sampling in all ocean basins to provide a better understanding of population structure	4	Academia, NGOs, foreign government scientific institutions	$25	$25	$25	$25			$100	
1.3.1	Continue and enhance cooperative research programs between scientists and fishermen to increase genetic sampling of giant manta rays	Continuous	RFMOs, academia, NGOs	*	*	*	*	*	*	*	
1.3.2	Enhance, as needed, standardized genetic collection protocols for all ocean basins to improve genetic sampling	Continuous	Observer programs (foreign and domestic), RFMOs, academia	*	*	*	*	*	*	*	
1.4	Determine census and effective population sizes for each subregion/region using genetics research (ideally every 5 years).	Continuous/ every 5 years	RFMOs, academia, NGOs	$35					$525	$560	

				Cost Estimates							
Activity #	**Activity Description**	**Duration (Years)**	**Potential Partners**	**FY1**	**FY2**	**FY3**	**FY4**	**FY5**	**FY6+**	**Total Costs ($)**	**Comments**
1.5	Utilize new emerging techniques, such as close-kin mark-recapture (CKMR), to estimate population size as a form of validation of the estimates derived through population assessments	Continuous/ every 5 years	RFMOs, academia, NGOs	$250					$3,750	$4,000	
2	**Improve knowledge and understanding of giant manta ray distribution, movement, and habitat use**			**$450**	**$20**	**$20**	**$20**	**$20**	**$4,265**	**$4,795**	
2.1	Develop and enhance cooperative research programs between scientists and fishermen to increase tagging effort of giant manta rays	Continuous	Academia, NGOs, foreign government scientific institutions	$20	$20	$20	$20	$20	$875	$975	
2.2	Continue and expand and/or develop ecosystem-based/ habitat-predictive modeling efforts to improve understanding of environmental, oceanographic, and other factors influencing areas of high use/occurrences of giant manta rays and identify important habitat areas for different life stages	Continuous / every 20 years	Academia, RFMOs, NGOs	$130					$390	$520	

				Cost Estimates							
Activity #	**Activity Description**	**Duration (Years)**	**Potential Partners**	**FY1**	**FY2**	**FY3**	**FY4**	**FY5**	**FY6+**	**Total Costs ($)**	**Comments**
2.3	Identify additional locations to tag giant manta rays to further understand movement patterns and connectivity and expand these studies to places that have not already been heavily studied to date.	As needed	Academia, NGOs, foreign government scientific institutions	$300					$3,000	$3,300	
3	**Improve knowledge and understanding of the demographics and life history of giant manta rays.**			**$95**	**$20**	**$20**	**$20**	**$20**	**$2,025**	**$2,200**	
3.1	Increase and improve data collection and biological sampling of giant manta rays in all Regions, including but not limited to: fishery observer programs (domestic and international), scientific surveys, and landings data	Continuous	Academia, NGOs, foreign government scientific institutions	$20	$20	$20	$20	$20	$1,500	$1,600	
3.2	Determine and/or update life history information (e.g., age, growth, reproduction) using accepted or novel techniques	Continuous/ every 10 years	Academia, NGOs, foreign government scientific institutions	$75					$525	$600	
Fisheries Interactions											

				Cost Estimates							
Activity #	**Activity Description**	**Duration (Years)**	**Potential Partners**	**FY1**	**FY2**	**FY3**	**FY4**	**FY5**	**FY6+**	**Total Costs ($)**	**Comments**
4	**Minimize and ultimately eliminate targeted fisheries for giant manta rays in foreign fisheries through enhanced coordination and collaboration with relevant organizations to support national and regional development of policies, management plans, and capacity to make giant manta ray fishing commercially unviable and domestically less favorable relative to sustainable species.**			**$690**	**$690**	**$690**	**$240**	**$240**	**$1,600**	**$4,150**	
4.1	Encourage and assist countries with targeted manta ray fisheries, particularly in the Indian Ocean, in the development of policies and management plans to prohibit targeting fishing	Continuous	foreign governments, NGOs	TBD	TBD	TBD	TBD	TBD	TBD		
4.1.1	Encourage countries to implement and/or enforce regulations for the conservation of the giant manta ray	Continuous	foreign governments and enforcement, NGOs	*	*	*	*	*	*		

				Cost Estimates							
Activity #	**Activity Description**	**Duration (Years)**	**Potential Partners**	**FY1**	**FY2**	**FY3**	**FY4**	**FY5**	**FY6+**	**Total Costs ($)**	**Comments**
4.1.2	Coordinate and collaborate with relevant organizations to monitor and evaluate the effectiveness of enforcement	5 years to begin then once every 5 years	foreign governments, NGOs	$40	$40	$40	$40	$40	$600	$800	
4.2	Coordinate and collaborate with relevant organizations, governments, and communities to develop alternative income and food resources in communities that are dependent on giant manta ray fisheries	Continuous	foreign governments, NGOs	--	--	--	--	--	--		Captured in 4.2.1 - 4.2.3
4.2.1	Support development projects (e.g., through grants or technical assistance) to generate alternative sources of protein for the communities	10 / as needed	foreign governments, NGOs	$500	$500	$500	$100	$100	$500	$2,200	
4.2.2	Support development projects (e.g., through grants or technical assistance), such as manta ray tourism locales, to generate alternative sources of income for the communities	10 / as needed	foreign governments, NGOs	$100	$100	$100	$50	$50	$250	$650	
4.2.3	Support or directly provide outreach and education on giant manta ray conservation to encourage and motivate	5 / as needed	foreign governments, NGOs	$50	$50	$50	$50	$50	$250	$500	

