

Assessment of Marine Debris in the Mid-Atlantic

Delaware, Maryland, New Jersey, New York and Virginia



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The Mid-Atlantic Regional Council on the Ocean (MARCO) recognizes that information on marine debris is rapidly evolving; continued review is important to understand the systems affected by marine debris management and research efforts. The information in this report will inform MARCO activities, but nothing in this document should be construed as a MARCO endorsement or MARCO policy. We hope that others find the information in this report useful to their marine debris efforts. Funding for this project was through Delaware Coastal Management Program using Federal funds under award NA15NOS4190166 from the National Oceanic and Atmospheric Administration (NOAA), U.S. Department of Commerce (DOC). The statements, findings, conclusions, and recommendations do not necessarily reflect the views of NOAA or the DOC.

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Background

This report is an initial assessment of marine debris in the five state MARCO region and a compilation of highlights from the National Oceanic and Atmospheric Administration Marine Debris Reduction Workshop for Delaware, D.C., Maryland and Virginia held in June 2015 (National Oceanic and Atmospheric Administration Marine Debris Program, 2015). Marine debris and coastal litter is becoming a glaringly obvious indicator of increased world consumption, population, and neglect for the environment. The United States has taken a lead role in reducing marine debris and onshore marine litter through many government and NGO initiatives. Marine debris has slowly become a hot button issue because of its highly visible and abundant presence in the marine environment. One of MARCO's shared regional priorities is water quality which highlights ocean acidification and marine debris initiatives.

Since 1986, the International Coastal Cleanup (ICC) has been leading volunteers on a crusade to clean the world waterways and oceans. In addition to removing trash and litter from streams, rivers, beaches and coastal waters, volunteers also collect data about what they find. The data used to analyze marine debris in the region are gathered by the ICC through large-scale volunteer efforts (Ocean Conservancy, 2013) (Fig.1). Data are available to the public for the years 2008-2015. Though the data collected by the ICC are robust, spanning many years for a large geographic range, they are only a snapshot of marine debris trends and collection efforts happening in the region. The ICC does not account for volunteer effort as a measure of time spent on each beach; it also does not require a specific methodology for data collection and cleaning. For this reason, it is also important to look at other

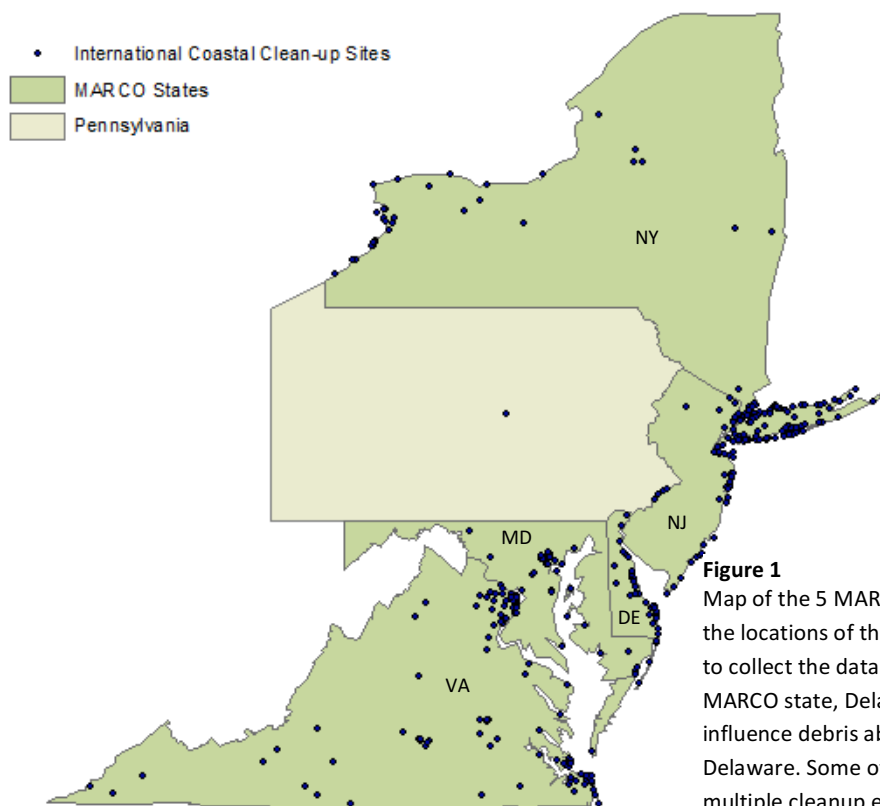


Figure 1
Map of the 5 MARCO states plus Pennsylvania (PA) and the locations of the International Coastal Cleanup used to collect the data. Though Pennsylvania is not a MARCO state, Delaware River cleanups in PA can influence debris abundance in New Jersey and Delaware. Some of the dots on the map represent multiple cleanup events.

valuable data sources such as the National Marine Debris Monitoring Program (NMDMP) (Sheavly, 2007).

The Environmental Protection Agency along with the Ocean Conservancy developed the NMDMP after a series of pilot studies that evaluated the best methodology for collecting marine debris monitoring data. The program was created to standardize marine debris monitoring methodology leading to more statistically valid data collection. The NMDMP used indicator items to track changes in debris abundance from land-based, ocean-based, and general-source items over a period of five years from 2001-2006. For the study the United States was split into nine regions and 20 beaches were chosen in each region; region 2 encompassed the Northeast/Mid-Atlantic from South of Cape Cod, MA to Beaufort, NC (Sheavly, 2007). There were 13 sites in the monitoring study found on MARCO state beaches:

- | | |
|--|--|
| SITE 6 Hither Hills State Park, NY | SITE 13 Fenwick Island State Park, DE |
| SITE 7 Westhampton Beach, NY | SITE 14 Delaware Seashore State Park, DE |
| SITE 8 Robert Moses State Park, NY | SITE 15 Strathmere, NJ |
| SITE 9 Jones Beach State Park, NY | SITE 16 Chincoteague Island National Wildlife Refuge, VA |
| SITE 10 Gateway National Recreation Area, NJ | SITE 17 Back Bay National Wildlife Refuge, VA |
| SITE 11 Island Beach State Park, NJ | SITE 21 Bradley Beach, NJ |
| SITE 12 Cape Henlopen State Park, DE | |

From 2001 to 2006 the NMDMP found a significant increase of indicator items from land-based, ocean-based and general source items. The increase of general-source items was 30.2% annually and included items such as plastic beverage bottles (13.8%) and small plastic bags (7.7%). Land-based sources increased by 24.2% annually and included indicator items such as straws (39.4%), balloons (7.7%), and cotton swabs (5.9%) (Sheavly, 2007).

Though the NMDMP monitoring is no longer occurring in the Mid-Atlantic the guidelines set forth by the EPA and Ocean Conservancy can serve to help standardize future marine debris monitoring surveys. It is also important to note that the National Oceanic and Atmospheric Administration (NOAA) has also developed methodology for standardized shoreline monitoring and cleanup (<http://marinedebris.noaa.gov/sites/default/files/ShorelineFieldGuide2012.pdf>). As stated before, the data gathered by the ICC from 2008 to 2013 will be used in this report to find initial general trends of marine debris in the Mid-Atlantic.

The ICC is organized worldwide by the Ocean Conservancy. In the mid-Atlantic, the ICC is organized by:

Delaware: Delaware Department of Natural Resources & Environmental Control

Maryland: Geri Schlenoff- Independent

New Jersey: Clean Ocean Action and Adopt a Beach program (run by the NJ Clean Communities Council)

New York: American Littoral Society

Trends Over Time in the Mid-Atlantic

According to ICC data, from 2008-2015 the region had 156,878 volunteers clean 5,500 miles of coast and collect over 3.7 million pounds of debris (Ocean Conservancy, 2013). Cigarette butts show a very drastic dip in number collected during the 2011 collection year (Figure 2). This could possibly link to increased smoking bans on outdoor public places such as beaches and parks in the entire Mid-Atlantic region during this time frame. The trend could have also been influenced by extreme weather and rain events; the cleanup in 2011 occurred only a few days after Hurricane Irene. In 2013, the ICC changed the data collection process and regrouped some of these categories. For example, the category of food wrappers and containers in the 2008-2012 data is split into multiple categories in 2013-2015 including: food wrappers (candy, chips, etc.), take out/ away containers (foam), and takeout/away containers (plastic); the ICC does not provide a list of how categories were merged or divided between the data prior to and after 2013. Food wrappers (candy, chips, etc.) did make the top ten list for 2013-2015 as well as 2008- 2012 (table 1).

