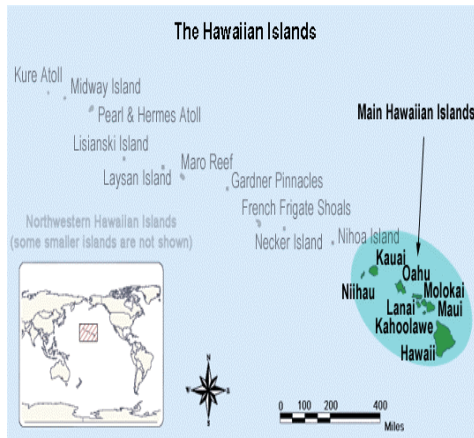




## The Total Economic Value for Protecting and Restoring Hawaiian Coral Reef Ecosystems



Main Hawaiian Islands



J.E. Smith

Schools of fish live near reefs



James Watt, Ocean Stock, Inc.

A variety of shallow coral

### Study Background

*The study used a survey of more than 3,200 U.S. households to let the public express their preferences and values for protection and restoration of the coral reef ecosystems around the Main Hawaiian Islands.*

### Introduction

The results summarized here are from a study funded by NOAA's Coral Reef Conservation Program through the National Ocean Service's Office of Response and Restoration and Office of National Marine Sanctuaries. The study was implemented through a contract with Stratus Consulting, Inc.

### Study Goal – Estimate the Total Economic Value of the Coral Reef Ecosystems around the Main Hawaiian Islands

Recent advances in environmental economics have called attention to the possibility that people hold both direct use and passive use values for environmental resources. Direct use values stem from personal use of environmental resources and personal consumption of products derived from them. For example, people may derive value from snorkeling over a coral reef or from consuming fish produced by coral reef ecosystems. But people may also receive positive values for reasons that are not related to personal use. For example, people may value restored

ecosystems as part of their legacy to future generations. Early research involving focus groups indicated that many people from across the United States do hold passive use values for Hawaii's coral reef ecosystems. Hence, the goal of the study was to estimate the total value – including both direct use and passive use values – for the U.S. population.

### Value of Protection and Restoration

Several human activities impinge on Hawaii's coral reefs, with two prominent ones being fishing impacts and damage to reefs from ship accidents. Steps to minimize fishing impacts and to repair reefs damaged by ships were taken as case examples of measures to protect and restore coral reef ecosystems by establishing a market mechanism in which survey respondents could express their preferences and values for the protection and restoration of the coral reef ecosystems around the Main Hawaiian Islands. More specifically, we studied the potential value of increasing the size of no-fishing zones, a specific type of Marine Protected Area (MPA) around the Main Hawaiian Islands, from the current 1% of reefs to 25%. This would be done in order to restore fish populations and achieve broader ecosystem benefits from fish restoration. The figure of 25% was based on the judgment of NOAA scientists regarding a threshold where substantial benefits to fish both inside and outside the no-fishing zones would start being achieved. We also studied the potential value of repairing five acres of reefs per year damaged by ship accidents. There is currently no specific program to repair such damage in Hawaii; NOAA scientists and the Coast Guard estimate that five acres is a rough, current estimate of

average annual damages from ship accidents. Restoration of ship-damaged reefs would reduce recovery time by 40 years compared to natural recovery. Expansion of MPAs served as a case study of measures that can be taken to address a widespread degradation of coral reef ecosystems. The ship damage repair program served as a case study of measures to address more localized, small-scale sources of degradation.

## State-of-the-Art Methods of Survey Research and Economic Valuation

A national survey was conducted by joining efforts funded by the National Science Foundation to conduct national surveys using Internet Panels through a grant to Stanford University. Two Internet panels were constructed using two different methods of sample recruitment to tests for methods of sample recruitment and possible biases of Internet samples. One sample was recruited using a random digit dialing telephone survey and the other sample was recruited using U.S. Bureau of the Census methods of going to a random sample of households and recruiting households face-to-face. More than 3,200 households were included in the two panels and were used in this study. The survey was conducted from June through October 2009. Conclusions were that the Internet samples did provide a representative sample of the U.S. population living in households and there were no significant biases using Internet

panels.

An important aspect of this research was the use of a physical/natural science panel to provide facts about the Hawaiian Coral Reef Ecosystems and to provide estimates of how the coral reef ecosystems would change in response to the two management options analyzed. This latter contribution provided survey respondents with a clear description of the ecosystem services that they were being asked to value or more importantly how the ecosystem services they would receive would change with changes in the management options proposed versus the status quo or the state of the coral reef ecosystems without the management options proposed.

Extensive use of focus groups from different regions around the nation, cognitive-one-on-ones, and large scale pretests were used to test people's understanding of the scientific facts presented, through both the use of bulleted facts and visual illustrations (how the coral reef ecosystems would respond under each management option), and test survey question wording.

There was also extensive use of peer reviewers. Peer review was conducted at each stage of the project (e.g. questionnaire and sample design, analysis, and report). Peer reviewers in the design stages included experts on economic valuation, especially stated preference methods used in this study, survey sample design, and a social psychologist to ensure there were no biases related to question framing or provision of information that would bully people into certain positions. Since this survey was federally funded, the survey also had to receive review and approval of the U.S. Office of Management and Budget (OMB). OMB oversees the implementation of the Paperwork Reduction Act by evaluating burdens placed on the public by government sponsored surveys. It also administers the Information Quality Act to ensure the information provided to the public by

federally funded surveys is of high quality.

A state-of-the-art method of economic valuation was applied using a hybrid approach. The method is referred to as a hybrid because it married the method known as the contingent valuation method with the method called attribute-based methods (ABMs). In ABMs, survey respondents are presented with two or more alternatives. Each alternative is described in terms of its features or "attributes". Dollar values are included by making one of the attributes the cost of the alternative to the respondent. Several alternatives can be introduced by varying the attributes. Respondents are asked to either choose their most preferred alternative or rank the alternatives. This method more closely simulates how people make decisions in real markets when purchasing goods or services.

The actual method implemented used a full ranking of alternatives (most preferred to least preferred). This method produces more information about people's preferences than the single ranking of the most preferred choice. However, the choices are correlated and therefore required a specific econometric method to account for the correlation. The econometric method chosen was a rank-ordered probit model. Other models were estimated and are reported in the main report. The model chosen had the best fit to the data and also produced the second lowest (most conservative) economic values.

## Results

For a summary of the estimated values see the fact sheet at the following link that also has the main report.

<http://coralreef.noaa.gov/hicoraleconval/> or contact

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Sea urchins are common in Hawaii