A polluter pays principle for drifting FADs – how it could be applied?

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Summary

The use of drifting fish aggregating devices (dFADs) continues to threaten endangered, threatened, and protected species (ETP), as well as the broader marine environment in the form of marine litter and abandoned, lost, and discarded fishing gear (ALDFG) that can damage fragile coastal ecosystems. In the Indian Ocean, as in all other ocean regions, there is an urgent need to improve the management of dFADS, primarily to reduce catches of juvenile tropical tunas, but also to help mitigate the other ecological impacts associated with drifting FADs, including marine plastic pollution, ghost fishing and the bycatch of turtles, sharks and marine mammals. The lack of transparency in how dFADs are deployed, tracked and retrieved and the lack of responsibility dFAD owners take for the ecosystem and habitat damage and the pollution caused by these devices is of great concern. The 'polluter pays' principle is the commonly accepted practice that those who produce pollution should bear the costs of managing it to prevent damage to human health or the environment. It is part of a set of broader principles to guide sustainable development worldwide - formally known as the 1992 Rio Declaration. This paper suggests that compensatory mechanisms should be developed, which incorporate and implement a ***Polluter Pays Principle***, so that Indian Ocean coastal states are not saddled with the financial cost burden associated with the removal of derelict dFADs from the ocean. Such a compensatory mechanism should also provide coastal states with a framework for compensation for the ecosystem and habitat damage caused by dFADs.

The lack of transparency in dFAD operations

The increasing use of drifting FAD (dFADs) in tropical tuna purse seine fisheries over recent decades is well-documented. Current estimates suggest that upwards of 100,000 dFADs are deployed a year into the ocean for the express purpose of attracting tuna schools every year (Gershman et al. 2016). While the purse seine vessel operators have information regarding their location and exact numbers, dFAD data are not generally required to be reported to the relevant tuna RFMOs. The lack of transparency

associated with purse seine fishing operations leads to uncertainty around the number and locations of dFAD deployments, compliance with dFAD limits, the materials used to construct dFADs, the dimensions of dFADs, whether each dFAD is associated with only one or multiple purse seiners during its lifetime, or the fate of dFADs – whether they are retrieved, lost, sunk, beached discarded or deliberately abandoned. Currently, data submitted by the relevant CPCs involved in purse seine fishing operations using dFADs in not accessible to IOTC scientists. It is therefore almost impossible to make informed management decisions.

Contraventions of International Marine Pollution Law

The legality of FAD operations is also questionable, and in some instances, it is highly likely that FAD operations constitute IUU fishing (Gomez et al, 2020). Although the normal deployment or even the loss of a FAD does not constitute "dumping" within the meaning of the **London Convention** and **London Protocol**, and thus falls outside the scope of those treaties and is not regulated by them (Churchill, 2021), the deliberate abandonment of a FAD does in all likelihood constitute "dumping" and thus falls within the scope and regulatory provisions of both the London Convention and Protocol, as well as the provisions of **UNCLOS** relating to dumping. There is also support for that conclusion from the practice of the institutions of the London Convention and Protocol (Churchill, 2021).

Guidelines for the Implementation of **MARPOL Annex V**, state that "fishing gear that is released into the water with the intention of later retrieval, such as fish aggregating devices (FADs) … should not be considered garbage or accidental loss in the context of Annex V." The implication of that statement is that the nonaccidental loss and abandonment of a FAD do constitute "garbage" for the purposes of Annex V. Further support comes from paragraph 2.2 of the Guidelines, which provides extensive guidance as to what Annex V requires in the way of reporting and documentation with respect to "the discharge or loss of fishing gear," thereby confirming that such fishing gear constitutes garbage. Paragraph 2.2 also encourages the fishing industry and governments to carry out the research and development necessary to "minimize the probability of loss, and maximize the probability of retrieval of fishing gear from the sea" (Churchill, 2021). Thus, the nonaccidental loss and abandonment of a FAD are contrary to Annex V. If a FAD contains plastic material, its nonaccidental loss or abandonment violates the prohibition in Regulation 3.2; if it does not contain such material, it violates the prohibition in Regulation 3.1 (Churchill, 2021).

