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Insights from experimental economics on local cooperation in a small-scale fishery management system

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ABSTRACT

Cooperation is central to collective management of small-scale fisheries management, including marine protected areas. Thus an understanding of the factors influencing stakeholders' propensity to cooperate to achieve shared benefits is essential to accomplishing successful collective fisheries management. In this paper we study stakeholders' cooperative behavioral disposition and elucidate the role of various socio-economic factors in influencing it in the Roviana Lagoon, Western Solomon Islands. We employed a Public Goods Game from experimental economics tailored to mimic the problem of common pool fisheries management to elucidate peoples' cooperative behavior. Using Ostrom's framework for analyzing social-ecological systems to guide our analysis, we examined how individual-scale variables (e.g., age, education, family size, ethnicity, occupational status, personal norms), in the context of village-scale variables (e.g., village, governance institutions, group coercive action), influence cooperative behavior, as indexed by game contribution. Ostrom's framework provides an effective window for conceptually peeling back the various socio-economic and governance layers which influence cooperation within these communities. The results of our research show that the most important resource user characteristics influencing cooperative behavior were age, occupation and beliefs about giving access to others to fish for commercial gain. Through elucidating the factors affecting stakeholders' propensity to cooperate to achieve shared benefits, our analysis provides guidance in understanding cooperation in relation to collective management of marine resources.

1. Introduction

Researchers have stressed the importance of developing a standardized methodological approach for studying complex social and ecological systems (Basurto and Ostrom, 2009; Glaser et al., 2012), although they caution against using local panaceas for solving governance and resource use problems in resource management globally. Particularly, as emphasized in this volume, Ostrom (2007) developed a diagnostic multi-tier framework as a starting point in the analysis of social and ecological systems. This framework allows researchers to conceptually peel back the various socio-economic and governance layers existing within social and ecological systems and to identify the characteristics in social self-organization that lead these to sustainability or not. In her analysis, she identifies four core characteristics (or sub-systems) of social and ecological systems: a resource system (e.g., fishery, forest), the resource units (e.g., fish, trees), the users and stakeholders, and a governance structure. These sub-systems are embedded within social, economic, and political settings and associated ecosystems, and, in turn, produce a series of interactions and outcomes. Each of these sub-systems is composed of second-tier variables that can occur at multiple scales that may be used to address specific interactions affecting particular social and ecological systems. One such interaction is cooperative norms and behavior, and there are many demographic, socioeconomic and resource-related variables suggested to influence people's decisions to cooperate including the size and productivity of the resource system, resource unit mobility, collective-choice rules, leadership, monitoring and enforcement, and social capital.

Fundamental differences in the relationship between diverse users and natural resources can lead to significantly dissimilar behavior regarding resource exploitation or conservation. For instance, Atran et al. (1999) report that three distinct groups in northern Guatemala, which are dependent on a common resource, display very different resource use behavior and cognition, making any uniform conservation prescription very challenging. Even

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when groups are not ethnically or linguistically distinct, characteristics of users and the history of their interactions can impact social dynamics and collective action outcomes in important ways (Barr, 2003; Gurven et al., 2008). Given that conservation and natural resource management policies are largely contingent upon inducing changes in human activity and are thus intrinsically social phenomena, a key determinant of their efficacy is a grasp of the nature of human psychology, decision-making and behavior in the context of cultural institutions (Dimech et al., 2009; Suuronen et al., 2010). A comprehensive understanding of how and why different factors influence stakeholders' behavior in regards to natural resource management is therefore vital to designing and implementing effective management interventions.

Knowledge of the constraints and drivers on different elements of human behavior aids in predicting likely responses to new policy, and enables crafting of management activities to align with stakeholders' needs and aspirations, hence fostering positive attitudes toward conservation. However, the range and relative role of factors which influence human behavior in relation to natural resource management in general remains poorly understood (Anderies et al., 2011; Milner-Gulland, 2012; St John et al., 2010; Vollan and Ostrom, 2010). This is especially true in regards to stakeholder engagement in collective management of small-scale fisheries, including marine protected areas, and a number of authors (e.g., Christie, 2004; NOAA, 2005) have highlighted the issue as a critical area of research urgently requiring attention. In sum, central to stakeholders' behavior in regards to co-management or community-based approaches to managing small-scale fisheries is cooperation.

