Options for Improving dFAD Recovery and Accountability to Minimize Coastal Habitat Damage and Marine Litter

Adam Baske (1), M. Shiham Adam (2)

(1) International Pole & Line Foundation. London, United Kingdom. (2) Ministry of Fisheries, Marine Resources & Agriculture. Male, Republic of the Maldives. Main author contact details: adam.baske@ipnlf.org, Phone +1 207 747 9419

Summary

Drifting FAD (dFAD) ownership, recovery and accountability are issues that have not been fully addressed by the tuna RFMOs to date. The use of drifting fish aggregating devices (FADs) continues to threaten endangered, threatened, and protected species (ETP), as well as the broader marine environment in the form of marine litter and abandoned, lost, and discarded fishing gear (ALDFG) which can damage fragile coastal ecosystems. The impacts of abandoned, lost and discarded FADs on vulnerable marine ecosystems needs to be fully understood and measures put in place to minimize these impacts. Until the issues of accountability, FAD tracking, and transparency are addressed by the tuna RFMOs, dFAD fisheries will continue to contribute significantly to marine litter and coastal habitat damage, while giving no recourse to the coastal states whose ecosystems are harmed as a result of dFADs. This paper examines the status of dFAD ownership and recovery requirements/protocols across the tropical tuna RFMOs, evaluates the legal instruments related to dFAD accountability, and suggests various options for improved FAD management, including by improved compliance with marine debris reporting requirements, recovery of dFADs at sea, requiring dFAD owners to notify coastal states when dFADs are approaching, and development of compensatory mechanisms.

Background

The increasing use of drifting FAD (dFADs) in tropical tuna purse seine fisheries over recent decades is well-documented. Current estimates suggest that upwards of 100,000 dFADs are deployed a year into the ocean for the express purpose of attracting tuna schools every year (Gershman et. al. 2016). While the purse seine vessel operators have information regarding their location and exact numbers, these data are not generally required to be reported by the respective RFMOs. With this increase of dFAD deployments, it is important that dFAD impacts be properly addressed and managed. In particular, threats related to marine litter and coastal habitat damage should receive immediate management attention given the nature of the dFAD fishery as no RFMO requires the recovery of dFADs deployed into the ocean. Until such time, impacts on coastal ecosystems and contributions to marine litter will continue to increase and the consequences will be borne largely by coastal states in the tropical regions which depend on coastal habitats for critical ecosystem services and tourism.

Marine litter

Discarded or unrecovered dFADs fall under the Abandoned, Lost or otherwise Discarded Fishing Gear (ALDFG) classification which has multiple negative impacts on the marine environment. The ability of ALDFG to continue ghost fishing has detrimental effects on vulnerable marine species and coastal habitats.

Several international instruments recognize the need to address ALDFG and to mark fishing gear:

- UNGA Resolution A/Res/60/31
- United Nations Agreement on Straddling Fish Stocks and Highly Migratory Fish Stocks
- MARPOL Convention - Annex V
- International Guidelines on Bycatch Management and Reduction of Discards (FAO 2011)
- Agreement of Port State Measures to Prevent, Deter and Eliminate Illegal, Unreported and Unregulated Fishing (FAO 2009)
- Voluntary Guidelines for Flag State Performance (FAO 2015)
- Committee on Fisheries (COFI/FAO) Increased global concern: Sustainable Development Goal target 14.1 requests action on marine litter and marine pollution of all kinds which includes ALDFG.

The consequences of ALDFG, according to the Global Ghost Gear Initiative's report (Huntington, 2017), entitled DEVELOPMENT OF A BEST PRACTICE FRAMEWORK FOR THE MANAGEMENT OF FISHING GEAR include:

• **Interactions with marine wildlife**. ALDFG, especially when made of persistent synthetic material, can cause marine fauna, including sea birds, turtles, seals and cetaceans, pain and suffering after entanglement and also if they ingest it.

• **Physical impacts on the benthos**. Abandoned, lost or discarded net fragments may get dragged along the bottom by strong currents and winds. This can smother and often obliterate fragile organisms like sponges and corals. Litter accumulating in offshore sinks may smother benthic communities on soft and hard seabed substrates.

