

# PIER 2013 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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### 2013 Level of Effort

<a href="#">National Focus Area Name</a>	<a href="#">SG Federal</a>	<a href="#">Match</a>	<a href="#">Pass Thru</a>	<a href="#">Federal+ Match + Pass Thru</a>	<a href="#">LOE without Leverage (%)</a>	<a href="#">Leveraged (Managed)</a>	<a href="#">LOE with Leverage (%)</a>
Healthy Coastal Ecosystems	\$500,079	\$364,447	\$0	\$864,526	51 %	\$270,838	58 %
Safe and Sustainable Seafood Supply	\$0	\$0	\$0	\$0	0 %	\$0	0 %
Hazard Resilient Coastal Communities	\$260,068	\$157,986	\$0	\$418,053	25 %	\$0	21 %
Sustainable Coastal Development	\$234,680	\$162,940	\$0	\$397,621	24 %	\$1,000	20 %
Other	\$0	\$0	\$0	\$0	0 %	\$0	0 %
TOTAL ALL FOCUS AREAS:	\$994,827	\$685,373	\$0	\$1,680,200	100 %	\$271,838	100 %

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### 2013 Impacts & Accomplishments

#### Links between ecological processes - coral recruitment and post-settlement success - and decadal-scale dynamics of coral reefs are established

**NATIONAL FOCUS AREAS:** Healthy Coastal Ecosystems

- Impact
- PO Review Complete

**RECAP:** RECAP- This is the first study to demonstrate that the daily variability in seawater temperature is inversely related to coral recruitment, with more recruits occurring in locations with multiple stable thermal regimes.

**PROGRAM FOCUS AREAS:** HEALTHY COASTAL ECOSYSTEMS

**RELEVANCE-** Coral reef degradation is common in the near-shore habitats of Puerto Rico and the US Virgin Islands. In recent years, disturbances affecting coral reefs have become more severe and have been dominated by anthropogenic origin resulting in the loss of a substantial fraction of their coral cover. Eight years of annual censuses of juvenile corals demonstrates that their distribution is unrelated to the distribution of adult corals, and their density, growth and mortality are related to varying aspects of seawater temperature. Determining the role of seawater temperature on coral reef community structure will help assess future coral reef growth and importance.

**RESPONSE-** Variation in taxonomic composition of coral recruits along the south shore of St. John were tested as well as, the statistical association between the density of coral recruits and aspects of seawater temperature. The thermal regime of the rock substratum was quantified (carbonate versus igneous) as well as the growth, mortality, and photo-physiology of juvenile corals on each surface.

**RESULTS-** This study provides a rare example of an investigation of the effects of substratum choice for the success of juvenile corals. Recruit density is shown to have an inverse relationship with daily variation in seawater temperature. Substrate types (igneous and carbonate rock) differ slightly in temperature, and are associated with small differences in coral growth and photo-physiology. The significance of this

project lies in its ability to establish links between ecological processes - coral recruitment and post-settlement success - and decadal-scale dynamics of coral reefs along the south coast of St. John.

**PARTNERS:** None listed in Database

**ASSOCIATED PROJECT(S):**

CORAL RECRUITMENT, THERMAL STRESS AND CORAL REEF COMMUNITY STRUCTURE IN ST, JOHN, US VIRGIN ISLANDS (2006 - 2007)

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## **Conservation of connectivity functions among near shore sea grass and mangrove areas nursery habitats, essential for reef fish populations**

**NATIONAL FOCUS AREAS:** Healthy Coastal Ecosystems

- Impact
- PO Review Complete

**RECAP:** RECAP- Direct evidence from this study demonstrates the important connectivity with the mangrove habitat for adult French Grunt and Schoolmaster snapper captured in reef and sea-grass habitats. Conservation of these near shore 'nursery' habitats may be an important step in maintaining high levels of recruitment to harvested reef fish populations.

**PROGRAM FOCUS AREAS:** HEALTHY COASTAL ECOSYSTEMS

**RELEVANCE-** Many mangrove and sea grass habitats in the US Caribbean and worldwide are vulnerable to loss or deterioration from a variety of processes, including erosion, pollution, and urbanization. One of the most basic requirements for fisheries management is that it includes the area occupied by the fish species of interest including the adult stage and the different development stages of juveniles. The sea grass and mangrove areas are presumably ecologically significant nursery habitats and provide a significant amount of recruitment to adjacent reefs.

**RESPONSE-** Juveniles of the economically important fish species *Haemulon flavolineatum* (French grunt) and *Lutjanus apodus* (schoolmaster) were studied to determine if settlement and nursery areas within mangrove and sea grass habitats can be identified by chemical signatures from otolith microchemistry in order to determine if fish from known nursery grounds had distinguishable signatures. Otoliths are continual alternate layers of protein and calcium deposited in the ear of fish in the form of crystals that grow continually throughout the fish's life.

**RESULTS-** Findings of the current study suggest that near shore habitats such as mangrove lagoons and sea grass meadows commonly function as nursery habitats for juvenile reef fish populations.

**PARTNERS:** None listed in Database

**ASSOCIATED PROJECT(S):**

ASSESSING ESSENTIAL FISH HABITAT AND CONNECTIVITY OF REEF FISHING USING OTOLITHS (2006 - 2007)

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## **Aquarium trade should be properly managed to avoid over-fishing of sea anemones**

**NATIONAL FOCUS AREAS:** Healthy Coastal Ecosystems

- Impact
- PO Review Complete

**RECAP:** RECAP- Based on demographic results, a minimum body size for collection of anemones was recommended, and it was proposed that harvesting should be limited to populations with fast growing individuals.

**PROGRAM FOCUS AREAS:** HEALTHY COASTAL ECOSYSTEMS

**RELEVANCE-** Coral reef anemones provide habitat and other ecological services to important reef dwellers. Cleaner shrimp which remove fish parasites rely on anemones for protection. A potentially disruptive ornamental fishery has developed around this resource and the loss of these sea anemones can lead to cascade effects across multiple trophic levels on the reef.

**RESPONSE-** Three years of data on patterns of abundance and diversity of the crustacean associates of these sea anemones, and on the population dynamics of the anemones was collected. The abundance and diversity of cleaner shrimp and the population dynamics of corkscrew sea anemones (*B. annulata*) on Caribbean coral reefs was determined by mapping and conducting quarterly censuses of anemones at 2 coral reef sites on St. Thomas, USVI.

**RESULTS-** A scientific basis for sustainable management of the fisheries on these sea anemones and crustaceans, which are among the most heavily-collected organisms for the ornamental aquarium trade was established. Demographic data provided also improves the ability of resource managers to forecast recovery rates of these important reef organisms following disturbances.

**PARTNERS:** None listed in Database

**ASSOCIATED PROJECT(S):**

[SYMBIONT DIVERSITY AND POPULATION DYNAMICS OF CORAL REEF SEA ANEMONES \(2008 - 2010\)](#)

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## **Changing public perception on the ecological importance of near-shore sharks and their nursery habitats**

**NATIONAL FOCUS AREAS:** Healthy Coastal Ecosystems

- Impact
- PO Review Complete

**RECAP:** RECAP- Coral and Fish Bays represent essential nursery habitat for blacktip and lemon sharks in the USVI. There are indications that these areas are threatened by anthropogenic stresses and with natural mortality estimates as high as 90%, additional mortality will impact population growth. Given the importance of this habitat, fisheries managers should implement measures to protect these areas from anthropogenic impacts.

**PROGRAM FOCUS AREAS:** HEALTHY COASTAL ECOSYSTEMS

**RESPONSE-** Puerto Rico Sea Grant researchers examined sharks spatial and temporal dynamics of habitat use, specifically, information on movements, site fidelity, immigration and emigration between and within habitats, and associations with National Park boundaries, crucial information for coast-wide habitat protection and management. Additionally, they studied the extent to which these "pockets" of productivity are interconnected. Shark movements were monitored using passive acoustic receivers.

**RESULTS-** Evidence that juvenile blacktip and lemon sharks utilize this habitat for protection during the first several months of their lives, when they are most vulnerable to predation as well as was information for local fisheries managers to establish effective conservation measures such as fishing closures, habitat protection, additional marine protected areas, and limits on coastal development was also provided.

**PARTNERS:** None listed in Database

**ASSOCIATED PROJECT(S):**

[LONG-TERM PASSIVE ACOUSTIC TRACKING OF JUVENILE BLACKTIP AND LEMON SHARKS: AN INVESTIGATION INTO THE SPATIOTEMPORAL DYNAMICS AND CONNECTIVITY OF SHARK NURSERY HABITAT IN ST. JOHN, USVI \(2010 - 2012\)](#)

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## **Puerto Rico Sea Grant research expected to reduce the alarming drowning rate of beachgoers in the Archipelago of Puerto Rico**

**NATIONAL FOCUS AREAS:** Healthy Coastal Ecosystems

- Impact
- PO Review Complete

**RECAP:** RECAP- Information provided by Puerto Rico Sea Grant beach hazard warning system is being used by National Weather Service to emit official hazard warnings and improve safety for beach goers in Puerto Rico.

**PROGRAM FOCUS AREAS:** HEALTHY COASTAL ECOSYSTEMS

**RELEVANCE-** One of the gravest dangers to beachgoers are intense surf-zone currents which can cause serious hazards for beachgoers. A total of 30 persons drown every year at the beaches of the Archipelago of Puerto Rico. In other words every twelve (12) days, a person drowns at the beaches of Puerto Rico for a total of four hundred and twenty (420) persons in the course of the last 14 years. It is well known that the main factor leading to drowning deaths in Puerto Rico are wave-induced currents and the lack of education of the public on the topic of beach hazards.

**RESPONSE-** Puerto Rico Sea Grant efforts were focused on developing a beach hazard warning system for predicting potentially hazardous surfzone currents. Nearshore wave conditions were simulated for a total of 44 beaches of the Archipelago of Puerto Rico.

**RESULTS-** The Puerto Rico Beach and Surfzone Currents Warning System was developed in an effort to provide the public with potentially life-saving information on hazardous beach conditions. A customized webpage was designed to provide beach-specific estimates of the hazard posed by dangerous currents on any given day. The website is based on a beach hazard matrix developed for each of the four major coasts of Puerto Rico, taking into account local wave climate, wave sheltering, coupled wave and wind effects and local bathymetric effects for each major beach.

**PARTNERS:** None listed in Database

**ASSOCIATED PROJECT(S):**

DEVELOPMENT OF THE PUERTO RICO BEACH AND SURFZONE CURRENTS WARNING SYSTEM (2012 - 2013)

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## **Puerto Rico Sea Grant incorporates human dimensions to strengthen local stewardship at Wildlife Refuge**

**NATIONAL FOCUS AREAS:** Healthy Coastal Ecosystems

- Impact
- PO Review Complete

**RECAP:** RECAP- A Management Plan for RVSILAM was updated and developed, so that resource managers can implement it. SG currently continues to collaborate with RVSILAM by offering advice on the management and conservation of resources.

**PROGRAM FOCUS AREAS:** HEALTHY COASTAL ECOSYSTEMS

**RELEVANCE-** The Iris L. Alameda Martinez Wildlife Refuge (RVSILAM) in Boquerón, Cabo Rojo, displays impressive biodiversity as a result of its geographical position in the coastal zone of Cabo Rojo. This area features mangroves and salt marshes that provide food and shelter for a large representation in taxa from migratory and resident birds.

