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Update and Workplan on FAD Research

**WCPFC-SC21-2025/EB-IP-03
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Lauriane Escalle¹, Jennyfer Mourot¹ and Paul Hamer¹

¹ Oceanic Fisheries Programme of the Pacific Community

Executive Summary

Drifting Fish Aggregating Devices (dFADs) are used in large numbers in the Western and Central Pacific Ocean (WCPO). They have become an important part of the region's tropical tuna fishery. Managers, industry, NGOs and other stakeholders have become increasingly mindful of the need to improve management of dFAD use, and in particular mitigate their environmental impacts. The WCPFC is working towards improving the reporting, management and environmental sustainability of dFAD use in the Western and Central Pacific Ocean. This paper summarises the progress of the different dFAD-oriented research projects led by SPC and a workplan for future activities in order to support monitoring of current dFAD related CMMs and the development of potential future CMMs to manage and reduce the environmental impacts of dFAD use. This summary is provided in view of WCPFC priorities highlighted in the FAD Management Options IWG 2024–2026 work plan that includes: Satellite Buoy Data Transmission Requirements; FAD Recovery Programs/Strategies; FAD logbook; Biodegradable FADs; dFAD Deployment.

The dFAD related research in the WCPO region being led by SPC includes:

- analyses of satellite buoy data, including trajectory and echosounder data
- scoping of feasibility of dFAD recovery programs and assessing the impact of dFAD loss and abandonment, including:
 - o regional stranded dFAD data collection program and support for recovery of stranded dFADs;
 - o re-using satellite and echosounder buoys to support local projects;
 - o identification of hotspot(s) of dFAD stranding events, loss and abandonment;
 - o analysis of feasibility and cost-effectiveness of dFAD recovery options in the WCPO;
 - o a legal study on the international and regional frameworks around dFADs;
 - o monitoring of dFADs drifting outside the fishing grounds.
- analyses of FAD data collected using FAD logbook and comparisons with observer data
- non-entangling and biodegradable dFADs, including:
 - o partnering with industry on trials of non-entangling and biodegradable dFADs, capacity building and training in biodegradable and non-entangling dFAD design aspects and construction;
 - o monitoring dFAD designs and materials used in dFAD's construction by the industry;
- assessments of dFAD use per vessel, including deployments and active numbers of dFADs

We invite WCPFC-SC21 to:

- Note the current broad range of dFAD research implemented or planned by SPC, that has direct value and linkage to the FAD Management Options Intersessional Working Group (IWG) work plan for 2024–2026 and the Scientific Committee.
- Provide advice on the current and future focus of dFAD research and on the priorities for the Scientific Committee; including the list of proposed papers for SC22.
- Acknowledge the funding contributions to this research from certain WCPFC members and external organisations (i.e., EU, US, ISSF, World Bank), and the industry involvement as formal partners in some of this work.

1. Introduction

Drifting Fish Aggregating Devices (dFADs) are an important part of the purse seine fishery in the Western and Central Pacific Ocean (WCPO) and tropical tuna fisheries worldwide (Pons et al., 2023; Williams and Ruaia, 2023). In the WCPO, it has been estimated that 30,000 to 40,000 buoys attached to dFADs are deployed annually (Escalle et al., 2021b). In view of the potential impacts of this level of dFAD use (Pons et al., 2023), the Western and Central Pacific Fisheries Commission (WCPFC) has adopted several Conservation and Management Measures (CMM), mostly encapsulated in CMM-2023-01 (*The Tropical Tuna Measure*), including annual FAD closures, during which all dFAD-related activities (e.g., fishing, deployment, servicing) are prohibited; a limit of 350 dFADs per vessel monitored at any one time with activated instrumented buoys (activation on-board only); banning the use of netting in dFAD construction; promoting the use of biodegradable material in the construction of dFADs; and promoting dFAD recovery. In order to support monitoring of current CMMs and the development of potential future CMMs to reduce the environmental impacts of dFAD use, several research projects linked to dFADs are currently ongoing or have been developed and led by the Pacific Community (SPC), the WCPFC Scientific Services Provider (SSP).

The outline of the WCPO dFAD research presented in this paper has been developed to reflect the FAD Management Options Intersessional Working Group (IWG) work plan for 2024–2026 and provides feedback to the WCPFC Scientific Committee (SC) on the research led by the WCPFC-SSP on priority topics identified by SC19, SC20, WCPFC20 and WCPFC21.

