Bycatch is troublesome – Deal with it!

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I really dislike the term 'bycatch'. Why then does it appear not only in the title of this article but also in my job title? I guess it is because it has become a convenient and well-used term for all those 'other' species that get caught alongside the target tuna. Like the U.S. Supreme Court Justice said about pornography, we know bycatch when we see it – but the problem is that the terms used are inherently subjective. The terms non-target, secondary target, bycatch, byproduct, incidental, discard or trash could all be applied by different people to the same catch.

Regardless of what it's called, and whether it's utilised or not, bycatch usually means trouble for fishers. Fundamentally, bycatch is bycatch because the goal was to catch something else. This means that from the outset fishers are less than pleased when catching bycatch and they may feel less inclined to record this catch with the required level of detail, simply due to lack of interest. As a result, fishers' records of bycatch are often limited or non-existent, and observer programmes cannot always fill the gaps in data quantity or quality. Just as bycatch complicates life for fishers, it also complicates life for the fishery managers. Limited data lead to high uncertainty in the decisions about whether or how to protect bycatch populations from depletion. Bycatch management thus often takes a backseat to more pressing issues associated with managing target tuna species. A third problem with bycatch is that there is usually no quick fix. Mitigation technology may come at a price either in terms of gear cost, crew efficiency or reduced catch of target species, and just banning retention of bycatch will not necessarily prevent catch nor reduce mortality to sustainable levels for the most vulnerable species.

Limited data quantity and quality, which leads to uncertainty in the scientific advice and difficult management trade-offs, are thorny issues with no simple solutions. In tackling these issues for bycatch in tuna fisheries, the Areas Beyond National Jurisdiction (ABNJ or Common Oceans) Tuna Project has its work cut out for it. The Western and Central Pacific Fisheries Commission (WCPFC) has teamed up with the Secretariat of the Pacific Community (SPC) to implement three bycatch components of the Global Environment Facility (GEF)-funded, United Nations Food and Agriculture Organization (FAO)-led, ABNJ Tuna Project over a five-year period from 2014. Given the low probability that bycatch problems will be solved in this timeframe, the project's challenge is to identify ways to make a small, focused investment pay a large dividend over the long-term. This will require finding a way forward despite some imposing roadblocks, such as how to improve the quality and usefulness of collected bycatch data, how to prioritise bycatch management actions in data-poor situations, and how to evaluate the effectiveness of bycatch mitigation measures.

How to improve the quality and usefulness of collected bycatch data?

The first of three components of the ABNJ Tuna Project being implemented by the WCPFC is bycatch data improvement and harmonisation. Back in 2011, when the tuna Regional Fisheries Management Organizations (t-RFMOs) held a joint meeting of the Technical Working Group-Bycatch, all of the t-RFMOs and taxa experts present agreed that data issues were the major problems facing the group (Anon. 2011). Data sharing, subject to the applicable data confidentiality controls, was discussed throughout the meeting as a worthy goal. The group also prioritised adopting minimum data fields and standardised collection protocols to enable interoperability of the t-RFMOs' observer-collected bycatch databases.

Four years on, the ABNJ Tuna Project is working on sparking some progress toward these objectives on two fronts. The first front, interoperability, implies that the bycatch information that is collected should be similar enough in content and format so that, if shared, data from different sources can be combined and analysed. Usually referred to as 'harmonisation,' this is much more difficult than it sounds. For example, each of the five t-RFMOs have different bycatch reporting standards, so which t-RFMO's standards will be selected as the ideal and how will this be decided? If a new, composite set of standards are developed, how can adoption of that set be ensured across five independent organisations with different memberships? If the standards adopted by each t-RFMO represent individual mixtures of science,

practicality, and regional priorities, how reasonable is it to expect that there will ever be global agreement?

Part of the reason for the lack of progress on harmonisation is that simply deciding where to begin is difficult. In January 2015, a meeting of experts was convened with International Seafood Sustainability Foundation (ISSF) support in Keelung, Taiwan to discuss these issues in the context of longline observer data (ISSF 2015). As a result of this meeting, the ABNJ Tuna Project commissioned a review examining what data longline observers should collect in order to best understand bycatch interaction and mortality rates. The resulting study (Gilman and Hall 2015) provides a starting point for data improvement discussions in individual t-RFMOs, but does not depend on the agreement of a single set of minimum standards. Instead, it aims to provide a basis for each t-RFMO to make incremental improvements in a common direction that will allow some components of the various t-RFMO programmes to align sooner than others. The WCPFC's Scientific Committee took the first step in this direction in August 2015 with endorsement of eight modifications to bycatch data collected by longline observers (Table 1). The Commission will consider formally adopting these changes at its meeting in Bali in December.

