# AN INTRODUCTION TO FADS AS A SOURCE OF MARINE DEBRIS

**Issue: FADs as marine debris source**

**Background**

ACCOBAMS is committed to addressing threats to cetaceans, including impacts of marine debris. One significant source of marine debris in the ACCOBAMS area is the use of Fish Aggregating Devices (FADs) in fisheries. In the Mediterranean, when the fishing season ends, some FADs near the coast may be recovered, but the vast majority are lost or destroyed by storms or are otherwise abandoned (Sinopoli et al., 2020).

During the CMS COP 14 (Samarkand, 2024), the COP-appointed Councilor for Marine Pollution introduced the document here below - UNEP/CMS/COP14/Doc.27.1.2/Rev.1 - Fish Aggregating Devices. 'An Introduction to FADs as a Source of Marine Debris'.
CMS Parties were requested to address the potential negative impacts of FADs, including on CMS-listed species, and to work with relevant fisheries organizations to ensure the sustainability of FAD fisheries.

**ANNEX 1**

# AN INTRODUCTION TO FADS AS A SOURCE OF MARINE DEBRIS

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Contents

What are FADs and what are they made of?

According to FAO (2019) a fish aggregating device or FAD is "*a permanent, semi-permanent or temporary object, structure or device of any material, man-made or natural, which is deployed, and/or tracked, and used to aggregate fish for subsequent capture. A FAD can be either an anchored FAD (aFAD) or a drifting FAD (dFAD)*."

FADs have been deployed for centuries (Taquet, 2013). Probably as soon as it was discovered that fish concentrate under floating objects this relationship has been exploited, but now they are used on an industrial scale in some fisheries.

Anchored FADs are used in artisanal fisheries and semi-industrial fisheries (Murua et al., 2021). In artisanal fisheries they are usually made from materials such as cork, plastic bottles, inner tubes from tyres and polystyrene, and they are anchored near the coast (Churchill, 2021). In industrial fisheries aFADs are made of steel, aluminium or fibreglass, may be equipped with radar reflectors and solar-powered lights and they tend to be moored in deeper waters offshore. See Figure 1 for a typical aFAD used in the Mediterranean.

Tuna aFADs have a surface float, a mainline connecting them to the seafloor, a subsurface attractor such as palm fronds, and an anchor which is usually made of 25 to 40 concrete blocks or cylinders which are linked together (Proctor et al., 2019). Typical deep-water aFADs in Indonesia have approximately 4km long mooring lines, surface floats made from either steel cylinders, blocks of foam encased in car tyres or bamboo rafts (Gilman et al., 2022). Some of the aFADs with bamboo rafts have a shelter on them where the fishers or caretakers live for weeks or months at a time (Proctor et al., 2019). In the Maldives, aFADs are moored using ropes with wire-core and stainless-steel link chains and steel-reinforced concrete blocks are used as anchors (Adam et al., 2019). The Maldivian aFADs used to have old nets attached to their moorings but, since 2004, a set of floating buoys has been used instead, with netting fixed horizontally under the nets (i.e., it does not hang). See Figure 2.

