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LOST IN TRANSIT: FADS DRIFTING FROM FISHING GROUNDS TO THE WESTERN ATLANTIC

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SUMMARY

The commercial tuna industry has used Fish Aggregating Devices (FADs) for decades, a specialized fishing accessory to enhance the catch-size and efficiency of harvesting tropical tuna species. Drifting FADs (dFADs) are deployed by the thousand annually in the Atlantic region, set adrift with a geolocating buoy. It is estimated that 10 to 20% of deployed FADs end up lost or abandoned. Currently there are specific measures that indirectly reduce the impact of lost and abandoned FADs, such as a limit on their active number at sea per vessel, and a transition to biodegradable FADs. However, there is no direct measure on the reduction of dFAD loss and abandonment, or their tracking and recovery. Derelict dFADs often drift to coastlines in North and South America where they impact benthos, shores and the species that inhabit them. The Caribbean FAD Tracking Project (CFTP), a community-science database, crowd-sourced reports of derelict FADs, including photos and descriptions of composition. To date, reports of 417 FADs have been collected, 100% of which were composed of non-biodegradable materials based on photographic analysis of reported FADs.

RESUMEN

La industria atunera comercial lleva décadas utilizando dispositivos de concentración de peces (DCP), un accesorio de pesca especializado para mejorar el tamaño de las capturas y la eficacia de la captura de túnidos tropicales. En la región atlántica se despliegan miles de DCP a la deriva con una boya geolocalizadora. Se calcula que entre el 10 y el 20 % de los DCP desplegados acaban perdidos o abandonados. Actualmente existen medidas específicas que reducen indirectamente el impacto de los DCP perdidos y abandonados, como la limitación de su número activo en el mar por buque y la transición a DCP biodegradables. Sin embargo, no hay ninguna medida directa sobre la reducción de la pérdida y el abandono de DCP a la deriva, ni sobre su seguimiento y recuperación. Los DCPd abandonados suelen llegar a la deriva a las costas de Norteamérica y Sudamérica, donde afectan al bentos, las costas y las especies que las habitan. El Proyecto de Seguimiento de los DCP del Caribe (CFTP), una base de datos científica comunitaria, recopiló informes de DCP abandonados, con fotos y descripciones de su composición. Hasta la fecha, se han recogido informes de 417 DCP, el 100 % de los cuales estaban compuestos de materiales no biodegradables, según el análisis fotográfico de los FAD notificados.

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KEYWORDS

Fish Aggregating Devices, FAD recovery, ALDFG, Biodegradable FADs, Tropical tuna, Purse seine fishery, FAD tracking and monitoring, Atlantic Ocean

1. Introduction

1.1 FAD use

Fish Aggregating Devices (FADs) are human-made floating structures designed to attract pelagic fish species. Tropical tunas associate with FADs, and purse seine and pole and line fleets commonly use them in the Atlantic Ocean. Their use has become widespread in tropical tuna purse seine fisheries due to their effectiveness in increasing catch size and reducing search time at sea (Dagorn *et al*., 2013; Founteneau., 2013). There are two main types of FADs: anchored FADs (aFADs), which are fixed to the seafloor and remain in a specific location, and drifting FADs (dFADs), which are free-floating and move with ocean currents. In the Atlantic Ocean, dFADs are used more extensively, particularly by industrial purse seine fleets.

Drifting FADs (dFADs) consist primarily of a floating raft, sometimes manufactured specifically for FAD fishing, though many are handmade, composed of bamboo or plastic materials. Rafts are often combined with a subsurface structure referred to as an aggregator, a tail, or a curtain. The subsurface components are usually made of netting or rope that extends vertically to increase the aggregation effect (Maufroy et al., 2015) and slow down the FAD's drift (Moreno et al., 2023). The length of the aggregator can vary from a few meters to over 100 m. Recent conservation measures do not allow the use of netting in dFAD construction to avoid ghost-fishing (Filmalter et al., 2013) although anecdotal reports suggest that fishers are using ropes and canvas in their place (ICCAT, 2024).

The operational lifespan of a dFAD in the Atlantic Ocean is estimated to be 5 to 12 months (Moreno et al., 2016). Despite this brief period of use, dFADs are often primarily composed of synthetic materials with lifespans exceeding centuries. In the past two decades, there has been a growing global initiative to phase out synthetic materials in dFADs (aside from the GPS buoys), with tuna regional fisheries management organizations (tRFMOs) in the Indian, eastern Pacific, and Atlantic Oceans issuing guidelines for FAD deploying vessels to mitigate the effects of marine plastics (Zudaire et al., 2023). In the Convention Area for the International Commission for the Conservation of Atlantic Tunas (ICCAT), the use of mesh net is prohibited for any part of a FAD, and only non-entangling FAD materials are permitted as of 1 January 2025 (ICCAT, 2024).

Purse seine vessels deploy numerous dFADs per trip. Under current ICCAT regulations, the maximum number of FADs with operational buoys per vessel is limited to 300 (ICCAT, 2024). These dFADs are commonly equipped with satellite-linked electronic echosounder buoys that allow fishers to remotely monitor biomass underneath each device (Lopez et al., 2014). These buoys transmit location and biomass estimates, enabling fishers to optimize fishing effort by targeting dFADs with the highest potential catch. The fishing strategy typically involves deploying dFADs well in advance of the vessel's anticipated fishing route and tracking them over a period of several weeks or months. It takes approximately two weeks for biomass to begin to aggregate around a FADs subsurface components after deployment, and roughly 40 days for engagement to peak (Jayakody and Pieris, 2003; Orue et al., 2019). When dFADs drift beyond the fishing ground or the vessel's authorized fishing area, fishers often remotely deactivate the buoys to stop receiving signals and avoid exceeding dFAD limits, thus abandoning the dFAD.

