2019-2020 Bren School Group Project Proposal

Implementing Vessel Monitoring Devices in Small Scale Fisheries:
Analysis of Social and Economic Enabling Conditions to Maximize Adoption

---

Proposal Authors

Juan Silva, MESM 2020, Latin American Fisheries Fellow – (805) 869 8234– juansilva@bren.ucsb.edu
Barbara Rose Hoover, MESM 2020 – (206) 349 7458 –brhoover@bren.ucsb.edu

Client(s)

Paul Woods, Chief Technology Officer at Global Fishing Watch – (240) 432 1674 – paul@globalfishingwatch.org

External Scientific Advisors

Gavin MacDonald, Project Researcher, Sustainable Fisheries Group – (404) 787 7993 - gmcdonald@bren.ucsb.edu,
Juan Mayorga, Project Researcher, Sustainable Fisheries Group – (816) 877 2410 - juanmayorga@ucsb.edu

---

Objectives

Global Fishing Watch (GFW) is an independent, international nonprofit organization committed to advancing ocean sustainability and stewardship through increased transparency[1]. GFW uses satellite-based tracking systems –mainly Automatic Identification System (AIS) and Vessel Monitoring Systems (VMS) already in use by industrial commercial fishing vessels– to visualize, track and share data about global fishing activity in near real time[2]. Now, GFW plans to expand monitoring devices to the small-scale fishing sector (SSF), which makes up 50 percent of the global marine catch for direct human consumption[3].

An informed and effective implementation strategy will be essential for expanding tracking technologies to SSF vessels, mainly characterized as those less than 12 m in length[3]. Given the magnitude and complexity of the SSF sector, there remain many uncertainties as to what will result in successful project implementation at scale. Due to the scope of the project, both geographically and monetarily, GFW will first run a pilot study on three SSF. In this context, our team aims to design an implementation plan for the pilot study by identifying key factors and socioeconomic enabling conditions that contribute to scalable and sustainable adoption of tracking technology in SSF vessels. This will be done by building on existing socioeconomic data and lessons learned from ongoing trials of tracking devices implementation in small fishing communities, and complementary information from literature and similar cases.

Our project looks to fulfil the following objectives:

- Compile an extensive literature review that will allow GFW to understand the contributing factors that lead to failure and success of similar projects.
- Perform cost-benefit analyses that explore 1) implementing optimal monitoring devices and 2) externalities associated with monitoring implementation on SSF.
- Analyze data of past and ongoing trials of monitoring device implementation in SSF from Peru, Indonesia, and other cases, in order to identify key socioeconomic enabling conditions and incentives for adoption that informs the design of an implementation plan at scale.
- Use information and insight gained from the first three objectives to develop an implementation strategy for the pilot study, recommendations for pilot study design, and monitoring and evaluation strategy to test for effectiveness.

Significance

Small-Scale fisheries (SSF) are widely acknowledged for their fundamental contributions to food security, nutrition, and sustaining livelihoods globally, especially in the developing world[3]. They provide 50% of the global catch for direct human consumption and employ nearly 90% of the world's estimated 120 million fishers[3]. Despite their importance, resource depletion from Illegal, Unreported and Unregulated (IUU) fishing and overexploitation pose serious threats to SSF[4]. Poor enforcement and lack of representative science-based data, mainly due to cost and capacity limitations[3, 5, 6], are some of the biggest reasons preventing the development of effective management and curtailment of IUU.

In this context, a promising potential and cost-effective contribution to data generation that allows for a more comprehensive management in SSF comes from monitoring technologies. GFW successfully used this technology to enable scientific research, tackle IUU fishing, advocate for better policies and marine protection, and improve the way fishing is managed[7, 8, 9, 10]. Also, data of spatial and temporal distribution of fishing efforts provided by this technology are used for improving: the assessment of fisheries interactions with target stocks and the environment; the design and application of indicators of fishing pressure; the displacement of fishing activity following changes in regulations, area closures, and fuel costs; the description of fishing behavior and interactions among vessels; the establishment of track records that can be used when debating access rights and conflicts with other users and/or policy-makers[11], and making the seafood supply chain more transparent, providing consumers with better information about where their food came from and if it was sourced responsibly. This technology is also capable of integration with other management tools to give a holistic picture of the fishery, which can include electronic catch reporting (e-logs), integrated catch documentation schemes, catch share or quota monitoring[12].

