Marine Debris in North Carolina

North Carolina is home to a biologically rich coast and the second-largest estuarine system in the United States, the Albemarle-Pamlico Estuary. There are 325 miles of beach shoreline, 12,000 miles of estuarine shoreline and 2.2 million acres of estuarine waters in North Carolina, all supporting unique and biodiverse coastal and marine ecosystems (McVerry, 2012; North Carolina Coastal Atlas, 2018).

The tourism and fishing industries in North Carolina depend on the health of these ecosystems, as they provide important ecosystem services to communities throughout the state, including protection from storms, recreation, improved water quality, nursery habitat for important fish and shellfish species and biodiverse marine ecosystems (Barbier, et al., 2011). The coast of North Carolina is especially biodiverse due to its unique geography as the continental slope sits roughly 40 miles offshore Cape Hatteras, making North Carolina the closest landmass to the continental slope on the east coast. The Gulf Stream and Labrador currents meet in this area, creating a productive marine ecosystem that is home to many marine mammals, endangered species and commercially- and recreationally-important fish species (National Park Service, 2015). North Carolina's people, wildlife and habitats are affected by marine debris and increased coastal development in the state is exacerbating this critical issue.

Concerns with Marine Debris

Marine debris can negatively influence coastal environments in a variety of ways, including but not limited to: habitat damage, wildlife entanglement and ingestion, ghost fishing, vessel damage, navigational hazards, aesthetic decline and invasive species transport. Human health can also be influenced. Direct impacts to humans may occur when hazardous materials are deposited on beaches or coastal waters. Humans can also be influenced indirectly, when debris, particularly microplastics, are transported through the food chain (Miranda & Carvalho-Souza, 2016).

Marine debris is continually entering our state, national and global waters and the federal Marine Debris Research, Prevention, and Reduction Act (amended 2012) recognized the need for a program to address the sources and impacts in United States (U.S.) waters. However, quantifying marine debris impacts is a difficult task and few studies have been completed in North Carolina to make specific determinations.

The below figures are based on data from the University of Georgia's Marine Debris Tracker App and Ocean Conservancy International Coastal Cleanup database. Results show the number of volunteers, pounds and pieces of debris removed over thirty years. It also highlights the top 10 items collected, and a breakdown of debris composition into broad categories based on material type. The majority of debris was found to be plastic, which is consistent with national and international clean-up data.

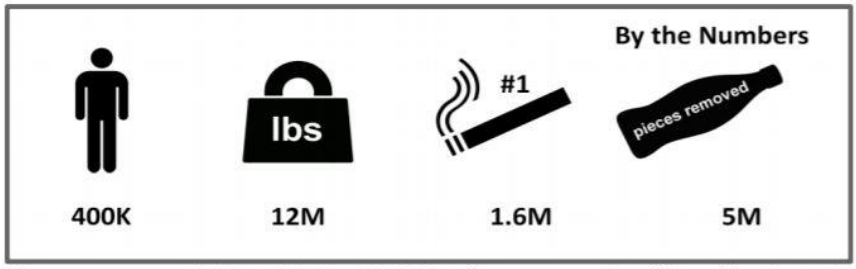

Figure 1. *From 1986 to 2016, 400,000 volunteers assisted in collecting 12 million pounds of primarily consumer debris in North Carolina Five million pieces of debris were removed, including the top item - 1.6 million cigarette butts. Data provided by the Ocean Conservancy International Coastal Cleanup.*

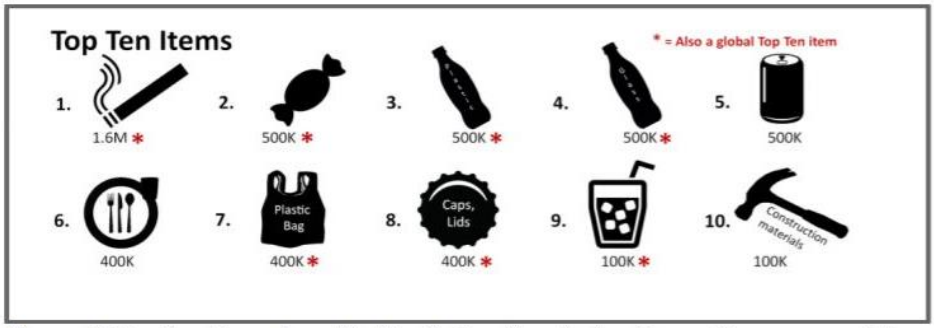

Figure 2. *Top ten items found in North Carolina during Ocean Conservancy International Coastal cleanups from 1986 to 2016. With the exception of construction materials, the most frequent type of debris removed is consumer debris.*

