



# **Florida Sea Grant College Program 2008-2009 Progress Report**



Florida Sea Grant College Program  
P.O. Box 110400  
Gainesville, FL 32611-0400  
(352) 392-5870

[www.flseagrant.org](http://www.flseagrant.org)

# Florida Sea Grant College Program

## 2008-2009 Progress Report

### **CONTENTS**

1.0	Introduction .....	1
2.0	Accomplishments and Impacts .....	4
3.0	Program Development Projects .....	45
4.0	New Directions .....	51
5.0	Program Funding .....	51
6.0	Institutions Involved.....	52
7.0	Publications .....	53
8.0	Students .....	54
9.0	Program Awards.....	55
10.0	Outreach Activities.....	57
11.0	Jobs/Businesses Created and Patents.....	57
12.0	Self Evaluation.....	58
13.0	Summary .....	62

TP 166  
November 2009

This publication was supported by the National Sea Grant College Program of the U.S. Department of Commerce National Oceanic and Atmospheric Administration under NOAA Grant No. NA06-OAR-4170014. The views expressed herein do not necessarily reflect the views of any of these organizations.



## 1.0 INTRODUCTION

The last year was a productive and positive one for Florida Sea Grant (FSG), as the program worked with member institutions and public and private partners to align its research, extension and education programs to address critical state and national priorities. In summer 2008, Sea Grant conducted a survey of coastal Florida stakeholders and residents to identify coastal and ocean priority issues. This was followed by a two-day workshop where more than 80 individuals representing universities, research institutes, federal and state resource management agencies, local governments and the private sector helped Sea Grant develop over-arching goals and strategies that would enable the program to address priority issues in Florida. That process resulted in a new Strategic Plan for the period from 2009 to 2013. The plan identifies four major focus areas:

1. Seafood Production and Safety
2. Sustainable and Hazard-Resilient Coastal Communities
3. Healthy Coastal and Marine Ecosystems
4. Climate Change: Impacts and Adaptations

Subsequently and with further input from constituents and partners, FSG developed a complementary Implementation Plan with specific four-year objectives and quantitative performance indicators that will evaluate program success in achieving planning objectives.

In spring 2009, FSG held the first meeting of its newly formed Advisory Council, comprised of leaders from the public and private sector who are highly knowledgeable about issues in the four programmatic focus areas, and who are passionate about helping FSG maintain program excellence. The advisory council reconvened in the fall of 2009 to develop strategies for increasing program visibility, soliciting extramural funding, and developing partnerships to advance programmatic activities. The result was a set of short-term recommendations that included:

1. Develop a unified message for congressional visits and meetings with senior NOAA administrators that showcases examples of effective collaboration and coordination between FSG and other NOAA programs in Florida.
2. Develop a research proposal with the National Estuarine Research Reserves (NERRs) to apply for EPA Gulf of Mexico funding tied to seagrass habitat restoration.
3. Develop a cost-shared internship or scholarship program with the NERRs.
4. Actively engage the council members in identifying donors to establish endowments to support new student scholarships and to support targeted research (examples included research to identify effects of goliath grouper on reef habitat and fisheries, and research to identify and support implementation of effective mangrove restoration)-.
5. Engage council members in congressional visits in Florida and in Washington D.C.

In 2008-09 FSG continued to provide highly relevant research, extension and education programs with significant impacts for the oceans and coasts. Research projects identified how building codes and construction products could be improved to reduce damage to residences and businesses from hurricanes; provided high-resolution data on flooding from storm surge for use by emergency managers and coastal planners; helped lobster fishers determine how to deploy traps in a manner that would reduce spread of a lethal virus; and developed methods for commercial production of a new aquaculture product in Florida, the sunray venus clam. Extension programs educated the fishing public about ways to increase fish survival in catch-and-release recreational fishing; provided legal expertise to local governments for preserving and promoting waterfront access; conducted the first-ever international oyster school, where seafood professionals acquired competencies in safe and effective product selection, handling and processing; and helped the state implement science-based boating safety zones for Florida intracoastal waterways. In 2008 the Extension Director led a NOAA program to build collaborative programs in ocean and coastal research, education and extension in Indonesia, including the establishment of formal cooperative agreements with five leading Indonesian universities that help support Indonesia's Sea Partnership Program.

FSG undertook several new initiatives in 2009 including an extension and education program focused on sea-level rise and coastal planning; development of regional research programs with Sea Grant and other partners in the Gulf of Mexico and South Atlantic states; and assisting rural coastal communities in visioning and decision-making related to preservation of cultural heritage, natural resources, and water-based recreational opportunities.

This document provides highlights of program accomplishments for 2008-09 and complements the program's 2008-09 Work Plan (FSG Technical Paper-162) that outlined proposed research and extension activities according to program strategic planning goals and objectives identified for this period.

### FSG Awards from NOAA Activities During Calendar Year 2009-09.

Number	Keyword Identifier	Start Date	Current End Date
NA16RG-2195	Omnibus Research, Extension, Communications, Management	02/01/02	12/31/08
NA060AR4170014	Omnibus Research, Extension, Communications, Management	02/01/06	01/31/10
NA080AR4170763	NMFS Population Dynamics Fellowship	06/01/08	05/31/11
NA090AR4170039	Dean John A. Knauss Marine Policy Fellowship	02/01/09	01/31/10
NA090AR4170042	Dean John A. Knauss Marine Policy Fellowship	02/01/09	01/31/10
NA090AR4170094	2009 NMFS/Sea Grant Fellowship in Marine Economics	06/01/09	05/30/11

### FSG Organization

Name	University / Unit	Title	Specialization
<b>Statewide Management and Staff</b>			
Karl Havens	UF/IFAS, FSG	Director	aquatic ecology, toxic algae, food webs
Charles Sidman	UF, FSG	Assoc Director	waterway planning and GIS
Michael Spranger	UF/IFAS, FSG	Assoc Director	coastal marine extension
Dorothy Zimmerman	UF/IFAS, FSG	Interim Director, Communications	communication

Ed Harvey	UF/FSG	Assist. Director, Fiscal	finance, accounting
Sharon Cook	UF/FSG	Administrative Assistant	finance, payroll
Jackie Whitehouse	UF/FSG	Executive Secretary	management programming
Kim Wagner	UF/FSG	Program Assistant	communications
Treva Damron	UF/FSG	Senior Secretary, Extension	extension
<b>Statewide Extension Specialists</b>			
Chuck Adams	UF/IFAS Food Resource Econ., FSG	Extension Faculty	fisheries and marine economics
Tom Ankersen	UF Law School	Extension Faculty	coastal and marine law
Bill Lindberg	UF/IFAS Fisheries and Aquatic Sciences	Extension Faculty	fisheries ecology and behavior
Steve Otwell	UF/IFAS Food Science, FSG	Extension Faculty	seafood safety and sustainability
Bob Swett	UF/IFAS Fisheries and Aquatic Sciences, FSG	Extension Faculty	waterway management and GIS
Russell Watkins	FSG	Extension Specialist	coastal planning and GIS
<b>County Extension Agents</b>			
Brian Cameron	UF/IFAS/FSG/Bay County	Marine Agent	fisheries, habitat, coastal development
LeRoy Creswell	UF/IFAS/FSG/St. Lucie County	Marine Agent	aquaculture, water quality, marine ecology
Andrew Diller	UF/IFAS/FSG/Escambia County	Marine Agent	aquatic ecology, conservation, sea turtles
Pam Fletcher	FSG	Marine Agent	coastal ecology and conservation
Bryan Fluech	UF/IFAS/FSG/Collier County	Marine Agent	fisheries, habitat, water quality, boating
Doug Gregory	UF/IFAS/FSG/Monroe County	Marine Agent	fisheries, resource management
Joy Hazell	UF/IFAS/FSG/Lee County	Marine Agent	water quality, fisheries, habitat
Scott Jackson	UF/IFAS/FSG/Wakulla County	Marine Agent	marine ecology
Bill Mahan	UF/IFAS/FSG/Franklin County	Marine Agent	oysters, seafood safety, marine ecology
Carlos Martinez	UF/IFAS/FSG	Aquaculture Specialist	aquaculture, marine ornamentals
Maia McGuire	UF/IFAS/FSG/Flagler/St. Johns Counties	Marine Agent	coastal ecology and conservation
Brooke Saari	UF/IFAS/FSG/Okaloosa, Walton Counties	Marine Agent	wetlands, non-native species
Betty Staugler	UF/IFAS/FSG/Charlotte County	Marine Agent	fishing, water quality, habitat
John Stevely	UF/IFAS/FSG/Manatee, Sarasota Counties	Marine Agent	sponges, fisheries, habitat, artificial reefs
Leslie Sturmer	UF/IFAS/FSG/Levy County	Marine Agent	aquaculture
Don Sweat	UF/IFAS/FSG/Pinellas County	Marine Agent	scallop aquaculture, commercial fisheries
Chris Verlinde	UF/IFAS/FSG/Santa Rosa County	Marine Agent	shoreline erosion, conservation
<b>Campus Coordinators</b>			
Larry Robinson	Florida A&M University	Professor / CEO	coastal and marine ecology
Darren Rumbold	Florida Gulf Coast University	Professor / Director	coastal ecology, fish, oysters, habitat
Junda Lin	Florida Institute of Technology	Professor	aquaculture
Jim Fourqurean	Florida International University	Professor / Chair	biogeochemistry, primary productivity
Felicia Coleman	Florida State University	Professor / Director	reef fish ecology, fishing impacts, conservation
Dennis Hanisak	Harbor Branch Oceanographic Institute	Senior Scientist	phycology, aquaculture
Ken Leber	Mote Marine Lab	Director	fisheries management, stock enhancement
Sandra Gilchrist	New College	Professor	marine invertebrate ecology
Mahmood Shivji	NOVA Southeastern University	Professor	recreational fish ecology, coral reefs
Linda Walters	University of Central Florida	Associate Professor	oysters, invasives, coral reefs
Nelson Ehrhardt	University of Miami	Professor	tropical fisheries ecology and management
Kelly Smith	University of North Florida	Associate Professor	juvenile fish ecology, habitat interactions
David Mann	University of South Florida	Assistant Professor	sound production and hearing in marine fish
William Huth	University of West Florida	Professor / VP	natural resource economics, water quality

## 2.0 ACCOMPLISHMENTS AND IMPACTS

FSG has for many years reported annually the accomplishments for each research project that is completed or ongoing during that year. It has also reported the accomplishments of extension programming. That process continues with this 2008-09 report, which additionally identifies project outcomes and realized or potential project impacts, where appropriate, within the context of strategic planning goals. To facilitate gathering this information, principal investigators are required to report on: (1) contributions of their projects to science and technology; (2) new scientific methods developed; and (3) impacts to society, the economy and/or the environment. In addition, extension accomplishments and impacts are reported against planned work for this period. Accomplishments and impacts are organized according to the four 2009-2013 strategic planning focus areas. The accomplishments and impacts also tie to goals and objectives that were in effect from the prior 2006-2009 strategic plan that ended during this reporting period. "Extension Program Highlights" attest to the richness and diversity of Sea Grant's outreach, as well as the devotion of its agents to their mission of providing science-based coastal and marine education and outreach to communities, teachers, and citizens of all ages and backgrounds.

### FOCUS AREA 1 – SEAFOOD PRODUCTION AND SAFETY

#### **Goal 1: Develop the food and ornamental fish segments of Florida's marine aquaculture industry.**

Florida's aquaculture industry generates over \$100 million in annual sales, employs hundreds of workers, and has a total annual economic impact of several hundred million dollars. The commercial culture of hard clams is a major success story and FSG now is supporting research to expand that industry with new products. The following are examples of research and extension activities aimed at increasing the value and sustainability of Florida's aquaculture industry.

**Objective 1.** Diversify the aquaculture industry to promote stability and expansion of the industry in Florida to support local coastal economies.

#### ***Research Activities***

**R/LR-A-39, ENHANCING STRESS RESISTANCE OF CULTURED HARD CLAMS IN FLORIDA BY TRIPLOIDY:** Florida has about 350 active clam growers that produced an annual crop valued at \$19 million in 2008. However, the industry has been plagued by low clam survival rates due to thermal stress in summer when water temperatures exceed tolerance limits of the clams. The main cause seems to be a loss of body mass during spring spawning, reducing clams' capacity to withstand the higher metabolism due to warmer water, and reduced food and oxygen levels all characteristic of summer.

Clam growers and scientists thought that a possible solution to the problem would be to sterilize clams to prevent the loss of body mass from spawning, so that clams will be better fortified to survive the summer. This has been successfully accomplished since the 1980s with other bivalves, especially oysters, using a chemical treatment that causes the animals to have three sets of chromosomes, known as triploidy, rather than the normal two sets, or diploidy. In most cases triploidy leads to sterility. To

address summer mortality problems similar to those experienced with Florida clams, today more than half of Pacific oysters are triploids.

A research project funded by FSG and the U.S. Department of Agriculture tested the hypothesis that triploid hard clams (*Mercenaria mercenaria*) would have improved survival at high summer water temperatures. In 2004 and 2005 researchers produced groupings of 90,000 diploid and chemically induced triploid clams, and measured their initial growth rates. These clams were then distributed to commercial growers in southwest Florida and Cedar Key who raised them in aquaculture facilities until large enough to be planted in nearby waters. During initial experiments, all of the clams at southwest Florida sites were lost, so data were only obtained from Cedar Key. The experiments were then repeated in 2006 to 2007 with successful sampling at all locations.

Overall, results from these experiments did not support the hypothesis. Triploid clams did not have gonad development, showing that the sterilization was successful. However, contrary to results with oysters and other bivalves, the triploids were generally smaller with lower survival rates than diploids.

In addition to fieldwork, the researchers also conducted laboratory experiments with diploid and triploid clams to assess the clams' responses to changes in temperature, salinity, and oxygen levels. Here the results were somewhat mixed with triploid clams showing greater survival under certain conditions, but overall, triploidy did not confer any survival advantage. This work, which was the first exploration of the impacts of multiple stressors on *M. mercenaria*, also revealed valuable general information about survival. Specifically, the team found that even at high temperatures, clams can survive unless they are subjected to at least one additional stressor such as low salinity or low oxygen.

A final goal was to assess the cost of producing triploid clams, which was a roughly 10 percent increase in production costs. The team concluded that triploid clams would not be adopted by growers because they do not offer higher survival or growth, either of which would help to recoup costs.

Nonetheless, the results do show that triploidy could have benefits. Given that sterilization was successful, triploidy could be a tool for preventing or limiting the spread of farmed or clam species into natural systems. The team also found that at certain times triploid clams had higher meat volume compared to shell weight. However, because the clam market bases pricing on shell size rather than meat volume, this does not offer a financial advantage.

This work spawned ancillary research on differences in the production of heat-shock proteins in triploid and diploid clams. The group hopes to continue this work, which could eventually identify parameters that could be selected for through breeding to increase survival and production.

**IMPACTS:** This project documented that triploidy does not impart greater survival rates or confer commercial viability for hard clams in Florida, despite its documented success with other aquaculture bivalve species. By engaging clam growers in the research and sharing the results in a public forum, this project helped the industry avoid investing time and money in a process they thought would be beneficial to clam survival, but in reality, had no benefits.

**R/LR-A-43, DEVELOPING IMPROVED HATCHERY TECHNOLOGY FOR MARINE ORNAMENTAL FISH USING STAGE-SPECIFIC FEEDING MANAGEMENT REGIMES:** The goal for this project was to determine how developmental changes in the growth of marine ornamental fish larvae affect their ability to feed, and, hence, survive. The motivation is that mortality rates among many ornamental larvae are currently so high that they create significant economic impacts for the industry. The key bottleneck is at the larval transition from feeding on remaining yolk from their eggs, to feedings on external food sources.

The team hypothesized that larvae's ability to feed sufficiently is constrained by inadequate development, and that better understanding these constraints should allow development of better feeding strategies to improve production at ornamental aquaculture facilities.

The study focused on lemon peel angelfish (*Centropyge flavissimus*), and the candy basslet (*Liopropoma carmabi*) because these have proven especially challenging to raise due to high mortality during the larval stages. The researchers used high-speed digital underwater photography, along with conventional experiments on prey selectivity, to explore the developmental factors that control larval feeding and to identify those foods most appropriate for specific ages.

An initial objective was to simply determine how feeding mechanisms develop in different species. The researchers found that bone and cartilage development varies, and is closely tied to the time between egg fertilization and hatching. The next step was to examine how prey capture performance improves over time, and what changes result in prey preference. The team found that, regardless of species, early on, larvae are less mobile, so they prefer less mobile prey. Over time, as greater mobility emerges, the larvae shift preference toward larger, more elusive prey.

The researchers also studied the specific implications of these developmental changes by experimenting with different diets. They found that from age 1 day to 5 days, death rates were consistent regardless of prey type. Larvae fed a diet of only rotifers, which are relatively mobile, had continued population declines. However, larvae fed a mixed diet including plankton and copepods, which are less elusive, showed stabilized mortality.

Based on these results, feeding guidelines were developed for hatchery managers, and they are being disseminated via a web log, journal manuscripts, and through talks at both local and international conferences.

**IMPACTS:** This project developed a new feeding strategy that could improve ornamental fish larvae survival and thus provide economic benefits to the ornamental fish aquaculture industry.

**R/LR-A-44, SUNRAY VENUS CLAM: A NEW SPECIES TO DIVERSIFY THE FLORIDA AQUACULTURE HARD CLAM INDUSTRY: PART I:** The goal of this research project was to initiate and evaluate aquaculture of the sunray venus clam, *Macrocallista nimbosa*, as a new species to diversify and expand the bivalve culture industry in Florida. The first-ever successful induced spawning of both male and female sunray venus clams indicated that the conditioning environment (temperature, salinity and feed) was conducive to clam health and reproduction. Experiments indicate that sunray venus clam



broodstock can be maintained in captivity for long periods for breeding purposes. Two spawns of sunray venus clams were successfully cultured through metamorphosis and beyond.

**IMPACTS:** This project is expected to lead to development of a new species of clam for commercial production by the domestic aquaculture food industry.

**R/LR-A-45, SPECIES DIVERSIFICATION IN FLORIDA SHELLFISH AQUACULTURE: NURSERY AND GROW-OUT OF THE SUNRAY VENUS CLAM: PART II:** The Florida clam industry has seen dramatic increases in production over the last two decades. However, the industry, which is built upon a single species, is susceptible to environmental factors (e.g., rising water temperatures and water quality) and fluctuating prices. This ongoing project is investigating the feasibility of developing and marketing a new aquaculture species, the sunray venus clam (*Macrocallista nimbosa*) as a means to diversify the monoculture-based industry and to spread production risk. The project is developing and defining culture techniques for nursery and grow-out phases, and is exploring alternative marketing opportunities along with an economic analysis of sunray venus clam culture. Initial results show that sunray venus clam larvae can be successfully spawned and cultured through metamorphosis and early nursery phases using techniques similar to those for hard clam hatcheries. A preliminary market analysis which distributed advanced product to select seafood restaurants indicates that the sunray venus clam was positively evaluated by patrons who received samples for tasting.

**IMPACTS:** This project is expected lead to development of a new species of clam for commercial production by the domestic aquaculture food industry.

### ***Extension Activities***

**Sturmer/Creswell** evaluated biological and environmental conditions of aquaculture production and assisted in improving genetic stocks to generate optimal production and survivability in support of the R/LR-A-39, R/LR-A-44 and R/LR-A-45 projects described above. Sturmer maintained a shellfish aquaculture research and education facility in Cedar Key.

**Adams/Sturmer/Mahan/Hazell/Creswell** explored the potential for aquaculture farming and markets in Florida. A number of these activities were in support of the R/LR-A-39, R/LR-A-44 and R/LR-A-45 projects described above.

**Sturmer/Mahan** coordinated and provided technical assistance, training and support for Florida's aquaculture farmers and state agencies involved with the regulation and support of the industry (e.g., '2nd annual Shellfish School'; 'Aquaculture America 08'; 'Fifth Annual CLAMerica Festival'; 'Seafood Workers Resource Fair').