The tasks of the FAD Management Options IWG for 2024–2026 include:

- Satellite Buoy Data Transmission Requirements
- FAD Recovery Programs/Strategies
- FAD logbook
- Biodegradable FADs
- dFAD Deployment

The current document provides a summary on the progress of the different research projects led by SPC and a workplan for future activities, in view of WCPFC priorities highlighted in the FAD Management Options IWG work plan.

2. dFAD research in the WCPO

2.1 Analyses of satellite buoy data

- **Trajectory data**

Analyses of dFAD trajectory data have been performed and presented to WCPFC-SC on a regular basis since 2017 (e.g., Escalle et al., 2017, 2023) using the PNA FAD tracking data (data from 2016 until now). This has allowed investigation of dFAD deployment patterns, dFAD density and inter-FAD distances, dFAD stranding events, dFAD loss and abandonment, use of echosounder, and estimates of active dFADs and dFAD deployments per vessels.

Recently, dFAD trajectory data are also submitted directly to the WCPFC-SSP, following the adoption by the International Seafood Sustainability Foundation (ISSF) Proactive Vessel Register Conservation Measures. This measure states that proactive vessels should report dFAD position data to the relevant

Regional Fisheries Management Organization (RFMO) science bodies with a maximum time lag of 90 days, from 1 January 2023 (Management measure 3.7 Transactions with Vessels or Companies with Vessel-Based FAD Management Policies). Data have been received since January 2023 and analyses of a small subset of the data has been performed (Escalle et al., 2023a). Similar investigations to those using the PNA FAD tracking data can be performed but now with a larger dataset.

- **Echosounder data**

SPC has also started receiving echosounder data on a voluntary basis, following the ISSF Proactive Vessel Register Management measure 3.7. Since January 2024, in addition to position data, echosounder data should also be submitted to SPC with a maximum time lag of 90 days.

A preliminary study analyzed a subset of echosounder data, comprising over 4.7 million acoustic transmissions from buoys (Satlink, Zunibal and Kato) deployed on dFADs in the WCPO in 2016–2018 (Escalle et al., 2021b) and indicated that acoustic biomass estimates from dFADs could potentially assist in the development of an independent biomass index for skipjack tuna in the WCPO. A tuna biomass index has been derived from echosounder buoys in the Eastern Pacific Ocean, and was used in the IATTC benchmark stock assessments of skipjack tuna and explored for bigeye and yellowfin tuna assessments in 2024 (Uranga et al., 2024). Longer-term, with the inclusion of historical data, the availability of echosounder data from buoys attached to dFADs in the WCPO could prove valuable as independent biomass indices in stock assessments. We suggest this could be discussed in relation to the ‘Tuna Assessment Research Plan’ which notes the need for focused project work to improve tropical tuna abundance indices for stock assessment, and especially for skipjack tuna.

Table 1. Research topics and projects based on analyses of satellite buoy data.

Topic	Objective	Latest report	Next submission of results to SC
Analyses of trajectory data	Identification of: - deployment patterns, - dFAD density, - inter-FAD distances, - stranding events, - dFAD loss and abandonment - use of echosounder, - estimates of active dFADs and dFAD deployments per vessels and at the scale of the WCPO.	SC 19 (Escalle et al., 2023a)	To be determined (TBD)
Analyses of echosounder data	- independent tuna biomass indices that could be considered in stock assessments	SC 17 (Escalle et al., 2021b)	Considered as part of a tuna abundance indices project under the Tuna Assessment Research Plan

2.2 FAD recovery programs and impact of FAD loss and abandonment

- **Regional stranded FAD data collection programme and support for recovery of stranded FADs**

Stranded FAD data collection programmes are in place in Pacific Island Countries and Territories (PICTs) to collect data on lost or abandoned FADs (industrial drifting and anchored FADs) reaching

coastal waters and/or becoming stranded, as well as the potential impacts of these events on coastal environments (Mourot et al., 2025). Data are then collated into a regional database at SPC. A total of 3,591 stranding events have been reported in the regional database across 18 PICTs between 2006–2025, with dedicated programs now in place in 16 PICTs, including American Samoa; Australia; Cook Islands; Federated States of Micronesia; French Polynesia; Guam; Hawai'i; Marshall Islands; New Caledonia; Palau; Palmyra; Solomon Islands; Tonga; Tuvalu; Samoa; and Wallis and Futuna). These numbers vary greatly between country programmes depending on the longevity of the program, the location of each country and the resources and effort available for stranded FAD detection and reporting. More detailed information can be found in the paper WCPFC-SC21-EB-WP-05 by (Mourot et al., 2025).

