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PROGRESS REPORT OF PROJECT 110 AND 110A: NON-ENTANGLING AND BIODEGRADABLE FAD TRIAL IN THE WESTERN AND CENTRAL PACIFIC OCEAN

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Executive Summary

WCPFC Projects 110 and 110a are conducting trials of non-entangling and biodegradable drifting Fish Aggregation Devices (dFADs) in the Western and Central Pacific Ocean (WCPO), with the objective to provide essential information to the Western and Central Pacific Fisheries Commission (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. The project supports industry to uptake more ecologically sustainable dFAD designs and provide the WCPFC with information to support consideration of Conservation and Management Measures (CCMs) related to non-entangling and biodegradable dFADs such as the staged transition towards fully non-entangling and biodegradable dFADs WCPFC recommended for adoption by the FAD IMO-WG in 2026.

SPC is also collaborating closely with the International Seafood Sustainability Foundation (ISSF) on non-entangling and biodegradable dFAD trials in the Pacific Ocean, involving both this project (110/110a) and their NOAA funded Bycatch Reduction Engineering Program (BREP) project with the US purse seine fleet, so that data, skills and resources can be leveraged across all the biodegradable dFAD work in the Pacific Ocean. Results presented in this paper cover biodegradable jelly-FADs (inspired by the neutral buoyancy of jellyfish; its design seeks to enhance durability at sea, while incorporating a three-dimensional drogue to reduce drift speed) deployed as part of both projects in the Pacific Ocean and are an updated from previous reports presented at the Scientific Committee (SC) of the WCPFC. The WCPFC projects 110/110a should be fully completed by January 2027. This report captures the key results to date, a final project report will be completed in early 2027 once the final datasets are received and analysed. This report will be provided to SC23.

Eight fleets, representing more than 56 vessels, are engaged as project partners: the American Tunaboat Association (ATA, USA), FCF CO. Ltd (Chinese Taipei), Silla (Korea), Caroline Fisheries Corporation (CFC, Federated States of Micronesia), Fishing Industry Association (FIA, Papua New Guinea), Koo's (Marshall Islands), Zhongyu Global Seafood Corporation, Shanghai Kaichuang Deep Sea Fisheries Co. Ltd and Zhejiang Ocean Family Co. (China) and KAIMAKI (Japan). The projects involve 56 vessels testing 673 jelly-FADs across different countries and fleets. The fishing companies participating in the project manage a total of around 90 vessels.

All non-entangling and biodegradable dFADs (jelly-FADs) have been constructed, as part of Project 110 and 110a (457) and the BREP (216) projects. A total of 455 jelly-FADs have been deployed to date. The design tested is the jelly-FAD, including the original 3D cubic structure, as well as a newly developed cylindrical jelly-FAD design, which is lighter, easier to handle, and further reduces the potential impact when stranded. The materials for both types include bamboos (poles or bamboo stripes), canvas and ropes made of cotton, and for 30% of the jelly-FADs tested by the Chinese fleet, a new high-strength cellulose-based material (Lyocell) called "Suncell".

The performance of the jelly-FADs is then compared with conventional dFADs, deployed nearby. Both types were monitored for an average 9 months (the longest being almost 3 years), which is an indicator of their usefulness and lifespan at sea. The spatial distribution of the deployed non-entangling and biodegradable dFADs and the conventional dFADs is very wide, covering most of the tropical WCPO and Eastern Pacific Ocean (EPO).

A total of 52 non-entangling and biodegradable dFADs visited had condition recorded, indicating that the jelly-FADs were in good condition until at least 4 months, and for one jelly-FAD visited after 6 months, the main rope was still in good condition. However other components were no longer intact. The number of jelly-FADs visited remains low (46 fishing sets and 13 visits without sets). The low setting/visitation rate per dFAD is typical for the purse seine fishery and presents some limitations to the conclusions that can be drawn regarding the condition of the biodegradable dFADs after prolonged periods at sea. We also note that, so far, no sets or visits have been made for either the conventional or jelly-FADs beyond 6 months post-deployment.

Despite the general low dFAD visitation rates, considerable data has been obtained from the biomass provided by the acoustic satellite buoys used to track dFADs. This data shows that the drift speed of conventional dFADs and jelly-FADs was similar. Biomass data from the echosounder buoys attached to the dFADs indicated that tuna aggregation patterns were similar between conventional and jelly-FADs, with a peak in biomass at 2 months after deployment. A total of 46 fishing sets have been performed on the jelly-FADs with an average catch of 34.8 t per set. More sets were made on the paired conventional dFADs (64), that showed a higher catch per set with an average of 68.2 t. This compares to a median of 30.0 to 35.0 t per set per year across over 43,024 dFAD sets in the WCPO in 2023 to 2025y. In comparison, the median catch on free school sets was of 10 t per sets in the 2023-2025 period.

This report covers the key results of the trial of non-entangling and biodegradable dFADs in the Pacific. While remaining deployments will occur in the next few months, and some new data will be collected, the results from these are not expected to markedly change the main results reported in this paper. The training and collaboration with industry during the project will be valuable for preparing industry to transition to biodegradable materials and for the WCPFC to consider the adoption of a staged transition towards fully non-entangling and biodegradable dFAD. SPC could continue to support this transition, through advice, training, scientific analyses of the performance of dFADs constructed and deployed by fishing companies and the development of approaches to monitor biodegradable materials and designs.

We invite SC22 to:

- Note that 673 jelly-FADs have been constructed, including 457 as part of WCPFC Projects 110 and 110a; and that 455 jelly-FADs have been deployed under the WCPFC and BREP project collaboration.
- Note that the drift speed, monitoring period and aggregation patterns of conventional dFADs and jelly-FADs were similar.
- Note that 46 fishing sets have been performed on jelly-FADs in this trial so far, representing 10.1% of the jelly-FADs deployed, with an average tuna catch of 34.8 t per set. The median catch per set on the jelly-FADs for this trial were similar to that of the traditional dFADs across the whole fleet over the same period (i.e., 34.8 vs 30–35.0 t per set, respectively).
- Note that results of WCPFC project 110 and 110a indicate feasibility and availability of biodegradable materials for a transition to the use of non-entangling and biodegradable dFADs in the Western and Central Pacific Ocean.
- Recommend that a framework to monitor the transition to biodegradable materials and designs should be considered, in view of the step-wise adoption proposed by the FAD IMO-WG to be adopted in 2026.

Contents

Executive Summary 2

1. Introduction 5

2. Methodology 6

  2.1 WCPFC project 110 6

  2.2 NOAA project 6

3. Updates on activities of the projects 6

  3.1 Stage 1. Information and planning workshops 6

  3.2 Stage 2: Construction of non-entangling and biodegradable dFADs 9

  3.3 Stage 3: Conduct at sea trials and broader industry communications program 10

  3.4 Stage 4: Data analysis and reporting 13

4. Conclusion and next steps 19

Acknowledgments 21

References 22

1. Introduction

The number of drifting Fish Aggregating Device (dFAD) buoy deployments in the Western and Central Pacific Ocean (WCPO) is estimated to vary between 23,000 and 40,000 per year (Escalle et al., 2020, 2021a). Up until recently, dFADs included netting materials that could result in entanglement of Species of Special Interest (SSIs; i.e., sharks, turtles). Since January 1st 2024, netting has been banned under CMM 2025-02 (Conservation and Management Measure for bigeye, yellowfin and skipjack tuna in the western and central Pacific Ocean). As a result, dFAD designs and construction materials are evolving rapidly, with fishers replacing netting with alternative materials such as plastic shading and sheeting materials, canvas or ropes. However, the use of petroleum-derived plastics is still predominant in dFAD construction (Escalle et al., 2023c) and continues to raise concerns related to marine pollution and damage of vulnerable ecosystems such as coral reefs. In addition, the rate of subsequent loss or abandonment, and stranding of deployed dFADs, is estimated at 44.8% and 11.3%, of tracked dFADs, respectively (Escalle et al., 2023a), with an additional 40% with an unknown fate. This is concerning for coastal states of the Pacific region, NGOs and fishery stakeholders, and is increasingly eroding the social license of the purse seine tuna industry in the WCPO. To mitigate these undesirable impacts of dFAD use, there is a growing need to transition to dFADs that are constructed from materials that are both organic and biodegradable and continue to mitigate the entanglement of SSIs. In CMM 2025-02, WCPFC also encourages the use of biodegradable materials to construct dFADs. In particular, the WCPFC FAD IMO-WG planned the adoption of a staged transition towards fully non-entangling and biodegradable dFADs in 2026. This transition has already been adopted in all other tuna Regional Fisheries Management Organizations (tRFMO), with a transition from 2025–2028 (ICCAT), 2026–2030 (IOTC) and 2026–2030 (IATTC).

