

PIER 2016 Annual Report

Puerto Rico Sea Grant

Official Level of Effort - Only Approved Funding

Report Generated by YULISSA GARCIA on 12/13/2021

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2016 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	\$576,884	\$386,406	\$0	\$963,291	48 %	\$55,135	48 %
Sustainable Fisheries and Aquaculture	\$107,034	\$45,388	\$0	\$152,423	8 %	\$21,430	8 %
Resilient Communities and Economies	\$366,586	\$218,846	\$0	\$585,432	29 %	\$27,268	29 %
Environmental Literacy and Workforce Development	\$169,932	\$85,950	\$56,500	\$312,382	16 %	\$5,718	15 %
TOTAL ALL FOCUS AREAS:	\$1,220,436	\$736,590	\$56,500	\$2,013,528	100 %	\$109,551	100 %

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2016 Impacts & Accomplishments

Agroforestry Conservation Practices: Educating PR/USVI Farmers to Improve Their Production at the Same Time that Our Coastal and Marine Resources are Conserved and Appreciated

NATIONAL FOCUS AREAS: Healthy Coastal Ecosystems

- Impact
- PO Review Complete

RECAP: Puerto Rico Sea Grant and the US Department of Agriculture developed and disseminated a novel soil conservation tool to promote agricultural sustainable practices and reduce the negative impacts of soil erosion and sedimentation in Puerto Rico and the US Virgin Islands coastal ecosystems.

PROGRAM FOCUS AREAS: Healthy Ecosystems and Habitats

Besides the loss of fertile land soil, erosion has led to increased pollution and sedimentation in streams and rivers. A major problem related to the erosion from soils used for agriculture, is the likelihood that these sediments are contaminated with pesticides and fertilizers and its impact on water quality and the health of coastal and marine ecosystems. Implementation of conservation practices to reduce erosion from agricultural lands and sediment impacts in our coastal and marine resources is a management priority.

Puerto Rico Sea Grant and the USDA Forest Service coordinated and developed a series of agroforestry and conservation practices fact sheets, tailor-made to the PR and the USVI reality. These fact sheets incorporate information to educate local farmers about the benefits of applying practices to control and reduce erosion and sedimentation in streams and rivers. Application of sustainable land use practices recommended are expected to improve water quality in our coastal and marine resources and protect the health of our coral reef communities.

Results: A series of 15 agroforestry fact sheets in Spanish and English were completed. This education and outreach tool will enhance extension efforts to prevent soil degradation, erosion and the loss of valuable agricultural land. Other benefits expected from this effort are a reduction of pollution and sedimentation on streams and rivers, curtail contamination in our waterways and contribute to the health of coastal ecosystems. Extension agents will be disseminating this information to farmers, resource users and resource managers.

PARTNERS: US Forest Service (USDA, USFS);

ASSOCIATED PROJECT(S):

COASTAL COMMUNITIES DEVELOPMENT (2014 - 2017)

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Promoting Conservation in Tres Palmas Marine Reserve Through the Development of Partnerships and Citizen Participation

NATIONAL FOCUS AREAS: Healthy Coastal Ecosystems

- Impact
- PO Review Complete

RECAP: Community self-enforcement efforts facilitated the building of networks with relevant agencies with jurisdiction at the TPMR and formalized the involvement and role of the local community in decision-making, to strengthened enforcement and safety issues.

PROGRAM FOCUS AREAS: Healthy Ecosystems and Habitats

Tres Palmas Marine Reserve (TPMR) has been heavily marketed as one of the top 5 best places for snorkeling in Puerto Rico. Given the reserve's attractiveness and popularity, the amount of visitors has significantly increased generating new management challenges, which are accentuated by the lack of enforcement at the reserve.

Puerto Rico Sea Grant and Amigos de Tres Palmas coordinated an interagency meeting to overview current institutional arrangements and enforcement activities of federal, state, and territorial agencies, with jurisdiction on Tres Palmas Marine Reserve. Opportunities for community self-enforcement efforts were also contemplated. Needed criteria for the development of management approaches to evaluate the effectiveness in achieving specified goals, collaboration with community self-enforcement efforts and objectives that contribute to the conservation of biodiversity, human caused changes and maintaining the integrity of ecological interactions at the reserve were discussed.

Results: Puerto Rico Sea Grant, Amigos de Tres Palmas, the DNER, the PR Police Department and the Municipality of Rincón implemented a series of management strategies aimed at the protection and conservation of TPMR and the education of resource users through the involvement of the local community. This measure attempts to promote adequate conditions to aid the recovery of mangroves, reduce sedimentation and protect the reserves principal attraction Acropora palmata, a critically listed endangered coral. To promote reserve users safety, the TPMR was included in the Sea Grant-CariCOOS breaking surf model, which provides wave height information and includes more than 90 beaches around all Puerto Rico. Two Green Stations were installed as part of a DNER program that intends to foster better management practices for solid wastes disposal in our beaches. Given the positive results from these partnerships, two agreements of collaboration were signed where Amigos de Tres Palmas and the DNER agreed to work together in co-managing the TPMR. In another agreement, signed by Amigos de Tres Palmas, the DNER and the Municipality of Rincón, reached an understanding to collaborate in enforcement, compliance and safety issues.

PARTNERS: Caribbean Integrated Coastal and Ocean Observing System (CarICOOS); Puerto Rico Department of Natural and Environmental Resources;

ASSOCIATED PROJECT(S):

MARINE OUTREACH PROGRAM (2014 - 2017)

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Coastal Nature Reserve: "Caño Boquilla"

NATIONAL FOCUS AREAS: Healthy Coastal Ecosystems

- Impact
- PO Review Complete

RECAP: Puerto Rico Sea Grant and partners, established an effort for the protection, education and conservation of the "Caño Boquilla Nature Reserve" (CBNR).

PROGRAM FOCUS AREAS: Healthy Ecosystems and Habitats

The Caño la Boquilla Nature Reserve (CBNR) which comprises 120 acres of maritime zone, beach and wetland forests, is located on the Río Grande de Añasco Watershed. The CBNR is habitat for resident and migratory birds, sea turtles, fishes, mollusks and marine mammals. It is also habitat for many flora species, particularly the endangered tree *Pterocarpus officinalis*. Outreach efforts to educate the local community, protect and conserve this natural ecosystem are pressingly needed to keep the natural balance of the ecosystem and enjoy the natural services provided.

PRSG established a collaborative effort with several partners to reforest and rehabilitate two (2) acres of coastal habitats in the CBNR. As part of our efforts one hundred and eighty three (193) coastal trees and mangroves were planted, ninety (90) *Pterocarpus officinalis* seeds were planted, one thousand (1,000) pounds of trash and marine debris were removed in one of the reserve's estuaries and seven (7)

workshops to capacitate one hundred fifty-seven (157) volunteers were offered.

The efforts to restore the health of the ecosystem are a learning platform for the continued protection and conservation of CBNR, while strengthening community education and stewardship. Continuity beyond the partnership will be sustained by Dewey University who committed to adopt the newly planted trees corridor. PRSG and its partners will continue outreach efforts in the CBNR through competitive proposal writing and posting publications on the reserve page. (granreservaboquilla.wordpress.com)

PARTNERS: Mayaguezanos Por la Salud y el Ambiente; Guama Comunidad Agro ecoturística (GCA); Cafiescencia; Dewey University; Puerto Rico Department of Natural and Environmental Resources;

ASSOCIATED PROJECT(S):

[MARINE OUTREACH PROGRAM \(2014 - 2017\)](#)

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

NATIONAL FOCUS AREAS: Healthy Coastal Ecosystems

- Impact
- PO Review Complete

RECAP: Puerto Rico Sea Grant's Virgin Islands Marine Advisory Service works with local restaurants to increase the number of restaurants certified as Reef Responsible

PROGRAM FOCUS AREAS: Healthy Ecosystems and Habitats

The demand for seafood is increasing yet many populations of fish are being overfished, especially around the island of St. Croix. This project promotes the purchasing and consuming of fish caught or farmed using environmentally friendly practices. It educates restaurants on purchasing fish that are legally caught using sustainable methods.

VIMAS has joined with staff from local agencies and organizations to develop an education and outreach program that promotes a sustainable fishing industry.

VIMAS has been working with partners to create the Reef Responsible program and supporting educational materials. One workshop was held during this period bringing the total of sixteen (16) restaurants certified as Reef Responsible. In addition, an exhibit on the program was done at "The Taste of St. Croix", a local annual event which attracts hundreds of St. Croix residents.

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

ASSOCIATED PROJECT(S): None listed in the database

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Puerto Rico Sea Grant reef restoration contributes to the growing tourism-based economy of Culebra Island, Puerto Rico

NATIONAL FOCUS AREAS: Healthy Coastal Ecosystems

- Impact
- PO Review Complete

RECAP: Puerto Rico Sea Grant research contributed to enhancing the growing tourism-based economy of Culebra Island by fostering increasing visitors to restored reefs, mostly attracted by the restored seascape and by rich fish assemblages and resident turtles.

PROGRAM FOCUS AREAS: Healthy Ecosystems and Habitats

The long-term combined impacts of local human-driven factors, such as land-based source pollution (LBSP), water quality decline and overfishing, as well as large-scale climate change-related factors, such as massive coral bleaching and mass coral mortalities, have resulted in a large-scale alteration of coral reef community dynamics and in the large-scale demise of coral assemblages. These have often resulted in a net coral reef decline and in often irreversible benthic community phase shifts, with critical impacts on a sort of coral and fish functional groups, which might impair significant coral reef ecosystem functions.

