Progress in addressing key research to inform Mobulid ray conservation in the Pacific Ocean

First permanent working Group on Bycatch and Ecosystem, IATTC

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SUMMARY

The habitat preference of mobulids for productive tropical and subtropical habitats, where tropical tunas also aggregate, increases their vulnerability to purse seine fishing. However, the rate of interaction of the purse seine fishery targeting tropical tunas with the different mobulid 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 with accuracy is the identification of mobulids at the species level by the crew and observers onboard purse seiners. To evaluate the impact on mobulids it is also necessary to assess mobulid post-release mortality when applying safe handling and release methods. This project aims to address key research to inform mobulid species conservation with the collaboration of 12 purse seiners from the U.S. fleet. Sorting grids were constructed, to release the mobulids for each of the 12 purse seiners. Since June 2022, in total eight mobulas were released using Bycatch Reduction Devices (BRDs). Five mobulid tissue samples were collected for species identification through genetic analysis and three of them were also tagged with a Survivorship satellite Pop-up tag to study their survivorship after being released. Lessons learned from applying current protocols and practices will allow developing improved best practices to be implemented by the tropical tuna U.S. purse seine fleet which could be scaled up to other purse seine fisheries and nations in the longer term.

RESUMEN

La preferencia de las móbulas por hábitats tropicales y subtropicales productivos, donde también se concentran los atunes tropicales, aumenta su vulnerabilidad a la pesca con redes de cerco. Sin embargo, la tasa de interacción de la pesca con red de cerco dirigida al atún tropical con las diferentes especies de móbulas no se ha cuantificado en detalle, especialmente en el Océano Pacífico occidental y central. Una de las dificultades encontradas para comprender y cuantificar esta interacción es la identificación de las mobulas a nivel de especie por parte de la tripulación y los observadores a bordo de los cerqueros. Para evaluar este impacto, también es necesario estimar el impacto de los métodos de manipulación y liberación en la mortalidad de las mobulas tras su liberación. Este proyecto pretende abordar cuestiones clave, para la conservación de las especies de mobulas, con la colaboración de 12 barcos de la flota de cerco estadounidense. Desde el comienzo del proyecto en Junio 2022, se han liberado ocho móbulas, se han recogido muestras de tejido para la identificación de la especie mediante análisis genéticos para 5 móbulas, y 3 de ellas se han liberado con marcas de supervivencia Pop-up, para estudiar su supervivencia. Los resultados de este proyecto, y la aplicación de los protocolos y prácticas actuales permitirán actualizar las buenas prácticas de liberación para su implementación tanto en la flota de cerco norteamericana como de otras pesquerías de cerco y países.

1. Introduction

Manta and devil rays, together known as mobulids, are experiencing global population declines. While national and international fisheries and trade regulations have recently sought to prevent the targeted fishing of Mobulids, many are caught as unintentional bycatch (Croll et al., 2016). In the U.S., the giant manta ray (*Mobula birostris*) has been listed as threatened under the federal Endangered Species Act, prompting the need for fisheries to reduce impacts on the species. The tropical tuna purse seine fishery contributes to Mobulid bycatch; however, the rate of interactions and mortalities associated with purse seine fishing is not well understood. Additionally, relatively minor operational modifications have been identified that have the potential to increase post-release survivorship in the fishery (Murua et al. 2019, 2021; Cronin et al. 2022).

This project, funded by NOAA Pacific Islands Regional Office and led by the International Seafood Sustainability Foundation (ISSF) in collaboration with UC Santa Cruz and AZTI, aims to fill key research gaps related to mobulid bycatch in tuna purse seiners, with the collaboration of the U.S tuna purse seine fleet. In particular, this project aims to 1) quantify the rate of interaction of the U.S. purse seine fishery with mobulids, 2) define and test safe handling and release best practices and evaluate mobulid ray post-release survival rate using survivorship tags , and 3) train fishers and observers to identify and sample mobulid rays and educate crew on best safe handling and release practices for mobulids. This document summarizes objectives, preliminary results, and recommendations from the first field trip for the project.

