

## Puerto Rico Coral Reef Ecosystem Valuation: Analysis of Non-Market Values of Reef Using Visitors



Photo: Environmental Protection Agency

### Motivation of Research

Working with coral reef scientists and focus groups, several key attributes that are significant to the health of ecosystems and consequently human use and satisfaction were identified. Coral reef scientists helped to determine realistic improvements to resource attributes that could be attained through various management strategies.

This information was then used to develop the surveys to estimate respondents (coral reef users in Puerto Rico) willingness to pay for marginal changes to the resource. Understanding how willingness to pay changes as resource attributes improve, helps resource managers to both maximize and communicate the benefits of policy or regulatory changes and to determine if benefits will exceed costs.

The results of this work provide the willingness to pay for marginal changes to 10 different coral reef resource attributes and the total willingness to pay for marginal changes across all reef using visitors to Puerto Rico.

### Background

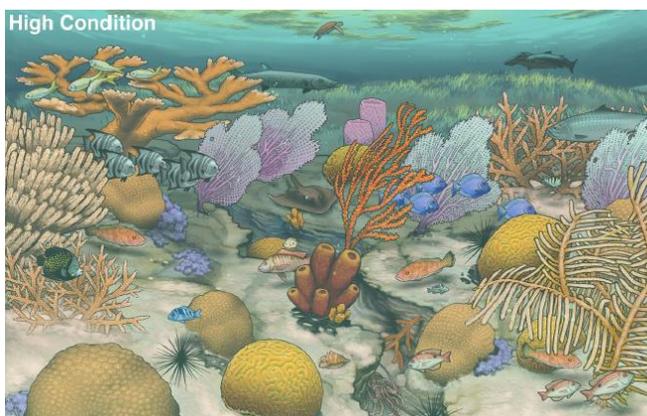
In 2016-2017, in partnership with the Environmental Protection Agency and Puerto Rico Sea Grant, NOAA's Office of National Marine Sanctuaries was able to estimate the non-market value of various coral reef attributes to reef using visitors. The report, *Technical Appendix: Non-market Economic Value by Reef Using Visitors on Puerto Rico's Coral Reef Ecosystems, An Attribute Approach, 2018*, presents the results of the marginal willingness to pay of users for nine different coral reef attributes.

NOAA's objectives included obtaining information on people's preferences for different corals (e.g. hard and soft corals), fish and wildlife, and water quality, and estimation of the non-market economic values, and estimation of how values for those attributes change with changes in natural resource attributes and user characteristics.

### Non-Market Value

The environment and ecosystems provide many benefits to humans. The ways in which humans benefit from ecosystems have come to be known as ecosystem goods and services. Examples include recreation and food supply. Recreation depends on water quality, abundance and diversity of fish and wildlife, and abundance and diversity of coral and sponges. Many goods and services are not traded in markets, meaning a person cannot go to the store and buy a unit of coral reef quality.

The environment and ecosystems provide many benefits to humans. The ways in which humans benefit from ecosystems, such as recreation, food supply, and shoreline protection from storms, have come to be known as ecosystem goods and services. The economic value of some of these goods and services, such as fish for food, can be estimated through market sales and pricing. But others, such as recreation, which depends on water quality and abundance and diversity of colorful fish, coral and sponges, are not traded in markets. The monetary value of these 'non-market' goods and services must be estimated using alternative methods.



The picture to the left shows the high coral reef condition presented to respondents. This illustration was used to estimate the value that coral reef users have for improvements to reef attributes.

Illustration by:  
Daniel Irizarri Oquendo

Change in Attribute Condition			
Variable	Low to Medium	Medium to High	Low to High
Stony Coral	\$22.30	\$30.31	\$52.61
Soft Coral	\$41.19	(\$54.35)	(\$13.15)
Consumptive Fish	\$29.55	\$65.76	\$95.31
Ornamental Fish	\$25.47	\$29.25	\$54.72
Invertebrates	\$93.35	\$2.12	\$95.46
Large Wildlife	Not Estimated	Not Estimated	\$66.82
Sport Fish	Not Estimated	Not Estimated	\$209.30
Water Cleanliness	Not Estimated	Not Estimated	\$255.78
Water Clarity	\$38.66	\$15.15	\$53.82
Crowdedness	\$11.87	\$27.06	\$38.93

The values to the table above were estimated based on changes in resource conditions relative to the "Status Quo" or "Low" Condition. Status quo is defined as the condition the resources would be in 10-20 years if no changes in policy/management were made. Scientists then provided a range of resource conditions that were possible to achieve with changes in policy/management. A "medium" and "high" condition was defined for each of the resources in the table above. Therefore, what is estimated is the change in non-market value for direct recreation use on Puerto Rico's coral reefs for each natural resource attribute as conditions are improved

## What was measured in Puerto Rico?

The research discussed in this factsheet uses non-market valuation to estimate the monetary value of potential improvements to several different coral reef resources. Nine natural resource attributes were included in the study (see the table above and full report for details on condition levels).

## Findings

Reef-using visitors to Puerto Rico, on an annual per-household basis, were willing to pay (WTP) for changes in water cleanliness, sport fish, invertebrates, and consumptive fish from low to high conditions. This was followed by opportunities to see large wildlife, ornamental fish, and stony corals. Soft coral abundance was considered by coral scientists to be an indicator of declining coral reef water quality, so the low condition was set as a high number of soft corals and the high condition was a low number of soft corals. However, reef-using visitors valued an increase in soft corals from the low to medium condition but had a negative value for going from low to high and medium to high conditions.

## More Information:

A complete copy of the report is available at:  
[https://www.coris.noaa.gov/activities/projects/pr\\_reef\\_ecosystem\\_valuation/](https://www.coris.noaa.gov/activities/projects/pr_reef_ecosystem_valuation/)

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