UF IFAS UNIVERSITY of FLORIDA

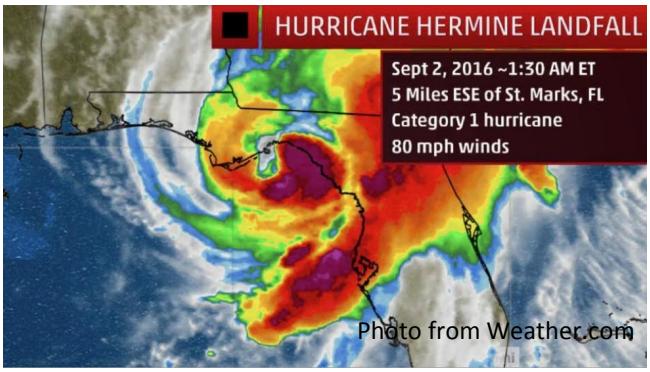
Florida

# LAKEWATCH

LAKEWATCH CITIZEN SCIENCE SINCE 1986

Dedicated to sharing information about water management and the Florida LAKEWATCH Program: Volume 75 (2016)

## Hurricane Hermine Meets Her Match in Cedar Key




Hurricane Hermine roared ashore in the wee hours of September 2, 2016, making landfall in Florida's Big Bend region. This area is home to the small town of Cedar Key, a popular tourist and fishing destination, and known for its successful shellfish aquaculture industry. The storm was accompanied by heavy rainfall and winds of up to 80mph, downing trees and powerlines, and damaging homes across the state.

Cedar Key residents and business owners prepared for Hurricane Hermine as they had for Tropical Storm Colin (which occurred in June 2016 and had a similar onshore track) by moving possessions indoors. What caught everyone by surprise, however, was the storm surge. The synergistic combination of landfall (1:30am) and high tide (3am) produced a storm surge reported at 5.8 ft. In Cedar Key, storm damage was estimated at over $10 million. Thankfully, no one was injured.

The shellfish aquaculture businesses of Cedar Key sustained variable types and extents of damage, depending on location. Docks were mangled and equipment damaged. Bags of seed clams, recently planted on lease sites, were washed away. One clam processing business experienced an electrical fire, leaving little more than a cinderblock shell. Fortunately, the Shellfish Aquaculture Research and Education Facility bore little damage. And the water quality monitoring station, located at the Gulf Jackson lease area off Cedar Key, continued to record throughout the storm (Figures A and B).

Fig: A

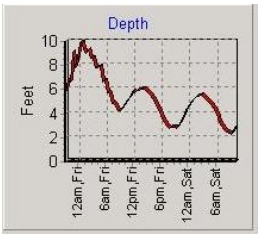
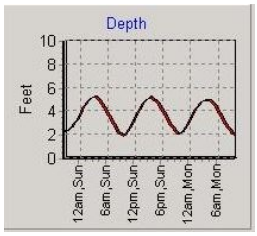



Fig. B




Figures A and B: The graphs show the depth gauge as the storm came over the Gulf Jackson clam aquaculture area. Fig. A is during Hermine, Fig. B shows a normal tidal cycle.

Heath Davis, Mayor of Cedar Key, is inspecting 2nd Street by boat on September 1, 2016. Davis also owns and operates Cedar Key Seafarms, a family-run clam and oyster growing facility and wholesaler (http://cedarkeyseafarms.com). Photo courtesy of Pat Bonish – Bonish Studio

The shellfish industry of Cedar key is resilient and the town is a community where everyone supports each other. Within hours of the storm, a great deal of cleanup and repairs had already been done. Farmers have stepped up to share equipment with those who sustained more damage than they. Businesses are re-opening daily, and the town went ahead with their annual Pirate Festival and Coastal Cleanup, only two weeks after the hurricane.

While the people of Cedar Key are upbeat, it will be a long road to recovery for the shellfish aquaculture industry, in general, and especially for those who lost not only their businesses but whose homes were also damaged. A Hermine Recovery account has been established by the Cedar key Aquaculture Association to help remove farm-related debris, re-establish Aids to Navigation on lease sites, rebuild infrastructure (hatcheries, nurseries, processing plants, docks), and purchase shellfish seed. Donations are tax-deductible and can be mailed to the Cedar Key Aquaculture Association, PO Box 315, Cedar Key FL 32625. Please include “Hermine Recovery” on the memo line.