A total of four replicate plots per cohort are being sampled regarding fragment survival, skeletal extension, branch production, branchiness index, % living tissue cover, % recent and old mortality, % disease prevalence, bleaching index, % bleaching frequency, causes of mortality, and predator density and 25 coral colonies/plot were randomly selected, tagged, geo-referenced and permanently monitored. Fish abundance and estimated fork lengths are being determined and used to estimate biomass at the lowest taxa possible. Herbivore-specific data is being extracted from fish counts.

Results: This project has documented that Staghorn coral out-planting has resulted in significant increases in fish species richness, diversity index, abundance, and biomass within restored plots in comparison to control plots, and that coral cohort size seems to be an important factor affecting fish assemblages. This study has paramount implications for the wider Caribbean region to understand the importance of coral reef rehabilitation, not only as a tool to replenish depleted coral species, but to rebuild reef fisheries. Declining coral reefs lose benthic heterogeneity and fish species. This project showed that low-tech coral reef rehabilitation can foster rapid changes in fish assemblages. Restoring depleted corals, rehabilitate reef accretion, reconstruct the shallow reef's seascape, represents a long-term buffering effect to damper wave action, and helps rebuild fish assemblages.

PARTNERS: Sociedad Ambiente Marino;

ASSOCIATED PROJECT(S):

ECOSYSTEM-LEVEL IMPACTS OF COMMUNITY-BASED CORAL REEF HEALTH REHABILITATION IN LIGHT OF RAPIDLY EVOLVING ECOLOGICAL PARADIGMS (2014 - 2015)

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Climate Education for Virgin Islands High School Students

NATIONAL FOCUS AREAS: Resilient Communities and Economies

- Impact
- PO Review Complete

RECAP: Puerto Rico Sea Grant, through the Virgin Islands Marine Advisory Service, has continued to provide high school students with the necessary information to understand global climate change and how they can work to mitigate it. Funds for 2016-17 were secured for additional climate change education on St. Croix.

PROGRAM FOCUS AREAS: Resilient Communities and Economies

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.

This project provides climate change education to high school students so that they are better equipped to adapt to the changing climate and its local impacts as they continue their education and enter the workforce. Increased awareness of the problem assists with better resource management and planning and better mitigation of climate change impacts, and the reduction of individual carbon footprints through changes in behavior.

Result: VIMAS provided climate change education to high school students by providing four climate change presentations to environmental science classes on St. Croix. Pre/post tests show significant improvement in climate change literacy in the students who participated.

PARTNERS: Virgin Islands Department of Education;

ASSOCIATED PROJECT(S):

VIRGIN ISLANDS MARINE ADVISORY SERVICE (2014 - 2017)

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Unmanned Aerial Vehicles are being used to assess and create a baseline of coastal erosion in the Puerto Rico Western region.

NATIONAL FOCUS AREAS: Resilient Communities and Economies

- Impact
- PO Review Complete

RECAP: UAV's are being used to assess and create a baseline of coastal erosion in the Puerto Rico Western region. Such actions will lead to the development of effective action plans to be implemented by the Government of Puerto Rico and its Coastal Municipalities.

PROGRAM FOCUS AREAS: Resilient Communities and Economies

Several reports about Puerto Rico shorelines indicate increased erosion losses in certain parts of the shore. To mitigate this problem, it is important to monitor the erosion over time, with special interest in pre/post storm events.

One of the many contributions of this work is the establishment of the 5 observational sites that encompassed the denoted Caribbean Littoral Aerial Surveillance System (CLASS). The idea behind CLASS is to produce a robust data set of coastal erosion and vegetation evolution, which can be linked to other variables such as climate, economics and demography data, allowing local stakeholders to develop policy tools.

Effective shoreline monitoring systems are needed to provide the foundation to determine erosion or accretion rates along the island and its

impact on coastal infrastructure. Such actions will lead to the development of effective action plans to be implemented by the Government of Puerto Rico and its Coastal Municipalities.

PARTNERS: None listed in Database

ASSOCIATED PROJECT(S):

COASTAL ECOSYSTEM ASSESSMENT, DEVELOPMENT AND CREATION OF A POLICY TOOL USING UNMANNED AERIAL VEHICLES (UAVs) FOR: A CASE STUDY OF WESTERN PUERTO RICO COASTAL REGION (2016 - 2017)

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Developing and Implementing Better Aquatic Services in Puerto Rico

NATIONAL FOCUS AREAS: Resilient Communities and Economies

- Impact
- PO Review Complete

RECAP: As a result of Puerto Rico Sea Grant's and the US Lifesaving Association's educational efforts and expert recommendations regarding lifeguard services implementation at the St. Regis Resort, several lives were saved by lifeguard rescues and no drowning incidents were reported.

PROGRAM FOCUS AREAS: Resilient Communities and Economies

Puerto Rico Sea Grant has been gathering drowning statistics in Puerto Rican beaches for the last 20 years. Statistics reveal that more than 30 deaths per year result from drowning incidents, which cause great suffering for families, friends and the community. Drowning victims are real people, and our program thinks of them not just as statistics but as persons that could have been saved if skills in survival swimming and water safety were provided. Statistics regarding near-drowning incidents and its lifelong health impacts are non-existent.

In collaboration with the La Concha and St. Regis hotels (where three tourists died during the last year), Puerto Rico Sea Grant invited representatives from the United States Lifesaving Association (USLA) to develop a risk assessment and aquatic safety proposal to provide information regarding personnel needs, essential equipment, training and the required budget to establish a lifeguard program, to reduce drowning incidents at these hotel beaches.

Even though the hotels considered onerous the implementation of the lifeguard program presented by the USLA as a result of PRSGs' effort, the St. Regis Hotel implemented several of the recommendations included in the risk assessment and aquatic safety study developed by USLA officials.

Result: Following the recommendations presented, the St. Regis Hotel contracted lifeguards, bought jet skis, developed signage and a banner system designating safe areas to swim, providing a safer environment for the hotel guests. No drowning incidents have been reported at the site since the safety measures were implemented, but many lives were saved from rescues performed by the lifeguards and water safety measures established.

PARTNERS: International Hospitality Enterprises; United States Lifesaving Association (USLA);

ASSOCIATED PROJECT(S):

MARINE OUTREACH PROGRAM (2014 - 2017)

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Center for the Education of Climate Change Adaptation (CenECCA): Transferring Applied Climate Science to Puerto Rico's Coastal Communities

NATIONAL FOCUS AREAS: Resilient Communities and Economies

- Impact
- PO Review Complete

RECAP: Puerto Rico Sea Grant through its Center for the Education of Climate Change Adaptation, provided capacity building opportunities to emergency managers, responders and coastal communities and enhanced their capabilities to adapt, reduce vulnerability and buildup resiliency to hurricanes, storm surge, coastal flooding and sea-level rise among other natural hazards.

PROGRAM FOCUS AREAS: Resilient Communities and Economies

Puerto Rico has 2.3 million people living on its 44 coastal municipalities. These coastal communities are at risk of storm surge, hurricanes, sea level rise, coastal erosion and flooding. Municipal administrators, emergency managers, public policy developers, emergency responders and coastal communities are in need of new tools, modeling and updated information on climate change expected impacts, to improve their skills and enhance their capacity to adapt and be resilient.

RESPONSE: PRSG through our CenECCA offered advice to resource and emergency managers, first responders, volunteers, planners, engineers, GIS experts and residents of coastal communities about the application and use of information and tools (including NOAA's Climate Tool Kit) that increased resilience and built the necessary capacity to endure vulnerabilities associated to natural hazards (hurricanes, storm surge, flooding, and sea level rise). Participants will incorporate this information into their mitigation and adaptation plans.

RESULTS: Emergency managers, responders and coastal communities were trained about expected impacts of climate change, the vulnerability of coastal communities to natural hazards and the urgency to develop adaptation and resilience strategies to the foreseen changes. Coastal communities were instructed about the use and application of NOAA's Digital Coast models and data. Close to three hundred (300) persons benefited of the training and instructional activities by improving their skills in emergency decision-making, resilience capabilities and adaptation strategies.

PARTNERS: None listed in Database

ASSOCIATED PROJECT(s):
CLIMATE EXTENSION (2014 - 2017)

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Building Environmental Youth Leadership in Rincón, Puerto Rico

NATIONAL FOCUS AREAS: Resilient Communities and Economies

- Impact
- PO Review Complete

RECAP: Rincón high school students have successfully become resource user educators and environmental interpreters, becoming ambassadors of the Tres Palmas Marine Reserve and playing a significant role in community self-enforcement efforts by educating resource users, promoting behavior changes and broadening local economic options.

PROGRAM FOCUS AREAS: Resilient Communities and Economies

Puerto Rico's Department of Natural and Environmental Resources (DNER) and the Department of Education (DE) developed the program "Contacto Verde" or "Green Contact" to encourage teachers and students participation in workshops and field trips that could serve as the foundation to introduce them to the conservation of natural resources and experience contact with nature as a complement to formal education. Sea Grant was selected as one of the education centers endorsed by the DNER and DE to coordinate activities and introduce teachers and students to ocean literacy.

