Toward a Sustainable Caribbean FAD Fishery

An Analysis of Use, Profitability and Shared Governance

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SUMMARY

Fisheries are an important source of food, income and cultural identity for Caribbean communities. While reef fisheries in the Caribbean are frequently over-exploited, offshore pelagic resources also targeted by the US sport-fishing industry may generate alternative economic benefits and divert pressure from reefs. Key to the efficient harvesting of thinly-distributed pelagic fish is the use of fish aggregation devices (FADs). Traditionally, FADs were deployed by individuals or close-knit groups of fishers. Recently, governments have deployed public FADs accessible to all. There is concern that public FADs are exploited less efficiently and produce conflicts related to crowding and misuse.

In partnership with Counterpart International, the Caribbean Regional Fisheries Mechanism and the Dominica and St. Vincent and the Grenadines Fisheries Divisions, Florida Sea Grant collected information from fishermen on their use of FADs that were deployed privately, by small groups or by the government. This allowed for a determination of governance arrangements that were most profitable and provided input to stakeholder meetings with FAD fishers to identify best practices for sustainably using and co-managing FADs.

The fishing trip analysis shows that catch and profitability are higher when FADs are managed privately or by small groups and access to the aggregated fisheries resources is somewhat restricted. An engagement strategy that introduced an activity planner as a best practice to increase information sharing helped strengthen the rapport between government and fisheries stakeholders. Study results are helping shape regional implementation of policy, which favors FADs co-managed by fishers and government, but can benefit from positive aspects of FADs managed privately or by small groups.

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INTRODUCTION

The use of fish aggregation devices (FADs) in the Caribbean is becoming more widespread as small island nations attempt to shift exploitation from often overfished reef fisheries to the less heavily exploited off-shore pelagic fishery resources (Gomes, Mahon, Hunte and Singh-Renton, 1998). FADs are man-made structures made to float on or just below the surface of the ocean. These structures are typically kept in place by buoys and ropes tethered to large concrete blocks or to sand bags that are dropped to the sea floor. FADs attract pelagic fish, such as tuna, dolphinfish and marlin that may associate with the structure for days or weeks. By concentrating fish in a known location, FADs increase the efficiency of fishing and are widely employed in artisanal and industrial-scale tropical, pelagic fisheries (Klima and Wickman, 1971; Wickham, Watson and Ogren, 1973). Usually, FADs are deployed by individual artisanal fishers or close-knit groups who then manage exploitation of the aggregated fish to optimize economic returns and other benefits. Fishers who deploy such FADs effectively restrict access of others to the aggregated fishery resources, either by placing FADs in secret or far-off locations or by defending territories around their FADs. Access restrictions are economically beneficial to the fishers deploying the FADs but can lead to conflict with others. More recently, Caribbean island governments and other organizations have started to deploy public FADs that are not associated with exclusive use rights in an attempt to make the technology more widely available, while reducing access conflicts. Some governments also stipulate regulations that require fishers to obtain permission before deploying private FADs and to make such FADs available to the public. Open access conditions can be detrimental to profits unless some regulation or limited entry scheme is introduced. Examples include user fees, licensing (Samples and Sproul, 1985), individual transferable quotas or territorial use rights (Christy, 1982; 1996; Wilen, Cancino and Uchida, 2012).

So far, FAD development programs and research have focused on the design (Friedlander, Beets and Tobias, 1994; Kingsford, 1998), deployment (Feigenbaum, Friedlander and Bushing, 1989) and recruitment characteristics (Kingsford, 1993; Beets, 1989) of the FAD infrastructure. Comparatively little attention has been given to evaluating the effects that governance arrangements have on the profitability and sustainability of the pelagic FAD fishery resources

Figure 1. Dominica study locations.

(Guyader, Bellanger, Reynal, Demaneche, Berthou, 2013). FAD programs thus pose governance challenges at three spatial levels: local (deployment and use of individual FADs); national (spatial distribution and planning of public FAD deployment within exclusive economic zones - EEZs); and regional (management of fishing effort within the distribution area of the exploited stock). Caribbean-based co-management governance efforts have largely been undertaken at national and regional levels through the establishment of fisherfolk organization networks (McIntosh, Lay, McConney and Phillips, 2010; Lay, 2011). At the local/community level, there also exists a need to strengthen synergies between government and fisher stakeholders through engagement processes that emphasize participatory decision-making (Caribbean Regional Fisheries Mechanism, 2004; 2008). Especially needed are practical non-regulatory interventions that build information sharing, collaboration and trust among fisherfolk and local government stakeholders that can complement efforts being undertaken at national and regional levels.

In 2012, the Florida Sea Grant Program (FSG) partnered with Counterpart International, the

Figure 2. Informal discussions with fishers helped to identify fisheries management issues.

Caribbean Regional Fisheries Mechanism (CRFM), and the Dominican and St. Vincent and the Grenadines Fisheries Divisions to undertake a pilot project to help strengthen information sharing and cooperation between government and fishers, as necessary precursors to building effective FAD co-management governance. The pilot engagement process was implemented on Dominica because fishers there have a 30-plus year history of using FADs (Figure 1). The intent is to share the Dominica experience with the broader Caribbean community through partnerships with the Dominica and St. Vincent and the Grenadines Fisheries Divisions and the CRFM.

PROJECT DESIGN

This project examined the relationship between FAD fishing governance arrangements and economics. Also explored was the role that fisheries officers and extension professionals can play in strengthening co-management between fisherfolks and key government agencies through an integrated process of data collection, profitability analysis and stakeholder engagement.

Phase 1. Fisher Interviews

Objective: Characterize FAD governance arrangements.

The first project phase consisted of informal interviews with government agencies, leadership affiliated with national and local fishing cooperatives, and fishers at landing sites on Dominica and St. Vincent and the Grenadines (Figure 2). This 'rapid reconnaissance' helped to identify fisheries-related issues pertaining to the developing offshore FAD fishery. Of particular significance was the identification of various governance arrangements that characterize artisanal FAD fishing. Governance arrangements include private, small group, and public forms, which represent a continuum of more restricted access to open access conditions (Figure 3). Private FADs are deployed and maintained by an individual under a condition of limited or restricted access either by placing FADs in secret or far-off locations or by defending territories around their FADs. Another common circumstance is for FADs to be set and maintained by small groups of fishers who work cooperatively to harvest the aggregated fishery resources and may trade access to FADs with other groups. More recently, governments have begun to deploy and maintain arrays of public FADs where access is open to all.