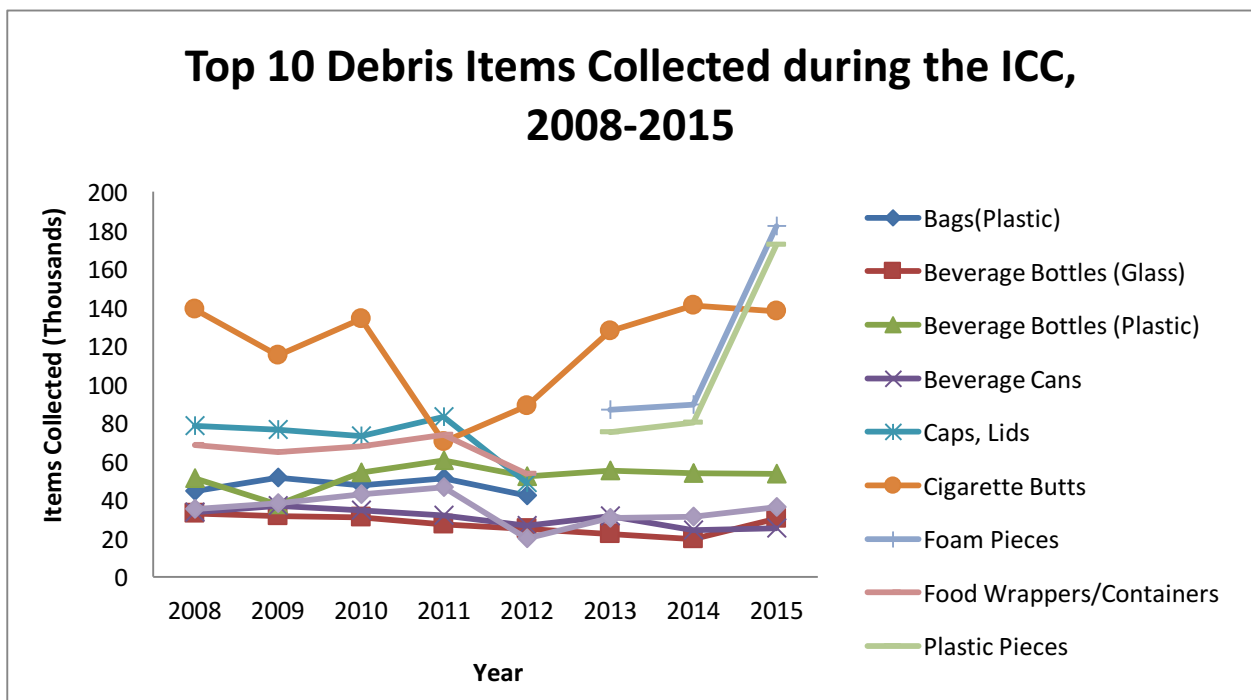


Figure 2

The graph details the top ten debris items from 2008-2015. Notably the categories of bags, caps and lids, and food wrappers and containers are removed as individual categories from the ICC after 2012, and are replaced by plastic pieces and foam pieces categories in 2013 (The Ocean Conservancy, 2013).

Table 1

Top ten collected debris items during the International Coastal Cleanup over the past 8 years were split into two timeframes due to changes in data collection and processing.

2008-2012	2013-2015
Cigarette Butts	Cigarette Butts
Caps, Lids	Foam Pieces
Food Wrappers/Containers	Plastic Pieces
Beverage Bottles (Plastic)	Food Wrappers (candy, chips, etc.)
Bags(Plastic)	Bottle Caps (Plastic)
Straws, Stirrers	Beverage Bottles (Plastic)
Cups, Plates, Forks, Knives, Spoons	Glass Pieces
Beverage Cans	Straws, Stirrers
Beverage Bottles (Glass)	Beverage Cans
Paper Bags	Grocery Bags (Plastic)

The Mid-Atlantic has seen an amazing amount of volunteer participation over the past 8 years of collection data. The ICC has been leading volunteer coastal cleanups for 30 years; given the steady participation of twenty thousand volunteers a year in the region, the Mid-Atlantic region has depended on over half a million volunteers to clean beaches after beach season over the past 3 decades. The distance cleaned during the ICC has fluctuated between 500 and 800 miles of coast line cleaned a year. The data reflected in Figure 3 contains data from inland waterways that flow into bays and ocean waters, as well as ocean and bay facing shorelines. Volunteers clean inland waterways such as the Anacostia River and Lake Erie; therefore, this data is not reflective of only the ocean facing shoreline (Fig. 1)

The material seen most often during the ICC in the Mid-Atlantic is plastic (83%) (Fig. 4). Not surprisingly plastic is also the most common type of marine debris found in the US, and scientists

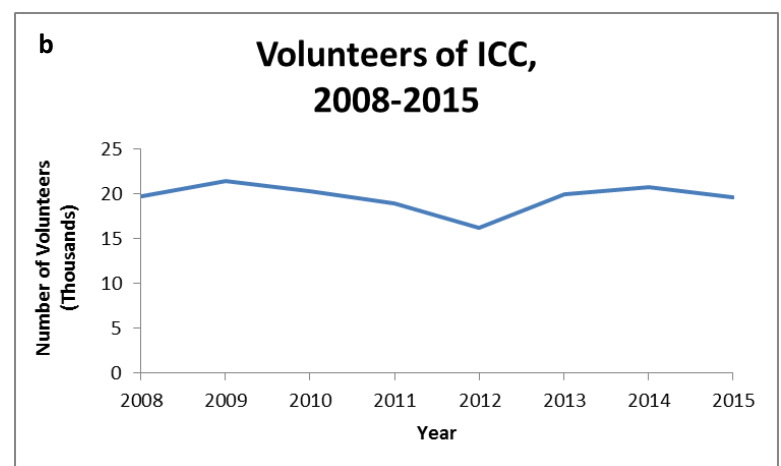
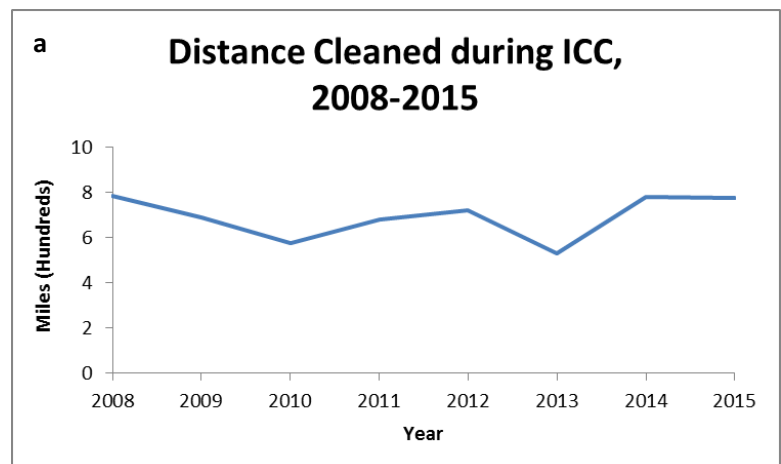


Figure 3 (a) and (b)

On average the Mid-Atlantic cleans 800 miles of beach a year (a) and the region has maintained a steady rate of volunteerism (b) over the past seven years. (The Ocean Conservancy, 2013).

estimate that 80 percent of debris that accumulates onshore and in the ocean is plastic (Wabnitz and Nichols,2010). The 16 percent of non-plastic waste represents categories that had specified material types such as metal bottle caps, rope, paper bags and glass pieces. The one percent of unspecified material found includes the categories of fishing buoys, pots & traps, and forks, knives, spoons; these categories did not specify material type nor could they be easily assumed.

