Identification of Suitable Alternative FAD designs

Prepared by Key Traceability – November 2019

Introduction

This Thai Union led Fishery Improvement Project is made up of a fleet of 20 tuna purse seine vessels, flagged either to Taiwan, Korea, Korea (the Republic of), Nauru, Micronesia (Federated States of) or United States of America (the). The vessels fish in the WCPO for the three commercial tropical tuna species (with most of the catch being made up of skipjack). They deploy FADs, and fish on FADs and other floating objects, as well as setting on free schools.

The fishery aims to improve its standard by working towards the objectives below:

- Achieve sustainable stock status' for tuna that is consistent with the Maximum Sustainable Yield (MSY) and management systems strengthened to achieve this.
- To improve the availability of accurate data on catches, retained and especially bycatch by strengthening information systems and training.
- To collaborate with other institutions working on tuna fisheries issues in the country, including working together to improve the management and policy towards sustainable fisheries for example Harvest Control Rules.
- Strengthen ETP and retained species management strategies.
- To promote traceability to ensure that the origins and status of Tuna products purchased are well-known and all coming from legal fisheries by engaging the supply chains that support improvement through the implementation of e-monitoring.
- Improve governance and decision-making process.
- Achieve MSC certification and the objectives above by 2024.

What is a FAD?

FADs are man-made floating objects specifically designed to encourage fish aggregation at the device. They can be anchored to the ocean floor (anchored FADs) or set to drift in the open ocean (drifting FADs).

FADs are widely used as a fishing method due to its high efficiency, although they have been associated with several negative ecosystem impacts, such as bycatch and overfishing. Today, they support a large number of fishing vessels, especially purse seine fleets targeting tropical tunas in open oceans, but also artisanal pole-and-line vessels in shallow nearshore waters (ISSF, 2019).

Floating objects have been used for centuries to enhance fishers' capacity to catch fish. In its origin they were mostly naturally occurring (dead animals, floating debris of natural or artificial origin, others) and were targeted by fishermen. Since the early 1990s, the use of FADs, made and deployed by fishermen and tracked by GPS for later retrieval, has widely and rapidly expanded for tuna fishing, especially for the purse seine fleet targeting tropical tunas: skipjack (*Katsuwonus pelamis*), yellowfin (*Thunnus albacares*), and bigeye tuna (*Thunnus obesus*).

What are the Issues?

(Filmalter et al., 2013) showed that, in the early 2010s, the magnitude of sharks that died entangled in the FAD structure, i.e. from ghost fishing by FADs, was much higher than the number of sharks that were actively caught by the purse seine net. Observers reports also showed that turtles can get entangled on the raft and sub-surface structure of FADs that have netting. Since then, ISSF, other NGOs, CPCs and several fishing associations have advocated for the adoption of non-entangling FAD requirements by the tuna RFMOs.

In addition to that, FADs can drift away from the fishing zone and end up being lost or abandoned by the vessel. In many cases, FADs end up beaching in vulnerable areas such as coral reefs (recent studies estimated that 7% in West Pacific, 10% in the Indian/Atlantic Ocean, and 2 % in a limited area of Seychelles of the deployed FADs ended up stranded Escalle et al., 2019; Zudaire et al., 2018). In addition, FAD structures have evolved towards more complex and deeper structures 60-80 meters deep. Naturally, the impacts of these deep FADs are greater compared to those 5-20 meters deep used in the past (Moreno et al., 2018b).

To ensure the participating vessels meet the above objectives the fishery has made this commitment to using only Non-Entangling Fish Aggregating Devices (Non-entangling FADs). Non-entangling FADs, as defined by the International Seafood Sustainability Foundation (ISSF) are constructed with no netting material to minimise ghost fishing (entanglement of fauna, primarily sharks and turtles). For a FAD to be completely non-entangling, it must use no netting materials either in the surface structure (raft) or the submerged structure.

By not using netting in FADs, tuna-vessel owners and fishers can prevent the entanglement and "bycatch" of sharks, sea turtles, and other non-target marine species. In addition, by choosing vegetal instead of plastic-derived materials for FADs, fishers can avoid contributing to the ocean pollution caused by ghost gear and reduce impacts on vulnerable marine habitats.

