



DEPARTMENT OF COMMERCE RESEARCH PERFORMANCE PROGRESS REPORT (RPPR)

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AWARD INFORMATION	
1. Federal Agency: Department of Commerce / NOAA	2. Federal Award Number: NA21NMF4720541
3. Project Title: Towards the Use of Biodegradable Fish Aggregating Devices (FADs) in the Pacific Ocean	
4. Award Period of Performance Start Date: 05/01/2022	5. Award Period of Performance End Date: 04/30/2024
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REPORTING INFORMATION	
Signature of Submitting Official: N/A	
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RECIPIENT ORGANIZATION	
20. Recipient Name: INTERNATIONAL SEAFOOD SUSTAINABILITY FOUNDATION, INC.	
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22. Recipient DUNS: 831469999	23. Recipient EIN: 263646127

ACCOMPLISHMENTS

24. What were the major goals and objectives of this project?

The present project aims to simultaneously form the basis for cooperation of key stakeholders across the Pacific Ocean (fishers, ship-owners, scientists and managers) to minimize the impacts caused by lost and abandoned drifting FADs (dFADs) on the ecosystem, while also defining and testing innovative, biodegradable dFAD (bio-FAD) structures. The new dFAD structures would achieve the following:

- (i) eliminate the use of netting;
- (ii) degrade as fast as possible once their useful lifetime for fishing ends; and
- (iii) minimize the use of plastic by replacing it with plant-based fibers or other organic materials.

Main tasks to achieve those objectives are:

Phase 1: Workshops to design biodegradable FADs

Task 1.1. Defining materials and designs for Biodegradable FADs

Phase 2: Trials at sea to test designed bioFADs

Task 2.1. Construction of biodegradable FADs

Task 2.2. Deployment and monitoring of biodegradable FADs

Task 2.3. Mid-term workshop

Phase 3: Data analysis on experimental FADs' performance

Task 3.1. Data analysis

Task 3.2. Final workshop to discuss results

Phase 4: Reporting and Outreach: outreach to fishers and ship-owners (Task 4.1), to scientific community (Task 4.2), to management bodies (Task 4.3) and to the general public (Task 4.4).

25. What was accomplished?

The following tasks were accomplished during the previous reporting periods:

Phase 1: Workshops to design biodegradable FADs:

Task 1.1. *Defining materials and designs for Biodegradable FADs:* The design of the bio-FAD, which will be tested with U.S. fleets, was developed through a series of three online workshops/meetings involving ship-owners and captains. All the fishing companies participating in the project were present at these three workshops.

The design defined for the project was the jelly-FAD. The jelly-FAD is constructed using natural materials such as bamboo canes, cotton canvas, and biodegradable ropes. Its unique design allows it to drift neutrally in the water column, resembling a jellyfish ([see Moreno et al. 2023](#))*

*G. Moreno, J. Salvador, I. Zudaire, J. Murua, J.L. Pelegrí, J. Uranga, H. Murua, M. Grande, J. Santiago, V. Restrepo, The Jelly-FAD: a paradigm shift in the design of biodegradable fish aggregating devices, *Mar. Policy* 147 (2023), 105352..

Status: completed in May 2022.

Phase 2: Trials at sea to test designed bioFADs

The construction and deployment of the Bio-FADs was designed to be in two phases: (i) 100 bio-FADs to be constructed and deployed in a first trial and (ii) 116 in the second trial. Thus, any improvement in the bio-FAD structure identified during the first phase/trial could be implemented and tested during phase 2.

Task 2.1 Construction of biodegradable FADs:

Initially, the construction of bio-FADs was planned to take place in American Samoa. However,

Attach a separate document if more space is needed for #6-10, or #24-50.

due to the pandemic, a change in strategy was necessary as ISSF experts in FAD construction were unable to travel there. It was collectively decided with the fleets that the port of Manta in Ecuador would be used for the construction of the bio-FADs. The construction of the first phase, consisting of 100 bio-FADs, was successfully completed in Manta.

Status: completed for phase 1 in previous reporting period.

The following tasks were accomplished during current reporting period 11/1/2022-04/30/2023:

Task 2.1 Construction of biodegradable FADs:

In Phase 2, the construction of jelly-FADs will be carried out in both Manta and Pago-Pago, as requested by fishing companies. During this reporting period, biodegradable ropes and canvas were sent to Manta and Pago-Pago in American Samoa to initiate the construction of jelly-FADs in these two ports for phase 2.

Construction in Pago-Pago: Since it was the first time working with jelly-FADs in Pago-Pago, a guide outlining the required tools and construction steps was sent to the FAD manufacturers, the *Purse Seine Samoa* company. The *Purse Seine Samoa* company collaborates with purse seiners from the US fleet, supplying nets, ropes, and FADs. Training sessions for them in Pago-Pago were organized in May 2023 (further details will be provided in the next reporting period).

