Towards Trash Free Waters: Quantifying Potential Aquatic Trash Recovery in the Hillsborough River Watershed

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Prepared by
Timothy G. Townsend (Principal Investigator)
Max J. Krause
Sarah A. Gustitus
Jeremy Toms
University of Florida
Gainesville, FL 32611
**Executive Summary**

Despite advances in solid waste management and increased awareness of the negative environmental consequences of pollution, littering is still common in the US. Littering can be the result of carelessness, accidents, or intentional actions, but the effect is the same. In recent years, concerned citizens have increased their attention to litter in the Hillsborough River Watershed (HRW). The University of Florida (UF) research team collaborated with local municipalities and non-government organizations (NGOs) to quantify and map the quantity of collected litter within the HRW. Because much of the storm water within the HRW drains into the Hillsborough River, all of the litter within the watershed has the potential to become aquatic trash (PAT). The PAT that was collected in roadside and park cleanups before it made its way into the Tampa Bay or the Gulf of Mexico (recovered PAT) was cataloged into a database and mapped using ESRI ArcGIS software. Concentrations of recovered PAT were reported as pounds per acre for 1,015 cleanup events at 168 unique sites within the HRW from 2008-2014, shown in Figure E1. Additionally, educational campaigns such as storm drain markings and field visits by the WaterVentures mobile lab were mapped to identify where residents could be expected to have increased awareness of the negative issues associated with littering.

![Figure E-1. Potential aquatic trash recovered in over 1,000 cleanup events from 2008-2014.](image-url)
For all 5 years, median concentrations of PAT were 6.7, and 0.79 for the City of Tampa and the City of Temple Terrace, respectively. Median PAT concentrations for Hillsborough County and Pasco County were 4.8 and 37 lbs/acre, respectively. The discrepancy in concentrations is a result of the currently available data. It is not believed that the counties have significantly different PAT concentrations, however the data presented here are the reflection of data submitted to UF during the previous year. No data were obtained regarding PAT in Polk County. The increased frequency of cleanup events and recovered PAT indicate not that littering is increasing within the watershed, but, for the first time these data are being reported and quantified. The results of this study are the first phase in quantifying and assessing the issue of PAT within the HRW.

On February 24, 2015, the HRW Trash Free Waters (TFW) Partnership was formed to manage PAT within the HRW. From the research presented in this report, the Partnership will develop metrics to monitor progress made to clean and restore the Hillsborough River and other waterbodies within the watershed. In conjunction with the Environmental Protection Agency’s (EPA) TFW Program, the Partnership established a Resolution to engage local communities and municipalities in their efforts to make the Hillsborough River and adjacent waterbodies, Trash Free Waters.
Acknowledgements

The volunteers that have removed debris, trash, litter, waste, refuse, garbage, junk, and all other treasures from the waterways are truly appreciated for their efforts to better their local and global communities. Because of them, we are that much closer to Trash Free Waters. The authors would also like to acknowledge the following people for their contributions to this project and report: Debora Fillis Ryba (Nestlé Waters NA), Debbie Evenson (KTBB), Tom Damico (KTBB), Melinda Spell (TBW), Peter Clark (TBW), Heather Maggio (City of Tampa), Joe Gross (City of Temple Terrace), Adam Saslow (SRA), Laura Johnson (EPA), Lottie Kelly (Covanta), and Karen Pate (Crystal Springs Preserve).
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Abbreviations and Acronyms

AT – Aquatic trash
EPA – United States Environmental Protection Agency
FDEP – Florida Department of Environmental Protection
HRCC – Hillsborough River & Coastal Cleanup
HRW – Hillsborough River watershed
KPB – Keep Pasco Beautiful
KPCB – Keep Polk County Beautiful
KTBB – Keep Tampa Bay Beautiful
MSW – Municipal solid waste
NW - Nestlé Waters North America
PAT – Potential aquatic trash
TBW – Tampa Bay Watch
TFW - Trash Free Waters program
TPAT – Total potential aquatic trash
UF – University of Florida
WTE – Waste to energy
1. Introduction

There is growing concern of the magnitudes and potential impact of unmanaged municipal solid wastes (MSW) in the marine and aquatic environments. MSW is made up of typical household wastes, such as paper, plastic, food scraps, beverage containers, and clothes. In a managed system, waste is disposed of in sanitary landfills or recovered for energy at a waste to energy (WTE) facility. When MSW is discarded inappropriately, it is considered litter. Litter has many negative societal impacts, increasing blight, reducing community value, and potential harm to human health and the environment (EPA 2015).

A watershed is an area of land that drains to a single location, or sink, usually a river or waterbody. Litter can be transported via rain runoff into the waterbody, where it becomes aquatic trash. Thus, any litter within a watershed can be considered potential aquatic trash (PAT). If the waterbody is connected to marine environments, the aquatic trash can be transported across the world (Jambeck et al. 2015). This is especially true in extreme storm events, such as hurricanes, where winds and storm surges can transport material over great distances.

![Figure 1-1: The Hillsborough River watershed](image)

Concerned citizens have organized groups to remove PAT from the Hillsborough River Watershed (HRW) and the 59 mile long Hillsborough River. This watershed covers 457,000 acres and spans portions of Hillsborough, Pasco, and Polk Counties in Southwest Florida, shown
in Figure 1-1. The waters of the Hillsborough River, along with any debris mobilized by its current, flow into Tampa Bay, the Gulf of Mexico, and the Atlantic Ocean.

1.1. Motivation

The objective of this research was to (1) quantify the amount of PAT in the HRW and (2) develop a map and database of cleanup efforts that quantified PAT recovered from the watershed. The results of this work are the first phase of quantifying and managing PAT within the HRW. This research, in conjunction with the Environmental Protection Agency’s (EPA) Trash Free Waters Program will be used to determine metrics for which local groups can use to assess cleanup and educational campaigns with the intent of making the Hillsborough River and other waterbodies within the HRW, trash free waters (TFW).

1.2. Scope

Researchers at the University of Florida (UF) collected, compiled, and geographically categorized pertinent data on various PAT cleanup activities documented within the HRW from county and city governments, and several non-government organizations (NGOs). This data was provided to the researchers by various member organizations of HRW TFW Partnership. Data points spanned the watershed, from points in, adjacent to, and further than 10 miles or more from the Hillsborough River. A major objective of this project was to consolidate all of the collected data into an electronic database linked with global positioning system (GPS) data. Other information that was incorporated included storm drain markings, storm drain sedimentation traps, waste disposal facilities and educational campaigns. Additional guidance was provided by the EPA’s Trash Free Waters Program in the Office of Wetlands, Oceans, and Watersheds.