Harmonisation creates the potential for data sharing, but what progress can be made toward actual exchange? The situation in each t-RFMO varies considerably: in some cases, the bulk of the observer bycatch data is already held centrally, whereas in other cases national programmes hold most of the data and provide only partial summaries to the t-RFMO. For bycatch species such as sea turtles or seabirds that migrate across t-RFMO boundaries, for example in the Pacific or Southern Oceans, analysis of fishery interactions may require not only data sharing within, but also between, t-RFMOs. To encourage thinking about how and whether data can be exchanged, the ABNJ Tuna Project has proposed a summarised template that each t-RFMO can populate with public domain data. These templates can provide a framework for consistent management of bycatch data within each t-RFMO, as well as a convenient inventory of bycatch data holdings and a prospective basis for cross-RFMO data sharing, if agreed (Clarke et al. 2015a). WCPFC's Scientific Committee agreed to trial the template, called the Bycatch Data Exchange Protocol (BDEP), and report back next year (WCPFC 2015).

How to prioritise bycatch management actions in data-poor situations

The 2013 listing of five species of sharks and all manta rays by the Convention on International Trade in Endangered Species (CITES), and the 2014 listing of 21 species of sharks and rays under the Convention on Migratory Species (CMS), leaves no doubt that elasmobranch conservation is a major global concern. The second of the three ABNJ Tuna Project bycatch components being implemented by WCPFC is designed to further the assessment and management of pelagic sharks within the t-RFMOs. Under this component, funding is available for four pan-Pacific assessments, which can provide a basis for regional conservation and management measures. As can be surmised from the discussion above, the major challenges for these assessments will revolve around data quantity and quality. Beginning in 2008, WCPFC designated a number of sharks as 'key shark species' and assessments have been conducted for those with ample observer data – oceanic whitetip, silky and blue sharks (Brouwer and Harley 2015). Some may suggest that assessments for the remaining 'key', but data-poor species should be paused until the data improve; however, ABNJ funding provides an opportunity to do more in the short-term than simply wait. The two examples below describe the potential to explore new

Table 1. Changes in minimum standard data fields for longline observer programmes endorsed by WCPFC SC11 and to be considered for adoption by WCPFC12 in December 2015 (WCPFC 2015).

Data type	Proposed change
Hooks	More detail on hook type (circle, J, etc.) and hook size
Bait	More detail on the proportions of different types of bait used
Leaders	More detail on the proportions of different types of leaders used
Branchline weighting	More detail on the use of different types of line weighting
Shark lines	Record the number of shark lines used (if used)
Lightsticks	More detail on the number and position of lightsticks used (if used)
Seabird mitigation	More detail on the use of tori lines, dyed bait, underwater or side-setting and offal management
Hooking location	For silky or oceanic whitetip sharks, sea turtles, seabirds and marine mammals, record whether hooked in mouth, hooked deeply (throat/stomach), hooked externally and whether hook and line removed

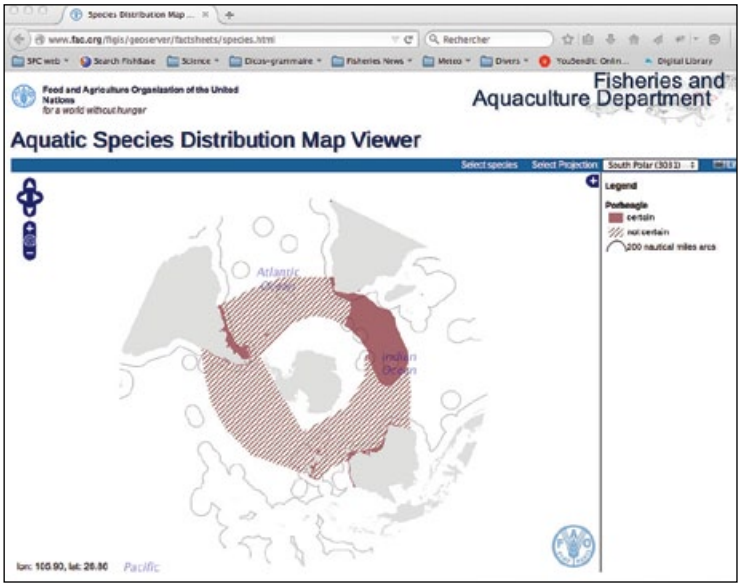
analytical approaches for data-poor sharks, open new avenues of collaboration and contribute to the global conservation dialogue.

