Ghost Fishing Mortality and Habitat Damage from Abandoned, Lost and Discarded Drifting FADs

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The most economically efficient method of catching surface schools of tuna is by purse seine with drifting fish aggregating devices or dFADs for short. Thousands of dFADs are deployed every year throughout the tropical ocean for the purposes of attracting and congregating tuna (Lopez et al. 2014). dFADs have come a long way in terms of their development with modern dFADs having the capability to be monitored in real-time via satellite, its position and the amount of fish aggregated under it (Maufroy et al. 2015). Use of dFADs in purse seine fishing has become so pervasive that in 2019 close to 40% of the world's five million tonnes of tropical tuna (skipjack, yellowfin and bigeye) were caught on dFAD sets (Restrepo, 2021). In 2019, PS gear contributed 44% of the more than 1.04 million MT of tropical tunas caught from the Indian Ocean. Of this, almost 70% of catches were taken from dFAD sets, a proportion much higher than the global average dFAD use. Species wise, in 2018, 99% of skipjack catches were from dFADs (IOTC–WPTT22(AS) 2020).

A major concern associated with the use of dFADs is the widespread use and numbers of dFADs getting abandoned, lost and discarded (Gomez et al. 2020). Of all the types of marine litter, abandoned, lost or discarded fishing gears (ALDFG) represent the greatest threat to marine life as they continue capturing, entangling, and killing a variety of marine species through what is termed "ghost fishing". Stranding of abandoned dFADs also frequently damage sensitive marine ecosystems such as coral reefs, seagrass beds and can continue to do so for decades after being abandoned or lost by a fishing vessel (Burt et al. 2020 and Imzilen et al. 2021). In the remote UNESCO World Heritage site of Aldabra Atoll in the Indian Ocean, a recent assessment shows some 83% of the 513 tonnes of marine litter consists of waste originating from regional fishery industry (Burt et al. 2020)

Within the IOTC, the issue of ghost fishing and entanglements of endangered, threatened and protected (ETP) species (sharks and turtles) were highlighted as early as 2003 by Chanrachkij, & Loog-on (2003). In a working paper submitted to the Working Party on Ecosystem and Bycatch (WPEB), Franco et al. (2009) state that 'it is now urgent that fishers use 'Ecological FADs' that reduce such ghost fishing in order to move towards sustainable and responsible purse seine fisheries'. Although, to what extent 'ecological FADs' will address the other aspects of dFAD use is unclear. Despite the clear and documented recognition as early as in 2003, not much progress has been made in addressing the issue. For instance, in the 25th Session of the IOTC Commission meeting held in 2021, the Secretariat noted the absence of publicly available information and data to inform science-based conservation and management of dFAD measures, as FAD related data is mired with confusion over terminology and poor reporting. This paper provides a brief review of recent literature on ghost fishing and habitat damage from dFAD strandings. This brief note provides a quick review of major issues in ghost fishing and habitat damage from dFAD strandings in the most recent literature.

Ghost Fishing

Ghost fishing occurs due to the entangling nature of material used to construct dFADs. It used to be common for dFADs to have various forms of netting to cover the floating raft and more commonly as part of dFAD's sub-surface appendages. Recently appendages appear to have been replaced by rolled net sausages dangling underneath the dFADs which goes as far as 80 m deep (pers obs). While they themselves do not cause entanglement, but contribute massively to marine litter and ocean plastic. Also over time they are known to unravel and the small mesh netting can tear and create holes causing entanglement (Balterson and Martin, 2015).

During period of explosive growth of dFAD use in purse seine fishery and with hardly any effective FAD conservation and management measures, Filmalter et al. (2013) estimated silky shark dFAD entanglement mortality was between 480,000 and 960,000 individuals which was as large as the total catch of this species in fisheries, 400,000 - 2,000,000 (Balderson and Martin, 2015). Stelfox et al. (2014) and Anderson et al. (2015) reported olive ridley turtle entanglements in the Maldivian waters with clear indication of origins to the western Indian Ocean Purse seine fishery.

