

# Boater Waste Education Campaign

GLO Contract # 13-035-000-6901

## FINAL REPORT

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### **Executive Summary**

Boat sewage is a source of concern for fecal bacteria found in Galveston Bay (TCEQ, 2008) and as such, can be a public health risk for oyster consumption, as well as for contact recreation where localized bacteria levels are heightened from the illegal discharge of boater waste. Regardless of having two mobile pump-out companies, and sixteen pump-out facilities throughout Clear Lake and Galveston Bay, many boaters continue to discharge raw sewage from marine heads directly in our waters due in large part to a lack of enforcement and lack of understanding of potential environmental and public health impacts. The bacteria referred to in this project (Enterococci) is found naturally in the gut of humans and other warm blooded animals, and if found in the bay indicates that pathogenic bacteria that can cause human illnesses are likely present. Galveston Bay Foundation's (GBF) Boater Waste Education Campaign (BWEC) addresses this issue in order to lead to direct and indirect improvements in water quality by educating boaters, collecting and communicating environmental data to the public, and collaborating with authorities to increase enforcement of illegal boater waste discharges.

The BWEC was initiated in 2008 with support from the CMP, and has continued to make strides in the local boating community thanks to a very passionate and committed stakeholder workgroup. This group consists of members from Galveston Bay Estuary Program, Texas Commission on Environmental Quality, Clean Texas Marina Program, Clear Lake Marina Association, Galveston County Health District, Maritime Sanitation, Redfish Island Marine, the general public, and more. The BWEC began with a top-down, marketing and advertising approach that spread the message mainly through print media (handouts, magazine ads, billboards). In 2011, GBF began phasing the campaign into an on-the-ground approach that works directly with marinas and boaters, in addition to distributing printed outreach materials. GBF added a Clean Water Partnership program that helps marina staff and boaters work together to carry out BWEC projects, participate in workshops, as well as GBF's Water Monitoring Team and Galveston Bay Action Network (GBAN).

During this funding cycle, enhancements were made to the BWEC including developing three new volunteer programs (Dockwalkers, College Research Experience (CRE), and Marina Service Learning Program) to collect survey and water quality data that is lacking in our boating community, as well as assembling a Clean Vessel Committee consisting of Coast Guard, Texas Parks and Wildlife Department, and other key players to collaborate on increasing enforcement efforts.

Moving forward, GBF will continue to maintain the campaign and the distribution of the campaign message, as well as develop a mobile application for GBAN that will operate on both Androids and iPhones to make it easier for citizens to report sewage discharges and other water pollution. Reports will be immediately directed to the appropriate authority via email and the app will also display these reports on a map, making it easy for the public to view problem areas. In addition, we will develop a communications plan for the citizen monitoring data now that enough data has accumulated to start establishing trends at select sites, and to display monthly bacteria results for at least 20 shoreline sites. Finally, we will continue collecting up-to-date, local statistics through Dockwalker surveys to better characterize the potential impact that boat sewage has on overall bacteria impairments in Galveston Bay. Continuing education and outreach regarding boater waste issues is needed as the boating population continues to grow and change, but GBF is hopeful that the BWEC's enhancements will continue to drive measureable progress forward.

### **Project Description**

Water and sediments are often degraded in and around marinas from boat sewage and introduction of dockside wastes and other non-point sources. It has been demonstrated that the combination of poor circulation and discharge from boaters and boat maintenance operations can create serious localized water quality and potential public health concerns (Jeong et al., 2005). The purpose of the Boater Waste Education Campaign (BWEC) is to decrease the incidences of illegal discharge of boater sewage waste in the Galveston Bay Estuary, particularly Clear Lake since it has the third highest concentration of privately owned marinas in the U.S. Due in large part to a lack of local data and communication of these potential environmental and public health impacts, and lack of enforcement of the existing No Discharge Zone in Clear Lake, behavior change through outreach alone is difficult and improvements are hard to track. GBF has continued to work toward overcoming these barriers to success and

Throughout the BWEC, GBF communicated the campaign message directly to boaters and marinas. This was achieved by contacting marinas to arrange special events, presentations, and/or exhibits where boaters were exposed to the campaign message, in addition to distributing education packets to new tenants. The campaign emphasizes 1) negative environmental and public health impacts caused by sewage and 2) how boaters can properly dispose of their waste, and 3) the existing laws and fines associated with illegal boat discharges. As part of the initiative, boaters and marinas have been encouraged to join the Clean Texas Marina and Clean Boater Programs. Marinas have also been encouraged to seek funding through the Clean Vessel Act Program to construct, renovate, or replace pump-out stations. Outreach programs have proved to be effective in the past, but there is a need for a strong campaign in the Clear Lake area to reach new boaters and reawaken awareness of the issue. GBF has directed the development and distribution of the message with the input of a workgroup comprised of stakeholders representing 17 different boating and environmental groups, as well as members of the recreational boating community.

Funding from the Texas Coastal Management Program has played a key role in the distribution of the BWEC messages by covering costs associated with marketing, advertisement, outreach, illegal discharge reporting, marina partnerships, and volunteer water monitoring. The BWEC has been well received in the Clear Lake/Galveston Bay community and GBF plans to continue carrying out and enhancing this project indefinitely.

## **Task 1: Maintain Active Workgroup and Marketing/Outreach Materials**

### **BWEC Workgroup**

A campaign workgroup continued to guide BWEC activities, and consisted of representatives from the Galveston Bay Estuary Program, Clean Marina Program, Clear Lake Marina Association, Texas Parks and Wildlife, and other relevant, bay-area groups (**Figure 1**). The workgroup was originally formed under a Galveston Bay Estuary Program grant beginning in 2007. The committee members were solicited in the fall of 2007; the original invitation sent to bay area entities predated the beginning of this grant cycle. The workgroup was formed to develop and execute the campaign. The current workgroup consists of several original members, but GBF continually recruits new members in order to keep the BWEC ideas fresh. Participation in the workgroup is open to any interested parties. **Table 1** includes a list of the

participating individuals during this grant cycle. The meeting schedule is included in **Table 2**.



**Figure 1. BWEC Workgroup members**

The workgroup members contributed to the project in different ways. The Clear Lake Marina Association provides the business perspective to BWEC efforts and acts as an effective means to disseminate information and build networks in the local boating community. The Clean Texas Marina Program offers Clean Boating Tip cards, Clean Boater Pledge cards, Scoop on Poop brochures showing pump-out locations throughout Texas, as well as technical information on the Clean Marina Program. Both of these organizations are associated with the Marina Association of Texas and aid in getting the BWEC efforts publicized state-wide. Redfish Island Marine and Maritime Sanitation are the

two mobile pump-out companies currently in operation in Clear Lake and Galveston Bay. They provide in-kind donations for marina outreach events, as well as technical information on pump-out equipment. Additionally, Maritime Sanitation has been a long-time partner in donating pump-out services for the annual Redfish Raft Up event and assistance to marinas interested in applying for Clean Vessel Act grants to install pump-out facilities. Texas Parks and Wildlife Department, Texas Commission on Environmental Quality, and Galveston Bay Estuary Program assist the workgroup with questions relating to environmental regulations, access to data, and aid in the workgroup's efforts to get Galveston Bay designated as a No Discharge Zone. Several members of the workgroup are solely recreational boaters, or in addition to their involvement in the boating industry. Their knowledge and experience in the community is invaluable to the BWEC efforts.

The most valuable result of continuing this workgroup has been the fact that GBF has a group of committed stakeholders from the boating industry that are always available to bounce ideas off of and to give feedback on BWEC efforts. In addition, their input led to the creation of a second stakeholder group (described below) to focus on compliance and enforcement. During this funding cycle, **organizational representation at the workgroup meetings was 70%**. In addition, **100% of the organizations were directly involved in assisting with campaign tasks**, such as assembling and distributing education packets, connecting GBF to audiences for giving presentations, implementing the campaign at their marina, providing technical assistance for the Water Monitoring Team, etc. The performance indicators used during this funding cycle were approved by the workgroup, and can be found in **Appendix I**. The measured results corresponding to these indicators are addressed throughout this final report in the appropriate sections.

**Table 1.** Boater Waste Education Campaign Workgroup

Last	First	Organization
Tuma	Scott	City of League City/Clear Lake Racing Association
Hollin	Dewayne	Clean Texas Marina Program
Clevenger	Cynthia	Galveston Bay Estuary Program
Bartsch	Trey	Galveston Bay Foundation
Bohanon	Charlene	Galveston Bay Foundation
McCann	Katie	Galveston Bay Foundation
Rhea	Neally	Galveston Bay Foundation
Fitz Simmons-Evans	Lori	Galveston County Health District
McDowell	Angela	Galveston County Health District
Johnston	Steven	Houston-Galveston Area Council
Wright	Jean	Houston-Galveston Area Council
Hall	Lynda	Lakewood Yacht Club/Clear Lake Marina Association
Paige	Helen	Marina Bay Harbor/ Marina Association of Texas
Fannin	Paul	Marine Surveyor/Recreational Boater
Covault	Philip	Maritime Sanitation, Inc.
Silva	Marianne	Maritime Sanitation, Inc.
Williams	Paul	Maritime Sanitation, Inc.
Frakes	Dick	Recreational Boater
Walker	David	Redfish Island Marine
Broach	Linda	Texas Commission on Environmental Quality
Derrick	Cassandra	Texas Commission on Environmental Quality
Morris	Chip	Texas Commission on Environmental Quality
Kropf	Philip	Texas Mariners Cruising Association
Carrier	Mary	Texas Parks and Wildlife Department
Respass	Logan	Texas Sea Grant
Guillen	George	University of Houston – Clear Lake

**Table 2.** Workgroup meeting schedule

CMP Cycle	Date	Location	Time	Attendance
16/17	2/19/2013	GBF Office	10:00am	6 (break-out)
16/17	2/20/2013	GBF Office	2:00pm	13

16/17	3/27/2013	GBF Office	2:00pm	3 (break-out)
17/18	12/11/2013	GBF Office	3:00pm	7
17/18	6/26/2014	GBF Office	3:00pm	4 (break-out)

**Clean Vessel Committee**

During this grant cycle, a new stakeholder group was formed to provide focused attention and collaboration on increasing compliance and enforcement of boat sewage discharge codes. Over the years, the BWEC Workgroup has met with various authorities individually to address the lack of enforcement, but a more collaborative approach was needed for several reasons: 1.) Many authorities shared that they receive very few reports of illegal discharges, 2.) When authorities do receive reports, they do not get all of the key details needed or by the time they arrive to the scene the sewage has dissipated, 3.) Jurisdiction, training, and emphasis of the safety concerns from illegal discharges varies widely amongst enforcement entities. **The Clean Vessel Committee met for the first time in December 2013 with 24 people in attendance**, and is made up of the members listed in **Table 3**.

**Table 3.** Clean Vessel Committee

Last	First	Organization
Brand	Bryan	City of Seabrook Police Department
Hollin	Dewayne	Clean Texas Marina Program/Marina Association of Texas
Bohanon	Charlene	Galveston Bay Foundation
Jones	Scott	Galveston Bay Foundation
McCann	Katie	Galveston Bay Foundation
Stokes	Bob	Galveston Bay Foundation
FitzSimmons-Evans	Lori	Galveston County Health District
Olson	Rebecca	GBF Volunteer
Hall	Denise	Harris County Pollution Control
Wheeler	Jennifer	Harris County Pollution Control
Bower	Justin	Houston Galveston Area Council
Johnston	Steve	Houston Galveston Area Council
Stevenson	Bob	Houston Sail and Power Squadron
Hall	Lynda	Lakewood Yacht Club/Clear Lake Marina Association/MAT
Paige	Helen	Marina Bay Harbor/Marina Association of Texas
Faubion	Amber	Marina Del Sol
Fannin	Paul	Marine Surveyor
Derrick	Cassandra	TCEQ Clean Water Certification Program
Morris	Chip	Texas Commission on Environmental Quality
Sears	Beth	Texas Commission on Environmental Quality

Wiles	Kirk	Texas Department of State Health Services
Carrier	Mary	Texas Parks and Wildlife – Boater Education
Moses	Dale	Texas Parks and Wildlife - Law Enforcement
Sidman	Ross	Texas Parks and Wildlife - Law Enforcement
Pelland	Jeff	U.S. Coast Guard - Houston
Franklin	Kim	U.S. Coast Guard - MSU Texas City
Naker	Keith	U.S. Coast Guard - MSU Texas City
White	Christina	U.S. Coast Guard - MSU Texas City
Muraglia	Frank	U.S. Coast Guard Auxiliary

**Marketing/Outreach Materials**

Marketing and outreach materials were maintained or newly developed, as needed, for all of the various programs within the BWEC, including Pump Don’t Dump, GBAN, GBF Water Monitoring Team, Clean Water Partnerships, College Research Experience, and Dockwalkers.

Based on the continued success and demand for the Pump Don’t Dump education packets and campaign giveaways, they were reprinted for distribution during this cycle. Items included Pump Don’t Dump paper bags, Pump-Out Guide postcards, GBAN plastic cards, and Pump Don’t Dump koozies and floating key chains (**Figure 2**). In addition, TCEQ’s brochure on the Clean Water Certification program, and Texas Sea Grant’s Clean Boater Tip cards and Clean Boater Pledge brochures were donated to us for distribution. During this cycle we continued to leave the packets unsealed so that our partners that help distribute them at boat show booths (Maritime Sanitation, Redfish Island Marine, Houston Safe Boating Council, Marina Del Sol, and Marina Association of Texas) can include their flyer in it as well.



**Figure 3. BWEC campaign materials**

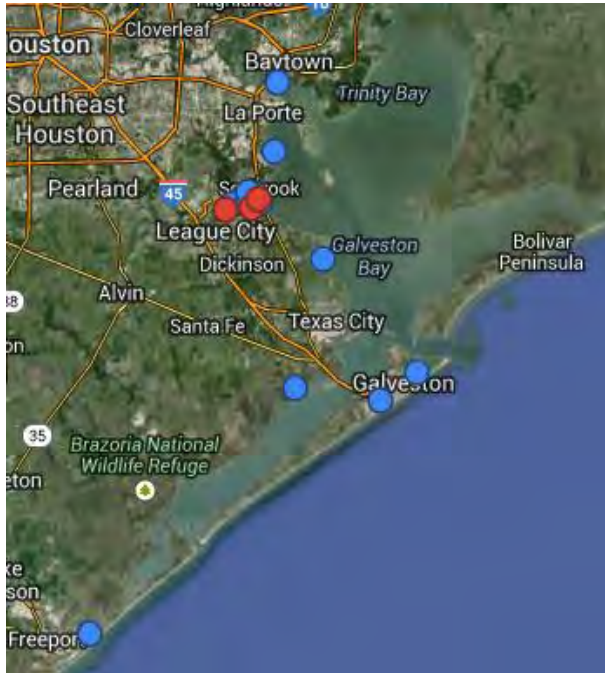


**Figure 2. BWEC campaign zip tie and PFD whistle**

we continued to leave the packets unsealed so that our partners that help distribute them at boat show booths (Maritime Sanitation, Redfish Island Marine, Houston Safe Boating Council, Marina Del Sol, and Marina Association of Texas) can include their flyer in it as well. New Pump Don’t Dump whistle key chains (**Figure 3**) were developed, which were recommended to us by the Texas Mariners Cruising Association as an item that boaters would keep because all personal floatation devices should have a sound-making device on them for safety purposes. Zip ties with the campaign web address were also ordered for Dockwalkers to distribute for securing discharge valves (**Figure 3**). The overarching goal was to use these items as a conversation starter so we



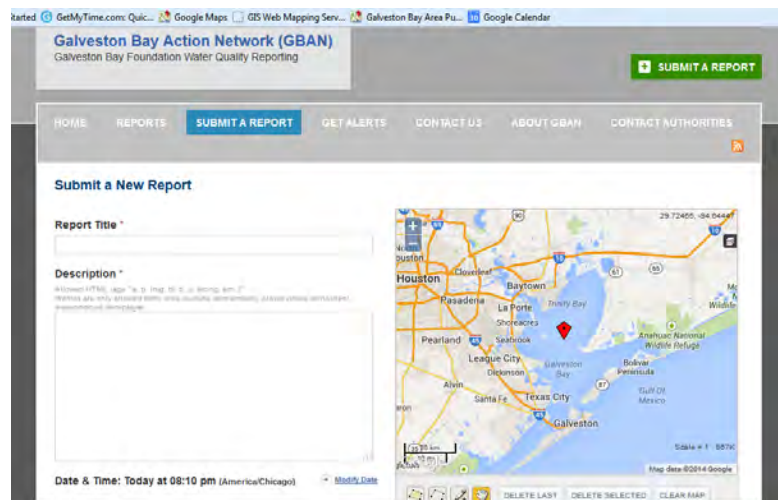
can more easily share the campaign message, to keep directing the boating community to the campaign website, to provide them with tools to help improve water quality, and to create ambassadors that will help spread the message as well.