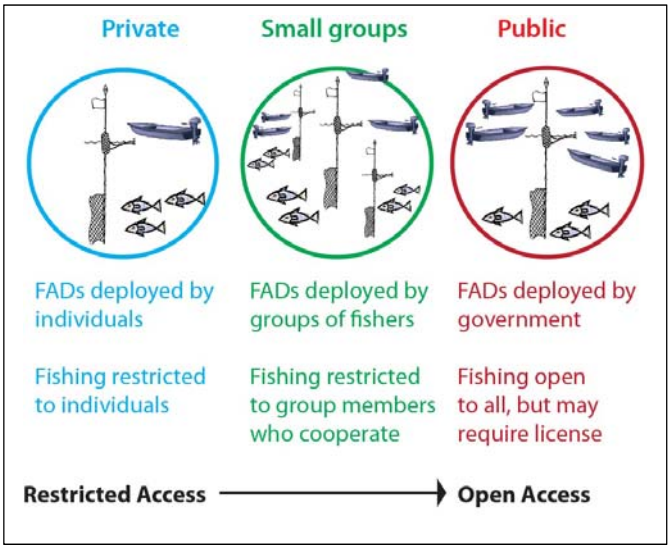


Figure 3. FAD governance arrangements.

Phase 2. Data Collection

Objective: Determine which governance arrangement produces the best FAD fishing results.

The second project phase established a monitoring program at three landing sites on Dominica: Fond St. Jean, Dublanc, and Marigot. The study locations are representative of different geographic regions on Dominica and are characterized by fishers who use private, small group and public FADs. A survey instrument, administered by field observers, consisted of three components: (1) a map which identified, located, and described all public, small group and

private FADs used by the fishers; (2) an inventory and description of all vessels used by FAD fishers; and (3) a record of catch and effort related to FAD fishing trips. (See Appendix A for the data collection forms.) The information collected from fishers allowed for a determination of which governance arrangements produced the best FAD fishing results (Figure 4).

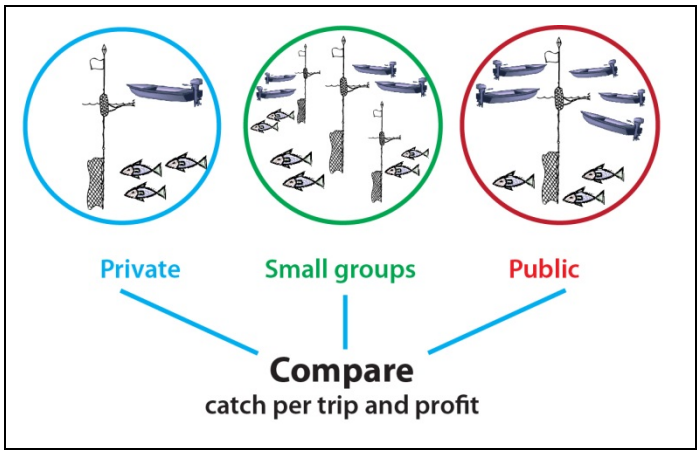


Figure 4. Governance and profitability analysis.

Data from 275 FAD fishing trips were analyzed to quantify the time spent fishing, the number of other boats seen by fishers at specific FADs, and the weight and species of fish that were caught at specific FADs. Fishing revenues, based on the current price per pound for fish, were compared with costs associated with fishing trips. This provided an estimate of the profitability of fishing on private, small group and public FADs (Figure 5). Fishing costs including fuel, crew share and boat and engine loans were provided by the 2011 Fisheries Industry Census of Dominica (Theophille, 2012).

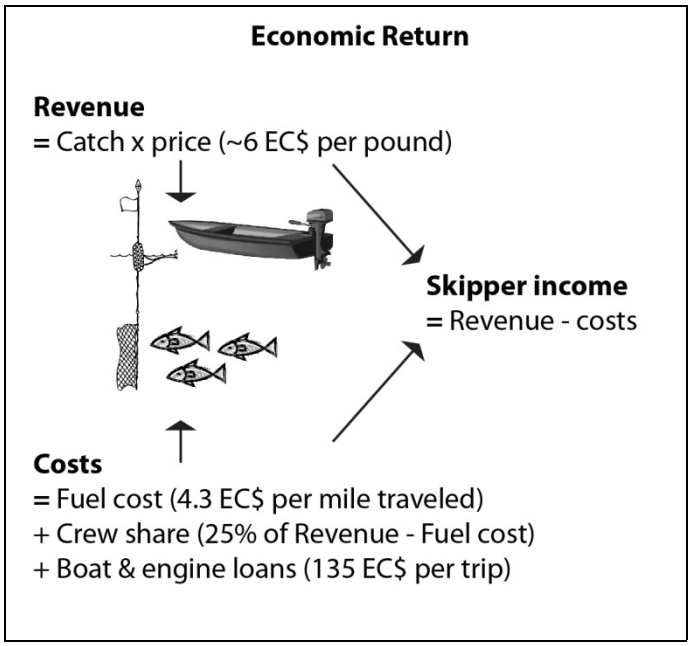


Figure 5. Profitability analysis factors.

Phase 3. Stakeholder Engagement

Objective: Strengthen co-management collaborations.

A multi-faceted engagement strategy that integrated data collection, data analysis and outreach was designed to build capacity and co-management synergies among government and fisherfolk stakeholders.

Capacity Development

During the third project phase, Florida Sea Grant hosted three personnel affiliated with the Dominica Fisheries Division at the University of Florida to evaluate the data collection process, interpret the collected data, and design a process for engaging fishers and other local stakeholders in discussion about options for managing FADs (Figure 6). An important element of the project was capacity-development and this training event served as an educational exercise that exposed our Dominica project partners to tools that facilitate meeting planning and participatory decision-making. (Please see Appendix B for the detailed workshop agenda.)

FAD Fisher Workshops

A series of workshops were held with fishers at the three landing sites on Dominica in order to share results of the data collection, discuss management implications, and solicit input from fishers about opportunities to improve FAD fishing success and sustainability (Figures 7 and 8).

More than 100 FAD fishers participated in the three workshops. The presentation of findings was received with great interest by fishers who were excited to see an analysis of data they themselves had provided. They clearly followed the analysis, embraced the results and almost immediately started drawing out management implications. Fishers felt that, in general, the analysis confirmed patterns they had expected but had been unable to quantify (e.g. the high returns to fishing on individual/private FADs and the reduction in catch variability associated with visiting multiple FADs on the same trip).