• **Introduction of synthetic material into the marine food web**. Modern plastics can last up to 600 years in the marine environment. This depends upon water conditions, ultraviolet light penetration and the level of physical abrasion. Much of the abraded material exists for many years as microscopic plastic fragments and fibers. These can join the food chain and may adsorb, release or transport chemicals and their toxic effects.

• **ALDFG also results in both economic and social costs that can be significant**. When ALDFG fouls the marine environment, clean-up and gear removal costs can be significant. Estimating the costs associated with compliance, rescue, and/or research costs associated with ALDFG is complex, and does not seem to have been attempted to date. In particular, it is difficult to rate or compare the magnitude of the wide range of the socio-economic costs of ALDFG. This could be, for example, the financial impact on other sea users due to the navigation and other risks from ALDFG. This is because literature is very scarce and there are particular problems in quantifying and comparing costs across different stakeholders.

• **ALDFG can act as a navigation hazard**. Ropes and nylon line can entangle propellers, drive shafts, jet drives and water intakes, affecting a vessel's propulsion and ability to manoeuvre. This can lead to operational delays and, in extreme cases, injury and loss of life.

Coastal Habitat Damage

Maufroy et al. (2015) tracked dFAD beaching from the French purse seine fleet and found:

"Results derived from the selected model enable us to identify the main areas and seasons of dFAD deployment and the spatial extent of their drift. We find that dFADs drift at sea on average for 39.5 days, with time at sea being shorter and distance traveled longer in the Indian than in the Atlantic Ocean. 9.9% of all trajectories end with a beaching event, suggesting that 1,500-2,000 may be lost onshore each year, potentially impacting sensitive habitat areas, such as the coral reefs of the Maldives, the Chagos Archipelago, and the Seychelles."

The exact number of beaching events is not known as vessels will often deactivate their buoys before a beaching event occurs and do not generally share locations of potential beaching events with the at-risk coastal states. It is therefore left to the coastal states, often those that have the least resources, to clean up the litter and suffer the consequences of damage to their coastal habitats which provide essential ecosystem services and often contribute to local tourism opportunities. While many coastal states throughout the world have laws and regulations on the books identifying specific fines for damage to fragile coastal ecosystems, it is currently unknown to the authors if such instruments have been used by coastal states to recover the costs associated with habitat damage caused by dFADs.

Appendix 1 provides a crowd-sourced dataset compiled by beachcombers in the US and Caribbean that have encountered over 100 beached dFADs since 2010. While the dataset is incomplete, it gives an indication of the widespread nature of dFAD beaching events, all of which cause some amount of damage and require clean-up. According to the data, there is an increasing trend in beaching events of FADs that use large metal and hard plastic disc frames that comprise the floating element of dFADs. With beaching events occurring regularly, there should be a mechanism in place for stakeholders in coastal states to inform the relevant RFMO, flag state, and/or vessel. Further guidance on what such a mechanism could look like should be explored.

While there is considerable discussion about non-entangling and biodegradable dFADs, such devices will still damage coastal habitats when beaching events occur, so it is critical that mitigation, management, and pay-back mechanisms are in place to minimize events in the future, and ensure the proper frameworks are in place to give

coastal states the appropriate recourse to pursue damages when such events occur. Further, there are currently no independent verification schemes in place that ensure that the biodegradable and non-entangling FAD provisions being implemented or considered by RFMOs are adhered to. In future, such independent verification mechanisms are essential to ensure compliance.

Opportunities to improve accountability around dFAD usage:

As it stands, there are no requirements for purse seine vessels or supply vessels to recover dFADs once they are deployed nor to take responsibility for them in the event that they damage coastal state habitats. This current short-coming in dFAD management could be improved through various management avenues, including:

- clear definitions of dFAD ownership and responsibilities
- clear requirements on "deactivation" to minimize harm to coastal habitats
- strengthen dFAD recovery requirement
- independent tracking/monitoring of dFADs
- clear avenues for coastal states to recover costs for habitat damage, in collaboration with RFMOs and vessel owners

Ownership: Without a clear understanding of dFAD "ownership" means, it will be difficult to apply appropriate accountability measures. As it stands, multiple vessels can share "ownership" of dFADs, as demonstrated by some of the beached dFADs in the western Atlantic that have multiple vessel names on them in Appendix 1. As for ownership, this could be attributed to whichever vessel deploys the dFAD. In the case where dFADs are deployed by supply vessels, RFMOs should consider clear guidance on how to clearly apply ownership responsibility to accommodate the operational realities of different fleets.

