

PIER 2020 Annual Report

Puerto Rico Sea Grant

Official Level of Effort - Only Approved Funding

Report Generated by YULISSA GARCIA on 12/13/2021

JUMP TO REPORT SECTION

[Impacts & Accomplishments](#)

[Leveraged Funding](#)

[Performance Measures](#)

[Program Metrics](#)

[Back to Top](#)

2020 Level of Effort

National Focus Area Name	SG Federal	Match	Pass Thru	Federal+ Match + Pass Thru	LOE without Leverage (%)	Leveraged (Managed)	LOE with Leverage (%)
Healthy Coastal Ecosystems	\$520,001	\$292,395	\$0	\$812,396	36 %	\$45,680	35 %
Sustainable Fisheries and Aquaculture	\$346,607	\$162,507	\$0	\$509,114	23 %	\$45,680	23 %
Resilient Communities and Economies	\$236,676	\$132,756	\$3,500	\$372,932	17 %	\$45,680	17 %
Environmental Literacy and Workforce Development	\$308,608	\$245,317	\$0	\$553,925	25 %	\$45,680	25 %
TOTAL ALL FOCUS AREAS:	\$1,411,892	\$832,975	\$3,500	\$2,248,367	100 %	\$182,720	100 %

[Back to Top](#)

2020 Impacts & Accomplishments

Empowered Local Community Removes 1,600 Pounds of Trash from Coastal Habitats and Promotes Behavior Change Regarding Proper Disposal of Marine Debris

NATIONAL FOCUS AREAS: Healthy Coastal Ecosystems

- Impact
- Approved

RECAP: Puerto Rico Sea Grant empowers local community leaders to take charge in an educational effort to change attitudes of resource users with respect to the proper disposal of marine debris, removing 1,600 pounds of marine debris, improving ecosystem health and enhancing recreational beach activities.

PROGRAM FOCUS AREAS: Healthy Ecosystems and Habitats

Relevance: The accumulation of debris on public beaches and neighboring marine ecosystems continues to threaten ecosystem function, public health, recreational activities, and beach-related economic opportunities. Despite the recognition that marine debris is a deterrent to recreational and economic opportunities, community members need technical, environmental and logistical assistance to become part of the solution.

Response: Puerto Rico Sea Grant advised and empowered AmandOcéano, and Caño La Boquilla Volunteers to kick-off their educational efforts to reduce marine debris, change irresponsible practices about solid waste disposal and create awareness about the impacts of marine debris in the economy and coastal ecosystems.

Results: Empowered by the advice and educational materials provided by PRSG AmandOcéano and Caño La Boquilla Volunteers coordinated several coastal cleanups and successfully removed a total of 1,600 pounds of marine debris from 30 acres of shoreline on public beaches, creating awareness and changing irresponsible attitudes of resource users.

PARTNERS: Mayaguezanos Por la Salud y el Ambiente;

Local Community Divert 340 Pounds of Prescribed Drugs, Protecting the Environment of the Western Puerto Rico

NATIONAL FOCUS AREAS: Healthy Coastal Ecosystems

- Impact
- Approved

RECAP: Puerto Rico Sea Grant empowers residents to participate in the DEA-National Prescription Drug Take Back Day to change attitudes with respect to the proper disposal of prescription drugs, improving ecosystem health and enhancing water quality.

PROGRAM FOCUS AREAS: Healthy Ecosystems and Habitats

Relevance: The accumulation of prescribed drugs in the home cabinet, that eventually could reach the drainage system of neighborhoods, threaten public health, water quality and the health of the ecosystems, is a serious problem in recent years. Residents and citizens need environmental and logistical assistance to become part of the solution, disposing medications in a safe way.

Response: Puerto Rico Sea Grant in collaboration with LOMAS Community Coalition, a recent community organization, participated in the DEA-National Prescription Drug Take Back Day, promoting citizen collection of prescribed drugs, disposing them in the containers prepared by the DEA and protecting the natural environments from the improper disposal of prescribed drugs.

Results: Empowered by the advice and educational materials provided by PRSG, DEA and LCC, more than 10 volunteers and 20 collaborators participated, for the first time, in the National DEA Take Back Day, removing 340 pounds of prescribed and unused drugs from home cabinet, creating awareness, and protecting the environment through the proper disposal of unused drugs and medicines.

PARTNERS: Agricultural Coop Extension Service, UPR;

ASSOCIATED PROJECT(S):
MARINE OUTREACH PROGRAM (2018 - 2021)

[Back to Top](#)

PRSG's Continuous Educational Efforts and Advice Inspire Community Coastal Restoration at the Caño Boquilla Wetland System

NATIONAL FOCUS AREAS: Healthy Coastal Ecosystems

- Impact
- Approved

RECAP: Puerto Rico Sea Grant leads the community driven restoration of 160 linear feet of protected shoreline and riverine habitats from The Caño Boquilla Wetland System (CBWS) that were severely impacted by Hurricane Maria.

PROGRAM FOCUS AREAS: Healthy Ecosystems and Habitats

Relevance: The Caño Boquilla Wetland System (CBWS) was designated in 2002 as the First Coastal Nature Reserve in the Municipality of Mayaguez because of its biological, historical, and archaeological value. Hurricane Maria severely impacted the coastal zone of the CBWS causing massive coastal deforestation and loss of essential habitat for protected bird species and marine turtles.

Response: Puerto Rico Sea Grant activated local partners to develop and implement a series of restoration initiatives to advance community knowledge and commitment and contribute to the post-hurricane recovery phase.

Results: After years of guiding and advising residents, the development of conservation and resilience capacities emerge from the community to protect life and property from the challenges posed by extreme weather events (climate change). The successful advancement and implementation of this project included four (4) reforestation events where twenty-five (25) volunteers removed invasive plants and coastal debris, and planted seventy-eight (78) new native coastal tree units.

PARTNERS: Mayaguezanos Por la Salud y el Ambiente; Dewey University; Agricultural Coop Extension Service, UPR; National Fish and Wildlife Foundation (NFWF); Natural Resources Conservation Service (USDA, NRCS);

ASSOCIATED PROJECT(S):
MARINE OUTREACH PROGRAM (2018 - 2021)

[Back to Top](#)

Puerto Rico Sea Grant Delivers Lifeline to Artisanal Fishermen Plummetered by Major Earthquakes

NATIONAL FOCUS AREAS: Sustainable Fisheries and Aquaculture

- Impact
- Approved

RECAP: Puerto Rico Sea Grant channels donations to aid a group of local artisanal fishermen from Guánica after major earthquakes forced them to live under makeshift tents outside their badly damaged homes.

PROGRAM FOCUS AREAS: Sustainable Fisheries and Aquaculture

Relevance: A combination of declining fish stocks, degraded habitats, high operational costs, natural hazards (hurricanes, earthquakes) and economic austerity has affected the socioeconomic status of Puerto Rico's artisanal fishermen forcing them to find other means of making a living and reducing uncertainty. After being struck by a major earthquake swarm that left over 40,000 people homeless and caused an estimated \$3.1 billion in financial losses, fishermen from Guánica resisted to be relocated to formal government shelters for fear that looters would take what little they had left.

Response: PRSG met with leaders of the Asociacion de Pescadores Bo. Salinas Providencia Inc. to personally deliver basic necessity items obtained from philanthropic donor groups. Once the situation stabilized, PRSG assisted fishermen with the formal application process for government financial aid programs designed to mitigate the economic and infrastructure losses caused by the unceasing earthquakes.

Results: At least fifteen (15) fishermen from the Asociación de Pescadores Bo. Salinas Providencia Inc. were able to regain their capacity to generate income from traditional fishing activities while remaining on their long-established traditional coastal communities.

PARTNERS: None listed in Database

ASSOCIATED PROJECT(S):

[MARINE OUTREACH PROGRAM \(2018 - 2021\)](#)

[Back to Top](#)

Puerto Rico Sea Grant Effort Leads to Creation of a New Business for Production of Aquaculture Feed René: creo que en este impacto

NATIONAL FOCUS AREAS: Sustainable Fisheries and Aquaculture

- Impact
- Approved

RECAP: Two students of the Animal Science Program at UPRM were positively impacted and recruited to choose aquaculture careers through a formal three credit course developed by Puerto Rico Sea Grant.

PROGRAM FOCUS AREAS: Sustainable Fisheries and Aquaculture

Relevance: Future increases in seafood availability and the variety of aquatic species will depend on the continued development and expansion of aquaculture as an essential component of the world's food supply. However, there is an urgent need for information with respect to scientific and technical aspects of marine culture, including: nutrition and feeds, health and disease, spawning and larval rearing technology and genetics of cultured species.

Response: Puerto Rico Sea Grant collaborated with the University of Puerto Rico, Mayaguez Campus, Animal Science Program to design and offer a three-credit course focused on management practices used in the culture and production of important aquaculture species. Introduction to Aquaculture (CIAN 4050) seeks to develop a cadre of professionals with the necessary skills to work on established aquaculture businesses and stimulate graduate studies in this field.

Results: Twenty (20) undergraduate students from the Animal Science Program of the College of Agricultural Sciences enrolled and approved the three-credit course Introduction to Aquaculture. One of the participants formally started a business for production of aquaculture feed with locally grown products while another former student will be conducting graduate research on the application of Integrated Multitrophic Aquaculture Systems in Puerto Rico.

PARTNERS: None listed in Database

ASSOCIATED PROJECT(S):

[MARINE OUTREACH PROGRAM \(2018 - 2021\)](#)

[Back to Top](#)

Puerto Rico Sea Grant Connects Teachers to Marine Science Through Professional Development Opportunities to Enhance Ocean Literacy

NATIONAL FOCUS AREAS: Environmental Literacy and Workforce Development

- Impact
- Approved

RECAP: The teacher-training model developed by Puerto Rico Sea Grant received high marks from educators. The model instructs participants on marine topics, facilitates educational resources, offers strategies and motivates teachers to keep participating in the program in order to enhance ocean literacy.

PROGRAM FOCUS AREAS: Environmental Literacy and Workforce Development

RELEVANCE: Most Puerto Rican teachers lack the training, educational background, and resources to incorporate marine science topics relevant to Puerto Rico into their curricula, resulting in K-12 students lacking marine literacy skills. Therefore, it is imperative to create online and face to face trainings for educators in marine topics to facilitate the incorporation of these topics into their classroom.

RESPONSE: PRSG developed (1) face to face and (3) online workshops for K-12 teachers and informal educators that addressed topics related to coastal ecosystems and coastal resilience.

RESULTS: PRSG trained a total of 64 teachers of K-12 levels in marine science subjects. This effort had an impact and economic savings of \$11,200.00 to the Department of Education of Puerto Rico for the training of these teachers. They received updated information and educational resources that enrich the teaching-learning process. Pre and post assessments reflected 72% in participants' knowledge gain.

PARTNERS: Puerto Rico Department of Education;

ASSOCIATED PROJECT(S):
[MARINE EDUCATION \(2018 - 2021\)](#)

[Back to Top](#)

Puerto Rico Sea Grant Program Redesigned the Curricular Guides to Provide Online Courses and Distance Trainings

NATIONAL FOCUS AREAS: Environmental Literacy and Workforce Development

- Impact
- Approved

RECAP: Due to the demands imposed on teachers during the COVID-19 pandemic, PRSG redesigned the mangrove and climate change guides, adapting them to the distance-learning format. The Puerto Rico Department of Education is implementing these modified guides into their offered curriculum.

