# Collaborative FAD Research

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**Made Possible by the Federal Aid in Sport Fish Restoration (Dingell-Johnson) Program of the USFWS and Grant (No:F14AF00688) Administered by the Puerto Rico DNER**

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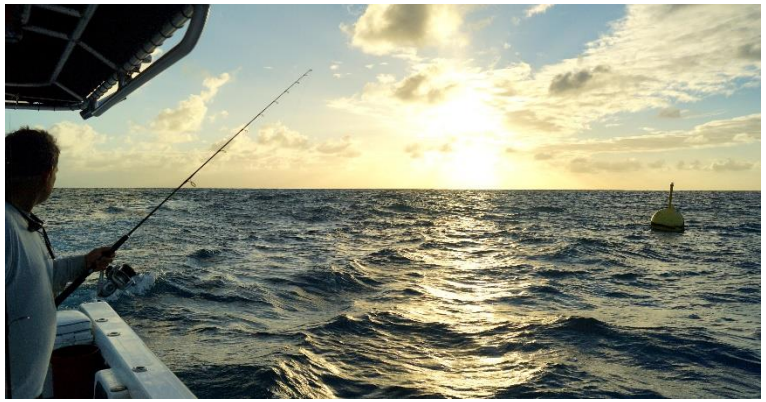

## Video Monitoring Provides Baseline Estimates of FAD Use

Fish aggregating devices (FADs) have been prolific throughout the Caribbean Sea for decades. Experimental FAD programs began in the U.S. Caribbean Sea in the early 80s, but it is likely that there were private FADs present even before then. Over the past few years, the governments of Puerto Rico and the United States Virgin Islands have pushed to reinvigorate sport fisheries, the fishing industry, and tourism by re-introducing open-access FAD programs. Currently, the managing agencies, the Puerto Rico Department of Natural and Environmental Resources and the USVI Department of Planning and Natural Resources and Division of Fish and Wildlife, are focused on maintaining deployments, on-site inspections, and fisheries research to ensure the FAD programs are here to stay. The timing of these programs coincides with a new era in data collection techniques and methods, data science, and technological advances in data collection devices to document FAD use, performance, and effectiveness in innovative ways. With the help of four charter boat captains (**Captain Luis Lagradier** of Puerto Rico SportFishing Charters, **Captain Luis Burgos** of Caribbean Fishing Academy, **Captain Rafa Terrassa** of Billfish, and **Captain Luis Iglesias** of Bill Wraps Fishing charters) in 2015 and 2016, our team was able to safely and successfully collect copious amounts of time-lapse imagery from three FADs to analyze vessel use. We identified three fishing sectors (recreational, charter and commercial) and 158 individual fishing vessels that used the FADs. The highest amount of activity occurred during late morning (9:00 am to 12:29 pm) and on Fridays, Saturdays, and Sundays. We also coupled vessel presence with an online catch survey, and we observed dolphinfish as the most frequently caught species around the FADs. The imagery was not only useful for documenting vessel presence but also marine life such as billfish (click for image), dolphinfish (click for image), unidentified marine life (click for image), and seabird activity (click for image). The imagery also showed a vessel that disobeyed rules by tying up to a FAD (click for image), an activity that could cause the FAD to break.

**SUPPORTED BY:**

SPORT FISH RESTORATION

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**Study Highlights**

- Fishing effort varied by time of day, day of week, and location
- Fishing effort increased 3X during fishing tournaments
- Recreational, charter, and commercial fishermen preferentially visited the FADs at different times
- FAD use varied based on vessel size
- FAD proximity to port influenced vessel visitation
- FAD placement can influence diversity of visitors or exclusivity
- Vessel tracking data supported camera observations
- Video monitoring is cost effective for short/medium-term studies

Additionally, many images revealed the close passage of massive tankers and cargo vessels (click for image) that are thought to have collided with FADs several times. Images also revealed different fishing modes including trolling (click for image), handlining (click for image), spearfishing (click for image), drift fishing (click for image), and the moments before fish were landed using gaffs (click for image).

In addition to the multitude of on-the-water observations the imagery provided, this study presents a new technique for rapidly identifying and detecting multi-sector fishing activity near FADs and highlights the potential to gather comparable data wherever FADs are deployed. There are also a number of ways to improve upon this study such as increasing recording time to compare FAD activity by season, recording at night, and using cameras with echosounder buoys and hydrophones to couple fish and fishery activity. These are areas of research that we intend to begin soon. This first study provides baseline information on FAD use including FAD specific vessel presence in hours and number of distinct vessel visits per day. The maximum number of vessel visits to a specific FAD in one day was 16, and there were a number of days when no activity was detected at FADs at all. We were able to confirm a visual range of .5 kilometers from each FAD for detecting small vessels (center console < 20'). The use of vessel tracking data with boats participating in our vessel tracking program confirmed patterns seen in the camera data for FAD visitation, movement between FADs (or the lack thereof), and FAD visit repeats. The placement of cameras on different FADs revealed that port proximity can heavily influence the diversity of vessel visits or exclusivity for specific vessels. Lastly, we worked with QuanTech, Inc. to conduct a cost-benefit analysis that compared video monitoring to traditional port, phone, mail and web survey techniques, which revealed the following:

- Video monitoring is cost effective for short and medium-term studies; costs increase with size of dataset and labeling images.
- Video monitoring is a fishery independent technique that can be used in conjunction with image recognition software.
- Port, phone, mail, and web surveys do not rely on remote monitoring equipment, which can be prone to failure.
- Port surveys can obtain extremely detailed fish trip reports, but they require visits to a dock, marina, or boat ramp.
- Combining video and port survey methods could result in more detailed reports of fishing dynamics near FADs.