Habitat Damage

Marine debris from fisheries pose significant threats to coastal marine ecosystems worldwide. Apart from gillnets, purse seine tuna fisheries using dFADs is a significant contributor to this problem via construction and deployment of thousands of human-made dFADs annually, many of which end up beaching in coastal areas (Burt et al, 2020). In a recent study, Gilman et al. (2021) assessed the relative risks from derelict gear, based on production rates, gear quantity and indicators of catch weighting, adverse ecological and socio-economic impacts (ghost fishing, transfer of toxins and microplastics into the marine food web, habitat degradation, among other things) ranking purse seine with drifting FADs as the third most damaging.

In contrast to IOTC, the Western and Central Pacific Fishery Commission's (WCPFC) has more effective mechanisms to monitor the dFAD related activities and regularly analyze FAD tracking data. The most recent analysis of 2016-2020 data showed that 90% of the dFADs deployed were never retrieved. The results also showed that 44 % of the dFADs (buoys) were abandoned, 9.6 were retrieved, 6.6% were beached; 18.4% were sunk, appropriated or had malfunction buoys; and 21.3% were deactivated by the fishing company and left drifting unmonitored (Escalled et al. 2021). If the fleets in the Indian Ocean operate similarly, then these results could be an indication to the situation in the Indian Ocean. Regrettably, the IOTC lacks such an independent body collating FAD-tracking data. However, it should be noted that data from the French purse seiners are being made available to their scientists and some analyses are being reported (e.g. those of Maufroy et et al.).

In the Western Central Pacific Ocean, Philip Jr. et al. (2020), found that in general, natural and low or non-entangling dFAD material are rarely used. On assessing whether newly introduced requirements in designing non-entangling dFADs were adhered to, changes in the design or mesh size of net used was not detected. There was evidence of high reliance on artificial material and nets which also support previous findings. Again, in the case of IOTC, data to support or refute such observations are not available publicly. Under such circumstances, it is natural to assume that impacts to marine environment and coastal habitats would be similar or far worse than in the WCPO region.

It should be noted that IOTC has several Conservation and Management Measures relating to FADs, such as Resolution 12/04 (adopted in 2012) that requested developing and improving FAD designs to reduce the incidence of entanglement of marine turtles, including the use of biodegradable materials. Annual limits of dFADs are in place since 2015 (Resolution 15/08, superseded), with Resolution 19/02 setting the maximum number of operational buoys being followed by any purse seine vessel at 300 and dFADs now required to be constructed from non-entangling material (Resolution 19/02). Resolution 19/02 also states that use of natural or biodegradable material in FAD construction *"should be promoted"* by the flag states with a view to transitioning to the use of biodegradable FADs from 1 January 2022. The extent of implementation of these CMMs are yet to be fully reviewed.

Considering the ecological and ecosystem impacts from dFADs as reviewed in this paper and the high number of dFADs used and the absence of or low quality of data related to the use of dFADs in the Indian Ocean, it is recommended that;

1. IOTC to ensure the existing requirement of FAD construction and data reporting are adhered to
2. FADs to be marked and ownership of FADs clarified by as per the FAO Voluntary Guidelines on the Marking of Fishing Gear, enabling all FADs to be traced back to their owners
3. 100% observer coverage be in place on all vessels involved in dFAD fishing, maintenance or retrieval
4. In order to ascertain ownership, instrumented buoys attached to the dFAD structure shall contain a unique reference number marking (ID provided by the manufacturer of the instrumented buoy) along with the vessel's IOTC registration number
5. To support the monitoring of compliance, CPCs shall ensure that real-time information is reported on the geographical location (in degrees, minutes and seconds), the date, the instrumented buoy ID and the name and registration number of the assigned vessels

References

Anderson, R. C. et al. (2009) Entanglement of Olive Ridley Turtles Lepidochelys olivacea in ghost nets in the equatorial Indian Ocean. in Working Party on Ecosystem and Bycatch 22 (IOTC - www.iotc.org, 2009).

Balderson, S.D., Martin, L.E.C., 2015. Environmental impacts and causation of 'beached' Drifting Fish Aggregating Devices around Seychelles Islands: a preliminary report on data collected by Island Conservation Society 15.

