New research plan provides a blueprint for addressing shark issues in the western and central Pacific

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The Western and Central Pacific Fisheries Commission (WCPFC) has taken a major step toward addressing concerns about shark populations with initial approval of a three-year Shark Research Plan by its Scientific Committee (see Useful Shark Links, #1). The plan will be led by the Oceanic Fisheries Programme of the Secretariat of the Pacific Community, and will contain assessment, research coordination and fishery statistics improvement components. The overall aim of the plan is to evaluate the status of blue, mako, oceanic whitetip, silky and thresher sharks in the western and central Pacific Ocean (WCPO) and to establish better datasets to support future assessments. Following its recent endorsement by the Scientific Committee, the Shark Research Plan will be presented for full Commission approval at its annual meeting in Hawaii in December. This article outlines the background and context of shark issues in the WCPO, introduces the key species and previews the forthcoming assessment work.

Introduction

Sharks are among the species to be managed by regional tuna fisheries management organisations (RFMOs) but little has been done worldwide by these organisations to manage shark catches. In fact, because so few national fisheries catch reporting systems record sharks, RFMOs often lack sufficient data upon which to draw conclusions about the status of shark stocks. At the same time, there are increasing concerns about fisheries targeting sharks and about continued growth in the shark fin trade. In the WCPO, two species of sharks are categorised by the International Union for Conservation of Nature (IUCN) Red List as globally endangered and another sixteen as globally vulnerable (see Useful Shark Links, #2), and it is not difficult to predict that catch limits may, in future, be required to safeguard some stocks. The current challenge facing the WCPFC is to find the proper balance between shark conservation and utilisation, given the considerable uncertainty regarding the current status of stocks (Fig. 1).

Figure 1. What should be done about sharks? Heavy fishing pressure is believed to be threatening some shark populations.

Shark management options

Within the overall shark policy debate, one of the most contentious issues is which organisation should take charge of management. Some conservation advocates, frustrated with what they see as the "failure" of RFMOs to protect stocks from overfishing, have lobbied for listing sharks and other fished species by the Convention on International Trade in Endangered Species (CITES). Three large and charismatic shark species (basking, whale and great white sharks) have already been listed by CITES (see Useful Shark Links, #4) but these species do not appear frequently in catch records from longline or purse seine-based tuna fisheries. At the March 2010 CITES meeting, proposals for eight sharks, most of which are common bycatch species in tuna fisheries, were debated but none gained the necessary votes for listing. Another tool for shark protection is the Convention on Migratory Species (CMS) on which seven shark species — three of which are potential tuna bycatch species — are listed (see Useful Shark Links, #5). Another approach, proposed in a forthcoming paper in the journal Marine Policy, rejects management options under all existing organisations and calls for the creation of a new "International Commission for the

Figure 2. Finning involves discarding the shark carcass at sea (left). Bringing the shark to shore, removing the fins and disposing of the carcass on land is not finning (right) (see Useful Shark Links, #3).
(Images sources: left – Nancy Boucha, www.scubasystems.org 2005/Marine Photobank; right – www.sharks.org/news/051213.htm)

Conservation and Management of Sharks", based on the International Whaling Commission.

Such potential threats to the management authority of RFMOs for highly migratory fished species have perhaps helped to foster consensus among WCPFC members that the Commission needs to do more to address shark issues. WCPFC's existing shark conservation and management measure (CMM 2009-04, see Useful Shark Links, #1) is similar to that adopted by other RFMOs in that it discourages waste and discards, encourages live release, and controls finning (i.e. cutting off a shark's fins and discarding its carcass at sea (Fig. 2), but it does not limit shark catches per se. The measure also specifies national catch reporting practices that are voluntary rather than required. Development of the WCPFC Shark Research Plan (see Useful Shark Links, #1) is designed to support the existing management measure, but at the same time it moves beyond the current utilisation-focused RFMO approach by proposing the most ambitious shark assessment programme of any of the tuna RFMOs. If formally endorsed and funded by the Commission in December, the Shark Research Plan will produce assessments for eight key shark species identified by the Commission (Fig. 3) and lay a solid research foundation to support future assessments.