Substantial efforts are being held globally to draw the attention to SSF importance and realize their potential. This is particularly true regarding the increase of knowledge and data-sharing to improve management[5]. Thus, an urgent need right now is to investigate the feasibility of implementing tracking devices on SSF vessels in various contexts and developing strategies for maximizing adoption.

Background

Global Fishing Watch was launched in September 2016 and is the provider of the world's first global view of commercial fishing activities[1]. Data from commercial fishing vessels are compiled, analyzed, and made publicly available on their website in near-real time to anyone with an internet connection[1]. "GFW was originally set up by three collaborating organizations: Oceana, an international ocean conservation organization; SkyTruth, experts in using satellite technology to protect the environment; and Google, who provide the tools for processing big data"[13].

GFW tracks global fishing activity through two different and complementary vessel tracking systems: Automatic identification system (AIS) and Vessel Monitoring System (VMS)[2]. AIS is a GPS-like device designed as a collision avoidance tool and as means to exchange pertinent navigation information in near real-time, via ship-to-ship or ship-to-shore[14]. International law requires boats over a certain size to publicly broadcast their location using AIS, making it a standardized, internationally adopted, and a non-proprietary communication protocol[14]. VMS are intended for remote monitoring of fishing vessel positions in relation to regulatory areas, maritime boundary lines, and other position-critical enforcement schemes[14]. Compared to AIS, VMS are often more reliable and offer higher resolution data[14]. However, requirements are at the national level and data is proprietary to the national government[15].

Currently, GFW has access to non-proprietary data from AIS and VMS data from countries that have also committed to transparency such as Indonesia and Peru[2]. However, large gaps still exist. AIS account for most of the industrial fishing vessels and as much as 80 percent of the fishing in the high seas, but only 0.2 percent of fishing vessels under 12 m[16]. To fill these gaps, GFW hopes to develop strategies to expand the capacity of monitoring SSF vessels through collaboration with Bren students as well as their partner organizations across the globe.

Available Data

The following data from GFW and GFW's partner organizations has been confirmed:

Indonesia: GFW has previously conducted a trial of SSF vessel trackers on 50 vessels in partnership with Bali Seafood International. They have a processing facility on the island of Sumbawa in Indonesia, where they buy hand-lined snapper and tuna from fishers operating around the island. There are about 800 vessels operating in the fishery. GFW and Bali Seafood will facilitate access to the fishers and provide market and catch data for vessels that they buy from.

Peru: GFW's partner organization, The National Agrarian University, is working with small scale hake gillnetters in Los Órganos on the north coast of Peru. Market data on quantity and value of catch from over 90 vessels operated by 250 fishermen is available, along with access to the fishermen for interviews.

Mexico: GFW's partner organizations, Centro para la Biodiversidad Marina y la Conservación and Scripps Institution of Oceanography at UC San Diego have an ongoing project (now in its 10th year) where they have deployed trackers on over 100 SSF vessels.

Rare Foundation has expressed interest on collaboration, however could not confirm at this time. They have two ongoing projects of monitoring device implementation in SSF located in Honduras and Myanmar.

Possible Approaches

We will adopt an interdisciplinary approach, drawing from behavioral, economics, and social sciences. Our approach considers that there must be a clear benefits exchange, beyond monetary incentives, for all stakeholders involved to sustainably adopt such a program in the long term. In fact, research indicates that program desirability and adoption is expected to increase among fishermen when incorporating needs related to self-determination, understanding, trust and belongingness[17]. Other studies on the adoption of agricultural technology among smallholder farmers in developing countries highlight the influence of human specific factors (e.g., education, age, gender, perception of new technology), economic factors (e.g., net gain from adoption), technological (e.g., trialability) and institutional factors (e.g., social capital, trust, access to information and extension services)[18]. This considered, we plan to perform the following:

