MIT2011-01 Protected rays – mitigate captures and assess survival of live-released animals: Presentation of methodology

Malcolm Francis, NIWA Wellington

Objectives

Overall objective:

- To identify methods to mitigate captures of protected rays and assess the fate of live released rays

Specific objectives:

- To identify methods to mitigate the capture of protected rays in commercial purse seine fisheries
- To make recommendations for future work to develop and/or assess the efficacy of methods to mitigate the capture of protected rays in commercial purse seine fisheries
- To assess the fate of live released protected rays captured in commercial purse seine fisheries and describe their spatial behaviour

“Manta” ray species in New Zealand

Manta ray (*Manta birostris*)

Spinetail devilray (*Mobula japanica*)

Photo: Will White

Background

- Paulin et al. (1982) reported data for 235 specimens of spinetail devilray caught by purse seiners off NE North Island 1975-1981. Temperatures of 17.2–22.5 oC over seabed depths of 110–434 m. Size 100 - 310 cm disk width. Five foetuses 58–85 cm DW.

- Bailey et al. (1996) analysed MAF observer data for 904 purse seine sets between 1976 and 1982. 74 sets (8.2%) contained “manta ray (Mobula japonica)” with an average of 2.2 rays per occurrence, suggesting a total of about 163 rays caught in 904 sets (0.18 per set).

- Observer coverage of the purse seine fleet ceased in 1982, and was reinstated in 2005. Bycatch of “manta rays” since then only reported in New Zealand’s “country reports” to the Western Central Pacific Fisheries Commission (WCPFC). The amounts observed were: 1450 kg in 3 sets in 2005, 1450 kg in 4 sets in 2006, 3840 kg in 7 sets in 2007, none in 11 sets in 2008, and 1545 kg in 4 sets in 2009.

- Catch rates are highly variable and species identity requires clarification. Observer coverage has not been very high, making it difficult to estimate total quantities caught

Methodology

Objective 1: To identify methods to mitigate the capture of protected rays in commercial purse seine fisheries

Review existing information and knowledge:

- Meeting reports and publications from regional tuna fisheries management organisations, especially WCPFC, the Inter-American Tropical Tuna Commission (IATTC), the Indian Ocean Tuna Commission (IOTC), and the International Commission for the Conservation of Atlantic Tunas (ICCAT).
- Scientists working on manta rays and other cartilaginous fishes taken as fisheries bycatch (personal collaborators and contacts, IUCN Shark Specialist Group, the American Elasmobranch Society, the Oceania Chondrichthyan Society and the European Elasmobranch Association).
- Non-governmental organisations that focus on the conservation of cartilaginous fishes (WildAid, Traffic, Shark Alliance, Pew Environment Group, the International Seafood Sustainability Foundation, Project GloBAL (Global Bycatch Assessment of Long-lived Species), Consortium for Wildlife Bycatch Reduction, Save our Sharks and The Shark Trust).
- Gear technologists working in the field of bycatch mitigation of megafauna, identified through organizations such as International Council for the Exploration of the Seas, Government departments and personal contacts.

Methodology

Description of capture process in the New Zealand fishery:

- A key part of developing successful mitigation techniques is to understand how and when mantas are caught in purse seine nets. There may be potential to avoid capture altogether, or release rays at a number of stages in the capture process, before pursing, after pursing but before brailing, during brailing, and after deposition of the brail contents on deck. To determine the best strategy, it is necessary to find out:
  - when mantas are first observed in the capture process
  - where they are relative to tunas (e.g. underneath the tuna, at the bottom of the net, mixed in with tuna)
  - at what point mantas first become physically trapped (e.g. meshed in the purse seine net as it is being hauled on deck, scooped up by the brail net)
  - life status of mantas when first observed – what proportion are already dead?
  - discard methods currently employed by New Zealand vessels
  - qualitative assessment of the success rate of New Zealand vessels in returning mantas to the sea alive