PROGRAM FOCUS AREAS: Environmental Literacy and Workforce Development

RELEVANCE: We are living a historic moment that represents a great challenge for education not just in Puerto Rico but in the world. The need to employ distance teaching, demands a shift from the way this process takes place. It is imperative, now more than ever, to develop educational material and alternative teaching methods to help us provide students and teachers with the essential tools to adapt and face the challenges in our new reality.

RESPONSE: PRSG redesigned and adapted the Mangrove and Climate Change curriculum guides to provide instructors opportunities to offer online courses and distance trainings. Through this effort we provide the necessary tool to insert these topics into their curriculum using this new teaching modality. Both the content as well as the activities were made interactive to facilitate student access to the different platforms and study the topics online, preserving the integrity and the quality of the original material. Besides these two guides, we are also redesigning the Seagrasses and the Coral Reefs guides. Similarly, we are designing a laboratory manual about marine and coastal resources so we can offer an additional tool to help instructors. All curricular materials are being translated to English to provide access to our clientele of the USVI.

RESULTS: The Puerto Rico Department of Education (PRDE) is implementing the newly designed educational guide in Puerto Rico schools. At the present, 210 elementary level teachers are being trained, and teachers are in turn transferring the gained knowledge to their students through the distance learning modality.

PARTNERS: Puerto Rico Department of Education;

ASSOCIATED PROJECT(S):
[MARINE EDUCATION \(2018 - 2021\)](#)
[COMMUNICATIONS AND PUBLICATIONS \(2018 - 2021\)](#)

[Back to Top](#)

Virgin Islands Marine Advisory Service Efforts Institutes Sea Grant as the Marine Debris Leader in the USVI

NATIONAL FOCUS AREAS: Environmental Literacy and Workforce Development

- Impact
- Approved

RECAP: PRSG's Virgin Islands Marine Advisory Service continues to increase awareness of the issue of marine debris through routine beach cleanups and virtual presentations continuing to reduce coastal litter and instill environmental stewardship ethics throughout the larger USVI community.

PROGRAM FOCUS AREAS: Environmental Literacy and Workforce Development

Relevance: Marine debris is a global pervasive problem of which the VI are not exempt. It is a deterrent to tourism, a human health hazard, degrades marine habitats and impacts marine organisms. Past studies have shown that about 80% of VI marine debris comes from land-based sources. If we are to mitigate this problem, we must increase community awareness and engage the community in actions that will result in behavior change. Participating in coastal clean-ups allows participants to engage in activities that benefit the marine environment and promote a sense of stewardship and behavior change.

Response: VIMAS coordinated six (6) Coastweeks cleanups, removing approximately 475 pounds of debris. Marine debris data was collected, and a marine debris activity book developed and disseminated among USVI educators. VIMAS was awarded \$62,043.94 in external funding from the Department of Planning and Natural Resources to coordinate 3 removal-based cleanups of approximately 5 tons of debris created by Hurricane Irma. Continued support from the NOAA Marine Debris Program resulted in the facilitation of the first ever, Great Mangrove cleanup event on St. Croix (Salt River Bay) which engaged 82 volunteers, covered 1.8 miles of mangrove shorelines, and removed 879.64 pounds of debris. This project also enabled the coordination of the first of two marine debris action plan workshops (virtual), which had 70 participants from 28 different government, NGO, non-profit, private, and industry organizations. VIMAS has also received \$55,000 in external funding support from the Community Foundation of the Virgin Islands and The Ocean Conservancy to support the purchasing of 7 glass crushers to be distributed between St. Croix and St. Thomas.

Results: Through Coastweeks and other NOAA funded efforts, VIMAS has been able to raise funding close to \$100,000, removed 5 tons of debris from the territory and recycle glass waste specifically to help improve the quality of coastal resources.

PARTNERS: Ocean Conservancy; University of Virgin Islands; Virgin Islands Department of Education; Virgin Islands Department of Tourism (VIDOT);

ASSOCIATED PROJECT(S):

[VIRGIN ISLANDS MARINE ADVISORY SERVICE \(2018 - 2021\)](#)

[Back to Top](#)

PRSG Researchers Map Ciguatoxin Hotspots to Help Predict Ciguatera Areas

NATIONAL FOCUS AREAS: Sustainable Fisheries and Aquaculture

- Accomplishment
- Approved

RECAP: PRSG researchers mapping effort, will help predict ciguatera areas and the ECOPATH model will produce a time course after an algal bloom is detected.

PROGRAM FOCUS AREAS: Sustainable Fisheries and Aquaculture

RELEVANCE: Ciguatoxin is a serious human health issue in tropical areas where people consume reef fishes. Ciguatera losses in the US are estimated at \$15 to \$22 million annually due to increased hospitalizations, lost work and lost fisheries. Globally, there are about 25,000 - 50,000 cases reported annually, with many of these cases occurring in Puerto Rico and the U.S. Virgin Islands (USVI) alone (Tosteson, 1995).

RESPONSE: PRSG researchers mapped CTX hotspots in Puerto Rico and St. Thomas, USVI through various key informants from the commercial and recreational fishing sector and seafood dealers in the region with expert knowledge of the fisheries and species involved.

RESULTS: Hotspots in Puerto Rico and USVI for ciguatoxin (CTX) have been identified by ethnographic fieldwork, with species of fishes commonly associated with the disease enumerated. Fishes from CTX hotspots and cold spots have been tested using the neuroblastoma N2A cellular bioassays. Hotspot areas have toxic fishes (great barracuda and hogfish), but the cold spot areas have no toxin in the fishes tested so far (great barracuda and hogfish among others). Gambieridiscus sp. dinoflagellates have been positively identified from hotspot areas. Species and strains are being characterized now with the PCR reaction, and cell counts are being determined for use in the food web model.

PARTNERS: East Carolina University (ECU);

ASSOCIATED PROJECT(S):

[CIGUATOXIN DETECTION AND MODEL PREDICTIONS FOR USE IN FISHERIES MANAGEMENT IN PUERTO RICO \(2018 - 2019\)](#)

The Puerto Rico Sea Grant Program translates the mangrove forest curricular guide into English

NATIONAL FOCUS AREAS: Environmental Literacy and Workforce Development

- Accomplishment
- Approved

RECAP: Due to the lack of English-Spanish bilingual educational materials educating school communities about the importance of conserving our marine and coastal resources, PRSG translated the originally-Spanish The Mangrove Forest educational guide into English. Information about this topic is more accessible to a larger number of students within, and outside of, the US Virgin Islands and Puerto Rico.

PROGRAM FOCUS AREAS: Environmental Literacy and Workforce Development

RELEVANCE: Extreme climate events are severely affecting US Virgin Islands and Puerto Rico's coasts as well as the rest of the world. Protecting the mangrove forest ecosystem is crucially important now more than ever before, since these are elements that help minimize climate change impacts in these areas. To carry this out, it is vital that children, youths and adults are well educated about coastal and marine resources and their functions. In this manner, the population can be made aware of its importance and achieve a behavioral change aimed at sustainable living that allows us to become more resilient to the risks we are facing. There is currently a marked lack of bilingual educational materials (Spanish and English) for teachers to provide this topic in class.

RESPONSE: Puerto Rico Sea Grant has translated The Mangrove Forest educational guide into English, to provide educators in bilingual schools both in Puerto Rico and other countries such as the United States and the US Virgin Islands with the necessary tools to teach this subject in their classrooms. The students' access to this information is therefore enhanced.

RESULTS: Public and private bilingual schools in Puerto Rico and the US Virgin Islands can access this material and include it in their curriculums at all educational levels. Furthermore, the educational systems in other English-speaking countries featuring this ecosystem on their coasts can also have access to a useful and approachable tool to aid the teaching and learning process regarding coastal conservation.

PARTNERS: None listed in Database

ASSOCIATED PROJECT(S):

[MARINE EDUCATION \(2018 - 2021\)](#)

[COMMUNICATIONS AND PUBLICATIONS \(2018 - 2021\)](#)

[Back to Top](#)

PRSG Researchers Identify First Time Occurrence of Introduced Ascidian Species in the Atlantic

NATIONAL FOCUS AREAS: Healthy Coastal Ecosystems

- Accomplishment
- Approved

RECAP: PRSG research provides resource managers with a practical tool kit to help prevent local ecosystem damage and economic losses from invasive species introduction, while integrating outreach activities to increase stakeholder awareness and stewardship of Puerto Rican waters.

PROGRAM FOCUS AREAS: Healthy Ecosystems and Habitats

RELEVANCE: Biological invasions have been estimated to cost \$314 billion per year to the US economy. Critical to management are cost-efficient assessment tools to quickly detect the arrival of new species, monitor the spread of established ones, understand the introduction pathways utilized by invasive species, and design adequate containment and eradication plans.

RESPONSE: PRSG funded a project that focuses on ascidians as bioindicators of invasive species introductions, spread and ecosystem impacts. Through extensive on-site surveys, researchers have constructed a Puerto Rican ascidian 'Species Catalogue', a 'Watch List', and will design an accessible, web-based 'Assessment Tool' to identify, monitor and manage species introductions along the Puerto Rican coastline.

RESULTS: Researchers identified 47 ascidian species in Puerto Rican harbors and marinas: 12 native, 13 cryptogenic (of unknown origin), 11 introduced, and 11 unclassified. We report for the first time the occurrence of *Phallusia* cf. *philippinensis* in the Atlantic. Ascidian community structure did not differ across geographic locations and distances between marinas; however, marina size had a significant effect on species richness and composition. On-site training sessions and catalogue distribution to stakeholders were conducted to encourage continuous species monitoring and immediate reporting of any perceived anomaly.

PARTNERS: University of North Carolina, Wilmington (UNCW);

ASSOCIATED PROJECT(S):

Benthic Foraminifera and the FORAM Index: Application and Implementation in the Coral Reef Monitoring Plan in Jobos Bay National Estuarine Research Reserve System in Puerto Rico

NATIONAL FOCUS AREAS: Healthy Coastal Ecosystems

- Accomplishment
- Approved

RECAP: PRSG research project shows fore reef of JOBANERR is an environment not conducive for reef growth and unsuitable for recovery.

PROGRAM FOCUS AREAS: Healthy Ecosystems and Habitats

RELEVANCE: Implementing benthic foraminifers (shelled protists) and its associated FORAM-Index as an indicator of coral health provides stakeholders a fast response bioindicator that will serve as an "early" warning system for coral reef monitoring.

RESPONSE: PRSG research project is currently evaluating the application of benthic foraminifera (shelled protists) as a proxy of coral reef water quality. By engaging in a multi-year seasonal study, researchers aim to identify the optimal sampling sites, as well as the best time of the year, to maximize the efforts of Jobos Bay National Estuarine Research Reserve personnel.

RESULTS: Although no relation is observed between the recorded abiotic variables and Foram Index, preliminary results are of importance for the resource managers (primary stakeholders) since it is indicating that the conditions for Cayo Caribe are much stressed and they can take proactive action. Once all the data is gathered and analyzed, discussions will take place with regards to the feasibility of the Foram Index and the possibility of amending current monitoring policies in Jobos Bay to use this index to monitor and assess coral health.