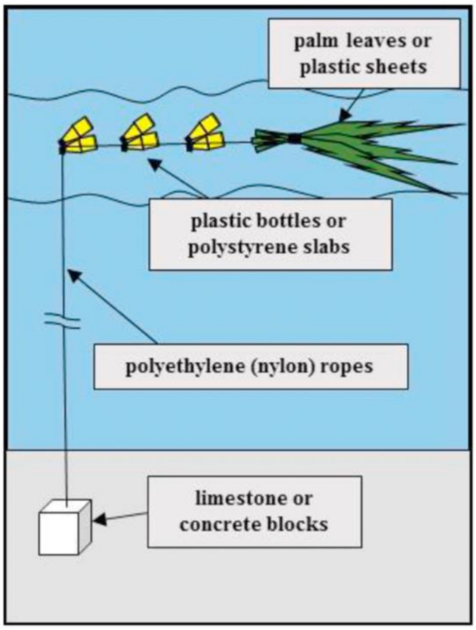


**Figure 1**: Typical anchored FAD deployed in the Mediterranean Sea (from Consoli et al., 2020)

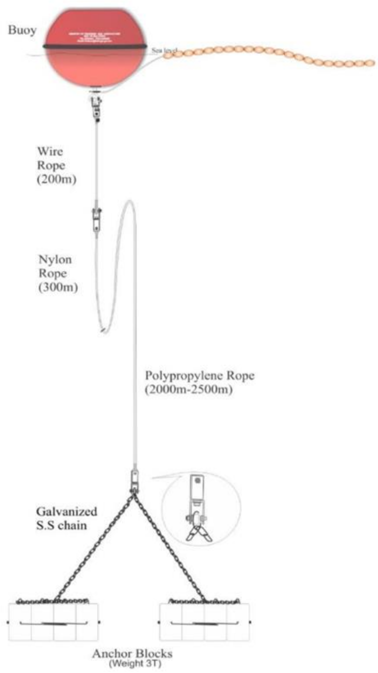


**Figure 2**: Anchored FAD design from the Maldives (Adam et al., 2019)

Drifting FADs comprise a floating surface structure or raft and a submerged part with underwater materials such as hanging nets (Murua et al., 2021). See Figure 3. In some fisheries, the rafts themselves are submerged a couple of metres below the water surface (Zudaire et al., 2020). Natural and artificial materials are used to construct dFADs. In the Mediterranean, dFADs used to be made from palm leaves, cork slabs, vegetable fibre ropes and large stones (Sinopoli et al., 2020). These natural materials have largely been replaced by plastic sheets, plastic bottles, polystyrene slabs and polyethylene cables. Other materials used in dFAD construction include nylon netting, net corks made from Ethylene Vinyl Acetate (EVA) and pipes made from polyvinyl chloride (PVC) (Zudaire et al., 2020). Less than 2% of FADs in the Western and Central Pacific Ocean (WCPO) are made entirely of natural materials, and over one third are made completely of artificial materials (Escalle et al., 2018).

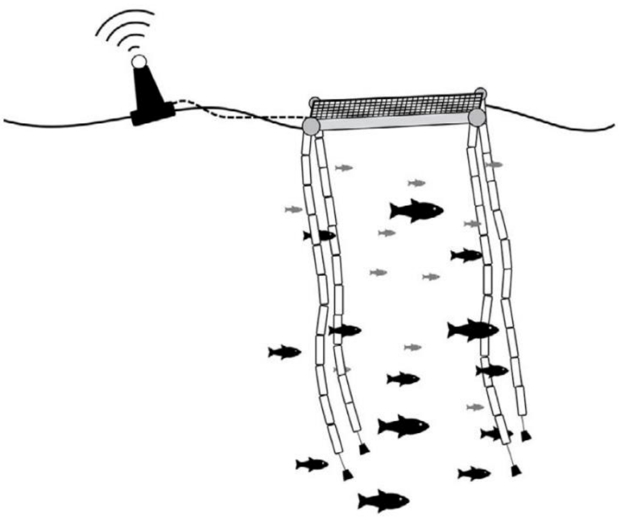

**Figure 3**: A typical drifting FAD (from Curnick et al., 2020)

Many dFADs are equipped with satellite buoys so that they can be tracked (Moreno et al., 2016; Murua et al., 2021). Some are tracked by the fishing vessels themselves, so that they can find them, but there is also tracking to monitor these devices more generally. The Indian Ocean Tuna Commission's Resolution 19/02, for example, requires the use of instrumented buoys on all dFADs (IOTC, 2019). An instrumented buoy is "clearly marked with a unique reference number allowing identification of its owner and equipped with a satellite tracking system to monitor its position". Nearly all dFADs used in waters managed by the Inter-American Tropical Tuna Commission are tracked using satellite buoys (IATTC, 2014). Sonar buoys or echo-sounders are used in some fisheries to estimate how many fish are under the FADs (Moreno et al., 2016). In 2020, 99% of buoys in the WCPO had echo-sounders (Escalle et al., 2020).

How many FADs are there and where are they deployed?

Data about the scale of FAD deployment is limited but an overview of the available information is provided here. In 2014, it was estimated that globally there were more than 73,000 aFADs in use, with the vast majority (60,000) anchored in the Mediterranean Sea and used for attracting dolphin fish (*Coryphaena* spp.) (Scott and Lopez, 2014). The aFADs deployed in the Mediterranean represent approximately 35% of all the world's FADs (including anchored and drifting FADs) (Sinopoli et al., 2020).

In 2014, it was estimated that nearly 13,000 aFADs were being used to harvest tuna and related species in tropical and subtropical regions (Scott and Lopez, 2014). However, it has recently been estimated that tens of thousands of aFADs are fished on by Indonesian tuna purse seine, handline, troll and pole-and-line vessels alone, although there are no accurate estimates for the exact locations of these, nor the total number (Gilman et al., 2022). As the Indonesian aFADs are installed in locations with deep water (1500 – 5000m) and strong currents, the surface floats can change position by as much as 2 nautical miles (nmi) or more (Proctor et al., 2019). If insufficient anchor weight is used, the whole aFAD can also move significant distances. In the Maldives, a network of 50 deep water aFADs is managed by the government (Adam et al., 2019). The aFADs are located approximately 12nmi from the atoll reef anchored at depths of approximately 2,000m.

