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Examining the impact of fisheries resources and quality on licence sales

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ABSTRACT

One expects that participation and effort in outdoor recreation activities would be directly related to the quality of available resources. However, this expectation remains a largely untested empirical question. We examined this relationship explicitly by analysing the proportion of the population with freshwater angling licences in 188 different administrative regions of British Columbia, Canada. Variations in the proportion of anglers in the population within a region were explained by resource quality measures, including multiple catch and non-catch related factors (such as stocking and the accessibility of fishing destinations). The proportion of the population holding a fishing licence was greatly affected by physical determinants such as access and the availability of many fishing options. Catch-related factors were also important and positively related to participation. The results suggest that management agencies could use actions such as stocking to provide more fishing opportunities across the landscape, or increase the accessibility of opportunities in order to retain licence sales. However, the results also imply that participation decisions arise from more than just considerations of catch at and the accessibility of fishing sites, i.e., socio-demographic characteristics.

MANAGEMENT IMPLICATIONS

The results of this study offer a novel analytical approach for deriving management recommendations, based on a model of fishing licence sales as a function of resource quality and socio-demographic information on a regional scale. The analysis, based on these aggregate types of data, relies on information for 188 administrative units covering the entire province of British Columbia, Canada, and provides a number of important insights for fisheries management:

- Stocking activities are an effective instrument to steer participation in recreational fishing;
- providing more fishing opportunities, or increasing accessibility is likely to lead to increased participation rates and licence sales; and
- non-catch related factors (i.e. accessibility, constraints, socio-demographic and cultural factors) also influence participation rates.

1. Introduction

The relationship between participation in outdoor recreation activities such as fishing and resource quality is of interest to both recreational researchers and managers. It is especially relevant for managers who are charged with the dual mandate of maintaining the integrity of the resource base, while ensuring that user demand for satisfying recreation experiences is met. Ultimately, the relationship between the resource base and users bears considerable economic and ecological consequences for management agencies and society, arguably more so in the case of consumptive recreational activities, such as fishing. While one might expect that the rate of the population participating in recreational activities should be correlated with the availability of recreational resources (Manning, 2010), and their quality, this expectation remains a largely untested empirical question. The

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purpose of our research, therefore, is to examine the relationship between the quality and availability of fisheries resources and freshwater fishing licence sales across different administrative regions (the Forward Sortation Areas, or FSAs of Canada Post) in the province of British Columbia, Canada.

Examining this relationship for recreational fisheries is important for at least three reasons. First, it is important to provide empirical results that address this relationship. Researchers have long been interested in the relationship between participation and the quality of outdoor resources, especially biologically or ecologically-related quality (Manning, 2010). Understanding this relationship allows researchers to forecast use in terms of which areas or locations are likely to attract the most users and why. Yet so far few research efforts have addressed the effects of the biological quality of fisheries on licence sales, and therefore on participation (Loomis & Fix, 1998). This paucity of research may partly result from the challenges associated with obtaining data about resource quality at larger scales that match available or existing data about participants in general, and licence sales in particular. Researchers usually gathered such data via surveys (which is costly) or tied to a particular geography, thus offering only a limited glimpse of the activity under investigation (Wood, Guerry, Silver, & Lacayo, 2013).

Second, it is important to understand this relationship due to the continuous feedback between the resource base and its users, since the actions of recreationists depend on the quality of resource systems and, in turn, the quality of resource systems depends on these actions (Fenichel, Abbott, & Huang, 2013; Hunt, Sutton, & Arlinghaus, 2013). Consequently, understanding whether or not recreationists respond to resource conditions provides critically important information for the management of both resources and people (Post, Persson, Parkinson, & Kooten, 2008). Researchers are in fact increasingly recognising the important interplay and feedbacks between resource dynamics and angler behaviour (Fenichel et al., 2013; Hunt et al., 2013; Post, 2013), which has led to the development and application of social-ecological systems (SES) models to understand the relationships between resource, social, and managerial conditions and how they affect fish, fish stocks, and anglers (Carpenter & Brock, 2004; Massey, Newbold, & Gentner, 2006; Johnston, Arlinghaus, & Dieckmann, 2010; Post & Parkinson, 2012). One crucial component of these coupled SES is an accurate forecast of the number of anglers in a system, which is required whether one wishes to predict the necessity and extent of possible management interventions to maximise the number of users, or to avoid a possible resource collapse (Post et al., 2002; Post, 2013). Thus, any information that can improve forecasts of participation rates in recreational fishing should result in better predictions from SES-based modelling outcomes.