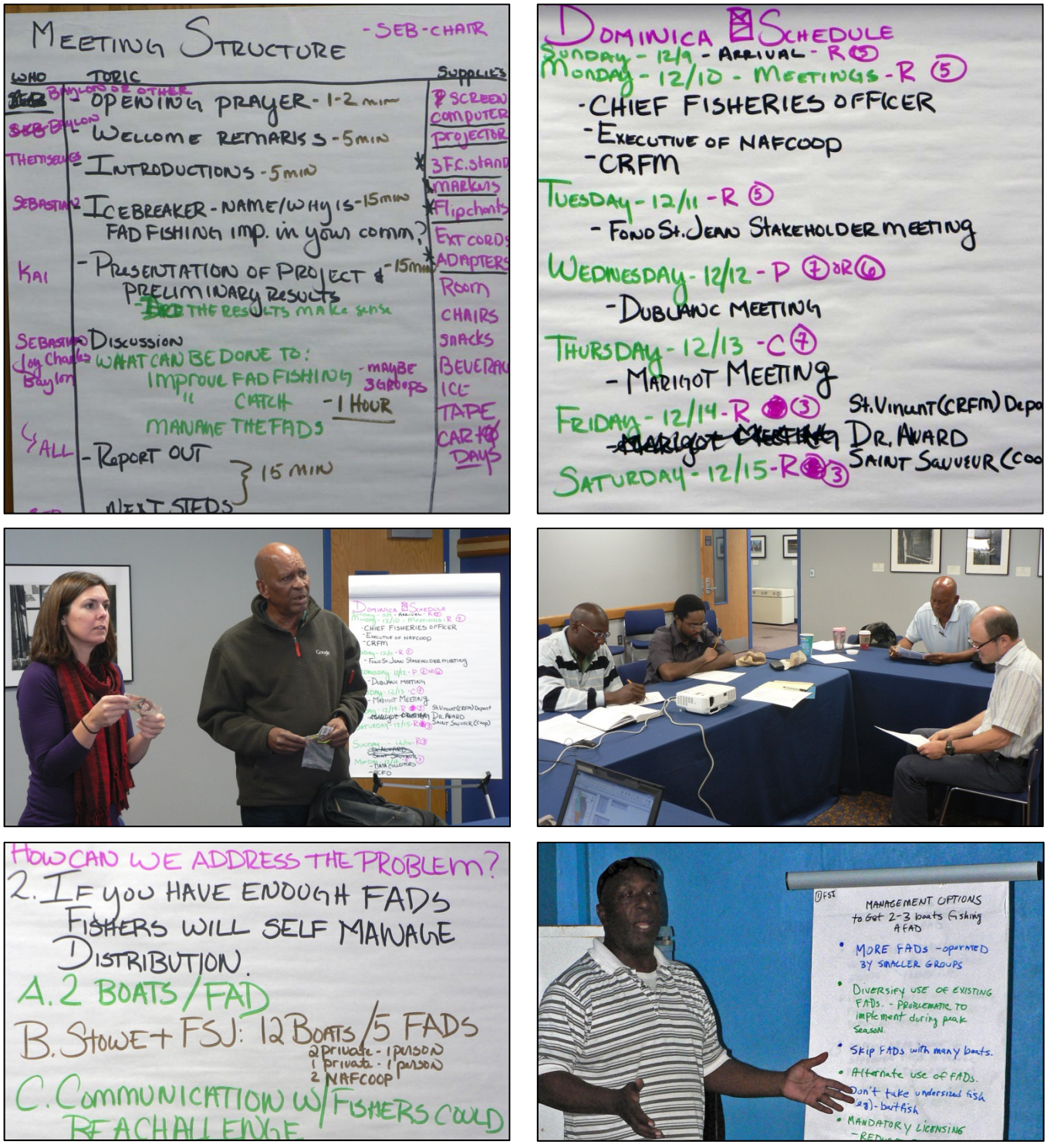


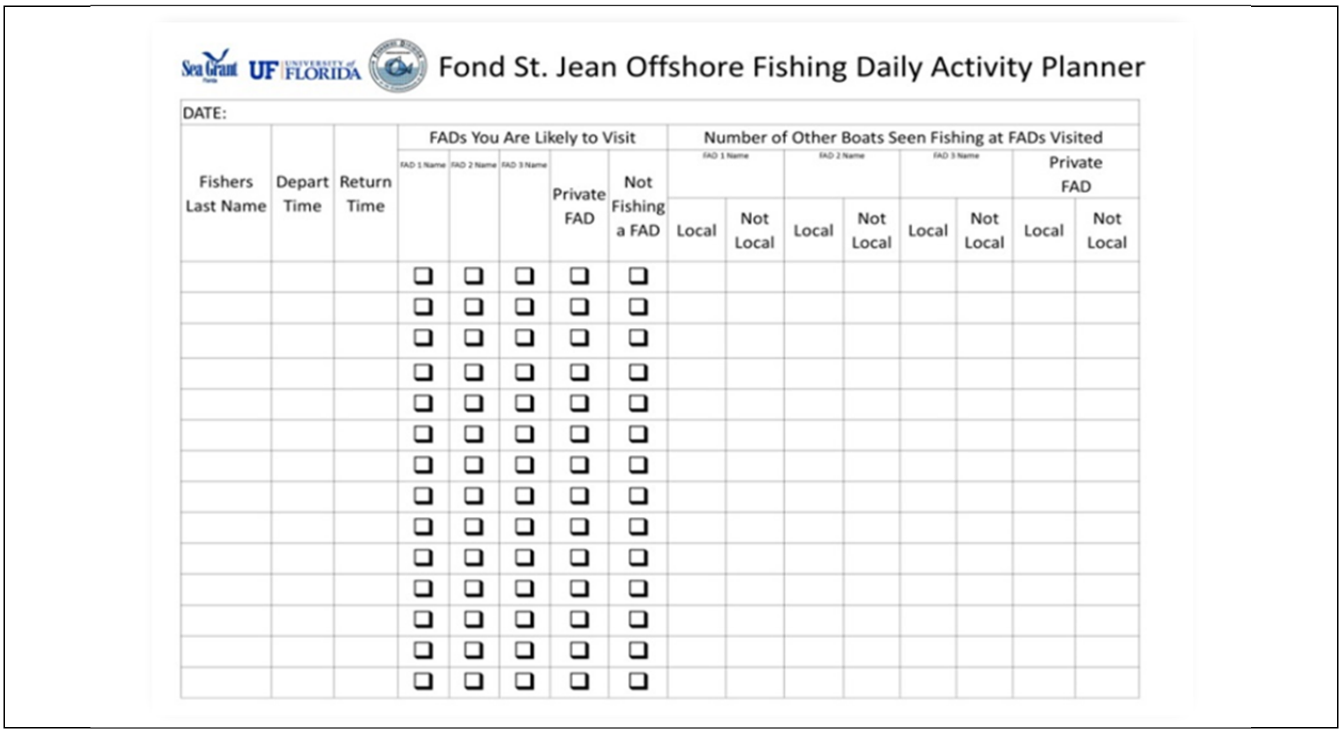
Figure 6. Planning the FAD Fisher workshops

The catch and effort analysis results provided fertile ground for small group discussions, which centered around three themes:

- Challenges to achieving optimal use of FADs and lessons learned from more successful approaches such as small group-based FADs.
- Co-management options that can increase catch and economic returns to FAD fishers.
- The role of fishers, fishing cooperatives, and the fisheries division in implementing co-management options for sustainably managing FAD use and pelagic fishery resources.