**Figure 4. Galveston Bay pump-out Google map**

The interactive pump-out guide for Clear Lake and Galveston Bay was maintained ([www.galvbay.org/boaterwaste](http://www.galvbay.org/boaterwaste)), as well as the GBAN web application ([www.galvbay.org/gban](http://www.galvbay.org/gban)). This guide was developed in a past grant cycle so that it could be updated in real-time and offer boaters more detailed and accurate information on local pump-out facilities than a printed guide (**Figure 4**). GBAN continues to teach boaters how to collect information for a useful water pollution report, provides contact information for local authorities, and gives them the opportunity to map their report online so it is visible to GBF and the public (**Figure 5**). Lessons learned through utilizing both of these online tools for an additional grant cycle are guiding current BWEC enhancements. A major social media push will be made for the pump-out station map (and other BWEC components) to increase its visibility and a mobile application for Androids and iPhones will

be developed for GBAN. GBF will host a Volunteer Digital Media Intern on a semester basis in order to help us carry out the social media campaign. The mobile app proposal received extremely positive feedback from members of the BWEC Workgroup and Clean Vessel Committee and GBF has received several bids from developers for the app and hopes to begin development soon.



**Figure 5. Galveston Bay Action Network reporting form**

GBF wrote Facebook posts, newsletter articles, and press releases to advertise BWEC campaign messages, as well as to share our campaign work with GBF followers and supporters. PowerPoint presentations and hands-on activities were developed for various audiences such as the Houston Safe Boating Council's W.A.D.E. summer program, GBF's Bay Day event, and the Texas Mariners Cruising Association. One activity that proved very popular was a life-sized board game for kids (**Figure 6**), which teaches them where dirty water goes to get cleaned up before going into Galveston Bay. The BWEC messages are incorporated (along with other common problems that cause sewage to get into the bay) and one of the finish line spaces is a pump-out station. The game board layout, instructions and signs can be viewed in **Appendix I**.



**Figure 6. Down the Pipes board game**



**Figure 7. Pump-out demonstration to W.A.D.E. teen boaters**

demonstration of pollution in a watershed on an Enviroscape model, a humorous Toilet Toss bean bag game and "Down the Pipes" life-sized board game that taught them about where wastewater can and should go, and an Oyster Bag Critter Bingo station where they learned that oysters play an important role in filtering water and providing habitat for many small critters while getting an up close and personal look at these organisms (**Figure 8**). All of these activities aimed to reach out to kids in the boating, fishing, and waterfront communities around Galveston Bay as part of GBF's Boater Waste

GBF also developed an interactive presentation for the teen boaters at the W.A.D.E. camp using the Enviroscape watershed model and a model of a pump-out connection, which are both items purchased or made in previous grant cycles (**Figure 7**). Finally, GBF held the first AquaKids class at Pelican Rest Marina on June 29<sup>th</sup>, 2013, which gave 1<sup>st</sup> – 5<sup>th</sup> grade kids and their favorite adult a chance to learn about the types of pollution humans put into the bay, how they can help keep our water clean, and how things in nature also help improve water quality. A total of 24 kids and 19 adults traveled through hands-on activities including a

Education Campaign and Clean Water Partnership Program in order to reduce the issue of illegal boat sewage discharge and other human bacteria sources in the bay before they start. Connecting with the kids can also result in them putting positive pressure on their parents, thus leading to behavior change. AquaKids was well received by both Pelican Rest Marina owners and staff and the families who were in attendance (and an absolute blast for GBF staff). GBF hopes to offer this class at marinas around Galveston Bay and Clear Lake in the future, but in the meantime has chosen to focus on more pressing BWEC goals that can result in greater water quality protection in the short term. However, educating the next generation of boaters is very important and should be revisited in the future.

GBF continued to manage the infrastructure for running the GBF Water Monitoring Team and Bacteria Monitoring Lab including renewing our EPA-approved Quality Assurance Project Plan and Quality Management Plan, modifying and creating new training materials (i.e. improved Bacteria Lab SOPs, Environmental Hazard SOPs), ordering and maintaining equipment, and maintaining our status as Certified Texas Stream Team Trainers. Copies of the new planning and training materials are in **Appendix III**. GBF created a new Water Monitoring Team webpage on the



Figure 8. Oyster Bag Bingo at AquaKids Family Program

GBF website and maintained the Google map of all of our current and potential monitoring sites in order to make it easier to communicate with volunteers when they are trying to choose a site, as well as with the public to let them know where we monitor. All of this information can be found at

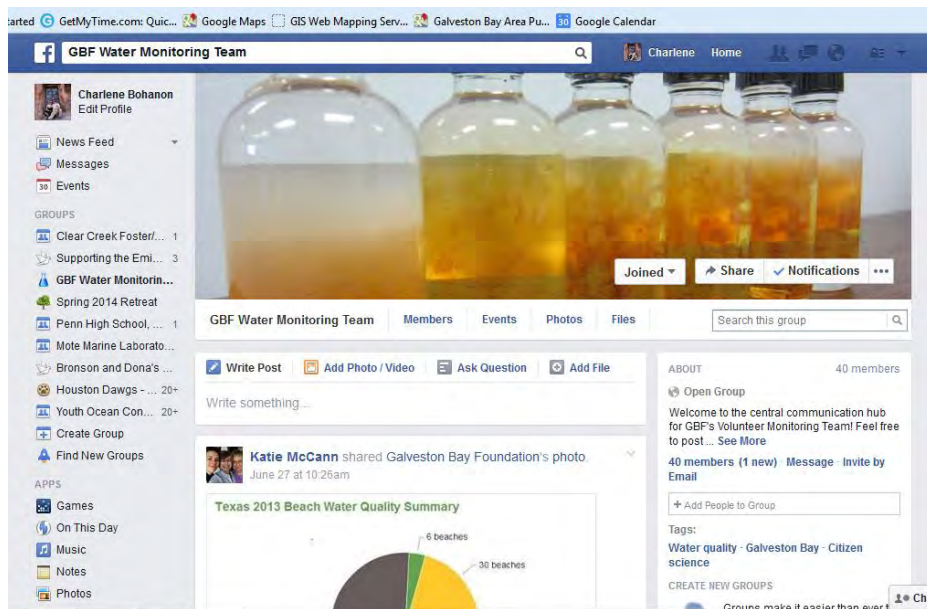


Figure 9. GBF Water Monitoring Team Facebook page

[www.galvbay.org/water-monitors](http://www.galvbay.org/water-monitors). A GBF Water Monitoring Team Facebook group was also created in order to increase communication with our volunteers and encourage them to interact with each other, share photos, etc. (Figure 9). It is an open group and can be viewed by searching “GBF Water Monitoring Team” on Facebook.

Several new volunteer programs and

internships were offered, which resulted in newly developed outreach materials and products, including the College Research Experience, Marina Service Learning Days, Dockwalkers, and a Water Quality Policy and Outreach Internship. These items and programs will be discussed in detail under Task 3.

Overall, the marketing and outreach materials developed during this cycle were quite extensive and have added significant depth to the BWEC by being able to connect with boaters on multiple levels. In addition to the original Pump Don't Dump message, GBF is now able to communicate how citizens can engage in enforcement by providing them with the tools for submitting water pollution reports, and can begin establishing water quality trends in marinas and near-shore recreational areas. These additional branches of the campaign have and will continue to allow GBF to reach a broader audience by giving boaters the opportunity to take action and empower them to spread the campaign message to their fellow boaters.

## Task 2. Develop Outreach Schedule and Distribution Plan

Enhancements to the BWEC during the last funding cycle and this cycle resulted in outreach being carried out through the original avenues of print media and education booths/presentations, as well as through Clean Water Partnerships and several BWEC volunteer programs including the Galveston Bay Action Network, Dockwalkers, GBF Water Monitoring Team, College Research Experience, and Marina Service Learning Days. BWEC outreach and distribution is detailed below for print media, booths, presentations and Clean Water Partnerships, and details on the reach of BWEC volunteer programs are found under Task 3. Total impressions achieved through the BWEC will be discussed under Task 4.

### Print Media, Education Booths, and Presentations

GBF contacted marinas and popular boating events to schedule outreach presentations and booth displays, and to offer printed materials for inclusion in tenant packets and event goodie bags. **Table 4** shows the list of marinas that were contacted during this grant cycle (current marina partnerships have an asterisk), **Table 5** shows the yacht brokers that were contacted, and **Table 6** shows the quantity of printed materials ordered and the distribution locations thus far.

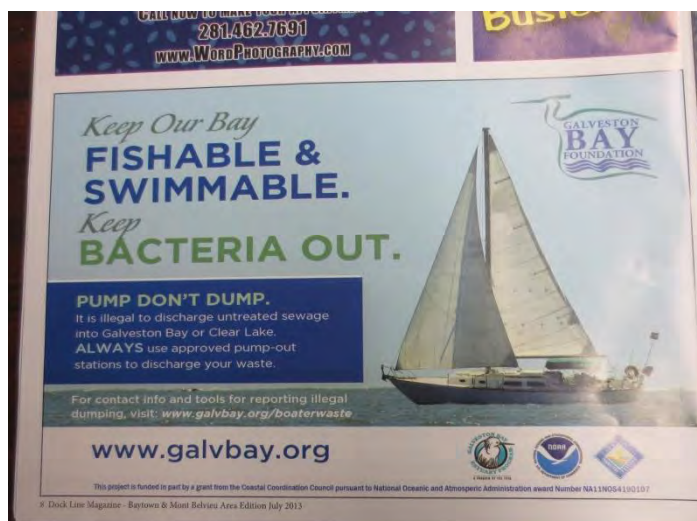


Figure 10. BWEC ad in Dock Line Magazine

Workgroup members and campaign partners frequently help with directly promoting the BWEC through donating banner space at events, inviting us to speak or host education booths, and even distributing campaign materials at their booths. GBF staff and volunteers have hosted many education exhibits throughout the project area to ensure one-on-one interaction with boaters.

In addition to these outreach booths, several group presentations were made throughout the BWEC project period. GBF continues to have quality interactions with the boating

community through giving live presentations due to the fact that it facilitates better discussions and the opportunity to disseminate more detailed information than can be done with a passive booth audience. Please see **Table 7** for a schedule of both types of education events carried out during this grant cycle. **Through these activities, GBF reached over 209,000 people at 84 live events.**

In terms of advertising, GBF has promoted the campaign in boat show event programs, magazines, websites, social media, and local print and online news sources (extensive press release list managed by GBF’s Marketing Coordinator). Some of the space was paid for, but much of it was donated because of the publication’s support for the BWEC. Examples of printed posts and ads are in **Figures 10 and 11**, and examples of articles and press releases published are in **Appendix II**. Numbers of impressions for the various BWEC advertisements, posts, and articles GBF was able to track are found in **Table 8**. **Through print and digital media, GBF was able to reach over 535,000 people with the various BWEC messages through 18 different media outlets.**

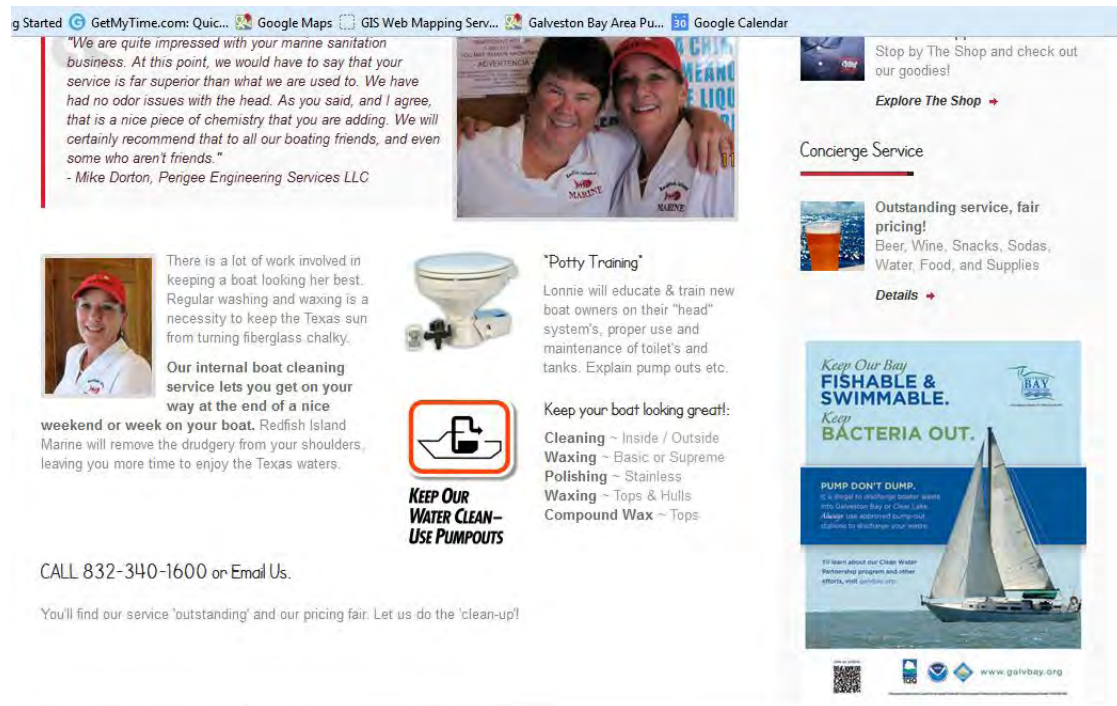


Figure 11. BWEC ad on Redfish Island Marine website

Table 4. Marinas contacted about the BWEC

Marina Name and Location			
<b>Clear Lake</b>			
Bal Harbor Marina	123 Lakeside Lane	Houston	(281) 333-5168
Blue Dolphin Yachting Center, Inc.	P.O. Box 123	Seabrook	(281) 474-4450
Clear Lake Marine Center, Inc.	P.O. Box 716	Seabrook	(281) 326-4426

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Constellation Point and Marina	451 Constellation	League City	(281) 334-2527
Endeavour Marina	3101 NASA Parkway	Seabrook	(832) 864-4000
Kemah Boardwalk Marina	555 Bradford St.	Kemah	(281) 334-2284
Lakeside Yachting Center, Inc.	2511- B Nasa Rd. 1, Ste. 101	Seabrook	(281) 326-5547
Lakewood Yacht Club	2425 Nasa Parkway	Seabrook	(281) 474-2511
Legend Point	1300 Marina Bay Drive	Clear Lake Shores	(281) 334-3811
Marina Bay Harbor Yacht Club	P.O. Box 478	Kemah	(281) 535-2222
Marina Del Sol	1203 Twin Oaks Blvd.	Kemah	(281) 334-3909
Nassau Bay Homes and Marina Assoc., Inc.	1120 Nasa Pkwy, Ste. 109	Nassau Bay	(281) 333-2570
Nassau Bay Yacht Club	1120 Nasa Pkwy, Ste. 109	Nassau Bay	(281) 333-2570
Portofino Harbour	One Portofino Plaza	Clear Lake Shores	(281) 334-6007
Seabrook Shipyard & Marina Inc.	1900 Shipyard Dr.	Seabrook	(281) 474-2586
South Shore Harbour	2551 South Shore Blvd., Ste B	League City	(281) 334-0515
Waterford Harbor Marina	800 Mariners Drive	Kemah	(281) 334-4400
Watergate Yachting Center	1500 Marina Bay Drive	Clear Lake Shores	(281) 334-1511
Wharf at Clear Lake	P.O. Box 1208	League City	(281) 334-5976

**Galveston Bay**

Bayland Marina	2651 S. Highway 146	Baytown	(281) 422-8900
Eagle Point Fishing Camp, Inc.	Route 1 Box 1718	San Leon	(281) 339-1131
Galveston Yacht Basin	715 North Holiday Dr.	Galveston	(409) 762-9689
Harborwalk Marina	P.O. Box 2328	Hitchcock	(409) 935-3737
Houston Yacht Club	3260 Miramar Drive	Shoreacres	(281) 471-1255
Payco, Inc.	501 Blume Dr.	Galveston	(409) 744-7428
Pelican Rest Marina	7819 Broadway	Galveston	(409) 744-2618
Pirates Beach Bait & Tackle	14302 Steward Rd.	Galveston	(409) 737-3635
Ray's Marina	6310 Herds Lane	Galveston	(409) 744-2111
San Leon Marina	100 6 <sup>th</sup> St.	Dickinson	(281) 339-1515
Waterman's Harbor, Inc	16426 Clearcrest	Houston	(281) 339-1416

**Table 5.** Yacht brokers and other boating businesses that received BWEC materials

Yacht Broker	Location	Address	Phone Number
Lauderdale Yacht Sales	League City	2551 South Shore Harbour Blvd Suite B	281-535-0900
Galati Yacht Sales	Seabrook	1902 Seabrook Shipyards	281-474-1470
United Yacht Sales	Kemah	1115 Marina Bay Drive	281-538-6231
Sea Lake Yacht Sales	Kemah	1500 FM 2094 rd	281-334-1993
Jay Bettis & Co Yacht Sales	Seabrook	2509 Nasa Parkway	281-326-3333
Flagship Yachts	Seabrook	2511 Nasa Parkwat #107	281-532-3200
Nautic Yacht Sales	Kemah	585 Bradford St	281-334-2628
J M Yachts	Clear Lake	1500 Marina Bay Dr #1570	281-538-0761
Texas Marine & Brokerage Inc	Seabrook	2700 Nasa Parkway	281-326-9595
HSH Yacht Sales	Kemah	1500 Marina Bay Drive #132b	832-864-2030