Current FAD policy

The fishery recognises the issues with FADs and has adopted the following practices and commitments:

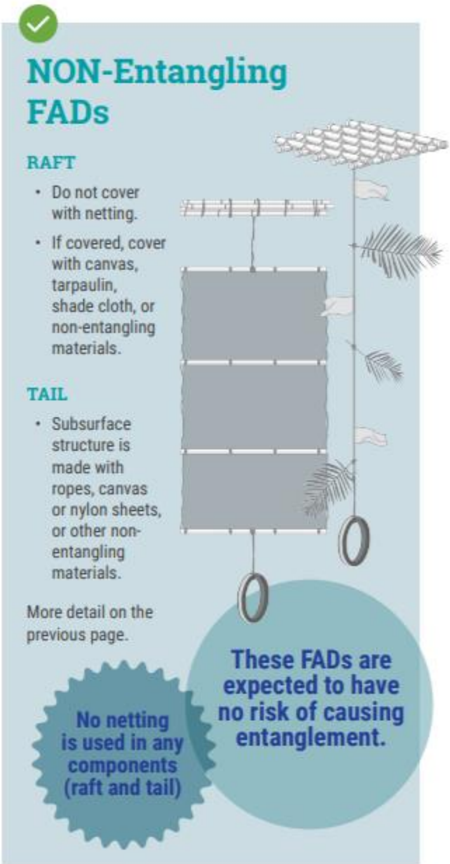
- To only deploy Non-Entangling FADs as per ISSF´s definition and recommendations for FAD management plans
- For all skippers to attend training to understand the reason for these changes and agree best practices.
- To retrieve and replace any encountered entangling FADs with non-entangling designs, when possible and safe to do so, regardless of FAD ownership.
- Continuously improve procedures in line with best practices.
- All vessels will comply with ISSF Best Practices including the ISSF Guide for Non-Entangling FADs and be listed on the ISSF Proactive Vessel Register (PVR).
- Initiate work and adopt best practices on Biodegradable FADs and FAD recovery strategies

Currently, these are created using the below design in and are not currently Biodegradable. Note, this policy shall be verified that it is being adhered to alongside developing alternative FAD designs through engagement with the fishery and site visits.

Figure 1 ISSF Design of Non-Entangling FADs (ISSF, 2019)

Alternative Designs

As per the current FAD policy, we are required to continually evaluate the FAD design and improve where possible, as well as align with ISSF. To do so, we must look at the possibility of ensuring the Non-Entangling FADs are also Biodegradable to reduce the impact of beaching and debris (Escalle *et al*., 2019). The term Biodegradable is applied to a material or substance that is subject to a chemical process during which microorganisms that are available in the environment convert materials into natural substances such as water, carbon dioxide, and decompose organic matter. The time required for biodegradation of different materials varies. Some fishers believe that a FAD should last up to one year before degrading. By choosing vegetal instead of plastic-derived materials for FADs, fishermen can avoid contributing to ocean pollution caused by discarded fishing gear, substantially reduce the risk of ghost fishing and reduce the risk of negative impacts in vulnerable marine habitats. A study estimated that 10% of FADs deployed in tuna fisheries end up stranded and can ensnare sharks and turtles as they drift



