TEST OF BIODEGRADABLE FADS WITH THE SENEGALESE POLE AND LINE FLEET

NOVEMBER 2023

Context

Drifting FADs (dFADs), which are comprised by a surface raft and a submerged appendage, are most often made of plastic (nylon nets, buoys and polypropylene ropes). The submerged appendages are mostly made of old netting material, reaching up to 80 m depth for some fleets. Due to the complexity of FAD fishing strategy, in which FADs are left drifting with a geo-locating buoy, it is estimated that around 20% of FADs are lost or abandoned every year (Escalle et al., 2019; Moreno et al., 2018). Impacts caused by lost and abandoned dFADs are ghost fishing (Filmalter et al., 2013)), accumulation of plastic at sea, damage on coral reefs and interference with other economic activities, such as tourism.

Considering potential impacts on the pelagic and coastal habitats and sensitive species interacting with the purse seine fishery, the tuna Regional Fisheries Management Organizations (RFMOs) adopted measures to progressively replace the entangling material in FAD construction by non-entangling and biodegradable material. ICCAT Rec. 19-02 includes also provisions regarding dFAD construction, bearing in mind the potential impacts of dFADs on both pelagic and coastal habitats, and Endangered, Threatened and Protected species. Among those provisions, Rec. 19-02 includes mitigation measures such as the use of non-entangling FADs and biodegradable materials for FAD construction.

Objectives

The present project aims at defining and testing innovative, biodegradable FAD structures. The new FAD structures would achieve the following:

(i) eliminate the use of netting;
(ii) degrade as fast as possible once their useful lifetime for fishing ends; and
(iii) minimize the use of plastic by replacing it with plant-based or other natural materials.

New biodegradable FAD designs will reduce: (a) ghost fishing by dFADs when they are lost and drifting at sea or end up sinking or stranding; (b) the impact of dFADs on the habitat (by degrading at a relatively faster rate); and (c) marine pollution due to the reduction in the amount of plastic used to build dFADs.

Progress by November 2023

Task 1. ***Defining materials and experimental designs for Biodegradable FADs***
At an early stage, ISSF and the Senegalese Pole and Line fleet (4 vessels) will organize a workshop in Bermeo/Donostia to design the biodegradable FADs (bio-FADs) and the protocols to test them at sea.

Progress in Task 1

1. Workshop with fishers

The design of the biodegradable FAD to be tested with the Pole and Line fleet was defined through a workshop held in Bermeo, Spain, with ship-owners and captains (see Appendix I for more details on the topics discussed and Agenda). The workshop was initially scheduled to take place earlier, however, due to the pandemic travel was not possible and, thus, the workshop was rescheduled in December 2021 (Figure 1).

During the workshop several issues were discussed and agreed as (i) FAD designs, both conventional FADs used by the pole and line fleet (Figure 2) and bio-FADs designs tested by other fleets; (ii) a specific bio-FAD design, the jelly-FAD, was selected as the most appropriate to be tested for the pole and line fleet (Figure 3), (iii) materials to be used in the FAD construction were also defined, which were 100% cotton ropes (20 mm diameter, 4 strands in torsion Z), bamboo and cotton canvas; (iv) the protocols to test them at sea, i.e. best deployment area and time and finally, (IV) the forms to be filled to provide information on the performance of the bio-FAD.

Figure 1. Workshop in Spain with the captains and shipowners of the pole and line fleet.

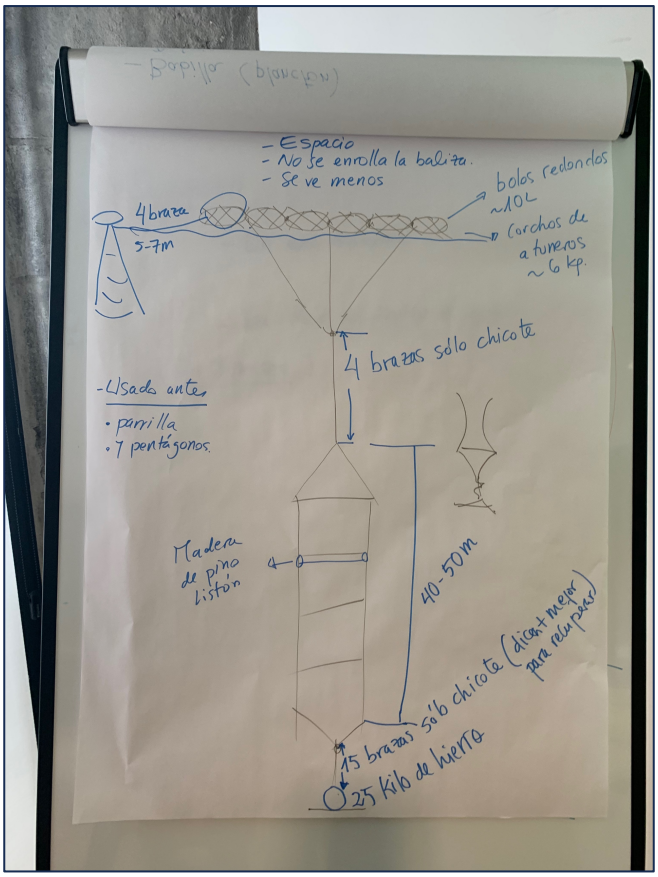

Figure 2. Drawing by fishers of the conventional FAD used and details about the different components.