PARTNERS: Florida A&M University (FAMU); Puerto Rico Department of Natural and Environmental Resources; Jobos Bay National Estuarine Research Reserve, Department of Natural and Environmental Resources;

ASSOCIATED PROJECT(S):

BENTHIC FORAMINIFERA AND THE FORAM INDEX: APPLICATION AND IMPLEMENTATION IN THE CORAL REEF MONITORING PLAN IN JOBOS BAY NATIONAL ESTUARINE RESEARCH RESERVE SYSTEM IN PUERTO RICO (2018 - 2019)

[Back to Top](#)

Understanding Direct and Indirect Land-based Sources of Pollution on Early Life History Stages of Corals

NATIONAL FOCUS AREAS: Healthy Coastal Ecosystems

- Accomplishment
- Approved

RECAP: PRSG project will help us understand how human development affects the early life history of reef-building corals and identify management strategies to conserve reefs and maintain their contributions to ecosystem function and economies.

PROGRAM FOCUS AREAS: Healthy Ecosystems and Habitats

RELEVANCE: Vulnerable early life history stages of corals, such as settlers and juveniles, are particularly susceptible to both anthropogenic stressors and competitive interactions, which may act synergistically to amplify any negative outcomes. There has been little work done on quantifying impacts to early life history stages of corals in the US Virgin Islands, and this project aims to fill that research gap and inform management strategies related to impacts of multiple stressors on coral recruitment success.

RESPONSE: PRSG research addresses gaps in our knowledge of coral recruitment rates and juvenile abundance and survival by quantifying recruitment and juvenile success at sites exposed to different levels of impact from human development. Researchers will assess water quality at these sites by measuring sediment accumulation rates and nutrient signatures, and determine how water quality and associated benthic communities differ between coral reefs near highly developed watersheds (high impact) compared with less developed watersheds (low impact).

RESULTS: Information from this study will help us to understand how human development affects the early life history of reef-building corals and identify management strategies to conserve reefs and maintain their contributions to ecosystem function and economies.

PARTNERS: University of Virgin Islands; University of Mississippi (OLE MISS); University of Alabama (UA);

ASSOCIATED PROJECT(S):

UNDERSTANDING DIRECT AND INDIRECT IMPACTS OF LAND-BASED SOURCES OF POLLUTION ON EARLY LIFE HISTORY STAGES OF CORALS (2018 - 2019)

[Back to Top](#)

Community Alliance for a Healthy Watershed Ecosystem

NATIONAL FOCUS AREAS: Healthy Coastal Ecosystems

- Accomplishment
- Approved

RECAP: Puerto Rico Sea Grant leads a remote outreach project to capacitate and advise three (3) non-governmental organizations towards the implementation of best management practices to control non-point source pollution (NPSP) in the coastal zone of the Río Grande de Añasco, Río Guanajibo and Río Culebrinas Watersheds

PROGRAM FOCUS AREAS: Healthy Ecosystems and Habitats

Relevance: Pollution due to the nonpoint sources is associated with the rain that flows over the land surface which contaminates the run-off that reaches the surface, ground, and coastal waters. In Puerto Rico, the NPSP sources were grouped in four categories: (1) Urban Areas, (2) Agriculture, (3) Hydromodifications (canalizations) and (4) Marinas. During Covid-19 pandemic, our outreach efforts must be remote, and many stakeholders must be capacitated in the use of different remote platforms (ZOOM, Go-To-Meeting, Google Meet and others) to continue the Sea Grant extension projects.

Response: Puerto Rico Sea Grant remotely advised, capacitated, and trained, three (3) non-governmental organizations in NPSP best management practices to address water quality degradation, green infrastructure practices, sustainable tourism alternatives, erosion control studies, public statements preparation, social media project promotion and use of the common webinars platforms to reach our users and stakeholders.

Results: The PRSG remote outreach project helped maintain the NGO efforts to continue their activities towards restoration and protection of their valuable natural ecosystems in the Western Puerto Rico. The project partners participated in remote public hearings and meetings, continued the working group meetings, and prepared technical letters for legislature and local government towards the protection of the coastal zone of the Río Grande de Añasco, Río Guanajibo and Río Culebrinas Watersheds.

PARTNERS: Mayaguezanos Por la Salud y el Ambiente; Ciudadanos Aguadeños Pro Conservación del Ambiente;

ASSOCIATED PROJECT(S):

[MARINE OUTREACH PROGRAM \(2018 - 2021\)](#)

[Back to Top](#)

PRSG Develops Virtual Efforts for Virgin Islands High School Students Climate Education

NATIONAL FOCUS AREAS: Healthy Coastal Ecosystems; Resilient Communities and Economies

- Accomplishment
- Approved

RECAP: PRSG's Virgin Islands Marine Advisory Service, in partnership with the USVI Storm Strong Program, provided climate science education to 35 families on St. Thomas, an effort that will be expanded to St. Croix and St. John by 2022.

PROGRAM FOCUS AREAS: Healthy Ecosystems and Habitats; Resilient Communities and Economies

Relevance: Island communities are particularly vulnerable to the impacts of climate change. Small islands like St Croix and St. Thomas have a major portion of its population located in coastal areas threatened by increased sea level rise. Impacts from sea level rise, increasing sea water temperatures and increases in the intensity of hurricanes as well as other effects of climate change will continue and intensify in coming years. Despite its vulnerability, the local population has little knowledge or understanding of climate change science.

Response: In its efforts to help the local community understand climate change science, VIMAS: (1) shared online resources and tools; (2) assisted with the creation and dissemination of an activity book focused on climate science; (3) assisted with the safe dissemination of hurricane disaster relief supplies; (4) collaborated with the Coastal Zone Management Division (CZM) to demonstrate to online viewers the effects of storm surge and the importance of mangroves in protecting our coastlines; and (5) worked with past program participants in the completion of their community transfer projects focused on improving the resiliency and understanding of hazard preparation within their communities.

Results: VIMAS assisted with the creation and dissemination of resources using a combination of virtual and in-person formats to engage 35 USVI families in hazard preparation and understanding climate science.

PARTNERS: Virgin Islands Department of Planning and Natural Resources;

ASSOCIATED PROJECT(S):

[VIRGIN ISLANDS MARINE ADVISORY SERVICE \(2018 - 2021\)](#)

[Back to Top](#)

Reef Responsible: A Market-Driven Approach to a Sustainable Commercial Fishing Industry in the Virgin Islands

NATIONAL FOCUS AREAS: Healthy Coastal Ecosystems

- Accomplishment
- Approved

RECAP: PRSG's Virgin Islands Marine Advisory Service has been working with local restaurants to certify new and update original restaurants in the Reef Responsible program. VIMAS has been working with local restaurants to certify new and update original restaurants in the Reef Responsible program.

PROGRAM FOCUS AREAS: Healthy Ecosystems and Habitats

Relevance: The demand for seafood is increasing yet many populations of fish are being overfished, especially around the island of St. Croix. The need to promote the purchasing and consumption of fish caught or farmed using environmentally friendly practices is evident. The education of restaurant owners on purchasing fish that are legally caught using sustainable methods is urgently needed.

Response: Because of past efforts educating and certifying local restaurants in the Reef Responsible program, both VIMAS Coordinators serve on the Advisory Board for the Reef Responsible program which has been transferred from The Nature Conservancy to the Department of Fish and Wildlife. VIMAS continues to regularly attend Board meetings and provide insight on engaging the public.

Results: Through recent efforts, the Reef Responsible Program is being revitalized and will continue to promote awareness to local fishermen and restaurants about the importance of sustainable seafood.

PARTNERS: Virgin Islands Department of Planning and Natural Resources; The Nature Conservancy;

ASSOCIATED PROJECT(S):

[VIRGIN ISLANDS MARINE ADVISORY SERVICE \(2018 - 2021\)](#)

[Back to Top](#)

Water Quality Monitoring Initiative in Storm Water Discharges at Western Puerto Rico

NATIONAL FOCUS AREAS: Healthy Coastal Ecosystems

- Accomplishment
- Approved

RECAP: Puerto Rico Sea Grant and partners established a Citizen Water Quality Monitoring Program to obtain scientific information of the 3 main estuaries of the Caño Boquilla Reserve and promoted educational opportunities for graduate and undergraduate students.

PROGRAM FOCUS AREAS: Healthy Ecosystems and Habitats

Relevance: Storm surge and flooding related to Hurricane Maria severely affected the integrity of the stormwater systems that discharge into the CBWS. Many discharge points are covered with debris and/or deteriorated by the effects of the storm surge and the overflow of the Rio Grande de Añasco. This runoff carries chemical and biological contaminants that threaten the stability of the ecosystem which ultimately includes the coral reefs of Mayagüez Bay.

Response: PRSG and partners established a weekly Water Quality Monitoring Initiative in three of the outfalls with the highest stormwater runoff flows and largest catchment areas.

Result: Characterization of floatable debris and water quality monitoring data will be used to determine the most suitable stormwater management technique to minimize the entrance of pollutants to Mayagüez Bay. This Citizen Monitoring Water Quality Program will offer the opportunity to keep empowering citizens in science and environmental protection. One graduate student is developing her thesis research with the dataset gathered by citizens, and a group of computer science undergraduate students are designing a prototype of a water quality monitoring application for cell phones.

PARTNERS: Mayaguezanos Por la Salud y el Ambiente;

ASSOCIATED PROJECT(S):

[MARINE OUTREACH PROGRAM \(2018 - 2021\)](#)

[Back to Top](#)

Puerto Rico Sea Grant Works on Development of a New Patented Method for Rapid, Portable, and Automated Fecal Bacteria Biosensor for Fresh and Sea Water Sources

NATIONAL FOCUS AREAS: Healthy Coastal Ecosystems; Resilient Communities and Economies

- Accomplishment
- Approved

RECAP: PRSG researchers work to develop a rapid and automated water quality biosensor using fluorescence-based methods to measure and predict water quality in a few hours with the intention of developing a water quality "alert" system.

PROGRAM FOCUS AREAS: Healthy Ecosystems and Habitats; Resilient Communities and Economies

RELEVANCE: It can take up to weeks to obtain and publish fecal contamination results from beaches around Puerto Rico. By the time a result is obtained and communicated it may not be representative of the current state of the water. Automating the water quality testing process could reduce the cost of monitoring water quality by reducing manual workload, increasing the sampling frequency and allowing for high- frequency measurements capable of detecting catastrophic water contamination events in a period of hours, not days.

RESPONSE PRSG researchers will study turbidity and fecal contamination in the Mayagüez bay, an urban area whose Yagüez river is both turbid and contaminated and discharges into the beach, to understand to what degree turbidity can predict fecal contamination in a beach using this visually observable characteristic. Rapid prototyping laboratories where manufacturing and electronics techniques will be used to build the proposed platforms, and where water quality experiments can take place.

