Puerto Rico Coral Reef Ecosystem Valuation

Non-market Economic Value by Reef Using Visitors on Puerto Rico's Coral Reef Ecosystems, An Attributes Approach: Policy/Management Scenarios

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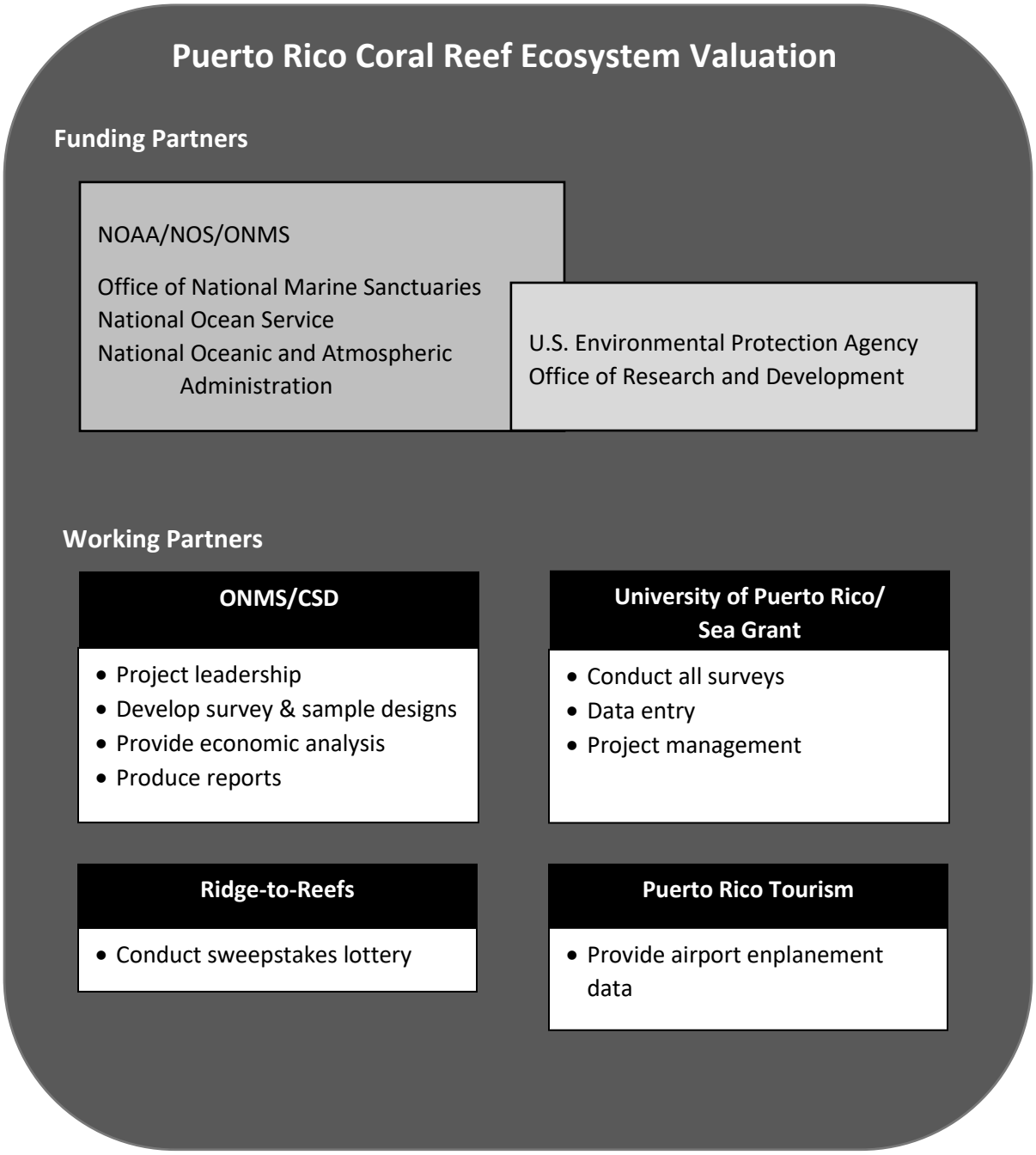

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Acknowledgements

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Any errors are the sole responsibility of the authors.

