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The social–ecological system framework as a knowledge classificatory system for benthic small-scale fisheries

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ABSTRACT

Ostrom proposed the underpinnings of a framework for the systematic study of the governance of complex social–ecological systems. Here we hypothesize that Ostrom's social–ecological system framework can be useful to build a classification system for small-scale benthic fisheries, regarding their governance processes and outcomes. The purpose of this paper is to contribute to knowledge accumulation of benthic fisheries. To tailor the framework, we relied on discussions among experts and a systematic literature review of benthic fisheries from 1980 to 2010. This literature review helped us refine variable definitions and provide readers with illustrative reference papers. We then illustrate the approach and its potential contributions through two studies of the emergence of self-organization in Mexico and Chile. We highlight synthetic lessons from the cases and the overall approach as well as reflect on remaining challenges to the development of a social–ecological system framework as a diagnostic tool for knowledge accumulation and synthesis.

1. Introduction

Small-scale fisheries are increasingly conceptualized as integrated social–ecological complex adaptive systems in part because of the type of problems they exhibit (Berkes, 2006, 2011; Folke et al., 2005; Gelcich et al., 2010; Mahon et al., 2008; McConney and Charles, 2010; Wilson, 2006). These problems, such as avoiding overexploitation, are rarely attributable to a single cause (Anderies et al., 2007). As Holling et al. (1998, p. 352) state:

> Characteristically, these problems tend to be systems problems, where aspects of behavior are complex and unpredictable and where causes, while at times simple (when finally understood), are always multiple. They are non-linear in nature, cross-scale in time and in space, and have an evolutionary character. This is true for both natural and social systems. In fact, they are one system, with critical feedbacks across temporal and spatial scales.

The role of multiple causes has also been described by Ostrom (2005) when discussing the behavior of social rule systems and the governance outcomes they produce. Sets of rules interact in complex patterns, and the addition or removal of a particular rule may affect the interactions of the rest of the set and thus the governance outcome (Cox, 2011). Scholars studying small-scale fisheries have made great strides toward identifying key processes affecting their governance (Castilla and Defeo, 2001; Cinner et al., 2007; Defeo and Castilla, 2005; Gelcich et al., 2010; Hilborn, 2007; Orensanz et al., 2013; Pauly, 2006). However, the role of rule configurations in social–ecological interactions, and how it challenges our ability to establish causal mechanisms linking conditions and governance outcomes, has received considerably less attention. One of the many challenges of understanding what configurations of conditions may lead to particular governance outcomes, consists of devising a tractable way to organize and document them. Ontologies, or systems of classification, can serve these functions. For instance, the Latin alphabet constitutes a relatively simple system of classification, and its dictionary serves as the framework in which empirical configurations of this ontology are expressed for a particular language. In this example, past and future books that have or will be written on diverse topics are expressions of how systems of classification allow knowledge accumulation and future

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innovation. Using the concept of ontologies, the pertinent question for SESs is then: How can the SES research agenda develop an approach that allows for knowledge accumulation that can inform typologies of governance arrangements for particular small-scale fishery outcomes?

In 2007, Ostrom proposed the underpinnings of a framework for the systematic study of the governance of complex SESs. Here we hypothesize that Ostrom's social–ecological system (SES) framework can be useful to build a classification system for small-scale benthic fisheries, regarding their governance processes and outcomes. The first step in this process is to develop a suite of key SES variables or processes potentially relevant to anyone considering conducting a study on benthic small-scale fisheries. This is referred to as an ontology. By analyzing the literature, this paper develops a benthic small-scale fisheries ontology. It then illustrates the use of the SES framework through two short studies concerning Mexican and Chilean benthic fisheries. Both studies focused on teasing out the underlying factors affecting the self-organization capacity of the fisheries to avoid tragedies associated with open access. We conclude with some lessons, cautionary notes, and remaining challenges for the use of the SES approach developed here.

