SCIENTIFIC COMMITTEE
EIGHTEENTH REGULAR SESSION

ELECTRONIC MEETING
10 – 18 August 2022

Addressing key research to inform Mobula rays conservation in the Pacific Ocean

WCPFC-SC18-2022/EB-IP-16

Moreno, G.[1], Murua, J.[2], Cronin, M.[3], Murua, H.[1] Ferarios, JM.[2],
Lezama, N.[4], Swimmer, Y.[5], Restrepo, V.[1]

[1] International Seafood Sustainability Foundation (ISSF)
[2] AZTI, Spain
[3] University of California, Santa Cruz
[4] NOAA Fisheries, Southwest Fisheries Science Center
[5] NOAA Fisheries, Pacific Islands Fisheries Science Center

Addressing key research to inform Mobula rays conservation in the Pacific Ocean

Moreno, G.[1], Murua, J.[2], Cronin, M.[3], Murua, H.[1] Ferarios, JM.[2], Lezama, N.[4], Swimmer, Y. [5], Restrepo, V.[1]

[1]International Seafood Sustainability Foundation (ISSF)
[2]AZTI, Spain
[3]University of California, Santa Cruz
[4]NOAA Fisheries, Southwest Fisheries Science Center
[5]NOAA Fisheries, Pacific Islands Fisheries Science Center

SUMMARY

The habitat preference of Mobulas to productive tropical and subtropical habitats where tropical tunas also aggregate, increase their vulnerability to purse seine fishing. However, the rate of interaction of purse seine fishery targeting tropical tuna, with the different Mobula ray species has not been quantified in detail, especially in the western and central Pacific Ocean. One of the difficulties found to understand and quantify this interaction is the identification of Mobulas at the species level by the crew and observers onboard purse seiners. It is also necessary to evaluate the impact of handling and release methods, assessing Mobula post-release mortality. This project aims at addressing key research to inform Mobula species conservation with the collaboration of the U.S purse seine fleet. Due to the extensive spatial and temporal coverage of U.S. purse seine vessels that operate in the Pacific Ocean, those vessels represent ideal platforms to collect information on Mobula spp. interactions, test handling and safe-release best practices learned for Mobulas and collect tissue samples to ascertain their population structure across the Pacific. Lesson learned from applying current protocols and practices will allow developing improved best practices to be implemented by the US fleet which could be scaled to other fisheries and nations in the longer term.

1 Introduction

Considering the decline of their populations, all Mobula ray species have been recently added to the Convention on International Trade in Endangered Species (CITES) Appendix II (CITES, 2016). The giant manta ray (*Manta birostris*) is listed as threatened under the U.S. Endangered Species Act. While fisheries regulations have sought to prevent the retention and landing of Mobula rays, the vast majority of Mobula captures are a result of unintentional bycatch (Croll et al., 2016). The level of bycatch depends greatly on the fishing method used, with the highest bycatch rates reported from gillnets and purse seiners (Alfaro-Cordova et al., 2017). The habitat preference of Mobulas to productive tropical and subtropical habitats where tropical tunas also aggregate, increase their vulnerability to purse seine fishing. However, the rate of interaction of purse seine fishery targeting tropical tuna, with the different Mobula ray species has not been quantified in detail, especially in the western and central Pacific Ocean. One of the difficulties found to understand and quantify this interaction is the identification of Mobulas at the species level by the crew and observers onboard purse seiners. In addition, it remains unclear whether the five species of Mobulas found in the Pacific Ocean are panmictic, genetically similar stocks, or whether there are multiple, genetically distinct sub-populations within each stock (Hosegood et al., 2020). There is an urgent requirement to resolve genetic population structure in the genus Mobula. This is crucial information for management for wide-ranging, data-poor marine species, as it determines whether conservation and management actions should occur at the local, small scale, or at the ocean basin scale. Understanding the population structure of Mobulas will allow for conservation efforts to identify and target unique and threatened populations for bycatch mitigation and conservation. In this regard, it should be noted that bycatch mitigation methods have not been explored in depth for Mobulas, and proposals for mitigating interactions between fishing gear and Mobulas through technological innovations or gear modifications are needed (Stewart et al., 2018; Cronin et al., in prep). It is also necessary that those studies evaluate the impact of handling and release methods, assessing Mobula post-release mortality. A comprehensive study is needed to understand purse seine - Mobula spp. interaction, to advance knowledge on Mobula population structure in order to identify unique stocks for management (Cronin et al., in prep) and finally to reduce the mortality derived from purse seine - Mobula interaction by identifying best practices for handling and release and evaluating post-release mortality. This proposal aims to address those key research priorities with the collaboration of the U.S purse seine fleet. Due to the extensive spatial and temporal coverage of U.S. purse seine vessels that operate in the Pacific Ocean, those vessels represent ideal platforms to collect information on Mobula spp. interactions, test best handling practices learned for Mobulas and collect tissue samples to ascertain their population structure across the Pacific using genomic methods. Resulting protocols and practices will be systematically developed and implemented during the study period and they could be scaled to other fisheries and nations in the longer term.