Foreword

We are fortunate to be able to drop into the remarkable world of coral reefs, diving through crystal blue water into forests of branching corals, swaying sea fans and schools of brightly colored reef fish. It is a truly unique and exhilarating experience. This underwater world provides other benefits as well - beautiful white sandy beaches, protection from stormy seas, and delectable seafood. But this vibrant beauty, along with its ecosystem benefits, is under constant threat and continued decline. Year after year since the 1970's, chronic declines and event-driven losses of coral ecosystems have been documented around the globe. The causes vary, but most declines are linked to high-temperature events that can be aggravated by local pressures such as overfishing or sediment and pollutants in terrestrial runoff. To protect reef systems, or even to stem the ongoing deterioration, requires commitment and urgent action to reduce anthropogenic stresses. However, such actions will be taken only when decision-makers are clearly aware of the value of coral reefs to economy and society. Healthy coral reef ecosystems are essential to economic benefits from fisheries, tourism, marine biodiversity, natural products discovery and shoreline protection, as well as cultural benefits like aesthetics, art and stewardship. As reefs have declined, so have the benefits they provide. This is a fact that decision-makers must recognize to properly weight their decisions affecting coral reefs.

Placing value on an ecosystem is not a trivial task. Whereas some of the benefits of an ecosystem have economic components determined in the marketplace, such as the value of fish landings, others are not valued through market pricing. In fact, many highly valued environmental goods and services, such as clean air and water or healthy fish and wildlife populations, are not traded in markets. To estimate non-market value requires approaches that determine how much people would be willing to pay for a particular attribute or characteristic. The six reports presented in this series document a non-market valuation of reef attributes assembled from survey responses of reef-visitors in Puerto Rico. The importance of this survey is to characterize the value of reefs so that individuals and organizations can be fully aware of the consequences of decisions, large and small, that affect coral reefs. Wanting to protect coral reefs, to preserve their unique beauty, is not sufficient; knowing why they should be protected imparts a stronger argument for ensuring their survival.

William S. Fisher, Associate Director for Ecology
National Health and Environmental Effects Research Laboratory
Office of Research and Development
U.S. Environmental Protection Agency

Preface

This report is part of a six volume series on the socioeconomics of visitor use of Puerto Rico's coral reef ecosystems. The project was sponsored and funded by the U.S. Environmental Protection Agency (EPA), Office of Research and Development. EPA is developing a decision-support tool to evaluate restoration alternatives in the Restoration Management Plan for the Guanica Bay Watershed in southwest Puerto Rico. Several teams were in charge of different ecosystem services (benefits humans receive from coral reef ecosystems). Ecosystem services for coral reef included recreation-tourism, food supply (commercial fishing and consumptive motive of recreational fishing), ornamentals (aquarium trade), pharmaceuticals, and property values from storm protection. Although the EPA decision-support tool was limited to the coral reefs off southwest Puerto Rico, public scoping determined that for recreation-tourism information was need for the entire island's coral reef ecosystems, so this study covers all of Puerto Rico, but due to costs, this study was limited to visitor use of Puerto Rico's coral reef ecosystems. Future studies will address resident's use of Puerto Rico's coral reefs.

This report is Volume 6 of the six volume series and reports the results of using the estimated models found in volume 5 for evaluating selected policy/management scenarios to demonstrate the utility of the models.

Volume 1 presents a socioeconomic profile of reef using visitors to Puerto Rico. Estimates are presented on the total amount of visitation measured in person-trips (visits) and intensity of visitation measured in person-days. The concepts of person-trips and person-days are defined and as with many measurements, separate estimates are provided by season (summer and winter). Extensive profiles are presented on activity participation for reef using activities and non-reef using activities for reef using visitors. An extensive set of appendix tables provides details by activity type, region and season. Puerto Rico was divided into five regions for estimation of activity use. Intensity of use is measured in person-days for selected reef using activities by region and season.

Volume 2 addresses the economic contribution/impact of visitor reef user's expenditures in Puerto Rico on the Puerto Rican economy. Estimates of total visitor spending by category are used in the IMPLAN input-output model for Puerto Rico to estimate the impact of these expenditures on the Puerto Rican economy in terms of output/sales, valued-added (gross regional product), income and employment, including multiplier or "ripple effects" of the spending by reef using visitors.

