TESTING DESIGNS AND IDENTIFY OPTIONS TO MITIGATE IMPACTS OF DRIFTING FADs ON THE ECOSYSTEM

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Abstract

Despite currently used EU FADs designs have eliminated their entangling characteristic, these are largely made by non-biodegradable materials contributing to increase marine debris, and with other negative impacts in the ecosystem like potential FADs beaching. The IOTC, along with other tuna RFMOs, have made recommendations and published resolutions to promote reduction of the amount of synthetic marine debris by the use of natural or biodegradable materials for drifting FADs. However, there are some practical aspects that needs to be clarified for the operationalization of this type of FADs construction and effective replacement of materials. The consortium formed by AZTI, IRD and IEO aims through the Specific Contract N^0 7 under the Framework Contract EASME/EMFF/2016/008 provisions of Scientific Advice for Fisheries Beyond EU Waters to address current impediments and to provide solutions that shall support the implementation of non-entangling and biodegradable FADs in the IOTC Convention Area. This project will count on the whole EU purse seine tropical tuna fishery and the International Seafood Sustainability Foundation active collaboration. The project has the following main objectives: (1) to test the use of specific biodegradable materials and designs for the construction of drifting FADs in natural environmental conditions; (2) to identify options to mitigate drifting FADs impacts on the ecosystem; and (3) to assess the socio-economic viability of the use of biodegradable FADs in the Purse Seine tropical tuna fishery. The methodology to be applied during at sea experimental operations was defined by the Consortium with the agreement of the collaborators. The results of this contract will create fruitful discussions and provide solutions that shall support and help IOTC defining the process of the implementation of non-entangling and biodegradable FADs.

1. Introduction

In the last decade, efforts have been focused to eliminate the entangling characteristics of drifting Fish Aggregating Devices (FADs), as it is believed that this may affect negatively on sensitive species like turtles, sharks, and other associated non-target species. However, most of those non-entangling FADs (NE FADs) are made by non-biodegradable materials (ex., nylon ropes or small pelagic fishing nets) contributing significantly to the increase of marine litter (Dagorn et al., 2012) and other potential negative impacts for the ecosystem, such as FADs beaching (Maufroy et al., 2015). The EU Common Fishery Policy and the Marine Strategy Framework Directive have as objective the need to ensure environmentally friendly fishing methods, which include the minimisation of seafloor or other habitat destruction, avoid effects on other species, but also minimise the introduction of any litter into the marine environment. Along these lines, the different tuna RFMOs have already addressed these issues through several recommendations and resolutions. For example, the Indian Ocean Tuna Commission (IOTC) and the International Council for the Conservation of Atlantic Tunas (ICCAT) have adopted the obligation to replace existing FADs with NE FADs and to undertake research on biodegradable FADs (i.e. BIO FADs). As such, the IOTC defined procedures on a FADs management plan through the resolution 13/08, where in Annex III it was also promoted the reduction of the amount of synthetic marine debris, by the use of natural or biodegradable materials for drifting FADs (IOTC, 2013). Similarly, the Inter-American Tropical Tuna Commission (IATTC) has recently stated the use of NE FADs by January 2019 and it promotes the gradual use of biodegradable materials (IATTC 2016).

However, an effective replacement of non-biodegradable FADs by those fully biodegradable still requires investigation to solve some practical aspects for the operationalization of this type FADs construction, including (1) the selection of appropriate materials taking into account their durability, (2) information of BIO FADs behaviour regarding tuna aggregation, drifting characteristics, etc., and (3) a socio-economic study to assess cost and benefits of a phase in of BIO FADs by EU purse seine tropical tuna fishery.

The Consortium, formed by the European research centres AZTI, IRD and IEO, has recently begun the Specific Contract N^0 7 under the Framework Contract EASME/EMFF/2016/008 provisions of Scientific Advice for Fisheries Beyond EU Waters, which addresses the problems associated to the current used materials and designs for FADs construction. This 21-month project aims to provide solutions that shall support the implementation of BIO FADs (i.e. non-entangling and biodegradable) through the collaboration with the International Seafood Sustainability Foundation (ISSF) and the EU purse seine tropical tuna fishery, and through the consultation with IOTC.

Main objectives

The main purpose of the project is to test the use of specific biodegradable materials and designs for the construction of BIO FADs in natural environmental conditions. The study will also provide criteria and guidelines to identify options to mitigate drifting FADs impacts on the ecosystem. It will also assess the socio-economic viability of the use of NE and BIO FADs in the purse seine tropical tuna fishery in the Indian Ocean. Finally, it will suggest potential biodegradable materials and designs providing recommendations to foster the implementation of fully NE and BIO FADs.

