

STATE OF KNOWLEDGE REPORT

Drifting Fish Aggregating Devices in the Galapagos Marine Reserve

AUGUST 2026

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Special thanks are extended to TUNACONS and its *Caring for Galápagos* initiative (*Cuidando Galápagos*) for its openness to dialogue and willingness to collaborate in the search for joint solutions to this shared challenge. We also extend our deepest appreciation to the artisanal fishers, naturalist guides, and other regular users of the Galápagos Marine Reserve, who generously shared their time, experience, and observations through surveys and interviews. Without their invaluable contributions, this report would not have been possible.

Finally, we thank the Galápagos National Park Directorate (GNPD) park rangers for their sustained efforts in monitoring and recovering abandoned, lost, or discarded fishing gear (ALDFG) in the field, as well as the technical teams from the GNPD's Environmental Management, Ecosystems, Public Use, and Legal Advisory Directorates for their active participation in internal workshops and in developing this first state-of-knowledge assessment.

2. Executive summary

Drifting Fish Aggregating Devices (dFADs) are now a dominant gear of industrial tuna fisheries, with significant ecological impacts across global oceans. In 2023, over 48,000 tonnes of tuna were caught using floating objects in waters surrounding the Galapagos Marine Reserve (GMR), highlighting the scale of dFAD-associated fishing pressure in this unique and sensitive region. Despite regulation by the Inter-American Tropical Tuna Commission (IATTC), major governance and data gaps persist for effective management of dFADs.

dFADs pose multiple, compounding threats including overfishing, bycatch of non-target species, entanglement of marine megafauna, plastic pollution, socio-economic impacts and invasive species dispersal. These risks are amplified in Marine Protected Areas (MPAs), where drifting FADs bring fishing effort and ecological impacts across marine reserve boundaries. For Galapagos, this raises serious concerns around biodiversity loss and the impacts of marine pollution.

Despite dFADs not being permitted in the GMR, preliminary data collected from coastal surveys, interviews and anecdotal reports (2016-2025) confirm frequent encounters with dFADs. Between 2016 and October 2025, 277 dFADs (as of October 2025) have been recorded in the GMR, of which only 21 still had satellite buoys attached, which is likely an underestimate of actual incursions, given that the absence of tracking and monitoring systems for these devices considerably limits their timely detection and documentation. The locations of dFADs found in the GMR suggests eastward accumulation patterns on coastlines, supporting the hypothesis that most deployments occur upstream on currents to the East of the reserve. Evidence also indicates low recovery rates of dFADs which remain stranded on the coasts of the Galapagos protected areas. Opportunistic surveys with artisanal fishers and other users of the GMR

suggest dFADs pose a collision risk with reserve-user boats, while also revealing mixed local perceptions and lack of awareness of the broader implications of dFAD use.

This highlights a critical need for systematic long-term monitoring, strengthening interinstitutional coordination to foster active collaboration, and scalable interventions. This report identifies dFADs as a priority pollution and conservation issue in the GMR, and highlights the region as a globally relevant case study. Addressing current knowledge gaps is essential to inform science-based management. We propose a coordinated programme to: (1) strengthen local technical, regulatory, and operational management capacities, (2) standardise and expand data collection for the long-term management of dFADs, including community participation, and (3) establish early warning systems in coordination with the IATTC and the industrial fishing sector. Given the global relevance of Galapagos, targeted action here has the potential to catalyse broader regulatory reform and greater interinstitutional cooperation and contribute to an improved sustainability for dFAD fisheries worldwide.

3. Acronym glossary

CI Ecuador (Conservation International Ecuador) - established in 1987, Conservation International has worked to spotlight and secure the critical benefits that nature provides to humanity. Combining fieldwork with innovations in science, policy and finance, CI has worked with partners to support the protection of more than 13 million square kilometres of land and sea across more than 70 countries.

CMAR (the Spanish acronym for the Eastern Tropical Pacific Marine Corridor) – an intergovernmental initiative between Ecuador, Colombia, Costa Rica and Panama to promote the conservation of the Eastern Tropical Pacific.

Ecuadorian EEZ (Ecuadorian Economic Exclusion Zone) - is the maritime zone surrounding Galapagos that extends from the outer limit of the territorial sea up to a distance of 200 nautical miles.

ETP (Eastern Tropical Pacific) - extends along the Pacific Coast of Central America, from southern Mexico to northern Peru, encompassing a surface of 199,665,900 hectares of coastal and marine habitats, and 20,853,000 hectares of continental shelf.

FAD (Fish Aggregating Devices) – man-made floating objects, which can be anchored (aFADs) or drifting (dFADs), used to aggregate open water fish. FADs can be comprised of a combination of natural and non-natural materials, and some have appendages (nets, ropes, hooks) hanging beneath the surface and/or baited drums. In this report, we focus on dFADs.

GCT (Galapagos Conservation Trust) – A non-governmental organisation with more than 30 years of experience. GCT works to conserve the unique ecosystems of Galapagos and collaborates with local and international partners to develop science, conservation and education projects, promoting sustainable solutions that protect biodiversity and support local communities.

GMR (Galapagos Marine Reserve) – the marine protected area around Galapagos was designated in 1998.

GNP Galápagos National Park – A protected area established on 4 July 1959 that encompasses approximately 97% of the terrestrial area of the Galápagos Archipelago and is managed by the Galápagos National Park Directorate (GNPD).

GNPD (Galapagos National Park Directorate) – the institution responsible for managing the protected areas of the Galapagos National Park and the Marine Reserves, reporting to Ecuador's Ministry of Environment.

HMR (Hermandad Marine Reserve) – a new reserve created in 2022 which extends the GMR by 60,000 km² to the northeast, towards Cocos Island (Costa Rica) but within Ecuadorian waters.

IATTC (Inter-American Tropical Tuna Commission) – the Regional Fisheries Management Organisation (RFMO) responsible for conservation and management of tuna and tuna-like species fisheries in the Eastern Pacific.

ISRA (Important Shark and Ray Area) - are discrete, three-dimensional portions of habitat, important for one or more shark species, that are delineated and have the potential to be managed for conservation.

IUU (illegal, unreported, and unregulated) fishing

MPAs (Marine Protected Areas) - are areas of the ocean that are established to protect marine habitats, species and ecosystem services.

PPFG (Plastic Pollution Free Galapagos) – GCT's flagship programme, initiated in 2017, began working on how to reduce plastic pollution in Galapagos. We partnered with a wide variety of local partners to research the risks of pollution and trial locally relevant solutions to support the Galapagos National Park Directorate and local community to take action.

PPSS (Pacific Plastics: Science to Solutions) – International network coordinated by Galapagos Conservation Trust and the University of Exeter, working across the Eastern Pacific region to reduce plastic pollution. PPFG forms the 'Galapagos branch' of the PPSS network.

RFMO (Regional Fisheries Management Organisation) – international entities to manage migratory fish species.

SPC (The Pacific Community) - the principal scientific and technical organisation in the Pacific region, supporting development since 1947. SPC is an international development organisation owned and governed by our 27 country and territory members.

USFQ (Universidad San Francisco de Quito) - is a liberal arts university, based in Quito with a campus and research organisation in Galapagos - the Galapagos Science Center (GSC). USFQ is a global leader in education, research, creativity, entrepreneurship, and freedom in Latin America.

4. Introduction

This report focuses on drifting Fish Aggregating Devices (dFADs) within the Galápagos Marine Reserve (GMR). While definitions for what constitutes a dFAD vary across scientific and legal literature, the UN's Food & Agriculture Organization (FAO) defines them as a 'permanent, semi-permanent or temporary [floating] structure, which is deployed and/or tracked, and used to aggregate fish for subsequent capture^{1,2}.

This report summarises the efforts of the Galapagos National Park Directorate (GNPD), together with Galapagos Conservation Trust (GCT), ProDelphinus, Conservation International Ecuador (CI Ecuador) and partners in the Pacific Plastics: Science to

Solutions (PPSS) research network to understand the state of knowledge on dFADs in the Galapagos Marine Reserve (GMR), and build a long term, sustainable methodology for standardised data collection, supported by citizen scientist action and monitoring. The objective is to provide robust information to support the GNPd in management decisions, and the IATTC and wider tuna industry to take action and reduce the threats of dFADs in the GMR. This report represents an important foundation from which a holistic programme can be built to map and address the threat of dFADs in Galapagos. This includes solutions based on scientific studies, monitoring, participation of the fishing sector, as well as the formulation of proposals to the IATTC oriented towards reducing the threats of dFADs in the GMR.

This report presents the preliminary assessment activities undertaken to evaluate the current state of knowledge on drifting Fish Aggregating Devices (dFADs) in Galápagos. It also describes pilot data collection initiatives, including insights and perspectives from the local fishing community. Furthermore, the report provides an overview of the main knowledge gaps, opportunities to drive progress, and priority actions moving forward, including the development of a monitoring and data collection protocol tailored to the Galápagos context.

