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Detecting fisheries trends in a co-managed area in the Kingdom of Tonga

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ABSTRACT

Community based and co-management approaches are increasingly used strategies for marine conservation and sustainable management in the tropical Pacific. However, our understanding of the effectiveness of co-management on marine resources and socio economic conditions is relatively limited, often due to insufficient resources to support monitoring based on ecological condition or catch landings data. Monitoring programmes based on the perceptions of resource users are often presented as a cost effective alternative to understanding the status and changes in resource and socio economic conditions. Ecological, catch landings and perception-based data, and their collection methods, have different benefits and limitations for community-based programmes. Here we present a study of the first community-based, co-managed area in the Kingdom of Tonga – the small island of 'O'ua. We examine both perception-based data from interviews and catch landings data to describe fishing activities, catches and changes in resource status and socio economic conditions since the inception of co-management. Landings data were collected by the community over a five year period; perceptions of change and management performance were collected through structured interviews with fishers based on the same time period. The majority of fishing within the 'O'ua co-managed area was by men, using hand spears in fibreglass vessels <5 m in length powered by an outboard engine. We found that catch per unit effort was high (especially the estimates generated from perception data) compared to other parts of the Pacific. Since the inception of co-management fishers reported improved socio economic conditions, a greater sense of stewardship over resources, active involvement in management and the effective exclusion of 'outside' fishers. We compared catch and catch-per-unit-effort estimates generated from landings and perception data. While fishers perceived that catches had improved since the inception of co-management, landings data suggested that catches were either stable or declining. These differences are important as they would suggest very different management responses. We discuss the trade-offs between the catch landings and perception data in terms of accuracy, precision, participation and cost for the purpose of guiding adjustments to co-management.

1. Introduction

The majority of people in the South Pacific rely on marine resources as a primary source of income and dietary protein through small-scale fisheries (Adams, 2012; Kittinger, 2013). However, fishing pressure has increased in recent times raising concerns for ecological sustainability and food security. The depletion of marine resources will continue to intensify with increasing pressures from global markets, climate change and the projected doubling of the population in the South Pacific in the next 30

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years (Bell et al., 2011, 2009). The social and economic impacts of declining resources are significant given that people have limited alternatives for generating livelihoods aside from extraction of primary resources, through small-scale farming and fishing (Govan et al., 2009).

Due to continued declines in fisheries resources and limited 'reach' and effectiveness of centralised government on the management and conservation of marine resources (Ruddle, 1998; World Bank, 2004) countries in the Pacific are increasingly supporting decentralised and often community-based approaches (Anon., 2015; Govan et al., 2009). Collaborative management, or co-management, has become a popular resource management approach whereby local communities manage resources in partnership with government agencies, non-governmental organizations, research organizations, private enterprises and/or civil society (Cohen et al., 2013; Evans et al., 2011; Wamukota et al., 2012). The central element of co-management is empowerment of local resource users to influence or control decisions affecting their lives, including the way in which fisheries resources are used and managed (Berkes, 2007; Pomeroy, 1995). The benefits of co-management of fisheries resources are variable, but reported to include a greater sense of stewardship, improved management through the use of local knowledge, reduced conflict between fishing groups, less overharvesting, increased compliance and improved food security (Baticados and Agbayani, 2000; Govan et al., 2009; Gutierrez et al., 2011).

Community-based forms of co-management have become a pivotal part of addressing small-scale fisheries concerns and the management of the decline of marine resources in many Pacific countries such as, Fiji (Jupiter et al., 2014), the Solomon Islands (Cohen et al., 2012; Cohen and Steenbergen, 2015), and Vanuatu (Léopold et al., 2013). In these contexts co-management normally focuses on particular areas that are near to communities and that are defined as being traditional fishing grounds or areas of customary tenure. As such, co-management in the Pacific tends to fall into the 'community-based' end of the management spectrum (Jupiter et al., 2014). However, co-management arrangements can vary according to the relative authority and influence resource users and government or non-government partners have over management (Sen and Nielsen, 1996). We examine co-management in Tonga because it presents a relatively unusual case in the Pacific given the lack of customary tenure or traditional fishing rights. In the Tongan context, the government plays a leading role in facilitating and formalising fisheries co-management with communities.

