



GRAY'S REEF - RESOURCE PROTECTION



Sanctuary Leads Fight Against Invasive Lionfish

Gray's Reef organized a meeting of sanctuary leadership from the southeast to formulate a cohesive regional policy to combat the invaders. Staff from the Reef Environmental Education Foundation (REEF), conducted a workshop on the safe capture and harvest of lionfish. Two days were dedicated to collecting lionfish at sites outside the sanctuary; a total of 58 were captured. At one site, 17 lionfish were captured in 14 minutes. The Chairman of the South Atlantic Fishery Management Council was invited and attended the collecting trip.

The sanctuary organized several public outreach events about various lionfish issues, focusing on their predation on commercially and recreationally important fish like groupers. Lionfish were also a topic of a Sanctuary Advisory Council meeting where the captured tasty lionfish were served up fried and grilled.

Gray's Reef supported the Georgia Aquarium's lionfish collection effort for a new exhibit on marine invasive species in the Atlanta facility. The sanctuary is prominently featured in the exhibit as well as in a lionfish exhibit in the University of Georgia Marine Extension Aquarium. Gray's Reef facilitated the making of a short film on lionfish, "Ocean Invaders," which won a BLUE Ocean Film Festival award. The film is being shown in various marine institutions across the country. Several print and television stories were generated by the lionfish outreach effort.



Gray's Reef is a Sentinel Site for Climate Change Study

Carbon cycling on the continental margins is poorly understood and is under-sampled to the point that it is uncertain whether these regions are a net sink or a net source of CO₂ to the atmosphere. The coastal environments directly interact with terrestrial air masses, and because of their sensitivity to changes in wind, river runoff and anthropogenic inputs of nutrients and carbon, are likely to be very sensitive to climate change.

The Gray's Reef data buoy is one of only seven buoys world-wide that has surface and subsurface CO₂ monitoring capacity and has been collecting data since 2006. The bottom mounted sensor collects data and must be retrieved every two to three months to download the data.



GRAY'S REEF – RESOURCE PROTECTION

Spearfishing Gear Ban

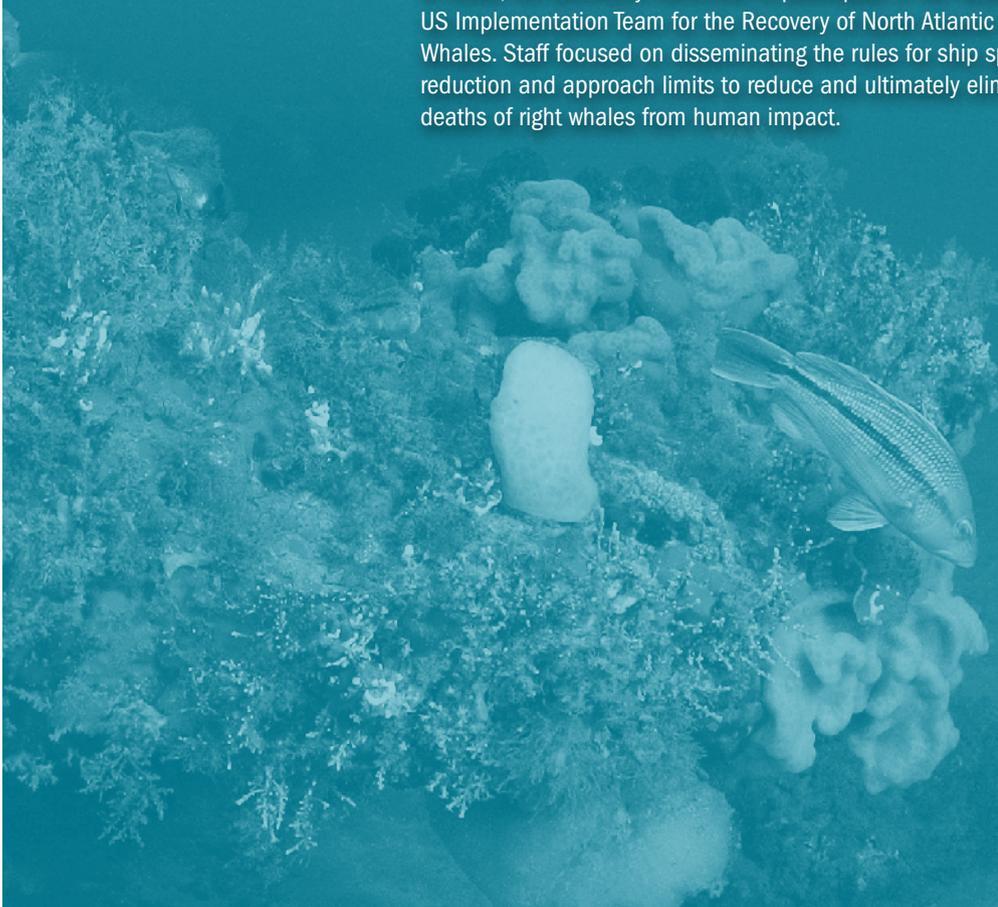
A draft rule to prohibit all spearfishing gear in Gray's Reef was published on March 4. On March 19, staff held a public hearing to receive comments in person. Comments were also taken by email and regular mail.

