



Non-binding Restrictions, Cooperation, and Coral Reef Protection: Experimental Evidence from Indonesian Fishing Communities

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ABSTRACT

We conduct a framed field experiment in Indonesian fishing communities, with an eye toward evaluating alternative decision-making processes for setting extraction restrictions to preserve coral reef fisheries in the absence of stringent monitoring and enforcement. We explore whether the individual extraction decision varies according to three non-binding recommended extraction levels originating from (1) a democratic process, (2) a group leader or (3) an external source. For the sample as a whole, we find a strong effect of the external treatment, with a weaker effect of the democratic treatment and no effect of the leadership treatment. Closer inspection reveals that the results are driven by one of the three sites where the experiment was conducted – that having the highest levels of ethnic and religious diversity. There we find that democratic decision-making as well as information originating from outside the community reduces the extraction level, a result that is robust to regressions controlling for individual and community attributes. The absence of effects in two of the three sites suggests that a non-binding recommendation may often be insufficient in promoting the cooperative behavior that underpins contemporary approaches to managing coral reefs.

1. Introduction

The ongoing destruction of coral reef ecosystems ranks among the major drivers of global environmental change, with already more than a quarter of the world's reefs irrevocably damaged from the combined effects of climate change and local stressors (Burke et al., 2011). Beyond serving as repositories of biodiversity and marine nutrients, coral reefs provide a multitude of benefits to local communities, including storm surge protection and livelihood from fishing and tourism. Coral reefs are often located within open-access fisheries, making them vulnerable to overfishing and destructive fishing practices. This situation is aggravated by the weak formal and informal enforcement mechanisms characterizing fisheries management in many developing countries. The establishment of exclusive access privileges is increasingly seen as an effective response to countering the resulting overexploitation (Afflerbach et al., 2014). One such management strategy is referred to as Territorial Use Rights for Fisheries (TURF), which has gained traction in recent years largely due to its promotion by non-governmental organizations (NGOs). Nevertheless, the decision-processes underpinning the establishment of a TURF, particularly as regards the setting of an

extraction rate that aligns the self-interest of individual fishers with the collective stewardship of the fishery, remains sparsely studied. Velez et al. (2010), Lopez et al. (2012) and Santis and Chávez (2015) are notable exceptions, focusing on the complementarity of informal and formal enforcement mechanisms using framed field experiments with artisanal fishers in Colombia and Chile, respectively.

The present study complements the work of these authors with an experiment of non-enforced limits on extractive behavior in fishing communities located in Sulawesi, Indonesia. The idea is to conduct an ex-ante analysis of alternative processes for reaching a decision on the extraction rate in a region where TURFs are planned but have not yet been implemented. We explicitly framed the experiment as extraction from a common-pool fishery for Indonesian fishers.¹ Our experimental design employs a common-pool resource (CPR) game that introduces treatments corresponding to alternative strategies for encouraging cooperative behavior. Drawing on Cardenas (2004), we specifically investigate whether recommendations originating either from a democratic decision process, a group leader decision or an external source affect participants' extraction behavior.

A distinguishing feature of our approach is that the

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¹ Following the common taxonomy of Harrison and List (2004) our experiment can be classified as *framed field experiment* because it was conducted with a population of Indonesian fishers for which the extraction from a common-pool fishery is an essential element of their daily lives.

recommendations are non-binding, with no formal or informal sanctioning mechanism introduced for non-compliance. Diverging from the substantial literature on monitoring and enforcement of state and federal regulation, we abstain from introducing even a weak enforcement protocol (e.g. Cardenas et al., 2000; Moreno-Sánchez and Maldonado, 2010) and, in addition, any informal internal sanctioning measures, e.g. self-imposed sanctions (e.g. Gatiso et al., 2015) or punishment (e.g. Ostrom et al., 1992; Vollan, 2008). Our set-up thereby represents an extreme case that we believe characterizes the environment that our study subjects actually encounter, one under which highly costly monitoring and sanctioning precludes a credible deterrent to over-fishing. Although many experiments document that costly monitoring and sanctioning devices are effectively used to increase cooperation in social dilemma situations (e.g. Casari and Plott, 2003; Carpenter, 2007), Villena and Chávez (2005) show that rational fishermen will not engage in monitoring when there are no economic incentives in place for the reporting of violators. Given the absence of compensation for monitoring within the TURFs in operation elsewhere in Indonesia, the question arises as to whether the process for determining the extraction level prior to the establishment of the TURF is sufficient to support compliance with a socially optimal extraction level.

Previous research suggests that participation in decision making affects behavior and increases individuals' willingness to cooperate in social dilemma situations (e.g. Ostrom and Nagendra, 2006; Dal Bó et al., 2010; Olken, 2010). However, it has also been shown that the means by which community involvement is implemented can have a fundamental bearing on outcomes (e.g. Agrawal and Chhatre, 2006; Cinner and Aswani, 2007; Persha et al., 2011; Cox et al., 2014). Moreover, there is evidence that the effects of measures that attempt to foster cooperation in social dilemma situations perform differently depending on the underlying set of personal attributes and informal norms prevailing in the community (e.g. Ostrom, 1990; Carpenter et al., 2004; Herrmann et al., 2008; Gächter et al., 2010; Vollan et al., 2017).