Dr. Shirley Baker
University of Florida
Originally published in the National Shellfisheries Association, Quarterly Newsletter 2016(3)

# Lake Seminole Restoration: Everything but the Kitchen Sink

*Rob Burnes, MAS, MS*

For over twenty years there have been continuous efforts aimed at restoring water quality and habitat in Lake Seminole and its surrounding area. Prior to the 1940s, the Lake did not exist as it does today. At that time, it was the upper portion of Long Bayou, essentially just a shallow tidal embayment accumulating fine organic sediments in the poorly flushed backwaters for several centuries. However, in 1945 the lake was established by Pinellas County Board of County Commission resolution with construction commencing shortly thereafter (Figure 1). During the early years (1950s and 1960s) of the lake's inception, the state of Florida experienced a population boom and the area surrounding the lake exploded with new residents. These conditions of existing in lake nutrient rich sediments from increased direct run-off due to the urbanization and long retention of water which provided an excellent medium for growth of both vegetation and algae. All of this contributed to water quality and habitat declines that could be seen as far back as the 1960s and are still issues today.

*Lake Seminole History and Background*

Lake Seminole is a 685 acre hyper-eutrophic lake located in the west central portion of Pinellas County on the west coast of Florida, about 90 miles west of Orlando. It was created by impounding an arm of Long Bayou, a brackish water segment of Boca Ciega Bay that ultimately spills into the Gulf of Mexico. The creation of the lake was in conjunction with the planned construction of Park Boulevard by the State Public Roads Administration. There were quite a few reasons for the creation of Lake Seminole with the two major reasons being to provide irrigation of orange groves and as a potential potable water source. A fixed weir on the north end took flow into the lake from Long Creek and water flowed out of the system from a fixed weir on the south end of the lake (Figure 2). In the late 1970s to alleviate upstream flooding and hoping to reduce the flow of untreated stormwater into the lake, the Seminole Bypass Canal was created. This provided immediate relief from flooding but only minimally addressed the water quality degradation.

Figure 1. Lake Seminole prior to 1940's (Left) and Lake Seminole Present Day (Right)

Figure 2. Lake Seminole Outfall during Construction of lake

Today, the lake is used primarily for recreational purposes with fishing and boating being the main activities. The lake supports a strong largemouth bass population with many large bass found in the lake, though recreational fishing in the lake has been declining over the past 30 years. Land use over time has shifted from low density residential and agricultural uses to its current status of high density residential and commercial. This rapid urbanization of the watershed is one of the main reasons for decline in ecological conditions within the lake as little advanced infrastructure existed to treat the increased, nutrient-rich stormwater runoff. In terms of vegetation, the lake was historically dominated by cattail (*Typha* sp.) which made up nearly 65% of the vegetation as well as *Hydrilla verticillata*, an invasive non-native submerged aquatic plant that is known for its rapid expansion, and eel-*grass (Vallisneria americana)*, a beneficial native submerged aquatic plant. In recent years management activities have focused on increasing a diverse native plant community, reducing cattails and controlling *Hydrilla*.

*Early Restoration Efforts on the Lake*

Early restoration efforts on the lake started back in the 1960s when state and local agencies identified pollution sources and started to eliminate them. The largest source of pollution was a City of Largo wastewater plant, which until 1971, was directing dumping untreated waste into the lake. However, due to continued inputs of untreated run-off from the surrounding residential and commercial areas, excess nutrients were entering the lake causing further degradation of water quality. By the1980s the water quality was extremely poor and the nuisance vegetation, a sign of an unhealthy system, increased primarily with an eruption of *Hydrilla*. This led to an introduction of Grass Carp in 1987 as means of biological control of *Hydrilla* in order to restore the native plant population. The Grass Carp did their job in reducing the *Hydrilla* abundance, but the unintended side effect was the release of a large quantity of nutrients that were previously stored in the plant's biomass. This influx of nutrients and the grazing by the Grass Carp, led to a system that switched from being dominated by macrophytes to one with an abundance of algae. In response to the continued degradation of water quality and lake habitat, the Pinellas County Board of Commissioners passed another resolution urging the joint development of a long-term lake management plan. This was followed by multiple studies in the 1990s aimed to gain a greater understanding of how the lake functioned, where the major areas of concern were, and what were the best approaches to restore the lake.

The aforementioned studies formed a framework for a watershed management plan, completed in 2001, that analyzed water quality, sediment and habitat data as well as many other lake parameters to come up with a multifaceted approach to restoring the lake. This plan had a multitude of structural, legal, policy, outreach, and management practices ranging from stormwater pond rehabilitations and sediment removal projects to public education and creation of redevelopment codes within the watershed. Now that a plan

with restoration goals was created, it was time to start implementing the practices and projects suggested.