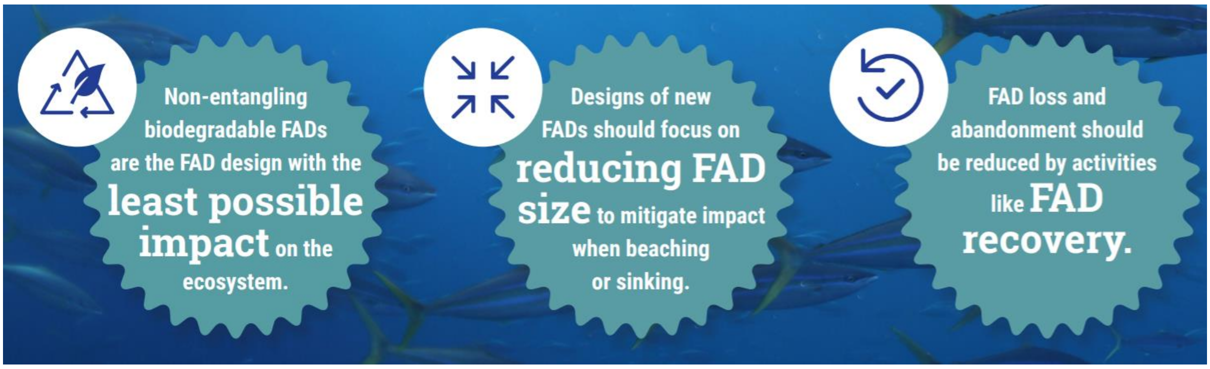


Figure 2 - Benefits of Biodegradable Non-Entangling FADs (ISSF, 2019)

In 2018, ISSF, with the help of FAO-GEF Common Oceans ABNJ financed project, launched a project on the use of Biodegradable Fish Aggregating Devices (FADs) in Ghanaian fleets, one of the most important fleets in the Atlantic, with 26 vessels fishing with FADs. Five Biodegradable FAD structures were designed by fishers in five groups separately, but all the designs converged towards a similar structure for pole and line and purse seine fleets. Materials used were bamboo canes (buoyancy and submerged structure), cotton ropes (submerged structure), cotton canvas (submerged flags and drift anchor), palm leaves (submerged structure) and finally plastic buoys or purse seine corks (*Figure 3*).

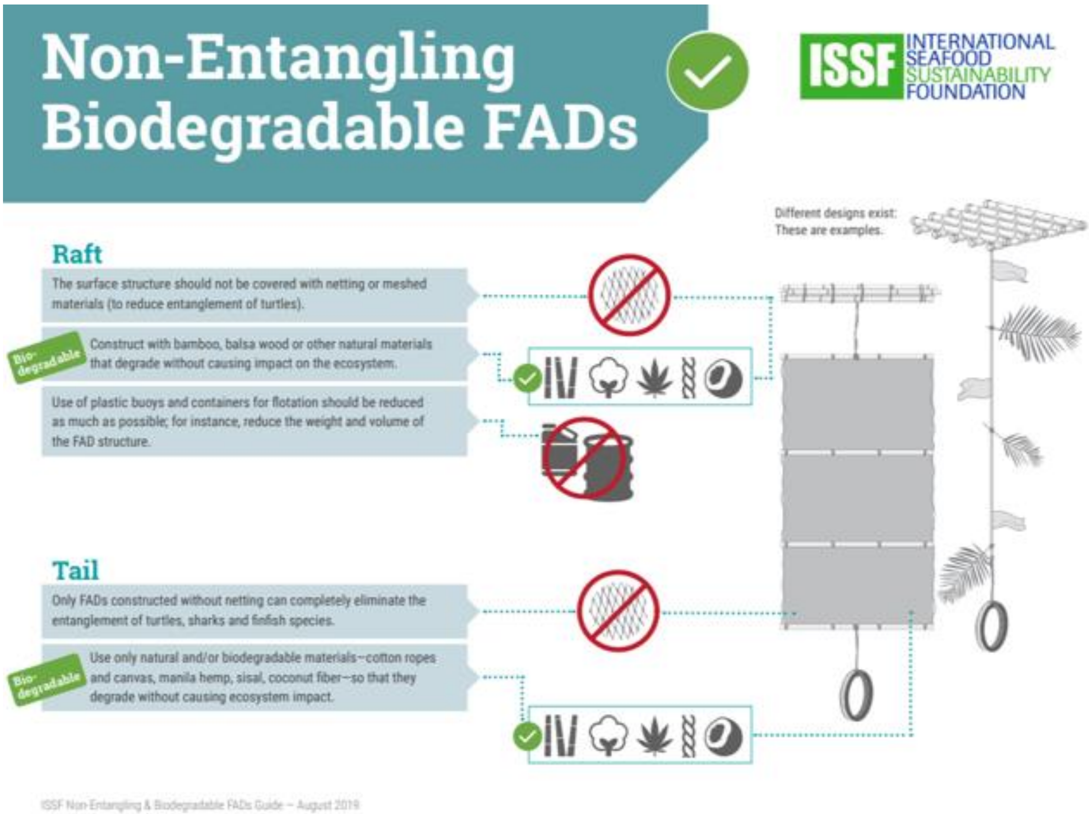


Figure 3 - ISSF Design of Biodegradable Non-Entangling FADs (ISSF, 2019)