In terms of the responsibilities of dFAD owners, there should be consistency applied across the tuna RFMOs, which would be in accordance with international instruments on gear marking, the reporting of ALDFG, and reporting of plastic pollution. Currently, several of the RFMOs distinguish between "active" and "inactive" dFADs, and have numerical limits for "active" dFADs in the ocean at any given time. While this accounts for the fact that some dFADs drift out of the fishing area or become otherwise unusable (beaching, sinking, etc.), the current requirements fall short of best practice as abandoned, or "deactivated" dFADs constitute threats to beaching, hazards to navigation, as well as sources of plastic marine litter, which should be reported under MARPOL Annex V.

"Deactivation": Current RFMOs do not put any requirements around when a dFAD should be considered "deactivated." This decision belongs solely to the vessel. Therefore, if a dFAD is about to impact a coastal area, the vessel owner can decide to "deactivate" a device, and choose to no longer receive data from it. Likewise, if a dFAD drifts out of the primary fishing area and the vessel owner does not wish to retrieve it, such a decision can be made with no consequence or reporting requirement. While this might be acceptable from the perspective of vessel operators, such actions can amount to an intentional disposal of ALDFG and should be characterized as a contribution to plastic marine litter under MARPOL Annex V. In line with international instruments, such practices should be avoided to the maximum extent possible.

Modifying practices around dFAD deactivation could protect countless corals and other habitats if sufficient warning can be provided to the coastal state. Also, if a dFAD is deactivated, there should be an automatic report generated to the competent authorities regarding a contribution to ALDFG, in line with international best-practice. Such information could be made available to the RFMO secretariats so that the overall contribution to ALDFG can be assessed, analyzed, and presented to decision makers to ensure all efforts are being made to reduce the contribution to marine litter, ghost fishing, and habitat damage in line with various international instruments. Better defining the conditions under which a dFAD can be "deactivated" or even requiring that all dFADs be tracked UNTIL a beaching event occurs would greatly reduce the contribution to ALDFG and could potentially foster greater cooperation with other bodies involved in the management of the marine environment if such information where made available.

dFAD Recovery: In terms of international best-practices, if any fishing gear is lost or abandoned, every reasonable effort should be made to recover the gear. Currently, tuna RFMOs do not require vessels to recover dFADs once they are deployed. This is viewed as impractical given that such devices are adrift and would incur too much cost and time to recover. The only RFMO data on dFAD deployment vs dFAD recovery comes from the IATTC, which suggests that the gap between deployments and recoveries has increased in recent years. If this trend is the

same in other ocean areas, then it is possible that the contribution to ALDFG from the tropical purse seine fisheries is on the rise. It also suggests that the tuna RFMOs should consider additional requirements on dFAD recovery to discourage contributions to marine litter and ALDFG. Such recommendations, for example, could be in the form of percentages of overall deployments (i.e. 80% of all dFADs deployed must be recovered) with a goal of achieving 100% recovery.

dFAD Tracking and Verification: Balderston and Martin (2015) have found that lost dFADs used by the purse seine fleet in the Indian Ocean can have major impacts when becoming beached on reefs and other sensitive habitats. Modelling drifter trajectories have shown potential for beaching events in the central Indian Ocean (Imzilen, et. al, 2016). FAD WATCH was established in recent years as a collaborative program between several organizations with the aim of preventing and mitigating dFAD beachings across islands in Seychelles where the Island Conservation Society (ICS) has a presence. A Memorandum of Understanding (MoU) was signed in 2016 by the Spanish Purse Seining Fishing Fleet (OPAGAC/AGAC), Island Conservation Society (ICS), Islands Development Company (IDC) and Seychelles Fishing Authority. Under this system an automated alert system was setup at ICS that reports whenever a dFAD arrives within 5 nautical miles of any atoll where ICS has a permanent presence, and provides GPS coordinates, trajectory and estimated projected time of beaching. This allows ICS staff time to plan and intercept these FADs before beaching occurs, preventing damage to reefs and other marine fauna. Since the beginning of the project, it is estimated that dFAD beaching events by the target fleet in the Seychelles have been reduced 20% and 41% respectively, during 2016 to 2017 period (Zudaire et al. 2018).

