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DEFINITION OF GUIDELINES TO REDUCE THE IMPACT OF LOST AND ABANDONED FISH AGGREGATING DEVICES (FADS) ON SEA TURTLES

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SUMMARY

The present Pacific Islands Regional Office (PIRO) - NOAA project (2020-2022) aims to define guidelines and conservation recommendations to reduce the impact of lost and abandoned drifting Fish Aggregating Devices (FADs) on sea turtles in the Pacific Ocean. The guidelines will identify means to reduce the interactions and mortalities associated with (i) entanglement in FADs structure, both, while active at sea and when lost or abandoned and with (ii) FAD stranding events in turtle´s essential habitats.

RESUMEN

El presente proyecto financiado por Pacific Islands Regional Office (PIRO) - NOAA (2020-2022) tiene como objetivo definir buenas prácticas y recomendaciones de gestión para reducir el impacto de los plantados perdidos y abandonados en las tortugas marinas del Océano Pacífico. La guía de buenas prácticas identificará los medios para reducir las interacciones y las mortalidades asociadas con (i) el enmallamiento de tortugas marinas tanto durante la vida útil de los plantados como cuando se pierden o abandonan y (ii) el daño asociado al varamiento de plantados en los hábitats esenciales de las tortugas marinas.

INTRODUCTION

Due to the associative behaviour of the principle tropical tuna species with floating objects, purse-seine fishers deploy drifting fish-aggregating devices (dFADs) to increase their catches (Scott and Lopez, 2014). These dFADs, composed of a surface raft and a submerged appendage are mostly made of netting material reaching on average 40 m depth but up to 80 m in some fleets. There is an estimate of ~50,000 dFADs deployed every year by fleets operating in the Pacific Ocean alone (Gershman et al. 2015). Due to the FAD fishing strategy, in which dFADs are left drifting with a tracking buoy, it is estimated that around 7- 22% of these dFADs are lost or abandoned every year, depending on the

oceanic region (Maufroy et al., 2017; Moreno et al., 2018; Escalle et al., 2020; Imzilen et al. 2021). Impacts caused by lost and abandoned dFADs are ghost fishing (Filmater et al. 2013), accumulation of plastic at sea, damage on coral reefs when stranded on shores and interference with other economic activities, such as tourism (Escalle et al. 2019).

Recent scientific literature (Escalle et al. 2019; Moreno et al. 2018) identified potential FAD accumulation areas in the Pacific Ocean, as Papua New Guinea, Solomon Islands, French Polynesia, Perú and Galapagos. Most of these islands are essential habitats for turtles and nesting areas for leatherback turtle. Furthermore, dFADs can interact with sea turtles during their drifts in open ocean and oceanic currents can take dFADs far from the fishing grounds as the recently reported dFAD beaching events in sea turtle foraging and nesting areas in Hawaiian Islands (NOAA Marine Debris Program, 2019).

Both entanglement in dFAD netting and ghost fishing are known to cause incidental mortalities for marine megafauna (FAO 2016). Current conservation measures in the Inter- American Tropical Tuna commission (IATTC), Resolution C-19-01, allow the use of netting to construct FADs, while in the Western and Central Pacific Fisheries Commission the use of netting is prohibited in dFAD construction (WCPFC CMM-2021-01).

In the eastern Pacific Ocean, if net is used, this could be of any mesh size if tightly tied into sausage-like bundles and, if open panel netting is used, only small mesh size (< 2.5 inch) can be used. According to the ISSF guide of Non-Entangling FADs (ISSF, 2019), these types of FADs correspond to Low Entanglement Risk (LER) FADs. The proportions of turtles that become entangled with dFADs but escape, and those that become permanently entangled, are currently unknown. Observer data from purse seine vessels indicate that entanglement of turtles while dFADs are active for fishing are low. In the WCPO, approximately 100 to 200 individuals per year have been observed interacting with purse seine gear (Pilling et al., 2017) and in 2020 a total of 291 sea turtle interactions (zero mortalities) were recorded in IATTC with 100% observer coverage (IATTC, 2021). Unfortunately, quantification of entanglements is difficult at dFADs, as these processes go unobserved at short time scales (fishers visit dFADs once or few times in FAD´s lifetime while they can remain drifting in the open ocean for years). Although the use of LER FADs reduces the risk of turtle entanglement at FADs while those structures are newly built and are monitored by fishers, the risk may increase as the lost and abandoned dFADs ´netting end up untied and broke. Due to the persistence of plastic netting, those FADs will remain intact for years at sea and may eventually evolve as High Entanglement Risk FADs (ISSF, 2019).