2. Objectives

The objectives of this project are the following:

1. To quantify the rate of interaction of the purse seine fishery with the various mobulid species, with emphasis on giant manta rays, and to collect **tissue samples** to identify unique stocks for management using genomic methods.
2. To **define and test safe-handling** and release best practices for mobulid rays, including gear modification or the use of BRDs and evaluate mobulid ray post-release **survival rate using survivorship satellite tags**
3. To **train fishers and observers** to identify and sample mobulid rays and educate crew on best safe-handling and release practices for Mobulas.
4. To **disseminate the result** of this project to fishers, scientist, managers and general public.

3. Purse seine - Mobulid spp interactions and population structure

To quantify the rate of interaction of the purse seine fishery with the various mobulid species, ten tissue sampling kits were distributed to each purse seine vessel participating in the project. Fishers were trained to take the tissue samples and started collecting data in June, 2022. Apart from fishers, scientists onboard purse seine vessels, during 3-4 cruises will also collect mobulid´s tissue samples. Those samples will contribute to the identifcation of unique stocks and species interacting with the purse seine fleet. So far, 5 tissue samples and 2 mucus samples were collected by the fleet (Table 1).

Table 1. Tissue and mucus samples collected by the U.S. purse seine fleet as of March 2023

ID	Vessel	Species	Tissue sample	Mucus sample
PP_01	Pacific Princess	*M. mobular*	NA	297
PP_02	Pacific Princess	*M. mobular*	315 / PP_02	285
FR_02	Friesland	*M. mobular*	FR_02	NA
FR_03	Friesland	*M. thurstoni*	FR_03	NA
FR_01	Friesland	*M. tarapacana*	FR_01	NA
CF_01	Cape Finisterre*			

*sample in transit; sheet not yet in hand

The target number of samples to be collected by the project was initially set at 100 but due to the low interaction, this number was adjusted to 20 samples. Once the 20 tissue samples are collected, DNA extraction will be conducted using Qiagen DNEasy Blood and Tissue kits. Restricted-Site Associated (RAD) Sequencing, a fractional genome sequencing technique that allows for high genome coverage at a relatively inexpensive cost. After genetic library preparation, sequencing will be conducted at the QB3 Vincent J. Coates Genomics Sequencing Laboratory at UC Berkeley. Finally, 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 if sample size allows it. This activity will be conducted throughout the duration of the project until December 2023.

4. Best safe-handling practices and post-release survival rate

To define and test safe-handling and release best practices for mobulid rays, including the development of BRDs and gear modification, 12 sorting grids designed by AZTI were constructed for each of the 12 participating PS vessels (Figure 1). For this activity, scientists from UCSC and AZTI will monitor sorting grid use on board purse seine vessels, during 3-4 trips. During those trips, scientists will (i) evaluate the efficacy and time of release mobulid using sorting grids or any other releasing method, i.e, stretchers, manual, etc. and (ii) evaluate post-release mortality using survivorship tags (sPAT tags). Fishers will also evaluate the efficacy of the sorting grid during the fishing operation by filling out a form specifically designed for the project.

Figure 1. Sorting grid (left) and a Manta released using the sorting grid (right)

Up to date, one scientist of the University of California, Santa Cruz, conducted a six-week cruise from December 12, 2022, until January 24, 2023, on board the US purse seiner F/V Pacific Princess. The vessel departed from Mazatlan, Mexico, and fished in the Eastern Tropical Pacific Ocean. The second trip started on April 20, 2023, with another scientist on board the US purse seiner F/V Cape Finisterre. The vessel departed from Pago Pago, American Samoa.

The primary goals of the cruises are to:
- Collect tail tissue samples for species identification and population genetics
- Collect mucous samples to aid in rapid species identification (led by iCatch)
- Collect size and species data for mobulid bycatch
- Deploy sPAT (in the EPO and WPO) and miniPAT tags (WPO) to measure post-release mortality
- Deploy and test a sorting grid bycatch release mitigation device designed by AZTI for rapid Mobulid release
- Conduct fisher workshops to improve species identification and knowledge of proper handling and release methods
- Train crew members to deploy tags and collect samples after scientist departs

4.1 Results from the first cruise

Tagging and sampling: Two mobulids were captured during the cruise, from which one tissue sample was taken. The two individuals were tagged by the scientist. An additional four mobulids were measured and sampled by the crews in other vessels with sampling kits. Of the total six mobulids, four were *M. mobular,* one *M. tarapacana,* and one *M. thurstoni* (Table 1).