In the preliminary results of the Biodegradable FAD Project: Testing designs and identify options to mitigate impacts of drifting fish aggregation devices non the ecosystem run by the WCPFC in the Indian Ocean, they aimed to; test the use of specific Biodegradable materials and designs for the construction of drifting FADs in real fishing conditions; identify options to mitigate drifting FADs impacts on the ecosystem; and assess the socio-economic viability of the use of Biodegradable drifting FADs in the purse seine tropical tuna fishery.

They did this by deploying 716 Biodegradable FADs alongside their conventional Non-entangling FADs. This represents 72% of the initially planned goal for Biodegradable FAD deployments to determine the effectiveness of tuna aggregation, drift, materials' durability. in comparison to currently deployed Non-entangling FADs. From the total of 716 Biodegradable FAD deployed 81% corresponded to A1 prototype, 12% to A2, 5% to B1 and 3% to C1 (*Figure 4*). Full details regarding materials, dimensions and construction of the 3 Biodegradable FAD prototypes were provided in (Zudaire et al. 2017).

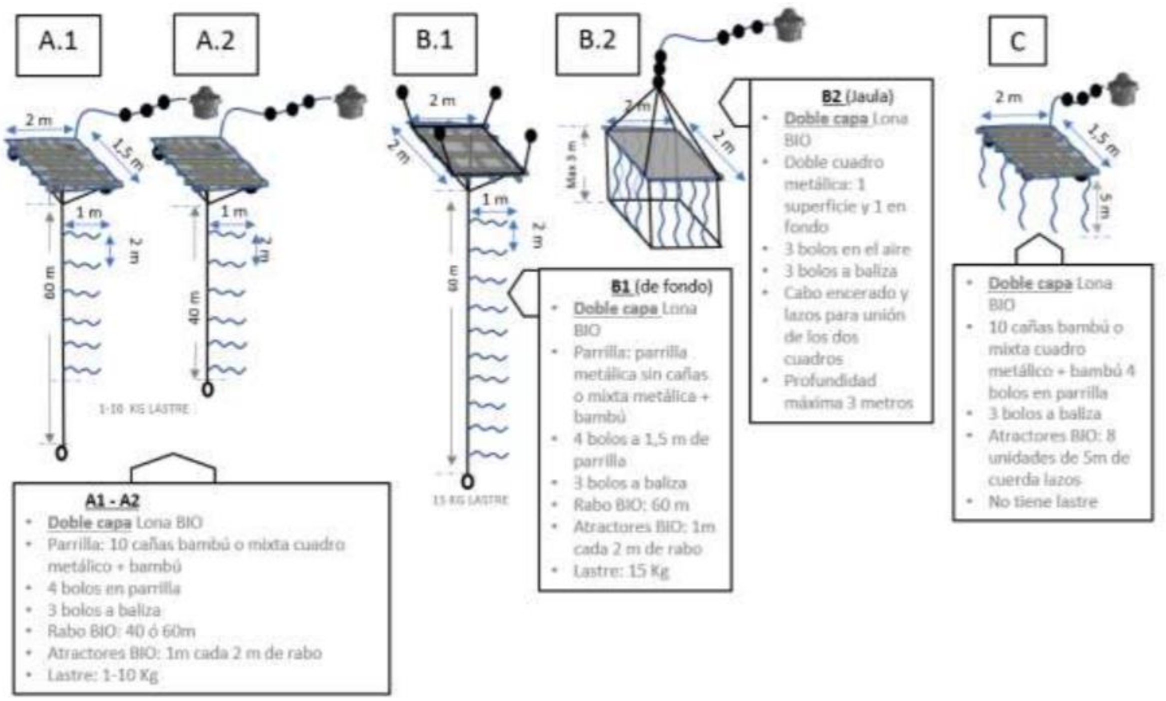


Figure 4 - Biodegradable FAD prototypes designs and the details of materials and dimensions for each of them

The distribution of the experimental FADs deployed between April and December 2018 covered the western Indian Ocean (*Figure 5*). Differences in the drifting patterns shown by pairing experimental FADs (BIODEGRADABLE FAD vs NON-ENTANGLING FAD) were also assessed without considering the effect of area and season at this stage of the analysis. Variability in the patterns was observed showing patterns with:

i) Pairs following totally different drift,
ii) Pairs following partly similar drifts and
iii) Pairs following same patterns.