Construction in Manta: the construction of bio-FADs in Manta for the second phase also commenced during this reporting period.

Status: phase 2 of FAD construction started during this reporting period and will continue in the next reporting period.

Task 2.2. Deployment and monitoring of biodegradable FADs

Phase 1:

The deployment of bioFADs began in the previous reporting period for phase 1 and is still ongoing due to several reasons. After the construction was completed, there was a delay in the fleets picking up the bioFADs in Manta. The timing of entering the port to pick up the bioFADs depends on the fishing performance which is difficult to predict. Some vessels have been in the dry dock for maintenance and had not been able to go to sea yet. Additionally, certain vessels had not entered the port where the FADs were available because their fishing activities were taking place far from that specific port. Furthermore, while some companies had the bioFADs on board, the deployment process had not been finalized. The majority of the FADs were picked up in Manta. Some vessels collected bioFADs on behalf of other vessels to be delivered at a later time at sea, and for two vessels, bioFADs were sent to Mazatlán, Mexico (for more information, refer to Appendix 2 in the previous reporting period on November 30, 2022).

In total, 40 bio-FADs (Jelly-FAD design) and 40 conventional FADs were deployed for phase 1 of the project. Among the 80 FADs deployed in phase 1, Cape Fisheries deployed 68 of them (34 jelly-FADs and 34 conventional FADs), as they have more vessels involved in the trials. The remaining 12 FADs were deployed by the Friesland vessel. Out of the 40 jelly-FADs, 7 were visited and fished, resulting in a total catch of 226 tons. Additionally, 3 conventional FADs were visited, and a total of 85 tons were captured. It is important to note that 4 sets were conducted on the same jelly-FAD (BIO11) (see Table 1 and 2 in Appendix 1). The structure of visited conventional and bio-FADs were found in good condition.

Phase 2: deployments have not started yet

Status Task 2.2: Phase 1 began during the previous reporting period and not ended yet. Deployment for phase 2 will start in the next reporting period.

Data analysis on experimental FADs' performance

Task 3.1. Data analysis

A database was created to introduce the information from bio-FADs and analyze echosounder buoy's data of the bio-FADs and conventional FADs deployed (see Appendix 2 for an example of the data collected by fishers). The data from the buoys will be used to estimate the amount of biomass aggregated in the jelly-FADs that were not visited by purse seiners.

Status: ongoing task

Task 3.2. Final workshop to discuss results

Status: not started yet

Phase 4: Reporting and Outreach: outreach was conducted to scientific community, to the general public and fishers and shipowners.

- The Pacific Community Fisheries Newsletter on the jelly-FAD (Appendix 3)
- Jelly-FAD Flyer for fishers and observers (Appendix 4)
- Regular contact by email with fishers and shipowners

ACCOMPLISHMENTS (cont'd)

26. What opportunities for training and professional development has the project provided?

Shipowners and fishers were trained about an innovative design of biodegradable FAD, called the "jelly-FAD" (see Appendix 7 in previous reporting period, November 2022). During this reporting period, fishers were contacted by email to follow the performance of the trials and to clear doubts regarding the jelly-FAD use. In addition, a workshop in Pago Pago to be held in May 2023 was organized during this reporting period (the details of the workshop will be shared in the next reporting period).

26. How were the results disseminated to communities of interest?

Although results are not yet available, outreach on project's objectives and progress was carried out to the general public, fishers, observers and shipowners.

- Pacific Community Fisheries Newsletter on the jelly-FAD (Appendix 3)
- Jelly-FAD Flyer for fishers and observers (Appendix 4)
- Regular contact by email with fishers and shipowners

ACCOMPLISHMENTS (cont'd)

28. What do you plan to do during the next reporting period to accomplish the goals and objectives?

Phase 2: Trials at sea to test designed bioFADs

Task 2.1. Construction of biodegradable FADs: A workshop will be held in American Samoa to train a FAD manufacturing company to construct the jelly-FAD. The second phase of FAD construction will be finished in both Manta and American Samoa.

Task 2.2. Deployment and monitoring of biodegradable FADs :

Fleets will retrieve Bio-FADs in Manta and American Samoa and deploy them. As for phase 1, vessels will send the forms to monitor those bio-FADs.

Phase 3: Data analysis on experimental FADs' performance

Task 3.1. Data analysis

This task will continue during the next reporting period, collecting forms, introducing them in the data base and analyzing the data.