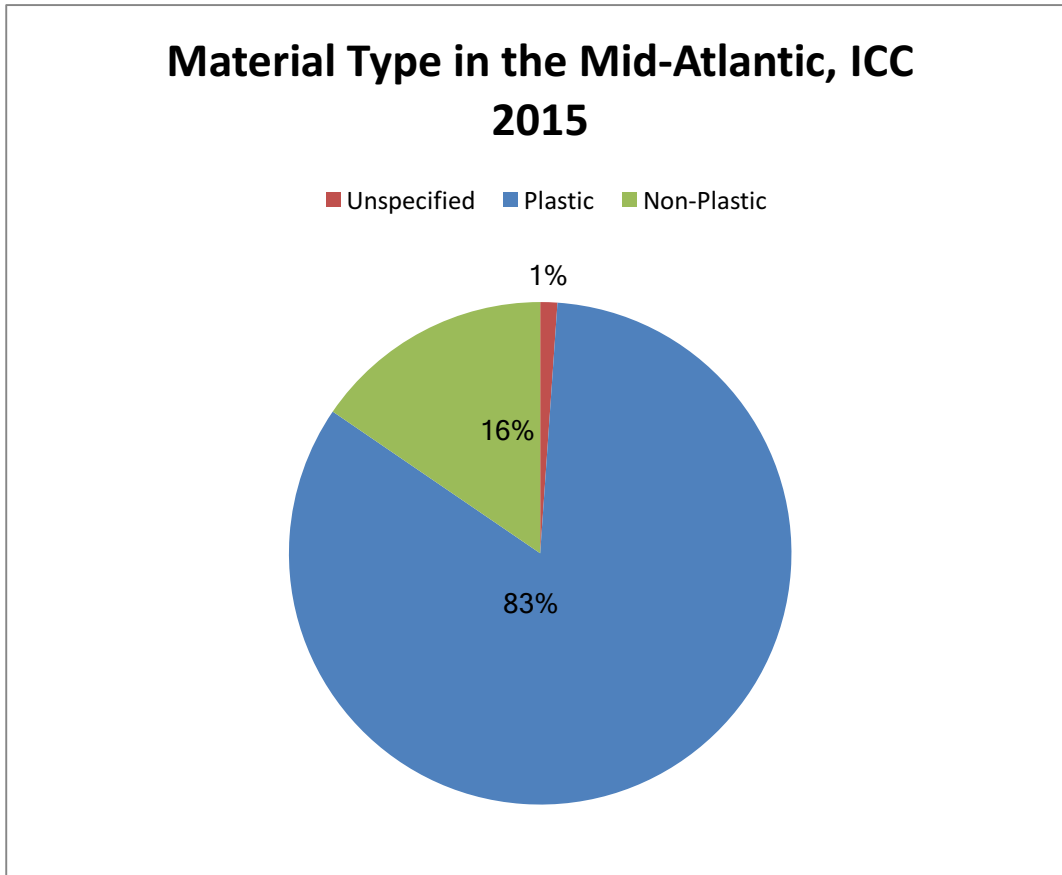


Figure 4
In the region plastics make up 83 percent of the debris found littering shorelines. Only one percent is unspecified material, which includes fishing buoys, pots & traps, and forks, knives, spoons (The Ocean Conservancy, 2013).

Comparison between States

The Mid-Atlantic is a very diverse region, home to many large coastal metropolitan areas and a variety of coastal and ocean environments which bring diverse environmental concerns. Many MARCO states have individual priorities because of the region’s assorted ecosystems and land use practices, therefore it is important to understand the issues of consumer debris and how they relate on a state by state basis. Comparing the top five items collected in each state, cigarette butts rank the highest in every state except Maryland (Fig. 5). Maryland has collected a significantly higher amount of foam pieces than any other state in the region as well as a large amount of plastic pieces.

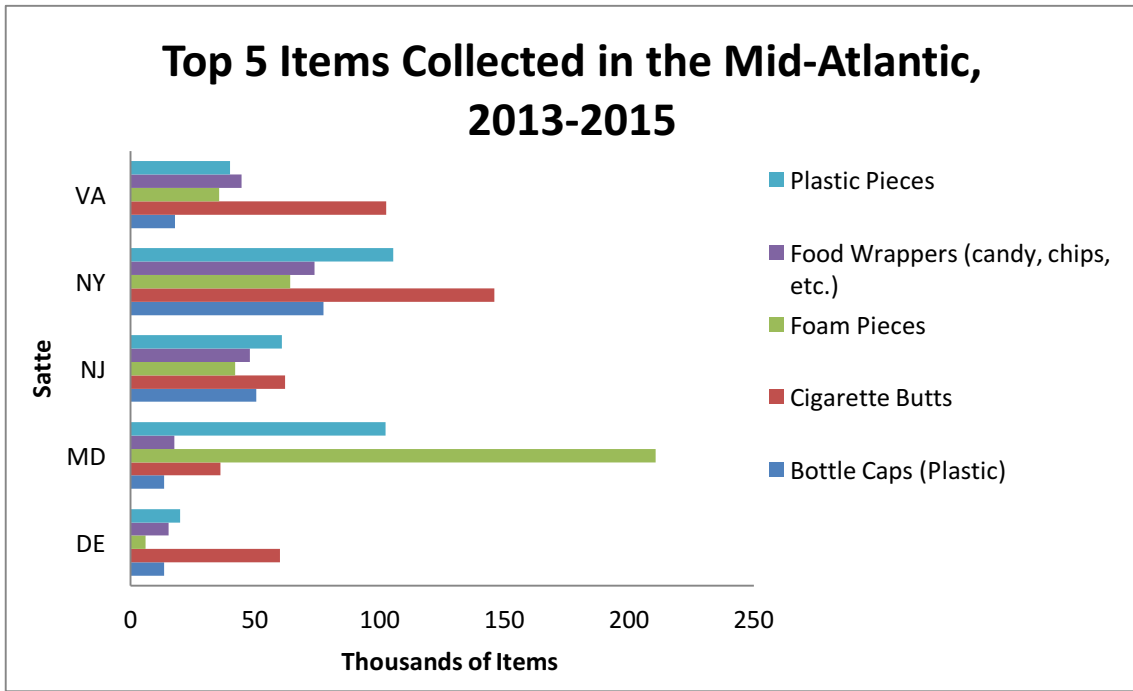


Figure 5
 The top five items of debris collected include three categories of consumer debris and two micro plastic categories. Only the years of 2013-2015 were used due to changes in data recording methods in 2013. The data reflects the diversity of regional debris and the abundance of cigarette butts found in most states. This chart does not account for amount of shoreline per state on which marine debris was collected (The Ocean Conservancy, 2013).

Virginia collected the greatest weight of debris of all five MARCO states; however, examining the number of debris items collected shows that Virginia is comparable to other states while New York has collected a high number of items (Fig. 6 (a) and (b)). This trend suggests that the debris Virginia is cleaning up is much heavier than debris New York is collecting. These results could point to the aquaculture industry; Virginia has a great amount of clam and oyster aquaculture and clam nets get washed onshore regularly. When nets and rope are found as debris items on beaches they are typically

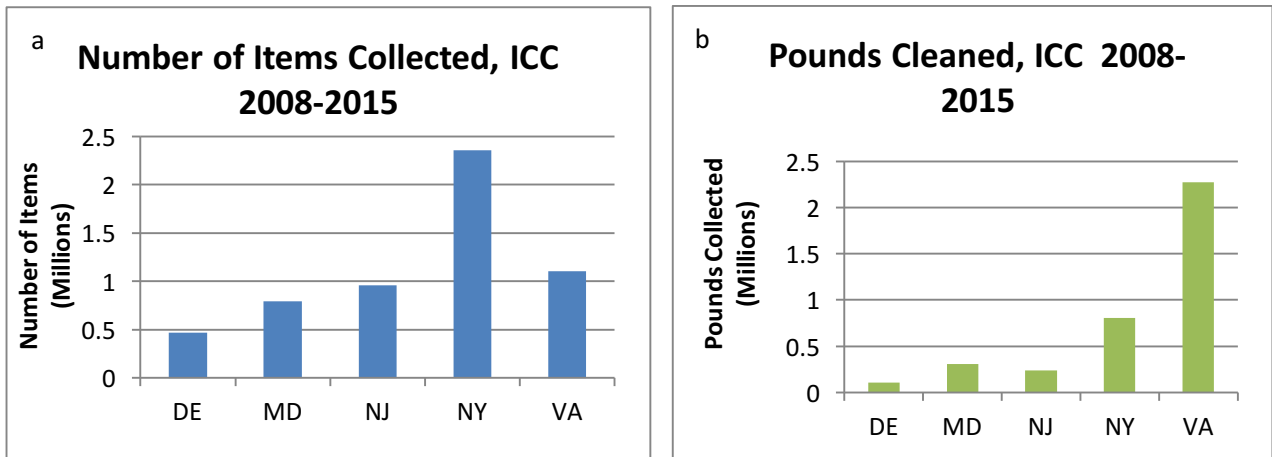


Figure 6
 New York had the most number of items collected over the past seven years (a); however, Virginia had the highest number of pounds of items collected (b) (The Ocean Conservancy, 2013).