Piloting the manta sorting grid: Using designs provided by AZTI, vessel crews fabricated manta sorting grids for release of large individuals. In this trip the grid was not employed as individuals released were small sized and an stretcher was used instead.

Fisher education: In addition to tagging, during the first cruise the scientist led two interactive workshops with the fishing crew and the onboard observer to educate about mobulid species identification and proper handling and release methods. It was noted that the crew were not knowledgeable about how to differentiate mobulids prior to these trainings. Even after trainings, there remained some difficulty to correctly identifying the different species. However, there was a broad interest in improving handling practices and contributing to mobulid conservation.

4.2 Total Mobulas released

Up to date, a total of 8 Mobulid rays have been released (Table 2). It is noteworthy that fishers need time to internalize the protocol when a Mobulid arrives onboard. In the case of the first mobulid released by the Western Pacific purse seine vessel, fishers were focused on the release operation and forgot to take the tissue sample. This issue was already discussed with them, and it is expected that the protocol will be fully followed in future interactions with mobulids. The

number of tissue samples collected has increased in the most recent months compared to those taken at the beginning of the project in which only one mobulid interaction was reported. Data analysis will help understand if there is a spatial-temporal effect for the increase in the number of interactions and/or a potential increase in fishers' awareness on the presence of mobulids and commitment to execute the tasks described in the project.

One tag that was deployed on an *M. mobular* individual by a crew member on board the Pacific Princess, reported after deployment. The data are being analyzed and presented in the coming months.

5. Fishers training and education

Finally, one of the key objectives of the project is to educate and raise fishers' awareness on mobulid´s conservation, train them on mobulid species identification, tissue collection and tagging (Figure 2). During the first year of the project online meetings were held with fishers as well as on board the purse seiners during port visits (e.g., Pago Pago, Manta). Scientists will continue visiting the ports to increase training outreach to the different fishers of the U.S. fleet. Neverthess, from the outset fishers have been showing interest in improving handling practices and contributing to mobulid conservation which will likely make for an easier implementation of better bycatch release practices in the long term.

Figure 2. Project scientist training fishers on board purse seiners (left) fishers measuring and releasing a mobulid using a stretcher bed (right).

Table 2. Mobulids released trought March 31, 2023. Three of them were tagged (IDs:2,3,6)

ID	Date	Vessel	Time start of set	Brailer number	Duration min. (from brailer to release)	Estimated total catch (tons)	Total No. Brails	Tag Number	Species	Size (cm)	Sex	Method of release
1	6/22/22	Western Pacific	16:30	3	1:05				M. mobular	2	NA	Grid
2	12/1/23	Pacific Princess	6:39	3	1:00	15	7	21P2018	M. mobular	122	NA	stretcher
3	12/1/23	Pacific Princess	5:19	3	1:30	15	7	21P2165	M. mobular	101,6	NA	stretcher
4	11/22/22	Friesland	23:30	3	8:00	25		NA	M. mobular	160	M	Grid
5	8/31/22	Friesland	17:25	5	2:00	12		NA	M. thurstoni	240	F	Grid
6	11/22/22	Friesland	23:30	2	5:00	2		NA	M. tarapacana	190	M	Grid
7	2/14/23	Pacific Princess		4	3:00			21P2008	M. mobular	185	NA	stretcher
8		Cape Finisterre*										

*sample in transit; information not yet in hand

6. Conclusion

Field data collection will continue over more cruises planned for 2023 onboard U.S. purse seiners. These cruises will continue sample collection and tagging, and also seek captain and crew feedback on the performance of the sorting grid. Given the rarity of mobulids in fishing sets, it will be advantageous to continue distributing tags on more vessels to increase the likelihood of encountering mobulids. Additionally, focusing tagging effort on larger individuals will allow for usage and testing of the sorting grid. The development and distribution of an in-depth species identification guide would be very useful to help fishers with species identification, which remained challenging. Utilizing the guide currently in development by the Inter-American Tropical Tuna Commission (pers. Comm, M. Hutchinson) will be valuable for this project and in general to improve fisher and observer species identifications. Finally, the use of a sorting grid to release mobulas has proven to be efficient for fishers, without disturbing the fishing operation and making the maneuver faster, easier and safer, both for fishers and mobulids. In addition, the construction of the sorting grid was feasible for all the vessels in the fleet due to easy access and low cost materials employed.

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