The bio-FAD model selected to be tested was the Jelly-FAD (Moreno et al., 2023)). The collaboration of International Seafood Sustainability Foundation (ISSF) with Instituto de Ciencias del Mar (CSIC) in Spain enabled, working together with physical oceanographers experts on oceanographic drifting buoys, to calculate the drag created by dFAD shapes, as well as flotation and weight needed for the different type of structures. This collaboration together with several workshops and meeting organized by ISSF to build a biodegradable dFAD in conjunction with fishers, resulted in a new dFAD designed developed by ISSF named Jelly-FAD (Moreno et al., 2023). The Jelly-FAD, is a new and innovative design of a dFAD, based on drifters used by physical oceanographers. Results of previous experiences testing biodegradable dFADs showed in general that the lifetime of biodegradable dFADs that maintain the traditional dFAD design but made of organic materials, is shorter than that required by fishers. The short lifespan of those biodegradable dFADs may be mainly due to the structural stress suffered by dFAD designs traditionally used. Thus, in order to use organic materials, instead of the persistent plastic, and increase the lifespan of those biodegradable dFADs, a paradigm shift is needed and, thus, biodegradable dFAD structures should be re-designed to suffer the least structural stress in the water. The innovation in the Jelly-FAD is that it drifts with quasi-neutral buoyancy and thus reduces the structural stress, which allows reducing the need for flotation (i.e., plastic buoys) and using biodegradable material such as bamboo raft, cotton ropes and canvas for the submerged structure. This new design will be tested in real fishing conditions by the pole and line fleet.

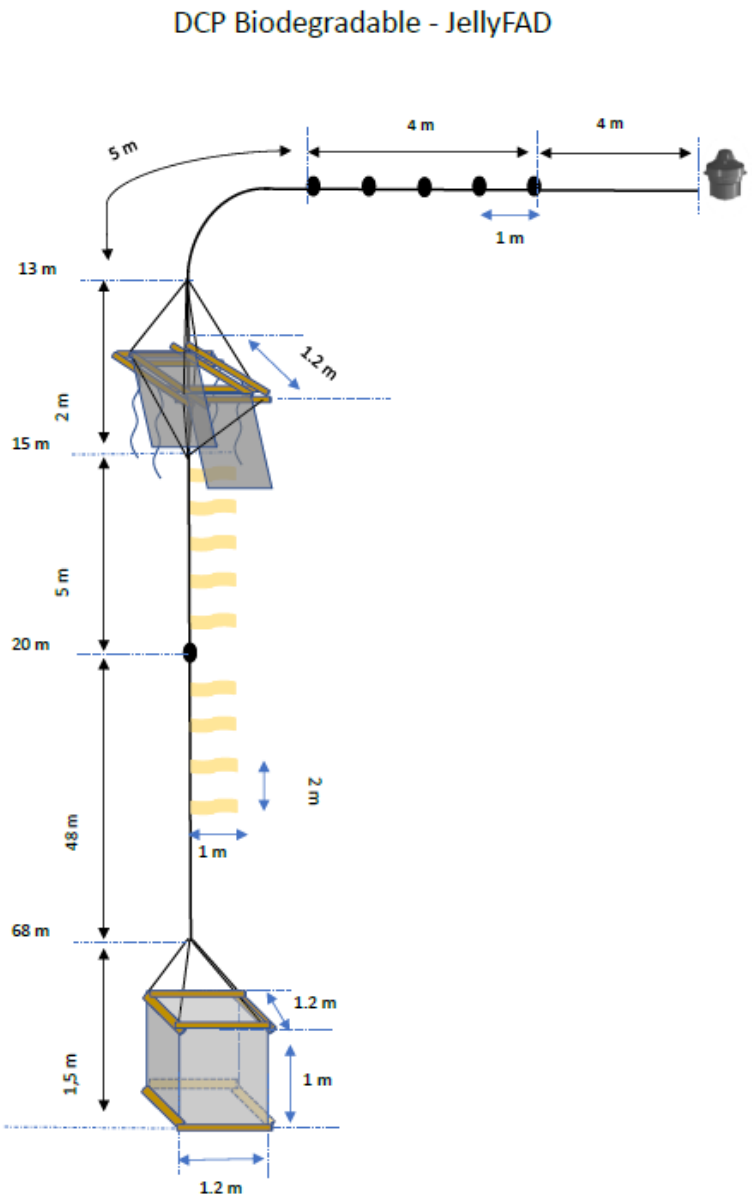

Figure 3. The Jelly-FAD a specific desing of biodegradable FADs that was selected to be tested by the pole and line fleet.

