Puerto Rico Coral Reef Ecosystem Valuation

Economic Contribution of Reef Using Visitor Spending to the Puerto Rican Economy

April 2018

Vernon R. Leeworthy,
Danielle Schwarzmann,
Sarah Hughes,
John Vaughn,
Chase Dato, 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

University of Puerto Rico Sea Grant

Suggested Citation:

Leeworthy, V.R., Schwarzmann, D., Hughes, S., Vaughn, J., Dato, C., and Padilla, G. (2018) Economic Contribution of Reef Using Visitor Spending to the Puerto Rican Economy. Silver Spring, MD: Office of National Marine Sanctuaries. National Oceanic and Atmospheric Administration.

Puerto Rico Coral Reef Ecosystem Valuation

Economic Contribution of Reef Using Visitor Spending to the Puerto Rican Economy

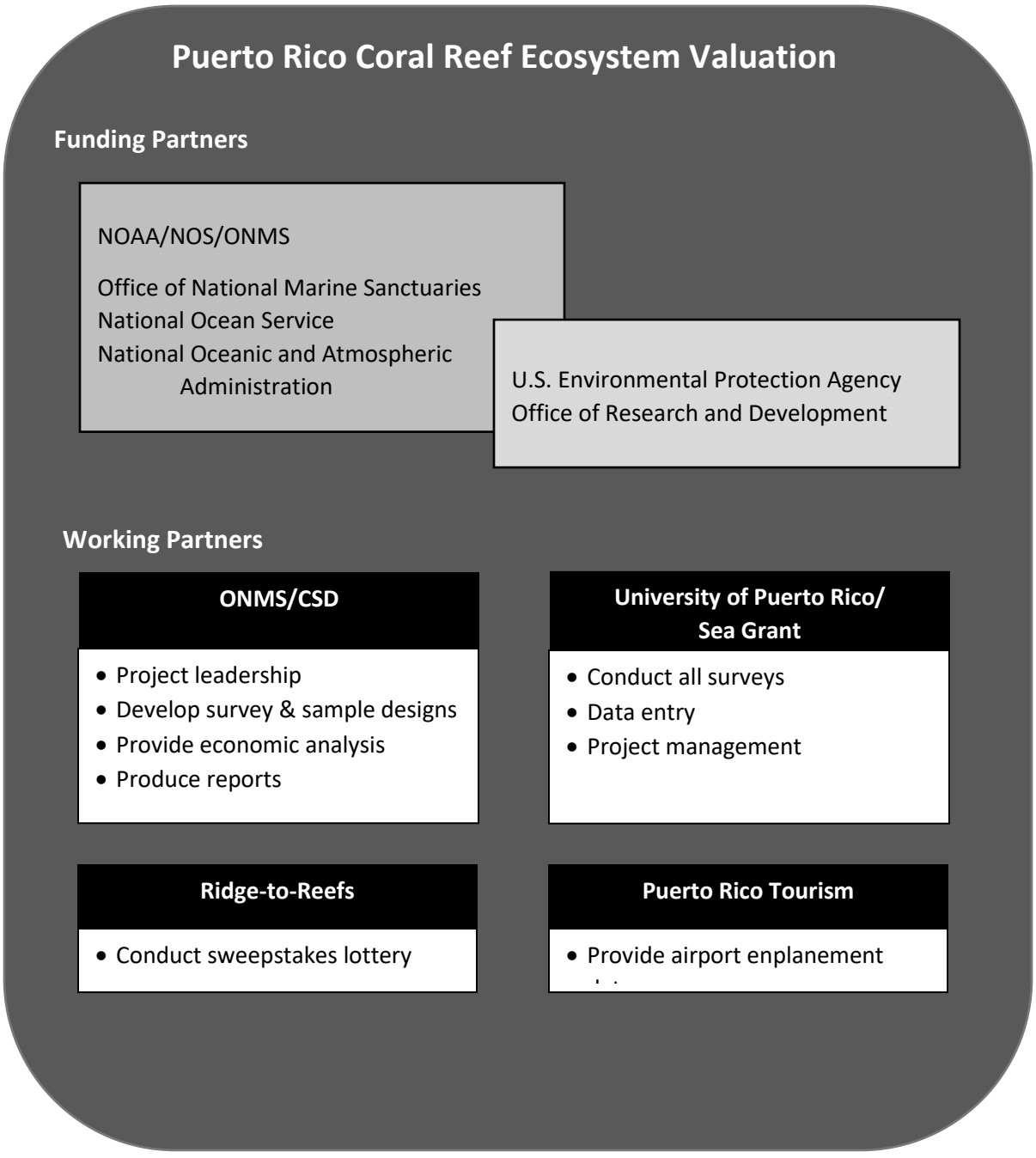

Table of Contents

List of Tables

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

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).