Spearfishing is a highly efficient harvesting gear that selectively targets larger fish relative to other fishing gears and can significantly alter abundance and size structure of target species toward fewer and smaller fish.

Spearfishing in Gray's Reef was considered for regulation during the original designation in 1981 and again in the revised management plan released in 2006. In 1981, only spearfishing with powerheads (a device with an explosive charge attached to a speargun) was prohibited. With the 2006 management plan, NOAA decided to revisit a possible spearfishing prohibition after more socioeconomic information could be gathered. A 2007 survey indicated no charter spearfishing activity and a very small amount of private spearfishing activity at Gray's Reef. Abundant substitution opportunities were also identified for spearfishing at other locations off Georgia. As a result, Gray's Reef has proposed a complete ban on all spearfishing gear in the sanctuary.

North Atlantic Right Whales

These highly endangered whales are seen in and around Gray's Reef. In 2009, the sanctuary continued to participate in the Southeastern US Implementation Team for the Recovery of North Atlantic Right Whales. Staff focused on disseminating the rules for ship speed reduction and approach limits to reduce and ultimately eliminate the deaths of right whales from human impact.





GRAY'S REEF - SCIENCE & EXPLORATION



Tagging & Tracking Reef-Dwelling Fish

Two research projects are revealing how shallow reefs serve as habitat for fish, how productive these reefs can be in the absence of disturbance, and how a natural balance of large predatory fish and their prey affect the reef and the thousands of species of invertebrates and fishes that live there.

The acoustic tagging project begun in 2008 has grown to 14 deployed receivers and 16 tagged fish. Preliminary data have shown the first eight fish have been present and active on the reef. The gag from 2008 has been a daily resident since it was tagged. The 2008 red snapper was detected for only a few days when it was first tagged in May. However, it has been a daily resident around one receiver since the beginning of November 2008. The data from the fish tagged in 2009 are just beginning to be collected and processed.

Scientists are also observing the interaction between reef fish like groupers and predatory pelagics like greater amberjack and Spanish mackerel. The fish species assist each other indirectly as feeding pelagics drive bait balls of small fish to the bottom, making them easily available to bottom-dwelling fish.



Algal Assessment

Scientists from Jacksonville University and NOAA's Southwest Fisheries Science Center visited Gray's Reef to conduct an algal assessment of the sanctuary. The last algal assessment was conducted by Duke University in 1988. On the sites visited, they found 11 species of alga in the sanctuary, down from the 14 found in 1988. The researchers agree that their level of collection effort (sampling size) was not as high as the 1988 study which may account for the difference in the number of species noted. The investigators are currently developing a proposal for future work in the sanctuary and hope to revisit the sites where the 1988 samples were collected.