The Manuel García Pérez High School of Rincón, Puerto Rico approved a proposal submitted by PRSG to recruit students and train them to become Tres Palmas Marine Reserve (TPMR) ambassadors and ecological guides and promote community self-enforcement efforts. The eighteen students recruited participated in four (4) workshops and three (3) field trips that highlighted natural attractions and resources of the marine reserve, management needs, problems and issues. Students learned about fish and reef ecosystems, marine debris, marine mammals and turtles, law enforcement in the Reserve, sand composition, endangered species, community participation in law enforcement and beach erosion. These topics were presented to students by PRSG staff and collaborators from the USFWS and the DNER enforcement agents. Presenters emphasized the need to educate locals and visitors on the conservation of the reserve, the environmental value and economic impact it generates, the need to enforce the management plan and the importance of community participation.

Result: Pre- and post-tests were administered, to measure students' learning achievement, resulting in a high knowledge gain outcome. Once the students completed the environmental training, the Cabo Rojo National Wildlife Refuge US Fish and Wildlife Service education specialist trained the students on environmental interpretation employing the National Association for Interpretation (NAI) standards. Students accomplished over 150 volunteer hours providing a range of benefits for the conservation of the TPMR, protecting its critical breeding, nursery and feeding habitats, raising the profile of the reserve for tourism and broadening local economic options.

PARTNERS: Amigos de Tres Palmas; Puerto Rico Department of Education; US Fish and Wildlife Service (US DOI, FWS); Puerto Rico Department of Natural and Environmental Resources;

ASSOCIATED PROJECT(s):
MARINE OUTREACH PROGRAM (2014 - 2017)

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Puerto Rico Sea Grant and partners collaborate to educate and assist in tsunami awareness, safety and response in Humacao schools

NATIONAL FOCUS AREAS: Environmental Literacy and Workforce Development

- Impact

- PO Review Complete

RECAP: Puerto Rico Sea Grant and partners provided educators with background information, knowledge, strategies, and materials to make students more resilient to earthquakes and tsunamis. About two thousand two hundred fifty one (2,251) students are impacted by this effort.

PROGRAM FOCUS AREAS: Education and Workforce Development

Tsunami hazard is a reality in Puerto Rico. In 1867 and 1918, two tsunamis have affected our coastal region, causing death and destruction. Vulnerability to this natural hazard is very high due to the fact that Puerto Rico has a very high population density near the coast and recreational and tourist activities are concentrated at the coast. Recent tsunami events around the world have shown the value of tsunami education and preparedness in saving lives of students and staff. The demography of each school and its surrounding area add to the necessary uniqueness of each school's tsunami preparedness plan to include hazard education, evacuation training and practice.

Results: Puerto Rico Sea Grant developed two days' workshop for teachers about Tsunamis in collaboration with Puerto Rico Seismic Network.

A total of nineteen (19) teachers attended the workshops and returned a Workshop Evaluation Form. One hundred percent (100%) of the educators registered in the 2016 Great Puerto Rico ShakeOut. They practiced how to drop, cover, and hold on, during Great ShakeOut Earthquake Drills. All the educators who responded to an evaluating form rated the workshops activities as excellent. Ninety five percent (95%) of the teachers were confident tsunami information and strategies will be introduced during the future shake out and tsunamis drill activities. Pre and post-test assessment indicated significant improvement in participant content knowledge. Knowledge gained by the participants was seventy nine percent (79%).

PARTNERS: Puerto Rico Department of Education; University Of Puerto Rico, Humacao (UPR); Puerto Rico Seismic Network;

ASSOCIATED PROJECT(S): None listed in the database

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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
- PO Review Complete

RECAP: A teacher-training model developed by Puerto Rico Sea Grant received high marks from educators. The model instructs participants about marine topics, facilitates resource materials and motivates teachers to keep participating in the program. About seven thousand four hundred forty three (5,595) students will be impacted by this effort.

PROGRAM FOCUS AREAS: Education and Workforce Development

Most Puerto Rican teachers lack formal or informal studies on issues related to marine sciences. This lack of knowledge is reflected in the classroom, where discussion of these issues, are limited. Training for in service teachers and hands-on student field learning experiences, are efficient ways to disseminate new and relevant research results, to enhance marine environmental stewardship.

Puerto Rico Sea Grant developed seven (6) professional development programs related to specific topics, including: marine birds, physical oceanography, manatee, rocky shore, whale and plankton.

A total of sixty seven (67) teachers attended the workshops and returned a Workshop Evaluation Form. The 100% of the educators who responded to an evaluating form rated the workshops activities excellent or good. Ninety eight percent (98%) of participants responding the questionnaire to measure effectiveness of the workshops acknowledged they learned new information about marine topics and marine topics related materials. Ninety six percent (96%) of the teachers were confident that they could use the materials with their students. Pre and post-test assessment indicated significant improvement in participant content knowledge. The knowledge gain for the participants was seventy one percent (74.8%).

PARTNERS: Puerto Rico Department of Education;

ASSOCIATED PROJECT(S):
MARINE EDUCATION (2014 - 2017)

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Marine and Coastal Education Programs for K-12 Students

NATIONAL FOCUS AREAS: Environmental Literacy and Workforce Development

- Impact
- PO Review Complete

RECAP: Puerto Rico Sea Grant contributed to the development of an ocean literate citizenry and a future workforce that is diverse, knowledgeable and adequately prepared to advance the understanding of marine and coastal environments, its wise use, management and conservation.

PROGRAM FOCUS AREAS: Education and Workforce Development

A well informed, marine-science literate and environmentally responsible citizenry is needed to ensure a sustainable future for Puerto Rico's marine and coastal environments. Scientific knowledge of the sea and its importance on planet Earth should be part of the culture and general education in the school curriculum of the educational system of Puerto Rico. There is a need to enrich the science curriculum in schools in order to strengthen ocean literacy and the interest on marine environments. The participation of K-12 students in topics related to marine science and marine careers activities will contribute to the development of a work force acquainted with the environmental needs of Puerto Rico.

The Marine Science Adventure Program includes a wide range of active, high-quality learning experiences with corresponding support services for school-aged children and their teachers. The program launches students into the marine environment through exhibitions, laboratories, conferences and field activities at diverse coastal nature reserves in Puerto Rico. This multidisciplinary (STEM) approach to illustrate environmental problems, develop science applications, and community involvement was well received among participants and has proved to be very effective.

In 2016 the PRSG coordinated thirty-seven (37) education events for 2,219 K-12 levels students, and one hundred thirty two (132) teachers. Students acquired new knowledge (61.3% knowledge gain) about marine and coastal ecosystems and had the opportunity to understand and appreciate the varied study fields in marine sciences.

PARTNERS: Puerto Rico Department of Education;

ASSOCIATED PROJECT(S):
MARINE EDUCATION (2014 - 2017)

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Sandwatch Project Begins in Mexico

NATIONAL FOCUS AREAS: Environmental Literacy and Workforce Development

- Impact
- PO Review Complete

RECAP: The La Ventana Association and the Clean Beaches Committee in the San Pedro Mixtepec municipality, with support from the Puerto Rico Sea Grant Program, began performing UNESCOs' Sandwatch Project activities, to monitor and inform the community about the importance of conserving their marine and coastal resources and using them in a sustainable manner.

PROGRAM FOCUS AREAS: Education and Workforce Development

Similar to Puerto Rico, Mexico is currently experiencing decaying beaches due to anthropogenic activities and climate change, among other factors. Marine ecosystems are at risk, and erosion-related problems are on the rise. There is a pressing need to have children, young people and adults learn about coastal and marine resources and their fragility, and how important it is to protect them and use them in a sustainable manner. It is also important that people have the chance to identify and analyze the problems occurring in their beaches so they can pose solutions and alternatives.

Puerto Rico Sea Grant Program offered resources, information and methodology from the Sandwatch Project to Mexico's, La Ventana Association. La Ventana Association is an NGO that read about Sandwatch through our Internet page and solicited information to start a similar effort in their community. PRSG sent information to introduce them to the monitoring activities at the beaches of their community.

Results: The La Ventana Association made an Alliance with the Clean Beaches Committee in the San Pedro Mixtepec municipality and began monitoring Bachoco Beach, in Mexico. They are currently working with the project in 4 local schools: two primary schools, a high school and a preparatory school. The monitoring occurs on a monthly basis using scientific instruments and educating the participants about the importance of conserving their resources. They have an interdisciplinary approach to the themes, applying them to biology, wood-working, poetry and mathematics.

PARTNERS: UNESCO;

ASSOCIATED PROJECT(S):
MARINE EDUCATION (2014 - 2017)

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Connectivity between shallow and mesophotic ecosystems along La Parguera and Guanica shelf-edge indicates they should be treated as one population.

NATIONAL FOCUS AREAS: Healthy Coastal Ecosystems

- Accomplishment
- PO Review Complete

RECAP: Overall, PRSG data revealed gene flow across *Agaricia lamarcki* populations on small spatial scales and structure between populations on larger scales, indicative of isolation-by-distance. The extent of connectivity is dependent on site-specific factors which regulate larval survivability and gene flow both pre- and post- settlement.

PROGRAM FOCUS AREAS: Healthy Ecosystems and Habitats

The Caribbean has been defined as a coral disease hotspot (Weil 2004) with large human populations bordering coral ecosystems and creating large amounts of effluents and terrigenous sedimentation, the cumulative effect degrades ambient water quality and impairs survivorship and recruitment of corals. Identifying genetic connectivity and discrete population boundaries is an important objective for management of Caribbean scleractinian corals. These reef building organisms are experiencing dramatic population declines from anthropogenic stressors.