Local staff of NOAA's Coral Reef Conservation Program, Rob Ferguson and Antares Ramos Alvarez, provided local coordination with many key government agencies and NGOs.

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 pf 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 Caitrull (Fundacion de Culebra), Alberto Arce (Kayaking Puerto Rico), Henry Rivera (ACDEC), Cindy Villanueva (Autoridad de Conservation 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 Vaugh 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. Chase Dato analyzed data, developed tables & figures and wrote sections for the Economic Contributions 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 the second volume in the six volume series. It 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 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 3 addresses importance-satisfaction ratings by reef using visitors on 25 natural resource attributes, facilities and services. 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 second 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 third report in the series titled "Importance and Satisfaction Ratings by Reef Using Visitors in Puerto Rico" 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.

This report, 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). The information presented in this report provides information on the expenditures visitors make both within Puerto Rico and to get to Puerto Rico. Additionally, using IMPLAN, the economic contributions of visitor spending was measured. Value-added, income, employment and output/sales were estimated based upon total expenditures.

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. Mailbacks were given to only 776 of these respondents due to delays in preparing the mailback surveys. There were 159 respondents to the mailback portion of the survey out of 776 on-site interviews, for a response rate of 20.5 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 or the expenditures. It was concluded non-response bias did not exist. See Leeworthy et al. (2017d) for the statistical analysis on non-response bias.

2. Expenditures

This chapter presents total expenditures for the trip and total expenditures within Puerto Rico. Expenditures were derived by determining the person-trip cost. After the person-trip cost was estimated, the total number of person-trips estimates were then multiplied by the average person-trip expenditure to estimate total annual expenditures. Expenditures per person-day were estimated by dividing the total annual expenditures by the total annual number of person-days. For a detailed explanation of how total person-trip expenditures were calculated please see (Leeworthy et al, 2018d).

The survey used to collect this data can be found in (Leeworthy et al, 2018d). The total expenditures represent the sum of the expenditures for the entire trip. Puerto Rico expenditures include the goods and services bought that are produced by the Puerto Rico economy. Table 2.1 present the average per person-day, per person-trip and total expenditures of all visitors within Puerto Rico. Table 2.2 presents the same information, but for expenditures both within and outside of Puerto Rico. The largest portion of expenditures within Puerto Rico went to lodging, followed by transportation. However, when considering total expenditures, regardless of location, the largest portion of expenditures was transportation followed by lodging. This makes sense, since the study area (Puerto Rico) is an island, and the purchase of airfare would occur outside of the primary study area.

Table 2.1 Summary of Trip-Related Expenditure within Puerto Rico (2017$)

Category	Per Person Per Trip	Per Person Per Day	Total Expenditure
Lodging	$380.96	$44.48	$446,249,919
Food & Beverage	$319.67	$37.32	$374,447,085
Transportation	$326.78	$38.15	$382,784,401
Boating	$38.52	$4.50	$45,122,237
Fishing	$5.23	$0.61	$6,128,349
Diving	$10.88	$1.27	$12,747,74
Sightseeing	$25.79	$3.01	$30,211,407
Other Activity	$16.58	$1.94	$19,424,348
Miscellaneous	$75.07	$8.76	$87,932,859
Services	$5.41	$0.63	$6,339,583
Total	$1,204	$140	$1,411,387,940

Table 2.2 Summary of Trip-Related Expenditures both within and outside of Puerto Rico (2017$)

Category	Per Person Per Trip	Per Person Per Day	Total Expenditure
Lodging	$455.95	$53.24	$534,083,084
Food & Beverage	$320.72	$37.45	$375,685,737
Transportation	$558.12	$65.17	$653,766,679
Boating	$38.59	$4.51	$45,199,806
Fishing	$5.23	$0.61	$6,128,349
Diving	$14.34	$1.67	$16,795,162
Sightseeing	$35.71	$4.17	$41,826,646
Other Activity	$20.95	$2.45	$24,541,784
Miscellaneous	$34.59	$9.03	$90,633,402
Services	$5.88	$0.69	$6,882,601
Total	$1,490	$178	$1,795,543,250