Lone Star Yachts Sales	Kemah	1500 Marina Bay Drive #3380	281-334-3500
Josh at Sea Lake Yachts	Kemah	1500 Marina Bay Drive Pier 23	281-334-0485
Texas Sport Fishing Yachts Sales	Seabrook	802 Hardesty Ave	281-474-9600
Discovery Yachts Inc	Seabrook	2101 Todville Road	281-291-9109
Texas Coast Yachts	Kemah	1500 Marina Bay Drive Suite 122-A	281-957-9046
Gibson Weaver Yacht Sales	Seabrook	2511B Nasa Parkway	281-326-1574
Kent Little @ Little Yacht Sales	Kemah	Waterford Harbor, 800 Mariners Drive	713-817-7216
Southern Cross Yacht Sales	Kemah	585 Bradford Ave	281-334-7411
Seawinds International Inc	Kemah	703 Bay Ave	281-334-5296
Marine Max Inc.	Seabrook	3001 Nasa Parkway	281-326-4224
Maritime Sanitation	Clear Lake Shores	1500 Marina Bay Drive	281-334-5978
Maximum Marine Services	Kemah	---	317-698-5063
Redfish Island Marine	Clear Lake Shores	1500 Marina Bay Drive, Suite 112	832-282-8202
Kevin E. Severance Insurance Agency	League City	3027 Marina Bay Drive, Suite 309	281-333-3100
Ron Hoover RV and Marine	La Marque	1903 Gulf Frwy	409-935-7101

**Table 6.** BWEC print materials and distribution locations

Item	Number of Items	Distribution Location
Postcard pump-out guides	5,000	Pump Don't Dump education packets; education booths/presentations; Dockwalker Clean Boater Kits
GBAN wallet cards	9,000	Pump Don't Dump education packets; education booths/presentations; Houston Safe Boating Council – Boater Safety Education Course; Galveston Bay Sail and Power Squadron; Gulf Coast Yacht Brokers Association; GBF Water Monitoring Team; Clear Lake Marina Association (marina managers)
Pump Don't Dump campaign bags	6,000	Pump Don't Dump education packets; education booths/presentations; new marina tenant packets; Dockwalker Clean Boater Kits
Pump Don't Dump floating key chains	3,000	Pump Don't Dump education packets; education booths/presentations; Dockwalker Clean Boater Kits
Pump Don't Dump koozies	1,500	Pump Don't Dump education packets; education booths/presentations; Dockwalker Clean Boater Kits
Pump Don't Dump whistle keychains	2,000	Pump Don't Dump education packets; education booths/presentations; Dockwalker Clean Boater Kits
Pump Don't Dump flow through trash bags	3,000	Dockwalker Clean Boater Kits
Pump Don't Dump discharge valve zip ties	2,000	Dockwalker Clean Boater Kits
Boat Discharge Laws/Enforcement signs	100	Blue Dolphin Yachting Center; Endeavour Marina; Kemah Boardwalk Marina; Lakewood Yacht Club; Marina Bay Harbor Yacht Club; Marina Del Sol; Seabrook Marina, Inc.; Pelican Rest Marina; Galveston Yacht Basin; Gulf Coast Yacht Brokers Association
TCEQ Clean Water Certification brochures	5,000	Pump Don't Dump education packets; education booths/presentations; TPWD Boater Education; Coast Guard Auxillary

**Table 7.** Distribution schedule of education booths and presentations

Date	Event	Location	Representative	Impressions
10/1/2012	Marina Association of Texas Conference - education booth	South Shore Harbor Marina	Charlene Bohanon and volunteers	150
10/14/2012	Bike Around the Bay - education booth	Bayshore Park	Charlene Bohanon and volunteers	1,000
10/22/2012	Restore America's Estuaries Conference - presentation	Tampa Convention Center	Charlene Bohanon	50
11/7/2012	UHCL Environmental Safety and Hygiene students - presentation	UHCL campus	Charlene Bohanon	20
11/17/2012	Marina partnership outreach event	Marina Del Sol	Charlene Bohanon, Teresa Long, and volunteer	30
11/27/2012	GBF Quarterly Meeting - presentation and booth	United Way of Houston	GBF staff	75
12/6/2012	UHCL Environmental Safety and Hygiene students - presentation	UHCL campus	Charlene Bohanon and Teresa Long	20
1/4/2013 – 1/13/2013	Houston Boat Show partner booths	Reliant Center	Maritime Sanitation, Redfish Island Marine, Marina Del Sol	75,000
1/10/2013	Gulf Coast Yacht Brokers Association Meeting - presentation	Lakewood Yacht Club	Charlene Bohanon and Katie McCann	30
2/1/2013	Watershed 101 Class	Ball High School	Charlene Bohanon	80
2/8/2013	Clear Lake Marina Association - presentation	Hoagie Ranch	Charlene Bohanon	15
2/23/2013	Nature Day - booth	Sea Center Texas	Katie McCann and Jessica Curran	800
3/9/2013	Houston Yacht Club event booth	Houston Yacht Club	Sharon Roark and Matt Singer	50
3/21/2013- 3/24/2013	Southwest International Boat Show partner booths	South Shore Harbor Marina	Redfish Island Marine, Houston Safe Boating Council, Maritime Sanitation, Marina Del Sol	13,000
3/23/2013	GBF Trash Bash education booth	Bay Area Park	Charlene Bohanon and Jessica Curran	600
3/27/2013	Clear Lake Racing Association event booth	Villa Capri	Charlene Bohanon and volunteer	100
4/14/2013	Earth Day Houston booth	Discovery Green	Justine Townsend and Scott Jones	15,000
5/4/2013	Galveston Bay Sail and Power Squadron presentation	GBSPS member's home	Charlene Bohanon and Katie McCann	40
5/29/2013	Public Participation and Education Committee presentation	Galveston Bay Estuary Program	Charlene Bohanon	18
6/1/2013	Bay Day booth	Kemah Boardwalk	Charlene Bohanon and Katie McCann	7,000



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6/13/2013	La Marque Rotary Club - presentation	Kelley's Country Cookin'	Charlene Bohanon	24
6/19/2013	Houston Safe Boating Council's W.A.D.E. Camp – class and presentation	Mud Lake Park	Charlene Bohanon and Katie McCann	40
6/29/2013	AquaKids Family Program - workshop	Pelican Rest Marina	Charlene Bohanon, Matthew Abernathy, and Rani Henderson	60
7/17/2013	Houston Safe Boating Council's W.A.D.E. Camp – class and presentation	Mud Lake Park	Katie McCann and Kendall Guidroz (Water Quality Policy/Outreach Intern)	40
7/27/2013	Ladies Casting for Conservation - event	Stingaree Restaurant	GBF Development Team	50
9/2/2013	Redfish Raft Up	Redfish Island/Star Fleet Yachts	Bob Stokes, Justine Townsend, Eric Hitt	500
9/12/2013	Clean Texas Marina Program - site visit	U.S. Coast Guard – Houston Station	Charlene Bohanon and BW Workgroup members	5
10/3/2013	Cedar Bayou Watershed Partnership - presentation	Eddie V. Grey Wetland Center	Charlene Bohanon	25
10/9/2013	GBF Water Quality Program presentation	Ball High School aquatic science classes	Charlene Bohanon	80
10/24/2013 – 10/27/2013	Boatoberfest partner booths	Endeavor Marina/Marine Max	Marina Del Sol, Maritime Sanitation	500
10/28/2013	GBF Water Quality Program presentation	GBF Executive Committee	Charlene Bohanon and Katie McCann	25
11/16/2013	Anahuac Wildlife Expo booth	Anahuac National Wildlife Refuge	Katie McCann	500
12/4/2013	Watershed 101 Class	Ball High School aquatic science classes	Katie McCann	80
1/3/2014 – 1/12/2014	Houston Boat Show partner booths	Reliant Center	Marina Del Sol, Maritime Sanitation, yacht brokers, boating publications	75,000
1/16/2014	GBF Water Quality Program booth	GBF Bravos for the Bay, Texas Corinthians Yacht Club	Katie McCann and Charlene Bohanon	50
1/31/2014	GBF Water Quality Program presentation	College of the Mainland	Katie McCann	12
2/26/2014	Clean Water Partnership AquaKids Family Program	EPA Urban Waters Learning Network Webinar	Charlene Bohanon	20
3/5-3/9/14	Houston Fishing Show booth	George R. Brown Convention Center	GBF Development Team	75
3/21/2014	Texas Mariners Cruising Association BWEC presentation	Elk's Lodge, Kemah, TX	Charlene Bohanon	75
3/24/2014	GBF WQ intro/Marina Survey	Lee College, Bayland Marina	Neally Rhea and Charlene Bohanon	16
3/27-3/30/14	Southwest International Boat Show partner booths	South Shore Harbour Marina	Galveston Bay Sail and Power Squadron, Marina Del Sol,	13,000

			Maritime Sanitation	
3/29/2014	Land and Sand Run booth	Stewart Beach	Neally Rhea	300
3/29/2014	Trash Bash booth	Bay Area Park	Katie McCann	800
4/3/2014	Give 5% Kick-Off event	Ruggles Green City Centre	Michelle Vryn	100
4/12/2014	Exploration Green groundbreaking ceremony booth	Exploration Green Park	Michelle Vryn	150
4/22/2014	U of H Earth Day booth	U of H main campus	Cari Denby	100
4/22/2014	Dow Chemical Earth Day booth	Dow Chemical – Freeport	Emily Seldomridge	150
4/26/2014	Bay Day - WQ booth	Kemah Boardwalk	Charlene Bohanon, Katie McCann, Neally Rhea	5,000
4/22/2014	Poop in Pipes board game demo	Clean Water Initiative Workshop, H-GAC	Charlene Bohanon and Katie McCann	50
5/9/2014	GBF Water Quality Program presentation	Kiwanis Club of Kingwood	Charlene Bohanon	10
6/4/2014	GBF BWEC and NDZ research project introduction	WQ Intern, GBF Conference Room	Charlene Bohanon	1
6/18/2014	Houston Safe Boating Council's W.A.D.E. Camp – class and presentation	Mud Lake Park	Charlene Bohanon and Sarah Cunningham (WQ Intern)	40
<b>Total Impressions:</b>				<b>209,956</b>

**Table 8.** Number of impressions from most utilized print and digital media outlets

Media Outlet	Distribution Period	Impressions
Dock Line Magazine (ad)	2012: Nov, Dec 2013: Jan, Feb, Mar, Apr, May, Jun, Jul, Aug, Sep, Oct, Nov	97,500 (7,500/month)
GBF Main Page (post)	Oct 2012 – June 2014	63,000 (3,000/month)
GBF Boater Waste Web Page	Oct 2012 – June 2014	770
GBF Water Monitoring Team Web Page	Oct 2012 – June 2014	904
GBF GBAN Launch Page	Oct 2012 – June 2014	822
GBAN Web Application	Oct 2012 – June 2014	1,552
GBF E-Newsletter (post)	2012: Jan, Feb, May, Oct, Dec 2013: Feb, Mar, Jun, Aug, Nov, Dec 2014: Feb	28,800 (2,400/month)
GBF Facebook Page (post)	2011: Nov 2012: Feb, Mar (3 posts), Apr, Jun (2 posts), Aug (3 posts), Sept (2 posts), Oct, Dec 2013: Feb, Mar (4 posts), Jun, Jul, Aug, Dec 2014: Jan (2 posts), Feb (2 posts), Mar (2 posts)	114,000 (3,800/post)

GBF Water Monitoring Team Facebook Group	Oct 2012 – June 2014	3,145
GBF Gazette (article)	2012: Winter, Spring, Summer 2013: Fall 2014: Spring	21,000 (4,200/issue)
GBF Online Pump-Out Guide	Oct 2012 – June 2014	9,845
GBF Online Water Monitoring Map	Oct 2012 – June 2014	5,250
GBF YouTube Videos (Pump Don't Dump: Maritime Sanitation, Marina Del Sol, South Shore Harbour, How To Pump Out Your Boat)	Oct 2012 – June 2014	9,130
Houston Boat Show Program (ad)	2013: Jan	75,000 (75,000/show)
The Boater's Directory (ad)	2012-2013 issue 2013-2014 issue	100,000 (50,000/issue)
YourHoustonNews.com (article)	2013: Mar	40
Wired.cc (article)	2013: Mar	2,500 (2,500/month)
City of Nassau Bay newsletter	2013: Oct	2,000
<b>* Total Impressions:</b>		<b>535,258</b>

\* Total impressions are likely higher due to press releases picked up by online and print media that were not easily traceable.

### **Clean Water Partnerships**

GBF began piloting Clean Water Partnerships with marinas during the last funding cycle (**Figure 12**). The program aims to develop relationships with marinas through long-term action projects instead of only utilizing them to distribute printed campaign materials. The pilot marinas during the last cycle were Marina Del Sol and Pelican Rest Marina. They both distributed Pump Don't Dump materials, and installed pet waste stations and storm drain markers. In addition,



**Figure 12. Clean Water Partnership logo**

Marina Del Sol's marina manager and two tenants were certified on the GBF Water Monitoring Team and monitor a site in the marina monthly. They allow us to host many presentations and training sessions at their club house, carry out research in the marina through the new College Research Experience, carry out surveying and outreach through the Dockwalkers, and bring groups of college students in for the Marina Service Learning Program (see Task 3). Finally, their marina manager is a participating member in the Clean Vessel Committee. Pelican Rest Marina allows GBF to place a volunteer from the Water Monitoring Team at a site in their marina and helped us develop and host the first AquaKids Family Program on their property. Aside from the BWEC, Pelican Rest Marina does a lot of work with GBF's Conservation Team including installing artificial reefs, participating in oyster gardening, as well as oyster shell recycling through their on-site restaurant. Due to the fact that much of the Clear Lake/Galveston Bay (western half) shoreline is privately owned, having these marina partnerships is extremely valuable for gaining access for outreach and data collection. **Table 9** shows GBF's current Clean Water Partnerships with the boating community and their partnership activities. By definition, a Clean Water Partner is an organization that works with GBF to take action to keep our bay fishable and

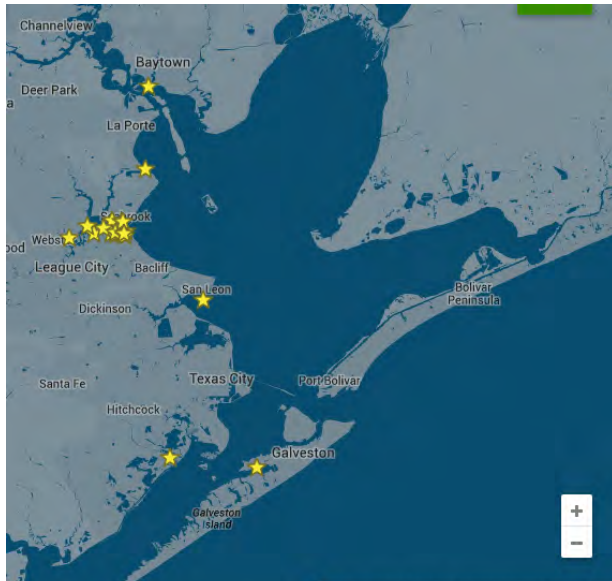


Figure 13. GBF Clean Water Partnership Google map\*

swimmable. Based on this definition, **GBF had 8 Clean Water Partnership marinas during the last funding cycle and more than doubled that to 19 partnerships this cycle (Figure 13)**. Over time, GBF’s increased presence in these marinas will help broaden our reach with the campaign messages. Furthermore, the volunteer programs that make up a majority of marina partnership activities allow GBF to build campaign ambassadors to spread the message in an efficient and cost effective manner, and much broader than our small staff could accomplish on our own.

\* Click here for Google map: <http://bit.ly/1rKNW2f>.

Table 9. Clean Water Partnerships – Boating Community

Clean Water Partner	Partnership Activities
Bal Harbor Marina	GBF Water Monitoring Team
Bayland Marina	Dockwalkers; Marina Service Learning Program
Blue Dolphin Yachting Center	Pump Don't Dump; GBF Water Monitoring Team
Endeavour Marina	Pump Don't Dump; GBF Water Monitoring Team
Harborwalk Marina	Dockwalkers
Houston Yacht Club	Pump Don't Dump; GBF Water Monitoring Team; Dockwalkers; Marina Service Learning Program
Lakewood Yacht Club	Pump Don't Dump; Boater Waste Workgroup; GBF Water Monitoring Team; College Research Experience
Marina Bay Harbor Yacht Club	Pump Don't Dump; Boater Waste Workgroup
Marina Del Sol	Pump Don't Dump; Clean Vessel Committee; GBF Water Monitoring Team; College Research Experience; Dockwalkers; Marina Service Learning Program <b>*Clean Texas Marina of the Year - 2012 and 2013</b>
Maritime Sanitation	Pump Don't Dump; Boater Waste Workgroup
Nassau Bay Yacht Club	GBF Water Monitoring Team
Pelican Rest Marina	Pump Don't Dump; GBF Water Monitoring Team; AquaKids Family Program
Portofino Harbour Marina & Yacht Club	Pump Don't Dump; GBF Water Monitoring Team
Redfish Island Marine	Pump Don't Dump; Boater Waste Workgroup
South Shore Harbour Marina	GBF Water Monitoring Team
Star Fleet Yachts	GBF Water Monitoring Team (training site)
Topwater Grill	GBF Water Monitoring Team
Waterford Harbor Yacht Club & Marina	Pump Don't Dump; GBF Water Monitoring Team; Dockwalkers; Marina Service Learning Program
Watergate Yachting Center	Pump Don't Dump; GBF Water Monitoring Team

### Task 3. Facilitate Volunteer Programs

Volunteer programs can be a very cost effective way to increase the visibility of a campaign and spread your message further. When the BWEC began in 2007, the only volunteer components were the BWEC Workgroup and occasional volunteers to assist with education booths and assembling outreach materials. There are now five additional volunteer programs, Galveston Bay Action Network, Dockwalkers, GBF Water Monitoring Team, College Research Experience, and Marina Service Learning Days, three of which were launched during this funding cycle. **BWEC volunteer programs generated a total of over 2,400 volunteer hours during this funding cycle and engaged about 150 volunteers through five programs and two stakeholder workgroups.** Each of them is described below.