WCPFC key shark species

Under Article 1 of its Convention, the WCPFC is responsible for managing highly migratory fish stocks, which are defined as those listed in Annex 1 of the United Nations Convention on the Law of the Sea (UNCLOS), as well as such other fish species as the Commission may determine. UNCLOS Annex 1 specifies that oceanic sharks consisting of bluntnose sixgill (*Hexanchus griseus*); basking shark (*Cetorhinus maximus*); threshers (Family Alopiidae, 3 species); whale shark (Rhincodon typus); requiem sharks (Family Carcharhinidae, 52 species); hammerheads (Family Sphyrnidae, 9 species) and lamnids (Family Isuridae [Lamnidae], 5 species) should be covered — in total, 72 species.

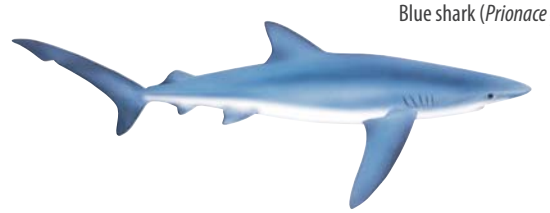
In order to focus and prioritise this list, WCPFC has developed a list of key shark species. These species were selected because they are 1) considered to be at high risk from fishing activities based on an ecological risk assessment project conducted by SPC (2006–2009); 2) most readily identified (thereby most likely to appear in logsheet and observer datasets); and 3) frequently reported in annual catch data provided by Commission members. The WCPFC key shark species currently include blue, silky, oceanic whitetip, shortfin mako, longfin mako, bigeye thresher, common thresher and pelagic thresher (Fig. 3).

In December 2009, the Commission requested its Scientific Committee to consider designating other shark species, including porbeagle (*Lamna nasus*) and hammerheads (Family Sphrynidae, nine species), as key shark species. Based on the known distribution of these species, these ten can be reduced to five species that occur within the WCPO: porbeagle (*Lamna nasus*), winghead hammerhead (*Eusphyra blochii*), great hammerhead (*Sphyrna mokarran*), scalloped hammerhead (*S. lewini*) and smooth hammerhead (*S. zygaena*). The Scientific Committee recommended that these five species be referred to the Commission meeting for addition to the key species list. However, the need for a formal process to evaluate whether additional sharks should be added to the key species list was also recognised. OFP will develop such a process for further consideration at the next meeting of the Scientific Committee in August 2011.

State of the data

One of the objectives of the Shark Research Plan is to examine the available shark information. OFP has reviewed catch and effort data, and fishery-specific and non fishery-specific biological data, to determine

Blue shark (*Prionace glauca*)

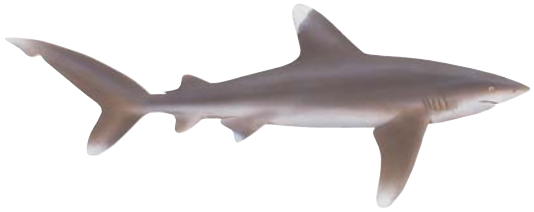


A widely distributed, temperate and subtropical species with high productivity compared with other sharks, the blue shark is the most common species in WCPO observer records for longline fisheries. Assessments for the North Pacific and Atlantic indicate that the biomass of this species is probably above the maximum sustainable yield level and overfishing is probably not occurring. Nevertheless, the blue shark is classified as "Near Threatened" by the IUCN Red List.

Silky shark (*Carcharhinus falciformis*)

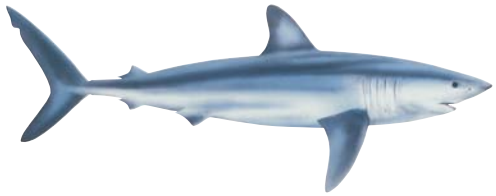
This widely distributed, subtropical species is commonly observed in both longline and purse-seine fisheries but is considerably less productive than the blue shark. Preliminary assessment work is underway by the Inter-American Tropical Tuna Commission (IATTC) for the eastern Pacific Ocean (EPO). The silky shark is classified by the IUCN Red List as "Near Threatened" globally, but "Vulnerable" in the eastern, central and southeast Pacific.