The next table presents information on the percent of expenditures occurring with Puerto Rico by expenditure category. Nearly 100% of food and beverage expenditures are spent on the island. However, only 36% of bus fares and 39% of airline fares are purchased in Puerto Rico. Although, the question was not asked, it is possible that some of the airline fares purchased in Puerto Rico were to go from the mainland to Vieques and some of the respondents reported spending time on Puerto Rico and Vieques (Leeworthy et al., 2017d).

Table 2.3 Percent of Trip-Related Expenditures within Puerto Rico (2017$)

Category	Average Per Person Trip-Related Expenditures	Average Per Person Trip-Related Expenditures in Puerto Rico	Percent of Expenditures in Puerto Rico
Lodging/Private	$440.29	$369.01	83.8%
Lodging/Public	$15.66	$11.95	76.3%
Food & Beverages	$320.72	$319.67	99.7%
Transportation	$218.97	$195.93	89.5%
Bus Fare	$9.67	$3.47	35.9%
Airline Fare	$329.48	$127.38	38.7%
Boating	$38.59	$38.52	99.8%
Fishing	$5.23	$5.23	100.0%
Scuba Diving/Snorkeling	$14.34	$10.88	75.9%
Sightseeing	$35.71	$25.79	72.2%
Other Activity Expenditures	$20.95	$16.58	79.1%
Services	$5.88	$5.41	92.1%
Miscellaneous Expenditures	$83.25	$80.48	96.7%
Total Trip-Related Expenditures	$1,490	$1,204	80.1%

The next two tables present information on the total expenditures by detailed spending categories. The information is specific to spending that occurs within Puerto Rico. All line items that respondents were presented are included in the tables below, even if no respondent spent money on these items within the study area.

Table 2.4 Total Trip-Related Expenditures in Puerto Rico by Detailed Spending Category (2017$)

Expenditure Category on Survey	Total Expenditures
Lodging/Private	
Hotel	$335,536,255.1
Rental	$96,711,550.8
Camp	$0.0
Lodging/Public	
Hotel	$11,131,874.4
Camp	$2,870,239.3
Food & Beverages	
Food and drinks consumer at restaurants and bars	$273,080,670.4
Drinks consumed at bars and clubs during non-meal times	$30,008,714.5
Food & Beverages purchased at a store for carry-out	$71,357,700.4
Transportation	
Rental Automobile, motor home, trailer, motorcycle, etc.	$120,451,771.4
Gas & Oil = auto/RV	$14,744,501.0
Repair & service - auto/RV	$71,357,700.4
Parking fees & tolls	$7,274,195.3
Taxi fare	$15,666,203.6
Ferry	$0.0
Train	$5,818.1
Bus Fare	$0.0
Package Tour	$3,180,535.9
Any other bus fare	$883,568.3
Airline Fare	
Package Tour	$81,279,925.3
Any other airline fare	$67,934,248.5
Boating	
Boat, jet ski, wave runner, rental	$4,104,959.6
Boat fuel and oil	$0.0
Boat repairs	$0.0
Boat launch fees	$0.0
Boat slip fees or marina fees	$103,432.0
Sailing charters or sunset cruises	$40,913,846.1
Fishing	
Cut bait	$0.0
Live bait	$0.0
Daily or special fishing permits	$0.0
Fishing lines, flylines, fishnets, minnow traps	$0.0

Charter/party boat, guide service	$6,128,349.0
Scuba Diving/Snorkeling	
Rental fee for equipment	$973,554.2
Charter/party boat, guide service	$11,774,192.9
Sightseeing	
Sightseeing tours	$5,777,973.0
Glass bottom boat rides	$193,935.1
Excursions, kayak tours	$14,183,966.3
Park Entrance fees	$3,193,464.3
Admission to tourist, amusement, festivals and other commercial attractions	$3,611,717.6
Food and drinks on sightseeing tours	$3,250,351.8
Other Activity Expenditures	
Rental fee for recreation equipment	$5,758,579.8
Guide service, tour. or outfitters	$1,047,249.5
Admission to motion pictures, theatres, museums, etc.	$995,533.5
Admission to musical performances, concerts	$0.0
Spa treatments	$11,442,171.0
Fitness activities	$180,815.2
Miscellaneous Expenditures	
Film Purchases	$116,361.0
Film Developing	$0.0
Footwear	$0.0
Clothing	$38,626,703.2
Souvenirs and Gifts (not clothing)	$49,189,795.3
Services	
Barber, laundry, and other personal services	$1,672,237.9
Telephone, copying, fax, and other business services	$340,162.2
Physician, dentist, and other medical services	$4,327,183.3
Total Trip-Related Expenditures	$1,923,650,475.2