*Reasonable Assurance Plan*

Based on all of the recommendations in the prior studies on the lake, a consulting firm completed a Reasonable Assurance Plan (RAP) for Pinellas County in response to Lake Seminole being listed by the Florida Department of Environmental Protection (FDEP) as an impaired waterbody. This document outlined a plan of action to implement management practices aimed to bring the lake into regulatory compliance. The main goals of the plan were to implement practices that would reduce chlorophyll-a concentrations, reduce existing phosphorus loads by half and maintain current water quality standards for dissolved oxygen and pH that comply with waterbodies classified for a fishable swimmable usage.

Many of the restoration techniques listed in the RAP have been completed on lakes throughout Florida to improve water quality. Lake Seminole took a holistic approach to try to solve the system's problems and used multiple restoration techniques together to complement one another.

Components such as adopting a resolution designating the Lake Seminole Watershed as a "Nutrient Sensitive Watershed" and expanding and enforcing restricted speed zones on the lake were easily accomplished. While others, like strengthening and standardizing local ordinances for regulating stormwater treatment for redevelopment in the watershed and to develop and implement a comprehensive public involvement program for the watershed, took more time to enact.

Of all the components (e.g. structural, management, legal, policy, etc.), the structural components of the plan have been, by far, the most costly in terms of both time and resources to implement. There were six structural components identified in the RAP and Pinellas County, along with State and Federal funding partners, immediately went into action to implement.

*Work Completed*

To date, several projects listed in the RAP have been completed or are nearing completion. These projects focused on cleaning up the lake shoreline and placing lake-level instrumentation on the lake. The first project completed removed organic sediments from the littoral shelf in 2006 and was a continuation of a smaller scale project of similar scope conducted by Florida Fish and Wildlife Commission (FWC) in 2002. The work focused on removal of organic sediments from nearshore areas and tussocks. Approximately 130,000 cubic yards of organic sediments were removed along with over 26 tons of garbage and debris (Figure 3). To visualize how much material was removed, the 130,000 cubic yards of material would create a 20-foot high pile of dirt over an entire football field and the garbage and debris removed weighed as much as three elephants.

Figure 3. Lake drawdown for shoreline muck removal

The same time the sediment removal project was underway, a lake stage gauge was installed at the outfall control structure on the south end of the lake. This gauge is still maintained and operated by the United States Geological Survey (USGS) with the goal of providing data to aid in calculating nutrient loading models and water/nutrient budget balancing.

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Figure 4. Upland revegetation after exotics removal

The next project to be undertaken was the restoration of priority wetland and upland habitats. The goal was to improve near-shore upland habitats through vegetation control. The main portions of this project were completed in 2008, though continued maintenance is still occurring on an as-needed basis. There were many areas targeted for restoration ranging from small strips of land adjacent to roadways that comprised no more than a few thousand linear feet to a large tract of wetland and upland several acres in size. The main upland species targeted were Brazilian *Pepper (Schinus terebinthifolius)* and air potato (*Dioscorea bulbifera*) and the main near-shore targeted species were cattail and willows (*Salix* sp.). The areas where nuisance vegetation was removed were immediately revegetated with native plants (Figure 4). These three projects helped to tackle the lake's issues but there was still much more work to do.

*Work Still In Progress*

With the previously mentioned projects completed, it was now time to take on the major issues with the lake. There are still three large projects that have not been completed but they may have the greatest impact on creating a healthier, more balanced system. These projects aim to reduce nutrient loading from stormwater runoff, reduce internal nutrient loading from sediments already in the lake, and increase lake flushing.

It was decided to first tackle the loadings coming from stormwater runoff. The Lake Seminole Regional Stormwater Retrofit project was initiated in 2004. Six systems were designed to treat stormwater run-off based on the areas around the lake that had the highest contributing pollutant loads. Construction on the first of 4 locations started in 2008 with construction of a combined system that treated two areas on the north end of the lake (Figure 5). Two other systems were built on separate sites on the western shoreline near the center of the lake. The last system is scheduled for completion late 2016 and is located on the northwestern side of the lake. One system could not be built as the site proved to be unsuitable for implementation.