Identifying genetic connectivity and discrete population boundaries is an important objective for management of declining Caribbean reef-building corals and coral reefs. Population connectivity is crucial for understanding marine ecology and proper implementation of marine management, since genetic exchange within and between populations regulates the abundance and distribution of marine organisms. PRSG study aims to estimate population connectivity of the plating coral, *Agaricia lamarcki* (Milne Edwards 1851), from both shallow and mesophotic reefs across the U.S. Caribbean, (Puerto Rico and U.S. Virgin Islands) spanning roughly 300km.

Results: This study suggests that *Agaricia lamarcki* is capable of horizontal and vertical dispersal on small spatial scales and structured along a larger geographic extent within the U.S. Caribbean. Strong horizontal and vertical panmixia persists for the eight localities in La Parguera and Guanica shelf edge (sampling localities B-I), as such they should be treated as one population for coastal resource managers. Favorable hydrodynamic forces could supply reefs in this area with local larval recruits and aid in propagule retention.

PARTNERS: None listed in Database

ASSOCIATED PROJECT(S):

CONNECTIVITY BETWEEN SHALLOW AND MESOPHOTIC ECOSYSTEMS IN PUERTO RICO AND THE US VIRGIN ISLANDS: USING CORALS AND COMMENSAL FAUNA (2014 - 2015)

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Puerto Rico Sea Grant researchers develop the capability of tracking fish with great accuracy improving effective fisheries management

NATIONAL FOCUS AREAS: Healthy Coastal Ecosystems

- Accomplishment
- PO Review Complete

RECAP: Researchers contributed to the understanding of ecosystem dynamics by tagging multiple species and developing a network of acoustic tracking stations through waters of Puerto Rico and the US Virgin Islands.

PROGRAM FOCUS AREAS: Healthy Ecosystems and Habitats

Fisheries managers realize that ecosystem-based management is a necessity for conservation of marine fisheries resources and consequently healthy ecosystems and habitats. Still, the value and use of habitats by many species remains understudied or unknown, in particular how species move amongst different habitats to complete their entire life-history.

PRSG developed a project that will contribute to a multi-species study over a large spatial and temporal scale that explores links among species and habitats. The research will leverage considerable support by using an expanding collaboration between academic, territorial, and federal researchers developing a network of acoustic tracking stations that cover PR and USVI waters. The goal of this collaboration is to enhance understanding of ecosystem dynamics by employing acoustic tagging technology, in conjunction with general fisheries techniques. Instead of focusing efforts on a single species, this project seeks to deploy acoustic tags on a variety of species that include sharks (apex predators), barracuda (mesopredators), reef fish (includes both low trophic level consumers and herbivorous species), and turtles.

Results: Twenty four (24) tags were implanted in a number of shark species, yellowtail and mutton snapper and other species. A VEMCO Positioning System (VPS) was installed that triangulates the animal's position with a potential accuracy between 2 and 6 meters. If a transmission is detected by three or more receivers the VPS takes the differences of arrival times at receiver pairs, and calculates an intermediate position. Furthermore, previously tagged fish tracking the same individuals for multiple years will allow for robust analyses

related to habitat selection, site fidelity, and inter-annual movement patterns related to life history events, such as spawning, in particularly when combined with fine-scale data.

PARTNERS: University Of Massachusetts At Amherst (Umass);

ASSOCIATED PROJECT(S):

BUILDING A MULTI-INSTITUTIONAL EFFORT TO UNDERSTAND REGIONAL CONNECTIVITY: LINKING FISH, ESSENTIAL HABITATS AND ECOSYSTEMS FOR EFFECTIVE MARINE RESOURCE MANAGEMENT (2014 - 2015)

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Long-spine sea urchin restocking efforts need to be remote from human influence and focus on establishing high-density populations.

NATIONAL FOCUS AREAS: Healthy Coastal Ecosystems

- Accomplishment
- PO Review Complete

RECAP: Puerto Rico Sea Grant study suggests that *Diadema antillarum*'s managers restocking efforts need to be remote from human influence and should focus on establishing high-density populations

PROGRAM FOCUS AREAS: Healthy Ecosystems and Habitats

Relevance: The need to uncover basic features of the immunological responses of *Diadema* and any possible relationship to recovery is of great importance for the health of coral reefs in the Caribbean. Recovery of *Diadema* has been found to be progressing at a very slow rate, and the potential deficiency in active response to challenge by LPS (a constituent of gram-negative bacteria) has been confirmed to exist in *Diadema antillarum*-a, but not in other common Caribbean sea urchins.

Response: PRSG funded this project to examine the variation in immune responses of *Diadema antillarum*-a on St. Croix, USVI. We hoped to answer the following questions: Is there immune variation within or among local *Diadema* populations; Does strength of immune responses depend on *Diadema* density; Is variation in immune response related to any geographic feature?

Results: The results of this study on *Diadema antillarum*'s immunity have implications for the practices used to foster restoration. The finding of this study that a persistent immune defect is present in *Diadema* suggests that managers may want to initiate restocking efforts that are remote from human influence if a persistent immune defect is found, since *Diadema* were found to be vulnerable to human gut bacteria at the time of the mass mortality. Managers should also know that restocking efforts should focus on establishing high-density populations.

PARTNERS: University of Massachusetts at Boston (UMass);

ASSOCIATED PROJECT(S):

THE IMMUNE RESPONSE OF DIADEMA ANTILLARUM AND RECOVERY FROM CARIBBEAN-WIDE MASS MORTALITY (2014 - 2015)

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Gnathiid isopod populations may be a useful indicator species for reef health

NATIONAL FOCUS AREAS: Healthy Coastal Ecosystems

- Accomplishment
- PO Review Complete

RECAP: As micropredators, gnathiid isopods in particular can have major impacts on hosts and thus coral reef ecosystems, underscoring the need to preserve live coral.

PROGRAM FOCUS AREAS: Healthy Ecosystems and Habitats

One of the major challenges facing ecologists, conservationists, and managers of marine reef ecosystems is to understand the complex biological interactions that occur within and between reef-associated habitats and how these interactions are affected by anthropogenic activity. Most research on the diversity and ecology of reef ecosystems focuses on organisms that are easily seen and surveyed by human observers. This occurs in spite of the fact that parasitism is the most common animal lifestyle and thus the most common biological interaction.

We ultimately aim to develop a comprehensive understanding of the direct and indirect effects of parasites in coral reef ecosystems through their role as disease vectors and influence on trophic interactions and food webs.

Results: While parasites are an important component of biodiversity, in high numbers they can have significant impacts on host populations. As micropredators, gnathiid isopods in particular can have major impacts on hosts and thus coral reef ecosystems. Given the emerging link between gnathiid populations and live coral, gnathiid isopod populations may be a useful indicator species for reef health. This link also underscores the need to preserve live coral in the US Caribbean. By demonstrating direct (mortality) and indirect (performance) effects of

gnathiid isopods on juvenile coral reef fishes, we demonstrate the potential impact of high levels of gnathiid isopods to negatively impact populations of coral reef fishes.

PARTNERS: Arkansas State University; US Geological Survey (US DOI, USGS);

ASSOCIATED PROJECT(S):

REEF HEALTH, FISH DISEASES, AND HABITAT CONNECTIVITY: UNDERSTANDING THE ROLE OF ECTOPARASITES AS VECTORS FOR DISEASE, ENERGY TRANSFER, AND BAROMETERS OF REEF ECOSYSTEM HEALTH (2014 - 2015)

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Protection of Natural Valuable Ecosystems by Community and Schoolchildren

NATIONAL FOCUS AREAS: Healthy Coastal Ecosystems

- Accomplishment
- PO Review Complete

RECAP: Puerto Rico Sea Grant and its partners collaborate on the implementation of the Green Contact Program for the Public School System of Puerto Rico. The purpose of the Program is to offer environmental education and hands-on experiences for the public school communities.

PROGRAM FOCUS AREAS: Healthy Ecosystems and Habitats

The Puerto Rico Department of Education (DE) has a federal mandate to implement the instructional program "Green Contact," intended to raise awareness in school communities about natural resources conservation, sustainable practices and outdoor interaction with nature.

In a collaborative effort with our partners, PRSG is participating in the Green Contact Program by means of two community environmental projects: The Rio Hondo Community Forest and The Boquilla Nature Reserve Community Forestation Program. These environmental projects provide recreational and environmental opportunities (walking trails, nature watching, forestation, coastal clean ups, improvement of well-being) to the students, their parents and the general public who participate in this Green Initiative. Through these efforts, the two natural resources located in the Río Guanajibo and Río Grande de Añasco Watersheds are protected.

One hundred (100) students participated in the PRSG Green Contact outreach activities integrating conservation strategies with natural laboratory experiences and enjoyment. The participants were exposed to hands on science and math skills on the field. Also guided tours to the community projects and short talks about their importance are contemplated as part of the Green Contact Program. PRSG and partners will continue outreach efforts throughout the PRSG page. (naturalezasintoxicos.wordpress.com)

PARTNERS: Proyecto Comunitario Agro Eco Turistico del Barrio Rio Hondo; Mayaguezanos Por la Salud y el Ambiente; Guama Comunidad Agro ecoturística (GCA); Public School Esteban Rosado Báez, Mayaguez, PR; Public School Luis Muñoz Rivera, Mayaguez, PR;

ASSOCIATED PROJECT(S):

MARINE OUTREACH PROGRAM (2014 - 2017)

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Community in Harmony with the Environment

NATIONAL FOCUS AREAS: Healthy Coastal Ecosystems

- Accomplishment
- PO Review Complete

RECAP: Puerto Rico Sea Grant and partners are promoting people's stewardship in environmental health and justice by the development of educational environmental projects and promoting leadership development in economically under served communities for a more healthy and sustainable environment.