RESULTS: Provisional patent submission for a new water quality analysis method, a product which started development under Sea Grant Project number R/92-02-16 and continued development under this project, R/90-2-20.

o Title of Invention: Water Quality Monitoring System o Application Number: 63146777

o Receipt Date: 08-FEB-2021

o Application Type: Provisional

PARTNERS: Caribbean Integrated Coastal and Ocean Observing System (CarICOOS); Surfrider Foundation Rincón, PR Chapter;

ASSOCIATED PROJECT(S):

[TOWARDS FAST RESPONSE TO HARMFUL BACTERIA LEVELS IN NEARSHORE WATERS: A LOCAL HYDRODYNAMIC MODEL AND IN SITU BIOSENSOR \(2015 - 2017\)](#)

[DEVELOPMENT OF A RAPID, PORTABLE AND AUTOMATED FECAL BACTERIA BIOSENSOR FOR FRESH AND SEA WATER SOURCES \(2020 - 2021\)](#)

[Back to Top](#)

PRSG Researchers Study Estuarine Forest Resource Dependency in the Southern Coast of Puerto Rico

NATIONAL FOCUS AREAS: Sustainable Fisheries and Aquaculture

- Accomplishment
- Approved

RECAP: PRSG researchers learn from Caribbean coastal foragers about how to craft good quality lives under conditions of precarity and environmental uncertainty in ways that are alternative to the dominant capitalist labor/income model

PROGRAM FOCUS AREAS: Sustainable Fisheries and Aquaculture

RELEVANCE: Coastal regions around the world are increasingly under pressures by a variety of factors, including increasing population density, development, pollution, environmental injustice and climate change. At the same time, millions of people routinely use and depend on tropical estuarine forest resources to make a living and enhance their well-being (Walters et al. 2008). To achieve policies that carefully balance economic development with environmental and livelihood sustainability, it will be essential to empirically assess the contribution of locally-based, small-scale CR use to well-being in communities and beyond.

RESPONSE: PRSG researchers developed structured questionnaires about coastal forest resource use patterns and dependency in the region. We conducted 109 interviews with randomly-sampled southern coast residents, 50 interviews with coastal forest resource users, and 20 interviews with local seafood restaurant owners/managers.

RESULTS: Tropical coastal forests contribute significantly to the well-being of coastal communities. Our ongoing results suggest that the proportion of people in the coastal regions we studied, who make at least part of their living and support food security from CR foraging, is routinely underestimated (García-Quijano et al. 2015; García-Quijano and Poggie 2019). Decisions about the future of rural coastal areas are often being made without specific knowledge of what is really lost in terms of human well-being if policies favor coastal development that 1) alienates local communities from access to productive coastal areas and/or 2) is environmentally destructive (García-Quijano and Lloréns 2018).

PARTNERS: University of Rhode Island; East Carolina University (ECU); University of Puerto Rico, Ponce;

ASSOCIATED PROJECT(S):

Addressing Decompression Sickness Crisis of Commercial Fishermen

NATIONAL FOCUS AREAS: Sustainable Fisheries and Aquaculture

- Accomplishment
- Approved

RECAP: Puerto Rico Sea Grant and partners formalize agreement to offer free SCUBA training as a requirement to qualify for new sponsored diving fishing equipment in an effort to change artisanal subaquatic fishermen diving practices and reduce vulnerability to decompression sickness.

PROGRAM FOCUS AREAS: Sustainable Fisheries and Aquaculture

Relevance: Loss of essential fish habitats, as a result of natural extreme events, pollution, overfishing and an austere economic situation, compel commercial fishermen of Puerto Rico to adopt SCUBA as the preferred and most effective fishing practice due to its high level of selectivity, specially to catch lobsters and conch. However, without adequate diving training or equipment, mishaps and accidents are common because of excessive repetitive deep dives that surpass appropriate bottom time. For these reasons, fishermen are increasingly suffering from decompression sickness, which requires treatment at the sole Hyperbaric Chamber in the archipelago, located at the Puerto Rico Department of Health (PRDH) in San Juan, congesting the facilities.

Response: In August 2020, the Municipality of Cabo Rojo, the University of Puerto Rico Agricultural Extension Service (AES) and Puerto Rico Sea Grant signed a Memorandum of Understanding (MOU) to collaborate in the design and implementation of a diving education program within the Fishermen Financial Aid Program.

Results: The Municipality of Cabo Rojo allocated \$10,000 from the Community Development Block Grant (CDBG) to provide participating fishermen with formal SCUBA lessons and \$200,000 for the purchase of safety and fishing equipment. The AES, the PRDH and PRSG are currently collaborating in the creation of professional development workshops and formal SCUBA diving lessons as a requirement for fishermen who receive CDBG funded equipment.

PARTNERS: Hyperbaric Medicine; Autonomous Municipality of Cabo Rojo, PR; Caribbean Fishery Management Council (CFMC); Agricultural Coop Extension Service, UPR;

ASSOCIATED PROJECT(S):

MARINE OUTREACH PROGRAM (2018 - 2021)

[Back to Top](#)

PRSG Applied Research Project Triggers Mobile Phone Water Safety App for Boaters

NATIONAL FOCUS AREAS: Sustainable Fisheries and Aquaculture

- Accomplishment
- Approved

RECAP: Puerto Rico Sea Grant joined forces with NOAA's Caribbean Coastal Ocean Observing System (CariCOOS) to bring about "CariCOOS Boating App", an excellent tool to promote boating safety activities. This free electronic marine safety information resource for iPhone and Android users, was launched this summer in both Spanish and English. This boating app provides weather forecasts, waves, winds, water quality, marine currents, tides, moon phases, and other information for the safety of boaters.

PROGRAM FOCUS AREAS: Sustainable Fisheries and Aquaculture

Relevance: Weather preparedness for boaters involves keeping a "weather eye" to keep the experience fun and safe. Boat accidents are a big concern to coastal and marine resources managers in Puerto Rico and the U.S. Caribbean. Effective transfer of reliable information about climate and ocean conditions is an essential element in any effort to promote water safety among oceanic resource users.

Response: PRSG and CariCOOS recognized the need for an information system to increase safety of boat users. Motivated in the same fashion as the Beach App funded by previous PRSG research, an electronic coastal weather App for mobile phones was developed. This App provides accurate and reliable information to boaters including: current weather conditions and forecasts (Wind, Waves, Tides, Moon Phase, Cloud Coverage and Rain Probability); weather alerts from the NWS; and an offline mode to download and save data before heading into areas with no network coverage. Following the completion of this new tool, a series of virtual webinars directed at fishermen and yacht club members are currently being offered in collaboration with the Caribbean Fisheries Management Council.

Results: The CARICOOS boating app was successfully launched this summer for iPhone and Android users, in both Spanish and English. A total of 1,154 stakeholders have already attended the instructional virtual webinars currently being offered through Facebook live broadcasts

PARTNERS: Caribbean Fishery Management Council (CFMC); Caribbean Integrated Coastal and Ocean Observing System (CarICOOS);

ASSOCIATED PROJECT(S):

MARINE OUTREACH PROGRAM (2018 - 2021)

[Back to Top](#)

PRSG Project Provides Data to Assist Natural Resource Managers to Make Decisions Regarding the Invasive Lionfish

NATIONAL FOCUS AREAS: Healthy Coastal Ecosystems; Sustainable Fisheries and Aquaculture

- Accomplishment
- Approved

RECAP: PRSG researchers provided one of the first assessments of the effectiveness of marine protected areas in providing natural control of lionfish abundance on mesophotic coral reefs (30m - 50m depth) in the US Caribbean

PROGRAM FOCUS AREAS: Healthy Ecosystems and Habitats; Sustainable Fisheries and Aquaculture

RELEVANCE: More than 60% of US Virgin Islands coral reefs are mesophotic but the majority of lionfish removals occur on reefs less than 30m depth. Thus, a large biomass of lionfish are still present and will require different approaches to reduce their potential impact of deep reef fish native populations.

RESPONSE: PRSG funded research provided important data on lionfish populations on deep coral reef habitats and inside and outside marine protected area boundaries. This will provide natural resource managers with the data to make informed decisions regarding the invasive lionfish. It also provided excellent technical diver training opportunities for student divers in the Marine and Environmental Science master's degree program, many of which are using technical diving in their thesis research.

RESULTS: PRSG research shows that native fish populations on two large mesophotic coral reef marine protected areas (MPAs) remained relatively stable despite the large increase in lionfish on these reefs. Analysis of lionfish abundance inside and outside two large marine protected areas in the US Virgin Islands showed 20% - 30% higher densities of lionfish inside both marine protected areas. Density and biomass of potential lionfish prey (small-bodied fishes) were also higher inside MPAs than outside. The biomass of herbivores inside and outside of MPA's were similar but piscivore density and biomass was higher outside MPA's boundaries. General trends before and after lionfish invasion showed an increase in lionfish inside and outside MPAs (as expected), but native fish species showed either no trend of mixed results depending upon trophic groups. Multi-dimensional statistical techniques showed no clear differences in density or biomass of the various functional groups for inside and outside comparisons of either MPA.

PARTNERS: NOS Coral Reef Conservation Program; University of Virgin Islands;

ASSOCIATED PROJECT(S):

ARE THE TWO LARGEST MARINE PROTECTED AREAS IN THE UNITED STATES VIRGIN ISLANDS WORKING? (2018 - 2019)

[Back to Top](#)

Responsible Consumers are Essential for Sustainable Fisheries: Is that Fish Edible?

NATIONAL FOCUS AREAS: Sustainable Fisheries and Aquaculture

- Accomplishment
- Approved

RECAP: Puerto Rico Sea Grant marketing efforts for the consumption of underappreciated fishes have developed an interest and created new nutritional alternatives for consumers, economic opportunities for fishers and restaurant owners, and developed shifts in consumer preferences for sustainable and healthy fisheries stocks.

PROGRAM FOCUS AREAS: Sustainable Fisheries and Aquaculture

Relevance: Even though the Archipelago of Puerto Rico is rich in diversity of commercially important fisheries, many of the species marketed by fishmongers and restaurants are subject to seasonal closures to protect their populations during the spawning season. While Puerto Rican seafood consumers prefer well known species, there is room in the seafood system for underutilized fish, provided it is marketed effectively.

Response: Partnering with the Caribbean Fisheries Management Council and The Nature Conservancy, Puerto Rico Sea Grant developed the educational and gastronomical campaign Responsible Consumer Leads to Sustainable Fisheries. Educational materials including placemats and posters depicting some of our edible fishes were created and disseminated in seafood restaurants, fish markets and fishers associations. A five-course dinner at a local restaurant was coordinated to promote the consumption of underappreciated fish species.

Results: The education of fish consumers about underappreciated fish species reached thousands of consumers through the dissemination of

8,660 colorful, educational and reusable placemats; three (3) Television and seven (7) radio programs, close to fifteen (15) presentations and two (2) publications; conversations with 62 restaurant owners and chefs; visits to fish markets and fishers associations.

PARTNERS: Caribbean Fishery Management Council (CFMC); The Nature Conservancy;

ASSOCIATED PROJECT(S):

[MARINE OUTREACH PROGRAM \(2018 - 2021\)](#)

[Back to Top](#)

Puerto Rico Sea Grant Sparks Marine Species Restoration Program at the DNER's Fisheries Resources Lab

NATIONAL FOCUS AREAS: Sustainable Fisheries and Aquaculture

- Accomplishment
- Approved

RECAP: PRSG efforts to enhance fish stocks by disseminating aquaculture knowledge of up-to-date practical skills of land-based aquaculture entrepreneurs ignited the development of the Puerto Rico Department of Natural and Environmental Resources (DNER) marine species stock restoration program at the Fisheries Resources Laboratory.