**RESPONSE-** The needs identified by local communities and the DNER, pointed to the urgent need to review the Management Plan for RVSILAM. In 2011 UPRSG began to review the two previous versions of the Management Plans for RVSILAM. Not only did UPRSG review the documents, but also several field and surrounding areas were also called upon to document the uses, impacts, and needs. In addition experts were consulted to identify conservation targets and possible alternatives for management. Legal assessment and environmental impact statement was also carried out. The plan was an outcome of a socio-economic monitoring (SOCMON) process, one that incorporated the human dimension.

**RESULTS-** The plan is a conservation tool produced by Sea Grant, which incorporated the stakeholders (service providers, hunters, scientists, managers). This tool is a blueprint for strengthening local stewardship.

**PARTNERS:** None listed in Database

**ASSOCIATED PROJECT(S):**

MARINE ADVISORY SERVICE (2012 - 2013)

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## **UPRSG collaborates in joint effort aimed at educating tourism operators about sustainable use of coastal and marine resources**

**NATIONAL FOCUS AREAS:** Healthy Coastal Ecosystems

- Impact
- PO Review Complete

**RECAP:** RECAP- Puerto Rico Sea Grant collaborates with NOAA, DNER, and East Island Adventure to educate tourism operators of La Cordillera Reefs Natural Reserve.

**PROGRAM FOCUS AREAS:** HEALTHY COASTAL ECOSYSTEMS

**RELEVANCE-** Tourism operators provide access to natural attractions and resources to recreational resource users and an excellent opportunity to collaborate in the education of their clientele. Education about conservation and the sustainable use of marine and coastal resources, which constitutes the natural resource and attraction that serves as the base for their recreational activities, represent a significant source of income to access providers and concessionaires.

**RESPONSE-** Puerto Rico Sea Grant collaborated with NOAA, DNER, and East Island Adventures to educate tourism operators regarding conservation and sustainable use of coastal and marine resources and offered a two-day workshop for tourism operators that work in the area of La Cordillera Reefs Natural Reserve.

**RESULTS-** Thirty tourism operators from various businesses participated in the two-day workshop and were able to learn about the coral reef ecosystem, its conservation, identification and economic importance through talks, hands on experience and the application of interpretation techniques. They also participated of a field trip in which they applied their previous and new knowledge. Participants are using what they learned in their daily tourism activities and are educating their clientele in topics related to conservation and sustainable use of marine and coastal resources using materials developed by Puerto Rico Sea Grant. To see pictures and information of the workshop, please access <http://www.flickr.com/photos/seagrantpr/>

**PARTNERS:** None listed in Database

## **Bajo las olas (Beneath the Waves) selected as one of the best five art books of Puerto Rico on 2013**

**NATIONAL FOCUS AREAS:** Healthy Coastal Ecosystems

- Impact
- PO Review Complete

**RECAP:** RECAP- Bajo las olas (Beneath the Waves) is an underwater photography book that contributes to develop ocean literacy and environmental stewardship among a variety of audiences and has been recognized as one of the best art books in Puerto Rico.

**PROGRAM FOCUS AREAS:** HEALTHY COASTAL ECOSYSTEMS

**RELEVANCE-** Different audiences need different ways to become informed and educated. Creating engagement and motivation for non-reader clientele is a big challenge. The use of artistic photography and art can foster interest in science and help people remember what they have learnt and bestow a means of fostering wisdom.

**RESPONSE-** Puerto Rico Sea Grant published Dr. Hector Ruiz subaquatic photography book Bajo las olas (Beneath the Waves), which offers the public the opportunity to increase their knowledge about marine and coastal resources through beautiful underwater artistic photography and provides information about the organisms highlighted in the photos.

**RESULTS-** The Arts Coalition of Puerto Rico, through its digital magazine, recognized Bajo las Olas as one of the best five (5) art books from Puerto Rico on 2013. Puerto Rico Sea Grant's publications now also figures among important art publications of Puerto Rico and has reached different audiences.

**PARTNERS:** None listed in Database

ASSOCIATED PROJECT(S):  
COMMUNICATIONS AND PUBLICATIONS (2012 - 2013)

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## **Puerto Rico Sea Grant Takes Advantage of New Technologies to Educate Marine Resource Users**

**NATIONAL FOCUS AREAS:** Healthy Coastal Ecosystems

- Impact
- PO Review Complete

**RECAP:** RECAP- Taking advantage of the popularity and accessibility of audiovisual resources, three new videos were published as part of our communications and education efforts.

**PROGRAM FOCUS AREAS:** HEALTHY COASTAL ECOSYSTEMS

**RELEVANCE-** Visual and audio resources are acquiring more relevance every day because of their accessibility and the amount of information that can be included. Videos can be used as learning resources by showing real life scenarios or problems, triggering discussions, explaining techniques and concepts or establishing different points of view. Videos have been used to support learning for many years, but as new technologies have become more accessible and the cost of producing media resources has dropped, it is now possible to develop videos using every day, accessible technology.

**RESPONSE-** Puerto Rico Sea Grant is taking advantage of its visual and audio resources and benefits, and designed an educational media effort in favor of coastal and marine resources.

**RESULTS-** For the period reported, Puerto Rico Sea Grant produced thirty-five (35) new videos: Marine Adventure, 8th International Multi-Purpose Reef & Surfing Science Symposium, Sandwatch Instructional Videos and What is Sea Grant. Videos are available in our YouTube channel <https://www.youtube.com/user/programaseagrantpr> and in our Sandwatch blog [http://seagrantpr.org/guardarenas/?page\\_id=715](http://seagrantpr.org/guardarenas/?page_id=715). People became aware of Puerto Rico Sea Grant's education efforts through the activity of the Marine Adventure, also people get to know what happened during the 8th International Multi-Purpose Reef & Surfing Science Symposium, and obtained more information about what Sea Grant is, its history and its mission.

**PARTNERS:** None listed in Database

ASSOCIATED PROJECT(S):  
COMMUNICATIONS AND PUBLICATIONS (2012 - 2013)

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## Collaboration with USLA leads to improved lifeguard training in Puerto Rico

**NATIONAL FOCUS AREAS:** Hazard Resilient Coastal Communities

- Impact
- PO Review Complete

**RECAP:** RECAP- PRSG coordinated several USLA lifeguard academies for the PRNPC and as a result this organization has adopted USLA standards for their lifeguards making them more effective in rescue fundamentals and has developed a sense of pride and responsibility for the lifeguarding profession.

**PROGRAM FOCUS AREAS:** HAZARD RESILIENCE IN COASTAL COMMUNITIES

**RELEVANCE-** Within the past 14 years, 420 persons drowned in Puerto Rican beaches. Any drowning incident on Puerto Rican beaches is unacceptable and Puerto Rico Sea Grant is in a strong position to coordinate training to make the beaches safer.

**RESPONSE-** In 2007, Puerto Rico Sea Grant took charge of this situation and developed an effort to reduce drowning incidents in our beaches by inviting a USLA delegation to visit and assess the beaches of Puerto Rico.

**RESULTS-** As a result of the USLA visit, the publication "Aquatic Safety Assessment & Recommendations: Commonwealth of Puerto Rico" was produced. USLA academies for lifeguards were coordinated with the collaboration of Florida lifeguards who trained and capacitated PR National Park Service lifeguards to improve their aquatic abilities and rescue techniques. At least two academies per year were conducted from 2012 to 2014. In 2011 the National Parks Company adopted the USLA standards in their lifeguard's academies as recommended by the Aquatic Safety and at they have already certified 116 lifeguards under USLA standards.

**PARTNERS:** None listed in Database

**ASSOCIATED PROJECT(S):**

MARINE ADVISORY SERVICE (2012 - 2013)

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## Reducing drowning incidents in Puerto Rican beaches through statistics

**NATIONAL FOCUS AREAS:** Hazard Resilient Coastal Communities

- Impact
- PO Review Complete

**RECAP:** RECAP- The Police Department, The Department of Natural and Environmental Resources and The Interagency Beach Management Board are using beach drowning incidents statistics generated by Puerto Rico Sea Grant to justify the need to improve aquatic safety services in Puerto Rico.

**PROGRAM FOCUS AREAS:** HAZARD RESILIENCE IN COASTAL COMMUNITIES

**RELEVANCE-** Drowning incidents represent a serious health problem at the beaches of Puerto Rico, where 420 persons have died within the past 14 years as a result of the lack of lifeguard services.

**RESPONSE-** The analysis of beach drowning statistics by Puerto Rico Sea Grant has been instrumental in making the island change their perceptions regarding the seriousness of this issue and the circumstances that lead to drowning incidents.

**RESULTS-** Through educational efforts having as a base the unacceptable statistic of 30 drowning incidents per year, or one drowning every twelve days, Puerto Rico Sea Grant has developed an educational campaign to make beach users aware of the dangers represented by hazardous surf and beach conditions, factors that contribute to drowning (alcohol or drug use, peer pressure and carelessness) and drowning peaks. Puerto Rico Sea Grant has further highlighted this topic into an important issue that needs to be taken into consideration by public policy developers, resource managers and the tourism industry. The National Weather Service implemented a Surf Zone Forecast on May 2014 which will be monitoring 15 beaches around Puerto Rico based on the beach drowning statistics generated by Puerto Rico Sea Grant.

**PARTNERS:** None listed in Database

**ASSOCIATED PROJECT(S):**

MARINE ADVISORY SERVICE (2012 - 2013)

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## Most benefits of coastal resources use and engagement underestimated by policy tradeoff assessments that only take into account formally reported economic exchanges

**NATIONAL FOCUS AREAS:** Sustainable Coastal Development



- Impact
- PO Review Complete

**RECAP:** RECAP- Public policy should not only be about economic health but about increasing people's quality of life and wellbeing. If a healthy coast contributes significantly to quality of life and wellbeing, then the coast's vulnerability to potentially disruptive and de-localizing processes such as excessive industrial and tourism development, and gentrification should be a concern of the greater society.

**PROGRAM FOCUS AREAS:** SUSTAINABLE COASTAL DEVELOPMENT

**RELEVANCE-** 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 coastal resources use to wellbeing and quality of life in communities and beyond.

**RESPONSE-** The relationship between the use of coastal resources and the quality of life and well-being are evaluated for people living along the southeastern coast of Puerto Rico through a variety of methods to collect data, including 1) coastal resources use mapping, 2) Ethnographic Interviewing, 3) Participant Observation, 3) Structured Interviewing, and 4) archival and secondary data collection.

**RESULTS-** This research shows that the quality of life and well-being of a large proportion of SE PR coastal residents of all walks of life is inextricably linked to the use of -and access to- the coast and its resources. It also provides a methodological blueprint to engage mixed qualitative and quantitative methods to provide policy makers with critical information to enhance people's total quality of life and well-being.

**PARTNERS:** None listed in Database

**ASSOCIATED PROJECT(S):**

**THE COAST'S BAILOUT: COASTAL RESOURCE USE, QUALITY OF LIFE AND RESILIENCE IN PUERTO RICO (2010 - 2012)**

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## **Data acquisition leads to better understanding for fisheries' managers in the USVI and Caribbean**

**NATIONAL FOCUS AREAS:** Healthy Coastal Ecosystems

- Accomplishment
- PO Review Complete

**RECAP:** RECAP- Fisheries independent data acquisition, educational workshops on sampling methodologies, and outreach on scientific data has been coordinated by MOP.

