Workshops to define a strategy to move forward on the use of biodegradable FADs in the Western Pacific Ocean

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February 2019

With support from:

Food and Agriculture Organization of the United Nations

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COMMON OCEANS

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Preamble

These workshops held in the Western Pacific Ocean, in Phonpei and Port Moresby the 23th and 28th of January 2019, are part of the research that International Seafood Sustainability Foundation (ISSF) is coordinating with support provided by the Common Oceans ABNJ Tuna Project to move towards the use of biodegradable FADs. The initiative addresses some of the challenges facing the fishing sector by implementing best practice solutions to reduce the amount of plastic used to construct FAD´s structures, with the aim to contribute to achieving responsible, efficient and sustainable fisheries and biodiversity conservation.

INTRODUCTION

Abandoned and lost FADs can end up stranded in coasts, sometimes in vulnerable ecosystems such as coral reefs, causing damage (Maufroy et al. 2015; Escalle et al. 2018). In addition, FADs with netting in their submerged structure can cause ghost fishing, even if the netting is tied in bundles because with time the netting may become unraveled. Other impacts related to the lost and abandoned FAD structures, is the accumulation of plastics at sea. This is a problem that affects all fishing gears at a global level, it is estimated that a major source of plastics found at sea comes from fishing gears. Plastic-based nets can take centuries to degrade. They accumulate year after year, and when they finally end up breaking down into smaller microparticles, enter the marine food web. Other impacts associated with FAD structures is their interference with other economic activities, such as tourism, marine transportation or aquaculture.

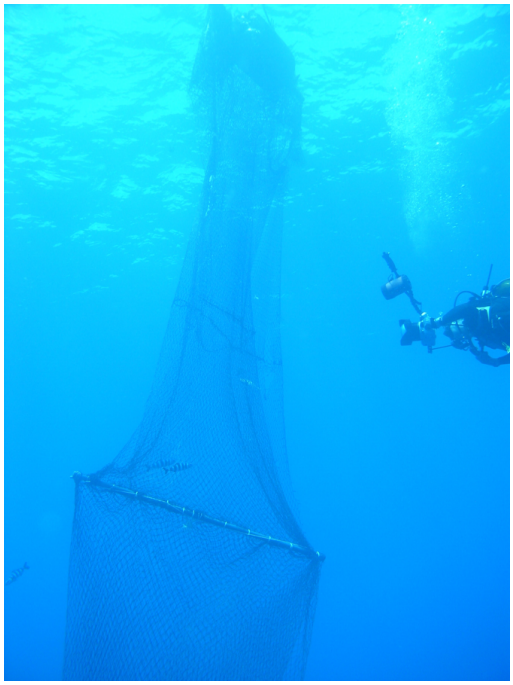

Figure1. Underwater view of a traditional FAD (© Fadio/IRD/ Ifremer/mtaquet)

The solution must include finding alternatives to plastics, applying good practices to avoid fishing gear abandonment and lost, and collecting non-utilized fishing gears.

ISSF´s research road map towards the use of biodegradable FADs (Figure 2) in Indian and Atlantic oceans has comprised first, testing of biodegradable materials in controlled conditions, so that the results on the time evolution of the biodegradable materials could be closely followed. Results of those tests under controlled conditions allowed selecting the most appropriate biodegradable ropes to be tested at sea. Instead of directly organizing a large-scale deployment of biodegradable FADs, first a pilot project was shaped to tests biodegradable materials in real fishing conditions. The pilot allowed advancing the potentials problems we could face in a large-scale experimental FADs deployment project, with the involvement of different fleets testing hundreds of FADs. The last step towards the use of biodegradable FADs is a large-scale deployment of FADs in a collaborative manner among the fleets in the region.

The present document summarizes the first steps taken by ISSF towards the use of biodegradable FADs in the western Pacific Ocean. These first steps are the workshops held in Pohnpei (Federated States of Micronesia) and in Port Moresby (Papua New Guinea) in January 2019.