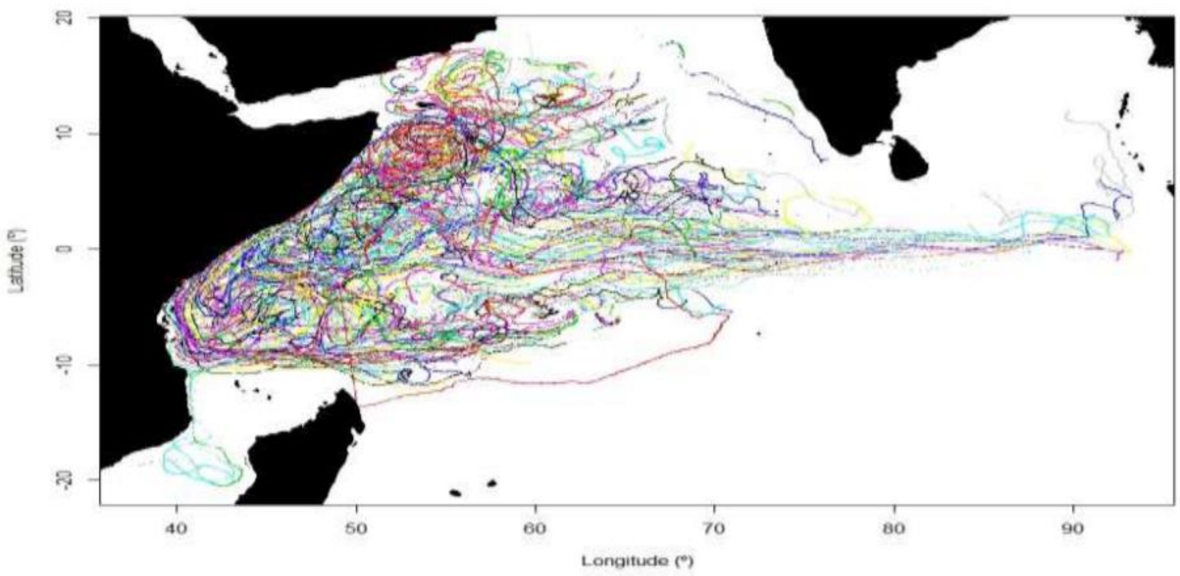


Figure 5 - Representation of Biodegradable FAD distribution through the echo-sounder buoy data provided by the EU PS

Biodegradable FAD efficiency was assessed by analysing different parameters: Biodegradable material degradation process, catch data and biomass indicators. To identify the pros and cons of each Biodegradable material (i.e., cotton canvas, and two type of cotton ropes), and justify the selection made, the quality status control of each component of the FAD which is collected by crew members onboard during their activities with experimental FADs has been used.

The degradation of the cotton canvas, used to cover the raft as a replacement of netting or synthetic raffia materials, started to suffer significant degradation already during the first month at sea and this degradation increased in the second and third months, when more than 50% of the observations of this material were deemed to be in a "bad", "very bad" or "absent" states.

The preliminary results showed that the 72% degradation of the two cotton ropes, used in the submerged part of the FAD one as tail and the other as attractors, were less pronounced compared to the cotton canvas.

The status control for both ropes were deemed to be in "very good" or "good" quality until the fourth month at sea. However, in 10-25% of the observations the "absence" of these two materials was reported during the first and second month at sea, respectively. Contrarily to the cotton canvas, and according to the feedback received, the absence of the cotton ropes from the raft of the Biodegradable FADs have been more related to failures at attachments between the tail and the raft rather than to a high degradation of the materials. If not correctly attached, this component could be lost resulting in the reported absences. Overall, the Industry had positively valued the performance of these two rope components. However, certain members of the fleet that they expect these items to have a longer lifetime.