The PNA in the Western and Central Pacific Ocean are also involved with dFAD tracking in their waters - https://pnatuna.com/content/pna-steps-work-fad-management. This tracking information will allow the PNA States to better monitor dFAD fishing in their waters and implement similar systems as in the Seychelles to protect sensitive habitats from the impacts of dFADs. Ideally this type of system should be implemented throughout all RFMO areas whereby location information is provided in near real-time to the relevant authorities for monitoring purposes.

Mechanism for Coastal States: As noted earlier in the paper, it is estimated that 10% of dFAD deployments result in beaching events in the Indian Ocean. While the exact percentages have not been scientifically estimated in other ocean regions, there are clear examples of dFAD beaching events on coastlines and coral reefs the world over. As of now, the RFMOs have not considered how such events should be addressed.

Important questions for RFMOs to consider include: Should coastal state stakeholders who discover a dFAD inform the RFMO? Should they inform their local government, and ask them to submit these events to the RFMO? What type of information about the dFAD should be submitted? Should inquiries and information go directly to vessel owners? Should there be information on dFADs (rafts and satellite buoys) on how to contact dFAD owners in the event of beaching events? These are all important considerations for the RFMOs, as these bodies hold the responsibility to ensure the use of, and impact on, the marine environment is well managed, and impacts on marine ecosystems, particularly from ALDFG and marine litter, are minimized.

References

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Appendix 1 - Atlantic dFAD beaching events

Nearly all of this data on dFAD beachings in the North Atlantic and the Gulf of Mexico was obtained using keyword searching on the internet for blogs and social media posts. Once a post about a likely dFAD was found, an attempt

was made to reach the person responsible for the post to collect specific information. Photo-verified of dFAD beacons and rafts were compiled into a database maintained by Tom Pitchford and summarized here.