Threats related to marine litter and coastal habitat damage should receive immediate management attention given the nature of the dFAD fishery. Until vessel operators are required to recover their

dFADs, the impacts on coastal ecosystems and contributions to marine litter will continue to increase and the consequences will be borne largely by coastal states in the tropical regions. These states depend heavily on coastal habitats for critical ecosystem services and tourism.

How much do we know about the fate of dFADs after deployment?

Data from the Indian Ocean on the fate of dFADs is almost non-existing and cannot be accessed by scientists for further analysis, but can only be released to the CPCs, upon request, for compliance purposes. This is a clear case of 'commercial confidentially' being used as an excuse to suppress information that is a public common good. **The foreword to the Paris Agreement on climate** for instance encourages all States to watch over the integrity of the Ocean as an ecosystem, with a view to protect its vast biodiversity:

> "*But We, signatories to this Appeal, consider that the entirety of the Ocean is under threat and vigorously demand that all marine spaces, from the coasts to the High Seas, be considered as a Common Good of Humanity*."

In laying out their **10 Principles for High Seas Governance** (IUCN, 2008), the **IUCN** has stated that the ocean governance system must evolve, and modern principles must be applied to improve high seas management and ensure sustainable development of the world's oceans. The principles on **Conditional freedom of activity on the high seas** states that "the time of treating the oceans as "open access, common pool" resources are over. Our ocean resources have proven to be exhaustible, so their use needs to be regulated. There is a need to reaffirm and enforce international law, in particular United Nations Convention on the Law of Sea (UNCLOS), and to condition the enjoyment of High Sea's freedoms upon the implementation of the convention's duties. Access to common ocean resources must be twinned with comprehensive and effective governance that includes monitoring, sanctions and enforcement."

The principle on **Transparent and open decision-making processes** states that "societies are demanding more effective management of fisheries and marine ecosystems and there is an urgent need to ensure greater transparency and increased participation by stakeholders in managing high seas resources. In addition, it is critical that decision-making processes are conducted in a manner that is transparent and accountable to minimise the likelihood of disputes and to promote international cooperation. Regional and global organizations need to promote the meaningful participation of all interested stakeholders in decision making, provide observers access to all meetings and documents and receive advice from all interested observers."

Although tuna dFAD fishing operations also lack transparency in other ocean areas, FAD data is more accessible in the Western Central Pacific Fisheries Commission (WCPFC). A recent study in the Western and Central Pacific Ocean found that the vast majority – more than 90% - of dFADs are never retrieved after deployment (Escalle et al, 2020 & Escalle et al, 2021)! Escalle et al (2020) also showed that of the subsample of 37,210 dFADs tracked between 2016-2020, 21.1% (7,851) were "deactivated by the fishing company and left drifting, unmonitored at sea". It is this type of deliberate abandonment of drifting-FADs at sea which clearly indicate a high level of non-compliance by purse seiners with international marine pollution law.

The study further showed that only 9.4% of these dFADs were actually retrieved. Other than the ones that were deliberately abandoned, 42.1% of FADs were classified as lost, 7.4% were beached and 20.0% were sunk, stolen or had a malfunctioning buoy (Escalle et al, 2020). All of the remaining 29,359 dFADs of the sub-sample that were not retrieved would have continued to impact on the marine environment through ghost fishing, entanglement mortalities, habitat destruction and marine plastic pollution. In another study done by Banks & Zaharia (2020) in the western and central Pacific Ocean, similar high levels of dFAD loss, abandonment and beachings were reported. They found that the majority (92%) of the identified beaching events involving dFADs were likely to have occurred on coral reef habitat (Banks & Zaharia, 2020). The remaining events occurred either on seagrass habitat, mangroves or sandy beaches, where no coral reefs were mapped. Some FADs likely impacted more than one type of habitat.