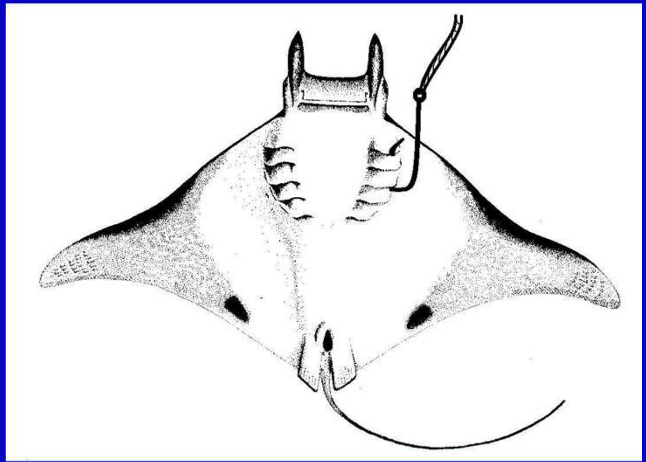
Methodology

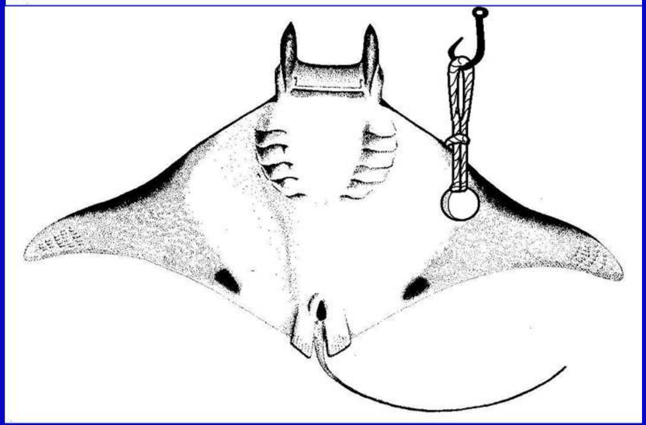
- Discussion with purse seine skippers, spotter plane pilots and observers will be the most effective way to understand when and where manta rays are caught, current practices and mitigation ideas that fishers themselves might support. “Buy-in” from the Industry is essential to the success of any future recommendations.
- Fisheries observers will also be asked to gather more detailed information during January (to allow mitigation efforts to occur in Feb-Mar), but continued through February-March to maximise observations. Information must be gathered from a number of purse vessels, including both the smaller domestic vessels, and the larger foreign-owned super-seiners.
- We will obtain logbooks and data from MAF Observer Programme. We will also search for photographs relating to species identification, size and sex in order to characterise the composition of the manta ray bycatch and identify the vulnerable species and life history stages.

Methodology

Development and testing of manta release method(s)

- The existing methods of releasing mantas that we are aware of occur from the deck after brailing. They are primitive, unlikely to result in high survival rates, and inhumane





Methodology

- Approach depends on whether we find any effective and appropriate methods in use overseas. We may (a) adopt existing methods if they are deemed suitable, (b) develop modifications of existing methods to improve them, and (c) develop new methods.

- One approach which has been mooted, but not to our knowledge tested or implemented, is to manoeuvre a cargo net under the manta while in the water, or place a cargo net on the deck underneath the brail net as it is being emptied. After removal of any trapped tuna, the cargo net is then hoisted and lowered into the sea where the manta ray is released. Modifications to this method might include covering the cargo net with material such as smooth rip-stop PVC sheeting to reduce abrasion of the net on the skin of the manta. Harm to the ray would be minimised if this procedure could be performed in the water, rather than after brailing the ray on to the deck, so emphasis will be given to developing methods and tools to allow this.