#### Galveston Bay Action Network (GBAN)

GBAN is a web application that aims to educate citizens on how and where to report boat sewage discharges and other common water pollution incidents (**Figure 14**). The BWEC workgroup's theory is that more citizens reporting illegal discharges will open the eyes of marina owners, boaters, and enforcement agencies to the reality of the boater waste issue instead of GBF and workgroup members just receiving the reports via word of mouth. Having a central location for these reports to be mapped allows GBF to determine if there are repetitive problem areas that we can then present to enforcement agencies to monitor. The reports in and of themselves will likely not result in direct enforcement action since it is difficult to document discharges in real-time, but GBF hopes that GBAN will help promote the need for and streamline enforcement activities. The toughest issue to overcome with GBAN is that people are still not comfortable with openly reporting incidents for fear of business or personal repercussions. GBF hopes that as GBAN usage continues to grow, this fear will lessen as they realize that our ultimate goal with GBAN is to keep our water fishable and swimmable through the transparent exchange of information, not to see people suffer from being fined or from hurting businesses. This transparency should be similar to a neighborhood crime watch program and result in safer and more desirable marinas, thus improving businesses.



Figure 14. GBAN web application

Additionally, reporting water pollution is currently quite cumbersome for the average citizen due to the fact that there are so many entities to track down based on the type of pollution and where it is located. GBF created a contact list (<http://www.galvbay.org/gban>) to try to make this easier for the public. However, after setting up GBAN and receiving calls and reports online that we then had to track down and refer to authorities; it became obvious that another bridge was still needed in order to simplify the process. Lessons were learned by looking at the number of GBAN webpage visits (2,374) compared to the number of reports received (25 reports). GBF believes that creating the mobile app version of GBAN will be the key to increasing citizen engagement in pollution reporting. These events are usually witnessed when people are not near their computer, so having the ability to easily report via a smart phone should be helpful. The mobile version is slated to be launched in the fall of 2014.

### **GBF Dockwalkers**

Dockwalkers is a volunteer program for boaters to educate other boaters on environmentally sound practices through positive “pier” pressure, to provide them with physical tools to keep the bay fishable and swimmable, and to collect local statistics to aid in environmental planning. GBF’s program is based off of a very successful program in California, but has been personalized to focus on the immediate water



Figure 15. Dockwalker volunteer kit



Figure 16. Clean Boater Kits

quality needs in the Galveston Bay area. GBF developed a training presentation (**Appendix III**), Clean Water Questionnaire (**Appendix III**), Clean Boater Kits, and a draft survey plan. The survey contains questions that will help us collect data needed for the Boater Waste Impact Study that will be written in the next funding cycle. Volunteer Legal Interns spent the past two summers compiling research on other states’ processes for applying for No Discharge Zones (NDZ), which culminated in them writing “memos” (**Appendix III**) that have helped GBF determine the next steps needed in order to successfully apply for Galveston Bay to be a federal NDZ. Their research, along with that of our current Water Quality Policy and Outreach Intern, has led to us using the Dockwalker program to collect important data that is lacking for our area. GBF is researching how our area stands in terms of number, reliability of, and average travel time to pump-out stations, recreational boater pump-out habits, and knowledge of boater waste laws and environmental concerns. Dockwalkers ask boaters to take a few minutes to fill out the educational survey (**Figure 15**) and the boaters receive a Clean Boater Kit (BWEC education materials, Pump Don’t Dump zip tie for discharge valve, dye tablet, and bilge oil absorbent pad) (**Figure 16**) in exchange for their participation. Dockwalkers are also asked to submit water pollution reports through GBAN.



Figure 17. Dockwalker pilot testing in Waterford Harbor Marina

During this funding cycle, GBF setup the infrastructure for this volunteer program and carried out pilot testing of the program in order to work out any bugs before doing a major launch (**Figure 17**). At the same time, we networked with members of the Galveston Bay and Houston Sail and Power Squadrons, and U.S. Coast Guard Auxiliary to garner interest in this program as an add-on volunteer opportunity to their vessel safety inspections. The survey plan was setup based on the U.S. EPA Guidance on Choosing a Sampling Design for Environmental Data Collection (EPA QA/G-5S) and The Social Indicator Planning & Evaluation System for Nonpoint Source Management. The main goal was to determine how many total surveys were needed and the survey distribution needed in order to obtain a representative data set of the Clear Lake/Galveston Bay boats greater than 25 feet long (having some sort of marine sanitation device). GBF will stick to this survey design as much as possible, while continuing to develop standard operating procedures when barriers come up (i.e. marina does not grant permission, marina with very few boats of target size, etc.). Based on Texas Parks and Wildlife boater registration data, there are 8,771 boats greater than 25 feet registered in the counties directly surrounding Galveston Bay. The 2013 Clean Texas Marina Directory indicates that there are 5,352 wet slips in Clear Lake and 1,345 in Galveston Bay, leaving 2,074 boats not in a marina. In order to achieve +/- 5% error, a maximum of 370 total surveys are needed so we divided this proportionally amongst the three categories of boat storage locations. This results in us needing to collect 57 surveys from Galveston Bay marinas, 226 surveys from Clear Lake marinas, and 87 from non-marina coastal communities (i.e. canal communities). We randomized each list of marinas/communities and will start at the top of the list and work our way down until we achieve the appropriate number of surveys. For the purposes of our preliminary study, the surveys will take place on Fridays and Saturdays from 9-11am, 1-3pm, and 4-6pm.

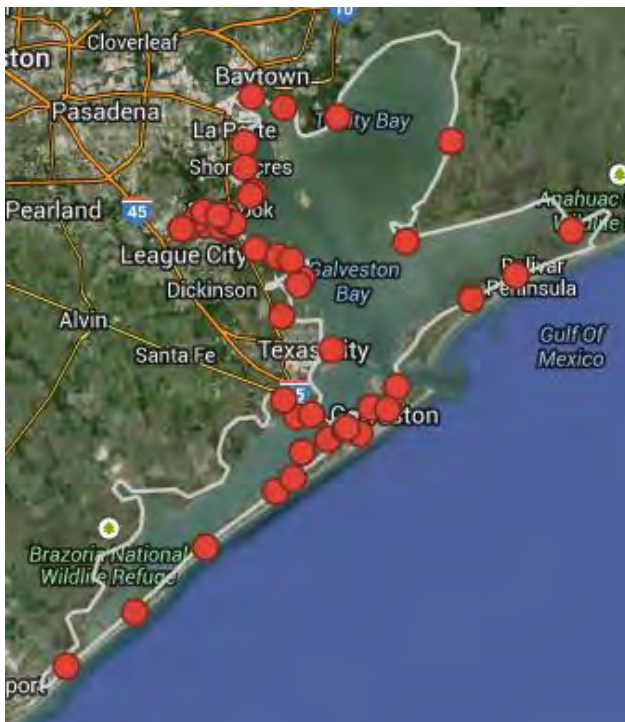
**Table 10** shows the pilot training and testing schedule, locations, and volunteers. GBF's Water Quality Policy and Outreach Intern will continue surveying for the next three weeks and compile her results and lessons learned. This information will be used to improve tweak and improve the program and GBF will offer the first Dockwalker training before the busy boating season ends in the fall. Results from the first week of surveying are summarized under Task 4.

**Table 10.** Dockwalker events, volunteers, survey locations and schedule

Date	Event	Site	Dockwalkers	# Volunteers	# Surveys
3/12/2014	Training and pilot testing	Marina Del Sol	Alternative Spring Break college students from University of North Texas and University of Texas – Dallas	18	3
6/3/2014	Training	GBF Office	Sarah Cunningham – Water Quality Policy/Outreach Intern	0	0
6/27/14	Pilot testing	Harborwalk Yacht Club	Sarah Cunningham – Water Quality Policy/Outreach Intern	0	11
6/28/14	Pilot testing	Harborwalk Yacht Club	Charlene Bohanon; Jamie Bohanon (volunteer); Sarah Cunningham (Water Quality Policy/Outreach Intern)	1	10

### **GBF Water Monitoring Team**

The GBF Water Monitoring Team (a group within the Texas Stream Team) launched in February 2012 and the Bacteria Sampling Program in January 2013. There are four main goals for collecting water quality data through these programs for the BWEC:



**Figure 18. GBF Water Monitoring Team sampling site Google map**

- 1.) To engage citizens in a hands-on program that empowers them to be Bay Ambassadors
- 2.) To create a line of communication between GBF, boaters, and marinas on a regular basis
- 3.) To establish baseline data trends at marinas and other near-shore recreational sites in Clear Lake and Galveston Bay
- 4.) To detect potential bacteria impairments associated with boat sewage discharges

GBF Water Monitoring Team volunteers are certified to sample at sites around the bay and Clear Lake for core parameters (temperature, pH, dissolved oxygen, salinity, transparency, and field observations), as well as Enterococci bacteria. They commit to sample their site(s) on at least a monthly basis. GBF's team is part of the Texas Stream Team by being a group within the Houston Galveston Area Council's region, in addition to having our own Volunteer Bacteria Sampling Program. **The monitoring team**

**currently has 52 volunteers sampling from 51 locations, 19 of whom have advanced certification to collect bacteria samples at 21 sites (Figure 18 and Table 11). This is more than double the number of volunteers and monitoring sites since the last funding cycle.** Monitoring locations are shown below and

### **First Ever Eco-Hero Volunteer Award Given to GBF Volunteer**

The Galveston Bay Foundation began a partnership with the Gulf of Mexico Coastal Ocean Observing System Regional Association (GCOOS) in 2012 and has since begun collaboration on a cohesive, Gulf of Mexico-wide data viewer for citizen-collected water quality data. Through this fruitful partnership, GCOOS has announced the very first recipient of their new Eco-Hero Volunteer Award, which honors outstanding citizen scientists around the Gulf of Mexico. GBF's Water Quality Team was extremely proud to present the Eco-Hero Volunteer Award to one of our own dedicated volunteers, David Bulliner, at Bravos for the Bay on January 16, 2014.

David Bulliner has contributed to the betterment of the Gulf of Mexico through his volunteerism

as a GBF Bacteria Lab Assistant and a certified Texas Stream Team Water Quality Monitor and through his involvement with the Galveston Bay Area Chapter of the Texas Master Naturalists, among many other things.

Chris Simoniello, GCOOS Education and Outreach Coordinator stated, "GCOOS is committed to enhancing the health and economic sustainability of the Gulf, and volunteer efforts like David's exemplify the power of individuals..." This award does not only acknowledge David's exceptional volunteer water quality monitoring services, but serves to thank him for his exemplary citizenship. Thank you, Dave, for contributing information for the benefit of all who live, work, and play in Galveston Bay!



*Dave Bulliner prepares to measure the bacteria concentration of a water sample in the GBF Bacteria Lab.*

the full map can be accessed at <http://www.galvestonbay.org/watermonitors>.

**Figure 19. GBF Gazette article about Eco Hero Volunteer Award**



Additionally, GBF has an amazing Volunteer Lab Assistant who receives, processes, and analyzes bacteria samples. Since the lab opened in February 2012, he has helped us process many of the over 500 samples that have been brought to GBF's lab. For that, he was awarded the Gulf of Mexico Coastal Ocean Observing System's Eco Hero Award (**Figure 19**).

The entire monitoring program is conducted under an EPA-approved Quality Assurance Project Plan and Quality Management Plan (**Appendix III**). The WMT has allowed GBF to develop a strong relationship with the local chapter of Master Naturalists, who are also interested in preserving, protecting, and enhancing Galveston Bay. Implementation of the WMT has allowed GBF to better connect with many marina and waterfront restaurant owners around Galveston Bay to provide sampling sites and promote clean water. Another unexpected benefit was that one of our volunteers, Neally Rhea (**Figure 20**) applied for and was hired for the new GBF Water Quality Outreach Assistant part-time position in February 2014! She is the main staff member working on the Dockwalker program, as well as several



other GBF water quality programs. **Table 12** shows the group and quality control training events that GBF held during this cycle. In addition, each volunteer that decided to complete their certification received a one-on-one Phase III certification session at their site with a GBF staff member to ensure that they were able to carry out the procedures accurately. GBF continued to make improvements to the

**Figure 20. GBF Water Quality Outreach Assistant - Neally Rhea**

management and processes within the WMT including increased written documentation of our standard operating procedures, as discussed under Task I (**Appendix III**). GBF plans to continue training new volunteers to fill in some of the gaps around the Galveston Bay coastline and marinas that are not yet monitored, as well as to refill sites if volunteers decide to stop monitoring. Also, GBF plans to test out plankton monitoring so that the volunteers can aid in screening for harmful algal blooms, which could be exacerbated by discharged sewage. Results from WMT activities will be discussed under Task 3.

**Table 11. GBF Water Monitoring Team volunteers, sites and monitoring schedule**

Site Description	Volunteer	Monitoring Schedule
Burnet Bay @ 1770 Hillcrest, Lynchburg	Karley Little	4th Saturday
Christmas Bay @ 257s County Boat Ramp	Annasheril Santos	TBD
Clear Lake @ Bal Harbor Marina (End of Pier A)	Brenda Hesse	3rd Thursday
Clear Lake @ Blue Dolphin Yachting Center	Tricia Lestarjette	1st Monday

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Clear Lake @ Clear Lake Park Pier	Diane Humes	Last Monday
Clear Lake @ Clear Lake Shores (near 1010 North Shore Drive)	Arline Laughter	2nd Tuesday
Clear Lake @ Endeavour Marina	Anne and Glenn Krum	1st Saturday
Clear Lake @ Lakewood Yacht Club	Tricia Lestarjette	1st Monday
Clear Lake @ Marina Del Sol	Amber Faubion, Glen Graves, Yulenty Deal	Middle of month
Clear Lake @ Nassau Bay Yacht Club	Helen Lane	1st Tuesday @ 9am
Clear Lake @ Portofino Harbor Marina	Steve Gammill	Every Other Saturday
Clear Lake @ South Shore Harbor	Candy Capuano-Day	3 <sup>rd</sup> Thursday
Clear Lake @ Watergate Yachting Center	Cindy Liening	3 <sup>rd</sup> Thursday
East Bay @ Bluewater	Dennis Peterson	19th of each month
East Bay @ Frozen Point, Anahuac NWR	Mark Danna	2nd Wednesday
Galveston Bay @ 1109 6th St. San Leon	Mark Niles	15th and 30th
Galveston Bay @ 3903 Bayshore Bacliff	Dianne Forthmann and Joe Cavallaro	1st Tuesday, 6pm
Galveston Bay @ Bayland Park	Sara Halpin	The last Sunday
Galveston Bay @ Bayshore Park	Brenda Gonzales	30th
Galveston Bay @ Candy Abshier WMA	Mark Danna	2nd Wednesday, first
Galveston Bay @ Galveston Bay RV Resort	Raul Rogel	2nd weekend of month
Galveston Bay @ Jetty off Starboard Lane	Gary Russell	1st Sunday
Galveston Bay @ Pier 21	Julie Birsinger	3rd Thursday 1-3pm
Galveston Bay @ Pine Gully Park	Madeleine Barnes	2nd and 4th Monday
Galveston Bay @ Seascape Pier	Gary Bell	Middle of month
Galveston Bay @ Seawolf Park	Sheena Abernathy	1st Thursday
Galveston Bay @ Shoreacres Pier	Kay and Kendall Pickett	2nd Wednesday
Galveston Bay @ Stingaree Restaurant	Ange Busceme	1st and 3rd Wednesdays
Galveston Bay @ Sylvan Beach Park	Brenda Gonzales	30th
Galveston Bay @ TAMUG	Clifford Pabon	beginning of month
Galveston Bay @ Texas City Dike	Cindy Liening	2nd Thursday
Galveston Bay @ Topwater Grill	Ray Rottmann	Tuesday closest to 1st
Jarboe Bayou @ Jarboe Bayou Park	Helle Brown	2nd Tuesday
Jones Bay @ Bayou Vista	Chris Roper	2nd Thursday @ 9am
Jones Bay @ Isles End Tiki Island	John (and Lynn) Wright	3rd Saturday
Jones Bay @ Tiki Tom's RV Park	Carol French	3rd Thursday
Moses Lake @ Texas City Prairie Preserve	Scott Buckel	Every Other Tuesday
Nassau Bay @ Upper Bay Road Howard Park	Ray Rottmann	Tuesday closest to 15th
Offatt's Bayou @ Pelican Rest Marina	Paul Day	Every other Thursday
Offatt's Bayou @ Sandbar Grill	Heather Brasher	1st Tuesday

Offatt's Bayou @ SSBG Dock #2	Abigail Hills	Mondays and Saturdays
Trinity Bay @ Carroll Rd	Bob Lanser	14th of each month
Trinity Bay @ Oak Island Lodge	Sandra Moreno	2nd Monday @ 4pm
West Bay @ Eckert Bayou	Christi and Marcos Torres	Every other Sunday
West Bay @ Oak Bayou	Skyler Carey	2nd Wednesday @ 8am
West Bay @ Sportsman Road	Kristi Fluker	3rd Thursday
West Bay @ Swan Lake	Jody Ainbinder	3rd Saturday
West Bay @ Sweetwater Preserve	Neally Rhea	Every other Sunday @ noon
West Bay @ Terramar	Jo Monday	3rd Sunday @ 8-10am