Volume 3 addresses importance-satisfaction ratings by reef using visitors on 25 natural resource attributes, facilities and services. The importance-performance four-quadrant analysis is used to place items as to their relative importance and satisfaction.

Volume 4 is a technical appendix detailing the sampling methods and estimation for items measured and presented in Volumes 1 to 3.

Volume 5 is a technical appendix detailing the methods used in estimating the non-market economic values of coral reef ecosystem attributes. Details are provide on sampling methodologies, sample weighting, questionnaire and experimental design, model estimations and use of the model in estimating the economic value of attributes under different scenarios. This report is intended for peer reviewers and for researchers that would like to implement the methods used in other geographies.

Chapter 1: Introduction

Purpose

This report provides estimates of non-market economic coral reef use values for visitors to Puerto Rico for four policy/management scenarios. The benefits of different policy/management scenarios are estimated using the peer reviewed model in Leeworthy et al. (2018e). This report is intended for decision-makers and technical support staff in evaluating coral reef restoration and protection efforts. Selected scenarios are presented to show the utility of the models.

The report is part of a six-volume series of reports on reef-using visitors to Puerto Rico in year 2016-17. Volume 1 (Leeworthy et al., 2018a) provides visitor profiles on amount of use by type of recreation activity for reef and non-reef activities and by five regions and two seasons (summer and winter). In addition, profiles by season are presented for demographics of visitors, spending profiles and special issue questions to address community and policy/management issues.

Volume 2 (Leeworthy et al., 2018b) provides estimates of the economic impact/contribution of reef-using visitor spending on the Puerto Rican economy in terms of output/sales, value-added (gross regional product), income, employment and tax revenues generated by the visitor spending, including multiplier impacts.

Volume 3 (Leeworthy et al., 2018c) provides estimates of the importance-satisfaction ratings for 25 natural resource attributes, facilities and services by reef-using visitors. A five-year retrospective analysis is also conducted on the satisfaction ratings and expectancy-discrepancy analysis is presented to provide additional explanation of the satisfaction scores.

Volume 4 (Leeworthy et al., 2018d) is a technical appendix documenting the sampling methodologies and estimation methods used in volumes 1 to 3.

Volume 5 (Leeworthy et al., 2018e) is a technical appendix detailing the methods used in estimating the non-market economic values of coral reef ecosystem attributes. Details are provided on sampling methodologies, sample weighting, questionnaire and experimental design, model estimations and use of the model in estimating the economic value of attributes under different scenarios. This report is intended for peer reviewers and for researchers that would like to implement the methods used in other geographies.

Background

In 2009, the U.S. Environmental Protection Agency (EPA) Office of Research Development (ORD) developed an “Ecosystem Services Research Program” and an “Ecosystem Studies: Coral Reef Research Implementation Plan” (Bradley et al., 2009). The plan used the Driving forces, Pressures, State, Impact, and Response (DPSIR) framework to integrate ecological, social, economic, and decision sciences. Major ecosystem services selected for study included fishing, tourism and recreation, shoreline protection and pharmaceutical products. The geographic focus

was on the U.S. coral reef regions of the Caribbean Sea, Atlantic Ocean, including (Florida Keys and Southeast Florida), Puerto Rico, and the U.S. Virgin Islands.

In 2010, NOAA's Coral Reef Conservation Program funded the development of a management plan for the restoration of the Guánica Bay Watershed in Southwest Puerto Rico (CRCP 2010). In 2011, EPA/ORD followed up with efforts to develop a decision-support tool to evaluate the benefits and costs of restoration management plan. The decision-support tool would essentially quantify the DPSIR Model for all the ecosystem services provided by the coral reef ecosystem affected by the Guánica Bay Watershed. Separate teams were developed to work on the economics of each ecosystem service.

In 2013, EPA met with the Director of NOAA's Office of National Marine Sanctuaries (ONMS) and requested that ONMS Chief Economist, Dr. Vernon R. (Bob) Leeworthy, lead the economic valuation of the tourism and recreation ecosystem service. NOAA/EPA entered an Interagency Agreement to conduct a study on Puerto Rico's tourism-recreation uses of Puerto Rico's coral reef ecosystems.