- **Re-using satellite and echosounder buoys to support local projects**

SPC and some member countries have joined initiatives to reduce the material pollution related to the stranding events of dFADs and buoys. Since July 2023, SPC is part of the Satlink project 'ReCon', a global circular economy initiative that works with a network of partners and a large part of the fishing industry with the aim of reusing shore-stranded buoys found by local PICT communities. Similarly, SPC joined Marine Instruments Blue Recovery project in March 2025 and is currently discussing with Zunibal and the Searcle project. One common objective shared by these projects is to mitigate the potential environmental impact and marine pollution caused by buoys that are stranded on shores, far away from the fishing grounds where they were originally deployed. Noting that some PICTs that experience high levels of stranded FADs on their shorelines may receive limited benefit from the purse seine tuna fishery. Buoys found that are in good condition have strong potential to be reused in local projects and benefit Pacific communities. The buoy can be re-used for its GPS function to track marine debris or the position of an anchored community FAD; its flashing light can mark a channel or a fishing spot; and its echosounder can be used to estimate the quantity of fish aggregated under a community anchored FAD. So far, four buoys have been re-used, as part of project ReCon in New Caledonia and have been deployed on artisanal anchored FADs. Additional buoys are currently being tested, under both the ReCon and Blue Recovery projects, in New Caledonia, Federated States of Micronesia and the Cook Islands.

- **Hotspots of dFAD stranding events, loss and abandonment**

Patterns of dFAD loss, abandonment and dFAD stranding events are regularly compiled and studied using available dFAD tracking data (e.g., Escalle et al., 2023). With the recent availability of additional and more complete dFAD tracking data, such patterns and quantification of dFAD loss, abandonment and stranding events will be re-assessed by a more thorough identification of hotspots of dFAD loss, abandonment and stranding events (see Figure 2). This will be compared to data available from in-situ stranded FAD data collection. Updated results will be presented at SC22.

Simulations can also be used to investigate patterns of dFAD use, loss and stranding events (Escalle et al., 2019, 2024; Scutt Phillips et al., 2019). Recently, we have undertaken a Lagrangian passive drift simulation experiment to examine corridors of loss of operational dFADs throughout the whole equatorial fishing zones, between 10°N and 10°S (WCPFC-SC21-EB-IP-05) (Scutt Phillips et al., 2025). Such an approach has also been used to investigate potential reduction in dFADs lost from the fishing ground under different dFAD lifetime scenarios, reflecting the industry's transition to biodegradable dFADs.

- **Analysis of feasibility and cost-effectiveness of dFAD recovery options in the WCPO**

SPC is starting a new project that will seek to assess the feasibility and cost-effectiveness of a range of different dFAD recovery options to reduce the environmental and economic damage associated with lost, stranded and abandoned dFADs. The assessment will include several steps, starting with gathering location specific information regarding feasibility, cost, and logistics of different recovery options, as well as assessing industry willingness to partake in the different recovery scenarios. This will rely heavily on different national and regional stakeholders consultations and support.

Recovery options considered could include:

- 1- Modifying purse seiners deployment areas, to avoid areas leading to high loss rates
- 2- Increase recoveries by purse seiners by promoting inter-company collaboration
- 3- Dedicated chartered vessel(s) at identified high dFAD loss areas at the edge of the purse seine fishing grounds
- 4- Longliners or other vessels retrieving dFADs offshore in Economic Exclusive Zones (EEZs) outside the purse seine fishing grounds
- 5- Local network of partners to recover dFADs close to shore ("*dFAD watch*" type initiative)

Additional information is available in WCPFC-SC21-EB-WP-04 (Escalle et al., 2025a).