#	FIND DATE	FIND LOCATION	FLAG	VESSEL NAME AVAILABLE	FAD TYPE	BUOY ID AVAILABLE	PHOTO AVAILABLE
1	10/22/2010	Crystal Beach Texas USA	Spain	Yes	Buoy	Yes	Yes
2	11/28/2011	Jacksonville Florida USA	Spain	Yes	Buoy	Yes	Yes
3	4/22/2012	Big Pine Key Florda USA	Ghana	Yes	Buoy	No	No
4	5/20/2012	Holly Beach Louisiana USA	Spain	Yes	Buoy	No	Yes
5	6/22/2013	Turneffe Belize	France	Yes	Buoy	Yes	Yes
6	9/2/2013	North Palm Beach Florida USA	El Salvador	Yes	Buoy	Yes	Yes
7	Unsure	Maudabo Puerto Rico	Spain	Yes	Buoy	Yes	Yes
8	5/25/2014	Miami Florida USA	El Salvador	Yes	Buoy	Yes	Yes
9	7/5/2015	Palm Beach Florida USA	Ghana	Yes	Buoy	No	Yes
10	8/23/2015	Bermuda	El Salvador	Yes	Buoy	Yes	Yes
11	9/10/2015	Fowery Lighthouse Miami FL	Cape Verde	Yes	Buoy	No	Yes
12	9/26/2015	Isla Blanquilla, Venezuela	Spain	Yes	Buoy	No	Yes
13	11/25/2015	East coast of Barbuda	Spain	Yes	Buoy	Yes	Yes
14	9/11/2016	Bermuda	Spain	Yes	Buoy	Yes	Yes
15	10/4/2016	Tequesta Florida USA	Unknown	No	Buoy	Yes	Yes
16	10/16/2016	St. Croix USVI	Ghana	Yes	Buoy	Yes	Yes
17	10/17/2016	Tequesta Florida USA	Senegal	Yes	Buoy	Yes	Yes
18	11/16/2016	Middle Caicos, TCI	Unknown	No	Buoy	No	Yes
19	11/10/2016	North Caicos, TCI	Unknown	No	Buoy	Yes	Yes
20	12/1/2016	St. Croix USVI	Ghana	Yes	Buoy	No	yes
21	12/24/2016	East coast of Barbuda	Cape Verde	Yes	Buoy	No	Yes
22	12/24/2016	East coast of Barbuda	Unknown	No	Buoy	Yes	Yes
23	12/26/2016	East coast of Barbuda	Unknown	No	Buoy	Yes	Yes
24	3/18/2016	East coast of Barbuda	Unknown	UNSURE	Buoy	Yes	Yes
25	Unknown	Matagorda Texas USA	Ghana	Yes	Buoy	Yes	yes
26	1/31/2014	Matagorda Texas USA	Spain	Yes	Buoy	Yes	yes
27	Unknown	Quintana Roo Xcalak Mexico	Unknown	No	Buoy	Yes	No
28	10/1/2016	Quintana Roo Xcalak Mexico	Ghana	Yes	Buoy	Yes	Yes
29	Unknown	Bimini	Unknown	No	Buoy	No	No
30	3/1/2017	Anegada, BVI	Unknown	UNSURE	Buoy	Yes	No
31	3/1/2017	Anegada, BVI	Belize	Yes	Buoy	Yes	No
32	4/29/2017	Miami Florida USA	Belize	Yes	Buoy	Yes	Yes
33	6/25/2017	Miami Florida USA	Unknown	No	Buoy	Yes	Yes
34	9/22/2017	Palm Beach Gardens, Florida	Unknown	No	Buoy	Yes	Yes
35	10/29/2017	Dania Beach, Florida	Unknown	No	Buoy	Yes	Yes
36	1/8/2018	Hollywood, Florida	Unknown	No	Buoy	Yes	Yes
37	2/25/2018	Palm Beach, Florida USA	Unknown	UNSURE	Buoy	Yes	Yes
38	1/29/2018	Summerland Key, Florida USA	Spain	Yes	Buoy	Yes	Yes
39	2/18/2018	Loblolly Bay, Anegada, BVI	Unknown	No	Buoy	Yes	Yes
40	3/3/2018	South Padre Island, TX	Unknown	No	Buoy	Yes	Yes
41	5/5/2018	Vero Beach, Florida	Ghana	Yes	Buoy	Yes	Yes
42	6/13/2018	Saint Lucia	Unknown	UNSURE	Buoy	Yes	Yes
43	Unknown	Matagorda Texas USA	France	Yes	Buoy	Yes	Yes
44	Unknown	Matagorda Texas USA	France	Yes	Buoy	Yes	Yes
45	7/10/2018	Hollywood, Florida	Unknown	No	Buoy	Yes	Yes
46	7/16/2018	Grand Bahama	Belize	Yes	Buoy	Yes	Yes
47	8/6/2018	Juno Beach, Florida	Unknown	No	Buoy	Yes	Yes
48	9/4/2018	St. Augustine Beach, Florida	Unknown	No	Buoy	Yes	Yes
49	9/28/2018	Hutchinson Island, Florida	Unknown	No	Buoy	Yes	Yes
50	10/4/2018	Briny Breezes, Florida	Unknown	No	Buoy	Yes	Yes