The present study expands on these themes with an experimental design that links different decision-making processes to different extractive outcomes, revealing how these outcomes are mediated by the socio-cultural setting in which the participants in the experiment reside. Among our main results, we find that non-binding recommendations originating from both a democratic process and an external source have a statistically significant effect in drawing participants toward the social optimum in the sample as a whole. Closer inspection reveals, however, that this result is driven by one of the three sites where the study was undertaken, that having the highest levels of ethnic and religious diversity. This result is robust to regressions controlling for individual and community level factors. Nevertheless, the absence of effects in two of the three sites underlines the importance of evaluating effects on a case-by-case basis, and suggests that non-binding recommendations may often have only a muted effect in encouraging cooperative behavior.

2. Background, Community Descriptions, and Sampling

2.1. The Indonesian Context

Harboring the largest expanse of reefs worldwide, Indonesia is heavily dependent on marine resources, with 54% of the country's animal protein coming from fish and seafood (Burke et al., 2011). A variety of stressors, including agricultural runoff and fishing activities, have put this resource base under severe duress. The World Bank (2014) reports that almost 65% of Indonesia's reefs are threatened by overfishing, and roughly half are threatened by destructive fishing practices.

The Indonesian government recognized the urgency of protecting the reefs decades ago. National and regional laws against destructive fishing practices and overfishing have been introduced over the years, but a lack of monitoring capacities has undermined law enforcement. Conservation NGOs have partially filled this void. A unifying principle

of many early interventions was the establishment of Marine Protected Areas (MPAs). The record of MPAs, however, has been mixed, with poor management performance (Mora et al., 2006), non-compliance with existing rules (Pieraccini et al., 2017), the prioritization of conservation over economic development, and the non-involvement of local communities in the implementation process (Ferse et al., 2010) being cited as sources of ineffectiveness. TURFs represent an integrated approach to management that couples conservation with economic development goals by bestowing local fishers with exclusive access to their fishing grounds in the form of territorial use rights.

As documented in a meta-study undertaken by Afflerbach et al. (2014), a common trend characterizing the creation of TURFs is a diversity of stakeholders. While TURFs have existed in various forms for centuries, Afflerbach et al. (2014) find that in most contemporary cases TURFs have emerged from the collaboration of an NGO, a governmental unit, and/or a community organization. Such is the situation on the island of Sulawesi, where the creation of the TURFs is supported by international NGOs working in tandem with the Indonesian Ministry of Marine Affairs and Fisheries and respective regional governments, which hold the authority to transfer geographically assigned property rights to the communities. The communities, in turn, set operational rules, define monitoring and enforcement procedures, and regulate harvest (Wilen et al., 2012).

Monitoring itself, which is in principle carried out by local fishermen, is often costly in practice, particularly – as in Sulawesi – when the planned TURF is large or located far from the coastline. Under such circumstances, rule enforcement may be correspondingly lax or even non-existent, including in cases where the rules are clear (De Alessi, 2014). Depending on local socio-economic, political and environmental features, NGOs have consequently availed a mix of strategies to encourage voluntary compliance with the rules established under the TURF. Perhaps the most important question in gauging the scope for garnering support relates to the process by which a given community reaches decisions on exploitation and resource extraction. While a variety of decision-making procedures are possible during the planning phase of a TURF, our experimental approach broadly distinguishes between decisions reached by way of a democratic process, a group leader, or through an outside entity. This division largely captures the alternative channels through which NGOs may attempt to coordinate behavior in the Indonesian context, where rule setting is left to the villages managing the TURF, without a clear agreement about the procedure.

2.2. Community Descriptions

An immediate challenge in undertaking survey work in Indonesia is the country's rich tapestry of cultural and ethnic heterogeneity. Indonesia is home to more than 300 ethnic groups, and around 700 different languages are spoken across its 14,000 islands. The study site of Sulawesi, which is the fourth biggest Indonesian island in territory and the third biggest in population, embodies this heterogeneity, with at least 117 local ethnicities residing on the island (Ananta et al., 2015). While the main religion is Islam, Christians are also prevalent and comprise about 20% of the population. Recognizing that this diversity conspires against drawing samples that allow the extrapolation of findings (e.g. Henrich et al., 2001; Herrmann et al., 2008), we selected culturally distinct communities indicated in Fig. 1 to test the extent to which generalizations can be drawn. Specifically, we selected three sites from a set of 12 sites in which one of the international NGOs working in the region is in the planning phase of a program to establish TURFs.

Two of the sites are on Wakatobi, a small string of islands in South-East Sulawesi that are primarily populated by two different ethnicities, the Badjo and the Liya. Badjo communities are primarily organized around fishing and have governance structures that are largely democratic, with village leaders determined by elections. Liya communities

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