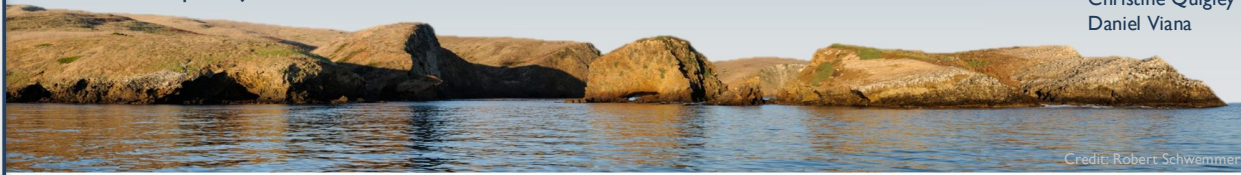


The Non-market Value of Private Recreational Boating in the Channel Islands National Marine Sanctuary

Group Project Brief

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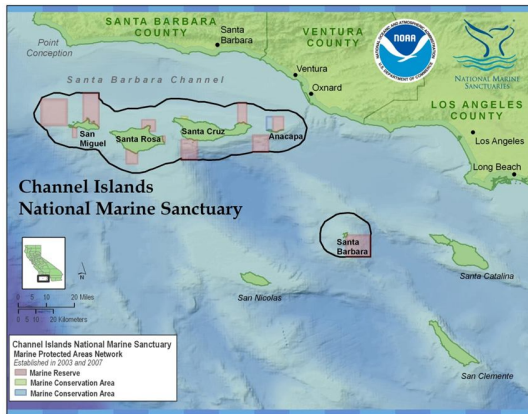


Credit: Robert Schwammer

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Background

The Channel Islands National Marine Sanctuary encompasses an area of 1,470 square miles around five of the eight Channel Islands in California: Anacapa, Santa Cruz, Santa Rosa, San Miguel, and Santa Barbara.



The Sanctuary provides environmental, economic, and social value to a variety of users. A lack of information on private recreational boaters (PRBs) limits the ability of managers to integrate the comprehensive socioeconomic value of the Sanctuary into policy. A particular gap exists in the understanding of non-consumptive PRB use of the Sanctuary. To address this need, our project analyzes data on spatial use patterns of private boaters through a multinomial logit Random Utility Model.

Objectives

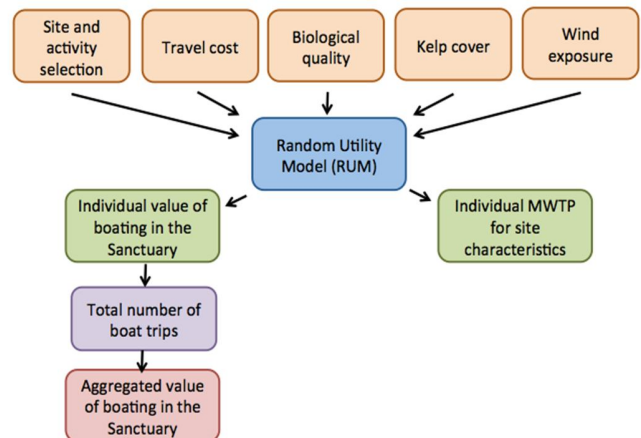
- 1) Determine the value of the Sanctuary to private recreational boaters.
- 2) Determine which biological and physical characteristics influence boaters' decisions, and how they value these attributes.

Methods

The components of this analysis are described as a flowchart in Figure 1. We used a multinomial logit Random Utility Model (RUM) to quantify the value private recreational boaters place on the Sanctuary and its attributes (blue box). This model has several inputs: individual site and activity choice, individual travel cost, and site-specific attributes (orange boxes). With these inputs, the RUM is able to monetize the value an individual boater associates with a trip as well as the marginal willingness to pay (MWTP) for the specified site attributes (green boxes).

The trip value is the consumer surplus boaters receive and is considered the monetary benefit these individuals gain over and above what they spent on their trip. These individual values are used to determine the annual value of private recreational boating in the Sanctuary (red box) using the total number of recreational boat trips (purple box).

Figure 1: Flowchart of Analysis



Model Inputs:

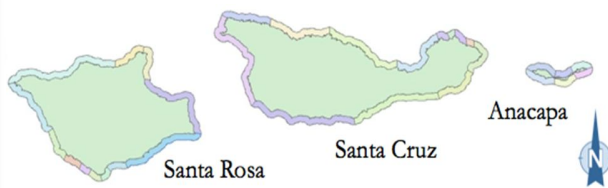
Site and Activity Selection

Site and activity selection data were taken from an intercept survey conducted in the months of May through October of 2006 and 2007 by Sanctuary staff and contracted researchers (LaFranchi and Pendleton, 2008). Respondents answered 43 questions and indicated locations for their various activities. Many boaters participated in several activities at different locations.