PROGRAM FOCUS AREAS: Sustainable Fisheries and Aquaculture

Relevance: Wild capture of fish will not be able to meet global future demands. Aquaculture offers a viable solution for the production of seafood. The most appropriate solution to this problem is the development of cultured systems based on artificial fish spawning and juvenile production in commercial hatcheries for grow-out with artificial feeds under controlled physical/chemical conditions.

Response: Puerto Rico Sea Grant provided specialized outreach advisory to expand and improve the understanding of marine and freshwater aquaculture, aquaponics and population restocking, to general stakeholders, private entrepreneurs and resource managers including the DNER.

Results: As a result of these efforts, a project on stock restoration for two commercial species have been initiated by the DNER under close consultation with PRSG. These species are the mutton snapper (*Lutjanus analis*), a marine species categorized as near threatened, and the freshwater fish species *Sicydium plumieri*, the larvae of which is known as "Seti", which develops in the marine environment and is commercially fished at the mouth of rivers while migrating upstream.

PARTNERS: Puerto Rico Department of Natural and Environmental Resources; Caribbean Fishery Management Council (CFMC); Puerto Rico Department of Agriculture; US Fish and Wildlife Service (US DOI, FWS); Caribe Fisheries, Inc.;

ASSOCIATED PROJECT(S):

[MARINE OUTREACH PROGRAM \(2018 - 2021\)](#)

[Back to Top](#)

Commercial and Recreational Fishermen Education

NATIONAL FOCUS AREAS: Sustainable Fisheries and Aquaculture

- Accomplishment
- Approved

RECAP: PRSG provides outreach, facilitator, and non-advocate advisory services for a diverse group of local fishermen (commercial, recreational sport-fishers, and wild ornamental) and state and federal resource managers.

PROGRAM FOCUS AREAS: Sustainable Fisheries and Aquaculture

Relevance: In order to influence and improve policy through stakeholder representation, the needs and objectives of artisanal and recreational fishermen must be integrated to management and conservation efforts.

Response: PRSG provided fisheries advisory services and specialized assistance to commercial and recreational fishermen regarding fishing regulations, biological aspects of regulated species, and issues dealing with environmental conservation.

Results: PRSG serves as the Scientific Academy representative to the DNER Fisheries Advisory Board providing specialized recommendations to ten (10) resource managers, and close to one hundred (100) commercial and recreational fishers. PRSG also advises FEPDEMAR fishing association which represents 180 fishermen. Other specialized advisories were provided through over 37 direct stakeholder interactions.

PARTNERS: Federación de Pescadores de Puerto Rico y Defensores Del Mar, Inc. (FEPDEMAR); Caribbean Fishery Management Council (CFMC); Puerto Rico Department of Agriculture;

ASSOCIATED PROJECT(S):
MARINE OUTREACH PROGRAM (2018 - 2021)

[Back to Top](#)

SEAMAP Generates Essential Information for Sustainable Fisheries Management Decisions in PR and the USVI

NATIONAL FOCUS AREAS: Sustainable Fisheries and Aquaculture

- Accomplishment
- Approved

RECAP: SEAMAP-C provides fisheries-independent populations' data on reef fish, conch and lobster, to support insular and federal management plans, sampling methodologies, and outreach initiatives.

PROGRAM FOCUS AREAS: Sustainable Fisheries and Aquaculture

Relevance: Fisheries management objectives and policy development need to be based upon analyses of reliable data in order to make rational decisions. NOAA's Southeast Area Monitoring & Assessment Program (SEAMAP) contributes to the development of fisheries independent baseline data, standards, and indicators to support ecosystem-based approaches to resource management.

Response: Through the coordination of SEAMAP-C, PRSG organizes liaison activities, effective and efficient data collection surveys, and manages and disseminates fisheries-independent data. The fisheries-independent data obtained from this long-term program is being used by students, scientists, and state and federal managers to describe fisheries population trends; explain responses to environmental factors; estimate stock abundance; and to track reproduction, recruitment and yields.

Results: The CFMC and the DNER developed local management plans for conch and reef fish, based on population independent data obtained by SEAMAP-C. These efforts have improved precision and accuracy of the long-term reef fish fisheries-independent data collection through quality control evaluations.

PARTNERS: Jobos Bay National Estuarine Research Reserve, Department of Natural and Environmental Resources; US Fish and Wildlife Service (US DOI, FWS);

ASSOCIATED PROJECT(S):
MARINE OUTREACH PROGRAM (2018 - 2021)

[Back to Top](#)

Marine Outreach Program Fisheries & Aquaculture Electronic Portal

NATIONAL FOCUS AREAS: Sustainable Fisheries and Aquaculture

- Accomplishment
- Approved

RECAP: PRSG expands resource users understanding of the ecosystem-based management approach and its relationship to sustainable fisheries.

PROGRAM FOCUS AREAS: Sustainable Fisheries and Aquaculture

Relevance: Marine users from public and private sectors have an imperative need to increase their appreciation of collaborative ecosystem-based management that integrates the connections between land, water and air and all living organisms including humans. The growing number of guidance documents and the preponderance of jargon describing the concepts of the ecosystem-based management approach is confusing and though widely discussed in academic circles it seems nebulous and difficult to put into practice. The inclusion of essential components including participation, planning, decision-making and the promotion of accountability and quality assurance is essential for sustainable fisheries development.

Response: PRSG developed an electronic "blog" to disseminate relevant information related to fisheries and aquaculture, summarized and posted for forum discussions <http://prsgfisheriesoutreach.wordpress.com/>. SEAMAP-C publications and data downloading are provided as well as applied fisheries studies, fisheries management announcements, publications and information on mariculture outreach efforts and projects.

Results: More than 11,846 visitor "hits" from thirty-three (33) different countries, 278 visits from seven (7) different countries correspond to this reporting cycle.

PARTNERS: Puerto Rico Department of Natural and Environmental Resources; Federación de Pescadores de Puerto Rico y Defensores Del Mar, Inc. (FEPDEMAR); Caribbean Fishery Management Council (CFMC); Pew Charitable Trusts; Sociedad Ambiente Marino;

PRSG Reduces Vulnerability and Augments Resiliency to Extreme Events in 53 Municipalities of Puerto Rico

NATIONAL FOCUS AREAS: Resilient Communities and Economies

- Accomplishment
- Approved

RECAP: Puerto Rico Sea Grant, in collaboration with NDPTC, coordinated and provided free certified online training/workshops on natural disaster awareness for Spanish speaking community leaders and related professionals from Puerto Rico and U.S. mainland with a significant improvement in participant content knowledge.

PROGRAM FOCUS AREAS: Resilient Communities and Economies

Relevance: Devastating hurricanes, earthquake swarms and the COVID-19 pandemic underscore education and training needs for professionals in the areas of coastal inundation mapping, flood hazards, planning for disaster recovery, natural disaster awareness and planning for disaster debris removal. Online capacity building and professional training during the pandemic can provide essential information and tools to develop awareness to natural disasters, climate change adaptation, and resilience and mitigation strategies.

Response: PRSG in collaboration with NOAA Office for Coastal Management and the National Disaster Preparedness Training Center of the University of Hawaii provided the first formal online training to improve management, planning and adaptation strategies to extreme natural events. This online format allowed Spanish speaking audience from both Puerto Rico and U.S. mainland to be impacted simultaneously through this effort.

Results: The first Spanish four-hour online course on natural disaster awareness was provided free of cost to audiences located both in Puerto Rico and the U.S. mainland simultaneously. A total of 30 participants completed the online course resulting in an overall investment of 120 hours, equivalent to an estimated \$4,243 in cost of salaries, based on information collected of participant profession and salary data from the Bureau of Labor Statistics. Pre and post-test assessments indicated a significant improvement of 93% in participant content knowledge.

PARTNERS: University of Hawaii at Manoa, National Disaster Preparedness Training Center;

Cabo Rojo Salt Flats: Nature-based adaptation and mitigation measures to address sea level rise

NATIONAL FOCUS AREAS: Resilient Communities and Economies

- Accomplishment
- Approved

RECAP: After hurricanes Irma and María affected the health of the Cabo Rojo salt flats and surrounding ecosystems by coastal flooding, storm surge, sea level rise and coastal erosion, the Autonomous Municipality of Cabo Rojo in collaboration with PRSG, USFWS, requested a State of Emergency to the State Government and proposed a restoration project for the area to restore approximately 400 acres of coastal wetland, and eventually enhance the coastal salt flats.

PROGRAM FOCUS AREAS: Resilient Communities and Economies

Relevance: The Cabo Rojo salt flats are part of the ecosystems along with the mangrove forest, the dry forest and hypersaline lagoons surrounding Los Morrillos Lighthouse. After hurricanes Irma and María the health of these ecosystems had been affected by the coastal flooding, storm surge, sea level rise and coastal erosion. This is also affecting the economy of the region by reducing the historical salt production (operating since 1511 nonstop), and a reduction on migratory birds had been observed.

Response: The Autonomous Municipality of Cabo Rojo in collaboration with PRSG, USFWS, requested a State of Emergency for the Cabo Rojo Salt Flats and the surrounding ecosystems to tend the coastal erosion of the area. The municipality also approved an Ordinance to create a multidisciplinary workgroup to develop and implement strategies, and erosion control mitigation projects to protect, restore, and promote the natural and cultural resources of the Cabo Rojo Salt Flats.

Results: The Puerto Rico Department of Public Safety officially declares a State of Emergency of the Cabo Rojo Salt Flats and ordered the PR Department of Natural and Environmental Resources to take actions and grant solutions to address and protect the area. Proposed restoration project will restore approximately 400 acres of coastal wetland, and eventually enhance the coastal salt flats.

PARTNERS: Puerto Rico Coastal Zone Management; US Fish and Wildlife Service (US DOI, FWS); Autonomous Municipality of Cabo Rojo, PR; Protectores de Cuencas;

ASSOCIATED PROJECT(S):

MARINE OUTREACH PROGRAM (2018 - 2021)

[Back to Top](#)

PRSG and Partners Develop Coastal Visualization Tool to Educate about Planning, Conservation, Coastal Development and Coastal Communities Resilience

NATIONAL FOCUS AREAS: Resilient Communities and Economies

- Accomplishment
- Approved

RECAP: PRSG, in collaboration with the CIEL and CariCOOS, developed the Costa VisPR, a coastal visualization tool to provide free access to georeferenced aerial photographs and opportunities to study coastal land-use planning, land changes, management, education and decision-making.

PROGRAM FOCUS AREAS: Resilient Communities and Economies

Relevance: The Porto Rico 1930 Aerial Image Database website (<http://pr1930.revistatp.com/>) in JPEG format is an instrumental product for visualizing, monitoring, and tracking land change. However, this database is limited in the sense that the photographs are not georeferenced, consequently their use and applicability within a Geographic Information System (GIS) has serious limitations. Aerial photographs for coastal areas of Puerto Rico need to be georeferenced to the geographic coordinate system NAD 83 PR State Plane, to enable analysis with other geographic data of the coastal areas of the Island.