Figure 5. Alum facility on Lake Seminole during Construction

The overall goal of the Stormwater Retrofit project is to reduce nutrient loads prior to entering the lake by injecting Alum (aluminum sulfate) into the stormwater which helps to sequester nutrients and sediments prior to entering the lake. Alum has long been used as a phosphorus removal tool in the wastewater treatment world and over the last 30 years it has gained acceptance as a tool to help remove nutrients and suspended sediments in surface water systems (lakes, streams, ponds, etc.). The process for treating the stormwater is relatively simple. The systems were designed to release the Alum to only treat stormwater flow after it reaches a minimum assigned level for a certain period of time, thus ensuring the flow is storm-event driven. The rate of Alum release is based on flow, so as flow increases more Alum is released to adequately treat the stormwater. Based on preliminary testing, it is anticipated that removal rates will be upwards of 80% of the total phosphorus and total suspended solids in the stormwater. This reduction in nutrients and sediments will have a great impact on the health of the lake by reducing the annual nutrient load to the lake. This project will be completed and all of the systems will be operational by spring of 2017.

The other project currently underway is the number one recommended project in the RAP, and also the most costly. The lake-wide dredging of organic sediments within the lake is a project whose goal is to remove sediments that have accumulated in the lake over time. This will be accomplished by using a specialized barge that will extract target sediments off the lake bottom and deposit them via piping to an upland site. Once on the upland site, the material will be separated, dried, and then shipped off to its final destination (either to a landfill facility or recycled for various uses). Though this project may be costly and time consuming, it should be highly effective in helping to reduce the lakes eutrophication problems. The project will remove approximately 900,000 cubic yards of muck which results in the removal of 416 tons of nitrogen and 77 tons of phosphorus. The design of the project began in 2010 and proposals are currently being solicited for implementation of the project. Once started, the actual dredging of the lake will take upwards of five years to complete and then it may take a few years after that to see a system-wide benefit.

The last project to be completed in this current round of restoration efforts will focus on developing an operational schedule for the outfall control structure at the south end of the lake. This will be accomplished by diverting Alum treated water from the bypass canal at the north end of the lake into the lake during the rainy season. Water level manipulation is a long held lake management technique, used not only for water quality management via flushing and dilution, but also for the control of nuisance aquatic vegetation. This component will be implemented once all of the dredge operations and Alum systems are completed.

*Where has all of this work gotten us?*

Based on water quality sampling conducted by Pinellas County since the 1970s scientists have the ability to study trends in the lake. Since 2003, the lake has shown a slight, yet statistically significant, decreasing trend in phosphorus, nitrogen and chlorophyll-a concentrations. This is good news showing that all of our efforts are working and gives us a basis to continue our work. The hope is that public outreach and education efforts on how to reduce citizen impacts on the lake will make a positive difference combined with better treatment of stormwater prior to it entering the lake and restoration of habitats will continue to increase the Lake's health. In the future, the goal is to complete all of our restoration projects and design more if needed, while continuing to monitor the lake and enhance community involvement to ensure that Lake Seminole is a healthy and productive system for all to enjoy!

Rob Burnes is a Senior Environmental Scientist with Pinellas County Environmental Management.

# Volunteer Bulletin Board

**Time line of sample processing and importance of proper labeling for complete results**

Volunteers send samples to collection centers

**TN/TP**

**Chl A**

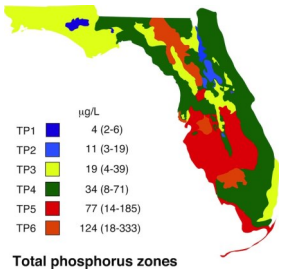
**Secchi data**

LAKEWATCH employees pick up and separate samples and datasheets and deliver them to the LAKEWATCH water lab for analysis

Once analyzed the data is sorted, brought together, and added to the LAKEWATCH data set.

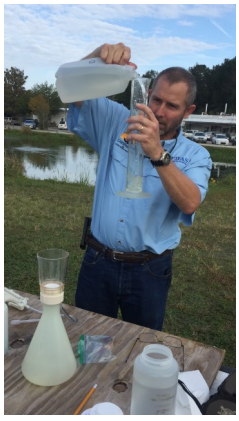
**Any mistakes in labeling interrupts this step!!**

Florida LAKEWATCH dataset




LAKEWATCH datasets are large and growing with every sample taken by volunteers across the state!

