A dFAD retrieval project: A case study on the utility of retrieval vessels

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Abstract

This paper presents the results of a pioneering pilot project designed to mitigate the environmental risk associated with derelict Drifting Fish Aggregating Devices (dFADs) in the Indian Ocean. Driven by regulatory measures that have significantly curtailed the operational capacity of the tuna fleet's supply vessels, this initiative sought to demonstrate the essential role of these specialized vessels in dFAD management. The project utilized the supply vessel Archanda for a 51-day campaign (October to December 2024) in the High-Seas eastern Indian Ocean (east of 065º00'E), focused exclusively on retrieving dFADs before potential stranding. The methodology included continuous electronic monitoring and material assessment upon recovery. The campaign successfully retrieved a total of 128 dFADs, confirming the high efficiency of dedicated supply vessels for this task. Subsequent analysis of the recovered components showed high material integrity, with 80% of reusable materials requiring no maintenance, thus strongly supporting circular economy principles within the fishery. These findings establish that dedicated supply or dFAD retrieval vessels are indispensable for minimizing the environmental footprint of dFAD fisheries, primarily by enhancing recovery mechanisms and ensuring the comprehensive management of these fishing devices.

Introduction

Fish Aggregating Devices (FADs) were introduced into the tropical tuna fishery in the early 1990s. Supply vessels are in some regions used for support by purse seine vessels fishing with dFADs. These support vessels, which typically range from 40 to 50 meters in length, are less demanding on fuel than the larger purse seiners. Over the past decade, various Indian Ocean Tuna Commission (IOTC) regulations have been enacted to characterize and monitor the activities of dFAD purse seine fishery and their corresponding supply vessel (also known as support vessels) fleet activities. In the IOTC Area of Competence, a trajectory of progressive reduction in the support of supply vessels by flag States has been established, beginning with Resolution 16/01 and continuing through subsequent resolutions including 18/01, 19/01, 21/01, and the current 24/02. These measures aim to understand the operational practices associated with Drifting Fish Aggregating Devices (dFADs) and their corresponding support fleet activities on the consensus that supply vessels historically contributed to increased fishing effort and capacity within the tuna purse seine fleet, prompting the need for control measures due to their growth. Concurrently, IOTC Resolutions such as 15/02, 15/08, 17/08, 18/08, 19/02, and 24/02 have implemented a system for continuously monitoring dFAD activity by both purse seine and supply vessels. As a direct outcome of these regulatory changes, the authorized Spanish fleet of supply vessels operating in the Indian Ocean has been substantially reduced, falling from eleven supply vessels in 2016 to three currently.

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Historically, supply vessels in the tropical tuna purse seine fishery played a dual role: the deployment and maintenance of dFADs and geo-location of tuna schools to guide purse seine vessels about the presence of fish. However, the increase in dFAD use together with the introduction of satellite buoys equipped with GPS and echosounders fundamentally altered this dynamic. As fishing vessels became capable of autonomously gather precise biomass data, the tuna locating function of the supply vessel was reduced. Recognizing this functional shift, regional bodies like ICCAT have now acknowledged that support vessels are primarily dedicated to dFAD deployment, maintenance, and retrieval (SCRS, 2024).

The mandatory reduction in the supply fleet has inadvertently led to a decline in the efficiency of dFAD management activities, particularly the retrieval necessary to prevent device loss and uphold fishery sustainability. In the current context, where the catch of the three targeted tropical tuna species is regulated by TACs and catch limits, support vessel activities can not contribute to effort creep, but reduces fuel consumption, minimizes dFAD losses, and lowers the overall footprint of the fishery.

This context led to the current pilot project. When the vessel Archanda, the sole supply vessel for the company ATUNSA, ceased its authorized activity in the Indian Ocean in early 2024, ATUNSA proposed a pioneering dFAD retrieval project. The aim was to secure temporary authorization to actively minimize the environmental footprint of their previously deployed dFADs (IOTC Circular 2024-55 and IOTC Circular 2024-60) as reflected on the provisions of point 29 (collection of FADs) of Resolution 24/02 on the management of FADs in the area of competence of the IOTC.

