

Puerto Rico Coral Reef Ecosystem Valuation

Importance and Satisfaction Ratings by Reef Using Visitors in Puerto Rico

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Vernon R. Leeworthy,
Danielle Schwarzmann,
DeMyra Harris, and
Glenis Padilla

Conservation Science Division
Office of National Marine Sanctuaries
National Ocean Service
National Oceanic and Atmospheric Administration
U.S. Department of Commerce
Silver Spring, MD

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Funding Partners

NOAA/NOS/ONMS

Office of National Marine Sanctuaries
National Ocean Service
National Oceanic and Atmospheric
Administration

U.S. Environmental Protection Agency
Office of Research and Development

Working Partners

ONMS/CSD

- Project leadership
- Develop survey & sample designs
- Provide economic analysis
- Produce reports

University of Puerto Rico/ Sea Grant

- Conduct all surveys
- Data entry
- Project management

Ridge-to-Reefs

- Conduct sweepstakes lottery

Puerto Rico Tourism

- Provide airport enplanement data

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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. But 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
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Acknowledgements

A project of this magnitude requires a special set of acknowledgments. Even though we cannot name everyone that has aided the effort, we feel it especially important to acknowledge all those that helped fund, organize, design and implement the project. This project was a community-based effort and demonstrates what can be accomplished when government, business and private non-profit interests work together.

Funding Partners. A special thank you goes to Pat Bradley (now retired) from the U.S. EPA's Atlantic Ecology Division who got NOAA's Office of National Marine Sanctuaries (ONMS) to agree to have me lead this study. Moreover, to Dan Basta, former Director of ONMS (now retired), for agreeing to allow me to lead the project even though, we currently do not have a national marine sanctuary in Puerto Rico. We would also like to thank Mitchell Tartt, Chief of the ONMS Conservation Science Division for his continued support of the project. In addition, we would also like to thank the rest of the U.S. EPA team involved in the project. Bill Fisher provided leadership as Director of the Gulf Ecology Division in providing the support of many in his staff. Bill was in charge of the development of a decision-support tool for the Guanica Bay Watershed Restoration Management Plan for which the recreation-tourism was a key component. Bill provided the funding for this effort and organized webinars on different components of the decision-support tool. Debbie Santavy and Susan Yee provided data and interpretation of the EPA/NOAA monitoring data on coral reef ecosystem attributes that were critical to our valuation effort. Debbie also provided maps for the different regions used in the surveys. Evelyn Huertas of EPA's Region 2 Caribbean Environmental Protection Division provided local coordination. Matt Weber at EPA's Western Ecology Division provided key technical advice in the survey's optimal design and economic valuation methods. Marisa Mazzotta from EPA's Atlantic Ecology Division provided review/advise on our economic valuation methods. Lenore Connell provided key administrative support in the EPA/NOAA Inter-agency Agreement and its amendments to conduct the project.

Working Partners. The major working partners were the University of Puerto Rico-Mayaguez and the Sea Grant Office located there. They were in charge of conducting all the surveys under contract to ONMS. When the project first got underway, Manuel Valdez Pizzini was the Project Lead, but early on was promoted to Dean and Ruperto Chaparro, Director of Puerto Rico Sea Grant Extension took over. Ruperto Chaparro, known locally as Chapa, was key to opening doors with the local community. It seems everyone on the island knows and respects Chapa and if Chapa endorses you, people will work with you, which for this kind of project is extremely valuable. Miguel del Pozo was the original Project Manager and conducted the focus groups and one-on-ones used to design the visitor survey questionnaires. After completing that task, Miguel left the University and we hired Glenis Padilla Plaza as the Project Manager. Glenis did a great job recruiting and training the many students that were used to implement the surveys and ensured good working relationships with all the organizations, especially Aerostar at the San Juan Airport. Glenis was also responsible for delivery of all survey data and documentation. Yullisa Garcia Lugo of Puerto Rico Sea Grant provided contract support. Daniel Irizari Oquendo did a great job in developing the illustrations of coral reef ecosystem conditions used in the survey. Michele Schare of Puerto Rico Sea Grant Extension provided local coordination with the

business community as did Rafael Boglio, Coordinator of Interdisciplinary Center for Coastal Studies.

Puerto Rico Tourism was another key working partner. Rafael Silvestrini provided the airport enplanement data critical to designing the airport surveys and for extrapolating airport survey sample estimates to population estimates. Rafael also shared Puerto Rico Tourism's past survey results so we could compare coral reef users with the general visitor population. In planning the study Michelle Bauza, Carolina Morales, Edgardo Afanador, Milda I. Luhring Gonzalez, Nilda Diaz Hiraldo and Naireisa Gines all provided their experience and guidance in visitor surveys.