4.1. dFADs and their use in the Eastern Tropical Pacific

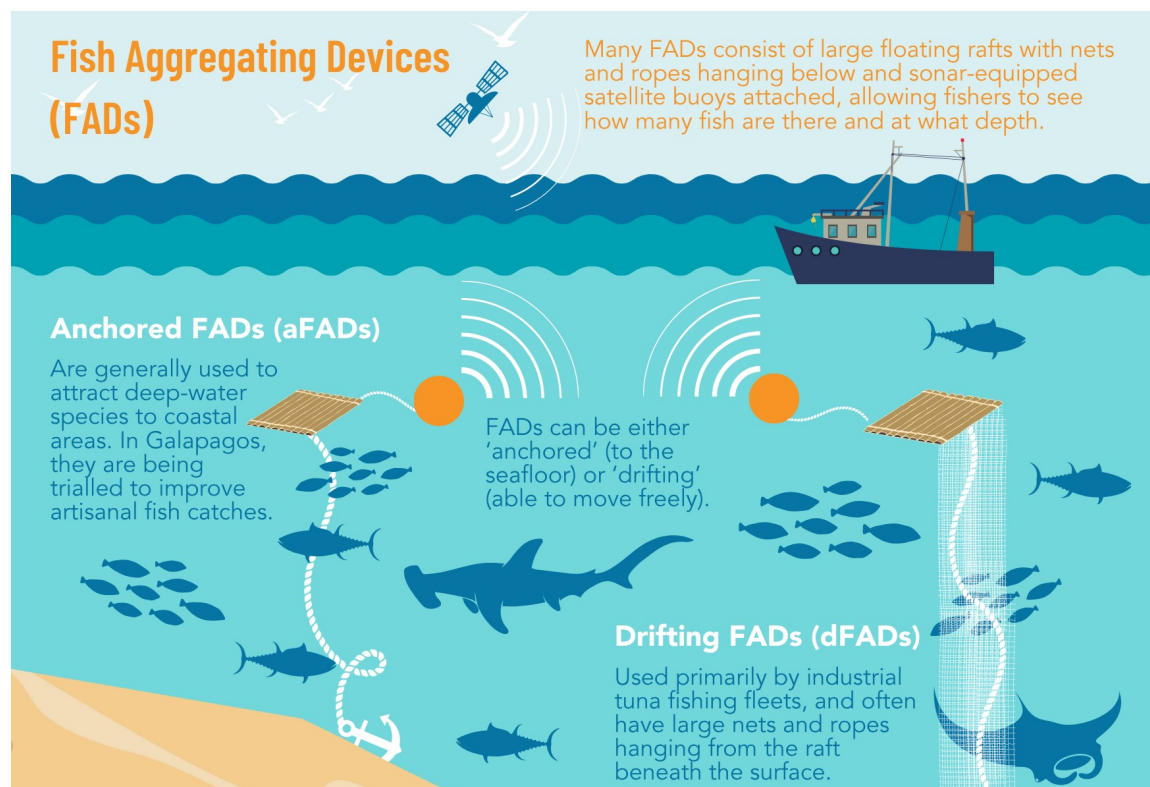


Figure 1. Diagram showing the types of FADs (anchored and drifting), their components and satellite communication systems with the fishing vessel (Source: GCT).

Open water species naturally aggregate underneath floating objects in the ocean, which makes the use of man-made dFADs in fisheries highly successful³. It allows fishers to maximise their catch and target the exact location of large schools for easier landing. dFADs are typically constructed from a combination of man-made materials (e.g. plastic sheeting, floats) and natural materials (e.g. bamboo poles) to create a raft designed to float on the ocean surface. Some dFADs have submerged plastic nets and/or ropes – often ranging between 30-80 m in length trailing beneath them, and some are also baited to help attract fish³. The effectiveness of this fishing method has led to the development of new technological advances to increase productivity, including satellite buoys attached to dFADs (see Figure 1). Not only do buoys enable vessels to track and relocate dFADs, but they are equipped with increasingly sophisticated technology, such as sonar to assess the fish density aggregated beneath. Once a dFAD is located, large purse-seine nets are used to encircle and catch the fish (and all other species) aggregated below. FADs can also be anchored, however this report focuses on the state of knowledge on dFADs that enter or are found around the GMR.

dFADs are widely deployed by industrial purse seine vessels across the Pacific, Atlantic and Indian Oceans for fishing tuna and other open water commercial fish species⁴. The ecological implications of dFADs have been of increasing concern globally over the last decade. In response to rising concerns, the IATTC created an Ad Hoc Working Group on FADs in 2015 to analyse and discuss the impacts and possible solutions of dFADs in the Eastern Pacific. In this region, 275 purse seine vessels are registered with the IATTC, of which 37% (104 vessels) belong to the Ecuadorian fleet (IATTC Online Vessel Register data accessed 22/10/2025)⁵. The IATTC's Working Group on FADs identified that annual catches of the tropical tuna purse seine fishery have exceeded 65 million tonnes, and in 2023 about 60% of catches were associated with 'floating objects', most of which are dFADs, but this also includes natural floating objects such as logs⁶. The number of fish caught using dFADs increased by approximately 8.33% from 2021 to 2023.

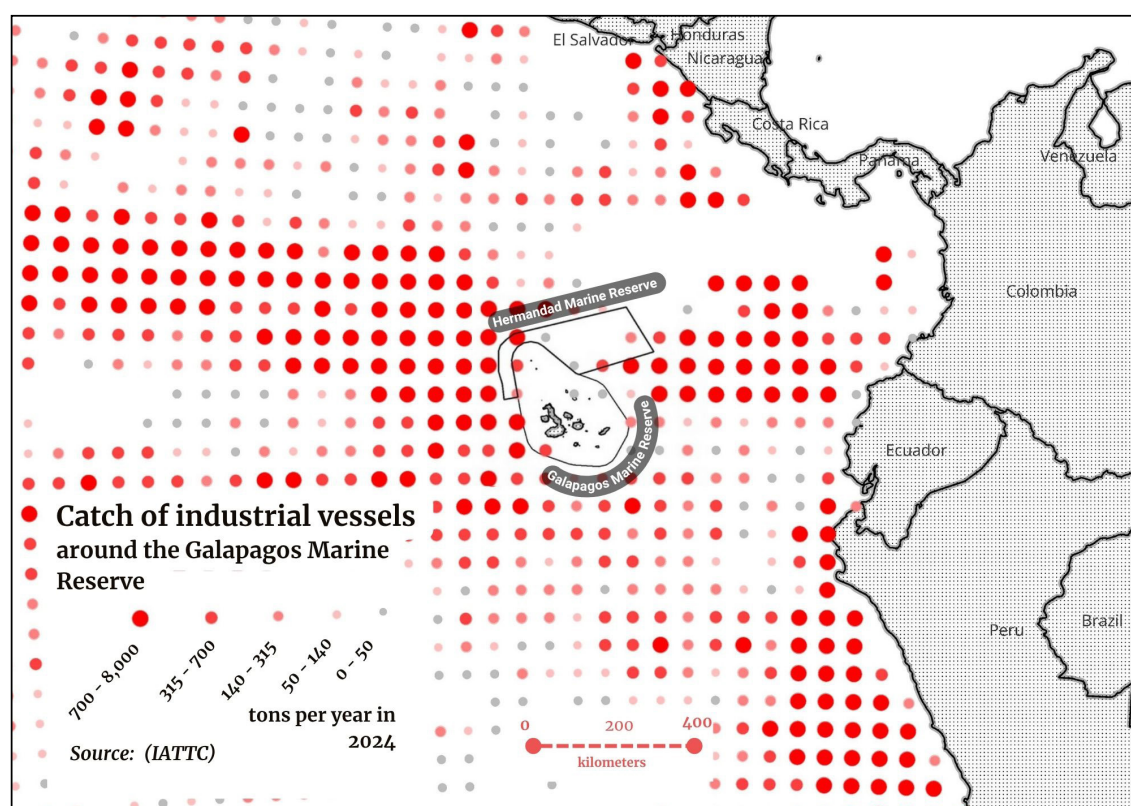


Figure 2. Catch figures reported by industrial vessels to the IATTC in the Eastern Pacific. Image: IATTC, elaborated by GCT.

The IATTC has a regulatory framework established for correct management of dFADs, which includes resolutions C-98-10⁷, C-99-07⁸, C-17-02⁹, C-19-01¹⁰, C-25-01¹¹ and amendments C-18-05¹² and C-25-07¹³. In this context, the deployment of dFADs by the tuna fleet is required to be regulated based on reported data including: (1) position, (2) date and hour, (3) FAD ID, (4) FAD type, (5) FAD design, (6) type of activity (including lost), (7) set results (including bycatch), (8) characteristics of other devices linked to the FAD (such as a satellite buoy). Despite efforts to better control dFADs used by tuna fleets, there is still a knowledge gap on their use and incursion within marine reserves such as Galapagos, as is seen in the 2022 report on 'Floating-object fishery indicators' of the Ad Hoc group⁶.

dFADs are highly mobile, capable of drifting across oceans. A recent global study by Schiller et al (2025)¹⁴ estimated that 1.41 million dFADs were released between 2007-2021 and drifted across 37% of the global ocean's surface (134M km²), crossing 157 maritime jurisdictions. Further, in 2024, 86.4% of buoys found beached in French Polynesia (in the south-central Pacific) could be traced back to fleets from the IATTC CA (Ecuador, Panama, US and Colombia), and 85.1% of the last recorded positions were from the IATTC CA15. The latter, combined with concerns about poor transparency and observer coverage of dFAD deployment¹⁶, means it is difficult to estimate the true number of dFADs in the ocean. The most recent annual estimates available for dFAD deployment in the Eastern Pacific indicate a substantial increase; estimates for 2006-2013 ranged from 8,006 – 14,110 per year¹⁷, with more recent estimates at 16,000 – 25,000 deployments annually¹⁸. The current IATTC tuna conservation regulation (2025-2026) and update to this agreed in September 2025 for 2026-2028, allow for the largest purse seine vessels ('Class 6', ≥1,200 m³ carrying capacity) to have up to 340 dFADs 'active' (deployed and being tracked for fishing by the purse seine vessel) at any one time, through to 50 active dFADs for the smallest vessels (Class 1-3) (Resolution C-21-0419, to be replaced by C-25-01)¹¹.

**Permitted Number of FAD
Deployments based on vessel type
IATTC's C-16-01 Resolution (September, 2025)**

Type of vessel	FADs
Class 6 (> 1,200 m ³)	340
Class 6 (< 1,200 m ³)	210
Class 4-5	85
Class 1-3	50

Figure 3. The IATTC's current resolution for permitted number of dFAD deployments by vessel class from Resolution C-25-01 (published September 2025).

The IATTC recognises that there is a diverging trend between dFAD deployment (increasing) and retrieval (decreasing) as shown in their analysis of data from 2005-2022⁶, meaning that dFADs are being lost or abandoned, polluting the ocean and coastlines. Beyond the low recovery rates of dFADs, and inadequate efforts to prevent their accidental loss, the loss or abandonment of dFADs violates the MARPOL treaty (which regulates pollution at-sea)²⁰. The issue of low retrieval rates of dFADs is reflected in other regions too – for example, Escalle et al (2021)²¹ found that fewer than 10% of dFADs deployed in the Western and Central Pacific from 2016-2020 were retrieved. This issue is partly a result of the cost (i.e. time and fuel) of retrieving dFADs perceived as not being worth the investment by industrial vessels¹⁷.