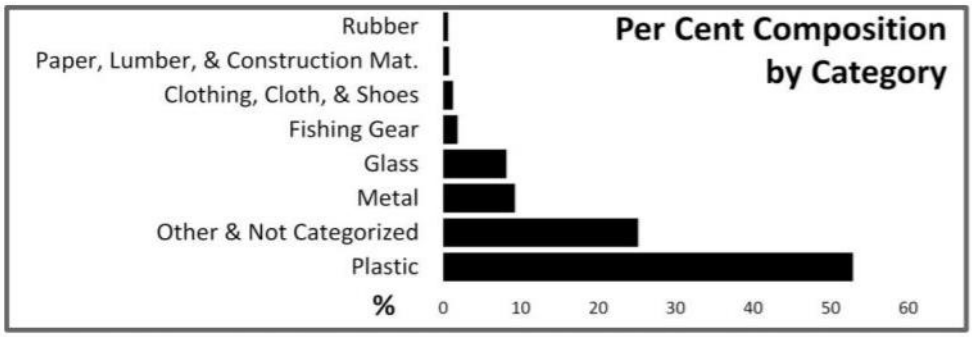

Figure 3. *Percent composition by category of marine debris collected in North Carolina from 1986 to 2017. Plastic contributes more than any other category, which is consistent with international cleanup data. Data is from the University of Georgia's Marine Debris Tracker and Ocean Conservancy International Coastal Cleanup.*

Figure 4. *Estimated decomposition rates of common marine debris items.* (ECOVENTURES INFOGRAPHICS)

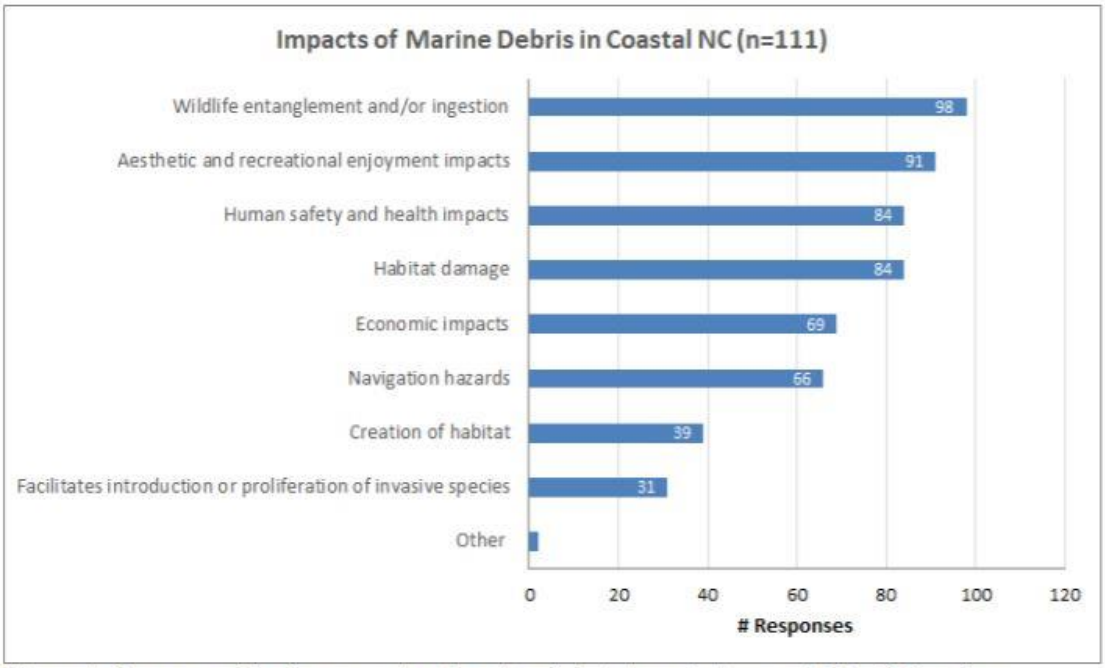

Figure 5. *Survey results show perceived marine debris impacts in coastal North Carolina Respondents were asked "Based on your professional experience related to marine debris, what are the impacts of marine debris found in coastal North Carolina?" The impacts were listed (vertical, y-axis) and respondents could choose all that applied.*

Figure 6. *a) Atlantic bottlenose dolphin with injuries from a rigid plastic flying ring that had slipped over its head (photo courtesy of North Carolina Marine Mammal Stranding Network, photographer unknown); b) Disentangling a Common Loon from plastic fishing line near a pier in Topsail Beach (photo by Dr. Gilbert S. Grant).*