- This diagram shows the timeline of samples from when volunteers collect them until the data is joined into the Florida LAKEWATCH dataset. As you can see, although the different components of the samples start off together, they get separated and go to different areas of the water lab. That's why proper labeling is so important. Florida LAKEWATCH staff try hard to assure all items are labeled accurately and completely before they are separated, but with 1000's of samples a year going through the program some mistakes slip past. Please do your part to help with this by labeling all items you handle with all the requested information. THANKS FOR EVERYTHING YOU DO TO HELP LAKEWATCH!
- Email has become one of our most important ways of communicating with volunteers and collaborators across the state. Please remember that if you change your email address to let us know so we can reach you and get you updated information.
- Please visit the new LAKEWATCH website, and get back with us with any questions or comments you may have about it.
- Check in on the website in the near future for training videos and more volunteer information.



# New fishing regulations go into effect to improve bass

**New regulations simplify rules to more effectively manage the quality of black bass fisheries**

New black bass fishing regulations are in effect throughout Florida, beginning July 1. This regulation change will streamline existing rules, allow anglers to keep smaller, more abundant bass and protect larger bass in order to ensure that Florida continues to produce trophy bass in the future.

Before developing proposals for amending current regulations, FWC staff received input from thousands of bass anglers, and blended angler desires and opinions with decades of fish population research.

"We are confident that these new regulations meet the desires of our bass anglers, ensuring that Florida lakes will continue to produce high quality fisheries," said Tom Champeau, director of FWC's Division of Freshwater Fisheries. "Florida's reputation for trophy bass is one reason we are known as the Fishing Capital of the World and these new regulations will help provide our anglers with unforgettable fishing experiences."

Florida contains five species of black bass: largemouth, Suwannee, shoal, Choctaw and spotted bass. Largemouth bass are the state freshwater fish and are found throughout Florida, while the other species are only found in rivers in the north central and northwest regions.

A summary of the new black bass regulations is below. Visit MyFWC.com/fishing and click on "Freshwater," then "Regulations" for a copy of the complete regulations.

- The previous three black bass fishing zones and 40 areas with special bass regulations have been eliminated.
- All species of black bass are included in the five fish daily aggregate black bass bag limit. This is the same as the previous statewide rule.
- Largemouth bass: Only one may be 16 inches or longer in total length per angler, per day, with no minimum length limit.

Suwannee, shoal, Choctaw and spotted basses: 12-inch minimum size limit, only one may be 16 inches or longer in total length.

One of the primary goals of the new regulations is to protect larger trophy bass desired by most anglers. The TrophyCatch program offers great prizes for anglers who document and release largemouth bass weighing eight pounds or heavier. Visit TrophyCatch-Florida.com for more details and to register for the program.

This news release was provided courtesy of the Florida Fish and Wildlife Conservation Commission via their website at www.myfwc.com

Florida Fish and Wildlife Conservation Commission

# Florida Microplastic Awareness Project

Maia McGuire, PhD, UF/IFAS Extension

Florida Microplastic
AWARENESS PROJECT

## Introduction

Many Florida residents are aware that plastic pollution in the ocean is a problem, but many associate this issue with the "Great Pacific Garbage Patch" and are unaware that plastics are also a problem in the Atlantic, much less in Florida's coastal waters. These plastics are commonly eaten by marine life (including those as small as plankton). The plastics often contain toxic chemicals, either from their manufacture, or adsorbed on their surface from the ocean water. The Florida Microplastic Awareness Project (FMAP) is a citizen science effort that was designed to have people learn for themselves how prevalent plastics (specifically those less than 5 mm in size) are in Florida's marine environment. FMAP has two main goals:

To train citizen scientists to look for the presence of microplastics in Florida coastal waters, and

To teach people ways to reduce their personal contribution to microplastic pollution (in part by selecting and using personal care products that do not contain polyethylene.)

FMAP volunteers were organized by regional coordinators in sixteen locations around the state of Florida. These citizen scientists sampled waters along the majority of the Florida coastline from Pensacola in the western panhandle, to Key West, to Amelia Island in northeast Florida (Figure 1)