1. Literature review on technology implementation strategies in developing countries to identify gaps in knowledge, and socioeconomic conditions and framing of new technology that enable successful adoption.
2. Compile, systematize and analyze the available data to identify main drivers, barriers, and incentives for technology adoption among fishers and other stakeholders.
3. Systematize and analyze data on hardware vendors, hardware and service pricing. Perform a cost-benefit analysis of different types of monitoring devices (price, model, range of device, ease of use, and other information that can be provided), and explore how they match with different SSF based on insight gained from step 1 and 2.
4. Based on our findings, design implementation plan containing: design of monitoring system, how stakeholders must be approached, how they must be considered in the design, and how to ensure benefits according to their needs.
5. Recommend comparative Randomized Control Trial design for the three fisheries that are to be the sites for the pilot project. This will include monitoring and evaluation strategy as well as other aspects.

Deliverables

1) Pilot plan for expanding GFW's monitoring capacity of commercial fishing vessels to include SSF vessels (specifically those less than 12 meters long). This plan will consider the following factors: design of technology, characteristics of fishing community (socioeconomic, demographic, cultural), characteristics of fishery, and incentives.
2) Comparative Randomized Control Trial design for the three fisheries involved in the pilot plan.
3) Monitoring and evaluation strategy for determining the effectiveness, sustainability and scalability of the pilot plan. Strategy to include evaluation of cost effectiveness, ease of collecting data, validity and reliability issues, as well as ways of analyzing the data in order to make decisions about how GFW will proceed with further implementation.

Internships

A paid summer internship will be funded by Global Fishing Watch, and a second internship by the Latin American Fisheries Fellowship (site yet to be determined between Peru, Indonesia, and Mexico). The objective will be to conduct on-site surveys and interviews among fishermen and other stakeholders to explore further non-monetary social factors (such as values, needs, and preferences) that could help drive sustainable implementation at scale, and explore how these incentives depend on fisheries characteristics (open access or regulated fisheries, targeted species, number and size of vessels, and other social-ecological settings).

References

1 Merten, W., Reyer, A., Savitz, J., Amos, J., Woods, P., & Sullivan, B. (2016). Global Fishing Watch: Bringing Transparency to Global Commercial Fisheries.

2 Global Fishing Watch. Retrieved January 10, 2019, from https://globalfishingwatch.org/wp-content/uploads/GFW_FACTSHEET-2_291118_LRES.pdf

3 Kolding, Jeppe & Béné, Christophe & Bavinck, Maarten. (2014). Small-scale fisheries: Importance, vulnerability and deficient knowledge. Governance of Marine Fisheries and Biodiversity Conservation: Interaction and Co-evolution. 317-331. 10.1002/9781118392607.ch22.

4 FAO (2016) The State of World Fisheries and Aquaculture 2016. Contributing to food security and nutrition for all. Rome. 200 pp.

5 FAO (2017) Improving our knowledge on small-scale fisheries: data needs and methodologies. Rome. 104 pp.

6 Costello, C., Ovando, D., Hilborn, R., Gaines, S. D., Deschenes, O., & Lester, S. E. (2012). Status and Solutions for the World's Unassessed Fisheries. Science, 338(6106), 517–520.doi:10.1126/science.1223389

7 Cabral R et al. (2018) Rapid and lasting gains from solving illegal fishing. Nature Ecology and Evolution, volume 2 650–658. April 2018.

8 McCauley DJ et al. (2018) Wealthy countries dominate industrial fishing. Science Advances Vol. 4, no. 8, eaau2161 DOI: 10.1126/sciadv.aau2161

9 Sala E et al (2018) The economics of fishing the high seas. Science Advances Vol. 4, no. 6, eaat2504 DOI: 10.1126/sciadv.aat2504

10 Dunn DC, Jablonicky C, Crespo GO, et al. Empowering high seas governance with satellite vessel tracking data. Fish Fish. 2018;19:729–739. https://doi.org/10.1111/faf.12285

11 Lee J, South AB, Jennings S (2010) Developing reliable, repeatable, and accessible methods to provide high-resolution estimates of fishing-effort distributions from vessel monitoring system (VMS) data. – ICES Journal of Marine Science, 67: 1260–1271.

