Developing participatory monitoring of community fisheries in Kiribati and Vanuatu

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Introduction

Securing a sustainable supply of coastal fish has been prioritised by national governments in a series of regional policy statements, notably the Vava'u Declaration (2007),[5] The Apia Policy,[6] the Melanesian Spearhead Group's Roadmap for inshore fisheries management and sustainable development 2014–2023,[7] the Pacific Islands Forum Secretariat's Framework for a Pacific Oceanscape,[8] and the 2014 Palau Declaration – The Ocean: Life and Future.[9]

A major milestone in giving effect to these aspirations came in 2015 with the publication of "A New Song for Coastal Fisheries – Pathways to Change: The Noumea Strategy" (the New Song Strategy),[10] and the workshops that led to its release. In the five years since the publication of the New Song, coastal fisheries are now firmly on national agendas, and there is increasing investment in national programmes to support policy and management. In Kiribati and Vanuatu, for example, roadmaps have been developed to operationalise the visions provided in the New Song and in national fisheries and development documents (MFMRD 2019; VFD 2019).

The New Song powerfully articulates the need for new directions and innovations in realising regional leaders' visions, and is clear about the challenges in doing so. Reversing declines in fisheries and increasing their contribution to food security and economic development is made difficult by geography and a lack of infrastructure: many islands and communities are small and isolated, and alternative sources of food and income are limited.

These challenges are evident when considering Outcome Two of the New Song: "adequate and relevant information to inform management and policy". By their nature, the thousands of small, complex fisheries in rural regions of Pacific countries defy the application of generic approaches and methods to achieve outcome two. There is no simple rubric or toolbox that can be applied to all situations and objectives and data are scarce. Programmes designed to serve global, regional and national reporting obligations or national commodity fisheries will not, for example, serve communities seeking to manage their resources better. For all purposes, financial constraints and capacity will further limit what is possible. The 2019 Pacific Community (SPC) Coastal Fisheries Report Card indicates that the extent to which coastal harvests are sustainable, and the degree to which the management of those harvests is informed by scientific evidence, remains poorly known across the region (SPC 2019).

Here we introduce a fishery monitoring programme developed to support community-based fisheries management (CBFM) in Kiribati and Vanuatu as part of the Pathways project. Pathways is a collaboration among national fisheries agencies in Kiribati, Solomon Islands and Vanuatu, the Pacific Community, the University of Wollongong and WorldFish. The project joins a long history of CBFM in the Pacific region (e.g. Ruddle 1998; Govan 2009; Schwarz et al. 2011; Cohen and Foale 2013; Leopold et al. 2013; Jupiter et al. 2014; Cohen and Steenbergen 2015; Webster et al. 2017; and references therein), and interest is growing in these initiatives as food and nutritional security issues in rural communities come to the fore, most sharply in the last four months with the advent of COVID-19 (e.g. Farrell 2020; Eriksson et al. 2020; Steenbergen et al. 2020). With increasing investment, comes more attention to the performance and evaluation of CBFM and the production of generalisable lessons. The project has engaged with 134 communities and established new fisheries management plans in 45, with a further 18 under development.

The fisheries in the communities we worked with are remarkably diverse in, for example, fishing gear, seasonality,

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[5] https://www.forumsec.org/2007/04/20/the-vavau-declaration-on-pacific-fisheries-resources-our-fish-our-future/
[6] http://purl.org/spc/digilib/doc/mgtfs
[7] http://purl.org/spc/digilib/doc/fmc3e
[8] https://www.forumsec.org/wp-content/uploads/2018/03/Framework-for-a-Pacific-Oceanscape-2010.pdf
[9] https://www.hokulea.com/wp-content/uploads/2016/08/Palau-Declaration-on-The-Ocean-Life-and-Future.pdf
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tide state, gendered patterns in fishing, cultural demands for fish, external forcing of demand, markets, weather, skill, politics, availability of outboard motors, and the presence of ciguatera (Adams 2012; Sulu et al. 2015; Bell et al. 2018; Gillett and Tauati 2018). In contrast, some fisheries target one or several species with a single gear type. Capturing the essence of fisheries in ways that are useful for communities to better manage their resources is reminiscent of the Indian parable about a group of blind people describing an elephant; all our truths are partial and there are a thousand ways to be wrong.

This complexity notwithstanding, there is an imperative to contribute to better informing management. Our purpose in this initiative was to evaluate the performance of community management plans in achieving their objectives. We note that CBFM can take many forms and may or may not be codified in a formal management plan. This diversity is evident among the communities we engage with, but for the purposes of developing our monitoring, we selected a subset of communities that have formalised their management aspirations in a written plan.

