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Unintended consequences of enforcement in a cooperative institution: Experimental evidence from Tanzanian fishers

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ABSTRACT

Small-scale fisheries in developing countries employ the majority of the world's fishers and are a critical source of income and nutrition for billions of people, yet they frequently suffer from overfishing. To date, institutional reforms have largely consisted of those that have worked well in developed countries, but are poorly suited to the institutional contexts of most developing countries, which are characterized by weak state capacity and poor enforcement. We study the introduction of an enforcement institution among Tanzanian fishers using a novel artefactual field experiment. Results suggest that enforcement mechanisms can sometimes damage cooperative behavior as players shift from cooperative harvest strategies to more destructive ones, which causes the common-pool resource to be depleted faster. We explore the mechanisms by which this undesirable outcome arises and argue that institutional reform should consider that resource users make jointly determined decisions about gear choice, including illegal ones, and harvest rates.

1. Introduction

Small-scale fisheries off the coasts of developing countries are a prime example of the important role that institutions (formal or informal) play in creating wealth and shaping development outcomes in rural communities. Small-scale fisheries are known to employ the majority of world fishers and to provide food and livelihoods to a vast number of people living in coastal areas. Approximately 90 percent of the 38 million people recorded by the FAO globally as fishermen are classified as small-scale (FAO, 2008). However, because it is difficult to exclude others from entering a fishery and because use of a fishery is rivalrous, fisheries naturally suffer from the "tragedy of the commons," whereby excessive entry results in overexploitation of the resource (Gordon, 1954; Hardin, 1968).

Developed coastal nations have typically responded to the threat of overexploitation through a "top-down" approach by using legislature and enforcement infrastructure to enclose the commons—e.g., through regulated and restricted access programs (Reimer and Wilen 2013)—and by fostering incentives to maximize the economic value of the fishery—e.g., through catch share programs. Such institutional innovations have resulted in billions of dollars of new wealth (Wilen, 2006). Developing countries, unfortunately, often lack the infrastructure and institutions necessary to follow the top-down approach of their developed counterparts (Ostrom, 2005). As such, small-scale fisheries in developing nations are often unregulated, or regulations are poorly enforced (FAO, 2008), yet a growing body of empirical and theoretical work has identified conditions under which a "bottom-up" approach to common-pool resources has flourished (Ostrom, 1990; Ostrom et al., 1999; Basurto and Coleman, 2010).

We studied the conditions that foster improved common pool resource management in small-scale fisheries in rural Tanzania. In this setting, a form of village-based institution known as a beach management unit (BMU) plays a key role in certain management tasks, including monitoring fishing catches, endorsing fishing permits, and administering other national policies on illegal gear. BMUs are part of an important trend in small-scale fishery management known as co-management in which some roles and responsibilities for management are devolved from central governments to local communities. As of 2011, an estimated 130 fisheries in 44 countries were co-managed but evidence on the effectiveness of these systems is mixed (Cinner et al., 2012; Gutiérrez et al., 2012).

We designed and implemented an artefactual field experiment with

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fishermen in a randomly selected group of BMUs. Groups of five fishers played a dynamic common-pool resource game in which payoffs evolve during game play as a function of stock size and group harvest, a design consistent with the importance of dynamics, stock effects, and path dependence in social-ecosystem interactions in experiments and the real world (Cardenas et al., 2013). Players used spoons to scoop out beans from a bin which, it is explained to them, represents catching fish in a body of water. They played numerous rounds during which they harvested beans and dumped them in their own personal bucket, which represented their own boat. The participants were informed before they began that they will be financially compensated at the end of the game for the amount of beans they individually harvest. The game was carefully designed to mirror the real world characteristics of the fishers' lives, including on fish stock size, harvest strategies, and opportunities to engage in illegal behavior. In particular, a ban on illegal gear is a formal regulation, which is supposed to be locally enforced by BMUs, but is characterized by imperfect compliance despite fishers having common knowledge about the existence of this regulation, the types of gear that are prohibited, the rationale for the prohibition, and the authority vested in the BMU committee to enforce it (Etiegni et al., 2011; Luomba et al., 2016). In local parlance, illegal gear types are referred to as “haram”, i.e., forbidden according to Islamic jurisprudence. It is therefore widely understood that certain types of gear are illegal because they are particularly destructive to fisheries.

By altering features of the game when played with different groups, we generated experimental variation in the possibility of punishment when engaging in “illegal” behavior and studied how this institutional feature affects behavior and fishery-level outcomes. Our results show that when faced with possible punishment from using illegal gear, participants harvest at significantly higher levels than those that do not face possible punishment. Fishing groups in the enforcement treatment were four times more likely to completely deplete and collapse the resource. Importantly, these outcomes are not driven either by higher use of illegal gear (which is never more than ten percent in either treatment) nor by actual punishment (which happens only once in all groups across all villages). Instead, the possibility of enforcement induced individuals to harvest during each round at significantly higher rates than in the comparison group.