**PROGRAM FOCUS AREAS:** HEALTHY COASTAL ECOSYSTEMS

**RELEVANCE-** The SEAMAP-C program, contributes to the development of fisheries independent baseline data, standards, and indicators to support ecosystem-based approaches to land use, water, fisheries, and other resource management. The information obtained, is shared with a wide variety of constituencies in PR/USVI and the Caribbean.

**RESPONSE-** This program established a common forum 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 (immature animals resembling their adult forms) 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 establishing regulatory programs for sustainable fisheries in PR and the USVI.

**RESULTS-** Marine Outreach Program fisheries liaison activities include effective and efficient data collection during 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 supervision, directed by the coordinator, has improved precision and accuracy of the long-term reef-fish data collected through quality control evaluation.

**PARTNERS:** None listed in Database

**ASSOCIATED PROJECT(S):**

**MARINE ADVISORY SERVICE (2012 - 2013)**

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## **Best practices for storm water management within municipal public facilities**

**NATIONAL FOCUS AREAS:** Healthy Coastal Ecosystems

- Accomplishment

- PO Review Complete

**RECAP:** RECAP- Puerto Rico Sea Grant, in collaboration with USEPA Caribbean Office is actively promoting best practices for storm water management in coastal municipalities to enhance water quality and reduce erosion and sedimentation in the coastal areas.

**PROGRAM FOCUS AREAS:** HEALTHY COASTAL ECOSYSTEMS

**RELEVANCE-** The management of storm water runoff is a priority issue in the conservation of our coastal and marine resources. There is an urgent need to implement educational efforts and conservation management practices at the municipal level to improve water quality and reduce erosion and sedimentation in coastal areas.

**RESPONSE-** In collaboration with the EPA Caribbean Office Storm Water Program, 37 employees from the municipalities of Cabo Rojo and Lajas received training on storm water management. They also learned how to effectively implement conservation practices and management in their public works facilities to improve water quality.

**RESULTS-** Key selected participants with responsibilities to implement erosion and sedimentation control practices at the municipal level learned about the impact of sediment on water resources and were trained on effective implementation of management practices and the conservation of water quality on coastal and marine resources.

**PARTNERS:** None listed in Database

**ASSOCIATED PROJECT(S):**

COASTAL COMMUNITIES DEVELOPMENT (2012 - 2013)

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## Fisheries and Aquaculture Electronic Portal

**NATIONAL FOCUS AREAS:** Healthy Coastal Ecosystems

- Accomplishment
- PO Review Complete

**RECAP:** RECAP- The MOP-fisheries electronic portal provides detailed fisheries/aquaculture to increase the public's awareness on maintaining a sustainable fishery.

**PROGRAM FOCUS AREAS:** HEALTHY COASTAL ECOSYSTEMS

**RELEVANCE-** In the present era with the World-Wide-Web expansion, instant access to information is available. PR-MOP fisheries is making science information available as an outreach product within the Web, promoting the wise utilization of coastal natural assets while increasing public awareness of the need to protect our local resources. The portal provides a local open forum for discussion and reporting on matters specifically related to fisheries and mariculture. Marine users from public and private sectors, receive direct support and advice while promoting collaborative ecosystem-based management.

**RESPONSE-** A public-access blog, administered by MOP-fisheries was created and may be seen at <http://prsgfisheriesoutreach.wordpress.com/>. Relevant information related to fisheries and aquaculture outreach and investigations conducted by MOP has been summarized and posted for public information and forum discussions. A section in the portal includes an open archive for SEAMAP-C data downloading, and access to program publications. Other sections include applied fisheries studies and mariculture outreach projects.

**RESULTS-** The web-portal provides detailed information of the works conducted by the MOP fisheries/aquaculture specialist, access to fisheries studies, their results and reports, including fishery independent studies, and relevant marine advisories. The site also promotes the aquaculture/mariculture development in Puerto Rico. All material is oriented to increase the public's awareness on maintaining a sustainable fishery and to ensure responsible and productive use of the resources.

**PARTNERS:** None listed in Database

**ASSOCIATED PROJECT(S):**

MARINE ADVISORY SERVICE (2012 - 2013)

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## Biodiversity conservation of endangered species through education

**NATIONAL FOCUS AREAS:** Healthy Coastal Ecosystems

- Accomplishment
- PO Review Complete



**RECAP:** RECAP- Through the collaboration with ATP, SG is educating resource users about the critical role of the reserve in biodiversity conservation.

**PROGRAM FOCUS AREAS:** HEALTHY COASTAL ECOSYSTEMS

**RELEVANCE-** The Tres Palmas Marine Reserve (TPMR) is home to *Acropora palmata*, an endangered coral, and is also the biggest surf break of the Caribbean. This marine reserve is under constant threat by coastal development activities including erosion, sedimentation, fishing activities, contamination, user pressure, insufficient funding and lack of management.

**RESPONSE-** Puerto Rico Sea Grant has been instrumental in the development of the NGO Amigos de Tres Palmas (ATP) which was incorporated in April 2011. Since its incorporation, in collaboration with our program, ATP has been developing efforts in favor of the reserve, submitting proposals to develop educational projects for the conservation of coastal and marine resources, and coordinating educational efforts with the local community and volunteers.

**RESULTS-** ATP received a grant from the Fish and Wildlife Foundation to develop and train volunteers from the local schools and community of users to advance the conservation of the marine reserve. With the collaboration of SG, the NGO Amigos de Tres Palmas submitted a proposal to the Ford Foundation and was awarded \$2,180 to produce a video about the marine reserve and the need to acquire land adjacent to the TPMR.

**PARTNERS:** None listed in Database

**ASSOCIATED PROJECT(S):**  
[MARINE ADVISORY SERVICE \(2012 - 2013\)](#)

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## **Scientists use shell deformations as indicators of pollution by toxic elements**

**NATIONAL FOCUS AREAS:** Healthy Coastal Ecosystems

- Accomplishment
- PO Review Complete

**RECAP:** RECAP- Foraminifera are used as bio-indicators to help trace and locate various types of contamination from potential toxic elements. Metal levels in the Torrecillas Lagoon, in San Juan, PR are measured by observing shell deformities in two different types of foraminifera.

**PROGRAM FOCUS AREAS:** HEALTHY COASTAL ECOSYSTEMS

**RELEVANCE-** Pollution of coastal systems by potentially toxic elements (PTEs), often referred to as heavy metals, is a major concern for scientists, resource managers, and regulatory agencies. Coastal estuarine lagoons in the San Juan watershed receive contaminants from numerous industrial and residential sources.

**RESPONSE-** Populations of bottom dwelling foraminifera are formed from one celled fast growing and amoeba like organisms, which can react quickly to surrounding environmental conditions. The small shells that they grow can be deformed under different types of contamination. The specific deformities induced by metals are determined in controlled culture experiments. Identifying specific shell deformations can be a cost effective way to track toxic metals and other contaminants in space and time through their special horizontal distribution.

**RESULTS -** The distribution and bio-availability of metals and organic sediment at Torrecilla Lagoon was determined as were the effects of metals on the spatial distribution of foraminifers and the morphological deformities in *Ammonia* spp. Heavy metal determinations from sediment are made for a number of elements. Lagoon sediments are tested for heavy metals and distribution maps are produced. A high helical spire growth shape is induced in *Ammonia* sp. when subjected to high levels of copper. Deformities were also observed in response to elevated organic carbon concentrations.

**PARTNERS:** None listed in Database

**ASSOCIATED PROJECT(S):**  
[BENTHIC FORAMINIFERA AS BIO-INDICATORS OF HEAVY METAL POLLUTION: TORRECILLA LABOON \(SAN JUAN BAY ESTUARY\), PUERTO RICO \(2008 - 2010\)](#)

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## **Antibiotic-resistant bacteria and fungicide-resistant yeasts and molds becoming increasingly common in wastewater**

**NATIONAL FOCUS AREAS:** Healthy Coastal Ecosystems

- Accomplishment
- PO Review Complete

**RECAP:** RECAP- Impacted coastal habitats and wastewater discharges were shown to comprise an environmental reservoir of fluconazole resistant yeast highly related to opportunistic pathogens.

**PROGRAM FOCUS AREAS:** HEALTHY COASTAL ECOSYSTEMS

**RELEVANCE-** Sewage discharges are major contamination sources of ecologically and economically important coastal environments. The widespread use of antimicrobials in human and veterinary medicine as well as in agricultural production settings have resulted in a large scale release of these chemicals into natural environments. Recently, integrons, a genetic system carried by bacteria, have been implicated in the establishment and dispersal of antibiotic resistance traits which include protection mechanisms against the most important antibiotics used for the treatment of infections in humans as well as in plants and animals.

**RESPONSE-** Sea Grant researchers applied polymerase chain reaction (PCR) analysis, a powerful and sensitive technique for DNA amplification, to detect integron encoded antibiotic resistant genes associated with mangrove, beach and estuarine habitats, exposed to high levels of wastewater pollution or anthropogenic impact.

**RESULTS -**The application of molecular techniques to the analysis of culturable bacteria, revealed the presence of similar resistance determinants among conventional fecal indicators as well as in reference isolates from hospital-related settings. A dominance of fungicide-resistant yeasts was observed in residential wastewater. Since fluconazole resistant yeasts similar to those being recently reported in hospital settings are recovered from the environment, it raises the concern of impacted coastal settings serving as reservoirs of these resistant varieties.

**PARTNERS:** None listed in Database

**ASSOCIATED PROJECT(S):**

**MOLECULAR ECOLOGY OF ANTIMICROBIAL RESISTANCE TRAITS IN BACTERIAL AND FUNGAL POPULATIONS FROM CRITICAL COASTAL HABITATS IMPACTED BY SEWAGE, ANIMAL WASTE, AND WASTEWATER TREATMENT PLANT DISCHARGES (2008 - 2010)**

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## **Potential Future Land Loss of Small Islands of Puerto Rico and the United States Virgin Islands**

**NATIONAL FOCUS AREAS:** Healthy Coastal Ecosystems

- Accomplishment
- PO Review Complete

**RECAP:** RECAP- New techniques were developed to improve rapid assessment of historical shoreline change, land loss due to sea-level-rise, and vulnerability of small islands critical habitat in PR.

**PROGRAM FOCUS AREAS:** HEALTHY COASTAL ECOSYSTEMS

**RELEVANCE-** Understanding how shorelines respond to rising sea level is critical for developing sound coastal management and land use planning guidelines, and it is even more critical when considering the effect of sea level rise on small islands.

**RESPONSE-** In this study, researchers evaluated potential shoreline change and associated land loss as a result of continuing sea-level rise of twenty (20) selected associated islands of Puerto Rico and the United States Virgin Islands (USVI). Three techniques of predicting change were employed: (1) the simple slope-retreat model, (2) extrapolation of historical shoreline change, and (3) a modification of the Coastal Vulnerability Index (CVI) currently in use in the United States and Canada, but applied here for the first time to small islands.

**RESULTS:** A completely revised Coastal Vulnerability Index (CVI) applicable anywhere in the world can better handle coastal features found in the Caribbean such as cays or smaller islands with diverse geological and biological frameworks. Employing the new AMBUR-HVA tool for this study permitted a better analysis of coastal vulnerability. Furthermore, geospatial datasets produced during the study will be compatible with future AMBUR-HVA.