This practice of abandonment results in untracked and unmonitored dFADs that continue drifting in the ocean, contributing to marine debris and potential environmental harm. Imzilen et al. (2022) found in the Indian Ocean, 40% of dFADs drifted outside of their original fishing grounds with seasonal variation. Unlike in the Indian Ocean, prevailing currents in the Caribbean and Gulf of Mexico are not subject to seasonal variation, suggesting that there would not be seasonal variation in FAD stranding events (Imzilen et al., 2021), substantiated by the community-reported observations in Kimak (2021). No matter the rationale for a dFAD's loss, they are considered ALDFG, or "abandoned, lost, or [otherwise] discarded fishing gear." Gilman et al. (2021) categorized the use of dFADs in commercial tuna purse seine fisheries as one of the five fishing methods most significantly contributing to ALDFG globally.

1.2 FAD structure impacts on the ecosystem

One of the primary impacts of fishing with dFADs is marine litter, as lost or abandoned dFADs are often stranded on coastlines or entangled in coral reefs, causing habitat degradation. Consoli *et al.* (2020) found that over one-third of all marine debris is marine in origin, commonly ALDFG such as fishing line, floats and synthetic mesh netting. The non-biodegradable materials used in many conventional FADs, such as synthetic ropes, nylon canvas and plastic floats, persist in the marine environment and contribute to macro- and microplastic pollution (Moreno *et al.,* 2018).

Recent efforts have focused on developing biodegradable FADs (bio-FADs) using natural fibers such as cotton, bamboo, or sisal, in order to reduce their long-term environmental footprint (Escalle et al., 2021; Moreno et al., 2018). However, dFADs can drift at sea for extended periods—often several years—and travel far beyond their original deployment areas. As a result, many dFADs constructed with entangling materials and deployed prior to the implementation of current conservation measures are still likely to be adrift or have stranded along coastlines, continuing to pose ecological risks despite recent regulatory advances (Royer et al., 2023).

The passive nature of dFADs lends itself to their role in ghost fishing as they do not require active maintenance, are commonly deployed in high numbers for months at a time and were commonly made with inherently entangling netting materials. An estimated 480,000 to 960,000 silky sharks (*Carcharhinus falciformis*) were entangled in dFAD netting each year from 2010 to 2012 in the Indian Ocean (Filmalter et al., 2013). The likelihood of megafauna entanglement in subsurface aggregators increases with the length of the material, and poses a risk to sharks, cetaceans, and sea turtles, as well as corals and other benthic species as the dFADs drift into nearshore habitats (Gilman, 2011). Current regulations in the three tropical oceans prohibit the use of netting in the construction of FAD structures. These conservation measures reduce—if not entirely eliminate—the risk of entanglement of marine fauna in the FAD structure. In the Atlantic Ocean, this regulation entered into force in January 2025. Therefore, FADs deployed before this date that were built using netting may still be adrift, posing a risk of entangling marine species.

Bycatch from sets on dFADs, i.e., non-target species caught during the active catch with the purse seine gear, accounts for 2-8% of total catch by weight in the Atlantic Ocean (Scott & Lopez 2014). In the Atlantic Ocean, dFAD sets are associated with significantly higher bycatch of vulnerable species such as sea turtles, billfishes, and sharks—mainly silky and oceanic whitetip sharks (*Carcharhinus longimanus*)—compared to free school (FSC) sets. Amandè et al. (2010) reported that shark bycatch per metric ton of target tuna is three times higher in dFAD sets, with overall bycatch rates of 8.1 mt per 100 mt of catch versus only 2.8 mt in FSC sets. Amandè et al. (2017) documented an important trade and utilization of bycatch, which are retained and landed in Côte d'Ivoire for local markets.

1.3 Current regulations in place to mitigate the loss and impacts of FADs

In response to the growing concerns over FAD impacts, ICCAT approved Recommendation 24-01, which updates and strengthens previous management measures. Key provisions include:

- A maximum number of FADs per vessel (e.g., 300 active buoys per vessel);
- Mandatory FAD marking: All FADs deployed by purse seine vessels in the ICCAT Convention Area must be clearly marked. However, no specific guidelines on FAD marking are defined, and fishers typically use the serial number of the echosounder buoy tracking the FAD as the reference in their logbooks.
- Requirements for non-entangling in new FAD deployments and redeployments: No netting allowed in any of the FAD components.
- Stepwise transition to biodegradable FADs, following the categories below, vessels shall only deploy and redeploy FADs of biodegradability categories I, II and III:
    - Category I- FADs fully composed of biodegradable materials
    - Category II- fully biodegradable with the exception of plastic flotation devices (foam, buoys, etc.)
    - Category III- Contain synthetic, non-biodegradable materials in the raft and floatation components while the submerged components (tail) are composed of fully biodegradable materials
    - Category IV- Composed of biodegradable surface components excluding floats, and a non-biodegradable tail
    - Category V- composed solely of non-biodegradable materials

- FAD recovery and retrieval efforts are encouraged but not mandatory

1.4 FAD Recovery

Despite the absence of mandatory FAD retrieval obligations under ICCAT, several fleet associations and NGOs have launched recovery programs in the Indian and Pacific Oceans. However, no comparable initiative currently exists in the Atlantic Ocean. Examples include:

- *FAD Watch (Western Indian Ocean)*: A retrieval program launched in 2016 through a collaboration between OPAGAC-AGAC (Organización de Productores Asociados de Grandes Atuneros Congeladores-Asociación de Grandes Atuneros Congeladores), ICS (Island Conservation Society), IDC (Islands Development Company), and SFA (Seychelles Fishing Authority). It uses geofencing alerts to recover stranded FADs near selected islands in Seychelles, with ICS carrying out retrieval operations funded by the fleet.
- *Seychelles Government Retrieval Campaigns*: Conducted using the vessel *Saya de Malha*, donated by the Spanish company INPESCA. Initially focused on beach retrievals around Aldabra and other islands, the strategy shifted in 2024 to include at-sea recovery using real-time buoy tracking. Operations are co-funded by SIOTI (Sustainable Indian Ocean Tuna Initiative).
- *Oceanika Program (Western Indian Ocean)*: Launched in 2023 by the NGO Oceanika, this program has recovered over 130 FADs in Seychelles waters, conducting expeditions with professional divers. In 2024, Oceanika partnered with OPAGAC-AGAC.
- *Palmyra Atoll Program (Pacific Ocean)*: Initiated in 2021 in collaboration with the U.S. tuna industry, Cape Fisheries, and later OPAGAC-AGAC. The program is supported by TNC (The Nature Conservancy) and includes recovery, waste processing, and reuse of buoys for anchored FADs.
- *Galápagos Islands Program (Eastern Pacific)*: Part of the "Cuidando Galápagos" initiative led by TUNACONS and supported by CNP (Cámara Nacional de Pesquería) and CORPAG (Corporation of Artisanal Fishermen of Galapagos). It relies on a 15-mile geofence around key islands and the involvement of artisanal fishers for retrieval. The program provides compensation for each FAD and integrates recycling practices with local municipalities.