Effective management involving local communities requires clearly defined objectives, systematic monitoring and evaluation of the resources, and the adjustment of management procedures if necessary to achieve pre-defined objectives (Weeks and Jupiter, 2013). In evaluating the effectiveness of co-management for reaching social, ecological and economic objectives, the ideal is to compare performance indicators before, during and after the management implementation. Examples of such indicators include focal species abundance, habitat quality, species richness, household income, equity of benefit distribution and other livelihood parameters (Maliao et al., 2009). However, the collection of formal scientific data prior to management implementation is rare and a key feature hindering comprehensive assessment of the performance of co-management is that often there are insufficient financial resources or technical capacity to support comprehensive and longitudinal monitoring and evaluation. Consequently detailed information tracking changes to socio economic and resource conditions are typically limited (Evans et al., 2011; Maliao et al., 2009; Ostrom 2009; Wamukota et al., 2012).

To make monitoring more feasible, affordable and relevant for local purposes an alternative is to use fisher's ecological knowledge and perceptions of change (Neis et al., 1999; Tesfamichael et al., 2014). The use of fisher's knowledge is gaining increasing acknowledgement in fisheries science and management (Haggan et al., 2007; Hind 2015; Johannes et al., 2000). Fishers are likely to have an intimate understanding of the environment in which they work and an extensive knowledge of resource patterns, making them well positioned to observe and understand changes (Berkes et al., 2000; Johannes et al., 2000). For example, the effectiveness of co-management may be determined based on whether fishers perceive local resource or socio-economic conditions to be improving, remaining the same or decreasing over a certain period of time (Maliao et al., 2009; Pomeroy et al., 1997; Webb et al., 2004). Given the financial and technical limitations that prohibit the collection of formal scientific data in community-based contexts, resource-user perceptions may provide a crucial, and even more fitting, method for the evaluation of management performance (Johannes 1998; Maliao et al., 2009).

Despite the value and practicalities of resource user knowledge, it has not been widely incorporated into conservation and resource management. Perhaps the most serious impediment is the difficulty in appraising the accuracy and precision of using local knowledge alone for detecting resource trends (O'Donnell et al., 2012; Tesfamichael et al., 2014). The use of perception-based data requires that interviews be carefully constructed to accurately capture information. The accuracy with which people recall and report past events or interpret trends is variable and can be influenced by various factors such as previous experience, beliefs and values, cognitive processes and motivational factors (Daw et al., 2015; O'Donnell et al., 2012; Tesfamichael et al., 2014; Yasue et al., 2010). The shifting baseline syndrome can also affect fisher's perceptions of deteriorating environmental conditions, where each generation subconsciously views 'natural' as the way the environment appeared in their youth (Bunce et al., 2008; Pauly, 1995; Saenz-Arroyo et al., 2005).

There have been relatively few studies that have quantitatively assessed the accuracy of fisher's perceptions against formal scientific methods. Some studies have found that interview and formal scientific data indicate similar trends and reached similar conclusions (Lozano-Montes et al., 2008; Neis et al., 1999; Otero et al., 2005). Other studies found that comparisons produced mixed results, with similarities in some indices but not others (Ainsworth and Pitcher, 2005; Daw et al., 2015; Gaspare et al., 2015), and still other studies indicated opposite trends between interview and ecological data within the same system (Yasue et al., 2010). If trends are extreme then there is a greater likelihood of consensus between local perceptions and scientific data (Katon et al., 1999; Rochet et al., 2008). There is therefore a continuing need to understand the relationships between perception and formal scientific data (O'Donnell et al., 2012).

The first goal of this paper is to describe a co-management arrangement and fisheries outcomes in the Kingdom of Tonga using two data sources; fisher's perceptions and landings data. Fisher's perceptions were based on interviews with household heads to understand how they perceived socio economic conditions and resources status to have changed since the inception of co-management. Landings data were collected by local community members who opportunistically recorded catch and effort data from fishers over a five-year period. We were particularly interested to know whether there had been any improvements to resources and socio economic conditions since the inception of co-management. The second aim of the paper is to evaluate the consensus between the two data types: fisher perceptions and landings data to see whether they showed the same results and trends. We used this comparison to explore the strengths and weaknesses of perception and landings data for monitoring fisheries performance