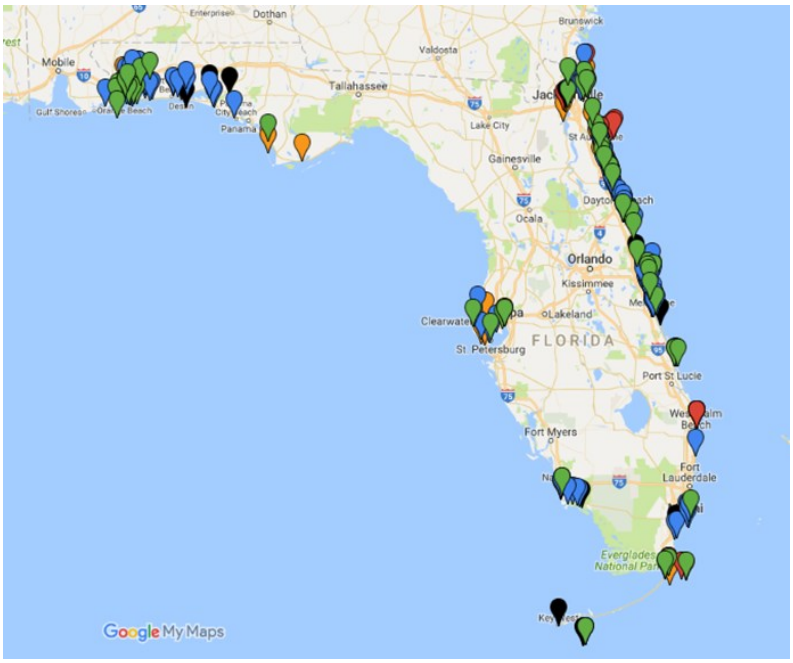


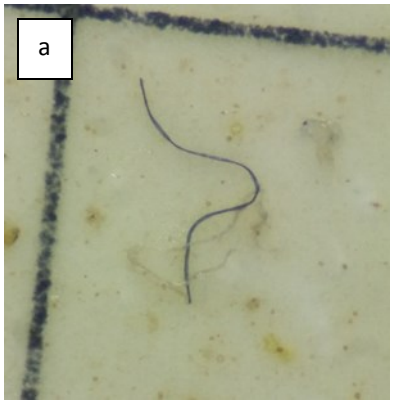

Figure 1: Map showing microplastic collection locations. Pin colors denote the number of plastic pieces found in 1 liter of water (black = 0; blue = 1-5; green = 6-10; orange = 11-20; red = 20+).

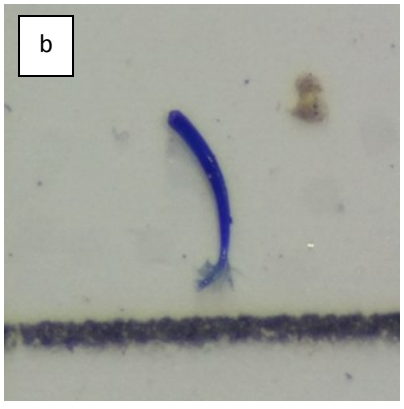
# Materials/Methods

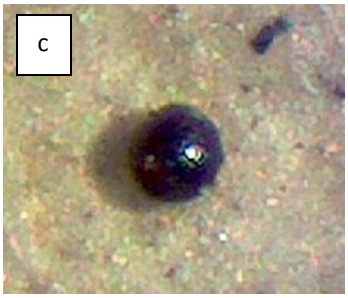
Sixteen regional coordinators around the state of Florida (for locations, see https://drive.google.com/open?id=1pRIc7P8BX2HxIOyQ26RUt8vefSg&usp=sharing) independently recruited and trained citizen scientist volunteers. Statewide, a total of 161 volunteers submitted time that they had contributed to the project. There were additional volunteers (based on names submitted with samples) who participated but did not enter their time online. Citizen scientists included Master Naturalist participants, college interns, volunteers in other water quality monitoring projects and Master Gardeners. Volunteers were required to attend training sessions with the coordinators. These sessions included hearing a presentation about the sources of and threats posed by microplastics (using a standard PowerPoint presentation), and a hands-on session showing how to collect and analyze water samples. Coordinators worked with individual citizen scientists to help them recognize microplastics in their first samples.

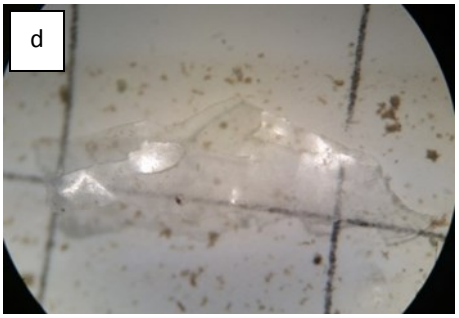
Volunteers collected one-liter water samples in Nalgene bottles, then filtered their samples through gridded 0.45 micron filter paper. They observed the filter paper using a dissecting microscope (20-40X magnification) and recorded the number of pieces of plastic found. (See volunteer manual and instructional videos at http://stjohns.ifas.ufl.edu/Sea/microplastics/get_involved.html.)
Based on oceanographic studies, for the Florida Microplastic Awareness Project we divide the plastics into four types:

a. Fibers: These look like thin threads, and are often colored (blue and red seem to be the most common colors) but may be clear.
b. Fragments: These are pieces of plastic that seem to have come from larger plastic items (but are not fibers).
c. Microbeads: These are completely spherical and can be up to 1 mm in diameter. They are usually colored.
d. Film: Pieces of thin plastic (like grocery bags, plastic wrap etc.)