2. Objectives

This document aims to highlight the presence of dFADs that have reached the Caribbean and the eastern coasts of North and South America. It is not the result of a targeted FAD recovery program, but rather a census compiled opportunistically, based on reported sightings of FADs. This database provides valuable insight into FADs as ALDFG and their stranding in sensitive coastal ecosystems leading to environmental damage. Additionally, compiled reports suggest patterns in FAD construction and compliance with ICCAT recommendations.

3. The Caribbean FAD Tracking Project

3.1 Background

In 2015, the collection of reports that would become the Caribbean FAD Tracking Project (CFTP) began as an independent search for derelict FADs along the eastern Florida coast to establish a pattern and substantiate claims that FAD stranding events were not isolated in nature. The term "FAD" is used here because the project has also identified stranded anchored FADs, although to a lesser extent than dFADs. Therefore, "FAD" in this context refers to both anchored and drifting types. Reports of derelict FADs were accepted from any location in the Atlantic Ocean and Caribbean Sea. The broad geographic scale of this undertaking resulted in data collection being exclusively supported by participatory science and internet searches. Many of the initial reports were documented through keyword searches of Instagram, X (formerly Twitter), Facebook, Flickr, independent blogs and Google image searches using terms such as "bamboo raft on beach," "buoy on beach" and "mystery raft."

Images were studied to determine if they were lost or abandoned FADs rather than other forms of marine debris. If the found object was a FAD, the individual that made the report was contacted, and additional information such as the find date and location, as well as any other pertinent information was requested. Photographs of FADs and FAD components were catalogued by finder's name, date and location, as well as a brief physical description of the FAD. Any keyword search report that did not receive a supplementary response from the finder was not included in the dataset. Both the find date and the date reported were noted as many FADs were discovered well before the finder was made aware of its significance.

In 2019, the keyword search dataset was incorporated into a master's thesis by the senior author expanding on the initial effort to document derelict dFADs (Kimak, 2021). The Caribbean FAD Tracking Project was launched in April 2019 and a flyer (in English, French and Spanish) and informative emails were distributed to existing contacts around the greater Caribbean region, the Gulf of Mexico, and the eastern seaboard of the United States informing the public that the CFTP was collecting reports of abandoned and derelict dFADs around the Caribbean and Western Atlantic.

A Facebook page (https://www.facebook.com/fadtrackers) and email account (fadtrackers@gmail.com) were established to serve as central reporting points for the public. Datapoints requested included the find date and location, as well as supporting photos. Location was requested in latitude and longitude for specificity, though some reports were vague in nature, naming beaches, streets, or sometimes coastlines. These locations were classified as approximate (versus exact). Photos were studied to determine the make and models of dFAD rafts, whether the dFADs had intact subsurface components or were secured with a cover. Images of buoys were analyzed to determine the make and model of the buoy, whether there were post-manufacture markings on the buoy, what the markings detailed, if the markings could be connected to a vessel, and whether the dFAD met ICCAT 19-02 recommendations pertaining to dFAD design.

The CFTP received publicity from numerous local (to southeast Florida), national and international outlets highlighting FAD strandings and the associated environmental impact, as well as the CFTP's efforts to document these events. As of the end of 2024, 40 mentions of the Caribbean FAD Tracking Project were noted in news stories, peer reviewed scientific documents, conservation action plans, and United States federal reports. Results are thus a conservative estimate as the CTFP was not consistently notified of features. All public mentions of the Caribbean FAD Tracking Project were published prior to the outlet contacting the CFTP or were published without notification.

3.2 Methodology

Photographs of all reported FADs were requested, and any reports that did not have any affiliated images ($n = 10$) were excluded from analysis. Submitted images were studied to confirm whether or not a report was of a FAD (some reports were of shipping materials or other miscellaneous objects and marine debris), as well as raft construction and post-manufacture markings on buoys. All reports were initially categorized as an anchored or drifting FAD, then dFADs were further classified as "lone buoy" (**Figure 1**), "lone raft" (**Figure 2**), or "full FAD" (**Figure 3**)- reports with both a buoy and raft still tethered together. Buoy manufacturer (Zunibal, Marine Instruments, SatLink, Thalos, or uncertain) and model were noted, as were any post-manufacture markings. Marks were categorized as legible, partially legible, illegible, or absent. The type of post manufacture marking (alphanumeric, vessel name, buoy serial number, or some combination of the aforementioned) were identified, as was the medium used to mark the buoy (e.g., paint, paint markers). Buoys with insufficient photographs were classified as uncertain.

Rafts were initially classified as manufactured (makes included Zunibal and J.J. Chicolino) or handmade. Hand-constructed platforms were also categorized by primary construction material (e.g., bamboo, plastic jugs, and PVC). The presence of netting or other materials covering the raft were documented (referred to as covers), as were aggregators and their composition. Rafts were categorized by ICCAT category (I – V) based on construction materials. Photographed rafts that clearly depicted mesh netting were classified as "entangling," and any image that did not clearly show the buoy or the raft construction were marked as uncertain due to insufficient imaging.