To conclude, video monitoring provided insights into FAD fishing activity down to the level of an individual vessel. This information can be used to improve FAD rules and regulations, better understand FAD fishing activity, better determine FAD deployment locations, and structure surveys that minimize costs but maximize the potential to approximate FAD catch and effort in the future.

Click here to watch a video report on this study.

Click here to download the full paper.


Around the time the first FADs were deployed in June of 2015, a graphic was shared on social media that showed the potential of FADs to be deployed all around Puerto Rico, much like in Hawaii. Since 1980, Hawaii has operated an extensive FAD program off the islands of Hawaii, Maui, Oahu, and Kauai. Currently, there are 55 FADs in the Hawaiian FAD system that exist to revitalize the fishing industry and increase sportfishing opportunities. Puerto Rico's Department of Natural and Environmental Resources (DNER) initiated the Puerto Rico FAD system to achieve the same goals as the Hawaiian program. Soon, four FADs will be redeployed to begin the process of reestablishing the original FAD array that was in place by the spring of 2016. Click here to see where the FADs were deployed at that time. With the exception of FAD K and the re-deployment of FAD F on 5/15/2017, every other FAD that Fundación Legado Azul has deployed has remained in the water for more than 9 months. The average soak time for all FADs deployed to date is 437 days. FAD G remained in the water for 839 days, or 2.29 years, the longest to date. The first FAD to be damaged by a suspected cargo/tanker vessel was FAD E in 2016. Puerto Rico DNER field biologists responded to the incident and attempted to salvage the FAD that had taken on water but the FAD did not last much longer. On several occasions, local fishermen aided in the recovery of damaged FADs. **Captain Luis Burgos** of Caribbean Fishing Academy was the first to respond to the loss of FAD A and a few others after that. He inadvertently became the FAD recovery lead which was not an easy task given the size of the FADs and the stress that outboard engines endure when towing heavy objects in rough seas. Moving forward DNER and Legado Azul will have a recovery action plan in place following new deployments this year to respond to damaged or lost FADs in the event that they occur. For more information and to stay informed about the FAD program visit prfadsystem.com

Table 1 FAD deployments and durations moored off the north coast of Puerto Rico as of June 2, 2018.

| FAD ID | Deployed | Depth (m) | Lost or Damaged | Days Active | Re-Deployed | Lost | Days Active | Re-deployed | Status | Days Active |
|---|---|---|---|---|---|---|---|---|---|---|
| **E** | 6/2/2015 | 550 | 2/19/2016 | 262 | n/a | 4/5/2016 | 46 | 7/17/2017 | Inactive | |
| **F** | 6/3/2015 | 600 | 1/17/2017 | 594 | 5/15/2017 | 10/29/2017 | 167 | - | Inactive | |
| **G** | 6/4/2015 | 598 | 9/20/2017 | 839 | - | - | - | - | Inactive | |
| **D** | 6/8/2015 | 260 | 8/4/2017 | 788 | - | - | - | - | Inactive | |
| **A** | 9/17/2015 | 305 | 12/10/2016 | 292 | - | - | - | - | Inactive | |
| **B** | 9/18/2015 | 402 | 3/30/2016 | 291 | 7/17/2017 | | | | Active | 320 |
| **C** | 9/19/2015 | 349 | 12/29/2017 | 832 | - | - | - | - | Inactive | |
| **H** | 2/10/2016 | 520 | 2/18/2018 | 739 | - | - | - | - | Inactive | |
| **K** | 5/22/2017 | 400 | 6/4/2017 | 13 | - | - | - | - | Inactive | |
| **L** | 5/22/2017 | 400 | | | | | | | Active | 376 |


## RECENT DEPLOYMENTS

2 FADs were deployed to replace buoys lost during Hurricanes Irma & Maria:

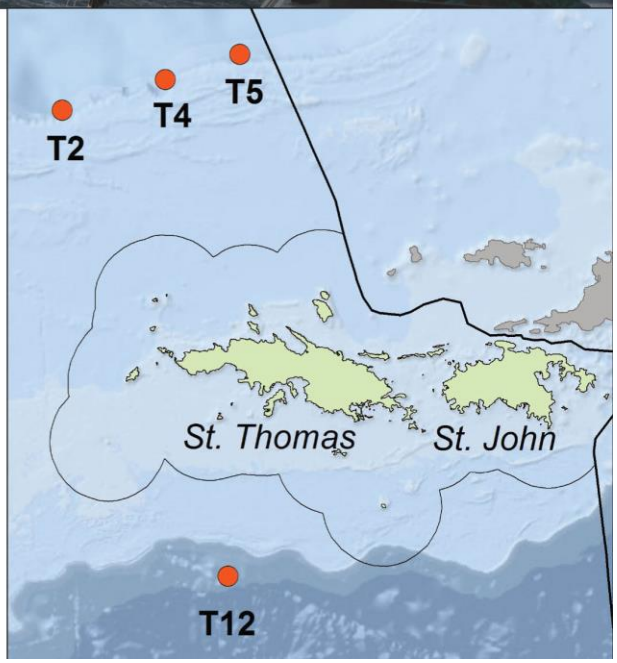
**T2**

18° 33.862' N
65° 08.773' W
1530' Depth
Submerged FAD

**T4**

18° 35.498' N
65° 03.188' W
1120' Depth
Submerged FAD

*For GPS coordinates of existing FADs, visit:*
***www.facebook.com/usvifads***




**New T-Shirts Are Available for Purchase**

Help support our FAD research by purchasing a program tee. The logo featured on the shirts was done by Casta Design in San Diego, CA, owned and operated by Dom Castagnola. You can also buy a Dolphinfish Research Program (DRP) tee with a logo done by Guy Harvey, the renowned marine artist and fisheries scientist. The DRP tees come in white, grey, and black. Please click here to order a t-shirt.

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