Oceanic whitetip shark (*Carcharhinus longimanus*)



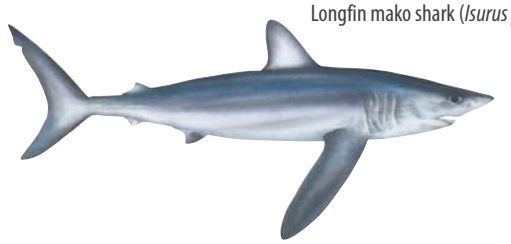
This subtropical species is similar in productivity to the silky shark and is the second most commonly noted shark in longline observer records. Localised depletions of oceanic whitetips have been reported in the Atlantic and it was unsuccessfully proposed for CITES listing (Appendix II) in 2010. It is classified by the IUCN Red List as "Vulnerable".

Shortfin mako shark (*Isurus oxyrinchus*)



This shark is similar to the blue shark in distribution, and to the silky and oceanic whitetip sharks in its relatively low productivity. It is commonly noted in longline observer records and is listed on CMS (Appendix II). Assessments for the Atlantic have produced highly uncertain results but several scenarios indicated that the biomass of this species is below the maximum sustainable yield level and overfishing is occurring. The shortfin mako is classified by the IUCN Red List as "Vulnerable".

Longfin mako shark (*Isurus paucus*)

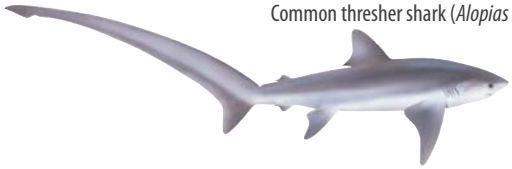


Little is known about this close relative of the shortfin mako except that it may be a deeper dwelling species; many records do not distinguish between the two. The longfin mako is also listed on CMS (Appendix II) and classified as "Vulnerable" by the IUCN Red List.

Bigeye thresher shark (*Alopias superciliosus*)

This species is believed to have the lowest productivity of the key shark species because it grows more slowly, reaches maturity later and is smaller than the other threshers. Few estimates of catch are available due to a lack of species-specific reporting. The International Commission for the Conservation of Atlantic Tunas (ICCAT) has prohibited catches of bigeye thresher since June 2010. This species is classified by the IUCN Red List as "Vulnerable".

Common thresher shark (*Alopias vulpinus*)



Although information about this species is limited, it is known to be the largest of the three threshers and believed to be more productive than the bigeye thresher. ICCAT discourages directed fishing for this species. The IUCN Red List classifies the common thresher as "Vulnerable".

Pelagic thresher shark (*Alopias pelagicus*)

Unlike the other threshers, the pelagic thresher is mainly distributed in tropical waters. Similar to the other threshers, productivity is low relative to other sharks and species-specific catch records are lacking. The pelagic thresher is also classified by the IUCN Red List as "Vulnerable".

Figure 3. Current list of WCPFC key shark species.
(Graphics by Les Hata, © SPC and Hawaii Division of Aquatic resources)

whether these are sufficient to support stock assessments for the WCPO. This review highlighted several critical gaps including:

- Mis-identification and under-reporting of shark catches (e.g. not reporting any shark catches or reporting all shark species in a single category of "shark [unidentified]");
- Some Commission members, which are reported in FAO databases as being among the world's leading shark fishing nations, submit no shark catch data to the Commission;
- Most logsheet catch data are provided in a summarised format, rather than set-by-set, which makes it difficult to properly account for changes in fishing techniques or targeting strategies. These changes can strongly affect the abundance indices used in population modeling;
- Onboard observers usually provide the best source of data for shark assessment but coverage of longline fleets, which account for much of the shark catch, is low and does not represent all areas where sharks are caught (Fig. 4);