Figure 7. Introductions at the Fond St. Jean meetings.

Figure 8. Reporting out at the Dublanc meeting.



Fond St. Jean Offshore Fishing Daily Activity Planner

DATE:

Fishers Last Name	Depart Time	Return Time	FADs You Are Likely to Visit: FAD 1 Name	FAD 2 Name	FAD 3 Name	Private FAD	Not Fishing a FAD	Number of Other Boats Seen Fishing at FADs Visited: FAD 1 Name – Local	FAD 1 Name – Not Local	FAD 2 Name – Local	FAD 2 Name – Not Local	FAD 3 Name – Local	FAD 3 Name – Not Local	Private FAD – Local	Private FAD – Not Local
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Figure 9. Daily Activity Planner.

Figure 10. Explaining how to use the Daily Activity Planner

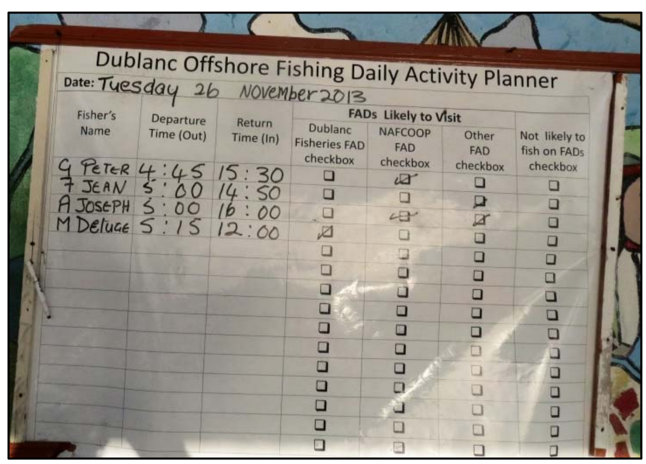

Figure 11. Daily Activity Planner used by FAD fishers

Best Management Practices

The second aspect of stakeholder outreach focused on the design and introduction of a practical tool in the form of a daily activity planner (DAP) – Figure 9. The concept of the DAP as a FAD fishing best management practice arose from workshop discussions with fishers who identified the need for better information sharing and cooperation.

The DAP was first introduced to small groups of fishers (Figures 10). Each group was affiliated with the three Dominica study sites where the FAD fishing catch and effort data collection took place. The initial response to the DAP from fishers was positive so it was formally implemented at two of the study locations, Fond, St. Jean and Dublanc. Marigot fishers exhibited a greater degree of small group cooperation so it was determined that efforts to increase cooperation and communication should be focused on those locations where fishing activities are more independent in nature.

Community-based liaisons were hired to facilitate use of the DAP among small groups of fishers at the Fond St. Jean and Dublanc landing sites. The liaisons were overseen by a fisheries officer assigned to the project by the Dominica Fisheries Division. The DAP was printed as a large-format poster with a special coating that could be used with erasable magic markers. Digital cameras were provided to the local liaisons who took images of the DAP after each day's use (Figure 11).

Development of these best management practices were based on three over-arching considerations:

- Non-regulatory options have the beneficial effect of fostering positive synergies between government and fisher stakeholders.
- Consensus-based options derived from direct consultation with fishers have a better chance for successful implementation.
- Data-driven options have a better chance for acceptance and adherence among stakeholders.

RESULTS

FAD Use and Profitability Analysis

Catches per FAD fishing trip are shown in Figure 12, for FADs deployed privately, by small groups, or for the public (with government support).

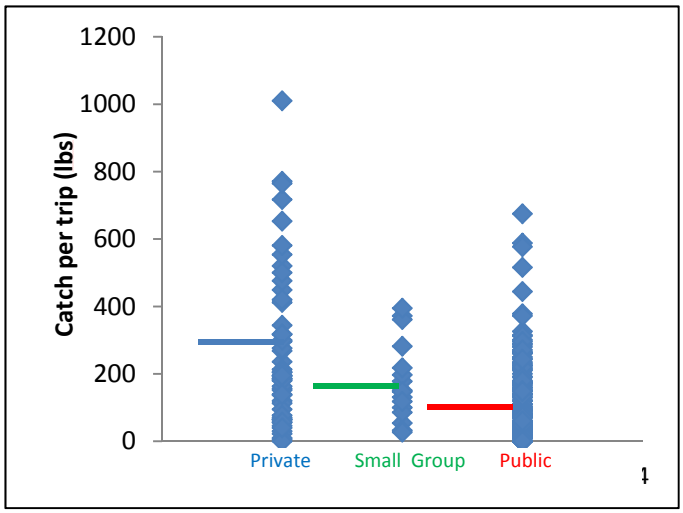

Figure 12. Catch per trip

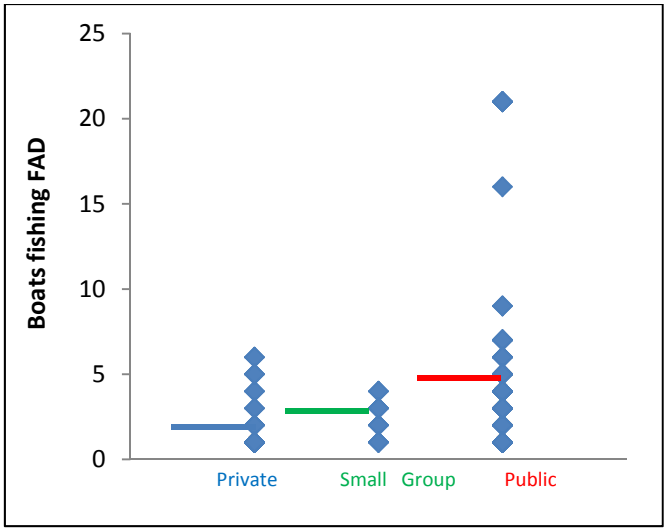

Figure 13. Boats seen fishing on FADs.