Drifting FADs are used extensively in industrial tuna fisheries (Gershman et al., 2015). Four tuna regional fisheries management organisations (tRFMOs) manage the world's tropical tunas and associated species: the Inter-American Tropical Tuna Commission (IATTC) in the eastern Pacific Ocean, the Indian Ocean Tuna Commission (IOTC), the International Commission for the Conservation of Atlantic Tunas (ICCAT) and the Western Central Pacific Fisheries Commission (WCPFC) (Gomez et al., 2020). Another tRFMO - the Commission for the Conservation of Southern Bluefin Tuna (CCSBT) - manages three non-tropical species. The tRFMOs have established limits for the number of active FADs each vessel can use (Murua et al., 2021). See Table 1 for relevant resolutions from the tRFMOs.

In 2013, between 81,000 and 121,000 dFADs were estimated to be deployed worldwide (Gershman et al., 2015). Regional use of dFADs is varied. In the eastern Pacific Ocean tuna fisheries managed by the IATTC, the number of dFADs set by vessels >363 t carrying capacity, increased from 4,281 in 2005 to 11,549 in 2018 (IATTC, 2021) [1]. Escalle et al. (2021) estimated that between 20,000 and 40,000 dFADs were deployed per year in the WCPO purse seine fishery between 2011 and 2019. In the Indian Ocean, between January and July 2020, there were between 9,516 and 11,583 buoys in operation on dFADs each day (IOTC Secretariat, 2020).

[1] Data for 2019 (10,373 dFADs) and 2020 (8,586 dFADs) were marked as preliminary.

FADs as marine debris

In the Mediterranean, when the fishing season ends, some aFADs near the coast may be recovered, but the vast majority are lost or destroyed by storms or are otherwise abandoned (Sinopoli et al., 2020). Approximately 1.6 million FADs were abandoned between 1961 and 2017 in the Mediterranean Sea (905,483 in Tunisia, 359,900 in Sicily, Italy, 277,580 in Malta and 53,555 in Mallorca, Spain). The abandoned materials included palm fronds, cork slabs, plastic bottles, inner tubes, polystyrene slabs, plastic sheets, limestone and concrete blocks, polyethylene cables, nylon cables and sisal rope.

Consoli et al. (2020) surveyed 4,000$m^2$ of seabed in the area between Malta, the Pelagian Islands and Panelleria for marine debris and found the highest value of litter density (4.63 items/100$m^2$) ever recorded by a Remotely Operated Vehicle survey in the Mediterranean Sea. Fishing gear made up 96.8% of the 185 debris items recorded. Ropes from FADs accounted for 81.1% of items and FAD anchoring ballast for 2.2%. Almost half the debris items (47.57%) were in contact or interacting with benthic fauna and 87 were entangled with 139 animal colonies; mostly with the black coral species *Leiopathes glaberrima* (i.e. 131 impacted colonies).

In the Maldives and Indonesia, aFADs are sometimes used to moor vessels and this could impact loss rates of FADs (Gilman et al., 2022). Devices can also be lost when longline or gillnet fishers cut aFAD mooring lines to avoid entanglements with their gear. Other vessels, including cargo ships, may accidentally strike aFADs, breaking them from their moorings, or operators of such vessels may cut mooring lines deliberately if the aFAD is in a shipping lane. Fishing competitors may also vandalise each other's aFADs. All of these actions may cause extra marine debris to be released.

Drifting FADs which are not collected and re-used may also end up as marine debris and they can sink or drift to beaches, coral reefs or mangroves (Zudaire et al., 2020). The deeper the tail of the dFAD extends, the higher the probability of the dFAD touching the seabed and beaching (Curnick et al., 2020). In the Indian and Atlantic Ocean, 9.9% of all dFAD trajectories were found to end with the FAD beaching and, potentially, negatively impacting sensitive habitats such as coral reefs (Maufroy et al., 2015). In the Chagos Archipelago in the Indian Ocean, a study looking at dFAD drift patterns in a marine protected area (MPA) found that 8.13% of dFADs beached (Curnick et al., 2020). Modelling estimated that 37.51% of dFADS would beach in the MPA.