In view of that objective, there was a recognition that facilitating the purse seine tuna industry´s transition to fully non-entangling and biodegradable dFADs requires continued research and development in close collaboration with the fishing industry itself. This includes designing and testing dFADs made of non-entangling and biodegradable materials and demonstrating their functionality, cost-effectiveness, and practicality compared to traditional designs made primarily of synthetic materials. In addition, options for supply of biodegradable materials should be investigated and capacity building in Pacific ports should be carried out.

Since 2021, trials of non-entangling and biodegradable dFADs have started in the WCPO, through WCPFC *Projects 110: non-entangling and biodegradable FAD trial in the WCPO*; as well as a similar parallel project; *the National Oceanic and Atmospheric Administration's Bycatch Reduction Engineering Program (BREP) project*, led by the International Seafood Sustainability Foundation (ISSF) in collaboration with The Pacific Community (SPC). While generating valuable information, both projects highlighted the fact that large numbers of non-entangling and biodegradable dFADs need to be deployed to generate statistically robust results. This is mainly due to the limited number of visits by fishing vessels to dFADs in general. A follow-up project, WCPFC *Project 110a*, was therefore added in 2024 to build on the two other projects by increasing both the number of biodegradable dFADs deployed and the regional industry involvement, training and capacity building.

The current paper provides an update on the activities of WCPFC *Project 110 and 110a*, as well as the *BREP project*, and provides recommendations to SC22, the FAD IMO-WG and WCPFC23 to move towards fully non-entangling and biodegradable dFADs in the WCPO.

2. Methodology

2.1 WCPFC project 110 and 110a

Project 110 and 110a (the projects) aim to conduct trials of non-entangling and biodegradable dFADs in the WCPO to contribute to the data required to deliver robust information to industry on the designs, types of materials, performance and cost-effectiveness of non-entangling and biodegradable dFADs in the WCPO. It has the following objectives:

1. Explore designs and cost-feasibility of non-entangling and biodegradable dFADs.
2. Undertake at-sea experiments to compare the performance/functionality of non-entangling and biodegradable dFADs to conventional dFADs.
3. Provide scientific advice to industry and national fisheries managers on the performance of non-entangling and biodegradable dFAD designs.
4. Increase regional support, capacity building and partnerships on non-entangling and biodegradable dFAD research with various stakeholders in the WCPO.

The project is led and coordinated by WCPFC Science Services Provider, SPC, with the support of the ISSF, and donor funds from the EU (majority), US and the ISSF. Analyses are carried out in collaboration with AZTI research institute in Spain. This work is carried out in collaboration with fishing industry, government and national fisheries agencies. Project 110 and 110a aimed to construct and deploy a minimum of 350 non-entangling and biodegradable dFADs. These experimental non-entangling and biodegradable dFADs are compared with 350 'conventional' (currently used) synthetic dFADs, deployed in the close proximity to the biodegradable dFADs. In addition to increasing the sample size of trialed non-entangling and biodegradable dFADs, Project 110a also involves additional fishing companies and fleets joining the trials, runs more training in the construction of jelly-FADs in alternative locations, and identifies additional options for biodegradable materials.

2.2 NOAA project

The project "Towards the Use of Biodegradable Fish Aggregating Devices (FADs) in the Pacific Ocean", under the framework of a National Oceanic and Atmospheric Administration Fisheries (NOAA)'s funded BREP project is being led by ISSF, in collaboration with SPC. It also aimed to construct and trial 216 non-entangling and biodegradable dFADs, but deployed more widely across the Pacific Ocean (including the IATTC area) in collaboration with the US fleet (the American Tunaboat Association "ATA", including Cape Fisheries). The project has similar objectives and methods to projects 110 and 110a and the data from both projects can be combined and compared, to increase the generality of the results. A new BREP-funded project started in 2026 and aims to continue testing jelly-FADs with the ATA fleet. A total of 182 jelly-FADs will be deployed, and their performance will be evaluated against that of conventional FADs.

3. Updates on activities of the projects

3.1 Stage 1. Information and planning workshops

In terms of activities already performed, a literature review has been undertaken on the designs and materials for non-entangling and biodegradable dFADs that have already been used globally as well as summarising previous initiatives in terms of their efficiencies, effectiveness, cost and the lessons learned (Escalle et al., 2022; Lopez et al., 2016; Moreno et al., 2020; Moreno et al., 2023; Zudaire, 2017).

Biodegradable FAD designs to be tested

Following the review (Escalle et al., 2022), and discussion with project collaborators at ISSF and fishing companies, it was decided to adopt the jelly-FAD as the primary design (Moreno et al., 2023) for this trial (Figure 1). The review, as well as early experiments with the jelly-FAD, highlighted that cotton rope (20 mm for the main rope) and cotton canvas were strong enough to last several months to a year at-sea if used in a dFAD design, such as the jelly-FAD, that drifts sub-surface in the water without structural stress and with quasi-neutral buoyancy (Moreno et al., 2019). In addition to the jelly-FAD model previously tested, which features a 3D cubic structure (Figure 1), a new cylindrical jelly-FAD design is also being trialled for the first time as part of this project (Figure 2). This cylindrical structure is significantly lighter, easier to handle and construct, and further reduces the potential impact if stranded. The materials are similar to the cubic jelly-FAD, although bamboo stripes are used instead of bamboo poles, making the structure lighter. In addition, as part of Project 110a, different materials are also considered with one fleet (China), canvas and ropes made of i) cotton (breaking strength of 3,300 kgf); ii) jute (breaking strength of 1,400 kgf) and iii) a new cellulose-based material called "Lyocell" ("Suncell"; breaking strength of 5,500 kgf).

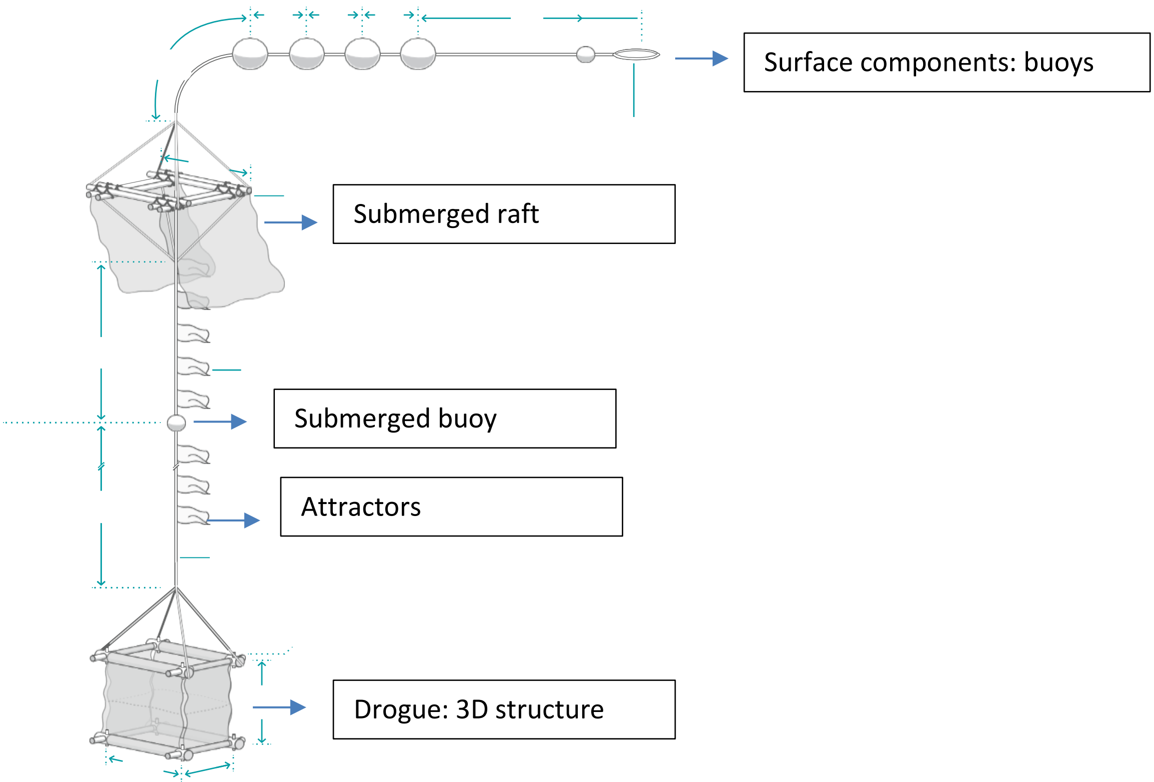

Figure 1. Scheme of the non-entangling and biodegradable FAD tested, called the "jelly-FAD".

