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Minimizing the impact of FAD structure on the ecosystem

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Minimizing the impact of FAD structure on the ecosystem

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FADs are fishing gears that drift in open ocean. Although fishers deploy them in specific areas expecting them to drift towards productive fishing zones, trajectories are difficult to predict, making them drift away from the fishing zone or even beaching close to the fishing zone. The impacts associated to FAD structure are ghost fishing*, damages to coral reefs and coastal areas and marine pollution (Dagorn et al., 2012; Maufroy et al., 2015; Davies et al., 2017). Due to the extension of FAD fishing grounds as well as to the strategy fishing with FADs, it is difficult to find a solution for the impact of these FAD lost and abandonment events unless a common effort is done to:

1. Modify FAD structure so that the impact when beaching and sinking events occur is minimal
2. Follow best practices to minimize their loss and abandonment
3. When FADs drift away or end up in beaching events, especially in vulnerable ecosystems, retrieve them to the extent possible

ISSF has been working mainly on point 1, above, to find FADs made of natural fibers that degrade faster than synthetic ones, and has recently started working on points 2 and 3. This document summarizes the research already conducted by ISSF and next steps to minimize the impact of FAD structures on the ecosystem.

1. Modification of FAD structure: ISSF road map towards the use of biodegradable FADs

Nowadays drifting Fish Aggregating Devices (dFADs) are made using as main components petroleum products as plastic, PVC, nylon nets, etc., that degrade slowly, causing a growing accumulation of these products in coastal areas and seabed. ISSF has been working on several projects to find new FAD structures to reduce the impact caused by beaching and sinking events of FADs when they are lost or abandoned. These projects were done in collaboration with FAO-GEF Common Oceans project, the International Pole and Line Foundation (IPNLF), EU projects and the research institutes AZTI, IRD, University of Hawaii and the Inter-American Tropical Tuna Commission and with the help of the EU and Ghanaian fleets. Figure 1 shows, in chronological order, research conducted by ISSF. Each step was based on the knowledge acquired in the previous experience. Currently ISSF is working on the last step, testing FADs made of natural fibers at large scale.

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*Research on ghost fishing has been addressed in a separate paper entitled "The use of non-entangling FADs to reduce ghost fishing", by Moreno et al.

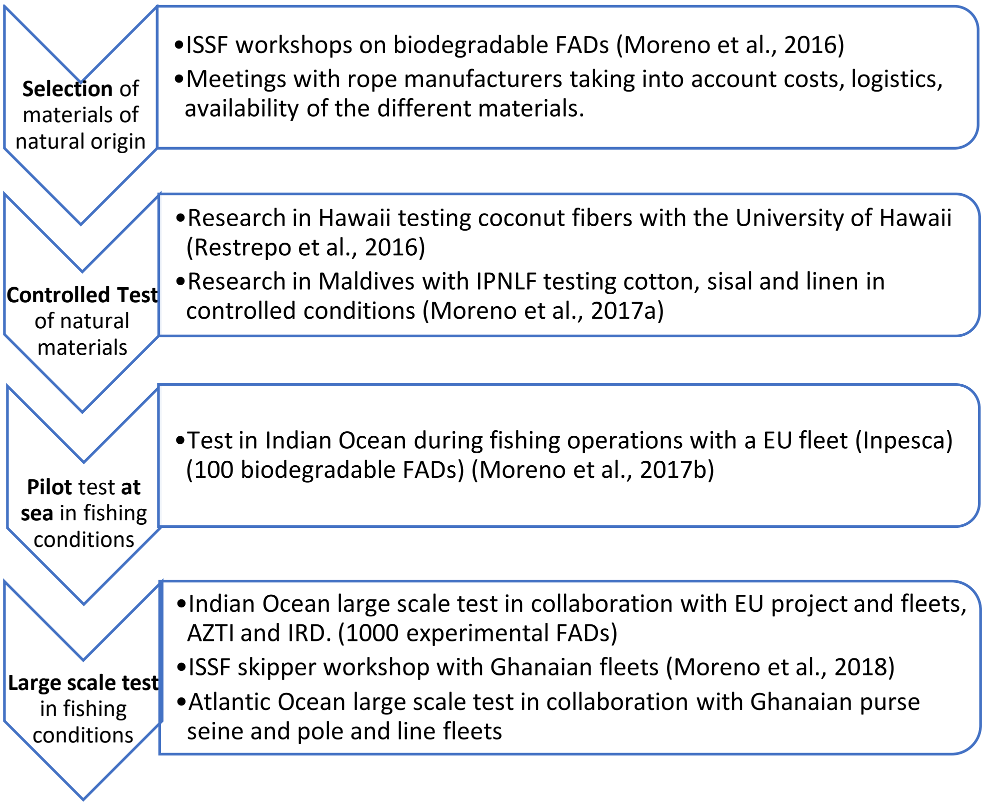

Fig 1. Research steps towards the use of biodegradable FADs conducted by ISSF in collaboration with various organizations and fleets.

