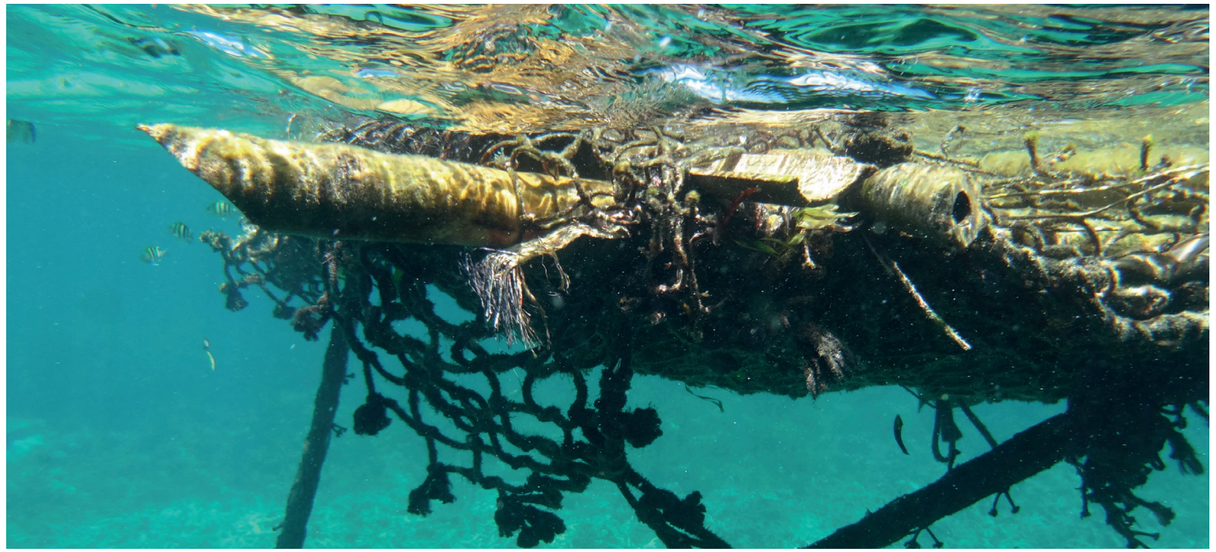
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TURNING THE TIDE ON FAD BEACHING

FAD-Watch Initiatives: Mitigating Adverse Impacts of Drifting Fish Aggregating Devices on Marine Ecosystems

2019-04-10

Producers' Organization of Large Tuna Freezers of Spain
Island Conservation Society of Seychelles
World Wide Fund for Nature
AZTI

THE PROBLEM

Since the early 1990's industrial tuna purse seine fisheries around the world have been using man-made Fish Aggregating Devices (FADs) in order to gain access to tuna schools that aggregate beneath them . A sustained increase in the number of FADs in all oceans, especially between the early-2000's and the mid-2010's prompted the tuna Regional Fisheries Management Organisations (t-RFMO) to adopt limits on the numbers of active drifting FADs (dFAD) per purse seiner, which some t-RFMO have agreed to reduce further over the years.

Most dFAD consist of a floating structure plus a submerged component, with a tracking device attached to them. The floating component is usually made of bamboo poles attached using ropes to make a square raft of about two square meters, often covered by a net, and usually has fishing buoys, corks or other materials to increase its floatability. The submerged part usually consists on hanging ropes, palm fronds, nets, open as sails or tied-up sausage-like and may also include additional heavy implements in order to reduce its drift. The length of the hanging part varies and may be up to 100 meters in some cases . Most vessels track their dFAD through satellite , for which they attach satellite buoys to them on deployment. Currently most of those buoys are equipped with echo-sounders, which are used to provide an estimate of the biomass beneath each dFAD, assisting purse seine skippers to select the dFAD around which setting the net .

dFAD drift and it is not feasible for a vessel to retrieve all the dFAD it has deployed, which leads to some of them being lost every year. Unretrieved dFAD might happen because they are intercepted and appropriated by others, or lost, sinking in the open ocean or beaching in coastal areas. Recent estimates indicate that around 10% of the dFAD deployed by purse seine fleets may end up beaching in coastal areas . As most of the materials used at present are highly durable synthetic material, their loss contributes to the growth of marine litter and may also have detrimental impacts on some sensitive marine fauna, such as marine turtles and sharks, through entanglement in the nets used for its construction .



