The use of wire leader by Japanese fleet in the Indian Ocean and the impact of leader type on sharks.

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Summary

In this document, we provide the additional information on the situation at the actual Japanese commercial longline operation in the Indian Ocean on the leader materials in use together with relevant shark catches, based on the Japanese scientific observer database, deployed in the Indian Ocean between 2015 and 2019. As a result of analysis on vessel-base, the actual utilization of wire leader was quite limited in the case of Japanese fleet operating in the Indian Ocean. Around 80% of vessels exclusively utilized monofilament leaders and even remaining vessels tended to replace with wire leaders for few branch-lines per basket. The species composition of shark in the observed catch indicates majority of sharks caught was blue shark, followed by shortfin mako generally, irrespective of leader type. Comparison of CPUE for blue shark and shortfin mako between leader type suggested higher or almost similar level of CPUE by monofilament operation, compared to the wire leader operation. Comparison of at-vessel mortality between leader type showed higher mortality in the operations with monofilament leaders for two majority shark species caught, blue shark and shortfin mako with inconclusive result for silky shark and bigeye thresher. As a conclusion, the quick analysis of Japanese observer data indicated no or insignificant impacts of introducing the non-use of wire leaders on the conservation of sharks, mainly due to the low proportion of branch lines with wire leaders at current stage, together with the results indicating lack or insignificance of its mitigation effects on sharks.

Introduction

The 20th session of the IOTC Working Party on Ecosystems and Bycatch (WPEB) – Data Preparatory meeting held in April 2024 by on-line, recommended to collect the information on leader materials in a mandatory manner with the Regional Observer Scheme Minimum Data Requirements and also recommended to consider the additional mitigation measures, including the no-use of wire leaders, in the condition of further discussion at the WPEB Assessment meeting.

Japan collected the detailed gear configuration information through its national scientific observer program, including the leader materials used. This document was prepared in addition to the request of summary information on the use of wire leader and shark line to inform the situation at the actual Japanese commercial longline operation in the Indian Ocean on the leader materials in use together with relevant shark

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catches.

Although the recommendations by the WPEB(DP) were made to the Scientific Committee, noting that the data preparatory meeting was organized under the WPEB, we believe that the review and endorsement by the WPEB main meeting is essential to pass any suggestions come out from its subsidiary bodies to the IOTC Scientific Committee.

Materials and Methods

Data utilized:

Information was extracted from the Japanese scientific observer database deployed in the Indian Ocean between 2015 and 2019, noting that the observer program was factually suspended between 2020 and 2022 due to the COVID-19 impacts. Data extracted included date and location of deployment, gear configuration per set, including leader materials and usage of shark line, observed number of hooks and species-specific catch data including life status at hauling.

Regarding the catch data of sharks, all information on following sharks (tuna and tuna-like species under the IOTC mandate) were extracted for the analysis: blue shark (*Prionace glauca*), shortfin mako (*Isurus oxyrinchus*), Bigeye thresher shark (*Alopias superciliosus*), Pelagic thresher shark (*Alopias pelagicus*), Silky shark (*Carcharhinus falciformis*), Oceanic whitetip shark (*Carcharhinus longimanus*), and Scalloped hammerhead shark (*Sphyrna lewini*).

Data handling:

First, we calculated the ratio of wire leader per total hook for each vessel to investigate the pattern of usage of wire leader on vessel-scale. For this purpose, we assumed that each vessel does not change the gear configuration within the cruise (e.g., if a certain vessel uses 50% wire leader branch line per total hooks in every operation, it does not change the ratio within the cruise). For example, ratio of 0% and 100% means that the vessel uses only monofilament leader and only wire leader, respectively. The frequency of the ratio was classified into three categories (“0%”, “0<ratio<50%”, “ratio>=50%”) and plotted as pie chart.

Catch number for seven shark species was summarized by dataset of operation with wire leader and operation with monofilament leader only, separately and the species composition was shown by year for each dataset. Depending on the sample size, species with low catch number was aggregated as “other”.

Based on the exploration on the use of the wire leader, we extracted the catch and effort data from 100% monofilament cruise and 100% wire leader cruise and then they were filtered with the same year and location of operation. For blue shark and shortfin mako, nominal CPUE was calculated for each type of cruise.

At-vessel mortality was calculated for four species of shark for each type of operation, using the same dataset above and compared between 100% monofilament operation and 100% wire leader operation.

Results

First, the actual utilization of wire leader was examined. Observer data indicated that most vessels

utilized wire leader in a limited proportion of branch lines, even if utilized. In order to standardize the difference in number of operations observed among vessels, the results were shown on vessel-base, considering that the branch-line configuration and their composition generally remained the same during operations when targeting the same species, i.e. unit of "observed cruise". Figure 1 indicated that 79 % of vessels observed and operated in the Indian Ocean, utilized exclusively monofilament leader, while that only 5.7% utilized wire leader to more than half of the branch lines deployed. In fact, only one vessel observed in 2016 indicated a full utilization of wire leader.