Microplastics Pledge

Members of the public were asked to take a pledge (available online at http://bit.ly/plasticpledge or in paper form at outreach events.) In the pledge, people are asked to indicate if they already do a particular action, or if they are willing to do it. The actions are all ways of reducing one's personal contribution to plastic waste. The eight actions suggested are:

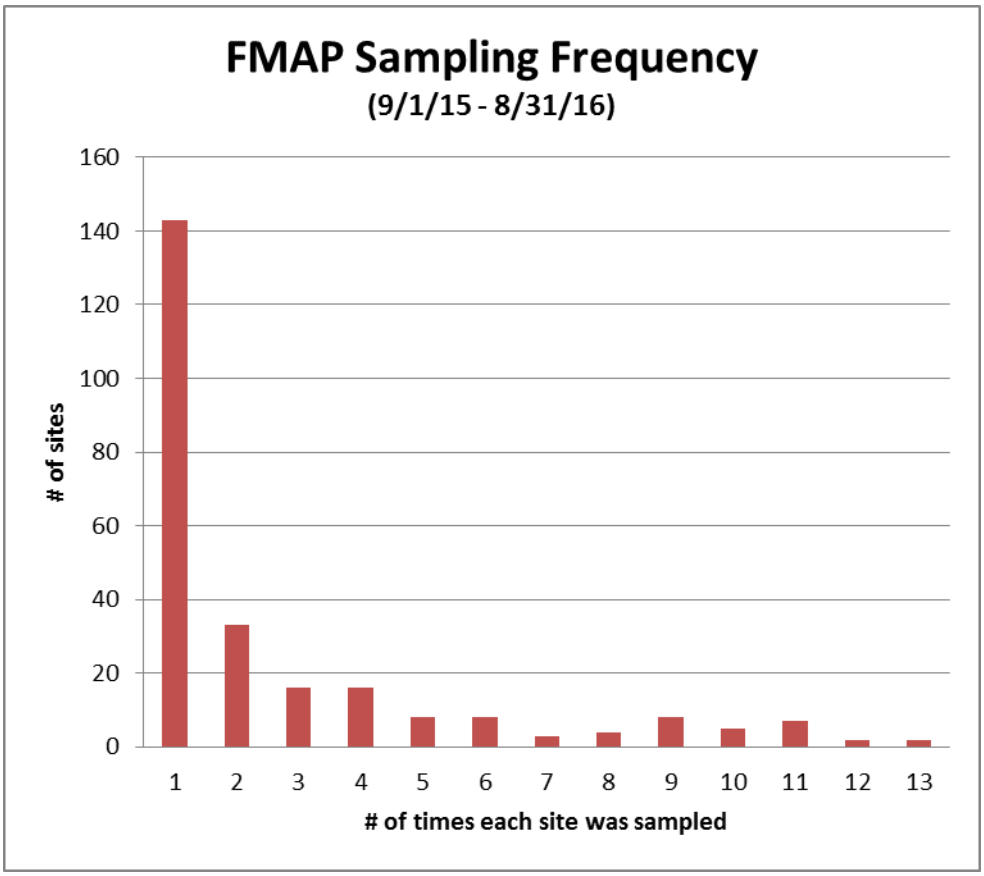
i. Read labels on personal care products and avoid products containing polyethylene (the type of plastic most commonly found in deodorants, facial scrubs, makeup and other personal care products)
ii. Use paper or reusable shopping bags instead of single use plastic ones
iii. Avoid using plastic drinking straws
iv. Bring my own water bottle instead of buying single-use plastic water bottles
v. Bring my own washable coffee/hot drink cup instead of using foam
vi. Use foil or a washable container as a "to go" box at restaurants, or for packing lunches
vii. Recycle as many plastic items (those with the triangular recycle logo) as possible
viii. Choose more natural fabrics instead of microfiber, nylon, acrylic, polyester or polypropylene

## Results/Discussion

There are several key results from the monitoring portion of the first year of the Florida Microplastic Awareness Project (Sept 2015-Aug 2016):

- The majority of coastal water samples collected in Florida (89%) contained at least one piece of plastic. On average, there were 7.6 pieces of plastic per liter.
- The plastic in the samples was primarily (82%) in the form of microscopic fibers.
- Microbeads (from facial scrubs and other personal care products) comprised only a small portion of the plastics found (7%). This number might be slightly high as it was discovered that some volunteers were mistaking planktonic diatoms for microbeads.
- There are not necessarily any huge trends that can be discerned from the data. It seems that in general samples collected in intracoastal waters contain more plastics than those collected along the beach. There were few offshore samples collected, but it appears that these samples might have higher quantities of plastic than nearshore samples. Weather conditions (waves) probably affected the amounts of plastics found in samples.