THE SEYCHELLES FAD-WATCH CASE STUDY: A WORKABLE SOLUTION TO MITIGATE IMPACTS

The FAD-Watch Project involves multiple stakeholders in the Seychelles and is intended to mitigate the impacts of dFAD beaching in coastal areas of the archipelago. The following paragraphs summarize the main milestones of this Project:

1. Identifying the issue:

The Republic of Seychelles lies northeast of Madagascar, an archipelago of 115 islands. It is an Indian Ocean tourist destination whose economy relies almost exclusively on tourism and fisheries. The Seychelles' Exclusive Economic Zone (EEZ) and Territorial Sea cover 1.37 million km2, have a rich biodiversity and are one of the main tuna fishing grounds of the Indian Ocean . Every year, thousands of dFAD drift through the EEZ of Seychelles. While the majority enter and leave the area, or are intercepted by fishing boats, some end up beaching in coastal areas in the Seychelles . The issue of dFAD beaching in the Seychelles was documented for the first time in 2015, following a baseline survey conducted by the Island Conservation Society (ICS) around the Saint François Atoll, where all dFAD beaching events were recorded, and their impacts over marine fauna and the habitat evaluated . This study was presented at the Working Party on Ecosystems and Bycatch of the Indian Ocean Tuna Commission (IOTC), followed by the publication of several articles by local and international media. The news reached, among other readers, OPAGAC .

2. Stakeholder contacts:

Aware of the adverse impacts that dFAD deployed by tuna purse seine fleets were having over coastal marine ecosystems in the Seychelles, OPAGAC decided to address the dFAD-beaching issue. For this, in 2015 OPAGAC approached representatives of the Island Conservation Society and communicated the interest that its boat owners had in evaluating the type of actions that could be put in place to address the dFAD beaching issue.



Additional contacts were also established with representatives of the Islands Development Company and the Seychelles Fishing Authority , the former responsible for the management of outer islands in the Seychelles and the latter the government body responsible for the management of fisheries resources in the Seychelles. OPAGAC also informed other tuna purse seine operators about its plans to initiate the Pilot.

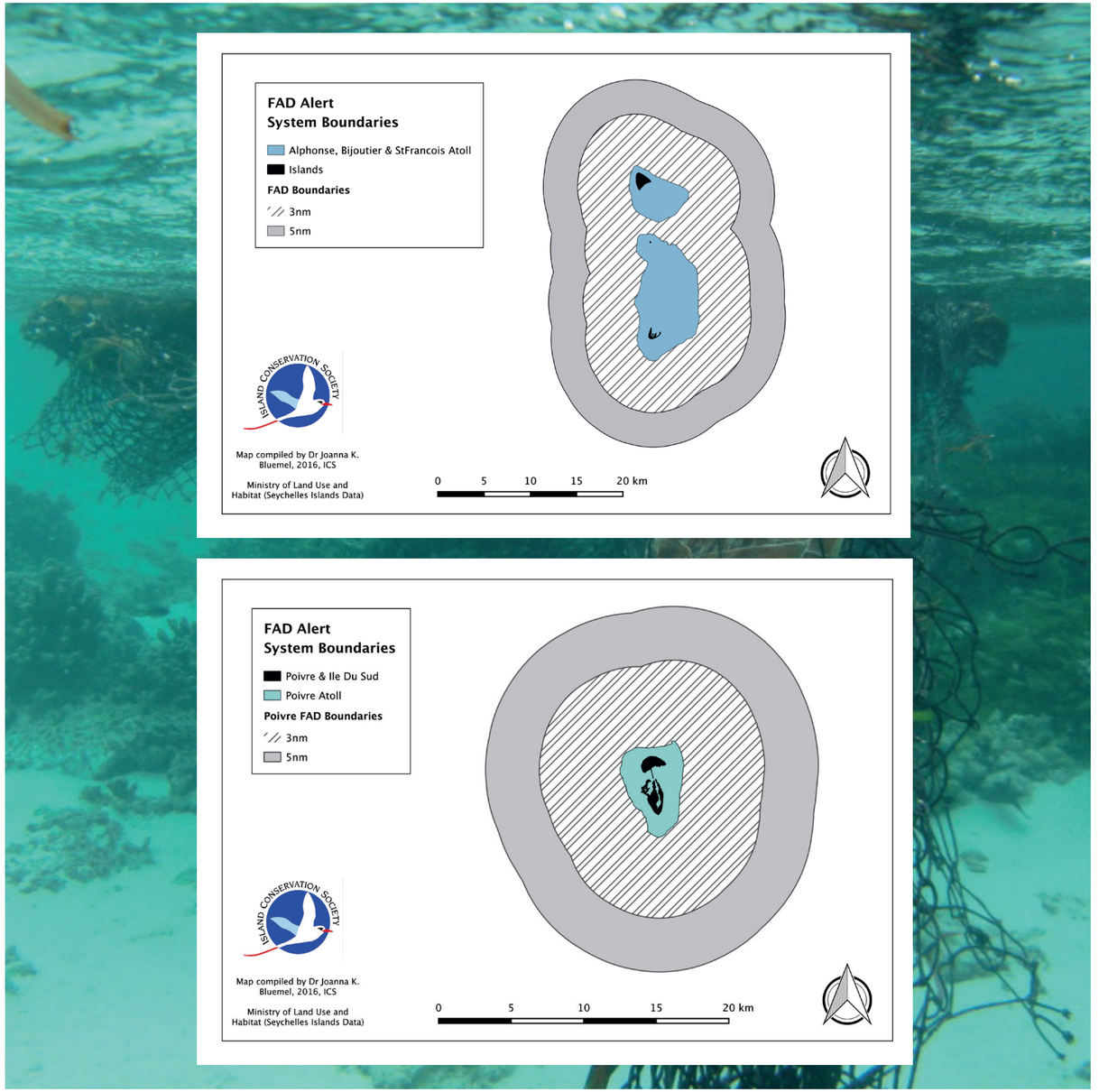
3. Planning the Pilot:

In 2016, ICS and OPAGAC worked towards design of the Pilot, which was completed in June 2016. The following arrangements were made:

A. Selecting the areas to be covered: ICS selected the areas for the Pilot Project bearing in mind the network of field offices ICS had in the Seychelles at the time, agreeing to consider extension of the trial to other areas in the future if it yielded good results. Those included the following islands or groups of islands: Alphonse, Farquhar, Desroches, Poivre, Aride and Silhouette.

B. Tracking of dFAD at risk of beaching: The OPAGAC fleet only uses instrumented dFAD, whose location can be tracked at will through satellite communications. Thus, the service providers of the buoys can set the frequency of transmission of each buoy position to the vessel is tracking it, upon request from its owner. This facilitated the set-up of an alarm system, through which ICS would receive information on all OPAGAC's fleet dFAD at risk of beaching in any of the areas covered. For this, the buoy service providers set-up the software used to monitor the movements of the buoys in ICS' computers. The software included buffer areas at 5NM and 3NM around the islands so as all buoys entering such areas will display at regular intervals in ICS' computers, facilitating their tracking and interception.

C. Interception, removal, and storage of dFAD: ICS' staff would be responsible for the monitoring, interception and removal of dFAD at risk of beaching in the areas covered by the Pilot, using the equipment available in each field office (e.g. boats and tools used to remove the dFAD). And the storage of dFAD, whole or apart, in the islands until its final collection. For each intercepted dFAD, the ICS staff collected the following information: the type of dFAD; the characteristics of the area in which the beaching event occurred or in which it was intercepted; impacts on the habitat; and impacts on marine species, e.g. through entanglement of marine turtles.



D. Recovery of dFAD and buoys by the OPAGAC fleet: Recovered dFAD and buoys stored in the islands would be sent to Port Victoria, to facilitate reutilisation by their owners. ICS and OPAGAC agreed that the transportation of dFAD and buoys could be undertaken by OPAGAC, through dispatch of one of its support vessels, or any other vessels IDC uses for transportation of goods between islands.

E. Data collection: ICS and OPAGAC agreed to keep all the data on dFAD movements and interactions, as stored by the service providers and ICS, to facilitate its use in a future evaluation of the Pilot.

4. Signing the Agreement

The above plan and the financial conditions governing it was incorporated into a Memorandum of Understanding (MOU), which was signed by ICS, IDC, SFA and OPAGAC on 5 July 2016, time of the formal inception of the FAD-Watch Pilot.

5. Clearing hurdles through implementation:

ICS faced several issues through the implementation phase of the Pilot, which they addressed through changes to the original plan.