Figure 2 showed a comparison of the catch composition of shark species between with and without utilization of wire leader. The latter corresponds to the operation exclusively with monofilament leader. Blue shark dominated the shark catch reported, followed by shortfin mako, silky shark, and bigeye thresher for both data sets in general. No significant difference was observed on the species composition between with and without utilization of wire leader, with some annual fluctuation for the composition.

The current Japanese observer program did not collect catch data according to the leader materials, and therefore it is not possible to compare the shark catch status (i.e., catch ratio) directly. As a compromise, the shark catch status was compared between the vessel with 100% wire leader and those with 100% monofilament leader operated in the same time-area (area bounded by 16.9 -8.7° S and 75.3-114° E in 2016). If monofilament would improve the survival of sharks hooked by biting off leaders, the overall catch rate by species would be expected *much higher* in the operations with 100% wire leaders. Results for blue shark and shortfin mako were shown in Table 1, noting that the number of other shark species caught was zero or smaller than five in the operation with wire leader. Nominal CPUE of blue shark with 100% wire leader operations (0.44) was lower than that with monofilament leader operations (0.60), while nominal CPUEs of shortfin mako were almost the same in the operation regardless the difference in leader materials. Oceanic whitetip shark was not reported in the operation with wire leaders and both pelagic thresher and scalloped hammerhead were not reported in any operations included in this analysis.

Figure 3 showed the difference in at-vessel-mortality for four shark species, based on the same data set utilized in Table 1. Again, if bite-off would be a source of reduced mortality of sharks hooked, substantial higher at-vessel-mortality would be expected in the operations with monofilament leaders, since vigorous sharks were expected to bite-off the line and escape before hauling. Results showed higher mortality in the operations with monofilament leaders for two majority shark species caught, blue shark and shortfin mako, but the difference was rather insignificant. For silky shark and bigeye thresher, the results showed opposite pattern than expected, with higher at-vessel-mortality in the operation with wire leader. Note that sample size of these species in the dataset with 100% wire leader was very small (two for silky shark and five for bigeye thresher), suggesting a large uncertainty in the estimates for these species and careful interpretation required.

Discussion and conclusion

The analysis indicated that the actual utilization of wire leader was quite limited in the case of Japanese longline fleet operating in the Indian Ocean. Around 80% of vessels exclusively utilized monofilament

leaders and even remaining vessels tended to replace with wire leaders for few branch-lines per basket, mainly for those deployed in shallower depth.

Although limited, the comparison of shark catch data between two types of leader materials did not show any clear evidence of higher survival of hooked shark by increased bite-off by using monofilament leader for most shark species, consistent with as Rosa et al. (2020) and Santos et al. (2024). This included catch composition, catch rate and at-vessel-mortality by species. It should be noted that Scott et al. (2022) also indicated no difference in overall shark catch rate between leader materials when assuming the all bite-off caused by sharks as reported by Afonso et al. (2012).

On the other hand, non-retention has become an increasingly common practice to reduce overall mortality caused by pelagic longline and purse seine operations for vulnerable shark species and it is shown that this measure contributes to the rebuilding of stock for several shark species such as silky shark in WCPO (Neubauer et al. 2024). The current analysis also suggested no improvement of fragile shark survival through bite-off by using monofilament leader, such as silky shark. Regarding the mortality after the release, Hutchinson et al. (2022) indicated no significant difference in post-release mortality between leader materials for some shark species such as oceanic whitetip, based on the satellite tracking data.

Anecdotal information indicated that a part of reasons of utilizing wire leaders, particularly, in high latitude operations included hardening monofilament materials with low temperature as well as taking an advantage of wire-weight for assisting an increase of sink rate at the time of setting for seabird bycatch mitigation purpose (Melvin et al. 2014).

As a conclusion, the quick analysis of Japanese observer data indicated no or insignificant impacts of introducing the non-use of wire leaders on the conservation of sharks, mainly due to low proportion of branch lines with wire leaders at current stage, together with the results indicating lack or insignificance of its mitigation effects on sharks. On the other hand, some fishers indicate strong needs to keep the use of wire leader option open to maintain its flexibility and operational abilities. Noting that lack of effects is known to be one of the most difficult things to evaluate, we believe it should be avoided to introduce unproven and unnecessary regulations against the fact observation opposing under the name of “precautionary approach”.

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Table 1 Comparison of catch and nominal CPUE for total shark, blue shark and shortfin mako between operation with monofilament and operation with wire leader.