- **Legal study**

A legal study on the international and regional framework of dFADs, in particular the issue of loss and stranding events has been undertaken. The objective was to review the provisions of applicable international and regional legislations, as well as those of national legislation of certain coastal states worldwide, in order to provide PICTs' decision-makers with reliable and up-to-date information on the topic. The study can be provided to individual members upon request.

- **Monitoring of dFADs drifting outside fishing grounds**

SPC has also started monitoring dFADs drifting outside typical purse seine fishing grounds and that would normally be deactivated by fishing companies. Since January 2024, the PNA fourth Implementing Arrangement prohibits deactivation of dFADs buoys in the WCPFC Convention Area between 20°N and 20°S (except if a FAD buoy has drifted onto a reef or beach and is stationary and may be deactivated after one month). Monitoring of the fate of dFADs is therefore now being done outside of this area. Additional information is available in WCPFC-SC21-EB-WP-04 (Escalle et al., 2025a).

Table 3. Research topics and projects linked to dFAD recovery programs and impacts of FAD loss and abandonment.

Topic	Objective	Latest report	Next submission of results to SC
Regional stranded dFAD data collection programme	<ul style="list-style-type: none"> - quantify the number of dFAD stranding events or dFADs drifting nearshore; - assess marine pollution and environmental impacts - evaluate materials and designs of dFADs found stranded; as well as how communities may repurpose or recycle dFADs and satellite buoys 	SC 21 (Mourot et al., 2025, 2023)	To be determined (TBD)

	<ul style="list-style-type: none"> - consider ways to mitigate the impacts of dFADs - highlight origin areas and owner fleets 		
Re-using buoys to support artisanal fishers	<ul style="list-style-type: none"> - support artisanal fishers - develop a circular economy that reduces waste from industrial fishers 		TBD
Hotspots of dFAD stranding events, loss and abandonment	<ul style="list-style-type: none"> - identify hotspots of dFAD loss, abandonment and stranding events - provide scientific advice to guide the sustainable management of the FAD tuna fishery 	SC 19 (Escalle et al., 2023a)	SC 22
Economic analyses of dFAD recovery options	<ul style="list-style-type: none"> - assess and compare the feasibility and cost-effectiveness of dFAD recovery options to reduce the environmental and economic costs associated with lost and abandoned dFADs 	SC 21 (Escalle et al., 2025a) WCPFC21	SC 22
Legal framework	<ul style="list-style-type: none"> - review the provisions of international law and national legislation of coastal states, in relation to dFADs drifting in EEZ and/or the stranding on their coasts 		
Monitoring of dFAD drifting outside the fishing grounds	<ul style="list-style-type: none"> - assess drift, connectivity and potential stranding events of dFAD normally deactivated by fishers outside the fishing grounds 	SC 21 (Escalle et al., 2025a) WCPFC21	SC 22

2.3 FAD logbook

- **Analyses of FAD data collected using FAD logbook and comparison with observer data**

Analyses of dFAD data collected using the PNA's newly developed FAD logbook (that has also been proposed to the WCPFC) (PNA and Tokelau, 2024; Pons et al., 2023) with the aim to review materials and designs of dFAD use, activities performed on dFADs and identification of dFADs encountered. A comparison will be made with data collected by observers.

Table 4. Analyses of dFAD data collected using the FAD logbook in comparison with observer data.

Topic	Objective	Latest report	Next submission of results to SC
Analyses of FAD data collected using the FAD logbook and comparison with observer data	<ul style="list-style-type: none"> - review materials and designs of FADs used in WCPO - assess FAD use and ability to monitor FADs using unique ID numbers - compare quantity and quality of data collected using FAD logbook with observer data 		To be determined

2.4 Non-Entangling and Biodegradable FADs

- **Non-Entangling and biodegradable FADs**

SPC is leading WCPFC Project 110, and its follow up Project 110a, to conduct trials of non-entangling and biodegradable dFADs in the WCPO and is also collaborating closely with the International Seafood Sustainability Foundation (ISSF) on this topic, including the WCPFC projects and their US NOAA Bycatch Reduction Engineering Program (BREP) project. The objectives of the projects are to provide essential information to the WCPFC and tuna fishing industry on the designs, types of materials, performance, implementation challenges and cost-effectiveness of non-entangling and biodegradable dFADs in the WCPO context. As part of projects 110/110a, industry partners are receiving staff training in biodegradable dFAD design considerations and construction, and materials supply options are necessarily being explored. More details and results of both projects can be found in WCPFC-SC21-EB-WP-03 (Escalle et al., 2025b).