**Sturmer/Mahan/Diller/Creswell/Sweat** continued to increase public knowledge about aquaculture in Florida through various communication modes (e.g., The Bivalve Bulletin Vol XII No 1, 2, and 3; Franklin Chronicle Newspaper articles; radio programs devoted to clam aquaculture and oyster farming).

## Extension Program Highlights

**Leslie Sturmer** – The 6<sup>th</sup> Annual CLAMerica Celebration, selected as one of the top 20 events for July 2009 in the southeastern U.S. by the Southeast Tourism Society, was held on the 4<sup>th</sup> of July in Cedar Key. Hosted by the Cedar Key Aquaculture Association and the UF/IFAS Shellfish Aquaculture Extension Program, this food festival celebrated the positive economic and environmental impact of clam farming in the area. CLAMerica featured educational and “clammy” activities for all ages. The 6<sup>th</sup> Annual Cultured Clam Cookoff, with 13 clam dishes entered from amateur chefs as far away as Tampa and Ft. Myers, showcased clams as a versatile seafood that can be prepared in a variety of recipes. Seven local restaurateurs competed in a new event this year, Clam Challenge Italia, in which the public tasted and voted for the best dish. Attendance was at an all-time high, with an estimated 10,000 visitors to the island community, considered the epicenter of Florida’s commercial hard clam industry.



**Chuck Adams** – Adams initiated an outreach program to determine the viability of cultured sunray venus clams as a new candidate species for Florida’s hard clam growers (see R/LR-A-45 above). Sunray venus clams were grown in Levy and Franklin counties. Market-sized clams were provided to chefs in four restaurants, one each in Cedar Key, Bronson, Gainesville, and Apalachicola. The effort addressed the need to help find a candidate species that would allow current commercial hard clam growers and processors to help mitigate production and market risks associated with culturing and selling only a single species. The audience included hatcheries, growers, wholesalers, distributors, restaurants and the general public. The outreach approach used for the market assessment was a restaurant patron survey, implemented in conjunction with the restaurant owners/managers/chefs. Collaborators included IFAS Shellfish Aquaculture Extension specialist Leslie Sturmer and Harbor Branch Oceanographic Institute research scientist John Scarpa. The notable outcome is that virtually all survey respondents found sunray venus clams to be a highly acceptable product, demonstrating the existence of a viable, latent market. The next step will be to assist the development of this market by providing the culture industry the necessary training to ensure a high quality product is introduced into the local, regional and statewide shellfish markets.

**Objective 2.** Increase scientific, industry, agency, and citizen knowledge about Florida aquaculture products.

### **Research Activities**

See above under Objective 1.

### **Extension Activities**

**Sturmer/Mahan** coordinated and provided technical assistance, training and support for Florida’s aquaculture farmers and to state agencies involved with the regulation and support of the

industry (e.g., Seafood Taskforce meetings; Department of Agriculture and Consumer Services Rulemaking Workshop; Interstate Shellfish Sanitation Conference workshop).

**Sturmer/Mahan/Diller/Creswell/Sweat/Martinez** increased public knowledge about aquaculture in Florida through various communication modes (e.g., training sessions, radio, newspaper, Web site, quarterly newsletters and fact sheets, demonstrations/exhibits at events, festivals, and tournaments). Examples include a new DVD product titled “Spawning and Early Culture of the Sunray Venus Clam (*Macrocallista nimbosa*),” and a new 18-week activity-based aquaculture curriculum developed for middle-school and high-school youth.

### **Extension Program Highlights**

**Dr. Steve Otwell and Bill Mahan** – “Shellfish School – Oysters & Clams - What Buyers Need to Know to be Successful” was held in Apalachicola, FL, October 7<sup>th</sup> through 9<sup>th</sup>, 2008. The Shellfish School is a one-of-a-kind educational program that brings major seafood/shellfish buyers and distributors from around the U.S. to Franklin County to learn about current local, state, regional and national issues impacting the oyster and clam industries. The program was a collaborative educational effort with Florida’s shellfish processors, state and federal regulators, the FSG Seafood Specialist, Steve Otwell, FSG Marine Economist Chuck Adams and University of Florida Extension Agents (Leslie Sturmer, Bill Mahan) and researchers (Anita Wright, Victor Garrido). The school offered a complete and informative workshop that included lectures and hands-on sessions on a wide range of topics from safety concerns to sustainable harvest and production of shellfish (oysters and clams) in Florida.

**Leroy Creswell** – Creswell collaborated with other UF/IFAS faculty and aquaculture scientists from Hillsborough Community College and Harbor Branch Oceanographic Institute to hold two day-long workshops dedicated to aquaculture education in the public schools. This was a teacher in-service program funded by the Florida Department of Agriculture and Consumer Services, and was available to science and agriculture teachers throughout Florida. Eighty-two teachers attended the in-service, which was held live at the Indian River Research and Education Center in Ft. Pierce and broadcast via Polycom to other IFAS facilities throughout the state. Over 20 presentations were given each day on topics ranging from recirculating systems, nutrition, water quality, mollusk culture, and aquaculture as a teaching tool in the classroom. In addition to the in-service instruction, the team of collaborators developed a complete aquaculture curriculum for public schools, lesson plans, laboratory exercises, and documentation for Florida “Sunshine Standards”. The curriculum is posted on the Web site: <http://irrec.ifas.ufl.edu/teachaquaculture/>. As the 2009-2010 school year commences, Sea Grant Extension will be working with participating teachers to design an appropriate aquarium and/or aquaculture demonstration so that they can implement the curriculum they received during their in-service training.

### **Goal 2: Use marine biotechnology to create and enhance products and processes from Florida’s coastal resources.**

This programmatic area seeks to use biotechnology to discover, develop and use products and processes from the living resources of the sea, to protect ocean resources and to promote human health.

**Objective 1.** Support the development of bio-products that promote human and ocean health and productivity

### **Research Activities**

#### **R/LR-MB-22 – CHEMICAL VARIATION IN MARINE CYANOBACTERIA FOR DRUG DISCOVERY:**

Many common medications, from pain relievers to cholesterol-reducing statins, stem from natural products that grow on the earth, but, according to researchers, there is “literally an ocean of compounds yet to be discovered in our seas.” Although scientists have been probing the depths of the ocean for marine products since the early 1960s, many pharmaceutical companies lost interest before researchers could deliver useful compounds because natural products were considered too costly and time-consuming to develop. This research on little explored marine cyanobacteria collections in Florida waters has yielded a potent new elastase inhibitor, *largazole*, that has the potential to be developed into a drug for anti-cancer therapy.

**IMPACTS:** The University of Florida has patented the largazole compound developed from this research. It is expected to fuel the development of new drugs to fight cancer.

**R/LR-MB-23 - PROFILING THE MARINE SPONGE DISCODERMIA TRANSCRIPTOME ENRICHED FOR SECONDARY METABOLITE-CODING MESSAGES:** Sponges, such as *Discodermia dissoluta* and their associated microbes comprise an important component of marine benthic communities, and they are considered to be important marine organisms to target for biologically active compounds. *Discodermia* is a chemically diverse genus from which a number of novel compounds have been identified, each having potent biological properties. For example, past research has discovered 20 new cytotoxic compounds, including the potent anti-tumor polyketide discodermolide, and the anti-fungal agent discodermide. Despite these discoveries, the wide chemical diversity that characterizes this sponge means that the eventual synthesis of bioactive compounds using traditional methods will likely require long periods of costly genome sequencing.

Marine sponges and their symbiotic microbes are selective in their choice of habitat and require specific conditions to survive and reproduce, making them difficult to culture. Novel and less costly approaches for isolating, characterizing, and cloning natural compounds from sponges are needed to provide a consistent and sustainable supply of secondary metabolites (SMs) to prevent over-harvesting of natural populations for genetic material. To circumvent these obstacles this project employed innovative molecular “transcriptome” techniques including subtractive hybridization (SSH), differential mRNA display (DD), and secondary metabolite (SM) primer specific RT-PCR to detect, characterize, and enrich novel (i.e., previously unknown) genes being expressed in sample marine sponges and their microbial symbionts.

**IMPACTS:** A genetic database was developed and it will serve as a toolkit for research and industry, enabling future experiments and possibly the sustainable production of unique bioactive marine natural products, reducing the need to collect sponge specimens from critical natural habitats.

**R/LR-MB-25 - DEVELOPMENT OF AN IMMORTALIZED SPONGE CELL LINE FOR SUSTAINABLE SUPPLY OF MARINE BIOPRODUCTS:** Numerous novel chemicals with great promise for treating cancer and other diseases have been discovered in marine sponges. But the sponges—or microbes associated with them—typically produce these compounds in only minuscule quantities, creating a major hurdle to their study and development as potential pharmaceuticals. Gathering enough wild sponges to produce the material needed to explore a compound's medical potential, much less to make it commercially available, is wholly untenable. This is because the sponges are often scarce and difficult to access, and because gathering them poses significant ecological risks. Researchers have therefore turned to other options for producing bioactive sponge compounds, such as laboratory synthesis and aquaculture, both of which can have substantial drawbacks.

In some cases the best option may be to culture sponge cells in the laboratory and harvest compounds from them, a goal that, if achieved, would mean an essentially endless and extremely economic production option. As part of the longest running program ever funded by FSG, researchers at Harbor Branch Oceanographic been studying this option for many years and have made significant advances in culturing sponge cells.

The group's most recent efforts focus on increasing the longevity of sponge cultures. Toward that end, this project is exploring the innovative idea of transforming sponge cell lines by inserting a gene isolated from mammalian cells that codes for the production of the enzyme telomerase reverse transcriptase. This enzyme can promote repetitive replication by preventing degradation of the telomere regions of DNA, potentially extending a cell's lifespan. A secondary and critical goal of the project has been to optimize growth media to support the transformed “immortalized” sponge cell lines.

If this ongoing project proves successful, sponge compounds ultimately produced can be used to supplement those isolated from wild marine sponges or other means. This will reduce harvest needs and impacts to benthic ecosystems, and with some compounds identified, could enable development of life-saving treatments that would otherwise not be possible.

**IMPACTS:** An immortalized marine invertebrate cell line will advance several areas of research, including understanding why sponges produce bioactive compounds, what role these compounds play in benthic ecosystems, and ways to manipulate the cells to over-produce these compounds for development as possible pharmaceuticals.

**R/LR-MB-26, DEVELOPMENT OF A SUSTAINABLE BIOLOGICAL PRODUCTION METHOD FOR THE POTENT CYTOTOXIC LEIODERMATOLIDE:** This ongoing project is evaluating a collection of marine sponge (*Leiodermatium*) specimens for the presence of leiodermatolide, a compound that shows particular toxicity to cancer cells. A screening system has been developed to identify candidate microbes which may be responsible for the production of this compound in the sponge. The goal is to develop a fermentation method by which sufficient amounts of leiodermatolide can be produced to satisfy preclinical and clinical trials to test the potency/effectiveness of this new cancer fighting compound.

**R/LR-MB-27, CORAL-ASSOCIATED “PROBIOTIC” BACTERIA: EXPLORING MECHANISMS FOR POTENTIAL APPLICATIONS IN BIOCONTROL OF CORAL DISEASES:** Coral reefs contribute an estimated

\$2.9 billion and 39,000 jobs to Florida's local economies annually. Corals are susceptible to colonization by pathogens such as *Serratia marcescens* which can have a major impact on reef systems. This ongoing study represents the first systematic effort to evaluate the feasibility of using biological approaches to ensure the health of coral reef systems, specifically, by identifying disease-specific virulence mechanisms that affect elkhorn coral and testing their inhibition by beneficial bacteria. The results will build a solid foundation for the development of sustainable reef management practices by harnessing the biocontrol potential of native coral-associated bacteria.

**R/LR-MB-28, CARBOXYLATED NEUROPROTECTIVE AGENTS FROM CONE SNAILS:** This ongoing project is isolating and evaluating a number of potentially therapeutic compounds found in cone snail venom to determine if it has applications in medicine.

### ***Extension Activities***

**Fluech** increased citizen knowledge of the importance of oceans for current and potential life-saving marine-derived pharmaceuticals by writing a newspaper article that provided an overview of some of the products used from the sea and the importance of ocean conservation.

### **Goal 3: Fisheries: Create and deliver production and management techniques that make fisheries sustainable and competitive.**

Recreational and commercial fishing in Florida has an annual economic impact in excess of \$3 billion. However, the growing number of saltwater anglers and demand for high-quality seafood are placing increasing pressure on Florida's marine fishery resources. Activities under this focus area aim to generate new, innovative, and effective approaches to identify and maintain critical habitats, manage marine fisheries and habitats, and evaluate the effects of management decisions on fishery resources and the people who use these resources.

**Objective 1.** Create and teach production, management and sustainable harvesting/angling techniques that preserve recreational and commercial fisheries.

### ***Research Activities***

#### **R/LR-B-60, DEVELOPING A MULTIPLE GENETIC MARKER APPROACH TO ASSESS GLOBAL SCALE POPULATION STRUCTURE AND MATING SYSTEMS IN HIGH FIN-MARKET DEMAND SHARK SPECIES:**

Many shark populations throughout the world face sharp decline, driven by the popularity of shark fin soup, which has created a highly lucrative but unsustainable market for shark fins. Conservation of sharks in the U.S. and worldwide in the face of intensive exploitation to supply the international fin trade requires comprehensive management and trade monitoring. This project used microsatellite loci and mitochondrial control region DNA sequences from probeagle and scalloped hammerhead sharks to determine their global population structure. This information was compared with Hong Kong marked-derived genetically identified fins of those species to determine the population of origin for those fins. The results on scalloped hammerhead fins reveal that the contemporary trade is globally-sourced with a substantial presence of fins from imperiled western Atlantic stocks.

**IMPACTS:** Now that resource managers can identify the source of shark meat and shark fins in worldwide markets, the U.S. can take a leadership role in population-specific shark management.

**R/LR-B-61, THE POSSIBLE EFFECTS OF COMMERCIAL TRAP FISHING ON A LETHAL VIRAL DISEASE:** The Caribbean spiny lobster (*Panulirus argus*) supports one of the most economically valuable fisheries in Florida with average landings worth over \$28M per year. However, in 2001 the lobster fishery experienced a precipitous (~30%) decline in landings – a downturn that corresponded with the discovery the prior year of a lethal virus (*Panulirus argus* Virus 1 – PaV1) that infects juvenile lobsters. This project is determining the regional prevalence of lobsters infected with the virus and the extent to which the commercial fishery contributes to or impedes the spread of this disease. Initial “den avoidance” and “shelter competition” experiments are already adding significant insight into the dynamics of shelter use between healthy and diseased lobsters (e.g., there are likely chemical cues that reveal the presence of an infected lobster and stimulate avoidance behaviors among naturally gregarious healthy individuals). Understanding how this disease is spread, and the aberrant (i.e., avoidance) behaviors it causes is of great interest to the commercial fisheries industry, fishery biologists, and resource managers.

**IMPACTS:** This ongoing project will add significantly to the understanding of disease in lobster social systems and highlight the need to incorporate disease ecology in management decisions, specifically in regard to exploited species. The *P. argus* - PaV1 relationship also is unique and will shed important light on host - pathogen co-evolution in complex social systems. Based on the initial results of this project, the researchers recently received a \$1.4M National Science Foundation grant to continue this research.

#### ***Extension Activities***

**SGEP-13-FE-C, RECREATIONAL MARINE FISHERIES EXTENSION PROGRAM:** Florida’s recreational fisheries utilize 110+ species along the state’s 1,350 mile shoreline. This project, established in 2004, provides Extension service to the recreational fishing sector. During 2008-09 this ongoing project mobilized FSG extension resources to focus on reducing recreational fishing mortality, enhancing artificial reef knowledge, developing responsible angling educational materials for ethnic groups, and fostering industry input to regulatory matters. To this end, FSG is developing a recreational fishing Web site and conducting several regional artificial reef workshops. In addition, a pilot project will demonstrate the usefulness of available sea surface data for the for-hire sector and offshore anglers in two regions of Florida.

**IMPACTS:** Thousands of anglers around the state have gained new knowledge of techniques for catch-and-release fishing using circle hooks, de-hooking tools, venting tools and proper handling procedures that minimize harm to fish while they are out of the water.

**Otwell/Lindberg/Adams/Creswell/Fluech/Gregory/McGuire/Mahan/Sevelly** increased scientific, industry, agency and local government knowledge about management issues and impacts to Florida’s fisheries and marine resources by organizing and participating in symposia, conferences, and trade meetings; producing publications in the form of brochures and fact sheets; serving on committees

and advisory boards; and participating in a series of fishery management workshops (e.g., Monterey Bay Aquarium Research Institute Workshop; Gulf States Marine Fisheries Commission meeting; Florida Gulf Coast University Fisheries planning workshop; American Agricultural Economics and American Fisheries Society annual meetings; see also SGEP-13-FE-C above).

**Creswell/Cameron/Diller/Fluech/Hazell/Staugler/Leonard/Sweat** increased citizen knowledge about management issues and human impacts on Florida's fisheries and marine species resources by organizing and developing short courses for citizen education and by participating in community-sponsored angling events (e.g., Reef Gear Workshop; Florida Sportsman Show; Kid's Cup Fishing Tournament; 4-H Fishing Camp; Pirate Coast Dive Festival; Ft. Pierce Boat Show; Lexington Fishing Club of Ft. Myers; Southwest Florida Angler's Club; Ocean Awareness Festival; Take a Kid Fishing Day; Bay Point Billfish Tournament; Florida Sportsman Fishing and Boat Show; Kids Sport Fishing Camps).

**Creswell/Cameron/Fluech/Saari/Sweat/Sevelly** informed the commercial fishing industry, local governments and citizens regarding management, regulations and fisheries-related issues through communication opportunities and media events (e.g., Morning Blend TV show on catch-and-release fishing practices including fish venting; Catch and Release: Things you can do to help saltwater fish survive" brochure; Marco Island Eagle newspaper articles answering common questions regarding fishing licenses and artificial reefs; Water Life Magazine articles on artificial reefs, the Kids Cup redfish tournament, and new fishing regulations).

**Adams/Creswell/Fletcher** provided up-to-date scientific information on management regulations and fisheries-related issues to policy makers at annual meetings of the Gulf States Marine Fisheries Commission and the Caribbean Fisheries Institute.

### **Extension Program Highlights**

**John Sevelly** – Approximately 75 artificial reef program managers, fisheries scientists and managers met at the Manatee County Extension Office in Palmetto on January 8<sup>th</sup> to share and discuss recent advances in understanding of goliath grouper biology and status of the stock. Although there is evidence that goliath grouper stocks are increasing, due to lack of sufficient data there is still a great deal of uncertainty in predicting when they will be fully recovered. One important outcome was that local artificial reef monitoring programs will be able to increase the quantity of goliath grouper abundance data by working in collaboration with the Florida Fish and Wildlife Conservation Commission.

**Bryan Fluech and Joy Hazell** – In January the Collier and Lee County Sea Grant agents coordinated efforts to host two workshops that focused on new Gulf of Mexico reef gear and gag grouper regulations for recreational anglers. The workshops were held at the Rookery Bay National Estuarine Research Reserve in Naples and at Bass Pro Outdoor World in Ft. Myers. The agents demonstrated the proper use of the required gear and provided details about the regulations. FWC law enforcement also assisted the agents in answering enforcement-related questions. Post-workshop surveys indicated that 98% of participants increased their knowledge about the new regulations.



**Lisa Krinsky** – Krinsky developed the “Kids Fish Friday’s” program. The pilot program ran for five weeks during summer 2009. The program is designed to promote the sport of fishing by making the party boat experience more accessible to children and parents alike while encouraging responsible angling and an appreciation for the marine environment. These fishing trips were all catch-and-release and included an educational briefing which discussed saltwater angling rules and regulations, using circle hooks and de-hooking tools, and proper handling and release techniques. On board, participants learned about fish identification and got to practice using the aforementioned techniques. More than 100 kids and adults participated during the first two weeks alone (a total of 62 kids and 45 adults). Results of a post event survey indicated an average increased confidence rate of 64% for understanding the State’s fishing rules and regulations and 57% for the ability to properly handle fish. Seventy percent of participants indicated that they were more likely to use circle hooks and de-hooking tools after the event. A follow-up survey of program participants is planned to determine 1) how much they would be willing to pay for such programs, 2) how often they would be willing to participate, and 3) what other types of fishing programs they would be interested in. Results will be presented to charter boat captains to promote kids fishing events as an alternate source of income during the slow season.