2. Workshop with manufacturers

Another key action during the workshop with the fishers was to decide where the bio-FADs would be constructed. It was determined that the best approach was to train the manufacturers of FADs that supply the pole and line fleet how to build the bio-FADs. In this way, the fleet could easily source them in the future. Consequently, ISSF organized a workshop with America Aparejos in Galicia, Spain, in June 2023, as soon as the funds to construct the jelly-FADs were secured, to provide training on how to construct

biodegradable FADs and shared their expertise with them (Figure 4).

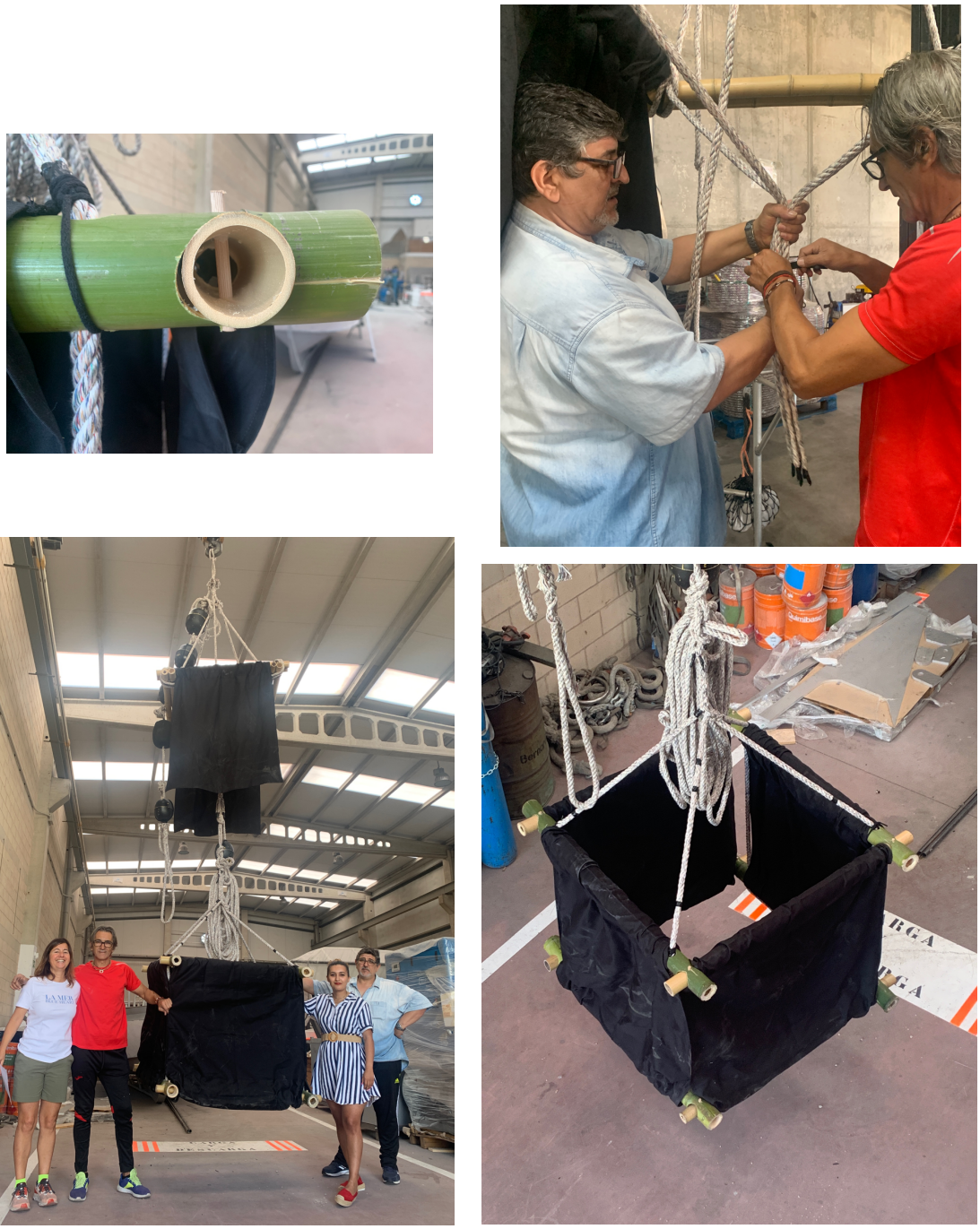

Figure 4. Training FAD manufacturing company, America Aparejos, in the construction of the Jelly-FAD.

