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Analysis

Fishers' Preference Heterogeneity and Trade-offs Between Design Options for More Effective Monitoring of Fisheries

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ABSTRACT

Sustainable fisheries management largely depends on how effectively fishing regulations are enforced, which often relies on active monitoring by fishers. If fishers perceive that monitoring schemes do not fulfill their needs, they will resist participating in monitoring. However, fisheries managers worldwide have been making blanket assumptions about the way fishers respond to a monitoring scheme. Although this has been proven to be a common mistake, the literature has remained almost silent about heterogeneity of fisher preferences for monitoring scheme, and how it affects their participation. This study contributes to this knowledge gap by carrying out a choice experiment with artisanal fishers in Vietnam to elicit preferences and value key design elements of monitoring schemes. This is the first study to investigate fishers' preference heterogeneity using an advanced technique - the Scale-adjusted Latent Class model - that accounts for variance in both preferences and scale. We identified five distinct preference classes. Remarkably for a poor community, monetary compensation was found not to be the prime driver of fishers' choices. A one-size-fits-all monitoring scheme is ill-suited to all fishers. The design of flexible schemes can be an effective way to enhance the likelihood of fisher participation and the effectiveness of regulation enforcement.

1. Introduction

Common pool resources such as fisheries account for a good portion of highly valued global natural resources and play an important role in the livelihood of many rural communities. However, due to the characteristics of non-excludability and non-rivalry, common pool resources face the free rider problem and degradation of resources that has come to be widely known as "the tragedy of the commons" (Hardin, 1968). A considerable amount of research effort has been dedicated to investigating the conditions under which the tragedy of the commons is less likely to occur. It is widely recognized that managing the commons effectively requires both a clear definition and strong enforcement of property rights (Williams, 1998): a clear definition of property rights is a necessary condition for eliminating the tragedy, but it is not sufficient. The tragedy still occurs if property rights are not well-enforced and secure (Ostrom, 1990).

Pervasive overfishing problems are a typical expression of the tragedy of the commons. Signs of degradation in fisheries and consequent reductions in catches have been observed worldwide (FAO, 2016). Management effort has been focused on building up adequate property rights systems, and approaches pursued include regulatory or conventional tools (e.g. limited entry systems and fishing gear restrictions) and rights-based fisheries management tools, such as Territorial Use Rights for Fisheries (TURFs). The fact remains; however, overfishing is still an enduring problem even after serious attempts have been put in place to curb it. The failure of current management tools can be attributed to various reasons and key among those is the lack of effective enforcement of the regulations associated with property rights (Ali and Abdullah, 2010; Dolsak and Ostrom, 2003). Consequently, illegal fishing has exacerbated the problem of overfishing in many fisheries worldwide (Agnew et al., 2009) and tended to offset benefits from even the most promising fisheries management tools (Guidetti et al., 2008; Petrossian, 2015).

Area-based management systems such as TURFs are no exception. Although TURFs have been designed to directly address the underlying cause of overfishing (poorly-defined property rights) by providing individuals or groups of fishers with access privileges and fishing rights[1] to exploit resources within a designated area, there is increasing

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[1] The review of the internal regulations associated with TURFs reveals that each TURF system has its own specific regulations, due to the diversity of fishery types and other contextual elements, such as socio-economic characteristics of fishers and local institutional arrangements. For example, the TURF system in Chile stipulates catch limits for each individual fisher, while that in Japan it imposes input restrictions, such as number and type of fishing gear (Nguyen et al., 2017).

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evidence that the effectiveness of TURFs is jeopardized by illegal fishing (Nguyen et al., 2017). The establishment of TURF regulations does not guarantee that fishers inside the TURF (insiders) will adhere strictly to the regulations or that outsiders will not engage in poaching (Boonstra et al., 2016), as observed recently in Malaysia (Ali and Abdullah, 2010), Chile (González et al., 2006), and South Africa (Raemaekers et al., 2011). Effective enforcement programs are essential for ensuring TURF effectiveness and effectiveness of fisheries management tools more generally (Diogo et al., 2016).

However, effective enforcement is likely to incur high costs and governments might not be able or willing to bear such costs. As a result, low level of enforcement is unlikely to curb or eliminate illegal fishing, thereby threatening the recovery of overexploited fish stocks in many parts of the world (Guidetti et al., 2008). But there is evidence to believe that fishers' participation in enforcing regulations would not only help governments reduce enforcement costs but also increase levels of compliance among fishers (Danielsen et al., 2009). The level of fisher participation in co-enforcement can occur at different stages, namely, monitoring (fishers observe and report violators to the authorities), apprehending (fishers arrest violators, and bring them to the authorities), and applying the penalty (fishers decide the penalty imposed on violators). Co-enforcement is expected to promote higher levels of compliant behavior than either government alone or pure self-enforcement by fishers (Santis and Chávez, 2015).