Risk of beaching may depend on location of deployment and time of year, which indicates that there is a potential for risks to be mitigated. In 2016-2017, over 1,300 dFADs beached in the WCPO with most beachings taking place in Papua New Guinea and the Solomon Islands (Escalle et al., 2019). Abandoned[2] dFADs often end up far from the core fishing ground of the company which originally set the FAD, with an average distance travelled of 1,824km recorded by the Parties to the Nauru Agreement (PNA) tracking programme in the WCPO (Escalle et al., 2020). Only 9.4% of tracked dFADs in that region were retrieved, whereas 42.1% were lost, 7.4% were beached, 20% were sunk, stolen or had a malfunctioning buoy, and 21.1% were deactivated and left to drift by the fishers (Escalle et al., 2020). Beaching of dFADs in the Indian Ocean mostly occurs in Somalia, the Seychelles, the Maldives and Sri Lanka (Maufroy et al., 2015). In the Atlantic Ocean, beached dFADs concentrate in the Gulf of Guinea although some have crossed the ocean and ended up on the coast of Brazil. Deployment location and timing, intensity of fishing effort and current strength can impact the likelihood of dFADs beaching (Maufroy et al., 2015). As noted above, dFADs are generally made from

[2] Escalle et al (2020) "considered that a FAD was abandoned when drifting outside the fishing ground of the company owning it (where the majority of that company's vessels were fishing)."

materials which do not degrade and they can accumulate in sensitive coastal ecosystems (Zudaire et al., 2020). The reporting of beached FADs will be affected by observer effort.

Generation of microplastics

The relationship between FADs and the generation of microplastics has not been directly researched but it can be assumed that, like other plastics in the marine environment, they will make produce microplastics through degradation, fragmentation and abrasion processes. The ingestion of microplastics has the potential to impact all parts of marine food webs, including by increasing the bioavailability of associated toxic substances (see for example, Fossi et al., 2018).

Reducing marine debris from FADs

The role of FADs in generating significant marine debris has been recognised and the use of natural biodegradable materials promoted as an option to address the problem of lost FADs breaking down in the environment (Zudaire et al., 2020). The WCPFC's recently published Conservation and Management Measures and Resolutions, for example, state that "*to reduce the amount of synthetic marine debris, CCMs [Commission Members, Cooperating Non-Members and Participating Territories] shall encourage vessels flying their flag to use, or transition towards using, non-plastic and biodegradable materials in the construction of FADs*" (WCPFC, 2022).

The International Seafood Sustainability Foundation (ISSF) Non-Entangling and Biodegradable FADs Guide recommends the use of bamboo, balsa wood and other natural materials in the rafts of dFADs, and cotton ropes and canvas, manila hemp, sisal and coconut fibre for the tail part (ISSF, 2019). Examples of biodegradable dFAD (bio-FAD) designs which fulfil the identified requirements (having a slow drift, creating drag but with reduced size, reducing the need for plastic flotation, providing shade and working for one year at sea) are given in Moreno et al. (2020). Tails for dFADs, in particular, should be made with biodegradable materials as they can become entangled in coral reefs and remain at sea for many years if they are made of plastic components.

If the same traditional dFAD design is used but with organic ropes and canvas, some fishers may judge that the lifespan of the dFAD is shorter than they require (Moreno et al., 2021). This means that consideration is being given to bio-FAD design to try to ensure that they suffer less structural stress in the water and will not break quickly. Moreno et al. (2021) propose the Jelly-FAD design, for example, which has quasi-neutral buoyancy like a jellyfish. Balsa wood is being tested as a biodegradable material to replace plastic buoys which are used for buoyancy (Moreno et al., 2021). Redesigning dFADs could also address this issue by coming up with designs which require fewer buoys.

The size of a dFAD is also relevant and reducing their size is an important step for reducing the amount of polluting material ending up in the environment. According to Moreno et al. (2021) "*the pollution impact of dFAD structures on the ecosystem is related to their size (i.e., the impact of five dFADs of 20 metres depth is proportionately four times less than five dFADs of 80 metres depth)*".

Fishers tend to think the best way to prevent plastic pollution is to use biodegradable natural materials in FAD construction (Murua et al., 2019). Management techniques can also be employed. For example, beaching events can be reduced by prohibiting the deployment of dFADs in areas where beaching is more likely to happen (Imzilen et al., 2021). For example, in the Indian Ocean in areas south of 8°S latitude in winter, and in the western Maldives in summer. In the Atlantic, deployment should be avoided in an area adjacent to the western African coast.

