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MITIGATION OF SILKY SHARK BYCATCH IN TROPICAL TUNA PURSE SEINE FISHERIES

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Mitigation of Silky Shark Bycatch in Tropical Tuna Purse Seine Fisheries

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THE ISSUE IN CONTEXT

Pelagic sharks are not targeted by tropical tuna purse seine fisheries, but they are caught incidentally, especially around floating objects like FADs. The shark bycatch-to-tuna catch ratio in purse seine fisheries is quite small, on average, less than 0.5% in weight. Over 90% of that bycatch is composed of silky sharks, *Carcharhinus falciformis*. Because of their low reproductive rates and other life history characteristics, silky sharks are a vulnerable species.

Other gear types such as longlines or gillnets have a larger impact on silky sharks than purse seine fisheries do. The contribution of purse seining to the total catch of this species varies by Ocean: From 4% in the Indian and eastern Pacific Oceans, to about 25% in the western and Central Pacific Ocean[i].

Within the purse seine fishery, all set types catch silky sharks, with the highest catch rates being on natural logs (which represent a relatively small fraction of the total number of sets) followed by man-made FADs. Catches on floating object sets (both natural and man-made) tend to be 2 to 6 times higher than they are on free swimming schools.

The global magnitude of catch of the purse seine fishery is quite large, so reducing the mortality caused by these fisheries can contribute towards global conservation efforts. This document summarizes mitigation techniques that can be used in this fishery.

MITIGATION OPTIONS

These options follow a hierarchical logic, ordered by the time at which the measure takes place within the fishing operation, with emphasis on sets on floating objects: Passive mitigation, avoid catching bycatch before setting, release bycatch from the net, and release bycatch from the deck.

Passive Mitigation

Use non-entangling FADs ✔. Man-made FADs have a submerged appendage that attracts tunas (as well as other species) and alters the FAD's drift. Many fleets use old netting for the hanging structure, which can cause entanglement of various species, including sharks. The magnitude of this problem may vary depending on a number of factors such as time and area, as well as the net's mesh size. A study in the Indian Ocean using data collected by ISSF and other organizations calculated that this type of ghost fishing could result in much greater mortality than that observed when sharks are brought onboard[ii]. The magnitude of the problem has not been calculated elsewhere, but this does not matter because there is a simple solution: To deploy non-entangling FADs[iii]. These can, if properly designed, completely eliminate entanglement and still be effective at attracting target tunas. Many fleets began to voluntarily use non-entangling FADs, and three RFMOs (ICCAT, IOTC and IATTC) now require a transition to such FADs[iv].

Avoid Catching Before Setting

Make fewer sets on floating objects ✔. Sharks are more commonly found in natural log and FAD sets than they are on free swimming schools. For a given amount of fishing effort, shifting to more free swimming school sets will reduce the overall catch of sharks. For example, a study calculated that in the western and central Pacific Ocean the catch of silky sharks could be reduced by 83% if all of the purse seine fishing effort shifted completely to free schools[v]. Less extreme shifts in set type towards free schools will also reduce shark mortality, by a smaller amount.

Avoid setting on floating objects with low tuna abundance ✔. Data from observer programs indicate that the amount of non-tuna species associated with logs and FADs is independent from the amount of tunas present. Therefore, the bycatch rate as a percentage of the total tuna catch will be lower when sets are made on larger tuna schools. A global study calculated that avoiding sets on schools of tuna less than 10 tons would reduce the amount of silky sharks by 21%-41% depending on the ocean, while only reducing the total amount of tuna by 3-10%[vi]. Through the avoidance of sets on small schools, the fishery would improve its efficiency both through reductions in the ratio of bycatch to catch, as well as through an increase in the average set size.

Set at a pre-determined time of the day ✘. All fish associated with floating objects make short excursions lasting a few hours, likely to forage. The idea for mitigation would be for the fishing vessel to set around the floating object at a time of the day when the tunas are typically present and the sharks are away. Through electronic tagging of tunas and sharks at FADs, ISSF research determined the periods during the 24-hour cycle when each species is usually present, and when they are usually making an excursion. Unfortunately, silky sharks and tunas happen to exhibit very similar temporal patterns: they all make excursions away from FADs at similar times (usually during night time)[vii]. Adjusting the fishing time in order to reduce catches of sharks while maintaining good catches of tunas therefore does not appear to be an effective solution.

Attract the sharks away before setting ?. ISSF has conducted tests using a small tender to drift slowly away from the FAD with a bag full of fish chum (bait), to see if sharks could be attracted away before making a set[viii]. The number of experiments to-date is limited. Preliminary results indicate that up to 50% of the sharks present can be attracted away from the FAD up to 500 m using chum. These experiments have not been followed by an actual purse seine set, so more tests are needed to determine the potential effectiveness of this activity.

Release from the Net

Fish and release sharks ✔. ISSF scientists have been researching ways in which sharks could be released before they are brailed onboard, by which time many have died. Fishing the sharks from inside the net and releasing them outside the net can be a very simple good mitigation technique. Results show that this is relatively easy to do and 100% of those sharks released survive[ix]. The proportion of sharks encircled that were fished and released in that study was 21%. But, this percentage can probably be increased very easily. Future research will focus on how to make the catch-and-release process more efficient, and making sure it will be safe for fishers to employ this technique.

Attract sharks out of the net ✘. ISSF has tested whether it is feasible to attract and lure the sharks out of the net by towing the FAD out of the net through a gap between the net and the hull of the purse seiner[x]. The sharks did not follow the FAD when it got towed by the tender out of the net. It appears that the fish are scared by the noise of the vessel and the turbulence generated by the side thrusters.