12 The Pew Charitable Trusts (2017, April) Tracking fishing vessels around the globe (brief from "Ending Illegal Fishing" project)

13 Global Fishing Watch. Retrieved January 10, 2019, from https://globalfishingwatch.org/wp-content/uploads/Intro-to-GFW-transparency.pdf

14 Shepperson, Jennifer L., Hintzen, Niels T., Szostek, Claire L., Bell, Ewen, Murray, Lee G., & Kaiser, Michel J. (2018). A comparison of VMS and AIS data : The effect of data coverage and vessel position recording frequency on estimates of fishing footprints. ICES Journal of Marine Science,75(3), 988-998.

15 Jarke, Matthias ; Mylopoulos, John ; Quix, Christoph ; Rolland, Colette ; Manolopoulos, Yannis ; Mouratidis, Haralambos ; Horkoff, Jennifer. (2014). Advanced Information Systems Engineering,8484, VI-VII.

16 Kroodsma, D., Mayorga, J., Hochberg, T., Miller, N., Boerder, K., Ferretti, F., . . . Worm, B. (2018). Tracking the global footprint of fisheries. Science (New York, N.Y.), 359(6378), 904-908.

17 Sorice MG, Donlan CJ, Boyle KJ, Xu W, Gelcich S (2018) Scaling participation in payments for ecosystem services programs. PLoS ONE 13 (3): e0192211. https://doi.org/10.1371/journal. Pone.0192211

18 Mwangi M, Kariuki S (2015) Factors Determining Adoption of New Agricultural Technology by Smallholder Farmers in Developing Countries. Journal of Economics and Sustainable Development, Vol.6, No.5

Global Fishing Watch

Group Project Committee
Bren School of Environmental Science & Management
University of California, Santa Barbara
Santa Barbara, CA 93106-5131

January 25, 2019

Subject: Support for Bren School Group Project on Small Scale Fishing Vessels

Dear Group Project Committee Members,

We are writing to express our full support for the 2019-2020 Bren School Group Project, "Implementing Vessel Monitoring Devices in Small Scale Fisheries: Analysis of Social and Economic Enabling Conditions to Maximize Adoption"

Given our long-standing relationship with the Bren School, Global Fishing Watch (GFW) looks forward to furthering and deepening that connection through this project. A major strategic objective of GFW's long term fisheries transparency vision is to make publicly trackable 75% of the world's commercial fisheries catch. This means that in addition to tracking all of the large fishing vessels that use AIS and VMS tracking systems, we will need to help to develop tracking for a significant fraction of small scale fishing fleets worldwide.

We believe that current efforts by NGOs and governments, as well as industry trade associations, can be accelerated greatly by uncovering economic and social barriers to adoption of tracking systems in small scale fisheries that currently exist and then applying GFW resources to help reduce those barriers in the fisheries that have the greatest potential for rapid adoption.

GFW is working with partners to be able to provide significant cost reductions in the hardware and software needed to operate a large fishing fleet tracking and traceability system and to understand better which fisheries are best positioned to benefit, and what other non-technological factors are the most important to consider.

Funding
Global Fishing Watch will provide funding for a summer internship for a Bren School student working on the project. GFW can also fund travel costs for one student to Peru or Indonesia for on-site work if needed.

Data

GFW will provide access to at least two sites through our partners in Indonesia and Peru.

GFW: GFW will collaborate with UCSB to solicit data directly from hardware vendors to get hardware and service pricing data. GFW is currently evaluating several vendors for a future vessel tracking trial in Indonesia.

Bali Seafood: GFW has previously conducted a trial of small scale vessel trackers on 50 vessels in partnership with Bali Seafood. They have a processing facility on the island of Sumbawa in Indonesia, where they buy hand-lined snapper and tuna from fishers operating around the island. There are about 800 vessels operating in the fishery. GFW and Bali Seafood will facilitate access to the fishers, and provide market and catch data for vessels that they buy from.

Peru: The National Agrarian University working with small scale hake gillnetters in Los Órganos on the north coast of Peru. Potential access to 90 vessels operated by 250 fishermen along with market data on quantity and value of catch.

Support
GFW has two technical staff based in Jakarta, Indonesia and 2 based in Lima, Peru that will be available to facilitate in-country activities

Sincerely,

Paul Woods
Global Fishing Watch CTO
paul@globalfishingwatch.org
+1 240 432 1674