The results show that users of private FADs reported the highest average catch per trip (260 pounds). Fishers that use FADs set by small groups reported average catches of 178 pounds of fish per trip, while those that use public FADs reported an average of 125 pounds of fish per trip. The results also suggest that fishers operating in small groups and trading access with other groups tend to have more stable (i.e., less variable) catches - as indicated by the tighter spread of the blue dots - than those who use private and public FADs.

Fishers also were asked to report the number of other boats seen fishing the FADs they visited. The results show that privately managed FADs experienced the lowest amount of competition with an average of 1.7 boats seen per trip. This is followed by FADs

managed by small groups (2.3 boats seen on average per trip). Public FAD's showed the highest level of competition with visitation averaging 4.4 boats per trip. Public FADs also showed the greatest variation in visitation rates, with up to 15-20 boats reportedly seen at a FAD during some trips (Figure 13).

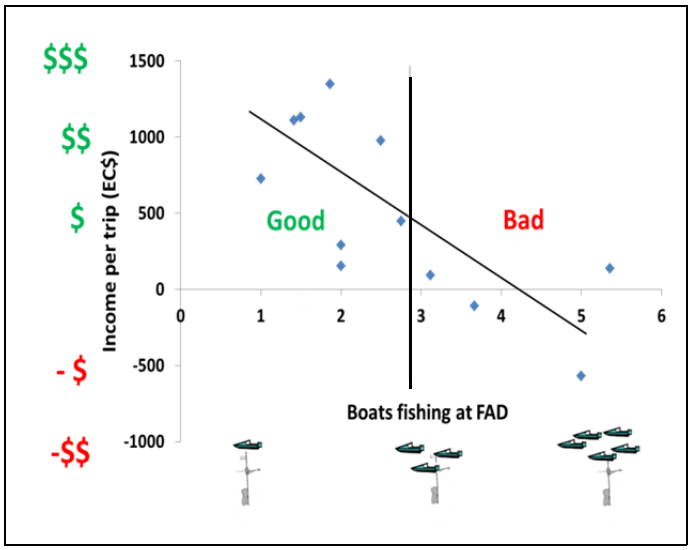

Figure 14. Profitability of FAD fishing

Revenue generated from FAD fishing trips (e.g., price per pound of fish caught) was compared with costs associated with FAD fishing trips (e.g., fuel, crew, engine and boat loans). This information is graphed in Figure 14 to illustrate the profitability of FAD fishing relative to the number of boats seen fishing on FADs at the same time (i.e., competition). Each data point represents the average number of boats fishing and income per trip for one FAD. The results show that profitability per trip declines with the number of boats visiting a FAD and that regular use of a FAD by more than 2-3 boats leads to very low profitability.

In general, how well a FAD produces for an individual fisher depends on how many boats of fishers are using it at any given time. Fewer than two to three boats of fishers using a FAD at the same time is best to maintain profits. Cooperation among fishers can lead to more reliable catches. And, being able to use multiple FADs on a trip can results in more dependable catches for fishers.

Workshops

Workshops with FAD fishers centered on three areas of inquiry: (1) soliciting feedback on the FAD use and profitability analysis, (2) discussing challenges to managing FADs, and (3) identifying best management practices for sustainably co-managing FADs. Facilitated discussions with FAD fishers focused on a finding of the data analysis, which indicted that catch and economic returns were significantly reduced when more than two or three fishers competed at the same time for a FADs resources.

The first topic of discussion solicited reactions to the findings of the profitability analysis. There was general consensus that the following conditions erode the profitability and sustainability of the FAD fishery:

- A lack of cooperation among fishers with respect to the deployment, use, and maintenance of FADs. For example, individual fishers, particularly those who have purchased licenses to use public FADs, do not believe that it is their responsibility to help maintain FADs. Thus, public FADs are not adequately maintained to the same degree as are private FADs.
- A lack of information sharing and communication among fishers, particularly with respect to which FADs are producing and which are not; the profitability of FAD fishing; and the desire for education on proper FAD fishing techniques.
- A very strong belief among some fishers that they should be allowed to deploy private FADs and to restrict access to those FADs by not disclosing their location or defending a small territory around their FAD. At present exclusive rights to resources aggregated around FADs are not recognized by most governments.
- Fishers do not let public FADs "rest" sufficiently to maintain consistent numbers of larger fish in the vicinity of the FAD. As a result, fishers tend to take too many small fish that remain for use as bait or subsistence, compromising the long-term sustainability of the pelagic FAD fishery.
- Too few public FADs have been deployed to optimally accommodate the number of FAD fishers. This creates a situation of crowding and conflict at FADs and lowers the economic return to fishers who must compete with many others for a share of the resources attracted by public FADs.
- A regulatory framework that promotes open-access to all FADs including those deployed by private individuals and groups discourages entrepreneurship, because it limits the benefits that may be derived by individuals and small groups of fishers deploying and maintain their own FADs.

The second topic of dialogue focused on best management practices that could support the co-management of FAD fishery resources and improve FAD fishing success. The following best management practices were identified.

- Greater inputs from government to deploy, monitor, and repair public FADs. This includes the desire among fishers for more FADs and consistent updating and communication by the fisheries division, which could take the form of a quarterly newsletter or scheduled meetings.
- A "code of ethics" and similar self-regulatory guidance to promote safety, FAD fishing education, increased cooperation, and to improve information sharing is needed (e.g., themes could include letting FADs rest, leaving small fish, poaching/piracy on private FADs, actions to optimally use public FADs). Two common suggestions were the need to observe a "first come first serve" ethic while fishing a public FAD: Fishers should be advised to "move on" if confronted with a situation in which there were already three boats of fishers working a FAD. It was also argued that owners have the first right to exploit resources around a private FAD.
- A strategy to manage the timing of fishing could help to reduce conflicts and improve fishing success. This could take the form of separate licensing for full or part-time fishers, or allocating specific fishing days and times based on the type of license purchased.
- A flexible regulatory framework that recognizes the benefits of supporting both exclusive right (private FADs operated by individuals or small groups) and open-access (public FADs open to all licensed fishers) choices.
- Spatially separate the FADs to balance use, reduce conflicts, and increase the chances of catching fish. A common suggestion was to disperse use and accommodate both private and public FADs based on distance to shore. It was suggested that public FADs could be deployed in near-shore waters less than 20 miles out; private FADs could be deployed offshore greater than 20 miles out.

