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Recreational boaters value biodiversity: The case of the California Channel Islands National Marine Sanctuary

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ABSTRACT

Marine ecosystems provide a range of valuable services, some of which come with market prices to quantify value and others for which markets have not set prices. Lacking perfect information, policy makers are at risk of undercounting non-priced values and services, leading to biases in policy decisions in favor of services valued through markets. Furthermore, understanding users' valuation of specific site attributes, such as marine biodiversity, can contribute to effective policy decisions. This paper presents a non-market valuation of private recreational boaters (PRBs) in the Channel Islands National Marine Sanctuary located in California, USA, using data from an intercept survey conducted in 2006 and 2007. A Random Utility Model is used to estimate PRBs' daily trip values and the importance of specific site attributes. The average consumer surplus was estimated at $48.62 per trip, with a total non-market value of non-consumptive private recreational boating of $86,325 annually. PRBs show a preference for visiting locations with lower exposure to prevailing winds and greater species richness and abundance, which to the authors' knowledge is the first time that PRBs have been found to value biological diversity in site choices. Furthermore, this suggests that improved biodiversity and productivity of marine ecosystems contribute to better recreational experiences. The results from this study reveal the importance of including non-market services and stakeholder's preferences into policy decisions.

1. Introduction

Marine ecosystem services provide environmental, economic, and social value to a variety of users and activities [1] including commercial activities such as fisheries and mining; recreational activities such as snorkeling, SCUBA diving, sport fishing and wildlife viewing [2,3]; and environmental values such as coastal protection and welfare derived from healthy ecosystems [4]. Ecosystem services reflecting the value of environmental amenities are particularly important to measure because they are often directly affected by resource management practices [5–7]. For example, private recreational boaters engage in activities, such as sport fishing, snorkeling, SCUBA diving, and whale watching, that bring them into close contact with an ecosystem's environmental amenities. Policy makers require detailed information about specific ecosystems services that generate value in order to make informed and balanced resources management decisions [8]. For example, scuba divers may value the diversity of species as much or more as the total biomass of species at their diving site [2]. Understanding such preferences can have important implications for marine resource management.

Effective ecosystem management requires taking into account value across social groups, their activities and the type of value they receive [7]. In many cases, natural resource access can be restricted at low cost, allowing well-functioning markets to allocate ecosystem resources and prices to signal economic activity. In such circumstances, market prices combined with costs and quantities demanded and supplied provide policy makers with quantified information of ecosystem service value for specific user groups [9,10]. Restricting access can be a useful policy tool when one group's activity interferes with another groups' use of the resource. For example, overfishing through large scale commercial operations can reduce a fishery's productivity [11], and commercial fishing rights can be restricted to those holding permits. In other cases, consumption of ecosystem resources is left unrestricted so that users enjoy unfettered access to the resource. Unrestricted access can be socially desirable when resource consumption does not diminish others' use, which generally occurs with non-consumptive recreational activ-

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ities like boating, wildlife viewing, and SCUBA diving [8,12,13].[1] Such activities are often undercounted in policy making, partially because of the absence of price and value information from well-functioning markets. This can undermine the perceived legitimacy and acceptance of the resource management regime among important stakeholder groups [8]. Management actions such as establishing marine protected areas (MPAs), adjusting shipping lanes, and increasing large scale commercial fishing can change the value of ecosystem services for recreational users. MPAs can enhance fish abundance and diversity, which is associated with better SCUBA diving and snorkeling experiences [2,14,15]. Conversely, increased commercial fishing can reduce fish abundance and diversity and thereby negatively affect the recreational experiences of divers and recreational fishers [15]. An increase in commercial shipping activities in important whale habitat can raise the risk of whale strikes and therefore have negative impacts on whale watching [16]. Non-market valuation can contribute to accounting for ecosystems services' overall values while also providing estimates of the value for the system's specific features, both of which can be crucial for effective policy decisions.

Non-market valuation techniques estimate consumer values for ecosystem services in the absence of price signals. Site choice methods estimate consumers' values by assuming the sum of the opportunity cost of time and travel cost to a location equals the price they would otherwise be willing to pay for the resource [17]. Differences in consumers' willingness to travel to sites with different attributes indicate their valuation of those attributes [18]. The Random Utility Model (RUM) used in this study is a multiple-site choice model that estimates recreational demand for ecosystem services and quantifies the value of site characteristics (e.g. biodiversity, water quality). The model assumes that individuals reveal their relative values of site attributes in the sites they choose to recreate, where each visit is assumed to be a function of site attributes and the trip cost of reaching the site [19]. Such models are often used to inform policy interventions since they can be utilized to calculate monetary costs or benefits of changes in site attributes [20,21].