1.3. Organization of Report

Section 1 is an introduction to the Trash Free Waters project in the HRW, including motivation and scope of the current report. A brief overview of major groups involved in this project and background information regarding current solid waste management systems in place within the Counties is presented in Section 2. In Section 3, the materials and methods used are reported. Results, both by year and by area, are presented in Section 4 followed discussion of the data. Recommendations for improving data quality are offered in Section 5. Conclusions of the
report are located in Section 6. Appendix A is a walkthrough for using the Marine Debris Tracker. Appendix B is the map database, including cleanup data and locations.
2. **Background Information**

2.1. **EPA Trash Free Waters Program**

With the growing concern of marine debris, the EPA recently implemented the Trash Free Waters (TFW) program, which is focusing its efforts in the Southeastern US. The TFW program implementation consists of three phases. The first phase, reconnaissance, involves creating an inventory of existing program and efforts relating to aquatic trash. The second phase, regional strategizing, involves discussing and planning for the most effective routes to achieving trash free waterways. The third phase, implementation, involves supporting and implementing various projects, as well as setting and measuring goals.

Reconnaissance efforts occurred in towns along the Gulf of Mexico in 2014 and a task force waste established to begin establishing a Trash Free Waters effort for the Hillsborough River and adjacent waterbodies. The data collection and analysis by the UF research team began soon after to quantify the PAT within the HRW.

2.2. **Keep Tampa Bay Beautiful**

Keep Tampa Bay Beautiful (KTBB), a local affiliate of Keep America Beautiful, is a non-profit organization that has been working to provide meaningful service to the Tampa Bay area since 1989. In 2012, they merged with a similar organization, Keep Hillsborough County Beautiful to increase their impact in the community. KTBB hosts various events to improve the quality of life in the area, including hosting various litter cleanups, lending recycling bins to local events, and creating adopt-a-road programs, along with other special events and educational programs. KTBB has removed over 125 tons of waste from their area and improved over 930 miles of road and 3,000 acres of public lands.

One of the most prominent events organized by KTBB is the Hillsborough River & Coastal Cleanup (HRCC). During this event, thousands of volunteers participate in cleanups along the Hillsborough River and other adjacent waterways throughout Hillsborough County. Volunteers not only collect and remove litter at this event, but also collect detailed data on the number and type of littered items that are collected, as well as the overall tonnage (Keep Tampa Bay Beautiful 2015).
2.3. Keep Pasco Beautiful

Keep Pasco Beautiful (KPB) is a local affiliate of Keep America Beautiful in Pasco County. They were established in 1992 as Keep Pasco Clean and Green, and underwent a name change when they received their certification through Keep America Beautiful in 1994. Much like KTBB, KPB hosts various cleanup activities, including the annual Great American Cleanup, a Keep America Beautiful event hosted on the third Saturday of every April. In 2015, KPB attracted 497 volunteers to this event and recovered over 17 tons of PAT. They also host various recycling events, educational events, and hold an annual art contest for local high-schoolers based on art made of recycled materials (Keep Pasco Beautiful 2015).

2.4. WaterVentures

WaterVentures: Florida’s Learning Lab is a mobile science center with a focus on water education and increasing awareness of how water affects the average person’s life. This customized 53 foot semi-trailer travels throughout Florida, making appearances at schools, communities and events. The WaterVentures truck is accompanied by a staff of trained educators who interact directly with the public to educate them on stewardship of Florida’s diverse watersheds. Topics covered by the WaterVentures exhibits include aquifers, wetlands, the water cycle, water conservation, recycling, global affairs, the water molecule, watersheds, and hydrology (WaterVentures 2015).

2.5. Tampa Bay Watch

Tampa Bay Watch (TBW) is a nonprofit organization established in 1993 that trains and organizes volunteers from various backgrounds to participate in environmental projects that benefit Tampa Bay. These environmental projects include salt marsh plantings, storm drain markings, oyster bar creation, coastal cleanups, and wildlife protection events. They also offer educational opportunities. Volunteers that participate in TBW activities include citizen volunteers, students, scout groups, at-risk youth and civic organizations. TBW regularly publishes newsletters, annual reports and long-term strategic plans for their restoration activities (Tampa Bay Watch, 2015).
2.6. Crystal Springs Preserve

Crystal Springs Preserve is a privately owned 525-acre sanctuary located in Crystal Springs, FL. The preserve’s name comes from Crystal Springs, a magnitude 2 spring system located within the preserve, which is also the source of water for Zephyrhills Water. Crystal Springs Preserve offers a variety of educational programs and experiences for visitors, including school groups and other youth organizations. The preserve prides itself on giving visitors the opportunity for hands-on, directed learning opportunities among its miles of wooded trails, river boardwalks, nature center, wilderness pavilion and butterfly gardens (Crystal Springs Preserve 2015).

2.7. Recycling Programs in the Watershed

The state of Florida has a 75% recycling goal by 2020, which all Florida counties are required to assist in reaching by implementing their own recycling programs (FDEP, 2010a). In 2013, Hillsborough County led the state with a recycling rate of 73%. Pasco County and Polk County reported recycling rates of 67% and 29% respectively in the same year (FDEP, 2014). These recycling rates include both traditional recycling, as well as renewable energy credits as assigned by the Florida Department of Environmental Protection (FDEP, 2010a). WTE facilities that recover energy from the incineration of MSW are given recycling credit, which is counted towards the county recycling rate. Traditional recycling involves the recycling of items such as plastic containers, paper products and metal containers into new products. The traditional recycling rates for each county in the HRW since 2008 are displayed in Table 2-1.