4.2 The threats posed by dFADs

Drifting FADs pose a threat to marine and coastal wildlife, both during their intended use and long after they are lost, abandoned, or stranded. Below we summarise the predominant known impacts of FADs.

4.2.1. Overfishing and population health

The widespread and increasing use of dFADs is contributing to overfishing by intensifying catch volumes²², and they are associated with significant catch of juvenile tuna due to their tendency to aggregate beneath floating objects¹⁶. A recent study investigating historical dFAD catches found that the proportion of immature yellowfin and bigeye tuna in catches exceeded 90% across the majority of ocean regions¹⁴. Both issues undermine overall stock health, negatively impacting artisanal fisheries and therefore livelihoods via reduced catch and economic returns.

In the Galapagos Marine Reserve (GMR) artisanal fishing is allowed, and dFADs are not an authorised fishing gear. Nevertheless, dFADs can be carried into the GMR by ocean currents originating from adjacent industrial fisheries. This issue is not unique to the Galápagos Marine Reserve (GMR); their presence has also been documented in the Hermandad Marine Reserve (HMR), for which dFAD management has also been flagged as a priority under its separate management plan.

The reduced population health of commercial species like tuna and the loss of threatened marine megafauna from bycatch and entanglement represent a major threat to the ecological balance and stability of the marine food web, reducing its overall resilience to other stressors, including climate change, pollution and climate phenomena such as the “El Niño” Southern Oscillation. dFADs also cause damage to sensitive habitats, with many ending up beached on coastlines or reefs, as highlighted in the Western and Central Pacific islands by Escalle et al (2022)²³.

4.2.2 Bycatch

The purse-seine nets used to encircle schools of tuna can also capture non-target species, resulting in bycatch of threatened species including turtles, rays and sharks, and in the Eastern Pacific, reported catches to IATTC show that silky sharks (Vulnerable on the IUCN Red List of Threatened Species) are particularly susceptible⁶. At any stage of their use, dFADs represent an entanglement threat due to the netting components used in their build. Some dFADs have long ‘tails’ made of netting that hang beneath them in the water column, posing a severe entanglement risk to species, and snagging on geological features such as reefs and rocks²⁴, and when lost or discarded in the ocean, they becoming a form of ghost fishing gear if separated from the main dFAD structure, indiscriminately entangling marine wildlife.

4.2.3 Pollution

Plastics used in the structure of dFADs (such as plastic ropes, netting, buoys) will eventually break down into smaller fragments and microplastics, and although little studied, there is a risk of heavy metal pollution from the electronic parts and batteries of buoys²⁵. Once a dFAD becomes stranded or snagged, it can start to rapidly break down in the high ultraviolet (UV) environment (highly relevant in

Galapagos), degrading and releasing microplastic fragments and fibres into the surrounding environment. Additionally, the pollution burden of tonnes of dFADs arriving to Galapagos coastlines is contributing to the ever-increasing pressure on the waste management system, which is already at risk of collapsing.

4.2.4. Socioeconomic costs

Surveys with the fishing community in Galapagos have highlighted the socioeconomic burden of dFADs in the GMR (detailed in section 5). The profile of dFADs in the water is very low, and they can directly collide with boats operating in the GMR (especially in low light), damaging the vessel, fishing gear, equipment, and posing a safety risk to crew. There is also the potential risk of diverting fish catch away from artisanal fishers, which could impact local livelihoods. In addition, in one study, pollution burden in Galapagos was shown to impact tourist perceptions and attitudes towards the Islands²⁶.

4.3 dFADs in the Galapagos Marine Reserve

A major data gap for dFAD stranding events in the wider Eastern Pacific is recognised in the literature²⁵. This area includes the Eastern Tropical Pacific Marine Corridor (CMAR), within which Galapagos is situated, 930 km off the coast of Ecuador. This isolated, volcanic Archipelago is famous for its endemic biodiversity and importance in the life cycle of many threatened migratory marine species. The Galapagos National Park (GNP) and the Galapagos Marine Reserve (GMR) are UNESCO World Heritage Sites since 1978 and 2001 respectively, and the Hermandad Marine Reserve (HMR) was proposed for inclusion as one in 2025, together making the Galapagos Biosphere Reserve. These Marine Protected Areas now cover almost 200,000 km², including the HMR that comprises 30,000 km² of no take zone and 30,000 km² of no long-lining to the north-east of the original marine reserve.

The use and deployment of dFADs is not permitted in the GMR, however this does not prevent dFADs being carried in on currents from the surrounding Ecuadorian Economic Exclusion Zone (EEZ) and the High Seas, where there is significant fishing effort by industrial purse seine fleets. For example, in 2023, 115 of the 740 purse seine vessels (14%, both Ecuadorian and foreign fleets) in the Eastern Pacific fished around Ecuador's Exclusive Economic Zone (EEZ) surrounding the GMR (amounting to a total of 243 hours of fishing effort in the area)²⁷. Anecdotal observations highlight that dFADs released by purse seine vessels in the Eastern Pacific are regularly entering the GMR. There are also concerns that purse seine vessels are exploiting a legal loophole by deliberately releasing dFADs on the eastern boundary of the GMR, which are then highly likely to drift through the GMR on the South Equatorial Current and eventually leave the Reserve to the West of the Islands – potentially taking with them the community of fish they have aggregated to be caught 'legally' outside the GMR boundary^{22,28}. This was explored by Hearn et al. (2022), who modelled a monthly release of approximately 61,000 dFADs from three release locations to the east of the GMR, including one in the High Seas, across La Niña, El Niño and neutral conditions. Results highlighted significant entry of dFADs into the GMR across all conditions and release sites, albeit to a lesser extent from the High Seas release site, with seasonal variation in numbers and duration within the GMR²². Using dFADs to fish in this way not only increases the risk of them beaching on and polluting Galapagos coastlines, but could be considered a form of illegal, unreported, and unregulated (IUU) fishing¹⁶. Removal of fish from the GMR not only poses a threat to the livelihoods of ~1,100 Galapagos artisanal fishers, but the presence of dFADs is also a collision risk for the smaller fishing boats operating at night or in low light.

There is an existing fishing industry-led recovery scheme for Galapagos' Marine Reserve operated by TUNACONS Foundation (an organisation that represents several major

Ecuadorian tuna companies) since 2021. Between 2022 and May 2025, a total of 49 dFADs (nearly 5 metric tonnes of marine debris) have been recovered, representing c. 0.08% of the total deployed by the TUNACONS member fleet in the Eastern Tropical Pacific (ETP)²⁹. They report that approximately 85 artisanal fishers have participated on board 20 different boats in these retrievals. However, many dFADs are still being found floating at sea, lodged underwater, or stranded on coastlines within the GMR, demonstrating the urgent need to reduce the incursions of dFADs in the GMR, increase retrieval and removal efforts. Given their size, weight, associated netting and biofouling, they can be dangerous items to remove, making adequate safety protocols essential. The nature of retrieval also varies with these three distinct scenarios:

- i) underwater dFADs require removal by qualified divers with specific tools for the retrieval following safety protocols,
- ii) drifting FADs (it is possible to remove them from the surface of the sea with the help of knives and ropes),
- iii) FADs stranded on the coast that can be retrieved using knives to dismantle them, often removed during coastal clean-up campaigns.

Within TUNACONS 'Taking Care of Galapagos' initiative, a results chain for a dFADs alert, recovery, and management framework is outlined ([see here for more information](#))²⁹. Implementing this type of framework represents a shared challenge in the Galápagos context, as the volumes of biofouled plastic and other waste generated through the recovery of dFADs exceed the current funding and waste management capacity of local systems. This presents an opportunity to strengthen and collaborate together with TUNACONS and other actors to secure the technical support and financing needed for the alert and retrieval systems. Extending collaboration to include more partners in the sector would allow the consolidation of a collective effort with greater reach.

4.4. Legal diagnostic

The governance of the Galapagos Marine Protected Areas (MPAs) is supported by a robust institutional framework. The GNPd, in accordance with the Organic Law of the Special Regime of the Galapagos (LOREG), is the authority responsible for managing activities within the GMR, while the administration of the Hermandad Marine Reserve (HMR) is carried out in coordination with the Undersecretariat of Natural Heritage of the Ministry of the Environment. The National Environmental Authority, within the framework of the Organic Code of the Environment (COAM), establishes guidelines, tools, and management mechanisms applicable to the entire National System of Protected Areas (SNAP).

Interinstitutional coordination is defined by the Organic Law for the Development of Aquaculture and Fisheries (LODAP) that stipulates; in SNAP areas, regulated by the National Environmental Authority, fishing activities must be coordinated with the fisheries governing body, applying environmental sustainability criteria. For its part, the National Maritime Authority, in accordance with the Organic Law on Navigation, Safety Management, and Maritime and River Protection of Aquatic Spaces, exercises Maritime Police functions in all national aquatic spaces, including the Galapagos, to ensure regulatory compliance and prevent illegal activities, coordinating its actions with the GNPd in matters of marine environmental protection.

Regarding dFADs, their regulation comes primarily from the resolutions of the Inter-American Tropical Tuna Commission (IATTC), which are automatically binding in Ecuador through the fisheries governing body. These resolutions establish measures regarding the number of dFADs allowed per vessel, their activation, duration, data transmission,

and location. While some positive measures have been taken under the IATTC to prevent and minimise the environmental issues generated by dFADs, such as prohibiting the use of entangling nets in dFADs as of January of 2025 and requiring the progressive use of biodegradable dFADs with 100% biodegradability requirement for 2030, there is still room for improvement. We suggest that Ecuador is in a unique position to champion efforts at the IATTC to ensure dFADs do not create harm, especially in MPAs such as the Galapagos Marine Reserve, the Hermandad Reserve in Galapagos, and the Galapagos National Park. Currently, the IATTC does not establish specific regulations for the use of dFADs in marine protected areas, and consequently, Ecuador does not have national regulations specifically governing their use or impact in MPAs, including Galapagos. Although there is a National FAD Management Plan and secondary regulations applicable in jurisdictional waters, it is insufficient to prevent the impacts of dFADs within MPAs.