This paper addresses the problem of undervalued non-market ecosystem services. A site choice revealed preference model was used to estimate ecosystem service values among private recreational boaters in the Channel Islands National Marine Sanctuary (CINMS or Sanctuary), located in California – USA. Data was obtained from an intercept survey conducted by CINMS staff in 2006 and 2007 in the Sanctuary that gathered information on individuals' characteristics and their recreational experiences [22]. This study aims to (1) quantify the value the Sanctuary provides to private recreational boaters (PRBs), and (2) determine the effect of biological and physical attributes on PRBs' site choices. Identifying ecosystem characteristics that are important to recreational users can improve resources management in these locations. The results show that PRBs experience positive value from marine resources, around $50 per trip. Moreover, the results show, for the first time to the author's knowledge, that PRBs value biological richness and abundance in determining site choices. Such results provide managers with information on how this stakeholder group values their recreational experience and how their decisions are affected by characteristics within the Sanctuary, thus offering insight on a stakeholder group that is underrepresented by previous research.

2. Study site

The Channel Islands National Marine Sanctuary encompasses a 1470 square mile area around five of the eight Channel Islands in California, USA: Anacapa, Santa Cruz, Santa Rosa, San Miguel, and Santa Barbara. The Sanctuary lies within the Southern California Bight, an area of the coastline that stretches from Point Conception to San Diego. It is an attractive location for many commercial endeavors, research activities, and recreational pastimes [23]. Within the Sanctuary is a network of 10 no-take State Marine Reserves and two limited-take marine conservation areas [24]. With nationally significant cultural and ecological resources, the Sanctuary is responsible for maintaining local biological communities and, where appropriate, restoring and enhancing natural habitats, populations, and ecological processes [25].

On the western side of the Channel Islands, the California Current travels south year round, bringing colder, nutrient-rich water to the region. As this current reaches the U.S.-Mexico border, it turns east and begins to flow northward along the coastline, bringing warmer water into the Santa Barbara Channel and along the eastern and southern sides of the Sanctuary. This ultimately creates a temperature gradient along the island chain, which supports an array of habitats and species [26]. These habitats include kelp forests, seagrass beds, intertidal and subtidal zones, as well as benthic and pelagic habitats. High levels of productivity from nutrient rich waters sustain numerous species of invertebrates, fish and marine mammals. This productive and unique ecosystem is significant to residents and visitors along the Southern California coast because it provides many opportunities for economic and recreational engagement [27].

Each year, over 30,000 visitors visit the CINMS, with another 60,000 recreating in their surrounding waters [28]. In 1999, an estimated total visitation of 437,908 person-day (number of visitors times number of days) was recorded within the CINMS [27]. Private recreational boaters represent a significant portion of the Sanctuary's stakeholders. In 2007, about 1621 private boat trips were observed [23], with boaters engaging in a range of recreational activities, both consumptive (e.g. recreational fishing) and non-consumptive (e.g. snorkeling, whale watching). A survey conducted in 2006–2007 by postcard found that 47% of boaters engaged in only non-consumptive activities and 51% of boaters participated in both non-consumptive and consumptive activities [22]. Additionally, about 16% of users described consumptive activities as the most important factor when choosing an anchorage site, while the remaining users (84%) named environmental factors or non-consumptive activities [22].

The CINMS also supports a broad range of commercial activities, including private and charter boat recreational fishing, commercial fishing, and whale watching. Commercial fishing in the CINMS had an average harvest yearly value of $27 million and generated 659 jobs from 2010 to 2012 [29]. The whale watching industry operates daily trips to the CINMS with an estimated value of $1.5 million per year and 119 jobs [30]. The average annual economic value from private and commercial recreational fishing trips to the CINMS from 2010 to 2012 is estimated to be $31.4 million, generating around 200 full time jobs [31].[2]

3. Materials and methods

3.1. Data

As part of a series of studies on PRBs, an Intercept Survey was conducted in 2006 and 2007 by CINMS staff and contracted researchers [22]. The intercept survey took place in waters surrounding Santa Cruz Island, although respondents reported visits at three islands: Anacapa, Santa Cruz, and Santa Rosa. The survey was conducted between the months of May and October to reflect the greatest frequency of

[1] In some cases, crowding can diminish the value of non-consumptive activities. For example, while scuba divers can generally spread out to maximally enjoy their experiences, sometimes enough divers may concentrate in an area that harms their experience [50].

[2] Of course, market size is not the same as the social value derived from consumer surplus. Estimating consumer surplus for activities like commercial fishing requires information such as prices, costs, and quantities demanded and supplied.