2 Objectives

The specific objectives of the present project are:

Objective 1: Purse seine - Mobula spp interactions and population structure

To quantify the rate of interaction of the purse seine fishery with the various Mobula species, scientists from UCSC and ISSF will design protocols for data collection and train U.S. fishers on Mobula spp. identification and sampling tissue for genetic studies. Special emphasis will be placed on giant manta rays which are listed under Endangered Species Act (ESA).

Once training is completed, data collection from purse seiners will be conducted:

(i) During one year, fishers onboard the participating vessels will record interactions and identify Mobula spp. as well as collect tissue samples, in order to cover different spatial and temporal strata.
(ii) UCSC, AZTI and ISSF scientists will carry out 3-5 trips onboard purse seine vessels to record Mobula spp. interactions, and collect as many samples from bycaught Mobulas as possible, with a target of 100 samples.

Information from the cruises on Mobula-PS vessel interactions will be processed and analyzed. DNA extraction will be conducted using Qiagen DNEasy Blood and Tissue kits. We will use Restricted-Site Associated (RAD) Sequencing, a fractional genome sequencing technique that allows for high genome coverage at a relatively inexpensive cost. After library preparation sequencing will be conducted at the QB3 Vincent J. Coates Genomics Sequencing Laboratory at UC Berkeley. We will use the UCSC Hummingbird supercomputer cluster to conduct species identification, test for population structure and/or the presence of identifiable stocks and calculate effective population size.

Objective 2: Design and testing of a sorting grid for Mobulas and evaluate post-release mortality

ISSF, AZTI, and US fleet industry (10 companies representing 80% of the US-flagged purse-seine vessels) will organize a series of meetings to design and develop sorting grids and, protocols for testing them at sea, for the safe-release of mobulas to be tested in real fishing conditions.

Once sorting grids are constructed, for each of the participating purse seine vessels, scientists from UCSC, AZTI and ISSF, will be on board PS vessels during 3-5 trips, depending on number of Mobulas encountered, (targeting spatial and temporal strata with the highest probability of the presence of Mobulas). During these trips, scientists will (i) evaluate the efficacy and time of release Mobula using sorting grids and (ii) evaluate post-release mortality using sPAT[1] tags. Fishers will also evaluate the efficacy

---

[1] sPaT satellite tags are used to study the survivorship of marine species during 30 or 60 days. They collect information in detail (depth, position) of the last 5 days before the tag is released.

of the sorting grid as tuna-Mobula sorting tools during the fishing operation by filling out a form designed in the project.

Data analysis will be conducted on (i) the efficacy of the sorting grid as a sorting and release tool, and (ii) post-release survival of Mobulas using the sorting grid. From those analyses and with the input of captains and crew, best handling practices will be defined, including modifications to the sorting grid design, or designing new tools, if needed.

Objective 3: Reporting, Outreach and Education

The following results will be delivered to fishers, scientists, managers and other relevant stakeholders:

- Results on quantification of US purse seine fleet interaction with Mobula spp.
- Results of the genetic study on the advances on population structure and/or the presence of identifiable stocks.
- Results of post release mortality using the sorting grid.
- Results on handling and safe-release best practices of Mobula spp. onboard purse seiners.
- Recommendations and future steps towards the long-term systematic data collection on Mobula spp interactions and tissue sampling with purse seine fleets.

Recommendations

That the 18th Regular Session of the Scientific Committee NOTES this document, on the project to define best handling practices and conservation recommendations to reduce the impact of purse-seine fishery on Mobula species.

Acknowledgement

References

Alfaro-Cordova, E., Del Solar, A., Alfaro-Shigueto, J., Mangel, J., Diaz, B., Carrillo, O., et al. (2017). Captures of manta and devil rays by small-scale gillnet fisheries in northern Peru. *Fish Res* 195**,** 28—36.

Barclay, K., and Cartwright, I. (2007). Governance of tuna industries: the key to economic viability and sustainability in the Western and Central Pacific Ocean. *Marine Policy* 31(3)**,** 348-358.

CITES (2016). Consideration of proposals for amendment of appendix I and II. CoP17 Prop. 44. Inclusion of the genus Mobula spp. in appendix II. Available at https: https://cites.org/sites/default/files/eng/cop/17/prop/060216/E-CoP17-Prop-44.pdf.

Croll, D.A., Dewar, H., Dulvy, N.K., Fernando, D., Francis, M.P., Galván-Magaña, F., et al. (2016). Vulnerabilities and fisheries impacts: the uncertain future of manta and devil rays. *Aquatic Conservation: Marine and Freshwater Ecosystems* 26(3)**,** 562—575.

Dagorn, L., Holland, K.N., Restrepo, V., and Moreno, G. (2013). Is it good or bad to fish with FADs? What are the real impacts of the use of drifting FADs on pelagic marine ecosystems? *Fish and Fisheries* 14(3)**,** 391-415.