2. Theoretical background

Theories of collective action and common-pool resources (CPRs) have contributed to our understanding of processes and conditions facilitating the likelihood of local self-organization (Acheson, 2003; Baland and Platteau, 1996; Berkes, 1989; Bromley et al., 1992; NRC, 1986, 2002; Ostrom, 1990, 2005), but scholars' ability to establish causal linkages among factors and determine their relevance at local contexts, and regardless of context, is still quite limited (Agrawal, 2002). Young (2002) argued for the need to develop an "institutional diagnostic" approach as a way to overcome these challenges. In medicine, doctors usually follow a diagnostic approach toward identifying a solution to a medical problem. A doctor will ask us a number of initial questions and do some regular measurements. In light of that information, the doctor proceeds down a medical ontology to ask further and more specific questions (or prescribes tests) until a reasonable hypothesis regarding the source of the problem can be found and supported. When we begin to think about a particular SES puzzle, we think about which of the attributes of a particular SES system are likely to have a major impact on particular patterns of interactions and outcomes. While each human being is unique, illnesses can be identified and diagnosed in a similar way to an entire population. A diagnostic approach for SESs should be capable of teasing out what makes each resource use problem unique and what makes each case generalizable and comparable across settings. Here we contend that the SES framework's multitiered organizational structure could be useful to develop a diagnostic approach for the study and governance of SESs (McGinnis and Ostrom, 2013; Ostrom, 2007, 2009).

The point of entry to the SES framework begins with the first-tier variables that a researcher would need to define to determine the particular focal CPR system of interest (Fig. 1): The Resource Units (RU) are part of the Resource Systems (RS), the Governance Systems (GS) define and set rules for Actors (A). All of them influence the resultant Interactions (I) and Outcomes (O) and create feedbacks. These variables (also conceptualized as processes) make up the focal CPR system that links to exogenous factors like other Related Ecosystems (ECO) and Social, Economic, and Political Settings (S).

In this paper, the Resource System (RS) is the small-scale fishery sector and the Resource Units (RU) are the benthic resources harvested by commercial fishers. The Governance System (GS) includes characteristics pertaining to central and local government and factors shaping rules and governance arrangements in Mexico and Chile. These determine incentives and behavior for Actors (A) involved in the fisheries. Such actors include local and non-local fishers, researchers, non-governmental organizations, and government officials. The Social, Economic, and Political Setting (S) is the Gulf of California in northwest Mexico, and the rural central Chilean coast. We aim to diagnose what combinations of SES variables were associated with fishers' ability to self-organize and avoid overexploiting their fisheries, and which interactions led to continued overharvesting.

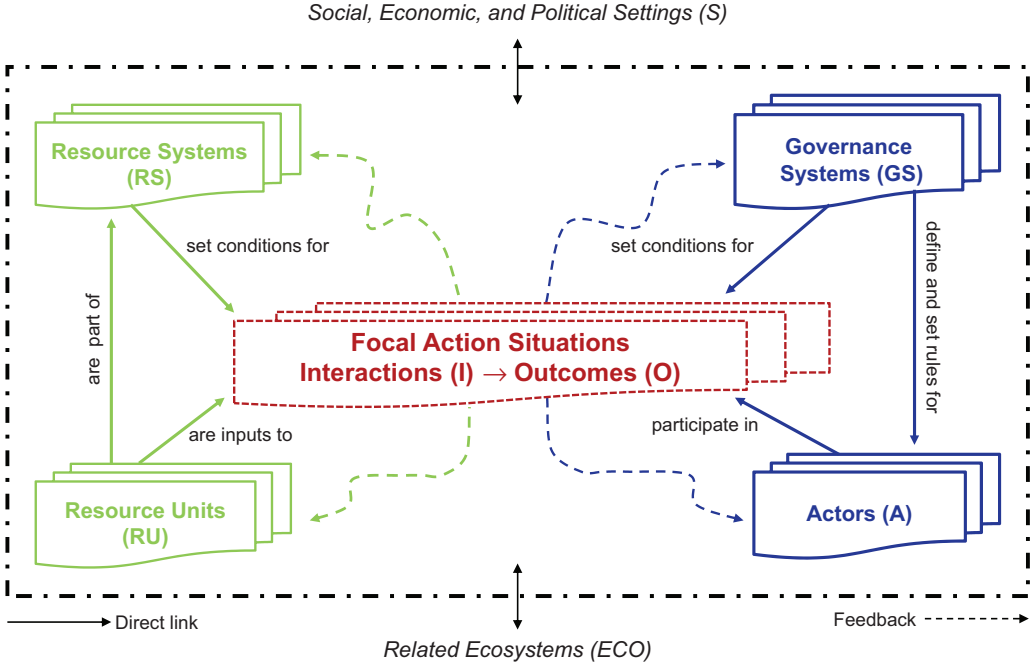

Fig. 1. Revised SES framework with multiple first-tier components. *Source*. McGinnis and Ostrom (2013).

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