				Cost Estimates							
Activity #	**Activity Description**	**Duration (Years)**	**Potential Partners**	**FY1**	**FY2**	**FY3**	**FY4**	**FY5**	**FY6+**	**Total Costs ($)**	**Comments**
	communities to choose alternatives										
5	**Minimize fisheries bycatch and mortality of giant manta rays by determining and addressing the frequency of capture and severity of fishing interactions in artisanal/small-scale and commercial fisheries globally**			**$605**	**$550**	**$420**	**$150**	**$75**	**$11,355**	**$13,020**	
5.1	Determine and reduce the frequency of giant manta ray interactions in artisanal/small-scale and commercial fisheries, taking into account potential impacts to other protected species (e.g, time-area closures and shifting of fishing effort on other species)	Continuous	Academia, RFMOs, fishing industry, NGOs	--	--	--	--	--	--	--	Costs are outlined below (5.1.1 - 5.1.3)
5.1.1	Conduct research to determine factors (e.g., environmental conditions, fishing tactics) affecting frequency of giant manta ray interactions in artisanal/small-scale fisheries and commercial purse seine,	3 years / every 10 years	Academia, RFMOs, fishing industry, NGOs	$135	$135	$135			$2,835	$3,240	

				Cost Estimates							
Activity #	**Activity Description**	**Duration (Years)**	**Potential Partners**	**FY1**	**FY2**	**FY3**	**FY4**	**FY5**	**FY6+**	**Total Costs ($)**	**Comments**
	gillnet, trawl, and longline fisheries										
5.1.2	Evaluate the potential utility and efficacy of time-area closures and/or protected areas in locations shown to have higher occurrences of giant manta rays in order to reduce interactions with the species in artisanal/small-scale and commercial fisheries, and if deemed effective, develop regulations and encourage governments to implement	3 years / every 10 years	Academia, RFMOs, fishing industry, NGOs	$135	$135	$135			$2,835	$3,240	
5.1.3	Investigate hotspots for ghost fishing and impacts on giant manta rays to define appropriate mitigation methods	Continuous/ as applicable	Academia, NGOs	$135	TBD	TBD	TBD	TBD			
5.1.4	Based on results of above research, develop and implement a strategy to reduce fishery interactions with giant manta rays	Continuous	Academia, RFMOs, fishing industry, NGOs	*	*	*	*	*	*	*	

				Cost Estimates							
Activity #	**Activity Description**	**Duration (Years)**	**Potential Partners**	**FY1**	**FY2**	**FY3**	**FY4**	**FY5**	**FY6+**	**Total Costs ($)**	**Comments**
5.2	Reduce mortality associated with capture, handling, and release of giant manta rays in artisanal/small-scale and commercial fishing gear, specifically gillnets, purse seines, longlines, and trawls, taking into account potential impacts to other protected species	Continuous	RFMOs, fishing industry, NGOs	--	--	--	--	--	--	--	Costs are outlined below (5.1.1 - 5.1.3)
5.2.1	Continue to evaluate factors (e.g., soak time, gear use, handling) affecting at-vessel and post-release mortality of giant manta rays in commercial fisheries	4 years / every 10 years	RFMOs, fishing industry, NGOs	$100	$140	$75	$75		$2,730	$3,120	
5.2.2	Based on results of the above research, implement best practices for increasing giant manta ray survivorship in domestic and international commercial fisheries	Continuous	RFMOs, fishing industry, NGOs	*	*	*	*	*	*	*	
5.2.3	Continue to support partners evaluating factors (e.g., soak time, gear use, handling) affecting at-vessel and post-release mortality of giant	4 years / every 10 years	RFMOs, fishing industry, NGOs	$100	$140	$75	$75		$2,730	$3,120	

				Cost Estimates							
Activity #	**Activity Description**	**Duration (Years)**	**Potential Partners**	**FY1**	**FY2**	**FY3**	**FY4**	**FY5**	**FY6+**	**Total Costs ($)**	**Comments**
	manta rays in artisanal/small-scale fisheries										
5.2.4	Based on results of above research, provide best practices for increasing giant manta ray survivorship in artisanal/small-scale fisheries	Continuous	RFMOs, fishing industry, NGOs	*	*	*	*	*	*	*	
5.3	Continue to support and develop existing domestic education and training programs for fishermen to enhance safe handling, release, and data collection, and expand internationally, particularly to artisanal/small-scale and commercial fishermen operating in the Indian Ocean, Western Pacific Subregion, and the Eastern Pacific Subregion.	Continuous	RFMOs, fishing industry, NGOs	*	*	*	*	$75	$225	$300	The costs in FY5 and beyond is for expanding internationally
6	**Minimize fisheries bycatch and mortality of giant manta rays in international fisheries through enhanced international coordination and collaboration with relevant**			**$1,140**	**$600**	**$600**	**$600**	**$600**	**$14,980**	**$18,520**	

