

June 28, 2019

General Land Office
Coastal Resources Management Program Area
1700 N. Congress Avenue, Room 340
Austin, TX 78701-1495

Attn: Mr. Russell Bond

Re: Boater Waste Education Campaign
GLO Contract No.: 18-082-000-A591
DRAFT Final Report

Dear Mr. Bond,

Enclosed please find the final report for the Boater Waste Education Campaign project for CMP Cycle 22's BWEC Campaign, Contract Number 18-082-000-A591. Please feel free to email or call me at (281) 332-3381 ext. 217 with any questions you may have regarding the project.

Sincerely,



Sarah Gossett Robinson
Water Programs Manager
Galveston Bay Foundation

Enclosure: DRAFT Final Report

Boater Waste Education Campaign

GLO Contract No. 18-082-000-A591



FINAL REPORT

Submitted: June 28, 2019

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A report funded by a Texas Coastal Management Program grant approved by the Texas Land Commissioner pursuant to National Oceanic and Atmospheric Administration award No. NA17NOS4190139.

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Project Description:

Boat sewage, one of the primary sources of fecal bacteria found in Galveston Bay, can be a public health risk for oyster consumption and contact recreation in areas where localized bacteria levels are heightened from the illegal discharge of boater waste. Despite the Galveston Bay and Clear Lake areas having 16 stationary pump-outs, five pump-out carts, four mobile pump-out boats, and two portable toilet dump stations, boaters continue to discharge raw sewage from marine heads directly into bay waters. In large part, illegal boater waste discharge is the result of a lack of enforcement and understanding of potential environmental and public health impacts.

The Boater Waste Education Campaign (BWEC) can lead to direct improvements in water quality by educating boaters, collecting and communicating environmental data to the public, and collaborating with authorities to increase reporting and enforcement of illegal boater waste discharges. The Galveston Bay Foundation (GBF) used CMP Cycle 13 funds to initiate the BWEC and the Dockwalker Program to raise awareness of environmental and public health concerns resulting from illegal dumping. Subsequent CMP funding allowed GBF to form the Clean Vessel Committee (CVC), which brings together groups focused on boater education, marina management, environmental policy, boat sewage enforcement and is working to designate Galveston Bay as a No Discharge Zone (NDZ).

Galveston Bay Foundation (GBF) used CMP Cycle 22 funds to refine the BWEC based on lessons learned from stakeholder feedback, previous water quality sample results, and Dockwalker survey data. GBF improved the Interactive Pump-Out Map and messaging on the “Pump, Don’t Dump” website, collected boater perception data from over 100 local boaters, collected and analyzed 1,061 water quality samples, created a relational database for GBF’s water quality data, launched a public-facing interactive data portal, continued building partnerships and stakeholder interest in designating Galveston Bay, updated the draft No Discharge Zone application and recommendations for moving forward with the NDZ. Additionally, GBF maintained the licensing of the GBAN app and website, and expanded outreach and education efforts for this pollution reporting tool.

Task 1: Maintain Stakeholder Groups and Develop Marketing/Outreach Materials

1.1 Pump Don't Dump campaign extension

During this cycle, focus was given to driving boaters to the PDD webpage and Interactive pump-out map (pumpdontdump.org). GBF created an interactive GIS story map for the PDD webpage to improve flow of information and create a more visually appealing look. The story map has been viewed 600 times and can be found at:

<http://www.arcgis.com/apps/Cascade/index.html?appid=ab4b66bd05b34415883cf2c644a2e0fa>.

Additionally, GBF updated the PDD map to include more information regarding pump-out station features and access. GBF received feedback from the Boater Waste Workgroup and from other boaters that lack of information regarding exact pump-out location within a marina and key pump-out features remained a barrier to boaters using the pump-out stations. GBF determined a list of additional information to include for each pump-out station in Galveston Bay, ground-truthed each pump-out station for the necessary information and added it to the pumpdontdump.org webpage. A table showing the updated information can be seen in Appendix 1.

GBF increased efforts to provide resources, messaging, and training to other boating organizations and business to expand the reach of the Pump Don't Dump campaign. Of note:

- GBF provided guidance and materials to the Texas Mariners Cruising Association to post within their marinas and to share with other boaters.
- GBF attended Marina Association of Texas meetings and provided PDD resources to MAT staff in an effort to expand PDD's success to the rest of the Texas coast.

GBF also established relationships with the new owners of the only two mobile pump-out services in Galveston Bay: Maritime Sanitation and Redfish Marine. The new owners of Maritime Sanitation's dockside pump-out services started attending the Boater Waste workgroup meetings in the spring of 2018 and partnered with GBF during the summer of 2018 to better promote the PDD campaign. GBF supplied Maritime Sanitation with PDD messaging on their service tags to provide to each of their clients. These tags were intended to encourage proper disposal of boater waste. Redfish Marine was bought by new owners in fall 2018 and began partnering with the PDD campaign almost instantly. GBF provided them with PDD giveaways, website messaging, and invited them to the Boater Waste workgroup. Their first workgroup meeting was February 2019.

During this cycle, the Pump Don't Dump webpage was viewed almost 700 times, with peak activity in February 2019, April 2019, and the end of May/early June 2019. An overview of the page views during this cycle are in Appendix 1.

1.2 Boater Waste Workgroup

During this project, GBF continued to facilitate quarterly stakeholder workgroup meetings, in which local representatives and stakeholders provided recommendations and guidance on key project messages and performance indicators, as well as on water quality survey data collection and analytical strategies. The workgroup members consisted of representatives from the Galveston Bay Estuary Program, local marinas and yacht clubs, local municipalities, County Officials, Houston-Galveston Area Council, local recreational boaters, Maritime Sanitation, and other local organizations and groups.

During this project period the following members were added to the Boater Waste workgroup: Sean and Allie Fitzgerald (Maritime Sanitation owners), Jim and Catherine Eisele (Redfish Island Marine owners), and Becki Begley with Houston-Galveston Area Council. Katie Wilson replaced Lori FitzSimmons-Evans

from the Galveston County Health District, and Christian Rines replaced Lisa Marshall from the Galveston Bay Estuary Program. This diverse group of stakeholders provides different perspectives regarding BWEC efforts. Some provided more technical support while others assisted with information sharing and program implementation. For example, Galveston Bay Estuary Program and Houston-Galveston Area Council provided environmental insight and expertise, access to data, and aid to the NDZ designation process. Galveston County Health District helped facilitate regulatory partnerships and enforcement. Marina Managers and recreational boaters spoke to the barriers to our desired behaviors and helped disseminate marketing materials. Maritime Sanitation assisted with providing support for pump-out installation and has helped spread the BWEC message to boaters using their dockside services. The insight provided by the various workgroup members have been instrumental in effective programming, messaging and implementation. At the February 2019 workgroup meeting, GBF sought feedback on target audiences and messaging from the workgroup to better inform PDD and BWEC messaging. At the workgroup meeting in February 2019, it was decided that the workgroup would meet every six months instead of every quarter. This would help with scheduling and provide more updates and progress at each meeting.

An updated workgroup roster, meeting schedule, and workgroup recommendations are outlined in Appendix 1.

1.3 Marketing and Outreach Materials

During this period marketing materials were maintained, distributed, and updated as needed for all various programs in the BWEC, including Pump Don't Dump, GBAN, the GBF Water Monitoring Team, and the Dockwalkers program.

Pump Don't Dump:

- For the summer 2018 boating season, GBF created and distributed boat flags that state "I Pump Out" for boaters to hang from their boat. The idea was that a boater will pledge to properly dispose of their waste, and then hang this flag from their boat. This flag will make their pledge visible to their neighbors, holding them accountable and encouraging their neighbors to also pump out instead of dump their waste. This concept was based on Community Based Social Marketing principals that most behavior change occurs from pressure by friends and neighbors and that people are more likely to actually change a behavior when their commitment to that action is public and durable – such as a flag flying from their boat. GBF promoted these flags through social media, at boating events, and to boating organizations such as Texas Mariners Cruising Association. These flags were very popular among boaters – GBF had distributed all the flags by the end of the summer to boaters who had pledged to hang them from their boats. For summer 2019, GBF ordered stickers to be posted in the head of boats and on boating accessories – this would make the commitment visible and durable and close to the action itself but was more cost effective and appealed to boaters who did not want something as large as a flag. Images of these flags and stickers can be found in Appendix 1.
- GBF also used the flag and sticker design to create flyers promoting pumping out of boater waste. GBF partnered with Texas Mariners Cruising Association (TMCA) to post these flyers at marina bulletins throughout Galveston Bay. TMCA has representation at every major marina in the area, and GBF cultivated a deeper relationship with these boaters to encourage them to be advocates for the BWEC message to their marinas. These flyers were one step to encourage these boaters to take action and promote the BWEC.
- In response to feedback from the boating community, GBF redesigned and reprinted the pump-out guide flyers distributed in the past. These flyers include information about the regulations for boater waste and a map of all local pump-out stations. These flyers were very popular among boaters and

GBF distributed the last of the original flyers at the end of Summer 2018. GBF redesigned the flyers based on feedback from partners in the boating community to include more messaging about the harmful impacts of fecal bacteria and the boater contribution to this contaminant. While printing for the flyers was funded by an external source of funds, the flyer still included the BWEC message and was paired with BWEC outreach. An image of the new flyers are in Appendix 1.

- Based on feedback from the Clear Lake Marina Association (CLMA), GBF updated and printed new signs highlighting the fines and regulations of improper dumping of waste in marinas, how to report illegal dumping, and promoting the use of pumpout stations. Through conversations at CLMA meetings, local marinas expressed that more of these signs would be one of the best ways GBF could help them promote the proper disposal of boater waste. GBF distributed these signs at the January and February 2019 CLMA meetings to all marina managers in attendance. An image of these signs can be found in Appendix 1.
- GBF continued to distribute the PDD education packets and campaign giveaways that were redesigned and printed during Cycle 19. – koozies, floating keychains, and whistles – at boating events, presentations and through marinas managers to include in “new member packets”. Additionally, outreach materials donated by the Marina Association of Texas (MAT) were also distributed, including the Clean Boater Tip Cards, the Scoop on Poop handouts, the Clean Texas Boater pledge cards, and zip ties and dye tabs.
- GBF created a “marina managers digital toolkit” with messaging about clean boating practices for marina managers to include in their newsletters and on their websites.
- GBF continued to use social media graphics and posts created in CMP Cycle 18.
- The PDD campaign was featured in several articles published during this cycle. A list of these publications can be found in Appendix 2.

Galveston Bay Action Network (GBAN):

- GBF published 13 posts on social media promoting GBAN, with a total reach of 21,007 known impressions. Many of these posts centered around 2 social media campaigns: one in the fall 2018 promoting GBAN successes, and one in winter 2019 around the New Year, asking for a “resolution to report pollution.” Posts from these campaigns are in Appendix 1.
- GBF designed and printed yard signs promoting the GBAN app, to display at community events, trash cleanups, and at other outreach booths. A photo of this sign a in the appendix.
- GBF created a 3-minute promotional video highlighting the GBAN app and some of its successes, as well as three shorter segments highlighting different success stories. These videos have been shared on the GBF website and will be used in a summer 2019 outreach campaign. A link to the main video can be found at: <https://www.youtube.com/watch?v=62nw86P2YY8>
- GBF included GBAN in several water quality promotional materials, including a poster and flyer promoting clean boating behaviors, a poster asking boaters/park visitors to properly secure and report trash, a flyer showcasing “five ways anyone can help keep Galveston Bay fishable and swimmable.” Copies of these materials can be found in Appendix 1.

GBF created and printed stickers promoting the GBAN app to be handed out at outreach events. These are designed to be attached to water bottles, computers, and other accessories people regularly carry around to remind them to use the GBAN app to report pollution. GBF distributed these stickers at the outreach events listed below, and asked partner organizations to do the same. An image of the sticker can be found in Appendix 1.

- GBF created a “floor mat” featuring the GBAN app to be used at outreach events. This mat is placed in front of our outreach table to catch people’s eye and bring them over. Many outreach events occur outdoors where winds blow over banners, decreasing their effectiveness. Additionally, some events are wet or muddy, so having a mat to keep our booth clean makes it easier for attendees to

stop by and learn about the GBAN app. A photo of this mat can be found in Appendix 1.

- GBF created and shared a GIS Story Map highlighting some of the successes from pollution reports filed on the GBAN app. The story map can be found at: <https://arcg.is/0C4rLH>.
- GBAN was featured in several articles and press released during this cycle. A table of all GBAN's published articles can be found in Appendix 2.

Water Monitoring Team (WMT):

- GBF updated the Water Monitoring Team webpage (galvbay.org/watermonitors) on the GBF website and maintained the Google map with the WMT monitoring sites to show volunteers where we monitor and communicate site openings with potential volunteers. GBF also maintained the Citizen Science webpage (galvbay.org/citizenscience). This page houses information about our bacteria sampling, including our bacteria concentrations map, as well as information about past Water Quality Research Internship projects.
- GBF created and launched a “data visualization portal” to improve the sharing, promotion, and understanding of the WMT data findings. This portal allows for automatic graphic visualizations of status and trends for each parameter at each location within a specified time period. It also allows for easy selection and download of WMT data. While GBF's data has historically been housed on the GCOOS Citizen Science data portal, the program continually encountered technical difficulties that, as a third party, GBF had no control over addressing. Additionally, GBF received feedback that the front-end programming was not user-friendly for a lay audience. This data portal improves functionality, gives GBF more control, and makes data visualization, interpretation, and download much more intuitive. GBF launched this portal in May 2019. The portal can be accessed at: <http://waterdata.galvbay.org/>.
- GBF created and published year-in-review summaries for both 2017 and 2018 WMT data. Summaries were created for Galveston Bay as a whole, as well as for each individual site. These summaries are posted on GBF's WMT website and monitoring map. Additionally, GBF shared these summaries with property managers and owners for each WMT site. The 2018 Bay-wide summary can be found at: www.galvbay.org/wp-content/uploads/2019/04/FINAL-Galveston-Bay-2018-Year-in-review-Data-Summary.pdf
- GBF created and launched a short video about water quality in Galveston Bay, and the actions individuals can take to improve water quality and remain safe. This outreach tool has been used on websites, during presentations, and has been shared by partner organizations. It has also been nominated for the 2020 Wild and Scenic Film Festival in Houston. The video can be found at: <https://youtu.be/Nbf8P51vOpA>.
- GBF updated the “5 ways you can protect water quality in Galveston Bay flyer” in spring 2019, once the first iteration of these flyers ran out. These are distributed at outreach events and through partner organizations. The new flyer can be found in Appendix 1.
- GBF partnered with Swim Guide, an international mobile app with information about beach recreation safety based on fecal bacteria levels throughout the US and world. GBF's bacteria monitoring sites were added to this app and are updated weekly. The Swim Guide tool can be viewed at www.theswimguide.org.
- GBF wrote and published several articles about the team and their findings. A list of these various articles can be found in Appendix 2.

Task 2: Public Outreach and Education

2.1 Print and Digital Media, Outreach and Education Booths and Distribution

During this project period, outreach was implemented through print and digital media, outreach booths, presentations, volunteer programs, public events, and through leveraging campaign partners. Each approach to outreach is outlined below.

Outreach Events & Presentations

GBF promoted BWEC messaging at many different educational exhibits, outreach tables, and presentations to facilitate one-on-one interaction and direct dissemination of BWEC information. Workgroup members and campaign partners assisted with this promotion through inviting GBF to outreach events, presentations, and through distributing campaign materials at their own booths and events. During this cycle, GBF staff promoted the BWEC programs at 129 different events and directly reached over 12,000 individuals. A table of these events can be found in Appendix 2.

Public Events

During this cycle, GBF hosted three public events that promoted the BWEC programs. These meetings were open to all members of the public, free to attend, and shared information on water quality threats to the Bay from fecal contamination, the work being done to address them, and what each individual stakeholder can do to help. The first public event was held on February 28, 2018 had 35 people in attendance. This event was held in conjunction with a Post Harvey Community Open House in partnership with Texas A&M Agrilife Extension. The event was based off of lessons learned from prior public events to focus on community needs (support from Hurricane Harvey) while still tying in program messaging (improving water quality).

The second public event was held on May 21, 2018 at Tommy's Restaurant and framed as a "summer kickoff event" for boaters and recreators. It also had 35 people in attendance. The third open house focused on the Galveston Community and included a presentation about our WMT findings, actions to reduce fecal bacteria contamination, and seafood consumption advisories. The event was held on November 15th, 2018 at the Proletariat Gallery. Approximately 25 members of the public attended. The last two events focused on hosting events in popular locations within the target community to increase attendance. Compared to prior public events, these were well attended.

Media Outreach

In addition to in-person outreach, GBF also promoted the BWEC materials through print and digital advertising, including through ads and articles on websites and in magazines, as mentioned in Task 1. A table of the published ads and articles can be found in Appendix 2.

In July 2018, GBF wrote and posted an article titled "Is Galveston Bay Safe For Swimming?" This article included information on the potential health impacts from fecal bacteria, the sources of fecal bacterial contamination (including boater waste), and resources to help reduce fecal bacteria pollution. Since its publication, the article has been viewed over 11,000 times and is one of the most popular pages on the GBF website during the Cycle 22 time-frame. A link to the article can be found at:

<https://galvbay.org/news/is-galveston-bay-safe-for-swimming/>

2.1 Marina Partnerships

Through the BWEC, GBF aims to develop relationships with marinas through long-term participation in various programs that support the goals of the BWEC. During this project period, GBF maintained and strengthened existing partnerships and continued to contact marinas about participating in the BWEC and joining GBF's Clean Water Partnership. Clean Water Partnership marinas actively participate in at least two BWEC programs including the BW Workgroup, Pump Don't Dump distribution, Water

Monitoring Team, Dockwalkers, or Water Quality Internship projects. During this period, five new marina Clean Water Partnerships were created or re-established and 18 existing partnerships were maintained. A list of marinas and boating groups actively involved in Clean Water Partnerships can be found in Appendix 2. During this period, GBF contacted marinas not currently part of GBF's Clean Water Partnership to encourage participation and met with interested marina managers to determine the best activities for their marina. Additionally, at these meetings GBF and marina managers discussed the current laws and regulations governing Galveston Bay, our efforts to enhance these regulations, the receptibility of the Marinas/Managers to an NDZ establishment, and what role they would play in any future legislation. A schedule of all one-on-one meetings with marinas can be found in Appendix 2.

Early cycles of the BWEC were informed and influenced by the Clear Lake Marina Association (CLMA). This coalition of marina managers, administrators, yacht brokers, and other boating professionals would meet every month to provide updates, discuss ongoing challenges, and share resources. However, the CLMA stopped meeting about four years ago due to lack of strong leadership. After a lengthy meeting between GBF and the Harbor Administrator at Lakewood Yacht Club about the BWEC, Lakewood's Harbor Administrator decided to bring back the CLMA and initiated the first new CLMA meeting on August 24, 2018. GBF participated in this meeting, and the monthly CLMA meetings since. The CLMA has been instrumental in informing GBF on existing challenges and conditions around boater waste, and the best messaging and resources needed by marinas to encourage proper boater behavior. These meetings also served as a great avenue for GBF to distribute BWEC materials, such as the PDD signs for marinas, PDD flyers, and PDD newsletter blurbs. GBF attended CLMA meetings on the following dates: August 24, 2018; September 28, 2018; November 2, 2018; December 14, 2018; January 18, 2019; February 15, 2019; and April 5, 2019.

2.2 Boating Groups & Agency Partnerships

During this cycle, GBF significantly strengthened its relationship with the Texas Mariners Cruising Association (TMCA), a local boating group. GBF delivered annual presentations about the BWEC during Cycles 20 and 21, but during Cycle 22 GBF more regularly attended TMCA meetings and began to cultivate TMCA members into BWEC spokespersons for their marinas. TMCA has members from all the major marinas in Galveston Bay. TMCA members handed out BWEC giveaways to their friends and neighbors and at their various events, hung PDD boater flags from their vessels, provided insight through one-on-one conversations and via Dockwalking surveys, posted PDD flyers on their marina bulletin boards, and further encouraged proper waste disposal and clean boating habits among their neighbors. Additionally, a few TMCA members have even become volunteer water quality monitors and GBF volunteers. During this cycle, GBF attended the following TMCA events: presented at their meeting on February 16, 2018, attended their Dock Party on July 6, 2018 and distributed Dockwalker surveys, attended their meetings on July 26, 2018 and August 17, 2018, and presented at their meeting on January 18, 2019.

During this cycle, GBF also established relationships with the Blessing of the Fleet event (April 28, 2019) and the Yachty Gras event (Feb 15-17, 2019) to help deliver PDD messaging to the event participants. PDD materials were included in all skipper bags for these events, as well as for TMCA's Spring Fling (May 3-6, 2019).

GBF also established relationships with the new owners of the two mobile pumpout service companies in Galveston Bay – Maritime Sanitation and Redfish Island Marine. The success of these partnerships are outlined in Task 1. The new owners have joined the Boater Waste Workgroup and have been key partners in both distributing PDD messaging to their clients and relaying information about pumpout habits and services to the Boater Waste Workgroup.

GBF met one-on-one with Galveston County Health District's (GCHD) Water Programs Manager to discuss NPS pollution issues in Galveston County, including boater waste, illegal dumping, and responding to pollution reports. GCHD is looking forward to increasing their engagement with the BWEC and partnering on various programs moving forward.

GBF maintained its relationship with the Marina Association of Texas (MAT). During this cycle, GBF attended the MAT meeting in Galveston, TX on October 17-18, 2017 and in Marble Falls on October 16-17, 2018. GBF worked with MAT to extend campaign messaging along the Gulf Coast through ads and articles in the Gulf Coast Mariner, their statewide publication and through conversations at the MAT conference each year. Additionally, MAT is looking to incorporate the Clean Marina Program back into their statewide initiatives, and GBF participated in early conversations with MAT about piloting the expansion within Galveston Bay.

During this cycle GBF focused on correspondence and relationship building with various commercial entities likely impacted by a future NDZ designation. GBF identified individuals and groups to contact about the proposed NDZ application and has identified many of the key groups targeted. GBF attended the Houston Boat Show on January 8, 2019. At this event, GBF discussed current marine sanitation treatment options and trends on boats with yacht brokers and boater waste outreach and education options with Galveston Yacht Basin. A list of all contacted commercial partners is in Appendix 2.

GBF attended the Texas Marine Industry Coalition Mixer on December 4, 2018. GBF hoped to create some good industrial partners and buy-in for the NDZ application. However, the Coalition's focus is primarily on changing the tax code for buying and selling boats in Texas. After the first meeting, GBF decided the partnership would not help the BWEC at the moment.