Ridge-to-Reef's Paul Sturm organized and conducted the sweepstakes/lottery that was the key incentive for visitors to take part in the survey. Paul was able to get significant contributions from many local businesses and non-government organizations (NGOs).

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We would like to make a special thank you to student Yasiel Figueroa. Yasiel was key in helping us organize meeting with the many government agencies, NGOs and business leaders in the community in our first set of meetings to discuss the project. He is a bright and resourceful person, and I am confident he will be successful in his educational and professional pursuits.

A key element of this project was the survey at the San Juan Airport. We could not have accomplished our survey objectives without the support of Jamie Paban of Aerostar. Jamie got our students interviewers through security clearance and provided parking at the airport for the students, and most importantly ensured the airlines that our students were approved to conduct the surveys at the gate waiting areas. So a special thank you to Jamie for the support.

Other Project Support

Many other government agencies, NGO's, businesses and business leaders provided project support. The Department of Natural and Environmental Resources of Puerto Rico (DNER) attended several meetings with us to hear about our project and offer advice on the types of information that would be useful to their agency. Meeting participants included Ernesto Diaz, Director of Coastal Zone Management Program, Craig Lilyestrom, Director of Marine Resources Division, Damaris Delgado, Director, Bureau of Coasts, Reserves & Refuges, Nilda Jimenez Marrero, Coordinator of Coral Reef Committee, Astrid J. Green Caceres of Public Outreach, Israel Umpierre, Assistant to the Secretary and Miguel Canals Sr. (Menqui), Guanica Dry Forest.

From the San Juan Bay Estuary Program, Jorge Bauza, Ernesto M. Olivares and Roberto C. Morales shared their thoughts with us. From the Puerto Rico Port Authority, Ivelisse Lorenzo, Jorge Bairun Benitez and Alfredo Montanez provided guidance. From Puerto Rico Conservation Trust, Soledad Gaztambide and Fernando Lloveras consulted with us. From the U.S. Fish and Wildlife Service, Ana M. Roman and Gisella Burgos shared their past survey efforts and advice for on-site surveys.

Many from the business community and community leaders shared their ideas and support: Luz Rivera Cairull (Fundacion de Culebra), Alberto Arce (Kayaking Puerto Rico), Henry Rivera (ACDEC), Cindy Villanueva (Autoridad de Conservacion y Desarrollo de Culebra), Brenda Cerezo (Puerto Rico Technical Diving & Rincon Diving), Steve Tamar (Surfrider Foundation), Ramse Morales (Surf Lessons Puerto Rico), Jose T. Rotolo (Aquatic Dive & Surf), Percy Ries (Kayaking Puerto Rico), Marcos Hanke (787 Fishing Company), Alberto J. Rivera and Pedro Rodriguez (Sea Ventures Dive Center), Luis Dotteau (Paradise Scuba and Snorkeling Center), and Ivan Lopez (La Parguera).

Student Interns

Finally, we would like to thank the many student interns that have come to Silver Spring, MD from several universities to assist us. Their work was critical to us getting data entry, quality analysis/quality control (QA/QC) of the databases, analysis and report writing. I hope that we provided them a valuable experience. We have made all of them co-authors of our reports so they leave with something on their resumes. Paul Conant, Ph.D. candidate at the University of Connecticut did the data entry, QA/QC, analysis and report writing for the non-market economic valuation report. Sarah Hughes from Roanoke College and John Vaughn from the College of William and Mary, entered all the data from the airport surveys, conducted QA/QC of the databases, developed tables & graphs and wrote first drafts of sections of the Socioeconomic Profiles report. DeMyra Harris developed tables & figures and wrote sections for the Importance-Satisfaction report.

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 3 of the six volume series and 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 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.

The profiles presented in this report also include demographic profiles of the reef using visitors. Place of primary residence (country and within the U.S. the state) age, sex, race, ethnicity, and household income of the survey respondent are provided. Additional items include party size, second home ownership in Puerto Rico, length of stay, number of annual trips to Puerto Rico, number of days annually spent in Puerto Rico and numbers of nights spent in each region of Puerto Rico on the interview trip.