In addition, there was interest in a finding of the profitability analysis that fishers who use the Marigot landing site, many of whom are indigenous Kalinago Indians, exhibit a greater degree of social cohesion and cooperation than Dublanc and Fond St. Jean fishers. This was particularly evident with respect to fishing activities related to deploying, using, and maintaining group FADs. This situation may help to explain the comparatively higher degree of fishing success and economic returns attributed to Marigot fishers.

The third topic of conversation involved a discussion of the roles of three key stakeholders (Fishers, Fishing Cooperatives, and the Fisheries Division) in managing FADs, FAD fishing, and FAD fishery resources. The following opportunities for stakeholder collaboration were identified:

- The Fisheries Division can help support and provide assistance to individuals or small groups of fishers to pool resources to construct, deploy, and maintain FADs. This includes helping to secure government and private funding.
- Fisherfolk cooperatives can help source markets for fish products and add value to fish products as a way of increasing fish consumption.
- Fishers and the Fisheries Division can collaborate to develop a "code of ethics" for FAD fishers and encourage self-compliance with FAD fishing principles through outreach and education. This may include education and training on proper FAD fishing techniques, and dealing with issues of poaching / piracy on private FADs.
- The Fisheries Division can implement a regulatory framework, such as licensing, to attain the optimal ratio of boats per FAD and to reinforce self-compliance with FAD fishing principles (i.e., a code of ethics).
- Fishers can promote individual accounting and primary data collection so that FAD use, catch effort, and profitability can be monitored.
- The Fisheries Division can collaborate with fishers too increase communication and cooperation among fishers. There is an opportunity to develop systems to help inform fishers about the location of FADs, where the fish are, who is out, and where fishing activities are planned.

Figure 15. Follow-up meetings with fishers using the Daily Activity Planner.

- The Fisheries Division can partner with fishers to optimally locate and space FADs to disperse fishing pressure. It was suggested that government should support more public FAD options closer to shore so that fishers can access more than one FAD on a trip if the first choice is not producing or is being visited by a large numbers of fishers.

Daily Activity Planner

A Daily Activity Planner was conceived as tool to help address needs identified by fishers and government stakeholders at the workshops. The DAP was introduced as a practical tool for fishers, who typically act independently, to share information about their fishing trips. In this way, fishers who use it would ideally make decisions on when and where to fish based on knowledge of which FADs other fishers intend to visit. The intent being to reduce competition and increase individual catches by distributing FAD use so that fishers do not congregate around the same FADs at the same time. The DAP was intended as a non-regulatory intervention to foster cooperation between fishers and government.

During the course of the project the DAP underwent several updates based on feedback from local liaisons and the fishers who used it (Figure 15). For example, the current version of the DAP (Figure 9) now includes fields that identify the number of local and non-local fishers who were observed using specific FADs.

Follow-up meetings provided an opportunity for fishers to comment on the utility of the DAP as an information sharing tool. The meetings also provided a venue to discuss the effectiveness of the engagement strategy with community-based liaisons. The following questions helped to frame the discussions, which lasted about one hour each.

1. What are the most pressing issues that affect FAD fishing in your community?
2. What are the benefits from using the DAP that may address pressing FAD fishing issues?
3. What factors limit broader use of the DAP?

1. Pressing issues that affect FAD fishing:

- There is a need to improve the quality of the materials being used in FAD construction and FAD maintenance so that FADs are more durable and are not lost so frequently. When a

FAD is being constructed and deployed by the government, there is a strong desire among FAD fishers to be more fully consulted on the types of materials, design characteristics, and deployment tactics that can result in longer lasting FADs.

- A primary social issue facing the artisanal FAD fishery involves addressing territorial use disputes at both individual and community levels. Fishers on Dominica have been deploying private FADs as individuals or in small groups since the early 1980s. The placement of government sponsored public FADs is relatively recent. Given the considerable investment made by some fishers in this technology it is only natural that they would strongly believe in their right to some degree of ownership of the FAD they place and the fish that it attracts. The government policy that advocates open or free access to FAD fishery resources is not supportive of traditional fishing practices that involve the establishment of private FADs by individuals or small groups. As a result, owners of private FADs are frustrated by fishers who make a living "poaching" or "pirating" fish around their FADs without offering fair compensation or without making a similar investment in FADs that can be accessed by others in the community. Moreover, although poaching is not desired, fishers who deploy their own FADs consider it less of an offence for fishers who belong to their community to poach and not contribute to the materials and upkeep of FADs, and more of an offence when fishers from outside the community are seen poaching. The issue of poaching is exacerbated by the lack of government resources to deploy and maintain enough public FADs to reduce competition at FADs considered to be private.

2. Benefits of using the DAP:

- The DAP is generally viewed as a beneficial tool for fostering information sharing among fishers who typically fish independently. Specific comments from follow-up interviews include:
- It allows fishers to determine where they are most likely to catch fish.
- It gives fishers an idea of what time of day is most suitable to catch fish.
- It can allow for a better distribution of use among FADs and reduce strain on particular FADs.
- It provides a source of safety and security to the fishers. In the event of difficulties responders know which direction to start searching.
- Implementation of the DAP, which included almost daily interaction among government appointed personnel and community-based liaisons, was viewed by fishers at participating landing sites as a positive affirmation that their views and input was being solicited and included in planning and management processes.
- FAD fishers were pleased that the information that they provided was being used to address issues important to them (e.g., profitability, use issues, information sharing, sustaining the ecological integrity of FAD fishery resources).
- The DAP was viewed by fishers as a positive interaction with government that can help build information sharing and trust among stakeholders as necessary precursors for organizing and supporting co-management.
- The DAP provided an outreach opportunity for government fisheries officers to cooperate with fishers in a collaborative context as opposed to interactions that are viewed as more controlling or regulatory in nature.

3. Factors that limit broader use of the DAP:

- The DAP was introduced to fishers in three additional communities with FAD fishing landing sites: Mahaut, Portsmouth, and Stowe. Fishers there were interested in the concept of the DAP but at present the Fisheries Division lacks the personnel and funding to hire local liaisons necessary to expand its use in those communities.
- Fishing is inherently unpredictable. Fishers were generally frustrated by the lack of durability and dependability of FADs, which can be found one day but disappear the next. Moreover, even when using FADs the fishing can be erratic. For example, fishers typically determine which FADs to use based on where the schools of targeted fish are located or thought to be located. One day the fish might be associated with one FAD and the next day associated with another. As a result, fishers typically depart and return at different times of the day and fish different days of the week. This makes it difficult for fishers to meet as groups to collectively discuss and organize fishing activities. Fishers will naturally go to the FADs where they have had success on the

previous day or where they think the fish will be the next day regardless of whether others intend to visit the same FAD or not.