***Figure 8**. Beachgoer debris at Indian Beach, North Carolina in July 2016 (photo by Lisa Rider).*

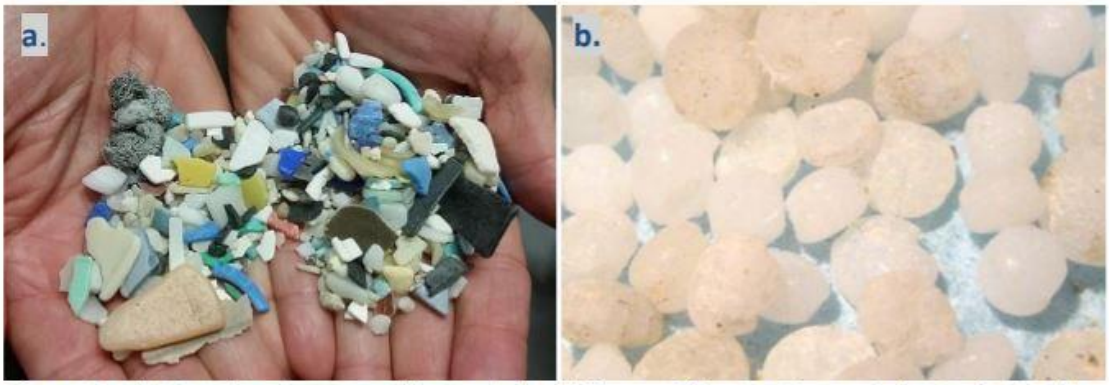

***Figure 9**. a) Microplastics created from the breakdown of larger pieces of plastic debris; b) Plastic preproduction pellets used to manufacture plastic (photos by NOAA).*

Figure 14. *Marine debris observed on an abandoned shellfish farm near Harkers Island, North Carolina (photo by James Morris).*

Shellfish mariculture debris can be a hazard for marine organisms and can lead to entanglement, be ingested or cause fatal injuries or health problems. Equipment that becomes abandoned or derelict, whether intentional or unintentional, can pose a risk to navigation and human safety. Improperly marked and maintained equipment, metal and netting can impact tourism, recreational activities and commercial fishing. Shellfish mariculture gear is different from commercial fishing gear in that it is concentrated in one location and can occupy many acres. Most shellfish farmers work to protect their gear and replace it whenever it becomes lost. Farmers understand that if debris escapes the confines of a shellfish mariculture farm, it reflects poorly on the industry and can lead to negative impacts (B. Charron, personal communications).

Proper disposal and recycling of monofilament fishing line is encouraged through the North Carolina Monofilament Recycling Program (NCMRP). The NCMRP collects monofilament from 42 recycling bins located throughout the North Carolina coast at fishing piers, marinas, bait and tackle shops, dive shops and beaches (Figure 18). Approximately 2,700 miles of monofilament fishing line has been collected and recycled by the NCMRP since 2007. A graph of the cumulative miles of fishing line recycled in North Carolina from February of 2007 to August of 2017 is provided in Appendix A. Other monofilament recycling programs are known to exist in North Carolina, but data about these programs is not presented in this document.

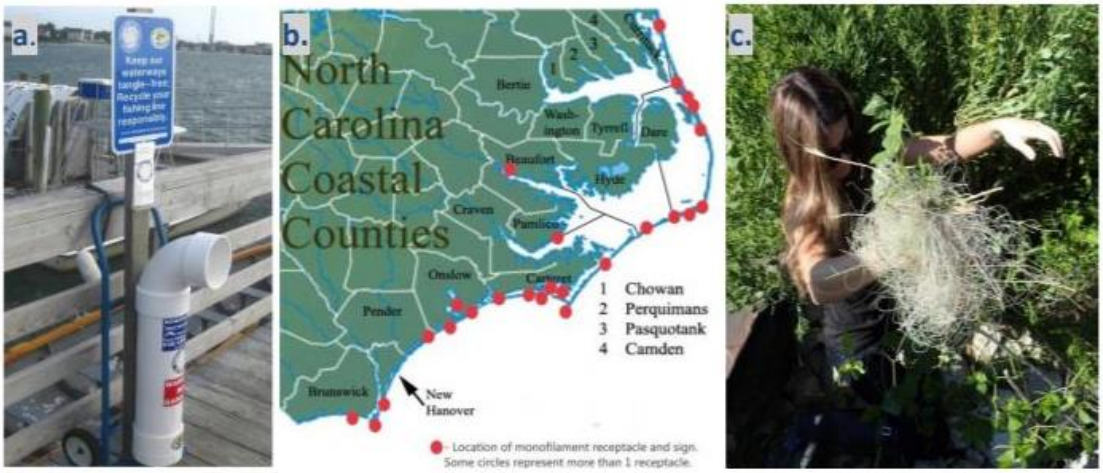

Figure 18. *a) Monofilament collection site (photo by Keith Rittmaster); b) Location of monofilament receptacles and signs along coastal North Carolina. Some circles represent more than 1 receptacle. (Photo by Keith Rittmaster); c) Monofilament line found during working shoreline cleanup in Rodanthe 2015 during NCMDS Cleanup. (Photo by Bonnie Monteleone).*