**Objective 2.** Determine the social and economic impacts of fishery management strategies.

### ***Research Activities***

**E/POPDYN-1, THE DEVELOPMENT AND USE OF AN AGENT-BASED MODEL TO EVALUATE THE EFFECT OF EFFORT REDISTRIBUTION DUE TO FLEET HETEROGENEITY AND POLICY IMPLEMENTATION ON ESTIMATING A STANDARDIZED CATCH PER UNIT EFFORT INDEX OF ABUNDANCE.** Fisheries science modeling has historically focused on single-species population dynamics, thereby only capturing a narrow range of the hierarchical levels that comprise the larger ecosystem and human-environmental interactions. Typically represented by sets of continuous differential equations, such models assume fish and individual vessels to be numerical replicates rather than heterogeneous individuals. The move towards a more complex system framework such as ecosystem-based management will benefit from newer agent-based modeling approaches that can more fully capture the dynamic interactions between individuals and other system elements. This population dynamics project, funded by the National Marine Fisheries Service, is supporting research intended to improve ecosystem-based models by developing an agent-based simulation to model fishing effort and pressure by incorporating (1) temporal and spatial fishing effort data (2) costs of fishing, (3) abundance, recruitment, and other biological information for target fish species, and (4) proposed management actions. The agent-based model will enable scientists and managers to study the decision-making process of individual vessels in this fishery, and base decisions based on a range of possible scenarios that may result from implementing proposed management on one or more target fish species. With these results, managers can weigh the costs and benefits of implementing various alternative policy scenarios.

**Adams/Swett/Larkin** are estimating the economic impact of artificial reefs to the Southwest Florida economy. This ongoing work is being funded by the West Coast Inland Navigation District and the Florida Department of Environmental Protection.

**Adams** assessed the economic impact of the hard clam culture industry in Florida in support of research projects R/LR-A-44 and R/LR-A-45. This work was funded by the Florida Department of Agriculture and Consumer Services Division of Aquaculture.

**Objective 3.** Identify and manage essential natural and artificial fisheries habitat.

### **Research Activities**

**R/LR-B-58, PASSIVE ACOUSTIC MEASUREMENT OF BLACK DRUM SPAWNING OUTPUT:** Many fishes produce distinctive sounds while courting and spawning that researchers have recorded to successfully monitor spawning activity. This study examined whether Long-Term Acoustic Recording Systems (LARS) are effective tools for recording sound profiles that will allow daily and seasonal monitoring of spawning activity for black drum (*Pogonias cromis*), an important Florida recreational sportfish species. A second goal was to determine if it would be possible to correlate sounds from black drum spawning aggregations with the number of eggs they produce, which would provide a useful management tool by allowing long-term monitoring of fish population health.

The team set up two LARS in a small, isolated residential canal at Cape Coral in southwest Florida that is a known black drum spawning area. These systems were used to record entire spawning seasons from December to May from 2004 to 2006. The researchers also made recordings biweekly using a more extensive 16-hydrophone array. At these times, the group also conducted hourly plankton tows to measure the number of eggs spawned in the canal.

The hypothesis was that the number of eggs found would increase at times when spawning sounds also increased. Instead, the team found no correlation between sound and egg number, suggesting that levels of sound production are not a useful indicator of spawning levels.

However, the research did confirm that passive acoustic sensors can provide a measure of the location and duration of seasonal black drum spawning. This enables measurement of fish spawning trends that resource managers can use to delineate essential fish habitat for this and other commercially and recreationally important fish species.

**IMPACTS:** This study used new acoustic technologies to identify essential fish habitat for a popular sport fish – black drum. In doing so, the study validated that Long-term Acoustic Recording Systems (LARS) can be used to effectively measure the location and duration of seasonal fish spawning, but the technology was not effective as a tool to measure egg production.

**R/LR-B-59, RECRUITMENT DYNAMICS AND POPULATION CONNECTIVITY OF GRAY SNAPPER, LUTJANUS GRIESUS, AMONG WEST FLORIDA ESTUARINE SYSTEMS:** The 1996 Sustainable Fisheries Act mandated the protection of essential fish habitat, a provision that was reinforced by the 2007 Magnuson-Stevens Fishery Management and Conservation Act. Yet none of this legislation clearly defines what qualifies as essential habitat, and determining areas that should be protected remains challenging. This study was designed to develop an approach for evaluating the importance of various nursery habitat types and linking them to adult habitats using gray snapper, *Lutjanus griseus*, as a

model. This species, which is among the most ecologically and economically important reef fishes in Florida, spawns near offshore reefs and its larvae recruit to inshore habitats. There are indications that gray snapper are overfished in some parts of Florida. Because little is known about its recruitment dynamics and habitat linkages, information gathered could improve the species' management. The approach developed is one that can be applied to any finfish with distinct nursery and adult habitats.

The project was conducted at four west Florida regions: the Panhandle, Big Bend, Southwest, and 10,000 Islands/Florida Bay areas. The first objective was to explore whether there are discernible differences in juvenile gray snapper density, growth, mortality and production in these areas. The team accomplished this by regularly trawling and seining over a 2-year period. They then analyzed juveniles collected and determined that depth, month, year, water temperature, and habitat type all significantly affected whether juveniles were present and/or their density. The researchers found that the presence of seagrass was the single most important factor in predicting both presence and density.

The second objective was to determine if elemental and stable isotope ratios from otoliths offer a unique chemical signature that will make it possible to examine adult snappers and determine the nursery area where they originated. This work showed that otolith chemistry is in fact a robust natural indicator of nursery origination, meaning the ratios allowed identification of a given fish's larval habitat.

Overall, the work made two major advances in the field. First, this was a novel and successful application of linear computer models that can now be more broadly applied to examine the importance of various habitat types and environmental variables on fish presence and abundance. The habitat analyses strongly suggest that continued degradation of estuarine habitats, especially seagrass beds – 60 percent of which have been lost over the last 50 years — will harm gray snapper populations. This is a problem with cascading economic costs for Florida coastal communities and the many citizens that earn a living or enjoy recreational pursuits that target fishes such as gray snapper.

Second, the successful identification of otolith signatures will enable estimation of the nursery source for adult fish at offshore reefs, which will not only reveal inshore-offshore connections, but also the extent of population mixing among regions in the eastern Gulf of Mexico and which nursery areas are most important for supporting offshore adult populations.

Further work using these techniques could help delineate essential fish habitat for gray snapper and other finfishes, and contribute to more effective management of the gray snapper fishery by NOAA.

**IMPACTS:** The novel application of linear computer models used in this study can be broadly applied to examine the importance of fish habitat types and environmental variables on fish presence and abundance as an aid in resource management. In addition, by using chemical signatures in fish otoliths the researchers were able to identify connections between juvenile and adult habitats, which can be used by fisheries managers in determining the importance of various nursery areas on adult fish populations.

**Behringer/Frazer/Swett/Watkins/Fann** are studying boating impacts to coral reefs by mapping and quantifying vessel activity and use patterns related to coral reefs. This study is the first to evaluate

spatial use patterns associated with offshore reefs, and document impacts to reefs associated with boat anchoring and other user activities (e.g., diving).

**Lindberg/Watson/Davidson** used side-scan sonar imagery to identify gag grouper essential fish habitat. This work was funded by the NOAA Marine Fisheries Initiative (MARFIN).

### ***Extension Activities***

**Diller/Cameron/Fluech/Staugler/Saari/Stevely/Sweat** conducted education programs to satisfy the information needs of artificial reef users and to develop, monitor and maintain artificial reef habitats. Much of this work was related to the SGEP-13-FE-C grant described above (e.g., Bay County Artificial Reef Educational Program; Pensacola Recreational Fisherman Association; Reef Gear Workshop; Marco River Marina Fishing Tournament; Marco Island Sport Fishing Club; Punta Gorda Isles Fishing Club; Pirate Coast Dive Festival; Clear Chanel Radio Program on new reef fishing regulations; Charlotte County Women Magazine interview on new reef gear fishing rules; Florida Outdoor Writing Association annual meeting; Frank Sargent Outdoor Exposition; St. Pete Pier Kids Fishing Tournament; Florida Sportsman Fishing Show).

### **Goal 4: Improve the quality and safety of Florida's seafood products.**

Florida is recognized as a center for high-valued seafood products. At the same time, Florida ranks in the top 10 states for food-borne illnesses. Activities under this goal address the increasing need to develop technologies and procedures for eliminating biological and chemical hazards in seafood and the processing, handling and shipping of marine food products in ways that enhance product safety and consumer value.

**Objective 1.** Develop and enhance the production, marketing and safety of seafood products via post-harvest processing, proper and consistent labeling and quality monitoring/assessment.

### ***Research Activities***

**R/LR-Q-28, PRODUCT CHARACTERIZATIONS TO ADVANCE THE USE OF POST-HARVEST TREATMENTS FOR RAW OYSTERS:** New federal mandates require that the oyster industry implement post-harvest treatments that will make raw oyster consumption safer by reducing or eliminating the pathogen *Vibrio vulnificus*, which on rare occasions causes life-threatening illness. Potential treatment methods include high pressure, cool pasteurization, irradiation and freezing, all of which can cause significant changes in taste, texture, and other oyster characteristics.

These changes can affect consumer acceptance of the treated products, so there is a great need to objectively quantify them, to help identify the best treatment options, and to direct the development of commercial practices and marketing efforts for treated oysters.

Preference testing and blind market studies alone do not offer adequate evaluation of oyster products because such methods are prone to chance and cannot provide enough information about the causes for the success or failure of a particular product.

This study, which was led by the University of Florida and FSG, in collaboration with Louisiana and Mississippi-Alabama Sea Grant, designed and implemented a sensory system for use by trained panelists to quantify oyster product characteristics.

Researchers established panels of pre-screened volunteers and conducted a series of focus group meetings to develop standard profile descriptions, product descriptors (lexicons), reference standards, vocabulary, intensity scales, and ratings necessary for a complete oyster product characterization (PC) program. For this work, sample oyster products from various regions in the Gulf of Mexico during different seasons and different periods of product storage were collected.

The team first developed and refined an extensive standard assessment system for raw oysters that enables classification of their appearance, aroma, flavor, and texture. This is the first such system ever designed for oysters. Evaluation of each classification is based on elements that can be reproduced or obtained by any group. For instance, color is judged according to color charts available at hardware stores, texture measurements are based on uniform standards such as Jell-O made using a specific recipe or a particular brand of canned peaches, and flavors are judged by comparison with readily available products such as canned sardines or Tyson's chicken livers. The researchers then developed an easier to use, condensed version of the full evaluation, suitable for a wider range of users.

Based on the results of this work, the team can now train evaluation panels, and the group is already in contact with various processing firms and agencies with seafood marketing programs in preparation for later planned training programs. The oyster sensory program is also available online at <http://oysters.ifas.ufl.edu> and includes details on how industry representatives can contact the University of Florida to schedule training, which can be accomplished using virtual tools to avoid the need for travel.

Future work using the systems developed through this project should make it possible to measure improvements in the marketability of post-harvest treated oysters; aid in establishing criteria for acceptable product shelf life; and improve oyster marketing efforts, for instance by allowing development of product specifications to suit the demands and expectations of a particular market.

**IMPACTS:** Both the standard and condensed raw oyster evaluation systems developed in this study are making it possible for the industry to assess the quality of its oyster products, especially those treated according to new safety mandates, so that the best treatment methods can be identified to maximize product safety, quality and marketability.

**R/LR-Q-30, EVALUATION OF QPCR METHODS FOR DETECTION OF VIBRIO VULNIFICUS:** The U.S. Food and Drug Administration recently mandated post-harvest processing (PHP) of oysters to reduce levels of *Vibrio vulnificus* — a bacteria common to oysters and at times lethal to humans. As part of this mandate, oyster processors are required to test oysters for *V. vulnificus* levels before and after treatment. The conventional method for this testing, known as the Most Probable Number (MPN) technique, allows estimation of bacterial concentrations, but is time consuming, costly, labor intensive, and unreliable.

This study evaluated the effectiveness of Quantitative Polymerase Chain Reaction (QPCR) testing as a replacement for MPN. The results indicate that QPCR is more sensitive than MPN, is two to three days quicker, and should be cheaper because, unlike MPN, a single technician can perform the analysis. Another advantage identified is that QPCR will also detect the presence of other species of *Vibrio* that may be of concern. QPCR testing was shown to be effective for both raw and post-harvest-processed oyster samples.

This was the first side-by-side comparison for QPCR and MPN ever conducted. By establishing QPCR's benefits and reliability in oyster testing, the results will help to establish and set standards for more rapid, efficient, and cost-effective oyster monitoring. Due to the potential for QPCR to reduce labor and costs, and to increase the effectiveness of monitoring, this study should ultimately prove a significant contribution to sustaining the Gulf oyster industry. The researchers conducted the work in collaboration with DuPont, and the results will enable the company to provide a commercial QPCR assay for wide application.

**IMPACTS:** This research has helped to establish and set standards for a more rapid, reliable, and cost effective method for monitoring the virulent bacteria *V. Vulnificus* in oysters.

**R/LR-Q-31, OBJECTIVE QUANTIFICATION OF THE EXTENT OF AQUATIC FOOD PRODUCT ENHANCEMENT WITH CARBON MONOXIDE:** Some U.S. seafood processors and importers currently treat fish fillets with carbon dioxide, which acts as a color fixative, in order to maintain or enhance appearance. Carbon monoxide binds to proteins in muscle, preventing the reddish and light colors in fresh fillets from changing, or even restoring these colors. The practice, which has been banned by the European Union, is legal in the U.S., but remains controversial, because carbon monoxide treatment could mask signs of spoilage.

New research tools and techniques are needed to properly assess the impacts of CO treatment and to help settle controversies about the impacts of such treatment and whether federal regulation of the practice is needed.

To date there has been no suitable means for objectively quantifying the colors in fish fillets as a means for identifying the effectiveness of CO treatment, or of detecting its use. A major goal for this project, successfully completed, was to develop machine vision software to analyze fillet colors, specifically the degree of lightness and redness in specific spots.

Using the software developed, the team was able to quantify color enhancement via CO treatment of fillets from tilapia, salmon, and catfish. This includes measuring preservation of color when fresh fillets were treated, and restoration of color for frozen fillets, including spoiled fillets. In all cases, CO increased redness significantly, even beyond initial values of fresh fillets.

Because CO treatment can improve the look of even spoiled fillets, this technique offers at least the potential for fraud if inspectors or consumers rely only on color. However, color is not a good indicator alone, because even fresh, safe fillets become discolored when exposed to oxygen well before they spoil.

To address this issue, the group also showed that both microbial counts and smell, based on measurements using an electronic nose, were significantly different between fresh and spoiled fillets, leaving these parameters available for detecting unacceptable products even if color is enhanced with CO.

Based on the findings of this project, the researchers make two regulatory conclusions. First, because CO can mask visual signs of spoilage, rapid, simple, reliable methods for detecting carbon monoxide in fish and other products should be developed. Second, standard procedures should be developed for use by the seafood industry to prevent the possibility of CO enhancement of inferior products.

**IMPACTS:** The computer machine vision software developed offers the first objective means of quantifying the degree to which carbon monoxide treatment enhances the color of fish fillets.

If used appropriately and with proper safety controls, carbon monoxide treatment can benefit the seafood industry by safely delaying discoloration and extending the shelf life of fish prior to freezing.

**R/LR-Q-32, OYSTER DEMAND ADJUSTMENTS TO ALTERNATIVE CONSUMER EDUCATION AND POST-HARVEST PROCESSES IN RESPONSE TO VIBRIO VULNIFICUS:** Oyster consumers' understanding of *Vibrio vulnificus* risk and the impact on consumer marketplace behavior is a major concern for the oyster industry and relevant state and federal agencies. Heightened consumer perceptions of risk and misconceptions about how to reduce and manage the risk of *V. vulnificus* infection from oyster consumption are widespread. These perceptual issues and Food and Drug Administration mandates have resulted in the development and implementation of educational and outreach programs to better inform consumers about the risks associated with *V. vulnificus*. This ongoing research is using contingent behavior analysis ported to a Web-based experimental design to test alternative educational information treatments directed at developing and implementing programs to better inform consumers of the potential risks associated with *V. vulnificus*.

#### ***Extension Activities***

**Otwell/Mahan** increased industry, agency and public awareness of the impacts of mislabeling and the fraudulent substitution and sale of seafood products (e.g., Statewide Clam Industry Task Force; Interstate Shellfish Sanitation Conference; Pacific Growers Association meeting; University of Florida Annual Shellfish School).

**Otwell/Mahan** increased industry, agency and public awareness of the health issues related to the consumption of aquaculture and shellfish products and post-harvest treatments to reduce risks (e.g., Oyster School; Shrimp School; University of Florida Shellfish School; Interstate Shellfish Sanitation Conference; Pacific Growers Association meeting).

**Otwell/Mahan/Sturmer** increased scientific, industry, agency and local government knowledge about seafood safety issues by organizing and participating in symposia, conferences, and trade meetings; producing publications; serving on committees and advisory boards; and participating in

aquaculture theme-specific workshops (e.g., Vibrio Small Workshop; Oyster Rulemaking Workshop; Seafood Science and Technology Society of the Americas Conference; 100<sup>th</sup> Annual Shellfish Growers Conference; 2008 Clam Industry Workshop; 2008 Aquatic Animal Clerkship).

**Objective 2.** Increase citizen awareness and knowledge about seafood safety issues.

### **Research Activities**

**R/LR-E-19PD. OYSTER DEMAND ADJUSTMENTS TO ALTERNATIVE CONSUMER EDUCATION AND POST-HARVEST PROCESSES IN RESPONSE TO *VIBRIO VULNIFICUS*: A PILOT STUDY:** Consuming raw oysters that contain the pathogen *Vibrio vulnificus* can cause life-threatening illness, but incidents are rare. Despite millions of oysters eaten each year in the U.S., the Food and Drug Administration logged only about 25 cases of serious illness associated with *V. vulnificus* per year between 1989 and 2002. Nonetheless, when the public hears negative news about the pathogen, or misinformation about risks, it can lead to a serious drop in oyster demand and a major impact on the multimillion-dollar oyster industries in Florida and other states.

This study used surveys to gauge both the economic impact of negative *V. vulnificus* information, and the effectiveness of various forms of risk information distribution. First, the group hired a commercial market research firm to survey 615 people by phone to gather baseline information about oyster health risks. This work quantified the degree to which news about an oyster-related human death decreases demand for oysters.

Survey participants were then asked to fill out an additional online survey, and 435 people agreed. These respondents were exposed to information from different sources designed to reassure consumers about oysters to determine what effect each would have on demand.

The results showed that information with no source identified, or from government sources, had no statistical impact on demand, which is in line with related past research. However, when respondents were told that information came from a not-for-profit non-governmental organization—for the purposes of the study a fictional organization dubbed the American Shellfish Foundation—oyster demand increased to a degree that more than offset the impacts of the initial negative information. As an extension of the same work, the group also found that processing oysters to effectively remove *V. vulnificus* would not impact consumer demand.

These results are especially important because, while previous research in the field found that information designed to counter negative impacts has little offsetting effect, the study has revealed a path by which consumer demand might be effectively restored once oysters are safe following an oyster-related health scare incident. As such, the results can guide the oyster industry and state and federal agencies in the best ways to design oyster consumer awareness campaigns. The work also opens a new avenue for future research into consumer education and outreach following food safety scares.



**IMPACTS:** This project implemented a novel web-based survey approach that evaluated a variety of risk information interventions and sources to improve the effectiveness of oyster safety information campaigns targeted to consumers.

**Adams/Larkin/Otwell** conducted a survey of 400 households regarding knowledge and awareness of mislabeling of seafood products in Florida, particularly as related to grouper. The survey found that the majority of respondents were aware of the issue and had changed their purchasing habits as a result, both in restaurant and in retail seafood settings. The study found that respondents do have a willingness to pay for an informational program that would better assure consumers of product identity and source. The study was funded by the Gulf and South Atlantic Fisheries Foundation.