Of the total coastal areas in that region, the impact of beached dFADs has been assessed as having affected cumulatively **between 4 and 6 km^2 of coral reef habitat per year**. It is highly likely that none of the corals survived the impact (Banks & Zaharia, 2020). Such high levels of preventable damage to sensitive coral systems is totally unacceptable and definitely not aligned with the **Paris Agreement on climate** nor with the **IUCN's 10 Principles of High Seas Governance**. Of the estimated 30 million small-scale fishers in the developing world, for example, most are dependent on coral reefs for food and livelihoods, with 25% of all fish caught in these regions coming from coral reefs. Dependence on reefs is complex and highly variable in different parts of the world. Coastal communities rely on reefs for multiple ecosystem functions and services including food security, fisheries employment, reef-derived exports (e.g. live fish, seaweeds), reef tourism, and shoreline protection providing resistance to erosion and the coral rock needed to maintain coral islands (Pacific SIDS, 2011). The transfer of a **disproportionate burden of conservation** to SIDS should be avoided. The disproportionate burden of conservation action is a concept recorded in Article 24 (2) (c) of **UNFSA** and recognizes the special requirements of developing states. SIDS face particular circumstances that have been recognized internationally. The ineffective management of dFADs are impacting directly on the ecosystem health

and resilience in the coastal waters of Indian Ocean coastal states, and as such, place a disproportionate burden of conservation on these states.

It is also well-known that the amount of marine litter in oceans and seas is growing, to the detriment of ecosystems, biodiversity and potentially human health causing widespread concern. The need to tackle these problems and reduce the environmental, economic and social harm is widely recognized (EU, 2018).

Plastic Pollution associated with dFADs

The **European Union** states in their Working Document, ***Reducing Marine Litter: action on single use plastics and fishing gear*** (EU, 2018), that "in addition to harming the environment, marine litter damages activities such as tourism, fisheries and shipping. …..It threatens food chains, especially seafood. Europe has a responsibility to deal with its part of the problem and committed to act globally. As part of the Plastics Strategy, the European Commission committed itself to look into further action to address plastic marine litter that builds on the piecemeal efforts underway in EU Member States. The problem of marine litter is transboundary by nature, as litter moves in the marine environment and litter originating from one country can affect another". FADs are specifically mentioned in this document as one of the potential sources of plastic pollution through the abandonment, loss or discarding of fishing gear.

In a study conducted at the **Aldabra Atoll in the Seychelles**, which is also an UNESCO World Heritage site, 25 tonnes of marine plastic litter was removed, and the researchers from Oxford University estimated that the cost to clean up the entire island would be approximately $4.68 million, requiring 18,000 person-hours of labour (Burt, 2020). This is the largest accumulation of plastic waste reported for any single island in the world (Burt, 2020). It was estimated that the team removed around 5% of the litter washed up on Aldabra's shores in their five-week mission. The researchers estimated that 513 tonnes remain on the island, dominated by waste from the industrial tuna fishing industry in Seychelles, which provides tuna to EU countries and other high-income markets around the world (University of Oxford, 2020). Of the litter collected and removed from Aldabra, the largest component by weight was fishing-related items (buoys, nets, FADS and ropes) which collectively made up 60% (15.8 tonnes) of the total (Burt, 2020). Seven of the 13 dFADs found in the clean-up on Aldabra had clearly decipherable identification codes and all came from purse-seine vessels registered to fish in the Seychelles Exclusive Economic Zone; five were from Seychellois vessels; one was Spanish and one French (Burt, 2020).

This unsanctioned import of plastic litter on small island states makes the economic burden abundantly clear. The project highlighted how even remote highly-protected island ecosystems are now being impacted by global pollution and how difficult and costly it is to remedy. The main sources of the pollution arriving on Aldabra are related to the fishing industry in Seychelles, which provides tuna to EU countries and other high-income markets around the world. There should be some recompense for the damage being caused ((University of Oxford, 2020). Removing the plastic waste equates to $10,000 per day of clean-up operations or $8,900 per tonne of litter —well beyond the capacity of non-profit organisations like the Seychelles Islands Foundation that was involved in the study ((University of Oxford, 2020).

The Aldabra Atoll is only one of many remote islands that are impacted by the purse seine sector and their abandoned, lost and discarded dFADs. Another study in the Pacific showed that around 20% of dFADs either sunk, were stolen or had a malfunctioning buoy (Escalle et al, 2020). Those that sunk could continue to impact on deepwater corals and other sensitive Vulnerable Marine Ecosystems (VMEs) for many years, long after fishing operations have ceased. The plastics that are used in the construction of these dFADs will continue to degrade and pollute these pristine ecosystems for many years to come.