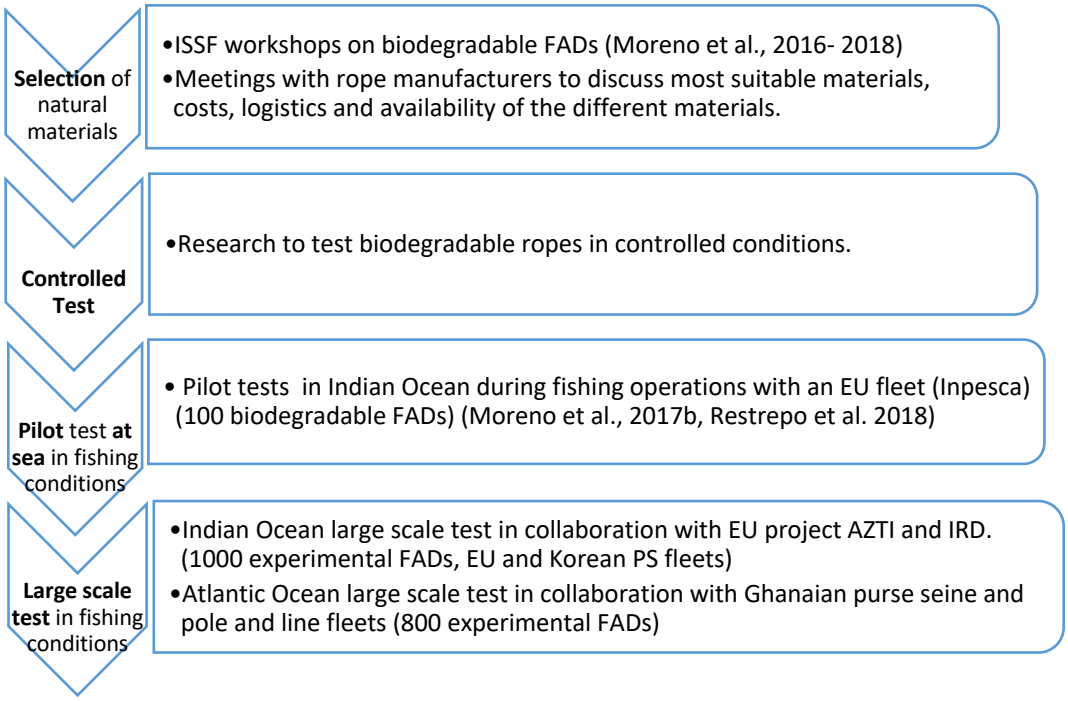

Figure 2. Diagram showing ISSF´s road map towards the use of biodegradable FADs

OBJECTIVES

The workshops help shaping the strategy to move towards biodegradable FADs in each region by generating awareness of the impacts caused by FAD structures on the ecosystem as well as the need to change the FADs to minimize ecosystem impacts.

To define a successful strategy to test biodegradable FADs in the western Pacific Ocean it was important to understand:

- the fishing strategy with FADs in the area
- the type of FAD structures used
- the type of tracking buoys used
- numbers of vessels working with FADs
- main ports.

The objective of the workshops was to define a good strategy to test biodegradable FADs with the fleets in the western Pacific Ocean.

MATERIAL AND METHODS

Two workshops were held in Pohnpei and Port Moresby and followed the same structure (see annex 1 for the power point presentation used).

The first part of the workshop was devoted to present by ISSF scientist, the impacts caused by FAD structure and the potential solutions, following the points below:

1. Presentation on the impacts of FAD structure on the ecosystem.
2. Presentation of potential solutions, non-entangling and biodegradable FADs and recovery of FADs
3. Ongoing experience in other Oceans

Plenary discussions were then conducted to ascertain the specific situation in the western Pacific Ocean, specifically regarding the following points:

1. What are the essential features of a productive FAD?
2. Life time of a FAD in the western and Central Pacific
3. Biodegradable materials to be used for FADs in the western and central Pacific Ocean
4. Potential biodegradable FAD designs in the western and central Pacific Ocean
5. Protocol for a possible pilot study

WORKSHOPS RESULTS

Workshop in Phonpei, Federated states of Micronesia

Workshop attendees comprised scientific staff from NORMA in Pohnpei, representatives from three purse seine (PS) companies and a staff member from the Western and Central Pacific Fisheries Commission (WCPFC). The workshop attendees were very participative and shared their FAD fishing strategies, their concerns as well as the potential actions to move towards the use of biodegradable FADs.