Expenditure profiles are also presented in terms of average expenditures per person per trip and expenditures per person per day by detailed spending category. The final section of this report addresses special issues identified through public scoping of the project. Special issues included private boats visitors keep in Puerto Rico, likelihood of return visits, cruise ship visits and their influence on making a non-cruise ship visit, visitor's preferences for the level of development, and visitor level of support for different natural resource management issues.

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 4 is a technical appendix detailing the methods used in sampling and estimation for items presented in volumes one through three.

Volumes 5 and 6 are fundamental to the EPA decision support tool. These reports address the non-market economic values of the coral reef ecosystems. Non-market economic values are the value people receive when consuming a good or service over and above what they pay to get the good or service. Economists refer to this as "consumer's surplus. These are the appropriate values to include in damage assessments when suing responsible parties for damages to coral reefs and in public investments to protect and/or restore coral reef ecosystems. The attributes approach to valuation is used valuing changes in the condition of coral reef ecosystem attributes (e.g. coral cover, coral diversity, fish abundance and diversity, water clarity, and the opportunity to see large wildlife). Volume 6 presents results for example scenarios using estimated models, while Volume 5 is the Technical Appendix detailing the methods used in survey sampling and economic value estimation.

For more information or a copy of this report, contact

Dr. Vernon R. (Bob) Leeworthy
1305 East West Highway
SSMC 4, 11th floor
Silver Spring, MD 20910
Phone 240-533-0647
Fax 301-713-0404
E-mail Bob.Leeworthy@noaa.gov

Dr. Danielle Schwarzmann
1305 East West Highway
SSMC 4, 11th floor
Silver Spring, MD 20910
Phone 240-533-0705
Fax 301-713-0404
E-mail Danielle.Schwarzmann@noaa.gov

1. Introduction

This is the third report in a series on reef using visitors to Puerto Rico as part of the project entitled “Puerto Rico Coral Ecosystem Valuation”. The first report, “A Socioeconomic Profile of Reef Using Visitors in Puerto Rico,” provides detailed profiles of visitors in terms of the number of visitors by mode of access (air); activity participation by region (Northwest, Southwest, Southeast, Northeast and Culebra & Vieques); intensity of activity (days and dives for reef uses); demographic profiles (primary place of residence, age, race/ethnicity, sex, household income, party size, and second home ownership in Puerto Rico); and spending patterns (per person per day and per person per trip). This report is referenced under Leeworthy et al. (2018a). The second report in the series, “Economic Contribution of Reef Using Visitors to Puerto Rico,” provides estimates of the market economic impacts of reef using visitor spending on both the Puerto Rican economy in terms of sales, output, income and employment. This report is referenced under Leeworthy et al. (2018b).

This report includes ratings given by reef using visitors on the importance of, and satisfaction derived from 25 natural resource attributes, facilities and services. For presentation, a technique called “importance-performance” or “importance-satisfaction” is used. This technique is a simple but useful way in which to summarize and provide an interpretation of visitor ratings. We hope that businesses will find the information useful in marketing applications and in improving the delivery of services and facilities to visitors. Similarly, we believe that government agencies responsible for managing natural resources or providing facilities and services will find the information useful when taking the customer-satisfaction approach in their endeavors.

Mailback Survey. The information reported here was obtained from the mailback portion of the Airport Survey conducted during October 2016 to May 2017. Over 2000 on-site interviews were conducted during this eight-month sampling period at the San Juan Airport. Mailback were given to only 776 of these respondents due to delays in preparing the mailback surveys. There were 176 respondents to the mailback portion of the survey out of 776 on-site interviews, for a response rate of 22.7 percent. Response rates varied by age, household income, race/ethnicity, and whether the visitor was foreign or domestic. Generally, response rates were higher for older visitors, for visitors with higher household incomes, visitors that were White Not Hispanic, and for domestic visitors. An analysis on possible nonresponse bias was conducted and it was found that although there were significant differences in response rates by the socioeconomic factors cited above, these factors were not generally significant in explaining importance or satisfaction scores. It was concluded non-response bias did not exist. See Leeworthy et al. (2018d) for the statistical analysis on non-response bias.

2. Importance-Satisfaction

For many years, the U.S. Forest Service and many other federal, state, and local agencies that manage parks and/or other natural resources have used the National Satisfaction Index (NSI) for measuring visitor satisfaction. Satisfaction is a complex feature of the recreation/tourist experience and it is now agreed upon by most researchers that “Importance-Performance” or “Importance-Satisfaction” is a much more complete measure and provides a much simpler interpretation than the NSI. First described in the marketing literature by Martilla and James (1977), it has been described and/or used in such studies as Guadagnolo (1985), Richardson (1987), Hollenhorst, Olson, and Fortney (1992), Leeworthy and Wiley (1996) and Leeworthy and Wiley (1997).