Status of Task 1*:* completed

Progress in Task 2

Task 2. ***Trials at sea to test biodegradable FADs***
Deployment strategy: After the workshop, ~20 experimental jelly-FADs will be constructed and deployed in pairs, along with ~20 conventional dFADs for comparative purposes. Ideally, each vessel will deploy ~5 bio-FADs and ~5 traditional dFADs.

Following the workshop, the company America Aparejos built the 20 bio-FADs for testing in the Atlantic and shipped them to Dakar. Those FADs arrived in Dakar September 15, 2023. However, even though the FADs are already available for the fleet in Dakar, it was decided not to deploy them until the first quarter of 2024 after ICCAT moratorium from January 1 to March 13 . This decision was based on the typical fishing strategy of the pole and line fleet, where FADs are not deployed at the end of the year but rather at the beginning of the year, taking into consideration the behavior of currents and tuna. Thus, to make the experiment more efficient it was considered worth waiting for better FAD deployment conditions and monitoring. FADs have been stored in a warehouse safely from rain until vessels pick them up to be deployed in the first quarter of 2024.

Status of Task 2*: Ongoing*

Next tasks

Task 3. ***Data analysis on experimental FAD's performance and final report***
A comparative analysis on the performance (e.g., their capacity to aggregate fish and lifespan at sea) of both bio-FADs and conventional FADs will be conducted following statistical approaches that use: catch data (biomass and species composition), experimental bio-FAD´s drift (speed and direction), data filled by captains on the status of the different biodegradable materials and echo-sounder buoy data (acoustic biomass estimates). Analysis will be conducted in relation to the specific bio-FAD designs and the time spent at sea.

Efficiency on the capability to aggregate tuna will be measured through several indicators, e.g. presence/absence of tunas, maximum and average amount of tuna and non-tuna aggregated under bio-FADs vs conventional FADs, time trends on aggregated tuna and non-tuna biomasses and the ratios between aggregated tuna and non-tuna biomasses.

ISSF will provide a short final report with recommendations including i) results of the assessment of new biodegradable materials and bio-FADs designs tested by the Senegalese fleet and ii) results of bio-FADs behavior and performance (e.g., efficiency in aggregating tuna and non-tuna species).

Task 4. ***Final workshop to discuss results***

Results obtained in the previous task (Task 4) will be used and discussed in a final workshop with fishers in Bermeo/Donostia. The results presented at this workshop will help to inform the discussion on possible, viable bio-FAD designs.

Cited references:

Escalle, L., Phillips, J.S., Brownjohn, M., Brouwer, S., Gupta, A. Sen, Sebille, E. Van, Hampton, J., Pilling, G., 2019. Environmental versus operational drivers of drifting FAD beaching in the Western and Central Pacific Ocean. Sci. Rep. 9:14005, 1–12. https://doi.org/10.1038/s41598-019-50364-0

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Moreno, G., Salvador, J., Zudaire, I., Murua, J., Lluís, J., Uranga, J., Murua, H., Grande, M., Santiago, J., Restrepo, V., 2023. The Jelly-FAD : A paradigm shift in the design of biodegradable Fish Aggregating Devices. Mar. Policy 147, 105352. https://doi.org/10.1016/j.marpol.2022.105352

Appendix I. Agenda of the biodegradable FAD workshop with the Pole and Line fleet

AGENDA

WORSHOP ON BIODEGRADABLE FISH AGGREGATING DEVICES

DATE AND TIME: December 16, 2021 at 9:00am
PLACE: Torre Madariaga, San Bartolomé, Spain

9:00 – 9:30
Welcome, introduction to ISSF, to the meeting and presentation of participants
(Gala Moreno and Hilario Murua)

9:30 – 10:00
PRESENTATION: Why are tuna aggregated to floating objects? (Gala Moreno)

10:00 – 10:30
DISCUSSION: What is the importance of FAD structure in the aggregation process? (All)

11:00 Coffee break

11:30 -12:00
PRESENTATION: Potential solutions to the impact including the Jelly-FAD: Experience in other fleets and oceans (Gala Moreno)

12:00- 13:30
DISCUSSION:
On the potential use of the JellyFAD by pole and line fleet (All)

13:30 Summary and end of the meeting

14:00 Lunch

International Seafood Sustainability Foundation
655 15th Street NW, Suite 800
Washington D.C. 20005
www.ISS-Foundation.org