Phase 4: Reporting and Outreach:

During the next reporting period, outreach will continue to:

- Fishers in American Samoa during May 2023.
- Tuna Regional Fisheries Management Organizations (tRFMOs), IATTC and WCPFC.
- To fishers from the U.S. fleet and NOAA scientists in American Samoa.
- The research will be made public on the regular channels used by ISSF to disseminate research to the public (social media and ISSF web-site).

PRODUCTS

29. **Publications, conference papers, and presentations**

- *Nothing to report*

PRODUCTS (cont'd)

30. Technologies or techniques

Nothing to Report

31. Inventions, patent applications, and/or licenses

Nothing to Report

PRODUCTS (cont'd)

32. Other products

Nothing to Report

PARTICIPANTS & OTHER COLLABORATING ORGANIZATIONS

33. What individuals have worked on this project?

- **Shipowners from the U.S. Tropical Tuna Purse seine fleet:**

1. Cape Fisheries,
2. Western Pacific Fisheries,
3. GS Fisheries,
4. Pacific Princess Partnership,
5. Da Silva Sea Encounter corp.,
6. AACH Holding

Fishers collected jelly-FADs in port, deployed and monitored them at sea using echosounder buoys.

- **William Gibbons-Fly from American Tunaboat Association (ATA)**
Coordinated the actions in the project among the different fishing companies.
- **The Pacific Community (SPC):** Lauriane Escalle and James Wichman
During this reporting period, SPC's main task was data collection, including the development of the database.
- **The International Seafood Sustainability Foundation (ISSF):**
 - Victor Restrepo's primary responsibilities during this reporting period included project management and oversight of budget management.
 - Gala Moreno coordinated FAD construction and distribution for fleets. She collected data sent by fishers and solved doubts regarding the jelly-FAD designs. She also sent the ropes and canvas to Pago-Pago. organized the workshop scheduled for phase 2 of this project in Pago-Pago.

Attach a separate document if more space is needed for #6-10, or #24-50.

-Hilario Murua helped with outreach and documents preparation for the project.

- Yonat Swimmer from NOAA: helped on the outreach of the project

PARTICIPANTS & OTHER COLLABORATING ORGANIZATIONS (cont'd)

34. Has there been a change in the active other support of the PD/PI(s) or senior/key personnel since the last reporting period?

Nothing to Report

35. What other organizations have been involved as partners?

The Pacific Community (SPC) is involved as partner, Lauriane Escalle and James Wichman from SPC

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PARTICIPANTS & OTHER COLLABORATING ORGANIZATIONS (cont'd)

36. Have other collaborators or contacts been involved?

During this reporting period, we have collaborated with the company Purse Seine Samoa located in the port of Pago-Pago in Samoa. This company's main objective is to repair the nets of tuna seiners and supply other provisions to the purse seine fleet. Additionally, they construct Fish Aggregating Devices (FADs) for the fleet. In this project, we are collaborating with *Purse Seine Samoa* to have them construct biodegradable FADs for the American fleet.

IMPACT

37. What was the impact on the development of the principal discipline(s) of the project?

Nothing to Report

IMPACT (cont'd)

38. What was the impact on other disciplines?

Nothing to Report

39. What was the impact on the development of human resources?

Nothing to Report

IMPACT (cont'd)

40. What was the impact on teaching and educational experiences?

Fishers have received online instructions on the fundamental concepts of the biodegradable FAD, also known as "jelly-FAD." Furthermore, during the training, we discussed deployment techniques and provided tips on proper usage. During this reporting period, it was organized an in-person workshop with fishers and shipowners for May 2023 in American Samoa, where we can collaboratively construct the jelly-FADs with the fishers.

The objective of this activity is to promote the adoption of bio-FADs and thereby reduce the amount of plastic deployed by tuna purse seine fleets in the ocean. Currently, fishers deploy drifting FADs made with netting panels, which pose a risk of entanglement for marine wildlife. By using biodegradable FADs, we can minimize marine pollution and the negative effects of ghost-fishing. Drawing from our previous experiences, ISSF aims to share knowledge on the construction and usage of biodegradable FADs, allowing fishers to make progress more efficiently by learning from others' experiences and avoiding the mistakes made by their counterparts.

41. What was the impact on physical, institutional, and information resources that form infrastructure?

Nothing to Report

IMPACT (cont'd)

42. What was the impact on technology transfer?

Nothing to Report

43. What was the impact on society beyond science and technology?

Nothing to Report

IMPACT (cont'd)

44. What percentage of the award's budget was spent in foreign country(ies)?

The majority of the budget, approximately 80%, was spent in foreign countries. A significant portion of the budget was allocated for the construction of bioFADs originally planned for American Samoa. However, due to the pandemic, this budget, totaling around \$56,000, was redirected and utilized in Manta, Ecuador.