		Wire 100%	Monofilament 100%
Number of operation		73	322
Observed hooks		181,545	748,059
Catch	Total sharks	95	554
	Blue shark	79	450
	Shortfin mako	9	30
CPUE	Total sharks	0.52	0.74
	Blue shark	0.44	0.6
	Shortfin mako	0.05	0.04

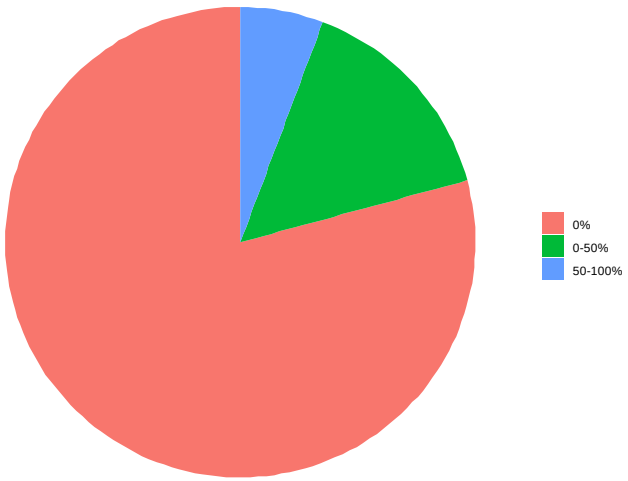

Figure 1. Ratio of cruise with three level of category about the usage of wire leader.

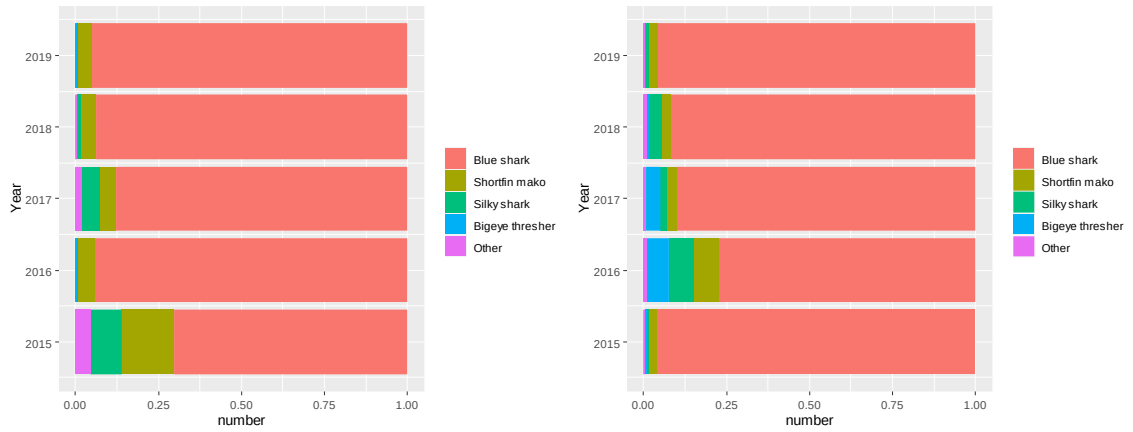

Figure 2. Species-specific catch number of major sharks recorded in operation with wire leader (left), and operation with monofilament leader only (right) between 2015 and 2019.

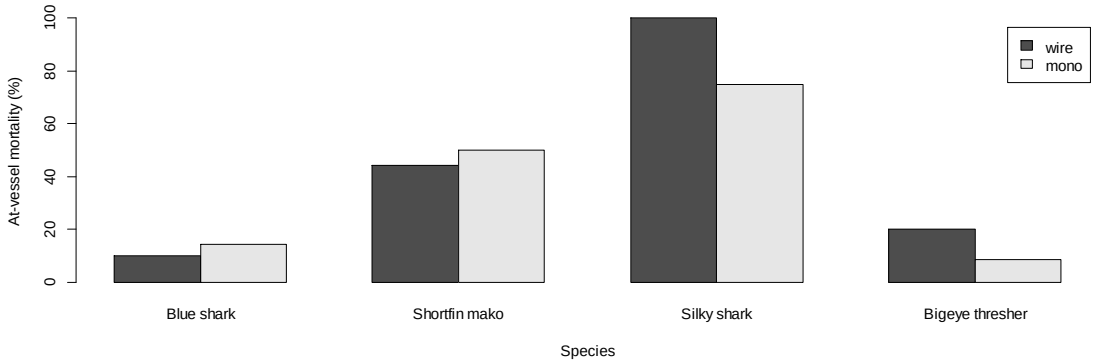

Figure 3. Comparison of at-vessel mortality for four species of sharks between 100% wire leader operation and 100% monofilament leader operation.