The first pan-Pacific assessment will be an analysis of the status of the southern hemisphere population of porbeagle sharks (*Lamna nasus*). This species was listed by CITES on Appendix II primarily based on declines in the northern stock. ICCAT attempted to include South Atlantic populations in its 2009 stock assessment, but concluded that data were too limited to provide a robust indication of stock status. The Commission for the Conservation of Southern Bluefin Tuna (CCSBT), with responsibility for areas in the South Pacific east to New Zealand, across the southern Indian Ocean and west to the Argentinian Atlantic, asked the WCPFC and ABNJ Tuna Project in March 2015 to coordinate an assessment across the joint t-RFMOs. This kind of approach allows access to data sets beyond those held by CCSBT members and enables coverage of the whole of the southern stock.

NIWA (New Zealand) has been selected as the coordinating consultant for the southern hemisphere porbeagle assessment. The study design involves obtaining indicators of stock status, such as trends in catch rate and size, from national scientists and combining these in both quantitative risk assessment and age-structured stock assessment models. The study will use the available information on shark biology and population dynamics to structure the models. In addition to being able to evaluate the stock status to the best extent possible, this collaborative and integrative approach will highlight where the greatest uncertainty lies and thus point to where investments are needed in better datasets. This type of approach also helps with the understanding of the risk associated with each fishery sector and shark population component (sex or life stage) and thus allows more focused management. The study kicked-off in August 2015 and will run for approximately one year.

Plans for a second pan-Pacific assessment are emerging after the WCPFC Scientific Committee noted its interest in a pan-Pacific assessment of thresher sharks based on consideration of trends and vulnerability. Like porbeagle, the bigeye, common and pelagic thresher sharks are listed as WCPFC key sharks (as 'threshers'), but analysis has thus far been constrained by data quantity and quality (Rice et al. 2015). In the case of threshers, many catches are not recorded to species, so preliminary work on species separation will be necessary. Recent studies of thresher catches in the Eastern Pacific indicate that common (*Alopias vulpinus*) and pelagic (*A. pelagicus*) threshers dominate, but in the Western and Central Pacific bigeye threshers (*A. superciliosus*) appear to be the most abundant thresher species, particularly in the waters off Hawaii (Clarke et al. 2011, Rice et al. 2015). The thresher species complex as a whole shows low productivity and high susceptibility to longline fishing

The ABNJ (Common Oceans) Tuna Project is coordinating the first global shark stock status assessment for the southern hemisphere population of porbeagle shark (Lamna nasus) *(image: Malcolm Francis).*



Southern hemisphere porbeagles (Lamna nasus) *may have a circumpolar distribution that intersects with all five tuna RMFOs' convention areas (http://www.fao.org/figis/geoserver/factsheets/species.html?species=POR-me&prj=4326).*

From top to bottom: common thresher (Alopias vulpinus)*, pelagic thresher* (A. pelagicus)*, and bigeye thresher* (A. superciliosus) *(illustrations: Les Hata).*

compared with most pelagic sharks (Cortés 2008, Cortés et al. 2010). Drawing upon ABNJ funds to conduct some form of stock status assessment for one of the thresher species in the next year could inform not only t-RFMO actions but also potentially preparatory discussions for the September 2016 CITES meeting, should thresher listing be proposed.

How to evaluate the effectiveness of bycatch mitigation measures

Bycatch mitigation refers to actions taken to lessen the impacts of fishing activities on non-target organisms. In tuna fisheries, mitigation has taken the form of tori (streamer) lines aimed at reducing seabird hooking rates, regulations on leader material aimed at reducing shark catches, and restrictions on types of hooks and bait aimed at reducing sea turtle interactions. How well do these mitigation measures work in practice, and are the mortality rates now low enough to allow bycatch populations to be sustained? Unfortunately, these questions remain largely unanswered in tuna fisheries. While it may feel good to adopt mitigation measures, it is not

Tori (streamer) lines scare seabirds away from baited hooks as they enter the water, reducing bait loss and seabird hooking (image: Lucy Kemp, Marine Photobank)

Sharks are usually unable to bite through wire leaders but have the potential to 'self-release' from monofilament leaders under some circumstances (image: Terry Goss Photography USA, Marine Photobank).

enough to just hope for the best. In order to confirm that good intentions actually make a difference in the water, mitigation measures need to be followed up by implementation, monitoring and data analysis to determine if they are working.