CHANGES/PROBLEMS

45. Changes in approach and reasons for change

A change in Bio-FAD construction site for phase 1:

Due to the COVID-19 pandemic, a change in the construction site for phase 1 of the Bio-FADs was necessary. Originally, the plan was to construct the Bio-FADs in American Samoa, the main port of the U.S. Fleet. However, the ISSF technician was unable to travel there, leading to the decision to build the FADs in Manta, Ecuador.

The pandemic caused several problems, including the delay in project commencement to January 2022 and the subsequent delay in deciding on the type of structure to be tested.

Solution: Online workshops were conducted instead of the planned in-person workshops to define the bio-FAD design. The construction was rearranged to take place in Manta, Ecuador. This search for a suitable workspace in Manta also caused a delay in phase 2 of the project.

Overall, the project experienced a three-month delay from the initial planning, which did not impact the tasks and research objectives. However, a no-cost extension was requested and accepted to ensure the project could be completed as originally planned. The project end date was subsequently moved to April 2024.

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The collaboration between ISSF and SPC has been instrumental in increasing the sample size of the experiment. Initially, the U.S. Fleet was set to deploy 216 Bio-FADs. However, through the collaboration with SPC in a project funded by the European Union, U.S. government, and ISSF, the sample size was increased to 266 Bio-FADs.

CHANGES/PROBLEMS (cont'd)

46 . Actual or anticipated problems or delays and actions or plans to resolve them

Due to the COVID-19 pandemic, the project underwent several modifications, as outlined below:

In-person Workshops: Originally planned as in-person workshops for Phase 1, the design of the bioFAD structure and materials had to be transitioned to online workshops. Travel restrictions prevented the workshops from taking place in American Samoa, which remained closed due to the pandemic. Conducting the workshops online resulted in delays in decision-making regarding the FAD structure and materials. Technical discussions proved more challenging in the online format, requiring additional communication via email and video conferences.

Bio-FAD Construction: The initial plan was to construct the bioFADs in American Samoa, the main port for the U.S. Fleet. However, due to travel restrictions, the ISSF technician was unable to travel to American Samoa. As a result, it was decided to build the FADs in Manta, Ecuador for phase 1.

Problems: The COVID-19 pandemic caused initial delays, pushing the project start to January 2022. Further delays were experienced in making decisions regarding the type of structure to be tested. Ultimately, an alternative location for phase 1, had to be found for constructing the bioFADs instead of American Samoa.

Solution: Online workshops were conducted, and the construction of the BioFADs was rearranged to take place in Manta, Ecuador, instead of American Samoa. The process of finding a suitable workspace in Manta also contributed to the delay in Phase 2 of the project. Overall, the project has been delayed by three months from the initial planning. Despite this delay, the project's tasks and research objectives remain unaffected. A non-cost extension was requested to ensure the project's completion as originally intended.

47. Changes that had a significant impact on expenditures

CHANGES/PROBLEMS (cont'd)

48. Significant changes in use or care of human subjects, vertebrate animals, biohazards, and/or select agents

Nothing to Report

49. Change of primary performance site location from that originally proposed

As mentioned earlier, the planned FAD construction site had to be changed for phase 1, from American Samoa to Manta in Ecuador due to the closure of American Samoa to visitors, which was unforeseen in our proposal. This change did not have any impact on the scientific performance of the project or the budget. However, we anticipate a delay of approximately three months in the project timeline due to the adjustments necessitated by the COVID-19 pandemic.

PROJECT OUTCOMES

50. What were the outcomes of the award?

Nothing to Report

DEMOGRAPHIC INFORMATION FOR SIGNIFICANT CONTRIBUTORS (VOLUNTARY)

<p>Gender:</p> <p><input type="radio"/> Male</p> <p><input type="radio"/> Female</p> <p><input type="radio"/> Do not wish to provide</p>	<p>Ethnicity:</p> <p><input type="radio"/> Hispanic or Latina/o Not</p> <p><input type="radio"/> Hispanic or Latina/o Do not wish to provide</p>
<p>Race:</p> <p><input type="radio"/> American Indian or Alaska Native Asian</p> <p><input type="radio"/> Black or African American</p> <p><input type="radio"/> Native Hawaiian or other Pacific Islander</p> <p><input type="radio"/> White</p> <p><input type="radio"/> Do not wish to provide</p>	<p>Disability Status:</p> <p><input type="radio"/> Yes</p> <p>[] Deaf or serious difficulty hearing</p> <p>[] Blind or serious difficulty seeing even when wearing glasses</p> <p>[] Serious difficulty walking or climbing stairs</p> <p>[] Other serious disability related to a physical, mental, or emotional condition</p> <p><input type="radio"/> No</p> <p><input type="radio"/> Do not wish to provide</p>

Attach a separate document if more space is needed for #6-10, or #24-50.