PROGRAM FOCUS AREAS: Healthy Ecosystems and Habitats

The lack of well-planned activities in land and coastal territories requires a strong educational campaign towards sustainability and the development and promotion of green public policies, community leadership and empowerment.

PRSG promoted the empowerment of 5 new community leaders in Western Puerto Rico, where each of them are working hand in hand with our program in the protection and conservation of the Rio Guanajibo and the Rio Grande de Añasco Watersheds. PRSG advised and supported community organizations in proposals preparation for state and federal programs, as an opportunity to allocate new funds for the community initiatives. PRSG support, provided opportunities for our partners to develop environmental and educational projects and initiatives that resulted in the allocation of more than \$40,000 in state and in-kind funds for this fiscal year. PRSG continues providing advice on community organization an environmental protection throughout local and federal public policy rules. (bibliotecalegalambiental.wordpress.com),

PRSG helps grow the body of community leaders in Puerto Rico, including new community groups and members as our partners continue

working on their environmental projects, contributing to the development of skills, abilities, leadership and teamwork. The new alliances increased the number of stakeholders (10 citizens) that are promoting sustainable communities in Puerto Rico.

PARTNERS: Mayaguezanos Por la Salud y el Ambiente; Ciudadanos Aguadeños Pro Conservación del Ambiente; Guama Comunidad Agro ecoturística (GCA); Cafiescencia;

ASSOCIATED PROJECT(S):

MARINE OUTREACH PROGRAM (2014 - 2017)

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Puerto Rico Sea Grant published the first resident marine birds book of Puerto Rico

NATIONAL FOCUS AREAS: Healthy Coastal Ecosystems

- Accomplishment
- PO Review Complete

RECAP: PRSG produced the book Marine Birds of Puerto Rico. This book provides the only complete summary of information about resident marine birds in Puerto Rico.

PROGRAM FOCUS AREAS: Healthy Ecosystems and Habitats

Marine birds are part of the complex marine and coastal ecosystems. Climate change, habitat destruction by urban development, pollution, lack of management and deforestation are threatening the survival of these species. Reliable information, presented in an attractive format, will contribute to increase the knowledge and awareness about the species of marine birds that live around Puerto Rico and its conservation.

During 2015, PRSG produced the book Marine Birds of Puerto Rico. This work was completed and published in 2016. The book provides the only complete summary of information about resident marine birds ever published in Puerto Rico. The book both summarizes and analyzes the physiology, biology, breeding grounds and conservation of marine birds. Marine Birds of Puerto Rico is written in a simple language and is the product of an acknowledged expert in the field of ornithology. This is the first book that highlights marine birds in Puerto Rico.

Results: PRSG published a book that serves as an introduction to marine birds of Puerto Rico. The book is available in printed and digital formats and has been widely distributed among teachers, resource managers, community groups and NGOs. It is available on: <https://issuu.com/seagrantpr/docs/aves-marinas-mayo11-2016/1?e=23601598/39182677>

PARTNERS: None listed in Database

ASSOCIATED PROJECT(S):

COMMUNICATIONS AND PUBLICATIONS (2014 - 2017)

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PRSG joins USFWS to educate wetland ecosystems visitors by the implementation of interpretive panels

NATIONAL FOCUS AREAS: Healthy Coastal Ecosystems

- Accomplishment
- PO Review Complete

RECAP: Puerto Rico Sea Grant collaborated with US Fish and Wildlife Service in the production of interpretive panels for Laguna Cartagena identifying significant features of the wetland, the importance of this natural resource, reinforcing basic rules, and safety and orientation information.

PROGRAM FOCUS AREAS: Healthy Ecosystems and Habitats

Wetlands are key ecosystems in Puerto Rico's coastal areas. They offer us green infrastructure, serve as buffer zones, and provide habitat to numerous organisms, especially to resident and migratory aquatic birds. Laguna Cartagena National Wildlife Refuge (LCNWR) is a highly visited area due to its ecological value, beautiful scenery, wide range of recreational opportunities, and its proximity to excellent beaches. There is a need for information about the refuge to increase awareness about the importance of the wetlands.

Interpretive signs are an excellent tool that enhances a direct and meaningful connection between visitors and the natural attractions. PRSG collaborated with USFWS in the production of a series of interpretive panels for Laguna Cartagena including: its location, endemic and native plants, restoration efforts, recreational and educational opportunities, and general information for the visitors.

Three panels were designed and produced by PRSG illustrators and are ready to be installed at the refuge. Interpretive panels already installed were renovated and elaborated by PRSG personnel.

PARTNERS: US Fish and Wildlife Service (US DOI, FWS);

PRSG and the USFWS educate children through a nursery plant guide

NATIONAL FOCUS AREAS: Healthy Coastal Ecosystems

- Accomplishment
- PO Review Complete

RECAP: Puerto Rico Sea Grant collaborated with the US Fish and Wildlife Service in the development of educational booklet for children to guide them through their visits to the nursery, develop interest in the environment, stimulate academic and social growth of children and promote the conservation of threatened or endangered species.

PROGRAM FOCUS AREAS: Healthy Ecosystems and Habitats

Families visit the USFWS National Wildlife Refuge (NWR) plant nursery to get a glimpse of different environments, helping children gain a broad understanding of nature. Environmental education processes should start at an early stage. Children have a natural interest in the environment and environmental education is an ideal way to stimulate academic and social growth of children and promote the conservation of threatened or endangered species. The USF&WS is looking for opportunities to provide memorable, immersive learning experiences that stimulate imagination, introduce children to unknown worlds and offer unique environments for quality of life with family.

Booklets are an excellent and effective tool to communicate environmental information in a format that is easily read and digested by children, grabbing their attention and giving only necessary facts about Puerto Rican flora. PRSG collaborated with USFWS in the development of a booklet for children that visit the NWR's nursery. This booklet is an excellent tool to explore the nursery, learn details about the plants, and have fun while learning.

PRSG and USFWS developed a booklet with activities to do at the nursery. It includes a welcome message given by a comic character (the character also serves as a guide through the booklet), observation and exploration exercises to do at the nursery, drawing activities, word-search games and a certificate.

PARTNERS: US Fish and Wildlife Service (US DOI, FWS);

ASSOCIATED PROJECT(S):

COMMUNICATIONS AND PUBLICATIONS (2014 - 2017)

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PRSG and USFWS publish educational fact sheets about endangered and threatened animals in Puerto Rico and the USVI

NATIONAL FOCUS AREAS: Healthy Coastal Ecosystems

- Accomplishment
- PO Review Complete

RECAP: Puerto Rico Sea Grant and the US Fish and Wildlife Service produced fact sheets about threatened and endangered animals in Puerto Rico and the US Virgin Islands to communicate threatened and endangered species information in a format that is easily read and understood.

PROGRAM FOCUS AREAS: Healthy Ecosystems and Habitats

Managers, agencies, public policy makers, teachers, and students need reliable and updated information about threatened and endangered animals in Puerto Rico and the USVI. Information about these species will contribute to increase awareness about the species, their populations' status, their characteristics and conservation measures.

Result: A cooperative agreement between PRSG and the USFWS was established to build awareness about candidate, threatened, and endangered species by producing educational materials with the most up-to-date scientific information available about species protected by the Endangered Species Act (ESA) in the Caribbean. USFWS provides technical assistance, including the latest scientific information about the Caribbean listed species and PRSG provides its expertise in the areas of flora and fauna illustration, document drafting, editing, and production to create original illustrations of species and a collection of fact sheets that will be used and distributed widely by both organizations.

Twenty-seven (27) fact sheets about threatened and endangered animals were published.

PARTNERS: US Fish and Wildlife Service (US DOI, FWS);

ASSOCIATED PROJECT(S):

COMMUNICATIONS AND PUBLICATIONS (2014 - 2017)

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Nautical newspaper La Regata and PRSG educate about fishing closures through the use of novel fishing closure cards

NATIONAL FOCUS AREAS: Healthy Coastal Ecosystems

- Accomplishment
- PO Review Complete

RECAP: Nautical newspaper La Regata and Puerto Rico Sea Grant are collaborating with fisheries resources managers through the dissemination of information related to fisheries closures with the use of fishing closure cards.

PROGRAM FOCUS AREAS: Healthy Ecosystems and Habitats

Fishing closures are a tool for management, conservation, and sustainable use of fisheries. Many persons, particularly recreational anglers, are not aware about fishing closures. The nautical newspaper La Regata is a trustworthy forum through which commercial and recreational fishers get informed about fishing events, laws and regulations, and fisheries environmental issues.

Nautical newspaper La Regata and PRSG joined efforts in the development of fishing closure cards. The cards have been published through the newspaper (printed and digital versions) and PRSG's Facebook page. Each card shows the name of the fish in English and Spanish, closure dates, and an illustration of the fish.

Result: Since April 2015, La Regata and PRSG have been educating readers of La Regata through the fishing closures cards. Thousands of persons have been able to learn about the fishing closures and an interesting forum for the exchange of ideas and opinions about fishing closures was developed as a by-product.