We were not, primarily, concerned with evaluating national policy, reporting on progress against the Sustainable Development Goals, or even against the New Song. Nor were we concerned with evaluating the performance of national commodity fisheries targeting, for example, beche de mer, tuna or deep-water snappers. Of course, the sampling programme will secondarily contribute to these goals, and to the pool of knowledge on species diversity, size structure of catches and so forth, but those were not the primary goals.

With this purpose in mind, the design process becomes a series of choices and compromises that balance practicalities and ambitions for information. Below we highlight some of those choices made to design a monitoring programme that was legitimate, simple, practical and useful for our purpose. Those choices build on the lessons and insights made by other programmes but may not be the decisions made in other contexts and with different objectives. In this and the companion national case study from Vanuatu, we focus on the data collection process, leaving other elements of the programmes to future articles.

More data is usually a good thing and a recurrent theme in the literature on fishery monitoring, and in small-scale fisheries in particular, it is the challenge of assessing data limited fisheries (see Halls et al. 2005 and Dowling et al. 2019). There is an enormous amount of literature to guide making the many compromises needed to implement a useful programme (Halls et al. 2005; Dowling et al. 2019), including many insights from the Pacific region (e.g. Dumas et al. 2009; Govan 2014; SPC 2016). There are many dimensions to these challenges relating to, for example, cost, simplicity, appropriateness, feasibility, scalability, legitimacy and adaptability. Below we highlight four dimensions and the challenges and compromises made to design a fit-for-purpose fishery monitoring programme. Each choice brings with it opportunity costs in terms of information collected or not collected, and both financial and time consequences.

Monitoring embedded in a larger process

Our approach positions the monitoring and evaluation process within, and subservient to, a deeper engagement with communities to support CBFM. This approach moves the fisheries biologist from centre stage and instead places more emphasis on other disciplines within a transdisciplinary approach to evaluation. A starting premise – based on our reading of the literature and experiences in rural development, fisheries and policy – was that sustainability may be more determined by the willingness of community members to decide a course of action, and develop and follow rules than by the robustness of assessment data. Baldly, science and data as a Western construct, may or may not be critical in that evolution of collective commitment. The purpose of the monitoring is to catalyse and support community-led conversations and to bridge worldviews of community members to those of national agencies and their partners.

As a consequence, we prioritised our relationship with communities, on mutual understandings of our role, and on the legitimacy of management institutions. Key in this was the process of engaging with communities, co-development of the monitoring programme, their ownership of data generated, and reporting back and translating results to make them useful to the community.

Based on established relationships and a common purpose, the monitoring and evaluation programme has three stages (Fig. 1). Before communities are visited, enumerators (project staff, fisheries officers and community members) were trained in the use of the survey instruments. Monitoring trips are "socialised" prior to visits to communities, and data collection teams spend their first day in communities discussing the monitoring activity and its role in supporting CBFM, upcoming or past activities, answering questions, recruiting interested participants, and addressing concerns. These activities are intended to foster community willingness to participate – through building an understanding of how important the participation of each fisher is – in developing a robust understanding of how the activity supports the community's CBFM aspirations.

Importantly, the findings resulting from collected data are reported back to each community after each round of data collection. Initial reports contain information about general trends and catch composition, as well as information tailored to each community's specific management efforts. The next step is to feed the data collected by this monitoring programme back into the management cycle, so that communities can use it to review their CBFM plans (or community rules) and make decisions about whether the plan needs adjusting. Respecting that government agencies