Invertebrate Recruitment Study

A new invertebrate recruitment monitoring station was established in the sanctuary. Scientists from Georgia Southern University have been collecting data at a similar site at J-Y Reef, an area of artificial and natural reefs, for the past five years. At the sanctuary, divers drilled holes in the substrate so that guide pins could be installed to enable a photo quadrat to be placed over the same patch of seafloor on a routine basis. By scraping the substrate clear of attached organisms and following recruitment over time, scientists will be able to determine how fast new organisms attach to the seafloor and how their community composition changes over time. It will also be possible to compare the rates of recruitment and community composition to the data collected at J-Y Reef. Because there are differences in the geological composition of the substrate between J-Y Reef and the sanctuary, there may also be discernable differences in the organisms which settle and colonize the ledge formations.

Research Area

Gray's Reef is currently considering making part of the sanctuary a research area. This would be a no-take, no diving area, where scientists could observe how the undisturbed ecosystem functions. Much of the research done in the sanctuary in 2009 was targeted to give us insight into how closed areas might be helpful in restoring natural ecosystem functions.

Significant research questions exist at Gray's Reef that can only be addressed by establishing a research area. The concept of a research (control) area within has been under discussion since 1999 during the early stages of the Gray's Reef management plan review process. The issue was characterized as a need to increase opportunities to discriminate scientifically between natural and human-induced change to species populations in the Sanctuary. In 2006, NOAA accepted the Sanctuary Advisory Council's recommendation to formally consider the concept. The Council designed a consensus-driven, constituent-based process to explore the issue. The public scoping process began in 2008.

Participants in the group process used a specially-designed Geographic Information System (GIS) tool developed by NOAA's Biogeography Team to analyze distribution of habitats, fishing effort and historical research. Extensive investigations resulted in a proposed boundary option that would minimize the impacts on users and allow research to be conducted in several habitats that cannot be conducted anywhere else in the region. The research area plan is in development and additional public comment will be asked for in 2010.



GRAY'S REEF - SCIENCE & EXPLORATION



Species New and Old

Scientists from Smithsonian are studying the 30,000 year old gray whale mandible (jawbone) found at a site near Gray's Reef. In consideration of the loan of the mandible, Smithsonian will make three resin casts of the bone; one will remain at Smithsonian for display, one will be displayed at the University of Georgia and the third cast will go on display at the University of Georgia's Marine Education Center and Aquarium in Savannah.

A species of eel, which had not previously been reported in the area, was seen in the sanctuary near the Gray's Reef monitoring site. A photograph was taken of the eel and the eel identified as the Key Worm Eel (*Ahlia egmontis*) which has not been observed further north than north Florida.

Deepwater Corals

In February, Gray's Reef staff hosted a meeting of scientists with experience and interest in mapping of deepwater coral banks off the southeastern U.S. The group - including representatives from NOAA Fisheries, Undersea Research Program, and Biogeography Team; the South Atlantic Fishery Management Council (SAFMC), and the University of South Florida - reviewed data collected to date.

The team's charge is to draft a science plan to locate and map deepwater corals and conduct research for NOAA's Coral Reef Conservation Program Deep Coral Initiative for the South Atlantic Bight. Initial surveys will include broad multibeam profiling of targets of interest to the SAFMC. Future work will include ground-truthing of sonar signals and additional species association and habitat characterization studies with autonomous or remotely-operated vehicles.

The SAFMC has been engaged for several years in developing a large Habitat Area of Particular Concern (HAPC) to protect deepwater corals off the southeast coast. Gray's Reef staff has contributed to development of the proposed HAPC through sonar mapping and participating in submersible cruises to describe the fauna associated with these deepwater coral banks. The SAFMC has approved five HAPCs to aid in the protection of deepwater (deeper than 400 m) coral habitats. These areas encompass more than 23,000 square miles off the coast from North Carolina through the Florida Keys.

Establishment of deepwater coral HAPCs would prevent destructive fishing practices, reduce bycatch, enhance management and allow for important research on these poorly-known habitats while they are relatively pristine.