**Table 12.** GBF Water Monitoring Team events

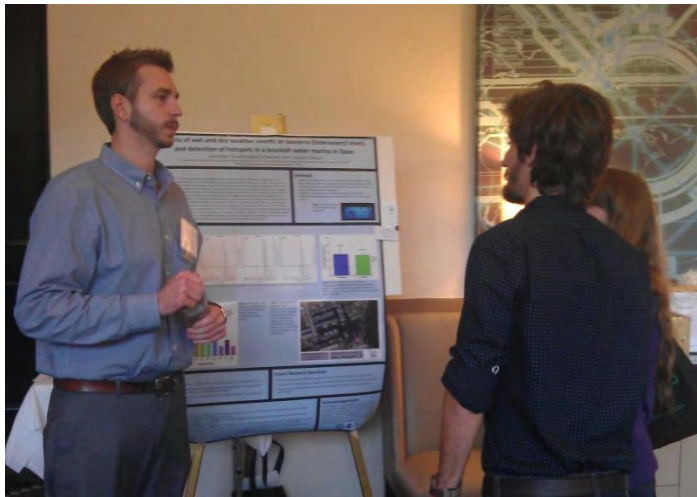
Date	Event	Location	Representative	Impressions
2/2/2012	Phase I and II training class	Watergate Yachting Center	Charlene Bohanon	8
4/21/2012	Phase I and II training class	Marina Del Sol	Charlene Bohanon	8
9/14/2012	Phase I and II training class	Star Fleet Yachts	Charlene Bohanon, Teresa Long, and Matthew Abernathy	24
1/31/2013	Volunteer appreciation event and bacteria sampling training	GBF Conference Room	Charlene Bohanon and Katie McCann	6
2/11/2013	Volunteer appreciation event and bacteria sampling training	GBF Conference Room	Katie McCann	2
3/9/2013	QC and bacteria sampling training	Marina Del Sol	Charlene Bohanon and Katie McCann	10
3/22/2013	Phase I and II training class	Star Fleet Yachts	Charlene Bohanon, Katie McCann and volunteer monitor assistant	14
5/8/2013	Volunteer appreciation event and data discussion	GBF Conference Room	Charlene Bohanon and Katie McCann	10
5/15/2013	High school intern presentation	GBF Conference Room	Charlene Bohanon, Katie McCann, Emily Ford	3
6/4/2013	Phase I and II training class (CRE)	GBF Conference Room/Nassau Bay	Katie McCann	2
6/10/2013	Bacteria sampling and processing training (CRE)	GBF Conference Room/Lab	Katie McCann	2
8/14/2013	Bacteria sampling training	GBF Conference Room	Katie McCann	3
8/21/2013	CRE research presentation	Marina Del Sol	Ryan Bare (CRE Intern), Charlene Bohanon, Katie McCann	13

9/4/2013	QC training	Boudreaux's on the Bayou	Katie McCann	1
9/14/2013	Phase I and II training class	Star Fleet Yachts	Katie McCann, Charlene Bohanon and volunteer monitor assistant	17
10/17/2013	CRE research poster presentation	Texas Association of Environmental Professionals	Ryan Bare (CRE Intern) and Charlene Bohanon	150
12/10/2013	QC training class	Marina Del Sol	Katie McCann	6
12/20/2013	Phase I and II training class	College of the Mainland	Katie McCann	2
1/8/2014	QC training class	Marina Del Sol	Katie McCann	2
1/13/2014	QC training class	Portofino Harbor	Katie McCann	1
1/16/2014	QC training class	Bayou Vista home	Katie McCann	1
2/22/2014	Bacteria sampling training	GBF Conference Room	Katie McCann	4
3/6/2014	How GBF WMT Uses Texas Stream Team presentation	Houston Galveston Area Council	Katie McCann	40
3/7/2014	QC training class	Bayshore Park	Katie McCann	1
3/25/2014	QC training class	Marina Del Sol	Katie McCann	2
3/31/2014	QC training class	Marina Del Sol	Katie McCann and Neally Rhea	11
4/5/2014	QC training class	Marina Del Sol	Katie McCann and Neally Rhea	5
4/11/2014	Phase I and II training class	Star Fleet Yachts	Katie McCann, Neally Rhea, and volunteer water monitor assistant	23
5/10/2014	QC training class	Tiki Island	Katie McCann	2
6/2/2014	Phase I and II training class (CRE)	GBF Conference Room/Nassau Bay	Katie McCann	2
6/10/2014	GBF marina water quality research introduction	CRE Interns, GBF Conference Room	Charlene Bohanon	2
<b>Total Impressions:</b>				<b>377</b>

**College Research Experience**

GBF's College Research Experience provides university students the opportunity to develop and execute a short-term water quality research project from start to finish including planning, design, sampling, data analysis and creating a final research product. This program launched during this funding cycle in

June 2013 in order to provide the many university students in the Clear Lake/Galveston Bay area an opportunity to participate in a hands-on, professional internship experience. Students are introduced to the Upper Gulf Coast Oyster Water TMDL Implementation Plan and the BWEC, certified to sample under GBF's QAPP, and carry out a project to help answer research questions related to the BWEC. This intern program helps provide the BWEC Workgroup and Clean Vessel Committee with focused data to help guide campaign activities, as well as track potential improvements in marina water quality over time in a more focused way than is possible with monthly ambient monitoring at just one site per marina.



**Figure 21. CRE presentation at Texas Association of Environmental Professionals conference**

June and July 2013. Enterococci concentrations were quantified using the IDEXX Enterolert method and three day rainfall accumulation prior to sampling was recorded from NOAA's Climate Data Online.

The first CRE project was carried out by a master's student from Texas A&M University at Galveston, Ryan Bare (**Figure 21**), with the assistance of several volunteers from the WMT. This study took place in Marina Del Sol on Clear Lake in Kemah, Texas and proposed that stormwater runoff was the primary cause of elevated Enterococci levels in the marina, that hotspots of Enterococci were present, and that the concentration of Enterococci increased from the entrance to the back portion of the marina. Sampling was conducted at 10 sites (**Figure 23**) between 0800 and 1100 every Monday, Thursday, and Saturday over five weeks in



**Figure 22. CRE Intern presenting to GBF and marina staff and volunteers**

hired as a research assistant for the Houston Advanced Research Center. Recently, his poster was

The results of the study are presented under Task 3. Ryan presented his data in a poster session through the Texas Association for Environmental Professionals (**Figure 21 and Appendix III**), gave a presentation to GBF and Marina Del Sol staff and volunteers (**Figure 22**), changed to a master's thesis track to conduct a follow-up study looking at survival of Enterococci in marina sediments (**Appendix III**), and has since graduated and was

accepted to be presented at the Restore America's Estuary and The Coastal Society's National Summit in November 2014. GBF is very proud of his hard work and we look forward to continuing to collaborate with him through his new career.



Figure 23. CRE sampling design at Marina Del Sol



Figure 24. Summer 2014 CRE Interns

This summer, two CRE interns (Winston Lee and Tanu Uppal, **Figure 24**), were selected and have begun their research for the summer. One is an undergraduate civil engineering student from the University of Texas – Austin and the other is a graduate student from the University of Texas, School of Public Health – Houston. They will be conducting a second year of sampling in Marina Del Sol, as well as a new study at Lakewood Yacht Club. The marina manager at Lakewood Yacht Club was very interested in learning more about the water quality in their marina after seeing the CRE 2013 research poster and results, so invited GBF to use their marina as a study site. Once again, the graduate student will continue her work with us through the fall in order to use this research for her master's thesis. The benefits of the CRE program are proving to be threefold: 1) Provides university student's with applied learning opportunities to make them competitive in the environmental job market, 2) Provides the Galveston Bay area with much needed data to

aid in watershed planning activities, and 3) Aids GBF in establishing even stronger relationships with local marinas and the boating community.



**Figure 25. College students testing water at Waterford Harbor Marina**

**Marina Service Learning Days**

Data collection is often limited by either monetary or human resources, making citizen monitoring a beneficial option for non-regulatory purposes. However, collecting quality data requires a significant amount of dedication from both staff and volunteers in terms of training and quality control. GBF wanted to create a protocol that would allow for local college classes to receive streamlined training and collect a substantial amount of data in one day, while still upholding a high level of quality control (**Figure 25**). Thanks to the Houston-Galveston Area Council (BWEC Workgroup member) loaning us YSI meters, we were able create Marina Service Learning Days in order to augment our monthly ambient sampling and intense CRE studies because it significantly cuts down on the sampling time for dissolved oxygen, salinity, and water temperature. The same methods for pH, transparency, air temperature, field observations, and bacteria sampling are used as for the WMT. Quality control is maintained by having a GBF staff member or advanced trained WMT volunteer accompany and oversee all of the sampling procedures. This

program will allow us to collect data at multiple sites within more marinas, with the hope of improving our chances of showing water quality improvements over time. At the same time, it allows us to give more students the opportunity to participate in hands-on citizen science. GBF is considering offering this opportunity to members of the WMT, as well. GBF added this method to our QAPP and developed a modified field guide and data sheet, and a draft water quality summary report that will be used to share the results with marinas that participate in the program (**Appendix III**). Table 13 shows the first two pilot events for this program, which will be used as GBF increases the frequency that it is carried out in the next funding cycle.

**Table 13. Marina Service Learning Day schedule, sites, and volunteers**

Date	Event	Site	Representatives	# Volunteers
3/12/2014	Marina Service Learning Day pilot test	Marina Del Sol and Waterford Harbor Marina	Alternative Spring Break college students from U of North Texas and UT Dallas; Charlene Bohanon, Katie McCann and Neally Rhea	18
4/25/2014	Lee College Marina Service Learning Day	Bayland Marina; Houston Yacht Club	Neally Rhea and Charlene Bohanon	18

#### Task 4. Track Behavior Change and Resulting Environmental Improvements

GBF is continuously looking for ways to improve our tracking methods in order to better demonstrate behavior change and environmental improvements resulting from the BWEC. Due to the nonpoint source, transient nature of boater waste pollution, it can be difficult to attribute changes in water quality specifically to this one source. This is compounded by the fact that data in marinas was lacking. During this funding cycle, GBF developed several new volunteer programs which will help increase the amount of water quality and supporting data that is able to be collected in marinas. The following sections will detail results for this funding cycle and will address opportunities for improvement in future cycles.

##### Galveston Bay Action Network (GBAN)

The purpose of GBAN during this grant period was to use a free version through Crowdfunder to beta test and determine exactly what we want in a future custom mobile app. **Figure 26** shows that GBAN received 274 unique visitors, 339 total visits, and 1,574 page views during this funding cycle and **Figure 27** displays the breakdown of reports by category. Boat sewage reports were the most common type of report, followed by trash and debris. These numbers are not very high, but we did not carry out a widespread marketing push since it was a beta test so that is to be expected. However, the GBAN wallet cards are extremely popular (we distributed 6,000 and are on our third order of 3,000 cards) and initial reactions to the app are very positive. We will need to utilize multiple types of media and calls to action in order to translate the initial excitement about the app into actually using it because time will pass between the time a citizen learns of the app and witnesses a pollution event. Additionally, this beta test verified that the app must be offered via mobile devices; otherwise it takes too much effort to remember to post a report once getting back to a computer. Finally, the app must be developed so that the reports are internally and automatically directed to the proper authority based on the type of pollution and the reporter's location. It is too much to expect for citizens to figure out where to send their report and GBF staff do not have the capacity to act as intercessors for every report.

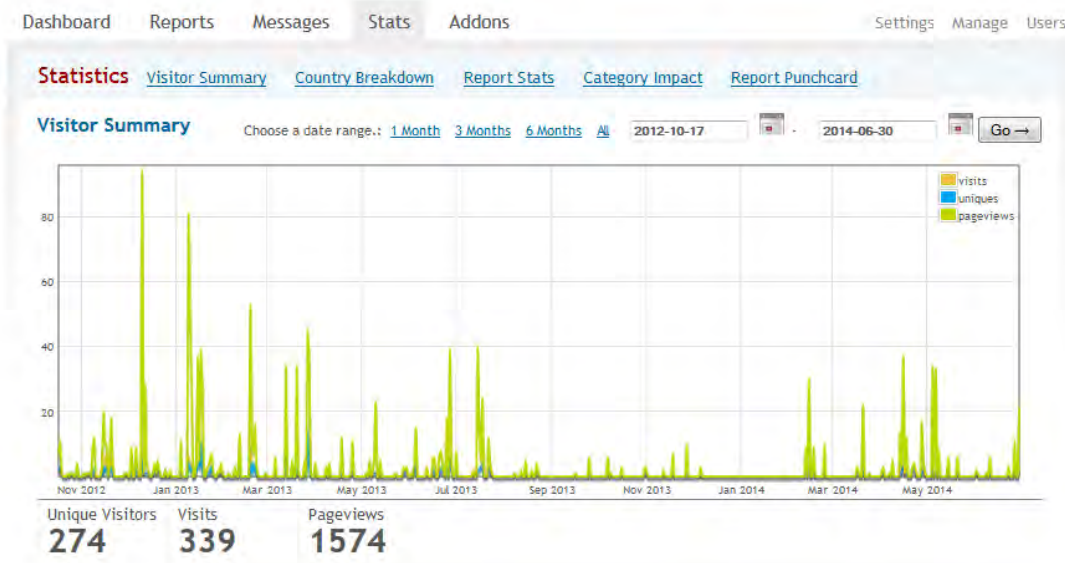


Figure 26. GBAN visitor summary



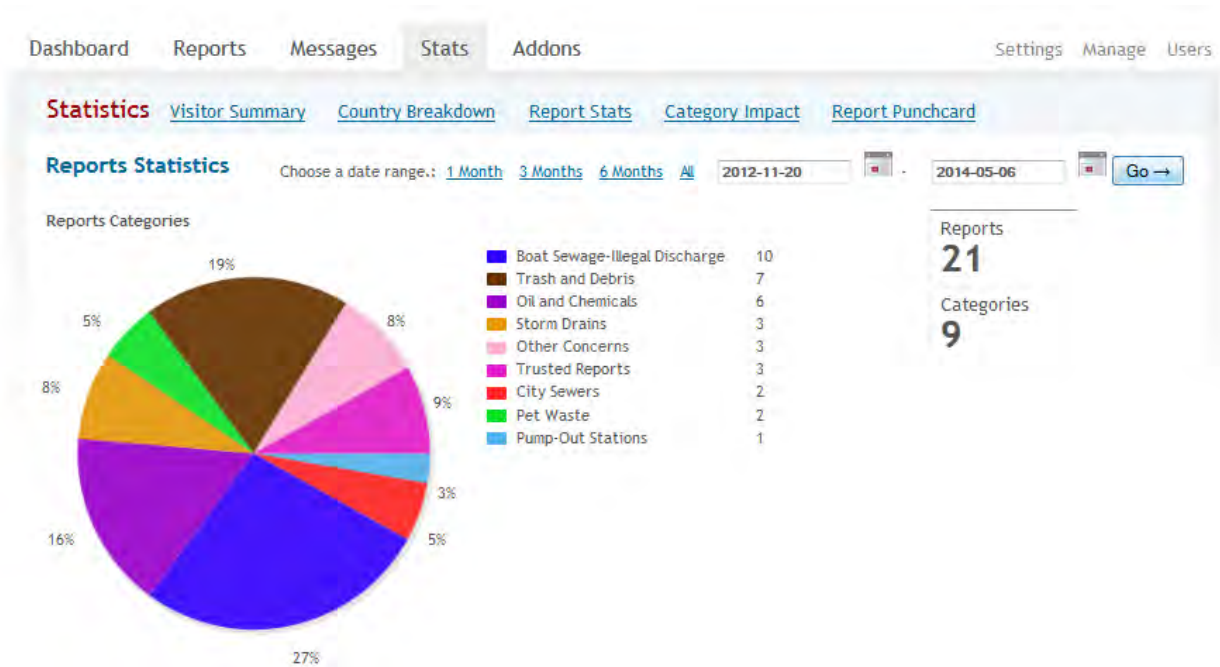



Figure 27. GBAN report statistics

### **GBF Dockwalkers**

Preliminary data was collected through Dockwalker surveys (**Figure 28**) at Harborwalk Marina, which is located in Hitchcock, Texas on West Galveston Bay. A total of 21 surveys were conducted on a Friday and Saturday between 0900 and 1800. Harborwalk has a total of 156 wet slips, so this data set represents 13.5% of the marina. **Table 14** and **Figures 29 – 34** summarize key findings. Based on these results, GBF will be able to tailor campaign messaging and strategy to improve knowledge and behavior change, determine priority areas for new pump-out facilities, share valuable market information with mobile pump-out companies, etc.

Overall, those surveyed at Harborwalk Marina were seasoned, live-aboard boaters (**Table 14**) who generally cared about Galveston Bay water quality, and a majority had a Type I or II MSD with a holding tank that they use frequently (**Figures 29 and 31**). Based on their observations, they believe that most people use the pump-out station frequently and that very few that discharge sewage (**Figure 34**). Interestingly, very few hire a mobile pump-out company (**Figure 30**). Also, a majority of those surveyed did not know that the consequence for not securing the discharge valve or having a Clean Water Certification sticker for the MSD can result in a fine of up to \$500 per day (**Figure 32**). Finally, most participants thought that there are only one to three pump-out facilities in the Galveston Bay/Clear Lake area (**Figure 33**), when in actuality there are 16 pump-out stations or carts and 3 mobile companies. These findings will continue to be updated as more survey data is collected and published in a report during the next funding cycle.