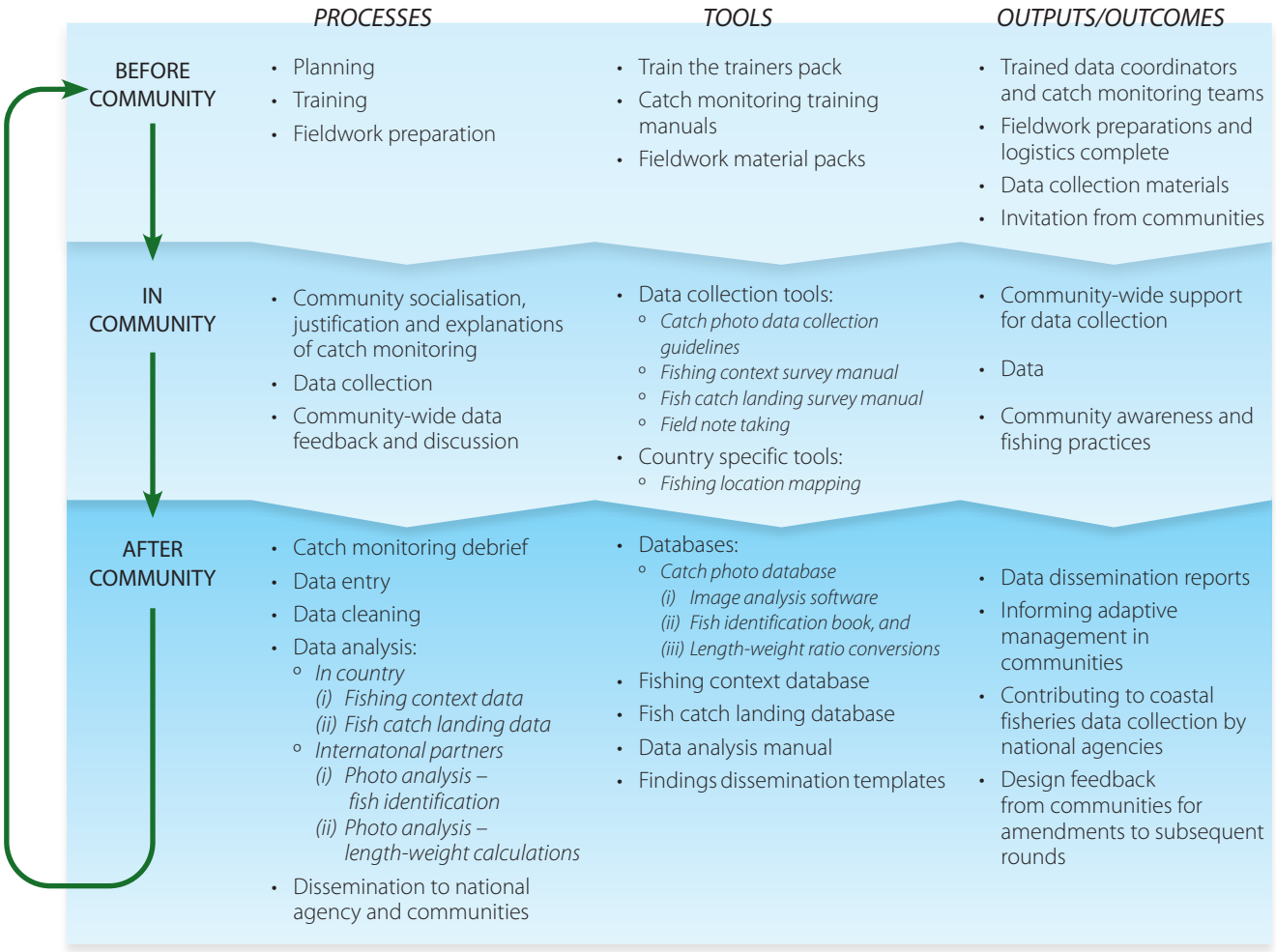

Figure 1. Components of the fishery monitoring programme.

are partners in CBFM, reports are also prepared for national government agencies, based on an awareness of their own reporting, management and policy needs.

Mixed methods

We use a mixed methods approach (Creswell and Creswell 2018) to capture snapshots of fisheries using four data collection tools: 1) a catch and effort survey, 2) a fishing context survey, 3) photographs of catch, and 4) catch monitor field notes. The fishing context survey used a recall method to understand fishing habits over the past seven days, travel times to main fishing grounds, perceptions of observed changes to fish and invertebrate resources over a defined timeframe, awareness of local management rules and their adherence, and any resource concerns. Where appropriate, questions were designed to replicate those in a range of national and SPC survey instruments, including household income and expenditure surveys, Tails+[11] and research surveys held by Pathways staff (see also Kaly et al. 2016; Molai et al. 2020).

These tools were tested in 10 communities implementing CBFM plans, each sampling trip lasting about two weeks, depending on logistics. Thus far, 7891 fish (313 species) from 295 fishing trips have been measured, and 279 fishers interviewed. Surveys are planned to be done quarterly for the next year and then reviewed. The surveys are currently paper based while catch monitors become familiar with the forms and while the design and questions are tweaked. Future iterations will integrate the photograph and the survey modules as a tablet-based tool.

Length, not weight (or both)

An early choice was to estimate the lengths of fish rather than their weight. The experiences of SPC colleagues and others suggested that, in a community-based programme

[11] Tails is a tablet application which facilitates the collection of tuna, deep bottom snapper and reef fish catch data from small scale fishers and allows for the data to be uploaded to a central database for analysis (for more information see https://oceanfish.spc.int/en/ofpsection/data-management/spc-members/dd/505-tails-application). Tails+ refers to the amended version of Tails that makes it suitable to address needs of the Vanuatu coastal fisheries context.

where a range of enumerators from fisheries officers to community members could collect data, the maintenance of reliable and accurate scales would be expensive and problematic. Further, in many instances the weights of fish were unreliable because the fish were gutted or bled prior to landing and/or had lost significant fluid during the course of the fishing trip if they were speared and/or left on the deck.