Recovery programmes can also help remove lost FADs from the environment. Approximately 20% of dFADs lost in the Indian and Atlantic oceans passed within 50km of major ports suggesting that port-based programmes could collect abandoned, lost or discarded dFADs at sea (Imzilen et al., 2022). Fishing companies could recover dFADs when they are clearly exiting purse seine fishing grounds. For example in the Atlantic Ocean FADs drifting west of 20°W in westward currents should be recovered to prevent them beaching on coral reefs in the Gulf of Mexico or the Caribbean Sea (Maufroy et al., 2018). However, such actions may be considered economically unfeasible by fishing companies. When dFADs are seen to enter sensitive areas (e.g., a few nautical miles from a coral reef) appropriate remedial actions could follow such as those used in the 'FAD-Watch' initiative in the Seychelles, which tracks, retrieves and recycles FADs (Zudaire et al., 2018).

Murua et al. (2021) recommend that lost FADs should be managed and that FAD ownership needs to be clearly defined so that responsibility for lost and abandoned FADs can be determined. One way to manage the recovery of lost FADs is that fishing fleets should recover a certain percentage of their FADs at the end of each year (as already required by the IATTC). The Joint t-RFMO FAD Working Group has discussed the possibility of owners of FADs which damage coral reefs, for example, also being required to pay compensation under a "polluter-payer" concept (JWGFAD, 2019). Gilman et al. (2022) recommend "no fault" reporting schemes so that fishers are not disincentivised from reporting lost FADs.

Regular inspection and maintenance of aFADs can reduce loss rates and the potential for them to become marine debris (Gilman et al., 2022). Technology such as satellite buoys can be used to alert when an aFAD moves position. Area management is also important so that there is no conflict with gillnet and longline fishers and so that shipping lanes are avoided when aFADs are installed. aFADs need to be properly marked so that they are visible and can be avoided by vessels. Designs with submerged structures could also reduce vessel strikes, entanglement and vandalism. Subsurface aFADs are being used in the Pacific region to combat these problems especially in areas of high boat traffic (Sokimi et al., 2020). In the Maldives, aFAD loss was reduced from 82% to 20% by improving aFAD buoyance, mooring and anchor designs and by paying fishers to retrieve lost aFADs (Gilman et al., 2022).

<u>Entanglement and ghost fishing</u>

Non-target wildlife can become entangled in dFADs which are actively deployed and being tracked by fishers, or in those which have been lost and which are considered marine debris. The full scale of this is unknown. Entanglement in dFADs tends to go unobserved by fishers because much of it takes place in the submerged sections of the FAD (Murua et al., 2021).

Sharks, turtles and other sensitive species are at risk of entanglement in dFADs. FADs with nets hanging from them which are spread out rather than tied into bundles are considered high entanglement risk FADs (HERFADs) (Zudaire et al., 2020). IATTC, IOTC, ICCAT and WCPFC require that newly deployed dFADs should be non-entangling (Murua et al., 2021).

*Sharks*

Most shark entanglement goes unrecorded as it happens when the dFADs are drifting and no boats are nearby to observe it, with the entangled animal dying and then its dead body falling off the FAD and sinking after a couple of days (ISSF, 2019).

The sharks which associate with dFADs are mainly silky sharks (*Carcharhinus falciformis*) and oceanic white tip sharks (*Cacharhinus longimanus*) (Murua et al., 2016). When they become entangled in the submerged tail of a FAD, they stop moving and, as obligate ram ventilators, they soon suffocate (Zudaire et al., 2020). Silky sharks are listed on Appendix II of the

Convention on International Trade of Endangered Species of Wild Fauna and Flora (CITES)[3], Appendix II of CMS[4] and have been assessed as Vulnerable on the IUCN Red List of Threatened Species (Rigby et al., 2021). Oceanic white tip sharks are listed on Appendix II of CITES, Appendix I of CMS and have been assessed as Critically Endangered on the IUCN Red List (Rigby et al., 2019). Filmalter et al. (2013) estimated that annually between 480,000 and 960,000 silky sharks were killed due to entanglement in the submerged netting of active FADs in the Indian Ocean.

Figure 4: Entangled silky sharks in the netting of a dFAD (From Filmalter et al., 2013)

*Sea turtles*

Whereas sharks only get entangled in submerged netting, sea turtles may also get caught in the netting on top of the raft when they climb on to the raft to rest (Zudaire et al., 2020). When this type of entanglement takes place there is a chance of the turtle being seen and rescued but this entirely depends on how soon the fishers check the FAD after the turtle has become entangled. Entanglements with FADs, including in the anchoring lines of aFADs, cause injuries which can lead to loss of limbs and death if the turtle is unable to surface to breathe (Blasi et al., 2016). If the turtle is entangled in material from a FAD but is still able to swim, it may survive for a period but will be susceptible to starvation if it is unable to forage properly. It may also be unable to escape from predators.