Overall, 256 sites were sampled. Numbers of samples at each site ranged from one to 13 (Figure 3). The average number of times a site was sampled was 2.7.




A total of 893 people completed the Florida Microplastic Awareness Project's pledge. 29 people (3.2%) were already taking all eight suggested actions to reduce plastic waste. Eight people (0.9%) did not indicate a willingness to make any behavior changes to reduce their plastic waste. On average, people pledged to make 3.4 behavior changes.

Pledge takers were asked to provide their email address in order to allow us to follow up with them after three months. 88 people who took the pledge and provided a valid email address between September 2015 and August 31 2016 responded to follow-up surveys. 90% of respondents indicated that they had made at least one behavior change to reduce their plastic waste production. It is possible that some respondents were already making all of the suggested behaviors prior to the follow-up surveys. On average, people reported having made three behavior changes. 85% reported having shared information about microplastics with others.

From the original pledge data, most people (64%) indicated that they were willing to read labels on personal care products (like body wash, deodorant, toothpaste, facial scrub, makeup) and avoid products containing polyethylene. 55% were willing to bring their own foil or washable container to use as a "to go" box at restaurants, or pack lunch contents in reusable containers instead of single-use bags. 49% said they would avoid the use of plastic drinking straws and 39% said they would try to choose more natural fabrics rather than microfiber or other synthetic fabrics (acrylic, nylon, polyester, polypropylene).

In the follow-up pledge, 70% of people reported having read labels on personal care products (like body wash, deodorant, toothpaste, facial scrub, makeup) and avoided products containing polyethylene. Other commonly-taken actions included:

- Bringing their own reusable water bottle/cup instead of buying single-use plastic water bottles (44%),
- Recycling as many plastic items (those with the triangular recycle logo) as possible (44%)
- Bringing their own washable coffee/hot drink cup instead of using a disposable one (40%)
- Use paper or reusable shopping bags instead of single use plastic ones (39%).

(Unfortunately, the choice of avoiding the use of plastic drinking straws was accidentally left off the follow-up pledge.)

Other actions that people stated having taken included the following:

- "Trying to be more aware of where I cut plastics such as PVC pipe and PVC sheets when I'm close to marine environments."
- "I have tried not to use plastic silverware."
- "I look closely for plastic at the beach and always pick it up."

# Conclusions

It was somewhat surprising to find how common the microplastic fibers were (and how much more abundant than fragments, film and microbeads) in our Florida project. The methodology used by FMAP was modeled after that used by the Marine and Environmental Research Institute in Maine (Abby Barrows, personal communication). This methodology differs from that used by ocean/Great Lakes researchers, who use manta trawls, typically with mesh sizes of 333 or 100 µm, that are towed over large areas (data are reported as number per $km^2$). Our method samples a relatively small volume/surface area of water (one liter) but captures all microplastics on the 0.45 µm filter. Therefore, we likely captured proportionally more fibers in our samples than the ocean studies, and were probably less likely to capture the larger plastic items (film, fragments and microbeads) in our bottles. This observation is validated by a recently published report (Barrows et al., 2016)

The Florida Microplastic Awareness Project provides the first comprehensive set of data for microplastics in coastal Florida waters. These data are being shared with the Wildlife and Habitat Impacts Group of the Florida Marine Debris Reduction Plan team. As one of the team members stated, "It's hard to know what our reduction goal should be if we don't know what's already there." The citizen science volunteers have often become passionate advocates for plastic waste reduction after seeing for themselves how much plastic is in their local waterways.

## Literature Cited

Barrows, A.P.W, C.A. Newmann, M.L. Berger and S.D. Shaw. 2016. Grab vs. neuston tow net: a microplastic sampling performance compariston and possible advances in the field. Anal. Methods. DOI: 10.1039/c6ay02387h.

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Infographic showing key results from the Florida Microplastic Awareness Project.