The satisfaction questionnaire was divided into two sections to obtain the necessary information for the importance-satisfaction analysis. The first section asks the respondent to read each statement and rate the importance of each of the 25 items as it contributes to an ideal recreation/tourist setting for the activities in which they participated in Puerto Rico. Each item is rated or scored on a one to five scale (1-5) with one (1) meaning “Not Important” and five (5) meaning “Extremely Important.” The respondent was also given the choices of answering “Not Applicable” or “Don’t Know.” The second section asks the respondent to consider the same list of items they just rated for importance and to rate them for how satisfied they were with each item at the places they did their activities in Puerto Rico. Again, a five-point scale was used with one (1) meaning “Terrible” and a score of five (5) meaning “Delighted.” Respondents were also given the choices of answering either “Not Applicable” or “Don’t Know.”

The collected data presented is several ways in this report. First, the means or average scores are reported along with the estimated standard errors of the mean, the sample sizes (number of responses), and the percent of respondents that gave a rating. This latter measure is important because many respondents provide importance ratings for selected items but may not have had a chance to use a resource, facility, or service and therefore do not provide a satisfaction rating. This might lead to biases in comparing importance and satisfaction.

The second method of presentation is the bar charts showing the mean scores for each item for importance and satisfaction. It is important to note that, while both importance and satisfaction are measured on a one to five scale, the scales have different meanings and are not directly comparable. They do, however, communicate relative importance/satisfaction relationships across the different items. However, some find this harder to work with than the simpler analytical framework provided next.

The most useful analytical framework provided in importance-satisfaction analysis is the four-quadrant presentation. The four quadrants are formed by first placing the importance measurement on the vertical axis and the satisfaction measurement on the horizontal axis (see Figure 1). An additional vertical line is placed at the mean score for all 25 items on the satisfaction scale and an additional horizontal line is placed at the mean score for all 25 items on the importance scale. These two lines form a cross hair. The cross hair then separates the importance-satisfaction measurement area into four separate areas or quadrants. This allows for

interpretation as to the “*relative importance*” and “*relative satisfaction*” of each item. That is, if everyone gave high scores to all items in Rico, we would still be able to judge the relative importance and satisfaction and establish priorities.

The use of the four quadrants provides a simple but easy-to-interpret summary of results. Scores falling in the upper left quadrant are relatively high on the importance scale and relatively low on the satisfaction scale. This quadrant is labeled “**Concentrate Here.**” Scores falling in the upper right quadrant are relatively high on the importance scale and relatively high on the satisfaction scale and are labeled “**Keep up the Good Work.**” Scores falling in the lower left quadrant are relatively low on both the importance and satisfaction scale and are labeled “**Low Priority.**” And, finally, scores in the lower right quadrant are relatively low on the importance scale but relatively high on the satisfaction scale and are labeled “**Possible Overkill.**”

In general, the 25 items that reef-using visitors were asked to rate are organized into four categories. In the survey, the order of the items was mixed. Each of the items is given a letter rather than a number and so are labeled A through Y. Items A through F are labeled “**Natural Resources.**” These six items are either natural resources or attributes of natural resources such as clear water. Items H through K and M are labeled “**Natural Resource Facilities.**” These five items are either facilities that provide access to natural resources or areas or features that provide public access to natural resources. Items N through T are labeled “**Other Facilities.**” These seven items are either facilities or features of facilities that are not directly related to natural resources but are indirectly related since they represent items associated with the general infrastructure of the area. Items G, L and U through Y are labeled “**Services.**” These seven items are either services or features of a service provided to visitors. We considered separate analyses for each group but rejected this approach in favor of establishing the relative importance of each item with respect to all items. The organization into four categories was done simply as an aid to those users that have responsibilities in separate areas.