Task 3: Facilitate Boat Sewage Discharge Reporting and Response

3.1 Outreach and Education of GBAN app

In order to increase reporting and enforcement of boater waste discharge, GBF created the Galveston Bay Action Network (GBAN). GBAN aims to educate citizens on how and where to report boat sewage discharges and other common water pollution incidents. The BWEC workgroup's theory is that an increase in citizens reporting illegal discharges will further open the eyes of marina owners, boaters, and enforcement agencies to the reality of the boater waste issue compared to GBF and workgroup members receiving the reports via word of mouth and sending them informally to the enforcement agencies. Having a central location for citizens to submit reports also makes it easier on the citizens and provides regulatory agencies with quicker reporting of pollution events. The tool was initially launched as a mobile-optimized webpage in Cycle 18, and as a downloadable mobile app in Cycle 21. Cycle 22 focused on increasing awareness of the tool, increasing app downloads and pollution reports, and better tracking report success.

GBF published ads in the following webpages: Houstonia Magazine, Houston Public Media, Houston Chronicle, Facebook, Google. Facebook and Google ads targeted certain geographic regions and keywords. Combined these ads received a total reach of 262,914 people. GBAN was featured in a radio ad aired on Houston Public Media (FM 88.7). The 15 second ad aired 10 different times from 12/25/2017 to 12/31/2017 in conjunction with the HPM online ad.

During this cycle, GBF conducted a year-long mass marketing campaign with Houston Press, running from June 2018 through May 2019. This multi-faceted campaign includes creation of digital ads to be used for a

Google Adwords campaign and Google Display Network, ads posted on various webpages that target determined audiences based on browsing history (audience extension display), digital ads on the Houston Press webpage, the creation and distribution of an infographic, distribution of a press release, a social media sprint. The final report can be viewed at the following link: <https://galvbay.org/wp-content/uploads/2019/05/2018-2019-Galveston-Bay-Report.pdf>. GBF also conducted a 9-month campaign with Houston Chronicle. The campaign includes both digital ads on the Houston Chronicle website and print ads in local, targeted newspapers.

As discussed in Task 1, GBF created a ArcGIS Story Map to highlight various successes from the GBAN app. GBF also created a 3-minute promotional video highlighting the GBAN app and some of its successes, as well as three shorter segments highlighting different success stories. These videos have been shared on the GBF website and will be used in a summer 2019 outreach campaign. A link to the main video can be found at: <https://www.youtube.com/watch?v=62nw86P2YY8>.

GBF posed social media posts and published articles, as described in Task 2.

3.2 Agency Partnerships

During this cycle, GBF continued regular communication with enforcement agencies: Texas Parks and Wildlife Department (TPWD), Coast Guard, local marine safety officers, Texas Commission on Environmental Quality (TCEQ) and Galveston County Health District. GBF followed up on the response to various pollution reports, updated partner contact information as needed, and ensuring ongoing functionality of the app. GBF strengthened their relationship with the City of Houston's pollution control department. In June 2018, GBF met with City of Houston Bureau of Pollution Control and Prevention to discuss the best way to ensure COH response to GBAN reports. In addition to these reports being sent to the City's 3-11 email service, the Bureau of Pollution Control and Prevention is also directly receiving these reports.

Based on feedback from partner agencies and users of the app, GBF worked with the app developer to make the contact information fields required. This will make it easier for agencies to follow up with people filing reports, increasing the likelihood of effective cleanup.

3.3 Pollution Reports

During this cycle, 142 pollution reports were filed on GBAN. These reports can be viewed at www.galvbay.org/gban. This webpage, and the webpage for the GBAN app (www.galvbay.org/gbanapp) have collectively been viewed 3,737 times during Cycle 22. During this cycle the GBAN app was downloaded 3,295 times.

To better document the impact of GBAN, GBF went through all previous GBAN reports and reached out to the individuals who filed reports and included contact information. GBF inquired into the success of their report being responded to, and the ease and functionality of the app in general. Feedback was very positive. Quotes from users can be found in Appendix 3.

Throughout the cycle, GBF remained in regular contact with the GBAN app developer to ensure the app's continued functionality and worked to improve some of the back-end admin functionality.

Finally, GBAN received the Houston-Galveston Area Council's 2019 Water Innovation Strategies of Excellence award for the Education and Public Awareness category. The awards ceremony was held on May 18, 2019.

Task 4: Facilitate Volunteer Programs

4.1 Water Monitoring Team

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

- 1.) To engage citizens in a hands-on program that empowers them to be stewards of Galveston Bay
- 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 in marinas and other near-shore recreational sites in Clear Lake and Galveston Bay

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. Core certification consists of a full day, two-phase group training session and a one-on-one Phase III training at the volunteer's site with a GBF staff member. This training process is based on the Texas Stream Team training protocol (<https://www.meadowscenter.txstate.edu/Service/TexasStreamTeam/citizenscientists/training.html>) . Volunteers commit to sampling their site(s) on at least a monthly basis. The entire monitoring program is conducted under an EPA-approved Quality Assurance Project Plan and Quality Management Plan.

GBF's team is part of the Texas Stream Team because of its partnership with the Houston Galveston Area Council's region. GBF also has its own Volunteer Bacteria Sampling Program. The monitoring team currently has 55 volunteers sampling from 55 locations, 26 of whom have advanced certification to collect bacteria samples. During this cycle, volunteers contributed over 3,400 volunteer hours, analyzed 1,061 water samples, and 704 collected bacteria samples. A full map of monitoring locations, data summaries, and trends can be accessed at www.galvbay.org/watermonitors.

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. GBF continues to make improvements to the management and processes within the WMT. Consistent, long-term monitoring is valuable because it identifies trends and hotspots, fosters community-based environmental stewardship, and aids in watershed planning activities. Due to budget constraints, professional monitoring is conducted at a limited number of sites and generally on a quarterly basis, so GBF's Water Monitoring Team is a cost-effective way to augment this professional data. Additionally, most professional monitoring occurs in the middle of the Bay, while GBF monitoring focuses on the nearshore, where most humans are interacting with the water. Current water monitoring sites, volunteers, and a training schedule for this project period are all outlined in Appendix 4. Analysis of the water quality data can also be found in Appendix 4. Within this cycle GBF focused a lot of our efforts on maintaining regular data sampling at existing sites, improving database management, data analysis, and communication of data findings.

- 1. Maintaining regular data sampling:** Prior CMP cycles facilitated the expansion of the WMT to a representative sampling of Galveston Bay. By sampling continually at the same existing sites, GBF can better track and interpret long-term trends at each location and across the Bay. During this cycle, GBF staff focused on filling existing sites as they opened and asking other monitors to "substitute" at

different locations when volunteers were unable to sample.

2. **Improving Database Management:** In order to truly have long-term success monitoring water quality throughout Galveston Bay, GBF identified the need to increase its capacity for data management and analysis. With over 2,000 data points and growing, GBF's data management system has outgrown the Microsoft Excel database that had been used to house the WMT data since the program's creation. During this cycle, GBF staff created a Microsoft Access relational database. This database better links WMT metadata with water quality data, ensures consistency in data reporting, provides additional QC of data entry, and expedites data extraction and manipulation. GBF completed this transfer to the Access database in fall 2018. An image of this database's main interface can be found in Appendix 4.
3. **Data Analysis:** GBF worked with a PhD candidate from Texas A&M University at Galveston to conduct a comprehensive analysis of GBF's water quality data to better track patterns, trends, and relationships. A summary of the final report can be found at: www.galvbay.org/wp-content/uploads/2019/06/Cullen-Water-Quality-Report.pdf. GBF also created annual summaries of the Bay and of each monitoring location, based on volunteer data. Finally, GBF conducted an initial analysis into the relationship between tidal stage and fecal bacteria levels. This was in response to high bacteria levels throughout the bay associated with observed low water levels. More information about these summaries and analysis projects can be found in Section 1.3 of this report.
4. **Communication of Data Findings:** More information on these tasks can be found in section 1.3 and under Task 2 accomplishments in this report.

4.2 Dockwalkers

Historically Dockwalkers has been a volunteer program for select volunteers to conduct surveys of boaters in exchange for clean boating kits and outreach materials. These surveys help inform GBF on current boater practices, perceptions and priorities while also promoting the BWEC message. Cycle 22 further refined the survey redesign from Cycle 21. Additionally, Water Quality interns and volunteers collected 104 surveys from recreational boaters during the spring and summer of 2018. The survey focused on better determining the barriers and benefits boaters see to proper waste disposal and pollution reporting to better inform the BWEC to reduce these identified barriers and speak to the perceived benefits of proper waste management. The Water Quality Community Engagement Intern walked docks throughout Summer 2018 and attended various boating events to collect boater surveys. A schedule of Dockwalking is outlined in Appendix 4.

4.3 Water Quality Internships

GBF hosted two water quality interns during the summer of 2018: a Water Quality Research Intern (WQRI) and a Water Quality Community Engagement Intern (WQCEI). These internships provide university students with the opportunity to develop and execute short-term water quality research projects from start to finish including planning, design, sampling, data analysis and creating a final research product. 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.

The WQRI conducted targeted water quality monitoring and analysis at Pier 19 marina on Galveston Island. GBF's WMT discovered very high bacteria concentrations at this site, both during wet and dry weather events. The WQRI collected samples from 5 different locations around the pier, targeting

different potential sources of fecal contamination – birds and stormwater outfalls. Samples were collected once a week for six weeks. Details on the report and finding are available at: <https://galvbay.org/wp-content/uploads/2018/08/The-Localized-Source-of-Enterococci-at-Pier-19.pdf>. GBF met with the Department of Public Works in the City of Galveston (COG) to share the findings, which resulted in upstream stormwater sampling by the COG.

The WQOI spearheaded the Dockwalker campaign for this summer by updating and distributing the boater survey and analyzing the results. Over the past several years, GBF has found that these WQ Interns are the more reliable and efficient way to conduct these surveys. Information on his work and findings are available at: www.galvbay.org/wp-content/uploads/2018/08/Boater-Waste-Perception-Report-2018-1.pdf.

Task 5: Quantify Boater Waste Impact and Track Behavior/ Knowledge/Environmental Change

One of the major challenges with behavior change campaigns such as the BWEC is effectively monitoring campaign success. Unobtrusively and accurately gauging behavior change on a granular level in a community as large as Galveston Bay's boating community is next to impossible. Additionally, due to the nonpoint source, transient nature of boater waste pollution and the many factors that impact fecal bacteria levels in the Bay, it can be difficult to attribute changes in water quality specifically to this one source. However, over the years GBF has constantly looked for ways to improve measuring program success. Programs such as the Dockwalker Program, the Water Monitoring Team, and GBAN can help measure potential successes and changes over time. During this cycle, Dockwalker data was analyzed to better understand the current issues around boater waste disposal and to better track behavior change over time. Additionally, trends and patterns in water quality data were analyzed.

5.1 Water Monitoring Team Data Results

GBF continued to collect ambient water quality data at marina and near-shore sites around Clear Lake and Galveston Bay throughout Cycle 21. A summary of the results from 2017 and 2018 can be found here. Additional data analysis is available in Appendix 5.

5.2 Behavior/knowledge indicator tracking

GBF surveyed 104 recreational boaters within Galveston Bay during summer 2018. The purpose of this survey was to understand the values of boaters within Galveston Bay, how these values impact their behavior, and their relationship with water quality. The survey itself was 23 questions long and took approximately four minutes to complete and is included in Appendix 5 for reference. Surveys were conducted in person at marinas and boater organization events from June to July 2018. Survey sampling was conducted at South Shore Harbour Marina, Houston Yacht Club, Pelican Rest Marina, Galveston Yacht Basin, Portofino Harbor, Seabrook Marina, Marina Del Sol, Harborwalk Yacht Club, and Waterford Yacht Club. These locations were selected non-randomly from a list of area marinas with whom the Galveston Bay Foundation has had a previous relationship. Within these marinas, boaters were selected at random from personnel walking around the docks, working on vessels, or sitting in vessels that were cycling water. Incentives were offered to increase boater participation, and included koozies, floating keychains, and whistles with the Pump Don't Dump brand. The results of the survey were entered into an online survey website (SurveyMonkey) for analysis and examination.

The full detailed results of the survey are included in Appendix 5 for reference. Out of the 104 respondents to this survey, 71% were male and 64% were over the age of 56. Most respondents (75%)

had more than 15 years of experience boating. This establishes that the respondents have sufficient experience on the water to form insights valuable to the purposes of this study. The amount of time spent onboard a vessel was evenly distributed, with 32% spending less than 7 days per month onboard, and 38% spending more than 20 days per month. Of these, 31 respondents (30%) were liveaboard boaters. These respondents were important because they are the heaviest users of marinas and waterways and must manage the most on-board waste and therefore could offer unique insights to the day to day conditions on the water.

This study indicates that people who participate in outdoor recreation tend to value the health of the environment, which was rated as important or very important by 92% of respondents. Additionally, 83% of respondents rated pumping out waste as important or very important to the health of the environment. Clean water was important or very important to boating for 92% of respondents and 89% thought that pumping out waste was moderately or very important to keeping that water safe for recreation. Most boaters have a head onboard (73%), with the most common treatment system being a holding tank (67%), which must not, by law, be dumped anywhere in Galveston Bay. Only 35% of respondents use their head every time they are on board their vessel while 47% of boaters never or very rarely use their head. This means most boaters should be pumping out their waste at least moderately often, which is supported by similarities between how often boaters report their tank needs to be emptied and how often they claim they pump out their waste.

Respondents report that the boating community perceived dumping waste overboard as bad, and that most local boaters use pump out stations. This is supported by 78% of boaters reporting they have never seen somebody dumping waste into the bay. However, respondents also believe that there is a small portion of the community that doesn't care about dumping and does it anyways. This may be because the population is not aware of the full extent of resources that are available for them to use; most boaters (73%) only know about and use a 1-3 pump-out stations. Despite this, 53% find local pump-out facilities very or moderately easy to access and operate, leading to the question of whether or not boaters need to know of more than 1-3 stations. They also believe that the cost of dockside pump-out facilities is appropriate for the services offered.

There are several conclusions that we can draw from this data and from talking to boaters while conducting the survey. The most definitive is that respondents are very concerned with the health of the environment, and they believe that pumping out waste in a facility is an important contributing factor to environmental health, as well as recreation. There were a few notable exceptions that didn't care about pumping out or about the environment and had opinions that were otherwise inconsistent with the greater community's feelings. They represent a segment of the population which can be difficult to reach with standard messaging and educational materials, and whose actions may have an overstated impact on others around them. These findings indicate that legally, very little dumping should be occurring in Galveston Bay from recreational boaters, and that very little dumping is actually occurring as well. This is supported by the fact that most of the general boating population has never seen someone dumping waste directly into Clear Lake or Galveston Bay, but believe a small portion of the boating population do. The vast majority of recreational boaters have a holding tank and use pump-outs on a regular basis, often more frequently than they need to. A common theme when talking with boaters was their frustration over the lack of enforcement of policies and regulations that are currently in place. Many boaters believe that fewer people will follow the rules if there are no consequences to breaking them.

However, the prevailing opinion of boaters is that boater waste is responsible for a small proportion of the bacteria found in the Bay. They believe that most bacteria are sourced from land, either through insufficient treatment by wastewater treatment facilities or via storm water runoff. Access, operations, and cost are not major barriers to getting boaters to use a pump-out station or service, but most boaters

only know of and use the pump-out located in their preferred marina. The data collected in this survey, as well as anecdotal evidence obtained through conversation between respondents and the surveyor, indicate that convenience is the largest hurdle preventing more widespread use of pump-out facilities. Many liveaboard boaters exclusively use land-side facilities provided in marinas because they do not want to go through the hassle of routinely going to a pump out station. Boaters believe that a greater number of their peers would use pump-out stations if there were more available, and they were more convenient.

5.3 No Discharge Zone Application

During this project period, GBF continued to research meet with stakeholders and garner support for a No Discharge Zone application in Galveston Bay. Additionally, GBF continued to meet with stakeholders to foster conversation on how this regulation change would impact them and gauge their support.

During this period the Draft NDZ Proposal was updated in the following ways:

The previous draft was reviewed to ensure comprehensive coverage of current challenges faced by the bay. Examples of other NDZs that have recently been approved were analyzed for style, topicality, and coverage of related issues. EPA guidance documents regarding NDZ draft regulations were consulted to ensure minimal compliance requirements were met. Vessel usage statistics were assembled.

Stakeholders (commercial groups and marinas) were contacted to gauge support for the application. A list of the marinas contacted can be found in Appendix 2 and a list of the commercial groups contacted can also be found in Appendix 2.

As a part of the draft update process, it was determined that at the moment the infrastructure is not currently in place to support the establishment of a Bay-wide NDZ. Before an NDZ can be supported, further resources and time must first be allocated to improved commercial pumpout availability and retrofitting of existing commercial vessel fleets. Additionally, based on the information gathered and recommendations from stakeholders, the lack of enforcement and effectiveness of the Clear Lake NDZ must be addressed before the expansion of an NDZ to the entire Galveston Bay system would be effective. Due to the perceived lack of enforcement, it is the recommendation of the workgroup to focus efforts on improving the effectiveness of the current NDZ designation before seeking expansion. GBF will continue to monitor perceptions around the NDZ, work with partners to increase enforcement, and track environmental data to support the NDZ, with the hope of establishing the necessary infrastructure and support for successful implementation in the future. It is the recommendation of the workgroup to focus efforts on successful enforcement of the existing Clear Lake NDZ before expanding it to an even larger body of water with more difficult enforcement standards.

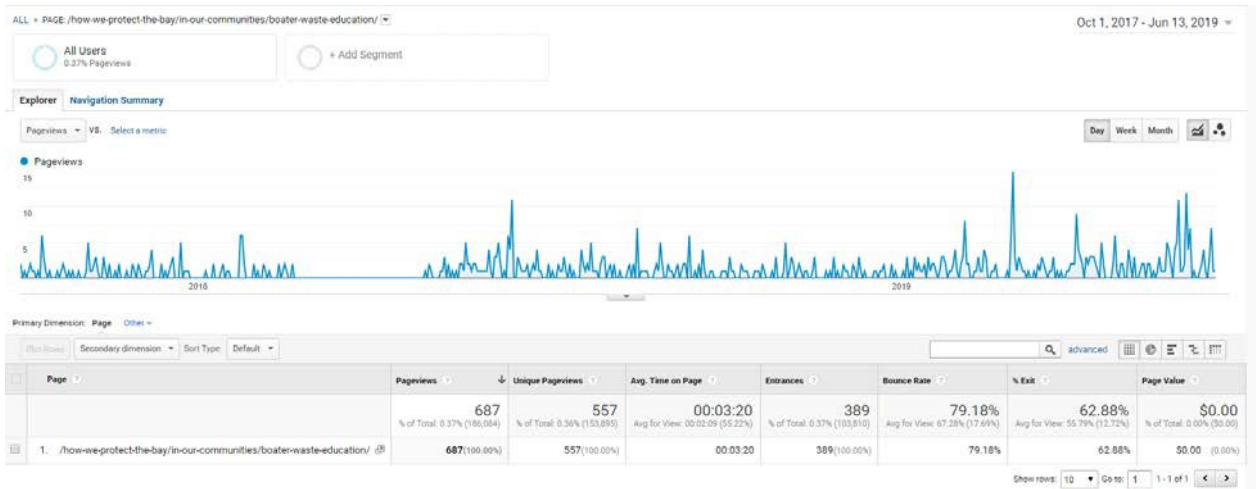
Appendices

Appendix 1: Stakeholder Groups & Outreach Materials

1.1 Pump Don't Dump campaign expansion

| | |
|------------------------------|--|
| Marina Name | Galveston Yacht Basin |
| Lat | 29.31774 |
| Long | -94.77564 |
| Website | www.galvestonyachtbasin.com |
| Access | Public |
| Cost | \$20 |
| Hours | Dawn to Dusk |
| Water Depth (Feet) | 7 |
| Channel Width (Feet) | 19 |
| Maximum Length (Feet) | 100 |
| Protocol | Must purchase a token inside the bait shop |
| Restroom Hours | 24/7 |
| Fuel / Hours | Yes, dawn - dusk |
| Port-a-Potty Dump | Next to dry stack vessel storage building |
| Direction from Water | Enter harbor with the fuel dock to port. After passing the fuel dock, the pump-out station is the first slip to the left, before the boat ramp |
| Directions from Land | Located behind the bait shop |

Example of updated information gathered for each pumpout station in Galveston Bay during Summer 2018. This table was added to each point on the PDD pumpout map.