Site Definition

In order to build a RUM, there must be a discrete set of site choices available to each individual. To create this set, the coastlines of Anacapa, Santa Cruz, and Santa Rosa islands were split up into 31 unique sites, visible in the image below as the colored polygons surrounding the islands.

Figure 2: Channel Islands Site Definition



The Activity Hierarchy

The RUM also requires each boater to be represented by only one activity and one site choice. To address this, we categorized the activities reported in the intercept survey into groups based on similar preference for Sanctuary attributes (Table 1). Second, we sorted the activity groups into a hierarchy to determine which activity choice would represent each respondent.

Non-consumptive activities were prioritized because doing so addressed the objectives of this study, and because the majority of PRBs indicated that their main motivations for taking trips to the Sanctuary involved non-consumptive activities and environmental factors (LaFranchi and Pendleton, 2008).



Table 1: The Activity Hierarchy

Activity Group	Activity
Underwater non-consumptive	Snorkeling/freediving SCUBA diving
Surface non-consumptive	Exploring by dinghy Kayaking Marine mammal watching Bird watching
Consumptive	Hook and line fishing Spearfishing Lobster diving Hoop netting Collection of rock scallops
Land-based	Beach-going and exploring Tide-pooling Hiking

Site Attributes

Biological Quality

The model incorporates four measures of biological quality into an overall biological index: fish richness, fish abundance, invertebrate richness, and invertebrate abundance. These data were obtained from SCUBA surveys conducted by the Partnership of Interdisciplinary Studies of Coastal Oceans (PISCO).



Kelp Cover

We used kelp data from a 2006 aerial survey conducted by the California Department of Fish and Wildlife (CDFW). This sample best represents the conditions present during the time of the survey. Kelp percent cover was found for each site using GIS.



Wind Exposure

Our model incorporates a metric of coastline exposure to represent the effect of weather factors on user site selection. The angle of each coastline was measured and assigned a value relative to the predominant NW winds. The exposure metric is expressed continuously from 0-180, where 0 represents a site with a coastline that is completely protected from the predominant winds (coastline facing SE) and 180 represents a site where the coastline has no wind protection (coastline facing NW).

Travel Cost

Total travel cost (TC) to recreation sites within the Sanctuary for each respondent was calculated by summing three components:

1. On-land TC (fuel/maintenance of car)
2. On-water TC (fuel/maintenance of boat)
3. Opportunity cost of time.

Total Number of Boat Trips

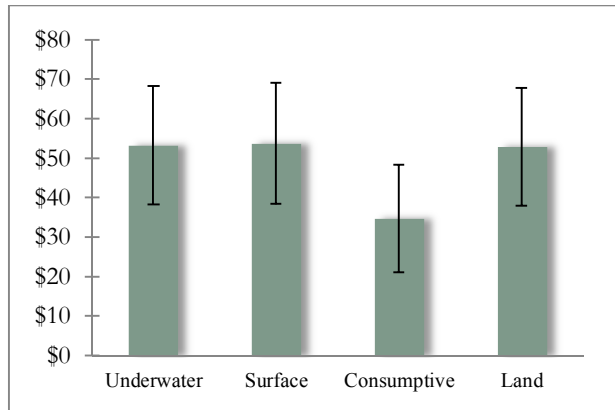
The Sanctuary Aerial Monitoring and Spatial Analysis Program provided the total number of boat trips, which was used to get the annual value of private boating in the Sanctuary. Non-consumptive PRBs took an estimated 1,621 trips to the Sanctuary in 2007 (Leeworthy, 2013).

The Value of the Sanctuary and its Attributes

Value of Boating in the Sanctuary

Results of the model show that boaters in all activity groups receive a positive consumer surplus from visiting the Sanctuary. This value ranges from \$34.72 to \$53.69. There is no statistically significant difference between activity groups (Figure 3), which suggests that PRB's value the Sanctuary similarly. Given the underwater non-consumptive consumer surplus of \$53.45, the total annual non-market Sanctuary value is estimated to be \$86,642 for this particular user group. Due to model and data limitations, this number should be considered a conservative estimate or lower bound.

Figure 3: Value of a Trip to the Sanctuary



Value and Influence of Site Attributes

Site attributes did influence boater decisions: the biological index had a positive impact, wind exposure was negative, and kelp was not statistically significant, possibly due to its highly dynamic nature (Dayton et al.,1992), (Table 2). All activity groups were influenced in the same way by site attributes and willingness to pay values were similar (Figures 4 & 5). This suggests that private boaters make decisions using the same criteria. This also shows that biological quality in the Sanctuary is an important and valuable factor in the decision process.