The objective of this paper is to present the results and actionable information from the pilot project conducted by the supply vessel Archanda between October 18 and December 17, 2024. The analysis specifically addresses the efficacy of using a dedicated vessel for minimizing potential dFAD loss and stranding, and for maximizing the recovery and re-use of fishing materials. The premise supporting the authorization of at least one supply vessel per vessel owner company is to incentivize the industry's direct action in reducing environmental impact by mitigating potential dFAD loss and stranding.

Project Material and Methods

The company ATUNSA secured a 60-day authorization for the Archanda, an IOTC-registered supply vessel, to conduct an exclusive dFAD retrieval campaign in the Indian Ocean, operating between October 18 and December 17, 2024 (IOTC Circular 2024-55 and IOTC Circular 2024-60).

The Archanda's activity was strictly limited to the retrieval of dFADs and buoys within the area defined as east of the 065°00’E meridian, extending to the borders of the Exclusive Economic Zones (EEZs) of Maldives, Chagos Archipelago, and India. This designated area, illustrated in Figure 1, was selected based on analyses indicating a high concentration of dFADs actively drifting eastward due to strong prevailing currents at that moment This drift pattern presented a significant risk of dFAD loss and potential stranding.

The retrieval campaign was designed with clear direct and indirect objectives:

Direct Objectives

- Environmental Mitigation: To actively collect drifting buoys and dFADs, thereby minimizing their potential loss and stranding in sensitive or regulated areas.
- Viability Assessment: To analyse the physical condition of the recovered dFAD components and determine their suitability for re-deployment in future fishing operations.
- Regulatory Compliance: To proactively support and fulfil the requirements of IOTC Resolution 24/02, paragraph 29, concerning the collection of drifting objects.

Indirect Objectives

- Scientific Data Collection: To gather material degradation data essential for future research into the biodegradability and durability of dFAD components.
- Resource Efficiency: To maximize the reutilization of recovered components, reducing the overall demand for new raw materials and supporting circular economy principles within the fishery.

Throughout the campaign, vessel activity was subject to rigorous and independent monitoring. The Vessel Monitoring System (VMS) requirements mandated for all fishing vessels were equally applied to the supply vessel Archanda. Additionally, the campaign achieved 100% observer coverage through an independent, continuous electronic observation system. This electronic coverage, commonly applied on a voluntary basis on all ANABAC supply vessels, specifically monitored and collected all required data pertaining to each dFAD recovery event.

Each retrieval event was precisely geo-referenced and recorded. All recovered materials were retained onboard for offloading at port, enabling comprehensive data collection on material integrity and guiding subsequent decisions regarding component recycling or reuse.

Project Results

The dedicated dFAD retrieval campaign, conducted by the support vessel Archanda, commenced on October 18, 2024. Following a three-day transit, operations initiated at the boundary of the authorized zone, specifically at 00°26’S, 065°00’E. Due to promising initial outcomes, the company ATUNSA successfully secured a 30-day operational extension from the Director General of Sustainable Fisheries, extending the campaign from November 20 to December 20, 2024 (IOTC Circular 2024-60). The project concluded on December 17, 2024, upon the vessel's return to port.

In total, the Archanda spent 51 operational days conducting retrieval activities exclusively east of the 065°00’E meridian, successfully recovering 128 ATUNSA buoys and dFADs (Figure 2). These retrieved devices were subsequently offloaded for detailed assessment and reintegration into the fleet's inventory. The data collected during the Archanda campaign allowed for a quantitative analysis of retrieval efficiency, material viability, and fleet interactions.

The retrieval operation spanned 44 active days and yielded a total of 128 dFADs and buoys (Table 1). The daily retrieval rate was highly variable and did not exhibit a consistent pattern. The campaign can be functionally divided into three stages based on accumulated retrieval activity: an initial 18-day period yielding 63 dFADs (with daily rates up to 9), a second 17-day period yielding 45 dFADs, and a final 9-day period contributing 20 dFADs (Figure 3).