#### ***Extension Activities***

**Mahan/Otwell** developed news and media publications and education programs that were geared toward the general public, and described facets of seafood safety, economically important fish species, and health-related issues (e.g., radio programs on clam aquaculture, oyster farming and oyster habitat restoration; Aquaculture Magazine; Florida Monthly Magazine; Bay News 9 TV interview).

**Mahan/Sturmer/Creswell** provided technical support to local governments, seafood processors, harvesters, retailers and consumers on seafood safety and management issues (St. Lucie Aquaculture Tour; Seminars on clam aquaculture; 2008 Clam Industry Workshop; 2<sup>nd</sup> Annual Shellfish School; Aquaculture America 08; Statewide Clam Industry Task Force; 16<sup>th</sup> Annual Washington Shellfish Growers Conference; 38<sup>th</sup> Annual Cedar Key Seafood Festival).

## **FOCUS AREA 2 – SUSTAINABLE AND HAZARD-RESILIENT COASTAL COMMUNITIES**

### **Goal 1: Sustainable Coastal Communities and Waterways**

Managing coastal development and waterways is a critical challenge in Florida. Water-dependent small businesses are at risk and FSG is supporting research and policy development to help water-dependent businesses maintain access to coastal waters. More than one million boaters use Florida's waterways, creating the need for improved waterway access and maintenance, greater public safety, improved boater education and enhanced resource management. FSG is supporting waterway management and planning initiatives, legal analysis and policies within this goal area with a focus on safe navigation and boating, and promoting recreational and commercial access to Florida's waterways.

**Objective 1.** Develop decision support tools and information to guide public policy and support coastal marine spatial planning and waterway management efforts.

#### ***Research Activities***

**R/C-P-29, MARINE SPATIAL PLANNING FOR SUSTAINABLE COASTAL COMMUNITIES AND WATERWAYS:** The ever-increasing demand for coastal living and water-based recreation is a catalyst behind the economic growth, development pressure and degraded resources that many coastal

communities experience. Florida's coastal communities face a critical challenge: how to balance the use and protection of waterway resources. To address this challenge an ongoing project is supporting the activities of the Boating and Waterway Management Program, affiliated with FSG, to provide waterway management and marine spatial planning assistance to local, regional, and state agencies. This project has been well leveraged through local and state sponsorship of programmatic activities. Notable 2008 activities include: (1) development of a spatial decision support system to assist the FWC Division of Law Enforcement, Boating and Waterways Section with boating safety zone rulemaking, which involved a series of consensus meetings and workshops with local boating experts and citizens; (2) Development of a waterways master plan for Alachua County which involved 35 meetings with various stakeholder groups; (3) continued development of the recreational boating GIS with applications in Bay and Collier Counties; (4) continued assistance to the West Coast Inland Navigation District (WCIND) regarding the implementation of the Regional Waterway Management System (Charlotte and Lee counties) and development of a 5-year strategic plan (2008 – 2013) for the WCIND; (5) determining coral reef impacts associated with boat anchoring and user activities; and (6) development of GIS training opportunities for Sea Grant and UF/IFAS research and extension faculty who will use the information in their individual educational/outreach activities.

**IMPACTS: Swett/Fik/Fann/Sargent/Sidman/Cameron/Fluech** implemented a “Recreational Boating Characterization” for Bay and Collier counties in Florida. These studies were conducted in partnership with the Florida Fish and Wildlife Conservation Commission’s (FWC) Fish and Wildlife Research Institute, the Bay County Planning Department, and the Collier County Coastal Management Program, and represent modules in a series of coordinated studies aimed at developing spatial information on the water-based patterns and behaviors of Florida’s boating community.

**Swett/Fann/Staugler** are implementing a spatial planning tool called the Regional Waterway Management System (RWMS) for Charlotte County, Florida. The RWMS is a decision-support and policy framework for prioritizing waterway management decisions that balances safe waterway access and navigation with environmental protection. The RWMS has successfully fostered collaborative decision-making with local, regional, and state management/environmental protection stakeholders and has resulted in a State policy governing the regional prioritization of waterway maintenance dredging throughout a four county regional waterway taxing district (i.e., West Coast Inland Navigation District).

**Watkins/Sidman/Swett** developed and implemented a boating safety risk analysis and a public input process to identify boating safety options for the FWC, Division of Law Enforcement, Boating and Waterways Section. This spatial decision support system represents a significant advancement in the application of GIS technologies to identify boating safety risk and zone options for rule-making activities. The GIS boating safety risk analysis and public engagement process implemented for the pilot areas of Martin and Palm Beach Counties satisfies the need for a standardized and data-driven approach to evaluate requests and applications for the establishment of boating safety speed zones in the Intracoastal Waterway (ICW).

### ***Extension Activities***

**Swett** is leading a consensus-building process that involves local, regional, and state agency stakeholders in support of the Regional Waterway Management System implementation in Lee County. (See project R/C-P-29 above).

**Swett/Fik/S. Fann/D. Fann/Sargent/Sidman/Cameron/Fluech** partnered with the FWC Fish and Wildlife Research Institute and local government agencies to develop spatial information on the boating patterns and behaviors of Florida's recreational boating community. Two such studies (e.g., Bay and Collier Counties) were implemented/completed during this reporting period (see impacts above).

**Watkins/Sidman/Swett** developed a GIS-based risk analysis to evaluate boating safety risk along Florida's waterways as input to a boating safety zone analysis for the FWC Division of Law Enforcement, Boating and Waterways' Section, which funded the project. This information formed the basis for the development of new boating safety zone rulemaking for Martin and Palm Beach counties waterways. These studies involved the development and implementation of a public outreach/engagement process that quantified input from the public regarding the necessity, timing, and type of boating restriction options for areas identified as being high-risk to boating safety, public safety, and to maritime property (see impacts above).

**Swett/Fann/Staugler** are completing an evaluation of the waterway maintenance needs and prioritization analysis for counties within the West Coast Inland Navigation District's jurisdiction. They are developing detailed spatial data on the locations and draft characteristics of vessels and waterway depth conditions in Charlotte County. A GIS routing analysis will identify and prioritize waterway segments in the county according to the number of vessels restricted within canal systems under a mean lower low (MLLW) water condition. Data from this project will be used by the WCIND and FDEP to develop a regional waterway maintenance permitting plan.

FSG faculty and staff (Spranger, et al.) are continuing to participate in activities of Coastal Ocean Observing System (COOS) projects including the Florida COOS, the Southeast Atlantic COOS and the Gulf of Mexico COOS.

**Swett/Coffin/Fann/Staugler** provided scientific, technical and planning expertise to the West Coast Inland Navigation District in support of its legislative mandate to maintain coastal waterways for safe navigation. This effort resulted in a 5-year strategic plan (2009-2013) for the District, addressing the need for a document that satisfied both planning and public relations/outreach objectives.

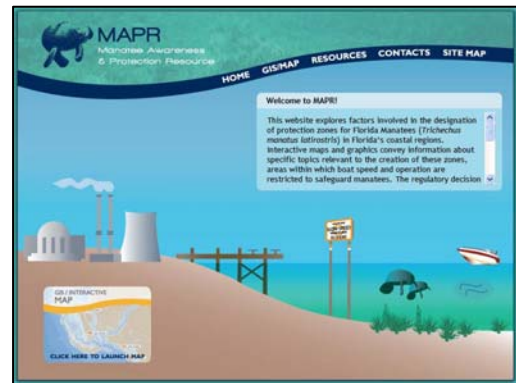
**Swett/Fluech/Watkins/Hazell/Mahan/Verlinde/Leonard** increased scientific, industry, agency and local government knowledge about waterway access and management issues, stewardship, and safe and sustainable boating by organizing and participating in symposia and conferences (e.g., Coastal Zone 2009); provided input on relevant publications (e.g., Recreational Boating Characterization for Bay and Collier Counties); served on committees and advisory boards; and participated in topical workshops (e.g., Brevard County Comprehensive Maritime Management Master Plan public workshops).

**Spranger/Fletcher/Hazell/Staugler** built international capacity on ocean observation systems by developing partnerships with NOAA's office of international programs and the office of climate change.

### Extension Program Highlights

**Bob Swett, Russell Watkins and Charles Sidman** – The NOAA Coastal Services Center's (CSC) new "Digital Coast in Action" Web site shows how data and tools are used to address coastal management issues. Sea Grant's recently developed spatial decision-support system (SDSS) to analyze safety risk for recreational boating is one of only nine US projects currently highlighted on the CSC Web site. With outreach assistance from the FSG Boating and Waterway Management Program specialists, The Florida Fish and Wildlife Conservation Commission (FWC) successfully applied the SDSS to Martin County waterways during a series of facilitated public meetings, resulting in adoption of a rule specifying the locations, types, and characteristics of boating regulatory areas in the Intracoastal and Okeechobee waterways. FWC and FSG currently are applying the SDSS in Palm Beach County. The URL of the Coastal Services Center's site is (<http://www.csc.noaa.gov/digitalcoast/action/index.html>).

**Robert Swett, Alisa Coffin and Charles Sidman** – A Manatee Awareness and Protection Resource (MAPR) was developed for the NOAA Coastal Service Center. MAPR is a new interactive Web -based education tool to view and interpret information relevant to manatee awareness and protection in Florida. The Web site incorporates educational modules that allows visitors to explore factors important to the delineation of manatee protection zones (e.g., laws, refugia, waterway infrastructure, boats, seagrass/aquatic habitats, manatee life characteristics, water quality/ temperature). The Web site also includes a unique interactive mapping feature that allows users to visualize some of the spatial data (e.g., spatial boating, environmental, and manatee occurrence data) used in delineating manatee protection zones. Providing stakeholders and the public with an interactive spatial data visualization tool to view and interpret relevant information—whether regarding manatees, habitat, or boats/boaters—will engender a greater understanding and appreciation of this complex management issue, possibly leading to greater acceptance of and compliance with protection zones. The MAPR Web site can be accessed at [www.flmapr.org](http://www.flmapr.org).



**Objective 2.** Develop policies and plans to sustain coastal communities and waterfront businesses, and promote public access to waterways and waterfronts.

### Research Activities

**R/C-P-30, PROMOTING POLICY PLANNING FOR COASTAL COMMUNITIES, COASTAL ACCESS AND COASTAL HAZARD MITIGATION:** This ongoing project supports legal research and extension to state and local policy professionals across a range of waterway and waterfront management issues confronting Florida. Local waterfront governments are benefiting from a comprehensive legal analysis of their coastal policymaking authority, especially in the confusing near-shore jurisdictional environment,

and from a systematic assessment of the planning tools at their disposal that is packaged in a user-friendly Web-based format. This is an applied legal and policy research and model code development project, coupled with legal and planning extension to disseminate results. Notable achievements for this reporting period include: (1) the development of a waterfront policy tool kit (i.e., best policy practices) focusing on public waterway access issues; and (2) a “Waterways and Waterfronts Community Guide and Policy Tools” Web site to disseminate model policies and guidelines generated from this project. The Web site highlights a number of specific programmatic accomplishments including:

1. a model uniform land development code for the town of Marineland which is adaptable to any small coastal community,
2. a comprehensive review of Florida’s boating statutes for the FWC,
3. an adaptive management plan for the St. Marys river watershed,
4. continuing legal support for Waterfronts Florida Partnership communities including St. Marks, Steinhatchee and Carrabelle, and
5. a legal analysis and policy development in support of living shorelines.

Most recently, the PI's are devoting attention to the development of model land-use planning options and policies for coastal communities seeking adaptive solutions to sea-level rise as a consequence of climate change.

This project has been well leveraged through local and state sponsorship of programmatic activities. The Conservation Clinic affiliated with the University of Florida’s Law School continues to demonstrate excellent value for FSG funding by offering law students applied working opportunities and conducting highly visible and relevant legal analysis in support of efforts to plan for and manage waterfronts and waterways under the backdrop of increasing urbanization of coastlines and associated waterway uses.

**IMPACTS:** A coastal community waterfront policy tool kit, focusing on public water access, is being used by local governments for comprehensive planning and for compliance with legislative coastal mandates. The tool kit and other products of this research are supporting sustainable coastal development and identifying policy options for adapting to sea-level rise. The research also has supported development of new rules that make boating in coastal waters safer and more environmentally friendly, and support development of mooring fields for vessels that will allow more effective enforcement of environmental and other regulations.

### ***Extension Activities***

**Ankersen/Ruppert/Swett/Watkins** developed locally applicable policies, plans and strategies to promote sustainable coastal planning and public access to waterways, which were tailored to individual community needs (e.g., City of Carrabelle; City of Steinhatchee; City of Panacea; City of St. Marks; City of Bradenton Beach; City of Punta Gorda; Town of Marineland; Brevard County; Martin County; Palm Beach County; Bay County; Collier County; Lee County; Charlotte County).

**Ankersen/Ruppert/Adams/Gregory/Swett/Watkins/Fletcher/Leonard/Verlinde/McGuire/Stevely** increased scientific, industry, agency and local government knowledge and collaboration regarding waterfront access, waterway planning and sustaining working waterfronts/coastal heritage by organizing and participating in symposia, conferences, and trade meetings; producing topic-specific publications; serving on committees and advisory boards, and by participating in topical workshops (e.g., Waterfronts Florida Partnership Program; National Sea Grant Law and Policy Center annual symposium; 2008 Coastal Geotools conference; Coastal Zone 2009 conference; Statewide meeting of boating law stakeholders; Florida Boating Advisory Council; Living Shorelines conference; UF Law Nelson Local Government Law symposium; 4<sup>th</sup> Annual Florida Keys Seafood Festival – partnership between Florida Keys Commercial Fishing Association and the University of Florida Extension and FSG Programs).

**Objective 3.** Promote non-regulatory/incentive-based approaches to foster industry/agency partnerships, stewardship, and smart community growth.

#### ***Extension Activities***

**Spranger/Diller/Gregory/Hazell/Staugler/Verlinde/Creswell** supported the Clean Boating Partnership by working with local marinas, boatyards and retail sectors to enhance voluntary compliance with environmental best management practices (BMP's) – (e.g., promotion of the Florida Clean Boater Program at the Pensacola and Miami Boat Shows).

**Cameron/Saari/Mahan/Gregory** promoted smart growth concepts in community forums for energy conservation, green development practices and sustainable living (e.g., Living Shorelines – Grasses in Classes Program/Workshops; Bay Green Exposition; Non-Point Education for Municipal Officials Program (NEMO); Earth Day Festival; Gulf of Mexico Alliance resiliency workshop; Resource Ranger Field Trips; Solar Energy Technology Certification Workshops).

**Swett/Fann/Staugler/Saari/Cameron/Verlinde** developed programs and products that instill responsible management and stewardship for Florida's waterways (e.g., Navigational, Historical, Environmental Perspective of Charlotte County Waterways guide; Recreational Boating Characterization for Bay County; Recreational Boating Characterization for Collier County; Boating Safety Risk Analysis for Martin and Palm Beach Counties; Regional Waterway Management System Workshops – Lee and Charlotte Counties).

#### **Extension Program Highlights**

**Betty Staugler** –The “Keep a Clear Head” (KACH) program won first place in the Interlux Waterfront Challenge for the Southeastern Region of the United States, which includes the states from South Carolina to Texas. Quality of water on a national level prompted Interlux Yacht Paint to create "The Waterfront Challenge", a competition to encourage people and organizations to improve their local waterfront environment. Responding to that challenge, the Charlotte County Sea Grant agent, Betty Staugler, working as a team member of the Punta Gorda Boaters Alliance created the innovative program to encourage boaters to use pump out stations. Now, when boaters use a pump-out station, they receive a reward card which gives them special discounts when presented to 11 different marine-

related businesses. The program received top honors because it educates the boating public regarding problems related to illegally discharging holding tank waste into surface waters; provides incentive for boaters to act responsibly; increases utilization of pump-out facilities; involves the entire boating community including boaters, marinas, and commercial service enterprises; will result in improved water quality; is easy to sustain; provides measures to success; and can be easily replicated in other communities. Staugler and the rest of the KACH team were recognized at the Miami Boat Show on February 12, 2009.

**Doug Gregory** – Gregory taught the fourth 40-hour solar photovoltaic installation class through the Florida Keys Community College. Classes have been held in Key West, Marathon and Key Largo. To date 51 local electricians, contractors and others have completed the course with 21 going on to attain the North American Board of Certified Energy Practitioners “Photovoltaic Entry-Level Certificate of Knowledge” by passing a national exam. This effort is in collaboration with the Florida Keys Community College and the Florida Solar Energy Center Alternative Energy Banner Program. In that regard Gregory arranged for the FKCC to partner with the FSEC train-the-trainer grant program for 2009-2010 that should help the college to develop a solar based industry training program for solar electric and solar hot water systems. To date, these classes have helped to create at least two new local businesses devoted to increasing the sustainability of coastal communities.

**Objective 4.** Provide GIS training and learning opportunities for graduate students, university faculty and resource managers with a focus on waterway resource and management issues.

#### ***Extension Activities***

**Swett/Lindberg/Andreu/Fann** developed and conducted four GIS training courses targeted to graduate students and professionals seeking to learn about GIS functionality and applications related to water resource planning and management.

**Objective 5.** Foster community decision-making processes that involve and balance the full-range of interests, to establish common understanding and consensus regarding waterfront and waterway planning including coastal land use, development, public access, and climate change adaptations.

#### ***Research Activities***

**PUBLIC ENGAGEMENT IN PLANNING FOR RECREATIONAL WATERWAY ACCESS IN A RURAL COASTAL COUNTY:** **Swett/Davidson/Ankersen** are developing and conducting an outreach initiative to provide decision support to rural coastal communities in planning for public waterway access. The rationale is that rural areas of the coast remain the most pristine and most at risk for uncontrolled coastal development. Yet, those same areas typically do not have the resources of large metropolitan areas to undertake planning efforts. Taylor County, the pilot study area, epitomizes the loss of public access due to conversions of marinas and ramps to private residential uses and, therefore, it makes a compelling case study to evaluate the potential for using public lands for coastal recreational access. The project will develop and implement a public engagement process in support of a site suitability analysis to help Taylor County plan for coastal waterway access in support of marine-based recreation. Project

outcomes will include a legal analysis of existing regulations that may facilitate or hinder the use of public lands for recreational activities, or information on the locations, characteristics, and capabilities of public waterway access facilities in Taylor County to support the marine-based recreational activities and needs of Taylor County residents; an assessment of the demand for waterway access versus the existing supply; and recommendations on how to address current and future public waterway access needs.

**IMPACTS:** This project will provide a model for engagement of citizens in visioning and planning for smart growth and environmental stewardship in rural coastal communities that lack the resources for comprehensive coastal resource planning, and at a local level, it will lead to enhanced planning for public waterway access in the community where the pilot study is occurring.

### ***Extension Activities***

**Fluech** (2008 Class) participated in the Florida Natural Resource Leadership program to enhance competencies related to public leadership engagement and group facilitation skills.

**Hazell** (2009 Class) is currently participating in the Florida Natural Resource Leadership program to enhance competencies related to public leadership engagement and group facilitation skills.

## **Goal 2. Hazard-Resilient Communities**

Florida's coastline is home to 80 percent of the state's residents who are at risk from winds, waves, and floods generated from tropical storms. These coastal processes and hazards can result in loss of life and billions of dollars in property damage. This goal seeks to improve the ability of coastal communities to identify risks and reduce losses of human life, property and coastal habitat from storms and natural hazards and increase the cost effectiveness of mitigation measures to improve community resiliency.

**Objective 1.** Improve prediction of the impacts of storms and community vulnerability to coastal storm events.

### ***Research Activities***

**R/C-S-46, FIELD MEASUREMENTS OF HURRICANE WAVE PROCESSES:** Historical capabilities for monitoring the devastating waves and surge associated with hurricanes have been so limited that it has severely constrained researchers' abilities to accurately predict storm effects. This is despite the fact that U.S. coastal populations, especially in Florida, are rapidly increasing, which increases the likely extent of hurricane wave damage, making effective prediction all the more valuable.