				Cost Estimates							
Activity #	**Activity Description**	**Duration (Years)**	**Potential Partners**	**FY1**	**FY2**	**FY3**	**FY4**	**FY5**	**FY6+**	**Total Costs ($)**	**Comments**
	international organizations, such as RFMOs										
6.1	Develop international capacity building programs and conduct regional training workshops with stakeholders in priority areas related to giant manta ray safe handling and release, species ID, and data collection protocols to address bycatch issues related to giant manta rays	5 years to begin then once every 5-10 years in priority areas	NGOs, CMS, FAO, fishing industry	$250	$250	$250	$250	$250	$3,750	$5,000	
6.2	Coordinate through RFMOs to enhance implementation, compliance, and effectiveness of existing conservation and management measures, and identify any new protective measures that may be needed for giant manta rays to reduce fishing impacts to the species	Continuous	NGOs, RFMOs	$40	$40	$40	$40	$40	$3,000	$3,200	
6.2.1	Consolidate the latest information on countries known to be catching and/or trading giant manta rays to	Continuous/ every 5 years	RFMOs, NGOs, fishing industry	$135					$2,025	$2,160	

				Cost Estimates							
Activity #	**Activity Description**	**Duration (Years)**	**Potential Partners**	**FY1**	**FY2**	**FY3**	**FY4**	**FY5**	**FY6+**	**Total Costs ($)**	**Comments**
	increase knowledge and understanding of international fisheries impacts to giant manta rays and compliance levels with existing regulations										
6.2.2	Encourage and assist Parties of RFMOs to develop, implement, and enforce domestic fishing regulations to minimize giant manta ray bycatch in artisanal/small-scale and commercial fisheries, and to comply with existing RFMO conservation measures related to giant manta rays, particularly retention prohibitions	Continuous	RFMOs, NGOs, fishing industry	TBD	TBD	TBD	TBD	TBD	TBD	TBD	Coordination with RFMOs is ongoing through NMFS Office of International Affairs, Trade, and Commerce. However, more focused conservation strategies specific to giant manta rays are required for recovery, and have not yet been initiated.

				Cost Estimates							
Activity #	**Activity Description**	**Duration (Years)**	**Potential Partners**	**FY1**	**FY2**	**FY3**	**FY4**	**FY5**	**FY6+**	**Total Costs ($)**	**Comments**
6.2.3	Encourage and assist Parties to comply with minimum observer coverage requirements established by relevant RFMOs, and work towards increasing observer coverage, particularly with the Indian Ocean Tuna Commission (IOTC), through at-sea observers and/or electronic monitoring	Continuous	RFMOs, NGOs, fishing industry	TBD	TBD	TBD	TBD	TBD	TBD	TBD	Coordination with RFMOs is ongoing through NMFS Office of International Affairs, Trade, and Commerce. However, more focused conservation strategies specific to giant manta rays are required for recovery, and have not yet been initiated.
6.2.4	Encourage RFMOs to require reporting of giant manta ray catches and discards, and for Parties to increase reporting of giant manta ray catch and disposition to improve data quality and quantify the impact of fishing on the species	Continuous	RFMOs, fishing industry	*	*	*	*	*	*	*	

				Cost Estimates							
Activity #	**Activity Description**	**Duration (Years)**	**Potential Partners**	**FY1**	**FY2**	**FY3**	**FY4**	**FY5**	**FY6+**	**Total Costs ($)**	**Comments**
6.2.5	Work bilaterally with countries that have known illegal trade of giant manta rays to assist them in combating illegal trade	Continuous	U.S. State Department, foreign governments	*	*	*	*	*	*	*	
Indian Ocean Region											
6.2.6	Increase U.S. engagement with IOTC by participating as an observer at relevant meetings related to giant manta rays, fisheries, and bycatch issues	Continuous	IOTC Parties, IOTC Secretariat	*	*	*	*	*	*	*	
6.2.7	Encourage the IOTC Secretariat and Members to prioritize giant manta rays as a conservation issue and advocate for an assessment of the Indian Ocean stock status	Continuous	IOTC Parties, IOTC Secretariat	*	*	*	*	*	*	*	
6.2.8	Encourage the IOTC Secretariat and Members to prohibit subsistence fisheries from targeting giant manta rays	Continuous	IOTC Parties, IOTC Secretariat	*	*	*	*	*	*	*	
6.2.9	Encourage the IOTC Secretariat and Members to monitor and ensure the compliance of Resolution 19/03, particularly pertaining to artisanal and subsistence fisheries and the prohibition to sell or offer for	Continuous	IOTC Parties, IOTC Secretariat	*	*	*	*	*	*	*	

				Cost Estimates							
Activity #	**Activity Description**	**Duration (Years)**	**Potential Partners**	**FY1**	**FY2**	**FY3**	**FY4**	**FY5**	**FY6+**	**Total Costs ($)**	**Comments**
	sale any part or whole carcass of mobulid rays										
6.2.10	Conduct regional workshops with pertinent stakeholders in priority areas (e.g., India, Sri Lanka, Mozambique, Thailand) about potential ways to address bycatch of giant manta rays	5 years to begin with then once every 10 years thereafter	NGOs, CMS, foreign governments, fishing industry	$50	$50	$50	$50	$50	$350	$600	
6.2.11	Encourage and assist (when possible) governments to develop protected areas in manta ray hotspots (as they become known) with adequate enforcement to ensure a decrease in the catch of manta rays	Continuous	NGOs, CMS, foreign governments	*	*	*	*	*	*	*	
6.2.12	Encourage and assist foreign nations with existing manta ray sanctuaries (e.g., Maldives) to enforce regulations for the conservation of giant manta rays	Continuous	NGOs, CMS, foreign governments	TBD	TBD	TBD	TBD	TBD	TBD	TBD	
Western Pacific Subregion											