The retrieval maneuver itself, employed consistently throughout the campaign, is documented in Figure 4.

The assessment of retrieved devices primarily focused on quantifying the proportion of non-deteriorated material suitable for re-deployment. Based on visual inspection, an exceptionally high proportion of the recovered material (99%) was estimated to be non-deteriorated and viable for reuse. The severity of damaged observed varied significantly across the device’s structural components, strongly suggesting that the duration of exposure to harsh oceanographic conditions is the principal determinant of material degradation. The visual analysis showed a high rate of immediate recyclability, where 80% of all reusable items required no maintenance and could be immediately re-integrated into the fleet's inventory (Figure 5, left panel). The remaining components required only minor repairs or maintenance to restore full operation integrity (Figure 5, right panel). While component reuse was the primary objective, the accompanying data collected on the non-reusable fraction provides a valuable dataset for future research, particularly in assessing the physical characteristics and biodegradability potential of dFAD construction materials.

The selected operational area was characterized by a significant dFAD incidence, a phenomenon primarily driven by the strong prevailing currents present during the pilot experiment, as evidenced by the distribution of retrieved devices (Figure 2). Despite the zone being geographically distant from the traditional grounds of the Atunsa fleet, in situ operations revealed other fleet interactions. Figure 6 illustrates the presence of other active fishing fleets in the region, which were observed to be attaching their own fishing gear directly to the dFAD structures. Furthermore, a critical finding was the increasing discrepancy between the number of recovered dFADs and their corresponding buoys as the campaign moved eastward (Figure 2). The recovered buoys often exhibited evidence of intentional manipulation—specifically, the separation of the dFAD structure from the buoy. This pattern indicates that other active fishing fleets are likely appropriating the dFAD structures for their own use, leaving the original, unattached buoys adrift.

Conclusions

The ATUNSA-Archanda dFAD retrieval pilot project successfully demonstrated that utilizing a dedicated supply vessel is an effective, efficient strategy for mitigating the environmental risk posed by derelict dFADs in the Indian Ocean. During the entire course of the pilot project, the Archanda was only authorised to collect drifting FADs and was not used as a support to purse seine vessels and was not involved in servicing or deploying FADs. By proactively intervening before dFADs entered off-limits areas, the project ensured that a significant number of devices were successfully retrieved before they could be lost or potentially strand in sensitive coastal areas.

In order to control the dFAD retrieving vessel Archanda was not involved in any other activity other than retrieving dFADs, the vessel was equipped with a functional VMS, tracked and monitored by the competent authority and 100% observer coverage through an independent, continuous electronic observation system.

Supply vessels are optimally equipped for retrieval maneuvers, proving an efficient, indispensable tool in dFAD management. The high retrieval rate and the subsequent assessment of material viability—with 80% of reusable components requiring no maintenance—provide robust evidence supporting the environmental rationale for dedicated retrieval. This directly contributes to the circular economy by reducing the cost and ecological impact associated with manufacturing new devices, reduces fuel consumption, minimizes dFAD losses, and lowers the overall footprint of the fishery.

Despite the positive environmental outcomes, the project exposed critical operational challenges. Current regulatory frameworks restrict the fleet's overall capacity to collaborate on sustainability efforts. The observed success argues for a policy review to allow flexible utilization of these specialized assets for environmental mitigation tasks. The project also generated significant socio-economic benefits, including the creation of direct and indirect employment opportunities for the crew during a period of otherwise guaranteed vessel inactivity.

Given that oceanic circulation in the Indian Ocean exhibits high spatial and temporal variability due to a complex interplay of monsoons, bathymetry, and climatic events, effective and continuous dFAD retrieval requires strategic planning. To maximize the effectiveness of dFAD collection efforts year-round, recovery operations should be permitted and planned without restrictive spatial (on the High Seas) or temporal limitations.

