Terms of Reference for a workshop on multi-taxa bycatch mitigation measures focused on drift/gillnet fisheries in the Indian Ocean

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Background

Bycatch in gillnets is of greatest concern in terms of impacts on cetaceans and other marine megafauna (such as shark, rays, sea turtle) populations (Lewison et al., 2004; Read et al., 2006; Reeves et al., 2013). Gillnets are relatively inexpensive to operate and maintain, and can result in high catch rates of various taxa, including target species like tuna and other large pelagic fishes, but they are also notorious for their poor selectivity and high bycatch rates of marine megafauna (Lewison et al., 2004; Reeves et al., 2013). Although some mitigation methods or devices such as acoustic and visual deterrents have been shown to reduce bycatch rates (e.g. Mangel et al., 2013; Bielli et al., 2020; Omeyer et al., 2020), most of them seem to work for some species and not others, which can be an issue when bycatch can affect multiple taxa at the same place and time.

Drift gillnets in the Indian Ocean Tuna Commission (IOTC) account for around 34% of the catch of tuna and tuna like-species (Anderson et al., 2020) and around 40% of shark and ray catches (IOTC–WPEB17(AS), 2021), although data are scarce and generally of low reliability and accuracy. Gillnet fisheries also impact turtles and other teleost species (Lewison et al., 2014) and pose a serious risk, due to the high number of vessels operating in both EEZ and high seas. In the past, gillnets were considered the primary source of mortality to seabirds (e.g. Johnson et al., 1993) but since the United Nations ban on high seas gillnets (Hewison, 1994) research and data on seabird bycatch in gillnet fisheries has decreased. The gillnet is a wholly indiscriminate fishing gear type, catching and killing almost everything that swims into it, including marine mammals, seabirds, turtles and all fish large enough to become enmeshed. As a consequence of this non-specific way of fishing, gillnet fisheries are considered the primary or highly significant source of mortality for cetaceans, seabirds, turtles and elasmobranchs in the Indian Ocean (Nel et al., 2013; Zydelis et al., 2013; Lewison et al., 2014; IOTC–WPEB16, 2020; Kiszka et al., 2021).

In the Indian Ocean, there are also growing concerns about the magnitude of marine mammal bycatch in both coastal (Kiszka et al., 2009; Temple et al., 2018) and offshore gillnet fisheries (Anderson et al., 2020). Estimated cetacean bycatch from gillnet fleets in the Indian Ocean peaked at around 100 000 cetaceans yr^{-1} between 2004 and 2006, decreasing to around 80 000 currently (Anderson et al., 2020).
An expert workshop convened by the International Whaling Commission (IWC) in 2019 concluded that there was a need to focus on gillnets as the fishing gear likely to be responsible for the most significant bycatch of cetaceans in the Indian Ocean region (IWC, 2019). In a recent global review of cetacean bycatch, the IOTC was classified as a 'high risk' tuna Regional Fisheries Management Organization (tRFMO) for cetaceans on the basis of its more prevalent use of gillnets compared to other tRFMOs (Elliott, 2020).

In gillnet fisheries, sharks and rays also have a very high mortality rate (Bettis, 2017) which range from 70% to 93% for some species (Jordan et al., 2013; Cosandey-Godin et al. 2015). Sharks are caught for direct consumption, but are mostly incidentally caught in both small-scale and industrial fisheries in the Indian Ocean. The Indian Ocean Tuna Commission (IOTC) estimated the average annual shark catch within the

Indian Ocean between 2014 and 2017 to be 104,982 metric tonnes (mt) with annual catches ranging from 97,155 mt in 2014 to 103,691 mt in 2017. Among these, Indonesia, Spain and India remain the top three shark catchers, as in previous analyses (Lack & Sant, 2009; Dent & Clarke, 2015). The species composition data is very weak, however, recent estimates have been made available from Pakistan, and based on the preliminary work undertaken by WWF-Pakistan, catches were dominated by shortfin mako (*Isurus oxyrinchus*) and pelagic thresher (*Alopias pelagicus*), which contributed about 46% and 24% respectively, followed by silky (*Carcharhinus falciformis*) and scalloped hammerhead (*Sphyrna lewini*) contributing 7% and 5% of the total catch (Shahid et al., 2016).