The impacts of lost and abandoned FADs on turtles and their habitat may be reduced through a set of measures including: dFADs constructed without netting; the use of biodegradable dFADs; limiting the number of dFADs deployed; best practices at sea to avoid dFAD loss; dFAD recoveries at sea and from land. The need for dFADs to be made of non-entangling and biodegradable materials is clear (Zudaire et al., 2020; Moreno et al., 2016, 2018), however, there are other options to minimize their impact on turtle habitats and reduce ghost fishing that have not been considered in depth. The present project aims to address these questions and to evaluate the different options to minimize mortality of sea turtles, such as leatherback, loggerhead and Hawksbill turtles that have are known to interact with dFADs (IATTC, 2021). Specifically, we aim to define guidelines to reduce the impact produced by dFAD structure on marine turtles. The guidelines will identify means to reduce the interactions and mortalities associated with (i) entanglement in dFADs structure, both, while active at sea and when lost or abandoned and with (ii) dFAD stranding events in turtle´s essential habitats.

OBJECTIVES

The present project aims to simultaneously form the basis for cooperation of key stakeholders across the Pacific Ocean (fishers, ship-owners and scientists) to minimize the impacts caused by lost and abandoned FADs on sea turtles, while also defining future guidelines to reduce the impact of dFAD structures on sea turtles´ populations and habitat. The project expects to achieve this overarching objective through the following four specific objectives:

1. **State of the art**: This objective will review the known and unknowns of dFAD structure impact on marine turtles' habitat and populations. It will identify the information gaps to estimate entanglements and lost and abandoned dFADs numbers, as well as their impact on sea turtles and their habitats. The review will gather information from scientific experts on sea turtles, dFAD ghost fishing, marine debris, dFAD fishing strategy, as well as from tuna RFMOs. The expected outcome will be the definition of recommendations in terms of research and data collection needs to inform science-based dFAD management to reduce the impact of lost and abandoned FADs on sea turtles populations and habitat.
2. **Modelling FAD trajectories:** this objective will simulate virtual FAD trajectories arriving at essential habitats for turtles with special focus on leatherback turtle and Hawaiian Islands. Due to the lack of real dFAD trajectories till the end of dFADs´ lifetime, this task will model dFAD trajectories to address (i) the identification of patterns (e.g. in deployment areas, FAD design, oceanographic conditions) linked to the more frequent arrival of lost dFADs in essential habitats for leatherback turtles and the Hawaiian EEZ and (ii) identification of potential ghost fishing hotspots related to dFAD density and leatherback inter-nesting areas in open ocean. Lagrangian simulation will be used to examine spatial and temporal patterns of overlap, and possible risk of interaction, between dFAD drifts and turtle habitats both in open ocean and coastal habitats (Escalle et al., 2019; Scutt Phillips et al., 2019). Preliminary results are presented by Escalle et al. (2022) in the 11th Meeting of the Working Group on Bycatch.
3. **Evaluating options to reduce dFAD impact and definition of best practices guidelines**: Based on previous work and discussions with key purse seine fleets in expert workshops, best practices to reduce the impact of dFAD structures in sea-turtles as well as best practices at-sea to avoid dFAD loss, dFAD recovery from land and at sea will be discussed and agreed. The definition of effective guidelines to reduce the impact of lost and abandoned dFADs will require a clear understanding of the logistical and economic challenges that fleets need to face to adopt a given best practice.
4. **Outreach to fishers, scientists and managers** will be done by disseminating the outcome of this project to (i) tuna purse-seine fishers in the Pacific region, (ii) to the tuna RFMOs to influence the adoption of conservation measures, (iii) to the scientific community, through presentations at symposia, and finally(iv) to the general public.

RECOMMENDATIONS

That the 11th Meeting of the Bycatch Working Group NOTES paper BYC-11-INF-A, on the Pacific-wide project to define best practice guidelines and conservation recommendations to reduce the impact of FAD structure on sea turtles´ populations and habitat in the Pacific Ocean.

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