**PARTNERS:** None listed in Database

**ASSOCIATED PROJECT(S):**

**POTENTIAL FUTURE LAND LOSS OF SMALL ISLANDS OF PUERTO RICO AND THE UNITED STATES VIRGIN ISLANDS (2010 - 2013)**

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## **Remote sensing techniques of mineral exploration are applied to the monitoring of mangrove wetlands for the presence of metal contamination**

**NATIONAL FOCUS AREAS:** Healthy Coastal Ecosystems

- Accomplishment
- PO Review Complete

**RECAP:** Study finds that some toxic metals absorbed by mangroves can be remotely detected using reflected light.

**PROGRAM FOCUS AREAS:** HEALTHY COASTAL ECOSYSTEMS

**RELEVANCE-** Health of mangrove wetlands is of critical importance to society in tropical regions. The location of the mangrove wetlands, fringing the land and filtering the fresh water draining into the ocean, makes them very susceptible to contaminants derived from the hinterland.

**RESPONSE-** Researchers selected a non-contaminated control area and analyzed substrate and leaves in the top of the canopy of mangroves and compared the chemical results, the reflectance spectra of the leaves, and the pH of the seawater, with other contaminated sites. A protocol to combine remotely sensed data and location for mangrove wetlands influenced by heavy metal contamination was developed. Hyper-spectral measurements of light reflected from mangrove leaves were measured with a hand held meter and correlated with remotely sensed hyper-spectral images were determined.

**RESULTS-** Analyses showed important differences in the transport of metals in mangroves. Some metals stay in the roots while others are found from root to canopy. The values for field and image data were consistent. A database was developed and a long term line of research at the University of Puerto Rico Mayaguez Geology Department laboratory was established.

**PARTNERS:** None listed in Database

**ASSOCIATED PROJECT(S):**

**DEVELOPING A PROTOCOL TO USE REMOTE SENSING AS A COST EFFECTIVE TOOL TO MONITOR CONTAMINATION OF MANGROVE WETLANDS (2006 - 2007)**

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## **Sedimentation, coastal development, and overfishing significantly impact the biodiversity of sea-grass communities in northeastern Puerto Rico.**

**NATIONAL FOCUS AREAS:** Healthy Coastal Ecosystems

- Accomplishment
- PO Review Complete

**RECAP:** RECAP- Sea-grass habitats are being impacted by urban development. Baseline data including indicators of environmental health have been collected for North East Puerto Rico sea-grass beds and sites for continued long-term monitoring have been established.

**PROGRAM FOCUS AREAS:** HEALTHY COASTAL ECOSYSTEMS

**RELEVANCE-** Sea-grass beds are a critical habitat for many near-shore and shallow water species including fish, sea turtles and manatees. Effective management requires knowledge of processes associated with this ecosystem and the effects of coastal contamination.

**RESPONSE-** Sea Grant researchers assessed marine and watershed processes affecting water quality, currents, and other key factors along with sea-grass community productivity and biodiversity for NE Puerto Rico. Chemical, biological, photographic and location data was generated which provided baseline sea grass information for long term studies of urban and climatic impacts. Pristine and impacted sites were compared and factors affecting sea-grass productivity and biodiversity were identified. Maps characterizing human population density and point source contamination in watersheds discharging into shallow coastal waters with established sea-grass beds were produced.

**RESULTS-** The study concluded that pristine sites with reduced watershed/anthropogenic impact had significantly higher biomass and a trend toward higher below ground (root/rhizome) biomass. Sea-grass cover was higher and a higher percentage of climax species also characterize pristine sites. Two permanent Sea-grass Net sites (<http://www.seagrassnet.org/>) were established for continued monitoring and information source for managers and researchers.

**PARTNERS:** None listed in Database

**ASSOCIATED PROJECT(S):**

**EFFECTS OF WATER QUALITY ON SEAGRASS COMMUNITY PRODUCTIVITY AND BIODIVERSITY (2006 - 2007)**

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## **Sea Grant research characterized highly diverse community of microbial plants, yeasts and molds that reside in living sea-grass leaves and provide evidence of endophytic infection in the sea grass.**

**NATIONAL FOCUS AREAS:** Healthy Coastal Ecosystems

- Accomplishment
- PO Review Complete

**RECAP:** RECAP- Evidence of endophytic infection in the sea-grass *Thalassia testudinum* was documented confirming that micro-flora can impact sea-grass health.

**PROGRAM FOCUS AREAS:** HEALTHY COASTAL ECOSYSTEMS

**RELEVANCE-** The effective management of sea-grass habitats requires an understanding of a community of microbial plants, yeasts and molds living within sea-grass leaf tissue (endophytes). Knowledge of the microbial assemblage and their impact on sea-grass productivity needs to be evaluated to determine if the relationship of these internal micro floras within the sea-grass host can be detrimental or beneficial.

**RESPONSE-** Sea Grant researchers characterized the highly diverse community of endophytes existing in sea-grasses around Puerto Rico. A total of 747 fungal colonies were cultured from sea-grass leaf extract of which, 35 species are identified. In addition, over a 1000 types of bacteria were separated from sea-grass tissue.

**RESULTS-** Baseline data and collection for an unexpectedly diverse assemblage of endophytes has been created. New areas for the study of marine plant ecology, characterizing sea-grass health, and bio-prospecting metabolites are identified. The first laboratory for sea-grass endophyte ecology is established in the Caribbean. A very diverse community associated sea grass tissue is characterized.

**PARTNERS:** None listed in Database

**ASSOCIATED PROJECT(S):**

ENDOPHYTIC MICROBIAL DIVERSITY IN SEAGRASS BEDS OF THALASSIA TESTUDINUM AND SYRINGEODIUM  
FILIGORME FROM CABO ROJO, LAJAS, PUERTO RICO (2006 - 2007)

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## **Puerto Rico Sea Grant research results recommend to increase seasonal closure time periods and closed boundaries for red hind, Nassau and yellowfin grouper**

**NATIONAL FOCUS AREAS:** Healthy Coastal Ecosystems

- Accomplishment
- PO Review Complete

**RECAP:** RECAP- As an alternative to increasing the size of the Grammanik Bank seasonal closed area to accommodate fish movements, agencies have used Sea Grant findings to negotiate a market closure for commercially important grouper species and implement a ban on fileting groupers at sea to reduce by-catch of protected Nassau grouper outside protected areas and seasons.

**PROGRAM FOCUS AREAS:** HEALTHY COASTAL ECOSYSTEMS

**RELEVANCE-** Movement, migration and spatial habitat information of commercially important species (red hind, Nassau and yellowfin grouper) is essential to better define seasonal closure time periods and closed area boundaries in order to ensure that these important Caribbean fisheries are maintained and protected.

**RESPONSE-** Sea Grant researchers captured red hind, Nassau and yellowfin grouper during spawning aggregations and implanted these fish with individually numbered acoustic tags and released them back into the wild. Through the use of software time and fish tag number are recorded and associated with the established receiver position. This data creates a track of each fish's movement, and identifies migration patterns and spatial habitat.

**RESULTS-** Observed migration patterns confirm that seasonal fishing closure of the Grammanik Bank (south of St Thomas) protects the fish spawning in this aggregation site. However, based on Sea Grant findings, an increase in the size and duration of the closure area is recommended.

**PARTNERS:** None listed in Database

**ASSOCIATED PROJECT(S):**

DETERMINING THE MINIMUM SIZE FISHERY CLOSURE FOR PROTECTING GROUPER SPAWNING AGGREGATIONS (2006 - 2007)

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## **Sea Grant Puerto Rico develops crucial component for marine education**

**NATIONAL FOCUS AREAS:** Healthy Coastal Ecosystems

- Accomplishment
- PO Review Complete

**RECAP:** RECAP- Puerto Rico Sea Grant developed educational guides on the topics of mangroves, sea grass beds, and coral reefs. We expect that the Department of Education will include them in its curriculum.

#### PROGRAM FOCUS AREAS: HEALTHY COASTAL ECOSYSTEMS

**RELEVANCE-** Schoolteachers are in great need for resources to educate their students about topics relevant to marine and coastal ecosystems, its conservation and sustainable use. Any educational process has to start with the development of a curriculum that contributes to the advancement of the capacities of specialists, practitioners and decision makers in the design, management and implementation of the quality of curriculum making process.

**RESPONSE-**The curriculum is a crucial component of any education process and taking advantage of this opportunity Puerto Rico Sea Grant got involved in the design and development of three educational guides of essential coastal and marine habitats: mangroves, sea grass beds, and coral reefs. Each guide contains background information about the ecosystem, pre and post-tests, plans, educational activities and exercises, complementary and supplementary materials, pictures, illustrations, stories, and music, all aligned with the standards of the Department of Education of Puerto Rico.

**RESULTS-** Guides are in the process of being presented to the Department of Education together with the hands on workshops to educate teachers about these three marine and coastal habitats and how to use the guides in their education efforts.

**PARTNERS:** None listed in Database

**ASSOCIATED PROJECT(S):**

COMMUNICATIONS AND PUBLICATIONS (2012 - 2013)

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### **Puerto Rico Sea Grant disseminates scientific information Through Collaboration with USGS and the UPRM Department of Geology**

**NATIONAL FOCUS AREAS:** Healthy Coastal Ecosystems

- Accomplishment
- PO Review Complete

**RECAP:** RECAP- Puerto Rico Sea Grant's Communications Section collaborated with USGS and the UPRM Department of Geology in the promotion of a series of lectures.

#### PROGRAM FOCUS AREAS: HEALTHY COASTAL ECOSYSTEMS

**RELEVANCE-** Scientists, resources managers, university students, and professors need to be informed about scientific research findings concerning our natural resources. Conferences and workshops, talks and presentations provide a forum for resource users, managers and scientists to discuss current topics in coastal and marine resource use, research, or management. They are also an opportunity for researchers, managers, extension agents, resource users, stakeholders, graduate and undergraduate students to discuss innovative scientific and practical ideas, and share research findings and recommendations at a stage before they have matured to warrant conference or journal publications.

**RESPONSE-** On 2013, USGS and the UPRM Department of Geology started a series of lectures. Puerto Rico Sea Grant collaborated with them in the preparation of promotional materials and the announcements of the lectures. On November 5th, 2013 the lecture was From Timbuktu to Old San Juan: Saharan dust, coral reefs and human health was presented by Dr. Virginia Garrison. Puerto Rico Sea Grant's Communications Section prepared a poster for the activity and announced it through our mailing list and the social networks. Puerto Rico also helped in the coordination of the webcast of the lecture.

**RESULTS-** More than 100 persons attended the lecture, with many geology students as part of the audience. The lecture generated a lot of interest for the scientific community.

**PARTNERS:** None listed in Database

**ASSOCIATED PROJECT(S):**

COMMUNICATIONS AND PUBLICATIONS (2012 - 2013)

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### **Providing Access to Coastal and Marine Information Through New Technologies**

**NATIONAL FOCUS AREAS:** Healthy Coastal Ecosystems

- Accomplishment
- PO Review Complete

**RECAP:** RECAP- Through the Marine Education and Information Center (MEIRC), Puerto Rico Sea Grant offers access to a wide variety of printed and digital educational resources and publications.

#### PROGRAM FOCUS AREAS: HEALTHY COASTAL ECOSYSTEMS

**RELEVANCE-**The term "Information Technology" can include all forms of technology applied to the processing, storing and transmitting information in electronic form, employing computers, telecommunication equipment and dissemination of information through multimedia. The accessibility of Internet revolutionized information technologies and increased the potential of virtual libraries broadening access to participation for education, business, researchers, communities, managers and resource users and public policy decision makers.