Pumpedontdump.org webpage views

1.2 Boater Waste Workgroup

| Workgroup Affiliation | Names | Organization |
|------------------------------|------------------|-------------------------------------|
| Boaster Waste | Christian Rines | Galveston Bay Estuary Program |
| Boaster Waste | Scott Tuma | City of League City |
| Boaster Waste | Steven Johnston | H-GAC |
| Boaster Waste | Jennifer Demers | Maritime Sanitation |
| Boaster Waste | Jean Wright | Clean Rivers Program |
| Boaster Waste | Katie Wilson | Galveston County Health District |
| Boaster Waste | Philip Kropf | Texas Mariners Cruising Association |
| Boaster Waste | Ron Schultz | Galveston County Health District |
| Boaster Waste | Marie Stewart | Marina Del Sol |
| Boaster Waste | Sean Fitzgerald | Maritime Sanitation |
| Boaster Waste | Allie Fitzgerald | Maritime Sanitation |
| Boaster Waste | Catherine Eisele | Redfish Marine |
| Boaster Waste | Jim Eisele | Redfish Marine |

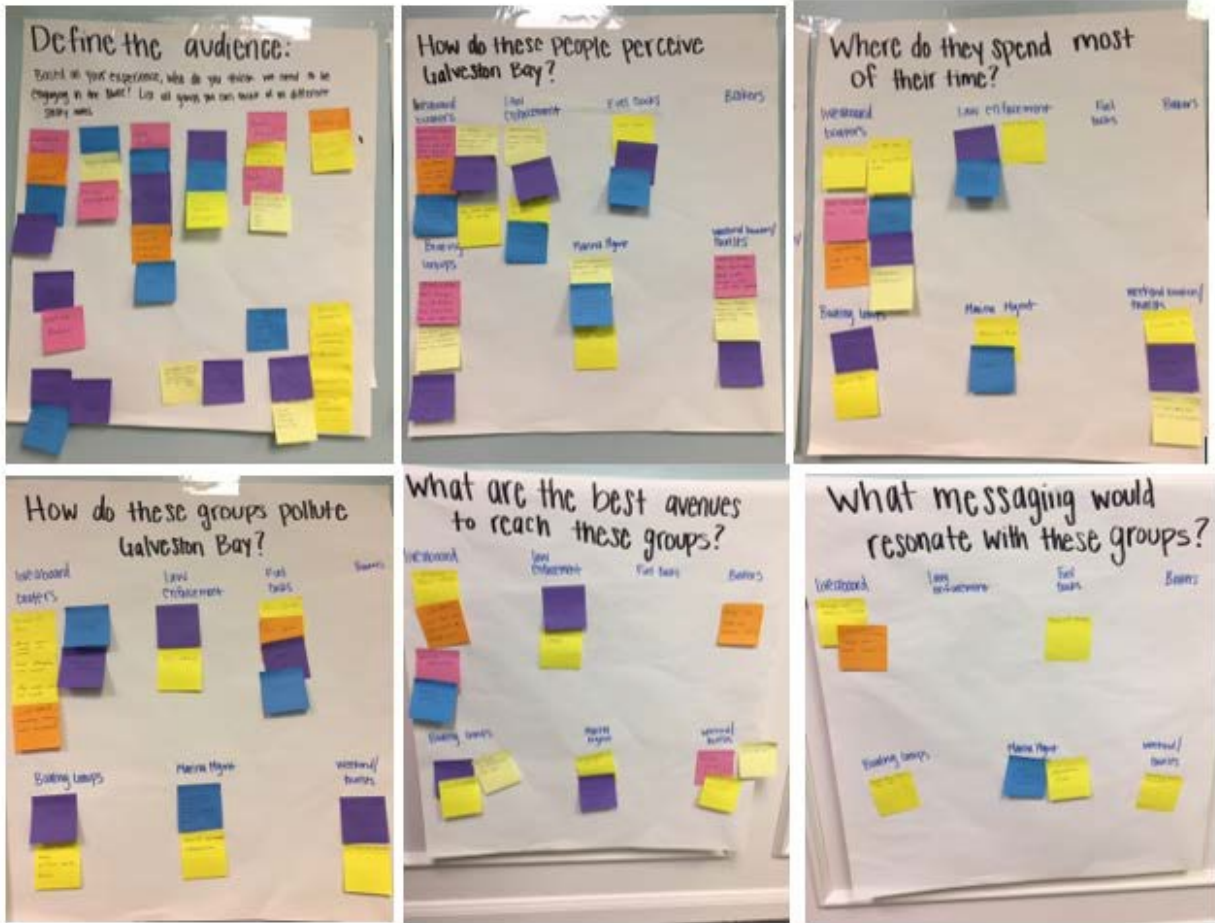
Updated Boater Waste Workgroup Roster

| Date | Location | Time | Attendance |
|-------------------|---------------------|-------------|-------------------|
| November 8, 2017 | GBF Conference Room | 2pm | 5 |
| February 5, 2018 | GBF Conference Room | 2pm | 10 |
| May 15, 2018 | GBF Conference Room | 2pm | 9 |
| August 17, 2018 | GBF Conference Room | 2pm | 7 |
| November 14, 2018 | GBF Conference Room | 2pm | 5 |
| February 28, 2019 | GBF Conference Room | 2pm | 8 |

Boater Waste Workgroup Meeting Schedule

Messaging Recommendations for BWEC from Boater Waste Workgroup

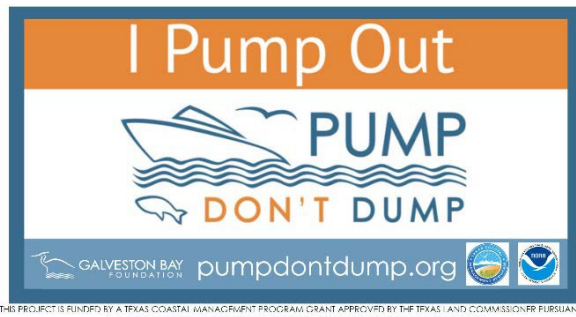
| Define the Audience.. | How does each group perceive Galveston Bay? | Where do they spend most of their time? | How do these groups pollute Galveston Bay? | What are the best avenues to reach these groups? | What messaging would resonate with these groups? |
|--------------------------|--|--|---|--|---|
| Liveaboard boaters | This is home so aesthetically they'd want the water clean; want water to be clean, most respect the water; most appreciate clean water and want their marinas to be clean; as a free space with no rules; as a great place to live; most are responsible, others just don't care | stay in dock; at the dock; tied at the dock; at their slips; boat/surrounding area; at docks/marinas; at pool/social areas & at the slip | dumping waste into the Bay; dump waste of various kinds; pumping holding tank overboard; dog waste wash into water, wash detergents into water, dump sewer waste into water; dump at dock | marina newsletters; send out info every month through mail; marina newsletters; marina meetings | keep your home clean; keep our marina clean |
| Marina Management | cash cow, source of income/need to preserve to make a living; generally trying to do a good job; | marina; marina office | not educating boaters who use facilities of importance of pump out stations/boat wash, etc.; poorly maintained infrastructure | set up meetings, give handouts, education; marina group meetings | regulations & fines; fines by regulatory agencies |
| Law Enforcement | as a people-filled polluted area; generally too busy with other issues; passionate about preserving its natural resources; another area to patrol | in and around the GB watershed; going from case to case; Kemah Boardwalk | fuel exhaust; hopefully they don't | certification classes; call/email with help or concerns | |
| Fuel Docks | source of income; great for business; cash cow | | spills; spills; gas spills; fuel spills | | Fear of fines |
| Brokers | | | | drop info off at broker office | |
| Boating Groups | most groups try to follow the rules, they have more experience; generally pretty aware w/ generally responsible members; wonderful place to spend time, concerned wat stay healthy | out in Bay; living their lives, boating, at group meetings | hopefully they don't; water bottles, trash, oil/fuel spills, sewer | club meeting; attend meeting; info on their websites and social media | keep Bay clean for all |
| Weekend boaters/tourists | weekend boaters don't worry about waste dumping - it's a lot like speeding; fun place possibly dirty but not enough to stay away; generally pretty uneducated on boater waste issues | on Clear Lake and/or close to Kemah/Seabrook; hanging out on/near the water; Galveston Bay | throw waste/trash/etc overboard/in the water (they're not staying - out of sight, out of mind); trash not secured | at commercial establishments, West Marine, Blackburn; posted signs saying "Don't Dump"; Info at boat ramps | potential health hazards |



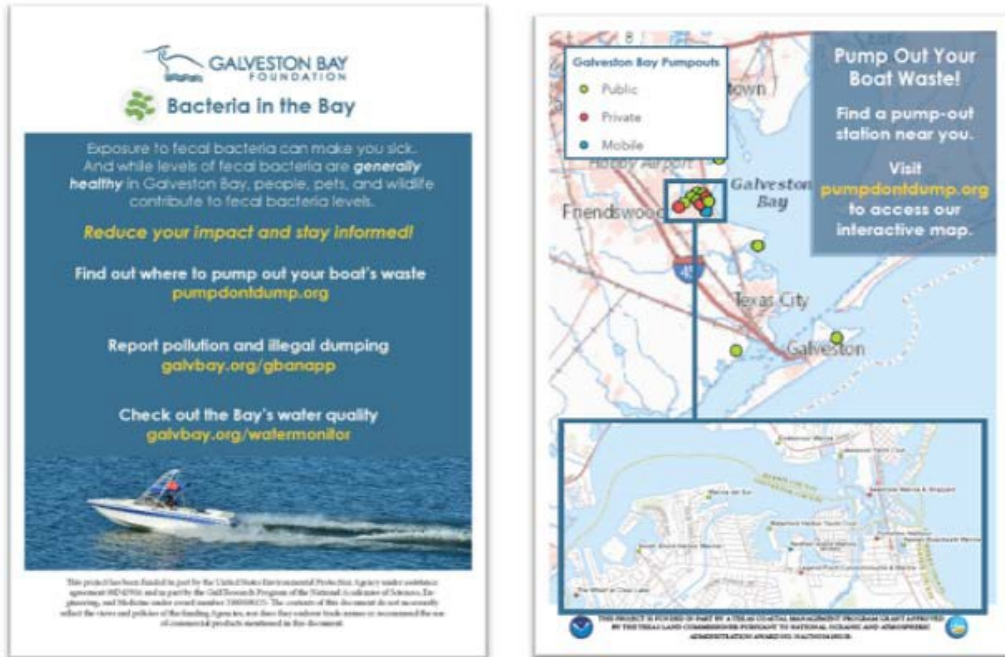
Photos of Messaging Activity at the Boater Waster Workgroup Meeting on February 28, 2019

1.3 Marketing and Outreach Materials

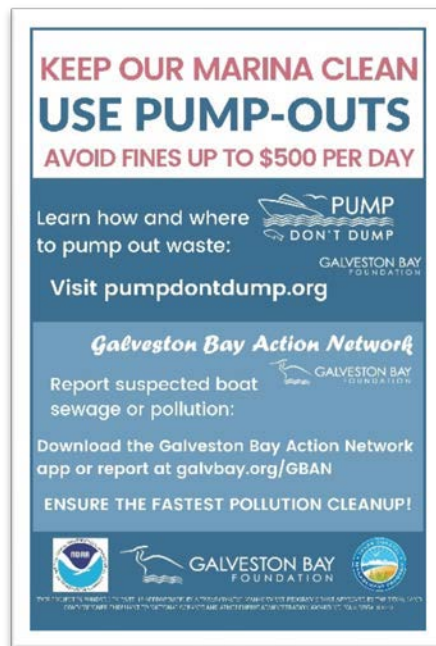
Pump Don't Dump



Photos of the PDD boater flag (left) and sticker (right) used to promote pledges to properly dispose of boater waste.

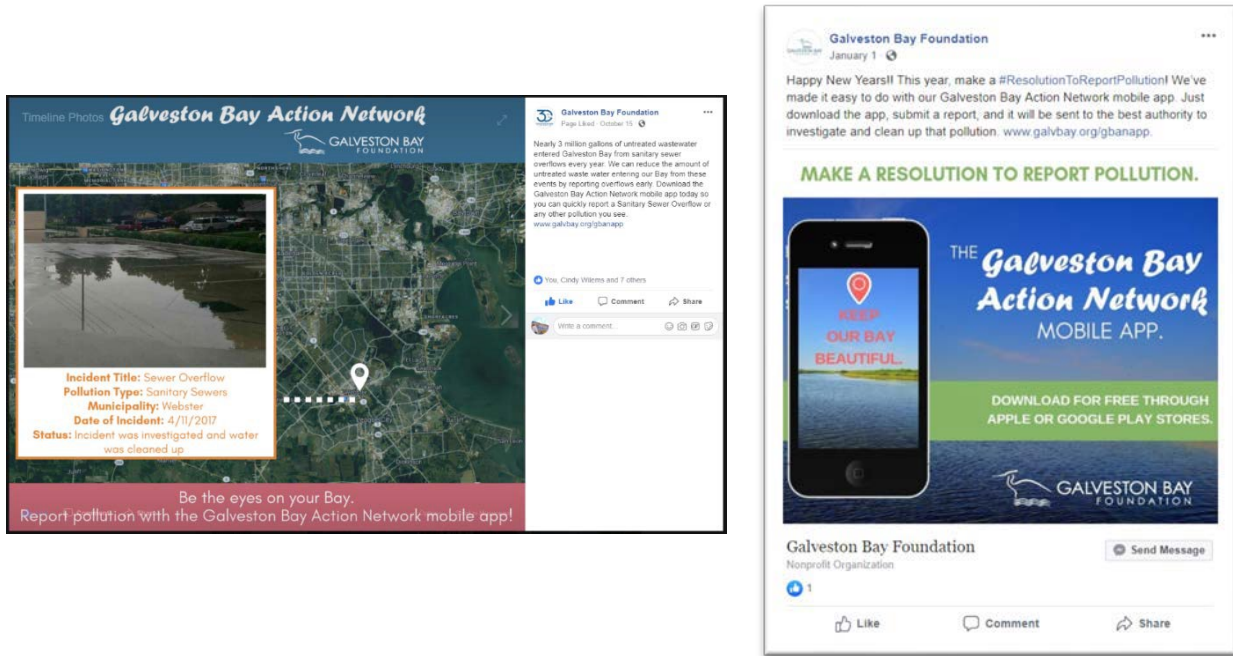


Front of flyer promoting clean boating practices in Galveston Bay, including reporting dumping or other pollution on GBAN. This flyer has been distributed to boaters during the summer 2019 boating season.



Sign promoting clean boating practices, including reporting boater waste on GBAN. These posters were distributed to marina managers during spring 2019 and were hung at marinas throughout Clear Lake and Galveston Bay.

Galveston Bay Action Network



Images of posts from the GBAN fall 2018 social media campaign (left) and winter 2019 social media campaign (right)



GBAN yard sign at shoreline cleanup event. This polluted shoreline was discovered via the app, and the cleanup was a direct result of this report. 110 bags of trash were filled within 3 hours by volunteers and local officials.



Left: Image of the poster hung at boat ramps and parks encouraging visitors to properly secure their trash and to report any trash pileups on the GBAN app.

Right: Image of the GBAN sticker & magnet



Image of the design printed on the 3'x5' floor mat to be used at outreach events.

Water Monitoring Team

Who Are We?
 GBF's Water Monitoring Team is filled with people like you: Citizens who care about Galveston Bay and are working to help protect it. Certified volunteers conduct monthly water sampling at over 60 sites around the Bay. Our team serves as advocates for the Bay and connects their communities to local water quality concerns.

What Do We Sample For?

- Air and water temperature
- Dissolved oxygen
- pH
- Salinity
- Transparency
- Depth
- Various field observations (e.g., water color and odor, weather, wildlife)
- Fecal indicator bacteria (optional and requires an additional certification)

Why Do We Collect This Info?
 These data help us to promote clean water for everyone to enjoy! It is intended to help citizens answer questions such as:
 Is it safe to swim in the water near me?
 How do storms impact water quality?
 Is water quality in this area healthy for fish?

Sampling and gathering this information allows us to piece together a complete picture of Galveston Bay, screen for potential problems, and educate both local decision makers and the public on water quality concerns.

If you're interested in learning more about our findings, visit galvbay.org/watermonitors

2017 Water Quality Year in Review

In 2017, GBF's Water Quality Monitoring Team collected and analyzed 413 water samples from 60 sites around Galveston Bay. Thank you to the 70+ volunteer water monitors who collected this information. Here is a summary of our findings from the Team's 2017 data.

Water Temperature: Average of 23.0°C
 This is **similar** to previous years. The sea's most biological factors such as reproduction and migration. It also impacts dissolved oxygen levels, as warmer water can hold more than warm water.

Air Temperature: Average of 23.5°C
 This is **similar** to previous years.

Dissolved Oxygen: Average of 4.1 mg/l
 This level is **good** for supporting animal life. 98% of 2017's DO samples could support life. Fish and other aquatic life depend on DO to survive, if levels are too low they will suffocate. In 2017, 88% of DO samples collected were 1 mg/l or higher. Overall, Galveston Bay's dissolved oxygen levels appear to be healthy.

Enterococcal Bacteria: Geometric Mean of 8.0 MPN
 This is considered **safe** for swimming by the EPA. 91% considered safe for swimming by EPA standards. Enterococci are bacteria that indicate the presence of harmful fecal waste in the water. More high levels of these bacteria are seen after major rain events, and dissipate after a few days. About half of GBF's monitoring sites test for Enterococci.

Salinity: Average of 14.3 ppt
 This is **higher** than previous years. Much of Galveston Bay's salinity only as a salinity range that isn't too salty or too fresh, but brackish. Salinity that's too high or low can be stressful on the Bay's plants and animals, such as oysters and dolphins. Major rains can increase salinity, while drought or dry spells can increase it. While Harvey led to several months of very low salinity, much of 2017 was drier than previous years, resulting in an overall higher average than the past two years. (Left: Salinity averages by site, 2017. Right: Salinity averages by site, normal year)

pH: Average of 7.9 in 2017
 This is **ideal** to support life. This is **similar** to previous years. pH is a measurement of how acidic the water is. A pH range that's too low or too high can lead to stress and the death of Bay life. pH has been relatively stable in the Bay, and is considered to be within a healthy range.

Water Transparency: Average of 0.5 meters
 This is **the same** as in previous years. Water transparency, or turbidity, measures how much solid matter is suspended in the water. The higher the transparency, the further down the light passes and the clearer the water appears. In 2017, the average transparency measured by GBF's Water Monitoring Team was 0.5 meters, very similar to transparency measured in prior years.

Poster of the WMT 2017 Summary. A PDF of the 2018 WQ Data Summary can be viewed at:

<https://galvbay.org/wp-content/uploads/2019/04/FINAL-Galveston-Bay-2018-Year-in-review-Data-Summary.pdf>

5 WAYS YOU CAN HELP ENSURE GALVESTON BAY IS FISHABLE AND SWIMMABLE

 GALVESTON BAY FOUNDATION



USE A RAIN BARREL

Rain barrels reduce stormwater runoff, which carries pollution into our waterways. One rain barrel can save 1,050 gallons of water per year!

Sign up for a Galveston Bay Foundation Workshop: galvbay.org/rainbarrel



BAG IT FOR YOUR BAY

There are enough dogs in the Houston area to fill 52 dump trucks of poop every day. Pet waste is a major source of polluted runoff. Pick up after your pooch! Learn more: galvbaygrade.org



CEASE THE GREASE

More than half of the sanitary sewer overflows in our region are caused by grease blockages. Throw cooking fats, oils, and grease in the trash. Help your pipes and your Bay: ceasethegrease.net



REPORT POLLUTION

Download the Galveston Bay Action Network mobile app to report any land or water pollution you see. Reports are instantly sent to the proper authority to clean it up!

Visit galvbay.org/gbanapp to file a report today.



CONSERVE WATER

Conserve water at home and at work to help maintain a healthy Bay for our wildlife to enjoy. Visit gbwb.org and pledge to conserve water!

galvbay.org

 GALVESTON BAY FOUNDATION

- 1 Sign up for a Rain Barrel Workshop
galvbay.org/rainbarrel
- 2 Scoop the poop
galvbaygrade.org
- 3 Find a cooking oil recycling station
ceasethegrease.net
- 4 File a pollution report
galvbay.org/gbanapp
- 5 Pledge to conserve water
gbwb.org

Learn more ways to take action for Galveston Bay } galvbay.org




Image of front and back of the new "How you can protect Galveston Bay's Waters" flyer.

Appendix 2: Outreach and Education**2.1 Print and Digital Media, Outreach and Education Booths and Distribution**

| Date | Event Type | Presenter/Staff | Event Name | Audience |
|-------------|-------------------|------------------------|--|-----------------|
| 10/11/2017 | Exhibit | T'Noya & Kaitlin | JSC Safety and Health Fair | 100 |
| 10/12/2017 | Presentation | T'Noya | Surfrider Galveston | 10 |
| 10/17/2017 | Exhibit | Sarah | Marina Association of Texas Annual Conference, vendor table | 90 |
| 10/26/2017 | Presentation | Sarah | Lone Star Groundwater Conservation District - Water Efficiency Network | 20 |
| 10/28/2017 | Presentation | Kaitlin | Pearland Rain Barrel Workshop | 30 |
| 10/30/2017 | Presentation | T'Noya | Pet waste pilot | 3 |
| 11/2/2017 | Presentation | T'Noya | Pet waste pilot | 6 |
| 11/5/2017 | Presentation | T'Noya | Keep Pearland Beautiful- HS Club | 13 |
| 11/8/2017 | Presentation | T'Noya | Sam Rayburn High School- Aquatic/Environmental Students | 300 |
| 11/9/2017 | Presentation | T'Noya | Energy Insitute Students | 105 |
| 11/16/2017 | Presentation | T'Noya | Seabrook Rotary Club | 40 |
| 11/30/2017 | Presentation | T'Noya | Dallas Zoo and Trinity River Partners | 75 |
| 12/7/2017 | Presentation | T'Noya | Ed White STEM Elementary | 2 |
| 1/8/2018 | Presentation | T'Noya Thompson | E H White Elementary School | 50 |
| 1/11/2018 | Presentation | T'Noya Thompson | Citizen's Climate Lobby (CCL) | 1 |
| 1/12/2018 | Presentation | T'Noya Thompson | Oppe Elementary School | 25 |
| 1/15/2018 | Presentation | T'Noya Thompson | PISD- Sam Rayburn HS | 15 |
| 2/7/2018 | Presentation | T'Noya Thompson | CCA, Sugarland Chapter | 40 |
| 2/14/2018 | Presentation | Sarah Gossett | Trash Bash Coordination Committee | 15 |
| 2/16/2018 | Presentation | Sarah Gossett | TMCA | 50 |
| 2/24/2018 | Exhibit | Emily Ford | Sea Center TX Nature Day Celebration | 200 |
| 2/28/2018 | Both | Sarah Gossett | Post Harvey Community Open House | 40 |
| 3/10/2018 | Presentation | Kaitlin Grable | La Porte Rain Barrel Workshop | 56 |
| 3/20/2018 | Presentation | T'Noya Thompson | Idylwood Civic Club | 41 |
| 3/21/2018 | Presentation | T'Noya Thompson | EIHS- Wildlife Class | 35 |
| 3/24/2018 | Exhibit | T'Noya & Kaitlin | REI Membership Event | 20 |
| 3/27/2018 | Presentation | T'Noya Thompson | JSC- Employee Brown Bag | 25 |
| 4/7/2018 | Presentation | Kaitlin Grable | Dickinson Rain Barrel Workshop | 47 |
| 4/7/2018 | Presentation | Paula Paciorek | Sam Houston Chapter Daughters of the American Revolution | 60 |
| 4/9/2018 | Presentation | T'Noya Thompson | Lee College | 13 |
| 4/11/2018 | Action Event | GBRC, GBAN, P3 | GBF, P3, MG, Port, Pct. 2, Downtown Aqm. | 38 |
| 4/13/2018 | Presentation | T'Noya Thompson | Tegler High School | 21 |
| 4/14/2018 | Exhibit | Sarah & Paula | Baytown Nature Nurture Festival | 100 |
| 4/14/2018 | Prentation | T'Noya Thompson | Bird Nerd Series- Audubon TX | 25 |