We document that significantly more individuals pursue self-interested behaviors in this enforcement treatment. This pattern occurs irrespective of actual cheating/enforcement during the game, and increases with experience across multiple rounds of the game. Individuals in the enforcement game are more likely to adopt harvest strategy profiles that overexploit the resource. Taken together, our experimental results with actual resource users suggest that institutional reforms that target specific behaviors when agents are simultaneously making multiple self-interested or cooperative choices may result in unintended consequences for both the group of resource users and for the resource itself. We interpret these results in reference to the crowding-out literature (see, e.g., the review by Bowles and Polania-Reyes, 2012), which posits that external incentives such as economic incentives or formal enforcement regimes can sometimes displace the intrinsic motivations of individuals to behave in pro-social manners. In our study, we find evidence that the imposition of an enforcement institution in our common-pool resource game relaxes an internal constraint to harvest at a sustainable level, which tends to cause overharvesting and massive resource depletion contrary to the goals of the policy.

The rest of the paper is organized as follows. Section 2 provides additional background on the experimental literature related to common pool resources and small-scale fisheries. Section 3 explains the experimental design and provides a detailed description of the experimental game. Section 4 provides the main analyses, which document the higher resource use and degradation in the game that include an enforcement institution. Section 5 concludes by discussing possible behavioral motivations that drive our results and the policy implications of our results.

2. Experimental literature on small-scale fisheries

The drivers of cooperation or self-interested behavior among fishers are numerous and their relative importance in different settings remains only partially understood because individual variables and social/institutional settings interact in complicated ways (Vollan and Ostrom, 2010; Anderies et al., 2011; Aswani et al., 2013). This paper contributes to the growing literature that uses experimental methods to study behavior and institutions in small-scale fisheries, in particular the roles that cooperation and self-interested behavior play in the successful management of such fisheries.

Of particular relevance to our study is the experimental literature on the impacts of external regulations on individual behavior in small-scale fisheries. Typically, studies of the exogenous imposition of a fixed quota system of harvest combined with some mechanism of enforcement generally conclude that the effectiveness of regulations varies greatly across time, across social and environmental settings, by intensity of enforcement, and by experimental design features, such as whether communication was allowed among subjects. For example, Cardenas et al. (2000) document declining effectiveness of enforcement as subjects realized enforcement was weak and the consequences of noncompliance were tolerable. Others have identified a role for “crowding out” of intrinsic motivations by external regulations (Ostrom, 2000). Whether external factors displace internal ones, or whether regulation “crowds in” intrinsic motivation, varies across individuals as well as environmental characteristics, economic incentives, and other geographical factors (Rode et al., 2013).

Additional sources of variation in the effectiveness of regulation in experiments comes from the intensity of the regulation. Beckenkamp and Ostmann (1999) found non-linear effects of regulatory punishment on overharvest of a common resource: sanctions that were either too lax or too strict failed to achieve regulatory goals, most likely because subjects felt little incentive to change (in the former case) or insufficient respect for what was perceived to be an unfair policy (in the latter). Finally, drawing on a larger experimental literature in other fields (Cardenas et al., 2003), research has also shown that communication serves a critical function in shaping the effectiveness of an experimental regulatory regime (Velez et al., 2010).

Our study contributes to this literature by exploring fishermen behavior under a regulatory structure that is important and widespread in real-world, small-scale fisheries. In particular, we consider the enhanced enforcement of a ban on especially detrimental gear types; this contrasts with the more common focus on harvest-level restrictions such as quotas (e.g., Velez et al., 2010). This focus is valuable because it mimics the rules facing many artisanal fishers, including those in the hundreds of BMUs in Tanzania and neighboring countries around Lake Victoria. Namely, fishermen with common knowledge of allowed versus prohibited gear types/methods make choices over gear type/method and harvest levels. Individual fishing income is a joint function of both of these choices, and both decisions influence outcomes of other local fishermen; thus, collective fishing income is a joint function of these two choices in aggregate. While a regulatory regime to improve fisheries in Tanzania could conceivably impose quotas on fishermen rather than enforce a ban on illegal gear, this is far from the reality of Tanzanian fishermen and well beyond the current capacity of the Tanzanian state.

Fishermen in our study grapple with institutional designs closely related to their actual fishing lives.[1] For example, in one treatment group fishermen are able to choose illegal gear without fear of formal punishment. But because cheating is partially observable (at the group level but not at the individual level), it is possible that other individuals

[1] In our baseline Harvest-only treatment, there is only the strategic issue of common-pool resource management. This is similar to the fisheries context but differs from reality by excluding the key role played by illegal gear use in undermining resource health.