Response: Puerto Rico Sea Grant and partners identified, edited, and georeferenced 800 aerial photographs for most coastal areas of Puerto Rico, specifically photographs within 1 km. from the coast. PRSG and partners developed a user-friendly tool that provides a quick understanding of coastal land cover changes in Puerto Rico since 1930.

Results: Through this tool, PRSG provides free access to georeferenced aerial photographs and opportunities for coastal land-use planning, management, education, and decision-making. The Costa VisPR application includes historical changes in Puerto Rico's coastal line; geomorphologic evolution of the coast; coastal erosion and changes in the coastal morphology, coastal ecosystems and coastal ecosystem processes; climate change studies; and coastal land transformation. Potential users of this viewer include government personnel from coastal municipalities, residents of coastal communities, educators, researchers, non-governmental organizations and the private sector, or anyone interested in learning about the transformation of the Puerto Rican coastal landscape. During the first month of publication the webpage of the tool (<https://costavispr.org/>) received around 10,218 visits.

PARTNERS: Centro Interdisciplinario de Estudios del Litoral (CIEL); Caribbean Integrated Coastal and Ocean Observing System (CarICOOS);

ASSOCIATED PROJECT(S):

MARINE OUTREACH PROGRAM (2018 - 2021)

[Back to Top](#)

Lessons Learned after Hurricane Maria: Successful and Failed Emergency Management Practices

NATIONAL FOCUS AREAS: Resilient Communities and Economies

- Accomplishment
- Approved

RECAP: Feedback from PRSG final report based on focus groups and interviews coordinated with key stakeholder groups concluded that disasters should not be understood, or dealt with, necessarily as isolated events since many of the factors that make society and management agencies vulnerable are constant and recurrent. In this context, what was learned after the passage of hurricanes Irma and María, combined with the earthquakes, and COVID-19, allows for a broader reflection on the larger issue of exposure, vulnerability, and emergency management in Puerto Rico.

PROGRAM FOCUS AREAS: Resilient Communities and Economies

Relevance: While the impacts of hurricanes in 2017 were disastrous and catastrophic for Puerto Rico, they provide opportunities to reflect on management practices and to learn how to manage future risks and hurricane-induced emergencies. There is an urgent need to document the process of emergency management during hurricanes and extreme events, at the institutional level and during the different phases of disaster.

Response: PRSG and the CIEL coordinated several focus groups and conducted interviews with directors and emergency managers of the Puerto Rico State Agency for Emergency and Disaster Management, to document the process of emergency and natural disaster management during hurricane Maria. Topics emphasized included successful management practices, failed strategies, actions that could be implemented but were not (and why), and areas of improvement.

Results: Participants representing the nine regions and operational zones of the Puerto Rico State Agency for Emergency and Disaster Management identified the best strategies and practices implemented during the response to hurricanes Irma and María; as well as failed efforts during the management of the disaster. They also made recommendations to improve emergency response and management in future natural extreme events. Final report in:
https://www.tlopezmarrero.com/uploads/8/6/3/9/86396506/temporada_de_huracanes_2017_en_pr_lecciones_aprendidas.pdf

PARTNERS: Centro Interdisciplinario de Estudios del Litoral (CIEL);

ASSOCIATED PROJECT(S):

[MARINE OUTREACH PROGRAM \(2018 - 2021\)](#)

[Back to Top](#)

Risk Communications: Informational Fact Sheets for Development of Resilient Coastal Communities

NATIONAL FOCUS AREAS: Resilient Communities and Economies

- Accomplishment
- Approved

RECAP: PRSG, in collaboration with the Interdisciplinary Center for Coastal Studies, produced a series of fact sheets with information on rapid hurricane intensification, forecasts and cyclone alerts to promote better decision-making and timely preparation before hurricanes.

PROGRAM FOCUS AREAS: Resilient Communities and Economies

Relevance: Hurricanes Irma and Maria combined with the ongoing 2020 seismic sequence have exposed the vulnerability of Puerto Rico's coastal communities to extreme natural events. A well-informed population is stronger and less susceptible to negative impacts related to extreme natural atmospheric phenomena.

Response: A series of fact sheets with information on rapid intensification, forecasts and cyclone alerts were developed to promote better decision-making and timely preparation before hurricanes.

Results: Five fact sheets on cyclone rapid intensification, alert and forecasting mechanisms, and an overview of 167 years of cyclones that passed through Puerto Rico were developed and published. These fact sheets are used as part of the reference materials provided to coastal communities in different outreach activities.

PARTNERS: Centro Interdisciplinario de Estudios del Litoral (CIEL);

ASSOCIATED PROJECT(S):

[MARINE OUTREACH PROGRAM \(2018 - 2021\)](#)

[Back to Top](#)

Historical Process: Vulnerability, Flooding and Resilience in Coastal Communities of Western Puerto Rico

NATIONAL FOCUS AREAS: Resilient Communities and Economies

- Accomplishment
- Approved

RECAP: Puerto Rico Sea Grant funding provided a unique opportunity for minority undergraduate and graduate students to study the biophysical vulnerability and resilience characteristics of western Puerto Rico coastal communities. Mitigation strategies that residents from coastal communities implemented to mitigate the effects of Hurricane Maria have been identified and inventory maps were developed to show structural losses in the vulnerable coastal communities under study.

PROGRAM FOCUS AREAS: Resilient Communities and Economies

RELEVANCE: Puerto Rico, due to its geographical position, is susceptible to facing atmospheric events. Therefore, the island has an impressive history filled with hurricanes and tropical storms among others San Felipe II, Santa Clara, Eloisa, Hugo, Hortensia, Georges, Irma and Maria. These atmospheric events caused numerous effects including psychological impacts, floods, material and economic losses, and lack of public safety being one of the imminent threats affecting vulnerable communities. Due to the biophysical vulnerability to which coastal communities (under study) are exposed, it is necessary to identify the mitigation strategies that residents implement and thus, analyze the characteristics that limit their resilience.

RESPONSE: Sea Grant funded researchers actively recruited and trained Hispanic minority students in applied sciences to qualitatively and quantitatively examine if there is a response network to guarantee public safety in coastal communities in the event of an emergency caused by the passage of an atmospheric event.

RESULTS: A total of fourteen (14) workshops and trainings were offered focusing on methodology (qualitative and quantitative), data

collection, statistical programs (SPSS and Qualtrics), content analysis / results, literature review, theoretical framework, among others. All this with the purpose of training and promoting the knowledge development in the field of applied sciences. Simultaneously, two (2) different conferences that responded to each phase of the investigation were arranged and carried out at the UPRM campus. Preliminary findings were also presented by a subset of participating students on two (2) international conferences.

PARTNERS: None listed in Database

ASSOCIATED PROJECT(S):

RESILIENCY ATTITUDES AND CHARACTERISTICS OF FLOOD VULNERABLE COMMUNITIES (2018 - 2021)

[Back to Top](#)

Responses, Feedbacks, and Adaptive Management of Tropical Coastal Wetlands to Rising Sea Level and Hurricane Disturbance

NATIONAL FOCUS AREAS: Resilient Communities and Economies

- Accomplishment
- Approved

RECAP: PRSG researchers are developing tools for spatial analyses of multi-source remote sensing images to identify driving forces to resistant and resilience of coastal ecosystems to hurricanes.

PROGRAM FOCUS AREAS: Resilient Communities and Economies

RELEVANCE: Press and pulse drivers of this human-natural systems keep altering the distributions, structures, functions, and services of coastal wetlands, and threaten the neighborhood communities. Hurricanes are the most important pulse driver affecting both nature and human society. Although hurricanes pass in a day, the recovery could last for years. Advanced understanding of coastal systems in their responses/feedbacks to press/pulse drivers, and scientifically- sound coastal development planning is key to improve conservation decision-making.

RESPONSE: PRSG researchers will integrate advanced remote sensing and GIS techniques with coupled modeling of ecohydrology and wetland migration to assess vulnerability and resilience of the coastal wetlands to hurricanes, and to simulate their responses and feedbacks to SLR under drying climate. Spaceborne and airborne remote sensing of optical, radar, LiDAR, multispectral, and hyperspectral imagery will be synthesized and analyzed using the cloud computing platform of Google Earth Engine.

RESULTS: The legacy of past severe drought on hurricanes' impact, and are aligned with our previous report on drought, that is, massive mortality especially for juveniles and low recruitment of freshwater *Pterocarpus* swamp during the severe drought in 2015 (Yu et al. 2019). Results based on optical images show that coastal mangroves are vulnerable to major hurricanes and recover very slowly, functionally or also structurally. The canopy height, as an important index of canopy structure, is highly related with the landscape features (Fig. 5d, p-value < 0.001, R² of 0.74) The collective parameters of forest stand such as stem density, tree cover, and canopy roughness or rugosity, quantified from ground-observation or LiDAR yet highlighting mutual support and evenness, played important roles in resisting damages to tropical dry forest during major hurricanes.

PARTNERS: University of Puerto Rico, Rio Piedras; US Fish and Wildlife Service (US DOI, FWS);

ASSOCIATED PROJECT(S):

RESPONSES, FEEDBACKS, AND ADAPTIVE MANAGEMENT OF TROPICAL COASTAL WETLANDS TO RISING SEA LEVEL AND HURRICANE DISTURBANCE (2018 - 2021)

[Back to Top](#)

Climate Education for Virgin Islands High School Students

NATIONAL FOCUS AREAS: Resilient Communities and Economies

- Accomplishment
- Approved

RECAP: PRSG's Virgin Islands Marine Advisory Service, in partnership with the VI Department of Education, one private school, and NOAA's Climate Stewards program, provided climate science education to 75 students on St. Croix.

PROGRAM FOCUS AREAS: Resilient Communities and Economies

Relevance: Island communities are particularly vulnerable to the impacts of climate change. Small islands like St Croix and St. Thomas have a major portion of its population located in coastal areas threatened by increased sea level rise. Impacts from sea level rise, increasing seawater temperatures, and increases in the intensity of hurricanes as well as other effects of climate change will continue and intensify in the coming years. Despite its vulnerability, the local population has little knowledge or understanding of climate change science.

Response: Four presentations to high school students were made on global climate change in the VI Education school system as well as one

presentation to a private school. The presentations reviewed the science of climate change and possible actions that can be taken to reduce it. In addition, the St. Croix VIMAS agent assisted teachers in one high school in a climate change relay with about 30 students on the global climate action day. This event was covered by the local newspaper. Professional development was done by St. Croix Marine Advisor by participating in several online webinars.

Results: VIMAS made 5 presentations to 75 students and worked with 30 students and 2 teachers to promote climate action day.

PARTNERS: Virgin Islands Department of Education;

ASSOCIATED PROJECT(S):

[VIRGIN ISLANDS MARINE ADVISORY SERVICE \(2018 - 2021\)](#)

[Back to Top](#)

Marine Debris Education and Community Engagement

NATIONAL FOCUS AREAS: Environmental Literacy and Workforce Development

- Accomplishment
- Approved

RECAP: PRSG's Virgin Islands Marine Advisory Service (VIMAS) continues to increase awareness of the issue of marine debris through routine beach cleanups and classroom presentations. VIMAS supports the reduction of marine debris and instills environmental stewardship through the engagement of 100 St. Croix students and adults and running the St. Thomas Great Mangrove Cleanup on St. Croix (82 people).