A. Poor internet: The main issue related to the poor quality of the internet connection in some of the islands, which prevented the direct monitoring of buoys by ICS staff in those locations, as the software did not work in those areas. In those cases, information on drifting buoys was transmitted via e-mail or mobile phone from headquarters. This hampered the work of ICS staff, as it took more time to locate the dFAD, which in some cases were only detected after beaching.

B. Handling of dFAD in the water: Another common issue was related to the handling of dFAD following its interception. dFAD are usually heavy, especially its hanging part, which indeed gains weight through colonisation from barnacles and other sessile species. This made some dFAD unmanageable, as they could not be brought onboard the ICS boats, which are usually of small size. In those cases, the ICS staff either dived to break the dFAD apart and bring its component onboard, one at a time, or towed the dFAD into open water and released it, for it to continue drifting.





C. dFAD from vessels not under the Pilot: over 65% of the dFAD beaching events registered by ICS through the duration of the Pilot referred to dFAD not owned by the OPAGAC fleet, some of unknown ownership. While the ICS staff removed also those dFAD, the fact that ICS did not receive information about their location prior to beaching led to increased adverse environmental impacts, as interception of those dFAD prior to beaching was not possible.

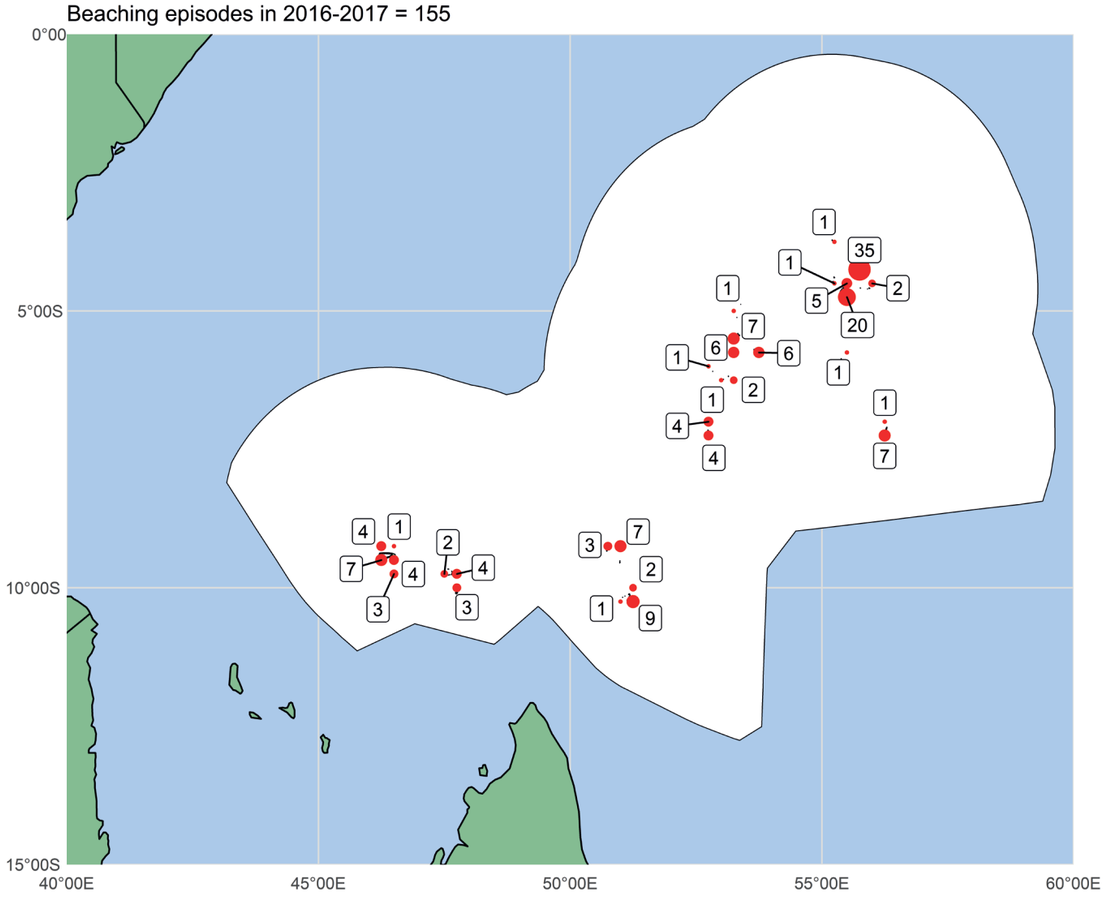
D. Storage and fate of recovered dFAD: All dFAD materials and buoys brought ashore were stored for further collection and transport to Port Victoria. However, some dFAD components were disposed off on site because they were too damaged to be reused or too bulky for transportation. All those components were usually dumped in each island and burned, along with other trash produced in there.