Table 2-1: Traditional recycling rates from 2008-2013 for each county in the Hillsborough River Watershed

<table>
<thead>
<tr>
<th>County</th>
<th>2008(^1)</th>
<th>2009(^2)</th>
<th>2010(^3)</th>
<th>2011(^4)</th>
<th>2012(^5)</th>
<th>2013(^6)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hillsborough</td>
<td>38%</td>
<td>38%</td>
<td>42%</td>
<td>29%</td>
<td>40%</td>
<td>43%</td>
</tr>
<tr>
<td>Pasco</td>
<td>33%</td>
<td>38%</td>
<td>22%</td>
<td>24%</td>
<td>24%</td>
<td>36%</td>
</tr>
<tr>
<td>Polk</td>
<td>23%</td>
<td>23%</td>
<td>24%</td>
<td>29%</td>
<td>30%</td>
<td>25%</td>
</tr>
</tbody>
</table>

\(^1\)FDEP, 2009; \(^2\)FDEP, 2010b; \(^3\)FDEP, 2011; \(^4\)FDEP, 2012; \(^5\)FDEP, 2013; \(^6\)FDEP, 2014

2.7.1. Hillsborough County

Waste management in Hillsborough County is split into five districts and the City of Tampa. Unlike the rest of the county, the City of Tampa is not within a district, and manages its own trash and recycling collection. Within the five waste districts, each household is provided
with a 65-gallon blue recycling cart. A single stream recycling system is utilized, where all recyclable materials, including paper products, plastic containers (#1-7), plastic packaging, glass containers, aluminum cans, and other recyclables may all be commingled in one receptacle. Residents receive two garbage pickups, one recycling pickup, and one yard waste pickup each week. The City of Tampa recycles a range of items similar to what is recycled throughout the rest of county, with the exception of plastic films and packaging. Beginning in February 2013, the City of Tampa began transitioning its residents from 14-gallon blue recycling bins to 96-gallon green recycling carts. There are several household hazardous waste collection locations throughout Hillsborough County.

2.7.2. Pasco County

Pasco County residents may recycle in any bin, can or cart that displays the reflective recycling sticker provided by their waste hauler. Residents who pay for twice-a-week curbside garbage pickup also receive recycling pickups at least twice a month. Only plastic, glass and metal containers may be recycled through curbside recycling. Paper recycling drop-offs are located at various fire stations, libraries, parks or schools throughout the county, and the profits from these drop-off locations typically go to the facility hosting them. Pasco County also offers recycling programs for a variety of household hazardous waste items including anti-freeze, fluorescent bulbs, and motor oil, among others.

2.7.3. Polk County

Polk County offers curbside recycling in yellow bins. A single stream system is utilized in Polk County, which accepts glass bottles and jars, paper products, cartons, cardboard, newspaper, plastic containers (#1-7), and aluminum or tin cans. Recycling is collected weekly on the same day as garbage and yard trash. Four household hazardous waste collection centers are available throughout the county.
3. Materials and Methods

Data were reported from a variety of sources to the UF research team. Most of the data had some location assigned, but further site descriptions were required to properly characterize and analyze the data. The mapping software, Google Earth Pro (https://www.google.com/earth/) was used to locate, identify, and determine acreage of sites on cleanup data cards. Microsoft Excel was used for statistical analyses and database management. ESRI’s ArcGIS software suite was used to map the points from the database. The following sections describe the process and assumptions required to accurately develop the 2015 HRW PAT Assessment Map, referred herein as “the map.”

3.1. Data Collection

An initial call for data was announced in March 2014. KTBB and KPB responded to this call with data from cleanup activities that occurred from 2008-2014 in their respective areas, which amounted to a total of 1,970 points. These data points were geolocated and filtered by the UF research team until they were reduced to only points that fell within the watershed and had quantifiable information on litter collected; this resulted in 1,015 usable points. As the efforts of these organizations have progressed through the years, their methods for data keeping have done the same. Data collected in later years typically had a higher level of detail compared to data from earlier years. This data was preserved within the database, but for comparisons between years total weights were used. Locations for storm drain markers, storm drain sedimentation traps, waste disposal facilities and educational campaigns were also provided and added to the map.

3.2. Data Assumptions

In many instances, assumptions had to be made to ensure that every applicable data point could be represented as accurately as possible. As provided, data points were typically indicated by a location name without specific geographic coordinates, and often without an indication of the total area covered by the cleanup. Sites with discrete boundaries (e.g., schools, parks, businesses) were geolocated by UF and cleanup areas were determined using the area measurement tool in Google Earth Pro. Unless explicitly stated in the reported data, the entire area of the cleanup site was established as the cleanup area. For example, John B. Sargeant Park
is 23 acres and all cleanup events at this site were assumed to have covered the entire 23 acres (SFWMD 2015). The use of this data is described in the following section. When the location listed was a roadway, the cleanup was assumed to cover the width of a double lane road (50 feet) and a distance of 2 miles, covering 12 acres. When “Hillsborough River” was listed as the location, an area of 9 acres was assumed, which was the median size of all other identified cleanup areas within the watershed (excluding the 12 acre road cleanup sites). The median was used instead of the average, which was 61 acres, because of a non-normal distribution of cleanup location areas towards smaller cleanups. The distribution of the areas covered in cleanups, excluding those that are based on the above assumption, is displayed in Figure 3-1. Cleanup areas of very large sites (greater than 100 acres) are preserves and larger parks. Without descriptions of the actual sub-areas covered at those sites, the entire area was used to determine concentration.

![Figure 3-1: Distribution of areas covered during cleanups](image)

In many instances, the number of trash bags used for a cleanup was reported but total collected weights were not. The weight of litter can vary considerably and in these cases, an assumption of 20 lbs of PAT per bag was made. This is the assumption typically used by KAB in their reporting (Keep America Beautiful 2012). Therefore, in many cases, both the weight of PAT collected and the area in which it was recovered were determined from assumed values. Wherever possible, reported measurements were used.
3.3. PAT Concentration

Cleanup data cards typically reported the number of bags and then a calculated weight based on the 20 lbs/bag assumption described in the previous section. The quantity of PAT recovered at a cleanup event was divided by the area of the cleanup site to determine a PAT concentration for that site. PAT concentrations (amount of waste in a specified area) are reported in lbs/acre. PAT concentrations were calculated for 1,015 points from 2008-2014 and were used in the development of the map.

3.4. Mapping

Following the filtering of the data, the applicable data points were mapped using ESRI ArcGIS software. Water body, county, and city boundaries were obtained from the Florida Geographic Data Library (FGDL, 2015). The map was projected using the Albers Conical system. The geographic coordinate system (GCS) used was North American 1983 HARN.

PAT concentrations were represented as points which were scaled and color coded by the lbs/acre value. Once the points were plotted, tools available within ArcGIS were utilized to separate the locations into several distinct areas: Tampa, Plant City, Temple Terrace, unincorporated Hillsborough County, and unincorporated Pasco County. Data sets were also calculated for Hillsborough County and Pasco County in their entirety. No data points were provided within Polk County, which covers the easternmost portion of the watershed. To achieve these results, the ArcGIS tools that were used included project, buffer, clip, dissolve, and IDW (inverse distance weighted).