**RESPONSE-** Puerto Rico Sea Grant's Marine Education and Information Center (MEIRC) offers the opportunity to search and gather trustworthy information sources. MEIRC offers a wide variety of services to our community through Puerto Rico Sea Grant's Marine Education and Information Center (MEIRC) offers the opportunity to search and gather trustworthy information sources, access to multiple printed and electronic educational and information resources. Also, people can visit the Center to study, read, have online access and develop educational and academic activities.

**RESULTS-** Over 1,362 persons have used MEIRC's resources. Printed and electronic resources are available through the Puerto Rico Sea Grant Catalog (<http://www.librarything.com/catalog/CRIEM>) and the UPR-Mayagüez Library Catalog (<http://www.uprm.edu/library/en>), which facilitates the process of searching and accessing information. Also, to broaden the use of our resources, the subject guides had been translated into English language (<https://sites.google.com/site/prseagrantsubjectguides/>). Puerto Rico Sea Grant has produced theme guides on the topics of mangrove and sea grass beds, and a Flickr page to preserve our photo archives. Through its Resources Center, Puerto Rico Sea Grant constantly promotes the National Sea Grant Library database and instructs users on how to use the searching items in order to retrieve information effectively. Moreover, in order to refer the community into trusted online information resources, we urge the community to take advantage of the NOAA's online resources, such as, NOAA Library catalog, NOAA Photo Library and its website.

**PARTNERS:** None listed in Database

**ASSOCIATED PROJECT(S):**

[COMMUNICATIONS AND PUBLICATIONS \(2012 - 2013\)](#)

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## **Federation of Fishers and Sea Defenders, Inc. (FEPDEMAR) celebrate their first national assembly**

**NATIONAL FOCUS AREAS:** Healthy Coastal Ecosystems

- Accomplishment
- PO Review Complete

**RECAP:** RECAP- Puerto Rico Sea Grant collaborated with FEPDEMAR during its first national assembly and facilitated the meeting with managers of the resource.

**PROGRAM FOCUS AREAS:** HEALTHY COASTAL ECOSYSTEMS

**RELEVANCE-** Local fishers need to get to know better the agencies that regulate their fishing activities; they should also develop contacts with other fishermen as well, in order to join efforts and achieve goals that serve their needs.

**RESPONSE-** Puerto Rico Sea Grant collaborated with FEPDEMAR in the organization of their general assembly by facilitating promotional services through our social networks pages, as well as contacts with managers of the resources in provided educational materials to disseminate among their members.

**RESULTS-** One-hundred-and-thirty (130) fishers attended the assembly. FEPDEMAR fishers were able to celebrate the assembly, select their leaders and meet with the secretaries of the Department of Natural and Environmental Resources and the Department of Agriculture.

**PARTNERS:** None listed in Database

**ASSOCIATED PROJECT(S):**

[COMMUNICATIONS AND PUBLICATIONS \(2012 - 2013\)](#)

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## **Puerto Rico Sea Grant coordinates field trips for public housing projects students**

**NATIONAL FOCUS AREAS:** Healthy Coastal Ecosystems

- Accomplishment
- PO Review Complete

**RECAP:** RECAP- In order to increase ocean literacy among children and teenagers, Puerto Rico Sea Grant organized two Marine Adventures for the Center for Access to the University's summer camps.

**PROGRAM FOCUS AREAS:** HEALTHY COASTAL ECOSYSTEMS

**RELEVANCE-** Children and teenagers need to be introduced to marine and coastal resources in order to develop a sense of belonging for these resources. Hands-on learning activities and field trips are excellent educational tools to increase ocean literacy and make people feel



more connected to their environment.

**RESPONSE-** During summer 2013, Puerto Rico Sea Grant offered two Marine Adventures for the kids that were participating in the Center for Access to the University's summer camps. Thirty-four (34) students participated in water quality, sand composition, plankton, and mangrove workshops. They had the opportunity to collect and analyze samples in the Marine Sciences Department laboratories and visited the bioluminescent bay in La Parguera, where they learned about dinoflagellates, currents, mangroves, salinity, moon phases and other topics related to the light generating organisms. The second Marine Adventure was offered to the students that were participating in the Creative Writing Camp. Thirty-five students participated of an educational field trip to the mangrove channels, the sea-grass beds, and the coral reef. During the afternoon they had a workshop about writing and the sea, writing techniques and ways to apply marine and coastal topics to literature.

**RESULTS-** Students demonstrated an average learning gain. At the end of the second Marine Adventure, participants had the opportunity to create their own piece of literature about the sea.

**PARTNERS:** None listed in Database

**ASSOCIATED PROJECT(S):**  
**COMMUNICATIONS AND PUBLICATIONS (2012 - 2013)**

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## **Ocean literacy as art**

**NATIONAL FOCUS AREAS:** Healthy Coastal Ecosystems

- Accomplishment
- PO Review Complete

**RECAP:** RECAP- Puerto Rico Sea Grant and the Literature and Environment Course of the UPRM Hispanic Studies Department had a collaboration in which students were able to learn about marine and coastal resources and develop their own literature creations.

**PROGRAM FOCUS AREAS:** HEALTHY COASTAL ECOSYSTEMS

**RELEVANCE-** Arts are one of many avenues available to educate and inform people about the conservation and sustainable use of coastal and marine resources. The ocean has been the object of poetry and songs, movies, drawings, stories and pictures in every culture. Artists, scientists and educators have developed efforts to collectively address and raise awareness about the conservation of natural resources including coastal and marine resources.

**RESPONSE-** During Fall 2013, the UPRM Hispanic Studies Department offered a Literature and Environment course where Puerto Rico Sea Grant collaboration included the development of two activities for the students which consisted of a lecture about marine and coastal ecosystems and a field trip and environmental literature workshop.

**RESULTS-** Participants had the opportunity to find in the sea another source of inspiration and became more interested in topics related to marine and coastal resources. They also produced their own pieces of literature.

**PARTNERS:** None listed in Database

**ASSOCIATED PROJECT(S):**  
**COMMUNICATIONS AND PUBLICATIONS (2012 - 2013)**

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## **Ocean Chats strengthen networks among resource users, managers and researchers**

**NATIONAL FOCUS AREAS:** Healthy Coastal Ecosystems

- Accomplishment
- PO Review Complete

**RECAP:** RECAP- Resource users and managers, government agencies, and the academic community need to stay on top of the latest research findings; to this end, Ocean Chats contribute to the dissemination of the research findings of Puerto Rico Sea Grant's projects.

**PROGRAM FOCUS AREAS:** HEALTHY COASTAL ECOSYSTEMS

**RELEVANCE-** Conferences and workshops, talks and presentations provide a forum for resource users, managers and scientists to discuss current topics in coastal and marine resource use, research, or management. They are also an opportunity for researchers, managers, extension agents, resource users, stakeholders, graduate and undergraduate students to discuss innovative scientific and practical ideas, and share research findings and recommendations at a stage before they have matured to warrant conference or journal publications.

**RESPONSE-** For the period reported, we held two Ocean Chats in which researchers and participants discussed the research projects: An

interdisciplinary evaluation of the fishery for *Cittarium pica* and Investigating local and regional movements, vertical movements and genetic structure of dolphinfish in Western Central Atlantic.

**RESULTS-** Ocean Chats encourage networking among researchers, students, coastal and marine resources managers, government representatives, and community leaders. Oceans Chats have been an excellent tool for the dissemination of the results of Puerto Rico Sea Grant's research projects. They are also transmitted through the Internet using the webcast service of the UPR-Mayagüez Campus.

**PARTNERS:** None listed in Database

**ASSOCIATED PROJECT(S):**

COMMUNICATIONS AND PUBLICATIONS (2012 - 2013)

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## **Reduction of lionfish population through fishing and consumption efforts**

**NATIONAL FOCUS AREAS:** Healthy Coastal Ecosystems

- Accomplishment
- PO Review Complete

**RECAP:** RECAP- Through Puerto Rico Sea Grant efforts, people have become aware of lionfish and how to control its population.

**PROGRAM FOCUS AREAS:** HEALTHY COASTAL ECOSYSTEMS

**RELEVANCE-** Lionfish are non-selective feeders and voracious predators that virtually have no natural enemies in the Caribbean. These invasive species are out-competing native predators for their food sources, as well as reducing fish populations through direct predation. Lionfishes are well established in Puerto Rico and occupy an extensive geographic range, surviving in different habitats and depths.

**RESPONSE-** Puerto Rico Sea Grant participated in over 20 chats, exhibitions, and fairs in which the Program oriented fishers and the general public about lionfish and how to control its population through consumption. Our program has been a regular in TV and radio programs promoting the consumption of lionfish. Also, as part of Sea Grants' sponsored research we have collaborated with the thesis project Lionfish Invasion of Puerto Rico: Assessing the Effectiveness of Lionfish Removals for Restoration of Ecological Function, where we coordinated a lionfish festival in which people had the opportunity to fish and taste lionfish. Equipment provided by the Caribbean Fisheries Management Council was given to volunteer artisanal fishermen to ensure the safe capture and handling of lionfish.

**RESULTS-** Over 5,000 persons learned about the lionfish consumption efforts, how to handle it, and learned that it is edible and not poisonous when handled correctly. Information regarding the different ways to catch and consume the lionfish was also disseminated. Also we have been developing another educational effort with six new restaurants that have been serving lionfish, and other restaurants are thinking of ways in which to incorporate lionfish as a regular fixture in their menus. The Puerto Rico Department of Agriculture included the lionfish as part of an initiative titled La Ruta del Pescado, aimed at improving the economic opportunities for fishing communities.

**PARTNERS:** None listed in Database

**ASSOCIATED PROJECT(S):**

COMMUNICATIONS AND PUBLICATIONS (2012 - 2013)

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## **Puerto Rico Sea Grant takes advantage of social networks educational capabilities**

**NATIONAL FOCUS AREAS:** Healthy Coastal Ecosystems

- Accomplishment
- PO Review Complete

**RECAP:** RECAP- Social networks have been a useful tool for Puerto Rico Sea Grant's dissemination efforts.

**PROGRAM FOCUS AREAS:** HEALTHY COASTAL ECOSYSTEMS

**RELEVANCE-** According to researchers, social networks improve communication skills, enhance participation as well as social commitment, reinforce peer support, and ensure realization of education based on collaboration strategies. Furthermore, social networking sites can be easily and inexpensively used without substantial support from universities. That is also to say that they can be successfully integrated into educational processes. It appears that this type of use rapidly becomes widespread all around the world (Gulbahar et al., 2010, p.2).

**RESPONSE-** Since 2009, Puerto Rico Sea Grant have been using Facebook, Twitter, and Flickr pages to share the information that Sea Grant produces and announce our events. For the period reported, Puerto Rico Sea Grant reached almost 1,400 likes in Facebook and 700 followers in Twitter, approximately. Also, we have published 7 entries in Marejada's blog (<http://seagrantpr.org/marejada/>) and one new entry in Fuede y Verguillas's blog (<http://fueteyverguilla.wordpress.com/>) that have been reposted in our social media profiles.

**RESULTS-** Through the blog and Facebook, Twitter and Flickr 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. 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.

**PARTNERS:** None listed in Database

**ASSOCIATED PROJECT(S):**

COMMUNICATIONS AND PUBLICATIONS (2012 - 2013)

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## **Fishermen organization at the forefront: Educating and representing diverse users of Puerto Rican fishery resources**

**NATIONAL FOCUS AREAS:** Safe and Sustainable Seafood Supply

- Accomplishment
- PO Review Complete

**RECAP:** RECAP- With MOP advice, FEPDEMAR (Federación de Pescadores de P.R. y Defensores Del Mar, Inc.) has become the main recognized organization representing fishery workers of Puerto Rico, by relying on their traditional knowledge, while asserting their social standing, their political status, and preserving their role in the natural environment. This was proven when the new PR Governor and the DNER Secretary had committed in writing to FEPDEMAR to attend main issues to support artisanal commercial fishers.