PARTNERS: La Regata, Nautical Newspaper;

ASSOCIATED PROJECT(S): None listed in the database

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Puerto Rico Sea Grant reaches over 5,000 stakeholders through social networks educating about marine and coastal resources

NATIONAL FOCUS AREAS: Healthy Coastal Ecosystems

- Accomplishment
- PO Review Complete

RECAP: Social networks have evolved into an excellent tool for Puerto Rico Sea Grant's ocean literacy dissemination efforts.

PROGRAM FOCUS AREAS: Healthy Ecosystems and Habitats

Ocean literacy has been defined as "an understanding of the ocean's influence on you and your influence on the ocean." In Puerto Rico there is a need to advance the understanding and protection of marine ecosystems among residents and resource users. Social networks improve communication skills, enhance participation as well as social commitment, reinforce peer support, and ensure realization of education based on collaboration strategies. Social networks are inexpensive media resources that, used correctly, contribute substantially to educational purposes and the dissemination of relevant information.

Since 2009, Puerto Rico Sea Grant has been using Facebook, Twitter, and Flickr pages to share the information and activities that Sea Grant produces to advance ocean literacy. For the period reported, Puerto Rico Sea Grant reached over 5,000 likes in Facebook and over 1,400 followers in Twitter. Through social networks, we share the information and pictures about PRSG activities and also communicate with our stakeholders via messages. In the PRSG Facebook page people are free to comment and share information about conservation and sustainable use of marine and coastal resources, request information and communicate their concerns.

Through social media pages, Puerto Rico Sea Grant promotes conservation and sustainable use of marine and coastal resources, and simultaneously, facilitates the process of sharing and searching information. People get informed about our publications, research results, educational services and activities, stories posted in the National Sea Grant's website, fishing closures, among other issues and topics. Also, other blogs, Facebook and Twitter pages from diverse entities, governmental agencies, and media organizations, such as newspapers and environmental electronic magazines and blogs, share the information that Puerto Rico Sea Grant posts in Facebook and Twitter. National Sea Grant reposts our information, too. For Puerto Rico Sea Grant, Facebook has been the most successful social media network.

PARTNERS: None listed in Database

ASSOCIATED PROJECT(S):

COMMUNICATIONS AND PUBLICATIONS (2014 - 2017)

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PRSG publishes a lionfish cookbook to promote lionfish consumption and reduce this invasive species

NATIONAL FOCUS AREAS: Healthy Coastal Ecosystems

- Accomplishment
- PO Review Complete

RECAP: Puerto Rico Sea Grant published ¡Come pez león!: El recetario (Eat lionfish!: The cookbook) to promote lionfish consumption.

PROGRAM FOCUS AREAS: Healthy Ecosystems and Habitats

Lionfish are voracious fishes that feed on small reef fishes and crustaceans some of which are economically or environmentally important. Consumption of lionfish is an effective way to control the lionfish population.

PRSG published ¡Come pez león!: El recetario (Eat lionfish!: The cookbook) as part of our campaign Eat lionfish! The book is available through our website and ISSUU account: <https://issuu.com/seagrantpr/docs/come-pe-leon-ene24>.

Chefs, cooks, artisanal fishers, and food lovers provided 26 lionfish recipes that were included in the book Eat lionfish!: The cookbook offering our stakeholders more options to cook this invasive but delicious species.

PARTNERS: None listed in Database

ASSOCIATED PROJECT(S): None listed in the database

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Puerto Rico Sea Grant in Collaboration with the NDPTC of the University of Hawaii Developed an Effort to Improve Preparedness, Relief and Recovery of Communities Affected by Disasters

NATIONAL FOCUS AREAS: Resilient Communities and Economies

- Accomplishment
- PO Review Complete

RECAP: Puerto Rico Sea Grant, in collaboration with the National Disaster Preparedness Center of the University of Hawaii, coordinated seven (7) training workshops to improve preparedness, relief and recovery of communities vulnerable to natural hazards and climate change. Close to two hundred (200) participants were certified in the areas of hurricane planning and awareness, and coastal flooding risk reduction.

PROGRAM FOCUS AREAS: Resilient Communities and Economies

Most of Puerto Rico's critical infrastructure is based on the archipelagos' coastal areas, where more than 60% of the population lives on its 44 coastal municipalities. These population centers and critical infrastructure are vulnerable to the impacts of natural hazards including hurricanes, severe and extreme weather events and those predicted from sea level rise. There is a need to increase resilience and adaptation capabilities of residents, emergency managers and other government employees on matters related to preparedness, mitigation, adaptation and recovery from expected natural hazards.

PRSG settled a MOU with the National Disaster Preparedness Training Center, of the University of Hawaii to collaborate in the coordination of capacity building activities in Puerto Rico to improve preparedness, relief and recovery of communities vulnerable by natural hazards.

PRSG coordinated seven (7) training activities during the reporting period. Trainings conducted included HURRIPLAN, Hurricane Awareness and Coastal Flood Risk Reduction. Close to two hundred (200) participants, including planners, community leaders, emergency management officers, engineers, government employees, natural resources managers, and representatives from coastal municipalities were certified by NDPTC.

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

ASSOCIATED PROJECT(S):
CLIMATE EXTENSION (2014 - 2017)

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Citizen Science and Its Importance In the Conservation of Tres Palmas Marine Reserve

NATIONAL FOCUS AREAS: Resilient Communities and Economies

- Accomplishment
- PO Review Complete

RECAP: Sea Grant and Amigos de Tres Palmas have successfully leveraged funding to establish a community self-enforcement project to train citizens to become community scientists, develop monitoring efforts to gather needed resource data and providing opportunities for

education and benefits as sites for reference in long-term research.

PROGRAM FOCUS AREAS: Resilient Communities and Economies

Tres Palmas Marine Reserve management plan was developed and approved by the PR Planning Board as a result of NOAA funding and drafted by PR Sea Grant and the Interdisciplinary Center for Littoral Studies of UPRM. Even though enforcement of laws and regulations is a key determinant in the successful implementation of marine reserves, due to the precarious status of Puerto Rico's economy, funding for the implementation of the TPMR management plan is non-existent. There is an evident need to invest in the implementation of the management plan to promote the conservation of the reserve and ensure that a few violators do not benefit at the expense of law-abiding users.

Puerto Rico Sea Grant marine extension agents have been advising TPMR Management Board about the critical need for a reserve enforcement program to develop ongoing education and outreach efforts aimed toward increasing the awareness of the marine reserve regulations, as a less expensive alternative to increased enforcement activities. The alternative of community self-enforcement was presented to the Management Board, hoping that it can play a critical role in enforcement since official enforcement activities are economically difficult to maintain.

Results: Amigos de Tres Palmas submitted a proposal to the Legislature of Puerto Rico to implement a community self-enforcement project which consisted of two citizen science projects in the Tres Palmas Marine Reserve. ATP was awarded \$7,820 to train volunteers from the UPR Marine Sciences Graduate Students Association (AECIMA) and community members on coral reef monitoring techniques. Volunteers participated in two workshops and two field trips and were trained in the use and application of NOAAs' Coral Reef Monitoring Program (NCRM) method. Volunteer divers have been integrated into the reserves monitoring efforts. Besides, a Sea Grant Sandwatch Program workshop was coordinated for high school students, teachers and community members introducing them to data gathering (on beach profiles, water quality, beach erosion, tides and currents) and providing monitoring kits. Once these projects were implemented, ATP coordinated the Tres Palmas Marine Reserve Festival, which included a photographic exhibition and competition, educational exhibits and lionfish degustation with the collaboration of over 10 non-governmental organizations.

PARTNERS: Amigos de Tres Palmas; HJR Reefscaping;

ASSOCIATED PROJECT(S):

[MARINE OUTREACH PROGRAM \(2014 - 2017\)](#)

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Caribbean/NMFS Cooperative SEAMAP Program Coordination

NATIONAL FOCUS AREAS: Resilient Communities and Economies

- Accomplishment
- PO Review Complete

RECAP: Puerto Rico Sea Grant coordination of SEAMAP-C provided population data to support the Caribbean Fisheries Management Council and Puerto Rico Department of Natural and Environmental Resources management plans for conch and reef fish.

PROGRAM FOCUS AREAS: Resilient Communities and Economies

Fisheries managers of the Caribbean have an urgent data collection need for essential information concerning decision-making, development of administrative policies and guidelines, understanding regional needs and priorities and to support educational efforts.

Puerto Rico Sea Grant coordinates SEAMAP-C efforts for the establishment of a common plan and a coordinated evaluation methodology for fishery data collection, which is essential for management activities. Collected information include: bottom and marine habitat mapping, independent data from reef fish, conch (*Strombus gigas*) distribution, lobster (*Panulirus argus*) pueruli settlement and juvenile abundance, and the West Indian top shell (*Cittarium pica*) recruitment and abundance. The fisheries independent data obtained from this long-term program is being used by students, scientists, and state and federal managers to describe population trends; to explain responses to environmental factors; to estimate stock abundance; and to track reproduction, recruitment, and yields. This information is essential for sustainable management fisheries decisions in PR and the USVI.

SEAMAP-C coordinated effective and efficient data collection efforts employing surveys, management and dissemination of fishery-independent data. As an example, CFMC and PR-DNER Management Plans for conch and reef fish have been based on population data obtained by SEAMAP-C. MOP efforts have improved precision and accuracy of the long-term reef-fish data collected through quality control evaluation.