If monitoring could be improved, it would enable better prediction of areas likely to be inundated by a storm, how much damage to expect, water heights relative to levees, and even the best evacuation routes.



While a storm-hardened, permanent wave-monitoring system would be ideal, it would also be extremely expensive. This study instead focused on developing a system of monitors—specifically self-recording pressure gauges—that can be deployed rapidly via helicopter ahead of a hurricane's landfall and collected by divers after a storm passes. The gauges record such parameters as wave height, the distance between waves, and the duration of breaking waves.

The team used this mobile monitoring system successfully during several storms including Hurricanes Ike and Gustav. Two days ahead of storms, a small team of investigators traveled to the expected landfall zone and distributed gauges across a large area, enabling measurements from the weak and strong sides of each storm, as well as the point of landfall and greatest destruction.

These efforts produced what is by far the most complete hurricane wave data set ever available. The data have been made available directly to researchers, and are being disseminated through meetings, scientific papers, and the internet. This information is destined to become the standard dataset for hurricane wave and surge measurement. Researchers are already using it to improve hurricane prediction models, and the data are being used to aid the development of flood maps for the Federal Emergency Management Administration.

**IMPACTS:** This study developed a mobile hurricane wave monitoring system that produces information about hurricane storm characteristics. This information is already being used by academics and by government agencies, including the Federal Emergency Management Administration, to improve hurricane models, which enables better prediction of storm damage and better identification of the safest evacuation routes.

**R/C-S-49, HIGH RESOLUTION COASTAL INUNDATION MAPPING TO ENHANCE HURRICANE RESILIENCY IN FLORIDA:** Hurricanes are among the most destructive natural disasters and cause catastrophic losses to coastal states such as Florida. Most hurricane induced damage occurs in the form of storm surge and inundation. This ongoing study is making use of the recently available high frequency inundation data collected by the USGS and integrating vegetation data to validate and enhance an integrated storm surge modeling system CH3D-SSMS. Project results will be made available to the Florida Department of Emergency Management and coastal county managers for an evaluation of model output and for hazard mitigation planning. The researchers have developed a plan to engage the public and FSG extension community to help evaluate a Web-based information portal that describes the CH3D-SSMS and storm surge and coastal inundation products. They will also be developing a public education strategy on the topics of storm surge and coastal inundation hazards that involves FSG Extension faculty.

### ***Extension Activities***

**Spranger/Diller** participated in the Specialized Marine Action Response Team (SMART) program to respond to tropical storms and foster community and agency hurricane preparedness.

**Spranger/Creswell/Cameron/Fluech/Verinde/McGuire/Hazell/Diller/Jackson** increased citizen knowledge about hurricane preparedness through seminars, communication opportunities, radio shows,

and the distribution of materials at a variety of community events (e.g., Hurricane Preparedness for Boaters Radio and TV Programming – Fox 4 TV; Wakulla Men’s Fraternity: Hurricane Preparedness and Response lecture; Flagler News Tribune newspaper article on storm surge impacts).

**Adams/Gregory/Shivlani/Murray** assessed the infrastructural characteristics of the Florida Key trap fisheries industry and associated waterfront communities concerning needs for storm damage assessment and resiliency. In particular, the study focused on the trap fishery in the Keys, including stone crab, spiny lobster, and blue crab. The study evaluated the patterns of trap placement and identified the most vulnerable regions to trap loss, as was experienced during Hurricane Wilma, in 2005. The study provides guidance to state fishery managers and disaster assistance agencies in better anticipating trap losses that may occur as a result of a major storm event in the Florida Keys region. This study was funded by the NOAA National Marine Fisheries Service.

**Objective 2.** Develop building products and construction standards to mitigate coastal storm impacts.

### ***Research Activities***

**R/C-D-18, FULL-SCALE SIMULATION OF HURRICANE EFFECTS ON RESIDENTIAL BUILDING ENVELOPES TO REDUCE HURRICANE-INDUCED LOSSES:** In this ongoing project, researchers are making substantial progress towards developing a new method to test the resistance of full-scale residential buildings in a repeatable strong wind and rain environment using a novel “Wall of Wind” facility. The first objective, to calibrate the Wall of Wind by comparing simulated wind conditions with actual hurricane parameters obtained from the Florida Coastal Monitoring Program, has been completed. Progress is being made on the other two objectives to measure wind induced pressure on different roof types (monoslope, flat, gable, and hip), and to determine the effects of wind-driven rain on full-scale roofs with clay tiles and shingles. Recommendations for existing codes and provisions for hurricane resistant and economical design of residential buildings will be forthcoming.

**IMPACTS:** The mitigation technologies and products (e.g., building codes and standards) developed from this study will result in safer homes and foster new commercial opportunities and industrial bases, trades and spin-off companies in Florida and other coastal states.

**GOM/RP-1, DEVELOPMENT OF INNOVATIVE LOAD TRANSFER MECHANISM TO REDUCE HURRICANE-INDUCED FAILURES IN NEW AND EXISTING RESIDENTIAL CONSTRUCTION:** This ongoing project is developing and testing the ability of a new polymer building material to better withstand hurricane induced winds using a new Wall of Wind facility. Preliminary evaluation of fiber reinforced polymer composite connection systems has been completed and shows promise as an innovative solution (particularly as a non-invasive retrofit method) for older structures to resist high loading during extreme wind conditions. The researchers have developed a substantial program with a great deal of academic synergy and industry support. This project will likely produce results that will be useful to building codes officials and development industry sectors.

**Objective 3.** Improve the ability of coastal communities to reduce risks to human life from natural coastal processes and environmental conditions.

### **Research Activities**

**R/C-S-50, A SPATIAL HAZARD INDEX OF SEMI-PERMANENT RIP CURRENTS IN NORTHWEST FLORIDA:** This ongoing study is developing a model to simulate wave and ocean surface conditions associated with rip-currents. The model will be used to develop a spatial hazard index to identify when and where there is a strong rip current potential. Testing and training in the use of field equipment has occurred and analysis of the test data is underway to characterize ocean conditions in which rip currents and rip current-related rescues occurred. Monitoring stations for further field experiments along test beaches have also been identified. This information can be used for evaluating the location of beach access sites, assisting safety officers in the placement of infrastructure (e.g. lifeguard towers), staffing decisions, and issuing public alerts to inform beachgoers of hazardous swimming conditions and locations.

**Adams/Gregory/Shivlani/Murray** evaluated the resiliency of the Florida Keys trap fishery industry infrastructure and associated waterfront communities to storm events. This project, funded by NOAA, combines fishery use patterns data with shore side infrastructure information, using geospatial analysis as a means by which to (a) identify sub regions (or other units) that may have been affected by a storm event, (b) estimate the approximate impacts on landings and fishing gear, and (c) assess the disruptions to commercial fishing center-fishing ground networks, including changes in fishery participants and landings.

**IMPACTS:** This approach is particularly important in identifying ports that are affected by a storm impacting offshore fishing grounds, as well as determining the number of ports that may be affected by a particular storm event. The method can be used in conjunction with standard field-based approaches and could be valuable for updating the spatial dimensions of fisheries vulnerable to hurricane events.

### **Extension Activities**

**Cameron/Fluech/Verlinde/McGuire/Mahan/Saari/Stevely** increased citizen knowledge about water safety, beach and sun safety, rip currents, red tide and shark awareness through seminars, other communication opportunities and media events (e.g., Bay County Rip Current Education Program; newspaper articles on beach safety; Nautical Mile Magazine article on rip currents; Santa Rosa County 4-H lecture on shark safety).

## **FOCUS AREA 3 – HEALTHY COASTAL AND MARINE ECOSYSTEMS**

### **Goal 1: Protect, Restore and Enhance Coastal Ecosystems**

Florida estuaries, where fresh water from the land meets saltwater from the sea, are characterized by enormous ecological, social and economic diversity. Most of the marine species that support Florida's multi-billion dollar fisheries depend on estuaries to complete their life cycle. Meanwhile, most of Florida's urbanization is taking place alongside estuaries, placing stress on the quality and quantity of these valuable habitats. Activities conducted under this goal will address water

quality issues and enhance coastal habitats and fisheries, by increasing the information for science-based decision-making of resource managers and by empowering citizens to be good stewards of the environment.

**Objective 1.** Provide science-based information to decision-making that protects, restores and enhances coastal systems.

### **Research Activities**

#### **R/C-E-52, A PORTABLE ENTEROCOCCUS SENSOR FOR MONITORING COASTAL WATER QUALITY:**

Beaches and near-shore coastal waters are important economic and recreational resources that can be highly affected by human activities. In Florida especially, beaches are major economic drivers tied to tens of billions of dollars in tourism each year. Despite increasingly aggressive measures to reduce coastal water pollution, 34 Florida counties must monitor beaches weekly for fecal coliforms and enterococci as part of the Florida Healthy Beaches program. Bacterial contamination remains a significant problem for beaches throughout the US and around the world.

To detect harmful bacteria in nearshore waters, resource managers currently use a process that takes 1 to 2 days for test results. This prevents optimal management of beach closures, because the lag time in processing samples can allow dangerously contaminated beaches to remain open during the testing period or keep economically significant beaches closed even after a problem has passed. That's a critical concern, as estimates suggest that in 2004, for instance, Florida lost more than \$187 million to beach closures.

The goal of this project was to address the problem by developing and testing a new chemical procedure to rapidly and accurately detect and count enterococci bacteria, one of the most common causes of dangerous water contamination, using a portable electronic device. Using a technique called nucleic acid sequence-based amplification (NASBA), the team developed an assay that recognizes a region of RNA with a sequence unique to enterococci. The technique did allow them to achieve rapid detection. However, despite exploring multiple strategies, the group was not able to develop a sufficiently precise means of quantifying bacterial cells as compared against conventional membrane filtration techniques.

The researchers therefore shifted their focus to improving the handheld detection device and made several significant improvements, including reducing its size. Earlier versions of the handheld device, developed in part with Sea Grant funding, have been used successfully to run quantitative NASBA assays designed to measure other important microbes such as *Karenia brevis*, Enterovirus, and Norovirus. Improvements made to the device should therefore improve capabilities for monitoring these groups.

**IMPACTS:** A molecular technique was developed that is more rapid than standard tests used to detect enterococci in coastal water. This could be a useful tool in beach management as a first response warning system for enterococci pollution that could then trigger quantitative testing as needed.

**R/C-E-53PD, ASSESSING THE IMPORTANCE OF SUBSTRATE COMPOSITION AND NOVEL MARINE BY-PRODUCTS IN ENHANCING MITIGATION OF ESSENTIAL FISH HABITATS:** There is strong evidence that in certain areas such as Florida's east coast, non-coral hard-bottom habitat plays an important role as nursery grounds for juvenile fish and other animals and as temporary animal refuges when competition is too high on neighboring coral reefs. One of Florida's main sources of such non-coral hard bottom is the polychaete worm *Phragmatopoma lapidosa*, also known as *Phragmatopoma caudate*. This worm glues sand together to make sand tubes that form vast, highly diverse "worm rock" reefs in intertidal and shallow subtidal areas. Among other contributions, these worm reefs are important sources of food and shelter for juvenile green turtles. Many other federally and state-listed species are also associated with the worm reefs, which are designated as Essential Fish Habitat of Particular Concern by the National Marine Fisheries Service.

Worm reefs can be dramatically altered by natural and man-made processes, especially the common practice in Florida of beach renourishment to replace lost sand. Predictions suggest that some 80 million cubic meters of sand will be pumped onto the beaches of Southeast Florida alone during the next 50 years. Although designed to minimize negative impacts, sand from renourishment projects can and does scour and bury worm rock and other hard-bottom habitat. In most cases mitigation of this habitat loss is required, generally through the deployment of materials such as concrete and limestone. But these efforts have often been unsuccessful because of variation in worm recruitment and limited knowledge of the factors that control recovery of worm communities.

Past research has clearly shown that *P. lapidosa* often settles in response to contact with the tubes of adult worms, and some work suggests the species will also settle in response to butylated hydroxytoluene (BHT), which may mimic a chemical used by worms during tube construction. One major goal of this project was to study whether coating artificial reef structures with BHT would lead to higher worm recruitment, thus offering the potential to improve mitigation efforts tied to renourishment activities. Another goal of the work was to look at the impacts of hydrodynamics on worm recruitment.

The researchers achieved these goals by deploying limestone settlement plates at a variety of Florida beaches, then recovering them to measure recruitment. Though many plates did show substantial recruitment, the group did not find that BHT had a significant effect. They were, however, able to identify potentially important settlement patterns. The work suggests that hydrodynamics has a greater effect on settlement than chemical cues, with preferential settlement in more turbulent, shallower areas. The researchers also found that recruitment peaks in Florida during the fall and winter, and that recovery rates for worm reefs are likely to be quicker in the more northern sections of the Florida coast.

Because so little information about *P. lapidosa* has been available, these results should be helpful in guiding the design of future mitigation efforts, thereby improving overall success rates of beach renourishment projects in Florida.

**IMPACTS:** The results of this project will help guide managers in planning more effective mitigation for the loss of essential worm rock hard-bottom habitat caused by beach renourishment projects on Florida's east coast.

**R/C-E-54, PREDICTING IMPACTS OF COASTAL HABITAT DEGRADATION ON AN ECONOMICALLY IMPORTANT FISH:** Recreational saltwater sport-fishing is a major economic driver for Florida, bringing in some \$2 billion in annual revenue. Despite this economic value, for most species, neither nursery habitats nor their connectivity to adult populations have been determined. This ongoing project is aimed at addressing that problem specifically for common snook, *Centropomus undecimalis*, one of the state's most popular sportfishing targets.

A primary objective for the project is to establish a system for reliably gauging survivorship of the juveniles in each creek. To do this, the team deployed in each creek three electronic tag-reading devices (radio frequency identification tags or RFIDs), which can register when a fish with an RFID tag swims nearby.

If the ratio of tagged fish in a creek to the number of times tags are read is lower, it indicates that either juveniles in that creek have lower survivorship, or that they are leaving the creek. If the more degraded creeks show lower ratios, this would suggest that creek degradation adversely affects snook populations.

So far, the group has tagged more than 3,000 juvenile snook less than one year old from four different mangrove creeks in the Charlotte Harbor area. Two were designated as more degraded and two as less degraded, based on aerial photography and other analyses of each creek's degree of urbanization. All the creeks are in the same hydrological zone, though, suggesting they should get similar supplies of snook larvae.

The antenna arrays are logging readings for about 40 percent of the tagged fish, as compared to the conventional technique of physically recapturing tagged fish, which only has a success rate of about 5 percent.

A second objective for the project is to better understand the connections between juvenile nursery habitat and adult populations found outside the creeks. For this component of the work the group must rely on physical recapture. Several local fishing guides have been equipped with RFID readers, so they check caught fish for tags. This has resulted in 4 recaptures to date. The group is planning to expand this effort by seining for the fish in collaboration with the FWC Fish and Wildlife Research Institute.

In addition to providing specific evidence of juvenile-adult connections, the recaptured fish could prove another measure of creek degradation impacts, for instance if demonstrably more recapture fish come from the less degraded creeks.

Ultimately, the goal for this and related research projects will be to use the information to improve resource management efforts. If there does appear to be a strong relationship between creek

water quality and the size and health of juvenile populations, researchers will then be able to build a predictive model of the effects of watershed alteration on the snook fishery. The techniques developed will also be helpful in guiding work with other fish populations, as evidenced by requests from a number of research groups for information about the project.

**IMPACTS:** This ongoing project has already developed a new and effective means for tracking tagged juvenile snook. Information from this tagging work should ultimately help managers understand the impacts of degraded water quality on snook populations, thus helping them to better plan measures to conserve this species and the habitat upon which it relies.

**R/C-E-55, PROJECTED REORGANIZATION OF SEAGRASS COMMUNITIES IN RESPONSE TO ALTERED FRESHWATER FLOW IN FLORIDA BAY:** Predicting the response of marine benthic communities in the Florida Bay and Everglades ecosystems is of critical importance for local, state and federal water managers charged with implementing the Comprehensive Everglades Restoration Plan (CERP), which aims to restore the natural volume, distribution, and timing of freshwater inputs to provide salinity patterns that will sustain seagrass beds. This project is supporting this management effort by developing a model to predict the spatial distribution of seagrass beds in Florida Bay based on anticipated changes in freshwater delivery. Initial model results indicate that mean salinity, salinity variability, the amount of light reaching the benthos, mean nutrient concentrations, and sediment depth are important predictor variables for seagrass presence and composition. The results of this model will be used as input to a GIS analysis to create maps of seagrass community composition and density before and after predicted changes to salinity and nutrient climate. Results from this ongoing project will be used by the National Park Service to help select among alternative water management strategies.

#### ***Extension Activities***

**Verlinde/Hazell/Diller/Creswell/Jackson** implemented programs to enhance and restore coastal and marine habitats (e.g., dune, mangrove, oyster, reef, seagrass and turtle habitats) and improve water quality (e.g., beach cleanups; habitat restoration events – dunes, beaches; Living Shorelines 101 community education course; Florida Master Naturalist Program; monofilament recycling program; law enforcement workshops on protecting birds, sea turtles, and turtle habitats; Earth Day Event; Ft. Myers Boat Show – “responsible boating protects seagrasses”; derelict crab trap cleanup program; Pelican Rescue Techniques Workshop; Santa Lucia Reef cleanup).

**Mahan/Verlinde/Staugler/Hazell/Cameron/Fluech/Stevely/McGuire/Fletcher** increased scientific, industry, agency and local government knowledge about water quality and marine ecosystem resources by organizing and participating in symposia, conferences, and trade meetings; producing publications, serving on committees and advisory boards; and participating in workshops (e.g., SW Florida Latino Environmental Education Network Newsletter on monofilament recycling; UF Extension Professional Association Conference; Regional Water Academy; Water Quality Protection Program; Conference on Ecosystem Services; International Coral Reef Symposium; Greater Everglades Ecosystem Research Symposium; see also above activities).

**Mahan/McGuire/Verlinde/Creswell** educated elected officials, teachers and the public on environmental issues associated with invasive species (e.g., radio appearance on invasive species; Marine Resources Council Seminar Series – “Florida’s Marine Invasives”; Caribbean Food Crops Society Invasives; Friends of Barefoot Beach lecture; International Coral Reef Symposium – “preventing the spread of marine invasives”; Master Gardener Class – aquatic invasives; Flagler News Tribune – “invasive pests”).

### **Extension Program Highlights**

**Bryan Fluech** – Fluech collaborated with the U.S. Fish and Wildlife Service South Florida Coastal Program, Rookery Bay NERR, and the Gulf of Mexico Alliance to host a Living Shoreline Workshop in Naples in May. More than 90 people from academia, biology, code enforcement, permitting and environmental management professions attended the full-day session. Sixteen speakers covered the fundamentals of living shorelines and shoreline alternatives including cost, maintenance, Florida-specific coastal processes, permitting and regulatory requirements as well as funding opportunities and best practices. Ninety-four percent of the attendees indicated that they increased their understanding of Living Shorelines as an erosion control strategy and 74 percent indicated that they increased their knowledge of the regulatory considerations for Living Shorelines projects. Eighty-five percent said that they would incorporate what they learned in their work. Examples included educating clientele on shoreline stabilization alternatives, collaborating more with regulatory agencies on potential living shoreline projects, and implementing recommended living shoreline practices. Fluech helped coordinate planning meetings, recruited speakers, and facilitated the workshop.



**LeRoy Creswell** – With the help of over 40 volunteers, and in collaboration with the St. Lucie County Artificial Reef program and the Florida Oceanographic Society, Creswell helped to establish an oyster reef off of a spoil island in the Indian River Lagoon. The project used about 800 mesh bags filled with oyster shell collected from local area restaurants to form an intertidal oyster reef that will eventually attract oyster larvae and repopulate the area with these filter feeding mollusks. Oyster reefs not only provide suitable habitat for fish and other marine life, but new oysters will help improve the water quality of the Indian River Lagoon because of their ability to filter copious amounts of water through their gills. The completed reef will be monitored quarterly for the next two years.



