

Holy mackerel: Small fish, big potential

Pacific Islanders are heavily dependent on marine resources for food security and income generation, especially in countries and territories with limited arable land. Fish stock depletion and coral reef degradation is creating a need for alternative income and protein sources. New technologies are required to improve access to resilient and sustainable protein sources, such as sardines and anchovies.

On Majuro in the Republic of the Marshall Islands, a new fishing technology called bagan is being trialled as a potential tool for enhancing food security, securing livelihoods and assisting with climate change adaptation in the Pacific.

Introduction

Small pelagic fish, such as sardines, mackerel and anchovies, are a plentiful and rich protein source that remains relatively underexploited in the western and central Pacific Ocean. Hall (2007) states that we are not overexploiting the ocean's protein resource, but we are overexploiting certain species; in particular, species that are in the upper level of the food chain.

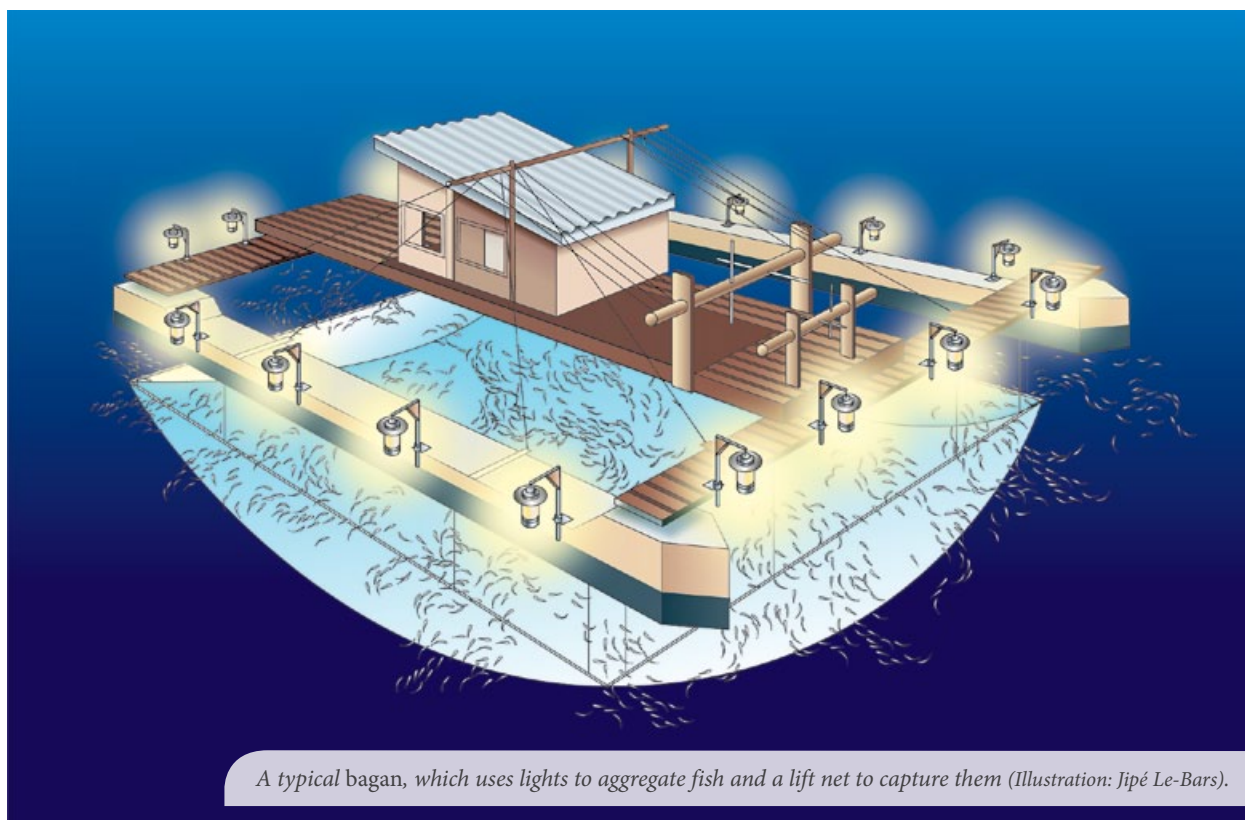
Diverting fishing effort from large predators, reef fish and invertebrates to more robust stocks, such as small pelagic fish, has the potential to rejuvenate overexploited marine resources while continuing to supply the world's growing population with protein.