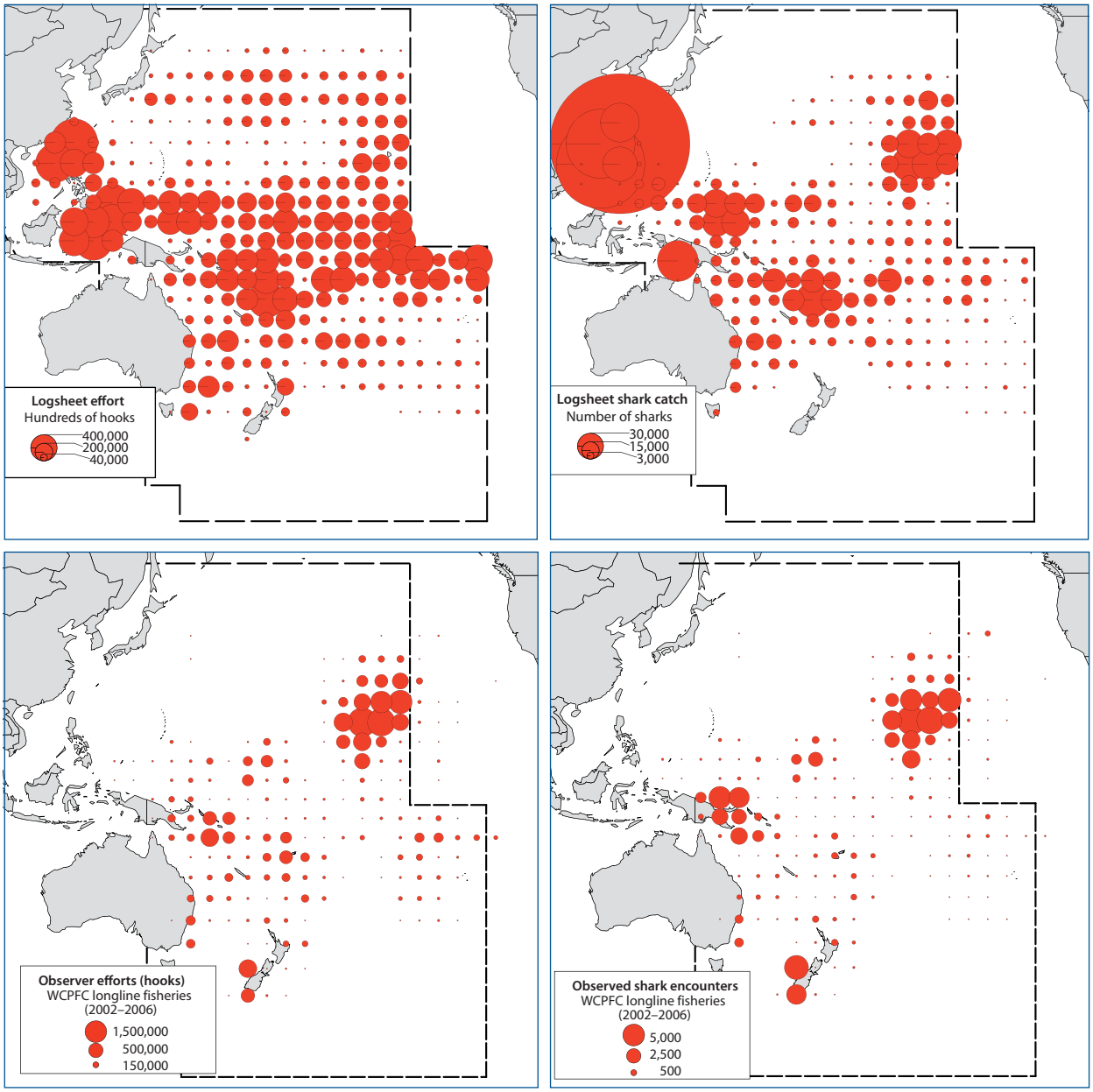


Figure 4. Longline effort from logsheets (top left), reported shark catches from logsheets (top right), longline observer coverage (bottom left), and shark encounters (presence or absence) recorded by observers (bottom right) for 2002–2006. Note the differences between the patterns in the observer data in the bottom two panels and the patterns of longline effort and logsheet-recorded shark catch shown in the top two panels.

- Biological information and tagging data are lacking for some of the rarer key shark species such as the longfin mako and the threshers.

In recognising these critical data gaps, Commission members have already taken several steps toward addressing them. First, observer coverage rates will improve under tuna conservation and management measures adopted by the Commission in 2007, which require 100% coverage of the purse-seine fishery as of 1 January 2010 and 5% coverage of the longline fishery (up from the current 1–2%) by June 2012. However, since the vast majority of sharks are caught by the longline fishery, further increases in longline observer coverage and representativeness would substantially improve knowledge about the status of sharks.

Second, during a special session at the Scientific Committee meeting in August, Commission members agreed to 1) investigate and remedy gaps in their own provision of data; 2) explore new sources of supplemental shark data such as recreational catch records and biological studies conducted by national academic researchers; and 3) consider summarising and coordinating tagging programmes on a regional level.