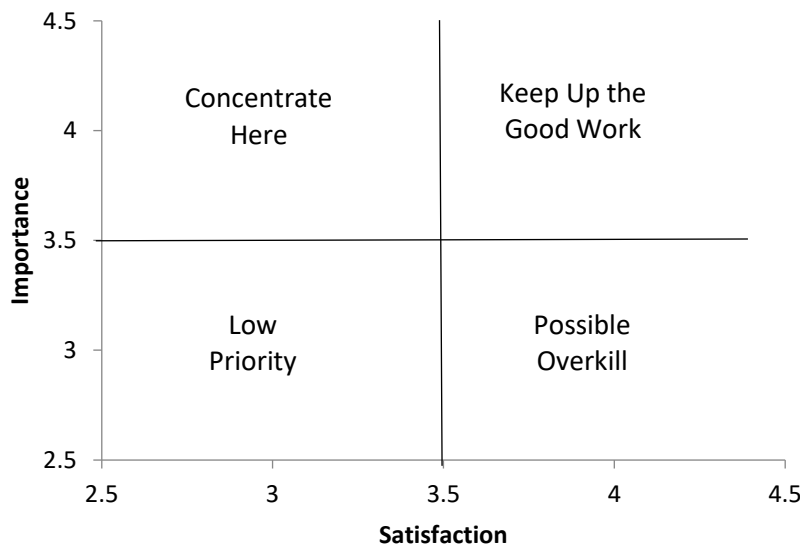


Figure 2.1 Four Quadrant Analysis

3. Importance-Satisfaction: Puerto Rico

Puerto Rico. There were 176 respondents for the importance-satisfaction ratings. Figure 3.1 shows the summarized account of the importance-satisfaction results for the results for the region. The last column will provide the percentage of respondents who provided the ratings. As previously stated under the “2. Importance-Satisfaction” heading, the results are classified by four quadrants: concentrate here, keep up the good work, possible overkill, and low priority.

Concentrate Here-

- N. Availability of Public Restrooms
- P. Well Maintained Roads and Bridges
- R. Parking
- Y. Good Maps and Signage for Navigation

Keep up the Good Work-

- A. Clear water
- B. Clean water For Swimming
- C. Amount of Living Corals of Reef
- D. Different Kinds of Fishes & Sea Life to View
- F. Control of Invasive Species
- G. Enforcement of Environmental Law
- I. Easy, Abundant, and Quality Beach and Shoreline
- L. Value of Lodging
- M. Resorts with Focus on Ecotourism
- O. Cleanliness of Streets and Sidewalks
- S. Historic Preservation
- T. Educational Posters, Signs, Brochures
- W. Customer Service and Friendliness of People
- X. Public Safety

Possible Overkill-

- E. Different Kinds of Fishes & Sea Life To Catch
- H. Artificial Reefs
- J. Marina Facilities, Boat Ramps/ Launching Facilities
- K. Mooring Buoys and Navigational Markers
- U. Availability of Tour Guides

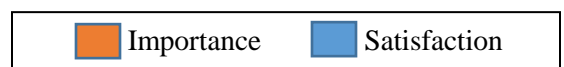
Low Priority-

- Q. Public Transportation
- V. Availability of Life Guards for Beach Safety

Cautionary Note. The results presented here are not intended as any policy statement about what either business or governments should or should not be doing. The interpretive framework for the importance-satisfaction is simply intended as a helpful guide in organizing the ratings given by visitors.

Figure 3.1 Importance/ Satisfaction Matrix Code Description, of Graphs of Means and Descriptive Statistics¹

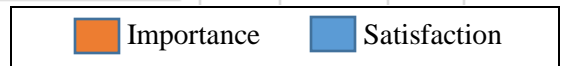
Code from Matrix- Description				Mean	Standard Error	N	% Rated
Natural Resources							
A. Clear water				4.26	0.0700	174	99.43
				4.24	0.0500	174	99.43
B. Clean Water For Swimming				4.66	0.0500	174	99.43
				4.29	0.0500	174	99.43
C.Amount of Living Corals of Reef				3.73	0.1100	149	85.14
				3.65	0.1000	149	85.14
D. Different Kinds of Fishes & Sea Life to View				3.75	0.1000	158	90.29
				3.58	0.1000	158	90.29
E. Different Kinds of Fishes & Sea Life To Catch				2.42	0.1400	132	75.43
				3.80	0.1500	132	75.43
F. Control of Invasive Species				3.78	0.1100	138	78.86
				3.95	0.1300	138	78.86
Natural Resources Facilities							
H. Artificial Reefs				2.97	0.1100	145	82.86
				3.98	0.1200	145	82.86
I. Easy, Abundant, and Quality Beach and Shoreline				4.40	0.0700	172	98.29
				4.10	0.0700	172	98.29
J. Marina Facilities, Boat Ramps/ Launching Facilities				2.67	0.1200	138	78.86
				3.84	0.1200	138	78.86
K. Mooring Buoys and Navigational Markers				2.67	0.1300	131	74.86
				3.87	0.1400	131	74.86
M. Resorts with Focus on Ecotourism				3.57	0.0900	168	96.00
				3.53	0.1100	168	96.00
Other Facilities							
N. Availability of Public Restrooms				4.05	0.0700	174	99.43
				3.32	0.0800	174	99.43
O. Cleanliness of Streets and Sidewalks				4.06	0.0700	176	100.57
				3.51	0.0900	176	100.57
P. Well Maintained Roads and Bridges				3.99	0.0700	175	100.00
				3.22	0.0800	175	100.00
Q. Public Transportation				3.33	0.0000	160	91.43
				2.98	0.1400	160	91.43
R. Parking				3.56	0.0900	169	96.57
				3.31	0.1000	169	96.57
S. Historic Preservation				4.16	0.0800	174	99.43
				3.96	0.0800	174	99.43
T. Educational Posters, Signs, Brochures				3.40	0.0800	168	96.00
				3.54	0.0800	168	96.00