| | | | | |
|-----------|--------------|---------------------------|---|-------|
| 4/14/2018 | Presentation | T'Noya Thompson | REI-Baybrook Store | 5 |
| 4/17/2018 | Presentation | T'Noya & Kaitlin | UH Sustainability Fest | 40 |
| 4/17/2018 | Presentation | Sarah Gossett | Houston Conchology Society | 20 |
| 4/19/2018 | Exhibit | Kaitlin & Genevieve | UTMB Earth Day | 125 |
| 4/21/2018 | Presentation | T'Noya Thompson | Bay Day | 120 |
| 4/22/2018 | Exhibit | Sarah & Paula | Earth Day Houston | 400 |
| 4/28/2018 | Exhibit | Anna Deichmann | Exploration Green Grand Opening | |
| 4/29/2018 | Presentation | T'Noya Thompson | Galveston Bay Oasis-UHCL | 20 |
| 5/1/2018 | Presentation | Anna Deichmann | Lower Trinity Basin Master Naturalist | 14 |
| 5/11/2018 | Exhibit | Sarah Gossett | Waterworks Festival Houston | |
| 5/12/2018 | Presentation | Kaitlin Grable | Pearland Rain Barrel Workshop | 65 |
| 5/21/2018 | Presentation | Sarah, Kaitlin, Lindsey | Oysters, Water, and Boaters (Bacteria Reduction Plan) | 35 |
| 5/16/2018 | Presentation | Sarah Gossett | UH HERE program | 75 |
| 5/19/2018 | Presentation | Sarah, Will Merrel (HGAC) | OSSF WorkShop - Bayou Vista | 8 |
| 5/21/2018 | Presentation | Sarah, Kaitlin, Lindsey | Oysters, Water, and Boaters (Bacteria Reduction Plan) | 35 |
| 6/5/2018 | Exhibit | Cindy Wilems | Chick Fil A Family Night | 30 |
| 6/8/2018 | Exhibit | Kaitlin Grable | World Oceans Day | 50 |
| 6/9/2018 | Exhibit | Sarah and Emily F. | World Oceans Day | 250 |
| 6/29/2018 | Exhibit | Ted Driscoll | TMCA Tippy Top Hat Party | 30 |
| 7/14/2018 | Presentation | Kaitlin Grable | Baytown Rain Barrel Workshop | 52 |
| 7/22/2018 | Presentation | Anna Deichmann | Galveston Bay Oasis-UHCL | 15 |
| 7/22/2018 | Exhibit | Emily Ford | Counting Crows concert - Greybird Foundation | 10 |
| 7/22/2018 | Exhibit | Kaitlin Grable | Galveston's Own Farmers Market | 55 |
| 7/24/2018 | Presentation | Emily Ford | Marathon HEART group meeting | 25 |
| 8/3/2018 | Presentation | Sarah & Paula | UH Geology 101 class | 60 |
| 8/8/2018 | Exhibit | Emily Ford | CenterPoint Cares Volunteer Fair | 1,000 |
| 8/11/2018 | Presentation | T'Noya Thompson | Circle of Friends- GBRC Preview | 60 |
| 8/25/2018 | Presentation | T'Noya/Sarah | REI-Community Class | 6 |
| 8/22/2018 | Exhibit | Kaitlin & Ted | H-GAC Coastal Communities Open House | 15 |
| 8/25/2018 | Exhibit | Michael/Shannon | AIA Sandcastle Competition | 3000 |
| 9/24/2018 | Presentation | T'Noya Thompson | Port of Houston- Citizen Council | 15 |
| 9/25/2018 | Workshop | T'Noya Thompson | Energy Institute | 165 |
| 9/27/2018 | Presentation | T'Noya Thompson | Gulf Coast Water Efficiency Network | 10 |
| 9/11/2018 | Presentation | Sarah Gossett | HGAC Clean River Programs | 25 |
| 9/8/2018 | Presentation | Sarah & Lindsey | WMT Training, Phase 1 & 2 | 13 |

| | | | | |
|------------|----------------------------|----------------------|---|-----|
| 9/15-9/16 | Exhibit | Emily, Haille, Sarah | Gatorfest | 150 |
| 10/19/2018 | Presentation | Lindsey Nolan | City of Pasadena | 20 |
| 10/31/2018 | Exhibit | Lindsey & Sarah | JSC Health and Safety Fair | 150 |
| 2-Nov | Presentation | T'Noya | Northside High School | 75 |
| 9-Nov | Presentation | Sarah & T'Noya | TAMUG Gulf Estuarine Research Symposium | 30 |
| 13-Nov | Presentation | T'Noya | Gloria Dei Lutheran- Men's Group | 21 |
| 13-Nov | Presentation | Sarah | North Pasadena Neighborhood Association | 16 |
| 15-Nov | Presentation | T'Noya | Converation and Cocktails | 20 |
| 15-Nov | Presentation | Lindsey, Scott, Ted | WQ Open House - Galveston | 25 |
| 28-Nov | Presentation | T'Noya | Lee College | 15 |
| 11-Dec | Presentation | T'Noya | North Pasadena Neighborhood Association | 15 |
| 17-Dec | Presentation | T'Noya | The Rice School | 76 |
| 6-Dec | Presentation | Sarah | GBEP WSQ Subcommittee | 20 |
| 12-Dec | Presentation | Sarah | GBF M&R Subcommittee | 20 |
| 1/18/2019 | Presentation (RCC) | T'Noya | GISD-Oppe Elementary | 18 |
| 1/29/2019 | Presentation (Partnership) | T'Noya | U of H- HSPA | 8 |
| 2/19/2019 | Presentation (Partnership) | T'Noya | Groundworks Dallas/Dallas Zoo | 45 |
| 2/26/2019 | Presentation (Partnership) | T'Noya/Genevieve | Delores Fenwick Nature Center | 3 |
| 1/18/2019 | Presentation | Sarah | TMCA Monthly meeting | 70 |
| 2/19/2019 | Exhibit | Ted | TAMUG | 30 |
| 2/19/2019 | Presentation | Sarah | Double Bayou WPP | 20 |
| 3/9/2019 | Exhibit | Ted | Dolores Fenwick Nature Center Grand Opening | 200 |
| 3/18/2019 | Presentation (RCC) | T'Noya | Tegler Career Center- PISD | 30 |
| 3/21/2019 | Presentation | Sarah, Haille | GBF Oyster Aquaculture Public Meeting | 50 |
| 3/26/2019 | Presentation | Sarah | NWQMC Conference | 40 |
| 4/2/2019 | Presentation (RCC) | T'Noya | Ball High School | 137 |
| 4/2/2019 | Presentation | Ted | UHCL Conservation Club | 18 |
| 4/6/2019 | Exhibit | Sarah | Bayou Greenway Day | 200 |
| 4/6/2019 | Exhibit | Ted | Us Power Squadron | 36 |
| 4/9/2019 | Exhibit | ted, Sarah | Houston Press, Menu of Menus | 250 |
| 4/12/2019 | Presentation | T'Noya | Evelyn Meador Branch Library | 5 |
| 4/14/2019 | Exhibit | Sarah, Ted | Earth Day Houston | 200 |
| 4/15/2019 | Exhibit | Ted | Crenshaw School | 50 |

| | | | | |
|-----------|----------------------------|------------------------------|--|---------------|
| 4/15/2019 | Presentation (RCC) | T'Noya | Lee College | 16 |
| 4/18/2019 | Presentation (Partnership) | Sarah | UHD - HIP Showcase | 50 |
| 4/23/2019 | Exhibit | T'Noya | Nokturne Art Night | 40 |
| 4/27/2019 | Exhibit | Sarah | Nassau Bay Street Eatz | 50 |
| 4/23/2019 | Presentation | Ted | Johnson Space Center | 4 |
| 4/28/2019 | Exhibit | T'Noya/Claire | Exploration Green Earth Day Event | 75 |
| 4/27/2019 | Exhibit | Ted | Houston Maritime Museum | 12 |
| 4/28/2019 | Presentation | Ted & Sarah | Rain Barrel Workshop - Spindletop Brewery | 15 |
| 4/30/2019 | Presentation | T'Noya | LaPorte Rotary Club | 55 |
| 5/2/2019 | Presentation-Event | T'Noya/Bob/Scott | Bay Connect: Media/Spanishi Influencers | 20 |
| 5/2/2019 | Presentation | T'Noya | GBRC: General | 5 |
| 5/3/2019 | Exhibit | Ted | Water Works Festival | 250 |
| 5/8/2109 | Presentation | Ted | Americas Boater Club | 15 |
| 5/9/2019 | Presentation (Partnership) | T'Noya | Houston Zoo- Conservation and Education | 5 |
| 5/9/2019 | Presentation | T'Noya/Scott | Texas Navy Association | 12 |
| 5/11/2019 | Presentation | Nicole | Galveston Bay Sail & Power Squadron | 20 |
| 5/20/2019 | Presentation | T'Noya | Mark Twain Elementary | 6 |
| 5/21/2019 | Presentation | Scott | Liberty County Master Gardeners | 30 |
| 5/25/2019 | Presentation (Birthday) | T'Noya | Asher's Birthday Party | 50 |
| 5/9/2019 | Exhibit | Sarah | Galveston Bay Texas Master Naturalist volunteer showcase | 50 |
| 5/16/2019 | Presentation | Sarah | UH HERE Program | 75 |
| 5/28/2019 | Presentation (RCC) | T'Noya | Forest Broke Middle School (NWF) | 17 |
| 5/28/2019 | Presentation (RCC) | T'Noya | Fondren Middle School (NWF) | 30 |
| 6/5/2019 | Exhibit | Emily F., Brandy | KBR World Environment Day | 400 |
| 6/7/2019 | Exhibit | Emily F., Sarah | HMNS World Oceans Day | 600 |
| 6/8/2019 | Exhibit | Emily F., Sarah | Houston Zoo World Oceans Day | 200 |
| 6/8/2019 | Exhibit | unmanned (Sarah dropped off) | Java Lava Brew World Oceans Day | 50 |
| 6/8/2019 | Exhibit | Nick | Artist Boat World Oceans Day | 500 |
| | | | Total | 12,274 |

Schedule of presentations and outreach events promoting BWEC programs

| Post Date | Program | Impressions |
|-----------|---------|-------------|
| 11/30/17 | GBAN | 1,312 |
| 1/17/18 | GBAN | 854 |
| 3/22/18 | GBAN | 1,279 |
| 4/12/18 | GBAN | 7456 |
| 6/8/18 | GBAN | 619 |
| 9/20/18 | GBAN | 1,078 |
| 10/2/18 | GBAN | 692 |
| 10/15/18 | GBAN | 638 |
| 11/2/18 | GBAN | 2,074 |
| 11/15/18 | GBAN | 654 |
| 7/19/18 | PDD | 2,707 |
| 5/7/18 | WMT | 904 |
| 7/11/18 | WMT | 8,644 |
| 9/4/18 | WMT | 803 |
| 1/1/2019 | GBAN | 693 |
| 1/3/2019 | GBAN | 679 |
| 1/6/2019 | GBAN | 843 |
| 1/9/2019 | GBAN | 623 |
| 1/12/2019 | GBAN | 816 |
| 1/15/2019 | GBAN | 679 |
| 2/13/2019 | WMT | 1275 |
| 5/25/2019 | PDD | 719 |

Schedule of Facebook posts for BWEC programs

| Publication | Date | Program | Description | Reach |
|--|------------------------|---------|------------------------------------|------------|
| Houstonia | 1/11/2018 | GBAN | banner ad on website | 72,000 |
| Houston Public Media | 12/25/2017 - 1/15/2018 | GBAN | banner ad on website | 29,400 |
| Houstonia | 1/16/2018 | GBAN | link from air pollution article | 131,958 |
| Facebook Ad | Apr-18 | GBAN | ads for pertinent facebook users | 21291 |
| Google Ad | Apr-18 | GBAN | ad for various keyword searches | 8265 |
| Houston Press Digital Marketing Campaign | 6/2018 – 6/2019 | GBAN | Multifaceted Digital Marketing ads | 87,697,422 |
| Houston Chronical ads | 6/2018 – 1/2019 | GBAN | Print and digital advertising | Unknown |

External advertisements published during reporting period

| Name of Publication | Date/Issue of Publication | Program | Link to Article (if possible) |
|----------------------------|----------------------------------|----------------|--|
| Houston Moms Blog | 1/17/2018 | GBAN | https://houston.citymomsblog.com/preventing-pollution-with-one-easy-step/ |
| Houstonia | 1/4/2018 | GBAN | www.houstoniamag.com/articles/2018/1/4/non-profit-offers-free-easy-to-use-tool-to-keep-houston-galveston-communities-clean |
| GBRC website | 4/30/2018 | GBAN | www.galvbaygrade.org/cover-stories/2018/04/galveston-bay-foundationplastic-pollution-prevention-partnership-collaboration-coordination-and-cleanup/ |
| Channel 13 | 2/20/2018 | GBAN | http://abc13.com/large-trash-piles-fill-parts-of-houstons-ship-channel-/3115599/ |
| Channel 11 | 3/7/2018 | GBAN | http://www.khou.com/article/news/local/whats-being-done-about-trash-off-galveston-bay/285-526717366 |
| Changing Currents Magazine | 5/2019 | PDD | |
| Crystal Beach Local News | 6/26/2018 | GBAN | |
| Texas Living Waters blog | 9/17/2018 | GBAN | https://texaslivingwaters.org/water-pollution-app/ |
| Houston News Wier | 6/19/2018 | GBAN | www.prnewswire.com/news-releases/galveston-bay-action-network-app-provides-easy-effective-way-to-report-pollution-300667890.html (see report below) |

Schedule of external articles written and published during reporting period

PRESS RELEASE

**Sent out on June 19, 2018
PR Newswire**



CONTACT: Claire Everett
281-532-1983 x 208
ceverett@galvestonbay.org

FOR IMMEDIATE RELEASE

Galveston Bay Action Network app provides easy, effective way to report pollution

June 19, 2018 - Houston, TX - Galveston Bay Foundation (GBF) has put the power of protecting Galveston Bay in the community's hands. GBF's Galveston Bay Action Network free downloadable mobile app for iPhone and Android allows users to report any land or water pollution within minutes. Reports are automatically sent to the proper authority, resulting in the quickest response to get the pollution cleaned up.

"Galveston Bay Action Network app is innovative because it provides one place for people in all four counties surrounding the Bay (Galveston, Harris, Brazoria, Chambers) to report pollution with the push of a button," said Sarah Gossett, GBF's Water Quality Manager. "They don't have to do the work of figuring out who to call or where to go."

This spring, Houston resident Carolyn Hernandez was driving through her neighborhood when she saw piles of trash and debris in the street.

"I had just learned about the Galveston Bay Action Network app so I pulled over, opened the app, took a picture of the trash and filed a report," she said. "It was easy and took about two minutes. When was driving through there a day or so later, all the trash was gone."

She added that it's "important to keep our environment clean and healthy for everyone to enjoy, and Galveston Bay Action Network is a great tool to do just that."

This app has resulted in many pollution cleanups throughout the region, including shoreline cleanups, debris removal, response to sanitary sewer overflows, and remediation of other sources of harmful pollutants.

The Galveston Bay Action Network app is a tool for everyone in the Houston-Galveston area and can be used as far north as Spring Cypress and as far east as Anahuac. Ultimately, Galveston Bay Foundation hopes communities will use this resource to improve their quality of life.

Visit galvestonbay.org/gbanapp for more information, or download from the iTunes Store or Google Play today!

About Galveston Bay Foundation
Established in 1987, the Galveston Bay Foundation is a 501(c)(3) non-profit organization. Its mission is to preserve and enhance Galveston Bay as a healthy and productive place for generations to come. It implements diverse programs in land preservation, habitat restoration, water quality and quantity, youth education, and advocacy. For further information, contact the Foundation at (281) 332-3332, visit www.galvestonbay.org, like us on [facebook](https://www.facebook.com/galvestonbayfoundation), or follow us on [twitter](https://twitter.com/galvestonbay) and [instagram](https://www.instagram.com/galvestonbayfoundation). #galvestonbayfoundation

Galveston Bay Action Network App Provides Easy, Effective Way to Report Pollution

PR Newswire ID: 2165567-1 Clear Time Jun 19, 2018 8:33 AM ET

Pickup
Where did my release get picked up?

| | |
|--------------|--------------------------|
| 223 | 83,569,385 |
| total pickup | total potential audience |

Traffic
What traffic did my release generate?

| | | |
|---------------|------------------|-------------|
| 476 | 1,040 | 123 |
| release views | web crawler hits | image views |

Audience
Who are the audiences viewing my release?

| | | |
|-------------|--------------------|----------------------|
| 150 | 10 | 3,158 |
| media views | organization views | targeted influencers |

Engagement
How are people engaging with my release?

| |
|--------------------------|
| 6 |
| total engagement actions |

| |
|----------------|
| 6 |
| click-throughs |



Impacts from press release released by Houston Press on PR Newswire

| Media Outlet | Publication Year | Location |
|--|------------------|--------------|
| Water Monitoring Team webpage | 2017 | GBF Website |
| Bacteria Monitoring webpage | 2017 | GBF Website |
| 2017 data summary | 2018 | GBF Website |
| 2017 individual site summaries | 2018 | GBF Website |
| WMT article on Report Card webpage | 2018 | GBRC website |
| Bacteria Testing infographic | 2017 | GBF FB Page |
| WQ Research Assistant Report | 2018 | GBF Website |
| "Is it Safe to Swim in Galveston Bay?" | 2018 | GBF Website |
| 2018 data summary | 2019 | GBF Website |
| 2018 individual site summaries | 2019 | GBF Website |
| Swim Guide partnership announcement | 2018 | GBF Website |
| WMT Blog Post: Volunteer spotlight | 2019 | GBF Website |

List of WMT Articles & Infographics published by GBF during project period

2.2 Marina Partnerships, Boating Groups, & Agency Partnerships

| Marina/Boating Group | Partnership Activities |
|--|--|
| Bal Harbor Marina | GBF Water Monitoring Team |
| Blue Dolphin Yachting Center | GBF Water Monitoring Team; |
| Endeavour Marina | GBF Water Monitoring Team |
| Harbrwalk Yacht Club | Dockwalkers |
| Houston Yacht Club | GBF Water Monitoring Team; CLMA; Pump Don't Dump; Dockwalkers |
| Galveston Bay Cruising Association | Dockwalkers; Pump Don't Dump |
| Lakewood Yacht Club | GBF Water Monitoring Team; Pump Don't Dump; CLMA; Dockwalkers |
| Marina Bay Harbor Yacht Club | Pump Don't Dump; GBF Water Monitoring Team |
| Marina Del Sol | GBF Water Monitoring Team; Pump Don't Dump; CLMA; Dockwalkers |
| Maritime Sanitation* | Pump Don't Dump; Boater Waste Workgroup |
| Nassau Bay Yacht Club | GBF Water Monitoring Team; Pump Don't Dump |
| Kemah Boardwalk Marina* | Pump Don't Dump; Dockwalkers |
| Portofino Harbour Marina & Yacht Club* | GBF Water Monitoring Team; Pump Don't Dump; CLMA; Dockwalkers |
| Redfish Island Marine* | Pump Don't Dump; Water Monitoring Team; Boater Waste Workgroup |
| Seabrook Marina* | Pump Don't Dump; CLMA; Dockwalkers |
| South Shore Harbour Marina | GBF Water Monitoring Team; Dockwalkers |
| Pelican Rest Marina | Dockwalkers |
| Galveston Yacht Basin | Dockwalkers |
| Texas Corinthian Yacht Club | Water Monitoring Team |
| Topwater Grill | GBF Water Monitoring Team |
| Waterford Harbor Yacht Club & Marina | GBF Water Monitoring Team; Pump Don't Dump |
| Watergate Yachting Center | Pump Don't Dump; GBF Water Monitoring Team |
| The Wharf Marina | Pump Don't Dump |

* denotes new Clean Water Partner

Cycle 22 marina & boating group participation

| Marina | Date |
|---------------------------|-----------|
| Portofino Harbour Marina | 4/10/2018 |
| South Shore Harbor Marina | 6/25/2018 |
| Houston Yacht Club | 6/26/2018 |
| Kemah Boardwalk Marina | 6/28/2018 |
| Galveston Yacht Club | 7/2/2018 |
| Marina Del Sol | 7/10/2018 |
| Lakewood Yacht Club | 7/11/2018 |
| Harborwalk Marina | 7/18/2018 |
| Portofino Harbour Marina | 7/19/2018 |
| Seabrook Shipyard | 7/19/2018 |
| Waterford Marina | 7/19/2018 |

Schedule of one-on-one meetings with Marina Managers and Administrators

| Company Name | Date Contacted | Nature of Conversation |
|---|-----------------------|--|
| US Coast Guard | 12/5/2017 | Conversations at Central Texas Coastal Area Committee meeting about logistics and enforcement of commercial entities for NDZ designation |
| Maritime Sanitation | 6/6/2018 | one-on-one meeting regarding partnerships in outreach and education of Pump Out resources |
| Edson Pumps | 10/16/2018 | one-on-one conversation regarding future partnerships and pumpout infrastructure |
| Suderman & Young Towing Company | 10/25/2018 | Phone conversation about current fleets, waste treatment of fleets, and necessary steps for pumpout services |
| G&H Towing | 10/25/2018 | Phone conversation about maintenance and crewing of commercial tug boats |
| Bay Houston Towing | 10/25/2018 | Phone conversation about current fleets, waste treatment of fleets, and necessary steps for pumpout services |
| Texas Marine Industry Coalition | 12/4/2018 | Mixer and meeting with industry representatives. Relationship building and information gathering. |
| SeaTow | 1/8/2019 | Conversation at Houston Boat Show about their business model, waste disposal, and potential support of an NDZ |
| Gulati Yach Sales | 1/18/2019 | CLMA meeting attendee. Asked for BWEC materials to help disseminate the message. |
| Yachty Gras | 1/28/2019 | Conversation about promoting the BWEC at Yachty Gras event on February 23, 2019 |
| Redish Island Marine | 2/1/2019 | one-on-one meeting regarding partnerships in outreach and education of Pump Out resources |
| Blessing of the Fleet - Kemah Elks Lodge | 3/22/2019 | Phone conversation about promoting BWEC messaging at Blessing of the Fleet event on April 26-28 |
| Gulf Coast Yacht Brokers Association | 4/26/2019 | Initial outreach to gauge support for current programs and interest in developing new ones |
| South Coast Sailing Adventure | 4/26/2019 | Initial outreach to gauge support for current programs and interest in developing new ones |
| Gulf of Mexico Reef Fish Shareholders' Alliance | 4/26/2019 | Initial outreach to gauge support for current programs and interest in developing new ones |

List of commercial groups contacted regarding the NDZ application for Galveston Bay

Appendix 3: Galveston Bay Action Network

| Partners | Official Email | Contact |
|---|--|------------------|
| TCEQ | R12Comp@tceq.texas.gov | Valerie Lara |
| Brazoria County Environmental Health | karenc@brazoria-county.com | Karen Carol |
| Galveston County Health Dept | environmental@gchd.org | Katherine Wilson |
| GLO | landoffice@glo.texas.gov | Greg Pollock |
| Harris County Pollution Control | pollution.control@pcs.hctx.net | Nancy Sibley |
| TPWD: Kills & Spills | laporte.le-communications@tpwd.texas.gov | Steven Mitchell |
| City of Galveston | KHockersmith@GalvestonTX.Gov | Kyle Hockersmith |
| TPWD: Environmental Crime Unit | laporte.le-communications@tpwd.texas.gov | |
| Chambers County Environmental Health & Permitting | rtunze@co.chambers.tx.us ; | Rex Tunze |
| City of Houston | 311@houstontx.gov | Paulette Pastor |
| P3 Partnership | stenmead@aol.com | Stenie Mead |
| City of Houston Health Department | FOGcomplaints@houstontx.gov | Emily Chacon |

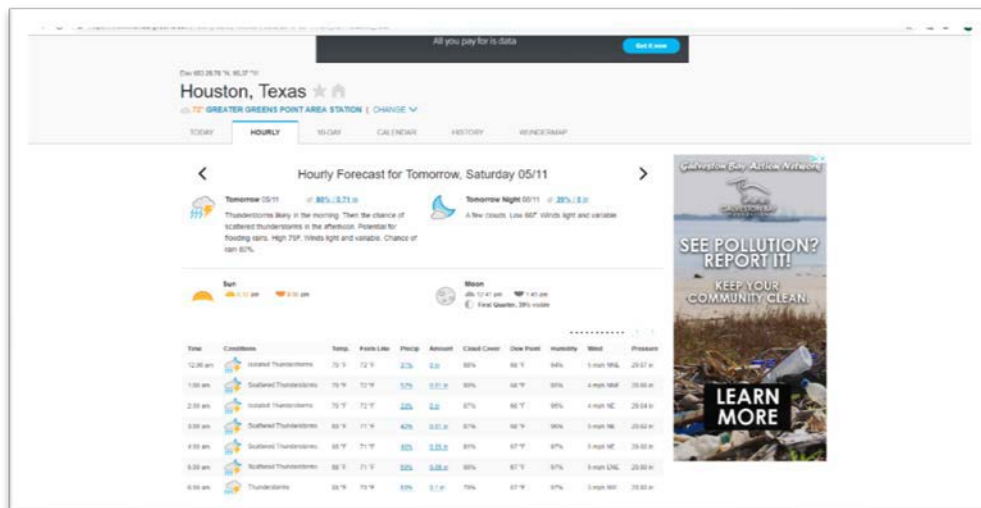
List of all agencies currently receiving GBAN reports

Quotes from GBAN Users

- ☐ "I like the app. It seems to work best when reporting something new." -Roma (repeat GBAN user)
- ☐ It's been super useful, and really effective at handling messes for me for the past 3 years - John Wuttke (repeat GBAN user)
- ☐ "I promptly received a call from the City of Houston Pollution Control the same day as the report (Which legitimately shocked me)." - Robin Elgart
- ☐ "the situation did give us the opportunity to run the GBAN app, see that it works, and find that the County Inspector is responding. So it sounds like a good system." - Tim Logan



GBF staff accepting HGAC’s 2019 WISE Award for Community Outreach and Education for the GBAN app.