1. Current FAD fishing strategy by purse seine fleets based in Pohnpei: FAD numbers, FAD structures and tracking buoys used.

- The South Korean company Dongwon, which owns 13 PS vessels in the WCPO (plus five in the Indian Ocean and three in the Atlantic) is using Low Entanglement Risk FADs (LERFADs). The tail structure is of open mesh panels of small mesh size (e.g. <2.5 inch). They are buying new netting material. It was suggested to them that if they bought their small mesh netting from second hand small pelagic PS fisheries, it would probably reduce the costs.
- According to a participant in the workshop, some bamboo-built drifting "house" FADs, with a person staying in a small house on top of the raft, are seen at times in the Parties to the Nauru Agreement (PNA) waters. These apparently belong to Indonesian fleets.
- While Dongwon Korean skippers use 60-80 m FADs, the local FSM companies Caroline Fisheries Company (CFC) and Diving Seagull used somewhat shallower FADs of 50 m and 20 m tails, respectively.
- Most companies use exclusively echo-sounder buoys of the brand Satlink.
- Diving Seagull estimated to be using 100 FADs per vessel per year (they own two PS vessels), while CFC was using perhaps more (this year they have increased the level of FADs being used). However, both companies are well below the 350 active buoy limitation by the WCPFC.
- Fishers like the raft of the FAD to be slightly below the water surface to reduce their visibility to other vessels. The most common type of raft is a line of corks (5-7 corks) which sometimes are crossed with a rope or a narrow bamboo cane for rigidity. The corks are then tightly wrapped in PS netting of >2.5 inches (usually 4-5 inches).
- Fishers also considered that for FADs to be attractive to fish they must have plenty of biofouling (e.g. encrusting barnacles, etc.)

- The cost of a traditional FAD made by Dongwon with a buoy is about USD 1600 of which the buoy makes USD 1000-1200. Thus, a synthetic FAD structure is about USD 400 for Dongwon.
- While CFC makes the FADs on land, being one of the few companies in FSM with a dock yard, most FSM companies make their FADs on the boat.
- Most participants agree that they lose between 70-80% of the FADs they deploy. Most of them are lost quickly through theft by other vessels, estimated to contribute 50% of the 80% losses. A FAD might change hands several times within a single day. The helicopters are very efficient at spotting other vessels' FADs. Some helicopters will land near the FAD and change the buoy themselves, without assistance from the mother PS vessel.
- Dongwon does not have supply vessels as such, but sometimes merchant vessels of the company will deploy FADs on its way.

2. Fishing ground characteristics

- The 200 nautical mile Exclusive Economic Zone (EEZ) of the Federated States of Micronesia (FSM) covers roughly 1,000,000 square kilometers of ocean. It is one of the largest fishing zones in the Western and Central Pacific Ocean (WCPO).
- The oceanic currents in the FSM, and indeed most of the PNA region, is predominantly east to west, so many FADs are seeded around the central Pacific because fishers estimate it takes 2-3 months for FADs to aggregate large enough schools of tuna.
- Unlike in other oceans, like the Indian Ocean for example, where there are marked seasonal patterns, fishers say that the WCPO is much more variable and difficult to plan the yearly fishing ahead. Depending on conditions (e.g. El Niño/La Niña) tuna can be "anywhere". Participants say that vessels move between Hawaii and Asia depending on where the fish might be at each time.
- FSM like the rest of the PNA countries manages fishing effort in their waters by selling a pre-established number of fishing days. Foreign flagged vessels fishing in FSM must pay twice as much for a fishing day as FSM-flagged and owned companies.