Specifically, this Specific Contract will carry out the following tasks (Figure 1):

- Task 1 – Revision of the state of the art regarding the use of "conventional FADs" (i.e. entangling and non-biodegradable), "NE FADs" (i.e. non-entangling and non-biodegradable) and "BIO FADs" (i.e. non-entangling and biodegradable) worldwide;
- Task 2 – Evaluating the performance (e.g. lifetime) of specific biodegradable materials and designs for the construction of FADs in natural environmental conditions;
- Task 3 – Testing, comparing and measuring the efficiency of new BIO FADs against current NE FADs to aggregate tuna and non-tuna species at sea in “real” conditions with the involvement of EU Purse Seine fishing fleet;
- Task 4 – Assessing the socio-economic impacts of BIO FADs use and phasing in the purse seiner fleet;
- Task 5 – Assessing the feasibility of using new biodegradable materials by the purse seiner fleet and recommendation of an optimum BIO FAD prototype.

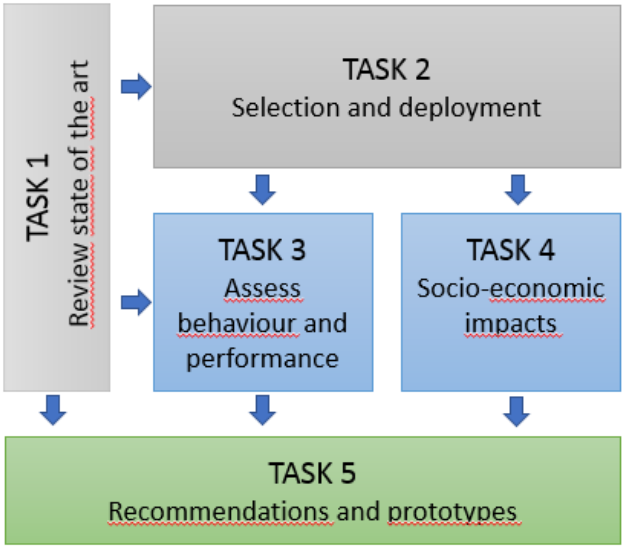

Figure 1. Flow chart of tasks of Specific Contract N⁰ 7.

2. Material and Methods

2.1. Partners, timeline and deployment effort

The project is led by AZTI, IRD and IEO with the collaboration of the European purse seiner fleet (fleets associated to ANABAC, OPAGAC and ORTHONGEL) and ISSF.

The Specific Contract Nº7 has started in August 2017 and will last 21 months. The Consortium, in order to obtain sufficient data to conduct reliable scientific research, has planned a large-scale experiment with the deployment of 1000 BIO FADs, along with their corresponding 1000 NE FADs for comparison, in 2018. BIO FADs deployment activity will be organized by trimesters, starting January 2018 and lasting 12 months to cover possible seasonality effects. For that, the project counts on the active collaboration of European purse seine industry with a participation of 42 purse seine vessels operating in the Indian Ocean. In total, each vessel will deploy 24 BIOFADs, 6 BIOFADs by trimester (2 per month). This deployment strategy has been planned by the Consortium to avoid the limitations identified in earlier small scale trials (Moreno et al., 2017).

The supervision of the traceability of deployed experimental FADs during the project has been identified as cornerstone to obtain reliable data for subsequent analysis (Moreno et al., 2017). However, in a relatively small Ocean like the Indian, FADs change hands very often. Thus, it was noted that deployment of a significant number of FADs and the collaboration of the different fleets is desired to gather enough data to analyze the performance of these new prototypes (Moreno et al. 2017). This means a higher engagement with the fleet to deploy BIO FADs that may not be successful for fishing. Besides, it is important for the project that these new prototypes will be used by fleet with normal fishing and use strategies. Including these experimental FADs within the limit of 350 active FADs per day, may force fishers to use them in a non-regular manner biasing results and hiding their real effectiveness. In line with this, the WPTT and WPEB noted that the future limit on active FADs per purse seine vessel could be a challenge to conduct this type of large scale experiments, and thus, these groups "*recommended the Commission consider special allocations for experimental FADs deployed for the collection of scientific data for vessels willing to participate in biodegradable FAD testing under protocols reviewed and endorsed by the Scientific Committee*" (IOTC, 2017).