A survey of loggerhead turtles (*Caretta caretta*) around the Aeolian Archipelago in Northern Sicily in the Mediterranean found that of 71 turtles which needed rescuing and 22 which had died, 19.4% (n=18) of them were entangled in plastic debris (FADs or floating debris probably of FAD origin) (Blasi et al., 2016). In the Eastern Pacific Ocean, around 80 to 100 turtles were estimated to have been entangled in FADs each year between 1991 and 2008 with 1% of FADs having entangled turtles, although these estimates had a high degree of uncertainty due to inadequate observer effort (Hall and Roman, 2013).

Entanglement in FADs, as well as bycatch in fisheries, could potentially be avoided through time-area closures (FAO, 2010), although FADs that are still in the area from earlier deployment would need to be considered and preferably removed. Some species of sea turtles follow migratory corridors from nesting beaches to foraging grounds, while other species' movements can be associated with temperature and other conditions (FAO, 2010). Spatial and temporal fishing restrictions including prohibitions on FAD deployment when there are

[3] https://cites.org/eng/app/appendices.php
[4] https://www.cms.int/sites/default/files/basic_page_documents/appendices_cop13_e_0.pdf

high concentrations of turtles could help reduce entanglement. However, there may be issues with determining which areas should see restrictions and how to implement them.

*Marine mammals*

NOAA (2017) considered that marine mammals are at risk of entanglement with the nets, rope and lines used in FADs and that the anchoring lines in aFADs are of particular concern. The FAD material can become chronically entangled around the animal's body, neck or flippers impeding its ability to swim and forage and even resulting in death if the animal is unable to surface to breathe. According to Anderson (2014), cetaceans do not regularly associate with FADs in the Indian Ocean although rough-toothed dolphins (*Steno bredanensis*) do associate with drifting objects and could be at risk of entanglement in FADs. However, there are some reports of cetaceans getting entangled in dFADs in the Eastern Indian Ocean between 1993 and 2005 (Rajruchithong et al., 2005). For example, from 17 dFADs in the Eastern Indian Ocean which were checked for entanglement, six of them had dead porpoises[5] (seven animals in total) in varying states of decomposition (Chanrachkij and Loog-on, 2003). It was speculated that the cetaceans were foraging around the FADs when they became entangled.

Reducing risk of entanglement

In many locations, hanging nets are being replaced by ropes and other non-entangling materials to prevent ghost fishing and bycatch (Murua et al., 2021). It is essential that new biodegradable materials should not be configured into a net format, and that ropes or canvas should be used instead (Moreno et al., 2020). The ISSF's Non-Entangling and Biodegradable FADs Guide gives recommendations about how dFADs might be designed to prevent entanglement (ISSF, 2019). See also Figure 5.

[5] These were not identified to species level. It is possible that they refer to dolphins.