				Cost Estimates							
Activity #	**Activity Description**	**Duration (Years)**	**Potential Partners**	**FY1**	**FY2**	**FY3**	**FY4**	**FY5**	**FY6+**	**Total Costs ($)**	**Comments**
6.2.13	Continue U.S. participation and engagement in Western and Central Pacific Fisheries Commission (WCPFC) on giant manta ray issues	Continuous	WPFMC, WCPFC Secretariat, WCPFC Parties	*	*	*	*	*	*	*	
6.2.14	Analyze data to determine if giant manta rays are being caught in foreign EEZs outside the purview of WCPFC as there is little or no observer data from those areas	Continuous/ every 10 years	WPFMC, RFMOs, fishing industry, foreign governments	$135					$945	$1,080	
6.2.15	Encourage the WCPFC Secretariat and Members to prioritize giant manta rays as a conservation issue and advocate for an assessment of the western and central Pacific stock status	Continuous	WPFMC, WCPFC Secretariat, WCPFC Parties	*	*	*	*	*	*	*	
6.2.16	Encourage the WCPFC Secretariat and Members to monitor and ensure the compliance of Conservation and Management Measure 2019-05, particularly the prohibition to sell or barter any part or whole carcass of	Continuous	WPFMC, WCPFC Secretariat, WCPFC Parties	*	*	*	*	*	*	*	

				Cost Estimates							
Activity #	**Activity Description**	**Duration (Years)**	**Potential Partners**	**FY1**	**FY2**	**FY3**	**FY4**	**FY5**	**FY6+**	**Total Costs ($)**	**Comments**
	mobulid rays when caught by purse seine vessels										
6.2.17	Conduct regional workshops with pertinent stakeholders in priority areas (e.g., Philippines, Papua New Guinea, Indonesia, Malaysia) about potential ways to minimize bycatch of giant manta rays	5 years to begin with then once every 10 years thereafter	NGOs, CMS, WPFMC, foreign governments, fishing industry	$50	$50	$50	$50	$50	$350	$600	
6.2.18	Encourage and assist (when possible) governments to develop protected areas in manta ray hotspots (as they become known) with adequate enforcement to ensure a decrease in the catch of manta rays	Continuous	NGOs, CMS, foreign governments	*	*	*	*	*	*	*	
6.2.19	Encourage and assist foreign nations with existing manta ray sanctuaries (e.g., Indonesia) to enforce regulations for the conservation of giant manta rays	Continuous	NGOs, CMS, foreign governments	TBD	TBD	TBD	TBD	TBD	TBD	TBD	
Eastern Pacific Subregion											

				Cost Estimates							
Activity #	**Activity Description**	**Duration (Years)**	**Potential Partners**	**FY1**	**FY2**	**FY3**	**FY4**	**FY5**	**FY6+**	**Total Costs ($)**	**Comments**
6.2.20	Continue U.S. participation and engagement in the Inter-American Tropical Tuna Commission (IATTC) on giant manta ray issues	Continuous	IATTC Secretariat, IATTC Parties	*	*	*	*	*	*	*	
6.2.21	Identify and prioritize fisheries in coastal Latin America (i.e., those that are not subject to IATTC resolutions) for engagement, and conduct regional workshops with regard to bycatch reduction of giant manta rays	5 years to begin with then once every 10 years thereafter	NGOs, CMS, foreign governments, fishing industry	$50	$50	$50	$50	$50	$350	$600	
6.2.22	Encourage the IATTC Secretariat and Members to prioritize the giant manta ray as a conservation issue and advocate for an assessment of the eastern Pacific stock status	Continuous	IATTC Secretariat, IATTC Parties	*	*	*	*	*	*	*	
6.2.23	Encourage the IATTC Secretariat and Members to prohibit small-scale/artisanal fisheries from targeting giant manta rays for domestic consumption	Continuous	IATTC Secretariat, IATTC Parties	*	*	*	*	*	*	*	

				Cost Estimates							
Activity #	**Activity Description**	**Duration (Years)**	**Potential Partners**	**FY1**	**FY2**	**FY3**	**FY4**	**FY5**	**FY6+**	**Total Costs ($)**	**Comments**
6.2.24	Conduct regional workshops with pertinent stakeholders in priority areas (e.g., Peru, Ecuador, Mexico) about potential ways to minimize bycatch of giant manta rays	5 years to begin with then once every 10 years thereafter	NGOs, CMS, foreign governments, fishing industry	$50	$50	$50	$50	$50	$350	$600	
6.2.25	Encourage and assist foreign nations with existing manta ray sanctuaries (e.g., Galapagos Islands, Colombia, and Costa Rica) to enforce regulations for the conservation of giant manta rays	Continuous	NGOs, CMS, foreign governments	TBD	TBD	TBD	TBD	TBD	TBD	TBD	
Atlantic Ocean Region											
6.2.26	Conduct regional workshops with pertinent high-level government officials in priority areas (e.g., Gulf of Mexico, Caribbean Sea, North and South Atlantic) about potential ways to minimize bycatch of giant manta rays	5 years to begin with then once every 10 years thereafter	SPAW, WECAFC, NGOs, foreign governments	$50	$50	$50	$50	$50	$350	$600	