Bycatch in fisheries has also been implicated as a significant source of mortality and subsequent population declines for numerous sea turtle species (Wang et al., 2010; Chan et al.1988, Chan & Liew 1996, Lewison et al. 2004, Lum 2006, Lewison & Crowder 2007, Peckham et al. 2007). Several concerns have been raised on the high mortality in gillnet fisheries. Price and Van Salisbury (2007) considered the incidental catch of sea turtles in passive net fisheries as one of the main threats to these species on a global scale. Coastal trawl and gillnet fisheries are considered the biggest contributors to sea turtle bycatch, although uncertainty estimates for different gear categories and locations are very high (Abdulqader et al., 2017; Burgess et al., 2018). Bycatch data records, while still scarce and very likely underreported, are predominantly available for longline fisheries in the Indian Ocean (Bourjea et al., 2008; Huang and Liu, 2010; Nel et al., 2013). Data from longline fisheries suggest the Southwestern Indian Ocean to be a hotspot for sea turtle bycatch (Lewison et al., 2014). These results, however, might be biased due to the increased data availability for longline fisheries in comparison with other gear types. In the Western Indian Ocean, the impact and extent of sea turtle bycatch is well known for fisheries of the Seychelles, La Réunion (France) and South Africa (Bourjea et al., 2008; Kiszka, 2012). Olive ridley turtle (*Lepidochelys olivacea*) and loggerhead turtle (*Caretta caretta*) populations might particularly benefit from reduction in fishing effort, although all sea turtle species are affected by bycatch (Burgess et al., 2018). WWF-Pakistan undertook a preliminary study to document sea turtle bycatch over 30 consecutive months from January 2013 to June 2015. Over the course of the sampling, 600 sea turtle bycatch events were recorded. Observed mortality (i.e. dead turtles upon hauling) accounted for 10% of the total caught turtles during the sampling period while 90% of the turtles were released alive in apparent good condition. The olive ridley sea turtle (*Lepidochelys olivacea*) accounted for 68.8% of captures (n = 178), followed by the green turtle (*Chelonia mydas,* 29.6%, n = 178*)*, and the hawksbill turtle (*Eretmochelys imbricata,* 1.5%, n = 9*)* (Shahid et al., 2015).

Fisheries bycatch is a conservation issue for seabirds in the Indian Ocean, particularly in offshore longline fisheries and affecting primarily *Procellariiforme* species (Fernandez-Costa et al., 2018). Each year, about 2,500 birds are estimated to be caught in the longline fishery, with White-chinned petrel *Procellaria aequinoctialis*, White-capped albatross *Thalassarche cauta* and the Black-browed albatross *Thalassarche melanophris* as the three most impacted species (Ardill et al. 2011). While set and drift gillnet are known to have the greatest number of documented bird species interactions among all gear types, the waters of the Indian Ocean and Asia have been poorly studied (Pott & Wiedenfeld, 2017). Although the diversity and abundance of diving seabirds is low in the region compared to the rest of the world, the artisanal fisheries sector in the Indian Ocean constitutes a significant gap in the global knowledge of seabird bycatch patterns (Pott & Wiedenfeld, 2017; Zydelis et al. 2013). It is however suspected that Socotra cormorants *Phalacrocorax nigrogularis* are caught in gillnets in the region (Zydelis et al. 2013).

Drift gillnets are used by around 21 countries in the Indian Ocean and some of the countries have vessels which are non-compliant with UNGA resolution (46/215) banning high seas gill/driftnets >2.5 km (Aranda, 2018). The Indian Ocean Tuna Commission adopted the UNGA resolution and recently extended the scope

of the moratorium on large-scale drift/gillnets on the high seas to cover the IOTC's entire area of competence (Resolution 17/07) from January 2022 (IOTC, 2017). Pakistan, which is among the countries with highest rates of drift gillnet fishing effort, has objected to this resolution considering that several data gaps exist due to lack of on-board observer coverage or other monitoring methods, insufficient reporting requirements, or poor data quality (Nel et al., 2013**;** Wallace et al., 2013; (Herrera & García Horcajuelo, 2018). In the recent past, there has been work on developing mitigation measures and using different techniques and tools for reducing the ecological impact of drift/gillnets in the Indian Ocean.

Bycatch mitigation strategies, such as gillnet illumination, different gear settings, use of acoustic deterrents, magnetic fields, among others have been fairly successful to minimize bycatch of endangered, threatened and protected species. Some measures work well for some species but have ecological impacts, such as the increase of certain non-target species. For instance, the use of LEDs/visual deterrents led to decline in sea turtle mortality but an increase in the catches of Spanish mackerel (*Scomberomorus spp.*) in a study undertaken in Pakistan (unpublished, personal communication) on coastal monofilament fishery. Moreover, several of such mitigation methods are limited due to their experimental nature, the fact that they are non-mandatory, and the extent to which these measures reduce bycatch may be insufficient to halt population declines (Kakai, 2019). Moreover, the cost of the available mitigation devices is usually high and this limits their use, particularly in developing countries where bycatch is increasingly recognized to be a major problem (Brownell et al., 2019; Anderson et al., 2020). In most cases, mitigation devices are time-consuming and logistically challenging to use, and fishers are often resistant to implementing them. There is an urgent need to reduce overfishing, employ bycatch reduction methods and estimate bycatch impacts in underrepresented regions and other gear categories using a multi-taxa/multiple species approach. In addition, it is also important that the design and effectiveness of these methods are robust, so they are able to be scaled in similar fisheries in the region.