Fleets involved in the trials

Partners involved in the non-entangling and biodegradable dFAD trials are operating in; i) the western part of the WCPO, mostly based or transshipping in Pohnpei (CFC, FCF, Silla, Koos, Zhongyu Global Seafood Corporation, Shanghai Kaichuang Deep Sea Fisheries Co, Ltd and Zhejiang Ocean Family Co, and Kaimaki), or ii) the central and eastern WCPO and the Eastern Pacific Ocean (EPO) (ATA) and based out of Pago Pago and Manta (Table 1). The initial construction locations were therefore chosen to be:

Pohnpei, Pago Pago and Manta. Additional training ports for jelly-FADs added during the project included Lae (PNG), Weihai (China), Majuro (MH) and Yaizu (JP). To note a major challenge in using Majuro as a base port for non-entangling and biodegradable dFADs is the lack of bamboo availability on the islands. For the project, bamboo has been shipped from Pohnpei.

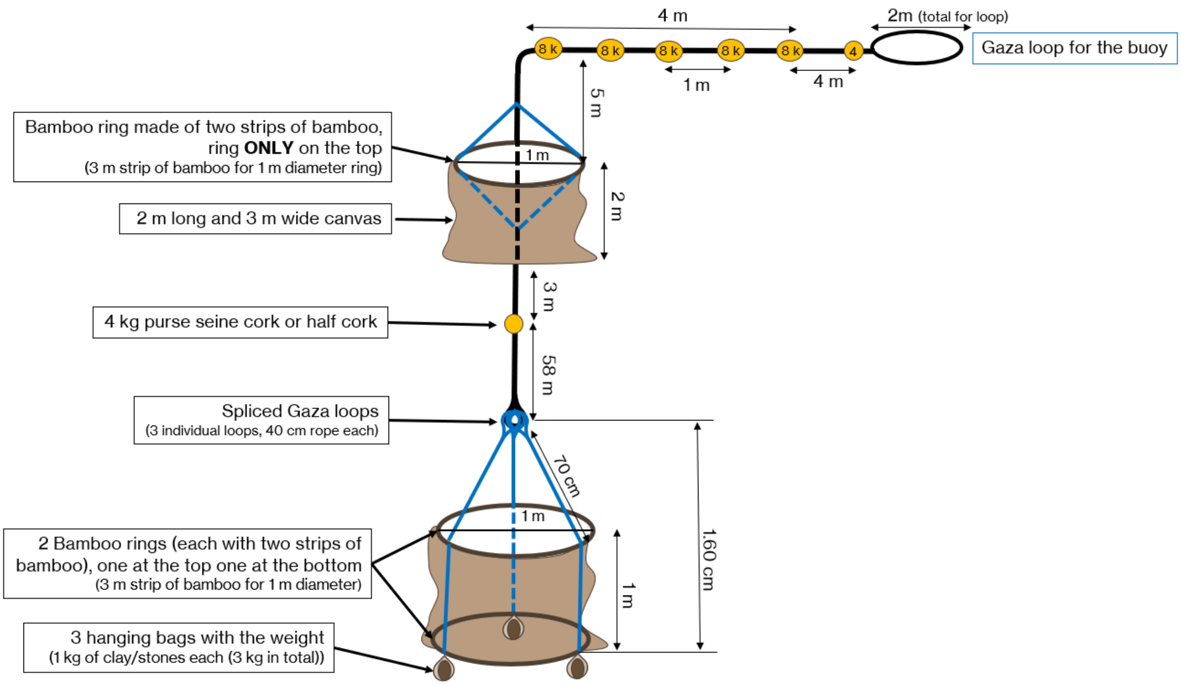

Figure 2. Scheme of the newly developed "cylinder jelly-FAD".

Table 1. Partner fishing companies in the non-entangling and biodegradable dFAD trials in the WCPO, construction location and planned number of non-entangling and biodegradable dFADs (BioFADs) to be tested.

Partners	**No. of vessels**	**Flag**	**Project**	**Construction location**	**No. of BioFADs WCPFC 110/110a**	**BREP**
Caroline Fisheries Corporation (CFC)	6	FM	WCPFC 110	Pohnpei (FM)	58	
FCF Co. ltd	8	TW	WCPFC 110	Pohnpei (FM)	50	
Silla	2	KR	WCPFC 110	Pohnpei (FM)	34	
American Tunaboat Association	16	US	WCPFC 110 & BREP	Manta (EC); Pago Pago (AS)	80	216
Fishing Industry Association (FIA)	12	PG	WCPFC 110a	Lae (PG)	60	
Koo's	2	MH	WCPFC 110a	Majuro (MH)	10	
Chinese fleet	8	CN	WCPFC 110a	Weihai (CN)	145	
KAIMAKI	2	JP	WCPFC 110a	Pohnpei (FM)	20	
TOTAL	56				457	216

Partner fishing companies are listed below:

- **CFC Fleet**: Operating 6 vessels under the flag of the Federated States of Micronesia, and all six vessels participating in the trial from this fleet planned to test 58 jelly-FADs, constructed in Pohnpei.
- **FCF Co. ltd**: With more than 20 vessels flying the Chinese Taipei flag, FCF Co, planned to test 50 jelly-FADs, all constructed in Pohnpei.
- **US Fleet**: 10 U.S. based fishing companies — including Cape Fisheries LLC, GS Fisheries, AACH Holding CO LLC, AACH Holding Company No. 2 LLC, Xuk S.A., Tumbaco Fishing Industries S.A., Pacific Princess Partnership LTD, De Silva Sea Encounter Corp, Western Pacific Fisheries, and

Tradition Mariner LLC — across 16 vessels that planned to test 296 jelly-FADs. The construction locations for these jelly-FADs are Manta and Pago Pago.

- **Silla**: Comprising 6 vessels from Korea, planned to test 34 jelly-FADs, constructed in Pohnpei.
- **Fishing Industry Association (FIA):** this fleet of 12 vessels from Papua New Guinea (PNG) planned to test 60 jelly-FADs, all constructed in Lae (PNG).
- **Koo's:** This fishing company, based in the Republic of the Marshall Islands, planned to test 10 jelly-FADs with 2 fishing vessels participating. Jelly-FADs were constructed in Majuro in May 2025.
- **Chinese fleet:** Comprising three fishing companies Zhongyu Global Seafood Corporation, Shanghai Kaichuang Deep Sea Fisheries Co., Ltd and Zhejiang Ocean Family Co., LTD with 18 vessels (8 vessels participating); with the support of Shanghai Ocean University planned to test 145 jelly-FADs. This fleet will exclusively test the newly developed cylinder jelly-FADs (Figure 2), with canvas and ropes made of cellulose (Lyocell "Suncell"; 30%) or cotton (70%) (Figure 3). All jelly-FADs has been constructed in Weihai (China).
- **Kaimaki:** the Japanese Far Seas Purse Seine Fishing Association planned to test 20 jelly-FADs (a mix of cubic and cylinder jelly-FADs) constructed in Pohnpei, with an in-person training workshop carried out in Yaizu (JP).

In total, the projects involve 56 vessels testing 673 jelly-FADs across different countries and fleets. However, the fishing companies participating in the project manage a total of around 90 vessels. The knowledge and insights gained from these trials will be disseminated across all the vessels managed by the participating companies, thus enhancing the overall understanding and implementation of bio-FADs in general and the jelly-FAD design in particular.

The communication and engagement strategy, including materials developed as part of the project are described in Appendix 1.

3.2 Stage 2: Construction of non-entangling and biodegradable dFADs and capacity building

Materials, cost and construction guidelines for non-entangling and biodegradable jelly-FADs are listed in Appendix 1 and are detailed in Escalle et al. (2023b). In addition, the ISSF has developed a construction guide (ISSF 2024) that is available via this link: https://www.iss-foundation.org/about-issf/what-we-publish/issf-documents/jelly-fad-construction-guide/. A similar construction guide is under development for the cylindrical jelly-FAD, with the construction guidelines, using the specifications for the construction of the jelly-FADs for the Chinese fleet, are available in (Escalle et al., 2025).

Construction and training workshops have been held in Zadar (Croatia; where many of the captains from the CFC fleet operating in Micronesia are based), Pohnpei (FM), Pago Pago (AS), Manta (EC), Lae (PNG), Weihai (CN), Majuro (MH), and Yaizu (JP) with more than 145 people attending from fisheries departments, purse seine companies, crew, staff in companies building FADs, scientists and material suppliers (Table 2). Supply of materials have been identified in Spain, Chinese Taipei and China.

Table 2. Location and dates of jelly-FADs Construction and training workshops as part of the projects.