				Cost Estimates							
Activity #	**Activity Description**	**Duration (Years)**	**Potential Partners**	**FY1**	**FY2**	**FY3**	**FY4**	**FY5**	**FY6+**	**Total Costs ($)**	**Comments**
6.2.27	Encourage the International Commission for the Conservation of Atlantic Tunas (ICCAT) Parties to prioritize giant manta rays as a conservation issue and prohibit all vessels from retaining onboard, transhipping, landing, or storing, any part or whole carcass of mobulid rays caught in the ICCAT Convention Area.	Continuous	ICCAT Secretariat, ICCAT Parties	*	*	*	*	*	*	*	
6.2.28	Continue and enhance coordination with the Western and Central Atlantic Fisheries Commission (WECAFC) to ensure coordination with ICCAT for non-ICCAT members and address artisanal fishing issues.	Continuous	WECAFC Secretariat, WECAFC Parties	*	*	*	*	*	*	*	
6.2.29	Continue U.S. participation and coordination in the WECAFC working group on sharks and rays, and advocate for WECAFC member countries to support a retention prohibition for giant manta rays.	Continuous	WECAFC Secretariat, WECAFC Parties	*	*	*	*	*	*	*	

				Cost Estimates							
Activity #	**Activity Description**	**Duration (Years)**	**Potential Partners**	**FY1**	**FY2**	**FY3**	**FY4**	**FY5**	**FY6+**	**Total Costs ($)**	**Comments**
6.2.30	Encourage and support West African nations to reduce capture and consumption and/or trade of giant manta rays in artisanal/small-scale fisheries.	Continuous/ every 10 years	NGOs, foreign governments, fishing communities	$120					$840	$960	
6.2.31	Increase coordination and engagement with the Sub-Regional Plan of Action for the conservation and sustainable management of Shark populations (SRPOA-Sharks) and RFMOs that manage West Africa fisheries (SRFC), as this is an area where more data is needed on the species.	Continuous	NGOs, SRFC, West African fishing communities	*	*	*	*	*	*	*	
6.3	Coordinate through other relevant non-RFMO international organizations and mechanisms to enhance conservation and management of giant manta rays to promote their recovery globally.	Continuous	U.S. State Department, CITES, CMS, IUCN Sharks Specialist Group, UNEP-SPAW, FAO, ISSF	*	*	*	*	*	*	*	

				Cost Estimates							
Activity #	**Activity Description**	**Duration (Years)**	**Potential Partners**	**FY1**	**FY2**	**FY3**	**FY4**	**FY5**	**FY6+**	**Total Costs ($)**	**Comments**
6.3.1	Continue U.S. engagement in the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) regarding giant manta rays (see **International Trade** section).	Continuous	U.S. State Department, CITES Secretariat, CITES Parties, NGOs	*	*	*	*	*	*	*	
6.3.2	Facilitate recovery of giant manta rays through enhanced engagement in the Convention on Migratory Species (CMS) and the CMS Sharks Memorandum of Understanding (MOU).	Continuous	U.S. State Department, CMS Secretariat, CMS Parties, NGOs	*	*	*	*	*	*	*	
6.3.2.1	Support implementation of actions of the CMS Sharks MOU for giant manta rays.	Continuous	U.S. State Department, CMS Secretariat, CMS Parties, NGOs	*	*	*	*	*	*	*	
6.3.2.2	Encourage top manta ray fishing nations to become signatories to the CMS Sharks MOU.	Continuous	U.S. State Department, CMS Secretariat, CMS Parties, NGOs	*	*	*	*	*	*	*	

				Cost Estimates							
Activity #	**Activity Description**	**Duration (Years)**	**Potential Partners**	**FY1**	**FY2**	**FY3**	**FY4**	**FY5**	**FY6+**	**Total Costs ($)**	**Comments**
6.3.2.3	Encourage signatories to CMS and the Sharks MOU to develop a strategy for expanding legal protections in priority areas.	Continuous	U.S. State Department, CMS Secretariat, CMS Parties, NGOs	*	*	*	*	*	*	*	
6.3.3	Facilitate recovery of giant manta rays in the Wider Caribbean Region through continued and enhanced engagement in and collaboration with the United Nations Environment Programme Protocol for Specially Protected Areas and Wildlife (SPAW Protocol).	Continuous	U.S. State Department, SPAW Secretariat, SPAW Parties, NGOs	*	*	*	*	*	*	*	
6.3.3.1	Encourage the use of existing SPAW protected areas to protect the species, identify hotspots, and collaborate and develop partnerships and strategic planning among Parties.	Continuous	U.S. State Department, SPAW Secretariat, SPAW Parties, NGOs	*	*	*	*	*	*	*	

				Cost Estimates							
Activity #	**Activity Description**	**Duration (Years)**	**Potential Partners**	**FY1**	**FY2**	**FY3**	**FY4**	**FY5**	**FY6+**	**Total Costs ($)**	**Comments**
6.3.3.2	Work with SPAW Parties to improve implementation of obligations under the Protocol with regard to giant manta rays.	Continuous	U.S. State Department, SPAW Secretariat, SPAW Parties, NGOs	*	*	*	*	*	*	*	
6.3.4	Facilitate recovery of giant manta rays through continued and enhanced engagement in and collaboration with the International Union for the Conservation of Nature (IUCN) Shark Specialist Group (SSG).	Continuous	IUCN SSG, NGOs	*	*	*	*	*	*	*	
6.3.4.1	Encourage SSG to update and disseminate their Conservation Strategy for devil and manta rays.	Continuous	IUCN SSG, NGOs	*	*	*	*	*	*	*	
6.3.4.2	Support and collaborate with the IUCN SSG to conduct safe handling/release, species ID, and other relevant training workshops, particularly with developing nations with capacity-building needs.	Continuous	IUCN SSG, NGOs, foreign governments	*	*	*	*	*	*	*	
6.3.5	Facilitate recovery of giant manta rays through enhanced collaboration with the United	Continuous	FAO, NGOs	*	*	*	*	*	*	*	