The use of dFADs is associated with industrial fishing. It should be noted that this fishing method is not permitted within the Galápagos Marine Reserve (GMR), where the 2025 Fisheries Regulations only authorises artisanal fishing³⁰. This regulation does not provide for or regulate drifting FADs. However, the regulation does provide for “fishing associated with anchored FADs”. The use of dFADs is not expressly regulated in the Hermandad Marine Reserve either, despite the fact that this area includes a responsible industrial fishing zone. This lack of specific regulation represents a public policy and regulatory gap in marine environmental management for the MPAs of Galapagos. In this context, Ecuador maintains relevant international commitments to marine conservation and fisheries through instruments such as UNCLOS, CITES, MARPOL, the CPPS, World Heritage, and the CMS. Ecuador ratified the High Seas Agreement (BBNJ) in October 2025 and actively participates in the negotiation of the Global Plastics Treaty. This international framework provides a strategic basis for the country to promote a national roadmap for dFADs in MPAs, incorporating criteria of conservation, transparency, jurisdiction, and sovereignty, and using the Galapagos as a regional reference case.

It is urgent to reduce the impacts of dFADs in Galapagos MPAs with efforts required at different levels, especially by the GNPD under the Ministry of Environment and Energy, the fisheries governing body, the Ministry of Foreign Affairs, the National Maritime Authority, the fishing industry, and the IATTC.

5. Methodology and results

The GNPD, GCT and partners in the PPSS network have been collaborating on understanding the impacts of plastic pollution in Galapagos since 2018³³. Through this work, it became clear that there was an important gap in data and adequate management responses to dFAD incursions. Since 2023, the GNPD, GCT, and CI, along with other local partners in Galapagos, have been developing a programme of work, as described below.

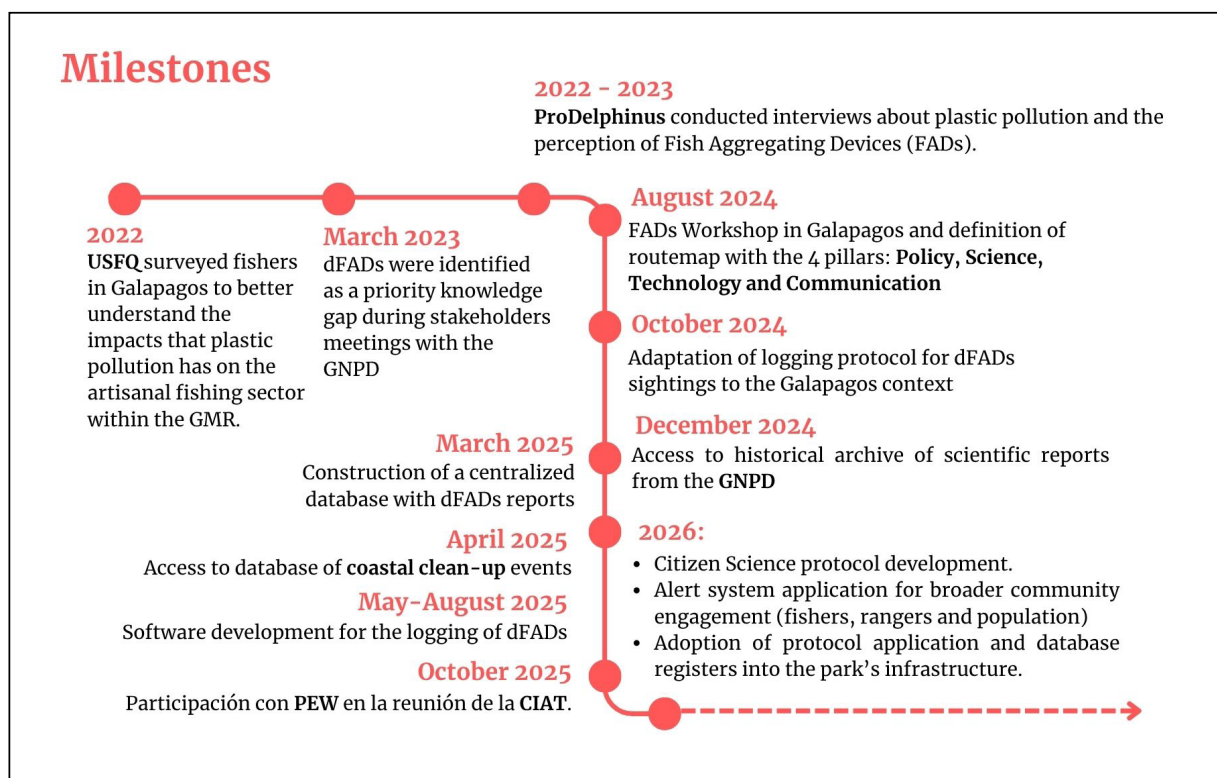


Figure 4. Phases of the dFADs programme, elaborated by the GNPD and GCT.

5.1 Scoping and baseline generation (2022-2024)

Between 2022 and 2024, the first in-depth scoping study for dFADs in Galapagos began with local, regional and international experts, to assess the state of knowledge of their quantities, composition, distribution around the Archipelago, impacts, and any qualitative information and associated organisms (e.g. algae and barnacles growing on their structures).

5.1.1 Stakeholder workshop in Galapagos

In March 2023, with the leadership of the GNPD, local stakeholders were brought together to discuss incoming plastic pollution to the Islands and summarise the outcomes from the Plastic Pollution Free Galapagos programme and Pacific Plastics: Science to Solutions (PPSS) network. dFADs were identified as a priority knowledge gap during these discussions (high importance, low state of knowledge – see Figure 5).

The following section outlines the specific methods and results across the areas explored during the initial scoping and baseline generation phase (2022 – 2024).

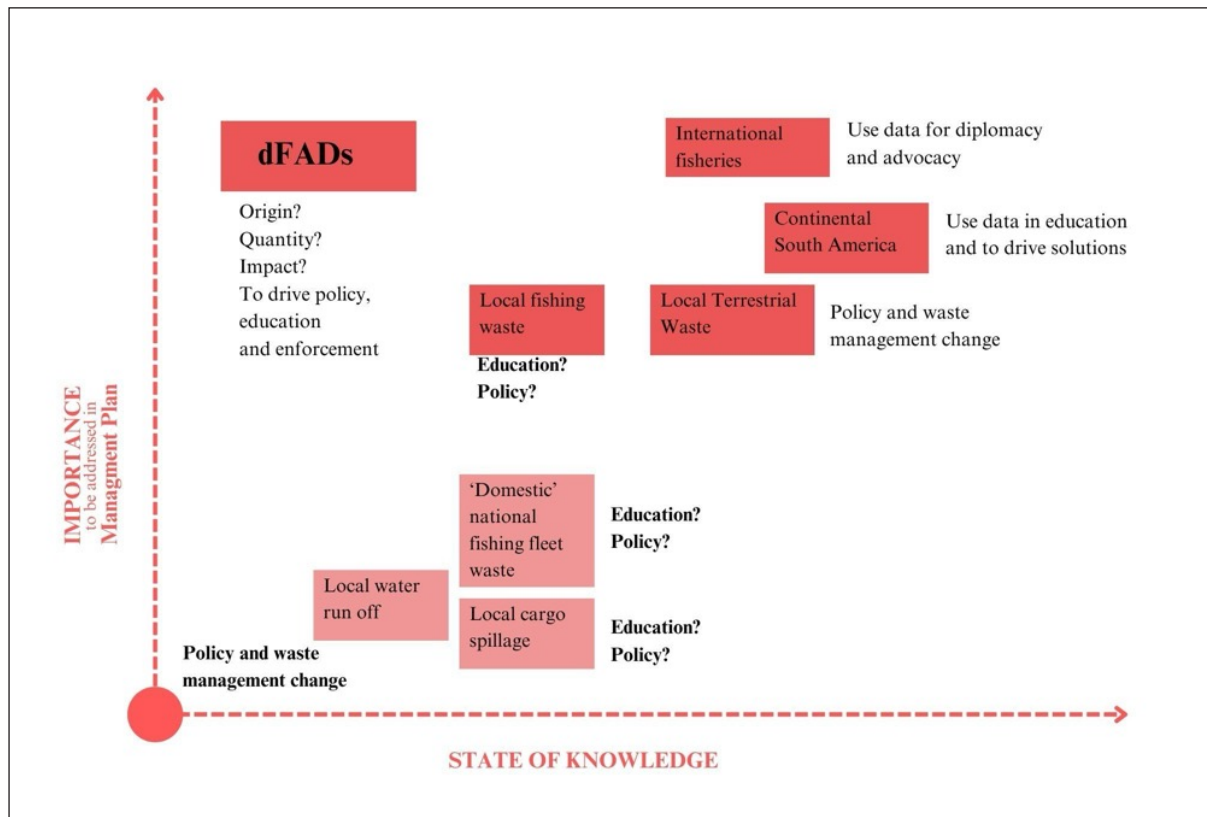


Figure 5. Excerpt from the GNPD's plastic pollution workshop: a digitised version of the matrix produced by workshop participants during a session on sources of plastic pollution to the GMR (elaborated by GCT).

Throughout meetings with local, national and regional experts, the following topics were discussed;

- **Concerns around the limited accountability and limited availability of information** in the use of dFADs were highlighted, and the lack of data available on dFADs generally, in the Eastern Pacific specifically, was reiterated as a major barrier to evidencing the scale of the issue. It was agreed that a dFADs case study based on data from Galapagos, a renowned Marine Reserve, could not only help fill this data gap, but be impactful for improving regional regulations.
- There are **three main buoy manufacturing companies** (Satlink, Marine Instruments and Zunibal). Some stakeholders perceived that little information exists on how their products are used, which presents an area of opportunity for a more direct dialogue with these actors.
- In the area of **oceanographic modelling**, progress has been made both in monitoring plastic pollution across the eastern Pacific and in modelling the trajectories of dFADs released around the GMR (with the support of the Charles Darwin Foundation). However more modelling of dFADs has been undertaken in the Western and Central Pacific, as well as work to assess the origins of dFADs, highlighting the importance of collecting data from the buoys (barcodes and hand painted markings).