51	10/5/2018	S. Ponte Vedra, Florida	Unknown	No	Buoy	Yes	Yes
52	10/25/2018	Mustique, SVG	Unknown	No	Buoy	Yes	Yes
53	10/19/2018	Cameron Parish, Louisiana	Unknown	UNSURE	Buoy	Yes	Yes
54	11/9/2018	Mustique, SVG	Unknown	No	Buoy	Yes	Yes
55	11/12/2018	Briny Breezes, Florida	Unknown	No	Buoy	Yes	Yes
56	11/13/2018	Jensen Beach, FL	Unknown	No	Buoy	Yes	Yes
57	11/14/2018	Surfside, FL	Unknown	No	Buoy	Yes	Yes
58	12/8/2018	St. Petersburg, FL	Unknown	No	Buoy	Yes	Yes
59	Unknown	Mustique, SVG	Spain	Yes	Buoy	Yes	Yes
60	Unknown	Mustique, SVG	Spain	Yes	Buoy	Yes	Yes
61	Unknown	Mustique, SVG	Unknown	No	Buoy	Yes	Yes
62	Unknown	Mustique, SVG	Curacao	Yes	Buoy	Yes	Yes
63	Unknown	Mustique, SVG	Unknown	No	Buoy	No	Yes
64	Unknown	Mustique, SVG	Unknown	Yes	Buoy	Yes	Yes
65	1/30/2019	Florida	Unknown	No	Buoy	Yes	Yes
66	2/12/2019	Hollywood Beach Florida	Unknown	UNSURE	Buoy	Yes	Yes
67	3/31/2019	Palm Beach Florida	Unknown	No	Buoy	Yes	Yes
68	5/29/2012	Ballast Key Florida USA	Unknown	No	Buoy, unreadable	No	Yes
69	3/22/2015	Freeport Texas USA	Unknown	No	Buoy, unreadable	No	Yes
70	11/13/2015	Elliott Key Miami Florida USA	Unknown	No	Buoy, unreadable	No	No
71	5/1/2016	Biscayne National Park	Unknown	No	Buoy, unreadable	No	Yes
72	9/12/2016	Palm Beach, Florida USA	Unknown	UNSURE	Buoy, unreadable	UNSURE	Yes
73	Unknown	Port Aransas Texas	Unknown	UNSURE	Buoy, unreadable	Yes	No
74	Unknown	Port Aransas Texas	Unknown	No	Buoy, unreadable	Yes	No
75	Unknown	Port Aransas Texas	Unknown	No	Buoy, unreadable	No	No
76	5/15/1999	Jensen Beach Florida USA	Unknown	No	FAD raft w/o buoy	N/A	Yes
77	4/4/2010	Mayaro Trinidad and Tobago	Unknown	No	FAD raft w/o buoy	N/A	Yes
78	11/5/2013	Port Aransas Texas USA	Unknown	No	FAD raft w/o buoy	N/A	Yes
79	11/23/2013	St. Andrew Barbados	Unknown	No	FAD raft w/o buoy	N/A	Yes
80	9/27/2014	St. Lawrence Gap Barbados	Unknown	No	FAD raft w/o buoy	N/A	Yes
81	10/22/2014	San Miguel de Cozumel MX	Unknown	No	FAD raft w/o buoy	N/A	Yes
82	1/1/2015	Middle Caicos TCI	Unknown	No	FAD raft w/o buoy	N/A	Yes
83	4/29/2015	Conception Island Bahamas	Unknown	No	FAD raft w/o buoy	N/A	Yes
84	7/9/2015	Tequesta Florida USA	Unknown	No	FAD raft w/o buoy	N/A	Yes
85	10/28/2015	Palm Coast Florida USA	Unknown	No	FAD raft w/o buoy	N/A	Yes
86	10/30/2015	Sauteurs Grenada	Unknown	No	FAD raft w/o buoy	N/A	Yes
87	11/20/2015	San Jose Island Texas USA	Unknown	No	FAD raft w/o buoy	N/A	Yes
88	11/28/2015	Palm Beach Florida USA	Unknown	No	FAD raft w/o buoy	N/A	Yes
89	1/30/2016	St. Andrew Barbados	Unknown	No	FAD raft w/o buoy	N/A	Yes
90	4/16/2016	Padre Island Texas USA	Unknown	No	FAD raft w/o buoy	N/A	Yes
91	8/10/2016	Vero Beach Florida USA	Unknown	No	FAD raft w/o buoy	N/A	Yes
92	9/20/2016	Mustique St Vincent & Gren.	Unknown	No	FAD raft w/o buoy	N/A	Yes
93	10/8/2016	Palm Beach Florida USA	Unknown	No	FAD raft w/o buoy	N/A	Yes
94	11/13/2018	Lake Worth, Florida	Unknown	No	FAD raft w/o buoy	N/A	Yes
95	3/15/2019	New Smyrna Florida	Unknown	No	FAD raft w/o buoy	N/A	Yes
96	3/15/2019	Cayenne French Guiana	Unknown	No	FAD raft w/o buoy	N/A	Yes
97	10/27/2017	St. Augustine Beach Florida	Unknown	No	ZunFloat	N/A	Yes
98	5/15/2018	Kingston, SVG	Unknown	No	ZunFloat	N/A	Yes
99	10/5/2018	South Ponte Vedra Florida	Unknown	No	ZunFloat	N/A	Yes
100	11/9/2018	Mustique, SVG	Unknown	No	ZunFloat	N/A	Yes
101	3/29/2019	Long Beach Barbados	Unknown	No	ZunFloat	N/A	Yes
102	3/29/2019	Long Beach Barbados	Unknown	No	ZunFloat	N/A	Yes
103	3/31/2019	Palm Beach Florda	Unknown	No	ZunFloat	N/A	Yes
104	4/7/2019	Bermuda	Unknown	No	ZunFloat	N/A	Yes