- FAD fishers in many Dominica communities are strongly independent. They work in pairs or in small groups. As such, some fishers are reluctant to share information on where they have been catching fish because they feel that this would put them at a competitive disadvantage. A subset of Marigot fishers, mostly from the Kalinago ethnic group, are an exception to this norm in that typically they each deploy and maintain their own private FADs, but they have an unwritten understanding that allows others to use their FADs in exchange for access to FADs placed by others. In this sense the Marigot fishers do exhibit a degree of community-level cooperation in that they share a common value in wanting to deploy and maintain FADs. This results in there being a greater choice in FADs to access on fishing trips, which likely yields more stable catches. Marigot FAD fishers also indicated that their form of arrangement permits adequate information exchange among them as to which FADs are producing and which are not at any given time. These factors tend to keep use-conflicts lower among Marigot FAD fishers making a DAP less needed there.

CONCLUSIONS and RECOMMENDATIONS

Many issues preventing optimal use of FADs stem from conflict between two fundamental requirements: (1) the desire for some level of exclusive use rights for fishers who (individually or collectively) invest in the deployment and maintenance of FADs, and (2) the need to provide equitable access to the wild fisheries resources, which the FADs are designed to aggregate. Although this conflict is often polarized, most fishers appear to recognize informally that FAD owners (individual or collective) are entitled to benefit from their investment, and that this entitlement is limited by the fact that others are also entitled to a fair share of fisheries resources. This suggests that it may be possible to design "compromise solutions" that would provide recognized and enforceable but limited exclusive rights to FAD owners. For example, exclusive fishing rights may be awarded to FAD owners for a period of three or six months after FAD deployment, upon which time fishing on the FAD might become open to the public. Another possibility might be to allow small groups of fishers to gain exclusive fishing rights for FADs they deploy, thereby incentivizing the formation of such groups and reducing barriers to entry into FAD fishing. The spatial segregation between public and private FADs was also offered as a potential solution. With these factors in mind, the following opportunities are recommended.

- There exists an opportunity through outreach to re-affirm an ethic among fishers who use FADs to either place their own FADs or compensate the person who places the FAD.
- Related to above, there exists an opportunity for a government program that matches funding for materials for fishers who want to deploy FADs, either as individuals, or as part of small groups or communities. This would offer some compensation for sharing access to FADs. This also would allow limited government resources to be spread more widely and support entrepreneurship.
- There exists an opportunity to quantify local and non-local FAD use as the basis for establishing policies to recognize or legitimize some level of exclusive rights to either individuals, small groups, or possibly to communities.
- There exists an opportunity to more deeply evaluate social conventions that characterize FAD governance arrangements as the basis for developing policy and management frameworks that legitimize traditional customs deemed to be beneficial to maintaining consistent economic returns and reducing conflicts (e.g., explore limited territorial use rights in fisheries -TURFs- as applied to FADs).

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LITERATURE CITED

Beets, J. 1989. Experimental evaluation of fish recruitment to combinations of fish aggregating devices and benthic artificial reefs. *Bulletin of Marine Science*, 44: 973-983.

Caribbean Regional Fisheries Mechanism. 2004. CTA/CRFM/CARDI Regional Workshop Report on Findings of Organizational Needs Assessment of Caribbean Fisherfolk Organizations. 47pp.

Caribbean Regional Fisheries Mechanism. 2008. Workbook for the CRFM/CTA Training Workshop on Management, Communication and Advocacy for Fisherfolk Organisations in CARIFORUM. 2008/2: 67pp.

Christy, F. 1982. Territorial use rights in marine fisheries: definitions and conditions. FAO Fisheries Technical Paper 227. 10pp.

Christy, F. 1996. The death rattle of open access and the advent of property rights regimes in fisheries. *Marine Resource Economics,* (11): 287-304).

Feigenbaum, D., Friedlander, A., and Bushing, M. 1989. Determination of the feasibility of fish attracting devices for enhancing fisheries in Puerto Rico. *Bulletin of Marine Science*, 44(2): 950-959.

Friedlander, A., Beets, J., and Tobias, W. 1994. Effects of fish aggregating device design and location on fishing success in the U.S. Virgin Islands. *Bulletin of Marine Science*, 55(2-3); 592-601.

Gomes, C., Mahon, R., Hunte, W., and Singh-Renton, S. 1998. The role of drifting objects in pelagic fisheries in the southeastern Caribbean. *Fisheries Research*, 34(1): 47-58.

Guyader, O., Bellanger M., Reynal L.,Demaneche S., and Berthou P. 2013. Fishing strategies, economic performance and managementof moored fishing aggregating devices in Guadeloupe. *Aquatic Living Resources*, 26: 97–105.

Kingsford, M. 1993. Biotic and abiotic structure in the pelagic environment: importance to small fish. *Bulletin of Marine Science*, 53: 393-415.

Kingsford, M., 1998. Fish attraction devices (FADs) and experimental designs. 1998. *Scientia Marina*, 63(3-4): 181-190.

Klima, E.F. and Wickham, D.A., 1971. Attraction of coastal pelagic fishes with artificial structures. *Transactions of the American Fisheries Society*, 100: 86-99.

Lay, M. 2011. Networking for partnerships. *International Collective in Support of Fishworkers, SAMUDRA Report,* No 59: 13-16.

McIntosh, S., Lay, M., McConney, P., and Phillips, T. 2010. The Development of a Caribbean regional network of fisherfolk organisations and its role in influencing fisheries policy. *Proceedings of the 62nd Gulf and Caribbean Fisheries Institute*. 298-305.

Samples, K.C., and Sproul, J.T. 1985. Fish aggregating devices and open-access commercial fisheries: A theoretical Inquiry. *Bulletin of Marine Sciences*, 37(1) 305-317.

Theophille, D. 2012. Fisheries Industry Census of Dominica. Report of the Second Fisheries Industry Census for Dominica. Fisheries Division. Ministry of Environment, Natural Resources, Physical Planning and Fisheries. Government of the Commonwealth of Dominica. 96pp

Wickham, D.A., Watson, J.W., Ogren, L.H., 1973. The efficiency of mid-water artificial structures for attracting pelagic sport fish. *Transactions of the American Fisheries Society*, 102: 563-572.

Wilen, J., Cancino, J., Uchida, H. 2012. The economics of territorial use rights fisheries, or TURFs. *Review of Environmental Economics and Policy*, 6(2): 237-257.