- Concerning a change to **the materials dFADs are made from**, to reduce their negative impacts, the increasing use of 'bio-FADs', 'EcoFADs', and 'non-entangling dFADs', was highlighted, via a Fisheries Improvement Programme (FIP) conducted with TUNACONS Foundation (the organisation representing major Ecuadorian tuna companies). However, there are mixed perceptions surrounding this focus on bio-FADs as a solution – for example, that they do not reduce the overall number of dFADs deployed, and some think this does not reduce the risk of biodiversity being transported out of the marine reserve.
- Finally, the efforts to reduce the number of active dFADs that the IATTC will allow a given purse seine vessel (based on the vessels' class-size) to release at any one time were recognised. While limits for active dFADs were reduced, there are concerns that the limits are higher than the number of dFADs actually deployed, undermining their effectiveness and allowing for the number of dFADs released to increase.

It was clear following this workshop that a significant acceleration in knowledge of dFADs in the GMR was needed. Workshop participants discussed existing initiatives to collect pilot data on dFADs in the GMR (see section below). Opportunities with individuals and organisations operating within the GMR that could help scale data collection under a more comprehensive, coordinated programme in the near future were also discussed such as with local fishers. Many of which are already engaged in buoy collection and reselling initiatives, and naturalist guides, who already report some dFAD sightings back to the GNPd.

5.1.2. Internal workshop on dFADs management in the GMR (August 2024)

In August 2024, the GNPd with the support of GCT, and CI Ecuador facilitated an internal workshop on dFADs management with the departments of Environment Management, Ecosystems, Public Use and Legal in the GNPd (preceded by interviews with each director). The workshop aimed to bring together their experiences and concerns, discuss any data compiled independently by the teams, and to align on next steps to be taken to effectively address the issue (see Image 1).

The workshop highlighted that most of the departments encounter dFADs regularly and record them differently, pointing to the need to standardise the data collection processes. A shared concern was also identified regarding the external origin of the problem, given that dFADs originate outside the Galápagos Marine Reserve (GMR), while their impacts on biodiversity and local livelihoods are felt within it. This highlights the importance of strengthening collaboration with the fishing sectors to find shared solutions. During the workshop there was consensus that technology will be important in the monitoring and management of dFADs to minimise their impacts. As a result, the workshop established four 'pillars' of work (Research, Technology, Policy and Communications).



Image 1. First internal workshop for defining the work pillars for dFAD management in Galapagos, 2024 (Source: GNPD).

5.1.3. Coastal clean-up data

Evidence gathered by the GNPD, CI, GCT and PPSS network suggests at least 40% of the plastics washing up on beaches in Galapagos is from maritime sources (double the global average of 20%). Fisheries operating in the Eastern Pacific are a major source of plastic waste via loss of fishing gear and poorly managed domestic plastics that are dumped after being used onboard - which violates the MARPOL convention^{31,32}, as discussed in the “PPFG 5 Years of Science to Solutions” report³³. Our regional oceanographic models have shown that plastic pollution arriving on oceanic currents enters the GMR and accumulates on east-facing coastlines around the Archipelago. Therefore, this would suggest that dFADs released on these currents would also accumulate on east-facing coastlines. Below we have summarised the information we have been able to access on dFADs in Galapagos until October 2025, which is limited but represents a good foundation to develop key research, outreach and communications objectives.

The ongoing Coastal Clean-up Initiative (Programa de Limpieza Costera), led by the GNPD, has been delivered since 2017 in coordination with CI-Ecuador and with the collaboration of key groups, such as the artisanal fishing sector, governmental bodies, NGOs and community groups. As of July 2026, over 112 tonnes of marine waste has been collected from Galapagos’ coastlines, the majority of which is plastic. While clean-up is the central focus of the trips, when dFADs are encountered (in various states of breakdown) the team logs their GPS locations (see Image 2) and dismantles them. The GNPD’s coastal clean-up dataset reveals the most detailed information available on stranded dFADs in Galapagos. This data suggests a greater accumulation of dFADs on east-facing coastlines ($n = c.100$), compared with western facing coastlines ($c.25$), which is consistent with the general trend observed in marine plastic pollution. This also supports the theory that dFADs are being released to the east of the GMR.



Image 2. dFAD found on Genovesa island during a coastal clean-up trip to remote sites, April 2025
(Source: Coastal clean-up programme, GNPD-CI)

Of 56 drone images taken in 2020 and 2021 (covering 224,750 m²) across four islands (Genovesa, Española, Santa Fe and San Cristobal), we identified 14 dFADs beached on coastlines, 13 of the dFADs were on east-facing beaches³⁵. While the footage only represents a subset of the coastlines surveyed by Leipzig's team, the close alignment of these results with our wider plastic pollution evidence further supports that dFADs are likely drifting from industrial vessels to the east of the GMR. Coastal drone surveys will be a useful tool for the GNPD to monitor trends in pollution, including dFADs, and manage clean-up over time. Nevertheless, drone data sets typically include vast quantities of aerial images that are time-consuming to analyse, meaning results can take longer to produce. One option for producing faster results is the use of artificial intelligence (AI) and machine learning (which is currently under development with the Leipzig University team), and another is the support of citizen scientists. So far, a citizen science project has been trialled on the "Zooniverse" platform for marine iguana counts, with volunteers also asked to mark the plastic items seen in the images. Guy (2022)³⁴ analysed how accurately citizen scientists were at counting plastic (including fishing gear) from a subset of this data, and found that overall, citizen science counts were not significantly different from expert counts. In terms of fishing gear specifically, citizen scientists had a tendency to overestimate its presence, and it was suggested to include a 'what not to record' guide to clarify objects which are not fishing gear for future volunteers or GNPD staff.

In addition to the drone studies, there is the opportunity to strengthen monitoring through collaboration with satellite companies and the tuna industry. Similar early warning systems, known as 'FAD-watch' programmes in other parts of the Pacific such as in Australia, can serve as a reference for the design of an equivalent initiative in Galapagos, with the coordination and support of the sector.

5.1.5 Stakeholder surveys

A series of surveys have been conducted with the local community in Galapagos, focussing on the fishing community, to better understand the presence, impacts, and perceptions of dFADs.

a) Socioeconomic cost of dFADs in Galapagos

In 2022, Universidad San Francisco de Quito (USFQ) surveyed fishers in Galapagos to better understand the impacts that plastic pollution has on the artisanal fishing sector within the GMR. The impact of marine litter on the fishing sector has caused damage to boats and fishing equipment, as well as potentially reducing catches. Floating objects, including dFADs, have the greatest impact, causing engine damage if their propellers become entangled in them³⁷. A total of 123 surveys were carried out with artisanal fishers of Galapagos who were asked if since 2017 they had had any incidents with marine plastic waste during their fishing trips: 25.2% (n=27) of the interviewees reported having had an incident, 56% of which resulted in entanglement and 30% in collisions with dFADs. For the incidents corresponding to entanglements, 20% of them caused damage to the engine, generating an average repair cost of USD \$533. In the case of collisions with dFADs, 88% of them represented an average cost of USD \$4,107, with the most prominent case being that of a fisher who suffered the complete loss of one engine and damage to the other engine, causing an economic loss of around USD \$24,000. Fishers were also asked: 'what is their perception of the level of ecological risk of objects discarded into the ocean voluntarily or involuntarily?'. dFADs were the objects they considered to have the highest ecological risk (29% very high risk and 34% high risk) followed by plastic packaging (24% very high risk and 34% high risk) and fishing nets (11% very high risk and 40% high risk). On

the other hand, buoys are considered to have the lowest ecological risk (45% very low risk and 28% low risk) followed by fishhooks (33% very low risk and 32% low risk)³⁸.

b) Perceptions of dFADs in Galapagos

In May 2023, NGO ProDelphinus-Peru conducted surveys with 32 local fishers to identify impacts, fisher's perceptions, and to identify the main localities where dFADs are found within the GMR. They also interviewed 6 local stakeholders to identify the different opinions about dFADs within GMR. Additionally, interviews of experts on satellite systems, dFADs and ghost gear retrieval, were conducted to better understand the global efforts toward dFAD management and identify ideas to address the problem within Galapagos.

Through the surveys, it was identified that dFADs are commonly found during their trips (91%) with mid to high frequency (frequencies ranging from one or more per year to every month, and a total number of 8 ± 12 dFADs/year on average per fisher). Despite the fact that most of the interviewed fishers considered dFADs to negatively affect local fisheries and cause an impact to the GMR (63% and 69% of respondents respectively), some fishers (31% and 25% respectively) did not perceive of dFADs as a problem. This highlights that dFADs still have yet to receive sufficient focused attention and that awareness of the issue remains low within the GMR.

The negative impacts identified by fishers in the GMR are related to the perception that FADs displace fish catch out of the reserve, and the unintentional entanglement of marine fauna and pollution once beached on shore. Additionally, some fishers mentioned a risk posed by dFADs once entangled with vessel engines, reflecting the findings of the Universidad San Francisco de Quito (USFQ) team. On the other hand, 16% of interviewees mentioned a positive impact of dFADs due to their attraction of fish, making those same fish easier to catch and available to local fishers.

Despite the mentioned differences between fishers' opinions about dFADs within the Galapagos National Park, most interviewed fishers (81%) mentioned that when they find dFADs they collect at least the satellite buoy to sell it, and part of the nets to sell or reuse them for agricultural activities. The satellite buoys are sold back to the tuna industry to be used again on new dFADs. In this 2023 survey, a single buyer of satellite buoys was identified within the entire Archipelago, according to fishers he was the only one, and bought buoys from 4 tuna enterprises that operate in the area.