Burt et al (2020) mention that a recent report for the Indian Ocean Tuna Commission investigated 214 individual FADs that had arrived on or entered into near-shore waters of a number of islands in Seychelles: 76% of the FADs were from Spanish owned or flagged vessels, licensed to fish in Seychelles (Balderson et al, 2015). These results are alarming: first because it shows that waste generated by the fishing industry within Seychelles is polluting island ecosystems within the same nation state; second, if the fishing industry is the major contributor to marine plastic litter in the region, then it is almost certainly having indirect negative impacts on the fish communities it needs to sustain (Gove et al, 2019).

Do non-entangling biodegradable dFADs provide the answer?

In an updated evaluation of drifting FAD construction materials in the WCPO, it was found that “in general, natural and low or non-entangling dFAD materials are rarely used in the WCPO. No changes in the design (i.e., low entanglement risk (mandatory as from 1st January 2020) or non-entangling FADs) or mesh size of net used was detected in 2020, since the implementation of the related Conservation and Management Measure (CMM)". In the Indian Ocean, reporting on the materials used in the construction of dFADs and the dimensions of the raft and sub-surface structure of dFADs relies

on self-reporting. Although many claims are made that only non-entangling and biodegradable dFADs are used, there is little evidence of this actually being the case. Without independent verification of this data, it will always lack credibility, especially since derelict dFADs that are constructed from plastic netting, polypropylene ropes and polypropylene salt bags still seem to be the norm when they wash ashore.

There is also clear evidence that the so-called non-entangling 'sausage' of netting that is used to construct the 'tail' of some dFADs becomes an entangling mess when it is beached on reefs. Such a 'disentangled' tail will continue to ghost fish and contribute to plastic pollution and other impacts on the environment. Biodegradability in dFADs has been suggested as a solution by the purse seine industry as far back as 2010, when Dagorn (2010) noted that "French and Spanish purse seine fleets are attempting to develop "ecological FADs," which are biodegradable and therefore are not conducive to ghost fishing, which is fishing that continues on fishing gear that has been lost or abandoned". It is now more than 10 years later and it is clear that biodegradability has not been adopted at scale by FAD owners in the construction of their dFADs.

Derelict FADs, including biodegradable FADs, can damage coral reefs and other sensitive coastal habitats (FAO, 2019). Derelict dFADs can also litter coastlines, including tourist beaches (Balderson and Martin, 2015; Duhec et al., 2015; Maufroy et al., 2015; Gilman et al., 2016). For example, in the Atlantic and Indian Oceans, about 9.9 percent of dFADs with satellite buoys deployed by French purse seine vessels ended up running aground on coastlines (Maufroy et al., 2015). Derelict FADs can also adversely affect other marine industry users such as through obstructing navigation, fouling fishing gear, and damaging mariculture facilities. Derelict FADS might also transport alien invasive species (FAO, 2019). Synthetic compounds, including microscopic plastic material and toxic chemicals from materials used to construct dFAD components and instrumented buoys (e.g. echo-sounder and satellite buoys), can accumulate in marine food webs (Gilman et al., 2016).

How much plastic pollution is caused by dFADs?

It is very difficult to determine an accurate estimate on the weight of ocean plastic that can be attributed to dFADs abandoned, lost and discarded by the purse seine industry. Very little verifiable data on the dimensions and construction materials used in dFADs in the Indian Ocean is available. In the WCPO, the situation is a bit different and there are more accurate estimates of FAD numbers (Escalle et al, 2021) and the materials used in the construction of dFADs (Jr NBP et al, 2020). Projections have also been made on the different fates of dFADs after deployment based on some tracking data (e.g. Escalle et al, 2021).

Based on data from these studies, and assuming that almost all of the dFADs in the WCPO are mostly constructed from plastic materials (fish nets, polypropolene rope, polypropylene rope etc).