The third component of ABNJ Tuna Project's bycatch work programme entrusted to WCPFC and SPC is focused on promoting effective bycatch mitigation. This involves publicizing new mitigation technologies as they are discovered and helping to evaluate what is, and is not, working effectively in ongoing fisheries. One aspect of this work is re-developing the WCPFC's existing Bycatch Management Information System (BMIS) as a global resource. The 'new look' BMIS will present a broader range of material, particularly regarding the management of bycatch, including species interaction rates and threats, population-level assessments, and national and international management schemes (Box 1).

One of the longstanding obstacles to examining whether bycatch mitigation works is data; as described above, this includes lack of harmonisation, sharing, quantity and quality. The WCPFC's mitigation work under the ABNJ Tuna Project aims to tackle this through a workshop format, which allows temporary pooling of data from different sources for joint analysis and subsequent publication of the findings (only). The first workshop topic will be sea turtle bycatch (Clarke et al. 2015b). Although the WCPFC has had a sea turtle conservation and management measure (CMM) in place since 2008, there has not yet been any formal assessment of its effectiveness. Other t-RFMOs also have sea turtle topics in their work plans but are struggling with data issues, particularly because sea turtle data are even more sparse than that of the data-poor sharks. Using ABNJ funds, SPC will convene a workshop to focus on characterizing interaction and mortality rates by species based on factors such as hook type, bait type, time of day, depth, location, season and year. Once a baseline is established, a second workshop will be held to explore the effect of various mitigation options, including the existing WCPFC CMM, on sea turtle populations. The first workshop is planned for early 2016 with a focus on Pacific longline fisheries, including the Eastern Pacific, if possible.

Box 1:
New modules under development for the updated Bycatch Management Information System

- ✓ bycatch interaction rates
- ✓ bycatch threats/mitigated threats
- ✓ population-level assessments
- ✓ implementation levels for mitigation techniques
- ✓ national and international agreements (e.g. CITES, CMS)
- ✓ static maps of bycatch distributions, threats, etc.
- ✓ bycatch data harmonisation across t-RFMOs
- ✓ E-monitoring

The analysis is expected to be similar to the shark mitigation analysis presented by SPC at the recent WCPFC Scientific Committee meeting (Harley et al. 2015). This analysis investigated the theoretical effectiveness of the new shark CMM 2014-05 in reducing mortality to overfished oceanic whitetip and silky sharks. Specifically, the analysis showed that if all fleets banned wire leaders, or if all fleets banned shark lines, the estimated mortality reduction from the current baseline would be between 15–25% for both species. If all fleets banned both wire leaders and shark lines, mortality would be reduced by 30–40%. Further work will be undertaken to explore how these estimates would change depending on which fleets choose to ban which gear – a choice provided for under CMM 2014-05. These types of analyses, which we hope to produce at the sea turtle workshops, provide essential input for managers' decision-making on bycatch mitigation.

Sea turtles can bite off small pieces of finfish bait and thus avoid becoming hooked but they tend to swallow squid bait whole and ingest the hook as well (image source: NOAA Fisheries, Southeast Fisheries Science Centre).

Conclusion

Whether due to formats, access, sparsity, unreliability, or a combination of these, bycatch data and thus bycatch management is troublesome. But allowing the status quo to continue could have severe consequences for shark, sea turtle, seabird and marine mammal populations, as well as for ocean ecosystems as a whole. Over the next four years, the ABNJ Tuna Project aims to synergise ongoing initiatives to reduce the ecosystem impacts of tuna fishing. The challenge is to identify practical and achievable steps that will move us closer to that target in that timeframe.

WCPFC's and SPC's ABNJ work involves a mixture of ambitious initiatives and smaller steps that may appear inconsequential, but can lead to significant incremental progress over time. All of the initiatives might not be successful, but they are designed to, at a minimum, clearly establish what we already know and what we still need to find out. Likewise, some of the smaller steps may not lead to major changes in the short-term, but they can remain as building blocks for future efforts.