3.5. Waste Composition

Historically, waste composition (components of the recovered PAT) was not recorded at all cleanup events. Waste composition was reported for the 2014 HRCC and these data were examined to determine if they could be used within the map or the Excel database. Waste composition was reported on each collection card by item count (not weight) and these data were imported into a separate Excel worksheet. These data have not been incorporated into the map, but the reported quantities of waste components from the 2014 HRCC are reported in the Results Section 4.3 and comments were made regarding the findings.
3.6. Total PAT in Watershed Areas

Some of the data submitted to the UF research team were not able to be used for the development of the map. National Pollutant Discharge Elimination System (NPDES) permits submitted by counties contained data reported by the NGOs (e.g., KTBB, KPB, etc.) for litter removal. Additional cleanups in stormwater basins, stormwater sediment traps, and street sweeping collection directly managed by the municipalities were also reported. To further estimate the amount of unmanaged litter that was recovered before becoming aquatic trash, these data were used to estimate the total PAT (TPAT) within the municipality. Data were reported by quantity of items, bags, or volumes. Assumptions to normalize all data were required in each case. A specific weight of 220 lb/yd$^3$ for litter was used in the case of collected litter volumes (Tchobanoglous et al. 1993). Tires and furniture were also assumed to be 20 lbs/item. The fraction of county area that falls within the watershed was multiplied by the TPAT determined in the NPDES to estimate the concentration within the watershed. This assumes TPAT are distributed evenly throughout the county.
4. **Results and Discussion**

Data from a variety of sources were compiled to develop a map of the concentrations of recovered PAT within the HRW. Data submitted by counties in the NPDES permits were not typically geolocated and could not be added to the map. However, they could be used to estimate the TPAT within the county. Additionally, storm drain markings submitted by TBW were not associated with cleanup data, but were added to the map to identify areas where active educational campaigns are underway to inform residents of the environmental impacts of littering. Similarly, WaterVentures locations were added to the map to identify areas visited by the learning lab. Cleanup data results and the estimation of TPAT within the HRW are presented below.

4.1. **Results by Year**

The number of submitted cleanup events with documented information on waste quantities increased significantly from 2008 to 2014. Due to the lack of available data at the time of completion of this report, 2015 was not reported here. The results by year are summarized in Table 4-1. In 2008, there were only two usable points in the watershed with documented waste quantities, both within the City of Tampa. The higher of these two points reported approximately 5.3 lbs/acre, and the lower reported 2.9 lbs/acre. In 2014, there were 235 applicable data points across the watershed. These points ranged in magnitude from 0.39-2800 lbs/acre, with 179 of these points falling below 20 lbs/acre. The greatest number of collection events reported occurred in 2013.

<table>
<thead>
<tr>
<th>Year</th>
<th>Number of Events</th>
<th>PAT Collected</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Minimum</td>
</tr>
<tr>
<td>2008</td>
<td>2</td>
<td>2.9</td>
</tr>
<tr>
<td>2009</td>
<td>27</td>
<td>0.59</td>
</tr>
<tr>
<td>2010</td>
<td>31</td>
<td>0.063</td>
</tr>
<tr>
<td>2011</td>
<td>181</td>
<td>0.39</td>
</tr>
<tr>
<td>2012</td>
<td>255</td>
<td>0.39</td>
</tr>
<tr>
<td>2013</td>
<td>279</td>
<td>0.063</td>
</tr>
<tr>
<td>2014</td>
<td>235</td>
<td>0.39</td>
</tr>
</tbody>
</table>

Figures 4-1 – 4-7 are the yearly cleanup efforts within the watershed from 2008-2014. Data are presented on a logarithmic scale (factors of 10). This emphasizes the point that the
majority of cleanups were found to have low concentrations of PAT but a handful of larger cleanups reported high recoveries of PAT from the watershed. This is described in detail in the following section, Results by Area.

Figure 4-1. There were 2 cleanup events in the HRW in 2008.

Figure 4-2. There were 27 cleanup events in the HRW in 2009.
Figure 4-3. There were 31 cleanup events in the HRW in 2010.

Figure 4-4. There were 181 cleanup events in the HRW in 2011.
Figure 4-5. There were 255 cleanup events in the HRW in 2012.

Figure 4-6. There were 279 cleanup events in the HRW in 2013.
The focus of the majority of the cleanups has been in the lower portion of the Hillsborough River, specifically within the City of Tampa. Significant portions of Pasco, Polk and unincorporated Hillsborough County have yet to be investigated for PAT recovery.

4.2. Results by Area

Data were analyzed by region to determine if there were differences observed in PAT concentration within the watershed. Once the points were mapped, they were separated by area and scaled by magnitude. Figure 4-8 displays the final map of recovered PAT from 2008-2014 from the HRW including litter cleanups, locations of sedimentation traps, waste disposal facilities, WaterVentures visits, and storm drain markings. A total of 1,015 cleanups at 168 unique locations were reported throughout the HRW. The average amount of PAT collected throughout these cleanups was 52 lbs/acre and the median amount was 4.8 lbs/acre. The large discrepancy between the average and median can be explained by the non-normal distribution of points and several outliers of large magnitude. Detailed results by data type and area are discussed below.
Figure 4-8: Map of the Hillsborough River watershed with all provided data incorporated.
4.2.1. Hillsborough County

Of the three counties in the watershed, Hillsborough County makes up the largest portion of the watershed, covering almost 230,000 acres of the total 457,000 acres. Of the 1,015 debris cleanups utilized in this study, 1,007 of them fell within Hillsborough County. These results are illustrated in Figure 4-9. The average value of PAT collected was 50 lbs/acre, and the median value of PAT collected was 4.8 lbs/acre. The two points with the highest values in the entire dataset, 4,700 and 7,600 lbs/acre respectively, fell within Hillsborough County, lending to the large discrepancy between the average and median. The distribution of the data was skewed towards events that resulted in less than 10 lbs/acre of PAT collected.

Figure 4-9: Histogram of events within Hillsborough County, with a non-normal distribution skewed to the right.