**Goal 2. Create a citizenry of all ages that is scientifically literate and environmentally engaged who act as stewards of the coastal environment.**



Creating a scientifically and environmentally informed citizenry of all ages is essential as Floridians find an acceptable way to satisfy the demands for coastal resources while protecting their environmental integrity. Activities under this goal will help instill an environmental ethic among Floridians of all ages through formal and informal learning and training opportunities.

**Objective 1.** Provide formal K-12 education programming and informal learning opportunities to increase environmental and coastal science literacy among elementary, middle and high-school teachers and their students.

### ***Extension Activities***

**McGuire/Verlinde/Saari/Staugler/Hazell/Cameron/Fluech/Diller/Creswell/Sweat** developed and taught marine environmental curriculum to educators and youth at schools (e.g., marine science class, 4-H summer camps, and K-12 events/class field trips).

**Spranger** developed and implemented a formal educator workshop as part of the Coastal Gulf of Mexico Center for Ocean Science Education Excellence.

### **Extension Program Highlights**

**Bryan Fluech** – In an effort to engage and excite under-privileged youth about marine science, Fluech has been working with Manatee Middle School in East Naples to host and instruct an 8-week afterschool marine dissection program for migrant farm worker students. 4-H provided funding to support the program, and the education coordinator from Rookery Bay NERR is providing assistance. The goals of the program are to increase student’s knowledge of representative marine taxonomic groups and enhance their science process skills through the use of dissection, classroom activities, and field experiences. The program has also served as an opportunity to expose students to different marine career choices related to the content being studied. Nine students are enrolled in the program and they have dissected a sea anemone, squid, sea star, blue crab, and a spiny dogfish. Following the dissections, students are taken on two field trips to collect, identify, and classify the specimens they catch using seine nets and an otter trawl. Each student is required to keep a journal to record notes, sketch and label their dissected specimens and reflect on their involvement in the program. Besides the journals, student progress is assessed by using pre/post test scores and a post-program evaluation. The program was featured on the front page of the Neapolitan Section of the Naples Daily News- <http://www.naplesnews.com/news/2009/mar/28/turning-oh-gross-so-cool-scientists-using-marine-l/>.



**Maia McGuire** – Formal educators (K-12 teachers) have many demands on their time and often have limited resources available to them. This makes it challenging for teachers to find hands-on classroom or field activities to use with their students. In February, 2009, McGuire partnered with the

UF/Whitey Laboratory for Marine Biosciences' educator to hold a teacher workshop. Seventeen teachers from thirteen schools/institutions participated in the 4-hour workshop (where they learned about marine invertebrates), a classroom lab teaching the connection between the sense of smell and the sense of taste, plankton sampling, and a series of beach activities including beach slope profiling, long-shore current measurement and sand analysis. Teachers were told about Florida's marine educators' collecting permit and were given information about upcoming collecting permit trainings. Teachers were given CDs which contained additional curricula and resources. All of the teachers indicated on post-workshop evaluations that they had learned new information and would be able to use some of the activities with their students. One teacher commented that it was an "excellent workshop with a lot of useful information to take back to the classroom and put to use."

**Objective 2.** Increase marine environment and coastal science literacy of citizens through formal and informal communication and teaching/learning opportunities.

### ***Extension Activities***

**E/T-9, SOUTH FLORIDA MARINE ECOSYSTEM OUTREACH PROJECT:** **Spranger/Fletcher** helped to design and deliver an education and outreach plan that uses new decision-support tools (e.g., automated "Decision Theater" technology) to educate the public on natural systems and human impacts in South Florida. The study area includes the Everglades, Florida Bay and the Florida Keys. This ongoing outreach program focuses on natural systems, their connections, and how they respond to human activities.

**Mahan/McGuire/Verlinde/Staugler/Hazell/Fluech/Diller/Creswell/Fletcher/Leonard/Stevley** advised citizens of actions that they can take to reduce and monitor environmental/water quality impacts (e.g., pesticides and fertilizers), through consultations, seminars, media events and other communication opportunities.

**Verlinde** helped to coordinate the development of a new marine education learning facility in Santa Rosa County to support local community marine education programs.

**Hazell/Fluech/Diller/Leonard** taught coastal modules for the Florida Master Naturalist Program.

### **Extension Program Highlights**

**Maia McGuire** – The Southeastern United States has been experiencing drought conditions for the past several years. Each person in Florida uses about 120-150 gallons of water per day; more than half of this is used outdoors on lawns and landscapes. Many Florida residents are not aware of the many simple ways that they can conserve water. McGuire developed and implemented an adult day camp program called "Exploring our Environment—From the Ocean to the River" in 2008. During this program, participants learned about water conservation methods ranging from capturing cold shower water to use for watering plants and animals to using rain barrels for non-potable water. In December 2008, 62 participants who had taken the class were asked to complete an online survey. Of the 21 adults who completed the survey, sixteen stated that they had changed their water use practices as a result of

participating in the class. These changes included reducing their water use in the shower, toilet or sprinkler. Three participants reported saving money on their monthly water bill—from \$50 to \$240 per year. One person reported a reduction in water use of 10%. Twenty participants reported that they have made changes that will reduce their contribution to storm water pollution or marine debris. Eighteen people reported that they now pick up trash when they visit the beach; 17 stated that they now use reusable bags instead of plastic bags when shopping.

**Chris Verlinde and Andrew Diller** – Verlinde and Diller coordinated and taught at the 3<sup>rd</sup> annual seventh grade fishing field trip with Woodlawn Beach Middle School. Working with Coach Pete Della Ratta and many volunteers from the community, they provided activities for more than 300 seventh graders over three days. Activities included: boating safety, “eat an estuary,” marine explorations, a touch tank, water quality instruction, mosquito control and two stations that included hands-on fishing at the Shoreline Park South pier in Gulf Breeze. The following is from one of the students, written in English class: “Yesterday, my class went on our only field trip this year, fishing. Our 7<sup>th</sup> grade fishing trip highlighted a great year. The breeze blew and the sun beat down, burning every face unprotected.



The waves rolled by fiercely and not many fish bit, though I had fun anyways. Boat safety tips sank in our brains, and then we made edible estuaries with delicious vanilla pudding and sweet brown sugar. Our group, fascinated by the water experiments, loved that station. Amazed when walking the beach, we learned new things about what we usually see. Above all, the trip educated me on awesome things.”

**Chris Verlinde** – Verlinde will assist in the development of classes and community events for the Navarre Beach Marine Science Station, located at the Navarre Beach Park in Santa Rosa County. This unique new coastal field station is operated in a partnership with the Santa Rosa County (SRC) Board of County Commissioners and the SRC School Board. The facility will be the focal point of marine, natural resource and watershed education for Northwest Florida K-16 students, 4-H members, scout groups and the community for years to come. The SRC school board will manage the science station. High school and dual enrollment marine science classes and community events will be offered. Funding for the establishment of the station was obtained from a Gulf of Mexico Alliance Environmental Education Grant, a Toyota Tapestry Grant and a Florida Sea Extension Enhancement Grant. Navarre Beach Park offers 130 acres of sandy white beaches, lush wetlands, and native vegetation. One-third of the park is completely undeveloped and will remain in its natural state. The facility, located on Santa Rosa Island, adjacent to the Gulf of Mexico and the Santa Rosa Sound, is ideal for a marine science program.

**Objective 3.** Promote citizen involvement in the protection, restoration, and enhancement of coastal ecosystems and habitats, including volunteer-based monitoring, cleanups, restoration projects and use of best management practices.

### **Extension Activities**

**Verlinde/Staugler/Hazell/Cameron/Diller/Creswell** increased citizen knowledge about human impacts to coastal and marine resources and habitats (e.g., stormwater runoff) and interventions by organizing and developing programs and short courses for adult education, and by organizing citizen involvement in beach and waterway community cleanups (e.g., crab trap removal program) and restoration projects (e.g., dune; mangrove; oyster reefs) to enhance coastal ecosystems.

**Fluech/McGuire/Verlinde/Staugler/Hazell/Fluech/Diller/Creswell/McGuire/Cameron** implemented a statewide effort to increase citizens' understanding of the importance of monofilament recycling and increase citizens' use of recycling devices through extension and outreach).

### **Extension Program Highlights**

**Betty Staugler and Joy Hazell** – Staugler and Hazell conducted, in cooperation with the area's commercial crabbers, three volunteer blue crab trap cleanup events during the gear closure for the Southwest Florida region. A goal of the event was to build local capacity among commercial fishers to conduct future cleanup events. This event strengthened the relationship between FSG, the Florida Fish and Wildlife Conservation Commission and the area's commercial fishermen. The event built upon a training exercise and 'train the trainer' held in Charlotte County on April 6th, 2009. To date, more than two hundred derelict traps have been recovered from Charlotte Harbor, including Lemon Bay to Estero Bay, and the Peace, Myakka and Caloosahatchee rivers during the three events. Additional events have been planned for the Florida Panhandle area to coincide with its gear closure in January 2010.



**Betty Staugler** – Staugler coordinated the 1<sup>st</sup> Great Bay and Sound Scallop Search during September, 2009, a resource-monitoring program where 139 volunteers snorkeled, looking for scallops in select areas within Gasparilla Sound and lower Lemon Bays of Charlotte County.

The purpose of this program is to document the status and monitor the health of the bay scallop population which suffered a collapse during the 1980s due to degraded water quality and declines in seagrass coverage. In the last couple of years, bay scallops have once again been observed in Southwest Florida waters, an indication that water quality and seagrass conditions are improving. Modeled off of the successful Great Bay Scallop Search conducted in Tampa Bay since 1993, the search was designed to be a fun family event.



The morning of the event, volunteers received survey equipment and participated in an orientation on survey methods. They then navigated to assigned locations where they deployed transects, snorkeled and counted live scallops. Volunteers recorded transect location, scallop counts, seagrass type and density, and other pertinent information on data sheets. Volunteers surveyed 111 transects during the event which covered a thirty-one nautical mile square area. End of event surveys determined that participants increased their ability to correctly identify bay scallops by 27% and the three seagrass species common to the area by 39%. Participants ranked the onsite training a 9.1 on a scale of 1-10 (10 the highest ranking).

This year's scallop search was an important step towards establishing baseline conditions for scallops in Lemon Bay and Charlotte Harbor. The data provides important management information for scientists where no data existed – for example, Staugler used GIS to map and evaluate the density of scallops observed along established transects within one square mile grids. Another benefit is that the event allows citizens to be a part of the scientific process for monitoring the health and distribution of scallop populations. The people who volunteered did so for different reasons, but most participated to have fun and give something back to the environmental community.

**Chris Verlinde** – Verlinde coordinated the annual Seagrass Awareness Celebration on April 4<sup>th</sup> at Shoreline Park South, which included hands-on activities allowing participants to learn about seagrass, estuaries and local natural resources. Activities included: make a shark tooth necklace, eat an estuary, seagrass coloring pages, fish painting, know-your-limits fishing game, backyard bass casting, an Easter egg hunt, a touch tank, kayaking, seining and a shark character. Local natural resource agencies and groups also participated. More than 150 children and adults attended this annual event.

#### **FOCUS AREA 4 – CLIMATE CHANGE: IMPACTS AND ADAPTATIONS**

**Goal 1. Widespread understanding of the processes of climate change and their effects on coastal ecosystems and human-built coastal communities, and use of effective strategies for adapting to change.**

Climate change has the potential to significantly impact Florida's coastal communities and its coastal and marine ecosystems. The National Oceanographic and Atmospheric Administration (NOAA) recently has recognized climate change as a critical area for research and extension, the State of Florida has recently formed a Climate Task Force to provide recommendations to the Governor, and major metropolitan areas now are developing plans on how to adapt to such things as rising sea level. FSG will play a role in providing the research, extension and education necessary to better inform citizens and local governments regarding the possible and probable impacts of climate change and the suite of adaptations that can minimize impacts on both society and natural coastal and marine ecosystems.

FSG will coordinate climate change activities with regional and national initiatives, local government plans, and state programs by drawing on its statewide network of marine extension agents and specialists, and by acting as a conduit for expertise sourced throughout Florida's public university

system and marine research laboratories. FSG's climate change programming is guided by objectives and strategies identified in the 2009-13 FSG Strategic Plan.

**Objective 1.** Help prepare coastal residents to effectively respond to climate change.

#### ***Extension Activities***

FSG has formed a climate work action group (WAG) comprised of agents and specialists devoted to incorporating climate change into already effective formal and informal education and outreach programs, targeted to a variety of lay audiences (e.g., community leaders, K-12 youth, 4-H, etc.).

FSG helped to develop an introduction to the effects of climate change on Florida's ocean and coastal resources. This publication of the Florida Oceans and Coastal Council is geared towards policymakers and provides straightforward information about the changes that global warming may bring to Florida's coasts and coastal residents. Copies of the document were provided by FSG to all Florida congressional offices in early 2009, and recently were distributed to the governing boards of the state's five water management districts. The Governor's Cabinet and members of the Florida Legislature also are using this document as an objective source of information regarding the causes and consequences of climate change.

FSG is partnering with the three other Sea Grant programs in the Gulf of Mexico and several NOAA offices to implement a Gulf of Mexico regional climate outreach pilot study to build a "community of practice" within the regional Sea Grant extension network for long-term climate change engagement with coastal residents and decision-makers.

**Objective 2.** Help governments incorporate climate change information and options into planning decisions.

#### ***Research Activities***

Florida Sea Grant is supporting a legal analysis of community Comprehensive Plans and Land Development Regulations (LDR's) to promote alternative growth management and development policies that can help to mitigate the probable consequences of sea-level rise (see impacts under R/C-P-30).

In 2009, FSG participated in a regional collaboration with other Gulf of Mexico Sea Grant programs (Texas, Louisiana, Mississippi-Alabama) that resulted in the funding of a multi-year project for 2010-2011 devoted to hazard resilience and climate change, which will directly impact Florida's coastal communities. The project will evaluate the implications of takings law to develop innovative planning options that Gulf of Mexico coastal communities can implement to mitigate impacts from sea-level rise.

#### ***Extension Activities***

Legal extension, supported by FSG, led to the inclusion of new model climate adaptation policies into the City of Punta Gorda's Comprehensive Plan. As a result, Punta Gorda has been selected by the

EPA to be a climate ready pilot city through the Climate Ready Estuary Program (see impacts under R/C-P-30).

**Objective 3.** Provide information and approaches needed to minimize the loss of coastal and marine ecosystems services due to climate change.

### ***Research Activities***

In 2009, FSG participated in a regional collaboration with other Gulf of Mexico Sea Grant programs (Texas, Louisiana, Mississippi-Alabama) that resulted in the funding of a multi-year project for 2010-2011 devoted to hazard resilience and climate change, which will directly impact Florida's coastal communities. The project will develop a climate change projection model for hurricane flooding, wave action, economic damages and population dynamics.

### **3.0 Program Development Projects**

Program Development projects complement longer-term and more involved Biennial Research projects, which allows Sea Grant to respond quickly throughout the year to timely, short-term applied marine needs; to conduct pilot studies and planning activities that show promise and lead to follow-up projects; to develop academic capabilities at Florida universities that address Sea Grant priorities; or to transfer science to target audiences through novel extension and outreach programming. Research, education, and extension faculty participate through field and laboratory investigations, technical demonstrations, conferences/workshops, and professional development opportunities.

The timely response of FSG-sponsored research and extension faculty to coastal issues of state and national importance – such as evaluating consequences of potential seafood packaging treatments, developing new approaches to fisheries extension and management, or the preparation and response of coastal communities to the traumatic impacts of hurricanes – gives Sea Grant and the university community a unique capability among scientific organizations. This capability has enhanced the reputation of Sea Grant in Florida, as a supporter of creative and applied research and extension. The modest investments in pilot projects often lead to extramural funding and new Sea Grant research and outreach in promising areas that sustain the aquaculture industry, promote seafood safety, improve the health of coastal ecosystems, and promote hazard resiliency and public safety on beachfronts and along waterways.

All program development funded projects must be consistent with the goals and objectives of the FSG Strategic Plan, which in turn is aligned with the Strategic Plan of the National Sea Grant College Program.

The following program development projects were funded during the 2008-2009 period:

**PD-08-01 AND PD-09-1: ELISE B. NEWELL SEMINAR SERIES:** Nineteen seminars at institutions that participate in the FSG network were funded during 2008 and 2009 as a way to increase the skills of faculty and students in ocean- and coastal-related academic disciplines.

## **2008**

- January 17, 2008, University of Central Florida, *From Modis to Mussels: Ecological Forecasting of Coastal Ecosystem Responses to Climate Change*;
- March 21, 2008, Florida State University, *Ecological Forecasting of Intertidal Ecosystems: Triaging the Train Wreck of Climate Change*, Dr. Brian Helmuth, University of South Carolina
- January 28, 2008, Florida Gulf Coast University, *Transverse Structure of Residual Circulation in Estuaries: Implications for Transport of Suspended Particles*, Dr. Arnaldo Valle Levinson, University of Florida
- February 7, 2008, University of North Florida, *Emerging Indicators of Human and Climatically-Induced, Change in Coastal Ecosystems*, Dr. Hans W. Paerl, The University of North Carolina, Chapel Hill
- April 11, 2008, University of Florida, *A Dynamic Model of Intra-Annual Species Selection in Fisheries*, FWRI Laboratory, Cedar Key, *Dynamic Fisheries Models to Predict Target Switching and Improve Management Plans*, Dr. Kurt E. Schnier, University of Rhode Island
- April 18, 2008, Florida Gulf Coast University, *Ciguatotoxicity in the Northern Gulf of Mexico*, Dr. Tracey A. Villareal, University of Texas
- April 23, 2008, Harbor Branch Oceanographic Institute, April 24, 2008, Florida Institute of Technology, *Sex Pheromones in Marine Invertebrates*, Dr. Jörg Detlef Hardege, Hull University, United Kingdom

## **2009**

- January 14 - 16, 2009, University of South Florida, U.S. Geological Survey, *The salt marsh paradigm revisited: a tier III stable isotope and biochemical condition approach to evaluating essential fish habitat; The anthropocene: restoration ecology and coastal management in the age of humans*, Dr. Michael P. Weinstein, Montclair State University
- January 22, 2009, Coastal and Marine Laboratory, Florida State University, *Florida's coral reefs: threats, declines, management, and signs of hope; Climate change and coral reef resilience: are we expecting too much from marine reserves?*, Dr. John Bruno, University of North Carolina
- January 28 and 30, 2009, University of Florida, Whitney Laboratory for Marine BioScience, *Managing the resilience of Caribbean reefs in the face of climate change*, Dr. Peter J. Mumby, University of Exeter, UK
- January 29 and 30, 2009, University of North Florida, *Climate change, sea-level rise, and storms: past, present, and future of our coastal system; A 180 million year record of change: the Atlantic continental margin*, Dr. Stanley Riggs, East Carolina University
- February 6, 2009, Florida A&M University, *Effects of global warming on marine microbial pathogens and human infectious diseases*, Dr. Rita Colwell, University of Maryland Biotechnology Institute
- February 9, 2009, Florida Gulf Coast University, *Hypoxia – spreading dead zones and consequences for marine ecosystems*, Dr. Robert Diaz, Virginia Institute of Marine Science
- February 19, 2009, Florida Gulf Coast University, *Consumer Rule: predator primary in shallow benthic ecosystems*, Dr. Kenneth L. Heck, Jr., Dauphin Island Sea Lab
- February 25-27, 2009, Florida Institute of Technology, Harbor Branch Oceanographic Institute/Florida Atlantic University, *Changing approaches to small-scale fisheries management*, Dr. Robert Stephen Pomeroy, University of Connecticut
- March 6, 2009, Edward Waters College, *Impacts of climate change on life and adaptations to survive*, Dr. Gyaneswor Pokharel, Mountain State University



The following six small-scale projects were funded during 2008 with program development funds.

**PD-08-3. PRELIMINARY GENOMIC SEQUENCING OF ENVIRONMENTAL VIBRIO VULNIFICUS STRAIN 99-520 DP-B8:** *Vibrio vulnificus* is the leading cause of reported death from seafood in the U.S. However, very little is known about how *V. vulnificus* causes human disease or how such disease can be prevented. There are numerous strains of *Vibrio* some of which can be more lethal than others. This project resulted in the genetic sequencing of a strain of *V. vulnificus* known to be less lethal to mice as a means to compare genetic patterns with more lethal strains, which have already been sequenced. This preliminary research provided a scientific basis for identifying the mechanisms by which this pathogen can cause human disease, thereby, leading to improved detection, treatments, and safer seafood products.