In this paper we study stakeholders' cooperative behavioral disposition and elucidate the role of various socio-economic factors in affecting it in the Roviana Lagoon, Western Solomon Islands (Fig. 1). We employed a Public Goods Game from experimental economics tailored to mimic the problem of common pool fisheries management, and survey data on demographic characteristics and perceptions of fishing access rights to examine how individual-scale variables (e.g., age, education, family size, ethnicity, occupational status, personal norms), in the context of village-scale variables (e.g., village, governance institutions, group coercive action), influence cooperative behavior, as indexed by game contribution. Individual-scale variables like wealth and education may affect the costs of public goods provisioning or the benefits of short-term defection, and so wealthier and more educated individuals who can obtain resources more readily can expect to be more generous. However, the educated and wealthy may represent a self-selected minority of striving, self-interested individuals, especially in developing countries where advancement opportunities are limited. In this case, education and wealth may associate with less willingness to contribute to the commons. Ethnicity and religion might influence cooperative behavior in villages where heterogeneity may impede coordination and increase transaction costs (Leigh, 2006; Letki, 2008). Other resource user characteristics, such as age, social status and family size, might also impact decision making due to effects on time preference, resource demand, perceived benefits of signaling behavior on reputation, and opportunity costs.

In addition to strategic behavior, as measured by individual-scale variables, village-scale variables should capture differences in norms and institutions that shape important features of people's choices in the context of social and ecological systems. These form the rules and playing field by which stakeholders interact and engage with each other, and shape expectations of others' behavior, potential sanctions and reputational dynamics. Villages may therefore differ in their willingness and ability to participate in pro-social behavior and conserve local resources (Barr, 2003; Gurven et al., 2008; Lamba and Mace, 2011). In sum, cooperation is central to collective action for the creation of marine protected areas in particular, and for small-scale fisheries management in general. Because the Public Goods Game mimics the kind of collective action problem typical of fisheries management, it may be a useful tool to provide insights into the conditions which may foster community-based and co-managed marine protected areas. Additionally, the Public Goods Game may be useful as a diagnostic tool to provide insights into obstacles to cooperation that are specific to certain villages or regions.

2. Methods

To gauge stakeholders' cooperative behavioral disposition and the factors which may affect it, we drew on Ostrom's (2007) diagnostic framework to inform our study design and used a simplified version of a voluntary contribution public goods game from experimental economics (Ledyard, 1995). The game is designed, in part, to understand prosocial behavior or voluntary actions such as sharing that can benefits others or groups (Gurven and Winking, 2008) and it examines people's behavior when individual and group interest conflict with each other (Andreoni, 1995).

2.1. Study sites and sampling

Roviana was selected for this research because of our long-term research and work in the region spent designing, establishing, and expanding marine conservation and fisheries management initiatives in partnership with local communities (see Aswani et al., 2007). This joint effort, therefore, makes the Roviana region ideal for studying decision making processes as they relate to the management of common pool fisheries resources. Human exploitation of marine resources is vital for both protein and income for coastal communities in the region and in recent decades marine resources have been increasingly overexploited. To assist local communities to manage their marine resources, we worked together with traditional authorities to establish a series of preventative-management measures across villages in the Roviana, Vonavona, and Marovo Lagoons starting in 1999. The management sites were selected through a combination of locally driven assessments and socio-ecological research of local habitats and associated management needs. Temporal and permanent closures were selected following a perceived decrease in fish and shell size and abundance driven by fishing pressure, site preferences, and village proximities (see Aswani et al., 2007). The social and ecological characteristics of this region in tandem with local conservation initiatives made this area an ideal candidate for experimental economics research.

Between 5 and 30% of men (depending on hamlet size) across seven villages and one regional town (Noro) between the ages of 40 and 70 years ($N = 171$) were asked to participate in the Public Goods Game and an associated questionnaire in July and August 2004 in the Roviana region. Only men were selected because they are in charge of most resource governance and management decisions and because of limited research time and resources. The sampled villages, all located within the Roviana and Vonavona Lagoons (Fig. 1), were selected due to their characteristics regarding levels of modernization, access to markets, land and sea tenure system, social and religious heterogeneity, and existence of marine protected areas (all have these barring Noro Town). Generally, Baraulu, Nusa Hope, Kozou, Olive, and Saika hamlets are the least modernized, are more socially homogenous, and have strong traditional governance. Dunde and Kekehe are more socially heterogeneous and have mid-level modernization and weak traditional governance. Noro town is semi-urban, socially diverse, and has no traditional governance area.