The four largest cleanups by density, resulting in over 2,000 lbs PAT/acre, were all at either Mann Wagon Park or Reese’s Fish Camp, two small parks. A majority of the largest cleanups by density took place in parks or communities as opposed to streets or industrial areas. Hillsborough County encompasses Tampa, Temple Terrace, and Plant City as well as a significant unincorporated area. Only four points within Hillsborough County fell in Plant City, and they were all at the same location. Further details on cleanup events within Tampa and Temple Terrace are discussed below.
4.2.1.1 City of Tampa

Tampa is the largest city represented in the watershed, and encompasses the point where the Hillsborough River meets Tampa Bay. Of the 1,007 points within Hillsborough County, 449 of them fell within the City of Tampa. The average and mean amounts of PAT collected were 56 and 6.7 lbs/acre, respectively, with a large discrepancy between the average and median once again explained by two of the largest data points having significantly higher concentrations than the majority of cleanups. The distribution of points in Tampa follows a pattern similar to that seen in Hillsborough County, with a skew towards smaller collections and a majority of the points falling between 1 and 10 lbs/acre of PAT collected. Similar to Hillsborough County, the majority of high density collections took place at parks. These results are summarized in Figure 4-10.

![Figure 4-10: Histogram of events within Tampa, with a non-normal distribution skewed to the right.](image)

Stormwater drain markers were added to areas by Tampa Bay Watch. The markers indicate that storm drains lead to the Hillsborough River without treatment, and should not be used as a waste bin. The storm drain markers were placed on the roads highlighted in Figure 4-11. Attention should be paid in future years to this area to evaluate the efficacy of the storm drain markers in reducing PAT concentrations here. As Figure 4-11 shows, there are some cleanup events in the vicinity that reported high concentrations of PAT.
4.2.1.2  

City of Temple Terrace

Of the 1,007 points within Hillsborough County, 252 of them fell within the City of Temple Terrace. The average and median amounts of PAT collected in this area were 2.5 and 0.79 lbs/acre, respectively. As with Hillsborough County and the City of Tampa, the distribution of cleanup concentrations were skewed to the right (the tail of data points is to the right), however the overall magnitude of events in Temple Terrace was much lower. Approximately 72% of the cleanups in Temple Terrace reported less than 1 lb/acre. Unlike Hillsborough County and Tampa, the five largest events in Temple Terrace took place along roads; a majority of the remaining points took place at Riverhills Park. These results are summarized in Figure 4-12.
4.2.2. Pasco County

Of the total 1,015 points used, only 8 were within Pasco County, which covers 166,000 acres of the HRW. The average and median amounts of PAT collected in Pasco County were 230 and 37 lbs/acre, respectively, which are both significantly higher than found in any of the other areas. Unlike the results in Hillsborough, the Pasco County results were skewed towards cleanup events with a larger PAT concentration. These results are summarized in Figure 4-13. Additional data points would be beneficial to more realistically assess PAT in Pasco County.

Figure 4-12: Histogram of events in Temple Terrace, with a non-normal distribution skewed to the right.

Figure 4-13: Histogram of events within Pasco County, with a non-normal distribution, skewed to the left.
4.3. Waste Composition

Because waste composition was infrequently or inconsistently reported in cleanups, the data have not been used in the development of the map. However, waste composition can be a crucial tool to assess potential environmental impacts (e.g., toxic materials) or target specific items for campaigns to reduce litter (e.g., monofilament line on fishing piers).

Typical waste composition studies report waste types, such as newspaper, cardboard, and food waste, by weight. This is because waste management programs charge for treatment or disposal of waste by weight. The following data from the 2014 HRCC are reported by count per category of waste and shown in Figures 4-14 – 4-19. Smaller more common items (e.g., food wrappers) are recovered in higher frequency than bulky items (e.g., furniture) and result in a higher count.

Figure 4-14 shows all plastic items collected during the HRCC. These are grocery bags, plastic bottles, cups, lids, straws, to-go containers, 6-pack rings, and other items. These are frequently single-use items, intended for disposal. They are inexpensive to manufacture, and while some of them are widely recycled, others are difficult to recycle.

Figure 4-14. Plastic items collected during the 2014 HRCC.
Figure 4-15 shows all items associated with food and beverage packaging and service. Similar to the items in Figure 4-14, these items are typically intended for a single use. Drink cans and glass bottles are both recyclable in Hillsborough County, where this debris was collected. The remaining items are typically more difficult to recycle.

Figure 4-15. Food wares collected during the 2014 HRCC.

Figure 4-16 shows household items including clothing, toys, and writing utensils. Unlike the items displayed in the previous figures, these items are typically intended for extended use. While difficult to recycle, items such as clothing, shoes and toys can be refurbished or repurposed to avoid disposal.
Figure 4-16. Household products collected during the 2014 HRCC.

Figure 4-17 shows residual items that were collected during the HRCC. Most of these items have limited, if any, recycling or reuse options. Several of these items, such as weapons, needles, and household hazardous waste (HHW) can pose significant threats to human health and the environment.

Figure 4-17. Residuals collected during the 2014 HRCC.

Figure 4-18 shows durable goods collected, including larger items such as appliances and furniture. Construction materials such as wood or metal, and a variety of components from
appliances and electronics often have viable recycling or recovery options. Furniture can often be refurbished or repurposed to avoid disposal. While most of the items seen in this figure are larger and heavier than previously discussed items, and therefore are less likely to be moved into the river by a storm event or other means, they can significantly decrease the aesthetic value of an area, and some may have the potential for harm to human health or the environment.

Figure 4-18. Durable goods collected during the 2014 HRCC.

Figure 4-19 shows a variety of items used for fishing that were collected. For this collection, each yard of fishing line was considered one piece. These items are often small and found in the water, where they can pose a significant threat to aquatic organisms who may try to ingest the debris or become ensnared in it. While most of these items don’t have many mainstream recycling options currently available, some smaller operations have found alternative uses for used fishing gear.
Waste composition can be valuable data for waste managers to target operations on specific waste fractions. The efforts documented here have historically been to remove all PAT from the watershed. At this stage, this strategy is still encouraged because of the vast quantities of small debris that are consistently reported in cleanup efforts. However, larger items such as TVs or appliances that are intentionally littered may have larger environmental impacts than small items and a potential avenue of research to investigate these impacts may guide cleanup and educational campaigns in future years.

One concept could be to develop a waste impact scale that could comparatively assess different waste components based on specified criteria. The point would be to develop criteria to quantitatively identify waste components of greatest concern, and focus cleanup and educational campaigns on those items. Examples of criteria could include toxicity to the environment, ability of items to be transported throughout the watershed (by air or water), the ability of items to photodegrade or biodegrade, and the potential of the wastes or degraded constituents to bioaccumulate within the ecosystem. Based on the different waste types, like those shown in Figure 4-20, the magnitude of each criteria would be different.
This idea would require a time and energy to be developed but could prove a useful tool for those seeking to prioritize cleanups of specific waste types. This would also require accurate waste composition to be collected for all cleanups to ensure accurate data are being collected across the watershed. This is not currently in development at UF but is provided as a point of discussion to highlight the fact that different waste types will behave and impact ecosystems differently. At this point in time, it is not recommended to prioritize removal by litter type, but continue to removal all PAT from the watershed.