The efficiency of the Biodegradable FADs, in comparison to Non-entangling FADs, was further analysed through catch data. In total, from April to December 2018, 40 sets were associated to these experimental FADs, 20 to Biodegradable FADs and 20 to pairing Non-entangling FADs. There has not been found any significant differences in catches, by tonnes of tuna between these FAD types. However, there was a faster (in days) presence of tuna in Non-Entangling FADs than in Biodegradable FADs and a higher proportions of FAD occupation by tuna were observed in Non-entangling FADs. This could be linked due to the pairing of FADs, however.

	BIOFAD	CONFAD		
Max (tons)	150	225		
Mean (tons)	40,7	46,8		
Sets	20	20		
Deployments	554	466		
% use	4%	4%		
BIOFAD	A1	A2	B1	C1
Max (tons)	150	75	....	....
Mean (tons)	38	....	....	....
Sets	15	1	0	0
Deployments	401	60	24	13
% use	4%	2%	0%	0%
CONFAD	A1	A2	B1	C1
Max (tons)	98	225	....	70
Mean (tons)	33	115	....	68
Sets	13	2	0	2
Deployments	313	60	24	13
% use	4%	3%	0%	15%

Figure 6 - Catch data (maximum and mean in tons), number of sets, number of deployments and % of use by FAD

Most of the sets in both FAD types were conducted using the A1 prototype (*Figure 4*). However, considering the number of deployments by each of the prototypes, the percentage of use (i.e., ratio between number of sets and number of deployments by each prototype and FAD type) for A1 did not differ from the other prototypes at which sets were conducted.

RFMO Regulations

The four tuna RFMOs responsible for the conservation and management of tropical tunas have adopted measures requiring the use of non-entangling FADs by purse seine fleets. These regulations differ in terms of the degree to which the technical criteria of FAD designs are specified.

The WCPFC noted as from 1st January 2020, CCMs shall ensure that the design and construction of any FAD to be deployed in, or that drifts into, the WCPFC Convention Area shall comply with the following specifications:

- The floating or raft part (flat or rolled structure) of the FAD can be covered or not. To the extent possible the use of mesh net should be avoided. If the FAD is covered with mesh net, it must have a stretched mesh size less than 7 cm (2.5 inches) and the mesh net must be well wrapped around the whole raft so that there is no netting hanging below the FAD when it is deployed.
- 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 have a stretched mesh size of less than 7 cm (2.5 inches) or tied tightly in bundles or "sausages" with enough weight at the end to keep the netting taut down in the water column. Alternatively, a single weighted panel (less than 7 cm (2.5 inches) stretched mesh size net or solid sheet such as canvas or nylon) can be used.

Currently, the use of natural or Biodegradable materials for FADs To reduce the amount of synthetic marine debris is only promoted by the WCPFC and the use of non-plastic and Biodegradable materials in the construction of FADs is encouraged.

The Scientific Committee shall continue to review research results on the use of non-entangling material and Biodegradable material on FADs and shall provide specific recommendations to the Commission as appropriate. The Commission at its 2020 annual session, based on specific guidelines defined by the FAD Management Options Intersessional Working Group and advice from SC16 and TCC16 shall consider the adoption of measures on the implementation of non-entangling and/or Biodegradable material on FADs (WCPFC, 2019).

Recommended approach towards implementation of Biodegradable FADs and Next Steps

While work is conducted to identify and test the best configurations and materials for biodegradable FADs, impacts resulting from derelict FADs, driting outside the fishing area and beaching in Vulnerable Marine Ecosystems (VMEs) such as, coral reefs, should as a first step, be mitigated considering the following options:

- Develop and implement a FAD recovery strategy before FADs become lost or drift out of the fishing zone. Initiatives could include:
  - Removing from the water every FAD encountered that is an entangling FAD or;
  - Removing a given number of FADs towards the end of a trip or the end of the fishing season.
- Recover stranded FADs from VMEs through collaboration with local NGOs.
- Identify and avoid high-risk deployment areas known to lead FADs into vulnerable habitats.