With known length-weight relationships for many fish species, estimates of weight could be derived in almost all instances. The database of length-weight relationships curated by SPC was an important source of information in this regard. Ongoing work by SPC's Fisheries, Aquaculture and Marine Ecosystems Division is rapidly increasing the reliability of the estimates. Although not sought by communities at this stage, length-based information has the potential to support length-based methods to set size limits for fish species (Hordyk et al. 2015; Prince et al. 2015; but see Dowling et al. 2019 on cautions in the search for generic methods).

Photographs of the catch, not of individual fish

Another early choice was to use photographs of catches rather than measure or photograph individual fish in the time-honoured creel survey tradition. Catches were either laid out on gridded mats or arranged beside a reference object of known length and a photograph taken with a tablet, phone or conventional camera (Fig. 2, see also Cohen and Alexander 2013).

There are significant advantages and disadvantages in this choice. The method minimises irritation for participating fishers at the end of their day's work, and reduces damage to the catch from prolonged exposure to the elements. Taking a photograph also creates a permanent record of the catch for error checking and as yet unimagined purposes. Taking photos also gives more control over the accuracy and consistency of the fish identification. Thus far more than 300 species of fish have been recorded in the catches. Because we anticipate the method may be used by a diverse range of enumerators, adequate species recognition would place a significant training burden on project and national agency resources. Conversely, the method requires that catch monitors take good images, curate the photographs and maintain the tablets.

Using photographs shifts time-consuming aspects of the process from the beach to the office. Data entry and curation of forms were managed in-country, with images processed at University of Wollongong using ImageJ (Rasband 2018) to provide information on species diversity, length and (by calculation) weights. Sending the digital files from Kiribati and Vanuatu was not problematic and, as ICT coverage continues to improve in the region (Cave 2012; Hunt

Figure 2. An example of a catch from Kiribati. This catch consists of small fish from only two families: tropical snappers (Lutjanidae) and tropical emperors (Lethrinidae).

2016, 2019), files will increasingly be able to be sent directly from rural areas. Image processing is an exacting and time-consuming task. Recent work at SPC and by James Cook University with the World Wildlife Fund offers the potential for greater automation of image processing, including through mobile apps for field-based identification and measurement (Andrew Halford, Senior Coastal Fisheries Scientist, SPC and Michael Bradley, Postdoctoral Research Fellow, James Cook University, pers. comm.).

Invertebrates

Many CBFM plans and research on coral reef fisheries focus on fish. Invertebrates are much less understood and pose particular and largely unresolved challenges for monitoring and evaluation of CBFM plans (Fig. 3). Invertebrates are an important part of catches in many parts of the region and we found this to be the case in Kiribati and parts of Solomon Islands, in particular. During one visit to a community in Kiribati, 75 catches consisted entirely of invertebrates, with only 29 containing fish. Descriptions of catches for some invertebrates such as *Trochus*, clams and whelks are relatively straightforward, but soft-bodied taxa such as holothurians, polychaetes, octopus and squid present major challenges. Seaweeds would similarly pose problems for both size estimation and image processing. We have recorded many photographs of invertebrate catches and are working with SPC to find solutions for capturing invertebrate data so that it can be used to inform community management. Another limitation is the use of non-standard units of measurement such as strings or buckets. We are also working on establishing proxies for non-standard units, which would reduce the need for enumerators to lay out the entire contents of a bag or bucket.

Conclusions

Based on the pilot work outlined here and in the companion article by Abel Sami and colleagues from Vanuatu, the sampling methods described appear to offer a fit-for-purpose compromise for describing catches and characterising fisheries in CBFM communities. The survey instruments and training materials developed are available upon request from the authors. The next steps will be to refine methods, further integrate sampling into management cycles with

Figure 3. A composite image of invertebrates collected from Kiribati and Vanuatu presented in the way that they are usually harvested. Clockwise from top left: Strings of peanut worms (*Sipuncula* sp.); a string of shucked giant clams (*Tridacna* sp.); a collection of snails and chitons; and an octopus.

communities, design a larger programme to cover more communities nationally, and to describe fishing patterns over time. Ultimately, these methods may contribute to systems of reporting against national goals and the New Song outcomes.

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