PARTNERS: National Marine Fisheries Service (US DOC, NOAA, NMFS); University of Virgin Islands;

ASSOCIATED PROJECT(S):

[MARINE OUTREACH PROGRAM \(2014 - 2017\)](#)

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MOP Fisheries & Aquaculture Electronic Portal

NATIONAL FOCUS AREAS: Resilient Communities and Economies

- Accomplishment
- PO Review Complete

RECAP: More than 9,787 visitor "hits" from twenty six different countries have been received at the Puerto Rico Sea Grant (PRSG) electronic portal "Marine Outreach Program in Fisheries and Aquaculture, Puerto Rico Sea Grant College Program" in support of collaborative ecosystem based management and sustainable fisheries practices.

PROGRAM FOCUS AREAS: Resilient Communities and Economies

Marine users from public and private sectors have an imperative need for direct support and advice to increase their appreciation of coastal and marine ecosystems and integrate it into collaborative ecosystem-based management.

An electronic "blog" site managed by PRSG was created and opened to public access: <http://prsgfisheriesoutreach.wordpress.com/>. Relevant information related to fisheries and aquaculture outreach and investigations conducted by PRSG has been summarized and posted for forum discussions. A section in the portal provides for SEAMAP-C publications and data downloading. Others sections include applied fisheries studies, fisheries management announcements, collaborators publications and information on mariculture outreach projects.

The web-portal provides detailed information of the works conducted by PRSG, access to fisheries studies, their RESULTS and reports, including fishery independent studies, links to other publication sources and relevant marine advisories. The site also promotes the aquaculture/mariculture development in Puerto Rico, while increasing the public's awareness on maintaining sustainable fisheries and to ensure responsible and productive use of the resources.

PARTNERS: None listed in Database

ASSOCIATED PROJECT(s):

[MARINE OUTREACH PROGRAM \(2014 - 2017\)](#)

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UPR Sea Grant characterizes flood vulnerability of Rincón coastal communities in terms of exposure, sensitivity, and adaptive capacity

NATIONAL FOCUS AREAS: Resilient Communities and Economies

- Accomplishment
- PO Review Complete

RECAP: A tsunami pedestrian evacuation model and a flood vulnerability assessment that includes FEMA, storm surge, and tsunami flood are currently under development for Rincón, PR.

PROGRAM FOCUS AREAS: Resilient Communities and Economies

As coastal areas become increasingly populated, what were once hazard-prone areas become potential sites for disaster. The level of disaster varies with the type of flooding, needs of the neighborhood, and infrastructure value. A GIS database and vulnerability assessments at the county subdivision level that integrate this information allow emergency responders to identify geographical hotspots for floods and potential strategies to mitigate their effect.

UPRSG researchers conducted a GIS inventory of infrastructure that will provide emergency responders with an estimate of the infrastructure at risk in the event of a flood. The tsunami pedestrian evacuation model will allow the capability to estimate the time to safety and, more importantly, pinpoint those geographical areas where individuals will not be able to reach safety in the event of a tsunami. Both data sources combined will allow emergency responders to identify which and where mitigation strategies (e.g. vertical evacuation) are most needed.

Conceptual frameworks were created to measure exposure and adaptive capacity to floods, and the implementation of adaptive capacity index is currently under way. Feature selection and internal consistency statistical analyses have been carried out to reduce the complexity of the models. A total of 192 surveys on a sample of tourists and residents of Rincón were used to gather data for the vulnerability model and to understand the evacuation response of individuals in the event of a tsunami. A total of 23 surveys were carried out on subject matter experts to determine the weights of the vulnerability attributes within the exposure and adaptive capacity indexes. The PEM model has been implemented using r.walk in QGIS and complemented with custom code in R to relax several restrictive assumptions found in the literature: all individuals evacuate immediately and separately, the evacuate speed is constant through the entire evacuation route, all individuals evacuate at the same speed.

PARTNERS: None listed in Database

ASSOCIATED PROJECT(s):

[EXPOSURE AND ADAPTIVE CAPACITY TO FLOODS: A COMPREHENSIVE VULNERABILITY ASSESSMENT OF RINCON'S NEIGHBORHOODS \(2014\)](#)

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Puerto Rico Sea Grant examines the feasibility of a beach nourishment project in Rincon, Puerto Rico and develops online tool for data sharing

NATIONAL FOCUS AREAS: Resilient Communities and Economies

- Accomplishment
- PO Review Complete

RECAP: PRSG funded an effort to carry out detailed beach morphology surveys, grain size studies, and numerical modeling to better understand coastal erosion processes in Rincón, Puerto Rico in order to examine the feasibility of a beach nourishment project.

PROGRAM FOCUS AREAS: Resilient Communities and Economies

Sea level rise, interruption of sediment supply, poorly designed coastal structures and unsuccessful coastal management practices, among others, have resulted in severe erosion problems for several sites around the island of Puerto Rico. Beach nourishment has recently been discussed as a potential solution to mitigate the erosion problems affecting beaches in the municipalities of San Juan and Rincón. The success of such a measure requires, among others, a thorough understanding of the coastal sediment transport processes present at each site, as well as a full assessment of the potential sand sources. This study examines in detail technical aspects required to evaluate the feasibility of a beach nourishment project for Rincón beaches.

Weekly beach profiles have been conducted at several beaches in Rincón since September 2015 until present, with the exception of June and July 2016 when very little morphological change occurred during summer. In Fall 2016 (hurricane season), the sampling frequency was increased significantly in order to capture erosion and accretion events at short time scales. For example, sampling frequency was increased in response to the wave event associated with Hurricane Matthew. Data analysis as well as processing of sediment samples is still ongoing.

Results: This project has collected a wealth of information that will be used by scientists and engineers in the design stage of a beach nourishment project for Rincón. The database of weekly beach profiles is an invaluable data set that will dictate the design beach profile. The spatial and temporal analysis of the sediment grain size is critical to determine the compatibility of nearby sand sources. Final results and recommendations will be provided in the upcoming final report. This project has led to the training of one undergraduate student and two graduate students and will lead to a graduate level thesis, expected to be completed by December 2017.

PARTNERS: None listed in Database

ASSOCIATED PROJECT(S):

[TOWARDS POTENTIAL BEACH NOURISHMENT IN RINCON: RTK BEACH MAPPING, SEDIMENT COMPATIBILITY ANALYSIS AND AN ONLINE TOOL FOR DATA SHARING \(2014\)](#)

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PRSG studies community use of coastal forest resources in southern Puerto Rico finding multiple linkages with community wellbeing

NATIONAL FOCUS AREAS: Resilient Communities and Economies

- Accomplishment
- PO Review Complete

RECAP: PRSG researchers gathered multiple linkages between estuarine coastal forest resources and community wellbeing throughout the region. These include multiple coastal activities that span income-generating and supplementing, resource sharing, value adding, and capturing for food. They also documented multiple social well-being and beneficence-related practices related to the capture and marketing of coastal forests resources.

PROGRAM FOCUS AREAS: Resilient Communities and Economies

Estuarine forest resource use and dependency along the Southern Coast of Puerto Rico is suspected to play an important role in the economic reliance and well-being of this regions' coastal residents. There is a need to assess the role of estuarine forest resources in coastal residents' household economies and economic histories and integrate cultural and socioeconomic data to enhance the information available about the trade offs involved in coastal use policy that affects the health and/or access to estuarine resources.

PRSG researchers mapped coastal forest resource use in the southern coast of Puerto Rico. They identified the portfolio of coastal forest resources used by coastal communities in the region and their geographical variation along the southern coast, and gathered primary and secondary data about community dependence on these resources, patterns of use, marketing, and sharing of these resources, and the local ecological knowledge (LEK) of harvesters. They conducted ethnographic interviews with 35 coastal resource users in the municipalities of Maunabo, Patillas, Arroyo, Guayama, Salinas, Juana Díaz, Ponce, Guayanilla, Guánica, Lajas, and Cabo Rojo.

Results: PRSG researchers developed, and are currently field testing and beginning to conduct, a series of ethnographic interviews with people involved in coastal forest resource vending and marketing in the study region, especially owners and managers of restaurants that sell resources such as land crabs, mangrove oysters, clams, and estuarine fish. The objective is to assess the degree to which the Puerto Rican

south coast seafood restaurants depend on local coastal forest resources, the reciprocity patterns related to the use of the resources, and the distribution of benefits from local CR use. They also worked in the analysis ethnographic data in order to identify and understand local cultural models related to quality of life and well-being (QOL/WB), the different modes of engagement with coastal resource use by SE PR residents, and the local importance of coastal resources for QOL/WB.

PARTNERS: University of Rhode Island;

ASSOCIATED PROJECT(S):

COASTAL FOREST FISHERIES: A STUDY OF ESTUARINE FOREST RESOURCE DEPENDENCY IN THE SOUTHERN COAST OF PUERTO RICO (2016 - 2017)

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Marine Debris Education and Community Engagement

NATIONAL FOCUS AREAS: Environmental Literacy and Workforce Development

- Accomplishment
- PO Review Complete

RECAP: VIMAS increased awareness of marine debris and engaged over four hundred fifty (450) people in reducing marine debris in the VI. VIMAS will be expanding marine debris education through the NOAA marine debris grant.

PROGRAM FOCUS AREAS: Education and Workforce Development

Marine debris is a problem throughout the VI as well as in many Caribbean islands. 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 is from recreational use of the beaches and surrounding areas. 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 allow participants to engage in an activity which helps our marine environment and develops a sense of stewardship, promoting positive behavior change.