Methodology

- Other methods of releasing manta rays from the net in the water could include adaptations of methods used successfully to release whale sharks and dolphins from purse seine nets, such as the “backdown manoeuvre” and Medina panels used in the eastern Pacific. The vessel reverses in a curved path so that the float line and netting of the net section farthest from the vessel is lowered beneath the sea surface allowing the dolphins to escape over the top. The medina panel is a section of smaller mesh inserted into the area where the dolphins congregate and prevents them becoming entangled. Unlacing the net ties to open a “window” below the surface may also be effective.
- The success of such techniques depends on being able to separate the manta ray from the catch so as to minimise any commercial losses. This may be assisted by understanding the behaviour of the mantas and the tuna in the net and the use of methods to attract or herd mantas towards designated escape areas.

Methodology

- A method which has been used very successfully to reduce turtle bycatch in purse seine nets is to position a small boat under the main net while it is being hauled from the sea up through a lifting block on the purse seiner. If a turtle is observed caught in the meshes, hauling is stopped and the crew in the boat remove the turtle from the net and release it immediately into the sea. However, we do not know yet whether manta rays are caught in the meshes during hauling.

- An important consideration when developing release methods is that they must be safe and simple for both the crew and the vessel to implement, or else they will not be adopted by purse seiners.

Methodology

Objective 2: To make recommendations for future work to develop and/or assess the efficacy of methods to mitigate the capture of protected rays in commercial purse seine fisheries

Work undertaken above should establish a best practice method for handling and release of manta rays from the deck and make good progress towards the development of possible mitigation techniques that allow release while still in the water. But the short purse seine season (Jan-Mar) will not allow much time for testing release techniques. We will review progress (successes and failures), identify information gaps, and develop priorities for future work on mitigation techniques and monitoring the success of those techniques in terms of manta ray survival.

Methodology

Objective 3: To assess the fate of live released protected rays captured in commercial purse seine fisheries and describe their spatial behaviour

Tagging of manta rays:

We will use popup archival (PAT) tags to determine the fate of individual manta rays released into the sea. PAT tags record their approximate location (estimated from the times of dawn, dusk and midday using on-board light sensors), temperature and depth. After a pre-programmed period, or after experiencing constant depth for a pre-determined time, the tag releases itself from the ray, floats up to the surface, and transmits summaries of the collected data to an orbiting Argos satellite. The data are then delivered to the tag owner's email inbox by the satellite operator (CLS France). Ray mortality may occur immediately following release, or days to weeks after release (e.g. as a result of infection, or major injury to body organs). Hence the planned tag deployment period must be long enough to cover most of the delayed mortality.