**2014 Clean Water Questionnaire**



Date: \_\_\_\_\_ Location where you received boater kit and questionnaire: \_\_\_\_\_

1. How does Galveston Bay benefit you?  
 (Check all that apply)  
 Fishing     Sailing     Boating/cruising  
 Seafood     Swimming     Bird-watching  
 Recreational tubing and skiing  
 Livelihood (specify occupation): \_\_\_\_\_

2. How long have you been boating? \_\_\_\_\_ year(s)

3. On average, how often are you on your boat per month?  
 \_\_\_\_\_ day(s)

4. On average, how many people are on board your boat at one time? \_\_\_\_\_

5. What is your 5-digit home zip code? \_\_\_\_\_

6. Where in Galveston Bay do you fish/boat most often?  
 (Rank locations from 1 to 5, 1 being most often)  
 \_\_\_\_\_ Dickinson Bay    \_\_\_\_\_ East Bay  
 \_\_\_\_\_ West Bay    \_\_\_\_\_ Clear Lake  
 \_\_\_\_\_ Other (specify): \_\_\_\_\_

7. What type of boat(s) do you currently own?  
 (Check all that apply)  
 Ski boat/run-about     Fishing boat  
 House boat     Sailboat  
 Motor yacht  
 Personal watercraft (jet-ski)  
 Off-shore racer (cigarette boat)  
 Other (specify): \_\_\_\_\_

8. What type of toilet is on board your boat?  
 No toilet on board (**Skip to question 14**)  
 Type I or II without a holding tank (**Skip to 14**)  
 Port-a-potty  
 Type I or II with a holding tank  
 Type III  
 I don't know

9. What year is your boat? \_\_\_\_\_

10. What is the size of your boat? \_\_\_\_\_ (ft)

11. What is your average cruising speed?  
 \_\_\_\_\_ mph or \_\_\_\_\_ knots

---

12. How often do you use your toilet on board your boat?  
 Every time I go out     Occasionally  
 Never

13. When using a sewage pump-out/dump station, how often:  

	Never	Half the Time	Most Often	Always
--	-------	---------------	------------	--------

A. Is the pump-out broken?   

B. Is the pump-out closed?   

C. Do you wait in line?   

D. Are you unable to find one?   

E. Is the station staffed?   

F.  Not applicable. I use a mobile pump-out service.


14. How many pump-out stations/carts do you know of in the Clear Lake or Galveston Bay area?  
 1-3     4-6     7-9  
 10+     I don't know

15. What is the consequence for boaters in Texas who do not secure their discharge valve or do not have a Clean Water Certification sticker for their marine sanitation device?  
 Nothing, it is discouraged but not against the law  
 Fine up to \$150 per day  
 Fine up to \$500 per day  
 I don't know

16. Do you conduct maintenance on your boat while in the water?  
 A.  Yes     No  
 B. If so, what kind?  
 Washing with cleaning product  
 Waxing (fiberglass)  
 Sanding/staining (wood)  
 Motor maintenance  
 Other (specify): \_\_\_\_\_

17. Have you, or anyone you know, discharged sewage into Galveston Bay?  
 Yes, treated sewage     No  
 Yes, untreated sewage  
 Yes, treated & untreated sewage

18. Did you know that sewage discharge from boats can cause elevated levels of bacteria that are harmful to wildlife, humans, and seafood/tourism economy?  
 Yes!     No, but now I do!

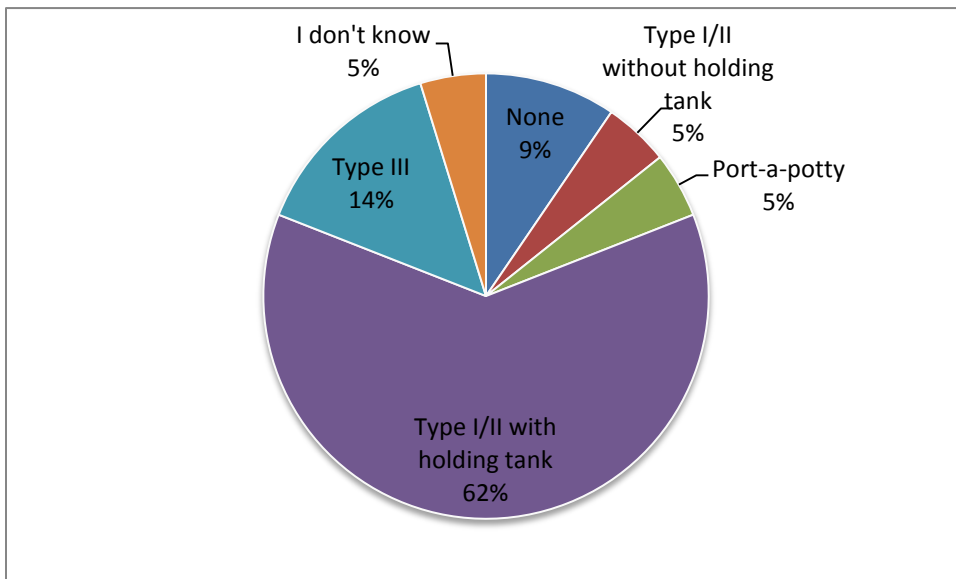


This project is funded in part by a Texas Coastal Management Program grant approved by the Texas Land Commissioner pursuant to National Oceanic and Atmospheric Administration award No. NA12NO04180164 and NA13NO04190113

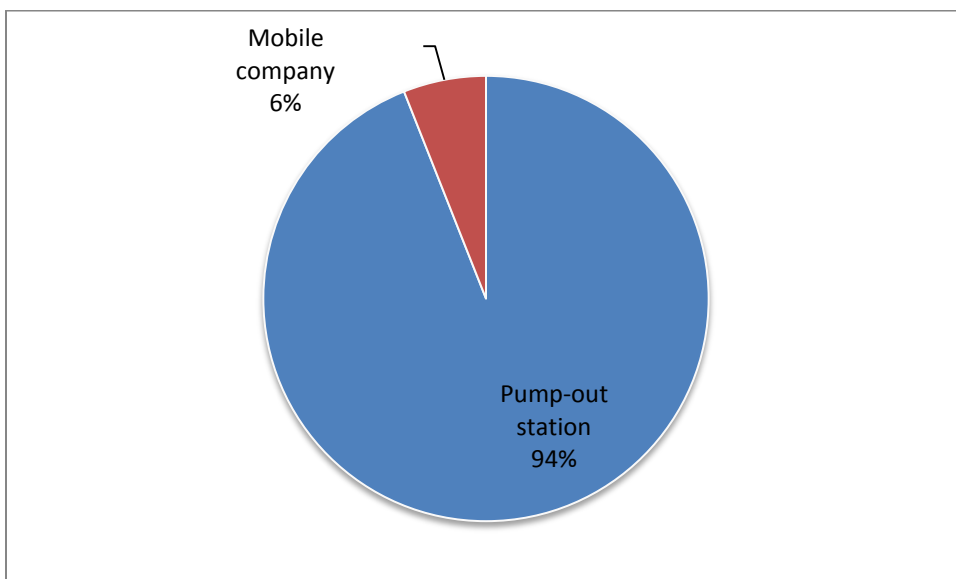
Figure 28. 2014 Dockwalker survey

**Table 14.** Basic characteristics of survey participants

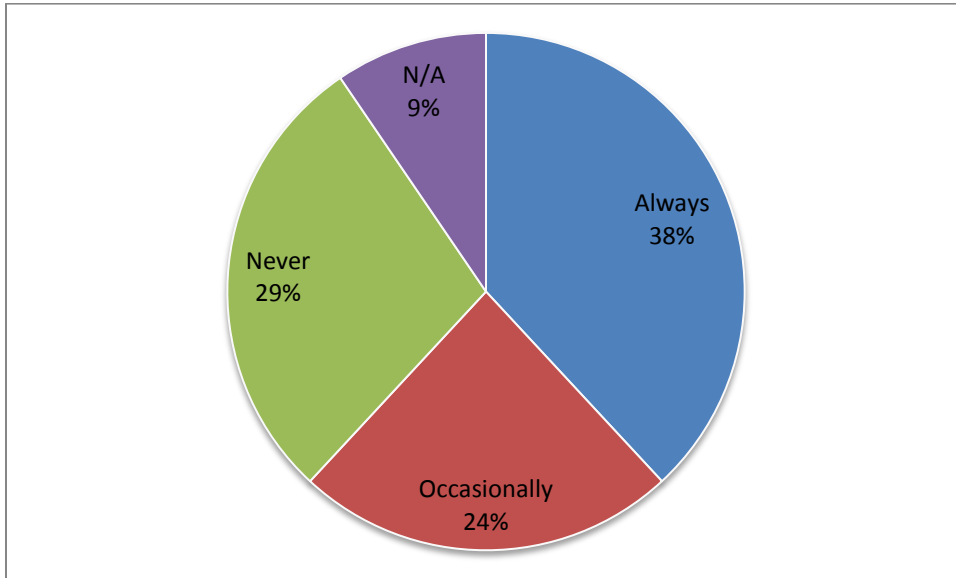
Question	Average answer
Boating experience	30 years
Number of days on board per month	18 days
Number of people on board	3 people
Boat length	38 feet



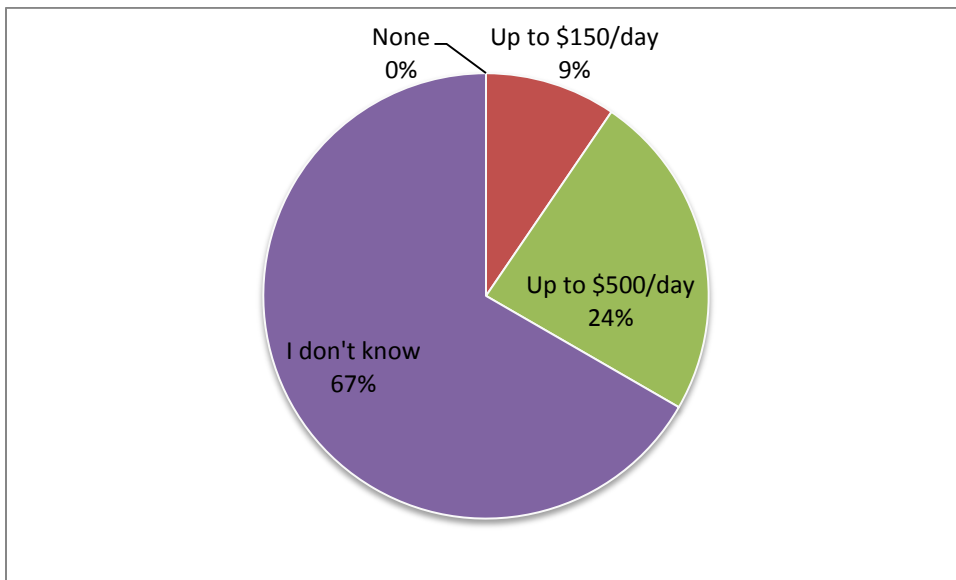
**Figure 29.** Type of MSD onboard boat



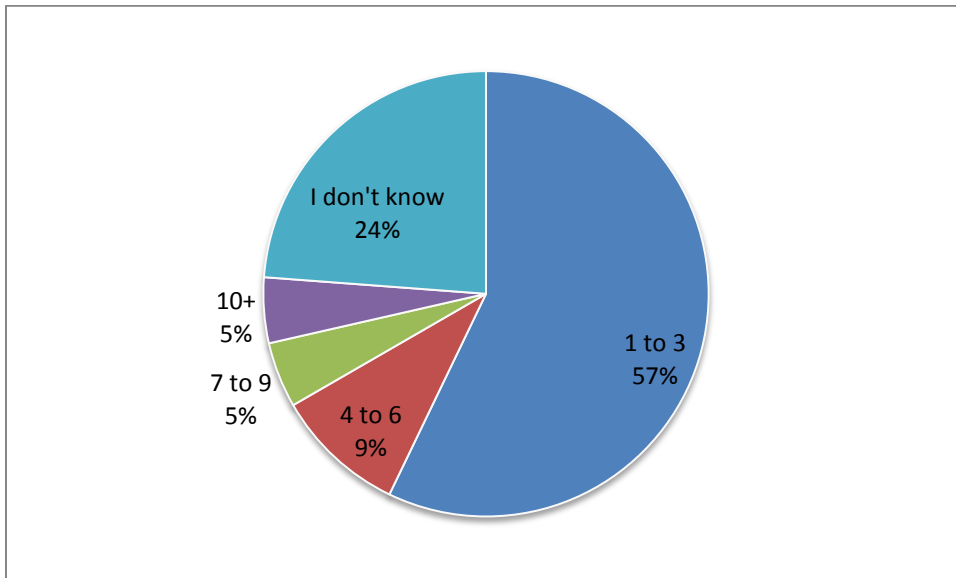
**Figure 30.** Type of pump-out facility used



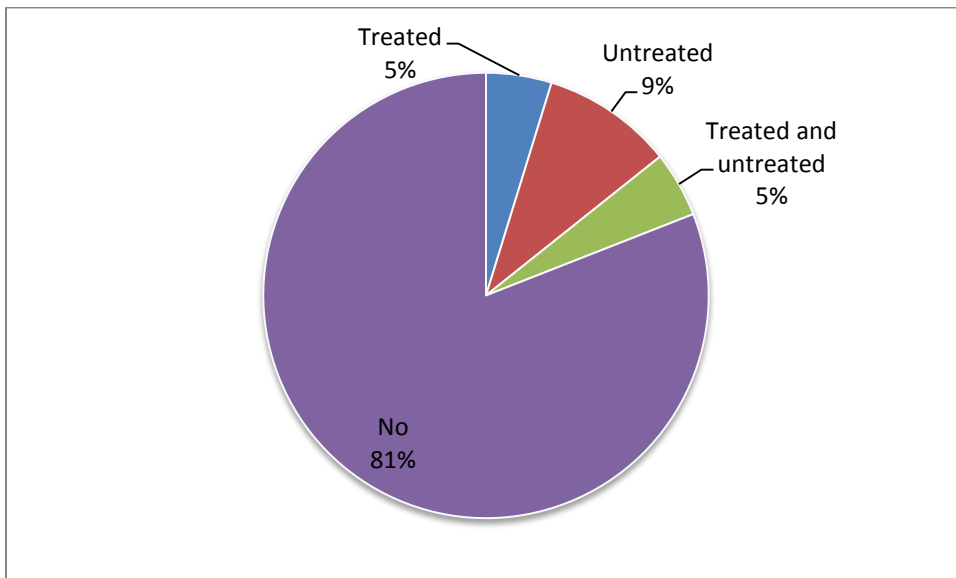
**Figure 31. Frequency of toilet usage while onboard**



**Figure 32. Consequence in Texas for not securing discharge valve or not having Clean Water Certification sticker for MSD**



**Figure 33. Number of pump-out facilities that survey participants know of in Clear Lake or Galveston Bay area**



**Figure 34. Type of sewage that survey participant or someone they know has discharged into Galveston Bay**

### **GBF Water Monitoring Team (WMT)**

GBF continued to collect ambient water quality data at marina and near-shore sites around Clear Lake and Galveston Bay throughout this funding cycle. As discussed in Task 3, the overarching goals of the WMT are:

- 1.) To engage citizens in a hands-on program that empowers them to be Bay Ambassadors
- 2.) To create a line of communication between GBF, boaters, and marinas on a regular basis
- 3.) To establish baseline data trends at marinas and other near-shore recreational sites in Clear Lake and Galveston Bay
- 4.) To detect potential bacteria impairments associated with boat sewage discharges

The following achievements were made regarding those goals:

- 1.) The number of volunteer monitors more than doubled since last year
- 2.) The number of Clean Water Partnerships with marinas more than doubled due to their interest in knowing the quality of their water and general interest in keeping the bay clean
- 3.) Many sites have been monitored long enough that it is now possible to look at trends
- 4.) Differentiating between bacteria sources through monthly ambient sampling is not likely, so detecting potential bacteria exceedances from boat sewage discharges is now being addressed through the CRE and Marina Service Learning Days

Geometric mean Enterococci concentrations from January 2013 through June 2014 at Clear Lake sites are plotted in **Figure 35** and at Galveston Bay sites in **Figure 37**. The bars are color coded based on low (green = geomean < 14.99 CFU/100 mL), medium (yellow = geomean between 15 - 34.99 CFU/100 mL), and high (red = geomean > 35 CFU/100 mL) ranges. Nassau Bay Yacht Club, which is actually upstream from Clear Lake on the tidal portion of Clear Creek, had the highest geometric mean concentration (193.3 CFU/100 mL) out of all of the sites. This is one of the newer bacteria sampling sites (4 months of sampling), so if it continues to remain high we will notify the city and TCEQ. Clear Creek does have a bacteria TMDL for contact recreation so this isn't a major surprise. We will also keep an eye on the sites that are in the medium range, such as Blue Dolphin Yachting Center (**Figure 36**), because they can have several single-grab samples that exceed the contact recreation limit (104 CFU/100 mL). The color coding for single grab samples corresponds with low (green = geomean < 35 CFU/100 mL), medium (yellow = geomean between 35.01 and 103.99), and high (red = geomean > 104 CFU/100 mL). All of the Enterococci geometric means for the Galveston Bay sites were in the low range. However, localized, high single-grab concentrations can and have occurred at many of these sites (**Figure 38**) so we will continue monitoring their trends.