In 2013, NOAA/ONMS and EPA conducted a series of meetings to develop community support for the project. Local business leaders, federal and Territorial government agencies, and non-government organizations attended meetings held around the entire island. From this process, it was determined that tourism-recreation would be addressed for the entire island's coral reef ecosystems, not just the southwest area corresponding to the Guánica Bay Watershed. Following the community meetings, NOAA/ONMS entered a contract with the University of Puerto Rico, Mayaguez to conduct surveys of reef-using visitors in Puerto Rico.

Chapter 2: Policy/Management Scenarios

Here we use the economic valuation model in Leeworthy et al. (2018e) to evaluate four policy/management scenarios provided by the U.S. EPA, Office of Research and Development, National Health and Environmental Effects Research Laboratory to demonstrate the versatility of the model for evaluating the benefits of coral reef ecosystem restorations.

The valuation starts with the "Status Quo", which is defined as the condition of the coral reef attributes in 10-years if no policy/management changes are made. The value of the "Status Quo" is zero ($0). Therefore, the model only values changes in policy/management that leads to improvement in conditions if changes are made to improve conditions to the "medium" or "high" condition. The "high" conditions are designed on the basis of the NOAA/EPA monitoring program that provides the range of coral reef conditions in Puerto Rico to make them policy/management relevant (i.e. are possible to achieve).

The definitions of the coral reef attribute conditions under the "low" (Status Quo), "medium" and "high" conditions are provided in Table 2.1. The change in economic value for a change in condition from "low" to "medium", "medium to high" and "low to high" are given in Table 2.2. These are called "marginal values". The marginal values represent what visitors to Puerto Rico, who are coral reef users, are willing to pay for improvement in coral reef conditions per household per year. To aggregate these values to an annual value for all coral reef users, we multiply by the number of coral reef visitor households that used Puerto Rico's coral reefs for one year. These annual streams of benefits are then calculated for different time periods (e.g. 10 years, 20 years, 30 years and perpetuity or the indefinite future) using standard formulas in finance to calculate the "net present value" of a future stream of benefits. We use a 2% and 3% real discount rate to discount future dollars to present dollars net of inflation.

The values here are considered lower bound estimates using conservative assumptions. Two key assumptions are used. First, the amount of future use by visitors is constant i.e. there is no increase in the amount of use with increases in coral reef attribute condition improvements. Second, the marginal values of attribute condition remains constant in the future. Both assumptions are not likely to hold as coral reef attribute conditions improve. Both are likely to increase, but there is no way to reliably forecast these changes in the future, therefore the estimates are considered lower bound, conservative estimates.

Table 2.1. Definition of Coral Reef Attributes Conditions.

Status Quo (Low)	Medium	High
Corals and Sponges	**Corals and Sponges**	**Corals and Sponges**
L: No stony corals, only soft corals and sponges	**M:** Up to 4 species of stony corals covering 5 to 20% of hard-bottom with 60 to 90% live coral tissue.	**H:** 5 to 17 species of stony corals covering more than 20% and up to 100% of hard-bottom with over 90% to 100% live coral tissue.
L: Up to 4 species of soft corals for a total of 14 to 25 square centimeters per square meter Up to 4 species of sponges for a total of 7 to 15 square centimeters per square meter	**M:** Up to 3 species of soft corals for a total of 4 to 14 square centimeters per square meter. Up to 3 species of sponges for a total of 2 to 7 square centimeters per square meter.	**H:** 1 species of soft corals for a total of less than 4 square centimeters per square meter. 1 species of sponges for a total of less than 2 square centimeters per square meter.
Fish and Wildlife	**Fish and Wildlife**	**Fish and Wildlife**
L: Up to two species of consumptive fish for a total of 3 fish per square meter with no fish of legal size to keep	**M:** 3 to 6 species of consumptive fish for a total of 10 fish per square meter with up to 50% of legal size to keep.	**H:** Up to 15 species of consumptive fish for a total of 100 or more fish per square meter with 75 to 100% of legal size to keep.
L: Up to 3 species of tropical/ornamental fish with a total of 3 fish per square meter	**M:** 4 to 10 species of tropical/ornamental fish with a total of 10 fish per square meter.	**H:** 25 to 30 species of tropical/ornamental fish for a total of 20 to 100 or more fish per square meter.
L: No Macroinvertebrates (conch, lobster or urchins)	**M:** 1 species of Macroinvertebrates with 1 to 20 per square meter (urchins)	**H:** 2 or more species of Macroinvertebrates (conch, lobster or urchins) 1 lobster, 1 conch, and 20 or more urchins per square meter.
L: No opportunity to see large wildlife (sharks, rays, turtles, manatees, dolphins)		**H:** Opportunity to see large wildlife (sharks, rays, turtles, manatees, dolphins)
L: No opportunity to see or catch Sport/Trophy fish (ladyfish, permit, bonefish, tarpon, snook, jacks)		**H:** Opportunity to catch or see Sport/Trophy fish (ladyfish, permit, bonefish, tarpon, snook, jacks)
Water Conditions	**Water Conditions**	**Water Conditions**
L: Clarity/Visibility: Less than 10 feet	**M:** Clarity/Visibility: 10 to 50 feet	**H:** Clarity/Visibility: Greater than 50 feet
L: Cleanliness: Not healthy for Swimming		**H:** Cleanliness: Healthy for swimming