6. Evaluation and dissemination of results:

A team of scientists and staff involved in the Project analysed all the OPAGAC buoy tracking data, collected by the service providers, and the data corresponding to the beaching events and associated environmental impacts, recorded by the ICS' field staff. This involved a group of scientists from AZTI, a research institution in the Basque Country, Spain, who coordinated the preparation and publication of a paper summarizing the results , and presented it at the 14th Session of the Working Party on Ecosystems and Bycatch of the IOTC, where it was well received . Contrary to what was expected, this work showed that less than 1% of the dFAD that transit the Seychelles EEZ end up beaching in coastal waters of the archipelago.

7. Broadening stakeholder participation:

Following the publication of the paper at the IOTC, OPAGAC engaged partners of the Sustainable Indian Ocean Tuna Initiative (SIOTI), and other organisations in the Seychelles (Ministry of Fisheries of Seychelles, Marine Spatial Planning Initiative) to promote the participation of all SIOTI purse seine operators in the FAD-Watch Pilot. The participation was secured in December 2018 and ICS and SIOTI are now negotiating the terms of a new Agreement. Having most purse seine fleets onboard this initiative represents a clear step towards the minimization of dFAD impacts in the coastal waters of the Seychelles.



REQUIREMENTS FOR ASSESSING DFAD-BEACHING IMPACTS AND THE FEASIBILITY OF FAD-WATCH INITIATIVES

The Seychelles Case Study represents just an example about how the dFAD beaching issue could be approached. However, while informative, it does not constitute a blueprint that can be reproduced in all other coastal countries or island states where dFAD beaching might be an issue.

The Roadmap in Annex (pages 18-21) provides some guidance on the steps to make in order to tailor FAD-Watch initiatives to the situation in each country, depending on the importance of dFAD-beaching, the relevance of impacts in the country, the feasibility of implementing a dFAD recovery programme, and considerations on the setting up of these Programmes.

The main message is that for FAD-Watch initiatives to be successful they shall be as inclusive as possible, aiming at securing the participation of all vessels responsible for the beaching of dFAD.

THE FUTURE

The OPAGAC Seychelles FAD-Watch Pilot was a world first. In addition, after its second year, it has succeeded to add value to the initiative through securing the participation of most purse seine vessel operators in the Indian Ocean. Within the context of the FAD-Watch initiative, there is less beaching events than originally estimated through simulations but still enough to justify the continuation and extension of the project to other outer islands considering that Seychelles is a top tourist destination and rich in biodiversity.
In addition, beaching events of dFAD may be also important in other areas of the Indian Ocean and should be evaluated.



In recent years, all t-RFMOs have adopted data reporting standards on FAD, with some recommending the implementation of initiatives to evaluate the number of FAD that are lost each year, their fate (e.g. appropriated by third parties, sank in the open ocean, beached, etc.), the risk that those FAD ultimately lost may pose to the environment, and the way in which those impacts could be reduced . As the Seychelles FAD-Watch demonstrated, multi-stakeholder cooperation and the commitment of all the vessel operators concerned are required to implement a successful programme. Similarly, dFAD risk analysis will require data from as many actors as possible, to avoid getting biased results because of both using a small sample and not accounting for all vessel-dFAD interactions. This stresses the need for all t-RFMO Member and Cooperating Parties to report dFAD data as per the agreed standards, and for the risk analysis to be based on as complete a dataset as possible.

The main reason why dFAD retrieval needs to be promoted is because they contain components that are made by non-biodegradable and highly durable synthetic materials and, once untracked, constitute a threat to the marine environment, through littering, or to some marine species, through entanglement. However, this may change in the future, as the use of non-entangling biodegradable dFAD become the norm. The BIOFAD Pilots that have been launched in the Indian , Atlantic and Pacific oceans must provide some light on materials and designs of dFAD that are more eco-friendly, while remaining efficient. It will then be the time for t-RFMO to agree on how the FAD future should look like.