	Dates	Number of participants
Zadar (Croatia)	June 2022	4 participants
Manta (EC)	July 2022 and remote	20 participants
Pohnpei (FM)	December 2022	20 participants

Pago Pago (AS)	May 2023	15 participants
Lae (PG)	July 2024	29 participants
Weihai (CN)	March 2025	30 participants
Majuro (MH)	May 2025	8 participants
Yaizu (JP)	October 2025	18 participants

Figure 3. Photos from the jelly-FAD construction workshop held in Yaizu (Japan) in October 2026, which included training on the cube jelly-FADs and the newly developed cylinder jelly-FAD.

3.3 Stage 3: Conduct at sea trials and broader industry communications program

Table 3 compares the jelly-FADs and conventional dFADs deployed by different fleets, including the US fleet and other international fleets. The data includes the number of dFADs deployed, deployment periods, number of sets, visits without sets, deactivations of buoys used to track dFADs, and stranding events.

- **Number of deployments**: The US fleet deployed 208 jelly-FADs and 183 conventional dFADs, while other fleets (FM, TW, KR and PNG only so far) deployed a total of 247 jelly-FADs and 157 conventional FADs (Figure 4). This corresponds to a total of 455 jelly-FAD deployments, 67%

of the 673 dFAD constructed, and 80% of the 566 minimum dFAD planned under project 110, 110a and BREP. Noting that the FM, US and Chinese fleets are still planning 8 and 45 deployments, respectively, in the next few months. Some other fleets have not deployed all their dFADs, and are not responding to SPC requests for updates, with 20 dFADs that were still to be deployed for KR, 3 for TW, 46 for PNG and 8 for MH (6 to 80% of the number of dFAD constructed).
It is also worth noting that while it was required to systematically deploy a jelly-FAD in the vicinity of a conventional dFAD, only 75% of the jelly-FADs were deployed with a conventional dFAD in close proximity, with high variability from 7% to 100% depending on the fleet.

- **Sets and visits**: The US fleet recorded more sets with conventional dFADs (58; corresponding to 31.7% of the deployed conventional dFADs) compared to jelly-FADs (15; corresponding to 7.2% of the deployed jelly-FADs). The Chinese fleet recorded 25 sets on jelly-FADs and 4 on conventional dFADs. Other fleets recorded 6 sets with jelly-FADs and one with conventional FADs. Additionally, there were visits without sets recorded for jelly-FADs in the CN (8), FM (3), PNG (1) and US (1) fleets.
- **Buoy deactivation**: There were more buoy deactivations for jelly-FADs (91) compared to conventional FADs (51), corresponding to 20% and 15% of the jelly-FADs and conventional FADs deployed, respectively.
- **Stranding events**: 7 stranding events were detected by the fleets for jelly-FADs in the TW, KR, US and PNG fleet but none for conventional FADs. Note that this corresponded only to what is detected and communicated by the fleet, more stranding may have occurred and will be further examined in the future using buoy trajectory data.

Table 3. Summary of deployments and activities performed on the non-entangling and biodegradable jelly-FADs and conventional dFADs from the project as of 30th of June 2026. FM = Federated States of Micronesia; KR = Republic of Korea; TW= Taiwan; PNG = Papua New Guinea; MH = Marshall Islands; CN = China; JP = Japan.

	FM		KR		TW		US fleet	
	Jelly	Conv.	Jelly	Conv.	Jelly	Conv.	Jelly	Conv.
Convention Area	WCPFC		WCPFC		WCPFC		WCPFC & IATTC	
Nb FADs to be tested	58	58	34	34	50	50	296	296
Deployments	50	27	14	14	47	30	208	183
Deployment period	04/23 – 04/24 06/26 – 08/26		04/24 – 01/25		03/23 – 07/23		09/22 – ongoing	
Sets	1	0	0	0	4	0	15	58
Visit (without set)	3	0	0	0	0	0	1	0
Buoy deactivation	0	0	13	5	23	11	33	26
Stranding events	0	0	1	0	3	0	1	0

	PNG		MH		CN		JP	
	Jelly	Conv.	Jelly	Conv.	Jelly	Conv.	Jelly	Conv.
Convention Area	WCPFC		WCPFC		WCPFC		WCPFC	
Nb FADs to be tested	60	60	10	10	145	145	20	20
Deployments	14	1	2	2	100	63	20	20
Deployment period	08/24 – 08/25		11/25–ongoing		09/25–ongoing		10/25 – 03/26	
Sets	0	0	0	0	25	4	1	2
Visit (without set)	1	0	0	0	6	8	0	0
Buoy deactivation	8	0	0	0	9	6	5	3
Stranding events	2	0	0	0	0	0	0	0

Figure 4. Deployments of jelly-FADs at sea in the WCPO. Photos from FCF and CFC.

Table 3 underscores the challenge of obtaining data on experimental dFADs, both for jelly-FADs and their conventional counterparts. Out of a total of 455 jelly-FAD deployed, 57 were visited or fished, representing 12.5%. Similarly, out of 340 paired conventional dFAD deployed, 72 were visited or fished, accounting for 21.2% of the total deployments. These percentages are consistent with other bio-FAD experiments, where approximately 5-10% of deployed dFADs were ever visited by the deploying fleets alone. This emphasizes the significance of deploying a large number of dFADs for these industry trials, or alternatively, systematically deploying a percentage of bio-FADs to yield meaningful insights into their performance. It also highlights that many dFADs, of any construction type, are never fished on, or even visited, by the deploying company vessels.

The successes and challenges of industry partners participating in these trials are highlighted below per fleet:

- **CFC Fleet**: this fleet planned to test 58 jelly-FADs. Most jelly-FADs, of the cubic design, were deployed in 2023–2024. While 8 cylinder jelly-FADs were constructed in May 2026 and are expected to be deployed soon. Only half the jelly-FADs were also deployed with a conventional FAD, limiting the comparative analyses. Very few sets and visits were carried out on any experimental dFADs.
- **FCF Co. ltd**: this fleet deployed 47 cubic style jelly-FADs (50 planned), with again only a portion of the jelly-FADs deployed with a conventional dFAD (Table 3).
- **US Fleet**: 208 cubic jelly-FADs have been deployed, most of them (88%) with a paired conventional dFAD. The jelly-FADs were constructed in both Manta (Ecuador) and Pago Pago (American Samoa), and hence it was sometimes challenging for the fleets to plan where they might be able to pick up the jelly-FADs. Some more deployments should occur in the next few months.
- **Silla**: only 14 of the 34 cubic jelly-FADs have been deployed, but all have been deployed with a conventional dFAD. The lack of updates/responses to queries from the fleet over the last year probably indicates that the remaining dFADs will not be deployed and may have been destroyed.
- **Fishing Industry Association (FIA):** only 14 of the 60 cubic jelly-FADs have been deployed, mostly without a paired conventional dFAD. Very few updates have been provided by this fleet, but recently it was indicated that the remaining dFADs have not been deployed and were now damaged due to poor storage and therefore are unlikely to be deployed.

- **Koo's:** only 2 of the 10 jelly-FADs have been deployed. Two have been destroyed before deployment, while 6 are still portside in Majuro.
- **Chinese fleet:** the fleet has deployed 100 jelly-FADs, with the other ones planned to be deployed in the next few months.
- **Kaimaki:** this fleet deployed the 20 jelly-FADs constructed, no specific challenge to mention.

The spatial distribution of deployments, sets and trajectories of jelly-FADs and their conventional counterparts are depicted in Figure 5. In the EPO, both types of dFADs were deployed within the same area. It is a common practice to deploy dFADs off Ecuador at around 0° latitude and fish on these within the region spanning from 10°S to 10°N (Lopez et al., 2023). Once dFADs drift beyond these latitudes, typically further north than 10°N or south than 10°S, they are deactivated. During the trials, the fleet has, to date, followed deployment practices for experimental dFADs that closely mirror those used in their standard fishing activities.

For the WCPO, we observed deployments along the equator in the central part of the WCPO, as well as along the boundary with the EPO, known as a hotspot of dFAD deployments (Escalle et al., 2023). The spatial distribution of the jelly-FADs and conventional dFADs is broad, covering the whole WCPO (Figure 5).