Rationale for workshop

In 2021, at the 17th Session of the IOTC Working Party on Ecosystem and Bycatch (WPEB17) it was recommended that the Scientific Committee(SC) endorse a workshop on multi-taxa bycatch mitigation measures dedicated to drift/gillnet fisheries in the Indian Ocean, to be conducted in 2022. The purpose is to develop recommendations for consideration by the WPEB and SC. The following paragraphs are extracts from the report of the WPEB17:

> "The WPEB also **NOTED** the need for development of terms of references for the proposed multi-taxa bycatch mitigation workshops, identifying roles and responsibilities and lead agencies, and **AGREED** that a proposal should be shared with the SC in 2021 for approval.
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> The WPEB also **NOTED** the request for joint collaboration on organizing multi-taxa bycatch mitigation workshops with relevant organizations including but not limited to IWC, ACAP, IOSEA Marine Turtle MOU and CMS Sharks MOU. The WPEB **NOTED** the need for detailed discussions around mitigation measures such as the use of artificial lights for gillnets which have been trialed in certain fisheries but for which research efforts are being hampered by the IOTC Resolution 16/07 banning the use of artificial lights on fishing gears. The WPEB **NOTED** the need to adopt a precautionary approach to the management of bycatch by considering the range of issues faced by many bycatch species, in particular in gillnet artisanal fleets." (IOTC–WPEB17(AS), 2021)

Workshop Goal and Objectives

The general objective of the workshop is to evaluate existing mitigation measures for their suitability to reduce bycatch of multiple taxa in drift/gillnet gears, and to scope and assess the feasibility of novel or experimental measures being developed for this purpose in the Indian Ocean.

The specific objectives of the proposed three-day workshop are as follows.

Provide an overview of the existing and new potential bycatch mitigation measures applicable for drift/gillnet fisheries (taking a sensory and behavioural ecology approach)

- Exchange of knowledge and experiences of those that have applied mitigation methods (including but not restricted to temporal/spatial closures, co-managed closed areas, use of alternative gears or switching/modification)
- Assess the available technologies, approaches and techniques, including lessons learned, limitations and future areas of research, such as the use of sensory ecology and/or behavioral research
- Collaboratively develop and codify approaches to understand ecological and economic trade-offs (and the acceptance of measures by industry and fishers) between the success of bycatch mitigation method and its impact on target catch
- Discuss potential new mitigation measures for drift/gillnet fisheries to reduce the bycatch of marine mammals, sharks and rays, sea turtles, sea birds among others, including examining measures and tools being used in other fisheries and Oceans.
- Consider the potential for a mitigation measure designed to reduce bycatch for certain taxa causing increases in bycatch in other taxa, and propose mechanisms to address or evaluate those risks

Replicate, scale, strengthen data collection protocols to assess the effectiveness of multi-taxa bycatch mitigation measures in IOTC

- Undertake feasibility on the use of alternate data collection systems, in particular for small-scale fisheries
- Identify and propose scientific research projects to evaluate the effectiveness, costs, practicalities and catch rate impacts on target species of different mitigation measures, including considering combinations of approaches
- Regional exchange and cooperation among coastal states primarily using drift/gillnets
- Challenges of reporting, mitigation and monitoring of Endangered, Threatened and Protected (ETP) species in addition to discards.
- Liaise with other ttRFMOs and international organizations that could inform tools and mitigation measures for gillnets/driftnets.

Developing Recommendations for IOTC – WPEB and SC

- Identify new techniques, such as use of LED lights, to be trialled across the Indian Ocean for small-scale vessels to reduce bycatch (Darquea et al., 2020)
- Strengthening data collection and harmonization for mitigation measures applied

- Undertake focused studies on ecological and economic trade-offs for several bycatch species versus the target species
- Produce an outline of best practices, coupling of other tools and incentives for scaling mitigation measures
- Develop recommendations for IOTC-WPEB and SC, such as, recommend multi-taxa mitigation measures for drift/gillnet fisheries aiming to reduce overall bycatch mortality by 50 per cent, and/or, develop and agree to a roadmap of actions to be achieved for reducing overall bycatch mortality by 50 per cent by 2025 in all IOTC fisheries

Expected Result

A full workshop report providing a comprehensive review of;

- Existing mitigation measures applicable for drift/gillnet fisheries;
- Common implementation problems/concerns and solutions for scale-up;
- Identify and evaluate a suite/mitigation toolbox for reducing multi-taxa bycatch (including cetaceans, elasmobranchs, seabirds, sea turtles among others);
- Determine ecological and economic trade-offs between ETP species interaction and tuna like species;
- The identification of new techniques that can be used in trials to assess their ability in mitigating bycatch in the future;
- A proposal of a best practice protocol on implementing mitigation, safe handling and release for ETP species monitoring for gillnet fisheries.

Participation

- Virtual Workshop (about 60 participants) or, if the situation allows, in-person/hybrid meeting/workshop of experts (30-45 participants)
- The workshop will take place latest by March 2022
- Anyone currently engaged in applying and/or investigating mitigation techniques for gillnets/driftnets for cetaceans, sharks, seabirds, sea turtles independently or collectively
- Representatives of countries/CPCs of IOTC that exclusively and/or significantly use drift/gillnets
- Scientists from other tRFMOs who have undertaken multi-taxa bycatch mitigation work for gillnets/driftnets.

Workshop Functioning

The workshop will be chaired by the Chair of the IOTC – WPEB, supported by IOTC – SC Chair and IOTC secretariat.

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