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PICTURE DESCRIPTION AND CREDITS

Page 3	Olive Ridley turtle (*Lepidochelys olivacea*) entangled in a FAD net in Alphonse at the time open nets were used on FADs. At present, 100% of the FADs deployed by the OPAGAC fleet are non-entangling.	**ICS**
Page 5	Non-entangling FAD beaching in Seychelles. The ICS Team in each atoll intercepts FADs using real-time reports on the position of FADs from the buoy service providers when FADs drift within the buffer areas adopted for each group of islands.	**ICS**
Page 7	Maps showing the 3 NM and 5 NM buffer areas adopted for some of the atolls covered by the FAD-Watch: Alphonse, Bijoutier and St. Francois atolls (top); and Poivre atoll (bottom).	**ICS**
Page 9	Top: FAD collected by the ICS team on board the boat that was used for its interception, following a warning received that the FAD drifted within the 3 NM buffer area. It was a non-entangling FAD of a different design. Bottom: ICS diver releasing the underwater structure of a FAD that had a tied-up net as its main underwater structure. At present, most purse seine fleets participate in the FAD-Watch Project and therefore FADs are less-likely to reach areas near shore.	**ICS**
Page 11	Map showing the total number of FAD beaching events recorded in Seychelles over the first two years of the Project.	**AZTI**
Page 13	Deployment of a Bio-Degradable FAD by the OPAGAC Fleet as part of an EU Project in which biodegradable materials are being tested in the Indian Ocean. The introduction of biodegradable FADs in the future could largely reduce the impacts of FADs on the habitat.	**AZTI**
Page 15	Release of a live hammerhead shark (*Sphyrna spp.*) from the deck of a purse seiner, using a stretcher. The OPAGAC fleet has implemented a Code of Good Practice, which includes guidelines for the release of sharks, mantas, rays, and marine turtles from the net or deck when incidentally caught on purse seine sets. The introduction of non-entangling FAD designs and live release of bycatch has assisted the fleet to markedly reduce its impact over bycatch species.	**AZTI**
Page 17	ICS crew returning to base following the interception and retrieval of a FAD at risk of beaching.	**ICS**



ANNEX: A ROADMAP

PHASE 1: SCOPING

To Bear in Mind

1. Request from Coastal Country

Consideration for starting a FAD-Watch Project can originate on a request from a specific country and/or a dFAD beaching risk analysis based on data from all, or at least a large proportion of the fleets using dFAD in a specific region;

2. Risk Analysis Importance of dFAD Beaching events

The total number of beaching events or the contribution of the fleet(s) to the total number of beaching events is significant, e.g. the average number of beaching events per month and kilometre of coastline and the estimated contribution of the fleet(s) to the total number of events is over some agreed thresholds;

PHASE 2: PRIORITIZATION

To Bear in Mind

3. Coastal Ecosystem and Biodiversity

The type of coastal ecosystem and its value in terms of biodiversity and conservation must be assessed in order to prioritize areas where a swift interception of dFAD at risk of beaching may be required. Knowing the type of ecosystem may be also helpful when designing the type of intervention required for the interception of dFAD. Information on coastal ecosystems and biodiversity may be obtained from governmental or non-governmental sources and publications and reports and can be completed at the time of the short-term survey (see point 7).

4. Interaction with other activities

The type of interactions between dFAD and other activities carried out in coastal waters and the risk that those interactions may pose shall also be assessed. Among the activities that can be assessed, the most important are:

a/ Tourism: The swift removal of dFAD at risk of beaching in countries having an important tourism industry, in particular small island states, may be important, especially in those areas where interactions are more likely to occur; there are some resources that can be used to assess this, and this information can be completed at the time of the short-term field survey (point 7);

PHASE 2: PRIORITIZATION

To Bear in Mind

4. Interaction with other activities

b/ Small-scale coastal fisheries: Interactions with coastal fisheries may go both ways as there are numerous cases in which local fishermen appropriate driftingdFAD and use them to enhance its fishing (e.g. Maldives); or simply appropriate them and bring them ashore (e.g. Sri Lanka), where they, or some of their components, are probably sold in local markets (e.g. nets, plastic and satellite buoys, etc.). In other cases, dFAD drifting in coastal waters may hamper navigation, especially of small boats. The numbers of dFAD drifting, e.g. the average number of dFAD drifting per square kilometre of surface in coastal waters, can be estimated from information provided by the buoy service providers. The importance of coastal fisheries and areas where they operate can be obtained from the last frame survey conducted in the country; or fisheries reports published by the government, or other sources; and completed at the time of the short-term field survey (point 7);

c/ Other coastal activities: The importance of other coastal activities and the risk that dFAD may pose to those may need to be assessed as well (e.g. coastal infrastructures like ports, jetties, navigation lanes, seismic surveys, etc.). The importance of those may be assessed through consultation of official records and completed through the short-term field survey (point 7).