heavy from water logging and biofouling. In contrast New York has the most items collected which could be linked to the large number of cigarette butts collected, approximately 150 thousand, greater than all other Mid-Atlantic States. The data was normalized by calculating effort using pounds of debris collected per volunteer (Fig. 7). Maryland and Virginia had the greatest amount of effort from their volunteers, averaging over 40 and 50 pounds per person respectively. Calculating effort per person considers the miles walked as well as the hours spent cleaning and therefore is the most efficient and accurate way to calculate effort with the data provided. The trends could be correlated to the intense cleanup associated with the Anacostia River in Washington D.C. The Anacostia River is known to be heavily polluted with consumer debris.

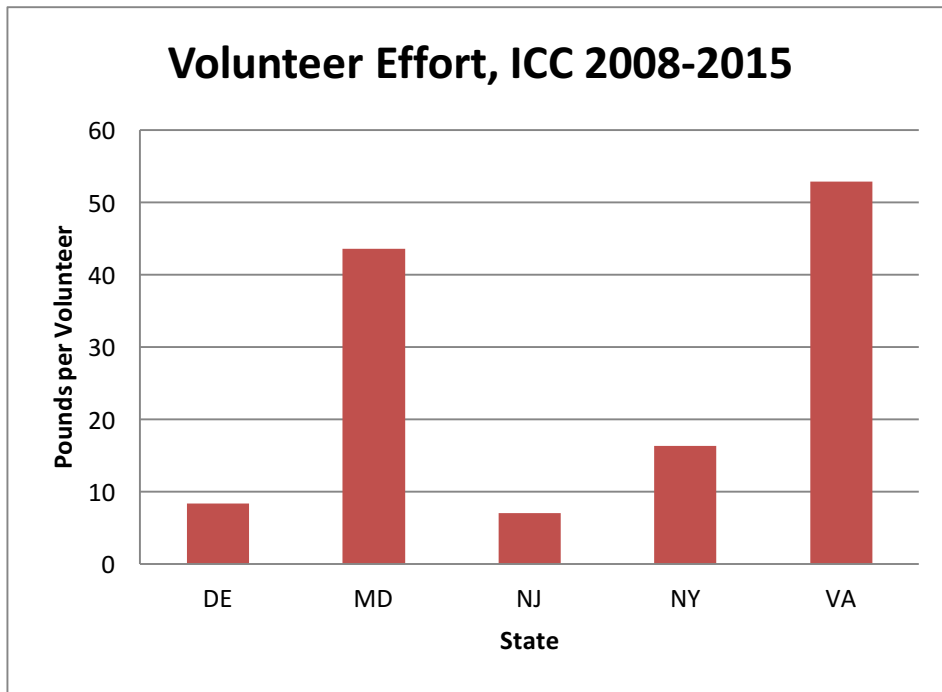


Figure 7

Virginia and Maryland had volunteers show the greatest amount of effort to clean the shorelines. Effort was calculated using the pounds of debris collected per person; this method factored in both time spent and distance walked (The Ocean Conservancy, 2013).

Another method used to understand the value of the ICC was calculating the monetary value of the volunteers. The ICC does not collect data on hours spent during the cleanup, therefore this value had to be calculated; It is estimated that it takes an adult, walking at an average pace, 20 minutes to walk one mile. Using this figure, hours were ascertained from mileage data and monetary value was calculated using state minimum wage (Volunteers X (miles X minutes) X state minimum wage= monetary value of volunteers' time). If MARCO states were to pay ICC volunteers a minimum wage to clean the Mid-Atlantic beaches, the states would spend on average a combined \$229,280 cleaning the coast line each year. Extrapolated over the last seven years it would have cost over \$1.5 million. These estimates are conservative because it typically takes longer to walk on sand and volunteers are constantly stopping to pick up debris. Using the same hourly estimate and the Independent Sector National Value of Volunteer Time (https://www.independentsector.org/volunteer_time) the Mid-Atlantic would have spent over \$700,000 on 2015's one day cleanup and almost \$5 million over the last seven years. The

Independent Sector's "value of volunteer time is based on hourly earnings of non-supervisory workers on private non-farm payrolls" (Independent Sector, 2016). Both of these figures represent ICC cleanup efforts, not the entirety of effort needed to clean all debris from the whole Mid-Atlantic coastline.

Cause for Concern

Consumer debris may seem small and harmless to humans, however, in the ocean, consumer debris as small as a bottle cap can cause death. According to *NOAA's Marine Debris Program*, there are two common ways marine organisms can be harmed by marine debris: entanglement and ingestion (NOAA Marine Debris Program, 2014a & 2014b). Animals can get entangled in derelict fishing gear and ropes, as well as aggregates of plastic floating on the surface of the ocean. Entanglement in plastic filament can lead to decreased swimming ability, life threatening injuries, disruption in feeding activity and even death by drowning (NOAA Marine Debris Program, 2014a).

Ingestion of consumer debris, common among sea turtles, marine mammals, and avian species, tends to have more prolonged effects. Ingestion of hard and sharp plastic objects can lead to lacerations and lesions in the intestines, causing malnutrition, starvation and internal bleeding. The blockage of the intestine can also lead to starvation and malnutrition, ending most certainly in death (NOAA Marine Debris Program, 2014a). Overtime consistent ingestion of plastics can cause large amounts of plastic debris to stay in the digestive tract eventually starving the animal of vital nutrients from natural prey. During this time toxins from plastic can be absorbed and buildup in the body causing neurological damage, reproductive failure, and cancer (Smith, 2014).

Plastic grocery bags and balloons are of special concern to the Atlantic Coast because of the large nesting and foraging populations of sea turtles that frequent the waters of the Atlantic Ocean. Research has found that plastic grocery bags look so much like jelly fish, sea turtles are selectively ingesting them (Schuyler, Wilcox, Townsend, Hardesty, & Marshall, 2014). Balloons and plastic bags get easily caught in a sea turtle's throat; the strings from the balloon can get wrapped around sea turtles' flippers and necks. Virginia is the only Mid-Atlantic state in which loggerhead sea turtles have been known to nest, but a large swath of ocean off the coast of Maryland, Virginia, Delaware and a portion of New Jersey has been designated as critical sargassum habitat for maturing hatchlings by the National Oceanographic and Atmospheric Association, National Marine Fisheries Service (NOAA NMFS) (Fig.8) (National Marine Fisheries Service, 2014). In the Mid-Atlantic, focus on shore nesting birds is much greater than sea turtles; the beaches are home to many migratory shorebird nesting grounds. A recent study claims that nearly every seabird species will have plastic in their gut by 2050; the scientists have already estimated that 60 percent of all seabird species have plastic in their gut and that 90 percent of all seabirds alive have ingested plastic (Wilcox, Van Sebille, & Hardesty, 2015). For these reasons, it is important to reduce the influx of consumer debris products into coastal waters and the ocean.