Make a shark escape panel in the net ✘. Observations and field testing in an ISSF scientific research cruise suggested that the use of a release panel could function and that it could be deployed in commercial fishing applications to allow sharks to escape. However, other research cruises have shown that many factors come into play[xi]. The success of such a measure appears to depend on the size of the vessel, the characteristics of the net, the depth of the thermocline, the skippers' skills and the behavior of the sharks which appears to be (at least) area-dependent. Investigations of other solutions or further experiments (still considering the above limitations) are needed and this measure does not appear to be widely applicable to purse seine fleets.

Release from the Deck

Use best handling and release practices ✔. Research cruises from ISSF and other organizations[xii] has shown that following simple best practices onboard to release live sharks from the deck can reduce the direct mortality of silky sharks by up to 20%. Good practices are described in the ISSF Skippers' Guidebook[xiii] (available in 10 languages). It should be noted that this technique works for catches from free school sets as well, which also catch sharks.

MANAGEMENT CONSIDERATIONS

Concerning the tuna RFMOs, IATTC Resolution C-16-06, ICCAT Recommendation 11-08 and WCPFC CMM 2013-08 prohibit the retention of silky sharks onboard purse seine vessels (no such prohibition is in effect in the Indian Ocean). In order to comply with these measures, it would be useful for vessels to quickly sort the brailed catch before putting it into wells, e.g. by the use of hoppers, so that the sharks can be spotted and released (alive if at all possible).

If fishers retain the sharks (where it is not prohibited by national or international legislation), they should retain both the fins and the carcass. Fishers should ensure that the information (discarded/retained) is recorded in the logbooks. This record-keeping can be greatly improved by the deployment of on-board observers. All tuna RFMOs have measures in place to prohibit shark finning by requiring that the landings of sharks conform to a ratio of fins to carcass weight. But this type of measure is ineffective because the actual ratios of fins to carcass can vary considerably depending on species and handling practices, and the ratios assumed by RFMOs can thus be quite inaccurate. ISSF advocates for RFMOs to prohibit shark finning and require sharks be landed with fins naturally attached. ISSF has also adopted a market-based resolution to prohibit shark finning by purse seine vessels.

CONCLUSIONS

Silky sharks are caught by a variety of fisheries. Although purse seining does not account for the majority of those catches, the impact by this fishing gear on silky shark populations can be important. This document notes some of the actions that can be taken to mitigate silky shark mortality, namely:

Regarding unobservable mortality ("ghost fishing") due to entanglement, its magnitude has not been studied in every ocean, but it likely occurs everywhere. Some people argue that it needs to be quantified before action is taken. But, a simple solution exists: Using non-entangling FADs can completely eliminate entanglement, while still attracting tunas efficiently. IATTC, ICCAT and IOTC already require a transition to non-entangling FADs, but WCPFC does not. ISSF has been advocating that WCPFC adopt a CMM transition to non-entangling FADs as the other three tuna RFMOs have done.

Regarding catches that are visible, there are several mitigation actions that can be taken. Shifting part of the effort from FADs to free schools will reduce shark mortality to varying degrees depending on the magnitude of the shift. As an example, a 20% effort shift could increase survival by 16% or so. Avoiding making sets on FADs that have tuna aggregations under 10 tons could increase survival by 30%. Catching sharks inside the net with handlines and releasing them could increase survival by 21% (or more, as the technique is improved). And, releasing sharks from the deck following best handling practices will increase survival by up to 20%.

Used in combination, the sequential survival following the same sequence of actions would be as follows:

- ✓ Shift 20% effort to free schools = +16%.
- ✓ Set only on FADs with > 10 t tunas = +25%.
- ✓ Fish sharks from the net = +12%.
- ✓ Release from the deck = +9%.

  - ➢ Altogether, these four actions in combination can increase silky shark survival in purse seine fisheries by 62%. And they will also increase the survival of other shark species.

Some of these mitigation actions will be easier to implement than others. For example, releasing from the deck following best handling practices is simple and would constitute a negligible cost during fishing operations (though crew safety needs to be ensured). Others, like not setting on small tuna aggregations and shifting effort to free schools, could incur costs to the fleets, as the total tuna catch could be affected. Fishing sharks from the net should not affect normal fishing operations, but there needs to be crew available to undertake the activity during the set. However, all of these activities are achievable and together would greatly contribute to shark conservation.

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[vii] See cruise #s 4, 8, 12 and 13 in Restrepo, V., L. Dagorn, G. Moreno, F. Forget, K. Schaefer, I. Sancristobal, J. Muir and D. Itano. 2016. Compendium of ISSF At-Sea Bycatch Mitigation Research Activities as of July, 2016. ISSF Technical Report 2016-13. International Seafood Sustainability Foundation, McLean, Virginia, USA.

[viii] See cruise #2 in Restrepo et al. 2016 (*op. cit.*)

[ix] Sancristobal, I., U. Martinez, G. Boyra, J. Muir, G. Moreno and V. Restrepo. 2016. ISSF bycatch reduction research cruse on the F/V MAR DE SERGIO in 2016. ICCAT SCRS/2016/156.

[x] See cruises #4 and #5 in Restrepo et al. 2016 (*op. cit.*)

[xi] See cruise #s 5, 6, 7, 9 and 14 in Restrepo et al. 2016 (*op. cit.*)

[xii] Filmalter, J., M. Hutchinson, F. Poisson, W. Eddy, R. Brill, D. Bernal, D. Itano, J. Muir, A.-L. Vernet, K. Holland, and L. Dagorn. 2015b. Global comparison of post release survival of silky sharks caught by tropical tuna purse seine vessels. ISSF Technical Report 2015-10. International Seafood Sustainability Foundation, Washington, D.C., USA.

[xiii] http://www.issfguidebooks.org/downloadable-guides/