4. Results

4.1 Abundance and distribution of reported FADs

As of the end of 2024, the Caribbean FAD Tracking Project received a total of 417 reports of FADs. Reports were initiated from 29 countries around the Atlantic, the majority of which came from the United States (n = 212, 50.8%) as seen in **Figure 4**. Eighty-two FADs (19.7%) were reported in Marine Protected Areas (MPAs) or other conservation regions where fishing was restricted or banned. This number reflects the percentage of FADs reported in protected regions, excluding those that provided only a region, state/sub-jurisdictional unit, or country as a location of reference (e.g., “Bahamas”, or “Texas”) ($n_{excluded}$ = 23). This figure is likely an underestimate as 47.2% of reports did not include an exact find location, but rather descriptive locations such as islands and coastlines.

There was no significant difference in the number of dFADs reported during the Atlantic hurricane season or outside the hurricane season (June 1st - November 30th; $\chi^2 = 0.42145$, df = 1, p = 0.5162), consistent with the findings of Imzilen et al. (2021). A total of 207 dFADs were reported to the CFTP in the months of December through May, while 194 were reported during hurricane season, and 15 dFADs were excluded from this analysis because the find date was not reported.

As seen in **Figure 5**, derelict FADs were reported from countries around the Atlantic and Caribbean, with reports from as far as southern Brazil and northern Norway. This geographic pattern of reports is consistent with the findings of Maufroy et al. (2015) that suggested that most reports of derelict FADs would be made from the east coast of Caribbean and South American countries with outliers on the west coast of European countries. Further simulations of FAD trajectories in the Atlantic Ocean using Lagrangian models could help to better understand the origin of FADs, as shown by Escalle et al. (2024) in the Pacific Ocean.

4.2 Composition of Reported FADs

Due to the passive and often retroactive nature of CFTP data collection, for the CFTP, the date of initial deployment of reported FADs is uncertain, meaning that it cannot be known if FADs were compliant at the time deployment only to be noncompliant at the time of discovery. Of the first reported FAD rafts, the majority were composed primarily of bamboo. The first raft reported that was composed of a material other than bamboo was an octagonal raft made buoyant by approximately a dozen 5L plastic jugs (similar to those containing motor oil) found on 13 March 2017. Seven months later, in October, the CFTP received the first report of a commercially manufactured raft made by Zunibal. Rafts produced by J.J. Chicolino Co. were first reported on 28 May 2019.

Drifting FADs (or dFAD components, i.e., a lone buoy or lone raft) made up 98.32% of all reports to the CFTP. Of the 102 manufactured rafts reported, 80.4% were Zunibal (n = 82), and 19.6% (n = 20) were J.J. Chicolino. The majority of homemade rafts (n = 143) were composed of metal or PVC frames with 5L jugs (n = 71, 49.6%). Seven anchored FADs (1.68% of all reports) were reported composed of PVC pipes capped to provide buoyancy, or common marine floats with burlap aggregators. As seen in **Figure 6**, two additional FAD rafts were reported constructed of PVC, and two were made of barrels lashed together. Three FADs were reported adrift and are believed to originate from Curaçao, due to a telephone number local to the country on the FAD. Given the fisheries in Curacao, there were likely aFADs that were been broken from their moorings.

Looking at the three basic types of reports, 162 lone buoys were reported, 38.8% of all reports, along with 120 lone rafts (28.8%), and 135 full FADs, (32.3%) as seen in **Table 1** and **Figure 7**. Of all reported FADs, 84 (20%) can be tentatively attributed to a vessel from legible post manufacture marks. Two deceased green sea turtles (*Chelonia mydas*) were reported entangled in a dFAD aggregator, and a third, unidentified deceased sea turtle was reported next to another beached buoy.

4.3 Classification of FADs according to biodegradability categories in ICCAT Recommendation 24-01

In 2021, the Caribbean FAD Tracking Project dataset was composed of 267 reported FADs which were analyzed in the same manner as the current dataset. At the time, ICCAT Rec. 19-02 was the most recent regulation mitigating FAD use in the Atlantic and Caribbean region. This recommendation encouraged the use of non-entangling materials in both rafts and in the subsurface aggregators, as well as required that post manufacture markings and serial numbers on buoys be legible. The use of biodegradable materials was recommended to be prioritized but was not required. Of the reports with sufficient photographic evidence, 66 buoys (50.38%) were not legibly marked per the ICCAT recommendation, and 63 rafts (41.18%) were made with netting materials. In total, 119 reports (61.03%) were not following the proposed recommendation in Annex 5 of ICCAT Rec. 19-02, of using non-entangling FADs and marking buoys.

ICCAT Rec. 24-01 is the most recent resolution regulating FAD use in the ICCAT Convention Area that will go into effect in June 2025. Though the database reflects FADs deployed prior to its implementation, the biodegradability categories defined in ICCAT Recommendation 24-01 were applied to reports to classify the FADs encountered. This provides a baseline figure for monitoring the transition toward Category I FADs, which are fully biodegradable. Of the 417 reported dFADs, 19 were Category IV, with subsurface components composed of non-biodegradable materials and surface components that were biodegradable aside from flotation devices. Category IV reports also included dFADs with non-biodegradable surface components where the subsurface aggregator was not visible and could not be analyzed and were thus given "the benefit of the doubt" regarding compliance evaluation.

The majority of reported FADs were Category V (n = 191), composed entirely of non-biodegradable materials both at, and below the surface. Over half of all reported rafts were entangling (n = 135). 200 reports were either insufficiently photographed to determine raft and aggregator composition (n = 38) or consisted solely of lone buoys with no associated raft to examine (n = 162).

Regarding FAD marking, of the 287 buoys reported, and the 276 that were sufficiently photographed, 144 (52.17%) bore legible post manufacture markings. In examining the buoy's markings, the majority (n = 101, 35.07%) were marked with the buoy's serial number, followed by 79 buoys (27.43%) marked with an unidentifiable alphanumeric code. Thirty-three (33, 11.46%) bore only the name of the vessel, 14 (4.86%) were marked with both the buoy serial number and vessel name, 26 (9.03%) had no post manufacture mark at all, and 35 (12.15%) were uncertain as a result of insufficient images or damage to the dome of the buoy. These can be seen summarized in **Figure 8**.