Total no. of FADs deployed in WCPO from 2016-2019[1]	*Percentage of FADs that are lost, abandoned or discarded (not retrieved)*[2]	*No. of FADs that have been lost, abandoned or discarded in WCPO from 2016-2019*[2]	*Average weight of a dFAD (mt)*[3]	*Total weight (mt) of dFADs that have been lost, abandoned or discarded in WCPO from 2016-2019*[23]
166093	90,6%	150480	1,5	225,720

Based on data published by Jr NBP et al (2020) it can be assumed that dFADs in the WCPO are currently mostly constructed from plastic materials. The total weight of dFADs that would have been lost, discarded and abandoned in the WCPO from 2016-2019 would be 225,720 tonnes. Most of this would be plastic waste, including considerable quantities of netting and other materials known to entangle and kill many animals long after their loss or abandonment.

If it is now assumed that the average weight carried by a garbage truck is around 10 tonnes, it would mean that the equivalent of 5,600 garbage trucks could dump their load in the ocean to match the amount of plastic waste associated with lost, abandoned and discarded FADs in the WCPO. The global figure would be considerably higher. It is therefore clear that plastic pollution is a huge issue that needs to receive urgent attention from dFAD owners/purse seine vessel operators.

Recommendations

Currently, there are no requirements for owners to retrieve their dFADs once they are deployed, nor to take responsibility for the damage they cause to ocean ecosystems and coastal habitats. These management shortcomings could be addressed through various measures, such as: definitions of ownership and responsibilities; clear requirements on "deactivation" of dFADs that are still adrift - to minimize harm to coastal habitats; strengthening of dFAD recovery requirements; independent

[1] Escalle, L., Hare, SV, Vidal, T., Brownjohn, M., Hamer, P. & Pilling, G. Quantifying drifting Fish Aggregating Device use by the world's largest tuna fishery, ICES Journal of Marine Science, 2021;, fsab116, https://doi.org/10.1093/icesjms/fsab116; (Figure 4 and Table S4) are relevant in terms of FAD numbers of the different years.

[2] Escalle L, Muller B, Vidal T, et al (2021) Report on analyses of the 2016/2021 PNA FAD tracking programme. In: WCPFC Scientific Committee 17th Regular Session. WCPFC-SC17-2021/MI-IP-04, Electronic Meeting https://meetings.wcpfc.int/node/12589

[3] Based on various social media posts, it is estimated that a dFAD in the WCPO weights around 1.5 tonnes.

tracking of dFADs; and clear mechanisms through which coastal states, in collaboration with RFMOs, can communicate with dFAD owners about beaching events and seek fair compensation.

In terms of international best-practices (Huntington 2018), dFAD owners should make every reasonable effort to recover lost or abandoned fishing gear. Currently, tuna RFMOs do not require vessels to recover dFADs once they are deployed. This recovery requirement is viewed as impractical given that such devices are adrift and would incur too much cost and time to recover.

The overall ecosystem impacts of dFADs can only be fully understood if their numbers, movements and impacts are independently tracked and incorporated in management decisions. Therefore, it is up to the RFMOs to take urgent management action to address the contribution of dFADs to marine pollution and habitat damage, while also ensuring fleets are in compliance with MARPOL Annex V and the London Convention.

Compensatory mechanisms should also be developed when dFADs cause damage in coastal states. The only way to effectively manage, monitor and verify dFAD fishing activities in tuna fisheries is by gaining a better understanding of the number of dFADs deployed in specific areas, knowing where they are, who owns them and what their ultimate fate is. This information will also help to reduce the detrimental environmental impacts of dFADs and their contributions to marine litter. Real time tracking of dFADs by independent parties, either the RFMO secretariats or by independent third parties appointed by the RFMOs, may be the best solution.

The **Polluter Pays Principle** is the commonly accepted practice that those who produce pollution should bear the costs of managing it to prevent damage to human health or the environment. For instance, a factory that produces a potentially poisonous substance as a by-product of its activities is usually held responsible for its safe disposal. The polluter pays principle is part of a set of broader principles to guide sustainable development worldwide (formally known as the 1992 Rio Declaration) and this principle underpins most of the regulation of pollution affecting land, water and air.

The Polluter Pays Principle is also one of the key principles underlying the European Union's (EU) environmental policy. Application of the principle means that polluters bear the costs of their pollution including the cost of measures taken to prevent, control and remedy pollution and the costs it imposes on society. By applying the principle, polluters are incentivised to proactively avoid environmental damage and are held responsible for the pollution that they cause. It is also the polluter, and not the taxpayer, who covers the cost of remediation.

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