Burt, A.J., Raguain, J., Sanchez, C., Brice, J., Fleischer-Dogley, F., Goldberg, R., Talma, S., Syposz, M., Mahony, J., Letori, J., Quanz, C., Ramkalawan, S., Francourt, C., Capricieuse, I., Antao, A., Belle, K., Zillhardt, T., Moumou, J., Roseline, M., Bonne, J., Marie, R., Constance,

E., Suleman, J., Turnbull, L.A., 2020. The costs of removing the unsanctioned import of marine plastic litter to small island states. Sci Rep 10, 14458. https://doi.org/10.1038/s41598-020-71444-6

Chanrachkij, I., Loog-on, A., 2003. Preliminary Report on Ghost Fishing by Drifting FADs in Eastern Indian Ocean (No. TD/RES/78). SEAFDEC. Also Presented at the IOTC Working Party on Ecosystem and Bycatch (2007), 21pp

Escalle, L., Muller, B., Vidal, T., Hare, S., Hamer, P., 2021. Report on analysis of the 2016/2021 PNA FAD tracking programme. Oceanic Fisheries Programme, The Pacific Community (SPC), Noumea, New Caledonia 2 Oceanic Division, Marshall Islands Marine Resources Authority (MIMRA), in: WCPC Meeting. Presented at the Scientific Committee Seventh Regular Session, Electronic Meeting, p. 44.

Filmalter, J.David., Capello, Manuela., Deneubourg, J.-Louis., Cowley, P.Denfer., Dagorn, Laurent., 2013. Looking behind the curtain: quantifying massive shark mortality in fish aggregating devices. Frontiers in Ecology and Environment 2013; doi:10.1890/130045, 11.

Franco, J., Dagorn, L., Sancristobal, I. & Moreno, G. (2009. Design of Ecological FADs. in Working Party on Ecosystem and Bycatch 22 (IOTC - www.iotc.org, 2009).

Gilman, E., Musyl, M., Suuronen, P., Chaloupka, M., Gorgin, S., Wilson, J., Kuczenski, B., 2021. Highest risk abandoned, lost and discarded fishing gear. Scientific Reports 11, 7195. https://doi.org/10.1038/s41598-021-86123-3

IOTC–WPTT22(AS) 2020. Report of the 22nd Session of the IOTC Working Party on Tropical Tunas, Stock Assessment Meeting. Online, 19 - 23 October 2020. IOTC–2020–WPTT22(AS)–R[E]: 105 pp.

Scott, G.P., Lopez, J., 2014. The use of FADs in tuna fisheries (Policy), Directorate General for Internal Policies - Policy Department B: Structural and Cohesion Policies Fisheries FISHERIES. European Parliament, Brussels. 70p.

Maufroy, A., Chassot, E., Joo, R., Kaplan, D.M., 2015. Large-Scale Examination of Spatio-Temporal Patterns of Drifting Fish Aggregating Devices (dFADs) from Tropical Tuna Fisheries of the Indian and Atlantic Oceans. PLoS ONE 10, e0128023. https://doi.org/10.1371/journal.pone.0128023

Phillip Jr, N.B., Escalle, L., 2020. Updated evaluation of drifting FAD construction materials in the WCPO. Presented at the Scientific Committee Sixth Regular Session, Secretariat of the Pacific Community, Electronic Meeting, p. 16.

Restrepo, V., 2021. Reviewing Progress on the Path to Better Designed, Better Managed FADs - Intern.pdf [WWW Document]. https://iss-foundation.org/. URL https://iss-foundation.org/reviewing-progress-on-the-path-to-better-designed-better-managed-fads/ (accessed 9.13.21).

Stelfox, M., Hudging, J.A., ALi, K., Anderson, C., 2015. High mortality of Olive Ridley Turtles (Lepidochelys olivacea) in ghost nets in the central Indian Ocean., in: IOTC Working Party on Ecosystem and Bycatch. Presented at the IOTC Working Party on Ecosystem and Bycatch, Seychelles.