PROGRAM FOCUS AREAS: Environmental Literacy and Workforce Development

Relevance: Marine debris is a pervasive problem not only throughout the VI but globally as well. It is a deterrent to tourism, a human health hazard, degrades marine habitats, and can impact marine plants and animals. Past studies have shown that about 80% of VI marine debris comes from land-based sources. If we are to mitigate this problem, we must increase community awareness and engage the community in actions that will result in behavior change. Participating in coastal cleanups allows participants to engage in an activity that helps our marine environment and develops a sense of stewardship, promoting positive behavior change.

Response: VIMAS coordinated the coastal cleanup events during Nov. 2019 and September and October 2020, although much more limited due to COVID-19. This included classroom presentations to 100 students and facilitation of coastal cleanups for about 200 volunteers. Data collected during Coastweeks was summarized and forwarded to TOC. VIMAS St. Croix also wrote a successful grant to support for underwater cleanups in Nov and Dec. 2020.

Results: Through the International Coastal Cleanup, VIMAS has provided the USVI with engagement opportunities to better understand the issue of marine debris and remove debris from St. Croix beaches.

PARTNERS: Ocean Conservancy; Virgin Islands Department of Education;

ASSOCIATED PROJECT(S):

[VIRGIN ISLANDS MARINE ADVISORY SERVICE \(2018 - 2021\)](#)

[Back to Top](#)

Puerto Rico Sea Grant's Virgin Islands Marine Advisory Service Increases Public Awareness of the Sea Grant Mission in the USVI

NATIONAL FOCUS AREAS: Environmental Literacy and Workforce Development

- Accomplishment
- Approved

RECAP: VIMAS is increasing public awareness and understanding of both VIMAS and Sea Grant through teacher professional development training, presentations made at national conferences, publication of news articles about VIMAS accomplishments, and the facilitation of community-based programs.

PROGRAM FOCUS AREAS: Environmental Literacy and Workforce Development

Relevance: In order for the Virgin Islands Marine Advisory Service to be effective, people must be aware of the program and the services it offers. To increase public awareness of VIMAS and Sea Grant, and promote the program's goals, VIMAS agents participate in several community events, activities, and boards. Objectives will be carried out through events such as community fairs and public presentations. In addition, VIMAS agents will provide technical assistance to governmental agencies and boards about marine resources. VIMAS provides technical support for the VI Fisheries Advisory Committee, the East End Marine Park (EEMP) Committee, the St. Thomas East End Reserve (STEER) Committee as well as the VI Nonpoint Source pollution committee (NPS). This initiative is to support the Education and Workforce

Development Focus Area in the UPRSGCP Strategic Plan 2018-2022.

Response: To increase awareness of marine issues, 18 newspaper articles were published to highlight VIMAS activities. Collaborations with researchers within UVI's Center for Marine and Environmental Studies have increased VIMAS's participation in federally funded projects such as the USVI Storm Strong Program, NOAA's Marine Debris Removal project to create a Marine Debris Action Plan for the USVI. \$33,130 in funding support from the Water Resources Research Institute and the Community Foundation of the Virgin Islands was awarded to VIMAS and aided in the expansion of the Water Quality Education Program throughout the territory. Prior to COVID-19, 5 STT educators and 135 students were engaged in water science education; during COVID, a virtual workshop was hosted to train 8 educators on St. Croix to utilize water science kits created through the program. Additionally, 1,300 At Home Water Testing Kits were created and distributed throughout the territory along with 50 Sawyer Water filters; VIMAS collaborated with DPNR to create a 360-degree video of the St. Thomas East End Reserves which is being used to virtually engage residents and students (<https://www.youtube.com/watch?v=Lqm3w2m2IwQ&t=5s>). Additionally, 2 students from the Ivanna Eudora Kean High School who were previously scuba certified through VIMAS programs assisted with the creation of a 360-degree video on coral tree maintenance at the Coral World Ocean Park.

Results: Through participation in a variety of community-based events, VIMAS is increasing awareness of Sea Grant and its mission in the USVI. The community is more aware of environmental issues present within the territory and how VIMAS and other organizations are addressing these concerns.

PARTNERS: University of Virgin Islands; Virgin Islands Department of Planning and Natural Resources;

ASSOCIATED PROJECT(S):

[VIRGIN ISLANDS MARINE ADVISORY SERVICE \(2018 - 2021\)](#)

[Back to Top](#)

Youth Ocean Explorers Summer Program

NATIONAL FOCUS AREAS: Environmental Literacy and Workforce Development

- Accomplishment
- Approved

RECAP: The Youth Ocean Explorers Summer Programs engaged 46 students in middle and high school on St. Croix and St. Thomas through advanced SCUBA certification and various opportunities to better prepare them for careers in marine science.

PROGRAM FOCUS AREAS: Environmental Literacy and Workforce Development

Relevance: Key points have been identified when students lose interest in STEM (Science, Technology, Engineering, Mathematics), primarily around middle school. This leaky STEM pipeline can be attributed to numerous causes such as a lack of engagement in science concepts and limited science professionals that could serve as role models for these students. As a result, many local Virgin Islanders do not envision themselves holding a career in the sciences, which further intensifies this gap in science participation.

Response: VIMAS instituted the Youth Ocean Explorers (YOE) Summer Program, a 4-week marine science-based summer program opportunity facilitated by the VIMAS St. Thomas. YOE occurs during the second week of July until the end of the first week in August. The program immerses enrolled students into 1) project-based learning activities, 2) authentic, placed-based research opportunities, and 3) possible career paths in the sciences. Since 2017, the Youth Ocean Explorers Summer Program has received additional support and program guidance from the National Science Foundation's INCLUDES program to better structure the program content around the geosciences.

Results: The Youth Ocean Explorers Summer Program has engaged to date 46 students during this reporting period, providing advanced scuba certifications to 17 students to better prepare them for careers in marine science. VIMAS continues to increase the number of funding partners and the amount of external funding from the V.I. community in support of this program. These combined efforts have helped to train the next generation of marine scientists and promote the broadening of participation in STEM.

PARTNERS: Virgin Islands Department of Planning and Natural Resources; National Park Service (US DOI, NPS);

ASSOCIATED PROJECT(S):

[VIRGIN ISLANDS MARINE ADVISORY SERVICE \(2018 - 2021\)](#)

[Back to Top](#)

Puerto Rico Sea Grant's efforts to bring Marine Sciences to K-12 students through distance learning experiences

NATIONAL FOCUS AREAS: Environmental Literacy and Workforce Development

- Accomplishment
- Approved

RECAP: Through the Marine Science Adventure Program for K-12 Students, Puerto Rico Sea Grant and its collaborators have contributed to the growth of a well-informed and environmentally responsible citizenry capable of applying ocean literacy to the wise use and management

of coastal and marine resources. The program enabled participants from all parts of the island to benefit from an online-based experience in marine sciences with a focus on conservation.

PROGRAM FOCUS AREAS: Environmental Literacy and Workforce Development

RELEVANCE: The inclusion of marine education in school curricula is central to the educational system and culture of our archipelago. However, Puerto Rico's educational system lacks exposure to marine ecosystems, which has generated little interest in studying, researching, conserving, and even considering a professional career in the field of marine sciences. Consequently, the sustainable future of these coastal and marine ecosystems that depend to a great extent on an environmentally responsible citizenry is compromised.

RESPONSE: PRSG developed the Marine Science Adventure Program for K-12 students in order to complement the school curricula with marine education. The program offered face to face and online activities of high-quality learning experiences focused on a wide range of topics to promote the conservation of coastal and marine ecosystems. The PRDE has enabled students to participate in PRSG virtual field trips to coastal natural reserves and virtual laboratories experiences, accompanied by their teachers.

RESULTS: In 2020, the Marine Science Adventure Program for K-12 Students offered 43 educational online events impacting a total of 1,031 students and 52 teachers from 33 schools in Puerto Rico. The participants practiced the use of technology and data analysis for the development of conclusions. More than 90% of the participants strongly agreed that the online activities contributed significantly to the acquisition of relevant knowledge in the coastal sciences.

PARTNERS: Puerto Rico Department of Education;

ASSOCIATED PROJECT(S):
MARINE EDUCATION (2018 - 2021)

[Back to Top](#)

Puerto Rico Sea Grant efforts contribute to bring K-12 students' coastal sciences knowledge through the Coastal Contact Program (CCP).

NATIONAL FOCUS AREAS: Environmental Literacy and Workforce Development

- Accomplishment
- Approved

RECAP: PRSG Coastal Contact Program provided K-12 students access to experience Puerto Rico's Natural Reserves and learn about environmental and marine sciences through face to face and online activities, successfully increasing environmental stewardship and conservation of Puerto Rico's coastal natural areas.

PROGRAM FOCUS AREAS: Environmental Literacy and Workforce Development

RELEVANCE: A considerable number of school students are unaware of the valuable ecosystems close to their homes. Consequently, the PRDE implemented the Green Contact Act requiring students to complete 10 hours studying Puerto Rico's natural resources. There is a lack of activities that allow students to learn about marine ecosystems, natural reserves, threats and environmental impacts through face to face and online activities and a need to develop a citizenship aware of environmental literacy.

RESPONSE: PRSG developed the Coastal Contact Program for students at the K-12 levels, which includes face-to-face and online activities, providing access to the Efraín Archilla Natural Reserve in Humacao and exposing students to ecological, cultural, and historical experiences through information stations. The online activities were lectures on various topics related to marine and environmental sciences.

RESULTS: Sixteen (16) coastal contact activities were carried out in which 307 students and 17 educators from the K-12 levels of public and private schools in Puerto Rico participated. Through online activities, students accumulated 1 hour of green contact. More than 80% of the participants strongly agreed that the activities offered contributed significantly to the acquisition of relevant knowledge in the marine and environmental sciences.

PARTNERS: Puerto Rico Department of Education; Puerto Rico Department of Natural and Environmental Resources;

ASSOCIATED PROJECT(S):
MARINE EDUCATION (2018 - 2021)

[Back to Top](#)

PRSG redesigns and transforms all the educational activities offered by the Marine Education Component

NATIONAL FOCUS AREAS: Environmental Literacy and Workforce Development

- Accomplishment
- Approved

RECAP: PRSG Marine Education Component redesigned and transformed its entire educational offer facilitating online and virtual educational activities for students and educators.

PROGRAM FOCUS AREAS: Environmental Literacy and Workforce Development

RELEVANCE: In Puerto Rico's reality in which face-to-face education has been paralyzed since the beginning of 2020 due to earthquakes and as a measure to stop the spread of the COVID-19 pandemic, online education has become essential to continue the educational process. This has created a high demand for online educational activities that complement and enrich distance learning processes carried out by educators in public and private schools throughout the archipelago.

RESPONSE: Puerto Rico Sea Grant redesigned and transformed all its educational offerings such as laboratory experiences, field trips, the coastal contact program, and professional trainings for educators into online educational activities. Continued participation of students and educators in PRSG activities has been guaranteed through the implementation of several online platforms that facilitate greater participation of public and private schools.

RESULTS: The Marine Sciences Activities Program ended with an online offer of 3 workshops for educators, for K-12 students, 4 field trips, 10 lab experiences, and 10 Coastal Contact Program lectures. Educators selected from this variety of marine activities complemented and enriched their online courses. A total of 62 activities were carried out during the period from August to December 2020.