¹ The average of all Importance Ratings is 3.7 and the average of all Satisfaction Ratings is 3.7.

Figure 3.1 Importance/ Satisfaction Matrix Code Description, of Graphs of Means and Descriptive Statistics (continued)

Code from Matrix- Description					Mean	Standard Error	N	% Rated
Services								
G. Enforcement of Environmental Law					4.21	0.0800	173	98.86
					3.51	0.1200	173	98.86
L. Value of Lodging					4.22	0.0700	170	97.14
					4.01	0.0700	170	97.14
U. Availability of Tour Guides					2.93	0.1000	162	92.57
					3.80	0.1000	162	92.57
V. Availability of Life Guards for Beach Safety					3.22	0.1000	167	95.43
					3.23	0.1100	167	95.43
W. Customer Service and Friendliness of People					4.31	0.0600	175	100.00
					4.20	0.0700	175	100.00
X. Public Safety					4.53	0.2319	175	100.00
					3.80	0.3126	175	100.00
Y. Good Maps and Signage for Navigation					4.26	0.2501	174	99.43
					3.45	0.3019	174	99.43



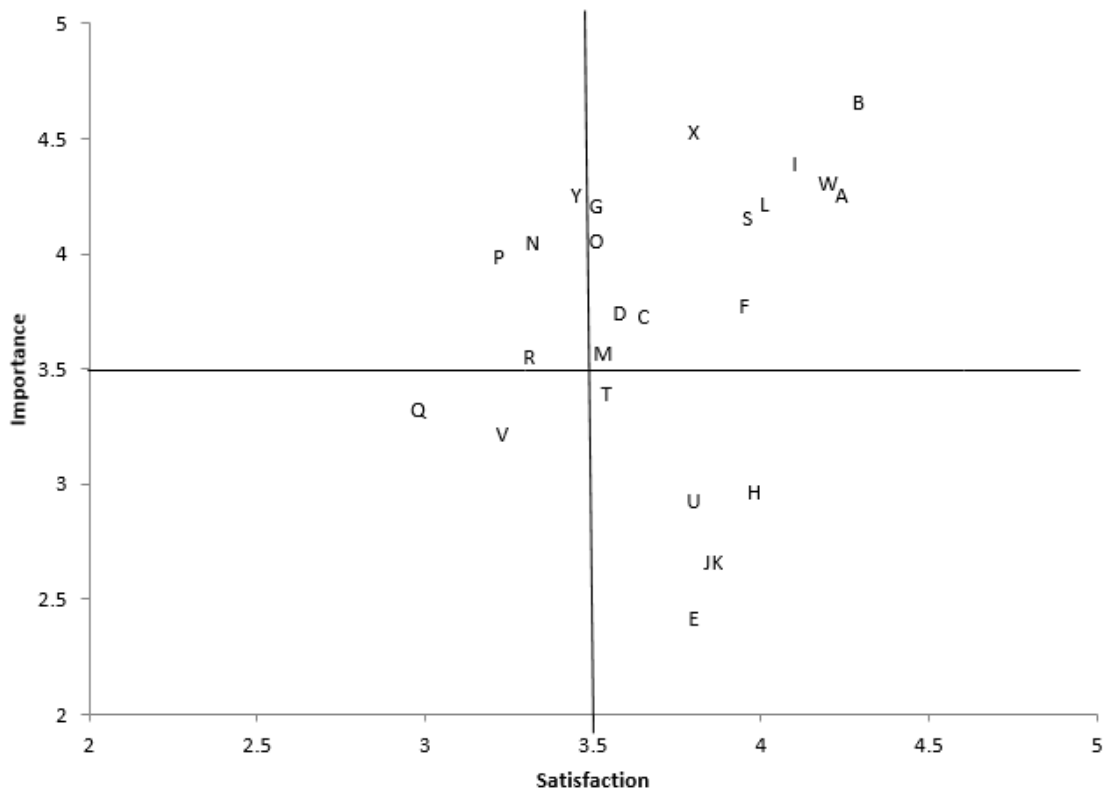


Figure 3.2 Importance/ Satisfaction Matrix: Puerto Rico

4. Five Year Comparison

Reef-using visitors that had visited Puerto Rico and used the reefs for recreation were asked for retrospective ratings for the same 25 items they rated in terms of importance and satisfaction for their satisfaction five years ago. Comparisons were then made between the current ratings and the ratings five years ago. The statistical test was a paired t-test for the differences in the means. See Leeworthy et al. (2018d) for details of the statistical tests. There were no statistically significant differences in the two mean scores for any item, indicating that there was no change in satisfaction levels over the five-year period (Table 4.1).

Table 4.1 Current Satisfaction Ratings versus Ratings Five Years Ago¹

Item	5 Years Ago Mean Rating	Current Mean Rating	Difference in Mean Ratings
1. Clear Water (high visibility)	4.24	4.24	0.00
2. Clean Water for Swimming and Other Water-Based Activities	4.19	4.29	0.10
3. Amount of Living Coral on the Reefs	3.74	3.65	-0.09
4. Many Different Kinds of Fishes and Sea Life to View	3.74	3.58	-0.16
5. Many Different Kinds of Fishes and Sea Life to Catch	3.82	3.80	-0.02
6. Control of Invasive Species	3.53	3.95	0.42
7. Enforcement of Environmental Laws and Regulations	2.89	3.51	0.62
8. Artificial Reefs (sunken ships, reef balls)	3.70	3.98	0.28
9. Easy, Abundant and Quality Beach and Shoreline Access	3.76	4.10	0.34
10. Marina Facilities, Boat Ramps/ Launching Facilities	3.37	3.84	0.47
11. Mooring Buoys and Navigational Aids	3.29	3.87	0.58
12. Value of Lodging	3.71	4.01	0.30
13. Resorts with Focus on Ecotourism	3.04	3.53	0.49