Copy of GBAN add on weatherunderground.com. This ad was displayed on a variety of webpages to target audiences when browsing the web, as a part of the Houston Press campaign.

**See pollution?
Report it!**

Download the app today
Keep your Community Clean

[CLICK TO LEARN MORE](#)

Galveston Bay Action Network

 GALVESTON BAY
FOUNDATION

The advertisement features a background image of a beach with a large pile of trash, including plastic bottles and debris, in the foreground. The text is centered and uses a mix of bold and regular fonts. A green button with white text is positioned below the main text.

Image 3: Copy of one of the ads used by Houston Chronicle.

Appendix 4: Volunteer Programs**4.1 Water Monitoring Team**

| Site ID | Site Description | Latitude | Longitude | Monitoring Schedule | Monitor Name |
|---------|--|-----------|------------|-----------------------|-----------------------------------|
| 15105 | Clear Lake at Clear Lake Park Pier | 29.563703 | -95.066049 | Last Monday at 0815 | Diane Humes |
| 30007 | Offatt's Bayou at Camarone's Coastal Tex Mex | 29.278705 | -94.83472 | 3rd Sunday at 1200 | Stan Conley |
| 30008 | Galveston Bay at 1109 6th St. San Leon | 29.478655 | -94.920231 | 1st Tuesday at 1800 | Mark Niles |
| 30009 | Galveston Bay at Bayland Park | 29.713048 | -94.993137 | 1st Thursday at 0900 | Lana Berkowitz |
| 30010 | Clear Lake at Nassau Bay Upper Bay Road | 29.544286 | -95.085907 | 20th at 1700 | Elizabeth Cornwell |
| 30012 | Clear Lake at Marina Del Sol | 29.55207 | -95.052056 | 3rd Thursday 1000 | Larry Watson |
| 30013 | Galveston Bay at Texas City Dike | 29.387027 | -94.874629 | 2nd Thursday at 1600 | Cindy Liening |
| 30014 | Clear Lake at Watergate Yachting Center | 29.545433 | -95.040012 | 3rd Thursday at 1600 | Catherine Navarro |
| 42316 | Burnet Bay at 1770 Hillcrest | 29.779727 | -95.053963 | 4th Saturday | |
| 80418 | Galveston Bay at Seascape Pier | 29.584541 | -94.996785 | 2nd Wednesday at 1100 | Gary Bell |
| 80463 | Galveston Bay at Pine Gully Park | 29.58958 | -94.990566 | Middle of month | Madeleine Barnes |
| 80467 | Clear Lake at Lakewood Yacht Club | 29.554589 | -95.03102 | 3rd Tuesday at 0800 | Claire McNulty |
| 80558 | Eckert's Bay at 13359 Settegast Road | 29.222036 | -94.934084 | | |
| 80589 | Galveston Bay at Starboard Lane | 29.501811 | -94.934304 | 1st Sunday | |
| 80718 | Jones Bay at Isle End Tiki Island | 29.299362 | -94.92793 | 2nd Wednesday | |
| 80719 | Moses Lake at Texas City Prairie Preserve | 29.428824 | -94.95047 | Mondays and Fridays | Scott Buckel |
| 80758 | Clear Lake at Jarboe Bayou Park | 29.542023 | -95.030541 | 2nd Tuesday | Helle Brown |
| 80759 | Clear Lake at Clear Lake Shores | 29.551061 | -95.03268 | 2nd Tuesday | Arline Laughter |
| 80949 | East Bay at Stingaree Restaurant Bar | 29.482082 | -94.605146 | 3rd Wednesday at 1300 | Carl Young |
| 80950 | Galveston Bay at Sylvan Beach Park | 29.652914 | -95.005539 | 2nd weekend at 0900 | Dan and Ann Hoge |
| 80951 | Galveston Bay at Bayshore Park | 29.506474 | -94.95805 | 4th Tuesday | Penny Bessire |
| 80952 | Galveston Bay at 3903 Bayshore Bacliff | 29.515548 | -94.9857 | 30th of each month | Dianne Forthman and Joe Cavallaro |
| 80953 | Clear Lake at Endeavour Marina | 29.559879 | -95.042235 | 1st Wednesday at 1000 | Mike Pettitt |
| 80954 | West Bay at Sportsman Road | 29.255152 | -94.918154 | Every 3rd Thursday | Becky Kowalski |
| 80955 | Clear Lake at Bal Harbor Marina | 29.554958 | -95.072739 | 1st week 0730 | Beverly Morrison |

| | | | | | |
|-------|---|-----------|------------|-----------------------------|-------------------------|
| 80956 | Clear Lake at Blue Dolphin Yachting Center | 29.558397 | -95.028258 | 1st Saturday at 0800 | Claire McNulty |
| 80957 | Jones Bay at 267 Isles End Tiki Island | 29.299985 | -94.927089 | 2nd Wednesday at 0900 | |
| 80958 | Jones Bay at Tiki Tom's RV Park | 29.304188 | -94.906542 | 3rd Wednesday | Janet Mason |
| 80959 | Offatt's Bayou at Pelican Rest Marina | 29.284831 | -94.85615 | Every other Thursday | |
| 80960 | Galveston Bay at Candy Abshier Wildlife Management Area | 29.525213 | -94.765333 | | |
| 80961 | East Bay at Frozen Point 3 | 29.540939 | -94.520594 | | Cindi Barrett |
| 81034 | Offatt's Bayou at Sea Star Base Galveston | 29.285622 | -94.853502 | 2nd Tuesday at 1600 | Joe Bryan |
| 81035 | Christmas Bay at 257S County Boat Ramp | 29.04855 | -95.165262 | 3rd weekend at 1000 | Becky Kowalski |
| 81036 | Trinity Bay at Carroll Road | 29.68569 | -94.86612 | 2nd Friday at 1000 | Bob Lanser |
| 81037 | Clear Lake at South Shore Harbor | 29.54733 | -95.064334 | 3rd Tuesday at 1300 | Kate Magee |
| 81038 | West Bay at Eckert Bayou | 29.221619 | -94.933181 | 13th-16th at 0900 | Suzanne Dehart |
| 81039 | East Bay at Bluewater Bait Camp | 29.45239 | -94.66999 | 1st week at 1000 | Denise Bell |
| 81040 | Clear Lake at Nassau Bay Yacht Club | 29.541451 | -95.09718 | 2nd Tuesday at 0900 | Helen Lane |
| 81041 | Swan Lake at 257J Boat Ramp | 28.979729 | -95.268679 | 3rd Friday at 1000 | Breana Hyche |
| 81042 | Galveston Bay at Pier 19 | 29.310333 | -94.79159 | Third Thursday | Becky Gantert |
| 81043 | West Bay at Terramar Drive | 29.13306 | -95.061093 | 3rd Sunday at 1000 | |
| 81044 | Galveston Bay at Shoreacres Pier | 29.62203 | -95.004664 | 3rd Sunday at 1300 | Kay and Kendall Pickett |
| 81045 | Clear Lake at Kemah Boardwalk Aquarium | 29.548575 | -95.021002 | 2nd Sunday at 9am | Carolyn Hembree |
| 81046 | West Bay at Sweetwater Preserve | 29.272506 | -94.881102 | 3rd Sunday at 0930 | Mary Warwick |
| 81047 | Trinity Bay at Galveston Bay RV Resort | 29.698141 | -94.945875 | 3rd Sunday at 0900 | Paul and Sabra Francis |
| 81048 | West Bay at Oak Bayou | 29.204895 | -94.957483 | 3rd Sunday at 1000 | Skyler Carey |
| 81049 | Clear Lake at Portofino Harbor Marina | 29.547255 | -95.025551 | 1st Friday | Catherine Eisele |
| 81050 | Trinity Bay at Oak Island Lodge | 29.654094 | -94.699173 | 2nd Tuesday | Susan Webb |
| 81051 | Galveston Bay at Topwater Grill | 29.470799 | -94.925598 | 4th Saturday | Mark Niles |
| 81052 | Galveston Bay at Seawolf Park | 29.338162 | -94.778087 | the 31st at 0900 | Taylor Cubbage |
| 81053 | Galveston Bay at TAMUG | 29.31271 | -94.816697 | 2nd week at 0900 | Rodrigo Carrizales |
| 81158 | West Bay at Pirate's Cove | 29.217963 | -94.949425 | 1st Sunday at 0900 | Sandra Metoyer |
| 81159 | Jones Bay at Bayou Vista | 29.323449 | -94.946625 | Every Other Tuesday at 0830 | Chris Roper |

| | | | | | |
|--------|--|------------|------------|---------------------------|---------------------------------------|
| 81160 | Galveston Bay at Texas Corinthian Yacht Club | 29.529115 | -95.003242 | 4th Tuesday | Kris Johnson |
| 81161 | Galveston Bay at Sunset Cove | 29.151222 | -95.030368 | 30th of each month | |
| 81162 | Galveston Bay at Houston Yacht Club | 29.619129 | -94.999132 | 3rd Tuesday at 1730 | Emily Innes |
| 81163 | East Bay at 1317 Siever's Cove | 29.433649 | -94.70683 | 15th and 30th | |
| 81164 | Clear Lake at Watergate Yachting Center Pier 4 | 29.545271 | -95.036368 | 3rd Monday at 0900 | Tyler Dudley |
| 81173 | Clear Lake at Waterford Harbor Marina | 29.54755 | -95.043812 | 1st Wednesday at 0900 | Mary Christian |
| 81174 | Clear Lake at 18 Waterford Oak Lane | 29.5459524 | -95.043871 | 4th Monday at 0830 | James Dismukes |
| 81181 | Christmas Bay at Drum Bay | 29.012245 | -95.218408 | 3rd Sunday at 1300 | |
| 81216 | Clear Lake at Encore on the Bay | 29.564799 | -95.059552 | | |
| 81217 | Clear Lake at Taylor Lake Entrance and Nasa Road | 29.565483 | -95.053867 | 1st Sunday at 0900 | Darling Martinez |
| 81218 | Galveston Bay at Todville Rd | 29.569982 | -95.009848 | the 28th at 1400 | Suzanne Milby |
| 81219 | West Bay at Sweetwater Lake | 29.254835 | -94.879686 | 2nd Saturday at 1200 | |
| 81280 | East Bay at Frenchtown Road | 29.371335 | -94.777401 | 2nd Sunday of month, 1130 | Rachel Martinez |
| 81281 | Galveston Bay at GBF | 29.532912 | -95.009303 | 15th at 1000 | |
| 81282 | West Bay at Jamaica Beach | 29.189151 | -94.980308 | 2nd Tuesday at 1400 | Wayne O'Quin |
| 81283 | Clear Lake at Sea Cove Ct | 29.537825 | -95.084316 | 1st Wednesday at 0900 | Jane Webb |
| 81284 | Galveston Bay at Morgan's Point | 29.678835 | -94.982656 | 2nd week at 1130 | Lori Glasgow |
| 81301 | Trinity Bay at Fort Anahuac Park | 29.75533 | -94.69028 | 1st Sunday | Laurie Gonzales and Karen Morris |
| 81302 | Lake Anahuac at Turtle Bayou | 29.828532 | -94.669831 | 4th Tuesday | Shelli Ellerbe |
| 81303 | Trinity Bay at McCollum Park | 29.74486 | -94.82787 | 3rd Friday at 1300 | Valerie and Mickey Redus |
| 81304 | Galveston Bay at Smiths Point Boat Ramp | 29.54666 | -94.78755 | | Joan Ward |
| 81305 | East Bay at East Bay Boat Ramp | 29.57498 | -94.55566 | 2nd Monday | Cindi Barrett |
| 81306 | East Bay at Frozen Point 1 | 29.55925 | -94.53404 | | |
| 81307 | East Bay at Frozen Point 2 | 29.55331 | -94.52593 | | |
| 81318 | Highland Bayou at Louis' Bait Camp | 29.33232 | -94.945561 | 2nd Saturday at 1300 | Rachel Gamblin |
| 81444 | Burnet Bay at Baytown Nature Center | 29.75956 | -95.053053 | 3rd Wednesday | Christina Butcher |
| 81517 | West Bay at Bay Harbor | 29.1315278 | -95.07128 | 3rd Sunday 0900 | Dana Kurtin, David and Margaret Labbe |
| 810421 | Galveston Bay at Pier 21 | 29.31031 | -94.793224 | Third Thursday | |

GBF Water Quality Monitoring Team Sites Monitored – Active as of June 2019

| Monitor ID | Monitor Name |
|------------|-------------------|
| 10350 | Ann Hoge |
| 11416 | Arline Laughter |
| 10039 | Becky Gantert |
| 9947 | Becky Kowalski |
| 10348 | Beverly Morrison |
| 8019 | Bob Lanser |
| 9172 | Breana Hyché |
| 9178 | Carl Young |
| 8816 | Casandra Carey |
| 10349 | Catherine Eisele |
| 8817 | Catherine Navarro |
| 8501 | Chris Roper |
| 10073 | Christina Butcher |
| 9444 | Cindi Barrett |
| 12173 | Cindy Liening |
| 9176 | Claire McNulty |
| 0 | Dan Hoge |
| 10346 | Dana Kurtin |
| 9951 | Darling Martinez |
| 11366 | Dave Bulliner |
| 10345 | David Labbe |
| 9952 | Denise Bell |
| 8186 | Diane Humes |

| | |
|-------|--------------------|
| 12221 | Dianne Forthman |
| 9950 | Elizabeth Cornwell |
| 9446 | Emily Innes |
| 9294 | Gary Bell |
| 8504 | Glenn Taylor |
| 8023 | Helen Lane |
| 11417 | Helle Brown |
| 8506 | James Dismukes |
| 9177 | Jane Webb |
| 1056 | Janet Mason |
| 9441 | Jim Harlow |
| 9445 | Joan Ward |
| 9949 | Joe Bryan |
| 12228 | Joe Cavallaro |
| 9949 | Karen Morris |
| 9949 | Kate Magee |
| 9949 | Kay Pickett |
| 9949 | Kendall Pickett |
| 9949 | Kris Johnson |
| 9949 | Lana Berkowitz |
| 10352 | Larry Watson |
| 9434 | Laurie Gonzales |
| 10351 | Lori Burris |
| 12052 | Madeleine Barnes |
| 10344 | Margaret Labbe |

| | |
|-------|--------------------|
| 12051 | Mark Niles |
| 9524 | Mary Christian |
| 8614 | Mary Warwick |
| 9946 | Michael Petitt |
| 9442 | Mickey Redus |
| 10353 | Paul Francis |
| 9943 | Penny Bessire |
| 9634 | Rachel Gamblin |
| 10355 | Rodrigo Carrizales |
| 10354 | Sabra Francis |
| 4117 | Sandra Metoyer |
| 11139 | Scott Buckel |
| 9440 | Shelli Ellerbe |
| 8034 | Skyler Carey |
| 8825 | Stan Conley |
| 9437 | Susan Webb |
| 10356 | Suzanne Dehart |
| 8826 | Suzanne Milby |
| 9169 | Taylor Cubbage |
| 10357 | Ted Driscoll |
| 10347 | Tim Kurtin |
| 8513 | Tyler Dudley |
| 9443 | Valerie Redus |
| 9175 | Wayne O'Quin |

GBF Water Quality Monitoring Team Members – Active as of June 2019

| Date | Presenters | Event/Organization Topic | Location | Estimated Audience |
|------------|-------------------------------|---|-----------------------------|--------------------|
| 10/30/2017 | Sarah Gossett | Texas Stream Team Phase I & II training | GBF Office | 2 |
| 11/7/2017 | Sarah Gossett | Texas Stream Team Phase III Training | Sea Cove Ct. | 2 |
| 11/10/2017 | Sarah Gossett | Bacteria Training | GBF Office | 2 |
| 12/15/2017 | Lindsey Nolan & Sarah Gossett | Bacteria Training | GBF Office | 7 |
| 1/26/2018 | Lindsey Nolan & Sarah Gossett | Quality Control Training | Texas Corinthian Yacht Club | 13 |

| | | | | |
|-----------|-------------------------------|---|-----------------------------|----|
| 1/27/2018 | Lindsey Nolan & Sarah Gossett | Quality Control Training | Texas Corinthian Yacht Club | 11 |
| 2/23/2018 | Lindsey Nolan & Sarah Gossett | Texas Stream Team Phase I & II training | Marina del Sol | 12 |
| 3/7/2018 | Lindsey Nolan | Texas Stream Team Phase III Training | Bluewater Bait Camp | 1 |
| 3/8/2018 | Lindsey Nolan | Texas Stream Team Phase III Training | Texas Corinthian Yacht Club | 1 |
| 3/8/2018 | Lindsey Nolan | Texas Stream Team Phase III Training | Pier 19, Galveston | 1 |
| 3/9/2018 | Lindsey Nolan | Texas Stream Team Phase III Training | Nassau Upper Bay Road | 1 |
| 3/10/2018 | Lindsey Nolan | Texas Stream Team Phase III Training | Frenchtown Rd, Bolivar | 1 |
| 3/11/2018 | Lindsey Nolan | Texas Stream Team Phase III Training | Sylvan Beach | 1 |
| 3/13/2018 | Lindsey Nolan | Texas Stream Team Phase III Training | Eckert Bayou | 1 |
| 3/16/2018 | Lindsey Nolan | Texas Stream Team Phase III Training | 257S County Boat Ramp | 1 |
| 3/20/2018 | Lindsey Nolan | Texas Stream Team Phase III Training | Endeavour Marina | 1 |
| 3/21/2018 | Lindsey Nolan | Texas Stream Team Phase III Training | Bayshore Park | 1 |
| 3/23/2018 | Lindsey Nolan | Texas Stream Team Phase III Training | Taylor Lake Entrance | 1 |
| 4/19/2018 | Lindsey Nolan | Bacteria Training | Pier 19, Galveston | 1 |
| 6/5/2018 | Lindsey Nolan | Texas Stream Team Phase I & II Training | GBF Office | 6 |
| 6/7/2018 | Lindsey Nolan | Texas Stream Team Phase III Training | Kemah Property | 2 |
| 8/6/2018 | Lindsey Nolan | Quality Control Training | Lakewood Yacht Club | 5 |
| 8/13/2018 | Lindsey Nolan | Quality Control Training | Lakewood Yacht Club | 6 |
| 8/26/2018 | Lindsey Nolan | Quality Control Training | Clear Lake Park | 4 |
| 9/8/2018 | Lindsey Nolan & Sarah Gossett | Texas Stream Team Phase III Training | Marina Del Sol | 12 |
| 9/16/2018 | Lindsey Nolan | Texas Stream Team Phase III Training | Sweetwater Lake | 1 |
| 9/20/2018 | Lindsey Nolan | Texas Stream Team Phase III Training | Marina Del Sol | 1 |

| | | | | |
|------------|---------------|--------------------------------------|-----------------------|----|
| 9/21/2018 | Lindsey Nolan | Texas Stream Team Phase III Training | Bal Harbor Marina | 1 |
| 10/5/2018 | Lindsey Nolan | Texas Stream Team Phase III Training | Portofino Harbor | 1 |
| 10/5/2018 | Lindsey Nolan | Texas Stream Team Phase III Training | West Bay Harbor | 2 |
| 10/11/2018 | Lindsey Nolan | Texas Stream Team Phase III Training | Morgan's Point | 1 |
| 10/12/2018 | Lindsey Nolan | Texas Stream Team Phase III Training | TAMUG | 1 |
| 10/12/2018 | Lindsey Nolan | Texas Stream Team Phase III Training | Sylvan Beach | 2 |
| 11/16/2018 | Lindsey Nolan | Texas Stream Team Phase III Training | Galveston Bay RV Park | 2 |
| 5/1/2019 | Nick Ellis | Quality Control Training | Marina Del Sol | 11 |
| 5/3/2019 | Nick Ellis | Quality Control Training | Marina Del Sol | 5 |