Table 2.2. Marginal Willingness to Pay For Changes in Attribute Conditions

	Change in Attribute Condition		
Variable	Low to Medium	Medium to High	Low to High
Water Cleanliness			$255.78
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			$66.82
Sport Fish			$209.30
Water Clarity	$38.66	$15.15	$53.82

Note: Negative value for soft corals means some people are willing to pay more for more soft corals. Improved condition was stated as a lower amount of soft corals (See Table 2.1).

Scenario 1: No Fish Sanctuary (Finfish & Shellfish-Invertebrates)

In this scenario, all of Puerto Rico's coral reefs are placed in a sanctuary that prohibits the taking of fish and shellfish (invertebrates). The changes in reef attribute conditions are shown in Table 2.3. This generates an annual benefit of a little more than $206.4 million using the estimate of 352,822 reef-using households per year times the change in marginal values per household per year. The net present value (NPV) of this stream of annual benefits over 10 years using a 2% discount rate is almost $1.9 billion and $1.8 billion using a 3% discount rate. NPV for 20 years is $3.44 billion using 2% discount rate and almost $3.2 billion using a 3% discount rate. NPV for 30 years is a little over $4.7 billion using a 2% discount rate and almost $4.2 billion using a 3% discount rate. If we assume that these annual benefits are received in perpetuity or the indefinite future, the NPV is a little over $10.3 billion using a 2% discount rate and almost $6.9 billion using a 3% discount rate (Table 2.4). The NPV represents the asset value of the annual stream of benefits and it is what someone would be willing to pay today if they owned the coral reef resources and could charge for their uses. These values are the appropriate values to use in a benefit-cost analysis of public investments in coral reef ecosystem protections and restorations.

Table 2.3. Scenario 1: No Fish Sanctuary (Finfish & Shellfish-Invertebrates)-Annual Value

Reef Attribute	Change in Attribute Condition	Change in Marginal Value	Change in Total Annual Value
Stony Corals	Low to Medium	$22.30	$7,867,931
Soft Corals	Low to Medium	$41.19	$14,532,738
Consumptive Fish	Low to High	$95.31	$33,627,465
Ornamental Fish	Low to High	$54.72	$19,306,420
Invertebrates	Low to High	$95.46	$33,680,388
Large Wildlife	Low to High	$66.82	$23,575,566
Sport/Trophy fish	Low to High	$209.30	$73,845,645
Water Clarity	No Change	$0.00	$0
Water Cleanliness	No Change	$0.00	$0
Total			**$206,436,152**

Table 2.4. Scenario 1: No Fish Sanctuary (Finfish & Shellfish-Invertebrates)-NPV

	Discount Rate	
Time Period	2%	3%
Annual	$206,436,152	$206,436,152
10-years	$1,891,416,891	$1,813,770,519
20-years	$3,443,037,522	$3,163,386,125
30-years	$4,715,906,869	$4,167,626,884
Perpetuity	$10,321,807,610	$6,881,205,073