The consortium will oversee both the construction of experimental BIO FADs and the monitoring of deployed BIO FADs, and their paired NE FADs, at sea, as well as the data collection and reporting. The procedures to do so, were agreed among all participants, and are described in the following subsection (subsection 2.2) and annex 1.

2.2. Methodology for BIOFAD construction, deployment, comparison to NE FADs and data collection

The methodology for i) BIOFAD construction with the selection of biodegradable materials and prototypes, ii) BIOFAD deployment strategy and comparison with NE FADs, and iii) BIOFAD monitoring, data collection and reporting were defined by the Consortium in the BIOFAD Workshop held in 17-18 July 2017 in Sukarrieta (Spain). In this workshop, with the participation of ISSF and representatives from the EU tropical tuna associations

(ANABAC, OPAGAC and ORTHONGEL) and fishing companies (Albacora, Atunsa, CFTO, Echebastar, Europea Tunidos, Inpesca, Pevasa, and SAPMER), the following three methodological procedures were agreed based on the objectives set at the Specific Contract and the experiences of previously conducted studies and workshops (Moreno et al., 2016):

2.2.1. Materials and prototypes for BIO FADs construction.

Three prototypes (Figure 2) were designed by the Consortium based on designs previously identified for Indian Ocean in the ISSF Workshop held in Donostia in 2016 (Moreno et al., 2016). Fishermen's requirements and needs for FADs construction were considered for those designs covering the different drifting performance that fisherman seek with their conventional NE FADs: superficial FADs (BIOFAD prototype C), medium-deep FADs (BIOFAD prototypes A1 and A2), and high-deep FADs (BIOFAD prototypes B1 and B2). All the details of these 3 prototypes regarding variations in their construction, dimensions and selected materials are provided in annex 1 (BIOFAD Workshop Report).

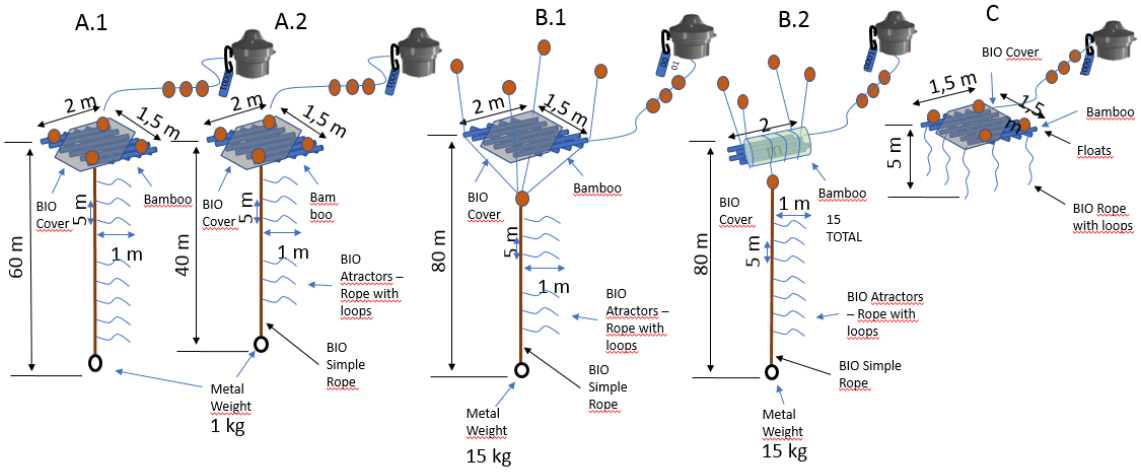

Figure 2. Prototypes designed during the workshop. Details of materials and dimensions are given for each prototype.

2.2.2. Identification and deployment strategy for BIO FADs and pairing conventional NE FADs.

Experimental FADs will be monitored always by the Consortium through a FADs identification system. Each BIO FAD will have an ID number (ex., BIOFAD 0001) that will belong to it during its entire life cycle. This procedure was adopted to allow scientist to follow BIO FAD traceability. In the Indian Ocean FADs change hands very often, and thus, their correct monitoring and traceability can be compromised. To avoid the loss of traceability when a FAD change hands, every time there is a buoy replacement, the plate with BIO FAD ID number attached to the buoy must be changed from the "old" buoy to the newly attached buoy, and the new buoy ID should be noted accordingly.