Ackowledges

The company ATUNSA thanks the Directorate-General of the European Commission for Maritime Affairs and Fisheries (DG MARE), the Spanish Directorate-General for Sustainable Fisheries (Secretaría General de Pesca), and the IOTC, for the opportunity to carry out this pilot project.

References

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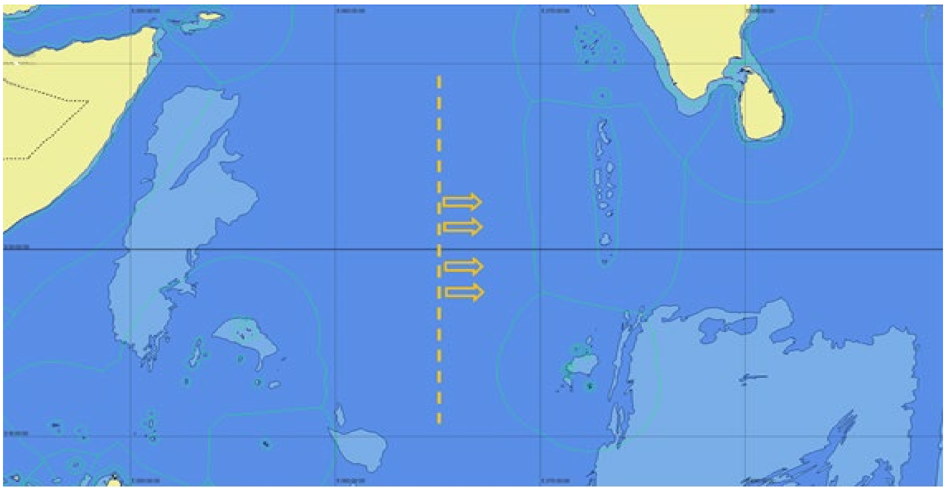

Figure 1. Digitized nautical chart showing the 065°00’E meridian as a dashed line.

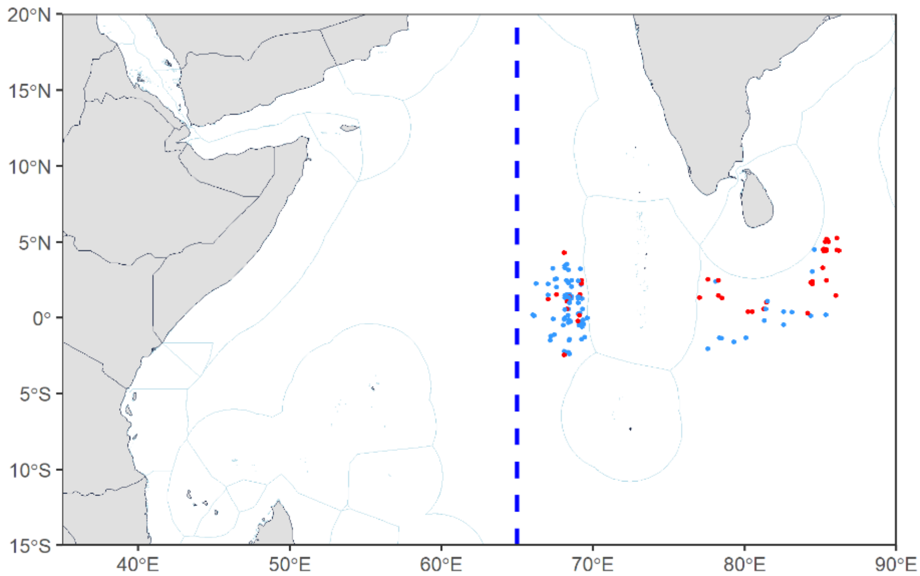

Figure 2. *Geolocation of recovered dFADs with buoys (blue dots) and only buoys (red dots). Dashed blue line represents the 065°00’E meridian.*