Table 2: Site Attribute Results

Attribute	Range for Marginal value of 1 unit	Impact on Boaters' Site Choices
Biological Index	\$10.11 - \$16.78	(+)
Exposure	-\$0.91 to -\$1.32	(-)
Kelp Cover	N/A	Not Statistically Significant

Figure 4: Marginal willingness to pay for 1 unit of wind exposure

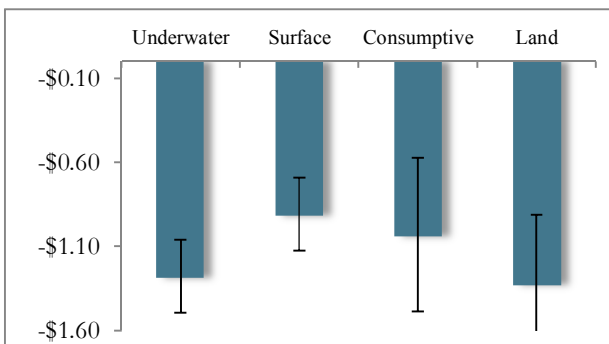
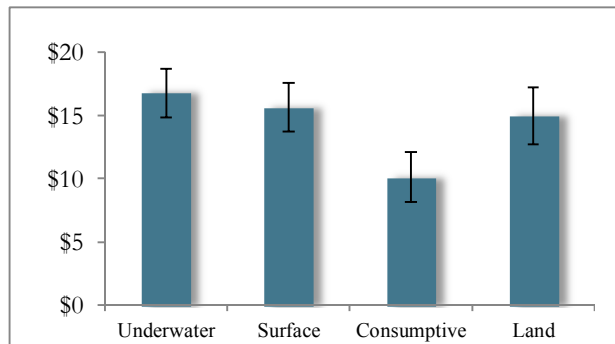


Figure 5: Marginal willingness to pay for 1 unit of biological index



Applying the Results to Predict Changes in Value of the Sanctuary

Managers of the Sanctuary and other marine resources managers can use the marginal willingness to pay for one unit of the biological index (i.e. \$16.78) to calculate changes in value associated with fluctuations in biological quality of marine ecosystems. This can transform the effects of management actions on biological quality into a monetary value. We conducted a small theoretical experiment to illustrate this. If fish abundance were to double in one popular site in the Sanctuary (as seen in Lester et al., 2010), there would be a corresponding increase of 4.45 units in the biological index. Multiplying this difference by the marginal willingness to pay and the predicted proportion of visitors to this particular site within a year, we arrive at an estimate of \$33,011 for the total value gained. This number can be considered an underestimate for several reasons: for example, it does not account for any additional boater who may choose to visit the site now that the biological attributes have improved.

Implications for Management

Based on the results of our model, managers may incorporate the benefits PRBs receive from a single trip to the Sanctuary (i.e. about \$54) in any quantitative or qualitative analysis of future policy. To improve the value that recreational boaters gain from access to the Sanctuary, managers may also consider management actions that protect or restore the biological quality of the Sanctuary. Our research suggests that these types of actions are especially relevant for non-consumptive PRBs. Some examples include water quality improvements, limits on oil and gas development, fishing restrictions and marine protected areas (MPAs), which are linked to proportional increases in fish biomass and invertebrate density for species targeted by fishing (Lester et al., 2009). By quantifying the total non-market value for private recreational boating (i.e. a lower bound of \$86,642), we are supporting managers' ability to consider the economic tradeoffs of various Sanctuary uses. Additionally, our estimate can be used in the discussion of management actions that affect the private recreational boater stakeholder group.

Conclusions

We advocate the use of RUMs as a methodology for exploring the non-market value of recreational activities and for defining factors that influence the behavior of individuals who engage in these activities. Our research process has highlighted several data gaps that, if addressed, will improve the relevance of our results. Useful data would include a more precise estimate of the total annual number of PRBs, finer temporal scale on kelp coverage, and inclusion of other attributes that may influence boater decisions.

Our findings advance the understanding of how an underrepresented stakeholder group associates value with the Sanctuary and confirms the socioeconomic importance of biological quality. This project demonstrates the feasibility of applying a RUM to recreational use of a National Marine Sanctuary and presents recommendations on future research of this nature. Additionally, our study is relevant to the non-market valuation of coastal and marine recreation worldwide. These results can be used in management decisions that affect marine resources and the stakeholders who value them.

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