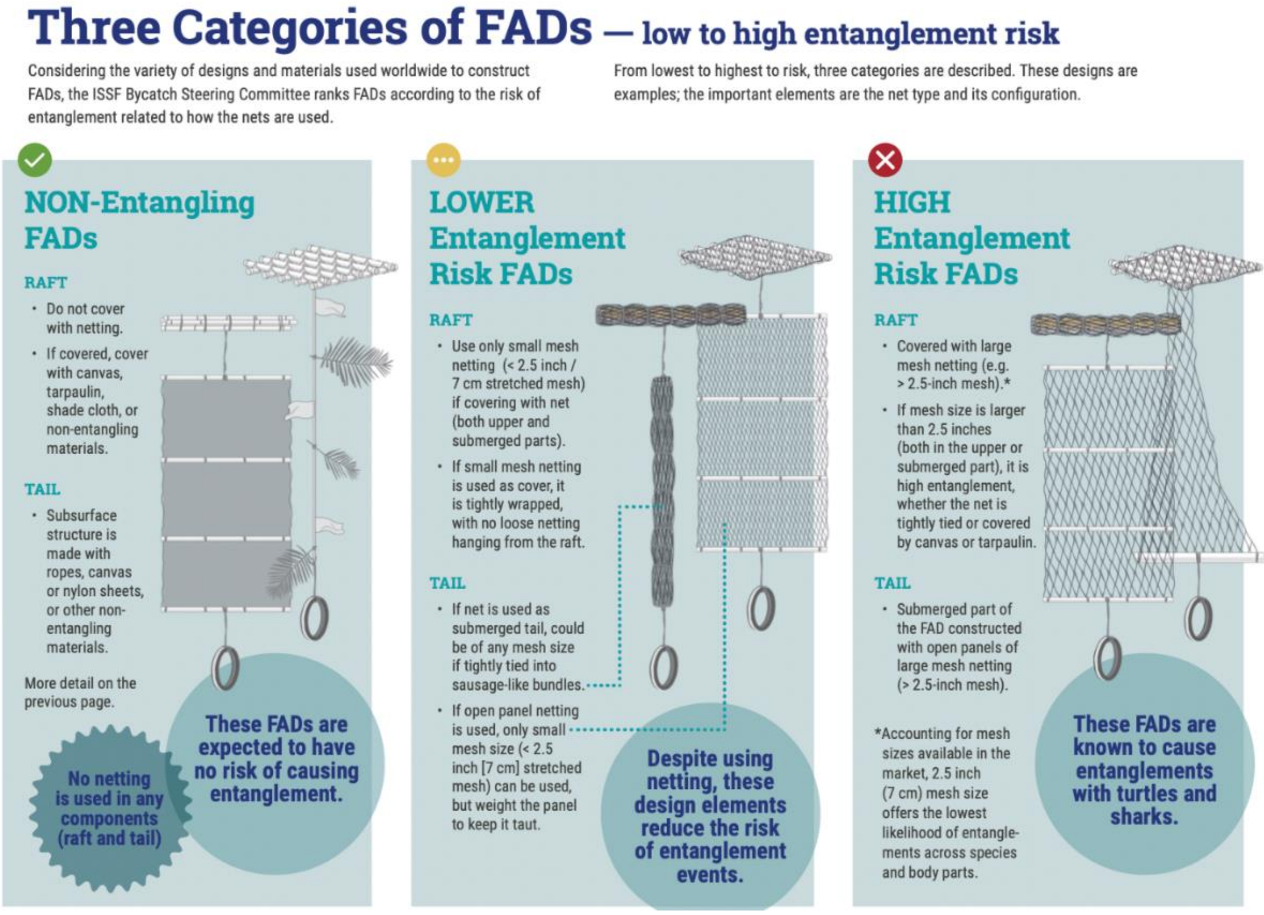


**Figure 5**: Examples of different drifting FAD designs – low to high entanglement risk (ISSF, 2019)

The WCPFC's Conservation and Management Measures and Resolutions, state that FADs should comply with the following specifications:

- "*The use of mesh net shall be prohibited for any part of a FAD,*
- *If the raft is covered, only non-entangling material and designs shall be used,*
- *The subsurface structure shall only be made using non-entangling materials.*" (WCPFC, 2022)

<u>Conclusions</u>

Marine debris, especially plastic and including ghost fishing gear, has negative impacts on marine wildlife primarily through ingestion and entanglement. Abandoned FADs become marine debris and can sink or drift onto beaches, coral reefs, mangroves or other coastal habitats with associated negative impacts.

Entanglement in marine plastics adversely affects many species, including marine mammals, sharks and sea turtles. The individual-level effects of interactions with marine debris include drowning, starvation, malnutrition, physical injury, reduced mobility, enhanced exposure to predators, and physiological stress, reduced energy acquisition and assimilation, compromised health and reproductive impairment. Furthermore, ingestion of plastics, including microplastics has the potential to impact all parts of the marine food web, including prey species.

Recommendations to CMS

Parties should ensure that FADs are:

a) Of non-entangling nature;
b) Designed to reduce the likelihood of them being lost;
a) Subject to regular inspection and maintenance to avoid loss;
b) Marked, monitored, maintained and retrieved in an environmentally sound manner by the fisheries concerned;
c) Located, where possible, away from
    i. shipping routes,
    ii. areas where they will be in conflict with other fisheries, and
    iii. migratory routes for species such as marine turtles;
d) Deployed at times of year and in locations where their beaching is less likely; and
e) Disposed of appropriately.

In addition,

f) Where they are a flag state for FAD fisheries and/or FAD deploying vessels, Parties should, whenever possible and feasible, ensure that natural biodegradable materials are used in the construction of FADs, noting that more research is needed on this topic;
g) Flag states should also ask fisheries for real-time mandatory lost gear reporting to track rates of loss, identify high risk locations and gear types and promote retrieval, particularly in sensitive marine habitats or areas of high importance for food security, where it is environmentally safe to do so;
h) States should strengthen environmental control measures through inclusion of terms in fishing licenses and the development of related guidelines;
i) Generally, all states should improve fisheries management practices and advocate for solutions to reduce loss or prevent dumping, as well as the full recovery of FADs; and
j) States should support a comprehensive global strategy on fishing gear to be developed under the new global plastics treaty, including a core obligation for the reduction of lost fishing gear.