**PD-08-4. MARINE BAITFISH AQUACULTURE: DEVELOPMENT OF CONTROLLED SPAWNING PROTOCOLS FOR YEAR ROUND PRODUCTION OF PIGFISH:** It is estimated that recreational fishermen in Florida purchase more than \$6 million worth of baitfish per year. The aquaculture of high-demand baitfish species can, therefore, be potentially lucrative for producers because the fish need not be cultured to maturity and multiple crops can be produced and marketed per year. This research evaluated various stocking densities to determine which generated the greatest survival rates for the year-round production of the popular pigfish (*Orthopristis chrysoptera*) and pinfish (*Lagodon rhomboids*) baitfish species. This research was a necessary first step because growout at various densities using standard aquaculture protocol is first required to determine if these methods are feasible for commercial production. Overall, both pigfish and pinfish demonstrated excellent growth and survival rates at all stocking densities and, thus, show great potential as new aquaculture species for recreational fishing markets.

**PD-08-5. PRELIMINARY DATA ANALYSIS TO TEST LAND-USE INFLUENCE ON RED TIDE IN CHOCTAWHATCHEE BAY, FL:** Red tides in northwest Florida are associated with fish kills, dolphin deaths, and human health concerns. This program development project used RT-PCR (reverse transcription -polymerase chain reaction) methods to evaluate pre-bloom and post-bloom population dynamics of *Karina brevis* as a basis for understanding the influence of water column physical and biogeochemical parameters on the establishment of red tides in the Florida Panhandle region. The results show that the *K. brevis* can be detected and quantified at levels well below the red tide density allowing resource managers to better predict the conditions (e.g., land use, nutrient loading) which can influence a red tide event.

**PD-08-6. DEVELOPMENT OF A DIAGNOSTIC TEST AND PILOT CROSS INFECTION STUDY FOR NEW EXOTIC PERKINSUS ISOLATED FROM VIETNAMESE TRIDACNID CLAMS IMPORTED INTO THE USA:** Verification of the incursion of exotic *Perkinsus* into Florida coastal waters and the susceptibility of oysters to the exotic *Perkinsus* is of vital State and National importance. This project developed a test to differentiate Vietnamese (*P. marinus*) vs. American (*P. olseni*) species in clams and it determined if new *Perkinsus* organisms found in imported Vietnamese Tridacnid clams can infect and kill domestic shellfish species. The results show that the domestic clam *Mercinaria mercenaria* is resistant to infection by Vietnamese *Perkinsus*. The resistance of native oysters is currently being

determined. This study has provided significant information needed to determine the risk of domestic shellfish to *Perkinsis* and represents a start to developing a response to limit the impact of exotic *Perkinsus* carried by ornamental clam hosts on our native ecosystems and shellfish industries. Information directed to hobbyists and retailers about the potential effects of contaminated imported shellfish is intended to reduce the threat of introduction of these products into natural ecosystems.

**PD-08-7. MECHANISMS OF OYSTER COLONIZATION BY SALMONELLA, A MODEL HUMAN PATHOGEN:** This project evaluated mechanisms of oyster colonization by the *Salmonella* pathogen. Twenty genes that promote *Salmonella* colonization in oysters were identified, thereby, offering an opportunity to develop treatments (temperature, salt concentration) or chemicals that can be used in the post-harvest processing of oysters to reduce *Salmonella* bacteria to levels for safe consumption of raw oyster products.

**PD-08-8. MOLECULAR TECHNOLOGIES FOR QUANTIFYING CORAL HEALTH: A WORKSHOP FOR FLORIDA'S REEF RESEARCHERS:** Coral reef health continues to be an area of critical concern for marine natural resource managers and researchers. Traditionally, physical signs or physiological responses have been measured to assess coral health. However, most physiological measurements do not identify the stressor or the underlying molecular mechanisms causing the response. DNA microarrays represent a new and unique tool for evaluating coral health because changes in gene expression can precede, underlie, and control changes in the physiological well-being and functional adaptation of coral species. This project implemented a workshop that provided training, instruction, and discussion on emerging molecular technologies in coral reef health and disease. The workshop, which targeted government scientists and resource managers, successfully introduced new technologies and techniques to evaluate coral reef health through hands-on training exercises.

The following nine small scale projects were funded during 2009 with program development funds.

**PD-09-2, TIMELY MARINE SCIENCE FACULTY SUPPORT:** Conferences, workshops and travel to conferences and workshops were supported for FSG researchers and potential researchers, and FSG Extension and Communications faculty. The activity was supported where it was consistent with priorities, established in the 2006-09 FSG Strategic Plan.

**PD-09-3, REOPENING A TIDAL PASS: IMPLICATIONS FOR WATER QUALITY AND SEAGRASSES:** This project will fulfill a critical information gap, taking advantage of a unique opportunity related to re-opening of a tidal pass (inlet) by broadly and critically assessing the impacts of the hydrologic restoration on adjacent water quality and its associated cascading effects including sedimentation, flow and nearby critical habitats.

**PD-09-4, BLUE CRAB TRAPS REMOVAL EXERCISE AND DEVELOPMENT OF GUIDELINES FOR STATEWIDE CRAB TRAP REMOVAL:** The proposers are working with area commercial crabbers on a blue crab trap removal exercise and training. They are working in partnership with FWC to develop guidelines for conducting volunteer blue crab trap cleanup events, in a short time, over large regions. The guidelines will explain the state protocols for permitted trap removal, and include opportunities for

funding, strategies for identifying cleanup locations and coordinating multiple groups within a geographic region to maximize coverage and avoid overlap. They are developing materials to educate the public about the need for cleanup events, explaining the role that commercial fisheries play in marine resource stewardship and training potential coordinators. The process will continue to be improved through formation of a Sea Grant action group that will meet to exchange information between regional coordinators.

**PD-09-5, DEVELOPING INITIAL EFFORTS TO ENGAGE SOUTHWEST FLORIDA'S HISPANIC RECREATIONAL ANGLERS IN SUSTAINABLE FISHING PRACTICES:** This project is gathering information about the fishing knowledge and behavior of Hispanic recreational anglers through the use of focus groups. Spanish-speaking anglers have been identified by state and federal fishery management agencies as a key audience in south Florida. Project outcomes will include the motivations causing Hispanic individuals to engage in saltwater angling; the extent of Hispanic angler's knowledge/compliance with state/federal saltwater fishing regulations and conservation methods; the best means of educating/reaching out to English and non-English speaking Hispanic recreational anglers; and what social and cultural barriers prevent English and non-English speaking Hispanic anglers from engaging in sustainable angling practices.

**PD-09-6, ENGAGING THE PUBLIC IN PLANNING FOR RECREATIONAL WATERWAY ACCESS IN A RURAL COASTAL COUNTY:** This project is engaging state, regional, and local stakeholders in a decision process to plan for public waterway access in Taylor County. Project outcomes will include information on the locations, characteristics and capabilities of the county's public waterway access facilities to support the marine-based recreational activities and needs of county residents; an assessment of the demand for waterway access versus the existing supply, and recommendations on how to address public waterway access needs.

**PD-09-7, HARD CLAM PRODUCT CHARACTERIZATION WITH SENSORY PROFILING FOR QUALITY ATTRIBUTES, SHELF-LIFE AND APPELLATIONS:** This project is developing a formal, science-based sensory profile to characterize aquaculture hard clams, *Mercenaria mercenaria*, relative to harvest locations, seasons and duration of storage. It is also demonstrating the utility of the sensory profile in assessing product quality, shelf-life and appellations that foster market opportunities and values for farm-raised hard clams, with particular attention for hard clam production in Florida.

**PD-09-8, CONSERVATION THROUGH EDUCATION: MEANINGFUL WATERSHED EXPERIENCES AT THE NAVARRE BEACH MARINE SCIENCE STATION:** This project is providing experiential learning opportunities for community leaders, county decision makers, 4-H and youth, Florida Master Naturalists and Florida Master Gardeners. Using kayaks to get the target audience on the water to experience local coastal resources first hand will lead to informed decision making based on sound scientific information and an informed citizenry that understands the value and vulnerability of coastal and marine resources.

**PD-09-9, RIP CURRENT SYMPOSIUM:** The intent of the symposium, scheduled to take place during 2010, is to provide a forum to better understand and communicate the physical, social, and legal dimensions associated with rip currents as inputs to improving beach and water safety.

**PD-09-10, CARBON FIXATION BY HARD CLAM AQUACULTURE IN FLORIDA:** Bivalve mollusk growers consider their industry to be environmentally sustainable in terms of water quality, but some preliminary analysis suggests that bivalve aquaculture may also address the issue of excess atmospheric carbon dioxide. Mollusks fix carbon in refractory proteins that are part of their shells but, more significantly, the shells themselves are 12% carbon by weight. These provide very long-term carbon sinks, much longer than other agricultural products, with rates of fixation comparable to that of softwood forests. Simply calculating the shell produced by marketable product, however, underestimates the carbon fixation rate, because of the fractions resident in non-harvested product and other organisms (other bivalves, barnacles, etc.) associated with the aquaculture process. The investigators will document and quantify the sources of refractory organic carbon and mineralized carbon in Florida hard clam aquaculture.

***International Programming:***

**Indonesia**

**Mike Spranger**, FSG Associate Director of Extension, led a UF team in 2008 that participated in the 4<sup>th</sup> annual NOAA-MMAF Capacity Building Workshop. **Betty Staugler**, Charlotte County Marine Agent, was also a member of the team. These workshops brought U.S. and Indonesian government officials and researchers together to share applications of science and outreach to local decision making regarding the use and protection of marine resources. The team also met with representatives of three Indonesian universities and established formal cooperative agreements to facilitate academic development and collaboration among the institutions. Spranger was also an invited member of the NOAA delegation and speaker at the World Ocean Conference in Indonesia in 2009. More than 3,000 individuals from 80 countries attended the event.

**Thailand and Vietnam**

At the invitation of Kasetsart University in Bangkok, marine extension economist **Chuck Adams** spoke to marketing students on recent trends in world seafood supplies, emphasizing talks between the U.S. and Thailand over seafood trade disputes and recently imposed tariffs, and also the growing dependence of the U.S. market on seafood culture in Southeast Asia.

**Ireland**

**Bill Mahan**, Franklin County marine extension agent, visited marine aquaculture and research facilities in Ireland's coastal communities. He also spent time with members of the Donegal Community Development group who had visited Florida and the town of Apalachicola in 2006 to study a community's transition from a commercial seafood-based economy to a more tourism -based economy.

**New Zealand**

**John Stevely** worked with scientists at the New Zealand National Institute for Water and Atmosphere Research to analyze 15 years of data on sponge population recovery in the Florida Keys,

following an extensive sponge mortality. The team documented that the impacts of the mortalities are long-lasting — over 15 years was required for sponges to recover to prior abundance levels. In contrast to other studies, the team found that the abundance of some species of Keys sponge populations change from year to year, and that sponges can be resistant to the impacts of hurricanes, but particularly susceptible to harmful algae blooms.

#### 4.0. NEW DIRECTIONS

FSG is moving forward with a number of initiatives under its new 2009-2013 Strategic Plan. In 2009, FSG-affiliated environmental law faculty initiated a multi-faceted program to allow coastal communities to incorporate sea-level rise into their land-use policies and actions. Law faculty will work with selected coastal communities as ‘climate test beds’ for implementation of adaptation strategies for sea-level rise. In a related effort, the Director will work with local decision makers to help them become better informed about the wide range of impacts to Florida’s coastal zone expected to result from climate change.

Building on a successful collaboration related to catch-and-release fishing, FSG will partner with the Florida Fish and Wildlife Conservation Commission in the upcoming year to develop a protocol for volunteer groups to conduct derelict crab and lobster trap removal events.

Finally, following the success of Gulf of Mexico regional collaborations, the Sea Grant programs of North Carolina, South Carolina, Georgia and Florida are identifying issues of common concern that also are a priority of the South Atlantic Governor’s Alliance, as the basis for possible cooperative research and outreach for implementation by 2012.

FSG management has also engaged its new advisory council to develop strategies for identifying extramural programmatic support. Strategies include the development of mutually beneficial partnerships with key agencies that share common goals.

#### 5.0 FUNDING

<b>FSG Budget 2008 – 2009:</b>		
--------------------------------	--	--

Funding Area	Total (dollars)	%Total
Research	1,854,085	38
Outreach and Education	2,250,108	47
Communications	276,449	6
Administration	441,409	9
<b>Total</b>	<b>4,822,051</b>	<b>100</b>

#### Leveraged Funds:

FSG sponsored researchers are required to obtain a 50% match in non-federal funds as a supplement to the FSG core funding allocated for their projects. For 2008-2009 this translated to a combined research portfolio (i.e., core and match funding) in the amount of \$1,854,085. Many of the investigators supported by FSG also are able to leverage core and match funds by successfully

competing for other extramural funding (e.g., private industry; National Science Foundation (NSF) grants) to continue existing projects or to address complementary research needs. For example, one FSG-sponsored researcher recently received a \$1.4M NSF grant to continue research on the *Panulirus argus* Virus 1 virus which is killing Florida spiny lobsters and impacting the industry.

FSG requests information on the source and amount of extramural funding through a mandatory annual research reporting process. Investigators who had ongoing projects during 2008-2009 reported that they were able to leverage FSG and match dollars by an additional \$4,819,455, which translates to five times the original non-matched FSG investment of \$927K, and underscores the importance and relevance of research sponsored by FSG.

## 6.0 INSTITUTIONS INVOLVED

For 2008-09 eight of 16 institutions (both public and private) participated through the receipt of FSG core funding for annual projects. In addition, 20 counties participated by sharing the support for county-based extension positions. A complete listing is in Table 1.

Table 1. FSG program participants in NOAA funded core 2008-2009 projects.

<p><b>ACADEMIC/RESEARCH</b></p> <p><i>Florida Institutions</i></p> <p>Florida Atlantic University          Florida Institute of Technology          Florida International University          Harbor Branch Oceanographic Institute          Mote Marine Laboratory          Nova Southeastern University          University of Florida          University of West Florida          Florida State University          University of South Florida          University of West Florida</p> <p><i>Cooperating Institutions</i></p> <p>Appalachian State University          Old Dominion University          Smithsonian Institution          University of Georgia</p> <p><b>GOVERNMENT</b></p> <p><i>State</i></p> <p>South Florida Water Management District          Florida Fish and Wildlife Conservation Commission</p>	<p><b>INDUSTRY</b></p> <p>Symbio Co.</p> <p><b>PARTICIPATING COASTAL COUNTIES</b></p> <table style="width: 100%; border: none;"> <tr> <td>Bay*</td> <td>Hernando</td> <td>Pinellas</td> </tr> <tr> <td>Brevard*</td> <td>Hillsborough*</td> <td>St. Johns*</td> </tr> <tr> <td>Broward</td> <td>Indian River</td> <td>St. Lucie*</td> </tr> <tr> <td>Charlotte*</td> <td>Jefferson</td> <td>Santa Rosa</td> </tr> <tr> <td>Citrus</td> <td>Lee*</td> <td>Sarasota*</td> </tr> <tr> <td>Collier*</td> <td>Levy*</td> <td>Taylor</td> </tr> <tr> <td>Dade*</td> <td>Manatee*</td> <td>Volusia</td> </tr> <tr> <td>Dixie</td> <td>Martin</td> <td>Walton*</td> </tr> <tr> <td>Duval</td> <td>Monroe*</td> <td>Wakulla**</td> </tr> <tr> <td>Escambia*</td> <td>Nassau</td> <td></td> </tr> <tr> <td>Flagler*</td> <td>Okaloosa*</td> <td></td> </tr> <tr> <td>Franklin*</td> <td>Palm Beach</td> <td></td> </tr> <tr> <td>Gulf</td> <td>Pasco</td> <td></td> </tr> </table> <p>*All 35 listed coastal counties participate via the Florida Cooperative Extension Service. However, 20 have specific Sea Grant agent coverage.          **The IFAS Extension Director is involved in coastal-related activities in Wakulla County, but there is no dedicated agent.</p>	Bay*	Hernando	Pinellas	Brevard*	Hillsborough*	St. Johns*	Broward	Indian River	St. Lucie*	Charlotte*	Jefferson	Santa Rosa	Citrus	Lee*	Sarasota*	Collier*	Levy*	Taylor	Dade*	Manatee*	Volusia	Dixie	Martin	Walton*	Duval	Monroe*	Wakulla**	Escambia*	Nassau		Flagler*	Okaloosa*		Franklin*	Palm Beach		Gulf	Pasco	
Bay*	Hernando	Pinellas																																						
Brevard*	Hillsborough*	St. Johns*																																						
Broward	Indian River	St. Lucie*																																						
Charlotte*	Jefferson	Santa Rosa																																						
Citrus	Lee*	Sarasota*																																						
Collier*	Levy*	Taylor																																						
Dade*	Manatee*	Volusia																																						
Dixie	Martin	Walton*																																						
Duval	Monroe*	Wakulla**																																						
Escambia*	Nassau																																							
Flagler*	Okaloosa*																																							
Franklin*	Palm Beach																																							
Gulf	Pasco																																							

## 7.0 PUBLICATIONS

FSG issues *Publication and Communication Support Guidelines* to all FSG project collaborators, and has an organized process for printing and tracking publications. Documents published “in-house” include Reports, Extension Publications, Technical Papers, thesis or dissertation abstracts, staff papers and other items such as Extension newsletters. Each is numbered and tracked in an appropriate series. Books and journal articles are published elsewhere, but tracked for completion and credit by Communications staff. All publications are distributed to the National Sea Grant Library, housed in the Pell Library at the University of Rhode Island.

FSG also contributes to the Electronic Data Information Source (EDIS), which is the database of online information maintained by the Institute of Food and Agricultural Sciences (IFAS) at the University of Florida. EDIS ([www.edis.ifas.ufl.edu](http://www.edis.ifas.ufl.edu)) provides a collection of information on topics relevant to agriculture, the environment and natural resources, 4-H, Florida-friendly landscapes, and Florida communities.

The EDIS system is a publication management system for providing a comprehensive, single-source repository of all current UF/IFAS numbered peer-reviewed publications. Using the EDIS system, UF/IFAS academic departments develop and maintain a collection of publications available for universal free distribution on the Web and through the Florida Cooperative Extension Service County Offices and Research and Education Centers statewide. From the EDIS Web site, more than 10 million educational print and electronic products are disseminated each year from some 7,000 publication titles. Together, the streamlined publication process, universal access, and print as needed services not only reduce the cost but also expand the impact of UF/IFAS publications.

FSG also maintains a running five-year list of publications sponsored by its research, education extension, communications and management efforts. The list categorizes items as either submitted, in press, or published. Publications are identified according to the categories of eport; Technical Paper; Books and Book Chapters; Journal Articles; Graduate Theses and Dissertations; Extension Publications; Extension Newsletters; Miscellaneous Papers, Articles and Conference Proceedings; and Web sites. Publications identified through annual research and extension progress reports are provided below. Some of the publications developed by county extension agents are collaborations with FSG communications and have been officially tracked (submitted to the Pell Library); others represent county-specific news items, brochures and fact sheets that are not officially tracked by FSG communications.

Table 2. Number of publications (by type) resulting from research and extension programming during 2008-2009.

<b>Type</b>	<b>Number</b>
Peer-Reviewed Journal Articles	29
Proceedings/Symposia	23
Brochure/Fact Sheets	36
Theses/Dissertations	8
Newsletters/Periodicals	37
Newspaper Articles	132
Web Sites Developed/Maintained	11
National Library Downloads of FSG Documents	155,027

## 8.0 STUDENTS

Investment in the future of Florida’s coastal resources requires both capital and labor. Through a wide range of education programs, FSG provides support and training for the next generation of researchers, resource managers, industry leaders, and teachers.

Table 3. 2008-2009 students supported by FSG funded research projects.

