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Strengthening post-hoc analysis of community-based fisheries management through the social-ecological systems framework

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ABSTRACT

Community-based fisheries management (CBFM) is held up as one of the most promising approaches for securing sustainable small-scale fisheries. Yet, the complex features that shape CBFM outcomes remain inadequately understood. In part, this stems from the fact that few community-based projects meet the data requirements for formal impact evaluations. Given this context, diagnostic approaches are increasingly seen as a frontier for strengthening CBFM analysis and securing small-scale fisheries sustainability. This study explores the capacity of Elinor Ostrom's social-ecological systems (SES) framework to strengthen post-hoc diagnosis of CBFM. It draws on data from published and grey literature (including field notes, meeting minutes, and project reports) generated throughout an eight-year CBFM project in five Solomon Island villages. Results suggest that successful CBFM outcomes were facilitated by effective information sharing, harvesting rules that merge traditional and contemporary practices, strong leadership, and resource monitoring, while uneven power differentials undermined positive outcomes. The paper argues that the SES framework can add analytical rigour to post-hoc analysis when it used to: 1) engage with temporal dynamics that shape CBFM processes; 2) integrate insights from plural theories, and 3) explore interactions between multiple CBFM outcomes. Ultimately, the paper argues that diagnostic applications of the SES framework can contribute towards conducting more systematic analysis of diverse CBFM data, improving CBRM practices, and realizing more sustainable small-scale fisheries

1. Introduction

Community-based fisheries management (CBFM) emerged in the 1980s as an alternative to government-led or private protection approaches to marine resource management [1–4]. CBFM is characterized by the devolution of resource management authority to local communities, allowing fisheries governance processes to be determined locally and often involving community partnership with stakeholders including government agencies and non-governmental organizations (NGOs) [5,6]. Support for CBFM is based on the notion that people who depend on marine resources are often the best informed about local resource contexts, the most committed to sustainable harvesting, and will thus develop more effective and appropriate management practices to address local objectives [7,8].

Despite a substantial shift towards CBFM for small-scale fisheries governance, particularly in the developing world, empirical evidence suggests that the outcomes of CBFM for people and ecosystems are mixed [9,10]. For example, community management benefited fishers in Indonesia by contributing to poverty alleviation, but the benefits did not endure after the project implementation period [11]. Alternatively, evidence from inland Africa suggests that the transition to CBFM redistributed power in a way that excluded local fishers from resource decision-making processes [12]. Ultimately, effective and sustainable fisheries governance requires more systematic understandings of the attributes that render some management strategies more effective than others [13,14].

Considerable efforts have been directed towards the design and implementation of CBFM [15–17]. By comparison, the factors that influence successful CBFM outcomes remain inadequately understood. In part, this stems from the fact that few CBFM projects meet the data requirements for formal impact evaluations such as before-after control-impact experiments [13,18]. The reasons for this are many. First, many CBFM efforts are low intensity so as to protect the “bottom-up” nature of the initiative, but also to ensure that CBFM is replicable in

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resource and capacity limited settings. Second, the use of randomized controlled trials or formal monitoring and evaluation programs may not be feasible or ethical for many marine resource projects and practitioners that support small-scale community initiatives. For example, the ethics of withholding support while requiring data from control communities is questionable. Yet, many CBFM projects, particularly where an external partner is involved, are documented through rich data sets comprised of, for example, field notes, meeting minutes, and formal and informal interviews accrued over long periods of time [19]. These data often remain unanalysed, and this represents a lost opportunity to generate knowledge that could contribute to the development of more effective and sustainable small-scale fisheries management.

Increasingly, diagnostic approaches are emerging as an important frontier for sustainable small-scale fisheries [20,21]. Diagnostic approaches refer to frameworks that can help identify a range of biophysical, socio-political, and institutional variables that contribute to the failure or success of resource management outcomes. Towards this aim, Elinor Ostrom's social-ecological systems (SES) framework offers significant analytical power to understand which combinations of variables underlie successful common pool resource outcomes, and by contrast, which combinations might lead to overexploitation and system collapse [22,23]. Importantly, the SES framework is designed to accommodate many forms of data, from diverse sources, and thus provides a theoretically grounded means for diagnosing social-ecological interactions and outcomes [24].

In response to the challenges associated with generating systematic understandings of CBFM outcomes through diverse, yet often informal, project data, this paper pursues two research questions. First, the paper asks: *what attributes influenced the social and ecological outcomes of community-based fisheries management in Solomon Islands?* To explore this question, the SES framework is operationalized for the diagnosis of an eight-year CBFM project across five villages in Solomon Islands. This diagnosis draws on multiple sources of social and ecological data, some of which has been analysed and published using narrower temporal windows and analytical lenses. Second, the paper asks: *can the social-ecological systems framework strengthen post-hoc analysis of community-based fisheries management?* Post-hoc analysis is defined as the synthesis of patterns from multiple types of data drawn from multiple sources once a CBFM project has concluded.