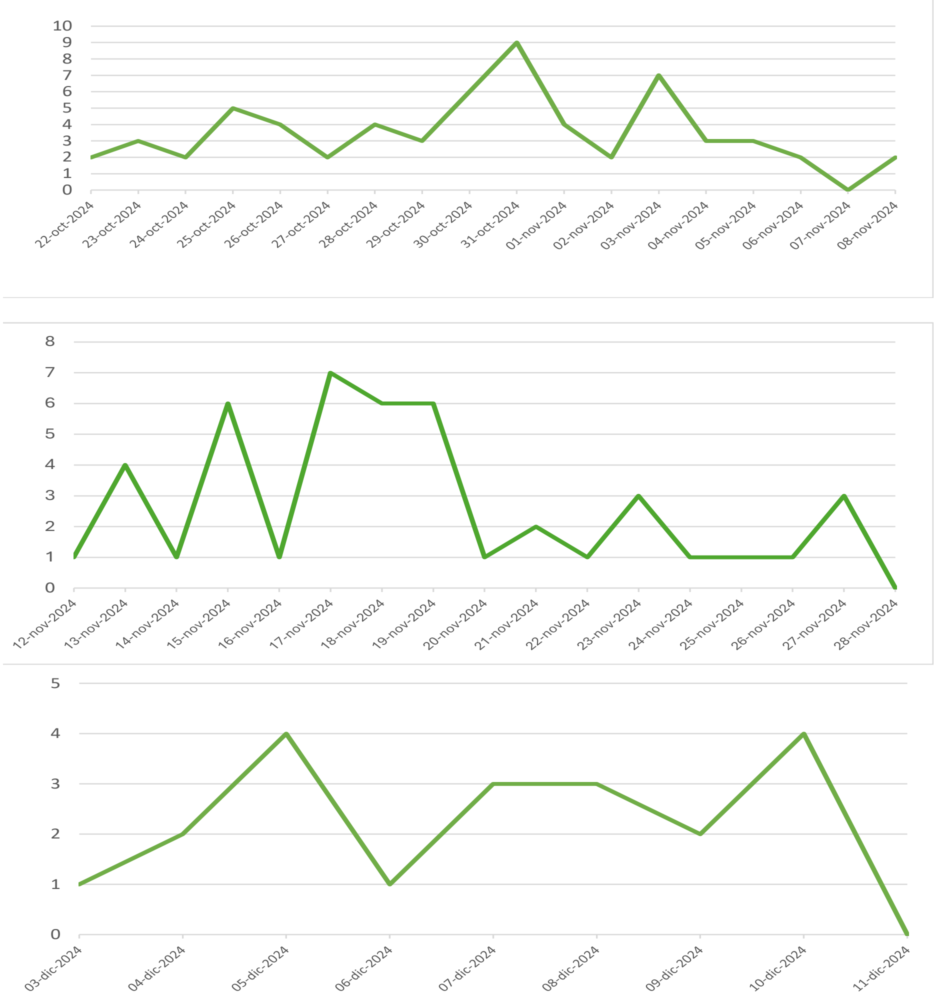

Figure 3. Recovered dFAD daily rate (in numbers)

Figure 4. dFAD Retrieval activity from the supply vessel.

Figure 5. Condition of dFADs retrieved during the campaign. The left panel displays a dFAD immediately suitable for reutilization with no required maintenance, while the right panel shows a dFAD requiring minor repairs before re-deployment.

Figure 6. Longline with transmission device attached to an Atunsa dFAD.

Table 1: Recovery of buoys and FADs during the 3 stages of the project; indicating start date, end date, and days of each stage

Start date	End date	days	Retrieved dFADs (buoy + dFAD)	Retrieved BUOYS (buoy alone)	**TOTAL**
22 OCT 2024	08 NOV 2024	18 days	53	10	**63**
Innocent passage **without activity** through the Maldives EEZ (Eastbound)					
12 NOV 2024	28 NOV 2024	17 days	16	29	**45**
Innocent passage **without activity** through the Maldives EEZ (Westbound)					
3 DIC 2024	11 DIC 2024	9 days	17	3	**20**
TOTAL		**44 days**	86	42	**128**