3. Current regulations related to FAD structure

- From 1st January 2020, the design and construction of any FAD shall comply with the WCPFC conservation measure CMM 2018-01, following specifications:

  -The raft part (flat or rolled structure) 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 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.
- To reduce the amount of synthetic marine debris, the use of natural or biodegradable materials for FADs should be promoted. 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.
- The government of the FSM developed a FAD Management Plan in 2009. Elements of this FAD Management Plan apply variously to FSM-flagged purse seine vessels and all foreign flagged purse seine vessels operating in the FSM EEZ under license. The Plan also includes anchored FAD and other FAD that fits the overriding definition of a FAD. The FSM FAD Management Plan is under continual review to ensure that management decisions are well informed with respect to the impact of FAD fishing.

4. Initiatives from the industry to test biodegradable FADs and allow the recovery of lost and abandoned FADs:

- CFC has started providing a collection point at their port yard for found buoy storage and collection by the different owners. Other WCPO ports such as Majuro (Republic of the

- Marshall Islands) and Pago Pago (American Samoa) are starting to do this. This practice has been done for many years already in other important ports of the Atlantic (e.g. Abidjan), Indian (e.g. Seychelles), and eastern Pacific Oceans (e.g. Manta).
- Dongwon is testing biodegradable FADs (Figure 2). The FADs consist of a bamboo raft covered by a jute cover. The bamboo is sourced from Pohnpei where it is locally abundant, and the jute is bought in Bangladesh. No additional artificial flotation is utilized to ensure long term floatability. While most of the bamboo frame is tied together with jute ropes, there are some plastic straps in the corners to maintain the rigidity of the frame. The underwater appendage consists of five ropes made of coconut fiber, sourced in Vietnam, which reach down to 80 m. The ropes are quite coarse, made by hand (e.g. not industrially machine-made), which makes them look relatively fragile and can easily come apart. At 10 m intervals there are palm leaves crossing the ropes perpendicularly and holding the tail structure together. In addition, the weight or ballast is made of chain material. This is the only non-natural biodegradable material. The Dongwon representative asked if this metal was considered biodegradable. Scientists suggested other alternative weights such as stones, concrete or also a bamboo cane filled with sand.
- Dongwon has rented some yard space at CFC, to construct these biodegradable FADs. They started constructing them and deploying them around August 2018. There have been three batches of 30, 50 and now 100 biodegradable FADs being tested for now. Results are still preliminary as some have been recently seeded and many FADs are stolen, but there have been some reports of successful sets on biodegradable FADs. Durability of these materials is a concern for the fleet manager coordinating these trials, as coconut fiber ropes appear to break down relatively quickly.
- The biodegradable FADs being constructed by Dongwon are costing about USD1800-2000 so the non-synthetic materials are about USD 700.

Figure 2. Biodegradable FAD prototype made of coconut fiber by Dongwon (© ISSF/ Gala Moreno)

5. Strategy to test biodegradable FADs

- The Federated States of Micronesia (FSM) islands are rich in several biodegradable materials already used in some FADs such as bamboo and coconut palm leaves. Currently the price of bamboo is $5-10 per cane and $1 per palm leaf. There are other plant-based materials such as banana fiber and hibiscus fiber which might be worth exploring. In addition, fiber from young green coconuts which has been traditionally used in fishing gear (e.g. fish traps) and to tie up boats, appear to be stronger than standard coconut fiber according to NORMA staff in FSM.
- Even if these alternative materials prove to be good candidates for biodegradable FADs, currently there is no industrialization to make available biodegradable ropes or canvas to be used at FADs. There are no textile factories to our knowledge in Pohnpei, thus they would have to be artisanal or a new factory to process these materials should be set up to provide enough materials and of higher structural quality.
- Fishers say that the lifetime of a FAD should be between seven months to one year. Some very well-kept synthetic FADs can last up to two years, but this is rare.
- Some participants say that they do not regularly repair FADs, as they do not have supply vessels conducting these maintenance tasks, and often the FADs are too far away to go regularly to check them.
- One of the best possible times to start the experimental trials with biodegradable FADs, in real fishing conditions, would be just before the FAD closure (July). This would ensure that FADs are not fished on at least for three months (July-September), ensuring data provision for those months.
- There are many fleets operating within the FSM (as well as other PNA countries). A large-scale deployment should take into account the most important fleets and an appropriate protocol to deploy the experimental FADs should be set up. An appropriate protocol and involvement of fleets would allow information from FADs not being lost.
- During the workshop potential biodegradable FAD designs were discussed (Figure 3), however a more technical workshop would be needed to better define a biodegradable FAD structure to be tested. From the point of view of one of the skippers of CFC any FAD design would aggregate fish.
- The three fishing companies present in the workshop showed interest in participating in trials to test biodegradable FADs.