5. Discussion

The use of dFADs in the Atlantic commercial tuna industry has been commonplace for nearly five decades, but despite this period of use, there have not been any studies quantifying actual dFAD stranding events. Several modelling studies have used buoy tracking data and projected stranding events (Maufroy et al., 2015, Imzilen et al., 2021). Imzilen (2021) estimated that approximately 10% of all FADs deployed by the French fleet in the Atlantic Ocean result in beaching events.

Though the dFADs reported to the Caribbean FAD Tracking project likely reflect a small percentage of the derelict FADs in the Atlantic and Caribbean region, they offer insight into the shortcomings of current FAD impact mitigation efforts. Conservative estimates suggest that approximately 17,300 dFADs were deployed in the Atlantic Ocean in 2013 with that figure increasing from previous years (Gershman et al., 2015), and up to 22% of all dFAD deployments result in a beaching event (Imzilen et al., 2021). This suggests that 3,960 dFADs could be beaching in the Atlantic annually, with unrecovered beach FADs in remote or inaccessible regions compounding each year. As the CFTP has been collecting reports of derelict FADs for six years, those reported could reflect just a small percentage of the total number of dFADs beaching annually in the Atlantic.

The majority of reports made from the United States were made from Florida (n = 159, 74.6%). Eighty-three reports were made from protected areas in United States State and National Parks, and from various MPAs and other conservation regions. While the original deployment location of the reported FADs cannot be determined at this time without increased transparency from vessels and buoy manufacturers as well as consistent post manufacture marking schemes, it is likely that the majority of the dFADs were deployed in the Gulf of Guinea, consistent with the findings of Maufroy et al. (2015, 2017) and Imzilen et al. (2021).

5.1 Stranded FAD categories

Every reported dFAD raft was composed of non-biodegradable materials that were commonly made with netting. Initial reports to the CFTP included rafts composed of bamboo, followed by platforms manufactured and sold in bulk at reduced rates. The use of plastic debris (such as 5L jugs) in FAD raft construction was first documented by the CFTP in 2017.

Reported FADs may have been compliant with ICCAT Recommendations at the time of their deployment; however, subsequent changes in regulations may render them non-compliant when found. For instance, FADs reported as stranded during 2024 may not meet current regulatory requirements, because they were deployed before the new legislation entered into force. Given that FADs can drift for extended periods before stranding - and may not be located immediately after stranding - it is likely that non-compliant FADs will continue to be found in the coming years.

In any case, collaboration with buoy manufacturers can provide valuable information on the year of deployment of each device, which is essential to determine whether a stranded FAD was compliant with the regulations in force at the time of deployment. Through this FAD census, it will also be possible to monitor how fleets are progressing in the transition toward non-entangling and non-biodegradable FADs.

5.2 FAD marking and traceability

Twenty-one rafts (8.5%) were marked with a post manufacture mark, all of which were rafts manufactured by J.J. Chicolino Co. or Zunibal. No handmade rafts bore a post manufacture mark. Less than half of reported buoys were legibly marked with some form of post manufacture marking, and only 22.54% of those could tentatively be attributed to a deploying vessel.

To enhance FAD traceability, ICCAT now recommends that, in addition to the buoy ID, the physical structure of the FAD (i.e., the raft) be permanently marked. If the FAD structure is not properly marked, it becomes very challenging to determine the origin and ownership of the FAD structures, particularly when the associated buoy is missing. FAD raft and buoy identification would facilitate accountability**,** monitoring of compliance, and data collection on FAD activity and fate (ICCAT 2024).

A key limitation in current traceability efforts is the deactivation of buoys, which prevents the identification and recovery of FADs once they are no longer monitored. One potential solution would be the deployment of an independent satellite-linked buoy—distinct from the operational buoy used by fishers—that remains active throughout the FAD's lifespan. Alternatively, regulatory frameworks could allow for controlled buoy deactivations. For instance, FADs located outside of fishing areas could be exempted from counting toward the limit of 300 active FADs, thereby incentivizing keeping FADs active without compromising compliance.

The enforcement of ICCAT Recommendations is primarily the responsibility of Contracting Parties and Cooperating Non-Contracting Parties (CPCs). Derelict FADs may result from both accidental (weather events, buoy damage) or intentional (remote deactivation) loss, creating difficulties in ascribing motive. The purposeful deployment of entangling FADs is a probability, though without CPC transparency regarding FAD ownership, marking schemes, loss, and deactivation, it is challenging to ascertain a reasonable estimate of frequency.

Despite the inherent biases in the dataset due to the method of data collection (keyword searches and word of mouth), as well as the lag between beaching events and subsequent reporting, these data offer valuable insight into dFAD construction techniques and post-manufacture marking schemes. The use of dFADs in Atlantic purse seine fisheries is expected to continue for the foreseeable future. The data from the CFTP FAD census can better inform ICCAT regarding future regulations to reduce the negative environmental impacts of the dFAD fishing strategy.

The Caribbean FAD Tracking Project is still collecting reports on lost and abandoned FADs in the Atlantic and Caribbean region. Discussions pertaining to reissuing a call for reports are ongoing. The CFTP is currently collaborating with echosounder buoy manufacturers Marine Instruments and Satlink to develop dFAD buoy recycling/reuse programs in an effort to reduce the waste of dFAD components and mitigate the environmental and economic impacts of commercial FAD fishing.

6. Recommendations for ICCAT (and tRFMOs in general)

The following recommendations to reduce the impact of lost and abandoned FADs and improve traceability are proposed:

1. Define the ownership of a FAD, specifying who owns both the float and the buoy in the water.
2. Establish rules for the possibility of transferring ownership
3. Regulate the deactivation or end of monitoring procedure of a FAD in a way that allows and enables its recovery outside the fishing area.