In collaboration with other FIPs, ISSF and other stakeholders, advance towards participatory recovery programs an agreed bioFAD definition by WCPFC. This will allow providing clear guidance and clarity when the term biodegradable is used to define the materials used for FAD construction.

As a first step, the FIP participants will reduce the use of plastic based materials as much as posible in FAD construction.

We will host a FIP steering group meeting on biodegradable FAD design, based on design A1, to include what the fishery needs, possible alternative materials and a plan to test our own designs. Further to this, we shall engage with the WCPFC and ISSF in their biodegradable FAD work.

References

Escalle, L., Phillips, J. S., Brownjohn, M., Brouwer, S., Gupta, A. S., Van Sebille, E., & Pilling, G. (2019). Environmental versus operational drivers of drifting FAD beaching in the Western and Central Pacific Ocean. *Scientific reports*, *9*(1), 1-12.

Filmalter, J.D., Capello, M., Deneubourg, J.L., Cowley, P.D., Dagorn, L. (2013). Looking behind the curtain: quantifying massive shark mortality in fish aggregating devices. Frontiers in Ecology and the Environment 11: 291–296. doi/10.1890/130045/abstract

ISSF. (2012). Guide for non-entangling FADs. IATTC SAC-04 external document, WCPFC-TCC8-2012-OP04, IOTC-2013-S17-INF02.

ISSF. (2019). ISSF guide for non-entangling FADs.

ISSF. (2019). Recommended Best Practices for FAD management in tropical tuna purse seine fisheries.

Moreno, G., Jauharee, A.R., Adam, M.S, Restrepo, V. 2019. Towards biodegradable FADs: Evaluating the lifetime of biodegradable ropes in controlled conditions. ISSF Technical Report 2019-13.

Moreno, G., Jauhary, R., Shiham, M.A. and Restrepo, V. 2017. Moving away from synthetic materials used at FADs: evaluating biodegradable ropes' degradation. IOTC-2017-WPEB13-INF12.

Moreno, G.; Orue, B.; Restrepo, V. Pilot project to test Biodegradable ropes at FADs in real fishing conditions in the Western Indian ocean. Collect. Vol. Sci. Pap. ICCAT, 74(5): 2199-2208; 2018

Moreno, G.; Restrepo, V.; Dagorn, L.; Hall, M.; Murua, J.; Sancristobal, I.; Grande, M.; Le Couls, S.; Santiago, J. Workshop on the Use of Biodegradable Fish Aggregating Devices (FADs). ISSF 2016-18A; 2016

Murua, J., Moreno, G., Hall, M., Dagorn, L., Itano, D., Restrepo, V. (2017). Towards global non-entangling fish aggregating device (FAD) use in tropical tuna purse seine fisheries through a participatory approach. ISSF Technical Report 2017–07. International Seafood Sustainability Foundation, Washington, D.C., USA.

Scott, J., López, J. (2014). The use of FADs in tuna fisheries. Report by Policy Department Structural and Cohesion Policies, European Parliament, P/B/PECH/ IC/2013-123.

Stelfox, M., Hudgins, J., Sweet, M. (2016). A review of ghost gear entanglement amongst marine mammals, reptiles and elasmobranchs. Marine Pollution Bulletin 117: 554–555.

WCPFC, (2019).Conservation and Management Measures (CMMs) and Resolutions of the Western Central Pacific Fisheries Commission (WCPFC) (December 2019)

Zudaire, I., Tolotti, M., Murua, J., Capello, M., Andrés, M., Cabezas, O., Krug, I., Grande, M., Arregui, I., Uranga, J. Goñi, N., Ferarios, J.M., Ruiz, J., Baidai, Y., Ramos, M.L., Báez, J.C., Abascal, F., Moreno, G., Santiago, J., Dagorn, L., Arrizabalaga, H. and Murua, H. (2019) Preliminary results of the BIODEGRADABLE FAD Project: Testing designs and identify options to mitigate impacts of drifting fish aggregation devices on the ecosystem