One of the main task of this Specific Contract is testing, comparing and measuring the efficiency of new BIO FADs against current NE FADs to aggregate tuna and non-tuna species. Every time there is a BIO FAD deployment, it will be accompanied by a deployment of conventional NE FAD. Both deployments will be conducted within an area not larger than 2 miles (based on fleet's regular FAD deploying strategies). The pairedly deployed BIO FAD and conventional NE FAD will be of similar design/prototype. As for BIO FADs, pairing NE FADs will also carry an identification plate for their traceability to allow comparison among both FAD types. The comparison of the efficiency of new prototypes will be sought by using same model of echo-sounder buoy attached to BIO FAD and its pairing conventional NE FADs, as well as with the data collected in the logbooks (i.e. catches). Similar to BIO FADs, every time there is a buoy replacement in NE FADs deployed for the project, the plate with NE FAD ID number attached to the buoy must be changed from the "old" buoy to the newly attached buoy, and the new buoy ID should be noted accordingly.

2.2.3. Data collection and reporting of data procedures.

Each time there is a new deployment or an encounter of BIO FAD or its pairing conventional NE FAD, the following information will always be required to the fleet:

- ID number of BIO FAD or conventional NE FAD.
- Echo-sounder buoy code number.
- When buoy replacement occurs, new echo-sounder buoy code attached.
- Status control information of BIO FAD and pairing conventional NE FAD.
- Pictures of newly deployed or encountered BIO FADs or NE FADs will also be required when possible.

The information regarding BIO FAD and NE FAD structure status control will be gathered using a table that has been defined by the Consortium (Table 1). Data collection will be done applying the following procedure:

- Every time the net is set to a BIO FAD or conventional NE FADs, if possible, the structure will be lifted up to carry out the assessment of the status of the structure.
- The control of the structure will be done by the Observer, if available. On the opposite cases, the crew will do it. It is recommended that the Skipper/Captain will be responsible of this task.
- All parts of the structure described in Table 1 will be checked. A scale from 1 to 4 will be applied to value the status of the FADs (1 = Very good, not damaged; 2 = Good, a bit damaged; 3 = Bad, quite damaged; 4 = Very bad, close to sinking).
- Every time there is a replacement of any part of the BIO FAD and pairing conventional NE FAD, will also be reported in Table 1.
- In the case of the BIO FADs, any damaged parts susceptible of replacement will be replaced by pre-defined biodegradable materials and structures.

Table 1. Status control information of BIO FAD and pairing conventional NE FAD

BIO FAD / NE FAD status control						REPLACEMENT	
Floating parts		1	2	3	4	YES	NO
	Raft						
	Floats						
	Cover						
Hanging parts							
	Rope						
	Attractor (rope with loops)						
	Weight (when possible)						
TOTAL							
1	Very good, not damaged						
2	Good, a bit damaged						
3	Bad, quite damaged						
4	Very bad, close to sinking						

All this information will be reported to the Consortium using an email template for skippers and a dedicatedly designed form for observers, and so making data available to scientist very quickly. Besides, all the information obtained from the echo-sounder buoys attached to BIO FADs and conventional NE FAD deployed in pair will be provided by the fleet in near real time.

Details of all these procedures are further developed in the annex 1 (BIOFAD Workshop Report).

3. Main scientific products

The Specific Contract will deliver the following main scientific products which aim to create fruitful discussions and provide solutions that shall support the implementation of non-entangling and biodegradable materials and designs for FADs construction through collaboration of EU purse seine tropical tuna fisheries and ISSF and consultation with IOTC.

- Review the state of the art regarding FADs use, development and impacts worldwide including initiatives in the Atlantic, Indian and Pacific oceans.
- List of best materials and designs for non-entangling and biodegradable drifting FADs as a result of experiments in natural conditions. This product will also take into account pervious experiments conducted worldwide. Moreover, workshops and meetings with purse seine tropical tuna fishery will be carried out during the project.
- Detailed recommendations regarding the use of new biodegradable materials and designs by EU fleet based on their performance (i.e., aggregation performance, life-cycle assessment of materials) and costs (i.e., socio-economic impacts).
- Final recommendation of an optimum biodegradable FAD prototype.

4. Relevance for IOTC process in implementing a non-entangling and biodegradable

drifting FADs

This project will contribute to summarize previous and current efforts carried out in the IOTC Convention Area as well as in other RFMOs for the implementation of non-entangling and biodegradable FADs. The results of this project will help IOTC to focus the discussion of suitable biodegradable materials and designs for FADs construction addressing the problematic of marine litter, ghost fishing and lost FADs beaching. The main scientific products and results of this Specific Contract aim to create fruitful discussions and provide solutions that shall support the implementation of non-entangling and biodegradable FADs.

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