Appendix A: Data Collection Forms

Dominica Division of Fisheries/University of Florida FAD Management Pilot Project

Boat Baseline Survey

Village/Landing site: _____

Date completed: _____ Surveyor: _____

Boat name	Registration number	Owner(s)	Skipper(s)	Boat type	Length	Engine HP	Sometimes fishes FADs?

(use additional forms for the same village/landing site as required)

Boat Baseline Survey

Purpose:

- To collect basic information on all boats fishing from a landing site and their owners and skippers.

Instructions:

- Assemble a small group of fishermen and ask them to list all boats fishing from the landing site
- Complete the table as far as possible with information obtained from the group
- Briefly meet with the skippers or owners of all boats listed to confirm and complete information on each boat
- Visit the landing site and check that all visible boats have been accurately recorded. Repeat visits until all boats listed have been seen, and all boats seen are listed.

Data columns:

Boat name: the name painted on the boat, e.g. 'O-KAY', 'SURVIVAL.'
Registration number: The official boat registration number, e.g. J7-053-STE
Owner(s): the person(s) owning the boat
Skipper(s): the person(s) normally in charge of the boat while fishing
Boat type: C (Canoe), K (Keel/Dory), F (FRP/Pirogue), O (Other)
Length: Length of boat in ft.
Engine HP: Engine horsepower
Sometimes fishes at FADs?: 'Yes' if the boat sometimes fishes at FADs, 'No' if not.

Dominica Division of Fisheries/University of Florida FAD Management Pilot Project

FADs Baseline Survey Part I - Map

Village/Landing site: _____

Date completed: _____ Surveyor: _____

FAD Baseline Survey Part I - Map

Purpose:

- To identify all FADs used by fishers from the landing site, and their approximate location.

Instructions:

- Assemble a group of fishermen (ideally, all fishers known to fish FADs) and ask them to draw a map of all the FADs used by people fishing from the landing site. Use a large piece of paper so that the whole group can participate.
- Include all FADs: public, private or group-owned.
- The map need not be accurate or to scale – its purpose is only to help fishers and surveyors to identify FADs in a consistent manner.
- Repeat at least once with a different group of fishermen, on a different day, to cross-check information. If discrepancies emerge between maps, discuss with fishermen and possibly repeat mapping exercise in a larger group until a complete and consistent map emerges.
- Either re-draw the maps on these survey forms or take photographs of the maps drawn by fishers.
- Keep the final, agreed map at the landing site to help FAD identification during later interviews.

Dominica Division of Fisheries/University of Florida FAD Management Pilot Project

FADs Baseline Survey Part II – FAD Description

Village/Landing site: _____

Date completed: _____ Surveyor: _____

<table>
<tr><td colspan="2">FAD Name:</td><td rowspan="11">Description of FAD design (drawing and/or text)</td></tr>
<tr><td colspan="2">Distance:</td></tr>
<tr><td colspan="2">Time to get there:</td></tr>
<tr><td colspan="2">Depth:</td></tr>
<tr><td colspan="2"></td></tr>
<tr><td>FAD Owner(s)</td><td>Owner’s boat</td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td colspan="3">Why was the FAD deployed in <u>this</u> particular location?</td></tr>
</table>

(use one form per FAD)

FAD Baseline Survey Part II – FAD description

Purpose:

- To collect baseline information on all FADs used by fishers from the landing site.

Instructions:

- After mapping the FADs (Part I), interview FAD owners or others knowledgeable about each particular FAD to obtain the baseline information requested in the form.
- Use a sketch drawing to illustrate the design of the FAD
- List the owner(s) of the FAD and their boats (name and/or registration)
- Ask why the FAD has been deployed <u>in this particular location</u>. Probe possible reasons including: bottom topography, oceanographic conditions, history of fish catches, convenience of access, hiding the FAD from other fishers, etc.

Dominica Division of Fisheries/University of Florida FAD Management Pilot Project

Fishing Trip Record (Pelagic Fishing)

Landing site: _____Boat name: _____Boat registration: _____

Date fished: _____ Date of survey:_____ Surveyor: _____

Weather conditions (circle): sunny, overcast, rainy Wind speed (circle): high, medium, low

FAD name (or 'none')	Gear		Start time	End time	Fish catch in weight (lbs)					Number of other boats seen at FAD	FAD sub-merged?
	Type	Number			Blackfin tuna	Yellowfin tuna	Dolphin fish	Marlin	Other		

Fishing Trip Record

Purpose:

- To collect detailed information on pelagic fishing activities and catches associated with FADs

Instructions:

- Complete one form for each boat and day fished
- Always interview the skipper of the boat
- List all pelagic fishing activities of the trip in the order they were carried out. 'Go through the day' of the fisher during the interview ('where did you go first', 'what gear did you use', etc.).

Data fields:

FAD Name: Refer to the FAD map to identify the name of each FAD visited. Write 'none' for fishing activities not associated with a FAD

Gear (type and number): Type and number of gear used at the FAD or non-FAD location. Use a separate line for each gear type (even if used on the same FAD)!

Start and end time: Start and end of the use of each gear type on the FAD or non-FAD location.

Fish catch in weight: Estimated weight of fish caught at the specific location, with the specific gear type.

Number of other boats seen at FAD: How many other boats were observed at the same FAD during this fishing activity?

Appendix B. FAD Fisher Workshop Agenda

Team Members	Agenda Item	Description	Time	
Sebastien, Fontaine	Opening prayer		5 minutes	5:00-5:05
Magloire, Sebastien, Fontaine	Welcome remarks	Why we are here. What we hope to accomplish.	5 minutes	5:05-5:10
Sebastien	Icebreaker and introductions	Name and why FAD fishing is important in your community.	15 minutes	5:10-5:25
Lorenzen	Presentation of project and preliminary results	Explain why we are collecting FAD fishing data. Discuss what data means. Get fisher's perspective. Do results make sense?	15 minutes	5:25-5:40
Magloire, Sidman, Norris, Sebastien, Hazell, Masters, Johnson	Discussion / Focus Groups	Management options to improve FAD fishing Challenges to reaching 2-3 boats per FAD at one time. Role of stakeholders in helping to co-manage the FAD fishery.	20 minutes 20 minutes 20 minutes	5:40-6:00 6:00-6:20 6:20-6:40
Masters, Norris, Hazell	Report out	Report findings from discussions.	15 minutes	6:40-6:50
Magloire, Sebastien, Lorenzen	Next steps	Upcoming tasks and how FAD fishers can help.	5 minutes	6:50-7:00
	Refreshments		1 hour	7:00-8:00

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