Increasing fishing effort on small pelagic fish is, within reason, deemed sustainable given the biological nature of these fish: they grow rapidly, have short life spans and high mortality rates (Dalzell 1990). Dalzell (1994) states

that for anchovies in particular, the short life span and high mortality of the population means that they can be fished heavily, have their biomass markedly reduced, and the population will recover in a short time — usually in a few weeks to a few months. As with any fishery, increasing effort must be done with caution and yields must be maintained within sustainable levels.

Indonesian-adopted fishing technology

As reported by Sokimi (2012), the Secretariat of the Pacific Community — in conjunction with the Pacific Islands Forum Fisheries Agency (FFA) and the Marshall Islands Marine Resource Authority (MIMRA) — is researching the potential of Indonesian-adopted fishing technology, which attracts and captures small pelagic fish using a lift-net platform, or *bagan*.



A typical bagan, which uses lights to aggregate fish and a lift net to capture them (Illustration: Jipé Le-Bars).

Fish are attracted to the platform by bright overhead and/or underwater lights. When sufficient numbers of fish have aggregated around the *bagan*, a bag net — one type of liftnet with a bag shape — is lowered inside the platform between the two hulls. The lights are gradually turned off one at a time until only one central light remains on. This light is centred above the net to attract the fish to the entrapment area. Once the school of fish has settled into an orbit beneath the light, a signal is given to lift and close the net to capture the fish.

Bagan research in Majuro, Republic of the Marshall Islands

The *bagan* bait fishing project aims to research the potential for using a *bagan* to catch small pelagic fish for food. It is planned that the fish will be consumed fresh and in a value-added form (e.g. salted, dried, smoked) on the local market.

The project began in October 2011 when the *bagan* was constructed in Kiribati and transported to Majuro for assembly. The *bagan* was launched in February 2012 and two Indonesian consultants (a pole-and-line specialist and a *bagan* operations specialist) were engaged to conduct fishing and value-adding demonstrations for eight days in March.



The bagan anchored for the first fishing trials.

Once a good operations and business model has been defined, and the *bagan* is proving to be successful, MIMRA will transfer ownership and operation of the *bagan* to a community group, who will have the opportunity to operate the *bagan* and market their catch through the Outer Islands Fish Marketing Centre (OIFMC).

If successful, this project will provide an alternative source of food and income from a healthy and robust fish resource that is not currently exploited in the Marshall Islands.

Fishing trials

Fishing trials were conducted for two nights in March, although due to adverse weather and sea conditions (i.e. moon phase, current, wind and location), catch rates were low.

Bagan fishing is a new concept for the fishermen who assisted and were trained by the project. Inexperience in using this type of technology also contributed to fish escaping. This is normal for any new fishing operation where gear must be adjusted and experiments carried out to fine-tune the system. It is envisaged that with practise, catch rates will increase.

The catch mainly comprised sardines, scads and mackerel.



Scads and mackerel caught on the first fishing trial.

The catch from each night's fishing effort sold quickly for USD 1.50 per pound on the local market, which indicates that there is demand for small pelagic fish in Majuro.

Data collection framework

A biological and economic data collection framework has been developed to monitor all aspects of the *bagan* operation. Data collection is an integral component of the research because it provides, among others, information on:

- optimal fishing period — moon, tide, weather, season;
- optimal fishing location — depth and position in the lagoon;
- species composition and catch rate over time; and
- costs used for conducting an economic assessment.