14. Availability of Public Restrooms	2.90	3.32	0.42
15. Cleanliness of Streets and Sidewalks	2.87	3.51	0.64
16. Well Maintained Roads and Bridges	3.06	3.22	0.16
17. Public Transportation	2.74	2.98	0.24
18. Parking	2.98	3.31	0.33
19. Historic Preservation	3.42	3.96	0.54
20. Educational Posters, Signs, Brochures	3.14	3.54	0.40
21. Availability of Tour Guides	3.31	3.80	0.49
22. Availability of Lifeguards for Beach Safety	3.11	3.23	0.12
23. Customer Service and Friendliness of People	3.98	4.20	0.22
24. Public Safety (areas with low crime rates)	3.46	3.80	0.34
25. Good Maps and Signage for Road Navigation	3.28	3.45	0.17

5. Expectations and Accomplishments

The satisfaction that individuals derive from various aspects of their trip can be understood by learning about their pre-trip expectations, determining from them what then actually occurred, and then asking how satisfied they were with the experience. In theory, it would be expected that if people's expectations were not met their satisfaction scores would be lower (Loomis et al., 2008). Twenty-three of the 25 items in the importance-satisfaction ratings were included for this analysis. Two of the items in the importance-satisfaction ratings were dropped (many different kinds of fish and sea life to catch and control of invasive species) and replaced by two new items (quality of restaurants and boat ramps/launching facilities separately from marina facilities).

In expectancy-discrepancy analysis, reef-using visitors were first asked about their expectations and then to what were their expectations were met (accomplished)². Differences are then calculated between the two scores and statistical tests were performed to determine if the differences were statistically significant. See Leeworthy et al. (2018d) for details of the statistical tests. Here we simply report if the differences were statistically significant. The results are summarized in Table 5.1.

The three items with the highest expectations identified by respondents were 'marine facilities' ($\bar{x}=5.61$), 'clean water for swimming and other water-based activities' ($\bar{x}=4.35$) and 'clear water' ($\bar{x}=4.29$). A measure of the quality of the experience can be tied to the ability to accomplish important components normally expected with an activity. The three items with the highest level of accomplishment indicated by respondents were 'customer service and friendliness of people' ($\bar{x}=3.97$), 'clean water for swimming and other water-based activities' ($\bar{x}=3.87$) and 'clear water' ($\bar{x}=3.84$). The item that was accomplished the least was 'availability of public restrooms' ($\bar{x}=2.84$).