In support of the above recommendations, the Scientific Committee should establish a workstream on FADs, which will better evaluate the relationship between FADs and marine debris and establish principles for best practice to avoid their loss, entanglement with marine wildlife, beaching of FADs in corals, mangroves and other marine and coastal habitats, as well as seeking to reduce their contribution to marine plastic pollution. This might include liaison with ISSF, further to their work on improving FAD design, and also the tuna RFMOs.

The Scientific Committee should also consider a possible case study area looking at FADs as a source of marine debris – for example in the Mediterranean Sea - to a) look at compliance with existing regulations, b) devise environmental management and control measures to avoid gear loss and c) how to improve the environmentally sound retrieval of lost FADs.

**Table 1**: Relevant tRFMO Resolutions

| tRFMO | Resolution / Recommendation | Sample text |
|---|---|---|
| IATTC | Resolution C-19-01 Amendment to Resolution C-18-05 on the collection and analyses of data on fish-aggregating devices | To reduce the entanglement of sharks, sea turtles and other species, FADs should be designed as follows:<br>"*1. The floating or raft part (flat or rolled structure) of the FAD can be covered or not. If it is covered with mesh net, it must have a stretched mesh size less than 7 cm and the mesh net must be well wrapped around the whole raft so that there is no loose netting hanging below the FAD when it is deployed.*<br>*2. The design of the underwater or hanging part (tail) of the FAD should avoid the use of mesh net. If mesh net is used, it must be tied as tightly as practicable in the form of sausages or have a stretched mesh size less than 7 cm in a panel with weight at the end.*<br>*3. To reduce the amount of synthetic marine debris, the use of natural or biodegradable materials (such as hessian canvas, hemp ropes, etc.) for drifting FADs should be promoted.*" |
| IATTC | Resolution C-19-04 to mitigate impacts on sea turtles | "*CPCs with purse-seine vessels fishing for species covered by the IATTC in the Convention Area shall:*<br>*…require owners/operators/vessel crew of purse seine vessels to promptly release unharmed, to the extent practicable, all sea turtles observed entangled in fish-aggregating devices (FADs).*" |
| ICCAT | Recommendation by ICCAT to establish an ad hoc working group on fish aggregating devices (FADs) | ICCAT recommends an ad hoc working group is established. One of the Terms of Reference is:<br>"*Assess the developments in FAD-related technology, including with regard to:*<br>• *Technological improvement in relation to fishing mortality.*<br>• *FAD and buoys marking and identification as a tool for monitoring, tracking and control of FADs.*<br>• *Reducing FADs' ecological impact through improved design, such as non-entangling FADs and biodegradable material.*" |
| IOTC | Resolution 12/04 on the Conservation of Marine Turtles | Encourages purse seine vessels to "*adopt FAD designs that reduce the incidence of entanglement of marine turtles according to international standards.*" |
| IOTC | Resolution 19/02 Procedures on a fish aggregating devices (FADs) management plan | "*To reduce the entanglement of sharks, marine turtles or any other species, CPCs shall require their flagged vessels to use non-entangling designs and materials in the construction of FADs.*" |

| **tRFMO** | **Resolution / Recommendation** | **Sample text** |
|---|---|---|
| | | *"To reduce the amount of synthetic marine debris, the use of natural or biodegradable materials in FAD construction should be promoted. CPCs shall encourage their flag vessels to use biodegradable FADs in accordance with the guidelines at Annex V with a view to transitioning to the use of biodegradable FADs, with the exception of materials used for the instrumented buoys, by their flag vessel from 1 January 2022".*<br>*"This Resolution sets the maximum number of operational buoys followed by any purse seine vessel at 300 at any one time. The number of instrumented buoys that may be acquired annually for each purse seine vessel is set at no more than 500. No purse seine vessel shall have more than 500 instrumented buoys (buoy in stock and operational buoy) at any time. An instrumented buoy shall be made operational only when physically present on board the purse-seine vessel to which it belongs or its associated supply or support vessel, and the event shall be recorded in the appropriate logbook, specifying the instrumented buoy unique identification number and the date, time and geographical coordinates of its deployment."* |
| IOTC | Resolution 18/04 on BIOFAD experimental project | |
| WCPFC | Conservation and Management of Sea Turtles. Measure 2018-04 | *"CCMs with purse seine vessels that fish for species covered by the Convention shall… ensure that operators of such vessels, while fishing in the Convention Area… To the extent practicable, release all sea turtles observed entangled in fish aggregating devices (FADs) or other fishing gear".* |

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