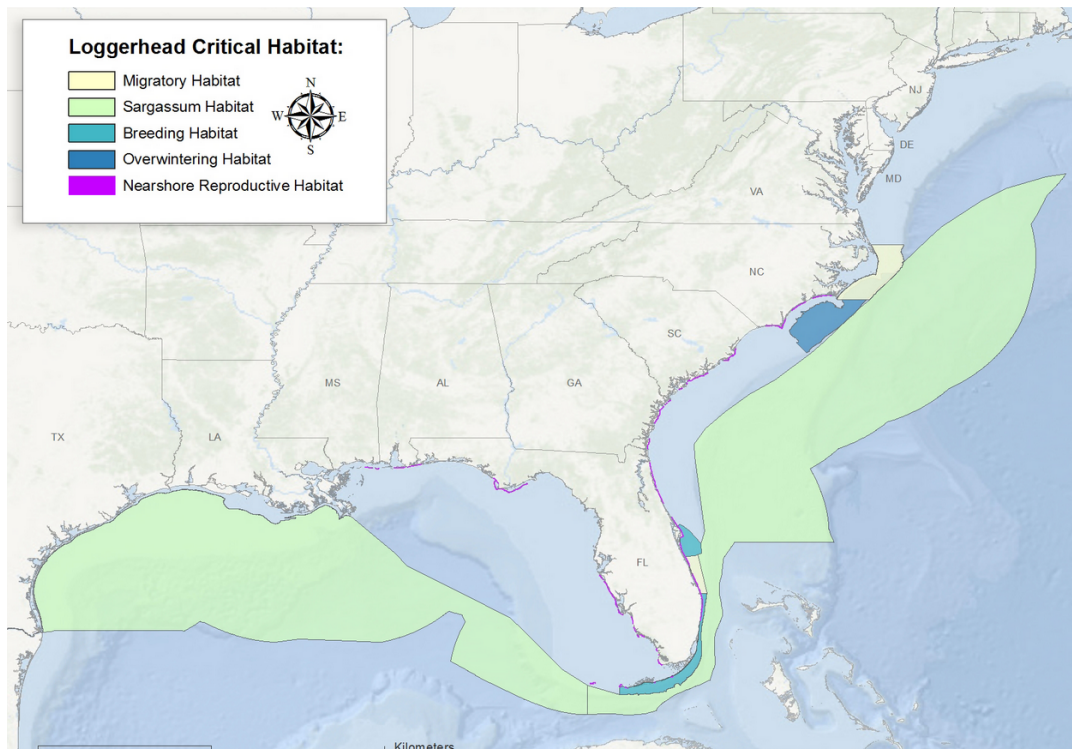


Figure 8
Critical habitat map created by NOAA NMFS showing essential habitats for threatened Loggerhead sea turtles. Even though there is very little nesting in the Mid-Atlantic there are still Mid-Atlantic coastal waters that would be hazardous for Loggerheads if polluted (National Marine Fisheries Service, 2014).

Policy Analysis

Cigarette Butts

Cigarette butts are the single most abundant marine litter in the world (Ocean Conservancy, 2015). The filters of cigarettes are made of plastic, and contain harmful chemicals that can leach into the water (Novotny, et al., 2011). The negative effects of these chemicals can persist in the environment for years. Sea birds are known to ingest large amounts of cigarette butts, ingestion not only leads to chemical toxicity, but also large amounts of indigestible plastics in the stomach can cause intestinal blockage (National Oceanic and Atmospheric Administration Marine Debris Program, 2014b).

Many states in the Mid-Atlantic have passed smoking bans on beaches and public parks over the past five years. Not only does this improve air quality and reduce the risk of second hand smoke, but it also helps keep cigarette butts off the ground avoiding ingestion by animals and humans, and keeping butts away from the ocean. Below is a list of beaches and parks with smoking bans for each state in the Mid-Atlantic.

New York

- Effective May 23, 2011, smoking was banned in all parks, boardwalks, beaches, recreation centers, swimming pools and pedestrian plazas in New York City.
- On December 31, 2014, a ban on outdoor smoking in New York parks was upheld unanimously by a mid-level court, reversing a judge and dismissing a challenge filed by a smokers' rights group to regulations promulgated by the Office of Parks, Recreation and Historic Preservation in 2013 establishing no-smoking areas various parks statewide, including popular beaches and all nine state parks within New York City. (NYC Parks, n.d.)

**For more information on smoking laws in New York City go to <https://www.nycgovparks.org/facility/rules/smoke-free>*

New Jersey

- There are more than 240 municipalities and 12 counties with ordinances in place that ban smoking in municipal and county parks. Additionally, more than a dozen municipalities have also enacted laws to ban smoking on beaches.
- Pequannock- banned smoking in public parks or playgrounds, 2011
- Seaside Park-smoking is banned on all beaches and boardwalks, 2011
- Harvey Cedars and Ship Bottom - banned beach smoking while lifeguards are on duty, 2013
- Long Branch and Sunset Beach in Cape May County -smoke free, 2014
- Belmar - smoking is banned on the boardwalk and on sections of its beaches, 2014
- Ocean City - designated smoking areas on its boardwalk, 2015
- Vetoed Bills
 - Introduced Bill 1/6/2014: Prohibits smoking on property acquired or developed for recreation and conservation purposes by local government units or nonprofit organizations using State funds.
 - Introduced Bill 1/6/2014: Prohibits smoking at State parks, forests, beaches, and wildlife management areas.
 - Introduced Bill 1/6/2014: Prohibits smoking at State-owned beaches.
 - Introduced Bill 1/6/2014: Permits municipality to establish civil penalty for smoking in public places. (New Jersey Legislature-Bills, n.d.)

**Taken from the NJ state Legislator, for more information about these bills go to <http://www.njleg.state.nj.us/bills/BillsByKeyword.asp>*

Virginia

- Smoking not allowed at state parks (Virginia State Parks, n.d.)

For more information on smoking laws in Virginia go to <http://www.dcr.virginia.gov/state-parks/rules-and-regulations>

Maryland

- Effective May 1, 2015, Ocean City has new designated smoking areas
 - Areas have 22-gallon waste receptacles located on the beach 15 feet off the Boardwalk.
 - Smoking allowed within 15 feet of the waste receptacle
 - The Boardwalk is a smoke-free zone.
 - The smoking rules apply to cigarettes, cigars, pipes, e-cigarettes, and any other matter or substance that contains tobacco.
 - Ocean City Beach Patrol is not responsible for enforcing the smoking rules
- Smoking is prohibited in state parks in areas where notice is posted (Smoking Rules at Ocean City, Maryland, n.d.)

**For more information about the smoking ban in Ocean City Maryland go to <http://ococean.com/explore-oc/smoking-rules>*

Delaware

- State Parks- May, 2011 “Tobacco Free Zones”
- Bethany Beach- Smoking banned in 2011
- Dewey and Fenwick Beach- smoking banned in 2013
- New Castles has smoke free parks and playgrounds since 2011
- Smyrna- smoking banned within 25 ft. of public spaces in 2011
- Delaware City- smoke Free parks since 2012
- Dover- smoke free playgrounds
- City of Rehoboth and Rehoboth Beach- Smoke free since March 2014
- City of Lewes- smoking banned at all city public parks and playgrounds (Delaware State Parks General Information, n.d.)

**For more information about Tobacco Free Zones on state park beaches go to http://www.destateparks.com/general_info/tobacco-free.asp*

Laws and regulations such as those listed above are the first step in decreasing cigarette butt abundance in the ocean, however large emphasis should be placed on social marketing and anti-litter campaigns in the future. Unfortunately, people are constantly throwing butts out of their car windows, though many who smoke would not consider this littering, the butts still end up in storm water drains that could lead directly to estuaries and the ocean.

Consumer Plastics

Plastic Bags

Plastic grocery bag bans gained national attention in 2007 when San Francisco, CA banned plastic bags in a number of grocery stores around the city. After a large national push for plastic grocery bag bans, many states, municipalities, and counties have adopted bag ban and bag fee ordinances. There are only a handful of states with municipality bag bans and fees, including two MARCO states: Maryland and New York. Also, notable in the region is the D.C. bag law entitled the Anacostia River

Clean Up and Protection Act (2009) which aims to change consumer behavior and encourage reusable bag use to decrease plastic grocery bag pollution in the Anacostia River (2010 DC B 150).

“DC- Bag Law

The Anacostia River Clean Up and Protection Act ('Bag Law') requires all District businesses that sell food or alcohol to charge five cents for each disposable paper or plastic carryout bag — whether or not food or alcohol products are purchased in the store.