Recent Publications

Following are 2009 publications relevant to Gray's Reef NMS and surrounding waters:

Kendall, M. S., L. J. Bauer and C. F. G. Jeffrey. 2009. Influence of hardbottom morphology on fish assemblages of the continental shelf off Georgia, southeastern USA. *Bulletin of Marine Science* 84: 265-286.

Núñez, Cecilia V., Erika V. R. de Almeida, Ana C. Granato, Suzi O. Marques, Kelly O. Santos, Fabio R. Pereira, Mario L. Macedo, Antonio G. Ferreira, Eduardo Hajdu, Ulisses S. Pinheiro, Guilherme Muricy, Solange Peixinho, Christopher J. Freeman, Daniel F. Gleason, and Roberto G. S. Berlinck. 2008. Chemical variability within the marine sponge *Aplysina fulva*. *Biochemical Systematics and Ecology* 36:283-296.

Ruzicka, R. and D. F. Gleason. 2008. Latitudinal variation in spongivorous fishes and the effectiveness of sponge chemical defenses. *Oecologia* 154:785-794.

Sarmiento, Leslie V. 2008. Inducible chemical defenses in temperate reef sponges of the South Atlantic Bight. M.S. Thesis, Georgia Southern University, Department of Biology, 68 pp.

Sanamyan, K. and D. F. Gleason. 2009. *Ascidians* of the genus *Aplidium* collected on shallow hard-bottom reefs of coastal Georgia (Atlantic coast of N America, U.S.A.). *Zootaxa* 2066:50-58.

Sanamyan, K., D. F. Gleason and N. Sanamyan. 2009. A new species of Polyzoa (*Ascidacea: Styelidae*) from the Atlantic coast of N America, U.S.A. *Zootaxa* 2088:65-68.



GRAY'S REEF - OUTREACH



Translating Science

Much of the outreach work done in 2009 was translating current Gray's Reef research projects into information for the public to enhance the general understanding of science within the sanctuary system.

For instance, local and regional media were invited to visit the NOAA Ship *Nancy Foster* to interview and photograph scientists working on the fish tagging project, the benthic and pelagic study of predator/prey interactions on the reef and dive operations. That effort led to a series of television and newspaper stories about those projects.

A new exhibit was constructed in the University of Georgia Marine Extension Aquarium tank depicting Gray's Reef. The exhibit features several fish with external tags from the tagging project, an acoustic receiver and explanatory panels that describe the project.

Media were also invited to come along on the lionfish collection trips. Sanctuary and Reef Environmental Education Foundation (REEF) staff were interviewed about the threat of the invasive fish to recreational and commercially important native species. A series of television and print stories resulted.

The sanctuary also organized public speaking engagements for REEF staff that drew in local divers and recreational anglers as well as the general public in a successful effort to spread the word about lionfish. A reporting form was developed so the public can report any lionfish sightings.

Gray's Reef supported the Georgia Aquarium's lionfish collection effort for a new exhibit on marine invasive species in the Atlanta facility. The exhibit draws the public's attention to marine invasive species in the offshore Georgia environment including Gray's Reef. The sanctuary is prominently featured in the exhibit as well as in a lionfish

exhibit in the University of Georgia Marine Extension Aquarium.

In addition, sanctuary staff facilitated the making of a short film on lionfish, "Ocean Invaders," which won a BLUE Ocean Film Festival award. The film is being shown in various marine institutions across the country.

Another short film on the

sanctuary's work with the Environmental Protection Agency to trace pollutants through the Altamaha watershed is also in the works. That project involved our science partners from Georgia Southern University putting non-toxic red dye and tracing it visually and chemically as it made its way offshore.



BLUE Ocean Film Festival

The BLUE Ocean Film Festival was held in Savannah from June 10 - 14 with more than 300 delegates from the film industry in attendance. Gray's Reef was the presenting host and responsible for the community films and an ocean themed street fair. Both were well attended. The four-day festival included dozens of ocean films.

A Savannah State University student, and Gray's Reef summer intern, surveyed attendees of the BLUE Ocean Film Festival. All age groups reported that they felt more knowledgeable about ocean issues after attending the BLUE Ocean Film Festival. The survey work was funded by a National Science Foundation Research Experiences for Undergraduates grant to Savannah State University.