Scenario 2: Reduction in Sediment from Watershed

In this scenario, reductions are made for sediment from run-off in the watersheds that affect the coral reefs. Sediment reduction actions could include land use changes, erosion prevention, and wetland restoration. The changes in reef attribute conditions are shown in Table 2.5. This generates an annual benefit of a little more than $281.4 million using the estimate of 352,822 reef-using households per year times the change in marginal values per household per year. The net present value (NPV) of this stream of annual benefits over 10 years using a 2% discount rate is almost $2.6 billion and $2.5 billion using a 3% discount rate. NPV for 20 years is almost $4.7 billion using 2% discount rate and a little more than $4.3 billion using a 3% discount rate. NPV for 30 years is a little more than $6.4 billion using a 2% discount rate and almost $5.7 billion using a 3% discount rate. If we assume that these annual benefits are received in perpetuity or the indefinite future, the NPV is a little over $14 billion using a 2% discount rate and almost $9.4

billion using a 3% discount rate (Table 2.6). The NPV represents the asset value of the annual stream of benefits and it is what someone would be willing to pay today if they owned the coral reef resources and could charge for their uses. These values are the appropriate values to use in a benefit-cost analysis of public investments in coral reef ecosystem protections and restorations.

Table 2.5. Scenario 2: Sediment Reductions in the Watershed – Annual Value

		Change in	Change in
Reef Attribute	Change in Attribute Condition	Marginal Value	Total Annual Value
Stony Corals	Low to Medium	$22.30	$7,867,931
Soft Corals	Low to Medium	$41.19	$14,532,738
Consumptive Fish	Low to Medium	$29.55	$10,425,890
Ornamental Fish	Low to Medium	$25.47	$8,986,376
Invertebrates	Low to Medium	$93.35	$32,935,934
Large Wildlife	Low to High	$66.82	$23,575,566
Sport/Trophy fish	Low to High	$209.30	$73,845,645
Water Clarity	Low to High	$53.82	$18,988,880
Water Cleanliness	Low to High	$255.78	$90,244,811
	Total		**$281,403,771**

Table 2.6. Scenario 2: Sediment Reductions in the Watershed – NPV

	Discount Rate	
Time Period	2%	3%
Annual	$281,403,771	$281,403,771
10-years	$2,578,287,958	$2,472,444,181
20-years	$4,693,382,101	$4,312,174,851
30-years	$6,428,495,985	$5,681,107,247
Perpetuity	$14,070,188,538	$9,380,125,692

Scenario 3: Sewage Reduction

In this scenario, reductions are made in discharges of sewage from water treatment systems on both land and from vessels that can affect the coral reefs. The changes in reef attribute conditions are shown in Table 2.7. This generates an annual benefit of a little more than $117.1 million using the estimate of 352,822 reef-using households per year times the change in marginal values per household per year. The net present value (NPV) of this stream of annual benefits over 10 years using a 2% discount rate is almost $1.1 billion and $1.03 billion using a 3% discount rate. NPV for 20 years is a little over $1.95 billion using 2% discount rate and almost $1.8 billion using a 3% discount rate. NPV for 30 years is almost $2.7 billion using a 2% discount rate and almost $2.4 billion using a 3% discount rate. If we assume that these annual benefits are received in perpetuity or the indefinite future, the NPV is a little over $5.85 billion using a 2% discount rate and a little more than $3.9 billion using a 3% discount rate (Table 2.8). The NPV represents the asset value of the annual stream of benefits and it is what someone would be willing to pay today if they owned the coral reef resources and could charge for their uses. These values are the appropriate values to use in a benefit-cost analysis of public investments in coral reef ecosystem protections and restorations.