4. Exclude FADs that have left the fishing grounds but remain active for retrieval purposes from the active FAD limits.
5. Design a registry of FADs to effectively account for the number deployed, lost, abandoned, and recovered.
6. Develop marking criteria for the entire FAD structure, not just the satellite-linked buoy.
7. Establish a multi-stakeholder group (including scientists, industry, ENGOs, and managers) to work on the definition and design of FAD retrieval programs.

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Table 1. The number of FADs reported to CFTP, grouped categorically.

	Buoys	*Rafts*	*Photos*	*Non-Degradable Materials*	*Netting Present*	*Uncertain (insufficient images)*	*Legible Post Manufacture Marking*	*Tentative Attribution to Vessel*
Full FADs	135	135	133	112	67	40	61	24
Lone Buoys	162	-	159	-	-	14	83	60
Lone Rafts	-	120	116	104	71	12	0	0
Totals	**297**	**255**	**408**	**216**	**138**	**66**	**144**	**84**

Figure 1. A Marine Instruments M3i model echosounder satellite-linked buoy; an example of a "lone buoy" reported without a FAD raft present. Reported 25 April 2019 from San Jose Island, Texas, United States of America. Photo courtesy of Jace Tunnell.

Figure 2. A Zunibal Zunfloat, a reusable FAD raft. An example of a “lone raft” reported without a FAD buoy present. Reported 1 January 2023 from Rutland Bay, Mustique, Saint Vincent and the Grenadines. Photo courtesy of Raven Hoflund.

Figure 3. A homemade FAD raft constructed with an octagonal PVC frame filled with empty plastic jugs to provide buoyancy. The raft is wrapped in netting to provide structural integrity. A Satlink ELB3010 ISL buoy can be seen tethered to the raft in the foreground. An example of a "full FAD". Reported 18 January 2018 from Hollywood, Florida, United States of America. Photo courtesy of Manon Wiese.

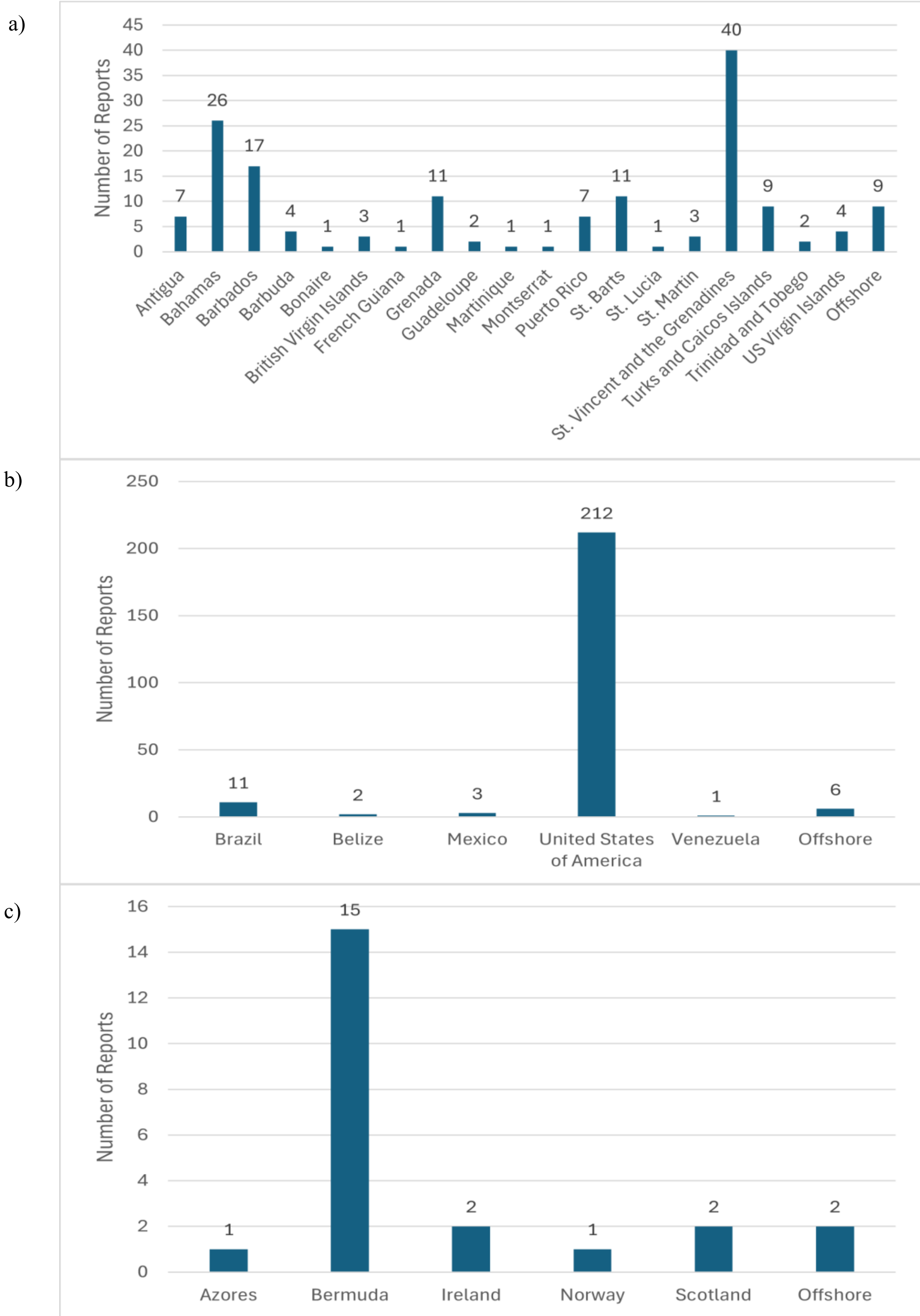

Figure 4. Total number of reported FADs from each country or island in the a) Caribbean Sea, b) Continental North and South America, and c) Other (Mid-Atlantic and Europe).