Drifter Buoy Launch

NOAA's Adopt a Drifter Program, Gray's Reef, the U.S. Coast Guard and BLUE Ocean teamed up in honor of World Ocean's Day to help third graders from Thunderbolt Elementary Marine Science Academy launch two drifter buoys into the Gulf Stream. The entire third grade from the school, about 70 students, adopted the buoys and tracked them through the summer and into this academic year. The Coast Guard cutter *Tarpon*, with the Thunderbolt principal and science coordinator aboard, dropped the buoys in eddies of the Gulf Stream. The students toured the *Tarpon* and Coast Guard Station Tybee. Gray's Reef provided transportation for the students.



GRAY'S REEF - OUTREACH



Outreach Events

Gray's Reef participates in several ocean-themed events with our various partners including the Savannah International Boat Show; CoastFest and Beach Week with the Coastal Resources Division of the Georgia Department of Natural Resources; Marine Science Day with the Skidaway Institute of Oceanography, and Earth Day with the City of Savannah among others. Events are added to and subtracted from the schedule as staff and volunteer time permits with an eye toward how and where we can best get our messages to stakeholders and the general public.

This year's events included an open house on the U.S. Environmental Protection Agency's *R/V Bold*. The *Bold* is used to monitor the health of the coastal waters of the Atlantic. Several federal and state agencies including Gray's Reef had displays on the *Bold* while she was docked in Savannah. Gray's Reef staff also gave public tours of NOAA Ship *Nancy Foster* while it was docked at the end of the research cruise. That offered another opportunity to discuss sanctuary science with the public. Both ship events were well received and well attended.

One of our most popular outreach events is our annual participation in the Savannah College of Art and Design's Sidewalk Arts Festival and Sand Arts Festivals. Some 700 artists competed for the Gray's Reef Fantastic Fishes Award and the Gray's Reef Sea Creatures Award at the 2009 festivals. The art festivals draw thousands to view the artwork and provide a way to get people—some of whom may not spend much time thinking about the ocean—to think about the marine environment as a source of inspiration.



GRAY'S REEF - EDUCATION

National Association of Black Scuba Divers Youth Education Summit

The National Association of Black Scuba Drivers (NABS) brought 35 students to Gray's Reef to explore the coastal environment through a series of hands-on learning activities. Students ranged from nine to 18 years old and many of them had already completed a basic scuba course with NABS. Student activities included marsh crawls, estuary trawls, building ROVs and other activities to promote an awareness of the marine and coastal environment. The program gave the students access to marine science professionals from the sanctuary and academic institutions. Gray's Reef is coordinating the NAB event in 2010 as well.



ROV Competition

Gray's Reef staff co-lead a Remotely Operated Vehicle (ROV) building workshop for educators at the Georgia Aquarium. Georgia educators and students attended to prepare for the Gray's Reef Southeast Regional ROV Competition which was held in April.

Ten teams competed at the Ranger level and one team at the Explorer level. Two teams advanced to the international competition that took place in Massachusetts in June. Sanctuary staff, volunteers and Team Ocean divers supported the event. The Skidaway Marine Science Foundation provided the lion's share of funding. Although only two teams came away as winners, all the students were rewarded for their hard work and ingenuity through creating and learning to pilot their machines. As part of their experience, they also learned how ocean science technology is used at Gray's Reef and at other sanctuaries and throughout NOAA.

Rivers to Reefs a Success

Two Rivers to Reefs Educators Workshops were conducted in 2009. The workshops were co-lead by Gray's Reef and Georgia Aquarium staff. There were 147 applicants for 32 participant slots. The groups studied and followed the Altamaha River Watershed that begins in Atlanta and winds through the middle of Georgia to the coast where it is believed to influence Gray's Reef.

Due to limited financial resources, the teachers were not able to go offshore to actually be in Gray's Reef and to see it via a remotely operated vehicle. Instead, more time was spent exploring NOAA Sapelo Island National Estuarine Research Reserve, Gray's Reef's close partner.