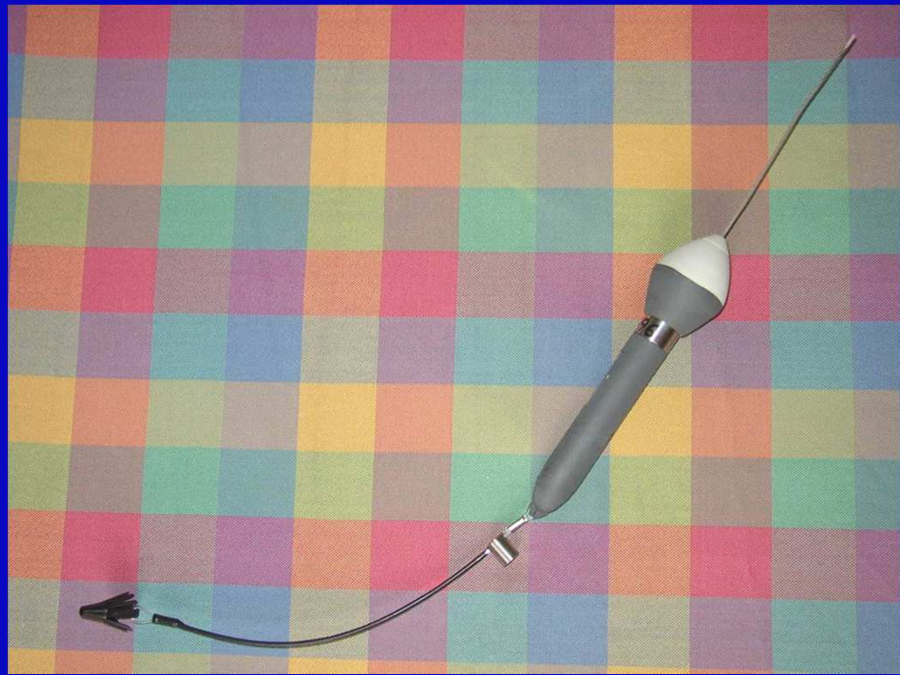
Methodology

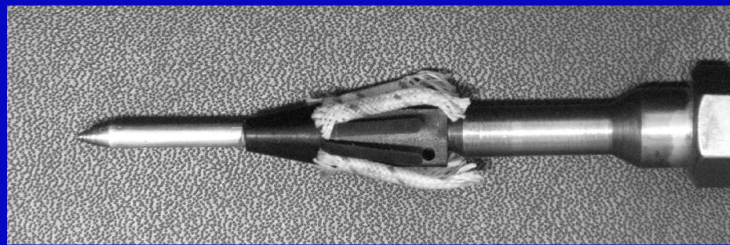
MK10 PAT tag

← MiniPAT

Images: D Croll et al.

Tag anchor



Methodology

- MiniPAT tags will be deployed by trained observers on purse seine vessels.
- Tags cost $US3950 each, limiting us to six tags in this project.
- Tags can be shed by marine animals, so care is required in the choice of an anchor and attachment technique. We will probably use PIER plastic “umbrella” anchors, which have better retention times when used with pop-up tags than nylon dart anchors, and probably cause less injury to the animal than sharp stainless steel dart anchors.
- We will also probably use a secondary “tie-down” loop tag positioned below the PAT tag float to hold the tag near the body, prevent excessive movement of the tag and reduce drag.
- Tags will be programmed to release after 6 months.
- The constant depth release will be programmed to activate after 3 days. There is also a maximum depth release set at 1800 m.

Methodology

Analysis of tag data (mortality)

- Dead rays are expected to sink to the seabed where their tags will release after the constant-depth delay and float to the surface and begin transmitting. If a ray dies over deep water, it’s tag will release itself with a depth-activated safety mechanism as it sinks past 1800 m depth. Live rays are expected to swim continuously and at various depths, so the constant-depth auto-release will not activate on living rays, and the tag will not pop up until the prescribed date.
- The summarised depth data recorded by the tag will provide information on the vertical movements of the ray in the day(s) before tag pop-up. A continuously varying depth record is indicative of a healthy swimming animal.
- Kaplan-Meier survival curves showing the proportion of released manta rays that are still alive at various times following release will be produced using the ‘survfit’ function of the ‘survival’ package in the R statistical language.

Methodology

Analysis of tag data (vertical behaviour)

- The vertical spatial behaviour of manta rays following release can be determined from the proportion of time each ray spends in each of the tag's depth bins (which can be programmed by the researcher).
- Analysis of such data can reveal preferred depth zones (perhaps related to thermoclines or concentrations of planktonic prey) and diel vertical movements.
- Manta and devilrays studied elsewhere seldom dive deeper than 100 m. In the eastern Pacific Ocean, *Mobula japanica* spent about 75% of their time shallower than 20 m, and rarely ventured below 50 m, although it has been recorded diving to 445 m.

Methodology

Analysis of tag data (horizontal spatial behaviour)

- Tracks will be plotted from the daily estimated positions. The accuracy of light-based position estimates can be very poor, having errors of several degrees, especially around the equinoxes. Errors can be corrected by fitting statistical state-space models (Kalman filtering) to the daily estimates, and by comparing remote-sensed sea surface temperatures with the SST recorded by the tag.
- Track positions will only be informative within about half a degree of latitude, which is adequate for tracking movement over moderate to long distances, but not short distances.
- Horizontal and vertical behaviour will be correlated with proximity to the edge of the continental shelf and thermal structure of the water column to determine whether manta rays exhibit preferences for particular locations and environmental conditions. Such information on time-space habitat preferences may lead to spatial and/or temporal fishing avoidance or restrictions as a tool for reducing manta ray bycatch.