Table 2.7. Scenario 3: Sewage Reduction-Annual Value

		Change in	Change in
Reef Attribute	Change in Attribute Condition	Marginal Value	Total Annual Value
Stony Corals	Low to Medium	$22.30	$7,867,931
Soft Corals	No Change	$0.00	$0
Consumptive Fish	No Change	$0.00	$0
Ornamental Fish	No Change	$0.00	$0
Invertebrates	No Change	$0.00	$0
Large Wildlife	No Change	$0.00	$0
Sport/Trophy fish	No Change	$0.00	$0
Water Clarity	Low to High	$53.82	$18,988,880
Water Cleanliness	Low to High	$255.78	$90,244,811
	Total		**$117,101,622**

Table 2.8. Scenario 3: Sewage Reduction-NPV

	Discount Rate	
Time Period	2%	3%
Annual	$117,101,622	$117,101,622
10-years	$1,072,912,778	$1,028,867,604
20-years	$1,953,074,951	$1,794,441,727
30-years	$2,675,114,493	$2,364,100,774
Perpetuity	$5,855,081,090	$3,903,387,393

Scenario 4: Reduce Physical Damage

In this scenario, reductions are made in physical damages to the coral reefs by the installation of mooring buoys, no anchoring regulations and education on buoyancy control for divers and vests for snorkelers on coral reefs. Indirect changes are included for invertebrates due to the change in habitats. The changes in reef attribute conditions are shown in Table 2.9. This generates an annual benefit of a little more than $66 million using the estimate of 352,822 reef-using households per year times the change in marginal values per household per year. The net present value (NPV) of this stream of annual benefits over 10 years using a 2% discount rate is almost $605 million and $580 million using a 3% discount rate. NPV for 20 years is a little over $1.1 billion using 2% discount rate and almost $1 billion using a 3% discount rate. NPV for 30 years is a little more than $1.5 billion using a 2% discount rate and $1.33 billion using a 3% discount rate. If we assume that these annual benefits are received in perpetuity or the indefinite future, the NPV is a little over $3.3 billion using a 2% discount rate and a little more than $2.2 billion using a 3% discount rate (Table 2.10). The NPV represents the asset value of the annual stream of benefits and it is what someone would be willing to pay today if they owned the coral reef resources and could charge for their uses. These values are the appropriate values to use in a benefit-cost analysis of public investments in coral reef ecosystem protections and restorations.

Table 2.9. Scenario 4: Reduce Physical Damage-Annual Value

		Change in	Change in
Reef Attribute	Change in Attribute Condition	Marginal Value	Total Annual Value
Stony Corals	Low to High	$52.61	$18,561,965
Soft Corals	Low to Medium	$41.19	$14,532,738
Consumptive Fish	No Change	$0.00	$0
Ornamental Fish	No Change	$0.00	$0
Invertebrates	Low to Medium	$93.35	$32,935,934
Large Wildlife	No Change	$0.00	$0
Sport/Trophy fish	No Change	$0.00	$0
Water Clarity	No Change	$0.00	$0
Water Cleanliness	No Change	$0.00	$0
	Total		**$66,030,637**

Table 2.10. Scenario 4: Reduce Physical Damage-NPV

	Discount Rate	
Time Period	2%	3%
Annual	$66,030,637	$66,030,637
10-years	$604,988,329	$580,152,371
20-years	$1,101,289,476	$1,011,840,221
30-years	$1,508,429,278	$1,333,056,523
Perpetuity	$3,301,531,865	$2,201,021,243

Chapter 3. Conclusions and Future Research

Conclusions

The economic valuation models estimated in Leeworthy et al. (2018e) are a flexible tool for estimating the benefits of coral reef protection and restoration policies and management strategies. The model produces lower bound, conservative estimates based on several assumptions. First, visitor use is held constant in the future when coral reef attribute conditions are improved. Second, annual willingness to pay per reef-using visitor households is held constant. And, third, value of the reefs for Puerto Rico's residents is not included.

Future Research

Although the model for estimating reef-using visitor values included reef depth and level of crowdedness, these attributes were combined due to complexity in estimating the values for a large number of attributes. Therefore, although these attributes were included in the model to avoid omitted variable bias, we cannot estimate separate values for improving those conditions. Future research might address these attributes.

Two key assumptions in calculating future changes in values could be addressed. The survey did include questions for each choice, on how many days of reef use would change for the choice in attribute bundle changes. Future research could test whether, in addition to the added willingness to pay, whether there is also a quantity in use response to increases in coral reef attribute conditions. This could partially address a change in quantity of reef use. Forecasts of future number of households and visits to Puerto Rico based on reef attribute changes and other socioeconomic factors such as per capita income of visitors.

A draft resident survey was designed but the project ran out of funds to implement the survey. Future research could pre-test the resident survey, then implement the full survey.

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