WMT Training Schedule

4.2 Dockwalkers

| Date | Marina |
|-----------|------------------------------------|
| 3/21/2018 | Clear Lake Racing Kickoff Party |
| 6/25/2018 | South Shore Harbour Marina |
| 6/26/2018 | Houston Yacht Club |
| 6/28/2018 | Kemah Boardwalk Marina |
| 6/30/2018 | Pelican Rest Marina |
| 7/2/2018 | Galveston Yacht Basin |
| 7/3/2018 | Portofino Harbor |
| 7/5/2018 | South Shore Harbour Marina |
| 7/10/2018 | Seabrook Marina |
| 7/10/2018 | Marina Del Sol |
| 7/11/2018 | Lakewood Yacht Club |
| 7/14/2018 | Galveston Bay Cruising Association |
| 7/18/2018 | Harborwalk Yacht Club |
| 7/19/2018 | Seabrook Marina |
| 7/19/2018 | Portofino Harbor |
| 7/19/2018 | Waterford Yacht Club |
| 7/25/2018 | Topwater Grill |
| 7/26/2018 | Bayland Marina |

Dockwalker Survey Schedule

4.3 Data Management and Analysis

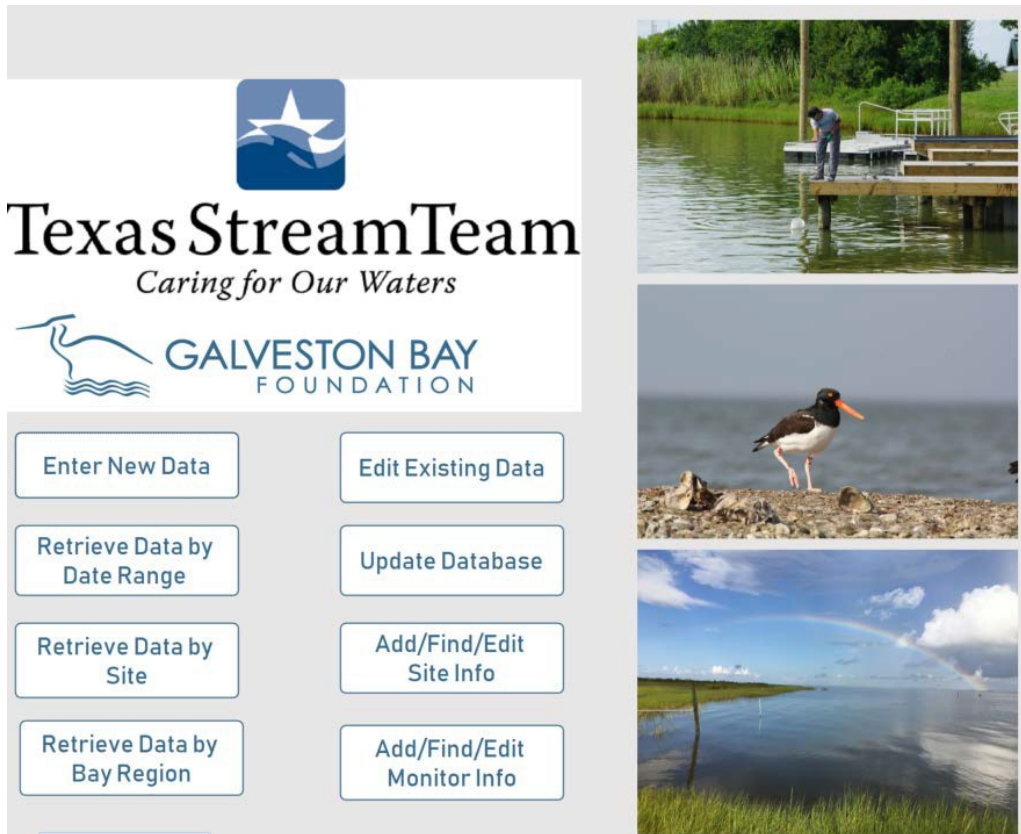


Image of new Microsoft Access front-end interface. The new access makes data entry, retrieval, and management much easier, cleaner, and more efficient.

| Site_Description | Air Temp (in C) | Water Temp (in C) | Avg_DO (mg/L) | pH | Transparency (meters) | Total Depth (meters) | Rain_Accum (inches) | Enterococcus (MPN) | Salinity (ppt) |
|-----------------------------|-----------------|-------------------|---------------|-------|-----------------------|----------------------|---------------------|--------------------|----------------|
| AVERAGES: | 22.27 | 21.77 | 6.51 | | 0.45 | 1.40 | 0.61 | 14.08 | 13.84 |
| MINIMA: | 2.00 | 2.00 | 0.50 | 6.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 |
| MAXIMA: | 38.00 | 34.00 | 15.40 | 10.00 | 2.00 | 9.50 | 8.00 | 2005.00 | 38.80 |
| RANGES: | 36.00 | 32.00 | 14.91 | 4.00 | 12.00 | 9.50 | 8.00 | 2004.00 | 38.80 |
| STANDARD DEVIATIONS: | 7.16 | 6.91 | 2.18 | | 0.28 | 1.02 | 1.12 | 410.38 | 8.60 |
| STANDARD ERRORS: | 0.28 | 0.27 | 0.09 | | 0.01 | 0.04 | 1.12 | 20.75 | 0.34 |

Data summary of 2018 WMT water quality data

Study on Tidal Influences on WQ in Galveston Bay

Galveston Bay Foundation has been experiencing elevated levels of Enterococci (ENT) at many of our Water Quality Monitoring sites. ENT are bacteria that live within the intestines of warm-blooded animals and indicate the presence of fecal material in water.

Literature Review

Previous studies have indicated elevated concentrations of bacteria in water are likely to occur during extreme tides, particularly when it is an extreme ebb tide (source 1).

Study

Galveston Bay Foundation will use its historical and present data to determine if there is any correlation between ENT concentrations and extreme tides. Using NOAA's tides and currents website we selected the following four stations, 8771972 San Luis Pass, 8771450 Galveston Pier 21, 87710136 Eagle Point, and 8770613 Morgan's Point. These stations were selected due to their abundance of historical data and location to Galveston Bay Foundation's bacteria testing sites. Due to the large volume of data, and somewhat limited time constraints for this project, GBF staff will first focus on average monthly water levels potential influences on ENT concentrations. Using this average monthly water level data, we hope it suggests which months were impacted by consistently extreme high tide levels or consistently extreme low tide levels. These monthly water levels will be compared to ENT concentrations from all sites sampled within that month.

Results

After compiling the data GBF staff first analyzed correlations between the average monthly water levels and the ENT concentrations from each site individually. The results are shown in figures 1-16. The strongest correlation between the two variables was found at Todville road with an R^2 value of 0.3211. sixteen of the thirty correlations showed enterococci increasing as average monthly water levels went down, however, most of these were not a strong correlation. GBF then analyzed all sites at once and showed a correlation of enterococci increasing as average monthly water levels decreased, but this was extremely weak with an R^2 value of 0.0029.

Conclusions

The results to this study did not show any strong correlations between average monthly water levels and enterococci concentrations. At this time GBF staff would need further studies in order to make any strong conclusions about tidal influences on ENT levels.

Potential Issues with Study

Tide and water levels are consistently changing, and although there may have been an extremely low tide level for one day, these monthly averages would not necessarily show that an event like

this happened. Water levels could be higher towards the beginning of the month and lower at the end of the month, but since they have been averaged water levels during a particular month could seem normal. Additionally, we receive samples from our sites throughout the month during different days and times. To avoid these issues data would have to be analyzed for each sampling event, taking in to account exact dates and times a sample was grabbed and comparing this to daily tide level data. A multivariate statistic approach will be necessary in order to determine and rule out other factors that influence ENT levels.

Figures

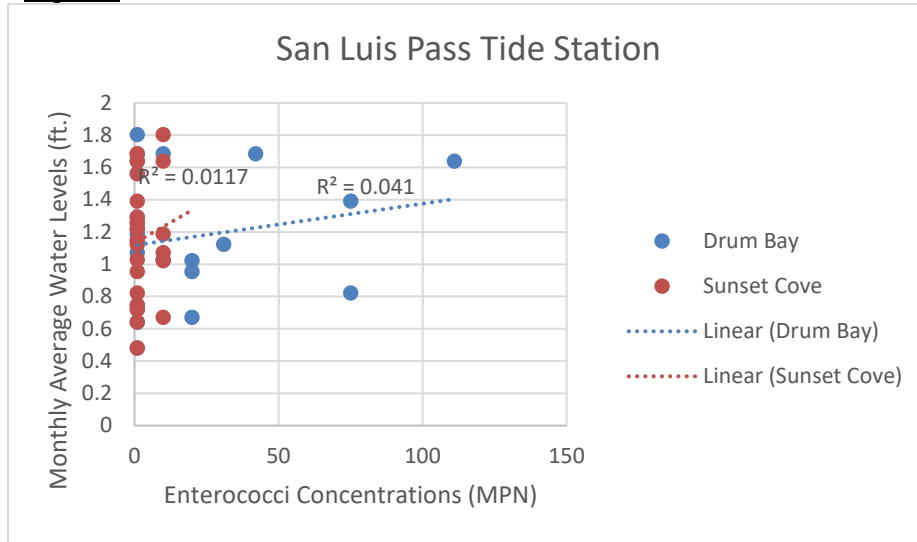


Figure 1: Site locations at Drum Bay and Sunset Cove compared to Monthly Average Water Levels from San Luis Pass Station.

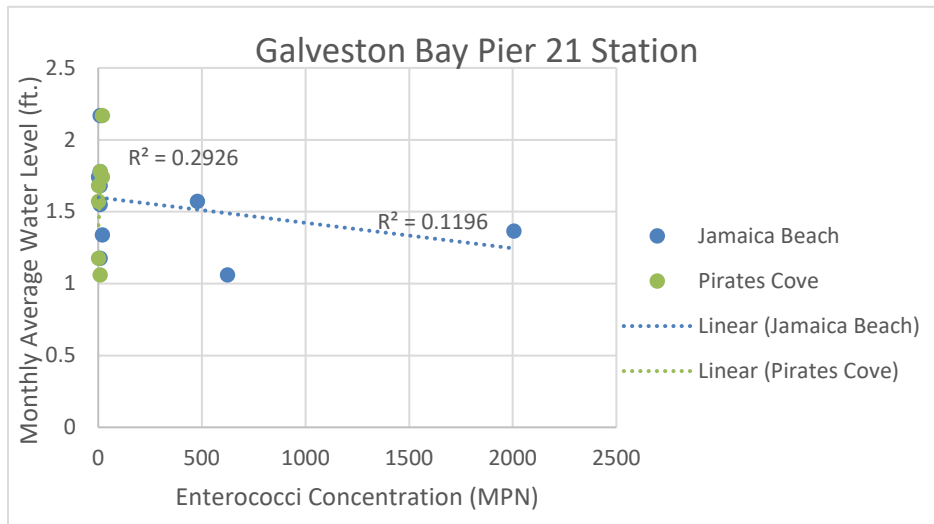


Figure 2: Site locations at Jamaica Beach and Pirates Cove compared to Monthly Average Water Levels from Galveston Bay Pier 21 Station.

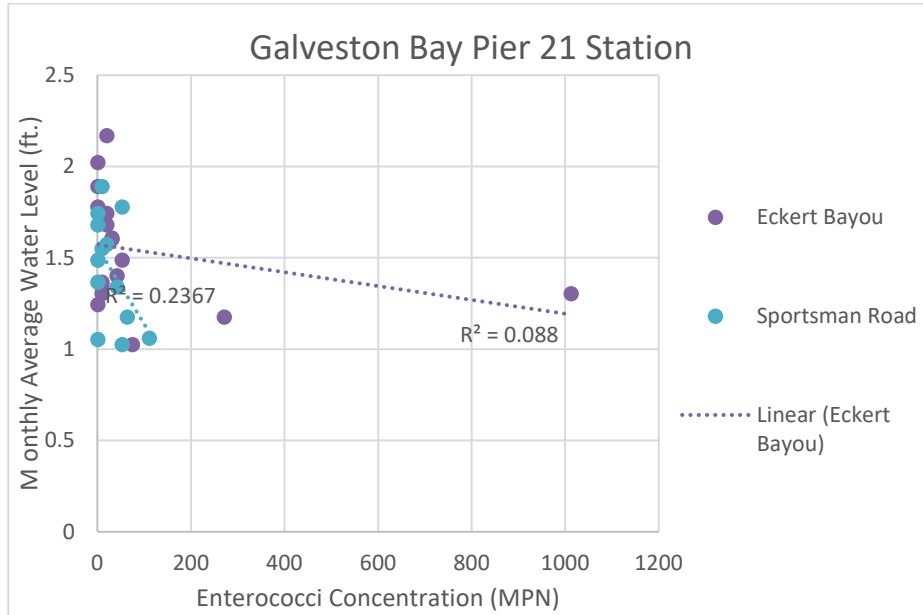


Figure 3: Site locations at Eckert Bayou and Sportsman Road compared to Monthly Average Water Levels from Galveston Bay Pier 21 Station.

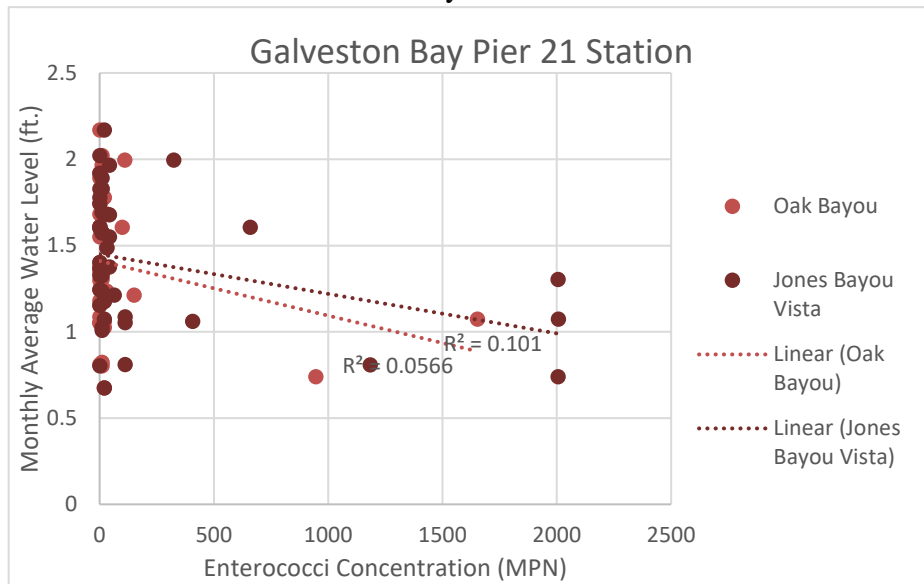


Figure 4: Site locations at Oak Bayou and Jones Bayou Vista compared to Monthly Average Water Levels from Galveston Bay Pier 21 Station.

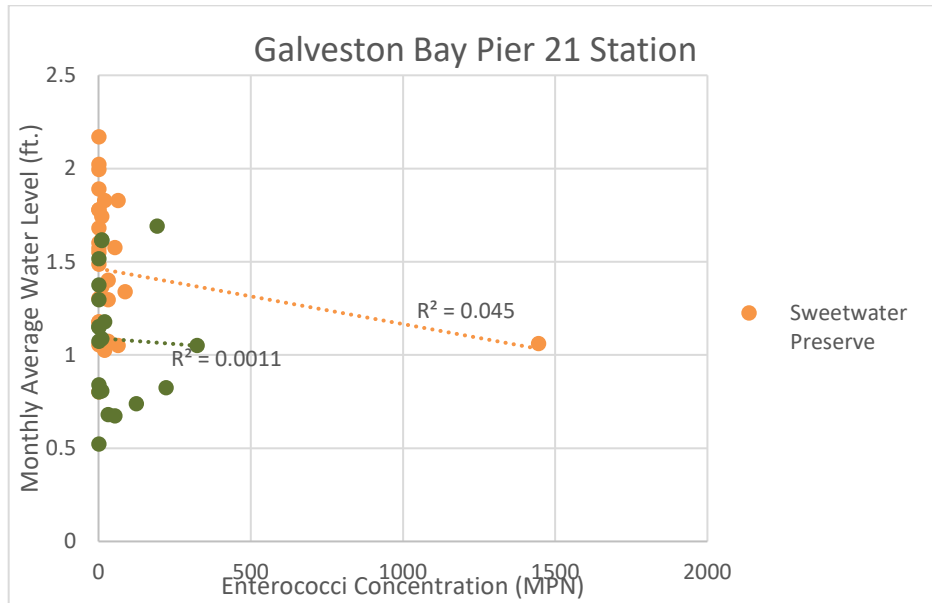


Figure 5: Site locations at Sweetwater Preserve and Tiki Tom’s RV compared to Monthly Average Water Levels from Galveston Bay Pier 21 Station.

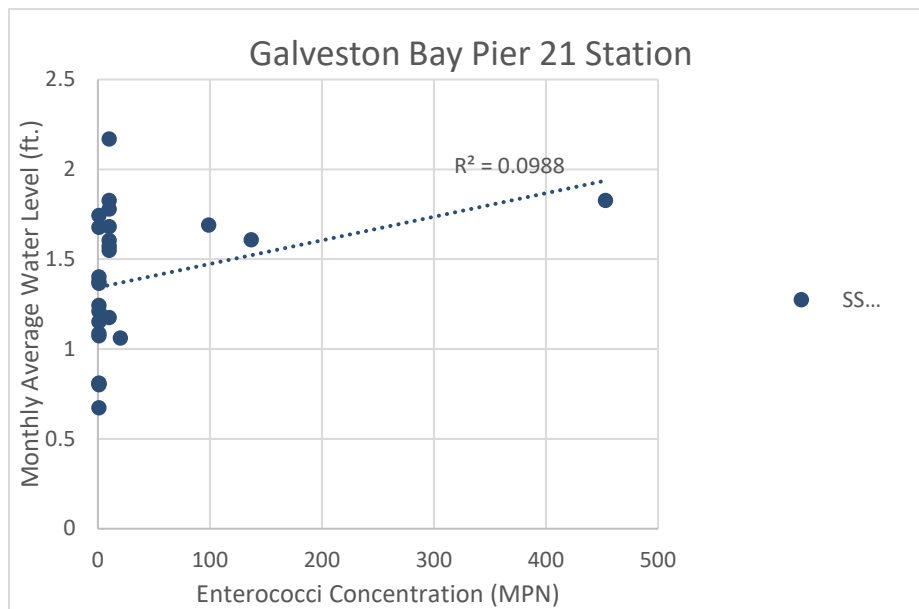


Figure 6: Site locations at SSBG compared to Monthly Average Water Levels from Galveston Bay Pier 21 Station.

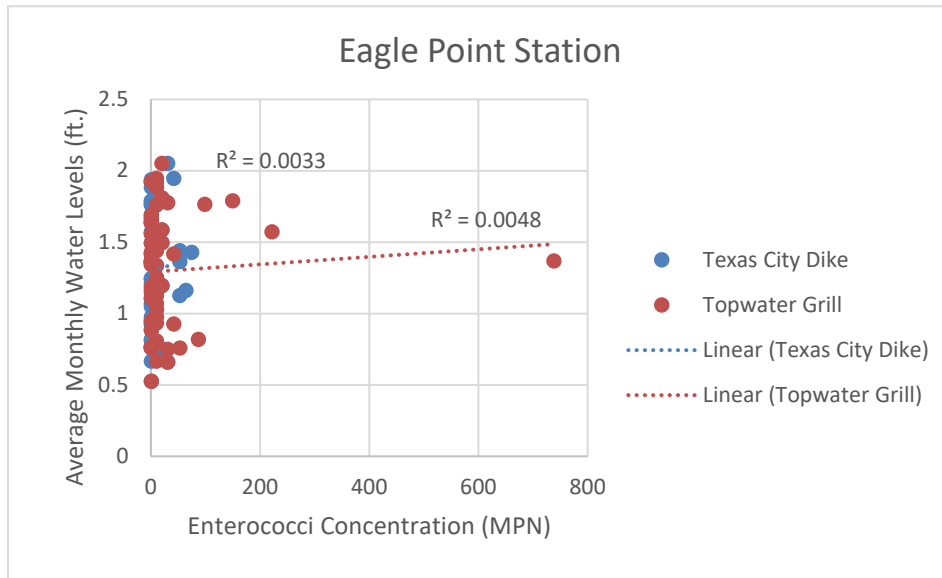


Figure 7: Site locations at Texas City Dike and Topwater Grill compared to Monthly Average Water Levels from Eagle Point Station.

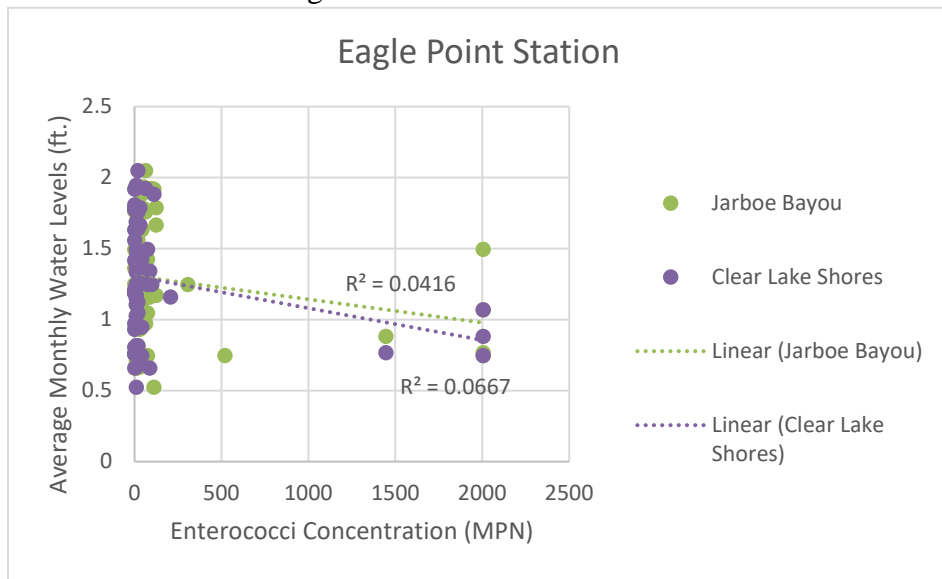


Figure 8: Site locations at Texas City Dike and Topwater Grill compared to Monthly Average Water Levels from Eagle Point Station.