The educators teach students ranging from kindergarten to advanced placement high school biology and chemistry. Each participant completed water quality profiles at ten stations along the watershed that included tests for pH, conductivity, phosphorous, nitrogen and dissolved oxygen. They learned how to deploy Niskin bottles, Secchi disks, plankton tows and trawl and cast nets. They experienced the watershed in a variety of ways that included canoeing, trawling from small boats, crawling through a marsh and walking a beach at night watershed in a variety of ways that included canoeing, trawling from small boats, crawling through a marsh and walking a beach at night. They heard from numerous presenters who live in and work with a particular link in the watershed chain. They are charged with developing lessons based on their experiences that will be posted to websites for other educators to use.

Saturday Teacher Cruises

Gray's Reef now hosts inshore cruises for educators to introduce teachers to the marine environment and Gray's Reef. The frequency of the cruises depends on availability of funding for fuel. During each cruise, teachers take water samples, collect plankton, test turbidity and examine larger species caught in a trawl net.

"Tagging" Students at Thunderbolt

In another translating science exercise, Gray's Reef staff visited our partner Thunderbolt Elementary School to discuss teaching students about the acoustic fish tagging project and to involve them in the project. To demonstrate how the acoustic tagging system works and the kinds of data on fish movements that can be collected, outreach and education staff "tagged" students with acoustic tags and used receivers to track one or two students as they moved about the school on a typical day. Additional educational materials will be developed for teaching the students about the life history of the fishes that are being tagged at Gray's Reef and how the data will be used to manage the sanctuary.



GRAY'S REEF - COMMUNITY INVOLVEMENT & PARTNERSHIPS



Volunteers

In 2009, Team Ocean volunteer divers located and replaced acoustic receivers that are part of the fish tagging project, aided in water quality sampling, assisted in replacement of a bottom CO₂ sensor, helped collect lionfish and transported Skidaway Institute of Oceanography staff to collect instrumentation packages and other gear from the R2 Navy tower. In addition, Team Ocean divers participated in several land-based outreach events.

Gray's Reef trained local recreational scuba divers to become "Team Ocean Volunteer Divers" in 2009. So far, five divers from the Blackbeard Scuba Club have completed the rigorous requirements to become NOAA volunteer divers.

A cadre of land-loving volunteers regularly assists sanctuary staff at outreach events such as the Ocean Film Festival, CoastFest and Earth Day. In addition, Clean Coast volunteers conduct a "Sweep the Beach, Sweep the Reef," shore-side trash pickup each June in honor of World Ocean Day and again in September for CoastWeeks.

The Gray's Reef Administrative and Volunteer Coordinator has begun development of several new Gray's Reef volunteer programs. One program is aimed at encouraging youth to become watershed stewards and increasing public awareness of the marine environment through teacher-led, action based extracurricular groups (Gray's Reef Eco-Ambassador Teams- G.R.E.A.T.). The G.R.E.A.T. pilot program will be hosted by two local elementary schools that will implement school or community based projects while making a commitment to the protection and conservation of local watersheds.



Sanctuary Advisory Council

Gray's Reef has a Sanctuary Advisory Council, which, through its members, serves as a liaison to the community with regard to sanctuary issues and represents community interests, concerns and management needs of the sanctuary. Council members represent research, education, recreational fishing and diving, commercial and charter fishing, state and federal government, law enforcement and conservation partners among others.

In 2009, the council continued its commitment to make itself more available to its constituents and the public by holding its quarterly meetings in a variety of locations up and down the Georgia coast to extend their meetings into the region to gather public comments. The council meetings include regular presentations from sanctuary program staff including regional science coordinators and managers of other sanctuaries. The council's research area working group deliberated on the design of and explored options for a designated research area in the sanctuary.

Development of a working group to look at visitor center options is underway.