The business retains one cent (or two cents if it offers a rebate when customers bring their own bag), and the remaining three or four cents go to The Anacostia River Clean Up and Protection Fund. The law also requires that reusable paper and plastic bags meet specific material and labeling requirements.” (Skip the Bag, Save the River, n.d.)

** Reprinted from the District Department of the Environment, for more information on the bag law in DC go to: <http://ddoe.dc.gov/bags>*

“MARYLAND - 2 ordinances covering 21 municipalities.

Chestertown - City Council passed a plastic bag ban that was effective January 2012

Montgomery County - Montgomery County passed legislation effective January 2012 that places a five-cent charge on each paper or plastic carryout bag provided by retail establishments in the County to customers at the point of sale, pickup or delivery. Retailers retain one cent of the fee and the remainder will be deposited into the County’s Water Quality Protection Charge Fund. The revenues will effectively shift the burden of litter clean-up costs from public taxpayers to consumers who have a choice to avoid the 5-cent charge by bringing reusable bags.

NEW YORK - 5 ordinances covering 5 municipalities.

Plastic Bag Reduction, Reuse and Recycling Act (2008 NY A 11725)

Retailers of stores are to establish in-store recycling programs that provide an opportunity for the customer to return clean plastic carryout bags to be recycled. The plastic carryout bags provided by the store must have printed on them “Please return to a Participating Store for Recycling.”

East Hampton - Plastic bag ban passed by the Village Board in July 2011 and effective February 2012.

Larchmont - The Village of Larchmont passed a plastic checkout bag ban in March 2013, effective October 2013.

Mamaroneck - Plastic bag ban passed by the Village Board in July 2012 and effective February 2013.

Rye - Plastic bag ban passed by City Council in December 2011 and effective May 2012.

Southampton - Plastic bag ban passed in April 2011 and effective November 2011.” (Surfrider Foundation, n.d.) (National Conference of state legislators, 2016)

**Reprinted from Surfrider and NCSL, for more state bag bans and fees go to <http://www.surfrider.org/pages/plastic-bag-bans-fees> or <http://www.ncsl.org/research/environment-and-natural-resources/plastic-bag-legislation.aspx#bans>*

Though only two MARCO states have existing legislation regarding the banning and feeing of plastic grocery bags, other states in the Mid-Atlantic are working to pass similar legislation. For example, Delaware State passed a law in 2009 that required retail stores with plastic carry-out bags to offer recycling receptacles for the bags in stores and to mark the bags with language that encouraged recycling (2009 DE H 15; Amended by 2014 DE H 198). Bag bans and bag fee bills have been considered in Virginia over the last few years, but have yet to result in passage of a law.

Plastic Beverage Bottles

Plastic beverage bottles are a prominent type of plastic consumer debris that plagues the natural environment. Areas with high population density such as Long Island, NY and Wilmington, DE see a large abundance of bottles in city adjacent water bodies. Though whole plastic bottles are not typically ingested by marine animals, there are still major implications to plastic bottles in the ocean, namely fragmentation (Barnes, Galgani, Thompson, & Barlaz, 2009). Fragmentation of plastic in the ocean occurs when sunlight causes molecules to split in a process called photodegradation (Barnes, Galgani, Thompson, & Barlaz, 2009). The fragmented pieces of plastic have many fates including ingestion by animals, which include smaller marine creatures, such as birds, fish and invertebrates, as well as becoming microplastics that have the potential to leach harmful chemicals into the environment.

There has been an effort to reduce litter, ease burden on solid waste facilities, and encourage recycling activity among some states through the introduction of a “Bottle Bill”. New York State is the only MARCO state with a “Bottle Bill” that requires retail stores to provide facilities for bottle return and a 5 cent per bottle deposit rate (2013 NY H. 202). The State of Delaware repealed their “Bottle Bill” legislation in 2009 and replaced it with the Universal Recycling Law which states recycling bins and regular recycling collection will be provided to all single-family homes and bottles that formerly carried the 5-cent refundable deposit then changed into a 4-cent recycling fee.

Caps and Lids

All plastic beverage bottles are accompanied by caps or lids, and though the beverage bottle (plastic #2) itself can easily be recycled, not all recycling facilities support bottle cap recycling (plastic #5) (Earth911, 2015). Recently, scientists and photographer Chris Jordan ventured to Midway Island in the Pacific to document the death of albatross related to the consumption of plastic (Jordan, 2014). Multiple bottle caps were found in the stomach content of many of the deceased birds, leading to a disturbing, yet eye opening realization that animals, specifically albatross are ingesting large magnitudes of plastic bottle caps on a regular basis (Jordan, 2014).

To find what local recycling facilities recycle plastic bottle caps go to <http://search.earth911.com/?what=%235+Plastic+Caps> .

To view a trailer for the movie *Midway*, documenting the scientists and Chris Jordan's time on the island, go to <http://blog.oceanconservancy.org/2013/03/28/midway-film-tells-story-of-plastics-in-our-ocean-through-plight-of-albatross/>

Food Wrappers and Containers

Another extremely abundant type of consumer debris found on beaches and in waterways especially close to highly populated areas are food wrappers. For the simple convenience of everyday life, most food comes prepackaged in plastic. Plastic is durable and light weight; it can keep food fresh for decades. Unfortunately, most of the plastic used to package food is difficult to recycle and is not reusable. Items such as individual candy wrappers or potato chip bags with a mylar lining, plastic bags that are used to package food, and cardboard or paperboard with oil stains from food (e.g. pizza boxes) are not recyclable (Earth911, 2015). Eventually these products make their way to a landfill where they can be easily blown into nearby estuaries and waterways.

A very specific type of food container typically used at restaurants for carry-out is polystyrene (Styrofoam). Polystyrene cannot be recycled. Below are two laws in MARCO states that ban polystyrene.

"NEW JERSEY

Rahway (1997) City ordinance bans retail food vendors located within the City of Rahway from selling, giving or providing eating utensils or food containers to any consumer within the City of Rahway if said eating utensil or food container is composed of polystyrene or polyvinyl chloride.

NEW YORK

Albany County (2014) County legislators passed an expanded polystyrene ban for chain restaurants with 15 or more locations nationwide. Passed in November 2013 and effective May 2014.

City of Glen Cove (1988) City ordinance banning all types of polystyrene foodware at restaurants.

New York City (2015) City ordinance banning all types of polystyrene foodware and foam packaging peanuts." (Surfrider Foundation, n.d.)

**Taken from Surfrider, for more polystyrene ordinances go to <http://www.surfrider.org/pages/polystyrene-ordinances>*

MARYLAND

Montgomery County banned foam food packaging at restaurants and the sale of foam food packaging and packing peanuts effective January 2016 (Lawson, 2015).

Prince George's County effectively passed a bill banning polystyrene foam food containers and packing material for distribution or sale at restaurants and retailers in July 2016 (Lawson, 2015).

DC

The District banned foam food packaging at restaurants effective January 2016.

*For more about polystyrene bans in Maryland go to <https://trashfreemaryland.org/2015/04/29/we-passed-the-foam-trifecta/>

Balloons

Balloons are not highlighted on the top ten list of debris items for the world, country, or region however, balloons are a very dangerous type of marine debris that deserve attention. Balloons have also been chosen as a focus of *Virginia's Marine Debris Reduction Plan* research (Register & McKay, 2014).

Balloons represent a small subset of debris that becomes litter intentionally. Many of the balloons found in the ocean are released for ceremonial purposes. Many people who take part in these balloon releases are unaware of the negative harmful affect balloons can have on wildlife. Though balloons do not make up a large proportion of the ICC numbers, they are a high concern item because of animal entanglement and ingestion. Though many believe latex balloons will biodegrade quickly, it takes many years for them to breakdown. Mylar balloons are made of plastic and do not biodegrade in the environment.

Balloon sales and manufacturing are hard to regulate because the public associates balloons with happy times and of the emotional and spiritual connection people have when they release balloons. However, one MARCO state was able to regulate mass releases of balloons.

"VIRGINIA

§ 29.1-556.1. Release of certain balloons prohibited; civil penalty.