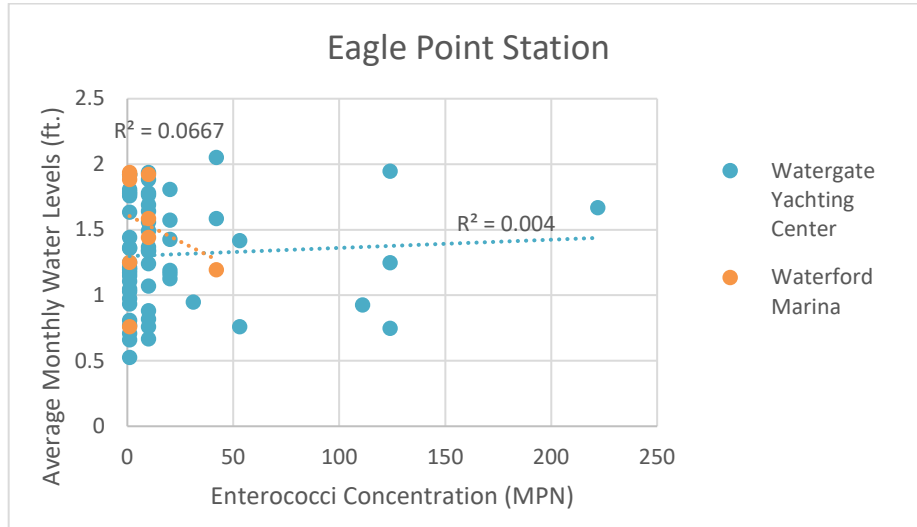


Figure 9: Site locations at Watergate Yachting Center and Waterford Marina compared to Monthly Average Water Levels from Eagle Point Station.

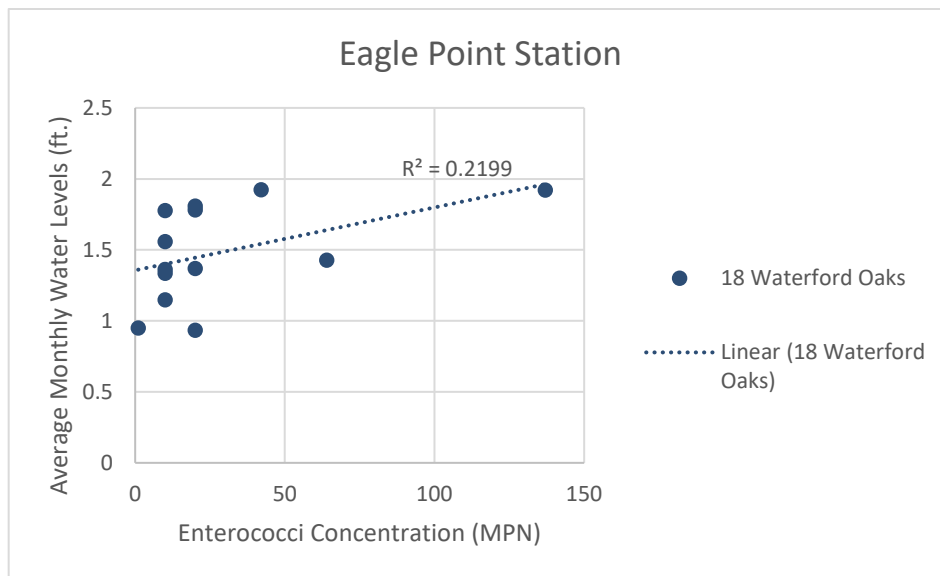


Figure 10: Site locations at 18 Waterford Oaks compared to Monthly Average Water Levels from Eagle Point Station.

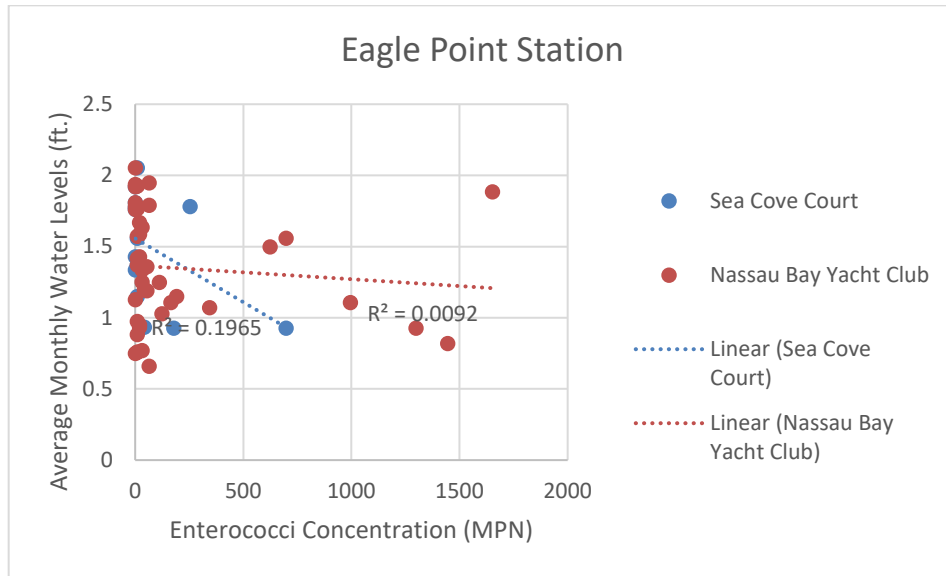


Figure 11: Site locations at Sea Cove Court and Nassau Bay Yacht Club compared to Monthly Average Water Levels from Eagle Point Station.

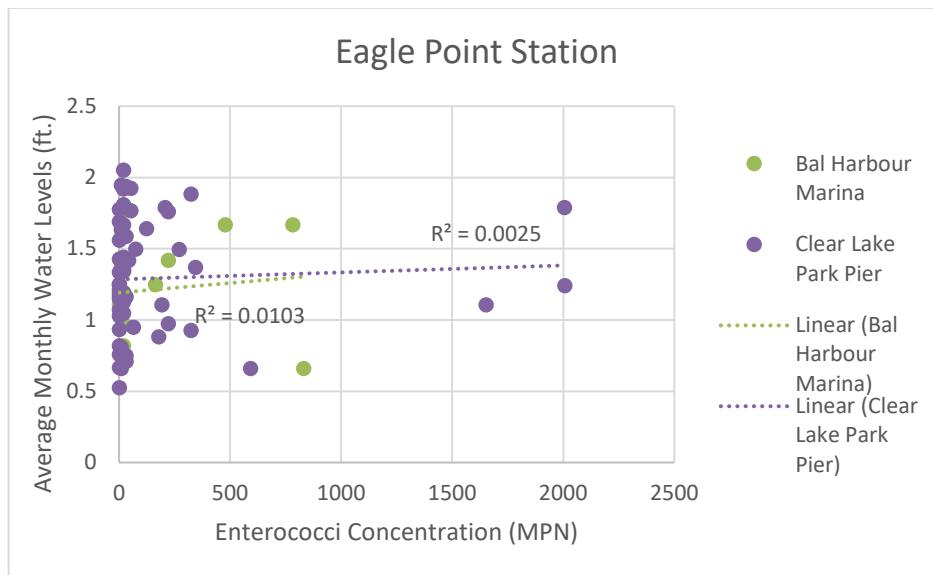


Figure 12: Site locations at Bal Harbour Marina and Clear Lake Park Pier compared to Monthly Average Water Levels from Eagle Point Station.

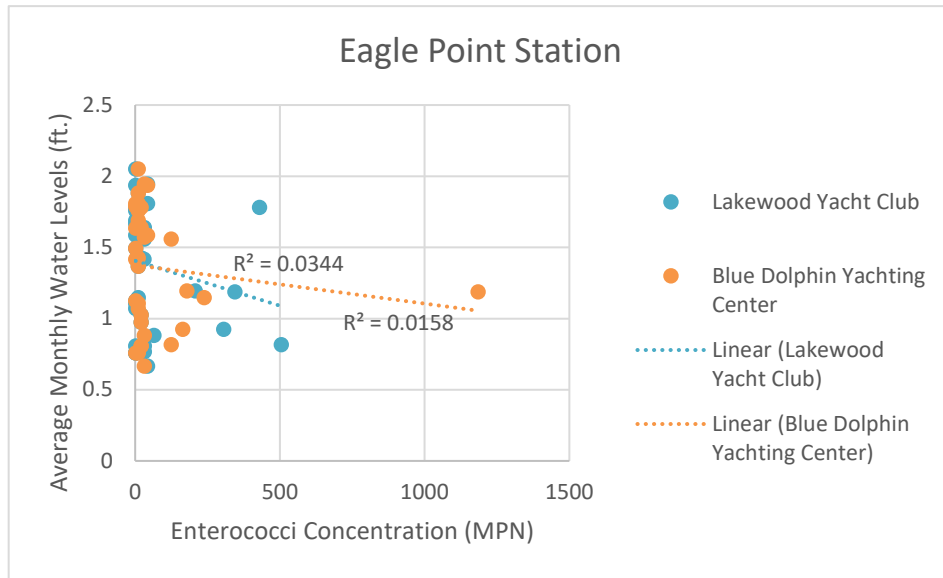


Figure 13: Site locations at Lakewood Yacht Club and Blue Dolphin Yachting Center compared to Monthly Average Water Levels from Eagle Point Station.

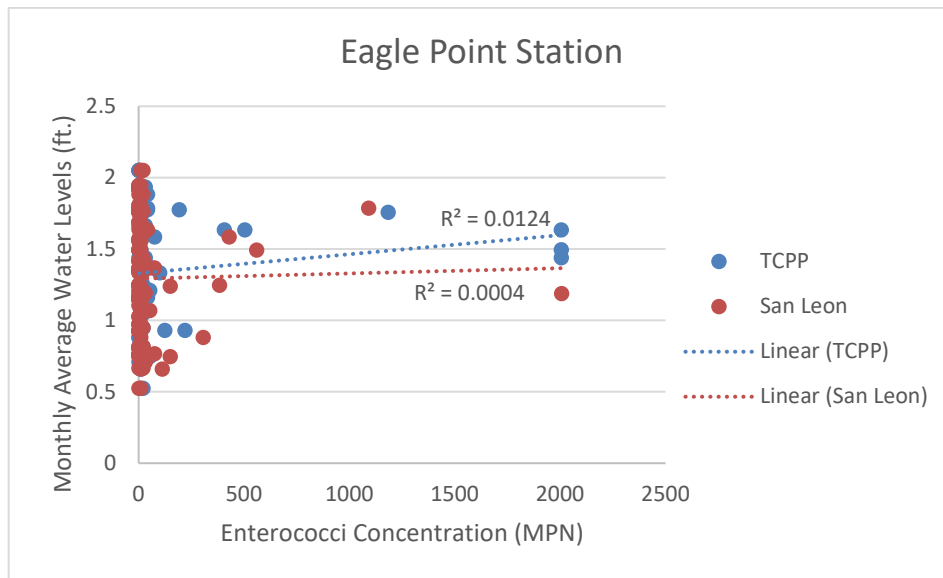


Figure 14: Site locations at TCPP and San Leon compared to Monthly Average Water Levels from Eagle Point Station.

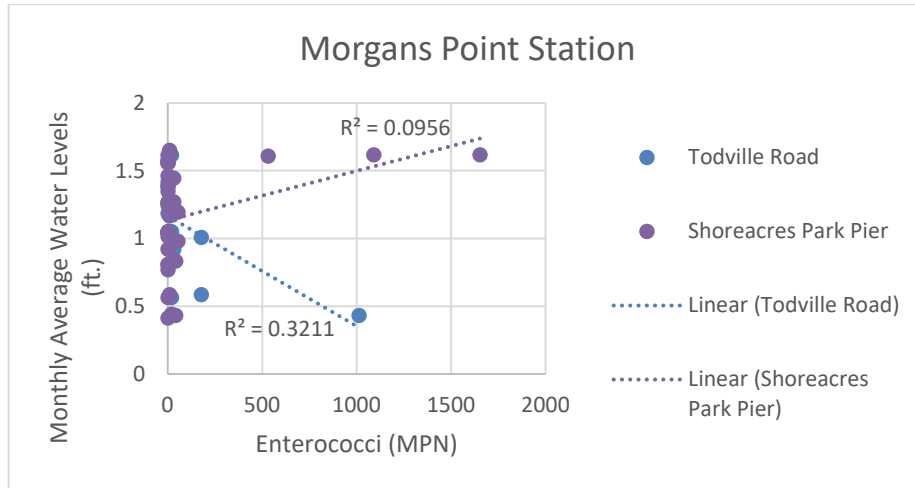


Figure 15: Site locations at Todville Road and Shoreacres Park Pier compared to Monthly Average Water Levels from Morgan’s Point Station.

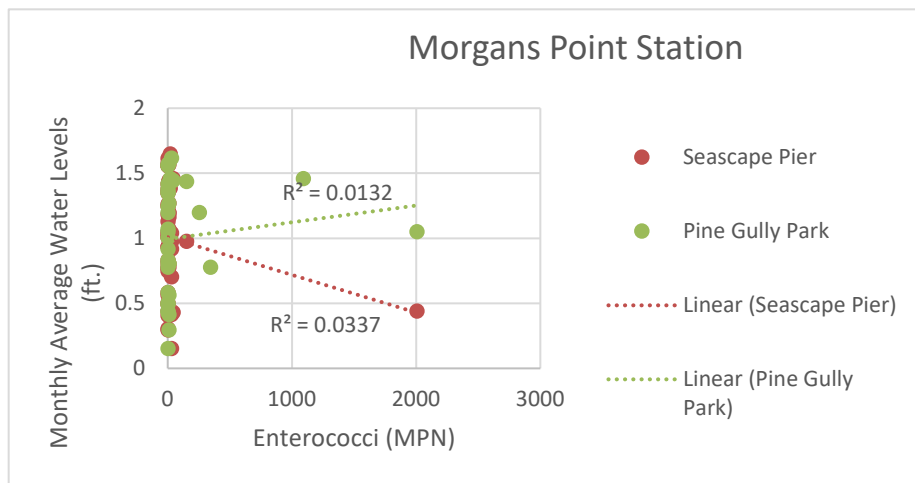


Figure 16: Site locations at Seascape Pier and Pine Gully Park compared to Monthly Average Water Levels from Morgan’s Point Station.

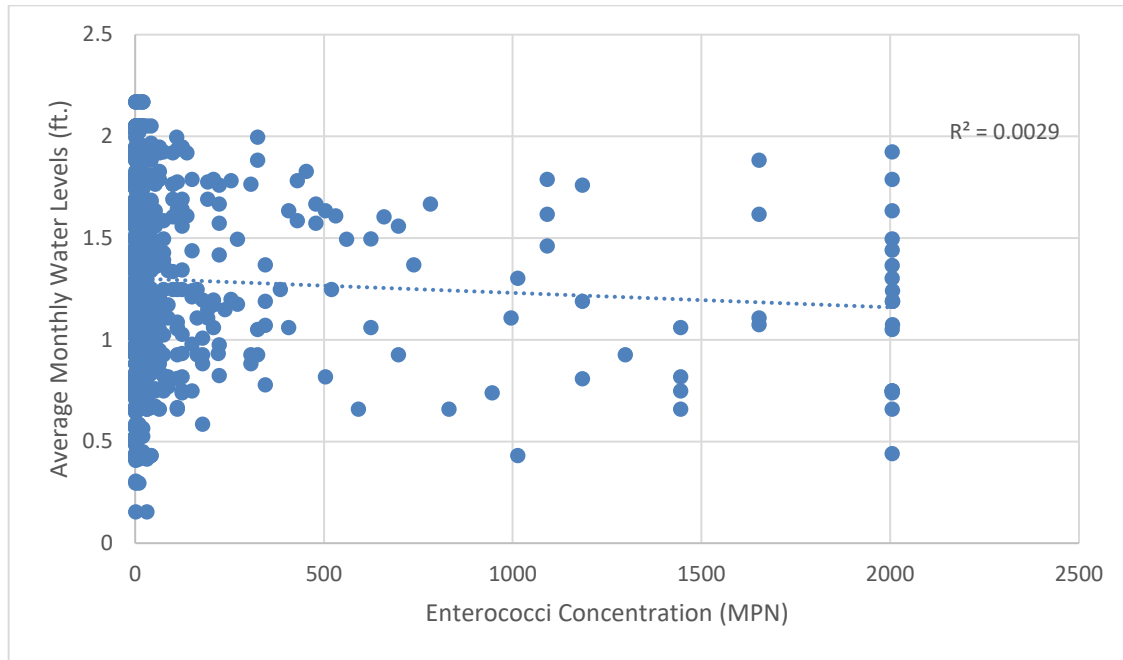


Figure 17: All site locations compared to Monthly Average Water Levels and perspective stations.

Sources

- 1) http://www.phschool.com/science/science_news/articles/bacteria_ride_tide.html
- 2) <http://pubs.acs.org/doi/pdf/10.1021/es071807v>
- 3) http://ftp.sccwrp.org/pub/download/DOCUMENTS/AnnualReports/2005_06AnnualReport/AR0506_263-276.pdf
- 4) <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4304835/>
- 5) <https://www.epa.gov/sites/production/files/2015-10/documents/rwqc2012.pdf>

7. How important is pumping out treated or untreated waste to the health of the environment?

1 - Not important 2 3 4 5 6 - Very important

8. Do you have a boat larger than 25 feet with a head on board?

Yes

No

If YES to #8, complete questions #9-18. If NO to #8, skip to #19.

9. Are you a liveaboard boater?

Yes

No

10. What type of treatment system do you have?

No head on board Holding tank only

Type 1 or Type 2 MSD ONLY Porta potty or composting only

Type 1 or Type 2 MSD AND holding tank I don't know

11. How often do you use your boat's head/toilet?

1 - Never 2 3 4 5 6 - Every time I'm on the water

12. On average, how often do you pump out your waste?

1 - Never 2 3 4 5 6 - Every time I'm on the water

2018 Boater Survey

13. How frequently does your holding tank need to be emptied?

1 - Never 2 3 4 5 6 - Every time I'm on the water

14. How many different pumpout facilities in Clear Lake/Galveston Bay do you know of?

0 7-9
 1-3 10+
 4-6

15. How many different local pumpout facilities have you used?

0 4-6
 1 7+
 2-3

16. Do you find local pump-out facilities easy to access and operate?

1- Strongly Disagree 2 3 4 5 6 - Strongly Agree

17. Are there are enough pump-out facilities in the area to meet all boater needs?

1 - Strongly Disagree 2 3 4 5 6 - Strongly Agree

18. Do you believe the cost of dockside pump-out facilities are appropriate for the services offered?

1 - Strongly Disagree 2 3 4 5 6 - Strongly Agree

Continue from HERE if you answered NO to #8.

Please rate how strongly you agree or disagree with the following statements:

19. Do you believe most local boaters pump out their treated or untreated waste instead of dumping it overboard?

1 - Strongly Disagree 2 3 4 5 6 - Strongly Agree

20. Do you believe pumping out treated or untreated waste is important to keeping our water safe for recreation?

1 - Strongly Disagree 2 3 4 5 6 - Strongly Agree

21. Is the health of the environment is important to you?

1 - Not Important at all 2 3 4 5 6 - Very Important

22. Have you ever seen someone dump sewage waste directly into Galveston Bay or Clear Lake?

Yes, only treated waste

Yes, only untreated waste

Yes, treated and untreated waste

No, I've never seen someone dump waste in Galveston Bay

23. If yes, how often?

1 - Rarely 2 3 4 5 6 - Every time I'm on the water

24. Do you have any comments about boater waste?

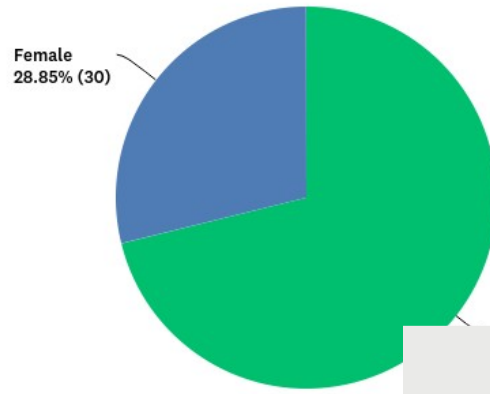
Thank you for taking our survey!