SPC developed logsheets for recording data on catch and effort, processing and sales, and MIMRA's Fisheries Officer, Peter Jaramiel, developed a database to input these data.

Project opportunities and constraints

The Majuro *bagan* project has a number of opportunities and constraints that are summarised in Table 1.

Table 1. Opportunities and constraints of the *bagan* project in Majuro, Republic of the Marshall Islands.

Opportunities	Constraints
<ul style="list-style-type: none"> • Establish retail outlet, cold chain and vessel support for marketing through the OIFMC • Supply bait to longline vessels and to fishers • Establish value-adding practice, capacity and infrastructure (e.g. smoker, drying racks) at the OIFMC • 12-month financial commitment from FFA to support fishing trials • Ongoing technical support from SPC • Commitment from MIMRA to continue fishing trials • Seemingly strong demand for small pelagic fish • Low-cost fishing method 	<ul style="list-style-type: none"> • No capacity for MIMRA staff to conduct frequent fishing trials • Uncertainty about fish resources and abundance • Uncertainty about the suitability of Majuro's weather for <i>bagan</i> fishing • No capacity to accurately record and compile data • Uncertainty about the size of the market for small pelagic fish • Relatively low-value product (USD 1.50 lb⁻¹) — although this is complemented by low-cost fishing method • Limited value-adding opportunities (based on the fish that were caught in the trial)

Recommendations for the project

- Improve lighting by investing in a generator and underwater lights to more effectively aggregate fish and subsequently, increase catch rates.
- Continue fishing trials in new locations, different moon phases and different weather conditions.
- Invest in some safety gear; night fishing can be dangerous and there is a need for safety gear on the *bagan* (such as fire extinguishers, safety helmets, hand gloves, man overboard life rings with safety line and water activated light attached to each, emergency spotlight).
- Install some safety lights and reflectors so that the *bagan* can be easily seen at night without being hit by passing vessels.
- Allocate a full-time employee or manager to run the *bagan* project.
- Provide additional training in fishing techniques and monitoring and evaluation.
- Explore alternative markets if catch rates improve, such as small-scale value adding, bait.



Towing the *bagan* to the fishing location.

Discussion

The Majuro *bagan* research project for food security is the first of its kind in the Pacific. FFA has implemented a similar project in the Solomon Islands, although the objective of that *bagan* project is to investigate the potential for supplying bait for small-scale pole-and-line vessels.

From a food security and livelihoods perspective (and assuming that catch rates improve), *bagan* fishing targets an underexploited and sustainable stock, and is a

low-cost fishing technique. Therefore, with further refinement, it is envisaged that this project has the potential to be a biologically sustainable and financially profitable venture.

Further research is required to increase catch rates and to develop a lower cost *bagan* that will contribute to making *bagan* technology an economically viable tool for food security, livelihood improvement and climate change adaptation in the Pacific.

Acknowledgements

The hard work of MIMRA and OFIMC staff in making this challenging project a reality is acknowledged — they are still facing challenges and their perseverance is admirable. Special thanks to: Glen Joseph, Candice Guavis, Peter Jaramiel, Fred Bukida, Tino Debrum and all of the OIFMC team who worked tirelessly during construction of the *bagan* and fishing trials.

Thanks also to our consultants, Anung Widodo and Ajub Dolo, and to the Research Centre for Fisheries Management and Fish Resource Conservation, Ministry of Marine Affairs, Indonesia, for lending their staff for this project.

Financial contribution from SPC, MIMRA and FFA is acknowledged with thanks.

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For more information:

Michael Sharp

Fisheries Development Office (Economics), SPC
(MichaelS@spc.int)

William Sokimi

Fisheries Development Officer, SPC
(WilliamS@spc.int)

Michel Blanc

Nearshore Fisheries Development Adviser, SPC
(MichelBl@spc.int)

All pictures in this article are by Michael Sharp.



Hauling the net can be physically demanding. OIFMC staff faced the challenge with enthusiasm.