A. It shall be unlawful for any person to knowingly release or cause to be released into the atmosphere within a one-hour period fifty or more balloons which are (i) made of a nonbiodegradable or nonphotodegradable material or any material which requires more than five minutes' contact with air or water to degrade and (ii) inflated with a substance which is lighter than air. Any person who violates this section shall be liable for a civil penalty not to exceed five dollars per balloon released above the allowable limit, which shall be paid into the Lifetime Hunting and Fishing Endowment Fund established pursuant to § 29.1-101.1.

B. The provisions of this section shall not apply to (i) balloons released by or on behalf of any agency of the Commonwealth, or the United States or pursuant to a contract with the Commonwealth, the United States, or any other state, territory or government for scientific or meteorological purposes or (ii) hot air balloons that are recovered after launch. (1991, c. 607.)

MARYLAND

In 2004, the Maryland legislature considered, but did not pass the following bill (House Bill 1029)

AN ACT concerning

Criminal Law - Large-Scale Balloon Release - Penalty

FOR the purpose of prohibiting a person from knowingly releasing or causing to be released in the outdoors a certain number of certain balloons as part of a public or civic event, promotional activity, or product advertisement; establishing a certain penalty for a violation of this Act; and generally relating to the prohibition against a large-scale balloon release.

SECTION 1. BE IT ENACTED BY THE GENERAL ASSEMBLY OF MARYLAND, That the Laws of Maryland read as follows:

Article - Criminal Law

(A) A PERSON MAY NOT KNOWINGLY RELEASE OR CAUSE TO BE RELEASED IN THE OUTDOORS 20 OR MORE BALLOONS THAT ARE FILLED WITH A GAS LIGHTER THAN AIR AS PART OF A PUBLIC OR CIVIC EVENT, ROMOTIONAL ACTIVITY, OR PRODUCT ADVERTISEMENT.

(B) A PERSON WHO VIOLATES THIS SECTION IS GUILTY OF A MISDEMEANOR AND ON CONVICTION IS SUBJECT TO A FINE NOT EXCEEDING \$500.

SECTION 2. AND BE IT FURTHER ENACTED, That this Act shall take effect October 1, 2004. (NOTE: BILL DID NOT PASS, AND IS NOT IN EFFECT AS OF JULY 2004)" (Clean Virginia Waterways, n.d.)

**Taken from Clean Virginia Waterways, for more information regarding balloon release laws in the US go to <http://www.longwood.edu/cleanva/BalloonLaws.html>*

Microplastics

Microplastics and microfibers are becoming an important part of marine debris research. These small fragments of plastic or plastic pellets can be ingested by filter feeders, such as mollusks, baleen whales, and copepods (Smith, 2014). There are a large amount of toxic compounds used to make plastics; plastics also have the ability to absorb organic contaminants like DDT and PCBs in the ocean. Research is showing a bioaccumulation of these chemicals up the food chain, indicating that even humans are ingesting possibly harmful persistent organic pollutants that could cause endocrine disruption, mutagenicity, and carcinogenicity (Smith, 2014).

Microplastics enter the ocean in various ways, including accidental spillage of small plastic resin pellets used in fabricating plastic products, referred to as "nurdles", and the fragmentation of large plastic items into smaller pieces over time (Smith, 2014). Microbeads found in cosmetic facial scrubs and dental whiteners are also a huge source of microplastic pollution in the water.

MARYLAND

In the spring of 2015, Maryland signed into law HB 216. The law bans plastic microbeads as an ingredient in personal care products, requiring manufacturers to phase out the use of plastic microbeads by 2018 and bans the sale of products containing them by the end of

2019. Maryland passed this law before the national microbeads ban passed in 2015 (Lawson, 2015).

*For more on Maryland's microbeads ban go to <https://trashfreemaryland.org>

Microbead Free Waters Act of 2015

In 2015, congress passed a bill to amend the Federal Food, Drug, and Cosmetic Act to prohibit the manufacturing and production of rinse-off cosmetics containing microbeads, including toothpaste. The ban on manufacturing microbead containing cosmetics begins July 1, 2017 and the ban on distribution begins January 1, 2018. Cosmetics that are over the counter drugs are granted an extra year for transition (<https://www.congress.gov/bill/114th-congress/house-bill/1321>).

Many people believe that the result of this bill will solve the issue of microplastics, however microbeads make up only a small proportion of microplastics in the ocean. There are many other sources of microplastics, such as those mentioned above, that could have grave impacts on the environment and numerous commercially valuable species of fish and mollusks.

Appendix (A) lists the location of Plastics Industry Trade Association members with headquarters in MARCO states. There are countless other small plastic fabrication and manufacturing plants in the Mid-Atlantic which can be accessed on the Plastics Industry Trade Association supplier website.

Derelict Fishing Gear

In addition to the consumer debris items discussed above, there are other sources of marine debris such as derelict fishing gear. Derelict fishing gear is a form of marine debris impacting the MARCO

watershed – especially derelict crab pots. The Chesapeake Bay is home to the largest blue crab fishery in the country. There are thousands of active pots a year that bring millions of dollars of revenue to the area. When pot lines are severed by boat propellers or lose their buoys they become derelict but continue to fish. In recent research scientists at the Virginia Institute for Marine Science (VIMS) found an average of 28-75 derelict blue crab traps per kilometer squared in the Chesapeake (Havens K. , Bilkovic,

Angstadt, & Hershner, 2008). The negative impacts of these traps include the catch of 33 different species of non-target animals including the endangered diamondback terrapin, oyster toadfish, Atlantic croaker, black sea bass, American eel, white perch, and catfish. The fishery loses a large proportion of harvestable catch, estimated at 900 thousand blue crabs,



Figure 2
Dead blue crabs and diamond back terrapins are often found in derelict fishing gear (Havens K. , Bilkovic, Stanhope, & Angstadt, 2011).

averaging 18-20 blue crabs per trap per year, possibly costing the fishery close to 300,000 in revenue per season (Havens K. , Bilkovic, Stanhope, & Angstadt, 2011). Another impact of derelict traps is habitat degradation. Traps can get tossed in storms and drag along the bottom damaging fragile benthic habitat (Havens et al., 2008).

NOAA Mid-Atlantic Marine Debris Reduction Workshop

In mid-June of 2015, the NOAA Marine Debris Program gathered scientists and managers from Delaware, D.C., Virginia, and Maryland to discuss the future of marine debris management in the region (National Oceanic and Atmospheric Administration Marine Debris Program, 2015). At the workshop scientists shared their research on marine debris and discussed goals and strategies to manage an array of marine debris types. Derelict fishing gear and consumer debris were both of high concern. As a group, participants brainstormed goals, objectives and strategies for each of five debris categories (derelict fishing gear, wildlife habitat impacts, abandoned or derelict vessels, consumer debris, and emergency response to debris). Workshop participants also learned about the goals and strategies found in the *Virginia Marine Debris Reduction Plan*. When complete, this plan, the first on the East Coast, may serve as a model or template for other states and may be expanded to include New York and New Jersey. Below is a compilation of major themes from the workshop discussions about derelict gear and consumer debris:

Derelict Fishing Gear

Who from the region is involved?

- Kirk Havens, Virginia Institute of Marine Science
- Matt Ogburn, Smithsonian Environmental Research Center
- Ward Slacum, Oyster Recovery Partnership
- Donna Bilkovic, Virginia Institute of Marine Science
- All scientists are working on a variety of different derelict trap issues like new technologies for doors and economic analysis.

Goals

- An assessment of the entire regions derelict pot issues including economic analysis
- Reducing impacts of derelict traps by focusing on culling rings
- Reach a percent reduction of impacts of derelict Blue Crab traps
- Prevent lost gear
- Clean up existing DFG

Unaddressed Issues

- Including recreational gear
- No research on ocean-side traps
- How to decrease impacts before a storm

2-5 Year Strategies

- Educate recreational boaters through informal and formal training
- Research and implement technologies for excluding devices and door releases
- Enforce a crabbing season
- Remove pots in hotspot areas
- Find low cost options for disposal of old pots
- Reward pot accountability with a deposit program

- Collaborate with watermen

Consumer Debris

Who from the region is involved?