PHASE 3: FEASIBILITY

To Bear in Mind

5. Country Status Evaluation

It is convenient to look at some country status indicators to assess if implementation of a FAD-Watch type initiative is feasible in the country concerned, for instance: Security, Governance, Utilities, etc.

6. Identification of Implementing Agency

This can be governmental, non-governmental, a service provider, or multi-agency. It is preferable that the Agency identified has the staff, equipment & tools necessary to carry out the work (e.g. boat, etc.)

PHASE 3: FEASIBILITY

To Bear in Mind

7. Short-term field survey

The short-term survey is like a frame survey of beached dFAD, in order to identify the geographical area, and assess the type of collection that may be required, depending on the size and the nature of the environment where beaching events are recorded (e.g. collection of dFAD in land versus collection at-sea; see point 3).

8. Cost & Funding

Implementation and running costs of a FAD-Watch shall be estimated by the Agency selected. Depending on the cost, the identification of alternative funding mechanisms may be required, especially in the case that running costs are very high. In some cases, the implementation of mechanisms alternative to a dFAD-beaching Project may be considered

PHASE 4: PROJECT DESIGN

To Bear in Mind

9. Design of the Project

If the feasibility study concludes that the implementation of a FAD-Watch in the country of interest is recommended, and the fleets involved are identified, the fleet operators and institutions concerned can design the project, considering also the priorities established in Phase 2. It is worth to bear in mind that for the Project to be successful it is very important to secure the participation of as many vessels as possible.

PHASE 5: IMPLEMENTATION

To Bear in Mind

10. Formalizing the Agreement

A FAD-Watch Project can be formalized in various ways, e.g. through signing a Memorandum of Understanding by the partners. The type of project (e.g. Pilot or Full-scale) and its duration will depend on the design that is proposed in Phase 4.

PHASE 5: IMPLEMENTATION

To Bear in Mind

11. Set-up and training

Following formalising of the FAD-Watch by the Partners, the first phase of implementation shall contemplate the following:

1/ Setting-up of the hardware and software for tracking the dFAD: this can be done through arrangements with the buoy service providers;
2/ Storage of buoy track data throughout the duration of the Project: as 1 above;
3/ Setting-up of the software to record the data collected at interception of dFAD: This can be done by the agency in charge of coordinating field work;
4/ Training of project staff: Project staff shall be trained on dFAD monitoring, interception and handling; collection of data from each intercepted dFAD, as indicated in the project design; and its computerization and safe-keeping;

12. Implementation Test Phase

Following set-up, the implementation of the project design shall be tested on the field. During the testing Phase it may be required to adjust the Project. The main adjustments normally relate to the handling of dFAD, and their fate. The duration of the set-up and test-phases will depend on the project design; a minimum duration of 3 months from the time of signature is recommended;

13. Full Implementation

Following the test phase and changes to the original design and arrangements, where required, the Project can be starting its full-scale implementation;

14. Evaluation and Dissemination of Results

Implementation of the Project shall be reviewed at regular intervals. The Project partners shall also make arrangements for the data collected through the Project to be analysed, and results presented through publications presented at the agreed fora. This work may involve project partners, project staff, and/or alternative research institutions, as required.

15. Extension and Consolidation

At the end of the Project, the partners shall contemplate a full Project internal review or, where required, a review by an independent third party. The partners will then agree extension and consolidation of the Project, based on the Final Evaluation Report of the Project.

END NOTES

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https://www.idcseychelles.com/

[XIV]http://sfa.sc/index.php/about-us/our-activities

[XV]SATLINK (https://satlink.es/en/) and Marine Instruments (https://www.marineinstruments.es/?lang=en).

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[XXV]The Worldwide Governance Indicators (WGI) project reports aggregate and individual governance indicators for over 200 countries and territories over the period 1996–2017, for six dimensions of governance.
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