The paper begins, in Section 2, with of a review of Ostrom's institutional theory and SES framework. Section 3 explains the methods used to operationalize the SES framework for post-hoc diagnosis of CBFM. Section 4 unpacks key explanatory variables that emerge as useful for understanding multiple and diverse outcomes that were observed in the five Solomon Islands communities. The results generated through this analysis are then compared to other CBFM analyses to explore the utility or value-added of the SES framework for strengthening post-hoc analyses. The paper concludes with a reflection on some of the implications of framing post-hoc analyses through the SES framework for the way civil society organizations, NGOs, and governments study and support CBFM.

2. The social-ecological systems (SES) framework

Elinor Ostrom's research developed directly out of dissatisfaction with institutional analyses that proposed simplified solutions (e.g., nationalization or privatization) for complex settings. Stemming from observations that voluntary collective action, built on trust, reciprocity, and communication, could overcome so-called tragedy of the commons, Ostrom's research group (referred to as the Bloomington institutionalists) developed a nuanced description of the social and ecological conditions under which common pool resources could be sustainably managed [25]. A central assumption of this work is that institutions (defined as the formal and informal rules, norms, and strategies that structure human interactions), govern the relations among individuals and groups [26]. For more than four decades, Ostrom and her colleagues produced extensive empirical, experimental, and theoretical research showing that distinctive institutional arrangements, such as community cooperatives or nested enterprises, can overcome collective action challenges (tragedy of the commons) and help achieve sustainability in the use of common pool resources.

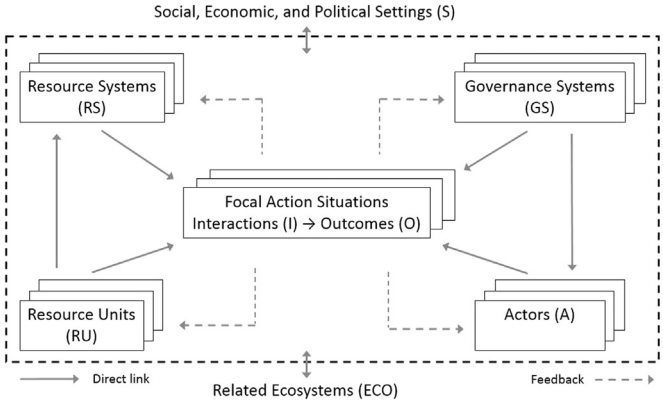

Fig. 1. First tier variables of the social-ecological systems (SES) framework (reproduced from 22, 23).

Building on this work, Ostrom developed the social-ecological systems (SES) framework to facilitate interdisciplinary knowledge accumulation and theoretical analysis about which variables and processes are critical for understanding social-ecological governance outcomes [22,23]. Within the SES framework, outcomes (abbreviated to 'O') are interpreted as the aggregate result of interactions (I) within and between four first tier variables: resource units (RU), which form part of resource systems (RS), which are managed through rules determined by an overarching governance system (GS) and provide benefits to a diversity of actors (A) within broader social, economic, political (S) and ecological (ECO) contexts (Fig. 1). The focal action situation is described as the space within which "individuals (acting on their own or as agents of formal organizations) interact with each other and thereby jointly affect outcomes that are differentially valued by those actors" [26].

An innovative aspect of the SES framework is its explicit call for analysts to draw on diverse theories and methods (e.g., game theory, historical institutionalism etc.) to select which of the framework's variables will likely be particularly relevant for specific cases and questions [27]. For example, theories of polycentricity and scalar politics inform Gruby and Basurto's [28] analysis of governance in Palau. Alternatively, Cinner et al. [10] operationalize the SES framework through the lens of social legitimacy to explore the impact of fisheries co-management on livelihoods, compliance, and fish biomass in the Indo-Pacific. While more than fifty second tier variables are included in the framework (Table 1), "it is often misunderstood that all variables in the SES framework are needed for one particular analysis" [29]. Rather, analysts are expected to hold some variables constant while focusing on those hypothesized as relevant based on a particular theory for a particular context.

Another useful aspect of the SES framework lies in its emphasis on interactions [30]. Identification of relevant variables is intended as a starting point for inquiry; the focus of analysis is on what occurs between them. Ostrom stated that without sufficient attention to interactions, "recommendations of reform may be based on naïve ideas about which kinds of institutions are 'good' or 'bad' and not on analysis of performance" [31]. In other words, attention to the design of institutions alone cannot adequately explain patterns of resource use because the implementation of rules is conditional on the contexts in which they are practiced [32]. Yet, to date many empirical applications of the SES framework focus on unpacking variables within the four first tier system components (resource system, governance system, resource