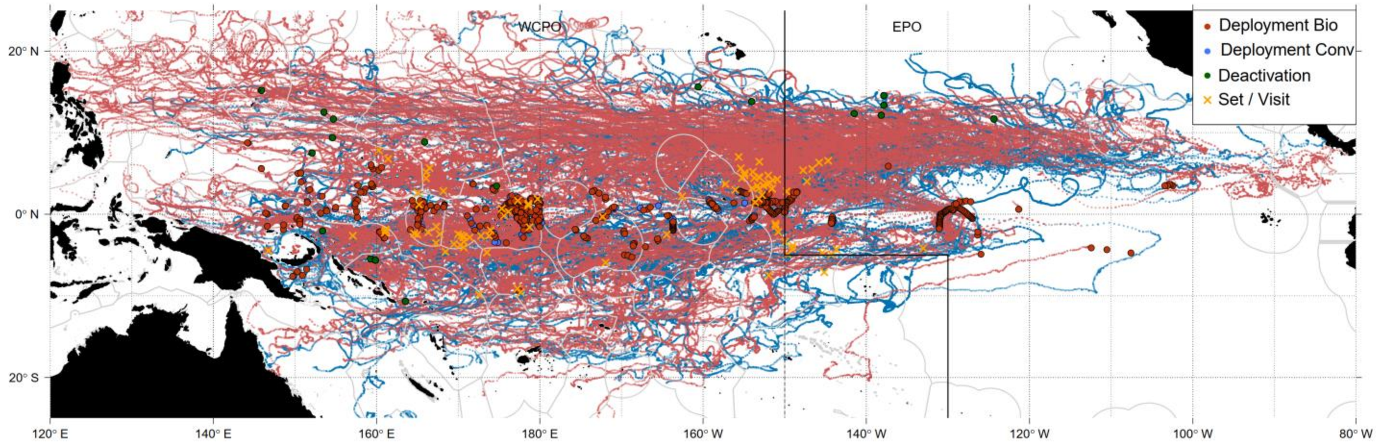

Figure 5. Trajectories, deployments, deactivations, fishing sets and visits of drifting biodegradable (red) and conventional (blue) dFADs in the trial.

3.4 Stage 4: Data analysis and reporting

3.4.1 Duration at-sea

The duration at sea is tracked through two primary methods: (1) direct observations recorded by fishers in standardized forms during visits to, and sets made on, the experimental dFADs, including both jelly-FADs and their paired conventional FADs; and (2) indirect monitoring using data transmitted by the satellite buoy attached to each dFAD.

The visits made by fishers involve filling out forms detailing the state of the dFAD, any catches, and other relevant information. This method offers direct insights into the condition and activity on the dFAD while at sea.

On the other hand, the buoy tracking system provides data on biomass and other parameters indirectly related to the duration of the dFAD's deployment, as well as dFAD drift speed and trajectories. Although the dFAD itself is not monitored in real-time, the echosounder data from the buoy serves as an indicator of the presence and amount of fish around the dFAD, thus providing valuable information about its effectiveness. In addition, fishers typically continue to monitor dFADs that are deemed active and productive, while deactivating those that are no longer deemed useful for fishing operations. Thus, active dFADs, or transmissions from the buoy are an indicator of the useful lifespan of dFADs for fishing operations.

The average number of buoy transmissions before a buoy is no longer monitored is very similar between non-entangling and biodegradable dFADs and conventional dFADs and varies from 3 to 6,200 transmissions, with an average of 631 and 678, respectively (Table 4).

Table 4. Summary of deployments, number of transmissions and duration at-sea for the non-entangling and biodegradable jelly-FADs and conventional FADs at time of last data extracts (from 02/03/2023 to 01/05/2026).

	Jelly-FADs	Conventional
Deployments	455	340
Data available	393*	294*
Transmissions (positions or biomass)		
Min	3	5
Mean	631	678
Max	4,958	6,200
Duration (days)		
Min	0	0
Mean	251	230
Max	969	983

* Missing data correspond to jelly-FADs equipped with satellite buoys from manufacturers other than Satlink, as well as data that had not yet been received at the time of analysis.

Interestingly, the monitoring duration for jelly-FADs compared to their conventional counterparts is quite similar, with averages of 251 and 230 days, respectively (Table 4 and Figure 6). Additionally, the graph in Figure 6 depicts how only 50% of both jelly and conventional dFADs are monitored after around 200 days at sea. The percentage of conventional dFADs' monitored drops below 25% after 1 year, while bio-FADs continued to be monitored for a longer duration (below 25% after 1.5 years; Figure 6).

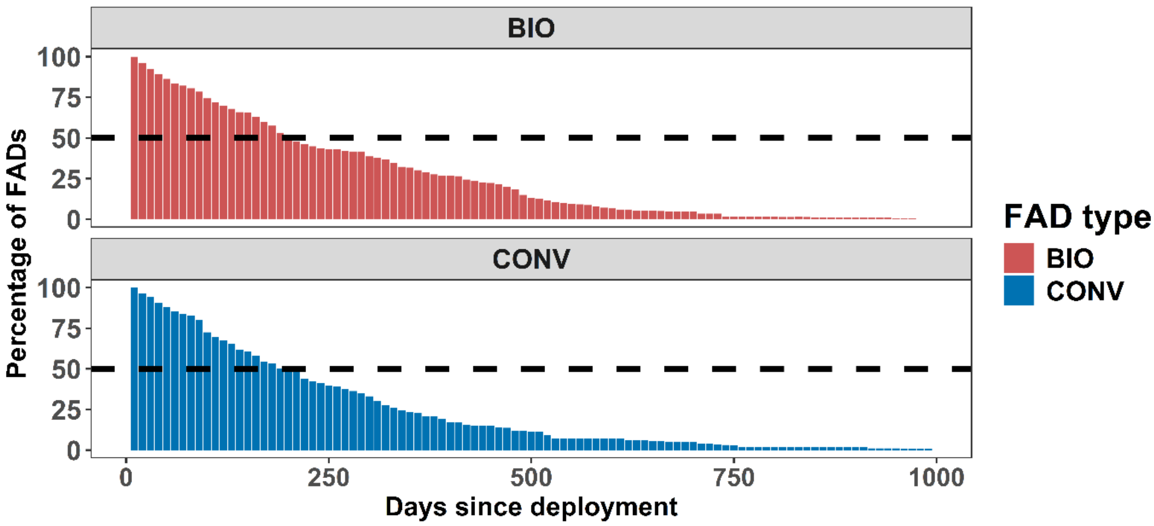

Figure 6. Days of dFAD monitoring from deployment to the end of signal transmission (based on satellite and echosounder buoys) of biodegradable and conventional dFADs of the trial.

DFAD pairs, which are deployed together, may remain within the same water masses throughout their entire lifespan, stay together for a limited period and then separate, or separate immediately after deployment (Figure 7). Only those that drifted in the same water mass have been compared directly for performance (i.e., the top 2 examples from Figure 7). DFAD pairs typically remain relatively close for the first month, but can be found very far from each other after six months and more (Figure 8).