Through the surveys with fishers in two islands, they identified key zones where they find dFADs. These zones are similar to those found in the GNPD's coastal clean-up data, and those reported by Moreau-Smith (2023)³⁵ and Anderson (2023)³⁶ through drone photographs, with a distinct occurrence of dFADs in the southeast zone of the Archipelago. The identification of these zones is an important tool for actions to recover dFADs, but also as an input for future ocean current modelling studies to inform policies that could avoid the entrance of dFADs into the GMR.

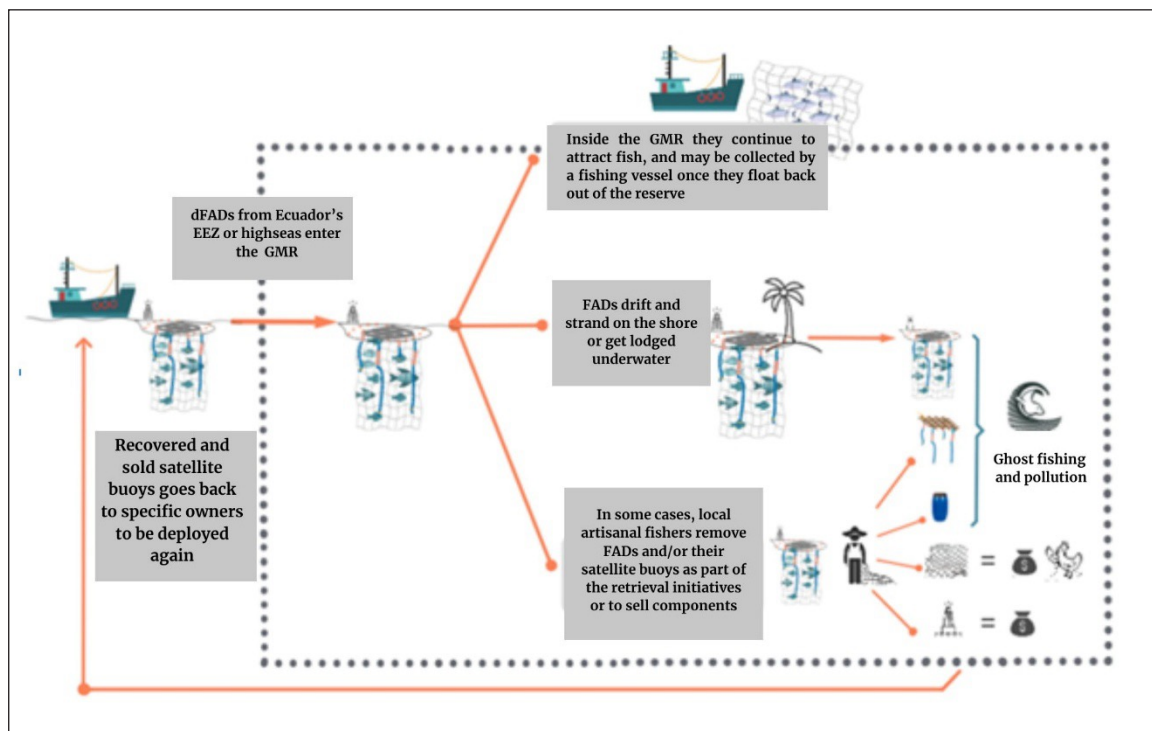


Figure 7. Destination and use patterns of FADs entering Galapagos. (by ProDelphinus-Peru).

c) Broader community surveys

In May 2023, ProDelphinus complemented information regarding the issue of dFADs in Galapagos through interviews with local people including conservation groups, tour guides, fishers, and journalists. In all cases, the people interviewed mentioned a change in dFADs design and management within those found in the GMR. Some years ago, dFADs were composed of wider opened nets of bigger mesh sizes, and PVC tubes as floating articles. More recently certain sectors of the tuna industry have made them with rolled nets of smaller mesh sizes and biodegradable materials. This has reduced the bycatch and contamination but has not solved these problems entirely. dFADs continue aggregating fish inside the protected GMR and damage its sensitive ecosystems once they are lost, beached or sunk. During the interview with a tour guide, they mentioned that retrieving a dFAD is very dangerous for a person without adequate preparation or specialised equipment due to the weight of nets/rope hanging in the water column. Many opt for cutting free the satellite buoy and part of the net, to be able to sink the rest to avoid collisions with other vessels. This produces another problem: contamination of the seabed and ghost fishing.

Interviews with dFAD experts were conducted to identify solutions for the lack of information and awareness about dFADs: Below we describe the 3 lines of action identified:

- Collecte Localisation Satellites (CLS) has proposed a simple and compact Argos-GNSS satellite buoy designed for tracking and re-locating fishing gear such as lines, nets, pots, traps and anchored and drifting FADs³⁹. This innovative system aims to better understand the paths of dFADs structures, independently from their satellite buoys that in most cases are detached from the FADs and have encrypted signals⁴⁰ which are inaccessible to local stakeholders. In the case of the GMR, a study on dFADs drifting pattern once entered into the protected

area could help to model their possible drift patterns and impacts. However, this has cost and logistical implications to implement, which is a barrier that could be resolved by a collaborative early warning system or 'FAD watch' between satellite companies, the industry, and the GNPD.

- The tuna industry has data from the buoys attached to dFADs, and report this periodically to the IATTC. Having this information available collaboratively would help reduce the need for expensive modelling and other techniques being trialled to understand dFAD drift trajectories, however confidentiality clauses and the data protection that apply to this information limits the access for other stakeholders, which represents an opportunity to explore, together with the industry, data-sharing mechanisms that improve the management of these devices.
- The recovery of dFADs that have sunk or that are trapped underwater within the GMR could provide information about the impact on the seabed and benthic ecosystem. The marine safety program of Conservation International - Ecuador has trained park rangers, guides and fishing divers to safely remove ghost fishing gear, including dFADs. Through a conversation with dive trainer Edgardo Ochoa, the viability and need of implementing training courses with more reach in Galapagos is clear. It is worth noting that the recovery of underwater FADs can be a high-risk activity, requiring rigorous health and safety measures, as well as appropriately qualified divers.



Image 3. Training on the safe recovery of ghost fishing gear and FADs, led by Edgardo Ochoa from Conservation International's Marine Safety Program, with the participation of park rangers and local fishers (Source: CI).

The interviews carried out by ProDelphinus identified private initiatives to register found dFADs. However, the respondents agreed that the Galapagos National Park Directorate should be the responsible authority for managing information on dFADs. A dFAD reporting programme should be accompanied by the development of ideas for solutions, with the involvement of the relevant Ecuadorian authorities. ProDelphinus' meeting with the IATTC Ad-Hoc Permanent Working Group on FADs showed that regional efforts on dFADs are in place⁶. However, information on dFADs that enter the GMR was still very limited in 2023.

This survey work in 2023 represented a key first step in better understanding the issue of dFADs in GMR. It evidenced how the issue of dFADs in Galapagos represents an important topic of conflict at both local and regional levels. This survey has given the GNPd, GCT and partners an initial reference point upon which to construct an integrated dFADs management programme.



Image 4. Recovery of a dFAD off San Cristóbal Island, carried out with the participation of ProDelphinus-Peru and CI-Ecuador, in coordination with the GNPd and with the support of local artisanal fishers (Source: GNPG, ProDelphinus,

5.1.6 Anecdotal sightings

Through a combination of activities in the GMR by National Park Rangers, fishers, naturalist guides and researchers, dFADs, often still attached to buoys, have been encountered at-sea, as well as on remote coastlines. In many cases, the buoys are removed as soon as they are found, preventing subsequent tracking. This practice is driven, in part, by the opportunity to resell the buoys to fishing companies on the mainland, creating an economic incentive that competes with monitoring efforts and limits the ability of both authorities and the fishing sector to improve management based on the available data. Indeed, out of the 277 FADs registered, only 21 had satellite buoys attached. This shows the importance of delivering a local comms campaign that promotes not only reporting FADs, but not removing buoys. Since 2023, the GNPd and its partners have been building a photo database of anecdotal sightings of FADs and buoys, through recording the GPS locations and other key information such as wildlife interactions. This database includes data from photos of buoys that park rangers and fishers have collected, to partially trial a method used by Escalle et al (2023)²⁵, to better understand dFAD origins by matching painted vessel names on buoys to the IATTC online vessel register.



Image 5. Examples of satellite buoys found in the Galapagos Marine Reserve. 'Lucia T', 'Ocean Lady' and 'Rocio' all matched with names of Ecuadorian purse seine vessels that are registered with the IATTC.

Including the 14 dFADs identified in the drone footage, we registered between 30-40 anecdotal sightings of dFADs and/or buoys in the GMR additional to the dFADs found during the GNPD's coastal clean-up efforts. Of the nine buoys we could trace back to the IATTC's online vessel register, all of them appeared to be from the Ecuadorian purse seine fleet (see examples photographed in Image 5). While this could indicate that the primary source of dFADs is Ecuadorian fleets, there is not enough data to confirm this. We have examples of buoy models produced by all three of the main buoy manufacturers: Marine Instruments, Satlink and Zunibal. Most of the data we have on buoys has come from photos taken either by local fishers after encountering a dFAD at-sea, or fishers sharing photos of buoys that had been retrieved and taken to land.

During coastal pollution research conducted by the University of Exeter on San Cristobal island, a dFAD was found with two sea lions resting between the bamboo poles at a mangrove and lagoon site (see Image 6), providing an example of how species continue to interact with dFADs after stranding events. These mangrove lagoon sites are vitally important nursery grounds for juvenile sharks and rays, providing refuge for species including Critically Endangered scalloped hammerhead shark pups (*Sphyrna lewini*)⁴¹, and poorly studied spotted eagle rays (*Aetobatus ocellatus*) and golden cownose rays (*Rhinoptera steindachneri*).