25. If you don't have a head on board, how do you relieve yourself while onboard?

Summary of Survey Data

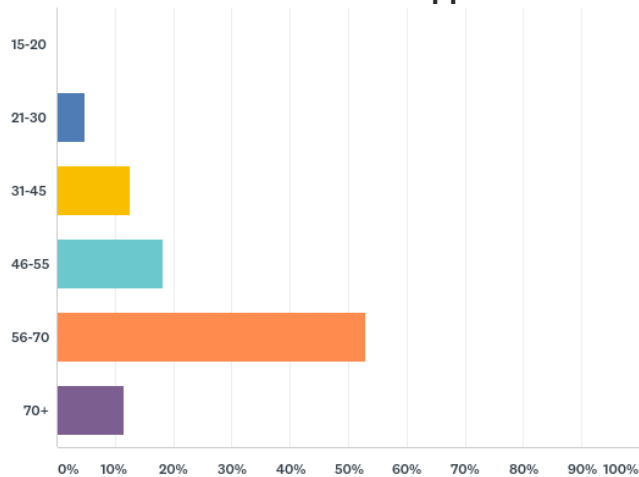
What is your gender?

| Answer Choices | Responses | |
|----------------|-----------------|------------|
| Male | 71.15% | 74 |
| Female | 28.85% | 30 |
| | Answered | 104 |
| | Skipped | 0 |



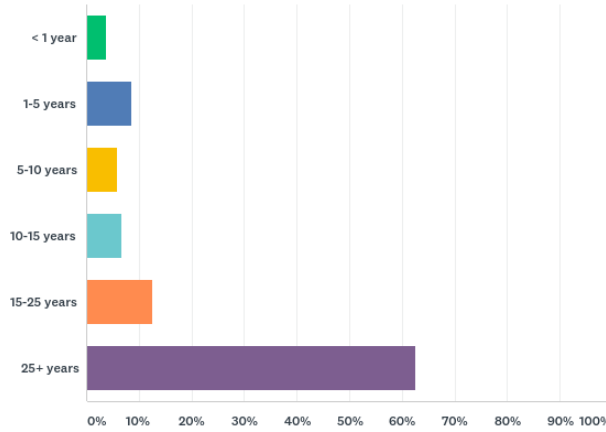
What is your age?

| Answer Choices | Responses | |
|----------------|-----------------|------------|
| 15-20 | 0.00% | 0 |
| 21-30 | 4.81% | 5 |
| 31-45 | 12.50% | 13 |
| 46-55 | 18.27% | 19 |
| 56-70 | 52.88% | 55 |
| 70+ | 11.54% | 12 |
| | Answered | 104 |
| | Skipped | 0 |



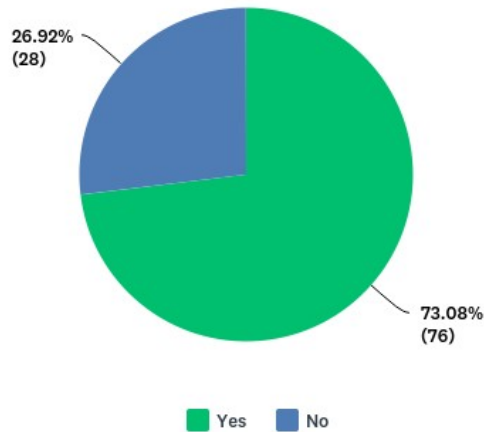
How long have you been boating?

| Answer Choices | Responses | |
|----------------|-----------------|------------|
| < 1 year | 3.85% | 4 |
| 1-5 years | 8.65% | 9 |
| 5-10 years | 5.77% | 6 |
| 10-15 years | 6.73% | 7 |
| 15-25 years | 12.50% | 13 |
| 25+ years | 62.50% | 65 |
| | Answered | 104 |
| | Skipped | 0 |



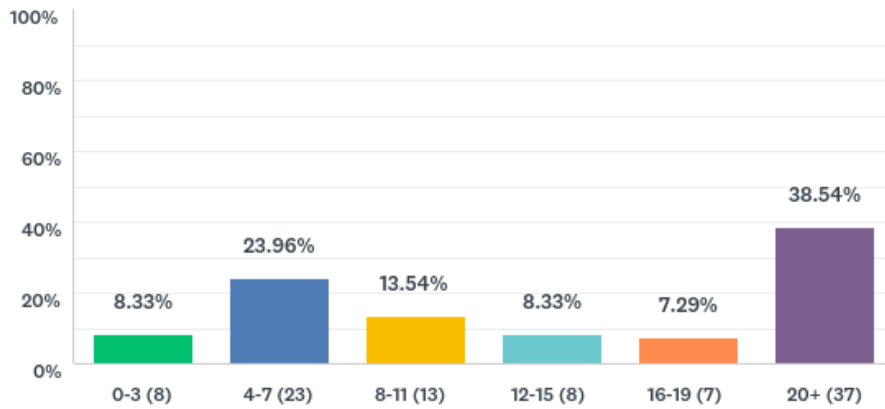
Do you have a boat larger than 25 feet with a head on board?

| Answer Choices | Responses | |
|----------------|-----------------|------------|
| Yes | 73.08% | 76 |
| No | 26.92% | 28 |
| | Answered | 104 |
| | Skipped | 0 |



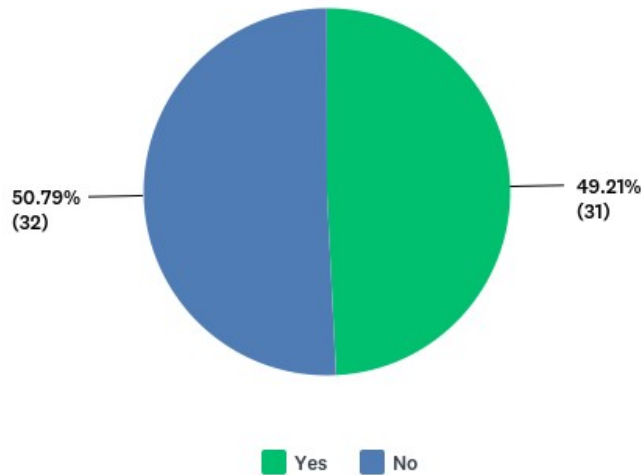
On average, how many days are you on your boat per month?

| Answer Choices | Responses | |
|-----------------|-----------|-----------|
| 0-3 | 8.33% | 8 |
| 4-7 | 23.96% | 23 |
| 8-11 | 13.54% | 13 |
| 12-15 | 8.33% | 8 |
| 16-19 | 7.29% | 7 |
| 20+ | 38.54% | 37 |
| Answered | | 96 |
| Skipped | | 8 |



Are you a liveaboard boater?

| Answer Choices | Responses | |
|-----------------|-----------|-----------|
| Yes | 49.21% | 31 |
| No | 50.79% | 32 |
| Answered | | 63 |
| Skipped | | 41 |



How important is the health of the environment to you?

| Answer Choices | Responses | |
|--------------------------|-----------|----|
| 1 - Not Important at all | 1.30% | 1 |
| 2 | 1.30% | 1 |
| 3 | 0.00% | 0 |
| 4 | 5.19% | 4 |
| 5 | 24.68% | 19 |
| 6 - Very Important | 67.53% | 52 |

Weighted Average

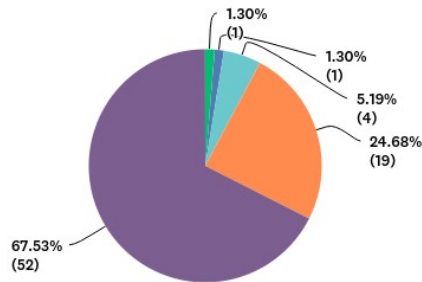
5.53

Answered

77

Skipped

27



1 - Not Important at all 2 3 4 5 6 - Very Important

How important is clean water for boating to you?

| Answer Choices | Responses | |
|--------------------|-----------|----|
| 1 - Not important | 0.96% | 1 |
| 2 | 0.96% | 1 |
| 3 | 0.00% | 0 |
| 4 | 5.77% | 6 |
| 5 | 14.42% | 15 |
| 6 - Very important | 77.88% | 81 |

Weighted Average

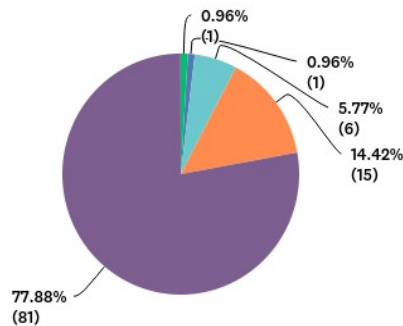
5.65

Answered

104

Skipped

0

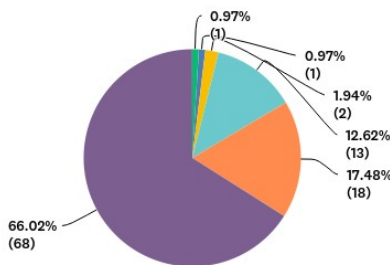


1 - Not important 2 3 4 5 6 - Very important

How important is pumping out treated or untreated waste to the health of the environment?

| Answer Choices | Responses | |
|-------------------------|-----------|-------------|
| 1 - Not important | 0.97% | 1 |
| 2 | 0.97% | 1 |
| 3 | 1.94% | 2 |
| 4 | 12.62% | 13 |
| 5 | 17.48% | 18 |
| 6 - Very important | 66.02% | 68 |
| Weighted Average | | 5.43 |

Answered 103
Skipped 1

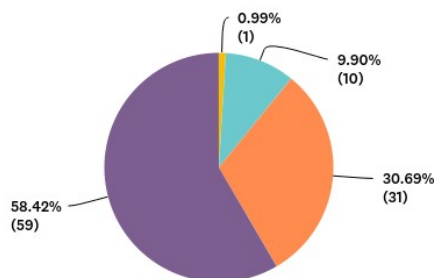


1 - Not important 2 3 4 5 6 - Very important

How important is pumping out waste to keeping our water safe for recreation?

| Answer Choices | Responses | |
|-------------------------|-----------|-------------|
| 1 – Not Important | 0.00% | 0 |
| 2 | 0.00% | 0 |
| 3 | 0.99% | 1 |
| 4 | 9.90% | 10 |
| 5 | 30.69% | 31 |
| 6 – Very Important | 58.42% | 59 |
| Weighted Average | | 5.47 |

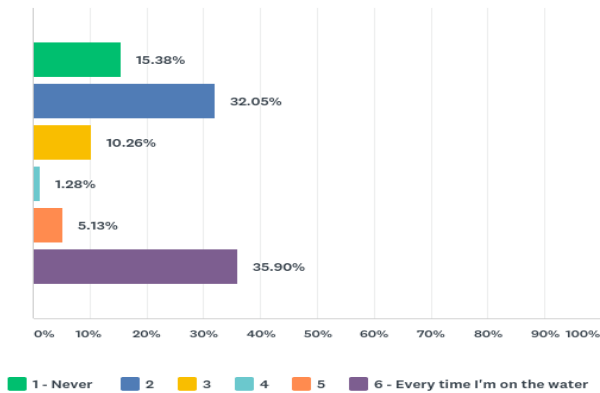
Answered 101
Skipped 3



1 - Not Important 2 3 4 5 6 - Very Important

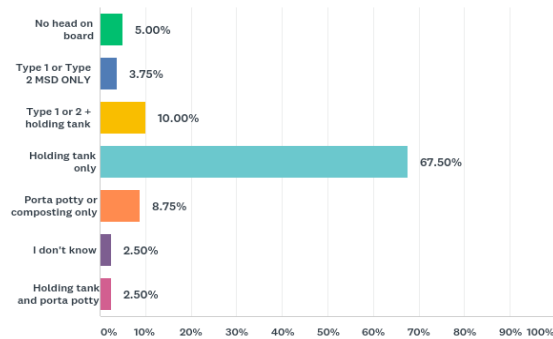
How often do you use your boat's head/toilet?

| Answer Choices | Responses | |
|---------------------------------|-----------|-------------|
| 1 - Never | 15.38% | 12 |
| 2 | 32.05% | 25 |
| 3 | 10.26% | 8 |
| 4 | 1.28% | 1 |
| 5 | 5.13% | 4 |
| 6 - Every time I'm on the water | 35.90% | 28 |
| Weighted Average | | 3.56 |
| | | 78 |
| | | 26 |



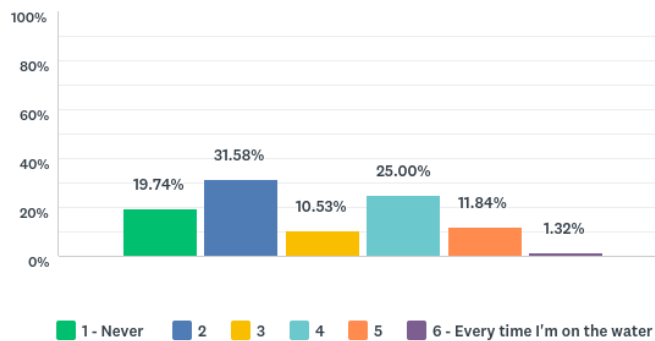
What type of treatment system do you have?

| Answer Choices | Responses | |
|---------------------------------------|-----------|-----------|
| No head on board | 5.00% | 4 |
| Type 1 or Type 2 MSD ONLY | 3.75% | 3 |
| Type 1 or Type 2 MSD AND holding tank | 10.00% | 8 |
| Holding tank only | 67.50% | 54 |
| Porta potty or composting only | 8.75% | 7 |
| I don't know | 2.50% | 2 |
| Holding tank and porta potty | 2.50% | 2 |
| Answered | | 80 |
| Skipped | | 24 |



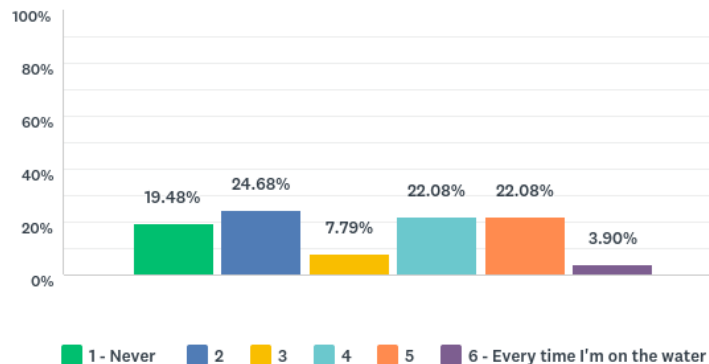
How frequently does your holding tank need to be emptied?

| Answer Choices | Responses | |
|---------------------------------|-----------------|-------------|
| 1 - Never | 19.74% | 15 |
| 2 | 31.58% | 24 |
| 3 | 10.53% | 8 |
| 4 | 25.00% | 19 |
| 5 | 11.84% | 9 |
| 6 - Every time I'm on the water | 1.32% | 1 |
| Weighted Average | | 2.82 |
| | Answered | 76 |
| | Skipped | 28 |



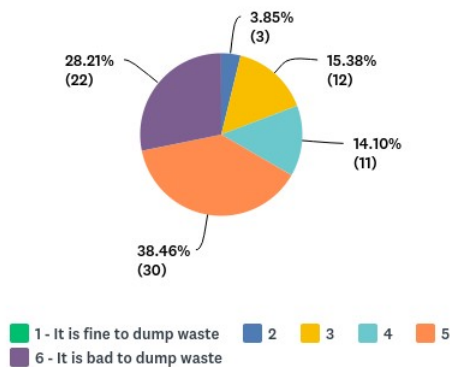
On average, how often do you pump out your waste?

| Answer Choices | Responses | |
|---------------------------------|-----------------|-------------|
| 1 - Never | 19.48% | 15 |
| 2 | 24.68% | 19 |
| 3 | 7.79% | 6 |
| 4 | 22.08% | 17 |
| 5 | 22.08% | 17 |
| 6 - Every time I'm on the water | 3.90% | 3 |
| Weighted Average | | 3.14 |
| | Answered | 77 |
| | Skipped | 27 |



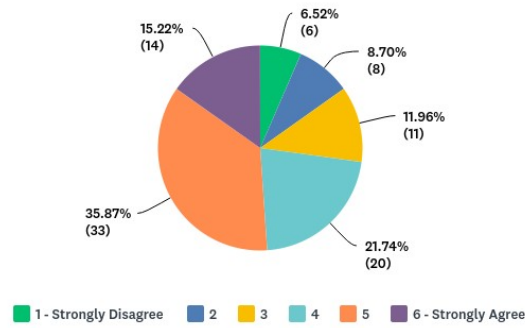
Based on your experience, how does the local boating community feel about dumping waste overboard?

| Answer Choices | Responses | |
|------------------------------|-----------------|-------------|
| 1 – It is fine to dump waste | 0.00% | 0 |
| 2 | 3.85% | 3 |
| 3 | 15.38% | 12 |
| 4 | 14.10% | 11 |
| 5 | 38.46% | 30 |
| 6 – It is bad to dump waste | 28.21% | 22 |
| Weighted Average | | 4.72 |
| | Answered | 78 |
| | Skipped | 26 |



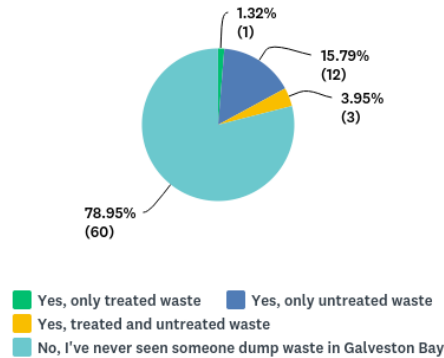
Do you believe most local boaters pump out their treated or untreated waste instead of dumping it overboard?

| Answer Choices | Responses | |
|-------------------------|-----------------|-------------|
| 1 - Strongly Disagree | 6.52% | 6 |
| 2 | 8.70% | 8 |
| 3 | 11.96% | 11 |
| 4 | 21.74% | 20 |
| 5 | 35.87% | 33 |
| 6 - Strongly Agree | 15.22% | 14 |
| Weighted Average | | 4.17 |
| | Answered | 92 |
| | Skipped | 12 |



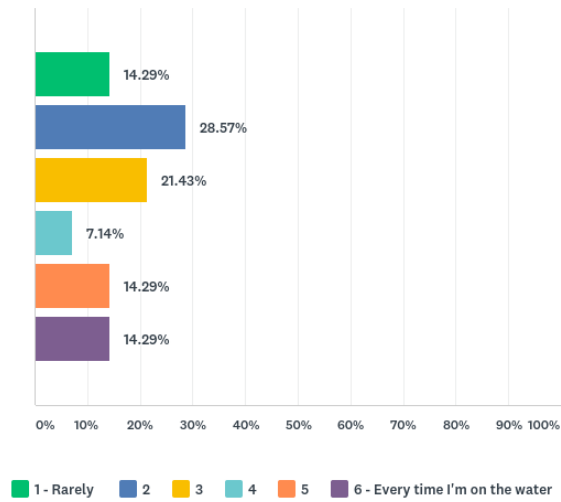
Have you ever seen someone dump sewage waste directly into Galveston Bay or Clear Lake?

| Answer Choices | Responses |
|---|-----------|
| Yes, only treated waste | 1.32% 1 |
| Yes, only untreated waste | 15.79% 12 |
| Yes, treated and untreated waste | 3.95% 3 |
| No, I've never seen someone dump waste in Galveston Bay | 78.95% 60 |
| Answered | 76 |
| Skipped | 28 |



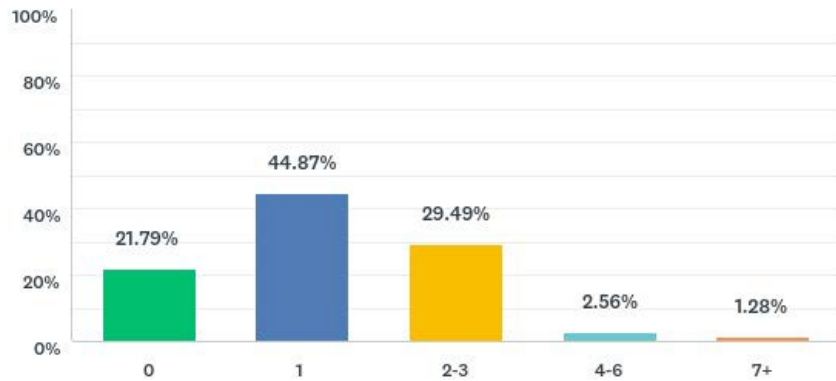
If yes, how often?

| Answer Choices | Responses |
|--------------------------------|-------------|
| 1 - Rarely | 14.29% 2 |
| 2 | 28.57% 4 |
| 3 | 21.43% 3 |
| 4 | 7.14% 1 |
| 5 | 14.29% 2 |
| 6 - Every time Im on the water | 14.29% 2 |
| Weighted Average | 3.21 |
| Answered | 14 |
| Skipped | 90 |



How many different pump-out facilities in Clear Lake/Galveston Bay do you know of?

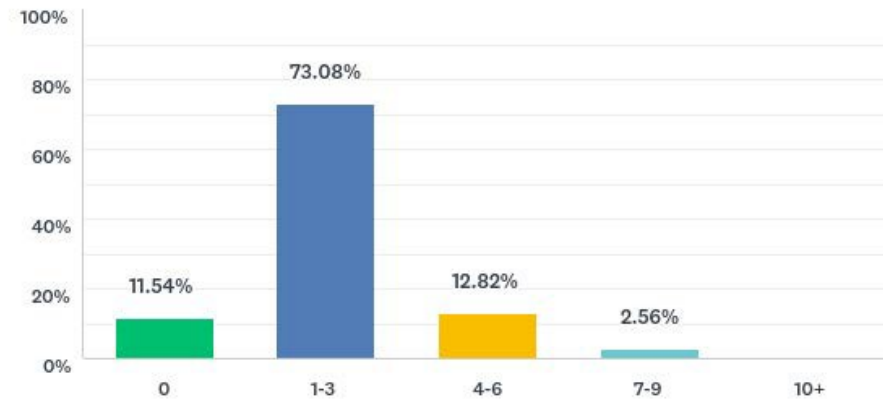
| Answer Choices | Responses | Count |
|-----------------|-----------|-----------|
| 0 | 11.54% | 9 |
| 1-3 | 73.08% | 57 |
| 4-6 | 12.82% | 10 |
| 7-9 | 2.56% | 2 |
| 10+ | 0.00% | 0 |
| Answered | | 78 |
| Skipped | | 26 |



How many different local pump-out facilities have you used?

| Answer Choices | Responses | Count |
|----------------|-----------|-------|
| 0 | 21.79% | 17 |
| 1 | 44.87% | 35 |
| 2-3 | 29.49% | 23 |
| 4-6 | 2.56% | 2 |
| 7+ | 1.28% | 1 |

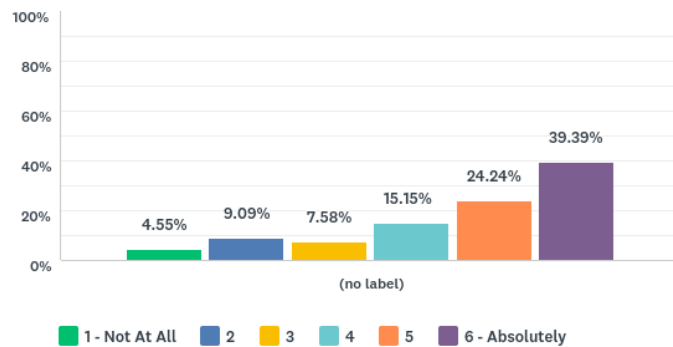
Answered 78
Skipped 26



Do you find local pump-out facilities easy to access and operate?

| Answer Choices | Responses | |
|-------------------------|-----------|-------------|
| 1 - Strongly Disagree | 4.55% | 3 |
| 2 | 9.09% | 6 |
| 3 | 7.58% | 5 |
| 4 | 15.15% | 10 |
| 5 | 24.24% | 16 |
| 6 - Strongly Agree | 39.39% | 26 |
| Weighted Average | | 4.64 |

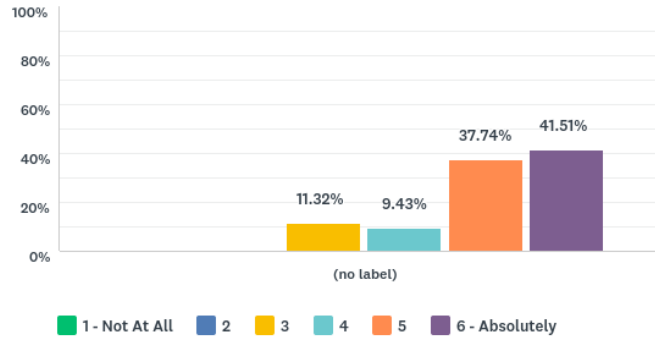
Answered 66
Skipped 38



Do you believe the cost of dockside pump-out facilities are appropriate for the services offered?

| Answer Choices | Responses | |
|-----------------------|-----------|---|
| 1 - Strongly Disagree | 0.00% | 0 |
| 2 | 0.00% | 0 |
| 3 | 11.32% | 6 |
| 4 | 9.43% | 5 |

| | | |
|-------------------------|--------|-------------|
| 5 | 37.74% | 20 |
| 6 - Strongly Agree | 41.51% | 22 |
| Weighted Average | | 5.09 |
| Answered | | 53 |
| Skipped | | 51 |



Are there are enough pump-out facilities in the area to meet all boater needs?

| Answer Choices | Responses | |
|-------------------------|-----------|-------------|
| 1 - Strongly Disagree | 6.56% | 4 |
| 2 | 19.67% | 12 |
| 3 | 13.11% | 8 |
| 4 | 24.59% | 15 |
| 5 | 26.23% | 16 |
| 6 - Strongly Agree | 9.84% | 6 |
| Weighted Average | | 3.74 |
| | | 61 |
| | | 43 |