**PROGRAM FOCUS AREAS:** SAFE AND SUSTAINABLE SEAFOOD SUPPLY

**RELEVANCE-** This project provides specialized assistance in marine advisories for the sustainable use of the fishery resources, not only to general users (commercial and recreational fishers), but also to resource managers and scientific investigators, oriented toward applied science for the conservation of these resources.

**RESPONSE-** The Sea Grant MOP fisheries extension agent has been serving as a long-term facilitator and a non-advocate advisor for a diverse group of local Puerto Rico fishers, representing commercial, recreational, skin-diver and kayak recreational sport-fishers, and wild ornamental fishers.

**RESULTS-** Advisory services have been oriented to help commercial fishers to set priorities and develop long-range plans that include alternatives for product diversification. The specialized advisories from MOP have been extended to include recommendations to resource managers, particularly to the PR-Department of Natural and Environmental Resources, and the PR Department of Agriculture, on matters related to marine resources regulations, government incentive programs, and other critical fishers' needs. These include technical support to maintain all fishers informed about fishing regulations, biological aspects of regulated species, and issues dealing with environmental conservation.

**PARTNERS:** None listed in Database

**ASSOCIATED PROJECT(S):**

MARINE ADVISORY SERVICE (2012 - 2013)

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## **Puerto Rico mariculture project succeeds in grow-out of yellowtail and lane snappers in locally managed recirculation systems**

**NATIONAL FOCUS AREAS:** Safe and Sustainable Seafood Supply

- Accomplishment
- PO Review Complete

**RECAP:** RECAP- During this reporting period, more than 690 persons showed interest in the project while visiting the community, or during "Open-house" activities. Twelve (12) commercial fishers received various levels of training, related to distinct phases of the grow-out project, while more than 15 students from the Corozo's community (from the INSEC educational/incentive program) received direct specialized training related to marine fish.

**PROGRAM FOCUS AREAS:** SAFE AND SUSTAINABLE SEAFOOD SUPPLY

**RELEVANCE-** This project developed a marine closed grow-out recirculation system at the Corozo CAUF Fishery Villa in Combate, Cabo Rojo, which included a program of marine outreach extension to train commercial fishers and all general public interested in raising marine fish. This project has been the first step in Puerto Rico to successfully transfer science and technology to stakeholders, while promoting sustainable aquaculture.

**RESPONSE-** The project primarily served as a demonstration project for hands-on activities and workshops for Puerto Rico fishers. The facility was continually fine-tuning to optimize the culture techniques, train fishers at the CAUF villa, and offer "Open House" demonstrations oriented toward the general public, students, and especially to fishers from other fishing communities.

**RESULTS-** The project has been successful in achieving the goals planned, which included technological outreach and education on water quality management, harvesting of wild fish, control of nutritional aspects while adapting wild caught fish to artificial diets, system engineering and maintenance, and developing clear-cut, relatively simple, grow-out aquaculture management procedures for fishers to utilize in the future.

**PARTNERS:** None listed in Database

**ASSOCIATED PROJECT(S):**

MARINE ADVISORY SERVICE (2012 - 2013)

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## Multiple agencies collaborate in large-scale coral reef monitoring and assessment project

**NATIONAL FOCUS AREAS:** Hazard Resilient Coastal Communities

- Accomplishment
- PO Review Complete

**RECAP:** RECAP- Collaborative efforts made by CMES and VIMAS have provided the local government with tools they need in order to protect marine resources.

**PROGRAM FOCUS AREAS:** HAZARD RESILIENCE IN COASTAL COMMUNITIES

**RELEVANCE-** Evaluating the effectiveness of government management plans at reducing the impact of anthropogenic activities on coastal resources is essential. The evaluation process requires an assessment of baseline conditions of those resources followed by a long-term monitoring effort. For example, if new development guidelines are effective at reducing sedimentation and other non-point source pollutants, coral reef monitoring programs will quantify the resultant change in the health of coral reefs and their associated fish and invertebrate fauna relative to baseline conditions.

**RESPONSE-** Virgin Islands Marine Advisory Service (VIMAS) has partnered with the Center for Marine and Environmental Studies (CMES) researchers to conduct large-scale assessments of Virgin Islands reefs and has initiated a territorial coral reef monitoring effort of heavily impacted sites. These data, which are being provided to the VI Department of Planning and Natural Resources, will allow the Coastal Zone Management and Fish and Wildlife to establish benchmarks on the condition of coastal resources and to assess whether or not management regulations are effective at improving near-shore water quality and marine life. During this reporting period, all sites were completed.

**RESULTS-** The CMES data provided to the Government of the VI has improved their ability to make sound decisions about that status of the coral reefs and association biota in order to protect this ecosystem on an annual basis.

**PARTNERS:** None listed in Database

**ASSOCIATED PROJECT(S):**

USVI MARINE ADVISORY SERVICE (2012 - 2013)

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## Enhancing ocean literacy through professional development opportunities

**NATIONAL FOCUS AREAS:** Hazard Resilient Coastal Communities

- Accomplishment
- PO Review Complete

**RECAP:** RECAP- Puerto Rico Sea Grant efforts improved teacher's knowledge in marine science concepts

**PROGRAM FOCUS AREAS:** HAZARD RESILIENCE IN COASTAL COMMUNITIES

**RELEVANCE-** 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 is limited. Teachers need training on marine sciences topics to better master concepts related to the marine environment

**RESPONSE-** Puerto Rico Sea Grant Education Component (PRSGEC) developed nine (9) workshops to enhance teachers knowledge on marine science topics; their instructional skills, and provide high quality classroom materials to be integrated in their curricula.

**RESULTS-** One hundred (100) teachers participated in nine (9) workshops. They shared their experience and knowledge with students through lesson plans and resource materials from the workshops. An estimated 7,018 students have been impacted by those teachers. Pre and post testing were analyzed and found to be significantly higher at the post level (pre-test result- 47.5% and post-test 89.8%). The knowledge gained by the participants was 80.3%. Further evaluations rated the programs as Excellent (90-100%).

**PARTNERS:** None listed in Database

**ASSOCIATED PROJECT(S):**  
**MARINE EDUCATION (2012 - 2013)**

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## **Marine science hands on experiences for K-12 students develops interest in the marine environment**

**NATIONAL FOCUS AREAS:** Hazard Resilient Coastal Communities

- Accomplishment
- PO Review Complete

**RECAP:** RECAP- Puerto Rico Sea Grant efforts promote ocean literacy and encourage lifelong knowledge and interest in marine science for k-12 students.

**PROGRAM FOCUS AREAS:** HAZARD RESILIENCE IN COASTAL COMMUNITIES

**RELEVANCE-** Science courses offered at local schools of Puerto Rico lack information related to the marine environments of the Caribbean. Scientific knowledge of the sea and its importance needs to be part of the general education provided in our classrooms.

**RESPONSE-** The Marine Science Adventure is an intense program that introduces students to the marine environment through lectures, exhibitions, laboratories and field activities. Three workbooks and a Power Point presentation for plankton, fish and marine invertebrates were developed as educational tools.

**RESULTS-** The SGEC delivered a total of 32 educational events for 2,464 K-12 levels students and 96 teachers (school programs). Students acquired new knowledge about marine and coastal ecosystems and acquired a better understanding and appreciation of the various fields in marine science. In August of 2013, 25% of the Coastal Marine Biology Program from UPR-Humacao freshman class participated in the Puerto Rico Sea Grant educational activities during their K-12 school program.

**PARTNERS:** None listed in Database

**ASSOCIATED PROJECT(S):**  
**MARINE EDUCATION (2012 - 2013)**

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## **Puerto Rico Sea Grant informs marine stakeholders through its magazines Marejada and Fuede y Verguilla**

**NATIONAL FOCUS AREAS:** Hazard Resilient Coastal Communities

- Accomplishment
- PO Review Complete

**RECAP:** RECAP- Puerto Rico Sea Grant publishes Marejada and Fuede y Verguilla in order to disseminate and share information and increase ocean literacy among a wide variety of audiences.

**PROGRAM FOCUS AREAS:** HAZARD RESILIENCE IN COASTAL COMMUNITIES

**RELEVANCE-** Resource users, scientists, governmental agencies, schools, and academic institutions in Puerto Rico have a need for information related to the wise use and conservation of marine and coastal resources.

**RESPONSE-** Puerto Rico Sea Grant through its magazines, Marejada and Fuede y Verguilla, disseminates relevant information about conservation and sustainable use of marine and coastal resources, educates diverse audiences, and provides a forum to share knowledge, increase ocean literacy, and outline a wide variety of sustainable economic activities and opportunities offered by our marine and coastal resources.

**RESULTS-** Both magazines have been widely distributed among resource users, fishermen scientists, governmental agencies, schools, and academic institutions. Magazines are available in their printed and digital versions.

**PARTNERS:** None listed in Database

**ASSOCIATED PROJECT(S):**  
**COMMUNICATIONS AND PUBLICATIONS (2012 - 2013)**

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## **Puerto Rico Sea Grant advances ocean literacy through the Sandwatch Project**

**NATIONAL FOCUS AREAS:** Hazard Resilient Coastal Communities

- Accomplishment
- PO Review Complete

**RECAP:** RECAP- Puerto Rico Sea Grant, through the Sandwatch Project, increases ocean literacy and develops scientific and data gathering skills among leaders and volunteers and the use of the scientific method.

**PROGRAM FOCUS AREAS:** HAZARD RESILIENCE IN COASTAL COMMUNITIES

**RELEVANCE-** Puerto Rico is a need for environmental education in schools and communities as well as opportunities to learn about marine and coastal resources through the development of scientific and data gathering activities. Coastal communities and young adults need to be informed about the fragility of marine and coastal resources and the importance of conservation and sustainable use of those resources.

**RESPONSE-** On 2013, Puerto Rico Sea Grant conducted two different workshops to prepare leaders and volunteers to do the different scientific activities included in the Sandwatch project, a collaboration with UNESCO. Also on 2013, Puerto Rico Sea Grant concluded the preparation of 16 instructional videos, in English and Spanish, to simplify the learning process of the participants.

**RESULTS-** Nineteen groups of volunteers have enrolled in Sandwatch. Leaders and groups learned to take measurements of the maritime zone and water quality. Most of them are mastering the different activities and submitting data. While they are taking data, they are applying scientific and mathematical knowledge, writing skills, technical skills and creative abilities. Data is posted in the blog. Videos are being distributed among Sandwatch groups in different countries of the Pacific and the Caribbean regions. Information related to Sandwatch Project and videos can be found in Sandwatch's blog: <http://www.seagrantpr.org>.

**PARTNERS:** None listed in Database

**ASSOCIATED PROJECT(S):**  
**COMMUNICATIONS AND PUBLICATIONS (2012 - 2013)**

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## **Puerto Rico Sea Grant gets involved in educational talks, fairs and exhibitions**

**NATIONAL FOCUS AREAS:** Hazard Resilient Coastal Communities

- Accomplishment
- PO Review Complete

**RECAP:** RECAP- Puerto Rico Sea Grant's participation in different activities contributes to increase marine and coastal literacy and awareness about the fragility of Puerto Rico's natural resources.