VIMAS increased awareness about the problem of marine debris and engaged the community in activities to address the issue. VIMAS coordinated the annual coastal cleanup event in Sept. and Oct. In addition classroom presentations were made to local schools on the issue.

Results: VIMAS coordinated thirteen (13) coastal cleanups engaging 492 volunteers. All data is transmitted to TOC. VIMAS made classroom presentations to six (6) classes on marine debris. VIMAS agents, partnering with CMES staff, secured a NOAA marine debris grant to provide local teachers with locally-relevant curricular materials on marine debris. A workshop with 30 teachers was held in Oct. 2016.

PARTNERS: Ocean Conservancy;

ASSOCIATED PROJECT(S): None listed in the database

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PRSG published an excellent tool to provide guidance to fisheries resource users and ascertain changes in fisheries laws and regulations

NATIONAL FOCUS AREAS: Environmental Literacy and Workforce Development

- Accomplishment
- PO Review Complete

RECAP: Puerto Rico Sea Grant published three issues of the magazine Fuede y Verguilla to ascertain laws and regulations issues related to fisheries management.

PROGRAM FOCUS AREAS: Education and Workforce Development

Fishing laws and regulations in Puerto Rico are divided into federal and insular jurisdictions. Commercial and recreational fishers are in need of accurate information about the role of federal and state governmental agencies with a mandate to enforce fishing laws and regulations in Puerto Rico's territorial sea and its EEZ.

PRSG published three issues of the fishing magazine Fuede y Verguilla to advance knowledge of artisanal fishermen regarding the role of federal and state agencies on matters related to fisheries laws and regulations, enforcement, commercial fishing license requirements, special fishing permits and legislation to further fisheries use and conservation.

The three Fuede y Verguilla magazines are an excellent tool to provide guidance to commercial and recreational fishers and ascertain changes in fisheries laws and regulations. To access the issues, please access <http://seagrantpr.org/communications-and-publications/fuede-y-verguilla/#1444940315465-fb2c2ad9-380c>.

PARTNERS: None listed in Database

ASSOCIATED PROJECT(S):
COMMUNICATIONS AND PUBLICATIONS (2014 - 2017)

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PRSG Trains Volunteers to Play an Active Role in Enhancing, Monitoring and Protecting Sea Turtles in East and Southeast of Puerto Rico

NATIONAL FOCUS AREAS: Environmental Literacy and Workforce Development

- Accomplishment
- PO Review Complete

RECAP: Puerto Rico Sea Grant trained volunteers (university students and citizens) to protect sea turtle nesting beaches in Humacao and Fajardo, helping local and state decision makers in the development of resource management policy.

PROGRAM FOCUS AREAS: Education and Workforce Development

Biologists of sea turtle conservation projects depend on the support of citizen volunteers to collect nesting data and oversee sea turtles and their habitats. Lack of agency staff, as a result of budget deficits, make volunteers an essential part of conservation efforts. There is a real need to integrate volunteers and offer them the opportunity to learn and understand natural processes, the importance of data gathering and of resource conservation.

PRSG developed three (3) sea turtle training workshops related to sea turtle biology, how to collect data, beach ecology and nest relocation.

Fifteen (15) university students and other volunteers (10 general public) participated in active field learning experiences for sea turtle monitoring. The volunteers program is progressing beyond the expectation of a mere tool for data collection. PRSG training efforts have developed sea turtle volunteers that save money to the government in management and protection. The volunteers worked 624 hours in the year, helped in the collection of quality sea turtle nesting data and contributed important information regarding the identification and reduction of sea turtle threats.

PARTNERS: Puerto Rico Department of Natural and Environmental Resources;

ASSOCIATED PROJECT(S):
MARINE EDUCATION (2014 - 2017)

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2016 Leveraged Funding

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Project Level

Source	Project	Title	Amount	Type
National Marine Fisheries Service (US DOC, NOAA, NMFS)	9919 - Marine Outreach Program (A/151-1-14)	SEAMAP-C	\$78,800.00	Managed
Puerto Rico Department of Natural and Environmental Resources	9919 - Marine Outreach Program (A/151-1-14)	Georeferencing Puerto Rico's 1930 Coastal Aerial Photography	\$28,350.00	Managed
US Fish and Wildlife Service (US DOI, FWS)	9924 - Communications and Publications (C/161-1-14)	Outreach Material - Desecheo Rat Eradication Projecto	\$2,400.00	Managed
National Fish and Wildlife Foundation (NFWF)	9919 - Marine Outreach Program (A/151-1-14)	Community Restoration, Stewardship and Monitoring in the Caño Boquilla Wetland System (CBWS) at the Río Grande de Añasco Watershed, Puerto Rico	\$31,600.00	Influenced
Puerto Rico Legislature	9919 - Marine Outreach Program (A/151-1-14)	Citizen Science and Its Importance In the Conservation of Tres Palmas Marine Reserve	\$7,820.00	Influenced
		TOTAL:	\$148,970	

Program Level

No Program Level Leveraged Funding for this year

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Performance Measures

2016 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
Humacao	Palmas del Mar	3	Yes
Loiza	Loiza	2	No
Rincón	Rincón	8	Yes
San Juan	Ocean Park	2	Yes

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2016 Sea Grant Products - (tools, technologies, info services)

Description	Developed	Used
The book Marine mammals from Puerto Rico and the US Virgin Islands was developed. End users: resource managers, citizen scientists, gradeschool teachers and students, marine mammal watchers.	Yes	No
Tres Palmas Marine Reserve species identification cards. End users: citizen scientists, school children, NGOs, recreational divers and snorkelers, resource managers and educators.	Yes	Yes
Pepe Uca storybook and activity book about mangroves was developed. End users: Private and public schools, Gradeschool teachers and students, NGOs, resource managers, homeschoolers, citizen scientists.	Yes	Yes
One educational guides were developed and used by teachers and students. End users: Private and public schools, NGOs, resource managers, homeschoolers, citizen scientists.	Yes	Yes
Marine birds of Puerto Rico identification cards. End users: bird watchers, educators, resource managers.	Yes	Yes
Lionfish recipe book was published. End users: Housekeepers, restaurant owners, fish vendors, culinary arts schools, recreational and artisanal fisherman.	Yes	Yes
Corals of Puerto Rico identification cards. End users: researchers, marine science professors, resource managers, recreational divers.	Yes	Yes
A video promoting the Department of Marine Sciences of the University of Puerto Rico and marine science careers.	Yes	No
A Fuede y Verguilla magazine was published educating fishers on the process to obtain permits and licenses. End users: artisanal fisherman and resource managers.	Yes	Yes
A baseline of coastal erosion in the Puerto Rico Western region was developed. Potential End users: resource managers, public policy developers, real estate agents, insurance agents, FEMA, emergency management officers, tourism and recreation industries, municipal officials.	Yes	No
2017 Calendar identifying fishing closures was developed with the Caribbean Fisheries Management Council. End users: resource managers, recreational and artisanal fisherman, restaurant owners, housekeepers, fish vendors, and enforcement agents.	Yes	Yes

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2016 Economic (market and nonmarket) impacts

(No Data)

2016 National Performance Measures - General

Performance Measure	Annual Target	Reported	Program Comment
Number of fishermen, seafood processors and aquaculture industry personnel who modify their practices using knowledge gained in fisheries sustainability and seafood safety as a result of Sea Grant activities.	4,196	166	Emailed from YG on 7/28/17.
Number of communities that implemented sustainable economic and environmental development practices and policies (e.g., land-use planning, working waterfronts, energy efficiency, climate change planning, smart growth measures, green infrastructure) as a result of Sea Grant activities.	223	14	Emailed from YG on 7/28/17.
Number of acres of coastal habitat protected, enhanced or restored as a result of Sea Grant activities.	331,630	388	Emailed from YG on 7/28/17.
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.		22	Emailed from YG on 7/28/17.
Number of people engaged in Sea Grant supported informal education programs.	773,973	220	
Number of Sea Grant-supported graduates who become employed in a career related to their degree within two years of graduation.	118	4	Emailed from YG on 7/28/17.

2016 Program Performance Measures

(No Data)

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2016 Metrics

Staffing Numbers	Individuals	SG FTEs	non-SG FTEs
Administrative	5.00	2.67	2.33
Communications	13.00	3.85	4.64
Education	4.00	2.00	0.72
Extension	10.00	4.27	1.57
Research	64.00	4.66	3.15

Core Funding	Proposals	Institutions Involved	From Home Institution
Pre-Proposals	10	3	8
Full Proposals	3	1	1
Proposals Funded	2	1	1

Student Support	Number of New Students	Number of Continuing Students	Number of Degrees Awarded
Sea Grant Supported Undergraduate Students	25	19	
Sea Grant Supported MS/MA Graduate Students	10	12	2
Sea Grant Supported PhD Graduate Students	1	3	
Other Sea Grant Supported Professional Degree Graduate Students		6	

Other Metrics	Amount
VolunteerHours	11223
Number of P-12 Students Reached Through Sea Grant-Trained Educators or Directly through Sea Grant Education Programs	50028
Number of P-12 Educators who participated in Sea Grant education programs	235
SG-Sponsored/Organized Meetings/Workshops	201
Attendees in SG Meetings/Workshops	48434
Public or Professional Presentations	27
Attendees at Public or Professional Presentations	3316
Clean Marina Program -- Certifications	
HACCP -- Number of people with new certifications	