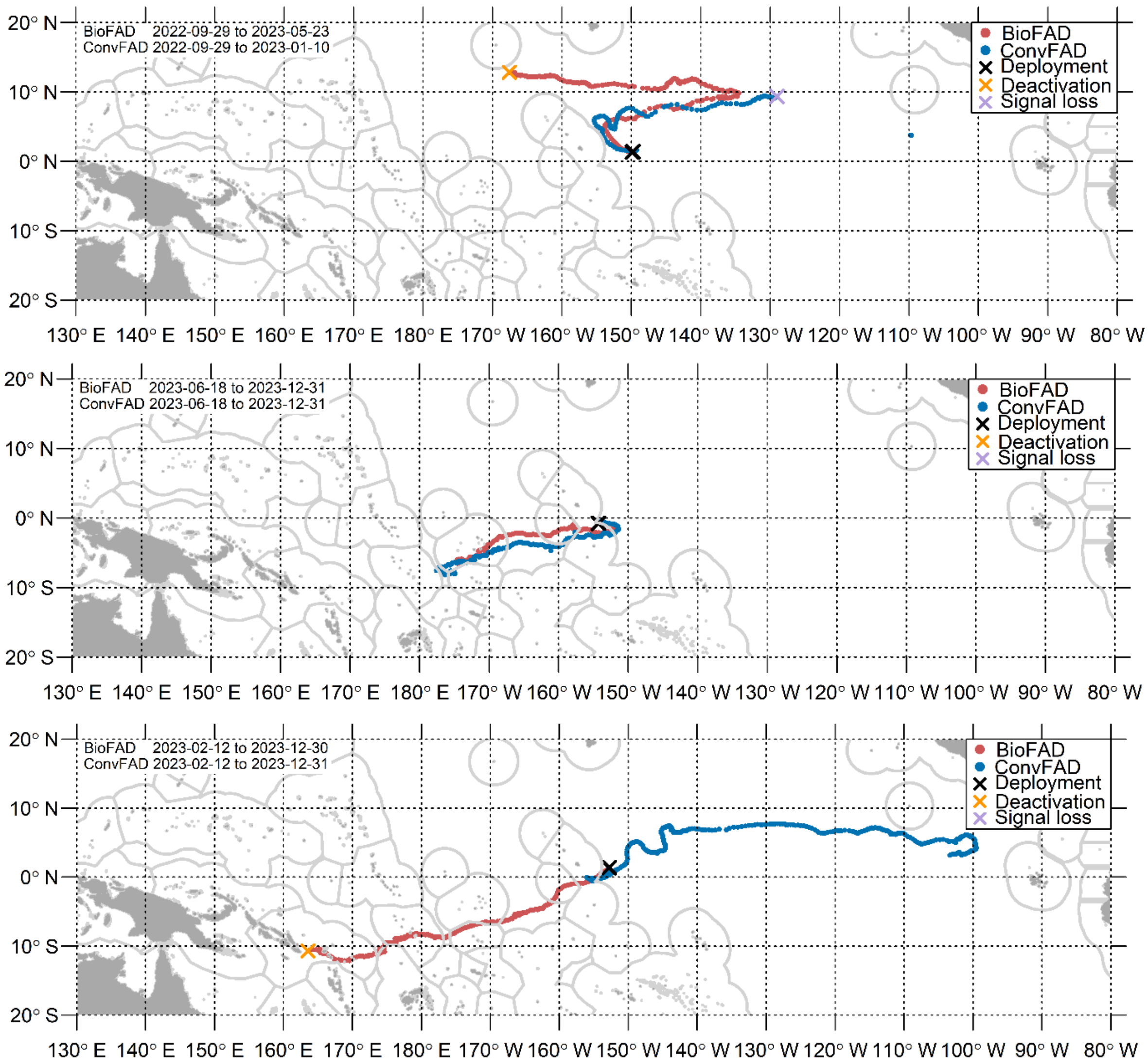

Figure 7. Example drift trajectories (based on satellite and echosounder buoys) of paired releases of biodegradable and conventional FADs in the trial. Top: dFAD pairs that drifted together for a period before separating; middle: dFAD pairs that remained together throughout the monitored period; bottom: dFAD pairs that never drifted together.

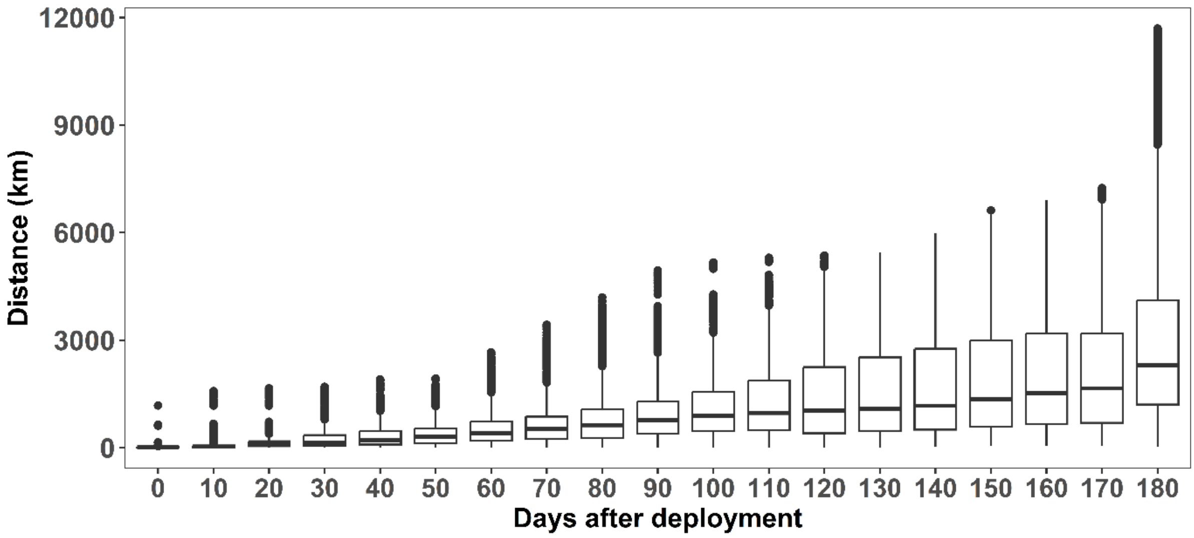

Figure 8. Distances between released pairs of biodegradable and conventional dFADs at time periods from 0 to ≥180 days post-deployment (180 days includes all data ≥180 days).

3.4.2 Speed

From the fishers' perspective, a low drift speed is a key characteristic of a productive dFAD. Slower-drifting dFADs are more likely to remain within productive fishing grounds for longer periods, thereby increasing the time available for fish aggregation and reducing the risk of early loss or abandonment as a result of rapid displacement outside the fishing area. Accordingly, the drift speed of conventional dFADs was compared with that of jelly-FADs to determine whether the two designs differed significantly in this important performance metric (Figure 9 and Table 5). Speed of conventional dFADs and jelly-FADs that drifted under the same oceanographic and weather conditions indicated that there was no significant difference in the drift speed of the jelly-FAD and the conventional dFAD.

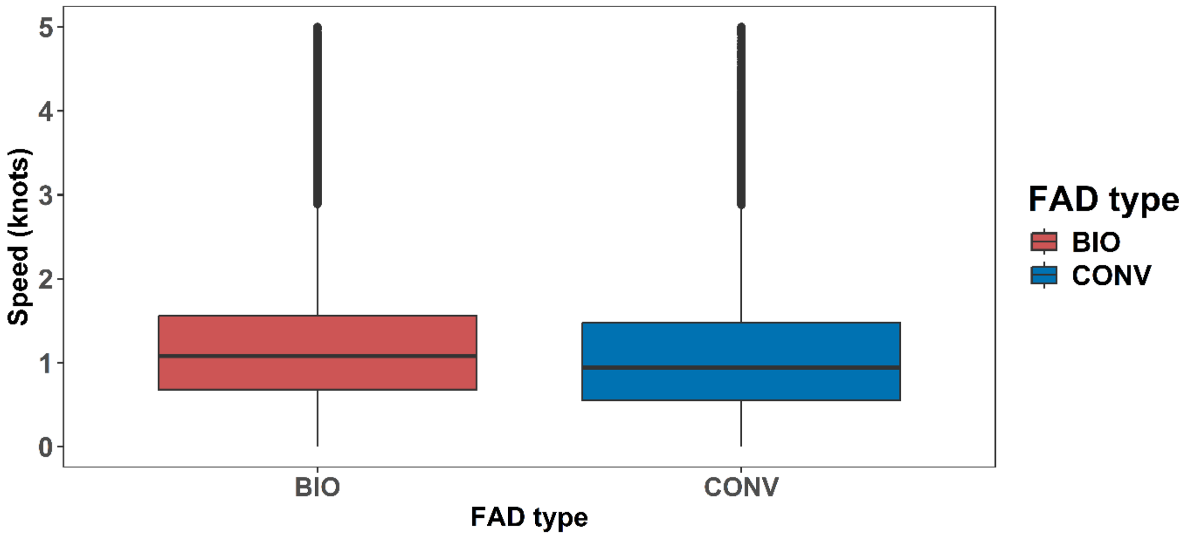

Figure 9. Speed of drifting at-sea for jelly FADS and conventional dFADs in the trial.

Table 5. Summary of drift speed values (knots) of the jelly-FADs and conventional dFADs.

	Jelly-FADs	Conventional
Min	0.0	0.0
Mean	1.14	1.14
Max	4.9	4.9

3.4.3 Aggregation patterns

Tuna aggregation patterns were studied using biomass data from the echosounder buoys attached to the dFADs (Figure 10). The 90th percentile of the biomass estimated by the echosounder buoys was used for this analysis and only the pairs of conventional dFADs and jelly-FADs that drifted under the same oceanographic and weather conditions were considered (239 pairs included). Both types of dFADs (jelly-FADs and conventional dFADs) showed similar aggregation patterns from deployment until 100 days of drifting. Maximum tuna biomass was detected from around 2 months at-sea for both types of dFADs.