**PROGRAM FOCUS AREAS:** HAZARD RESILIENCE IN COASTAL COMMUNITIES

**RELEVANCE-** It is highly recognized that the role of educational organizations in third world countries is even more critical as they seek to supplement, complement or substitute the formal education efforts in the country and reach out to excluded, underprivileged and challenged sections of society. Every day the challenge is present to provide educational materials to a clientele that does not like or know how to read.

**RESPONSE-** Almost 8,000 persons attended the activities where Puerto Rico Sea Grant participated. We know that many of the stakeholders do not like to read so we concentrate in the coordination of talks, hands-on educational activities, and educational videos and colorful printed educational materials about marine and coastal ecosystems, its conservation, sustainable use and development.

**RESULTS-** Attendees to Puerto Rico Sea Grant activities were introduced to the concept of conservation and sustainable use of marine and coastal resources. They also had the opportunity to receive information on climate change, coastal hazards and resilient coastal communities through materials produced by our program directed to change negative attitudes and behaviors.

**PARTNERS:** None listed in Database

**ASSOCIATED PROJECT(S):**  
**COMMUNICATIONS AND PUBLICATIONS (2012 - 2013)**

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## Multidisciplinary community proposes solutions for coastal erosion and degraded fish habitats

**NATIONAL FOCUS AREAS:** Hazard Resilient Coastal Communities

- Accomplishment
- PO Review Complete

**RECAP:** RECAP- Puerto Rico Sea Grant collaborated in the coordination of the 8th International Multi-Purpose Reef & Surfing Science Symposium.

**PROGRAM FOCUS AREAS:** HAZARD RESILIENCE IN COASTAL COMMUNITIES

**RELEVANCE-** Several natural forces can be responsible for the problems related to beach erosion including waves, ocean currents and tides. Puerto Rico like many other Caribbean countries is no exemption to coastal erosion and habitat degradation problems.

**RESPONSE-** Puerto Rico Sea Grant joined efforts with Tetrattech and Blue Legacy Foundation to celebrate the 8th International Multi-Purpose Reef & Surfing Science Symposium held during February 19-21, 2013 in Domes Beach, Rincón, PR. This was a forum where scientists and engineers presented research projects related to hydrodynamics, biology of coral reefs, artificial coral reefs, wave dynamics, and surf sciences looking for a solution to erosion and habitat degradation problems.

**RESULTS-** Scientists, managers, and representatives of governmental agencies had the opportunity to discuss and present solutions to problems related to coral cover reduction, beach erosion, and lack of sustainable use of marine and coastal resources.

**PARTNERS:** None listed in Database

**ASSOCIATED PROJECT(S):**

COMMUNICATIONS AND PUBLICATIONS (2012 - 2013)

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## Puerto Rico Sea Grant collaborates in the creation of the first Environmental Law Digital Library in Puerto Rico

**NATIONAL FOCUS AREAS:** Hazard Resilient Coastal Communities

- Accomplishment
- PO Review Complete

**RECAP:** RECAP- The establishment of the First Digital Spanish Environmental Library for Puerto Rico in the UPR Sea Grant Program web page ([www.seagrantpr.org](http://www.seagrantpr.org)) and the UPR Agriculture Extension Service website ([www.uprm.edu/cms/index.php/page/1036](http://www.uprm.edu/cms/index.php/page/1036)) are improving and strengthening stakeholders' understanding of the tropical environments and their association with Puerto Rico's legal system.

**PROGRAM FOCUS AREAS:** HAZARD RESILIENCE IN COASTAL COMMUNITIES

**RELEVANCE-** In Puerto Rico, many impacted communities and nongovernmental organizations are involved in programs and activities focused on environmental protection, conservation, restoration and education. Because of this, they need to understand the law and mandatory procedures that regulate each of them, and an easy and simple way to obtain legal information was sorely needed.

**RESPONSE-** Puerto Rico Sea Grant and the Agriculture Extension Service of the University of Puerto Rico (SG-AES) designed, developed and published the First Digital Spanish Library specialized in Environmental Issues for Puerto Rico in the internet site: [www.bibliotecalegalambiental.wordpress.com](http://www.bibliotecalegalambiental.wordpress.com). The website includes information and papers about: environmental public policy, environmental justice, coastal zone, water law, maritime laws, environmental crimes, renewable energy, climate change, public participation topics and other legal information.

**RESULTS-** The digital library is currently improving and enhancing citizens' knowledge, awareness and stewardship on the legal environmental framework of Puerto Rico. Stakeholders like teachers, nongovernmental organizations, governmental agencies and coastal communities are increasing their access to the Puerto Rico legal system. Also, lawyers and the Legal Assistance Society (SAL) can get faster access to this environmental information through the web pages.

**PARTNERS:** None listed in Database

**ASSOCIATED PROJECT(S):**

MARINE ADVISORY SERVICE (2012 - 2013)

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## Community Education on Toxic and Hazardous Pollution

**NATIONAL FOCUS AREAS:** Hazard Resilient Coastal Communities

- Accomplishment

- PO Review Complete

**RECAP:** RECAP- The SG-AES partnership continues improving and enhancing stakeholders' awareness about toxic and hazardous wastes pollution in Puerto Rico. Efforts continue empowering and promoting community participation in public hearings and/or meetings and improving their stewardship on environmental and watersheds protection.

**PROGRAM FOCUS AREAS:** HAZARD RESILIENCE IN COASTAL COMMUNITIES

**RELEVANCE-** The Environmental Quality Board (EQB) reported that industrial and residential pollutants are the principal impairment causes in aquatic habitats that eventually reach the marine environment in Puerto Rico.

**RESPONSE-** Puerto Rico Sea Grant and the Agriculture Extension Service of the University of Puerto Rico (SG-AES), in alliance with the organization "Campus Verde" designed, developed and published the internet site "Naturaleza sin Tóxicos" ([www.naturalezasintoxicos.wordpress.com](http://www.naturalezasintoxicos.wordpress.com)), a community education site about Toxic and Hazardous Waste Pollution in Puerto Rico. This SG-AES partnership published, a digital presentation about toxic and hazardous waste pollution control along the Río Grande de Añasco (RGA) and Río Cagüitas (RC) Watersheds. Four training sessions were organized to build local empowerment capacity to prevent toxic and hazardous waste pollution in the region.

**RESULTS-** The SG-AES Community Education Initiative capacitated members of the community organization, Mayaguezanos por la Salud y el Ambiente (MSA), to participate in public meetings and/or hearings providing Sea Grant technical information and studies concerning threats and impacts for the RGA if a hazardous wastes storage facility is located inside the river flood valley. PR-SG helped MSA in the development of outreach activities and the coordination of meetings and presentations for residents of several communities in the Municipalities of Mayagüez and Añasco, educate and stimulate and the stakeholders to participate in the state and federal permit application procedures.

**PARTNERS:** None listed in Database

**ASSOCIATED PROJECT(s):**

MARINE ADVISORY SERVICE (2012 - 2013)

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## Ecotourism as a tool to promote conservation

**NATIONAL FOCUS AREAS:** Sustainable Coastal Development

- Accomplishment
- PO Review Complete

**RECAP:** RECAP- PR-SG efforts continue the educational campaign to encourage and support the Estuary Conservation and Eco Tourism Initiatives at the Boquilla Nature Reserve (120 acres), promoting an ecosystem-based management approach towards this coastal ecosystem.

**PROGRAM FOCUS AREAS:** SUSTAINABLE COASTAL DEVELOPMENT

**RELEVANCE-** The Boquilla Nature Reserve is an important coastal-estuary-mangrove ecosystem in the Municipality of Mayaguez. The estuary discharges to the Mayaguez Bay, one of the most important western sand beaches where two species of marine turtle nest.

**RESPONSE-** PR-SG facilitated the stakeholders' integration in the preparation of a Sustainable Eco Tourism Proposal for the restoration and conservation of the Boquilla Nature Reserve. The proposal was approved by the local legislature. PR-SG and the NGO "Mayaguezanos por la Salud y el Ambiente" (MSA) designed, developed and published the first website about the Boquilla Nature Reserve ([www.granreservaboquilla.wordpress.com](http://www.granreservaboquilla.wordpress.com)).

**RESULTS-** PR-SG and the ACREB organized the "2do Festival Eco Amistoso Redescubriendo el Estuario Boquilla". The festival was visited by over 500 citizens, promoting, through education and awareness, the importance of estuaries and biodiversity. PR-SG and the NGO MSA designed hiking and kayak tours through the Boquilla Reserve, including presentations about coastal ecology, marine turtles, estuaries, mangroves and coastal endangered species. PR-SG collaborated with the Municipality of Mayagüez, "Campus Verde" and the NGO MSA in the preparation of the Environmental Proposal: Community in Harmony Integrating People and the Environment (CHIPE). The proposal was granted by AmeriCorps STATE Program (\$323,000) to the Municipality of Mayaguez to continue PR-SG initiatives in the Boquilla Nature Reserve.

**PARTNERS:** None listed in Database

**ASSOCIATED PROJECT(s):**

MARINE ADVISORY SERVICE (2012 - 2013)

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## Education, Prevention and Response Capacity: reducing hurricane vulnerability with an important dose of policy determination

**NATIONAL FOCUS AREAS:** Sustainable Coastal Development

- Accomplishment
- PO Review Complete

**RECAP:** RECAP- Puerto Rico Sea Grant efforts improve multiagency coordination and communications to better manage and reduce hurricane vulnerability in coastal municipalities.

**PROGRAM FOCUS AREAS:** SUSTAINABLE COASTAL DEVELOPMENT

**RELEVANCE-** Hurricane forecasts for the Caribbean and the Atlantic in 2013 reflected a highly and active season. Close to 20 tropical storms were predicted for the region during the season.

**RESPONSE-** Based on these 2013 forecasts, our program convened state agencies and municipal dependencies of the coastal municipality of Cabo Rojo to discuss how to effectively improve the coordination and communication efforts to reduce hurricane vulnerability through education, prevention and response capacity.

**RESULTS-** The dialogue within representatives of state agencies and municipal dependencies enhanced their capabilities to improve planning and coordination efforts to reduce hurricane vulnerability in the municipality. Cabo Rojo was the first municipality in the west coast of Puerto Rico ready to effectively manage the hurricane season.

**PARTNERS:** None listed in Database

**ASSOCIATED PROJECT(S):**

[CLIMATE CHANGE ADAPTATION CAPACITY BUILDING INITIATIVE \(2012\)](#)

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## **Improving resiliency of coastal communities through educational efforts**

**NATIONAL FOCUS AREAS:** Sustainable Coastal Development

- Accomplishment
- PO Review Complete

**RECAP:** RECAP- Puerto Rico Sea Grant sponsored a FEMA certified disaster preparedness course to enhance community awareness about resiliency on the island coastal communities, and facilitated knowledge for a target audience with little or no exposure to the tools and methodologies for enhancing community resilience.

**PROGRAM FOCUS AREAS:** SUSTAINABLE COASTAL DEVELOPMENT

**RELEVANCE-** Coastal communities around the world are experiencing unprecedented change resulting from population growth in coastal regions and increased vulnerability to natural hazards. Coastal communities need to develop their capabilities to plan for and take action to mitigate the risks from coastal hazards, increase the pace of recovery from destructive events, and adapt to changing environments.