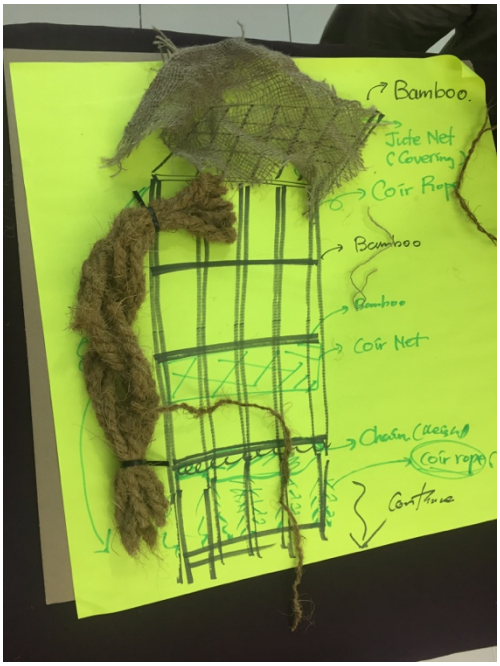

Figure 3. Biodegradable FAD prototype discussed during the meeting (© ISSF/ Gala Moreno)

Workshop in Port Moresby, Papua New Guinea

The attendees to the workshop in Port Moresby were representatives from the fishing industry association and the government, fishers and fishing companies did not attend. Thus, more than technical discussions on FAD designs and structures, the meeting was focused on the impacts of FADs, and how to move forward in PNG for the use of biodegradable FADs.

1. **FIshing strategy and fishing ground characteristics in PNG**

- The Fishing Industry Association in PNG represents over 60 tuna PS vessels and 15 LL vessels. All these vessels are owned by distant water fishing nation (DWFN) companies mainly from Philippines, but also other Asian nations such as Taiwan, China, Korea and Japan. Some of them are joint ventures Taiwan-EU, Philipines-Thailand.
- Catch from PNG waters accounts for 20-30% of the regional catch and is about 10% of the global catch. However, catches can oscillate greatly between years, affected by the Niño and La Niña effect.

- According to the FIA chairman PNG is typically an area of free school fishing, and less of FADs. In the last five years most catches in the WCPO have been to the east of the fishery in the Kiribati region. Previous to this, PNG was one of the prime fishing regions.
- Last year they did not manage to sell all their fishing days, with over 2000 fishing days unsold. PNG charges the same for fishing days to their fleet vessels (i.e. no discount rate) and PS from other countries, which is about USD 10,000 to 12,000. With the fishing days PNG is now obtaining in the region of 200 million USD in revenues, whereas in the early 2000's with the fishing licenses (when the vessel day scheme was still not in place) they were getting USD 15 million.
- Several years back, anchored FAD fishing was quite important in PNG, however now larger PS vessels do not fish on AFADs and rely instead on DFADs. The size range of the PS vessels ranges from 600 to over 1000 GT.
- There are important fishing ports in PNG where most PS activity (e.g. unloading to canneries or transshipping) occurs such as Lae and Madang. Currently there are six tuna processing plants in PNG.