4.4. Total Potential Aquatic Trash

The map in Figure 4-8 shows the progress of cleanup events that have taken place throughout the watershed. However, this should not be taken as a complete accounting of the total amount and distribution of PAT and aquatic trash present in the HRW. The absence of data do not mean the absence of PAT. In order better estimate the total potential aquatic trash (TPAT) distribution in the watershed other reports of litter removal were reviewed. Collected PAT by NGOs was considered along with other previously unmanaged debris that is recovered by municipalities (e.g., stormwater basins, sediment traps, street sweepings, etc.). In order to estimate this, NPDES reports from each county were utilized, which report the total amount of litter collected each year by county programs as well as NGOs. These amounts were then multiplied by the ratio of the area of the county within the HRW to the total area of the county to estimate how much TPAT exists within the watershed.
4.4.1. **Hillsborough County**

Litter cleanups reported in the Hillsborough County NPDES included operations by the county and a contractor, as well as KTBB and its predecessor, KHCB. An average of over 1,150,000 lbs (5.1 lb/acre) was estimated for the portion of Hillsborough County within the HRW. This data is summarized in Table 4-2 below. The discrepancies between these values and values reported in Section 4 are expected because this information includes operations run directly through the county. In Tampa alone, 16,850,000 lbs of PAT was reported between government and NGO cleanups. Applying the fraction of the city in the watershed to this total, 9,390,000 lbs (220 lbs/acre) of TPAT is estimated to be in the portion of Tampa within the HRW. This value is larger than the value of litter collected within Hillsborough County and this is discussed in Section 4.4.4.
<table>
<thead>
<tr>
<th>Data Type</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
</tr>
</thead>
<tbody>
<tr>
<td>County¹</td>
<td>16,216</td>
<td>3,567,520</td>
<td>6,095</td>
<td>1,340,845</td>
<td>17,163</td>
</tr>
<tr>
<td>Contractor²</td>
<td>401,180</td>
<td>383,000</td>
<td>319,240</td>
<td>40,900</td>
<td>22,380</td>
</tr>
<tr>
<td>KHCB/KTBB Adopt-A-Road</td>
<td>40,900</td>
<td>22,380</td>
<td>30,192</td>
<td>38,777</td>
<td>35,159</td>
</tr>
<tr>
<td>KHCB/KTBB Coastal Cleanup</td>
<td>49,720</td>
<td>61,827</td>
<td>70,888</td>
<td></td>
<td></td>
</tr>
<tr>
<td>KTBB Pick-up Events</td>
<td>40,900</td>
<td>22,380</td>
<td>30,192</td>
<td>38,777</td>
<td>35,159</td>
</tr>
<tr>
<td>Street Sweepings</td>
<td>401,180</td>
<td>383,000</td>
<td>319,240</td>
<td>40,900</td>
<td>22,380</td>
</tr>
<tr>
<td><strong>Total (lbs)</strong></td>
<td>4,059,320</td>
<td>1,808,052</td>
<td>4,196,180</td>
<td>3,833,343</td>
<td>3,416,482</td>
</tr>
<tr>
<td><strong>Total in watershed (lbs)</strong></td>
<td>1,356,170</td>
<td>604,048</td>
<td>1,401,893</td>
<td>1,280,674</td>
<td>1,141,406</td>
</tr>
<tr>
<td><strong>Total in watershed (lbs/acre)</strong></td>
<td>5.92</td>
<td>2.64</td>
<td>6.12</td>
<td>5.59</td>
<td>4.98</td>
</tr>
</tbody>
</table>

¹ From 2008-2010 a value of 220 lb/yd³ (Tchobanoglous et al. 1993) was used to estimate weight for county collection, which included large materials (appliances, furniture, etc), not litter, during those years. In 2011, weights of 20 lb/bag for full 42 gallon bags was used to estimate weight for county collections, which were typical litter that year.

² Contractor data was not tracked in 2011 and 2012

### 4.4.2. Polk County

The litter cleanup operations reported in the Polk County NPDES includes inmate work through the Weekend Detention Program, county operations, and Keep Polk County Beautiful (KPCB) events. An average of over 83,000 lbs (1.35 lbs/acre) was estimated for the portion of Polk County within the HRW. This data is summarized in Table 4-3.
Table 4-3: Litter collection reported in Polk County NPDES reports 2007, 2008, 2011 and 2012. Reports from 2009 and 2010 were not available.

<table>
<thead>
<tr>
<th>Data Type</th>
<th>2007</th>
<th>2008</th>
<th>2011</th>
<th>2012</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>bags/items</td>
<td>lbs</td>
<td>bags/items</td>
<td>lbs</td>
</tr>
<tr>
<td>Inmate work</td>
<td>32,318</td>
<td>646,360</td>
<td>38,876</td>
<td>777,520</td>
</tr>
<tr>
<td>KPCB Litter Pickup</td>
<td>1,894</td>
<td>37,880</td>
<td>1,333</td>
<td>26,660</td>
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<tr>
<td>KPCB Adopt-A-Highway</td>
<td>3,001</td>
<td>60,020</td>
<td>1,545</td>
<td>30,900</td>
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<tr>
<td>KPCB Waterway Cleanup</td>
<td></td>
<td></td>
<td>152</td>
<td>3,170</td>
</tr>
<tr>
<td>Roadway Maintenance/ Water</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Resources</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tires (all)</td>
<td>4,640</td>
<td>92,800</td>
<td>9,093</td>
<td>181,860</td>
</tr>
<tr>
<td>Furniture (all)</td>
<td>24</td>
<td>480</td>
<td>668</td>
<td>13,360</td>
</tr>
<tr>
<td>Appliances (all)</td>
<td>7</td>
<td>140</td>
<td>20</td>
<td>13,600</td>
</tr>
<tr>
<td><strong>Total (lbs)</strong></td>
<td><strong>837,680</strong></td>
<td><strong>1,030,700</strong></td>
<td><strong>2,375,700</strong></td>
<td><strong>2,708,560</strong></td>
</tr>
<tr>
<td><strong>Total in watershed (lbs)</strong></td>
<td><strong>40,024</strong></td>
<td><strong>49,246</strong></td>
<td><strong>113,509</strong></td>
<td><strong>129,413</strong></td>
</tr>
<tr>
<td><strong>Total in watershed (lbs/acre)</strong></td>
<td><strong>0.65</strong></td>
<td><strong>0.80</strong></td>
<td><strong>1.85</strong></td>
<td><strong>2.10</strong></td>
</tr>
</tbody>
</table>
4.4.3. Pasco County

NPDES reports were not available from Pasco County at the time that this report was produced. A total of 42,560 lbs of PAT was reported in cleanup events examined in this study. If that quantity of PAT were distributed over the 166,650 acres of Pasco County within the watershed, it would produce a PAT density of 0.26 lbs/acre. This value is expected to increase when county operated cleanups are taken into account.