Battle of the Atlantic Expedition

For three weeks in August, Gray's Reef boat operations staff provided vessel support in the Monitor National Marine Sanctuary's Battle of the Atlantic Expedition. This is the second year in a row that personnel from Gray's Reef have been a part of this exciting project. Despite vessel problems and some rough weather, the mission was a success.



GRAY'S REEF - HOMEPORT

Where We Live

Gray's Reef National Marine Sanctuary is about 16 miles east of Sapelo Island Georgia, in the South Atlantic Bight on an area of the continental shelf where temperate and tropical waters mingle west of the Gulf Stream. Other nearby features include the Charleston Bump and deep water *Oculina* coral outcroppings. The 22 square mile (approximately 14,000 acres) of Gray's Reef is just a tiny part of the vast Atlantic Ocean, yet it is linked to a much bigger region. Gray's Reef is part of the Office of National Marine Sanctuary's Southeast/Gulf of Mexico/Caribbean region which also includes the Florida Keys and Flower Garden Banks National Marine Sanctuaries. Because of Gray's Reef's unique location at the intersection of temperate and tropical waters, the sanctuary serves as a sentinal point for various monitoring programs of the Office of National Marine Sanctuaries.

Our administrative offices are on the campus of the Skidaway Institute of Oceanography, an independent unit of the University of Georgia System. This location enhances our ability to work in partnership with a variety of academic and research institutions.

Vessels

In 2009 Gray's Reef initially operated three vessels: the 33-foot *R/V Sam Gray*; a 41-foot renovated Coast Guard patrol vessel, the *R/V Joe Ferguson* and a 41-foot catamaran. In February, the original *Joe Ferguson* made its last trip to the sanctuary. A cracked piston and repetitive engine issues led staff to determine repair was not reasonable. The vessel was surplused.

The catamaran became a permanent part of the Gray's Reef fleet and was named the *Joe Ferguson*, again honoring a National Geographic photographer and expedition leader who perished along with seven students, teachers and staff on the aircraft that hit the Pentagon on September 11, 2001.

The *Joe Ferguson* was accompanying three teacher-student pairs on an educational trip to the Channel Islands National Marine Sanctuary as part of a society-funded marine research project known as Sustainable Seas Expeditions. In 1999, the expedition spent two weeks exploring Gray's Reef National Marine Sanctuary. A formal vessel naming ceremony is planned for 2010.

Both the *Joe Ferguson* and the *Sam Gray* were used for research and monitoring, dive operations, education and outreach, as well as in support of a variety of activities for our research and academic partners. The sanctuary logged at total of 80 boat days at sea, a 25-percent increase from last year.

Sanctuary Greening

The sanctuary has an active commitment to environmental stewardship that extends beyond its water boundaries. On-going "greening" projects include recycling, lighting management, commitment to two sided printing, commitment to using non-disposable and reusable items at meetings and around the administrative office. Staff is moving toward use of plant-based lubricants sanctuary vessels and has opened a dialog with the managers and vessel operators at the Skidaway Institute of Oceanography about converting their 6,500 gallon fuel tank to biodiesel to fuel all the campus related vessels, forklifts, vehicles and generators.

Data Buoy

Down and Out

The National Data Buoy Center data buoy in Gray's Reef broke loose during a three-day gale with 50-knot gusts and 12 ft. seas. It came ashore on Cumberland Island, GA. The Buoy Center replaced it several months later. The Gray's Reef buoy is one of only seven buoys world-wide that has surface and subsurface CO₂ monitoring capacity.

Safety and Planning

Over the spring, Gray's Reef marine operations staff conducted a series of trainings and planning sessions for safe sanctuary operations including flare training, CPR, O₂, AED and First Aid certifications, vessel safety drills, and more. Staff attended the National Marine Sanctuary Small Boat Workshop in Seattle, Washington to discuss hurricane planning, maintenance and safety. Given the storm experiences of recent years, Gray's Reef and other sites vulnerable to hurricanes have overhauled response plans.





GRAY'S REEF - HOMEPORT



Staff

A staff of nine persons are responsible for the daily operations of the sanctuary. A graduate student research assistant from Savannah State University and the regional associate science coordinator assist in research.

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