Table 2.5 Total Durable Goods Spending in Puerto Rico

Expenditure Category on Survey	Total Expenditures
Marina & Boat Storage	$0
Condo	$9,222,489.5
RV	$1,077,946.0
Total Durable Goods Spending	$10,300,435.5

3. Economic Impacts

Study Area

When people recreate in an area and spend money their expenditures contribute to the local area economies. This chapter quantifies those economic contributions of visitor spending to employment, income, value-added and output.

IMPLAN

Using the expenditures profiles presented in Chapter 2 of this report, the economic impacts of recreational activities in Puerto Rico were estimated. Table 3.1 provides a more detailed explanation of the terminology used in this report, as defined by IMPLAN.

Table 3.1 IMPLAN Economic Indicators' Definitions

Indicator	*Definitions and Relationships*
Employment	Total annual average jobs. This includes self-employed and wage and salary employees, and all full-time, part-time and seasonal jobs, based on a count of full-time/part-time averages over 12 months
Labor Income	Defines the total value paid to local workers within a region. Labor income is the income source for induced household spending estimations. Labor Income = Employee Compensation + Proprietor Income
Value Added	Comprised of Labor Income, Indirect Business Taxes (IBT), and Other Property Type Income (OPTI), Value Added demonstrates an industry's value of production over the cost of its purchasing the goods and services required to make its products. Value Added is often referred to as Gross Regional Product (GRP). Value Added = Labor Income + IBT + OPTI
Output	The total value of an industry's production, comprised of the value of Intermediate Inputs and Value Added. In IMPLAN, this is typically viewed as the value of a change in sales or the value of increased production. However, annual production is not always equal to annual sales. If production levels are higher than sales, surpluses become inventory. Because inventory does not drive additional impacts in the year it was produced, in IMPLAN, Direct industry sales = Direct Output. Output = Intermediate Inputs + Value Added

Source: Day, 2011

Impacts/contributions are defined as direct, indirect or induced. In short, direct effects are those that occur within the sector of the expenditure. Indirect effects occur as a result of spending within the primary sector on goods and services from other sectors. Induced impacts result from the wage earners within the study area spending money on goods and services within the region. The indirect plus induced effects make up what is generally referred to as the "multiplier" effects. Table 3.4 explains these types of impacts in more detail.

Table 3.2 Impact Type Definitions

Type of Impact	*Definition*
Direct Effect	The effect of spending by recreators at each business they purchased goods or services from within the study area.
Indirect Effect	The result of a sector purchasing goods and services to produce their product from other industries located within the study area.
Induced Effect	Results from spending of employee wages that stem from both the direct and indirect effects within the study area.

Economic Contributions by Study Area

The next several tables present the economic contributions resulting from the expenditures explained in Chapter 2. The contributions were estimated using IMPLAN. Table 3.3 shows the trip-related economic contributions. Tourist spending in Puerto Rico results in nearly 30,000 jobs being sustained and $935 million in labor income. The value-added or regional domestic product was roughly $1.3 billion dollars as a result of visitor spending in Puerto Rico. Table 3.4 presents the contributions from durable good expenditures (condos and RVs). This spending results in 74 jobs and roughly $3.34 million in labor income.