	<b>Undergraduate</b>	<b>MS</b>	<b>Ph.D.</b>
College Students Supported	22	40	30
Students Graduated	10	19	5

### Graduate Education:

FSG supports graduate education through the funding of applied marine science and research. The objective is to produce a highly competent workforce which can make major contributions to coastal ecosystem science and management – working in academia, resource management agencies, government, NGOs and the private sector.

Dean John A. Knauss Marine Policy Fellowship: one student was select for 2008 but withdrew. Two students were selected for 2009.

Three graduate students received scholarship funding through private funds in cooperation with the Aylesworth Foundation for the Advancement of Marine Science and the Old Salt Fishing Club.

### Undergraduate Education:

One high school senior received a college scholarship through the FSG Chuck Skoch Scholarship.

### Scholarship Recipients:

Steven Saul is a doctoral student in marine biology and fisheries at the University of Miami Rosenstiel School of Marine and Atmospheric Science. Details of his population dynamics research project are provided above (See E/POPDYN-1 research project for more details).

Melanie King is a recent graduate of the University of Florida Levin College of Law with a specialty in environmental land use law. She earned a Knauss Marine Policy Fellowship, which matches



graduate students with hosts in the legislative and executive branch of federal government in the Washington, D.C. area, for a one-year paid fellowship.

Jennifer DuPont, also a Knauss Fellow, is a Ph.D. candidate at the University of South Florida College of Marine Science. She is working as a program analyst of international activities in NOAA, and recently traveled to the Unmanned Vehicle Systems Conference in Paris, where she delivered a presentation on NOAA's environmental applications of unmanned aircraft systems in the Arctic.

Brian Badgley is the 2008-09 recipient of the Aylesworth Foundation for the Advancement of Marine Science Scholarship and the Old Salt Scholarship. Brian is a Ph.D. candidate in the Biology Department at the University of South Florida.

Zy Biesinger is the 2009-10 recipient of the Aylesworth Foundation for the Advancement of Marine Science Scholarship. Zy is a Ph.D. candidate in the Fisheries and Aquatic Sciences Department at the University of Florida.

Brooke Denkert is the 2009-10 recipient of the Aylesworth Foundation for the Advancement of Marine Science Scholarship. Brooke is a MS candidate in the Environmental Science Department at Florida Gulf Coast University.

## **9.0 PROGRAM AWARDS**

The following awards were presented to various FSG extension and education faculty during 2008-2009.

### **Betty Staugler:**

1. Association of Natural Resource Extension Professionals (ANREP). ANREP silver award for leadership related to the Mangrove Marauders program.
2. Association of Natural Resource Extension Professionals (ANREP). ANREP bronze award for the Web-based Redfish Tracking Project.
3. Florida Association of Natural Resource Extension Professionals (FANREP). FANREP gold award for leadership related to the Mangrove Marauders program.
4. Florida Association of Natural Resource Extension Professionals (FANREP). FANREP bronze award for the Web-based Redfish Tracking Project.
5. Coastal Conservation Association Award for "Conservationist of the Year."

### **Bryan Fluech:**

1. Florida Natural Resource Leadership Institute 2008 "Burl Long Award" for outstanding leadership.
2. Association of Natural Resource Extension Professionals (ANREP). ANREP silver education materials award for a series of newspaper articles.

3. Association of Natural Resource Extension Professionals (ANREP). ANREP bronze award for promotional items.
4. Florida Association of Natural Resource Extension Professionals (FANREP). ANREP conference travel scholarship.
5. Florida Association of Natural Resource Extension Professionals (FANREP). FANREP gold communications award for video.
6. Florida Association of Natural Resource Extension Professionals (FANREP). FANREP silver communications award for newspaper articles.

**Chris Verlinde:**

1. Florida Association of Natural Resource Extension Professionals (FANREP). First place for publication.
2. Florida Association of Natural Resource Extension Professionals (FANREP). Second place for slide presentation.

**Brooke Saari:**

1. Walton County Fair. Second place fair booth award.

**Bill Mahan:**

1. ABC School certificate of appreciation.
2. UF/IFAS Jim App Outstanding Goal Team Award

**Andrew Diller:**

1. Florida Association of Natural Resource Extension Professionals (FANREP). Innovative Program Award.
2. Florida Association of County Agricultural Agents. Search for Excellence in Youth and 4-H Award.
3. ESP Team Award
4. Florida Association of Extension 4-H Agents. Search for Program Excellence Award.
5. Florida Extension Association of Family and Consumer Sciences. Search for Program Excellence Award.
6. National Association of County Agricultural Agents. National 4-H Youth and Development Award.
7. National Association of Extension 4-H Agents. Excellence in Teamwork Award.
8. University of Florida Institute of Food and Agricultural Sciences. Silver IMAGE Award

**Doug Gregory:**

1. Solar Energy Center. Certificate of Achievement for Installing Photovoltaic Systems
2. Solar Energy Center. Certificate of Achievement for Installing Solar Thermal Systems
3. National Marine Fisheries Service, NOAA, DOC. Sustainable Fisheries Leadership Award.

**Robert Swett:**

1. Florida Association of Natural Resource Extension Professionals. Second Place: Outstanding Educational Materials Award for Short Publication. "A Navigational, Historical, and Cultural Perspective of St. Augustine."
2. Florida Association of Natural Resource Extension Professionals. Second Place: Outstanding Educational Materials Award for a Web site. "Manatee Awareness and Protection Resource."

**Charles Adams:**

1. Student Appreciation Award: Institute of Food and Agricultural Sciences, Department of Agricultural Economics, Agricultural Economics Club.

**10.0 OUTREACH ACTIVITIES**

Each year, FSG extension agents complete an Education, Extension, Events report and an Annual Report of Accomplishments. These reports capture and characterize major extension/outreach activities conducted over the past year. The following table highlights the number of attendees at outreach events, the number of hours volunteered by citizens involved in FSG sponsored outreach activities, and the number of radio and TV appearances.

Table 4. Summary of attendees associated with 2008-2009 outreach events.

<b>Outreach Activity:</b>	<b>Number of Attendees</b>
K-16 Teacher Training	701
Seminars/Workshops/Symposia	7,894
Public Presentations	11,31
Professional Development Sessions	569
Programs for Children and Families	4,508
Hours Volunteered by Citizens	2,320
Radio Interviews	63
TV Appearances	8

**11.0 JOBS/BUSINESSES CREATED AND PATENTS**

**Patents:**

1. University of Florida. Paul, V.J., Ross., C., West, L., and Luesch, H. 2008. #12606 "Structure and Antitumor activity of Largazole"
2. University of Florida. Paul, V.J., Ross., C., West, L., and Luesch, H. 2008. UF #12542 "Structures and Elastase Inhibition of Depsipeptides Lyngbyastatins 5-7".

**New Business:**

1. Six small businesses that produce tools for venting fish brought up from deep waters.
2. FSG-sponsored research and extension helped to sustain the Cedar Key and Apalachicola aquaculture industries.
3. FSG research and extension helped to diversify the marine ornamental fish industry by developing methods of rearing two new fish species (Puffer and Angelfish) for the aquarium trade.

4. Two new businesses resulted from solar photovoltaic installation training classes developed and implemented by the Monroe County extension agent in support of a sustainable coastal development initiative.

## 12.0 SELF EVALUATION

FSG annually conducts a self-evaluation that includes both management and administrative measures of accountability. The following information summarizes results for 2008-2009.

### Management Performance Accountability:

1. Conduct a competitive grants process that is open and transparent, resulting in funding rigorous science in areas that will significantly impact Florida's coastal communities and natural resources.

During 2009 a Call for Statements of Interest for 2010-11 research funding was advertised statewide and over 800 faculty at 16 academic institutions in Florida received the advertisement. In response, 96 faculty from all 16 institutions submitted 5-page preliminary proposals. These preliminary proposals were reviewed by research, natural resource management, industry and other subject matter experts within and outside of Florida. All of their comments were considered in deliberations by an out-of-state peer review panel whose members are nationally recognized for their science and program management competencies. Each PI subsequently received a written preliminary proposal evaluation and individual peer reviews. Based on the preliminary evaluation, a total of 25 researchers were invited to submit full research proposals. Full proposals were, in turn, evaluated by subject matter experts within and outside of Florida. This peer evaluation was again complemented by a review from the same independent panel of technical experts invited to critique the preliminary proposals. In 2009, this process resulted in the funding of eight projects with PIs at the University of Florida, Florida State University, Florida International University, Harbor Branch Oceanographic Institute at Florida Atlantic University and the University of South Florida. Each of the eight research projects described below addresses critical issues identified in the 2009-2013 FSG Strategic Plan.

1. Cryopreservation of Florida Sea oats germ plasm: A technology to ensuring long-term availability of site-specific genotypes for dune restoration. Michael Kane. University of Florida.

This project will use micropropagation techniques and develop long-term germplasm storage procedures to preserve sea oats genotypes for plants and seed. This will result in a commercially cost-effective technology for maintaining and producing sea oats seed donor populations for dune restoration. A workshop will train project co-sponsors and user groups in micropropagation and cryopreservation techniques. A high school student dune restoration outreach experience coordinated, in part, by Andrew Diller and Maia McGuire will impart knowledge of the challenges, issues, and science behind ecologically sound dune restoration.

2. Environmental controls on the dynamics of nursery habitat quality for estuarine-dependent fishes. Kevin Craig. Florida State University.

This project will develop a model for resource managers to evaluate how natural and human-induced flow variations in the Apalachicola-Chatahoochee-Flint River Basin and how projected climate change may affect the capacity of Apalachicola Bay to support the production of juvenile estuarine-dependent fishes (e.g., spot). The PI's will also work through the Apalachicola National Estuarine Research Reserve's, Coastal Training Program, the FWC, the NF Water Management District, and a local high school biology/chemistry teacher to develop a "hands on" education module and lecture series to inform middle and high school teachers and students, policy makers, and the general public about the ecology of estuaries and how estuary function can be influenced by anthropogenic activities. FSG agent Scott Jackson will assist in the development and implementation of some of the planned outreach activities.

3. Development of test-based hurricane-induced building interior damage and loss of contents data for improved risk mapping. Arindham Chowdhury. Florida International University.

This project builds upon an ongoing FSG funded research which is evaluating "full-scale" building envelope construction materials and techniques to reduce wind-induced damage using a state-of-the-art Wall of Wind (WoW) facility that can simulate category 3 hurricane wind and rain conditions. This project will determine the impacts of hurricane wind and rain penetration to interior construction materials (drywall, flooring, etc) which will factor into to a re-calibration of the Florida Public Hurricane Loss Model - an industry standard used by insurance companies to assess risk and policy valuation. A multi-faceted outreach agenda that targets high school and undergrad students takes advantage of a number of existing FIU resources (e.g., WoW facility) and outreach programs developed in part by the PI and his program (e.g., Magnet Hurricane Engineering Program being implemented by Dade County's Coral Park Senior High School; FIU college of Civil Engineering Professional Certificate Program in Sustainable Construction). The outreach plan also engages a wide spectrum of end users through industry and agency collaborators (e.g., Federal Alliance for Safe Homes; Disaster Survival House). The proposal states that FSG agent Lisa Krinsky has been contacted to help coordinate/participate in anticipated outreach activities in Miami-Dade County.

4. Structural retrofit for extreme winds of aged wood residential roofs using spray-applied adhesives. David Prevatt. University of Florida.

This project will determine the durability of spray-applied polyurethane foam adhesives to strengthen residential roof construction under high-wind and hurricane conditions. Only limited data exist on how well roofs with these applied adhesives resist uplift from strong winds and promote/react to moisture build-up due to rain penetration. The PI's will work through an advisory panel of industry and agency representatives established for this project to disseminate study findings in the form of a fact sheet and the development of formal design guidelines for the testing and optimal application of these adhesives.

5. Ecosystem-based fishery management: An interdisciplinary approach to evaluating grouper harvest policies. Mike Allen. University of Florida.

This project will develop and implement an ecosystem simulation model to explore the ecological and economic impacts of different harvest policies for grouper in the West Florida Shelf. It will integrate the effects of protected areas, seasonal closures, quotas, and length limits on ecological, economic, and social aspects of the grouper fishery. Outreach will consist of two “gaming” workshops allowing invited industry, agency, and other stakeholder representatives to (1) evaluate biological, ecological, and economic data sources used in the model, and (2) to run a variety of ad-hoc simulated conditions to explore the effects of various policy interventions on economics and impacts to the reef fish community.

6. Eliminating barriers to commercial production of Sunray Venus clams in Florida through enhanced hatchery production, growout site selection, and definition of product attributes. Dr. John Scarpa. Harbor Branch Oceanographic Institute.

This project represents the third phase of a research strategy to determine the commercial viability of the sunray venus clam as a means to diversify the Florida clam aquaculture industry. Project investigators will interface directly with hatchery operators and growers to train them in enhanced production methods. Agents LeRoy Creswell and Leslie Sturmer will be involved in the implementation of workshops that describe hatchery methods. In addition, Otwell and Adams will conduct product quality and attribute evaluations from wholesale dealers and their clients to determine the demand for and marketability of the Sunray Venus clam.

7. Grouper forensics for seafood quality control. John Paul. University of South Florida.

A major challenge facing the seafood industry is confirming the identity of fish products sold in restaurants, seafood markets, and by wholesalers. A commonly “substituted” fish is grouper. This project will develop and validate a grouper-specific nucleic-acid sequence based amplification (NASBA) assay for use in field investigations with a hand-held monitoring / detection device. The expectation is that this device can be commercially developed and provide quick and reliable grouper species identification. The new device will be evaluated by a number of users / benefactors of this new technology including: The Florida Department of Agriculture and Consumer Services (FDACS), Division of Food Safety; Bureau of Food Laboratories; Bama Seafood; Bonefish Grill, Beaver Street Fisheries; Pacific-Coral Seafood.

8. Implementation of *Vibrio* monitoring methods needed to sustain Florida coastal communities. Anita Wright. University of Florida.

This project seeks to develop a rapid and cost-effective test using a new approved multiplex QPCR system for simultaneously detecting and monitoring three pathogenic *Vibrio* species found in fresh and post processed oysters. This new system shows great promise for detecting pathogens in seafood but lacks field testing and integration into current post-harvest processing protocols. The outreach element will address this issue by offering workshops to inform and train appropriate user groups on the QPCR detection methodology via the recently established Oyster Industry Laboratory in Apalachicola and through existing extension programs (e.g., UF Oyster School).

2. Actively engage Florida graduate students in national fellowship competitions.

FSG works with its 16 partnering academic institutions in Florida to identify students who will be highly competitive for national fellowships, and has a strong track record of success in this area. In 2008, FSG sponsored two applicants for the Knauss Fellowship program and both were selected as finalists (See Section 8.0 Students). Three of four candidates submitted in 2009 were selected for the class of 2010. Their names and information will be reported in next year’s annual report.

3. Fully engage in regional and national projects.

During 2008-09, FSG was an active participant in regional research or extension projects or activities in which each participant was investing funds. They are summarized below.

<b>Project</b>	<b>Sea Grant Partner/Agency Partner/Industry Partner</b>
SEACOOS: Southeast Atlantic Coastal Ocean Observing System	University of North Carolina (UNC), University of South Carolina (USC), University of South Florida (USF), University of Miami (UM), Skidaway Institute of Oceanography (SIO), Sea Grant (Florida, Georgia, South Carolina, North Carolina), South Carolina Department of Natural Resources
GCOOS: Gulf of Mexico Coastal Ocean Observing System Regional Association	Over 40 organizations, including FSG have signed the memorandum of agreement to participate in GCOOS.
Fish Extension Programs for the Gulf of Mexico	Texas, Mississippi/Alabama, Louisiana and FSG
Fish Extension Program for the South Atlantic	Florida, Georgia, South Carolina, North Carolina Sea Grant
Regional Center for Ocean Science Education Excellence (COSEE) – Gulf of Mexico	University of Southern Mississippi, Dauphin Island Marine Laboratory, University of Texas Marine Science Institute, Louisiana Marine Science Consortium, Mississippi State University, University of Florida (SG)
Seafood HACCP Alliance (Florida leadership)	Association of Food and Drug Officials; U.S. Food and Drug Administration Office of Seafood; National Marine Fisheries Service; National Fisheries Institute; National Food Processors Association; Interstate Shellfish Sanitation Conference; USDA Cooperative Research; Education and Extension Service; Sea Grant Programs in Alaska, California, Florida, Louisiana, North Carolina, Oregon and Virginia
Gulf of Mexico Regional Research Plan	Texas, Louisiana, Mississippi/Alabama and FSG
South Atlantic Regional Research Plan	North Carolina, South Carolina, Georgia and FSG

**Administrative Performance Accountability:**

FSG has a demonstrated record of success in harnessing the resources of Florida’s academic institutions to design the best possible approach to solving the problems resulting from human interactions with the state’s coastal environment. The role of administration is to help determine the highest priority needs, keep the correct balance of research, education, extension and communication focused on solving the problem or creating the opportunity, recruiting the best talent to work on the issue, securing funds to support the work and tracking progress against performance measures. The following performance measures and associated administrative outcomes in 2008-09 support this role.

1. Long range planning documents in both research and extension are maintained and updated as appropriate to enable the development of highly competitive proposals and to ensure that FSG programs do not duplicate other academic programs.

During spring 2008, FSG management conducted a survey of program stakeholders and Florida citizens to identify and prioritize coastal and ocean issues, and in a two day workshop developed comprehensive goals and strategies for the program’s new Strategic Plan for 2009-2013.

During spring 2008, FSG also developed its annual Plan of Work for 2008-09 which identifies planned research and extension activities in support of strategic planning goals. The work plan allows extension specialists and faculty to plan upcoming activities and provides a mechanism for program management to evaluate the degree to which planned activities are achieved.

This 2008-09 Report of Accomplishments tracks program successes against complementary 2008-09 Work Plan commitments and represents the ninth year of this process. Two summary brochures which highlight 2008-09 program accomplishments and impacts were also produced. The first described new research investments and initiatives that align with strategic planning priorities. The second highlighted program achievements and impacts for the 2008-09 period and was distributed during coordinated annual visits with Florida Representatives in Washington DC. These congressional visits coincide with the annual Sea Grant Association meeting and provide an opportunity for program management to discuss FSG activities, the national program, and new research and outreach initiatives with state representatives.

An annual in-service training and coordination for extension faculty and marine agents was conducted in St. Petersburg, FL (September 2008). Status reports on-going research and extension projects were provided, as well as updates on administrative and budget issues. Extension program plans for 2009 were discussed. This information formed the basis for the 2008-2009 Work Plan.

An annual in-service training and coordination for extension faculty and marine agents was held in Gainesville, FL during September, 2009. The three and a half day meeting focused on highlighting programmatic successes during 2009, and on developing program management, research, and extension plans of work for 2010-11. This information will form the basis for the development of the 2010-11 Plan of Work.

2. Coordinate with the National Sea Grant Office (NSGO), NOAA, to insure that Florida's program is competitive and responsive to national priorities.

FSG continues to evaluate NSGO drafts of program evaluation guidelines and other documents. Constructive feedback is always provided. During proposal preparation, FSG develops a detailed notebook and reviews that information with the program monitor on an ongoing basis, both by telephone and through personal visits to Washington, D.C.

During this period, FSG management undertook a planning process to align the program's research and extension with the NSGO 2009-2013 Strategic Plan. This involved the preparation of the 2009-2013 Strategic and Implementation Plans that developed logic models identifying linkages between goals, objectives, and performance measures for programmatic focus areas.

## **13.0 SUMMARY**

Florida Sea Grant is pleased to showcase these achievements for the 2008-2009 period which contributed to a productive and positive year. They reflect strong connections with FSG's member institutions, and public and private partners to align research, extension and education programs to



address critical state and national priorities. These achievements also attest to the richness and diversity of FSG's research and extension programs which are based on strong partnerships with universities and local governments throughout Florida. These partnerships ensure that FSG research and outreach programming will continue to address the critical needs of Florida's coastal communities, industries, and State management agencies. Please visit the newly updated Florida Sea Grant Web site to learn more about how Florida Sea Grant is making a difference through "Science Serving Florida's Coast."