**RESPONSE-** Puerto Rico Sea Grant collaborated with the National Disaster Preparedness Training Center from the University of Hawaii and coordinated the FEMA Certified Coastal Community Resilience course to provide decision makers, emergency managers and municipal officials background on natural hazards and guide an approach to assess community resilience and develop steps for improved resilience.

**RESULTS-** A total of 42 decision makers, stakeholders, emergency management officers and municipal officials were certified in matters related to Coastal Community Resiliency. Participants received a background on natural hazards and an approach to assess community resilience.

**PARTNERS:** None listed in Database

**ASSOCIATED PROJECT(S):**

[CLIMATE CHANGE ADAPTATION CAPACITY BUILDING INITIATIVE \(2012\)](#)

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## **Grappling with development and the challenges of municipal sustainability in the coastal zone of Aguada, Puerto Rico**

**NATIONAL FOCUS AREAS:** Sustainable Coastal Development

- Accomplishment
- PO Review Complete

**RECAP:** RECAP- Puerto Rico Sea Grant collaborates and advises the municipal government of Aguada, encouraging sustainable development, promoting community education and capacitating them on matters related to residency of coastal communities.

**PROGRAM FOCUS AREAS:** SUSTAINABLE COASTAL DEVELOPMENT

**RELEVANCE-** The Municipality of Aguada has a large coastal area in which a variety of uses and activities converge. The coast in this town also serves as a host to a large and diverse population of urban dwellers. The shores of Aguada represent an invaluable resource and a asset for its residents that needs to be sustainably developed.

**RESPONSE-** An evaluation assessment that included literature review and field visits to the coastal areas was carried out at the municipality of Aguada. This process included orientation meetings with the vice-mayor of the municipal government. Stemming from these meetings, the team identified problems, needs and opportunities for the use and conservation of the coast. An assessment of the coast was conducted through field observation identifying threats, risks, needs and opportunities.

**RESULTS-** A report of the assessment results and recommendations for the management, use and coastal planning was presented to the Municipal Government. A collaboration effort was established to continue advising and collaborating with the municipal government.

**PARTNERS:** None listed in Database

**ASSOCIATED PROJECT(S):**

MARINE ADVISORY SERVICE (2012 - 2013)

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## **Puerto Rico Sea Grant examines surfing's socioeconomic impact**

**NATIONAL FOCUS AREAS:** Sustainable Coastal Development

- Accomplishment
- PO Review Complete

**RECAP:** RECAP- UPRSG produced a publication that underscores the social and economic importance of surfing for coastal areas, paying especially close attention to Rincón, Puerto Rico.

**PROGRAM FOCUS AREAS:** SUSTAINABLE COASTAL DEVELOPMENT

**RELEVANCE-** Surfing is more than a sport; it's a lifestyle and surf economists have been alerting for the fact that surfing is attracting new businesses and attraction sources to the coastal regions of the world. Surfers are travelling all over the world paying for accommodation close to the perfect wave and contributing to the local economy yearly.

**RESPONSE-** To address the increasing importance of surfing, Puerto Rico Sea Grant and the CIEL, led an effort to understand the cultural, social and economic values of surfing, taking a closer look at income, conservation efforts, social activities and businesses through literature review, interviews with stakeholders and documented field observations.

**RESULTS-** A publication on the socioeconomic impact of surfing in Rincón was written. This is the first publication in Puerto Rico to address surfing and the importance of the waves from a social and economic perspective. It has been disseminated among several UPR campuses and has been discussed in local radio programs. The publication is available on line through the Puerto Rico Sea Grant website of and may be downloaded on [http://www.seagrantpr.org/catalog/files/books/Sociologia\\_del\\_Surf.pdf](http://www.seagrantpr.org/catalog/files/books/Sociologia_del_Surf.pdf)

**PARTNERS:** None listed in Database

**ASSOCIATED PROJECT(S):**

MARINE ADVISORY SERVICE (2012 - 2013)

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## **Education, ecosystem management and community awareness**

**NATIONAL FOCUS AREAS:** Sustainable Coastal Development

- Accomplishment
- PO Review Complete

**RECAP:** RECAP- In response to efforts by VIMAS the community better understands how to protect the environment from land-based sources of pollution.

**PROGRAM FOCUS AREAS:** SUSTAINABLE COASTAL DEVELOPMENT

**RELEVANCE-** Land-based sources of pollution are widely known to be one of the leading causes of coral reef degradation, both locally and globally. In 2007, St. Thomas Fishermen's Association (STFA) requested that an outreach campaign be devoted to non-point source pollution. In 2009, the National Oceanographic and Atmospheric Administration's Coral Reef Conservation Program (CRCP) realigned their focus areas to address the main threats to corals reef ecosystems: land-based sources of pollution, overfishing, and climate change. The UVI's CMES research program (Integrated Caribbean Coastal Ecosystems) also focuses on coral reef ecosystems, land-sea interactions and the

development of an integrated ecosystems approach to managing our coastal environments.

**RESPONSE-** During this reporting period, VIMAS coordinated 17 cleanups on St. Croix for 2013 Coastweeks, engaging 531 people. Six marine debris presentations were made to St. Croix school children including 200 students. On St. Thomas, 6 beach cleanups including 344 volunteers were coordinated. VIMAS partnered with the Environmental Association of St Thomas/St John (EAST) to increase the number of volunteers.

**RESULTS-** More than one thousand (1,000) volunteers were educated regarding proper handling of marine debris and its impact on the marine environment. Changes in attitude towards the marine environment were promoted among participants.

**PARTNERS:** None listed in Database

**ASSOCIATED PROJECT(S):**

USVI MARINE ADVISORY SERVICE (2012 - 2013)

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## Vetiver grass buffers proved to be effective in the conservation of watersheds

**NATIONAL FOCUS AREAS:** Sustainable Coastal Development

- Accomplishment
- PO Review Complete

**RECAP:** RECAP- The implementation of conservation buffer zones to reduce sedimentation and erosion problems at the Río Loco watershed helps to improve water quality and the health of coral reefs.

**PROGRAM FOCUS AREAS:** SUSTAINABLE COASTAL DEVELOPMENT

**RELEVANCE-** The Río Loco/ Guánica Bay Watershed in the south coast of Puerto Rico has a current land use of approximately 57,000 acres. The watershed land is divided into agricultural lands (43%), forests (48%) and urban development (9%). The byproducts and impacts of agricultural production in the watershed are impacting the quality and health of coastal and marine ecosystems, characterized by coral reefs and associated habitats.

**RESPONSE-** In collaboration with the Natural Resources Conservation Service, Puerto Rico Sea Grant coordinated the workshop Conservation Buffers in the Río Loco Watershed, to teach local farmers about the design of erosion control efforts to impede sedimentation to reach the coral reefs.

**RESULTS-** The local NGO Protectores de Cuencas began to implement conservation buffers using vetiver grass as a practice to reduce and control sedimentation and erosion in several projects impacting almost 100 acres of coastal areas in Puerto Rico.

**PARTNERS:** None listed in Database

**ASSOCIATED PROJECT(S):**

COASTAL COMMUNITIES DEVELOPMENT (2012 - 2013)

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## 2013 Leveraged Funding

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### Project Level

Source	Project	Title	Amount	Type
Virgin Islands Community Foundation	7410 - US VIRGIN ISLANDS MARINE ADVISORY SERVICE (M-151-2-10)	Coral Reef Discovery Week 2013	\$1,000.00	Managed
		TOTAL:	\$1,000	

### Program Level

Source	Title	Amount	Type
Office of National Marine Sanctuaries (US DOC, NOAA, NOS, ONMS)	Economic Valuation for Coral Reefs	\$190,000.00	Managed
National Marine Fisheries Service (US DOC, NOAA, NMFS)	SEAMAP-C	\$80,838.00	Managed
Ford Motor Company	Educación, herramienta esencial y vital en la conservación de la RMTP	\$2,300.00	Influenced
	TOTAL:	\$273,138	

## Performance Measures

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### 2013 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
	Northeast	1	Yes
	Southwest	1	Yes

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### 2013 Sea Grant Products - (tools, technologies, info services)

Description	Developed	Used
The Puerto Rico Beach and Surfzone Currents Warning System was developed in an effort to provide the public with potentially life- saving information on hazardous beach conditions. A customized webpage was designed to provide beach-specific estimates of the hazard posed by dangerous currents on any given day. The website is based on a beach hazard matrix developed for each of the four major coasts of Puerto Rico, taking into account local wave climate, wave sheltering, coupled wave and wind effects and local bathymetric effects for each major beach. Information provided by Sea Grant beach hazard warning system is being used by National Weather Service to emit official hazard warnings and improve safety for beach goers in Puerto Rico.	Yes	Yes

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### 2013 Economic (market and nonmarket) impacts

(No Data)

### 2013 National Performance Measures - General

Performance Measure	Annual Target	Reported	Program Comment
Number of fishers who adopt and implement responsible harvesting techniques and practices.	2,356	34	
Number of stakeholders who modify their practices using knowledge gained in fisheries sustainability, seafood safety, and the health benefits of seafood.	34,268	63	
Number of coastal communities who have adopted/implement 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.	71	18	
Number of coastal communities who have restored degraded ecosystems as a result of Sea Grant activities.	27		

### 2013 Program Performance Measures

Program Performance Measure	Annual Target	Reported	Program Comment
Number of stakeholders who use ecosystem-based approaches in the management of land, water, and living resources in coastal areas as a result of Sea Grant activities.	100	3.000	
Number of coastal communities engaged in activities (e.g. visioning, resource inventories, analysis of development policies) or making informed development decisions that address the sustainability of economic and environmental resources as a result of Sea Grant's capacity building, tools, data, technologies, and/or education of community leaders.	10	6.000	
Number of coastal communities who have adopted/implement 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.	30	6.000	
Number of fishermen, resource managers (harvesters, and fishermen) who adopt and implement responsible harvesting and processing techniques and practices.	500	34.000	
Number of coastal communities provided with information/trained in local hazard resiliency, and hazard mitigation tools, techniques, and best practices.	48	18.000	
Number of coastal municipalities who adopt/implement hazard resiliency	15	6.000	



practices to prepare for and respond to/minimize coastal hazardous events.			
Number of citizens provided with information/trained in local hazard resiliency, and hazard mitigation tools, techniques, and best practices.		2500.000	

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## 2013 Metrics

Staffing Numbers	Individuals	SG FTEs	non-SG FTEs
Administrative	5.00	2.67	1.75
Communications	14.00	0.75	5.52
Education	2.00	1.21	
Extension	8.00	3.24	3.14
Research	25.00	4.41	2.08

Core Funding	Proposals	Institutions Involved	From Home Institution
Pre-Proposals	30	23	10
Full Proposals	14	9	7
Proposals Funded	5	5	2

Student Support	Number of New Students	Number of Continuing Students	Number of Degrees Awarded
Sea Grant Supported Undergraduate Students	15	13	8
Sea Grant Supported MS/MA Graduate Students	3	4	1
Sea Grant Supported PhD Graduate Students	1	6	
Other Sea Grant Supported Professional Degree Graduate Students	1	2	

Other Metrics	Amount
VolunteerHours	5915
Number of P-12 Students Reached Through Sea Grant-Trained Educators or Directly through Sea Grant Education Programs	13682
Number of P-12 Educators who participated in Sea Grant education programs	
SG-Sponsored/Organized Meetings/Workshops	33
Attendees in SG Meetings/Workshops	2362
Public or Professional Presentations	88
Attendees at Public or Professional Presentations	14030
Clean Marina Program -- Certifications	
HACCP -- Number of people with new certifications	