When comparing the geometric mean Enterococci concentrations for all of GBF's monitoring sites between 2013 and 2014 (to date), it appears that bacteria concentrations are increasing instead of decreasing (**Figure 39**). However, GBF does not carry out on-the-ground outreach programs at most of these sites yet, so if you compare that data to the geometric means at Marina Del So then the results are different. While it is slight, the geometric mean bacteria concentrations decrease from 2013 to 2014 at Marina Del Sol (**Figure 40**). Professional monitoring data shows a decreasing trend in average Enterococci concentrations between 2005 and 2009 (HARC & GBEP, 2014), so over time it will be

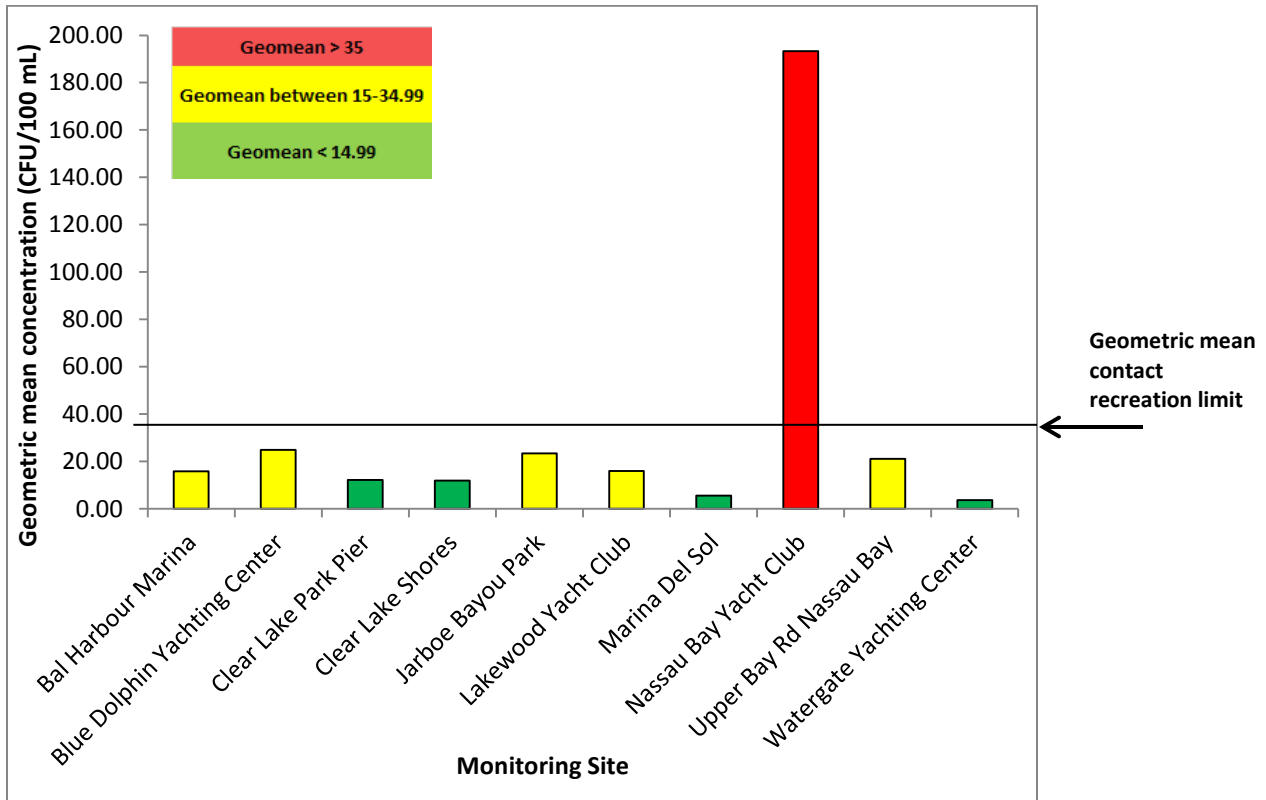


Figure 35. Enterococci geometric means at Clear Lake monitoring sites between January 2013 – June 2014

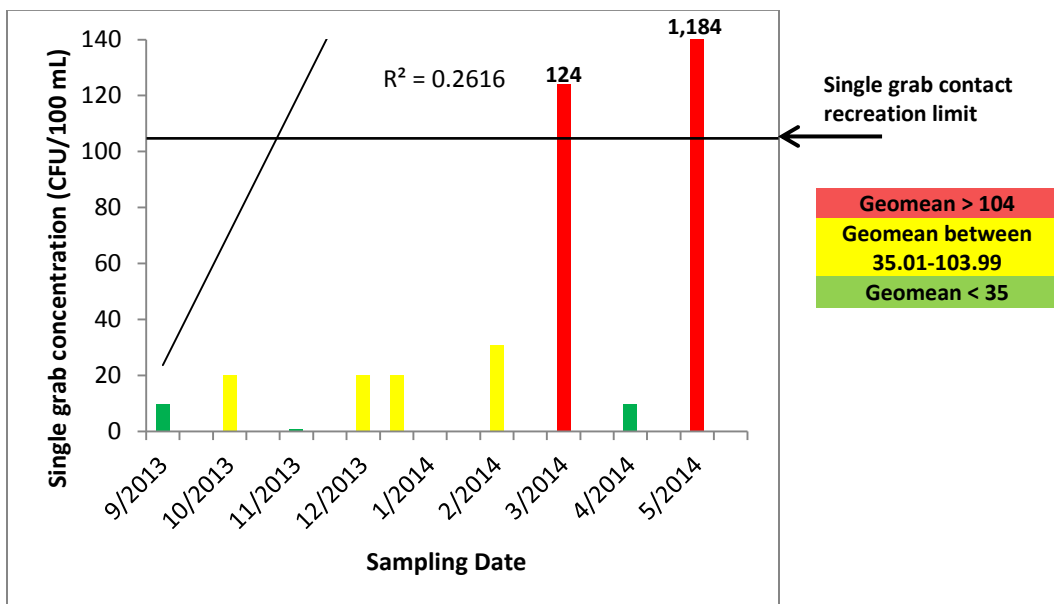


Figure 36. Ambient single grab Enterococci concentrations at Blue Dolphin Yachting Center

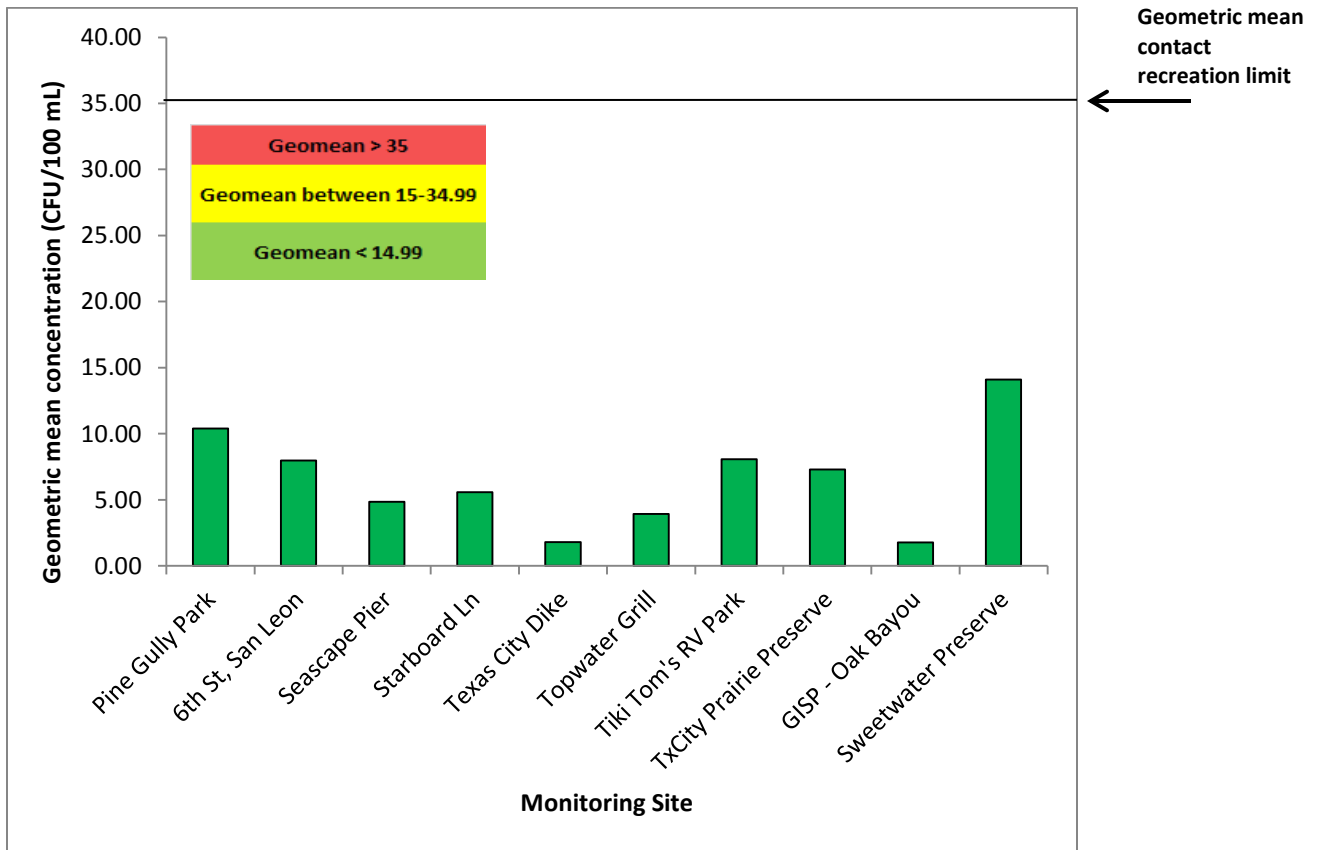


Figure 37. Enterococci geometric means at Galveston Bay monitoring sites between January 2013 – June 2014

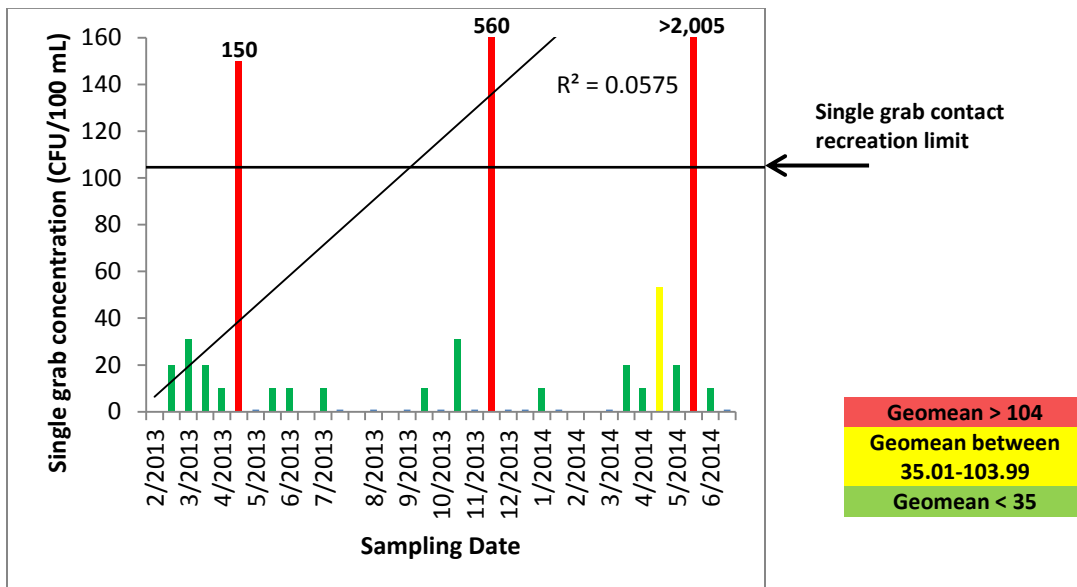


Figure 38. Single grab Enterococci concentrations for Galveston Bay at 6th Street, San Leon ambient



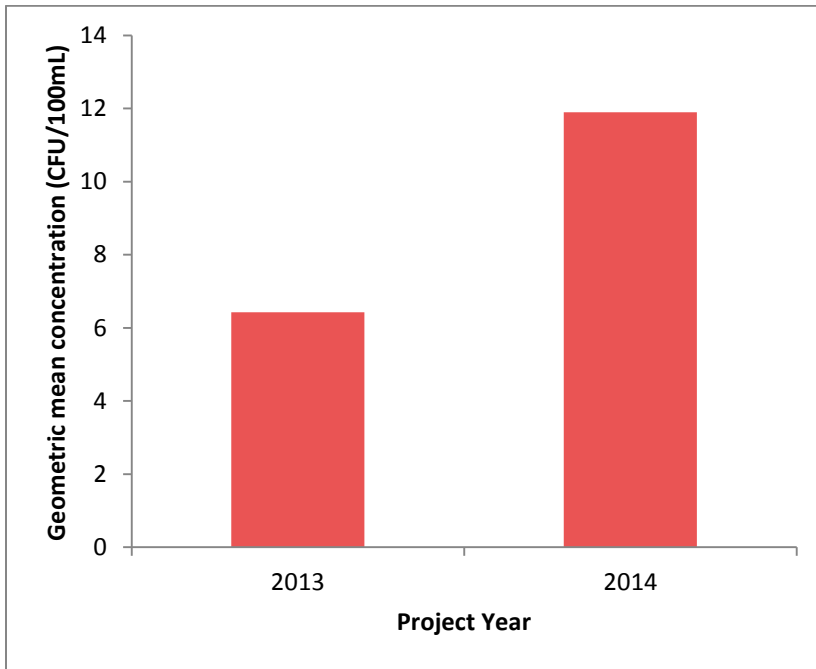


Figure 39. Comparison of Enterococci geometric means in 2013 and 2014 for all sampling sites

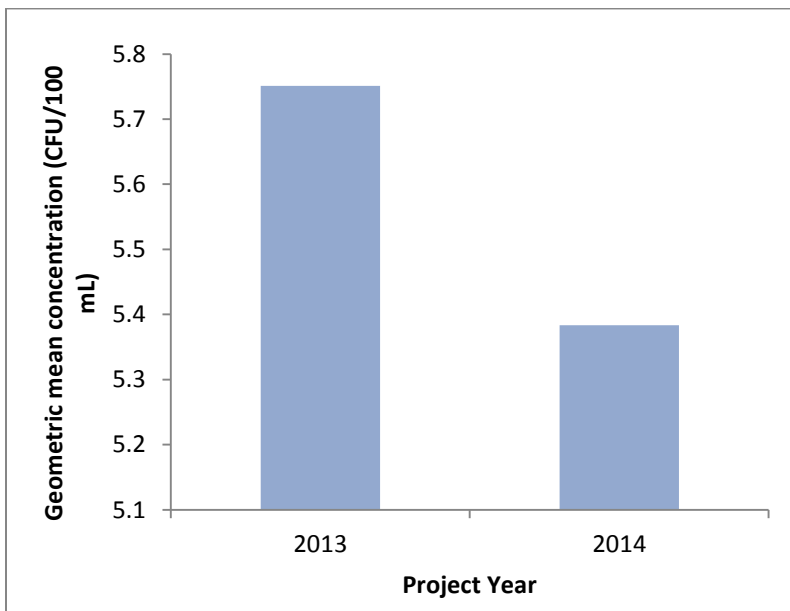
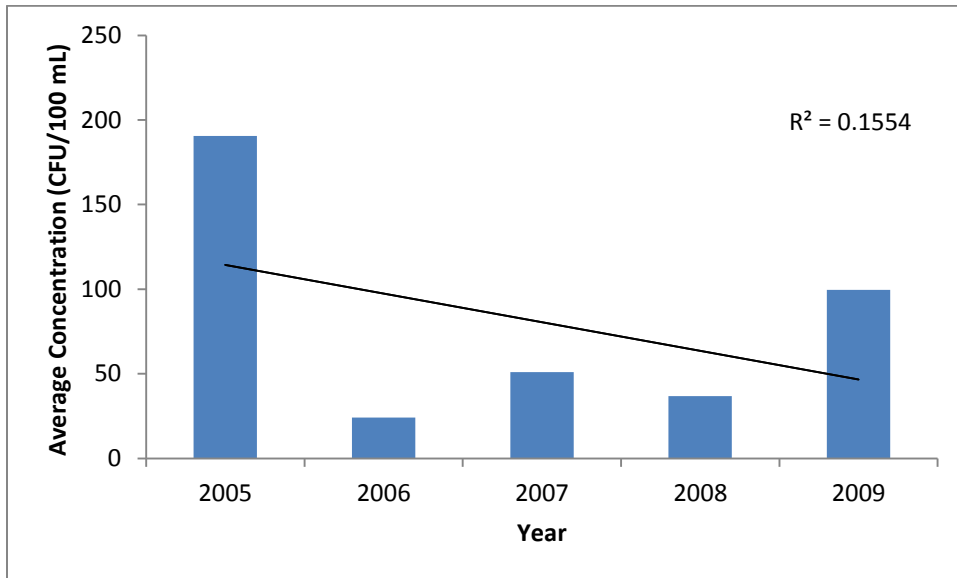


Figure 40. Comparison of Marina Del Sol Enterococci geometric means in 2013 and 2014 (to date)



**Figure 41. Annual average Enterococci concentrations in subbays of Galveston Bay; Data Sources: (TCEQ 2009; HGAC 2010; TCEQ 2010; TDSHS); Galveston Bay Status and Trends (GBEP & HARC, 2011)**

interesting to see if similar trends are established at sites where GBF carries out on-the-ground BWEC activities (aside from volunteer monitoring).