For all but one of the 25 items (mooring buoys and navigation aids), mean accomplishment scores were less than mean expectation scores and statistically significant meaning reef-using visitor's expectations were not met. The expectancy-discrepancy theory holds for 18 of the 23 items with satisfaction scores less than 4.0. The theory does not hold for five of the items (Value of lodging; Easy, abundant, quality of beach and shoreline access; Customer service and friendliness of the people; Clear water; and Clean water for swimming and other water-based activities) since satisfaction for these items exceeded 4.0.

² It is possible that by asking both sets of questions after their trip this could result in a downward bias on accomplishment and expectations are held higher. However, there is no way to test this without splitting the sample in a future application.

Table 5.1 Expectancy-Discrepancy Analysis

Item	Expected Mean	Accomplished Mean	Discrepancy Mean	Satisfaction Mean
Marina Facilities	3.85	3.29	-0.56	3.84
Availability of Public Restrooms	3.53	2.84	-0.69	3.32
Public Transportation	3.42	2.88	-0.55	2.98
Parking	3.45	2.91	-0.54	3.31
Cleanliness of Street and Sidewalks	3.52	3.14	-0.38	3.51
Boat Ramps/ Launching Facilities	3.66	3.12	-0.54	N/A
Well Maintained Roads and Bridges	3.53	2.94	-0.60	3.22
Value of Lodging	3.88	3.52	-0.36	4.01
Mooring Bout and Navigational Aids	3.62	3.33	-0.29	3.87
Good Maps and Signage for Road Navigation	3.53	2.93	-0.60	3.45
Resorts with Focus on Ecotourism	3.66	3.15	-0.51	3.53
Educational Posters, Signs, Brochures	3.56	3.07	-0.50	3.54
Availability of Lifeguards for Beach Safety	3.68	2.92	-0.76	3.23
Easy, Abundant, and Quality Beach & Shoreline Access	4.03	3.62	-0.41	4.10
Enforcement of Environmental Laws and Regulations	3.62	3.16	-0.46	3.51
Public Safety	3.78	3.43	-0.35	3.80
Customer Service and Friendliness of People	4.13	3.97	-0.16	4.20
Availability of Tour Guides	3.93	3.46	-0.47	3.80
Historic Preservation	4.13	3.70	-0.43	3.96
Artificial Reef	3.83	3.59	-0.24	3.98
Quality Restaurants	4.23	3.79	-0.44	N/A
Clear Water	4.29	3.84	-0.45	4.24
Clean Water for Swimming and Other Water Based Activities	4.35	3.87	-0.48	4.29
Amount of Living Coral on the Reefs	4.03	3.26	-0.77	3.65
Many Kinds of Fish and Sea Life to View	4.01	3.10	-0.91	3.58

1. Bold differences are statistically significant at 0.05 level.

6. Conclusions and Future Research

Conclusions

Importance-satisfaction analysis revealed there were four items for which the reef-using visitors had relatively high importance scores but relatively low satisfaction scores meaning there needs to be a focus on improving these items. All four items were local infrastructure and island navigations items. For most of the items, were classified as “keep up the good work”, so generally reef-using visitors are satisfied with most of the items of importance to them.

Reef-using visitor’s expectations generally were not met for many items, and for the most part, this explained the relatively low satisfaction scores for many items. The theory is that expectations drive behavior and if expectations are not being met and satisfaction scores remain low, it is possible reef-using visitors will choose other destinations for their reef-use with implications for the local tourist-based economy. Fortunately, people’s changes in behaviors lag behind their expectations and therefore there is time to fix any problems before people change their behavior with the resulting negative impact on the economy.

Future Research

Important baselines were measured for items of importance to reef-using visitors and their satisfaction scores. Future research should replicate these measures to track the performance in meeting visitor’s preferences. The local community is the best judge of how often the measurements should be replicated. For example, in the Florida Keys, the local community wanted these ratings replicated approximately every five years.

The recent hurricanes may have affected the reefs and other island infrastructure for many of the items rated by reef-using visitors. In future restoration activities, the importance ratings may serve as a baseline against which to measure future shifts. Additionally, they may assist in developing priorities and future monitoring of visitors can be used to assess performance.

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