4.4.4. Watershed

The estimated TPAT densities derived from NPDES reports varies greatly from 0.65 lbs/acre seen in 2007 in Polk County, to a maximum of 6.12 lbs/acre seen in 2010 in Hillsborough County. Applying these values to the entire watershed produces estimates ranging from 457,000 to 2,800,000 lbs of TPAT generated in the HRW each year. The actual amount of TPAT is likely closer to the higher end of the estimates, since not all PAT is collected, and the density of PAT increased significantly in Polk County since the estimate of 0.65 lbs/acre was seen in 2007. This may have more to do with increased cleanup efforts than an actual increase in littering.

The PAT recovered by NGOs was compared to the TPAT reported by municipalities, and is shown in Table 4-4. In general, the PAT is a fraction of the other debris collected by the municipalities, indicating that even more PAT may be unaccounted for in areas that have not been investigated, such as northern Hillsborough County.

<table>
<thead>
<tr>
<th>Year</th>
<th>Hillsborough County</th>
<th>City of Tampa</th>
<th>Polk County</th>
<th>Pasco County</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PAT (lbs)</td>
<td>TPAT</td>
<td>PAT (lbs)</td>
<td>TPAT</td>
</tr>
<tr>
<td>2007</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>40,024</td>
</tr>
<tr>
<td>2008</td>
<td>540</td>
<td>1,356,170</td>
<td>540</td>
<td>49,246</td>
</tr>
<tr>
<td>2009</td>
<td>6,620</td>
<td>604,048</td>
<td>6,580</td>
<td>-</td>
</tr>
<tr>
<td>2010</td>
<td>11,700</td>
<td>1,401,893</td>
<td>10,160</td>
<td>-</td>
</tr>
<tr>
<td>2011</td>
<td>49,542</td>
<td>1,280,674</td>
<td>37,014</td>
<td>113,509</td>
</tr>
<tr>
<td>2012</td>
<td>70,389</td>
<td>1,141,406</td>
<td>34,560</td>
<td>129,413</td>
</tr>
<tr>
<td>2013</td>
<td>54,108</td>
<td>19,531</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>2014</td>
<td>50,961</td>
<td>18,467</td>
<td>9,390,734</td>
<td>42,320</td>
</tr>
</tbody>
</table>
The TPAT quantities are estimates based on the assumptions described in Section 3.6. The magnitude difference between the PAT and TPAT values indicates littering in the HRW will continue without strong educational campaigns, regulatory policies, and implementations of programs that encourage litter reduction. Litter cleanups are a response to a problem that has already occurred. The solution is to engage the public in ways that decrease the ability or desire to litter. This may include increasing waste bin availability in public areas or adding signage in areas where significant PAT is recovered. As mentioned previously, it is difficult to determine with the current dataset if generation is occurring at these sites or if they are points of accumulation within the watershed.

4.5. Costs of PAT Recovery

There are a number of waste collection and management facilities throughout the HRW. These facilities charge a tipping fee to dispose of waste. NGOs help remove unmanaged waste that enters the environment either through accidental negligence or intentional abandonment. These groups rely on the volunteer hours, incur the costs of paid employees and necessary equipment (nets, bags, vehicles) to recover the PAT. The city or county incurs the cost of tipping fees to actually dispose of the waste, as well as the costs of employees to transport the waste. Meanwhile, the entire community incurs the costs of environmental degradation and lost tourism that may result from accumulation of litter in the waterways. While these organizations have an essential role in keeping their communities clean, ultimately the best way to reduce the cost of managing waste within the HRW is for each citizen and visitor to responsibly manage the waste that they produce. Factors such as availability of waste receptacles, incentives for recycling, and educational campaigns could have an impact on individuals’ decisions about how they manage their waste.

As the impacts of the 2008 Recession are receding, tourism is again taking off in Southwest Florida. The warm waters of the Gulf of Mexico, beautiful beaches with tropical shells, and warm climate are ideal for vacationers from across the world. As part of the continued investment in the community, it is vital to reduce the amount of PAT that could pollute the waterways, reduce the aesthetics of these valued areas, and negatively impact local habitats that the tourist industries depend on.
It is difficult to quantify environmental degradation or its impacts to tourism, especially when such changes take lengths of time to be fully realized. The total quantity of waste collected by NGOs from 2008-2014 was 144 tons. Taking the average tipping fee (waste disposal fee) as $65/ton, the cost of all waste—had it been properly managed—was found to be $9,340. A small sum to ensure clean waters.

Figure 4-21. The cost of collecting all the litter outweighs the cost of the trash being disposed of properly in the first place.

However, when accounting for all 94,400 volunteer hours and using the federal minimum wage of $7.25/hour, the cost of waste collection and disposal for the same time was $693,000 or about $5,000/ton. This does not include the cost of equipment and supplies to collect the waste, the fuel required for volunteers to reach cleanup sites, or any quantification of environmental degradation, as indicated in Figure 5-2. The actual costs of PAT recovery could be even higher.
5. **Recommendations to Improve Data Quality**

In order to transform the Hillsborough River into a trash-free waterway, it is first necessary that the magnitude and impact of current efforts are understood. This report offers a basic understanding of the current state of cleanup operations within the HRW. Since any debris within the watershed have the potential to become aquatic trash, it is crucial that litter reduction efforts focus not only on the river and adjacent land, but also areas throughout the watershed. In order to gain the best understanding of the progress of these operations, accuracy in measurements must become a priority.

In order to continue tracking the progress of cleanups in the HRW, it is essential information be recorded and reported in a consistent manner. There were hundreds of points that were not incorporated into this study because of a lack of information; most no information on the amount of waste collected was reported. Additionally, much of the recovered PAT are estimated based on a conservative 20 pound per bag assumption. Because the most common types of litter are disposable items, such as cigarette butts, plastic bottles, plastic bags, aluminum cans, etc., this assumed value may overestimate the quantity of PAT within the HRW. Portable hanging scales could be used to weigh bags, significantly increasing the accuracy of the reported measurements and removing this uncertainty from future studies.