PARTNERS: Puerto Rico Department of Natural and Environmental Resources; University Of Puerto Rico, Humacao (UPR);

ASSOCIATED PROJECT(S):
MARINE EDUCATION (2018 - 2021)

[Back to Top](#)

2020 Leveraged Funding

[Back to Top](#)

Project Level

Source	Project	Title	Amount	Type
National Marine Fisheries Service (US DOC, NOAA, NMFS)	13194 - Marine Outreach Program (A/151-1-18)	SEAMAP-C	\$83,084.00	Managed
Virgin Islands Community Foundation	13195 - Virgin Islands Marine Advisory Service (A/151-2-18)	USVI Glass Recovery Program	\$50,000.00	Managed
Virgin Islands Department of Planning and Natural Resources	13195 - Virgin Islands Marine Advisory Service (A/151-2-18)	Cleaning Our Coasts	\$21,336.00	Managed
University of Hawaii at Manoa, National Disaster Preparedness Training Center	13194 - Marine Outreach Program (A/151-1-18)	Agreement for the delivery of NDPTC courses	\$20,000.00	Managed
Ocean Conservancy	13195 - Virgin Islands Marine Advisory Service (A/151-2-18)	USVI Glass Recovery Program	\$5,000.00	Managed
Virgin Islands Department of Planning and Natural Resources	13195 - Virgin Islands Marine Advisory Service (A/151-2-18)	Diving for Debris	\$3,299.00	Managed
		TOTAL:	\$182,719	

Program Level

No Program Level Leveraged Funding for this year

[Back to Top](#)

Performance Measures

2020 Communities implementing hazard resiliency practices

County of the Coastal Community	Name of Coastal Community	Number of Resiliency Training/Tech Assistance provided	Community hazard resiliency improved
Puerto Rico	Adjuntas	1	Yes
Puerto Rico	Añasco	1	Yes
Puerto Rico	Carolina	1	Yes
Puerto Rico	Ciales	1	Yes
Puerto Rico	Fajardo	1	Yes
Puerto Rico	Guaynabo	1	Yes
Puerto Rico	Hormigueros	1	Yes
Puerto Rico	Las Marias	1	Yes
Puerto Rico	Loiza	1	Yes
Puerto Rico	Manati	1	Yes

Puerto Rico	Mayaguez	1	Yes
Puerto Rico	Moca	1	Yes
Puerto Rico	Ponce	1	Yes
Puerto Rico	Rio Grande	1	Yes
Puerto Rico	San Juan	1	Yes
Puerto Rico	San Lorenzo	1	Yes
Puerto Rico	Santa Isabel	1	Yes
Puerto Rico	Utua	1	Yes
Puerto Rico	Villalba	1	Yes
Puerto Rico	Yabucoa	1	Yes

[Back to Top](#)

2020 Sea Grant Products - (tools, technologies, info services)

Description	Developed	Used
Puerto Rico Sea Grant has translated The Mangrove Forest educational guide into English, to provide educators in bilingual schools both in Puerto Rico and other countries such as the United States and the US Virgin Islands with the necessary tools to teach this subject in their classrooms. Due to the financial crisis affecting Puerto Rico, the law enforcement budget for the management of coastal and marine ecosystems has been significantly reduced exposing these resources to bad habits and practices regarding their use and conservation. By educating resource users through these educational tools, we expect to change behaviors towards the use and conservation of coastal and marine ecosystems. The tools produced by PRSG educate resource users about Ecosystem Based Management, the importance of using coastal and marine resources wisely and developing an effort to replace the lack of enforcement with an educated clientele knowledgeable of the services and benefits (economic and recreational) provided by these ecosystems and the threat posed by climate change and its impacts already being experienced in the Archipelago of Puerto Rico and the U.S. Virgin Islands. Due to the financial crisis affecting Puerto Rico, the law enforcement budget for the management of coastal and marine ecosystems has been significantly reduced exposing these resources to bad habits and practices regarding their use and conservation. By educating resource users through these educational tools, we expect to change behaviors towards the use and conservation of coastal and marine ecosystems. The tools produced by PRSG educate resource users about Ecosystem Based Management, the importance of using coastal and marine resources wisely and developing an effort to replace the lack of enforcement with an educated clientele knowledgeable of the services and benefits (economic and recreational) provided by these ecosystems and the threat posed by climate change and its impacts already being experienced in the Archipelago of Puerto Rico and the U.S. Virgin Islands.	Yes	No
PRSG redesigned and adapted the Mangrove and Climate Change curriculum guides to provide instructors opportunities to offer online courses and distance trainings. Through this effort we provide the necessary tool to insert these topics into their curriculum using this new teaching modality. Both the content as well as the activities were made interactive to facilitate student access to the different platforms and study the topics online, preserving the integrity and the quality of the original material. Due to the financial crisis affecting Puerto Rico, the law enforcement budget for the management of coastal and marine ecosystems has been significantly reduced exposing these resources to bad habits and practices regarding their use and conservation. By educating resource users through these educational tools, we expect to change behaviors towards the use and conservation of coastal and marine ecosystems. The tools produced by PRSG educate resource users about Ecosystem Based Management, the importance of using coastal and marine resources wisely and developing an effort to replace the lack of enforcement with an educated clientele knowledgeable of the services and benefits (economic and recreational) provided by these ecosystems and the threat posed by climate change and its impacts already being experienced in the Archipelago of Puerto Rico and the U.S. Virgin Islands. Due to the financial crisis affecting Puerto Rico, the law enforcement budget for the management of coastal and marine ecosystems has been significantly reduced exposing these resources to bad habits and practices regarding their use and conservation. By educating resource users through these educational tools, we expect to change behaviors towards the use and conservation of coastal and marine ecosystems. The tools produced by PRSG educate resource users about Ecosystem Based Management, the importance of using coastal and marine resources wisely and developing an effort to replace the lack of enforcement with an educated clientele knowledgeable of the services and benefits (economic and recreational) provided by these ecosystems and the threat posed by climate change and its impacts already being experienced in the Archipelago of Puerto Rico and the U.S. Virgin Islands.	Yes	Yes
PRSG project provides resource managers with a practical tool kit to help prevent local ecosystem damage and economic losses from invasive species introduction, while integrating outreach activities to increase stakeholder awareness and stewardship of Puerto Rican waters.	Yes	No
Puerto Rico Sea Grant joined forces with NOAA's Caribbean Coastal Ocean Observing System (CariCOOS) to bring about "CariCOOS Boating App", an excellent tool to promote boating safety activities. This free electronic marine safety information resource for iPhone and Android users, was launched this summer in both Spanish and English. This boating app provides weather forecasts, waves, winds, water quality, marine currents, tides, moon phases, and other information for the safety of boaters.	Yes	Yes
PRSG, in collaboration with the CIEL and CariCOOS, developed the Costa VisPR, a coastal visualization tool to provide free access to georeferenced aerial photographs and opportunities to study coastal land-use planning, land changes, management, education and decision-making. https://costavispr.org/	Yes	Yes
PRSG researchers mapping effort, will help predict ciguatera areas and the ECOPATH model will produce a time course after an algal bloom is detected.	Yes	No

Description	Businesses Created / Retained	Jobs Created / Retained	Economic Benefit	Patents
PRSG committed approximately 400 hours of time to translate and edit the Mangrove educational curriculum to English and design this new translated version. PRSG provided marine science and interpretation expertise. According to the Bureau of Labor Statistics, the national median hourly wage for interpreters and translators is \$27.95/hr. (https://www.bls.gov/oes/current/oes273091.htm), the national median hourly wage for an editor is \$30/hr (https://www.bls.gov/ooh/media-and-communication/editors.htm) and the national median hourly wage for a graphic designer is \$25.66 (https://www.bls.gov/ooh/arts-and-design/graphic-designers.htm). Using these three estimates for the service provided and hours of time, we estimate that we are saving the Education Department \$10,370 in developing this tool. This tool was already shared with our Virgin Islands Marine Advisory Service for use in Virgin Islands schools and bilingual schools in Puerto Rico.	/	/	\$10370	
The first Spanish four-hour online course on natural disaster awareness was provided free of cost to audiences located both in Puerto Rico and the U.S. mainland simultaneously. A total of 30 participants completed the online course resulting in an overall investment of 120 hours. We collected data of each participants profession. Based on the Bureau of Labor Statistics, the estimated value in cost of salaries is \$4,243.	/	/	\$4243	
The Puerto Rico Department of Education (PRDE) endorsed Puerto Rico Sea Grant's Curriculums. Due to the COVID-19 pandemic, PRSG adapted two of these curriculums (Mangrove and Climate Change) to online learning. The PRDE shared with PRSG that curriculum development costs them approximately \$100,000. Adaptations to online learning are estimated at 25% of the full cost of development, thus, we estimate savings to the PRDE at about \$50,000. Teachers (210) have been trained in the use of these new online tools. These trainings involve approximately 6 contact hours per teacher, saving the PRDE an additional \$214,200 based on a per hour training fee of \$170.00 usually invested by the PRDE in teacher training.	/	/	\$264200	

2020 National Performance Measures - General

Performance Measure	Annual Target	Reported	Program Comment
Number of fishermen, seafood processing or aquaculture industry personnel who modify their practices using knowledge gained in fisheries sustainability and seafood safety as a result of Sea Grant activities	8,022		
Number of communities that adopt/ implement sustainable economic and environmental development practices and policies as a result of Sea Grant activities	216		
Number of acres of coastal habitat protected, enhanced, or restored as a result of Sea Grant activities	10,627	430	
Number of resource managers who use ecosystem-based approaches in the management of land, water, and living resources as a result of Sea Grant activities	1,161	1	
Number of people engaged in Sea Grant-supported informal education programs	815,294		
Number of Sea Grant-supported graduates who become employed in a job related to their degree within two years of graduation	244	12	

2020 Program Performance Measures

(No Data)

2020 Metrics

Staffing Numbers	Individuals	SG FTEs	non-SG FTEs
Administrative	6.00	3.50	0.51
Communications	7.00	2.55	3.39

Education	6.00	1.52	1.60
Extension	18.00	5.20	3.80
Research	17.00	1.10	0.94

Core Funding	Proposals	Institutions Involved	From Home Institution
Pre-Proposals	0	0	0
Full Proposals	0	0	0
Proposals Funded	0	0	0

Student Support	Number of New Students	Number of Continuing Students	Number of Degrees Awarded
Sea Grant Supported Undergraduate Students	8	6	2
Sea Grant Supported MS/MA Graduate Students	8	1	11
Sea Grant Supported PhD Graduate Students	0	0	0
Other Sea Grant Supported Professional Degree Graduate Students	0	0	1

Other Metrics	Amount
VolunteerHours	0
Number of P-12 Students Reached Through Sea Grant-Trained Educators or Directly through Sea Grant Education Programs	6024
Number of P-12 Educators who participated in Sea Grant education programs	258
SG-Sponsored/Organized Meetings/Workshops	62
Attendees in SG Meetings/Workshops	1471
Public or Professional Presentations	23
Attendees at Public or Professional Presentations	513
Clean Marina Program -- Certifications	0
HACCP -- Number of people with new certifications	0