				Cost Estimates							
Activity #	**Activity Description**	**Duration (Years)**	**Potential Partners**	**FY1**	**FY2**	**FY3**	**FY4**	**FY5**	**FY6+**	**Total Costs ($)**	**Comments**
	Nations-Food and Agriculture Organization (FAO).										
6.3.5.1	Support initiatives and recommendations developed as part of the Kobe Bycatch Workshop to reduce bycatch, in particular, as they pertain to rays and specifically giant manta rays.	Continuous	RFMOs, fishing industry, NGOs	*	*	*	*	*	*	*	
6.3.6	Facilitate recovery of giant manta rays through continued and enhanced collaboration with the International Seafood Sustainability Foundation (ISSF).	As needed	ISSF, fishing community	TBD	TBD	TBD	TBD	TBD	TBD	TBD	
6.3.6.1	Coordinate with the fishing industry, including the ISSF, to develop and implement proven mitigation measures across the international fishing community for improving survivorship of giant manta rays in commercial fisheries	Continuous/ every 5 years	ISSF, fishing community	$150					$2,250	$2,400	
6.3.6.2	Work with ISSF to encourage knowledge sharing/technology transfers among the	Continuous	ISSF, fishing community	*	*	*	*	*	*		

				Cost Estimates							
Activity #	**Activity Description**	**Duration (Years)**	**Potential Partners**	**FY1**	**FY2**	**FY3**	**FY4**	**FY5**	**FY6+**	**Total Costs ($)**	**Comments**
	international fishing community.										
6.4	Enhance bilateral cooperation and engagement with pertinent government officials and stakeholders through regional workshops in key countries that target or have significant bycatch of giant manta rays to promote conservation and recovery	5 years to begin with then once every 10 years thereafter	U.S. State Department, IUCN, CMS, CITES, RFMOs	$60	$60	$60	$60	$60	$420	$720	
International Trade											
7	**Implement management actions to eliminate giant manta ray gill plates in international trade**			**$200**	**$100**	**$200**	**$100**	**$200**	**$3,750**	**$4,550**	
7.1	Explore an uplisting of the giant manta ray in Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) to Appendix I.	Continuous	NGOs, CITES Parties, CITES Secretariat	*	*	*	*	*	*		
7.1.1	Work with other CITES Parties on the implementation of the existing Appendix II listing of giant manta rays.	Continuous	NGOs, CITES Parties	*	*	*	*	*	*		

				Cost Estimates							
Activity #	**Activity Description**	**Duration (Years)**	**Potential Partners**	**FY1**	**FY2**	**FY3**	**FY4**	**FY5**	**FY6+**	**Total Costs ($)**	**Comments**
7.1.2	Increase market surveys of landings to quantify domestic capture, local consumption, and local trade of giant manta rays in key areas (e.g., Indian Ocean Region, Western Pacific Ocean Subregion, Eastern Pacific Ocean Subregion).	Continuous/ every 2-3 years	Academia, NGOs, RFMOs	$70		$70		$70	$2,625	$2,835	
7.1.3	Determine prevalence of giant manta ray products being imported, exported, and re-exported in the international trade and by which Parties.	Continous	NGOs, CITES Parties	*	*	*	*	*	*		
7.2	Advocate for thorough and scientifically robust manta ray non-detriment findings, particularly those from CITES Parties located in the Indian Ocean, Western Pacific Subregion, and Eastern Pacific Subregion, and share results with the CITES Secretariat.	Continuous	NGOs, CITES Parties, CITES Secretariat	*	*	*	*	*	*		
7.3	Advocate for an increase in compliance with CITES permitting and reporting.	Continuous	NGOs, CITES Parties, CITES Secretariat	*	*	*	*	*	*		

				Cost Estimates							
Activity #	**Activity Description**	**Duration (Years)**	**Potential Partners**	**FY1**	**FY2**	**FY3**	**FY4**	**FY5**	**FY6+**	**Total Costs ($)**	**Comments**
7.4	Support custom agencies to identify accurately giant manta rays and their gill plates to better enforce CITES international trade regulations.	Continuous / as needed	Custom Agencies	$50	$50	$50	$50	$50	TBD	$250	
7.4.1	Provide identification pamphlets and training for custom agents, particularly in Guangzhou and Hong Kong, China.	Continuous / as needed	Custom Agencies	$50	$50	$50	$50	$50	TBD	$250	
7.5	Conduct mixed-stock analysis for Guangzhou and Hong Kong gill plate trade to determine which subregions/regions most giant manta rays originate from in order to inform RFMOs to take further management actions and to address IUU fishing.	Continuous/ every 2-3 years	Academia, NGOs, RFMOs	$30		$30		$30	$1,125	$1,215	
Monitoring and Reporting											
8	**Improve species-specific monitoring and reporting of giant manta rays in commercial and artisanal fisheries by RFMOs and individual countries to improve estimates**			**$450**	**$125**	**$0**	**$0**	**$0**	**$0**	**$575**	