FAO (2020). The State of World Fisheries and Aquaculture 2020. Sustainability in action. Rome.https://doi.org/10.4060/ca9229en.

Hall, M.A., and Roman, M. (2013). Bycatch and non-tuna catch in the tropical tuna purse seine fisheries of the world. *FAO fisheries and aquaculture technical paper* 568 FAO, Rome. www.fao.org/3/a-i2743e.pdf.

Hosegood, J., Humble, E., Ogden, R., de Bruyn, M., Creer, S., Stevens, G.M., et al. (2020). Phylogenomics and species delimitation for effective conservation of manta and devil rays. *Molecular Ecology* 29(24)**,** 4783-4796.

Justel-Rubio, A., and Restrepo, V. (2017). "Computing a global bycatch Rate of non-target species in tropical tuna purse seine fisheries". ISSF Technical Report 2017-01. International Seafood Sustainability …).

Lezama-Ochoa, N., Murua, H., Ruiz, J., Chavance, P., Delgado de Molina, A., Caballero, A., et al. (2018). Biodiversity and environmental characteristics of the bycatch assemblages from the tropical tuna purse seine fisheries in the eastern Atlantic Ocean. *Mar. Ecol.* 39(3)**,** e12504.

Moreno, G., Boyra, G., Sancristobal, I., Itano, D., and Restrepo, V. (2019). Towards acoustic discrimination of tropical tuna associated with fish aggregating devices. *PloS one* 14(6)**,** e0216353.

Moreno, G., J. Murua, L. Dagorn, M. Hall, E. Altamirano, N. Cuevas, M. Grande, I. Moniz, I. Sancristobal, J. Santiago, I. Uriarte, I. Zudaire, and V. Restrepo (2018a). Workshop for the reduction of the impact of Fish Aggregating Devices´ structure on the ecosystem. ISSF Technical Report 2018-19A. ISSF, Washington, D.C., USA. https://iss-foundation.org/knowledge-tools/technical-and-meeting-reports/download-info/issf-2018-19a-workshop-for-the-reduction-of-the-impact-of-fish-aggregating-devices-structure-on-the-ecosystem/.

Moreno, G., Murua, J., Jauharee, A., Zudaire, I., Murua, H., and Restrepo, V. (2020). Compendium of ISSF research activities to reduce FAD structure impacts on the ecosystem.

Moreno, G., Murua, J., Kebe, P, Scott, J. and Restrepo, V. (2018b). Design workshop on the use of biodegradable fish aggregating devices in Ghanaian purse seine and pole and line tuna fleets. ISSF Technical Report 2018-07. ISSF, Washington, D.C., USA. https://iss-foundation.org/knowledge-tools/technical-and-meeting-reports/download-info/issf-2018-07-design-workshop-on-the-use-of-biodegradable-fish-aggregating-devices-in-ghanaian-purse-seine-and-pole-and-line-tuna-fleets/.

Murua, H., Moreno, G., Itano, D., Hall., Dagorn, L., and Restrepo, V. (2019). "ISSF Skippers' Workshops Round 8. ISSF Technical Report 2019-01.International Seafood Sustainability Foundation, Washington, D.C., USA.".).

Restrepo, V., Dagorn, L., Itano D., Justel-Rubio and A., Forget F. and G. Moreno (2017). A Summary of Bycatch Issues and ISSF Mitigation Initiatives To-Date in Purse Seine Fisheries, with emphasis on FADs. ISSF Technical Report 2017-06. International Seafood Sustainability Foundation, Washington, D.C., USA.

Restrepo, V., Koehler, H., Moreno, G., and Murua, H. (2019). "Recommended Best Practices for FAD management in Tropical Tuna Purse Seine Fisheries. ", (ed.) W. ISSF Technical Report 2019-11. International Seafood Sustainability Foundation, D.C., USA.).

Restrepo, V., L. Dagorn, G. Moreno, F. Forget, K. Schaefer, I. Sancristobal, J. Muir, D. Itano and M. Hutchinson (2018). Compendium of ISSF At-Sea Bycatch Mitigation Research Activities as of September 2018. ISSF Technical Report 2018-20. International Seafood Sustainability Foundation, Washington D.C., USA.

Restrepo, V., L. Dagorn, G. Moreno, J. Murua, F. Forget, and A. Justel. (2019). "Report of the International Workshop on Mitigating Environmental Impacts of Tropical Tuna Purse Seine Fisheries. Rome, Italy, 12-13 March, 2019. ISSF Technical Report 2019-08. International Seafood Sustainability Foundation, Washington, D.C., USA".).

Stewart, J.D., Jaine, F.R.A., Armstrong, A.J., Armstrong, A.O., Bennett, M.B., Burgess, K.B., et al. (2018). Research priorities to support effective manta and devil ray conservation. *Front Mar Sci* 5, 314. doi: 10.3389/fmars.2018.00314.