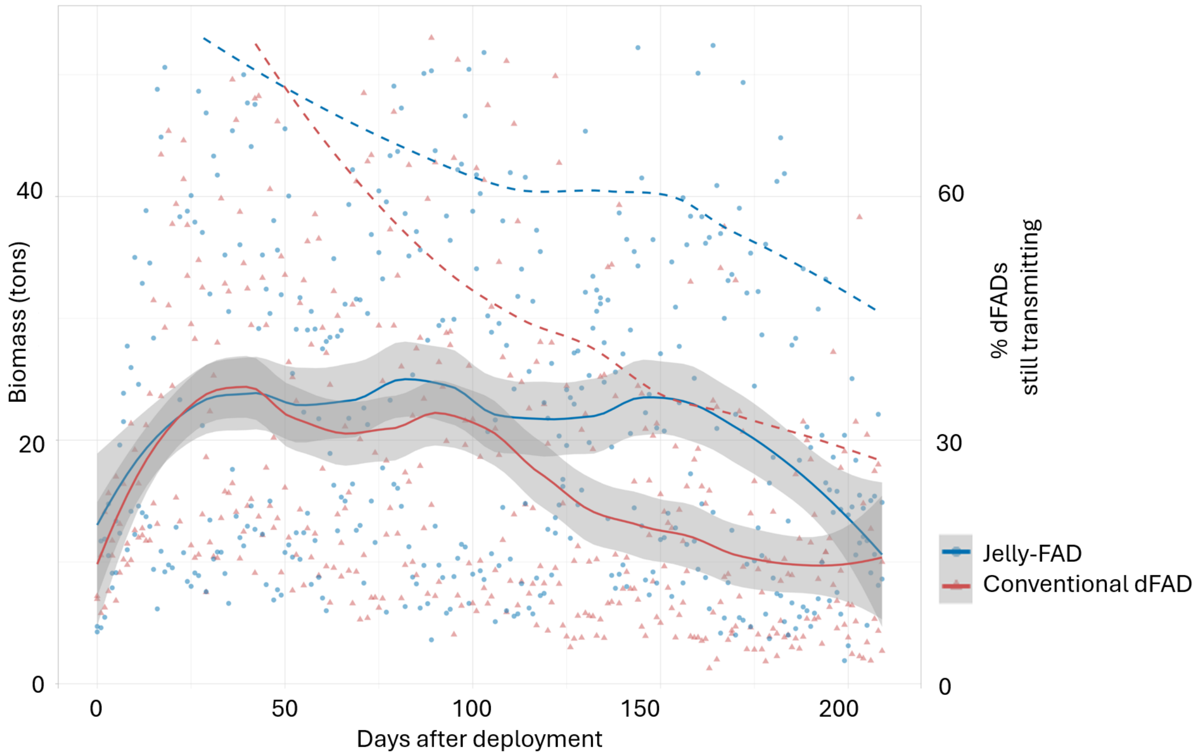

Figure 10. Biomass aggregation over time after deployment compared between pairs of biodegradable jelly-FADs and conventional FADs. The dashed line indicates the % of FADs still transmitting data after certain number of days after deployments (from 100% at time of deployment).

3.4.4 Catch

A total of 46 sets were performed on the jelly-FADs, with total catch ranging from 0 to 185 tons (t), and an average catch per set of 34.8 t (Table 6). More sets were made on the paired conventional FADs, with 64 sets recorded, and catch ranging from 5 to 260 t at an average catch per set of 68.2 t. This is higher than the median catch made on dFADs in the WCPO in the 2023–2025 period of 30 to 35.0 t per year. Overall, the catch made on the jelly-FADs from the trial is similar to the WCPO 2023 to 2025 median dFAD sets but lower than the catch on the paired conventional FADs. It is significantly higher than the median on the WCPO free school sets of 10 t. While the limited number of sets so far limits the robustness of the comparisons, the results do not indicate that the jelly FADs perform very differently to conventional dFADs. One potential source of bias in FAD visit patterns is that fishers tend to a priori trust conventional FADs more than experimental ones, leading them to prioritize, monitor, and visit conventional FADs more frequently than bio-FADs (Moreno et al., 2025b).

Table 6. Summary information on catches from sets made on the jelly-FADs and conventional dFADs from the project and average catch per set for the whole fleet in the WCPO in 2023, 2024 and 2025.

FAD type	Number of sets	Total tuna catches (mt)			
		Min	Mean	Median	Max
Jelly-FAD	46	0	34.8	25.5	185
Conventional	64	5	68.2	43.5	260
2023 WCPO dFADs	15050		47.5	30.0	
2024 WCPO dFADs	11178		54.9	35.0	
2025 WCPO dFADs	16796		43.9	30.0	

Table 6 shows that the performance of the jelly-FAD, in terms of metric tons per set, is close to the median for the entire WCPO fleet in 2023 to 2025. There is no scientific evidence suggesting that a particular dFAD design is more or less capable of aggregating fish (Moreno et al., 2023). Both fishers and scientists agree that tuna presence in the area and oceanographic conditions are likely the major factors influencing tuna aggregation around any given dFAD, irrespective of design features.

In Figure 11 it is noteworthy that both jelly-FADs and conventional dFADs can be fished at any time within the first 6 months. This timing is highly dependent on the strategy of the fleet, in terms of proximity to a given dFAD and also on the time needed for the dFAD to aggregate fish. This probably depends on the presence of tuna in the water masses it crosses. Although the data is insufficient to draw significant conclusions, an interesting observation is that neither type of dFAD was fished after six months at sea. This may present a threshold/minimum time period for which biodegradable FADs would need to remain intact to meet industry requirements.

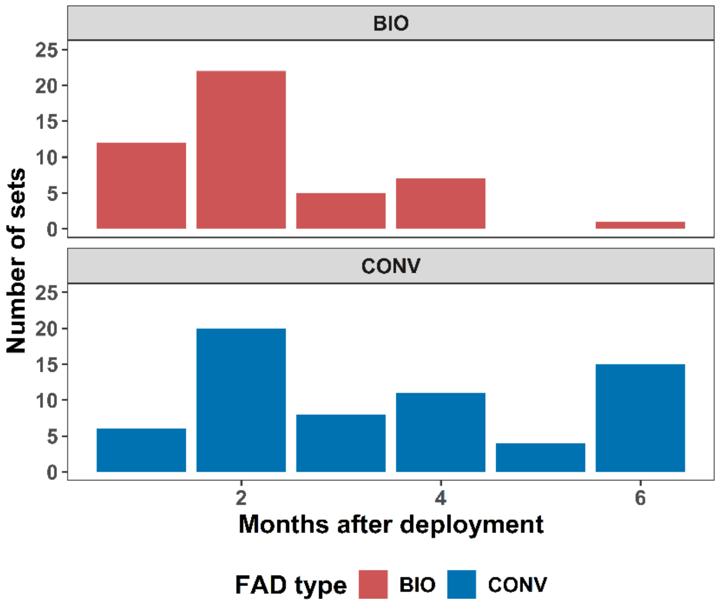

Figure 11. Soaking time for the jelly FADs and conventional dFADs fished.

3.4.5 Degradation of materials

A total of 52 jelly-FADs were visited with condition recorded (12.5% of all jelly-FADs deployed). All components remained mostly in good condition over a time period from 1 to 4 months (Figure 12). One jelly-FAD was visited after 6 months and the main rope used to sustain the non-entangling and biodegradable dFAD structure, remained in good condition. The submerged raft and the attractors needed repair or were missing after 6 months at sea. For the cube, the single observation after six months showed that the cube was destroyed. More data is needed to draw significant conclusions and account for the diverse stressors that dFADs suffer over their lifespan at sea.

Figure 12. DFAD state with time at sea of the different components of the 52 jelly-FADs visited with condition recorded. Number at the top of each bar corresponds to the number of dFADs visited that month. Some jelly-FADs did not present any attractors, corresponding to a condition recorded as "NA".

4. Summary, conclusion and next steps

This report presents a summary of findings from WCPFC project 110 and 110a: Non-entangling and Biodegradable FAD Trial in the Western and Central Pacific Ocean, led by SPC and with the support of ISSF and the BREP project led by ISSF. In 2024, the second phase of the project, WCPFC Project 110a, started, with additional fleets joining from PNG, CN, MH and JP; and jelly-FAD construction training workshops in Lae (PNG), Weihai (China), Majuro (MH) and Yaizu (JP). In addition, a new design of jelly-FAD, the cylinder jelly-FAD, which is lighter, easier to handle and construct, and further reduces the potential impact when stranded has been constructed and tested.

In total, eight fleets, representing more than 56 vessels, are engaged as project partners: the American Tunaboat Association (ATA, USA), FCF CO. Ltd (Chinese Taipei), Silla (Korea), Caroline Fisheries Corporation (CFC, Federated States of Micronesia), Fishing Industry Association (FIA, Papua New Guinea), Koo's (Marshall Islands), China and KAIMAKI (Japan). While this covers most of the main fishing fleets in the WCPO, it is important to note that the degree of engagement and commitment to the requirement of a scientific trial varied between the fleets. While the number of jelly-FADs to be tested and the construction location was decided by each partner fishing fleets, some jelly-FADs were never deployed (33% of the jelly-FADs constructed have not been deployed yet, with ~15-20% likely damaged and never to be deployed). In addition, to gather robust scientific data to compare the performance of the non-entangling and biodegradable dFADs to conventional dFADs, both should have been deployed at the same time. This was discussed with the fleets before the start of the partnership and mentioned in training workshop. Unfortunately, only 75% of the jelly-FADs were deployed with a paired conventional dFAD. Finally, not all dFADs have the same brand of satellite buoy, each of them having a unique echosounder algorithm and depth of biomass estimation. This further limited the possibility to analyse echosounder data from all dFADs of the project. While the project could not have occurred without the industry involvement and support, we will need follow-up to understand the difficulties that led to some industry partners not deploying the total bio- and conventional dFADs as planned.