Table 3.3 Trip-Related Economic Contributions (2017$)

Impact Type	Employment	Labor Income	Value Added	Output
Direct Effect	22,629	$661,213,069	$901,637,460	$1,285,476,829
Indirect Effect	1,795	$85,387,951	$121,497,774	$189,777,963
Induced Effect	5,043	$189,351,059	$322,348,161	$489,378,653
Total Effect	29,467	$935,952,079	$1,345,483,394	$1,964,633,445

Table 3.4 Durable Good Related Economic Contributions (2017$)

Impact Type	Employment	Labor Income	Value Added	Output
Direct Effect	30	$1,675,379	$6,579,497	$10,377,721
Indirect Effect	26	$992,102	$1,430,958	$2,105,245
Induced Effect	18	$684,548	$1,165,363	$1,769,217
Total Effect	74	$3,352,029	$9,175,819	$14,252,183

Multiplier Estimates

Chapter 2 presented expenditures for Puerto Rico and this chapter has presented the economic contributions of those expenditures. Using the previous tables in this chapter, multipliers can be developed. These multipliers tell us how much impact is generated per dollar of spending for labor income, value-added and output. For employment, the multiplier is the number of employees per $100,000 in spending.

The multipliers can be used to estimate the economic impact of new spending projected from a project or management action. For example, suppose a marketing campaign increased trip-related spending by visitors to Puerto Rico by $100,000. We would estimate that the spending would generate 1.53 more employees, $49,000 in labor income, $70,000 in value-added and $102,000 in total output in the OC local economy.

Table 3.5 Multipliers for Puerto Rico's Trip Related Expenditures

Type of Spending	*Employment*[1]	*Labor Income*[2]	*Value-Added*[2]	*Output*[2]
Trip-Related	1.53	0.49	0.70	1.02
Durable Goods	0.72	0.33	0.89	1.38

1. Number of employees per $100,000 in spending
2. Dollars generated per dollar of spending

4. Conclusions and Future Research

Conclusion

The economic impact analysis report completed revealed that reef using visitors to Puerto Rico spend over $1.9 billion annually within Puerto Rico. The visitors spend most heavily in the service sector, with lodging, food and beverage and transportation being the three largest expenditure categories. Further, these expenditures support over 3% of jobs, account for nearly 4% of total income to the region and generate nearly $2 billion in economic output to Puerto Rico.

Future Research

Important baseline data was gathered prior to Hurricane Maria. Future research should replicate these measures to determine if, and to what extent, the hurricane impacted the economy of Puerto Rico. Using metrics like expenditures, employment, labor income and output, the extent of the impact could be estimated. Even if this survey research is not replicated, the expenditure profiles developed in this report could be used with visitation estimates in the year or years following the natural disaster.

Further, future measures could collect expenditure data in both the winter and summer seasons to determine if there are difference among spending profiles based upon the season. The work here, did not collect enough observations in each season to develop separate spending profiles. Disaggregated information could be useful to determine if the visitors and their expenditures vary based upon the time of year they visit.

References

Day, Francis. 2011. Principles of Impact Analysis & IMPLAN Applications. First Edition. MIG.

Leeworthy, V.R., Schwarzmann, D., Hughes, S., Vaughn, J., Harris, D., Dato, C. and Padilla, G. (2018a) Visitor Profiles: Reef Users, Puerto Rico Coral Reef Valuation. Silver Spring, MD: Office of National Marine Sanctuaries. National Oceanic and Atmospheric Administration.

Leeworthy, V.R., Schwarzmann, D., Hughes, S., Vaughn, J., Harris, D. and Padilla, G. (2018b) Importance-Satisfaction Ratings: Reef Users, Puerto Rico Coral Reef Valuation. Silver Spring, MD: Office of National Marine Sanctuaries. National Oceanic and Atmospheric Administration.

Leeworthy, V.R., Schwarzmann, D., Hughes, S., Vaughn, J., Dato, C. and Padilla, G. (2018c) Economic Impact/Contribution of Spending on Puerto Rico's Economy: Reef Users, Puerto Rico Coral Reef Valuation. Silver Spring, MD: Office of National Marine Sanctuaries. National Oceanic and Atmospheric Administration.

Leeworthy, V.R., Schwarzmann, D., Hughes, S., Vaughn, J., Harris, D., Dato, C. and Padilla, G. (2018d) Technical Appendix: Estimation Methods Used for Visitor Profiles, Importance-Satisfaction Ratings and Economic Contribution/Impact of Spending: Reef Users, Puerto Rico Coral Reef Valuation. Silver Spring, MD: Office of National Marine Sanctuaries. National Oceanic and Atmospheric Administration.

SAS Institute, Inc. 2004. SAS/STAT 9.1 User's Guide and Version 9.4 Software, Cary, NC, USA.

StataCorp. 2015. *Stata Statistical Software: Release 14*. College Station, TX: StataCorp LP.