				Cost Estimates							
Activity #	**Activity Description**	**Duration (Years)**	**Potential Partners**	**FY1**	**FY2**	**FY3**	**FY4**	**FY5**	**FY6+**	**Total Costs ($)**	**Comments**
	of catch and discards, provide a better understanding of the effects of illegal, unreported, and unregulated (IUU) fishing, and measure progress towards recovery										
8.1	Evaluate the efficacy of electronic monitoring (EM) coupled with artificial intelligence (AI) for identifying giant manta rays and monitoring interactions in commercial and artisanal fisheries; if shown to be effective, promote the increased use of EM.	1	NGOs, technology industry, RFMOs	$325						$325	
8.2	Promote improved reporting of giant manta ray bycatch and discards in commercial and artisanal fishing logbooks.	Continuous	Fishing captains and crew, NGOs, RFMOs	*	*	*	*	*	*		
8.3	Investigate the use of advanced technology (e.g., satellite imaging) to monitor IUU fishing and better understand IUU fishing impacts to giant manta rays.	2	Academia, NGOs, RFMOs, technology industry	$125	$125					$250	

				Cost Estimates							
Activity #	**Activity Description**	**Duration (Years)**	**Potential Partners**	**FY1**	**FY2**	**FY3**	**FY4**	**FY5**	**FY6+**	**Total Costs ($)**	**Comments**
8.4	Continue to support training and deployment of observers on artisanal and commercial fishing vessels operating in the giant manta ray range, both domestically and internationally.	Continuous / as needed	RFMOs, NGOs, fishing industry	TBD	TBD	TBD	TBD	TBD	TBD		
8.5	For artisanal fishing vessels that cannot support observers, encourage deployment of alternative scientific monitoring that will collect data equivalent to the observer approach in a manner that ensures comparable coverage.	Continuous	RFMOs, NGOs, fishing industry	*	*	*	*	*	*		
8.6	Increase domestic observer coverage in longline, trawl, and purse seine fisheries as funding allows.	Continuous	OLE, Coast Guard, fishing industry	TBD	TBD	TBD	TBD	TBD	TBD		
8.7	Promote an increase in observer coverage globally (see Activity 6.2.3).	Continuous	RFMOs, NGOs, fishing industry	--	--	--	--	--	--	Captured under 6.2.3	
8.8	Collaborate internationally through RFMOs and other international fora to increase understanding of the scale and impacts of IUU fishing.	Continuous	RFMOs, CMS, CITES, SPAW, NGOs	*	*	*	*	*	*		

				Cost Estimates							
Activity #	**Activity Description**	**Duration (Years)**	**Potential Partners**	**FY1**	**FY2**	**FY3**	**FY4**	**FY5**	**FY6+**	**Total Costs ($)**	**Comments**
Regulatory Mechnanisms and Enforcement											
9	**Minimize fishing mortality of giant manta rays through effective development, implementation, and enforcement of international and domestic measures, such as legislation and regulations.**			**$250**	**$0**	**$0**	**$0**	**$0**	**$3,750**	**$4,000**	
9.1	Encourage development of and participation in multinational agreements that facilitate conservation of giant manta rays and eliminate the gill plate trade.	Continuous	U.S. State Department, foreign governments	*	*	*	*	*	*		
9.2	Encourage non-signatory nations to accede to relevant international agreements that facilitate management and conservation of giant manta rays.	Continuous	U.S. State Department, foreign governments	*	*	*	*	*	*		
9.3	Encourage Parties of RFMOs (specifically the IOTC, WCPFC, IATTC) to ensure sufficient enforcement exists to monitor compliance with regional and	Continuous	U.S. State Department, RFMOs, foreign governments,	*	*	*	*	*	*		

				Cost Estimates							
Activity #	**Activity Description**	**Duration (Years)**	**Potential Partners**	**FY1**	**FY2**	**FY3**	**FY4**	**FY5**	**FY6+**	**Total Costs ($)**	**Comments**
	domestic retention prohibitions.		NGOs, fishing industry								
9.3.1	Conduct assessments to evaluate spatial and temporal scale of giant manta ray retention and evaluate compliance levels with RFMO no-retention measures; if compliance is deemed inadequate, determine causes and solutions for improvement.	Continuous/ every 5 years	RFMOs and Compliance Committees	$125					$1,875	$2,000	
9.3.2	Investigate economic tools to incentivize compliance at the individual and national scale levels.	Continuous	U.S. State Department, RFMOs, foreign governments	*	*	*	*	*	*		
9.4	Encourage Parties of RFMOs to implement measures to increase the survival of manta rays, including measures to avoid interactions (such as time/area closures), modifications to fishing gear,	Continuous	RFMOs Parties, NGOs	*	*	*	*	*	*		

				Cost Estimates							
Activity #	**Activity Description**	**Duration (Years)**	**Potential Partners**	**FY1**	**FY2**	**FY3**	**FY4**	**FY5**	**FY6+**	**Total Costs ($)**	**Comments**
	and best practices for handling and release.										
9.4.1	Evaluate spatial and temporal distribution and mortality data of mobulid bycatch provided by observers to support the development and implementation of manta ray management measures.	Continuous / every 5 years	RFMO and Compliance Committees	$125					$1,875	$2,000	
9.5	Develop, as appropriate, and implement regulations to increase the survival of giant manta rays, including measures to avoid interactions (such as time/area closures), modifications to fishing gear, and best practices for handling and release in all U.S. commercial fisheries.	Continuous / as needed		*	*	*	*	*	*		
9.5.1	Evaluate spatial and temporal distribution and mortality data of giant manta ray bycatch provided by observers to support the development and	Continuous		*	*	*	*	*	*		