For this study, areas covered by most cleanup events were estimated by the UF research team. Current and common technologies now allow for location tracking without the use of stand-alone GPS devices. Third-party GPS applications (apps) for smartphones such as GPS Essentials (mictale.com) and Simple GPS Coordinate Display (Generic Co.), MyTracks (Google, Inc.) are available through the Google Play store for android smartphones. Similar apps are available for Apple devices via the Apple App Store. The Marine Debris Tracker (Southeast Atlantic Marine Debris Initiative) is a unique app specifically for cataloging and geolocating PAT. Registered users can report recovered debris and later download the quantity of items and GPS data. A walkthrough for this program is given in Appendix A.\(^1\) Smartphones and internet-enabled computers can track locations in real-time, enabling highly accurate location data.

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\(^1\) UF does not endorse the use of any third-party applications. The use of applications is at the discretion of the user.
In the development of the map, the entire area of each identified site was used to determine concentration (e.g., Rowlett Park is 84 acres). This may underestimate the PAT concentration in areas where waste is collected in only a specific region of the site (e.g., in the picnic area of Rowlett Park). If the areas were identified at the time of the cleanup, more accurate PAT concentrations could be calculated. Additionally, more conclusions could be drawn as to the source of the PAT. If recovery of PAT is occurring in the upland areas of parks, it could be assumed that generation of PAT is occurring onsite and different tactics such as increasing waste bins or signage could alleviate littering. However, if PAT recovery was occurring on shorelines or within the river at the site, that location may be a site of PAT accumulation, where actual waste generation is occurring upstream. In such instances, educational campaigns or increasing waste bins at the site would not significantly impact the amount of PAT recovered. Again, the use of GPS technologies could improve the quality of data for these purposes.

Additional information that affects the success of a cleanup event could further aid in normalizing data. Events attended by large groups of people, lasting for longer durations, or utilizing more equipment could result in much greater recovery than other events covering the same area with less resources. Consistency in what aspects of the cleanup event are reported could aid in the creation of a standard data set in which cleanups could be directly compared to better understand success and progress.
6. Conclusions

Litter cleanup data reported by NGOs were used to develop a map that quantified the PAT within the HRW. From 2008-2014, 1,015 cleanup events occurred at 168 unique sites within Hillsborough and Pasco Counties. Stormwater drain markings in the south Tampa area were installed to educate the local population not to litter. Fliers were also distributed in the area with personal, house visits in an effort to reduce litter from entering the stormwater systems, which drain to the Hillsborough River. It will be necessary to focus on the reported cleanups in these areas to determine if the educational campaigns are contributing to litter reductions. As previously mentioned, some of the litter is likely coming from upriver locations and is transported via the river or stormwater systems to downstream locations. There is a significant disparity between cleanup events occurring in the south Tampa area and the upper Hillsborough River near the border of Hillsborough County and Pasco County. Cleanup efforts in Pasco and northern Hillsborough should be targeted as these areas contain unknown quantities of PAT, which may be transported to the lower portions of the river and into Tampa Bay. If significant quantities of PAT are entering the river upstream, they may be more difficult to recover in the lower portions without sea-going equipment and resources. As mentioned in the Recommendations, identifying what types of equipment and specifying the areas that were cleaned can greatly improve the data analysis towards identifying sources of the PAT, which was not possible from the current data set.

Because areas within the watershed were not selected for cleanup, the total PAT within the watershed is likely an underestimate. TPAT was estimated by the local NPDES permits which track litter removal, street sweepings, and other debris collection programs. Some of the TPAT data were not geolocated and could not be added to the map. The PAT data reported by NGOs were mostly geolocated and constitute the points on the map. Therefore, the map represents - not all- but a significant quantity of the PAT actually recovered in the HRW.

The next phase of research and collaboration will focus on defining metrics that all groups within the Partnership will monitor. Once metrics are in place and a plan of action is agreed upon within the community, implementation can occur. The establishment of the HRW TFW Partnership will ensure the TFW program continues and grows in the coming years. The resolution drafted on February 24, 2015, will act as a motivating document for private and public
groups as well as government agencies to participate in the combined efforts to establish the Hillsborough River and adjacent waterbodies as EPA Trash Free Waterways.
7. References


Appendix A. Walkthrough to install and use the Marine Debris Tracker (MDT) for your smartphone or network-enabled tablet

MDT tracks debris collected just like you normally do with a pen and paper. Except it also adds GPS data so the exact location of items is also recorded. These data are sent to a marine debris database established by Dr. Jenna Jambeck and NOAA but are also available for download by registered users. Therefore, data recorded with MDT can be tracked in real-time, and analyzed at a later date (http://www.marinedebris.engr.uga.edu/).

To download the Marine Debris Tracker, go to your favorite app store and search “Marine Debris Tracker.” The logo is shown in Figure 1.

Install remotely to your device if you’re on the computer, the app is about 10 megabytes.

Before opening the app, make sure your phone’s GPS is enabled.

On android phones:
Settings
More
Location, Click ON

Smartphone companies (Android, Apple, Microsoft, etc.) record GPS data from users. You can prohibit this by Disagreeing with the terms prompted when you turn on the location feature of your phone.

Disagreeing will still allow the MDT to register GPS coordinates, so you can have your privacy, and still help collect data!
On your mobile device, open the app. You will see the following image. **Start tracking** takes you to the list of pollutants to track.

**Change list** refers to the list of pollutants. For our purposes, the default list (Marine Debris items) is what we want. You’ll see the top tracker groups below those two buttons.

The screen will show all sorts of categories and each category contains a lot of common waste items.

To test out the app, click **Top Items**

Scroll to the bottom to find the **Test Item**

Click on the 1 next to **Test Item**.

Enter 5.

Click **Log**

Click **Submit 5 items**

Click **Submit as MDT User**

Enter the following credentials:

Username: 
Password:  

Click **Login through MDT**

Logging in allows all the data to be stored under a single account that can be accessed online at [http://www.marinedebris.engr.uga.edu/data](http://www.marinedebris.engr.uga.edu/data)

You should log and submit the items at every new location you go to because the data are georeferenced.

You’ve tracked your trash. Now you know how to use the app, and you can always use it because it’s right in your pocket!

Other questions can be answered at [http://www.marinedebris.engr.uga.edu/](http://www.marinedebris.engr.uga.edu/)
Appendix B. Map Database of Recovered PAT from 2008-2014 in the HRW.
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