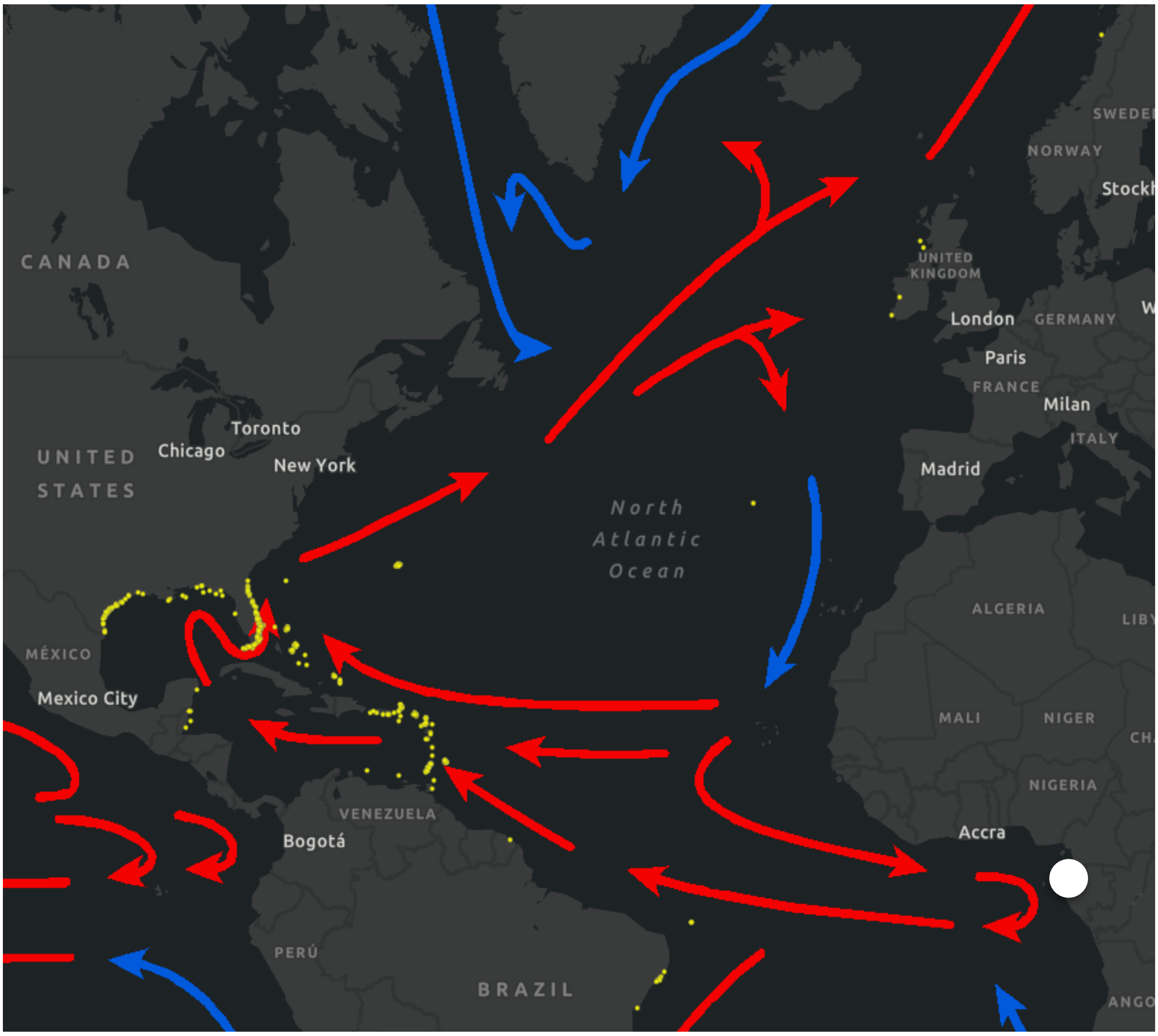

Figure 5. A visual comparison of all beaching locations of FADs reported to the Caribbean FAD Tracking Project from 1999-2025 and prevailing major currents. The white circle represents the general area where many dFADs are deployed in the Gulf of Guinea.

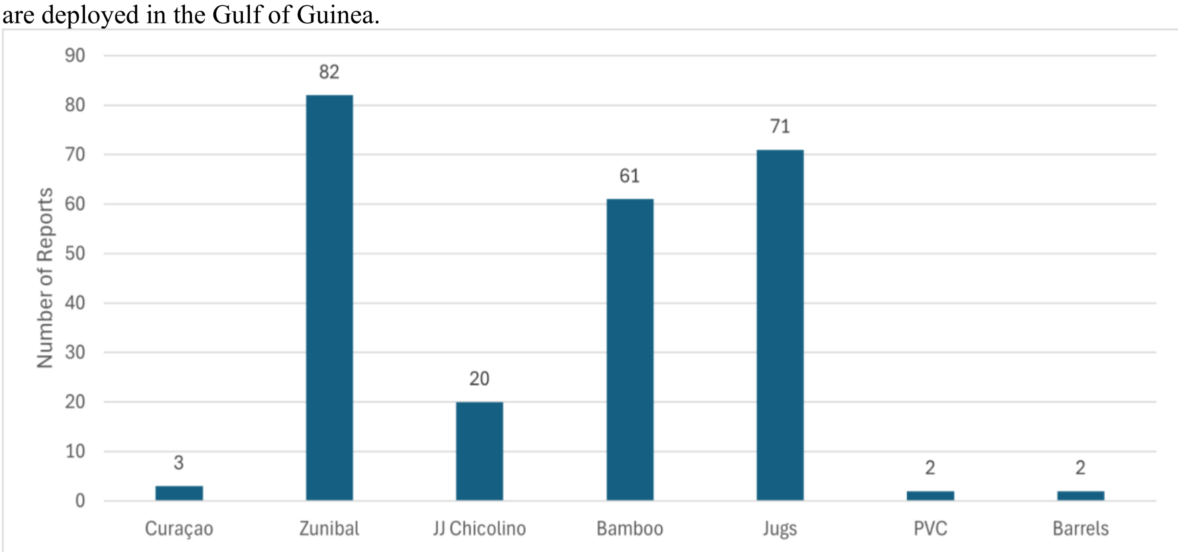

Figure 6. The number of reported FAD rafts of various compositions. Curaçao, Zunibal and JJ Chicolino FADs were all manufactured.