				Cost Estimates							
Activity #	**Activity Description**	**Duration (Years)**	**Potential Partners**	**FY1**	**FY2**	**FY3**	**FY4**	**FY5**	**FY6+**	**Total Costs ($)**	**Comments**
	implementation of giant manta ray regulatory measures.										
9.6	Revisit whether protective regulations under section 4(d) are necessary and advisable for the conservation of the giant manta ray.	2 years		*	*						
9.7	Ensure sufficient enforcement exists to monitor compliance with domestic regulations for giant manta rays.	Continuous	FWS, U.S. Coast Guard	*	*	*	*	*	*		
Outreach and Education											
10	**Develop and implement outreach and education strategies and programs to increase public (including consumers) and stakeholder (including fishermen) awareness on the status and recovery needs of the giant manta ray and decrease the demand for gill plates.**			**$220**	**$175**	**105**	**105**	**105**	**$4,730**	**$5,440**	

				Cost Estimates							
Activity #	**Activity Description**	**Duration (Years)**	**Potential Partners**	**FY1**	**FY2**	**FY3**	**FY4**	**FY5**	**FY6+**	**Total Costs ($)**	**Comments**
10.1	Conduct socio-economic surveys among fishing communities and stakeholders to contextualize attitudes and behaviors towards giant manta ray conservation and management measures.	2 years/ every 10 years	Academia, NGOs, fishing community	$70	$70				$980	$1,120	
10.2	Using results from the surveys, develop and implement an outreach campaign (including workshops, brochures in different languages, online learning, and video and photography tools) aimed at providing fishermen with understanding of the impact of their fishing on the status of the species and the rationale for management measures, recommendations for alternative economic incentives, and best effort and handling practices that could reduce mortality of giant manta rays.	5 / as needed	Academia, NGOs, fishing industry	$50	$50	$50	$50	$50	TBD	$250	

				Cost Estimates							
Activity #	**Activity Description**	**Duration (Years)**	**Potential Partners**	**FY1**	**FY2**	**FY3**	**FY4**	**FY5**	**FY6+**	**Total Costs ($)**	**Comments**
10.3	Using results from the surveys, develop an outreach and education campaign, including regional communication strategies in native languages, for the public to increase awareness of the status and importance of giant manta rays, while incorporating cultural insights and perspectives from various regions/locations of the species' range.	5 / as needed	Academia, NGOs, fishing community	--	--	--	--	--		Captured with 10.2	
10.4	Develop disincentive consumer campaigns of manta ray gill plates, such as providing information on heavy metals present in gill plates and the unverified medical claims, to encourage consumers to find alternatives to Traditional Chinese Medicine (TCM) involving gill plates.	5 / as needed	Academia, NGOs, fishing community	--	--	--	--	--		Captured with 10.2	
10.5	Develop regional outreach/education communication strategies to encourage communities reliant on subsistence fishing of the	Continuous / as needed	Academia, NGOs, fishing community	--	--	--	--	--		Captured with 10.2	

				Cost Estimates							
Activity #	**Activity Description**	**Duration (Years)**	**Potential Partners**	**FY1**	**FY2**	**FY3**	**FY4**	**FY5**	**FY6+**	**Total Costs ($)**	**Comments**
	species for revenue to develop sustainable alternative strategies, such as tourism.										
10.6	Promote sustainably managed manta ray tourism locations.	Continuous	Academia, NGOs, foreign governments	*	*	*	*	*	*		
10.6.1	Ensure that current and future manta ray tourism is properly managed, promoting responsible visitor practices and reducing human impacts on the habitats	Continuous	Academia, NGOs, foreign governments	*	*	*	*	*	*		
10.7	Place educational signs regarding the legal and conservation status of giant manta rays at public fishing/boat access points to the marine environment in priority areas.	5 / every 5 years as needed	State, Territorial and local governments, NGOs	$5	$5	$5	$5	$5	TBD	$25	As needed as new laws or regulations are implemented.
10.8	Develop and expand community and citizen science programs to increase data collection on giant manta rays and develop strong community relationships to explain goals of data collection.	Continuous	NGOs, fishing communities	$70	$50	$50	$50	$50	$3,750	$4,020	

				Cost Estimates							
Activity #	**Activity Description**	**Duration (Years)**	**Potential Partners**	**FY1**	**FY2**	**FY3**	**FY4**	**FY5**	**FY6+**	**Total Costs ($)**	**Comments**
10.9	Increase social media campaigns on awareness, including highlighting threats to the species as well as specific expeditions and/or other on-going research projects.	Continuous	NGOs	*	*	*	*	*	*		
10.10	Use video and film tools for effective storytelling and distribute to the public, with a particular focus on younger generations.	1	Academia, NGOs	$25						$25	
10.11	Continue to promote and contribute to World Manta Day to help raise public awareness of threats to giant manta rays.	Continuous	NGOs	*	*	*	*	*	*		

	FY1	**FY2**	**FY3**	**FY4**	**FY5**	**FY6+**	**Total Costs ($)**
GRAND TOTAL	**$5,660**	**$2,305**	**$2,830**	**$1,260**	**$2,010**	**$86,355**	**$100,285+**