- **Monitoring dFAD designs and materials used in dFAD's construction**

A review of dFAD designs and materials used since the adoption of the non-entangling dFAD requirement in January 2024 (CMM 2023-01) using observer data and the newly developed PNA FAD logbook can be performed by the SSP upon request by WCPFC. Similarly, the use of biodegradable materials, currently encouraged (CMM 2023-01) can also be reviewed.

Table 5. Research topics and projects linked to non-entangling and biodegradable dFADs.

Topic	Objective	Latest report	Next submission of results to SC
Non-Entangling and biodegradable FADs	<ul style="list-style-type: none"> - provide essential information to WCPFC and the industry on the designs, types of materials, performance, implementation challenges and cost-effectiveness of non-entangling and biodegradable dFADs - support industry training and uptake of more ecological dFAD designs 	SC 21 (Escalle et al., 2025b)	SC 22
Monitoring dFAD designs and materials used in dFAD's construction	<ul style="list-style-type: none"> - review materials and designs of FADs used in WCPO - compare quantity and quality of data collected using FAD logbook to observer data 	Escalle et al. (2023c, 2023d)	TBD

2.5 dFAD deployments

- **Assessment of dFAD use per vessel, including deployments and active number of dFADs**

Monitoring the number of dFADs deployed annually, and their spatio-temporal prevalence is important for assessing their influence on the tuna fisheries and other environmental and ecological risks. Estimates of the number of deployments and active dFADs per vessel and at the scale of the WCPO has been performed previously (Escalle et al., 2021a). These estimates should be re-evaluated to assess potential changes in dFAD use and provide advice to WCPFC on the effectiveness of the limit

on the number of active dFADs that can be monitored at any given time, as set out in paragraph 21 of the CMM 2023-01. This might be particularly important with the recent reduction in the FAD closure periods.

Table 6. Research topics and projects linked to dFAD use per vessel, including deployment and active number of dFADs.

Topic	Objective	Latest report	Next submission of results to SC
Assessment of dFAD use per vessel, including deployment and active number of dFADs	<ul style="list-style-type: none"> - assess potential changes in dFAD use - provide advice to WCPFC on the effectiveness of the limit on the number of active dFADs that can be monitored at any given time 	Escalle et al. (2021a)	SC 22

5. Conclusion and recommendations

The current paper summarises current and planned dFAD related research led by SPC, including timelines of future SC papers. This summary was developed in view of the WCPFC priorities highlighted in the FAD Management Options IWG 2024–2026 work plan that includes: satellite buoy data transmission requirements; FAD recovery programs/strategies; FAD logbook; biodegradable FADs; and dFAD deployment. Given the importance of dFADs to the WCPO purse seine fishery and the growing number of research topics, SPC is seeking feedback from SC 21 and WCPFC 22 on the ongoing research projects and future work plan presented in this paper, including any gaps or priority areas.

The SSP proposes the below minimum list of papers to develop for SC22 and seeks feedback from SC21 on this list:

- Spatial and temporal description of drifting FAD use in the WCPO derived from analyses of the FAD tracking programmes and observer data, including:
 - Hotspots of dFAD stranding events, loss and abandonment
 - Assessment of dFAD use per vessel, including deployment and active number of dFADs
- Assessment of the impacts of drifting Fish Aggregating Devices on marine environment in the WCPO: recommendations for mitigation strategies, including:
 - Economic analyses of dFAD recovery options
 - Monitoring of dFAD drifting outside the fishing grounds
- Progress Report of Project 110 and 110a: Non-entangling and Biodegradable FAD Trial in the Western and Central Pacific Ocean – Final report

We invite WCPFC-SC21 to:

- Note the current broad range of dFAD research implemented or planned by SPC, that has direct value and linkage to the FAD Management Options Intersessional Working Group (IWG) work plan for 2024–2026 and the Scientific Committee.
- Provide advice on the current and future focus of dFAD research and on the priorities for the Scientific Committee; including the list of proposed papers for SC22.
- Acknowledge the funding contributions to this research from certain WCPFC members and external organisations (i.e., EU, US, ISSF, World Bank), and the industry involvement as formal partners in some of this work.

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