Eight planning and training workshops have been held, including six in construction locations: Pohnpei (Federated States of Micronesia), Manta (Ecuador), Pago Pago (American Samoa), Lae (Papua New Guinea), Weihai (China) and Majuro (Republic of the Marhsall Islands). The training focused on the prototype of non-entangling and biodegradable dFAD tested – the jelly-FAD developed by ISSF and the Insitute de Ciències del Mar in Barcelona, AZTI (Spain) (Moreno et al., 2023). Some later trainings under the project 110a included the newly developed cylindrical jelly-FAD, a lighter biodegradable design intended to further reduce environmental impacts and construction costs. Materials used are mostly bamboos, cotton canvas and cotton ropes, except for the 145 jelly-FADs tested by the Chinese fleet, of which 30% were construced using bamboo and a new cellulose-based material (Lyocell) for the ropes and canvas.

To date, 673 jelly-FADs have been constructed and 455 deployed as part of Projects 110 and 110a led by SPC and ISSF led BREP project. The costs associated with materials and construction of the jelly-FADs, as part of this trial, were 500–550 USD / jelly-FAD (including labour, materials, shipyard cost) or 350–362 USD / jelly-FAD if only materials and their shipment are considered.

The main conclusions regarding the monitoring of the jelly-FADs tested by fleets in the Pacific Ocean in this report are similar to the ones presented at previous SC:

- It is important to deploy a large number of non-entangling and biodegradable dFADs to get meaningful results, or regularly deploy systematically a given number of dFADs made of biodegradable materials.
- The drift speed of the conventional and jelly-FADs is similar.
- Jelly-FADs were monitored by fishers for the same duration or longer than the conventional dFADs, being an indicator of the usefulness and durability of the dFADs at sea.
- Similar aggregation patterns are detected using biomass data from echosounder buoys attached to dFADs, with a peak at 2 months after deployment.
- Conventional dFADs showed a higher catch per set (median of 43.5 t) compared to jelly-FADs (25.5 t t) however the median catch per set on the jelly-FADs for this trial were similar to that of the whole WCPO fleet (30.0 to 35.0 t).
- Jelly-FAD condition for the monitored periods so far, shows that the jelly-FAD can remain useful for at least 6 months with the main cotton rope supporting the structure, intact, there were no observations after that time, both, for conventional and jelly-FADs. Six months may be a threshold/minimum period of durability at sea for bioFADs to meet industry needs.
- The non-entangling and biodegradable dFAD trials carried out since 2022 highlight that:
    - i) supplier of biodegradable materials are available in the Pacific region;
    - ii) the performance of non-entangling and biodegradable dFAD in terms of speed, tuna aggregation and catch are similar to conventional dFADs;
    - iii) most fleets have been engaged, but the requirement to follow scientific trials are not always followed.

Results from Projects 110 and 110a will be critical to supporting and preparing industry for transition to non-entangling and biodegradable dFADs and for the WCPFC to consider Conservation and Management Measures related to the use of dFADs in the WCPO, in particular the adoption of a staged transition towards fully non-entangling and biodegradable dFAD.

To continue supporting the industry and to move towards a more sustainable dFAD fishery, we recommend that:

- The industry continues to work with biodegradable materials, identify suppliers, shipment routes, companies to build non-entangling and biodegradable dFADs, and test designs and materials adapted to their fishing practices. These efforts build on the lessons learned from the present projects and from comparable trials conducted in other oceans (Escalle et al., 2025; Moreno et al., 2026, 2025a; Zudaire, 2017; Zudaire et al., 2023).
- SPC could continue to support this transition, through advice, training and learning workshops, as well as scientific analyses of the performance of dFADs constructed and deployed by fishing companies. Further information and the Term of Reference for a project are included in WCPFC-SC22-EB-IP06 (Escalle et al., 2026).
- Materials to replace netting historically used to covered dFAD raft and create volume in submerged appendages, should be a priority biodegradable material, as plastic sheeting, tarp and farming shading materials that have replaced netting in recent years could easily break into micro-plastics, get entangle on reefs and are very difficult to remove.
- Ways to monitor biodegradable materials and designs should be considered, in view of the staged transition being proposed by the FAD IMO-WG, as i) some clarification on definitions or international standards and certification might be needed; ii) biodegradable materials might be difficult to recognize for observers, especially after some time at sea. Further information and the Term of Reference for a project are included in WCPFC-SC22-EB-IP06 (Escalle et al., 2026).

We invite WCPFC-SC22 to:

- Note that 673 jelly-FADs have been constructed, including 457 as part of WCPFC Projects 110 and 110a; and that 455 jelly-FADs have been deployed under the WCPFC and BREP project collaboration.
- Note that the drift speed, monitoring period and aggregation patterns of conventional dFADs and jelly-FADs were similar.
- Note that 46 fishing sets have been performed on jelly-FADs in this trial so far, representing 10.1% of the jelly-FADs deployed, with an average tuna catch of 34.8 t per set. The median catch per set on the jelly-FADs for this trial were similar to that of the traditional dFADs across the whole fleet over the same period (i.e., 34.8 vs 30–35.0 t per set, respectively).
- Note that results of WCPFC project 110 and 110a indicate feasibility and availability of biodegradable materials for a transition to the use of non-entangling and biodegradable dFADs in the Western and Central Pacific Ocean.
- Recommend that a framework to monitor the transition to biodegradable materials and designs should be considered, in view of the step-wise adoption proposed by the FAD IMO-WG to be adopted in 2026.

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Declaration of generative AI and AI-assisted technologies in the SC paper preparation process

No AI technologies were used in the preparation of this paper.

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Appendix 1. List of communication and awareness materials developed during projects 110 and 110a.

Type of communication material	Title of document and link
SC paper and presentation	Progress Report of Project 110 and 110a: Non-entangling and Biodegradable FAD Trial in the Western and Central Pacific Ocean WCPFC-SC21-2025/EB-WP-03 https://meetings.wcpfc.int/node/26626
SC paper and presentation	Progress Report of Project 110: Non-entangling and Biodegradable FAD Trial in the Western and Central Pacific Ocean WCPFC-SC20-2024/EB-WP-03 https://meetings.wcpfc.int/node/23001
SC paper and presentation	Progress report of Project 110: Non-entangling and biodegradable FAD trial in the Western and Central Pacific Ocean WCPFC-SC19-2023/EB-WP-02 https://meetings.wcpfc.int/node/19392
SC paper and presentation	Report of Project 110: Non-entangling and biodegradable FAD trial in the Western and Central Pacific Ocean WCPFC-SC18-2022/EB-IP-01 https://meetings.wcpfc.int/node/16323
SC paper and presentation	Report of Project 110: Non-entangling and biodegradable FAD trial in the Western and Central Pacific Ocean WCPFC-SC17-2021/EB-IP-03 https://meetings.wcpfc.int/node/12602
IATTC FAD WG paper and presentation	Transitioning to Bio-FADs: Ongoing Trials with Jelly-FADs by fleets in the western and eastern Pacific Ocean IATTC-FAD-09-RD https://www.iattc.org/GetAttachment/0d50aa68-b5b6-4c2f-9808-f2f3beaf5499/FAD-09-RD-A_Transitioning-to-Bio-FADs-Ongoing-Trials-with-Jelly-FADs-by-fleets-in-the-western-and-eastern-Pacific-Ocean.pdf
IATTC FAD WG paper and presentation	Transitioning to Bio-FADs: Ongoing Trials with Jelly-FADs by fleets in the western and eastern Pacific Ocean IATTC-FAD-08-MISC https://www.iattc.org/GetAttachment/1aa357b3-dbd2-4bc8-a272-24d7756964bc/FAD-08-MISC_Transitioning-to-Bio-FADs-Ongoing-Trials-with-Jelly-FADs-by-fleets-in-the-WPO-and-EPO.pdf
Video	Non-entangling and biodegradable FAD training workshop video https://www.youtube.com/watch?v=Y3bPaT2tZsM
Video	Jelly-FAD construction training video https://www.youtube.com/watch?v=I7z-CRMCks8
Construction guide (ISSF document)	Jelly-FAD construction guide https://www.iss-foundation.org/about-issf/what-we-publish/issf-documents/jelly-fad-construction-guide/.
Fisheries newsletter article	New biodegradable FADs developed for the Pacific Islands region: A step towards more sustainable tuna fisheries. SPC Fish. Newsl. 170 https://fame.spc.int/node/780
Story on SPC website	Jelly-FAD trial in the Pacific: A step towards sustainable fisheries https://www.spc.int/updates/blog/interactive-story/2023/04/jelly-fad-trial-in-the-pacific-a-step-towards-sustainable