In March 2023, some of these mangrove lagoon sites were included in the 'Galapagos Nursery Complex' Important Shark and Ray Area (ISRA)^{42,43}, one of the first ISRAs to be announced globally by the IUCN SSC Shark Specialist Group in recognition of their ecological importance for sharks and rays and the need for greater protections. Exeter's observations highlight these sensitive sites are impacted by dFADs, and more data on dFAD quantities and wildlife interactions with dFADs in mangrove lagoons and other sensitive coastal sites would be beneficial for understanding risk, and potentially strengthening the case for stronger dFADs regulations.



Image 6. Beached dFADs found during research conducted by the University of Exeter at Montones de Arena in an area of mangrove on San Cristobal island in May 2022 (left) and May 2023 (right) (© Georgie Savage).

Beyond the studies and anecdotal sightings documented by its partners, the Galápagos National Park Directorate (GNPD) plays an active and ongoing role in directly addressing the issue of dFADs through its regular coastal and subtidal cleanup campaigns. Conducted systematically at remote and difficult-to-access sites throughout the Galápagos Marine Reserve (GMR), these operations have not only documented the presence of dFADs along the archipelago's coastline (see Image 7 and 8), but have also enabled their physical removal from the natural environment, preventing their prolonged persistence and the associated risks to wildlife and marine-coastal ecosystems. Each dFAD recovered during these cleanup campaigns is recorded, photographed, and entered into the GNPD's coastal cleanup database, creating the most comprehensive and systematic dataset currently available on this issue in Galápagos. This long-term field effort, led directly by GNPD park rangers, represents a tangible operational response to a threat whose origin lies predominantly outside the Galápagos Marine Reserve.



Image 7. dFAD recovered offshore by GNPD park rangers near Mosquera Islet, 2026. (Source: GNPD)



Image 8. FAD recovered during a GNPD macroplastic monitoring survey on San Cristóbal Island, 2024. (Source: Andrea Osorio Baquero and GNPD)

Regional studies of dFADs in the Western and Central Pacific Islands have been conducted, but there are data gaps for the Eastern Pacific region. Filling these data gaps in the rest of the IATTC region, including the Galapagos Marine Reserve, should be a priority. We present here initial pilot data, of 277 dFADs recorded in the GMR over the last 9 years, which is likely a significant underestimate.

5.2 Developing a long-term monitoring programme

5.2.1 Methodology

From December 2024 to October 2025, two sources of information from the GNPD were reviewed, including the following historical records from 2014 to 2024:

- Scientific reports from the researchers on field trips,
- Coastal cleanup records (430 entries with details such as materials collected, weight, and location)
- Observations from guides (approximately 145–150 documents)

In cases where a dFAD was mentioned, it was recorded using the AppSheet platform. The AppSheet was developed iteratively with the GNPD, GCT and CI, using a standardised protocol that allows dFAD sightings to be recorded and managed in a centralised database. This was adapted from the protocol developed by researchers Jennifer Mourrot and Lauriane Escalle from The Pacific Community (SPC), specifically for the study of dFADs, and later adjusted to fit the IATTC reporting guidelines. This protocol was designed to quantify the number of dFADs, assess their impact on the environment and wildlife, and promote standardised management of such findings.

This tool thoroughly analyses the physical characteristics of the dFAD, its context, and its destination. To simplify the recording process, these elements were organized into the following categories:

- Main characteristics.
- dFAD data.
- Buoy data.
- Floating device data.
- Tail data.
- dFAD destination.
- Terrestrial impacts.
- Marine impacts.
- Multimedia evidence.

It was decided to standardise data recording efforts in order to establish a scientific reference aligned with the methods used by other organisations to categorise and document dFAD encounters. This protocol has been recognised by the Inter-American Tropical Tuna Commission (IATTC) as a mechanism for comprehensive dFAD monitoring.

The use of a digital platform for recording dFADs offers several benefits, including:

- Automatic report generation which can be referred to the relevant GNPD department heads.
- A centralised database that automatically updates.
- Integration with various digital applications and services such as Ecuadorian mapping services and servers.
- Real-time updates to digital maps.

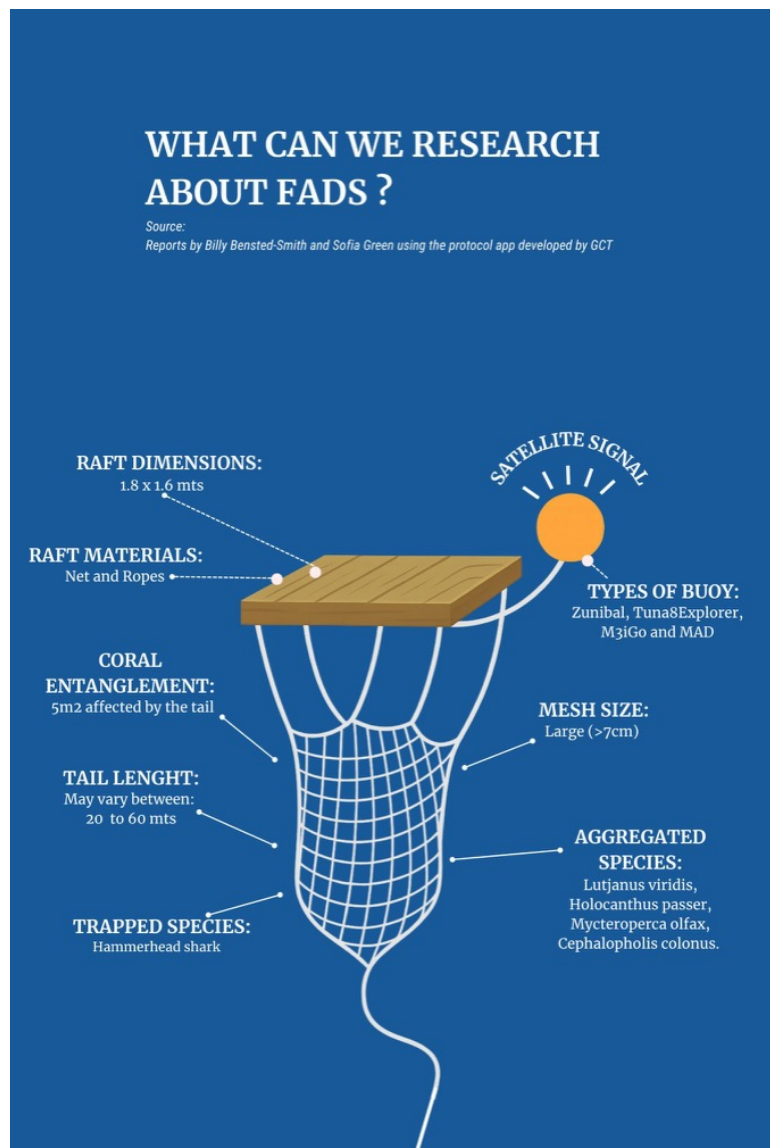


Figure 8. Schematic of the main FAD variables, according to the GNPD's standardized protocol. (© GCT)

Relevant statistics on FAD Sightings

Number of FADs per Island

Island	Number of FADs	Percentage
Baltra	1	0.40%
Darwin	7	3%
Wolf	7	3%
Española	19	7%
Floreana	5	2%
Genovesa	4	1%
Isabela	59	21%
La Pinta	14	5%
Marchena	41	15%
Reserva la Hermandad	1	0.40%
San Cristóbal	71	26%
Santa Cruz	30	11%
Santa Fe	1	0.40%
Santiago	16	6%
Seymour	1	0.40%

Total number of FADs registered using the protocol

277

(2016–October 2025)

Type of sighting

	Num.	%
Coastal cleaning	249	89.89
Scientific research	15	5.41
Random finding	8	2.88
Fisher's finding	3	1.08
Drone flight	2	0.79

21 satellite buoys



Yearly registers in Galapagos Islands

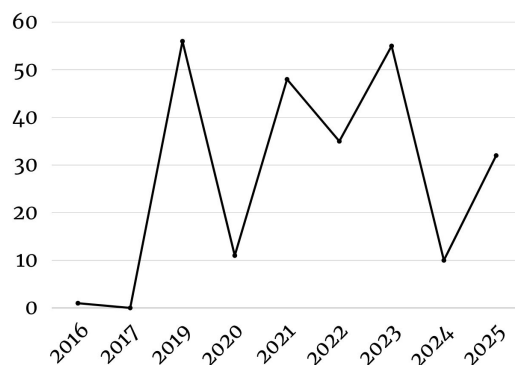


Figure 9. Results of the analysis of historical information on dFADs in the GMR (Source: GNPd. Figure prepared by GCT).

**Download the app for reporting:
FAD sightings**



Get to know the app
Online mode



Download the app
Offline mode:

1. Download appsheet
2. Log in with your account
3. Scan the following code



Available for:




Figure 10. Summary of methods, including App development (© GCT).