One area for improvement that GBF will be working on is our data communication plan. We now have enough data to be useful for data discussions with volunteers and additional CRE research projects that can utilize existing data. In addition, we plan to setup a Google map that operates similar to Texas Beach Watch, in that the most recent bacteria sampling result will be posted on the map and color coded either green, yellow, or red based on the concentration ranges that they set. This is a free way for us to display our volunteer data until we get funding to building something more sophisticated. Data collection will continue in the next funding cycle of the BWEC in order to continue developing trends and screening for problem areas. In addition, GBF will continue pushing for our data to be displayed on the Texas Stream Team Dataviewer and Houston-Galveston Area Council's Water Resource Information Map since it is not yet up online anywhere. This has been a significant difficulty for us since our volunteer really want to be able to access their data. On the flipside, the Gulf of Mexico Ocean Observing System (GCOOS) chose GBF to be one of two pilot citizen science programs with which they will design a Gulf-wide citizen science data portal. This project is ongoing and we are hopeful that it will be complete during the next funding cycle.

### **College Research Experience (CRE)**

The CRE was started because there is very little existing water quality data for marinas in the Galveston Bay area. To our knowledge, the only study conducted took place over 20 years ago (Guillen et al., 1993). That study was conducted over a 3 month period, looking at various water quality parameters in comparison to flow rates, in order to make recommendations for marina designs. The following summarizes the results from CRE in 2013:

Approximately 50% of Texas surface waters are impaired with bacteria from fecal waste, including several tributaries and segments within the Galveston Bay system. This study took place in Marina Del Sol on Clear Lake in Kemah, Texas, USA and proposed that stormwater runoff was the primary cause of elevated Enterococci levels in the marina, that hotspots of Enterococci were present, and that the concentration of Enterococci increased from the entrance to the back portion of the marina. Sampling was conducted at 10 sites between 0800 and 1100 every Monday, Thursday, and Saturday over five weeks in June and July 2013. Enterococci concentrations were quantified using the IDEXX EnteroAlert method and three day rainfall accumulation prior to sampling was recorded from NOAA's Climate Data Online. Eleven dry weather and four wet weather events occurred during the sampling period with the largest rainfall accumulation peaking at 1.39 inches. The geometric means of wet versus dry weather samples were not significantly different (**Figure 42**). Two hotspots were found yielding geometric means of 42.98 and 41.25 CFU/100 mL, which exceed the U.S. EPA primary contact recreation limit of 35 CFU/100 mL (**Figure 43**). Additionally, EPA single sample maximums (104 CFU/100 mL) were exceeded at nine out of ten sampling sites at least once, including a spike of 1,445 CFU/100 mL and several others over 1,000 CFU/100 mL (**Table 15**). A low to high gradient of Enterococci from the entrance to the back portion of the marina was evident (**Figure 45**). Further research is still needed to determine the primary sources of Enterococci. (Please note: The statistics for this study are in the process of being redone due to a potential error found on the poster.)

GBF will continue this study in Marina Del Sol through the 2014 CRE, as well as expand to Lakewood Yacht Club. We are excited about the potential that CREs have opened up for allowing university students to gain hands-on research experience, and for the resulting environmental data that will benefit the Galveston Bay area for decision-making purposes. This summer, the interns will consider how the number of birds, boat activity, rainfall, water transparency, flow, and marina design affect bacteria concentrations. They will make comparisons within Marina Del Sol from last summer to this summer, as well as between Marina Del Sol and Lakewood Yacht Club. If possible, GBF and the interns will partner with either Texas A&M Galveston or the University of Texas, School of Public Health to carry out microbial source tracking on some of the samples. Overall, the goal is to use this data to identify ways that the marinas can improve their water quality.

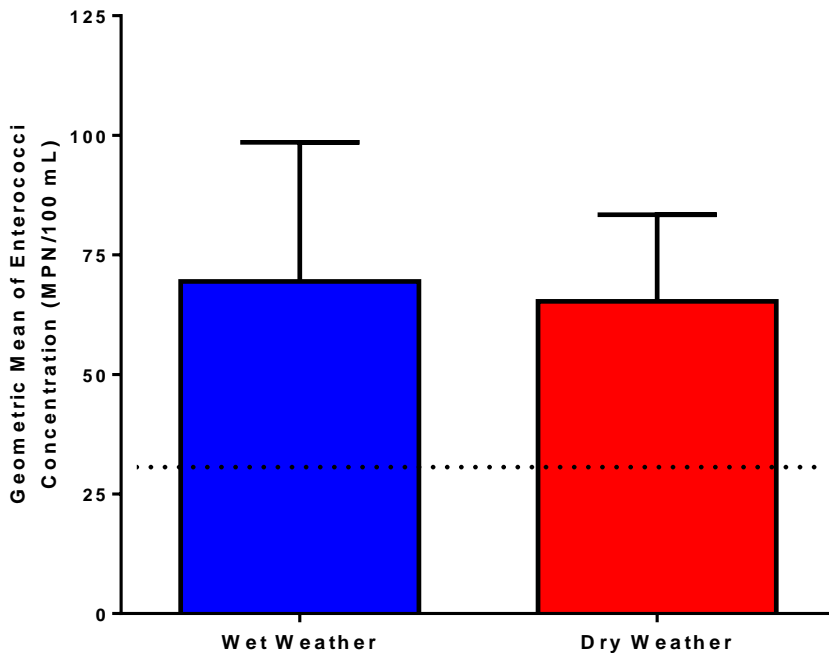


Figure 42. Overall geometric mean Enterococci concentrations (CFU/100 mL) for all sites during wet weather versus dry weather events

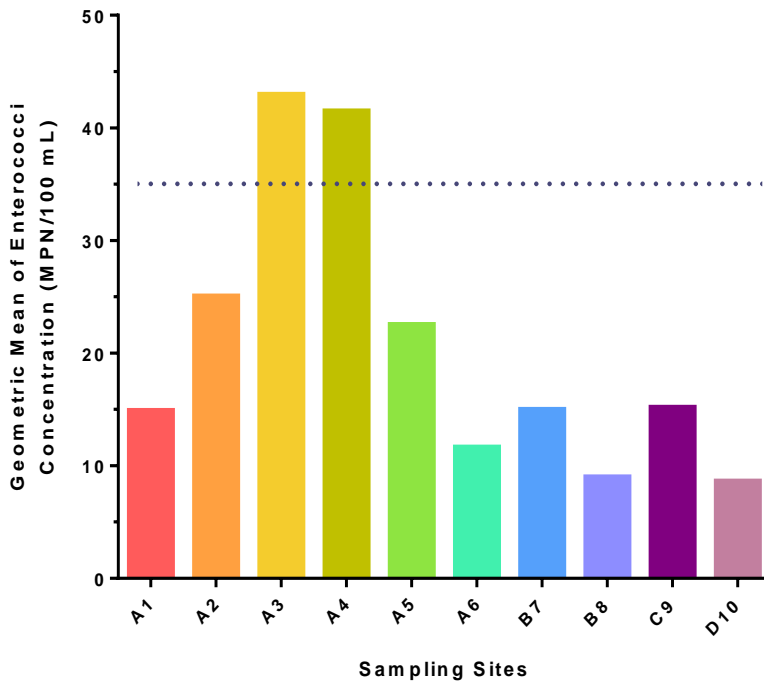


Figure 43. Geometric mean Enterococci concentrations (CFU/100 mL) of samples taken at each site throughout the study period

**Table 15. Minimum, maximum, and geometric mean Enterococci concentration (CFU/100 mL) for each sampling site at Marina Del Sol**

Site ID	n	Min	Max	Geometric Mean
A1	15	<10	164	14.92
A2	15	<10	99	25.07
A3	15	10	271	42.98
A4	15	10	624	41.25
A5	15	<10	137	22.56
A6	14	<10	110	16.21
B7	15	<10	1,445	20.4
B8	15	<10	591	11.86
C9	15	<10	1,184	27.23
D10	15	<10	110	10.36



**Figure 45. Comparison of geometric mean Enterococci concentrations (CFU/100 mL) at sampling sites throughout Marina Del Sol. Results were ranked high (red; >35 CFU/100 mL), medium (yellow; 15-34.9), or low (green; < 14.9 CFU/100 mL)**

### **Conclusions and Lessons Learned**

The Boater Waste Education Campaign saw many rewarding enhancements during this funding cycle. The Clean Vessel Committee gave a much needed push to some efforts that the BWEC Workgroup has been trying to accomplish for several years. The launch of new volunteer programs including the College Research Experience, Dockwalker Team, and Marina Service Learning Days have and will continue to provide the campaign with much needed data. And finally, teen and elementary-aged boaters were engaged in the campaign through new hands-on activities and the AquaKids Family Program.

To summarize our major findings, 70% of the organizations on the BWEC workgroup attended meetings and 100% directly contributed to campaign activities, such as certifying Clean Texas Marinas, distributing BWEC education packets, and helping us build relationships with and gain access to marinas for the various volunteer programs. Through education booths, presentations, and workshops, the BWEC reached over 209,000 people at 84 live events. Through print and digital media outlets, GBF was able to reach over 535,000 people with the Pump Don't Dump campaign message through 18 media outlets. GBAN is still in beta testing, but GBF has developed a project proposal based on lessons learned and recently selected a developer to build it into a custom mobile app. Since the last funding cycle, the GBF Water Monitoring Team has more than doubled to 52 certified volunteer monitors at 51 sites around Clear Lake and Galveston Bay and 19 of them have their advanced certification to sample for bacteria. GBF's Volunteer Lab Assistant helped us run the lab by analyzing hundreds of bacteria samples, and our first CRE Intern completed a

In addition to this data, the BWEC project area had an increase in the number of certified Clean Texas Marinas (**Figure 46**), and while the number of pump-out stations/carts remained the same this year (**Figure 47**), a new mobile pump-out company recently opened and has already volunteered to participate in the campaign (**Figure 48**)! GBF is hopeful that this new company, along with the data collected through Dockwalkers, will result in strategically placed new pump-out facilities and one step closer to Galveston Bay being declared a federal No Discharge Zone.

Overall, GBF and the workgroup are pleased with the advances that have been made to the campaign. The information collected during this cycle will assist us as we continue to strive for authorities to more proactively enforce existing boater waste laws. GBF recognizes that the BWEC is a complex balance of education and advocacy efforts and we look forward to continuing work on this project. Thank you to the Coastal Management Program and NOAA for your ongoing support of this important environmental, economic, and public health issue.

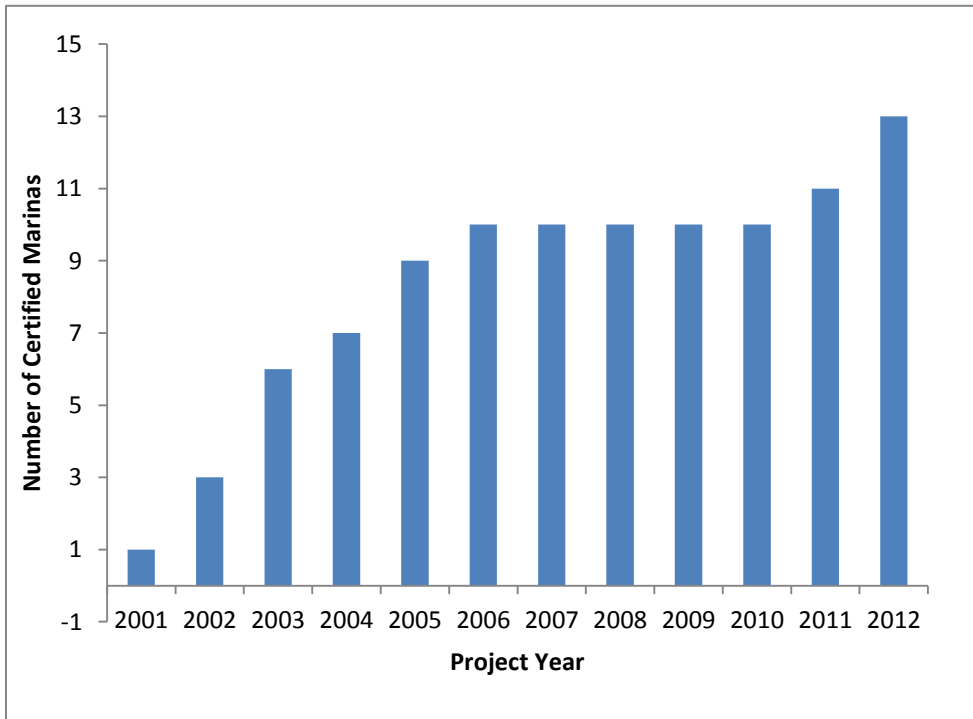


Figure 46. Number of Clean Texas Marinas certified and/or pledged over time

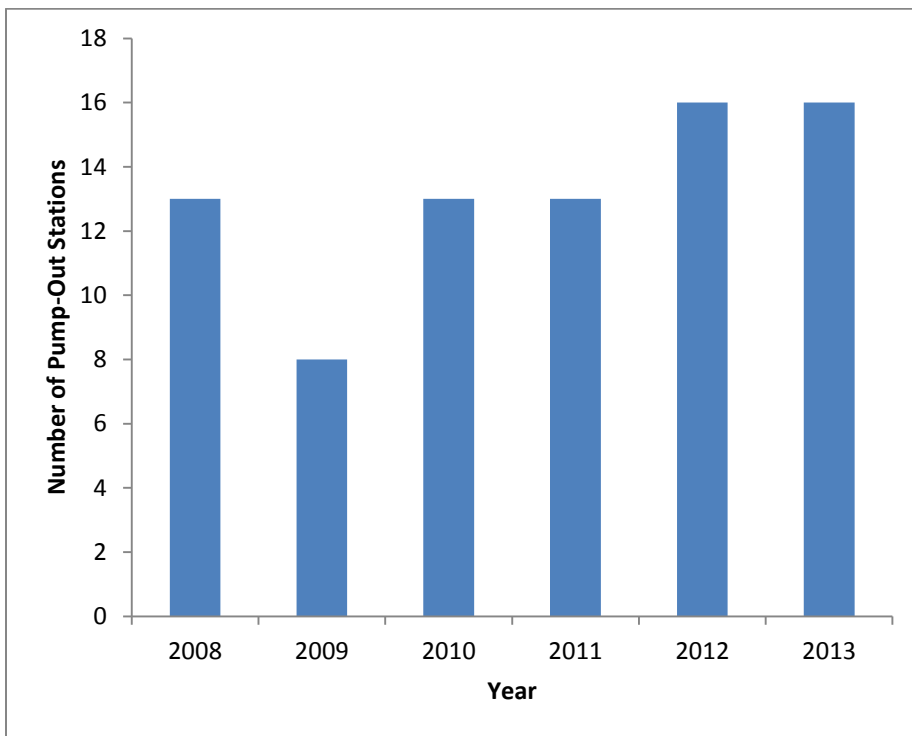
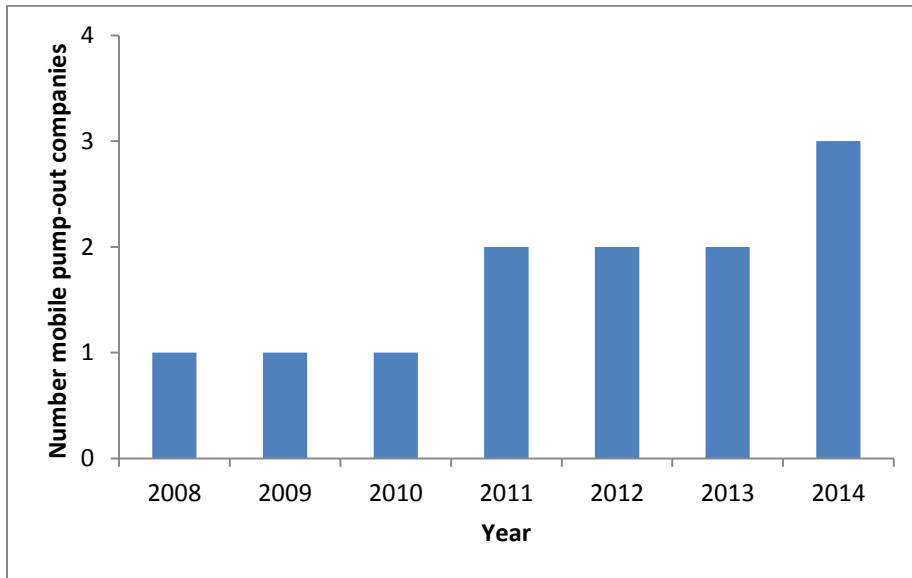


Figure 47. Number of pump-out stations on Clear Lake and Galveston Bay



**Figure 48. Number of mobile pump-out companies on Clear Lake and Galveston Bay**



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**Appendices:**

Appendix I, II, and III can be downloaded and saved via this link:

<https://www.dropbox.com/sh/wppta7mrrojg3kw/AABYnB1zfdUCW4x3bfithZb4a>



**GBF Water Monitoring Team: 2014 QC Session**