Finally, and perhaps most importantly for sharks, the Scientific Committee recommended that national data provision requirements in the existing conservation and management measure for sharks be strengthened from voluntary to mandatory. If approved at the Commission meeting in December, this single change in policy will represent a huge breakthrough in the Commission's ability to gather the data necessary for scientifically sound assessments.

The proposed shark assessment programme

The Shark Research Plan proposes a three-step assessment programme that begins with simple, indicator-based assessments (Step 1) followed by more complex assessments of those species for which there are sufficient data. As the results of research coordination and improved data from fisheries become available, existing assessments can be updated and improved, and new types of assessments may become feasible for some species. OFP will present preliminary results from Step 1 at the annual Commission meeting in December 2010.

Step 1 assessments will consider the following indicators:

- Trends in shark catch by gear type, flag state and area may be strongly influenced by logsheet reporting practices but can provide useful insights for some fisheries.
- Trends in catch per unit of effort are a common indicator of stock status in exploited fish populations and will be computed from observer data.
- Trends in the size of captured sharks can be used to infer the extent of stock exploitation.
- Trends in the proportion of the population that has reached sexual maturity and the sex ratio of the population can have important implications for stock production.
- A measure of fishing effort relative to areas of highest shark density can provide information on the potential risks posed to the stock by fishing.
- Formal approval and funding of the Shark Research Plan will trigger assessment Steps 2 (revised risk assessments) and 3 (stock assessments). Given the data gaps already identified, it is clear that the use of existing data alone is unlikely to produce meaningful results for some of the key species. One proposed strategy is to conduct combined assessments for the two mako species, and the three thresher species (Fig. 5), respectively. Another proposed strategy is to phase the assessments so that those species with the most data are assessed first, leaving more time for new information to be identified, obtained and prepared for data-deficient species.

Figure 5. This Alopias *species represents one of three thresher shark species that will be assessed as a group under the proposed Shark Research Plan. (Image: Igone Ugaldebere / www.idivesharks.com)*

Work will begin on silky and oceanic whitetip sharks in 2011 in order to capitalise on similar assessments planned for the eastern Pacific by the Inter-American Tropical Tuna Commission (IATTC). A blue shark assessment will then be initiated in 2012, followed by mako and thresher assessments. A final element of the strategy to combat data deficiencies involves the choice of methods. Bayesian methods will be incorporated to better account for data uncertainties, and both surplus production and simple age-structured models will be applied in order to compare and contrast results and evaluate the strengths and weaknesses of each model structure.

Conclusion

Despite a number of obstacles in the form of data deficiencies, which currently block the path toward understanding the status of shark stocks, the Shark Research Plan is an important first step for the WCPFC. The plan not only outlines an assessment programme using existing available data, it also provides an essential framework for improving these data in the short and long term. Steady progress in both areas, and continuation of the momentum gained through decisions made by the Scientific Committee, will be necessary to assist the Commission in meeting its responsibilities for ensuring the sustainability of shark stocks in the region.

USEFUL SHARK LINKS:

1. The full text of the WCPFC Shark Research Plan can be downloaded from http://www.wcpfc.int/node/2950 and the existing WCPFC Conservation and Management Measure for Sharks is available at: http://www.wcpfc.int/doc/cmm-2009-04/conservation-and-management-sharks. A Pacific Islands Regional Plan of Action for Sharks can be found at http://www.ffa.int/sharks.
2. The International Union for Conservation of Nature (IUCN) maintains a "Red List" of threatened species containing assessments for 1,044 shark, skate and ray species including 181 species classified as "critically endangered", "endangered" or "vulnerable": http://www.iucnredlist.org/about/red-list-overview
3. The IUCN's Shark Specialist Group website provides more information on shark finning bans and management options for RFMOs: http://www.iucnssg.org/index.php/conservation
4. The Convention on International Trade in Endangered Species (CITES) has listed three shark species (basking, great white and whale shark) on its Appendix II: http://www.cites.org/eng/app/e-appendices.pdf
5. The Convention on Migratory Species (CMS) has listed the three CITES-listed sharks species plus shortfin mako (*Isurus oxyrinchus*), longfin mako (*Isurus paucus*), porbeagle (*Lamna nasus*) and spiny dogfish (*Squalus acanthias*): http://www.cms.int/pdf/en/CMS1_Species_5lng.pdf