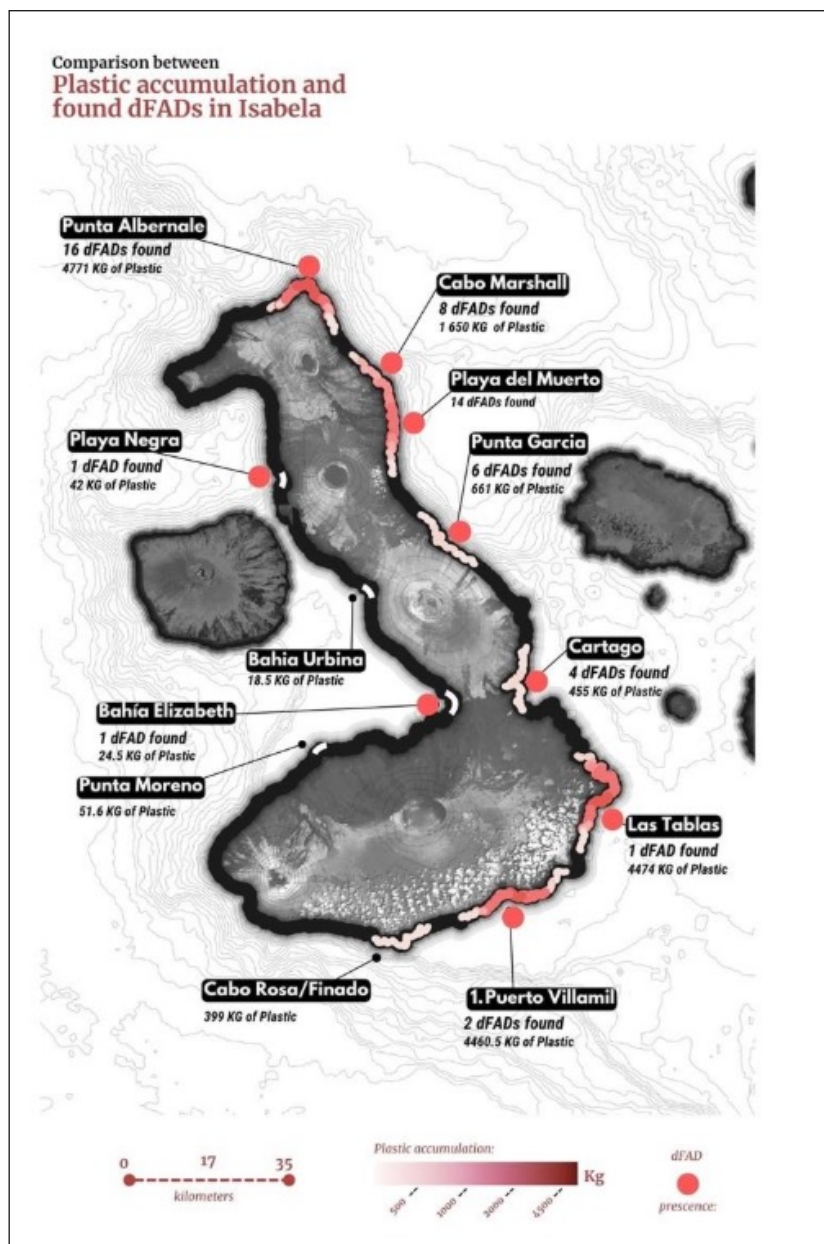


Figure 11. Map of plastic accumulation recorded on Isabela Island during GNPD coastal cleanup campaigns, with FAD sightings overlaid. (Source: GNPD. Prepared by: GCT).

6. Study limitations

The findings presented in this report should be interpreted in light of several methodological limitations inherent to this initial phase of the research. First, much of the available information on dFADs within the Galápagos Marine Reserve (GMR) consists of anecdotal data collected prior to the implementation of the standardised reporting protocol (AppSheet platform) in 2024–2025. As a result, the historical records available may not consistently reflect the true magnitude of the problem over time.

Second, the samples used across the different components of the study, including surveys of artisanal fishers (123 and 32 respondents, respectively), drone image analyses (56 images from four islands, covering 224,750m²), and anecdotal sighting records (30–40 observations) provide a valuable foundation for this pilot phase, but represent only a limited subset of the total population of users and the geographic extent of the GMR. Consequently, the results should not be extrapolated to the entire archipelago without appropriate caution.

In addition, a substantial portion of the evidence is based on perceptions and self-reported observations from artisanal fishers, naturalist guides, and other local stakeholders. Although these data provide important qualitative insights, they may be subject to recall bias, differences in risk perception, or variation in participants' willingness to report observations. Finally, the period of systematic data collection under the standardised protocol remains relatively short; therefore, the trends identified in this report should be regarded as preliminary and subject to validation as a more extensive time series becomes available.

These limitations do not undermine the findings presented in this report but rather highlight the importance of continuing to strengthen standardised data collection, expanding the geographic and temporal coverage of monitoring efforts, and advancing information-sharing mechanisms with the fishing industry and the Inter-American Tropical Tuna Commission (IATTC), as recommended in this report.

7. Conclusions, knowledge gaps and next steps

This report outlines our understanding of the state of knowledge on dFADs in Galapagos, taking a holistic approach to capture information available from a broad range of stakeholders, within the context of the regional and global need for more data on dFADs. It provides a baseline from which the GNPD, GCT and partners are developing a collaborative dFADs programme. The planned objectives and activities will be reviewed periodically as we continue to strengthen technical expertise, the collaborations and the funding available.

Based on the scoping activities of pilot research, we highlight the following key knowledge gaps:

Regionally:

- There is a major data gap for dFADs in the Eastern Pacific in general, and it is not possible to define with certainty whether the current 'Active FAD' limits exceed the level of past dFAD deployment.

- Information and traceability limitations persist on vessels releasing dFADs.
 - Industrial fishing companies have satellite tracking systems on dFADs, including those entering the GMR, but this information is not yet shared in a timely manner with MPA managers to support a timely response.
 - Data is reported to the IATTC, but information is bound by confidentiality agreements.
 - A divergence is observed between deployment and retrieval efforts by the industry, but it is not clear to what extent lost dFADs are being fully reported. The IATTC's voluntary dFAD recovery scheme represents a relevant step toward strengthening efforts.
- There is limited understanding on the polluting impacts of dFADs and their satellite buoys, including the possible leaching of heavy metals from its component parts.
- There are early warning systems available in other parts of the Pacific. The TUNACONS "Cuidando Galapagos Initiative" represents an important step in this direction, with the potential to increase its reach and ambition in Galapagos:
- There is a good understanding of plastic pollution sources and pathways in the GMR, including maritime sources, although specific knowledge around dFADs (quantities, origins, types/materials, pathways, accumulation sites) is still in an initial stage.
- Most data collected on dFADs in the GMR to date has been opportunistic without a standardised protocol for data collection. dFAD and buoy retrievals (with the exception of those during coastal clean-up campaigns) have had little coordination and data-sharing with the GNPd.
- The evidence on the ecological impacts of dFADs in the GMR is still preliminary, including the presence of ghost fishing in the water column and on the seabed, and how many are stranding in sensitive coastal habitats.
- The initial phase of the collaborative dFADs programme has allowed the adoption of a standardised data collection protocol and created initial heat maps of distribution, which are key inputs to help guide solutions. The next phase will engage more Galapagos stakeholders in real-time reporting of dFADs sighted in the GMR, whether stranded, drifting, or submerged.

8. Opportunities to make change & connect to decision makers

Based on the route map established by the GNPd in August 2024, the evidence gathered in this State of Knowledge report and on the legal diagnosis undertaken, we recommend considering the following actions:

- i. **Establish dFAD non-deployment zones** in waters adjacent to the GMR to reduce their entry driven by ocean currents, applying the precautionary principle and based on the analysis of historical trajectories and oceanographic models.
- ii. **Promote the creation of a dFADs monitoring and retrieval programme** by the GNPd, including a retrieval taskforce and safe final disposal, approved dFADs retrieval protocols and financial mechanisms to allow sustainable implementation.

- iii. **Promote the establishment of early warning systems** with buoy satellite service providers, ensuring that dFAD trajectories are shared with the GNPD from the moment they enter the GMR and throughout their presence within the reserve, thereby strengthening the effectiveness of recovery efforts. This could be achieved through a FAD monitoring system in Galápagos, coordinated by the GNPD.
- iv. **Increase information availability and traceability** of dFADs through:
 - A. the creation of a dFAD registry and traceability system;
 - B. mechanisms to identify and link owners with their active and inactive devices;
 - C. the recognition of dFADs as an official fishing gear and method;
 - D. the promotion of shared responsibility schemes with industry, satellite companies, tuna canning companies, and other relevant stakeholders to finance dFAD recovery and management through programmes aligned with the GNPD.
- v. **Promote incentives for industry efforts** aimed at the effective recovery of dFADs and the development of more rigorous control mechanisms to prevent dFAD abandonment or loss.
- vi. **Strengthen compliance** with existing IATTC measures aimed at reducing the use of plastics in dFAD structures by incorporating a technically rigorous definition of biodegradability.
- vii. **Establish an interinstitutional technical working group** tasked with proposing measures to reduce the impacts of dFADs, strengthening the national position within the IATTC, and coordinating preventive, management, and regulatory strategies at the national level.
- viii. As a complementary measure to the above, **evaluate the application of existing enforcement authorities** in response to the entry of dFADs into the GMR and the HMR, as well as the revision of the existing sanctions regime in cases where no alert systems or recovery protocols have been implemented despite the availability of collaborative mechanisms.

Building the Galapagos dFAD Case Study

It is important to focus research and management efforts toward better understanding the deployment and use of dFADs that enter the GMR and Hermandad. There is an opportunity to deliver a programme that builds a comprehensive case study in Galapagos which documents the impacts, quantities, origins and pathways of dFADs in a marine reserve with UNESCO World Heritage Status, contributing to advocacy for improved regulations at the regional level. It is important that frequent users of the GMR, (fishers, naturalist guides, scientists among others) are aware of opportunities to participate in data collection to increase reports to a centralised reporting system operated by the GNPD, and that communication programmes to engage the authorities and the local community with the problem of dFADs are delivered. Furthermore, opportunities exist for collaboration with formal and informal parallel activities, such as the collection of satellite buoys by fishers, the GNPD led coastal cleaning trips, ghost gear collection and diving courses, to start progressively integrating these efforts to standardised dFAD data collection. Within this programme, there are opportunities to further strengthen the work of the GNPD by building capacity to report and retrieve dFADs safely, using sustainable finance mechanisms.

The Galápagos National Park Directorate (GNPD) reaffirms its commitment to continuing to lead the development of an integrated management approach to address the challenges posed by drifting Fish Aggregating Devices (FADs). This first State of Knowledge Report provides a robust technical baseline, resulting from collaboration with GCT, CI, and other strategic partners, which will help guide future phases of research, monitoring, and informed decision-making.

The GNPD recognises that the progress achieved to date, from the standardisation of data recording to the legal assessment, defines a roadmap for joint efforts with local and national authorities, as well as international organisations, aimed at effectively and sustainably reducing the impacts of dFADs within the GMR and HMR. In this regard, the GNPD reiterates its commitment to dialogue and interinstitutional cooperation as the most effective pathway toward advancing lasting solutions.

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STATE OF KNOWLEDGE REPORT

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