Although co-enforcement by fishers would have significant additional benefits, the challenge lies in the fact that fishers tend to resist participation in rule enforcement (Davis et al., 2015a). This is partly due to a lack of mechanisms for allowing fishers to contribute and participate in designing enforcement schemes (Ferse et al., 2010), leading to the mismatch between these and fishers' needs. Much of the previous research recognizes the critical role played by the involvement of fishers in the early stages of planning and design (Leslie, 2005; Lundquist and Granek, 2005). In practice, the typical design of an enforcement scheme follows a top-down approach which ignores the views of fishers. Being excluded from the planning and designing process tends to discourage active co-enforcement by fishers. Furthermore, as fishers are highly heterogeneous in their technical and socio-economic characteristics (Castello et al., 2013), ignoring this heterogeneity may result in a counter-productive one-size-fits-all enforcement scheme that does not induce the highest level of fishers' participation. Hilborn (2007) demonstrated how important fishers' views are in determining their responses to top-down regulations.

While the literature on TURFs has been centered on investigating factors affecting co-enforcement behavior of fishers (Nguyen et al., 2017), to our knowledge there is no work focusing on the heterogeneity of fishers' preferences and responses towards key attributes of a monitoring scheme. The present study fills this gap by addressing the following questions: 1) To what extent do fishers differ in their preferences for monitoring scheme attributes? 2) What design elements of a monitoring scheme do fishers find desirable? 3) What are the potential factors explaining the heterogeneity in fishers' preferences? and 4) What would be the welfare effects of alternative monitoring scenarios?

To address these questions, we conducted a choice experiment with fishers in artisanal fishing communities in Tam Giang Lagoon, Vietnam, where TURFs have been established. A choice experiment is a non-market valuation technique useful for informing policy design towards effective and efficient management programs (Greiner et al., 2014). An exhaustive review of the literature on TURF enforcement and results from focus group discussions in the Lagoon area were used to identify the key design elements of a monitoring scheme that could be studied using choice experiments. Heterogeneity in fishers' choices is examined by employing the Scale-adjusted Latent Class model proposed by Magidson and Vermunt (2007).

This study is expected to make several noteworthy contributions to current knowledge of fisheries management. First, the research to date has tended to focus on understanding the heterogeneity in biological and ecological characteristics of fisheries (e.g. Charton and Ruzafa (1999); Tzanatos et al. (2005)) and the heterogeneity in fishers' socio-demographic characteristics (e.g. Gelcich et al. (2007); Tzanatos et al. (2006)), but rarely on the heterogeneity in fishers' preferences for the design of management regulations (Fitzpatrick et al., 2017). A better understanding of the latter is needed to provide deeper insights into how the effectiveness and efficacy of fisheries management programs can be improved. Acheson and Gardner (2011) did consider heterogeneity of fisher preference, but they did so with respect to the characteristics of fishing regulatory schemes. In our work, we do so with respect to fisher involvement in monitoring activities that impose direct private costs.

Secondly, an increasing number of choice experiment studies have recently adopted models that are capable of accounting for heterogeneity in both preferences (taste variance) and consistency in preferences (scale variance), since scale variance could confound the estimated utility parameters (Davis et al., 2016; Permadi et al., 2017). This study used an advanced technique - the Scale-adjusted Latent Class (SALC) model – to explicitly capture both preference and scale variance. To our knowledge, this is the first study to apply the SALC model to the study of fisheries management. Thirdly, as poor enforcement of property rights is relevant in the context of other common pool resources worldwide, such as forests, water and grasslands, the implications of our findings are not limited to fisheries.

2. Methods

2.1. Discrete Choice Experiments

Fishers' preferences for design elements of monitoring schemes were elicited through a discrete choice experiment (DCE), a method first developed by Louviere and Hensher (1982) but now widely applied in many disciplines such us transportation, marketing, food and environmental and resources management for valuing non-market goods or services. The theoretical foundations of the method are grounded in Lancaster's consumer theory where an item is valued by its attributes (Lancaster, 1966). In the context of our problem, this would mean that a fisher's utility from participating in a monitoring scheme depends on the utility derived from the different design elements of the monitoring scheme. In a DCE survey, combinations of different attributes are used to construct profiles of hypothetical monitoring schemes (alternatives) that could be proposed to fishers. Two alternatives from these profiles and the current monitoring scheme (status quo) are then assembled into a choice set for the survey. Fishers are presented with a series of choice sets in which they are asked to state their most preferred alternative (from the three) in each choice set.

2.2. Discrete Choice Models

The choice experiment responses are analyzed using the behavioral framework assumed by random utility theory (RUT) (McFadden, 1974). Fishers will select the alternative which generates the highest level of utility among those in a choice set. Assume that a fisher n is shown a set of C choice sets. The utility that fisher n receives from selecting alternative i (U_{nci}) in choice set c ($c \in C$) is specified as follows:

$$U_{nci} = V_{nci} + \varepsilon_{nci} = f(X_{nci}) + \varepsilon_{nci} = \beta X_{nci} + \varepsilon_{nci} \quad (1)$$

That is, the utility of fisher n is comprised of a systematic and deterministic component (V_{nci}) and a random component to the analyst (ε_{nci}). While the former is a function of the vectors describing a monitoring scheme's attributes (X_{nci}), capturing the observed factors affecting fisher n's utility, the latter incorporates the effect of unobserved factors such as social, economic and attitudinal characteristics of fisher n on his/her utility. The random component varies across individuals as well as across alternatives, so that a fisher's utility cannot be predicted with certainty. Therefore, choices made between alternatives of fisher n