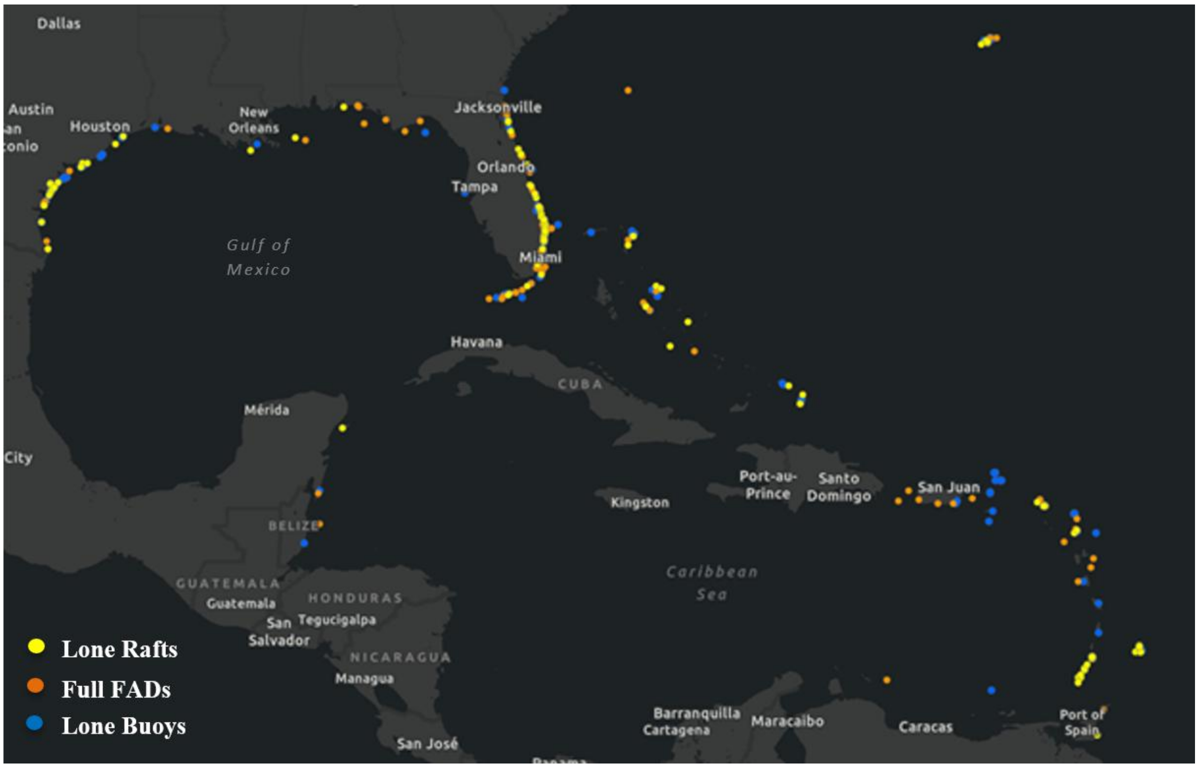

Figure 7. The location of all FADs reported to the Caribbean FAD Tracking Project from 1999-2025 excluding those reported in Europe and Brazil for ease of viewing. Orange points represent full FADs (both a raft and buoy present), yellow points represent lone rafts, and blue points are the location of lone buoys.

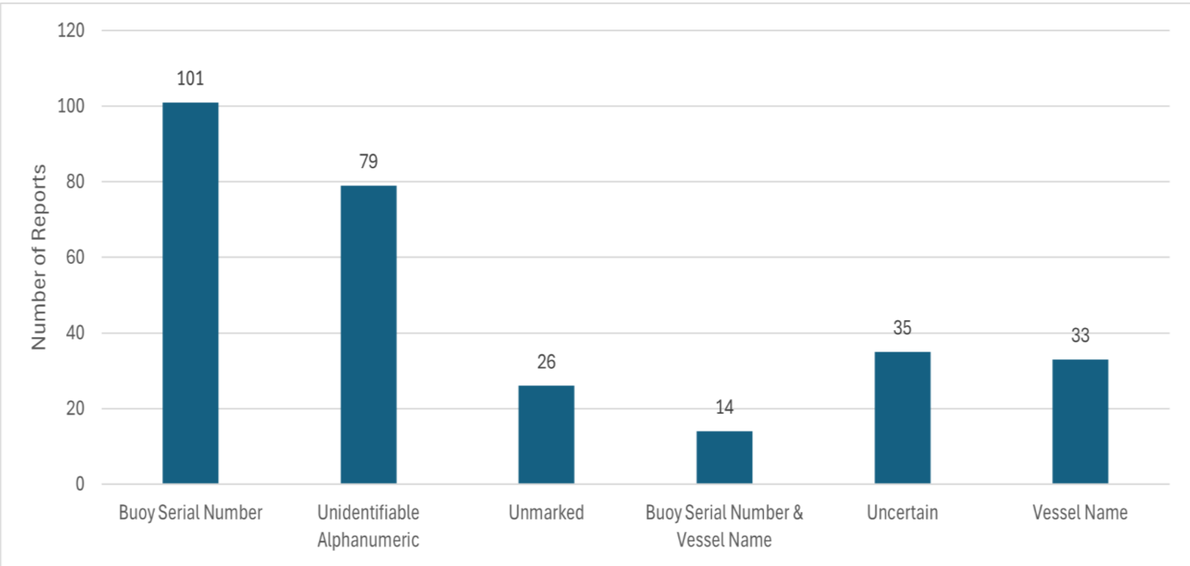

Figure 8. The number of reported FAD buoys with various post-manufacture markings by category.