Third, the relationship is important because the viability of many management activities, including fish and wildlife conservation, depends on maintaining or increasing revenues from recreational licence sales (Williams, 2010). Many countries require anglers to obtain a licence to participate in recreational fishing. Often, these licence revenues are earmarked to an agency that manages recreational fishing resources. Agencies rely on these revenues to conduct activities that directly affect fish stocks (e.g., stocking and habitat improvement), anglers (e.g., licence fees, marketing activities) and the impact of anglers on fish (e.g., regulations, enforcement activities). Fewer licence sales mean fisheries and wildlife management agencies have less revenue to achieve their management objectives with direct consequences on the welfare of agencies, people, and conservation efforts (Bruskotter & Fulton, 2013). Annual resident licence sales in BC have fallen considerably since 1990 (Fisheries & Oceans Canada, 2012). In fact declines in outdoor recreation have been "widespread" (Kareiva, 2008). In the United States per capita visits to national parks have declined since 1987 (Pergams & Zaradi, 2008), and the number of anglers in 2011 was over 2 million less than that reported in 1991 (U.S. Department of the Interior, 2001; U.S. Department of the Interior, 2011). These declines in participation are likely to lead to multi dimensional social and environmental consequences.

Many management agencies and fisheries-related businesses believe that one way to prevent declines in fishing participation is through stocking, and conversely, that reduced stocking would result in reduced angler visitation. Loomis & Fix (1998) refer to this belief as the "stocking treadmill." Stocking is certainly an essential component in the management of many recreational fisheries around the world that is conducted to encourage participation in fishing and to recover and protect native fish populations. In British Columbia (BC), for example, the Freshwater Fisheries Society of BC (FFSBC) and the Ministry of Forests, Lands and Natural Resource Operations (MFLNRO) routinely stock hundreds of lakes. The goal of these stocking efforts is to provide high quality and diverse fishing opportunities across the province and redirect angling pressure away from wild populations. Between 2008 and 2012 the FFSBC released almost 35 million fish across the province.[1] About half of all (freshwater) angler effort in BC is directed towards stocked lakes (GSGislason & Associates Ltd., 2009). Therefore the question of whether or not stocking or other resource quality factors are significantly related to licence sales (and thus participation) is an important one.

We use licence sales for freshwater recreational fishing across all of BC, Canada, from 2009–2012 to examine the relationship between regional licence sales and the quality of the recreational fishing resources. The quality of the fishing resources in the region is described by multiple factors, including stocking. In the next section we briefly discuss factors that have been theorized or observed to affect angler participation. Following that, we describe the data collection, management and methods used to conduct the research. In Section 4, we present the modelling results, the composition of different models, evidence for the most suitable models, and the information contributed by the variables of interest. Finally, in Section 5, we assess the meaning of our models relative to published recreational fishing literature and elaborate on implications for management efforts.

2. Determinants of participation

Many reasons have been proposed to explain why individuals participate in fishing, and, therefore, buy a licence. These reasons include a desire to achieve certain physical and psychological outcomes that improve angler well being (Knopf, Driver, & Bassett, 1973), the capability of anglers to achieve these outcomes, and the availability of time to achieve these outcomes (Fedler, Ditton, & Duda, 1998). We viewed the decision to purchases a fishing licence from a utility maximising perspective (Marshall, 1920), which assumes that individual anglers purchase a fishing licence because it is expected to contribute to their well being (Thurstone, 1927; Manski, 1977; McFadden, 1974). Models drawing on utility theory have become widely used to model human recreational behaviour (see for example Haab, Hicks, Schnier, & Whitehead, 2012; Sutton, Stoll, & Ditton, 2010). We estimated aggregate licence sales as a function of both catch and non-catch-related factors that were likely to affect the purchasing decision; due to the nature of the data used in this study (aggregate licence sales) we could not explicitly address psychologically-related factors in the

[1] http://www.gofishbc.com/fish-stocking-reports/reports-species.aspx.