Bycatch work within the t-RFMOs can be constrained by a limited appetite for these issues amidst the competing priorities of managing some of the world's largest and most valuable commercial fisheries. Working in this space, though, is working at the front line of bycatch impact where management's direct influence can be felt. There's no better place to deal with it!

References

Anon. 2011. Report of the first meeting of the Joint Tuna RFMO Technical Working Group on Bycatch. La Jolla, California, USA – 11 July 2011. Accessed online at http://www.tunaorg.org/Documents/TRFMO3/RFMO%20TECH%20WG%20BY-CATCH_REP_ENG.pdf

Brouwer S. and Harley S. 2015. Draft Shark Research Plan: 2016–2020. Working Paper EB-WP-01 (rev 1), Eleventh Meeting of the Scientific Committee, WCPFC, 5–13 August 2015, Pohnpei, Federated States of Micronesia. Accessed online at https://www.wcpfc.int/node/21717

Clarke S., Harley S., Hoyle S. and Rice J. 2011. An indicator-based analysis of key shark species based on data held by SPC-OFP. Working Paper EB-WP-01, Seventh Meeting of the Scientific Committee, WCPFC, 5–13 August 2015, Pohnpei, Federated States of Micronesia. Accessed online at https://www.wcpfc.int/node/2766

Clarke S., Nicol S. and Williams P. 2015a. Proposal for a bycatch data exchange protocol (BDEP) amongst the t-RFMOs. Working Paper EB-WP-06, Eleventh Meeting of the Scientific Committee, WCPFC, 5–13 August 2015, Pohnpei, Federated States of Micronesia. Accessed online at http://www.wcpfc.int/node/21721

Clarke S., Nicol S. and Williams P. 2015b. Analysis of sea turtle mitigation measure effectiveness in tuna longline fisheries. Working Paper EB-WP-05, Eleventh Meeting of the Scientific Committee, WCPFC, 5–13 August 2015, Pohnpei, Federated States of Micronesia. Accessed online at https://www.wcpfc.int/node/21720

Cortés E. 2008. Comparative life history and demography of pelagic sharks. p. 309–322. In: Camhi M.D., Pikitch E.K. and Babcock E.A. (eds). Sharks of the open ocean: biology, fisheries and conservation. Oxford: Blackwell Science. 536 p.

Cortés E., Arocha F., Beerkircher L., Carvalho F., Domingo A., Heupel M., Holtzhausen H., Santos M.N., Ribera M. and Simpfendorfer C. 2010. Ecological risk assessment of pelagic sharks caught in Atlantic pelagic longline fisheries. Aquatic Living Resources 23(1):25–34.

Gilman E. and Hall M. 2015. Potentially significant variables explaining bycatch and survival rates and alternative data collection protocols to harmonize tuna RFMOs' pelagic longline observer programmes. Working Paper EB-IP-05 (Appendix 1). Eleventh Meeting of the Scientific Committee, WCPFC, 5–13 August 2015, Pohnpei, Federated States of Micronesia. Accessed online at http://www.wcpfc.int/node/21730

Harley S., Caneco B., Donovan C., Tremblay-Boyer L. and Brouwer S. 2015. Monte Carlo simulation modelling of possible measures to reduce impacts of longlining on oceanic whitetip and silky sharks. Working Paper EB-IP-02. Eleventh Meeting of the Scientific Committee, WCPFC, 5–13 August 2015, Pohnpei, Federated States of Micronesia. Accessed online at https://www.wcpfc.int/node/21718

ISSF. 2015. Report of the Tuna RFMO Expert Working Group: Harmonisation of longline bycatch data collected by tuna RFMOs. 27–29 January 2015, Keelung, Taiwan. ISSF Technical Report 2015-08. International Seafood Sustainability Foundation, Washington, D.C. Accessed online at http://iss-foundation.org/resources/downloads/?did=583

Rice J., Tremblay-Boyer L., Scott R., Hare S. and Tidd A. 2015. Analysis of stock status and related indicators for key shark species of the Western Central Pacific Fisheries Commission. Working Paper EB-WP-04, Eleventh Meeting of the Scientific Committee, WCPFC, 5–13 August 2015, Pohnpei, Federated States of Micronesia. Accessed online at https://www.wcpfc.int/node/21719

WCPFC. 2015. Summary Report of the Eleventh Meeting of the Scientific Committee. 5–13 August 2015, Pohnpei, Federated States of Micronesia. Accessed online at http://www.wcpfc.int/meetings/11th-regular-session-scientific-committee

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