2. Initiatives from the industry to test biodegradable FADs and allow the recovery of lost and abandoned FADs:

- The Philippine owned company Philbest will undergo a biodegradable FAD project with the Global Ghost Gear Initiative (GGGI).
- Some ports are starting to store recovered buoys, but the associated DFADs still remain at sea.
- PNG soon will announce their intention of applying for MSC certification for both their free school and FAD caught tuna. The USA-based consultancy company SCS Global Services will aid the FIA in their FIPs geared towards certification.
- PNG observers could collect information on biodegradable FADs for studies when the vessels are fishing within PNG waters.

3. Strategy to test biodegradable FADs

- No members from PNG flag industry attended the meeting. It was suggested that a second meeting is held in Philippines (General Santos or Manila) because it is a more central location for many of the companies owned by Asian country company. This action could be coordinated not only with FIA but also WTPO. The second workshop will be more technical on FAD designs and protocols to test at sea.

- There is plenty of balsa wood already produced in PNG. Most of this wood is used for match making but could be utilized for DFAD flotation. The price of balsa wood is not expensive.
- If needed, the chairman of Fishing Industry Association (FIA) thought that PNG could pass laws to limit the depth of FADs to reduce pollution and maybe also mitigate the small BET catches.

RESEARCH NEEDS TO MOVE TOWARDS BIODEGRADABLE FADS IN THE WESTERN PACIFIC OCEAN

Using the same road-map for the research conducted in other oceans, the suggested next actions are recommended for the western and central Pacific Ocean:

1. Workshops with fishers

To continue to build momentum and create awareness of the impacts of FADs and the need to find an alternative to the current FADs used, workshops with skippers are needed (Moreno et al. 2016, 2018; Murua et al. 2018). Skipper's knowledge is also best placed to support the development and testing of biodegradable FADs across the region.

At minimum, it is suggested that the following three workshops are undertaken:

- A second workshop in Pohnpei for the fleets operating in FSM and elsewhere and Croatian skippers from CFC company who are willing to conduct a biodegradable FAD pilot
- Workshop in Philippines with the fleets operating in PNG and elsewhere
- Workshop in Marshall Islands (RMI) for the skippers landing in Majuro.

2. Pilot to test biodegradable FADs in real fishing conditions

Following the same strategy as in the Indian Ocean (Moreno et al. 2017b), before conducting a large-scale deployment of experimental, biodegradable FADs, it is very useful to conduct a pilot with just one fleet, to advance potential difficulties in an ulterior massive deployment of FADs.
Pilots allow understanding the behavior of fishers in the area, the degree of FAD lost and abandonment due to FADs being stolen, sinking or beached, and the behavior of fishers

towards experimental FADs and the protocols established for data collection. A pilot project would allow a better designing of a large-scale deployment, where many resources need to be employed, and risks need to be minimized. Croatian skippers in the CFC company which is involved in a FIP are willing to conduct a pilot program.

3. Test of biodegradable materials in controlled conditions

As previously noted, the FSM islands are rich in several biodegradable materials, some of which are already being used in FAD construction, for example, bamboo and coconut palm leaves. There are many other vegetal fibers such as banana fiber, manila hemp, hibiscus fiber, cotton, coconut fiber, that are worth further exploration.

To understand the performance of these natural vegetal fibers in sea water, including their longevity, a controlled experiment would be useful. Following the same experiment conduced in Maldives (Moreno et al 2017a), different fibers could be deployed close to an island, sampling every month those materials and measuring their breaking strength, which gives an idea of the robustness with time. This experiment would enable determination of which vegetal fibers are more suitable to be used at biodegradable FADs.

Even if some of the materials prove to be good candidates for biodegradable FADs, currently there is no industrialization for some of them to make available biodegradable ropes or canvas in great quantities to be used at FADs. Thus, they would have to be artisanal or a new factory to process these materials should be set up to provide enough materials and of higher structural quality.

Acknowledgements

We would like to thank the staff from NORMA in Pohnpei, particularly Bradley Phillip and Eugene Pangelinan, who helped with the organization of the workshop and for providing a sound perspective of possible research that could be carried out in the area. ISSF would like to thank Jerome Tioti and the Fishing Industry Association (FIA) team in PNG, particularly Sylvester Pokajam for their support and for sharing with us their knowledge of the fishery with FADs in PNG.

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