- International Coastal Cleanup- coastal cleanup and marketing (app)
- Clean Virginia Waterways- Butts and Balloons
- Trash Free MD- Politics and regulation reform
- BoatU.S. Foundation- Fishing line collection
- DC Department of Environment- TMDL
- Healthy Harbor- Water wheel in Baltimore
- Virginia Coastal Zone Management- Marine Debris Reduction Plan
- National Aquarium- Animal entanglement
- Chesapeake Bay Foundation
- American Littoral Society
- Marine Defenders-NJ
- Clean Ocean Action
- Clean Marina
- Virginia Aquarium & Marine Science Center
- Keep Virginia Beautiful
- Virginia Department of Environmental Quality
- Maryland Department of Natural Resources
- Delaware Department of Natural Resources and Environmental Control
- Many other government agencies and NGOs

Goals

- Eliminate single use, disposable plastic packaging
- Educate underserved communities
- Targeted messaging
- Increased consumer debris legislation
- Reduce consumer debris
- Sustained behavior change
- Limit waste generation

Unaddressed Issues

- Microplastics
- Recycling innovations

2-5 Year Strategies

- Social marketing to change behavior
- Creating more incentives
- Enforce fines for littering
- Broaden education about recycling
- Strategic waste disposal actions
- Focus on refusing the use of plastic
- Publicize the good work being done by the good guys
- Voluntary systematic change in industry
- Tap into funding – Clean water state revolving fund
- Maintain and install trash traps
- Tap into business marketing that will help their business too

At the end of the workshop the group highlighted overarching goals and strategies that included:

1. Using marketing and education to change people's behaviors and reduce the amount of consumer debris entering the ocean through land based sources. Scientist must understand social issues and behavior patterns to create focused and effective marketing strategies.
2. Microplastics, though a fairly new trend in research, still has many unanswered questions and needs increased attention.
3. Targeted education of recreational boaters to reduce occurrence of severed buoy lines and decrease the number of derelict traps.
4. Research on innovations for derelict pot bycatch reduction devices is crucial for decreased environmental impacts of derelict traps.
5. Create a plan to respond to and prevent marine debris emergencies like Super Storm Sandy.

It is important for MARCO to continue involvement in the NOAA Marine Debris Program because it will foster regional partnerships and create funding opportunities for future water quality and marine debris initiatives. Marine debris management and research is a popular environmental topic among the general public; getting involved with marine debris could help publicize other important actions taken by MARCO.

Conclusions

It is important to note that this document provides a snapshot of marine debris issues and initiatives occurring in MARCO's five state region. The ICC data used to estimate regional trends over the past seven years is citizen science which can be highly variable. That being said the data are still informative and able to suggest key trends in debris status over the years.

It is becoming increasingly apparent that national efforts such as the ICC and NOAA Marine Debris Program need to be paired with regional marine debris prevention, education, research, and outreach coordination to make larger impacts on marine debris reduction. MARCO is uniquely qualified to become a leader of marine debris reduction initiatives in the Mid-Atlantic region because of the ongoing state, federal, and tribal communication forum that currently exists, as well as MARCO's dedicated stakeholder engagement priorities. A marine debris project focused on education and outreach and/or in convening experts from all aspects and perspectives of the topic matter will provide much needed public exposure and give MARCO an opportunity to increase expertise in other aspects of ocean science.

Gaps in Information

MARCO sought expertise from Ocean Conservancy representatives Allison Schuttes, Trash Free Seas program manager, and Sarah Cooley, science outreach manager and Trash Free Seas Coordinator, to gain a better understanding of gaps in information and knowledge in the Mid-Atlantic region. Microplastic reduction research and outreach emerged in this conversation as an increasingly important

and under studied topic. Furthermore, there are large gaps in scientific understanding of how microplastics are affecting the ocean.

Project Ideas

- Focus on Ocean Stewardship for Recreational Boaters
 - Fishing gear and line- link to ocean planning- user conflicts
 - Create a regional outreach campaign with targeted messaging similar to what Virginia is doing with balloons
 - Introduce new regional signage
 - Determine a way to measure changes in behavior
 - Partner with Boat US
 - Expand upon projects NOAA is already conducting in NY and NJ with fishing gear
- Design a regional social marketing campaign
 - research and implement a social marketing campaign aimed to reduce consumer plastics in beach towns and coastal urban areas with high population densities
 - The same campaign and images reflected through the entire region will make the campaign more noticeable and understood
- Encourage monitoring for microplastics with research and the creation of regional microplastic water standards
- Design a study that looks at how marine debris affects the tourism industry in the mid-Atlantic
 - This might not be applicable because many of the beaches in the Mid-Atlantic are combed daily to remove debris for tourists; however, since tourism is such a huge part of the economy in the region it could be an eye-opening study

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Rigid Plastics Packaging Group

Berry Plastics
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Hanover, MD 21076

Klockner Pentaplast
3585 Klockner Rd
Gordonsville, VA 22942

Eastman Specialties Corporation
10380 Worton Rd
Chestertown, MD 21620

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Materials Committee Members***

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DuPont
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Eastman Specialties Corporation
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Material/Resin Suppliers:

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DuPont

ExxonMobil Chemical
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Kureha America Inc.
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SC Johnson
Rahway, NJ 07065FBD

Flexible Film and Bag Division Committee

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S.C. Johnson

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Mahwah, NJ 07430

Kureha America

Processors:

Berry Plastics
Heritage Bag
S.C. Johnson
Sigma Plastics
Trex

***Pharmaceutical and Medical Device
Applications Committee***

BASF

Appendix A. Plastic Industry Trade Association Members of the Mid-Atlantic

Berry Plastics
DuPont
Eastman Chemical
ITW Medical
Exxon Mobil

<http://www.plasticsindustry.org/>

Appendix B. Funding Opportunities

Funding Organization	Timeline	Overview/ Description	Funding	Additional Comments
NOAA-Community Based Marine Debris Removal	Soon-application window ends in November 60 day window	Funding that supports locally driven, community-based marine debris prevention and removal projects. These projects benefit coastal habitat, waterways, and wildlife including migratory fish.	1 million for the whole opportunity- all us coast and pacific island project or 2 in each region generally 100-200K	Unless we have a large item we want to remove, then this won't be a good grant to try for
NOAA- Marine Debris Prevention, Education, and Outreach Partnership	Beginning of September-Fall	Funding to support activities to educate the public about the issue of marine debris that: 1) encourage changes in behavior to reduce and address marine debris; 2) develop and implement activities to reduce and prevent marine debris working with students, teachers, industries, and the public, and, 3) engage the public in active, personal participation (e.g. a small-scale shoreline cleanup with students or other hands-on activities, etc.). This grant's purpose is to involve audiences in measurable behavior changing activities and limit the increase of marine debris in the world's oceans.	smaller dollar amounts 20-50K average 10 to 12 projects across the country	10% success rate
NOAA- Marine Debris Research	Suspects there will be but doesn't know when	Funding for original, hypothesis-driven research projects focused on the persistence and chemical impacts of marine debris		
NFWF/NOAA-Fishing for Energy	Spring	Disposal opportunities: provide collection bins at strategic ports for commercial fishermen to unload gear; Regulation: collaborate with state managers to address legal impediments of derelict fishing gear removal; Technological Innovation: identify, test, and deploy innovations to address accidental introduction of derelict fishing gear into the marine environment and innovations to reduce the effectiveness of gear once lost; and, Outreach and Education: educate the public about the impacts of derelict fishing gear and Fishing for Energy initiatives to make measurable change.	recently awarded 4 - less predictable 20-50K fishing gear or practices related	

Appendix B. Funding Opportunities

EPA- Pollution Prevention (P2)	Spring	Grants/cooperative agreements that implement pollution prevention technical assistance services and/or training for businesses and support projects that utilize pollution prevention techniques to reduce and/or eliminate pollution from air, water and/or land.		
EPA- Clean Water State Revolving Fund	Ongoing	Programs provided, on average, more than \$5 billion annually to fund water quality protection projects for wastewater treatment, nonpoint source pollution control, and watershed and estuary management		
EPA- Environmental Education	Early Winter/ Spring	Support environmental education projects that promote environmental awareness and stewardship and help provide people with the skills to take responsible actions to protect the environment. This grant program provides financial support for projects that design, demonstrate, and/or disseminate environmental education practices, methods, or techniques.		
EPA- Trash Free Waters	Ongoing	Federal-State Partnership that helps conquer that water quality		