2. Main lessons learned so far on the modification of FAD structure

FAD design and materials:

- Globally, FAD structures have evolved towards more sophisticated and deeper structures. The impact of bigger structures, FADs of 60-80 meters length, are greater compared to those used in the past of 5-20 meters in length. Fleets and research projects should focus on simplifying FAD structures to minimize the impact, which would in turn decrease construction and transport costs.
- There are numerous natural fibers with potential to be used in FADs. However, costs, large-scale availability and the lack of industrialization for these fibers to manufacture ropes or canvas constrains their utility to be used in FADs at the present time.
- New materials called "Bio-plastics" should be considered with caution because the product of their degradation could be toxic in the marine environment. Before testing them, it would be necessary to ensure that they are innocuous for the marine environment.
- An appropriate buoyancy is crucial for a FAD to be effective and last enough to be useful for fishing purposes. One of the main challenges is finding biodegradable flotation for a FAD:
    - Bamboo looses buoyancy with time due to seeping of water inside the cane´s air chambers, eventually making the FAD sink. That is why fishers today still

need to add plastic flotation to prevent the FAD from sinking. Another alternative worth exploring are natural oils, waxes or other treatments that are already used in some countries to enhance the lifetime of bamboo canes.
    - Although there have not been tested yet in FADs, current research with new polymers from natural origin (potatoes, algae, etc.) to manufacture containers, open up a series of alternatives to be used for FAD flotation, as long as the product of their degradation is innocuous for the marine environment.
    - As noted before, a shallower, simpler FAD requires less flotation components and thus reduces the use of plastics at FADs.

Tests of experimental FADs at sea in real fishing conditions:

- Due to the complex fishing strategy currently followed with drifting FADs, a high percentage of FADs deployed by a given vessel is usually fished and retrieved by other vessels. This makes it difficult to obtain information on how the biodegradable structure evolves as well as on its lifetime. It is thus necessary to be able to monitor a FAD in a coordinated way with the collaboration of purse seine fleets operating in the same fishing grounds.

- A large number of experimental FADs should be tested in order to get significant results.

- Having access to the trajectories and biomass data from echo-sounder buoys attached to biodegradable FADs would allow assessing the capability of biodegradable FADs to aggregate tunas even if they are not visited or fished by purse seiners, as well as following their lifetime if they are not retrieved.

The main impact of FAD structure on coral reefs and on the ecosystem in general is created by the submerged structure that is made of long pieces of netting. Recycled cotton shows potential to replace the submerged part of FADs, but there are other natural fibers that could also be effective. The main challenge for now is to find a successful biodegradable alternative to the artificial floats (purse seine corks, buoys, etc.). Still, having 90% of the structure of the FAD made of biodegradable materials (by replacing all of the submerged structure with biodegradable materials) would be a huge step towards minimizing FAD impacts on the ecosystem.

3. **Other actions to minimize FAD impacts on the ecosystem**

While modifying FAD structure using biodegradable materials is key to minimize marine pollution and the impact of FAD structure on the ecosystem, other additional practical solutions are needed to avoid FAD beaching events in vulnerable ecosystems as well as to retrieve them to the extent possible.

ISSF recently organized a workshop to evaluate different actions that could be taken in the three oceans. Fishers with experience in the three oceans as well as scientists with FAD expertise were invited to discuss practical solutions to avoid FAD beaching and sinking events. First, a review of data on FAD beaching events was done, both using data available of actual FAD trajectories and from data gathered during ISSF Skipper Workshops. The review revealed that sufficient data on FAD beaching events is generally lacking. Participants worked in groups by ocean to identify likely FAD beaching areas as well as areas of FAD accumulation in the open ocean.

The workshop discussed the following options in chronological order related to a FAD´s lifetime, starting from FAD construction and deployment to its loss or abandonment:

- Use shallower/simpler FAD structures
- Avoid areas of FAD deployment where the risk of beaching events is high
- Use FADs that do not abandon the fishing ground:
    - Autonomous FADs with navigation capability
    - FADs that could be sunk on purpose to avoid a beaching event
    - Using anchored FADs in some areas
- Retrieve FADs in the open ocean
- Retrieve FADs from the coast

The solutions listed above were prioritized taking into account logistics, costs etc. Most of them were accepted by participants as actions that could be taken in the short term. Some options are more likely to happen in the long term (FADs with navigation capability), and other solutions had low acceptance levels (sinking FADs and anchored FADs).

The strategy to applying any of the above activities should be designed by ocean region taking into account regional conditions (oceanography, extension of the fishing ground, fleets, strategy with FADs, etc.). A workshop in each ocean would be desirable.

ISSF will soon publish a report with detailed information on the results of the workshop.

Conclusion

In recent years, there has been a significant effort by researchers and purse seine fleets towards the use of biodegradable FADs. Currently, a large number of experimental FADs are being tested in the Indian Ocean and tests in Atlantic Ocean will start soon. Similarly, in the Eastern Pacific Ocean, a EU-funded project with the IATTC will be launched to test biodegradable FADs. While these efforts are ongoing, additional actions to retrieve FADs and follow best practices to avoid FAD beaching events are being designed. Fishers involved in the experiments and workshops clearly understand the need for biodegradable FADs and minimizing the use of plastics.

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